—PRODUCT INFORMATION—

Diode

1AY2-A

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

■ MONOCHROME TYPE ■ 22000 VOLTS DC ■ 0.5 MILLIAMPERES DC ■ X-RADIATION RATING

The 1AY2-A is a filamentary diode designed for use in television receivers as the high-voltage rectifier to supply power to the anode of the television picture tube. It is primarily intended for use in flyback types of power supplies.

Features of the 1AY2-A include built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Filament

Filament Characteristics and Ratings

Filament Voltage, AC or DC*	1.25±0.2	Volts
Filament Current‡	0.2	Amperes

Direct Interelectrode Capacitances§

Plate to Filament: (p to f)	1.4	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E2-92, Button 2-Pin
Top Cap - C1-49, Small
Outline Drawing

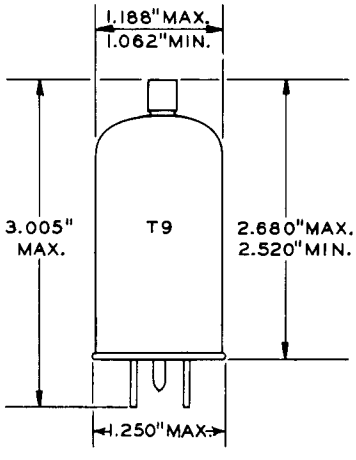
Maximum Bulb Diameter	1.188	Inches
Maximum Seal Diameter	1.250	Inches
Minimum Bulb Diameter	1.062	Inches
Maximum Over-all Length	3.005	Inches
Maximum Seated Height	2.680	Inches
Minimum Seated Height	2.520	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE¶—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Plate Voltage		
DC Component (Absolute-Maximum Value)	22000	Volts
Total DC and Peak (Absolute-Maximum Value)	26000	Volts
Steady-State Peak Plate Current	50	Milliamperes
DC Output Current	0.5	Milliamperes
Filament Voltage, AC or DC (Absolute-Maximum Value) ¢	1.45	Volts
Filament Voltage, AC or DC (Absolute-Minimum Value)	1.05	Volts

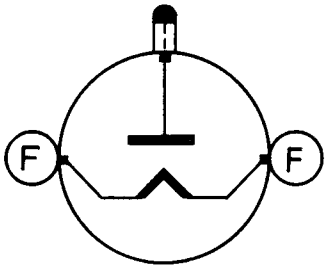
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pins - Filament
Cap - Plate

BASING DIAGRAM



The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes DC	100	Volts

X-RADIATION RATING¶

X-radiation, maximum	0.5	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on data obtained with the use of the Victoreen 440 RF survey meter with a 3 3/8 inch aperture. X-radiation is measured with the face of the meter at a distance of 4 3/4 inches from the external surface of the tube. This rating information is not necessarily applicable when a different radiation measuring instrument or aperture is used.

Operation of the 1AY2-A outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

WARNING

X-RADIATION

Operation of the 1AY2-A outside of the Absolute-Maximum Ratings indicated may produce soft X-rays above 0.5 milliroentgens per hour which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide required shielding.

Precautions must be exercised during the servicing of equipment employing the 1AY2-A to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 1AY2-A is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 1AY2-A in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that filament voltage is centered at the specified bogey value, with filament supply variations restricted to maintain filament voltage within the specified tolerance.

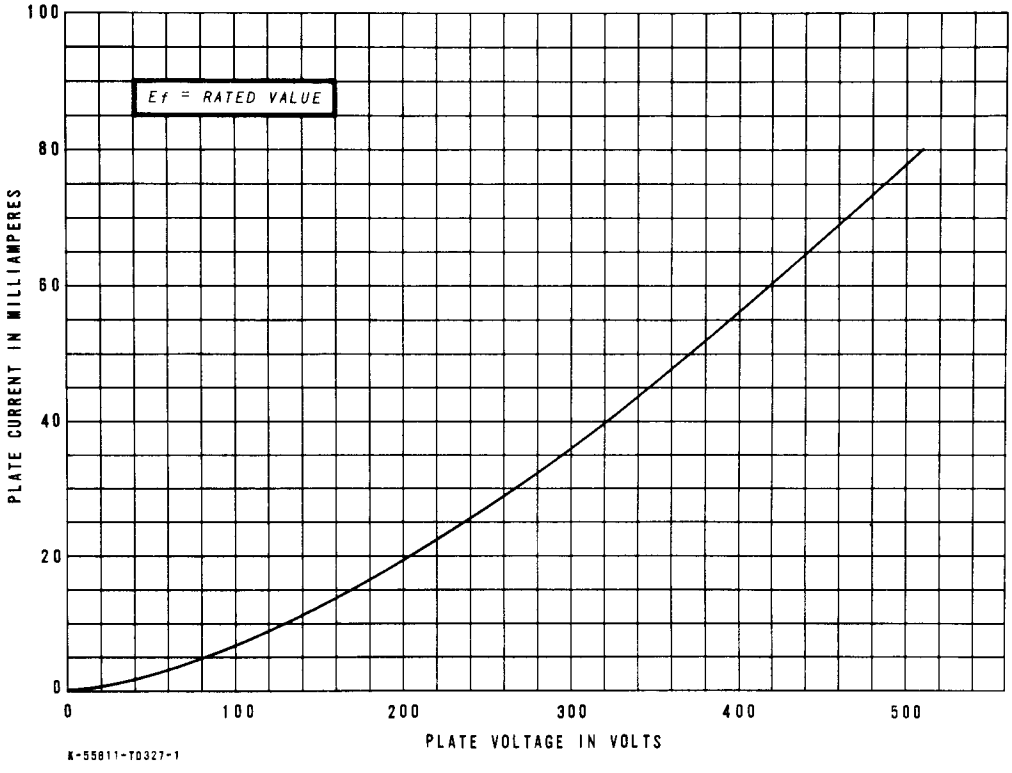
‡ Filament current of a bogey tube at Ef = 1.25 volts.

§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¢ CAUTION - Operation of this tube for an extended period of time with the filament voltage above the absolute maximum rated value of 1.45 volts may result in the production of X-radiation in excess of the maximum rated limit of 0.5 mR/hr.

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

DESCRIPTION AND RATING

TR TUBE GL-1B24-A

The GL-1B24-A is a gas switching tube of the integral-cavity tunable type for use in simple duplexers in pulsed microwave circuits which do not require that the short circuit in the tube have a fixed electrical position. The tube operates to decouple effectively the receiver from a common transmitting and receiving antenna during a transmission period. The operational band is from 8490 to 9600 megacycles.

TECHNICAL INFORMATION

GENERAL CHARACTERISTICS

Electrical

Operational Band	8490 to 9600	Megacycles
Loaded Q, maximum	350	
Ignitor Starting Voltage, maximum	-1000	Volts
Ignitor Voltage Drop, Ignitor Current = 100 Microamperes		
Minimum	325	Volts
Maximum	450	Volts
Leakage Power peak power = 10 kw, pulse repetition rate = 1000pps, pulse duration = 0.5usec, ignitor current = 100ua, frequency = 9375mc, maximum	30	Milliwatts
Ignitor Interaction, Ignitor Current = 100 Microamperes, maximum	0.2	Decibel
Insertion Loss at 9375 Megacycles		
Maximum	1.50	Decibels
Minimum	0.85	Decibel
Recovery Time at 10 Kilowatts Peak, 3 Decibels Down, maximum	4	Microseconds

Mechanical

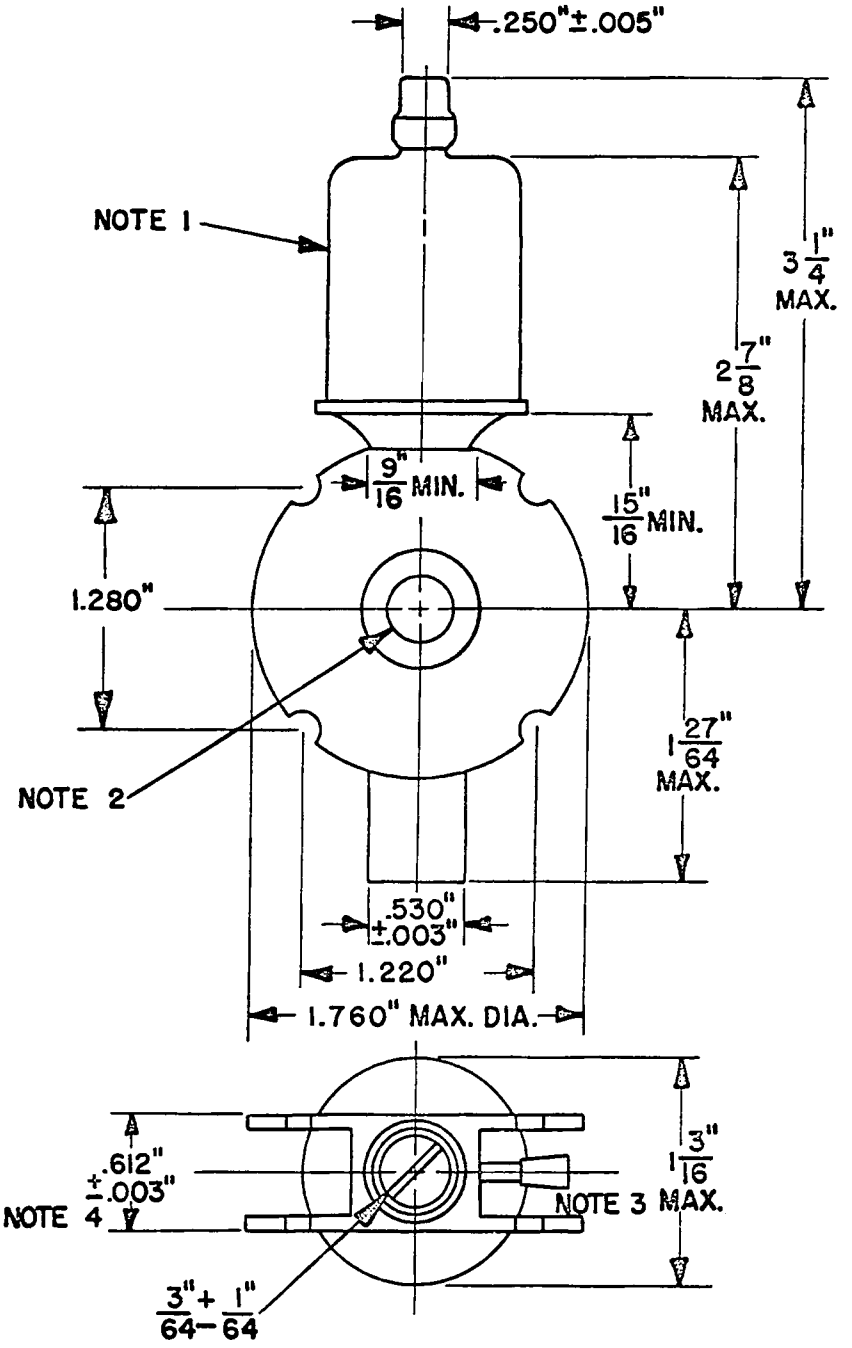
Mounting Position - Any		
Ambient Temperature Range, non-operating	-40 to +100	C
Net Weight, approximate	1/4	Pound

MAXIMUM RATINGS

Igniter Current	200	Microamperes

from RMA release # 470, Feb. 11, 1946

GENERAL ELECTRIC



NOTES:

1. MAXIMUM PROJECTION OF RESERVOIR LIES WITHIN A CYLINDER OF $1\frac{1}{4}$" DIA. WITH AXIS CO-LINEAR WITH TUBE AXIS.
2. NO PART OF IRIS ASSEMBLY SHALL EXTEND BEYOND THE BODY SURFACE.
3. EXHAUST TABULATION NOT TO EXTEND BEYOND PERIPHERY.
4. APPLIES FOR AREA BETWEEN PERIPHERY OF THIS SECTION OF TUBE AND CONCENTRIC CIRCLE OF $\frac{5}{16}$" RADIUS.

N24537AZ October 15, 1952

Outline
GL-1B24-A

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

RMA Release No. 428

August 20, 1945

sponsor:
General Electric Co.

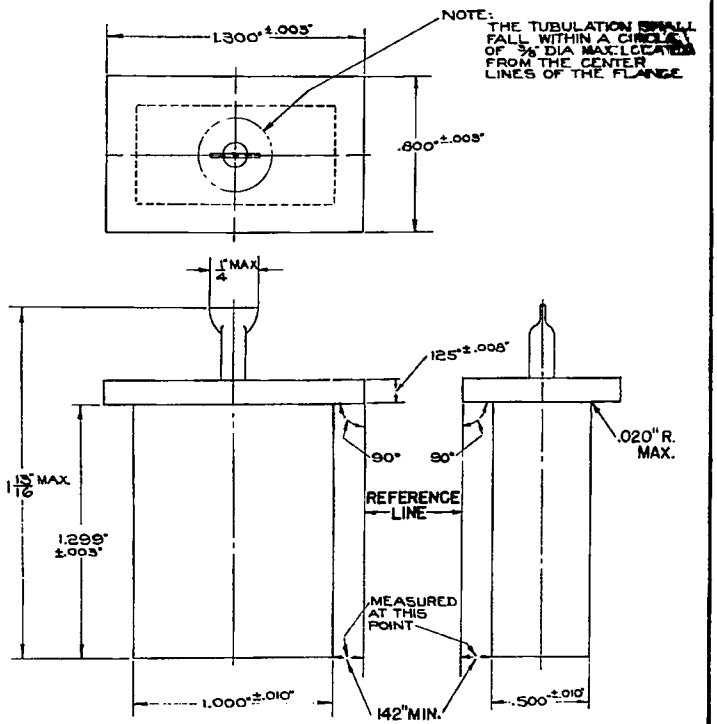
Types

1B35, 1B36, 1B37, 1B38

Gaps

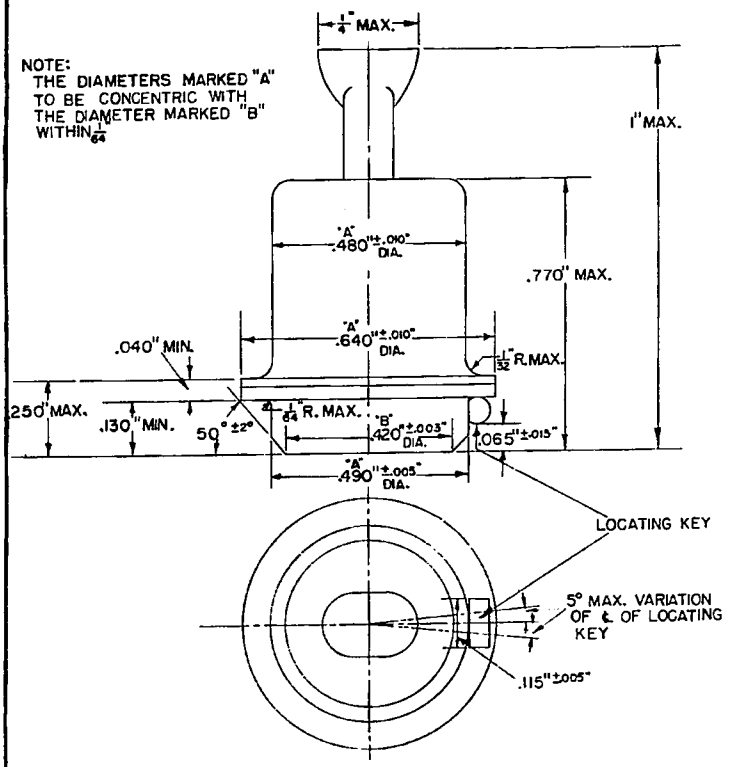
	1B35	1B36	1B37	1B38
Description	ATR	ATR	ATR	Pre-TR
Number of Electrodes	2	2	2	2
Cathode	Cold	Cold	Cold	Cold
Wavelength at Center Frequency (Fo), Centimeters	3.22	1.25	3.43	10.7
Voltage Standing Wave Ratio at Fo	25	25	25	1.05
Loaded Q	5.5	6	5.5	
Leakage Energy, Joules				1.3×10^{-4}
Temperature Range, K				
Maximum	+100	+100	+100	+100
Minimum	- 40	- 40	- 40	- 40

1B35

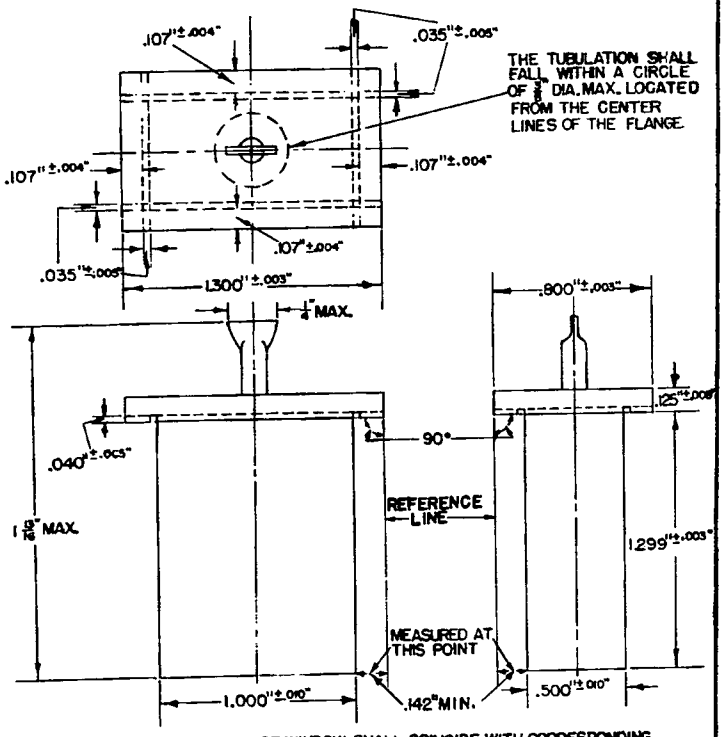


CENTER LINES OF WINDOW SHALL COINCIDE WITH CORRESPONDING CENTER LINES OF THE BOX WITHIN .015" THIS MEASUREMENT SHALL BE MADE IN THE PLANE OF THE WINDOW.

1B36

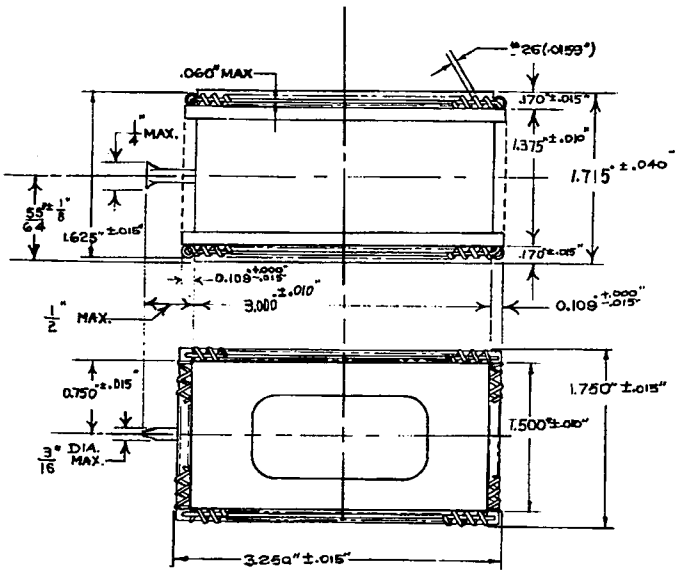


1B37



CENTER LINES OF WINDOW SHALL COINCIDE WITH CORRESPONDING CENTER LINES OF THE BOX WITHIN 0.015" THIS MEASUREMENT SHALL BE MADE IN THE PLANE OF THE WINDOW

1B38



DESCRIPTION AND RATING

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

The 1B3-GT is a half-wave rectifier designed for use in high-voltage, low-current applications. It is especially suitable for use as the high-voltage rectifier in television receivers to supply power to the anode of television picture tubes.

GENERAL

ELECTRICAL

Cathode—Coated Filament
Filament Characteristics and Ratings
Filament Voltage, AC or DC*....1.25 ± 0.2 Volts
Filament Current†.....0.2 Amperes
Direct Interelectrode Capacitances, approximate‡
Plate to All: p to (f+i.s.).....1.3 pf

MECHANICAL

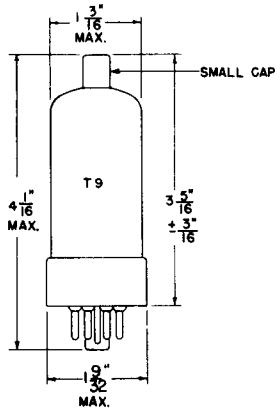
Mounting Position—Any
Envelope—T-9, Glass
Base—B8-6, B6-8, B8-58, B6-60, B5-82, B6-144, B7-166 or B7-211, Octal 5, 6, 7, or 8-Pin
Top Cap—C1-34, Small
Outline Drawing—EIA 9-51 or 9-52

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Flyback Rectifier¶	RF Voltage Rectifier	
Peak Inverse Plate Voltage	.....	33000	Volts
DC Component	22000	.....	Volts
Total DC and Peak	26000	.....	Volts
Steady-State Peak Plate Current	50	35	Milliamperes
DC Output Current	0.5	1.1	Milliamperes
Frequency of Supply Voltage			
Maximum	.....	100	Kilocycles
Minimum	.....	1.5	Kilocycles

PHYSICAL DIMENSIONS

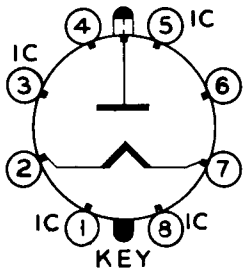


EIA 9-52

TERMINAL CONNECTIONS‡

Pin 1—Internal Connection
Pin 2—Filament
Pin 3—Internal Connection
Pin 4—No Connection
Pin 5—Internal Connection
Pin 6—No Connection
Pin 7—Filament and Internal Shield
Pin 8—Internal Connection
Cap—Plate

BASING DIAGRAM



EIA 3C

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate Ib = 7.0 Milliamperes ..... 100 Volts

* The equipment designer should design the equipment so that filament voltage is centered at the specified bogey value, with filament supply variations restricted to maintain filament voltage within the specified tolerance.

† Filament current of a bogey tube at Ef = 1.25 volts.

‡ Without external shield.

§ Socket terminals 1, 3, 4, 5, 6, and 8 may be connected to terminal 7 or to a corona shield which connects to terminal 7. Terminals 4 and 6 may be used as tie points for components at or near filament potential.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

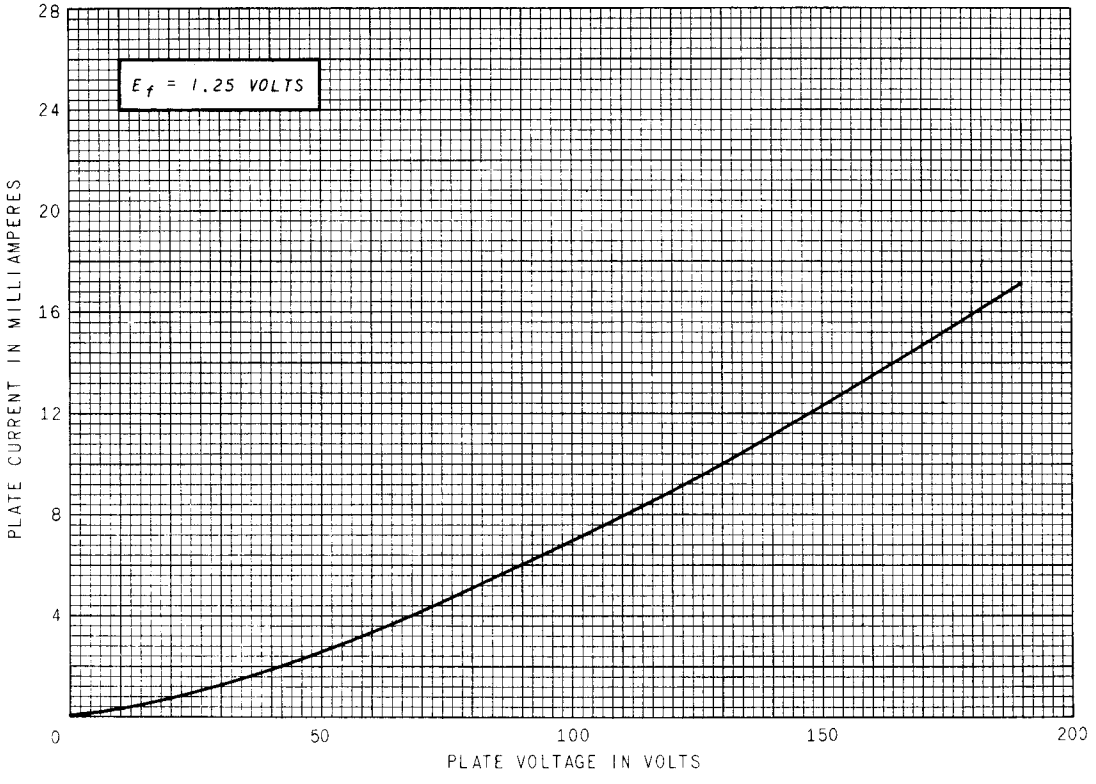
Note: The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce soft x-rays which can constitute a health hazard unless such tubes are adequately shielded. The need for this precaution should be considered in equipment design. Relatively simple shielding should prove adequate.

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE PLATE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Diode

1BC2-B

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

- MONOCHROME TV TYPE
- 15000 VOLTS DC
- 0.5 MILLIAMPERES DC
- X-RADIATION RATING

The 1BC2-B is a filamentary diode designed for use in the television receivers as the high-voltage rectifier to supply power to the anode of the television picture tube. It is primarily intended for use in flyback types of power supplies.

Features of the 1BC2-B include built-in X-radiation shielding and additional design and specification controls to reduce the X-radiation output to very low levels even under conditions of equipment misadjustment and/or circuit failure mode operation.

GENERAL

ELECTRICAL

Cathode - Coated Filament

Filament Characteristics and Ratings

Filament Voltage, AC or DC*	1.25 ± 0.2	Volts
Filament Current●	0.2	Amperes

Direct Interelectrode Capacitances, approximate▲

Plate to Filament: (p to f + i.s.)	1.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-6½, Glass
Base - E9-1, Miniature Button 9-Pin
Top Cap - C1-2 or C1-45, Skirted Miniature
Outline Drawing - EIA 6-18

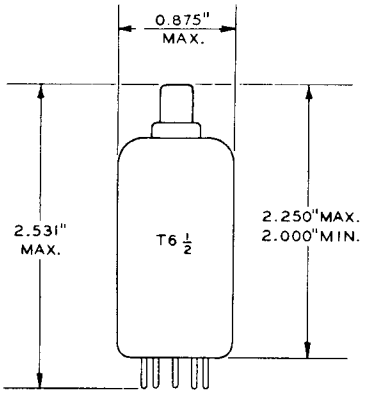
Maximum Diameter	0.875	Inches
Maximum Over-all Length	2.531	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE♦—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Plate Voltage		
DC Component (Absolute-Maximum Value)	15000	Volts
Total DC and Peak (Absolute-Maximum Value)§	18000	Volts
Steady-State Peak Plate Current	45	Milliamperes
DC Output Current	0.5	Milliamperes
Filament Voltage, AC or DC (Absolute-Maximum Value)§	1.45	Volts
Filament Voltage, AC or DC (Absolute-Minimum Value)	1.05	Volts

PHYSICAL DIMENSIONS

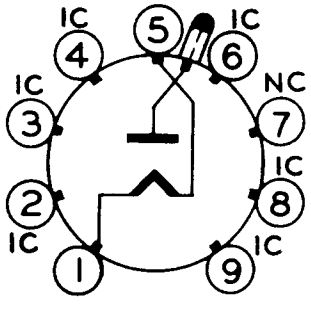


EIA 6-18

TERMINAL CONNECTIONS ⊕

Pin 1 - Filament and Internal Shield
Pin 2 - Internal Connection - Do Not Use
Pin 3 - Internal Connection - Do Not Use
Pin 4 - Internal Connection - Do Not Use
Pin 5 - Filament
Pin 6 - Internal Connection - Do Not Use
⊕ Pin 7 - No Connection
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Cap - Plate

BASING DIAGRAM



EIA 9RG

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MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate
Ib = 7.0 Milliamperes ..... 80 Volts

X-RADIATION RATING♦

MAXIMUM RATED OPERATING CONDITIONS

Total DC and Peak Inverse Voltage	Maximum X-Radiation Output
§18 KV	0.5 mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including filament voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation at voltages outside of the Absolute-Maximum Ratings will cause permanent damage to the tube resulting in short life and/or catastrophic failure. Any tube known to have operated above 18 KV peak inverse voltage and/or 1.45 V filament voltage should be replaced with the latest version of the same tube type.

The X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein, except as noted under "X-Radiation Characteristics."

X-RADIATION CHARACTERISTICS

EQUIPMENT MISADJUSTMENT AND/OR CIRCUIT FAILURE MODE OPERATION

The 1BC2-B will produce varying levels of X-radiation depending upon operating conditions. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the indicated value under equipment misadjustment and/or circuit failure mode operations of plate and filament voltage listed below.

Total DC and Peak Inverse Voltage	Maximum Filament Voltage	Maximum Expected X-Radiation Output
§20 KV	§1.8 V	0.5 mR/hr

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated with total DC and peak inverse voltage above 20 KV, or with filament voltage above 1.8 V.

Operation at voltages outside of the Absolute-Maximum Ratings will cause permanent damage to the tube resulting in short life and/or catastrophic failure. Any tube known to have operated above 18 KV peak inverse voltage and/or 1.45 V filament voltage should be replaced with the latest version of the same tube type.

WARNING

X-RADIATION

X-radiation in excess of 0.5 mR/hr may constitute a health hazard on prolonged exposure at close range. Therefore, equipment design must provide for adequate shielding.

Operation of the 1BC2-B with total DC and peak inverse voltage greater than 20 KV may result in radiation in excess of the "Maximum Expected X-Radiation Output" listed under "X-Radiation Characteristics."

Precautions must be exercised during the servicing of the equipment employing the 1BC2-B to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 1BC2-B is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and in the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 1BC2-B in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that filament voltage is centered at the specified bogey value, with filament supply variations restricted to maintain filament voltage within the specified tolerance.

• Filament current of a bogey tube at Ef = 1.25 volts.

▲ Without external shield.

– May be used as a tie-point for filament dropping resistor or may be connected to filament. Do not connect to any other circuits.

♦ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

CAUTION - Operation at voltages outside of the Absolute-Maximum Ratings will cause permanent damage to the tube resulting in short life and or catastrophic failure. Any tube known to have operated above 18 KV peak inverse voltage and 1.45 V filament voltage should be replaced with the latest version of the same type.

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Compactron Diode

1BY2-A

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

■ MONOCHROME TYPE ■ 22000 VOLTS DC ■ 0.5 MILLIAMPERES DC ■ X-RADIATION RATING

The 1BY2-A is a filamentary diode designed for use in television receivers as the high-voltage rectifier to supply power to the anode of the television picture tube. It is primarily intended for use in flyback types of power supplies.

Features of the 1BY2-A include built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Filament

Filament Characteristics and Ratings

Filament Voltage, AC or DC ★	1.25 ± 0.2	Volts
Filament Current ●	0.2	Amperes

Direct Interelectrode Capacitances, approximate ▲

Plate to All: p to (f+i.s.)	1.6	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Top Cap - C1-1, C1-34 or C1-49, Small
Outline Drawing

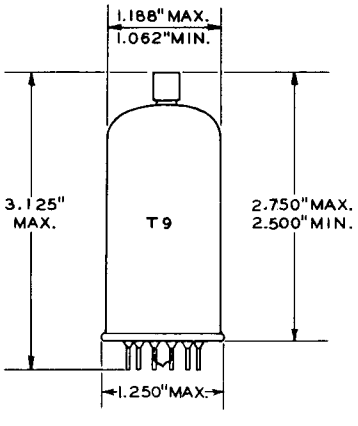
Maximum Bulb Diameter	1.188	Inches
Maximum Seal Diameter	1.250	Inches
Minimum Bulb Diameter	1.062	Inches
Maximum Over-all Length	3.125	Inches
Maximum Seated Height	2.750	Inches
Minimum Seated Height	2.500	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE ♦—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Plate Voltage		
DC Component (Absolute-Maximum Value)	22000	Volts
Total DC and Peak (Absolute-Maximum Value)	26000	Volts
Steady-State Peak Plate Current	50	Milliamperes
DC Output Current	0.5	Milliamperes
Filament Voltage, AC or DC (Absolute-Maximum Value) §	1.45	Volts
Filament Voltage, AC or DC (Absolute-Minimum Value)	1.05	Volts

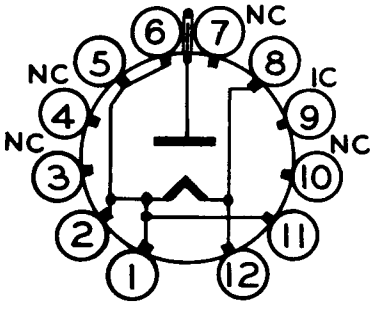
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS ⊕

Pin 1 - Filament and Internal Shield
Pin 2 - Filament and Internal Shield
⊕ Pin 3 - No Connection
⊕ Pin 4 - No Connection
Pin 5 - Filament and Internal Shield
Pin 6 - Filament and Internal Shield
⊕ Pin 7 - No Connection
Pin 8 - Filament
Pin 9 - Internal Connection - Do Not Use
⊕ Pin 10 - No Connection
Pin 11 - Filament and Internal Shield
Pin 12 - Filament
Cap - Plate

BASING DIAGRAM



EIA 12HZ

GENERAL ELECTRIC

Supersedes PI Sheet dated 11-69

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes	225	Volts

X-RADIATION RATING♦

X-radiation, maximum	0.5	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including filament voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation of the 1BY2-A outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

WARNING

X-RADIATION

Operation of the 1BY2-A outside of the Absolute-Maximum Ratings indicated may produce soft X-rays above 0.5 milliroentgens per hour which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide required shielding.

Precautions must be exercised during the servicing of the equipment employing the 1BY2-A to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 1BY2-A is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 1BY2-A in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

★ The equipment designer should design the equipment so that filament voltage is centered at the specified bogey value, with filament supply variations restricted to maintain filament voltage within the specified tolerance.

● Filament current of a bogey tube at Ef = 1.25 volts.

▲ Without external shield.

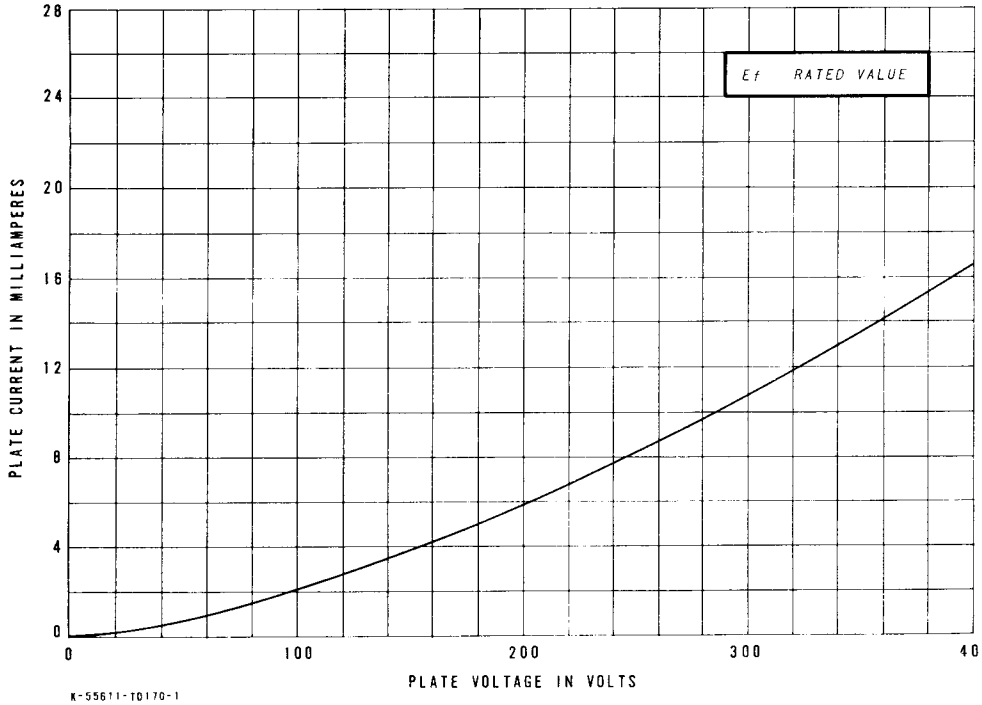
♦ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ **CAUTION** - Operation of this tube for an extended period of time with the filament voltage above the absolute maximum rated value of 1.45 volts may result in the production of X-radiation in excess of the maximum rated limit of 0.5 mR/hr.

⊕ Socket terminals 3, 4, 7 and 10 may be used as tie points for components at or near filament potential.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Diode

1DG3-A

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

■ MONOCHROME TYPE ■ 22000 VOLTS DC ■ 0.5 MILLIAMPERES DC ■ X-RADIATION RATING

The 1DG3-A is a filamentary diode designed for use in television receivers as the high-voltage rectifier to supply power to the anode of the television picture tube. It is primarily intended for use in flyback types of power supplies.

Features of the 1DG3-A include built-in X-radiation shielding and additional design and specification controls to reduce the radiation output to very low levels even under conditions of equipment misadjustment and/or circuit failure mode operation.

GENERAL

ELECTRICAL

Cathode - Coated Filament

Filament Characteristics and Ratings

Filament Voltage, AC or DC ★	1.25 ± 0.2	Volts
Filament Current ●	0.2	Amperes

Direct Interelectrode Capacitances, approximate ▲

Plate to All: p to (f + i.s.)	1.6	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - B8-251, Ultra-Short Small-Wafer Octal 8-Pin
Top Cap - C1-49, Small
Outline Drawing

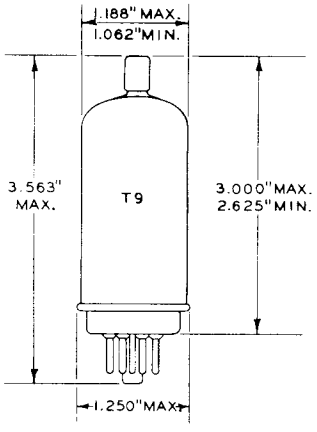
Maximum Bulb Diameter	1.188	Inches
Maximum Seal Diameter	1.250	Inches
Minimum Bulb Diameter	1.062	Inches
Maximum Over-all Length	3.563	Inches
Maximum Seated Height	3.000	Inches
Minimum Seated Height	2.625	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE§—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Plate Voltage		
DC Component (Absolute-Maximum Value)	22000	Volts
Total DC and Peak (Absolute-Maximum Value) ⊕	26000	Volts
Steady-State Peak Plate Current	50	Milliamperes
DC Output Current	0.5	Milliamperes
Filament Voltage, AC or DC (Absolute-Maximum Value) ⊕	1.45	Volts
Filament Voltage, AC or DC (Absolute-Minimum Value)	1.05	Volts

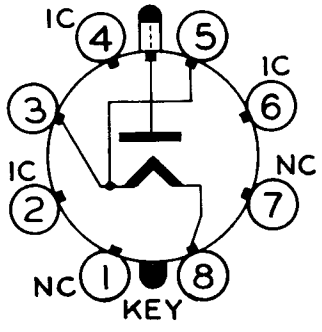
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS ♦

♦ Pin 1 - No Connection
Pin 2 - Internal Connection - Do Not Use
Pin 3 - Filament
Pin 4 - Internal Connection - Do Not Use
Pin 5 - Filament
Pin 6 - Internal Connection - Do Not Use
♦ Pin 7 - No Connection
Pin 8 - Filament and Internal Shield
Cap - Plate

BASING DIAGRAM



EIA 8ND

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate
Ib = 7.0 Milliamperes ..... 225 Volts

X-RADIATION RATING §

MAXIMUM RATED OPERATING CONDITIONS

Total DC and Peak Inverse Voltage	Maximum X-Radiation Output
⊕26 KV	0.5 mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including filament voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation at voltages outside of the Absolute-Maximum Ratings will cause permanent damage to the tube resulting in short life and/or catastrophic failure. Any tube known to have operated above 26 KV peak inverse voltage and/or 1.45 V filament voltage should be replaced with the latest version of the same tube type.

The X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein, except as noted under "X-Radiation Characteristics."

X-RADIATION CHARACTERISTICS

EQUIPMENT MISADJUSTMENT AND/OR CIRCUIT FAILURE MODE OPERATION

The 1DG3-A will produce varying levels of X-radiation depending upon operating conditions. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the indicated value under equipment misadjustment and/or circuit failure mode operations of plate and filament voltage listed below.

Total DC and Peak Inverse Voltage	Maximum Filament Voltage	Maximum Expected X-Radiation Output
⊕30 KV	⊕2.0 V	0.5 mR/hr

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated with total DC and peak inverse voltage above 30 KV, or with filament voltage above 2.0 V.

Operation at voltages outside of the Absolute-Maximum Ratings will cause permanent damage to the tube resulting in short life and or catastrophic failure. Any tube known to have operated above 26 KV peak inverse voltage and/or 1.45 V filament voltage should be replaced with the latest version of the same tube type.

WARNING

X-RADIATION

X-radiation in excess of 0.5 mR/hr may constitute a health hazard on prolonged exposure at close range. Therefore, equipment design must provide for adequate shielding.

Operation of the 1DG3-A with total DC and peak inverse voltage greater than 30 KV may result in radiation in excess of the "Maximum Expected X-Radiation Output" listed under "X-Radiation Characteristics".

Precautions must be exercised during the servicing of the equipment employing the 1DG3-A to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 1DG3-A is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and in the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 1DG3-A in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

★ The equipment designer should design the equipment so that filament voltage is centered at the specified bogey value, with filament supply variations restricted to maintain filament voltage within the specified tolerance.

● Filament current of a bogey tube at Ef = 1.25 volts.

▲ Without external shield.

♦ May be used as a tie-point for filament dropping resistor or may be connected to filament. Do not connect to any other circuits.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

⊕ **CAUTION** -Operation at voltages outside of the Absolute-Maximum Ratings will cause permanent damage to the tube resulting in short life and/or catastrophic failure. Any tube known to have operated above 26 KV peak inverse voltage and 1.45 V filament voltage should be replaced with the latest version of the same type.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

Electronic TUBES

1DN5

DIODE-PENTODE

DESCRIPTION AND RATING

The 1DN5 is a miniature, filamentary, single-diode, remote-cutoff pentode intended for use as a combined detector, audio-amplifier, and automatic volume-control tube in battery-operated receivers. As a result of its remote-cutoff characteristic, automatic-volume-control voltage may be applied to the pentode section of the 1DN5. By introducing AVC to the audio-amplifier stage, an improved over-all AVC response of the receiver can be achieved.

GENERAL

ELECTRICAL

Cathode—Coated Filament		
Filament Voltage, DC	1.4	Volts
Filament Current	0.05	Amperes
Direct Interelectrode Capacitances*		
Grid-Number 1 to Diode Plate, maximum	0.04	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	90	Volts
Screen Voltage	90	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
DC Cathode Current	3.0	Milliamperes
Diode Current for Continuous Operation	0.25	Milliamperes

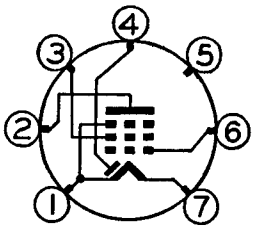
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	67.5	Volts
Screen Voltage	67.5	Volts
Grid-Number 1 Voltage	0	Volts
Plate Resistance, approximate	0.6	Megohms
Transconductance	630	Micromhos
Plate Current	2.1	Milliamperes
Screen Current	0.55	Milliamperes
Grid-Number 1 Voltage, approximate		
Gm = 10 Micromhos	−11.5	Volts
Average Diode Current		
With 10 Volts DC Applied	1.0	Milliamperes

GENERAL ELECTRIC

BASING DIAGRAM

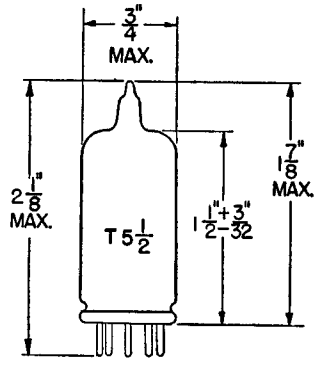


EIA 6BW

TERMINAL CONNECTIONS

Pin 1—Negative Filament and Grid Number 3 (Suppressor)
Pin 2—Plate
Pin 3—Grid Number 2 (Screen)
Pin 4—Diode Plate†
Pin 5—No Connection
Pin 6—Grid Number 1
Pin 7—Positive Filament

PHYSICAL DIMENSIONS

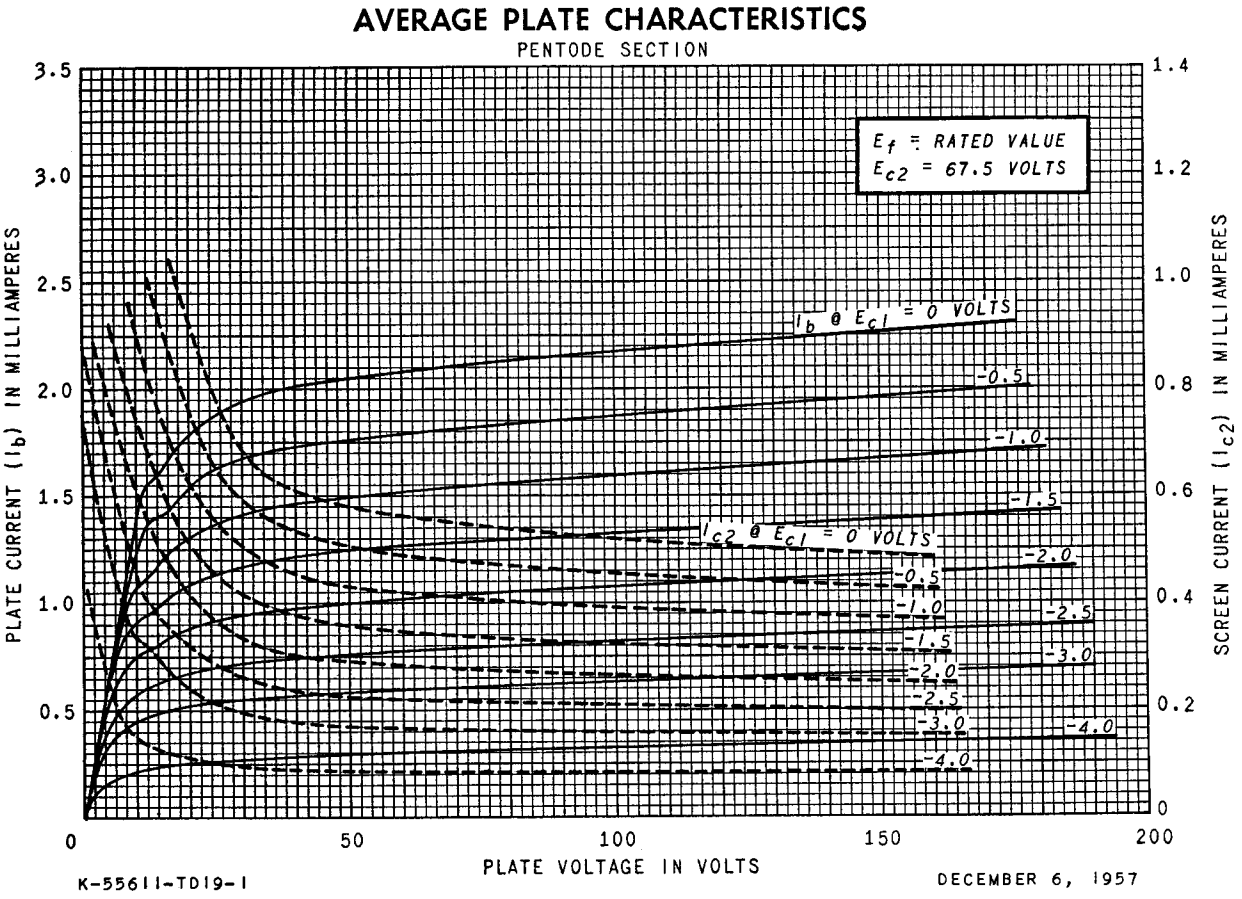


EIA 5-2

* Without external shield.

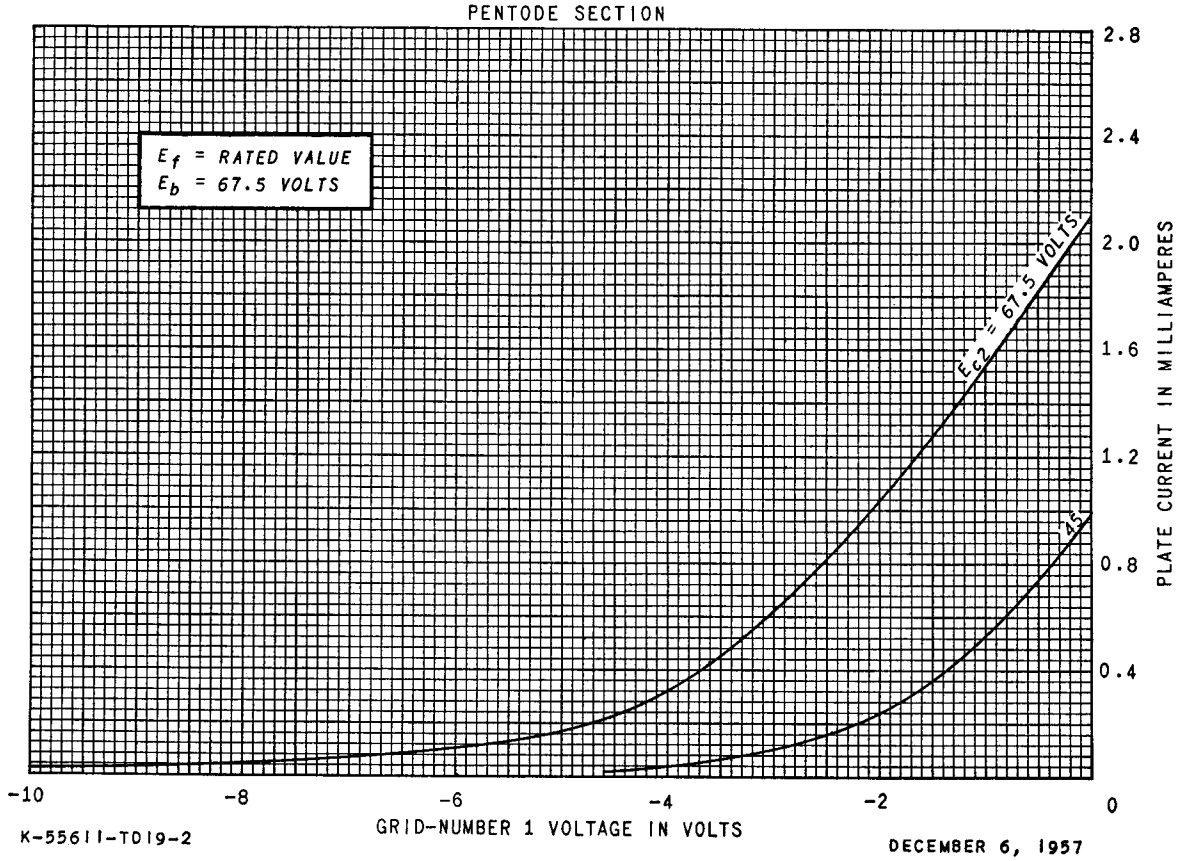
† The diode is located at the negative end of the filament.

Note: All voltages are referred to the negative terminal of the filament.



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

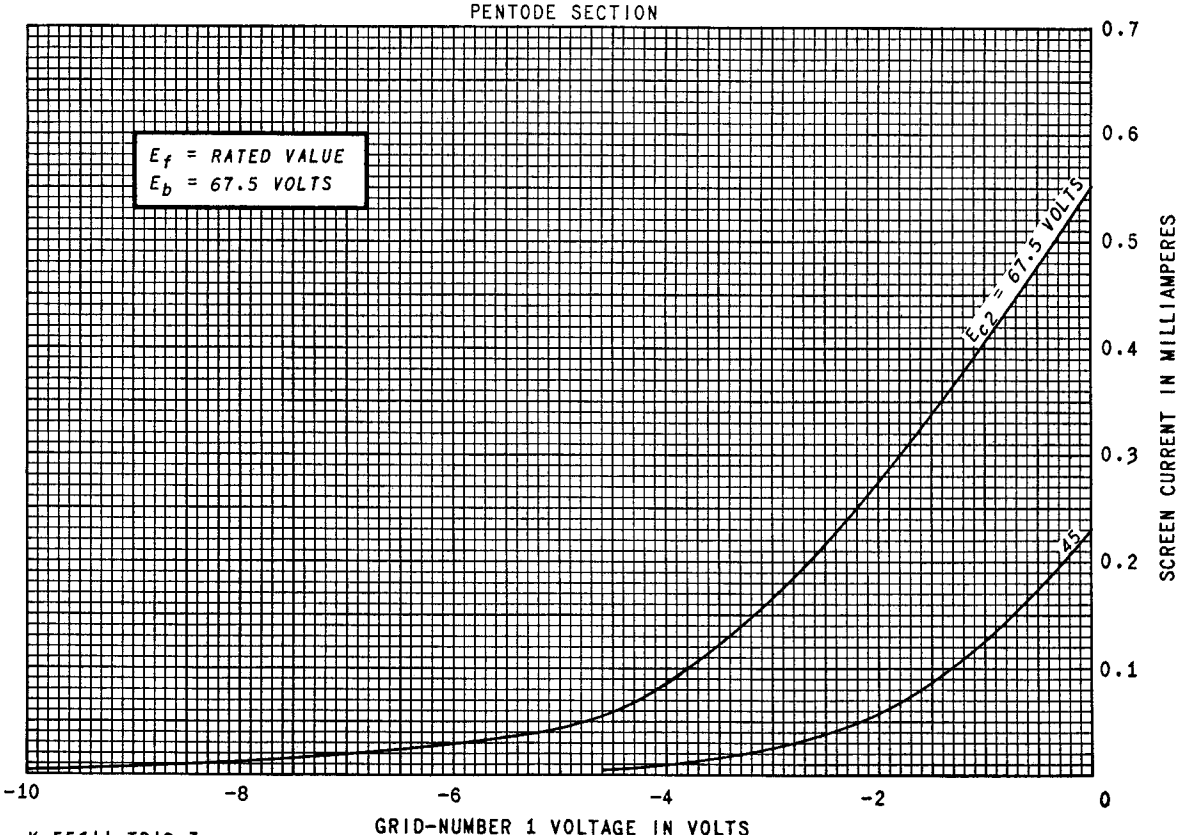


K-55611-TD19-2

DECEMBER 6, 1957

AVERAGE TRANSFER CHARACTERISTICS

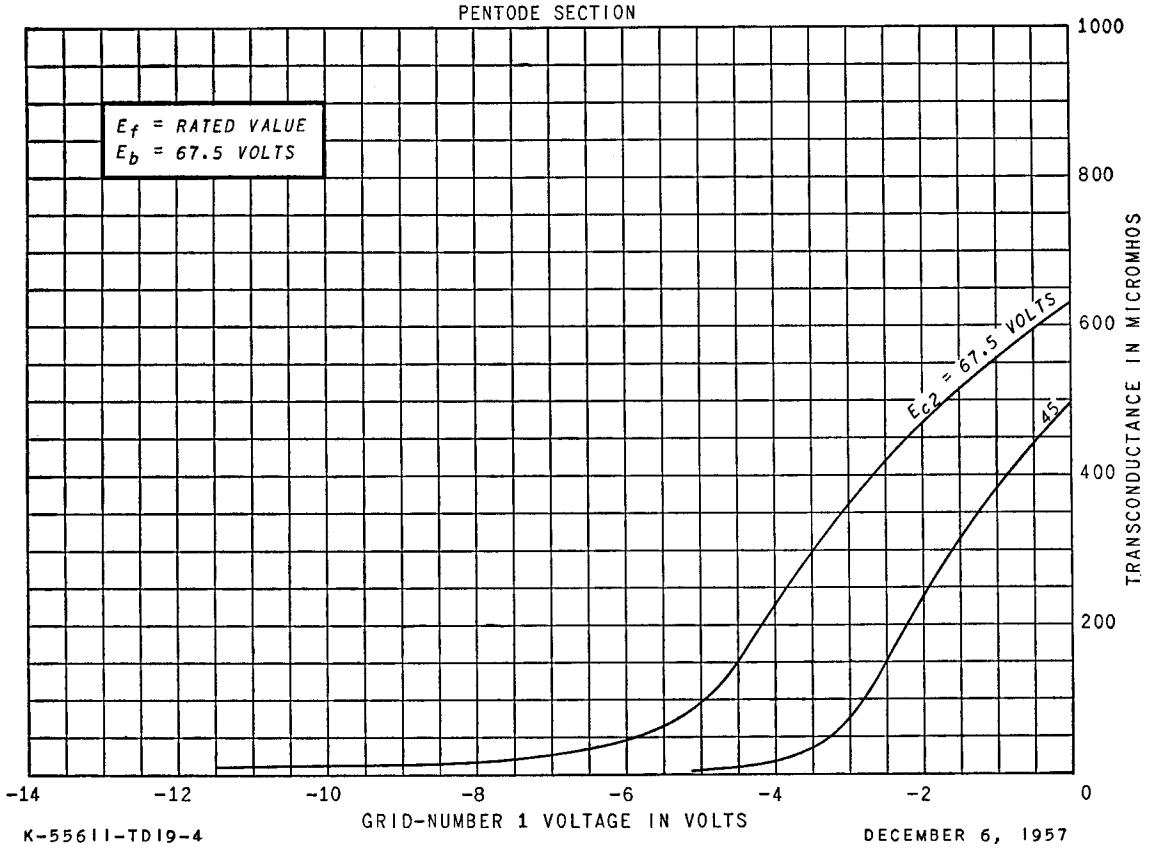
PENTODE SECTION



K-55611-TD19-3

DECEMBER 6, 1957

AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

DESCRIPTION AND RATING

FOR TV HIGH-VOLTAGE-RECTIFIER APPLICATIONS

The 1G3-GT is a filamentary diode designed for use in high-voltage low-current rectifier applications. It is especially suitable for use as the high-voltage rectifier in television receivers to supply power to the anode of television picture tubes.

GENERAL

ELECTRICAL

Cathode—Coated Filament
Filament Characteristics and Ratings
Filament Voltage, AC or DC*....1.25±0.2 Volts
Filament Current†.....0.2 Amperes
Direct Interelectrode Capacitances, approximate‡
Plate to All: p to (f+i.s.).....1.3 pf

MECHANICAL

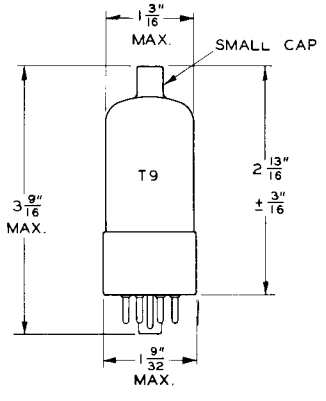
Mounting Position—Any
Envelope—T-9, Glass
Base—B5-82, B5-85, B6-8, B6-60, B7-47, B7-166, or B8-6, Octal 5, 6, 7, or 8-pin
Top Cap—C1-34, Small
Outline Drawing—EIA 9-53 or 9-54

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Flyback Rectifierϕ	RF Voltage Rectifier	
Peak Inverse Plate Voltage	.....	33000	Volts
DC Component	21000	.....	Volts
Total DC and Peak	26000	.....	Volts
Steady-State Peak Plate Current	50	35	Milliamperes
DC Output Current	0.5	1.1	Milliamperes
Frequency of Supply Voltage			
Maximum	.....	100	Kilocycles
Minimum	.....	1.5	Kilocycles

PHYSICAL DIMENSIONS

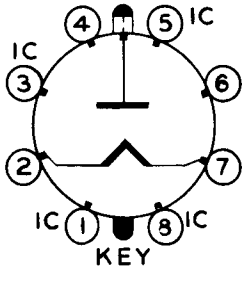


EIA 9-54

TERMINAL CONNECTIONS§

Pin 1—Internal Connection—Do Not Use
Pin 2—Filament
Pin 3—Internal Connection—Do Not Use
Pin 4—No Connection
Pin 5—Internal Connection—Do Not Use
Pin 6—No Connection
Pin 7—Filament and Internal Shield
Pin 8—Internal Connection—Do Not Use
Cap —Plate

BASING DIAGRAM



EIA 3C

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AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate Ib = 7.0 Milliamperes..... 100 Volts

* The equipment designer should design the equipment so that filament voltage is centered at the specified bogey value, with filament supply variations restricted to maintain filament voltage within the specified tolerance.

† Filament current of a bogey tube at Ef = 1.25 volts.

‡ Without external shield.

§ Socket terminals 1, 3, 4, 5, 6, and 8 may be connected to terminal 7 or to a corona shield which is connected to terminal 7. Terminals 4 and 6 may be used as tie points for components at or near filament potential.

ϕ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

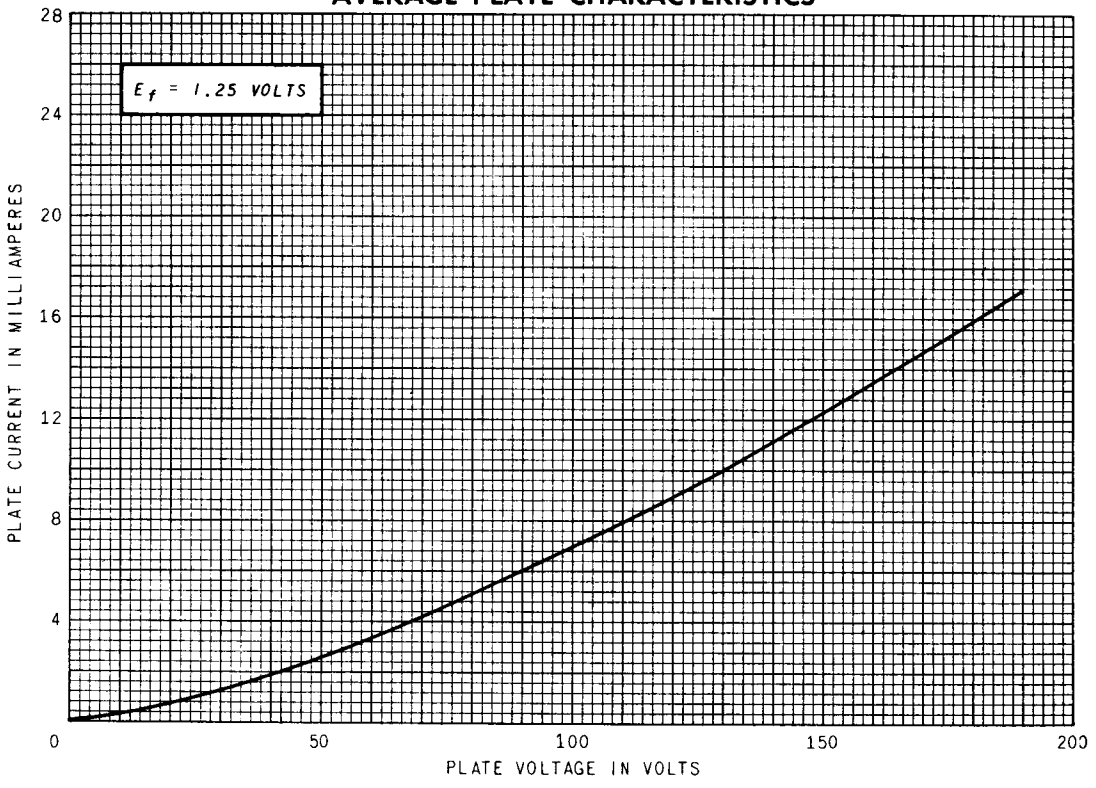
Note: The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce soft x-rays which can constitute a health hazard unless such tubes are adequately shielded. The need for this precaution should be considered in equipment design. Relatively simple shielding should prove adequate.

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE PLATE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Diode

1G3-GTA

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

- MONOCHROME TYPE
- 21000 VOLTS DC
- 0.5 MILLIAMPERES DC
- X-RADIATION RATING

The 1G3-GTA is a filamentary diode designed for use in television receivers as the high-voltage rectifier to supply power to the anode of the television picture tube. It is primarily intended for use in flyback types of power supplies.

Features of the 1G3-GTA include built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Filament

Filament Characteristics and Ratings

Filament Voltage, AC or DC*	1.25±0.2	Volts
Filament Current‡	0.2	Amperes

Direct Interelectrode Capacitances, approximate§

Plate to All: (p to (f + i.s.)	1.3	pf

MECHANICAL

Operating Position - Any

Envelope - T-9, Glass

Base - B6-8, Intermediate Shell Octal 6-Pin or
B8-6, Intermediate Shell Octal 8-Pin or
B6-120, Short Medium-Shell Octal 6-Pin or
B8-118, Short Medium-Shell Octal 8-Pin or
B6-253, Ultra-Short Small-Wafer Octal 6-Pin or
B8-251, Ultra-Short Small-Wafer Octal 8-Pin

Top Cap - C1-49, Small

Outline Drawing

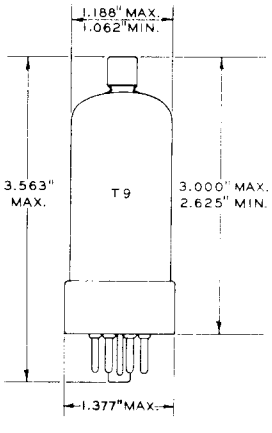
Maximum Diameter	1.377	Inches
Maximum Bulb Diameter	1.188	Inches
Maximum Over-all Length	3.563	Inches
Maximum Seated Height	3.000	Inches
Minimum Seated Height	2.625	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE¶—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Plate Voltage		
DC Component (Absolute-Maximum Value)	21000	Volts
Total DC and Peak (Absolute-Maximum Value)	26000	Volts
Steady-State Peak Plate Current	50	Milliamperes
DC Output Current	0.5	Milliamperes
Filament Voltage, AC or DC (Absolute-Maximum Value)¢	1.45	Volts
Filament Voltage, AC or DC (Absolute-Minimum Value)	1.05	Volts

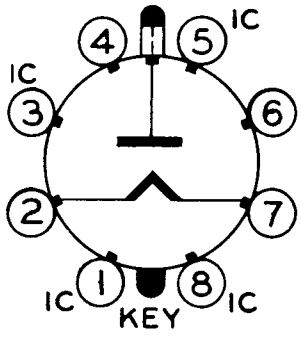
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS△

Pin 1 - Internal Connection - Do Not Use
Pin 2 - Filament
Pin 3 - Internal Connection - Do Not Use
△Pin 4 - No Connection
Pin 5 - Internal Connection - Do Not Use
△Pin 6 - No Connection
Pin 7 - Filament and Internal Shield
Pin 8 - Internal Connection - Do Not Use
Cap - Plate

BASING DIAGRAM



EIA 3C

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes DC	100	Volts

X-RADIATION RATING¶

X-radiation, maximum	0.5	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on data obtained with the use of the Victoreen 440 RF survey meter with a 3 3/8 inch aperture. X-radiation is measured with the face of the meter at a distance of 4 3/4 inches from the external surface of the tube. This rating information is not necessarily applicable when a different radiation measuring instrument or aperture is used.

Operation of the 1G3-GTA outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

WARNING

X-RADIATION

Operation of the 1G3-GTA outside of the Absolute-Maximum Ratings indicated may produce soft X-rays above 0.5 milliroentgens per hour which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide required shielding.

Precautions must be exercised during the servicing of equipment employing the 1G3-GTA to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 1G3-GTA is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 1G3-GTA in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that filament voltage is centered at the specified bogey value, with filament supply variations restricted to maintain filament voltage within the specified tolerance.

‡ Filament current of a bogey tube at Ef = 1.25 volts.

§ Without external shield.

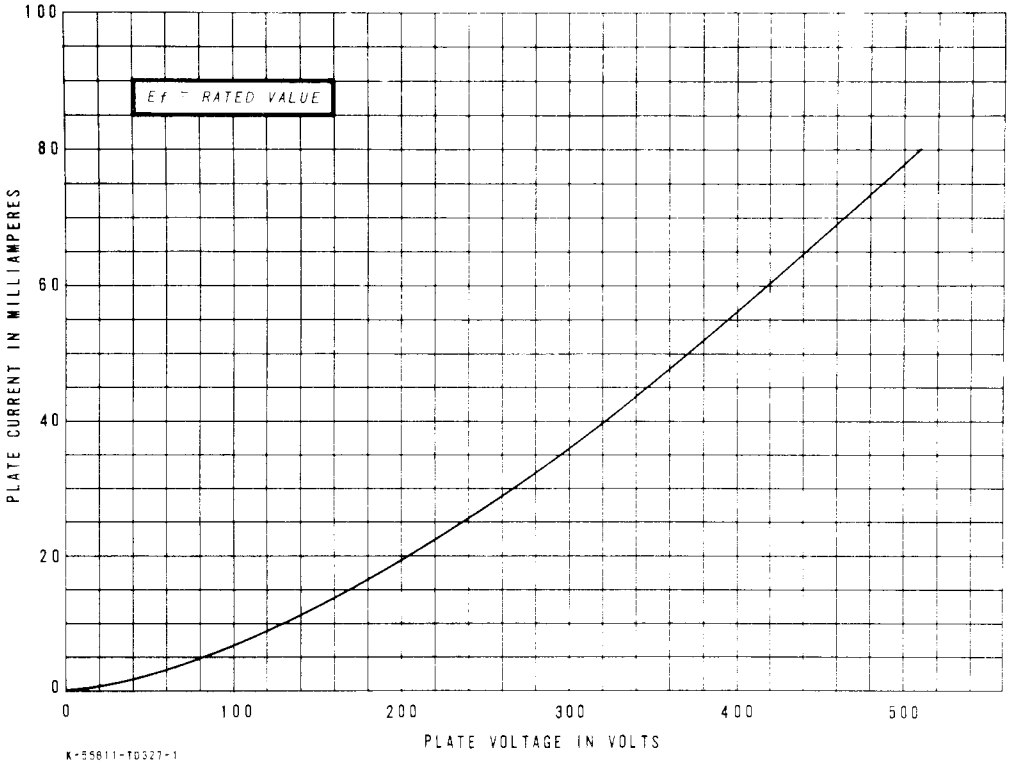
Δ Pins 4 and 6 are omitted on Bases B6-120 and B6-253. Socket terminals 4 and 6 may be used as tie points for components at or near filament potential.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¢ CAUTION - Operation of this tube for an extended period of time with the filament voltage above the absolute maximum rated value of 1.45 volts may result in the production of X-radiation in excess of the maximum rated limit of 0.5 mR/hr.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



Electronic TUBES

1H2

DIODE

FOR TV HIGH-VOLTAGE-RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 1H2 is a miniature heater-cathode type diode designed for use in television receivers as the high-voltage rectifier to supply power to the anode of the television picture tube. The 1H2 is primarily intended for use in fly-back types of power supplies.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	1.4	Volts
Heater Current	0.55	Ampere
Direct Interelectrode Capacitances, approximate*		
Plate to Heater, Cathode, and Internal Shield	1.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin
Top Cap—Miniature, JETEC No. C1-40

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE†
DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage		
DC Component	24000	Volts
Total DC and Peak	30000	Volts
Steady-State Peak Plate Current	50	Milliamperes
DC Output Current	0.5	Milliampere

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes	100	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

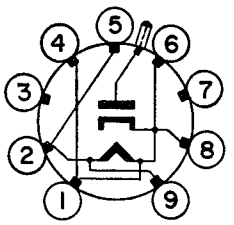
The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM



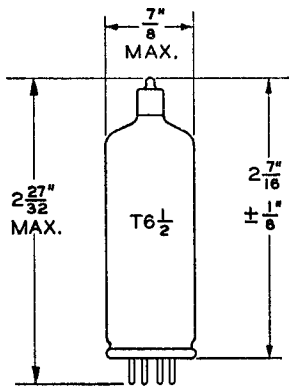
EIA 9LX

TERMINAL CONNECTIONS‡

Pin 1—Heater, Cathode, and Internal Shield
Pin 2—Heater
Pin 3—No Connection
Pin 4—Heater, Cathode, and Internal Shield
Pin 5—Heater
Pin 6—Heater, Cathode, and Internal Shield
Pin 7—No Connection
Pin 8—Heater, Cathode, and Internal Shield
Pin 9—Heater
Cap —Plate

‡ Socket terminals 3 and 7 may be used as tie points for components at or near filament potential.

PHYSICAL DIMENSIONS



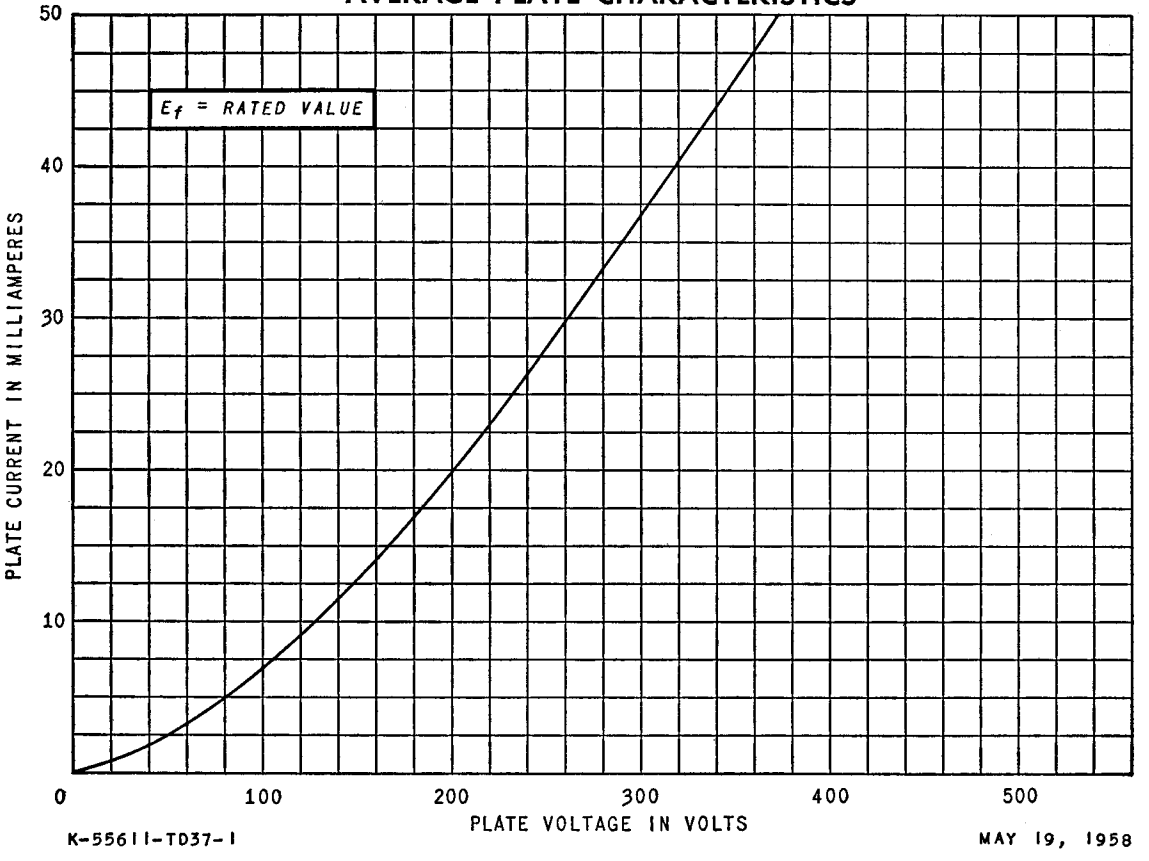
EIA 6–9

* Without external shield.

† For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

NOTE: The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce soft x-rays which can constitute a health hazard unless such tubes are adequately shielded. The need for this precaution should be considered in equipment design. Relatively simple shielding should prove adequate.

AVERAGE PLATE CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

1J3

DIODE

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 1J3 is a filamentary diode designed for use in television receivers as the high-voltage rectifier to supply power to the anode of the television picture tube. The 1J3 is primarily intended for use in flyback types of power supplies.

GENERAL

ELECTRICAL

Cathode—Coated Filament

Filament Voltage, AC or DC	1.25*	Volts
Filament Current	0.2	Amperes
Direct Interelectrode Capacitances, approximate†		
Plate to Filament	1.6	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B6-8, Intermediate Shell Octal 6-Pin
or B6-60, Short Intermediate Shell Octal 6-Pin
Top Cap—C1-34, Small

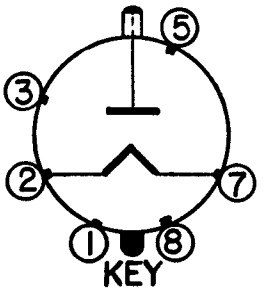
MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE§ DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage		
DC Component	22000	Volts
Total DC and Peak	26000	Volts
Steady-State Peak Plate Current	50	Milliamperes
DC Output Current	0.5	Milliamperes

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

BASING DIAGRAM



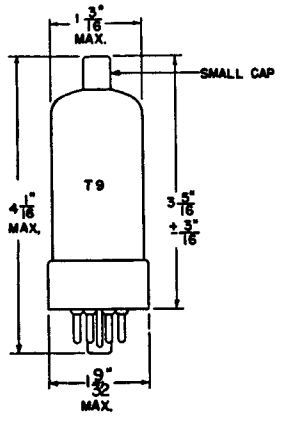
RETMA 3C

TERMINAL CONNECTIONS

Pin 1—No Connection‡
Pin 2—Filament
Pin 3—No Connection‡
Pin 5—No Connection‡
Pin 7—Filament and Internal Shield
Pin 8—No Connection‡
Cap—Plate

‡ May be used as tie point at filament potential. Do not connect to any other circuits.

PHYSICAL DIMENSIONS



GENERAL ELECTRIC

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate
Ib = 7.0 Milliamperes DC . . . . . 225 Volts

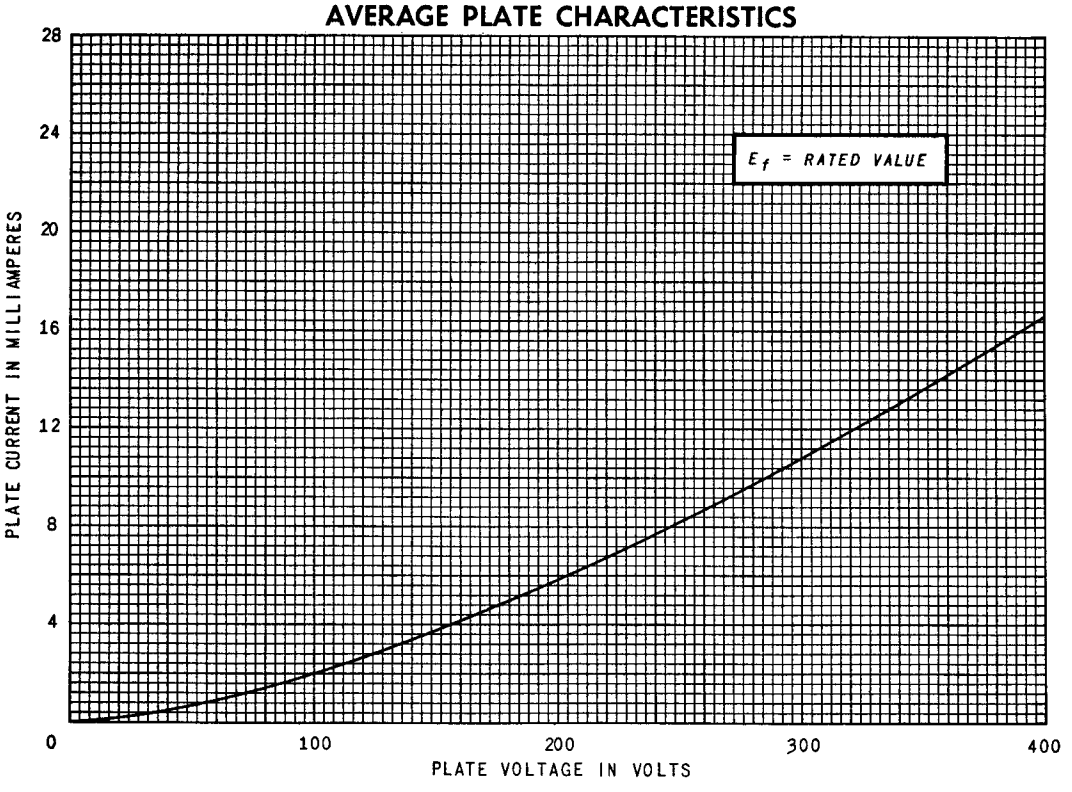
* Under no circumstances should the filament voltage be less than 1.05 volts or more than 1.45 volts.

† Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

Note: The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce soft x-rays which can constitute a health hazard unless such tubes are adequately shielded. The need for this precaution should be considered in equipment design. Relatively simple shielding should prove adequate.

AVERAGE PLATE CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.

PRINTED IN U.S.A.

DESCRIPTION AND RATING

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

The 1K3 is a filamentary diode designed for use in television receivers as the high-voltage rectifier to supply power to the anode of the television picture tube. It is primarily intended for use in flyback types of power supplies. The 1K3 is a direct replacement for the 1J3.

GENERAL

ELECTRICAL

Cathode—Coated Filament
Filament Characteristics and Ratings

Filament Voltage, AC or DC*	1.25 ± 0.2	Volts
Filament Current†	0.2	Amperes
Direct Interelectrode Capacitances, approximate‡		
Plate to Filament (p to f)	1.6	pf

MECHANICAL

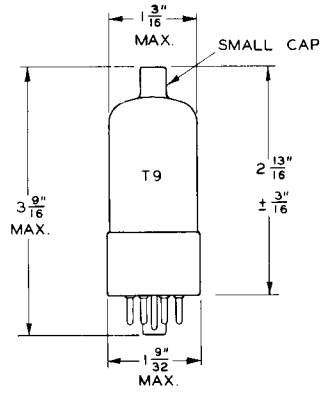
Mounting Position—Any
Envelope—T-9, Glass
Base—B6-8, Intermediate Shell Octal 6-Pin
or B6-60, Short Intermediate Shell Octal 6-Pin
Top Cap—C1-34, Small

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE§—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage		
DC Component	22000	Volts
Total DC and Peak	26000	Volts
Steady-State Peak Plate Current	50	Milliamperes
DC Output Current	0.5	Milliamperes

PHYSICAL DIMENSIONS



EIA 9-53

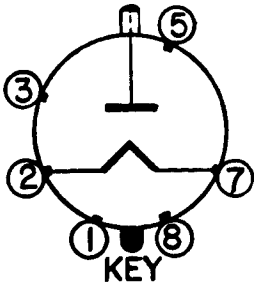
TERMINAL CONNECTIONS‡

Pin 1—Internal Connection
Pin 2—Filament
Pin 3—Internal Connection
§Pin 4—No Connection
Pin 5—Internal Connection
§Pin 6—No Connection
Pin 7—Filament and Internal Shield
Pin 8—Internal Connection
Cap—Plate

‡ Socket terminals 1, 3, 4, 5, 6, and 8 may be connected to terminal 7 or to a corona shield which connects to terminal 7. Terminals 4 and 6 may be used as tie points for components at or near filament potential.

§ Pins 4 and 6 omitted on Base Numbers B6-8 and B6-60.

BASING DIAGRAM



EIA 3C

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate Ib = 7.0 Milliamperes DC. . . . . 225 Volts

* The equipment designer should design the equipment so that filament voltage is centered at the specified bogey value, with filament supply variations restricted to maintain filament voltage within the specified tolerance.

† Filament current of a bogey tube at Ef = 1.25 volts.

‡ Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

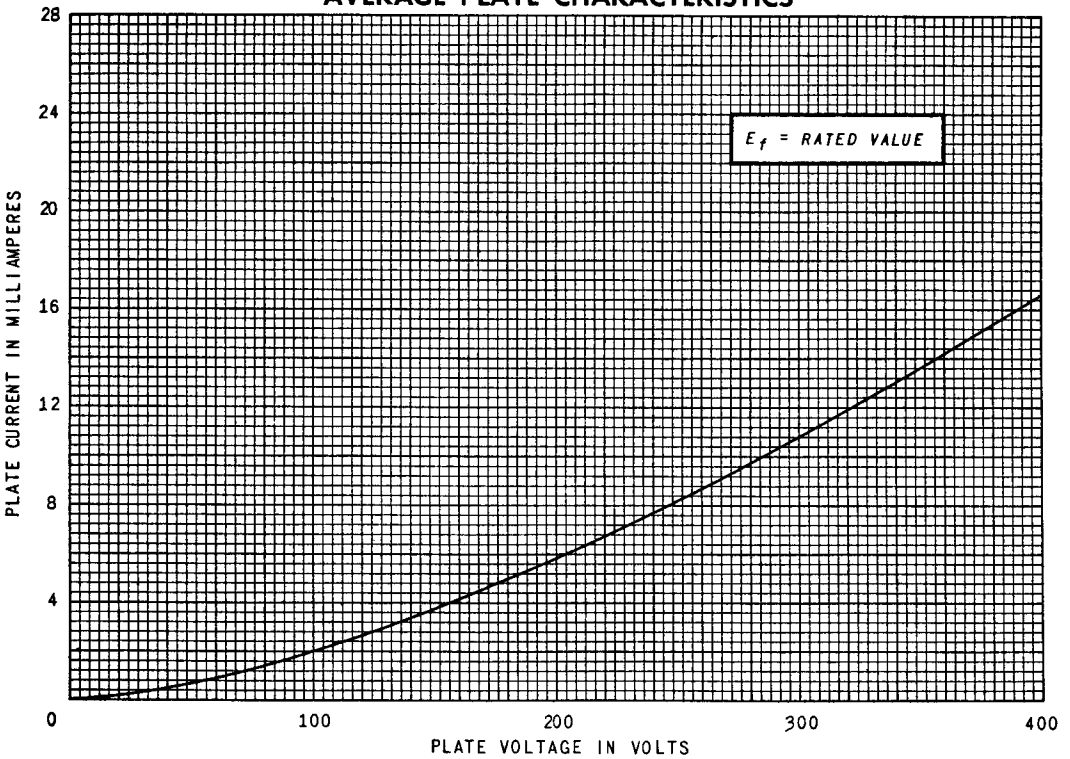
Note: The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce soft x-rays which can constitute a health hazard unless such tubes are adequately shielded. The need for this precaution should be considered in equipment design. Relatively simple shielding should prove adequate.

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE PLATE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Diode

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

1K3-A

■ MONOCHROME TYPE ■ 22000 VOLTS DC ■ 0.5 MILLIAMPERES DC ■ X-RADIATION RATING

The 1K3-A is a filamentary diode designed for use in television receivers as the high-voltage rectifier to supply power to the anode of the television picture tube. It is primarily intended for use in flyback types of power supplies.

Features of the 1K3-A include built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Filament

Filament Characteristics and Ratings

Filament Voltage, AC or DC*. .	1.25±0.2	Volts
Filament Current‡	0.2	Amperes

Direct Interelectrode Capacitances, approximate§

Plate to All: p to (f + i.s.). .	1.6	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - B6-8, Intermediate Shell Octal 6-Pin or
B8-6, Intermediate Shell Octal 8-Pin or
B6-120, Short Medium-Shell Octal 6-Pin or
B8-118, Short Medium-Shell Octal 8-Pin or
B6-253, Ultra-Short Small-Wafer Octal 6-Pin or
B8-251, Ultra-Short Small-Wafer Octal 8-Pin
Top Cap - C1-49, Small
Outline Drawing

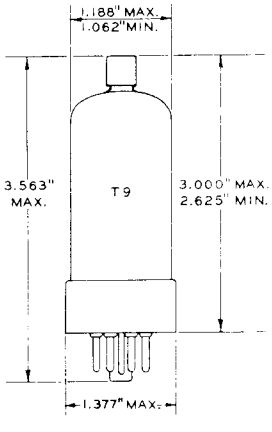
Maximum Diameter.	1.377	Inches
Maximum Bulb Diameter	1.188	Inches
Maximum Over-all Length	3.563	Inches
Maximum Seated Height	3.000	Inches
Minimum Seated Height	2.625	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE• —DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Plate Voltage		
DC Component (Absolute-Maximum Value).	22000	Volts
Total DC and Peak (Absolute-Maximum Value)	26000	Volts
Steady-State Peak Plate Current.	50	Milliamperes
DC Output Current	0.5	Milliamperes
Filament Voltage, AC or DC (Absolute-Maximum Value)¢	1.45	Volts
Filament Voltage, AC or DC (Absolute-Minimum Value)	1.05	Volts

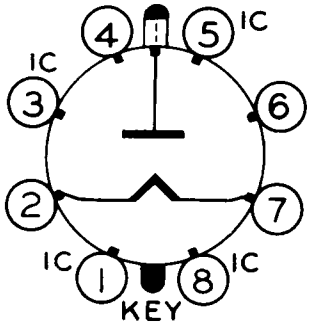
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS△

Pin 1 - Internal Connection - Do Not Use
Pin 2 - Filament
Pin 3 - Internal Connection - Do Not Use
△Pin 4 - No Connection
Pin 5 - Internal Connection - Do Not Use
△Pin 6 - No Connection
Pin 7 - Filament and Internal Shield
Pin 8 - Internal Connection - Do Not Use
Cap - Plate

BASING DIAGRAM



EIA 3C

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes DC	225	Volts

X-RADIATION RATING*

X-radiation, maximum	0.5	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on data obtained with the use of the Victoreen 440 RF survey meter with a 3 3/8 inch aperture. X-radiation is measured with the face of the meter at a distance of 4 3/4 inches from the external surface of the tube. This rating information is not necessarily applicable when a different radiation measuring instrument or aperture is used.

Operation of the 1K3-A outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

WARNING

X-RADIATION

Operation of the 1K3-A outside of the Absolute-Maximum Ratings indicated may produce soft X-rays above 0.5 milliroentgens per hour which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide required shielding.

Precautions must be exercised during the servicing of equipment employing the 1K3-A to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 1K3-A is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 1K3-A in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that filament voltage is centered at the specified bogey value, with filament supply variations restricted to maintain filament voltage within the specified tolerance.

‡ Filament current of a bogey tube at Ef = 1.25 volts.

§ Without external shield.

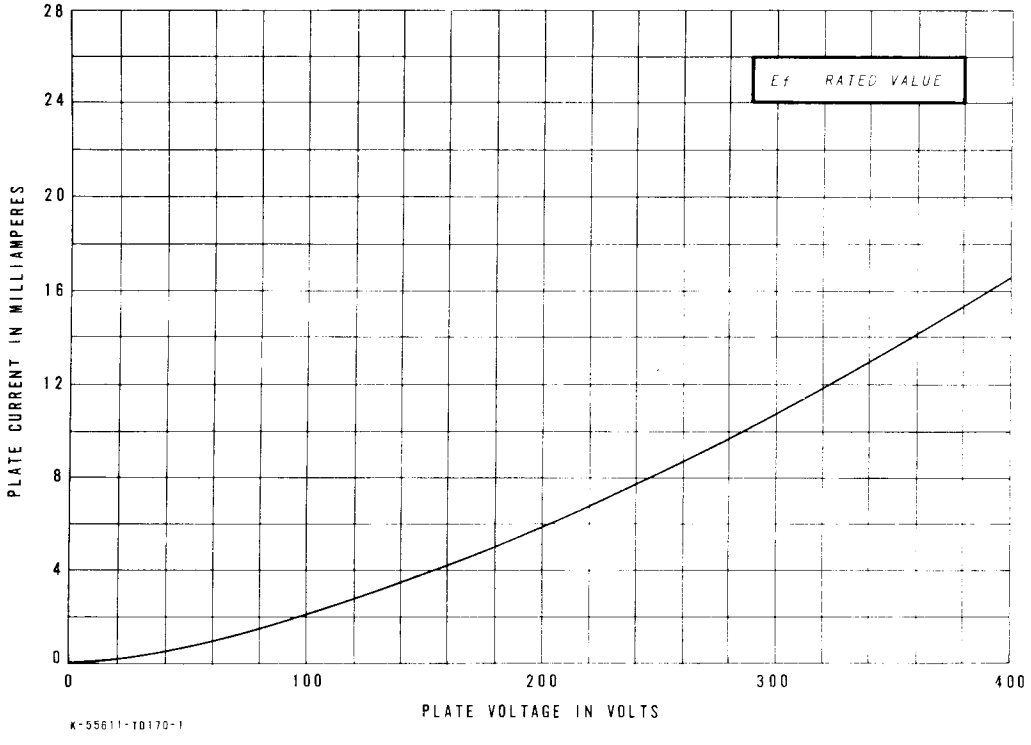
Δ Pins 4 and 6 are omitted on Bases B6-120 and B6-253. Socket terminals 4 and 6 may be used as tie points for components at or near filament potential.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¢ CAUTION - Operation of this tube for an extended period of time with the filament voltage above the absolute maximum rated value of 1.45 volts may result in the production of X-radiation in excess of the maximum rated limit of 0.5 mR/hr.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



RMA RELEASE NO. 341
July 7, 1943

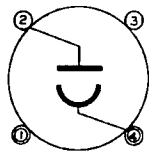
TECHNICAL INFORMATION

sponsor: General Electric Co.

1P23

Gas-Filled Phototube
Number of Electrodes - 2

2K



GENERAL CHARACTERISTICS

Electrical

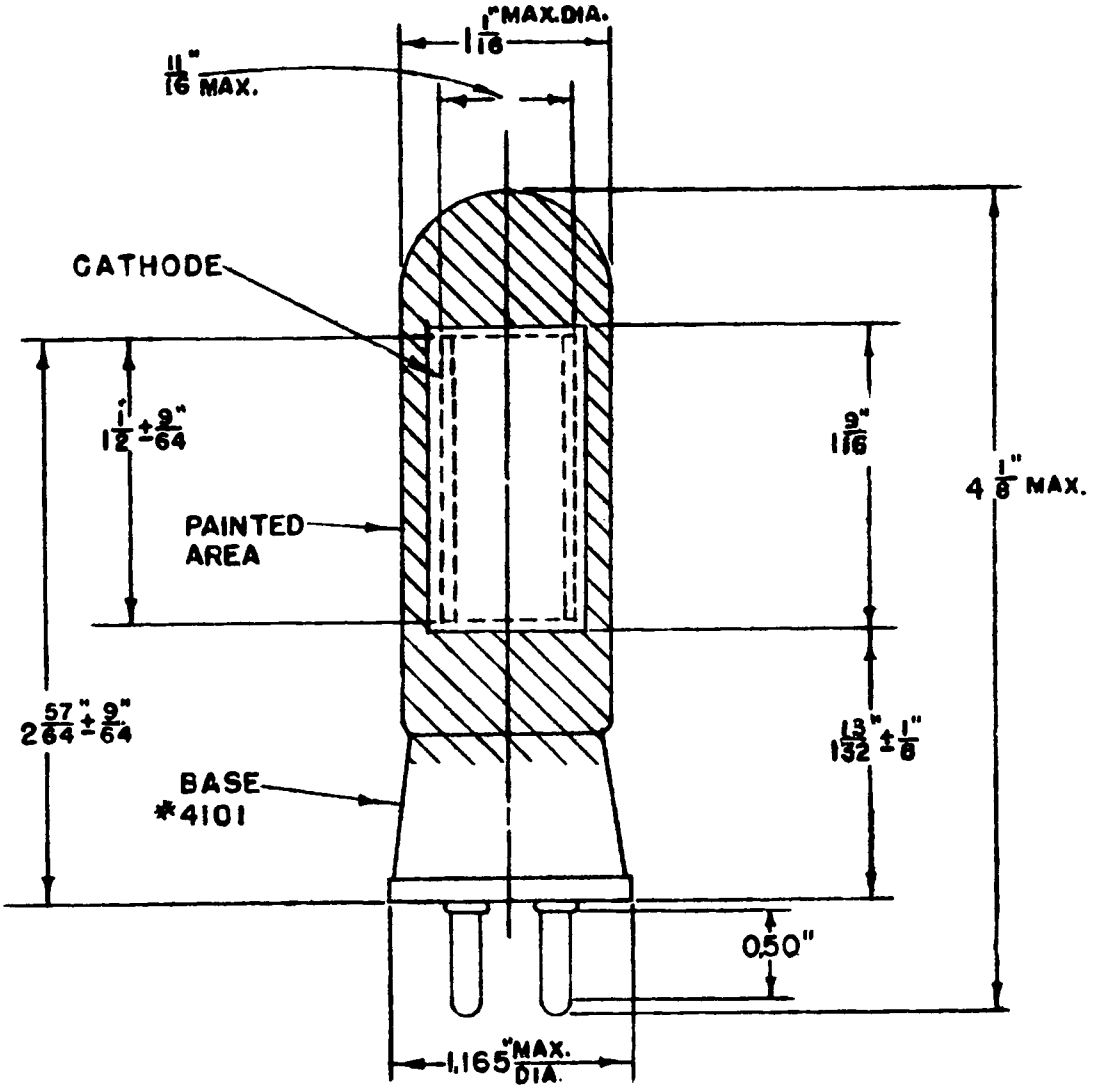
Cathode Photo-Surface	S-1
Luminous Sensitivity at 90 Volts, 0 Cycles	50 Microamperes Per Lumen
Relative Luminous Sensitivity at 90 Volts, 10,000 Cycles	70 Per Cent
Interelectrode Capacitance	2.5 uuf
Leakage Resistance, Minimum	900 Megohms
Wavelength of Maximum Response	7500 A
Sensitivity at Maximum Response	60 Microamperes Per Microwatt

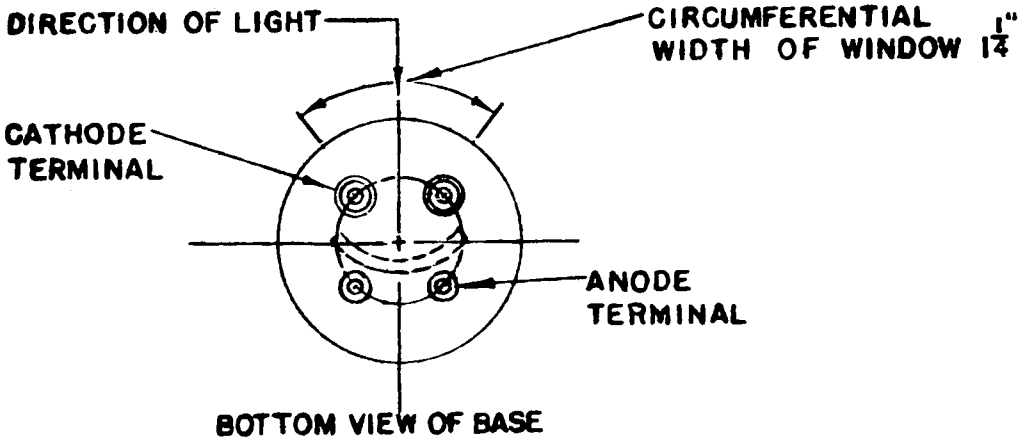
Mechanical

Window Dimensions	1 9/16 Inches X 11/16 Inches
Seated Height to Center of Useful Cathode Area	2 3/16 Inches
Maximum Overall Height	4 1/8 Inches
Maximum Seated Height	3 9/16 Inches
Maximum Diameter	1.165 Inches
Base	M8-074
Basing	2K
Mounting Position	Any
Net Weight Approximately	1 Ounce

MAXIMUM RATINGS

Anode Voltage (D-C or Peak A-C)	100 Volts
Anode Current Density	102 Microamperes Per Sq In.
Ambient Temperature	100 C





OUTLINE

IP23 PHOTOTUBE

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release No. 429

August 20, 1945

sponsor:
General Electric Co.

TYPE 1P24

Vacuum phototube; cartridge type.

GENERAL CHARACTERISTICS

Number of Electrodes	2	
Electrical		
Cathode Photosurface	S-4	
Luminous Sensitivity at 135 Volts, 0 cycles - minimum	40	Microamperes per Lumen
Maximum Gas Amplification	1.1	
Interelectrode Capacitances	0.5	Micromicrofarad
Maximum Dark Current at 250 Volts	0.05	Microamperes
Wavelength of Maximum Response	4500	
Sensitivity at Maximum Response	0.040	Microamperes per Microwatt
Mechanical		
Illuminated Area of Cathode (Light at a 60° angle with tube axis)	0.25	Square Inch
Maximum Overall Height	1.054	Inches
Maximum Diameter	0.885	Inch
Mounting Position	Any	
Net Weight, approximate	2	Ounces

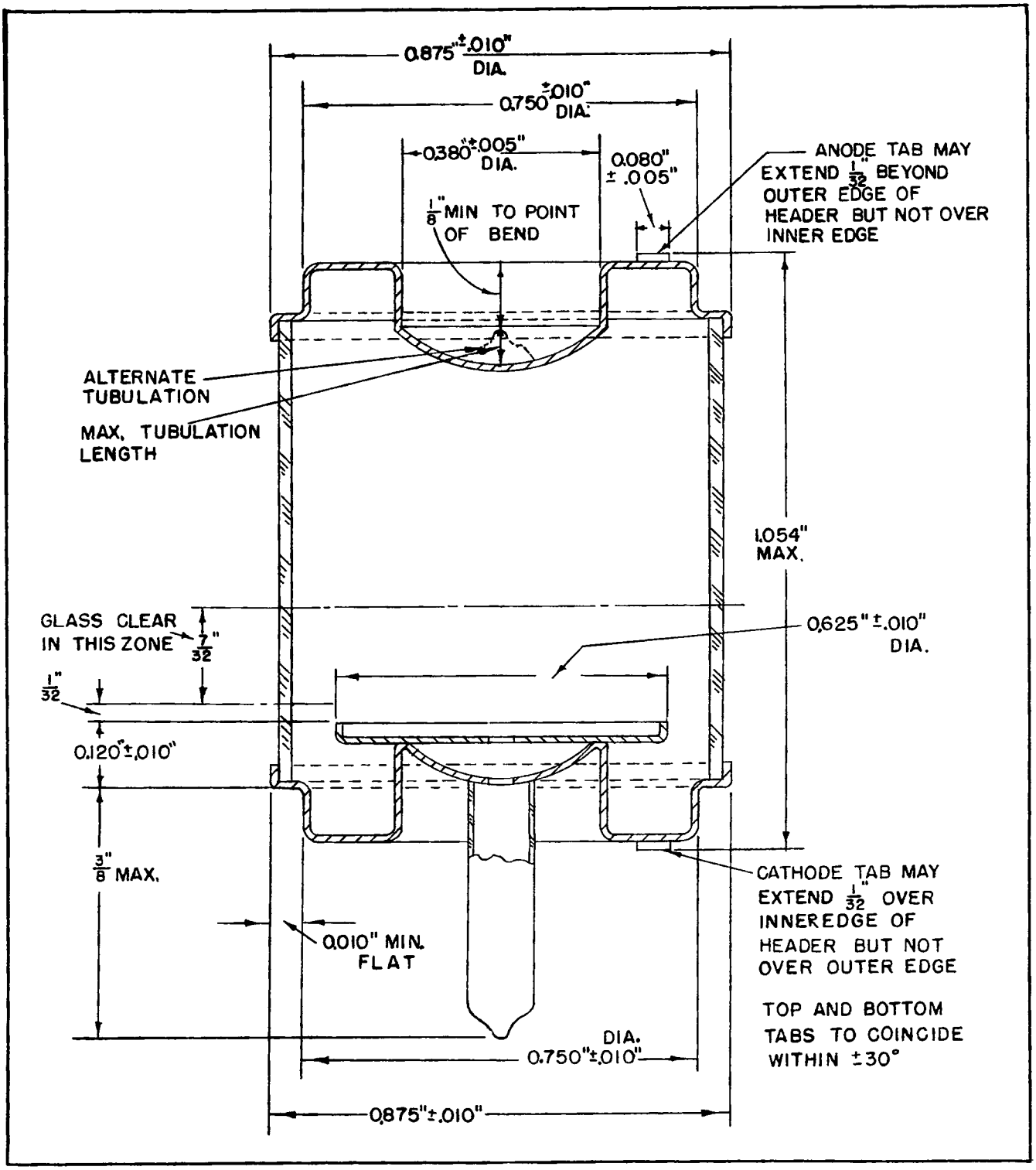
MAXIMUM RATINGS

Anode Voltage (D-c or Peak A-c)	500	Volts
Cathode Current Density	100	Microamperes per Square Inch
Ambient Temperature	50	C

Ratings are on an absolute maximum basis.

TYPE 1P24

Vacuum phototube; cartridge type.



Release No. 370

March 1, 1944
sponsored by
General Electric Co.

RMA
TYPES 1P26 AND 1P27

Gas filled, two electrode phototubes with high sensitivity in the red and infra-red.

GENERAL CHARACTERISTICS

Electrical	1P27	1P26	
Spectral Response	S-1	S-1	
Luminous Sensitivity at 90 V, 0 cycles	150	90	Microamp per Lumen
Maximum Gas Amplification	10.5	8.0	
Interelectrode Capacitances	3.0	3.0	uuf
Maximum Dark Current at 90 Volts	0.1	0.1	Microamp
Wavelength of Maximum Response	8000	7500	A
Sensitivity at Maximum Response	.0145	.0105	Microamp per Microwatt

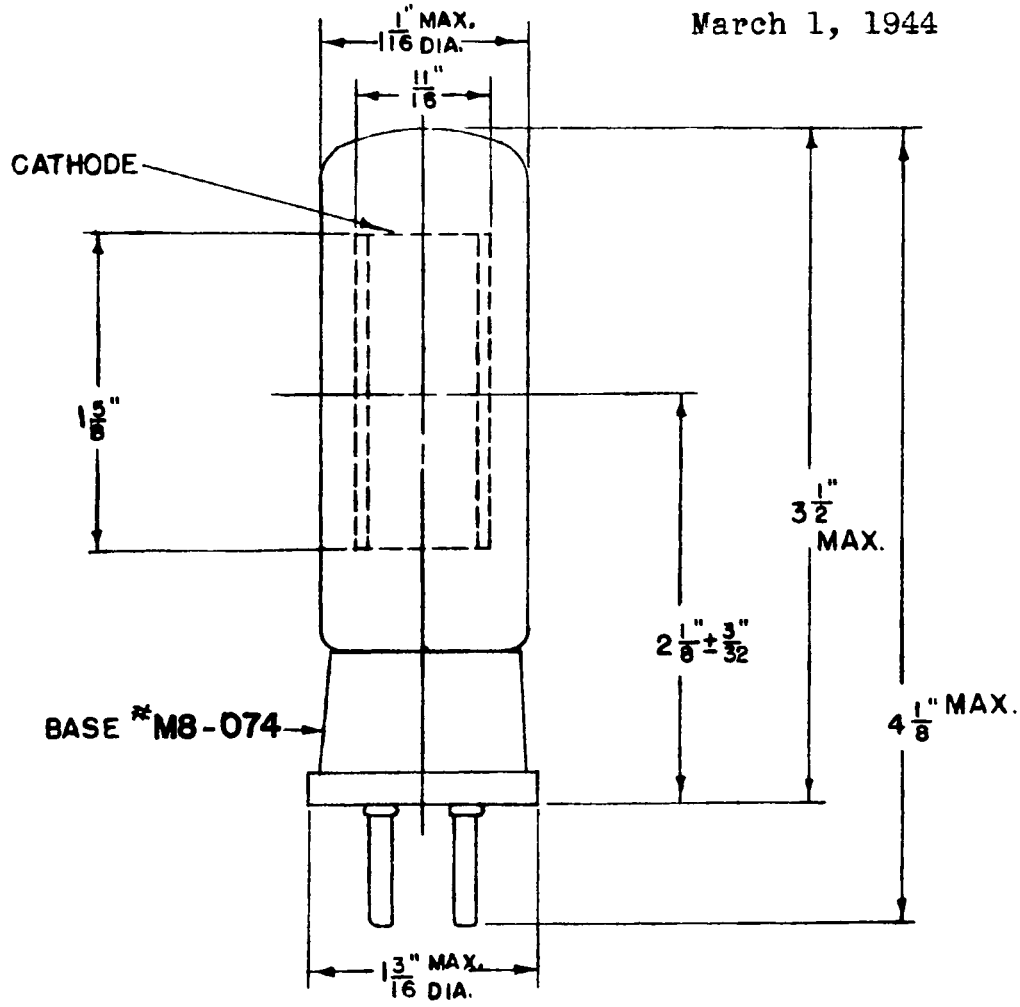
Mechanical		
Window Dimensions	11/16 Inches x 1-5/8 Inches	
Seated Height to Center of Useful Cathode Area	2-1/8 ±3/32	Inches
Maximum Overall Height	4-1/8	Inches
Maximum Seated Height	3-1/2	Inches
Maximum Diameter	1-3/16	Inches
Base	M8-074	
Mounting Position	Any	
Net Weight, Approximately	1/2	Ounce

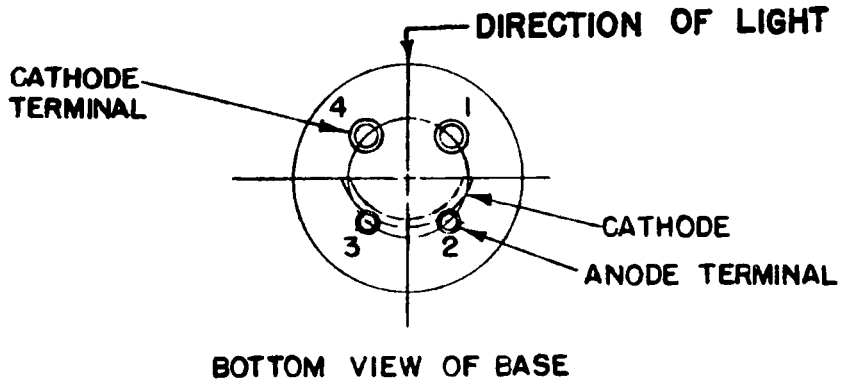
MAXIMUM RATINGS

Anode Voltage, D-c of Peak A-c	100	Volts
Cathode Current Density	102	Microamps per Sq. In.
Ambient Temperature	100°	C

Release No. 370

March 1, 1944





BOTTOM VIEW OF BASE

OUTLINE

PHOTOTUBE

IP26/PJ-23 & IP27

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release No. 430

August 20, 1945

sponsor:
General Electric Co.

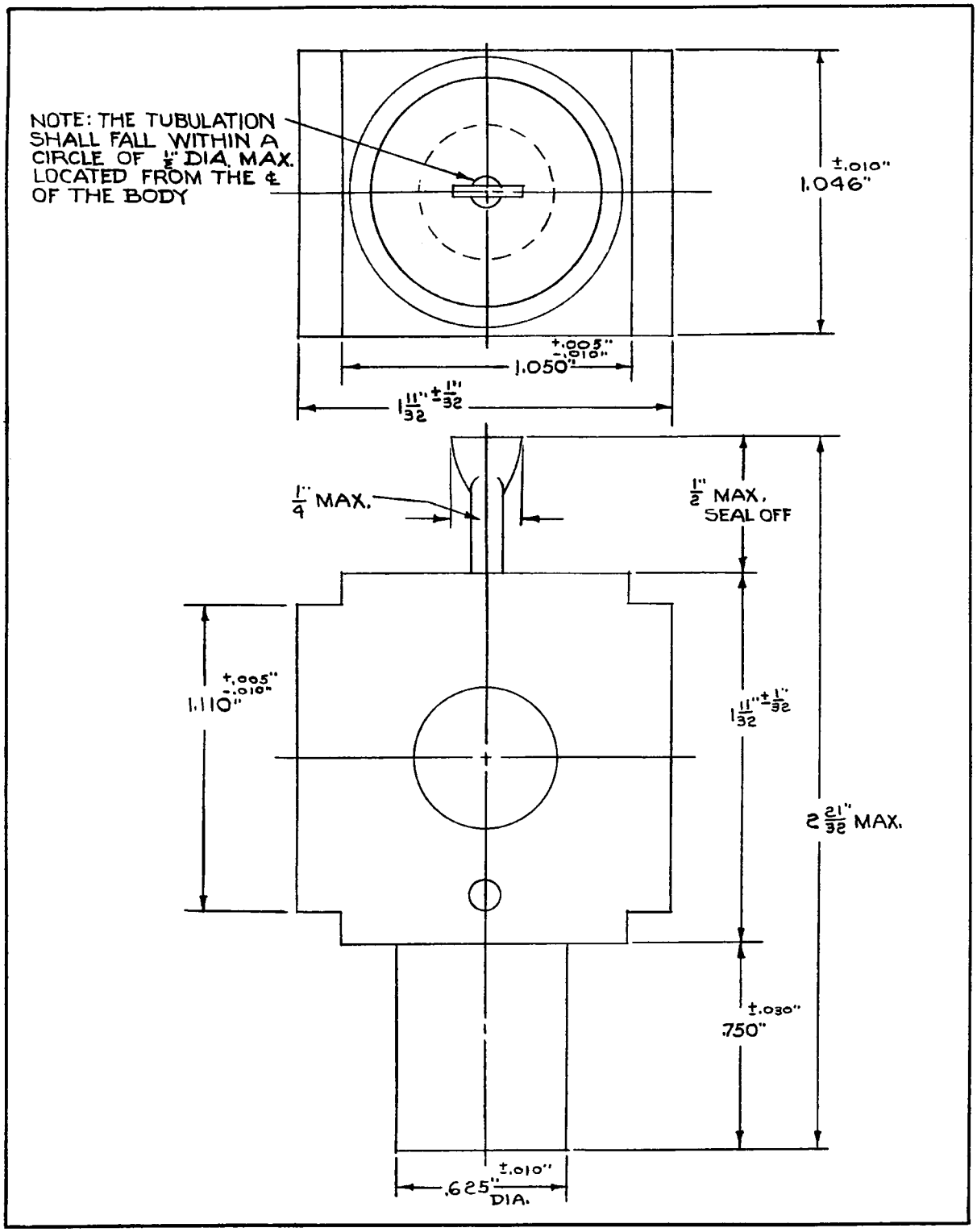
TYPE 1Q26

Beacon Reference Cavity

Resonant Frequency	9280 Megacycles
Loaded Q	1250
Insertion Loss	6.5 Decibels
Ambient Temperature Range	-50 C to +100C
Net Weight, Approximate	7 Ounces

TYPE 1Q26

Beacon Reference Cavity



DESCRIPTION AND RATING

REFERENCE CAVITY GL-1Q26-A

The GL-1Q26-A is a fixed-frequency, transmission-type, vacuum-sealed reference cavity for use as a frequency-determining reference at 9280 megacycles.

Particular advantages of this cavity are its ability to operate over a wide temperature range, from -40 to +100 C, with a change of only 0.3 megacycle in resonant frequency and the fact that it can be used in a pressurized system.

TECHNICAL INFORMATION

GENERAL

Electrical

Resonant Frequency Cavity mounted between a source and a load whose voltage-standing-wave-ratio = 1.05 maximum	9280	Megacycles
Change in Resonant Frequency		
With Vibration = 10 g	±0.1 Max	Megacycles
With Pressure = 100 millimeters of mercury to 45 pounds per square inch absolute	±0.1 Max	Megacycles
With Temperature = -40 C to +100 C	±0.3 Max	Megacycles
With Creep*	±0.3 Max	Megacycles
Loaded Q Cavity mounted between a source and a load whose voltage-standing-wave-ratio = 1.05 maximum	1000 - 1500	
Insertion Loss at Resonant Frequency	5 - 8	Decibels

Mechanical

Ambient Temperature Range	-55 to +100	C
Net Weight, approximate	7	Ounces
Mounting Position - Any		

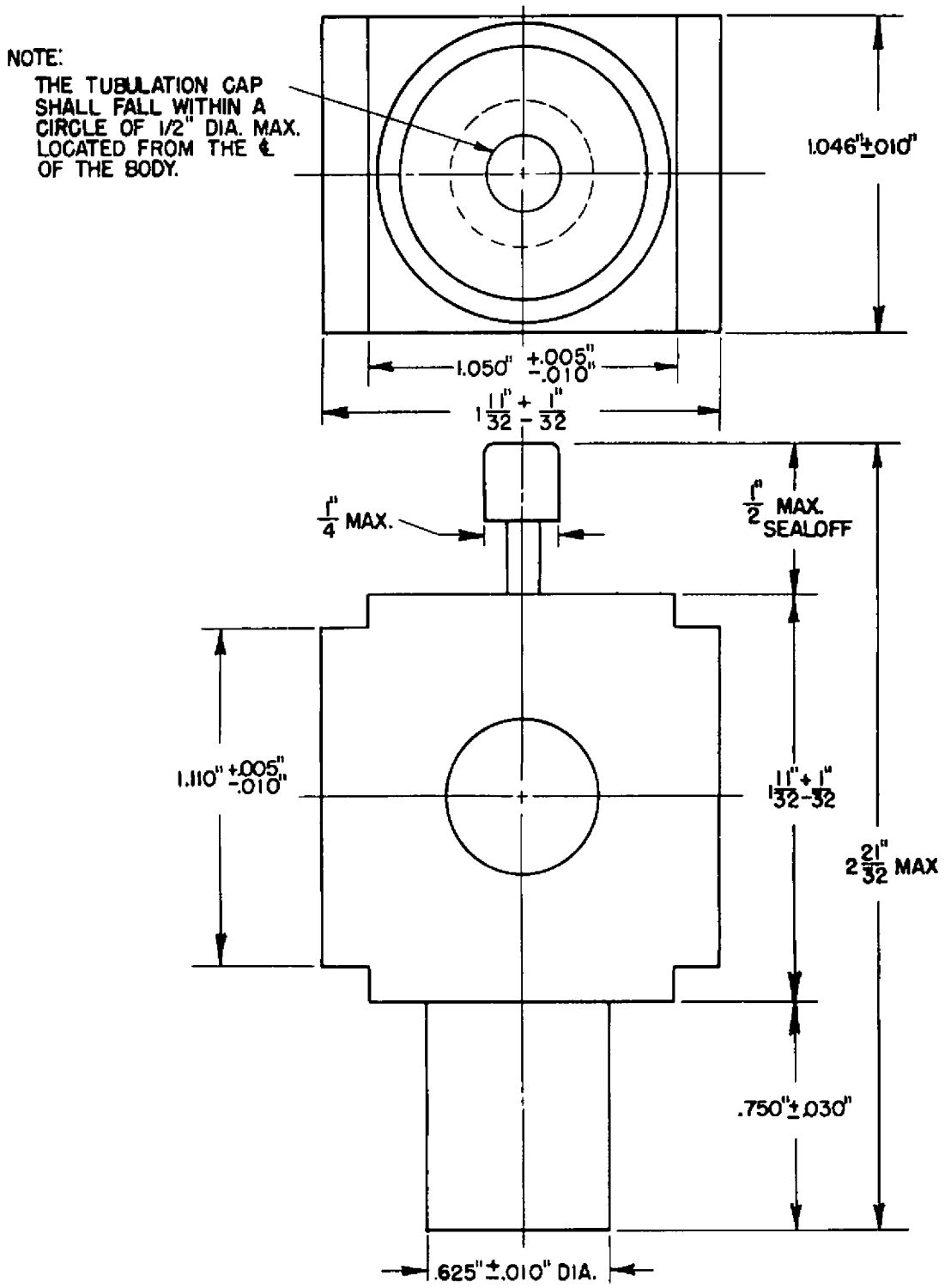
MAXIMUM RATINGS

Incident Peak Power, maximum	5	Kilowatts

* The small hysteresis change in length of a metal due to its being taken through heating and cooling cycles.

GENERAL ELECTRIC

from RTMA release #1076, April 8, 1952



N24560AZ

February 15, 1952

Outline
GL-1Q26-A

GENERAL ELECTRIC

ELECTRONICS DIVISION, TUBE DEPARTMENT

SCHENECTADY, NEW YORK

Electronic TUBE

1R5

Description and Rating

HEPTODE

FOR PENTAGRID CONVERTER APPLICATIONS

The 1R5 is a miniature pentagrid-converter designed for use as a combined mixer and oscillator in superheterodyne circuits. Because of its small size and high operating efficiency, the 1R5 is especially adapted for compact, battery-operated equipment.

GENERAL

Cathode - Coated Filament

Filament Voltage, D-C	1.4	Volts
Filament Current	0.05	Ampere

Envelope - T-5½, Glass
Base - E7-1, Miniature Button 7-Pin
Mounting Position - Any

Direct Interelectrode Capacitances

	With Shield *	Without Shield	
Grid-Number 3 to All	7.0	7.0	μμf
Plate to All	12	7.5	μμf
Grid-Number 1 to All	3.8	3.8	μμf
Grid-Number 3 to Plate, maximum	0.3	0.4	μμf
Grid-Number 3 to Grid-Number 1, maximum	0.2	0.2	μμf
Grid-Number 1 to Plate, maximum	0.1	0.1	μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES

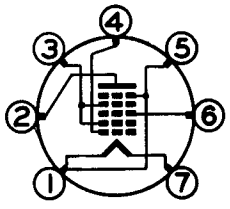
Plate Voltage	90	Volts
Screen-Supply Voltage	90	Volts
Screen Voltage	67.5	Volts
Positive D-C Grid-Number 3 Voltage	0	Volts
Zero-Signal Cathode Current	5.5	Milliamperes

CHARACTERISTICS AND TYPICAL OPERATION

CONVERTER SERVICE +

Plate Voltage	45	67.5	90	Volts
Screen Voltage	45	67.5	67.5	Volts
Grid-Number 3 Voltage	0	0	0	Volts
Grid-Number 1 Voltage, RMS	15	25	25	Volts
Grid-Number 1 Resistance	0.1	0.1	0.1	Megohm
Plate Resistance, approximate	0.5	0.4	0.4	Megohm
Conversion Transconductance	210	280	280	Micromhos
Plate Current	0.7	1.4	1.5	Milliamperes
Screen Current	2.1	3.5	3.5	Milliamperes
Grid-Number 1 Current	0.15	0.25	0.25	Milliampere
Cathode Current	3.0	5.2	5.3	Milliamperes
Grid-Number 3 Voltage, approximate, G_c = 10 Micromhos	-7.0	-13	-13	Volts
Grid-Number 3 Voltage, approximate, G_c = 100 Micromhos	-2.2	-4.9	-5.0	Volts

BASING DIAGRAM

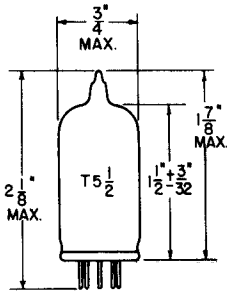


RTMA 7AT
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 - Negative Filament and Grid Number 5
Pin 2 - Plate
Pin 3 - Grids Number 2 and 4 (Screen)
Pin 4 - Grid Number 1 (Oscillator Grid)
Pin 5 - Negative Filament and Grid Number 5
Pin 6 - Grid Number 3 (Mixer Grid)
Pin 7 - Positive Filament

PHYSICAL DIMENSIONS



RTMA 5-2

GENERAL ELECTRIC

Supersedes ET-T229A dated 6-50

CHARACTERISTICS AND TYPICAL OPERATION

OSCILLATOR CHARACTERISTICS (NOT OSCILLATING)

Plate Voltage	67.5	Volts
Screen - Connected to Plate		
Grid-Number 3 Voltage	0	Volts
Grid-Number 1 Voltage	0	Volts
Amplification Factor ‡	6.5	
Transconductance ‡	1400	Micromhos
Cathode Current	9.0	Milliamperes
Grid-Number 1 Voltage, approximate, I_b = 10 Microamperes	-17	Volts

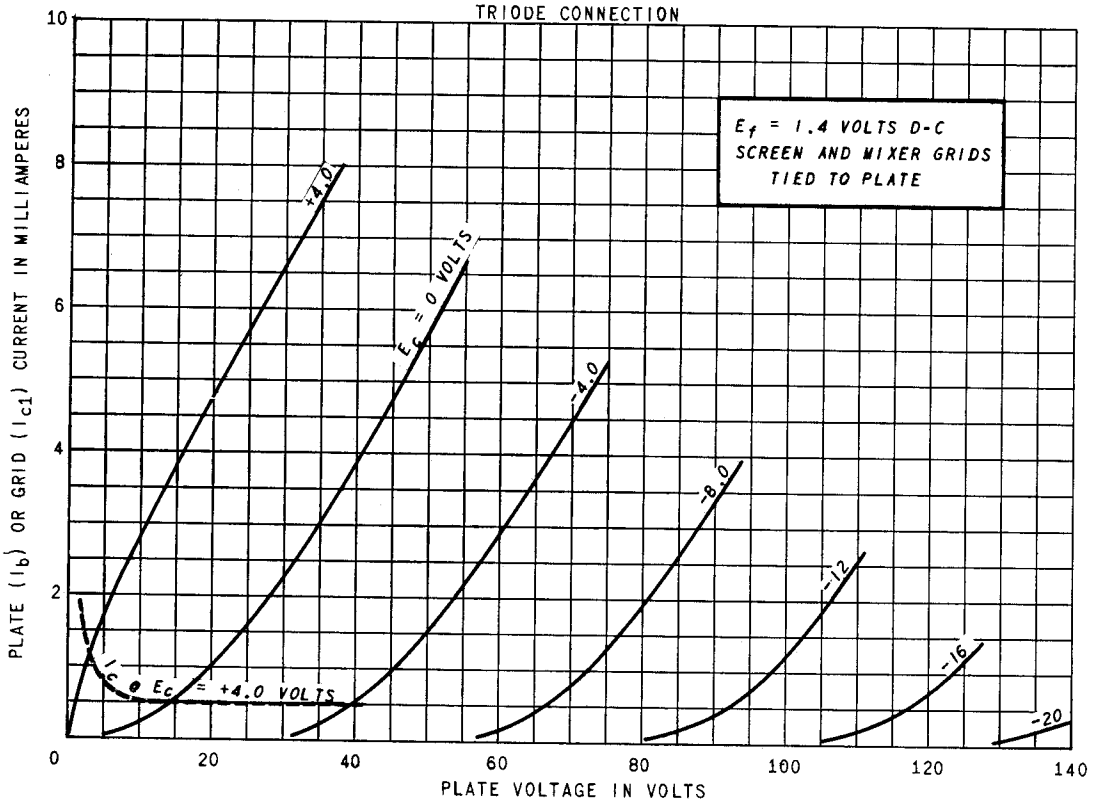
* *With external shield (RTMA 316) connected to pin 1.*

† *Characteristics shown are obtained in the standard RTMA conversion conductance test set which uses separate excitation. The characteristics under these conditions correspond very closely with those obtained in a self-excited oscillatory circuit operating with zero bias.*

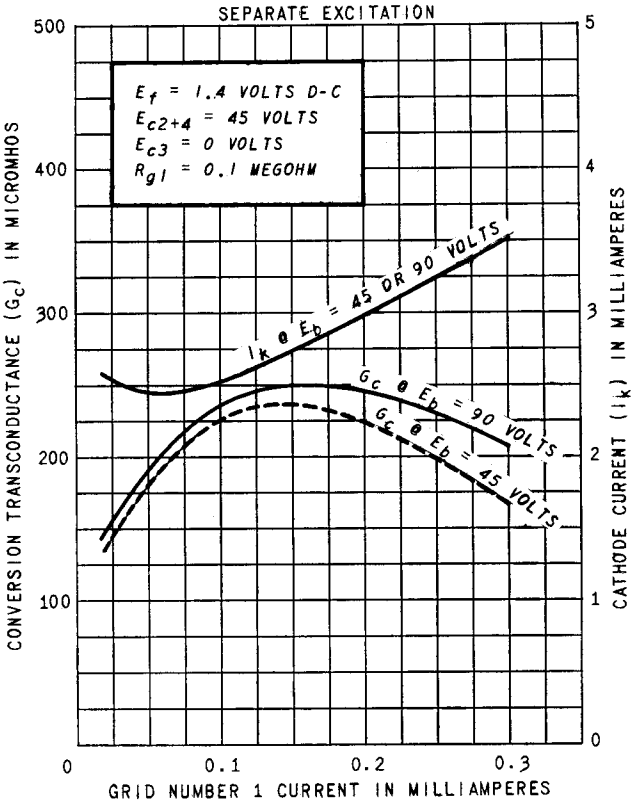
‡ *Between grid number 1 and grids number 2 and 4 connected to plate.*

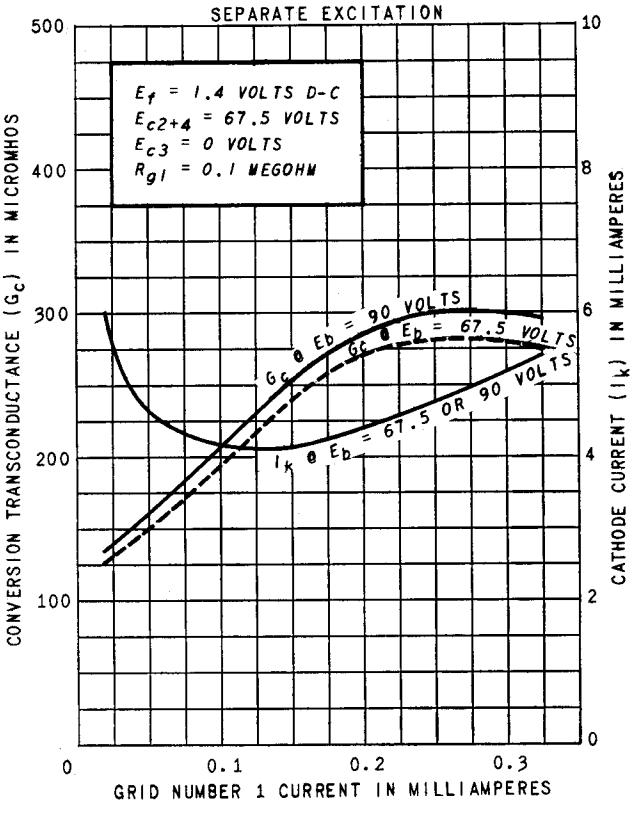
Note: All voltages are referred to the negative terminal of the filament.

AVERAGE PLATE CHARACTERISTICS



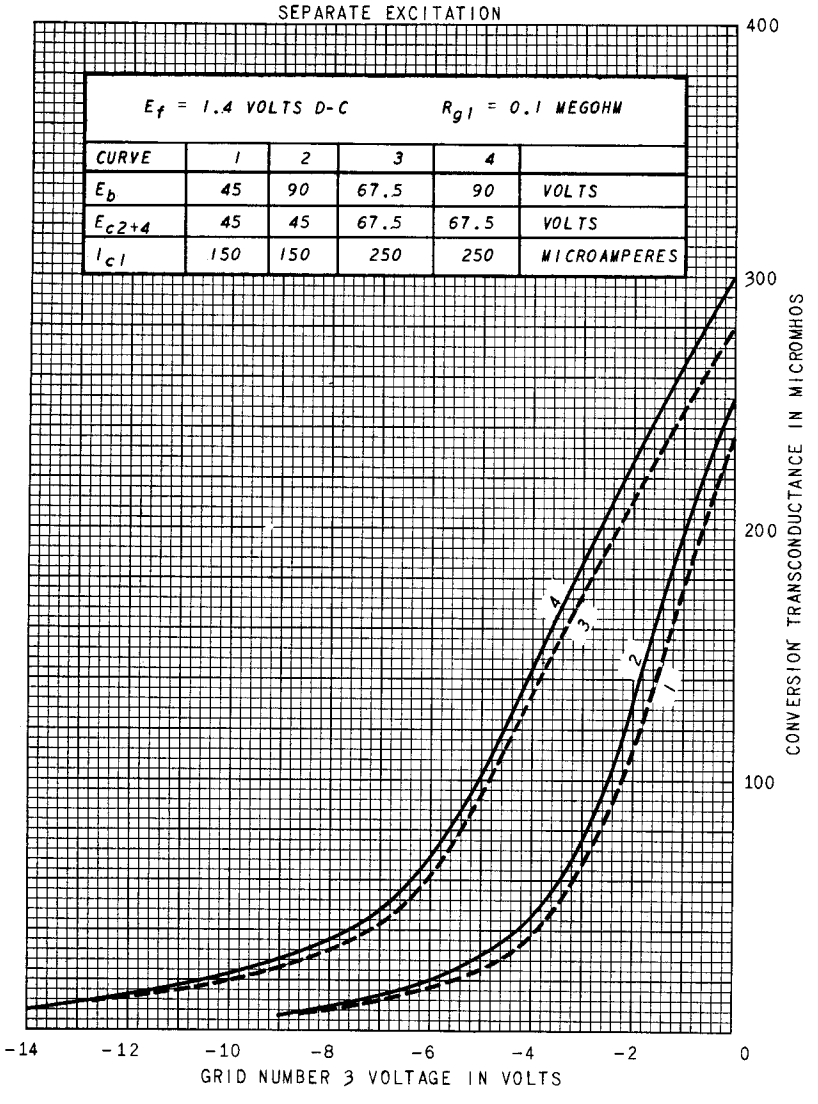
OPERATION CHARACTERISTICS





OPERATION CHARACTERISTICS

SEPARATE EXCITATION



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

Electronic TUBE
KEN-RAD

1S5
Description and Rating

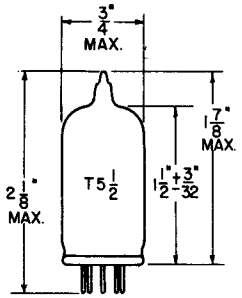
DIODE-PENTODE

GENERAL DESCRIPTION

Principal Application: The 1S5 is a miniature tube containing a diode and a sharp-cutoff pentode. It is designed for use as a combined detector and audio-frequency voltage amplifier in compact battery-operated equipment.

Cathode	Coated Filament
Filament Voltage (D-C)	1.4 Volts
Filament Current	0.05 Ampere
Envelope	T-5½, Glass
Base	E7-1, Miniature Button 7-Pin
Mounting Position	Any
Direct Interelectrode Capacitance: #	
Diode Plate to Grid 1 (Max)	0.1 μμf

PHYSICAL DIMENSIONS

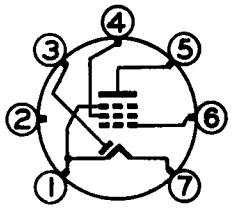


RTMA 5-2

TERMINAL CONNECTIONS

Pin 1 - Negative Filament and Grid Number 3
Pin 2 - No Connection
Pin 3 - Diode Plate *
Pin 4 - Grid Number 2 (Screen)
Pin 5 - Plate
Pin 6 - Grid Number 1
Pin 7 - Positive Filament

BASING DIAGRAM



RTMA 6AU
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES:

Plate Voltage	90	Volts
Screen Voltage	90	Volts
Positive D-C Grid Number 1 Voltage	0	Volts
Negative D-C Grid Number 1 Voltage	-50	Volts
Total Cathode Current	3	Milliamperes
Diode Current for Continuous Operation	0.25	Milliampere

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	67.5	Volts
Screen Voltage	67.5	Volts
Grid Number 1 Voltage	0	Volts
Plate Resistance (Approx)	0.6	Megohm
Transconductance	625	Micromhos
Plate Current	1.6	Milliamperes
Screen Current	0.4	Milliampere
Grid Number 1 Voltage (Approx) for I_b = 10 Microamperes	-5	Volts
Average Diode Current: Measured with 10 Volts D-C Applied	1.5	Milliamperes

 # With or without external shield #316 connected to pin 1

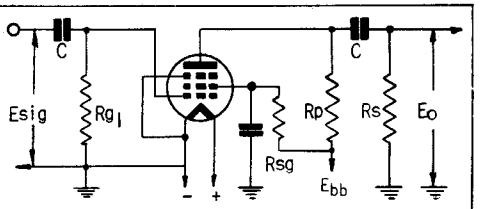
** The diode is located at the negative end of the filament*

GENERAL ELECTRIC

Supersedes ET-T231A dated 6-46

CLASS A RESISTANCE-COUPLED AMPLIFIER

Rp Meg.	Rs Meg.	R_{g1} Meg.	Ebb = 45 Volts				Ebb = 90 Volts				Ebb = 135 Volts			
			Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo
0.24	0.24	10	–	0.5	18	6.4	–	0.8	29	13	–	1.0	38	20
0.24	0.51	10	–	0.5	24	8.0	–	0.9	38	15	–	1.1	40	25
0.24	1.0	10	–	0.6	28	8.4	–	1.0	45	17	–	1.2	55	28
0.51	0.51	10	–	1.1	25	5.9	–	1.9	40	12	–	2.3	52	19
0.51	0.75	10	–	1.2	29	6.5	–	2.0	46	13	–	2.0	61	22
0.51	1.0	10	–	1.4	32	6.6	–	2.2	51	14	–	2.5	65	22
0.75	0.75	10	–	1.9	29	5.1	–	2.9	47	11	–	3.2	61	18
0.75	1.0	10	–	2.0	32	5.2	–	3.0	52	11	–	3.4	67	18
1.0	1.0	10	–	2.7	31	4.3	–	3.9	50	9	–	4.6	66	15

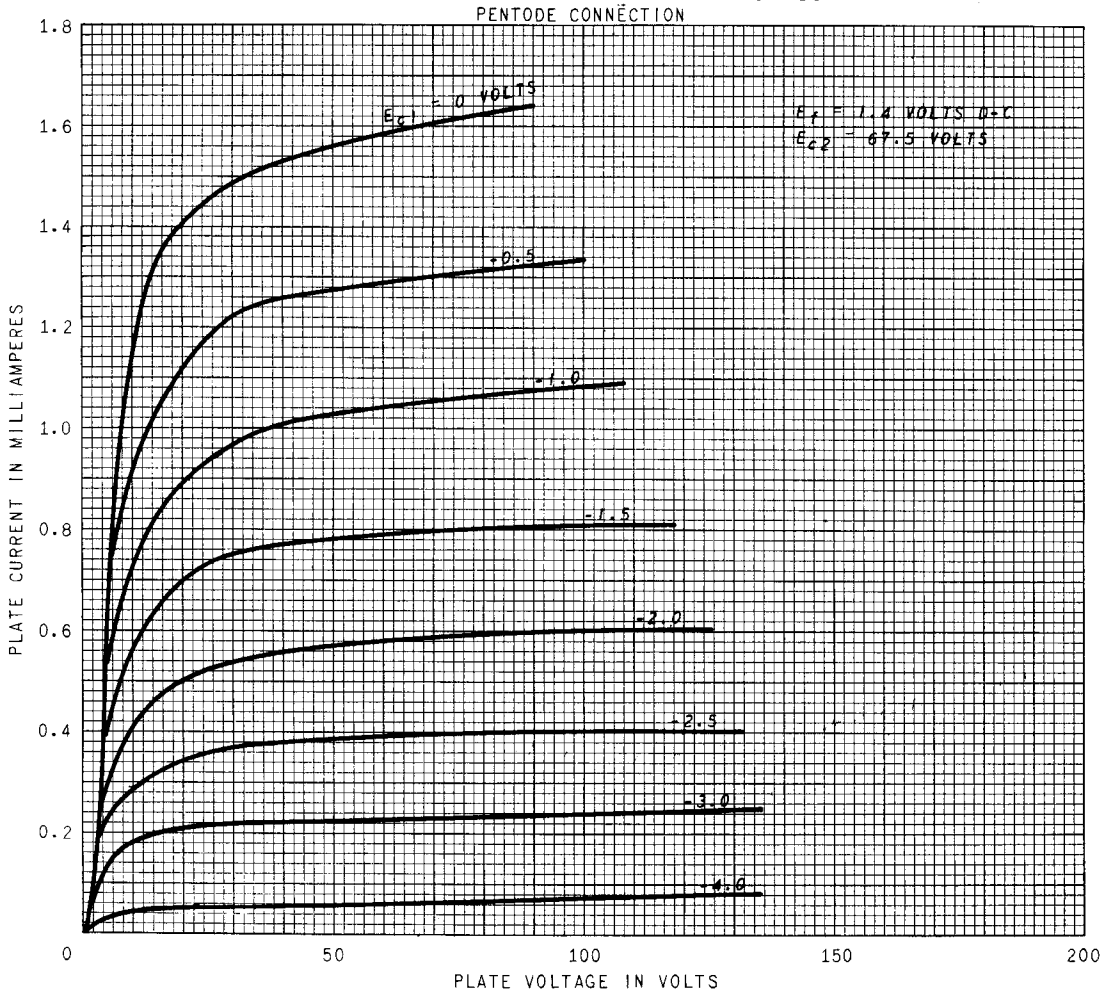


Note: Coupling capacitors (C) should be adjusted to give desired frequency response. Rk and Rsg should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

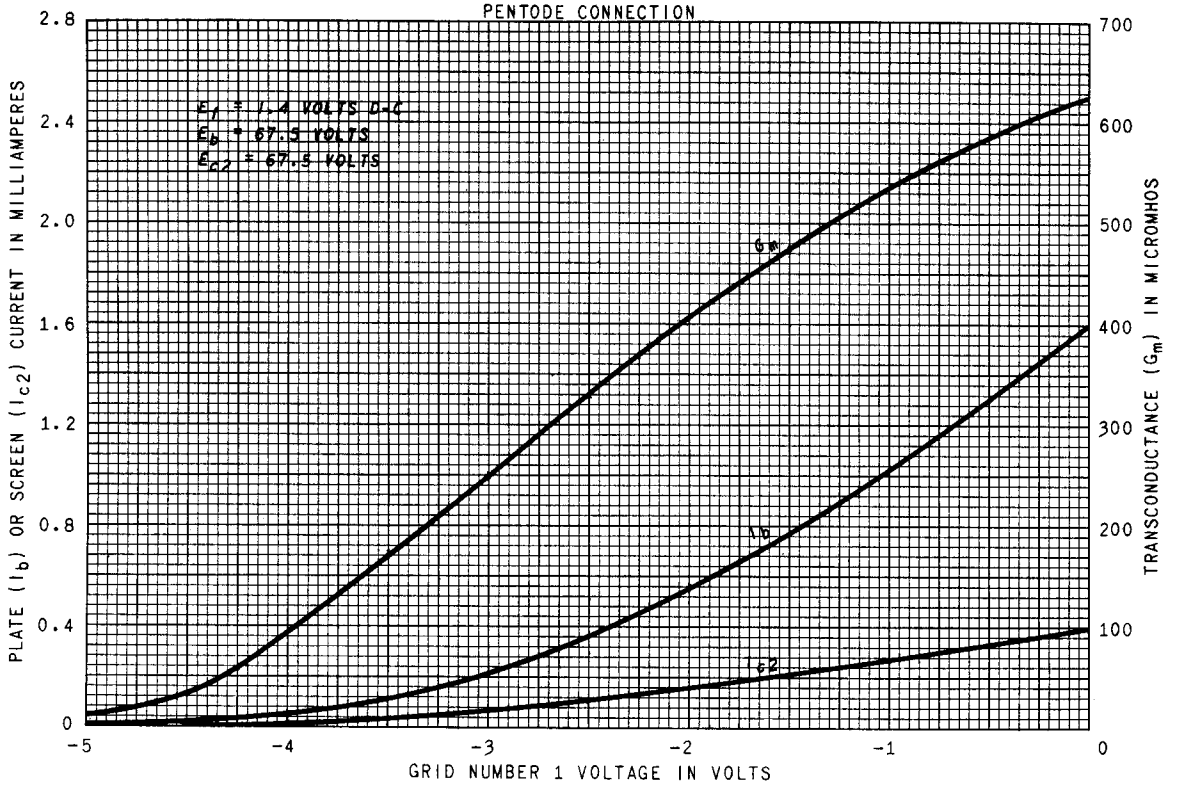
AVERAGE PLATE CHARACTERISTICS

PENTODE CONNECTION



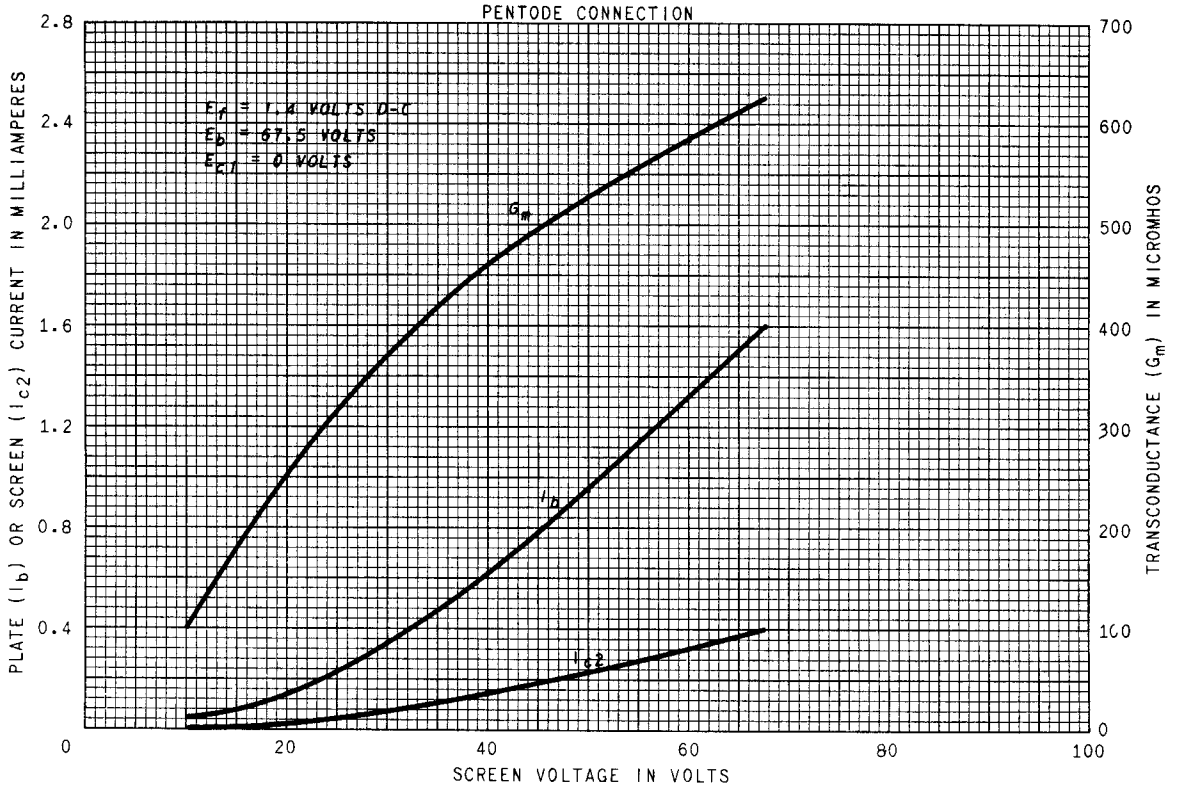
AVERAGE CHARACTERISTICS

PENTODE CONNECTION

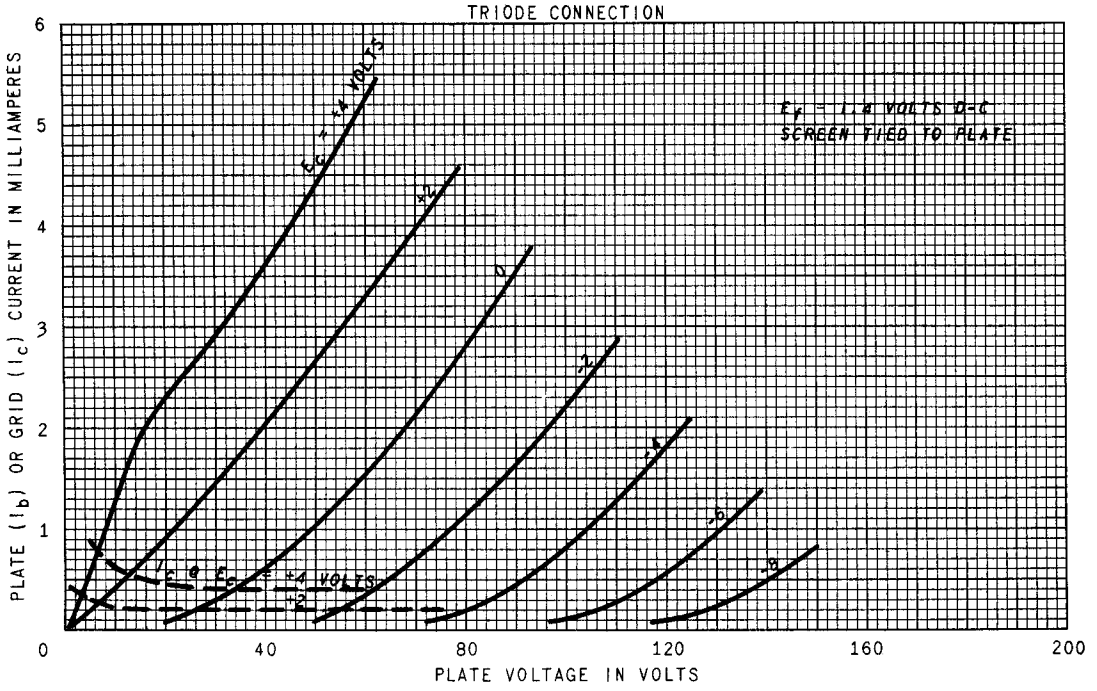


AVERAGE CHARACTERISTICS

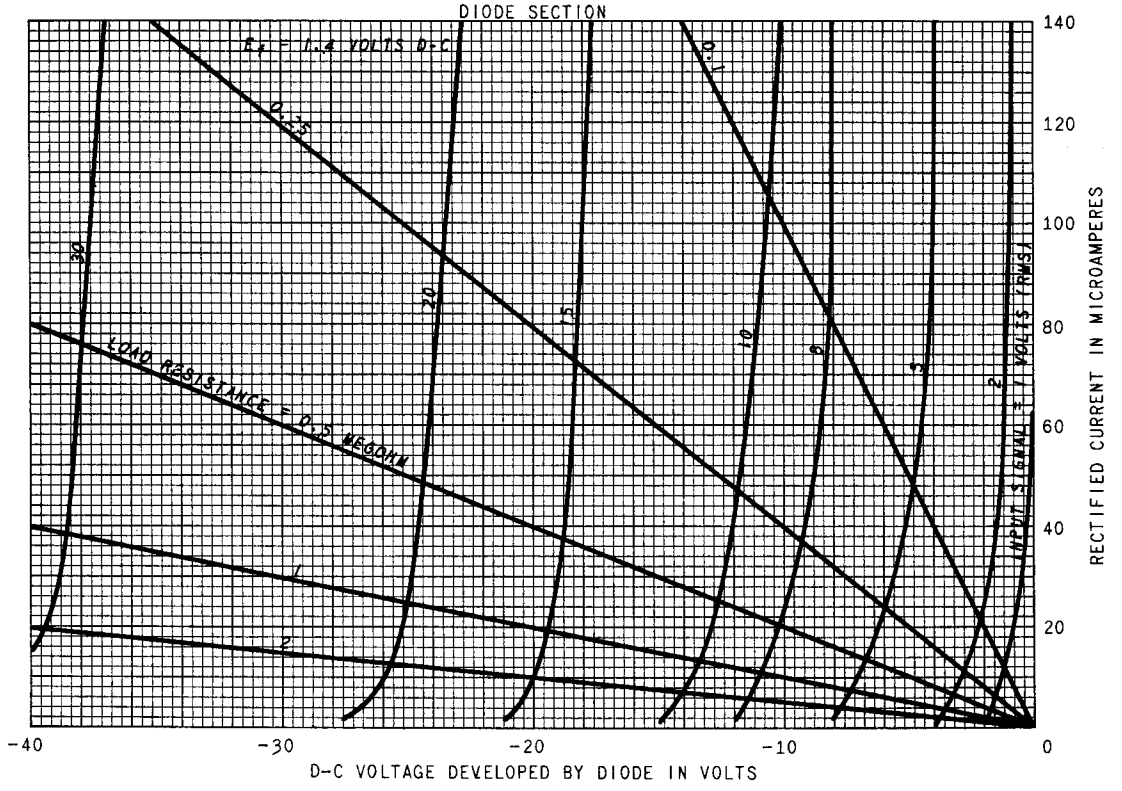
PENTODE CONNECTION



AVERAGE PLATE CHARACTERISTICS



OPERATION CHARACTERISTICS



Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

Electronic TUBE

1T4
Description and Rating
PENTODE

The 1T4 is a miniature remote-cutoff pentode designed for use as a radio-frequency or intermediate-frequency amplifier in compact, battery-operated equipment. Its remote-cutoff characteristic makes it particularly suitable for use in stages to which automatic-volume-control is applied.

GENERAL

Cathode - Coated Filament
Filament Voltage, D-C . . . . . 1.4 Volts
Filament Current . . . . . 0.05 Ampere
Envelope - T-5½, Glass
Base - E7-1, Miniature Button 7-Pin
Mounting Position - Any

Direct Interelectrode Capacitances

	With Shield *	Without Shield	
Grid-Number 1 to Plate, maximum	0.01	0.01	μμf
Input	3.6	3.6	μμf
Output	7.5	7.5	μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	90	Volts
Screen Voltage	90	Volts
Positive D-C Grid-Number 1 Voltage	0	Volts
D-C Cathode Current	5.5	Milliamperes

CHARACTERISTICS AND TYPICAL OPERATION

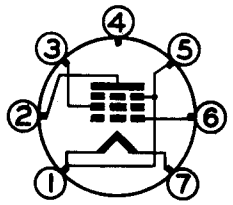
CLASS A_1 AMPLIFIER

Plate Voltage	45	67.5	90	90	Volts
Screen Voltage	45	67.5	45	67.5	Volts
Grid-Number 1 Voltage	0	0	0	0	Volts
Plate Resistance, approximate	0.35	0.25	0.8	0.5	Megohm
Transconductance	700	875	750	900	Micromhos
Plate Current	1.7	3.4	1.8	3.5	Milliamperes
Screen Current	0.7	1.5	0.65	1.4	Milliamperes
Grid-Number 1 Voltage, approximate, G_m = 10 Micromhos	-10	-16	-10	-16	Volts

* *With external shield (RTMA 316) connected to pin 1.*

Note: All voltages are referred to the negative terminal of the filament.

BASING DIAGRAM

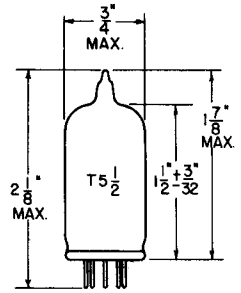


RTMA 6AR
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 - Negative Filament, Internal Shield, and Grid Number 3
Pin 2 - Plate
Pin 3 - Grid Number 2 (Screen)
Pin 4 - No Connection
Pin 5 - Negative Filament, Internal Shield, and Grid Number 3
Pin 6 - Grid Number 1
Pin 7 - Positive Filament

PHYSICAL DIMENSIONS

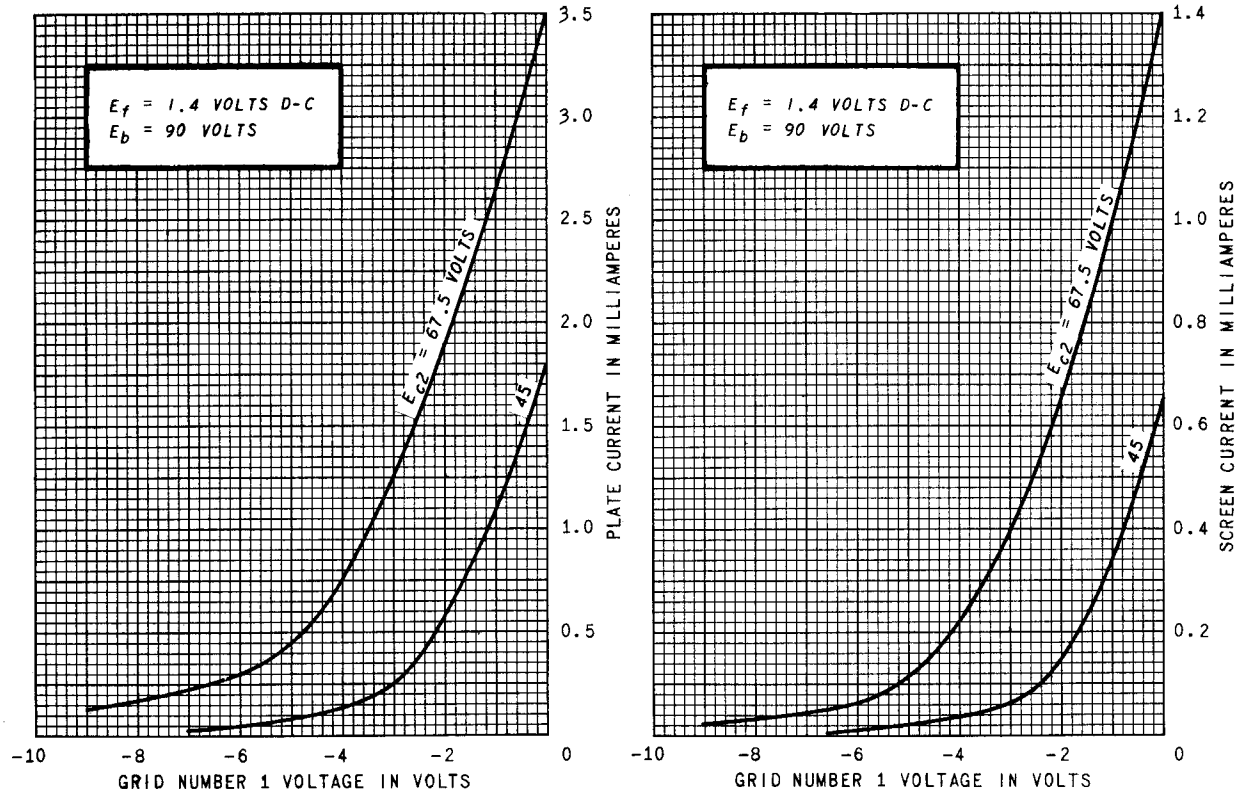


RTMA 5-2

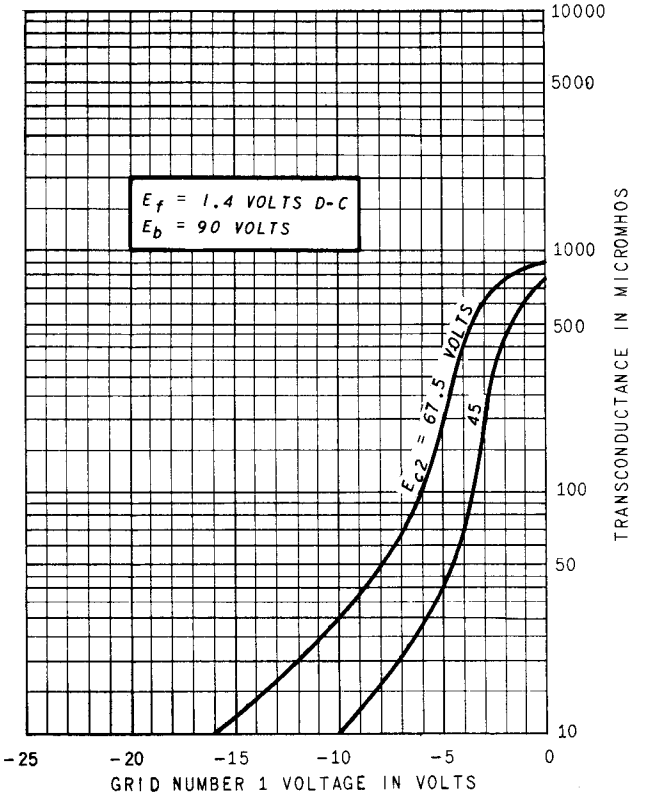
GENERAL ELECTRIC

Supersedes ET-T232A dated 4-50

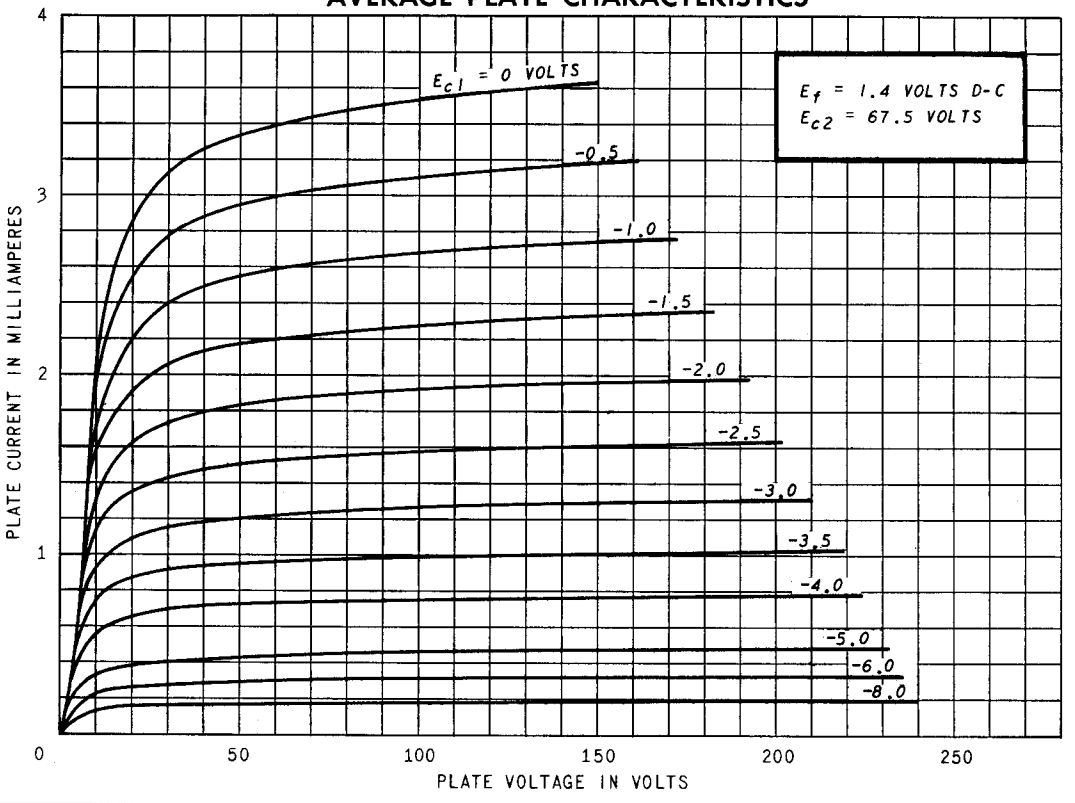
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

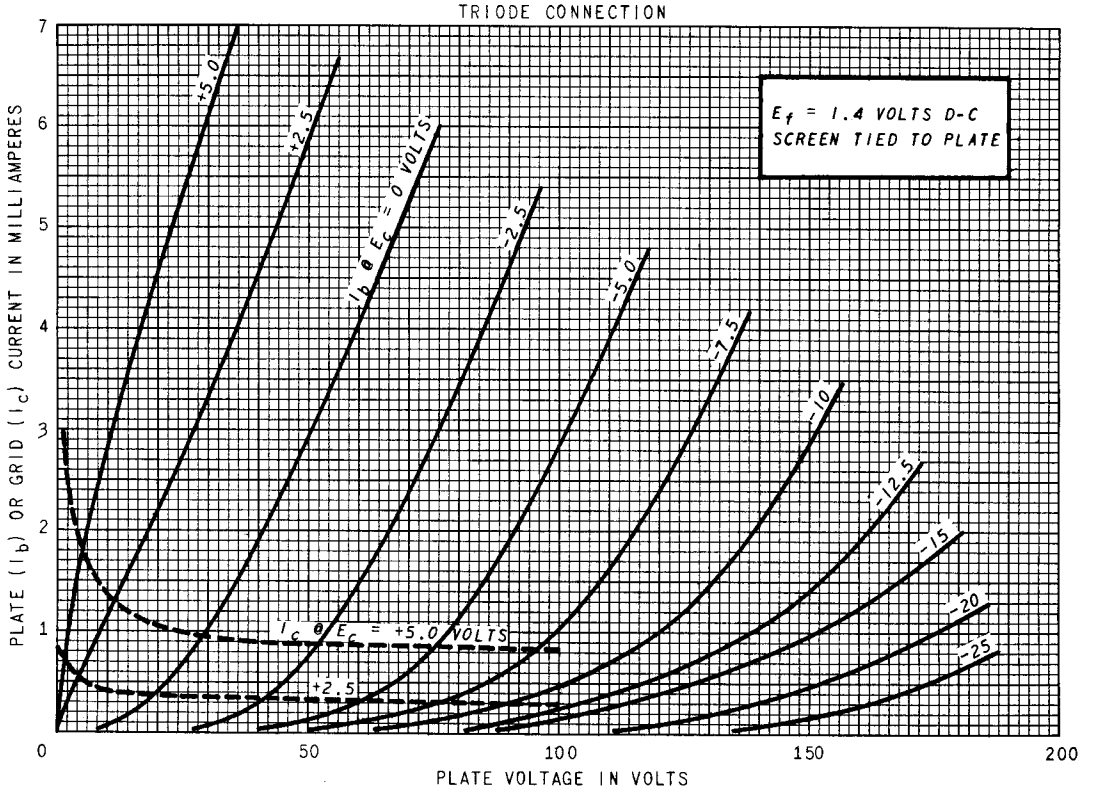


AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

TRIODE CONNECTION



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

ET-T232B
6-53

PRINTED IN U.S.A.

Electronic TUBES

1U4

PENTODE

DESCRIPTION AND RATING

The 1U4 is a miniature, filamentary, sharp-cutoff pentode intended for radio-frequency or intermediate-frequency amplifier use in battery-operated receivers.

GENERAL

ELECTRICAL

Cathode—Coated Filament

Filament Voltage, DC	1.4		Volts
Filament Current	0.05		Amperes
Direct Interelectrode Capacitances	**With Shield***	**Without Shield**	
Grid-Number 1 to Plate, maximum	0.01	0.01	μμf
Input	3.6	3.6	μμf
Output	7.5	7.5	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	110	Volts
Screen Voltage	110	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
DC Cathode Current	6.0	Milliamperes

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	90	Volts
Screen Voltage	90	Volts
Grid-Number 1 Voltage	0	Volts
Plate Resistance, approximate	1.0	Megohms
Transconductance	900	Micromhos
Plate Current	1.6	Milliamperes
Screen Current	0.5	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	−4	Volts

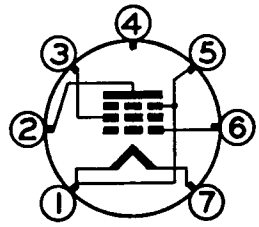
* With external shield (RETMA 316) connected to pin 1.

Note: All voltages are referred to the negative terminal of the filament.

GENERAL ELECTRIC

Supersedes ET-T234B, dated 5-50

BASING DIAGRAM

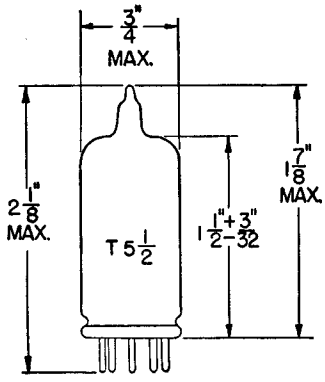


RETMA 6AR

TERMINAL CONNECTIONS

Pin 1—Negative Filament, Internal Shield, and Grid Number 3 (Suppressor)
Pin 2—Plate
Pin 3—Grid Number 2 (Screen)
Pin 4—No Connection
Pin 5—Negative Filament, Internal Shield, and Grid Number 3 (Suppressor)
Pin 6—Grid Number 1
Pin 7—Positive Filament

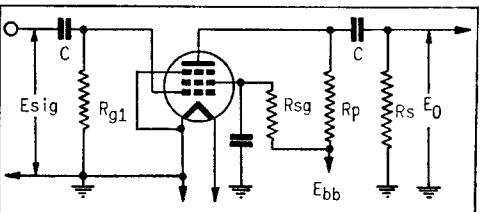
PHYSICAL DIMENSIONS



RETMA 5-2

CLASS A RESISTANCE-COUPLED AMPLIFIER

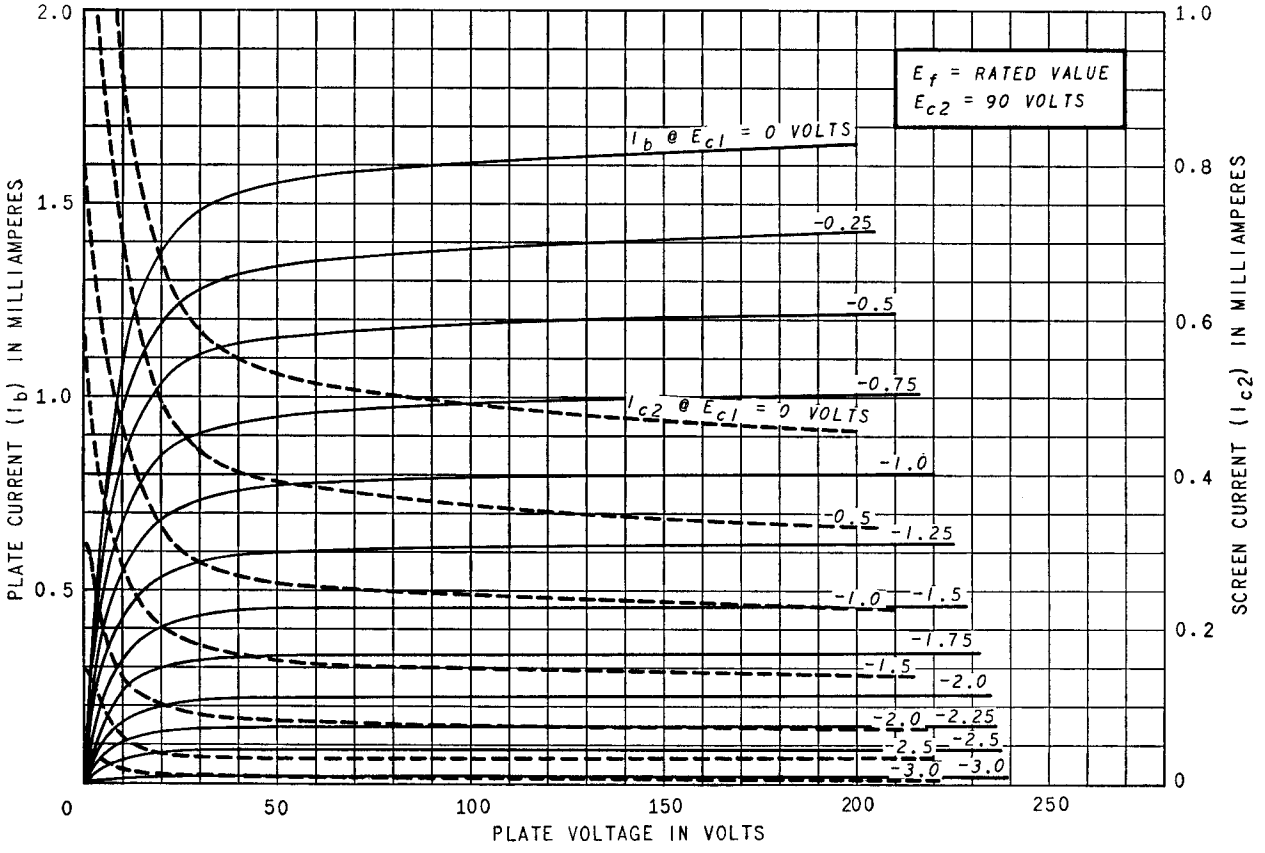
Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 45 Volts				Ebb = 90 Volts				Ebb = 135 Volts			
			Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo
0.24	0.24	10	—	0	26	8.1	—	0.26	43	18	—	0.37	57	28
0.24	0.51	10	—	0.02	34	9.6	—	0.30	55	20	—	0.41	67	32
0.24	1.0	10	—	0.03	39	10	—	0.33	62	22	—	0.45	75	34
0.51	0.51	10	—	0.42	42	7.1	—	0.93	61	15	—	1.2	80	22
0.51	0.75	10	—	0.47	48	7.9	—	1.0	76	17	—	1.3	102	26
0.51	1.0	10	—	0.50	51	8.1	—	1.1	82	18	—	1.4	108	27
0.75	0.75	10	—	0.83	47	6.3	—	1.6	75	14	—	2.0	101	22
0.75	1.0	10	—	0.90	51	6.5	—	1.8	82	15	—	2.1	108	22
1.0	1.0	10	—	1.4	48	5.0	—	2.6	79	12	—	3.1	106	17



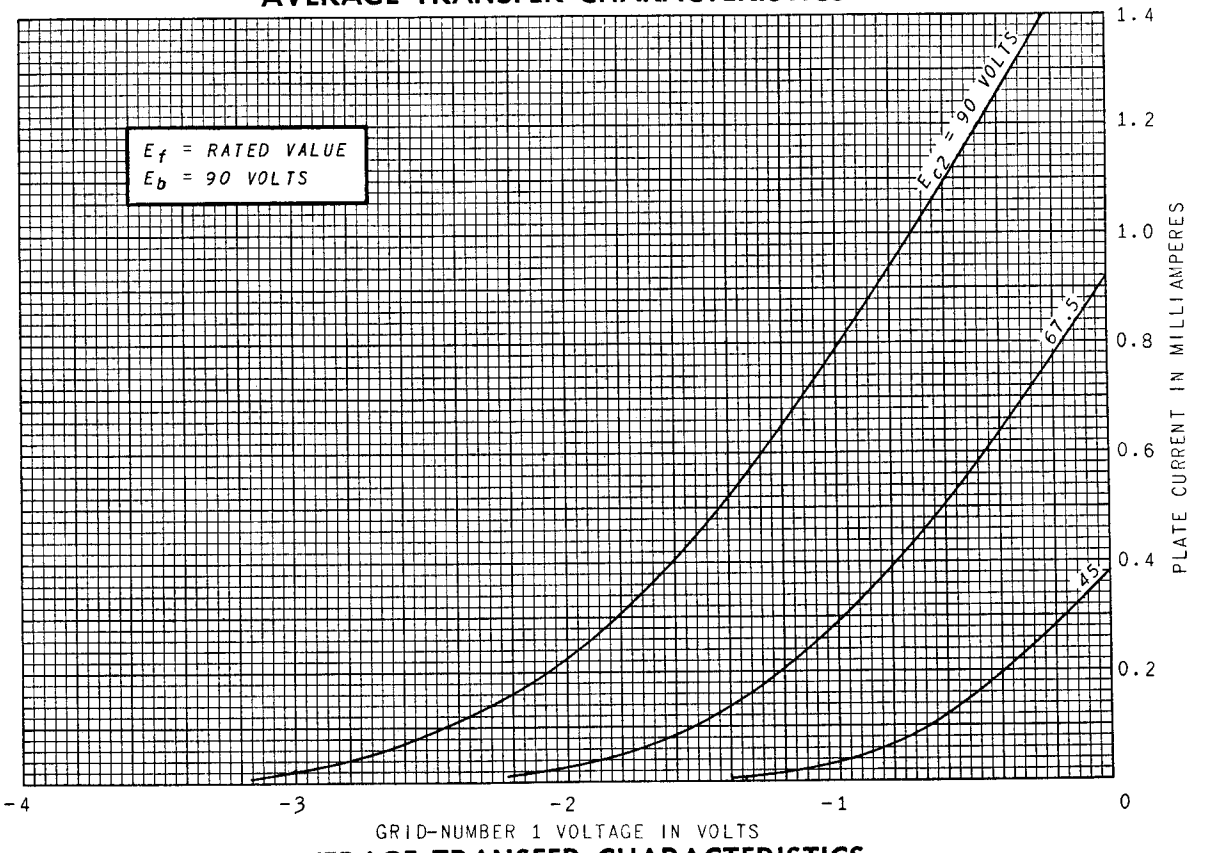
Note: Coupling capacitors (C) should be adjusted to give desired frequency response. R_{sg} should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

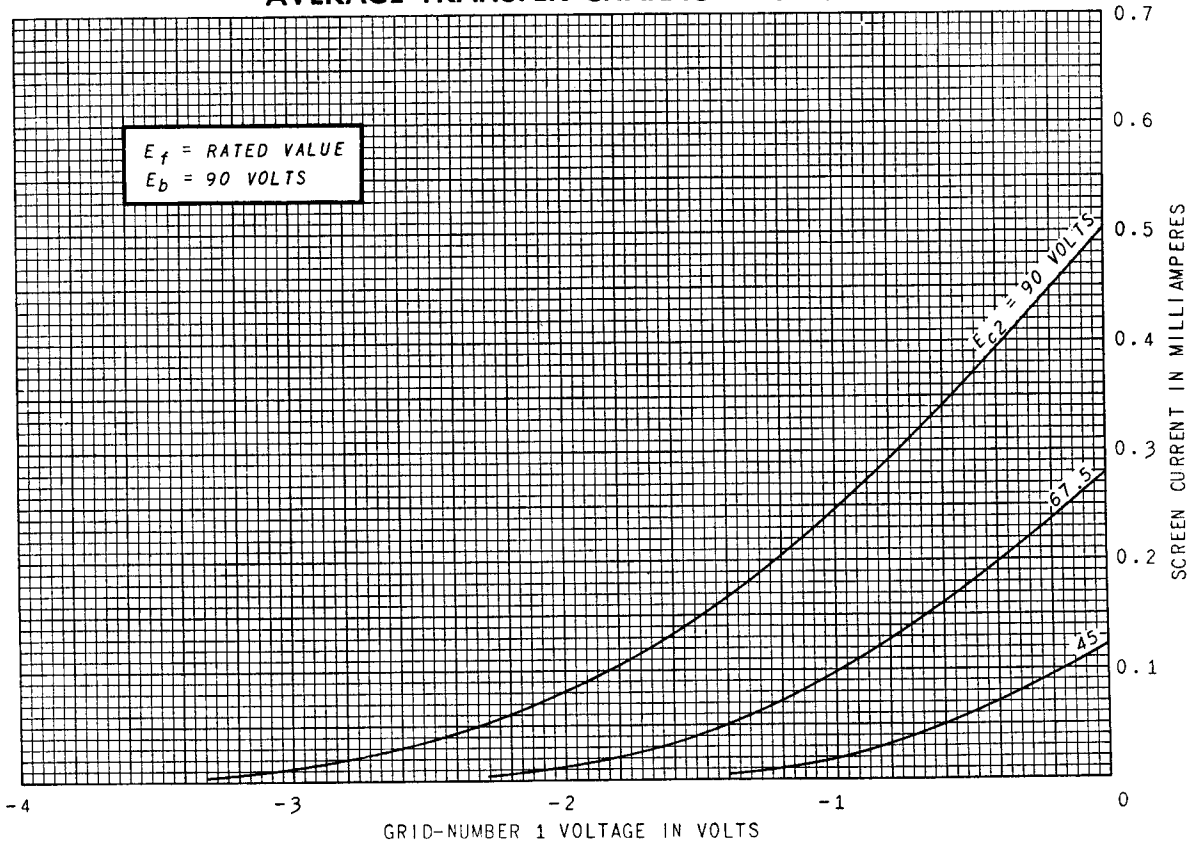
AVERAGE PLATE CHARACTERISTICS



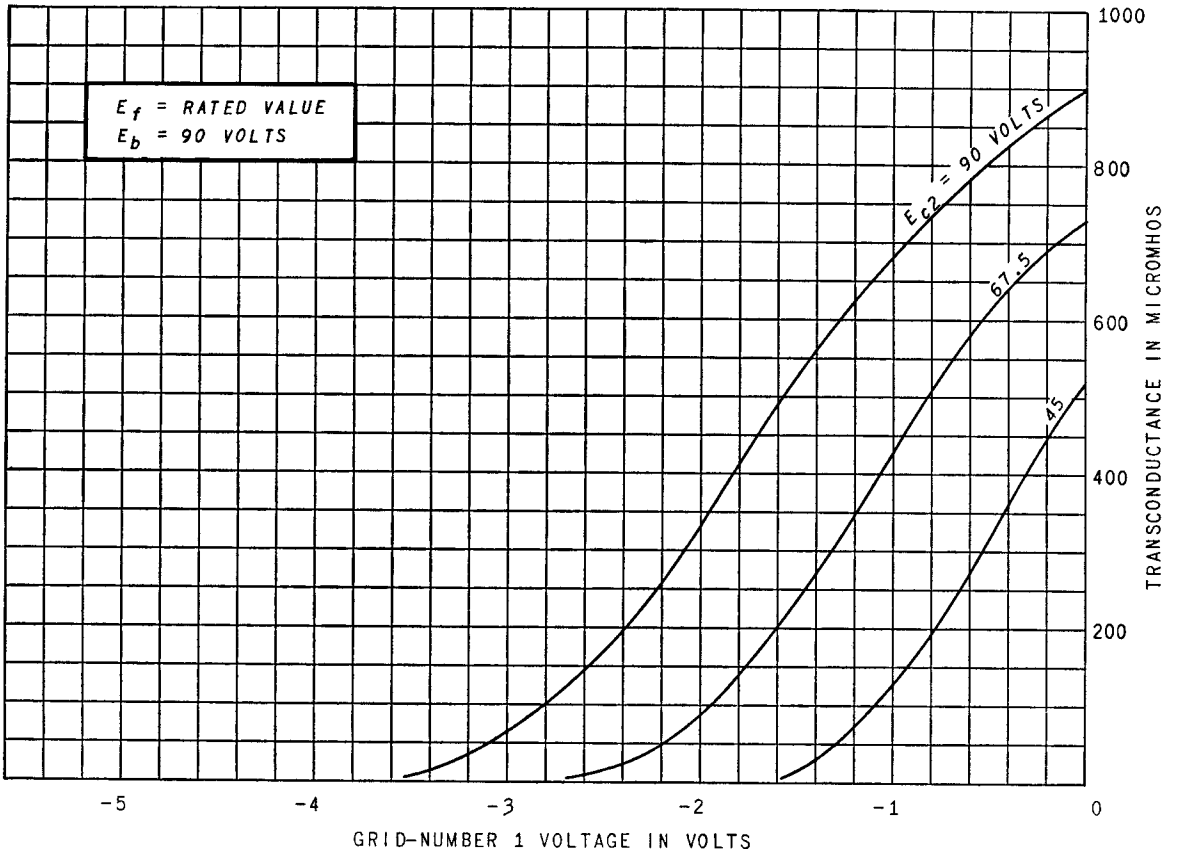
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

Electronic TUBE

1U5
Description and Rating
DIODE-PENTODE

The 1U5 is a miniature diode sharp-cutoff pentode designed for use as a combined detector, audio-frequency amplifier, and automatic-volume-control tube in compact, battery-operated receivers. The diode section is effectively shielded from the pentode section to reduce feed-through effects.

GENERAL

Cathode - Coated Filament		
Filament Voltage, D-C	1.4	Volts
Filament Current	0.05	Ampere
Envelope - T-5½, Glass		
Base - E7-1, Miniature Button 7-Pin		
Mounting Position - Any		

Direct Interelectrode Capacitance

	With Shield*	Without Shield	
Diode Plate to Grid-Number 1, maximum	0.04	0.04	μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	90	Volts
Screen Voltage	90	Volts
Positive D-C Grid-Number 1 Voltage	0	Volts
Negative D-C Grid-Number 1 Voltage	50	Volts
D-C Cathode Current	3.0	Milliamperes
Diode Current for Continuous Operation	0.25	Milliampere

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

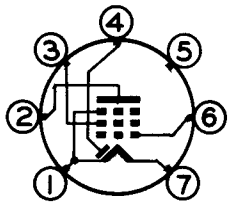
Plate Voltage	67.5	Volts
Screen Voltage	67.5	Volts
Grid-Number 1 Voltage	0	Volts
Plate Resistance, approximate	0.6	Megohm
Transconductance	625	Micromhos
Plate Current	1.6	Milliamperes
Screen Current	0.4	Milliampere
Grid-Number 1 Voltage, approximate, I_b = 10 Microamperes	-5	Volts
Average Diode Current With 10 Volts D-C Applied	1.5	Milliamperes

* *With external shield (RTMA 316) connected to pin 1.*

+ *The diode is located at the negative end of the filament.*

Note: All voltages are referred to the negative terminal of the filament.

BASING DIAGRAM

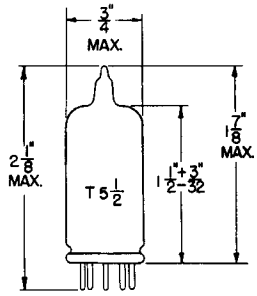


RTMA 6BW
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 - Negative Filament and Grid Number 3
Pin 2 - Plate
Pin 3 - Grid Number 2 (Screen)
Pin 4 - Diode Plate +
Pin 5 - No Connection
Pin 6 - Grid Number 1
Pin 7 - Positive Filament

PHYSICAL DIMENSIONS



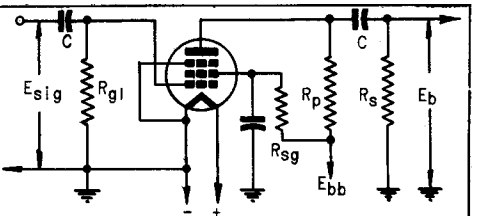
RTMA 5-2

GENERAL ELECTRIC

Supersedes ET-T533A dated 4-50

CLASS A RESISTANCE-COUPLED AMPLIFIER

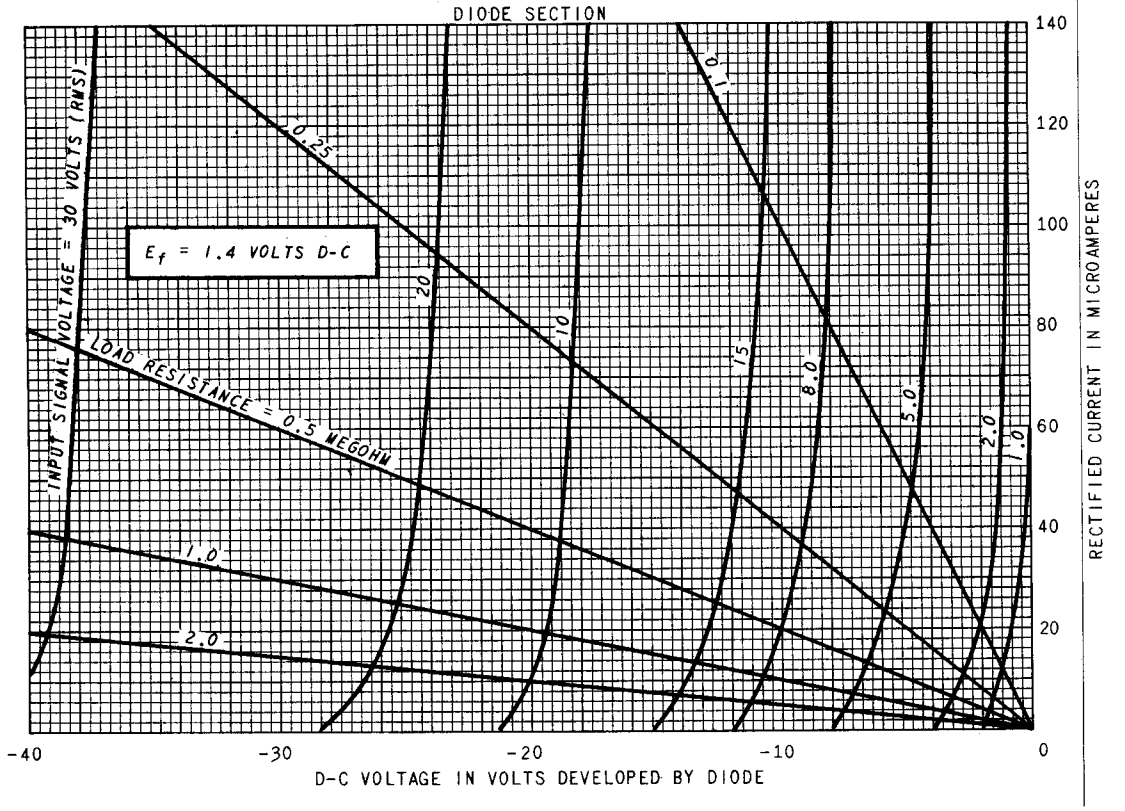
Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 45 Volts				Ebb = 90 Volts				Ebb = 135 Volts			
			Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo
0.24	0.24	10	–	0.5	18	6.4	–	0.8	29	13	–	1.0	38	20
0.24	0.51	10	–	0.5	24	8.0	–	0.9	38	15	–	1.1	40	25
0.24	1.0	10	–	0.6	28	8.4	–	1.0	45	17	–	1.2	55	28
0.51	0.51	10	–	1.1	25	5.9	–	1.9	40	12	–	2.3	52	19
0.51	0.75	10	–	1.2	29	6.5	–	2.0	46	13	–	2.0	61	22
0.51	1.0	10	–	1.4	32	6.6	–	2.2	51	14	–	2.5	65	22
0.75	0.75	10	–	1.9	29	5.1	–	2.9	47	11	–	3.2	61	18
0.75	1.0	10	–	2.0	32	5.2	–	3.0	52	11	–	3.4	67	18
1.0	1.0	10	–	2.7	31	4.3	–	3.9	50	9	–	4.6	66	15



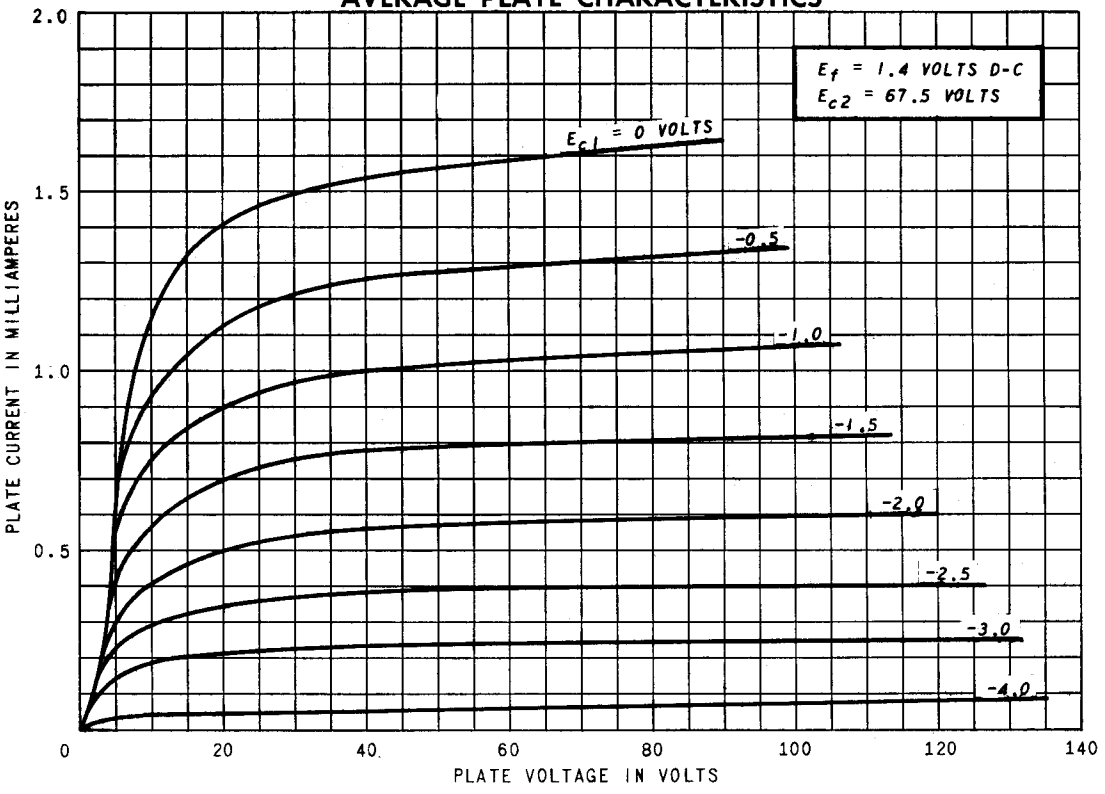
Note: Coupling capacitors (C) should be adjusted to give desired frequency response. R_{sg} should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

OPERATION CHARACTERISTICS

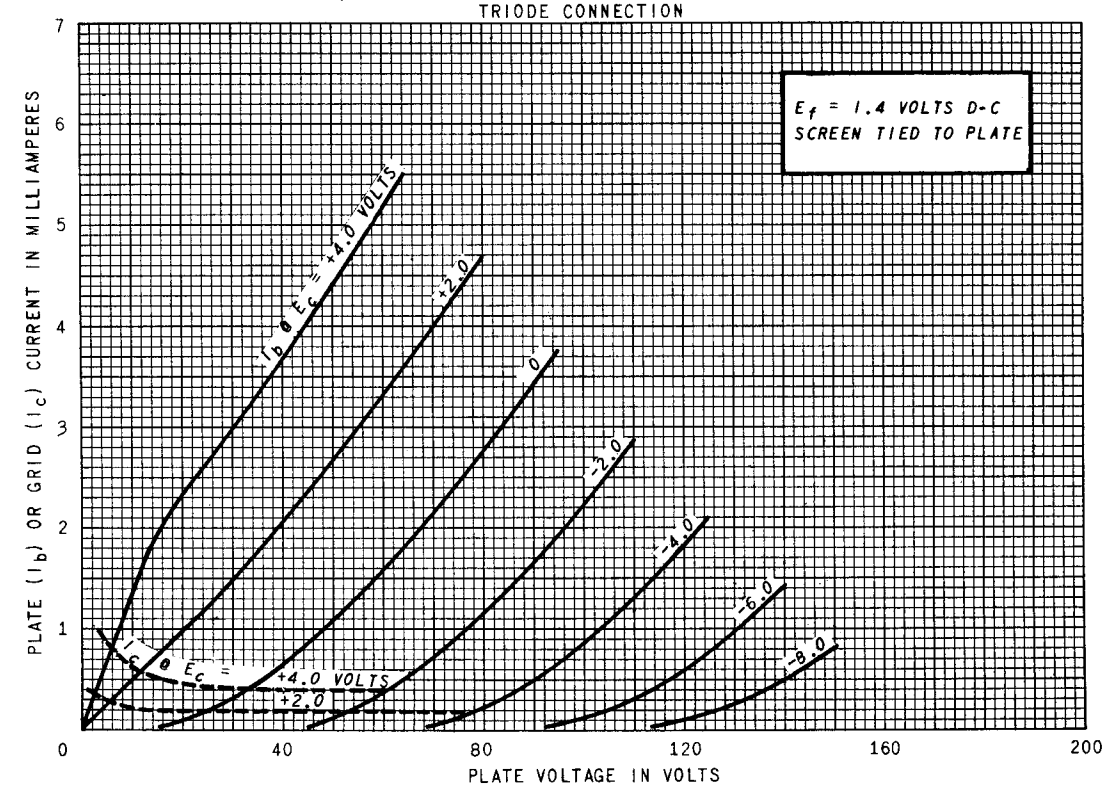


AVERAGE PLATE CHARACTERISTICS

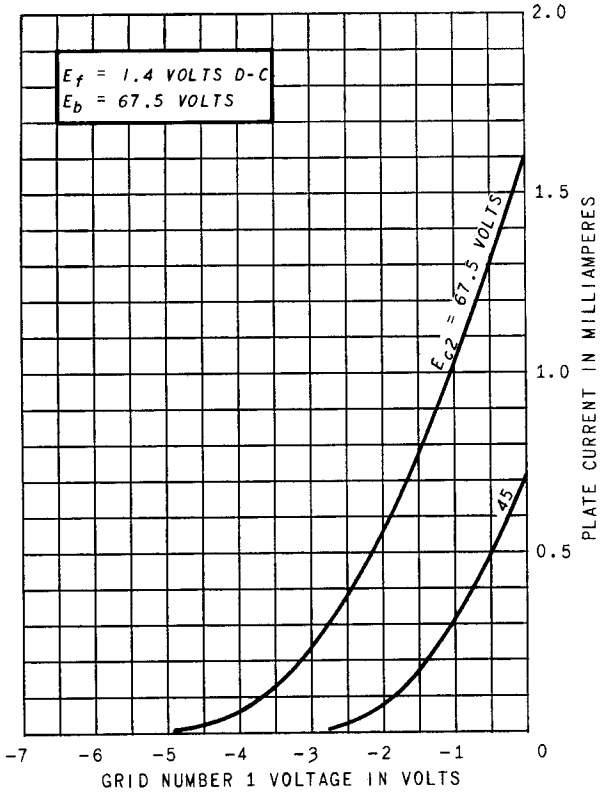


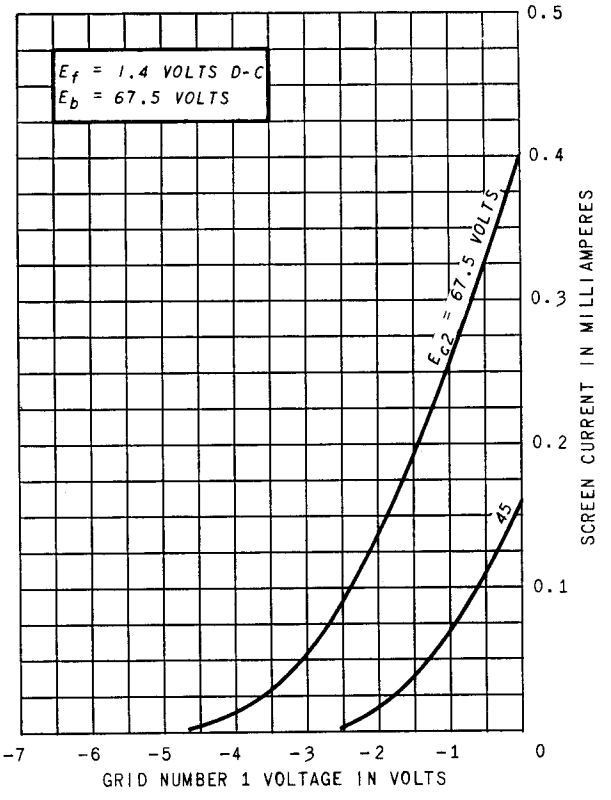
AVERAGE PLATE CHARACTERISTICS

TRIODE CONNECTION

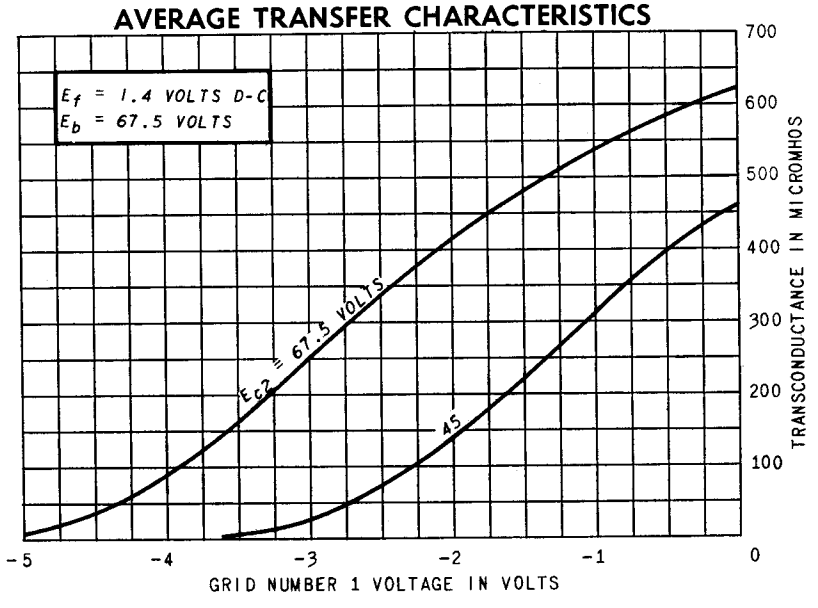


AVERAGE TRANSFER CHARACTERISTICS





AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

Electronic TUBES

1V2

DIODE

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 1V2 is a miniature filamentary diode designed for use in television receivers as the high-voltage rectifier in flyback types of power supplies.

GENERAL

ELECTRICAL

Cathode—Coated Filament

Filament Voltage, AC or DC	0.625*	Volts
Filament Current	0.3	Amperes
Direct Interelectrode Capacitances, approximate†		
Plate to Filament	0.8	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE§

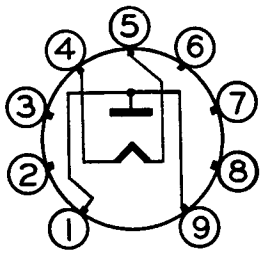
DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

Peak Inverse Plate Voltage		
DC Component	6600	Volts
Total DC and Peak	8250♦	Volts
Steady-State Peak Plate Current	10	Milliamperes
DC Output Current	0.5	Milliamperes

GENERAL ELECTRIC

Supersedes ET-T729, dated 7-50

BASING DIAGRAM



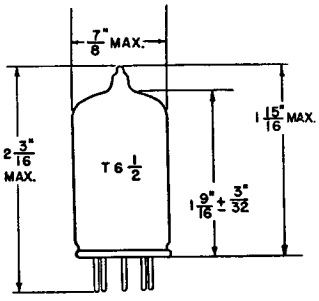
RETMA 9U

TERMINAL CONNECTIONS

Pin 1—Plate
Pin 2—Internal Connection—Do Not Use
Pin 3—Internal Connection—Do Not Use
Pin 4—Filament
Pin 5—Filament
Pin 6—No Connection‡
Pin 7—Internal Connection—Do Not Use
Pin 8—Internal Connection—Do Not Use
Pin 9—Plate

‡Socket terminal 6 may be used as tie point for filament dropping resistor or for components at or near filament potential; otherwise, do not use.

PHYSICAL DIMENSIONS



RETMA 6-2

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate
Ib = 7.0 Milliamperes DC . . . . . 135 Volts

* Under no circumstances should the filament voltage be less than 0.525 volts or more than 0.725 volts.

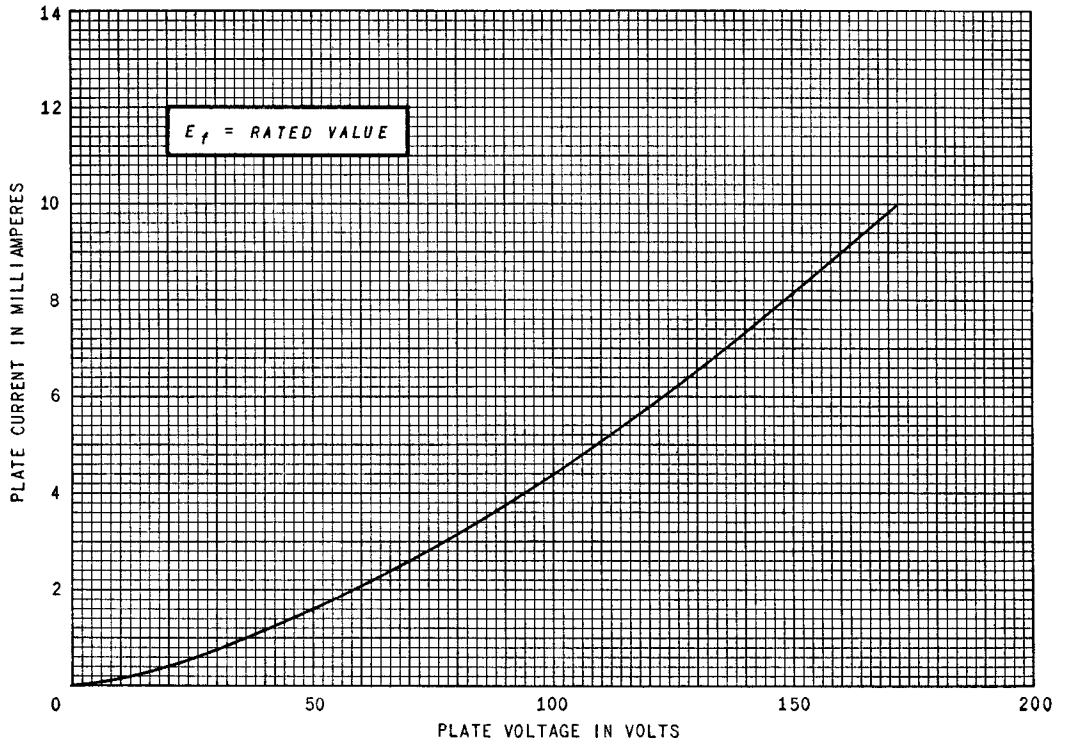
† Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

♦ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

Note: To provide the required insulation in noval 9-pin sockets designed with a cylindrical center shield, it is necessary to remove the center shield.

AVERAGE PLATE CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBE
KEN-RAD

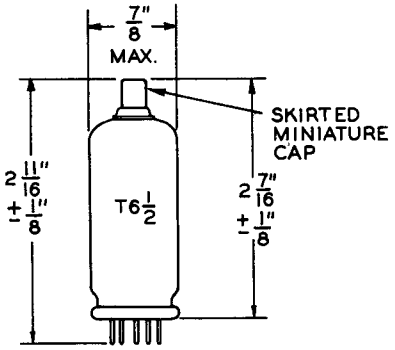
1X2-A
Description and Rating
HALF-WAVE HIGH-VOLTAGE RECTIFIER

GENERAL DESCRIPTION

Principal Application: The 1X2-A is a miniature half-wave rectifier designed for use in television receivers as the high-voltage rectifier to supply power to the anode of the television picture tube. The 1X2-A is intended primarily for use in fly-back types of power supplies.

Cathode:	Coated Filament
Filament Voltage	1.25 Volts
Filament Current	0.20 Ampere
Envelope:	T-6½ Glass
Base:	E9-1, Small Button 9-Pin
Top Cap:	C1-2, Skirted Miniature or C1-33, Skirted Miniature
Mounting Position:	Any
Direct Interelectrode Capacitance:	
Plate to Filament	1.0 μμf

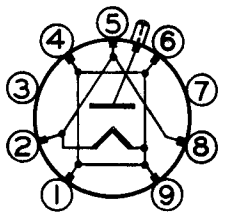
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pin 1 - Filament and Internal Shield
Pin 2 - Filament
Pin 3 - No Connection*
Pin 4 - Same as Pin 1
Pin 5 - Same as Pin 2
Pin 6 - Same as Pin 1
Pin 7 - No Connection*
Pin 8 - Same as Pin 2
Pin 9 - Same as Pin 1
Cap - Plate

BASING DIAGRAM



RMA 9Y
BOTTOM VIEW

MAXIMUM RATINGS AND CHARACTERISTICS

DESIGN CENTER VALUES:

Peak Inverse Plate Voltage (Maximum)#	20000	Volts
Peak Plate Current (Maximum)	10	Milliamperes
D-C Output Current (Maximum)	1.0	Milliampere

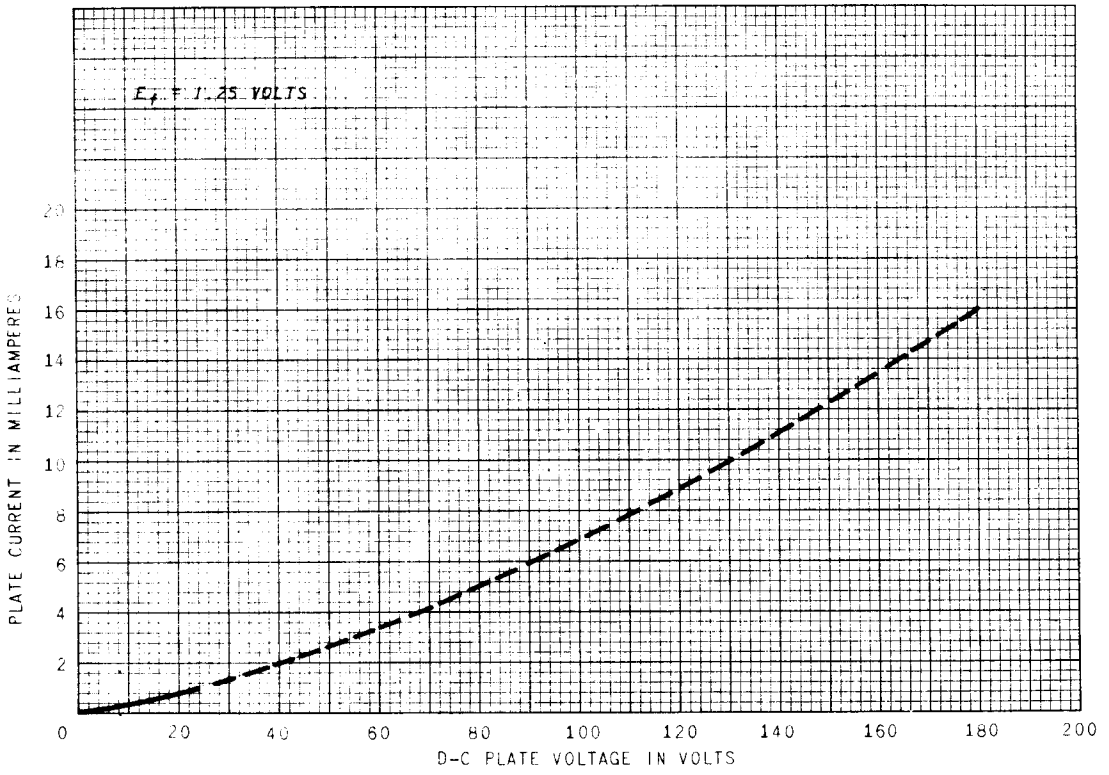
Tube Voltage Drop:		
Measured with Applied D-C at 7 Milliamperes	100	Volts

* *May be used as tie-point for filament dropping resistor and high-voltage filter resistor or may be connected to filament. Do not connect to any other circuits.*

\# *Value given is to be considered as the absolute maximum voltage beyond which the serviceability of the tube may be impaired from the viewpoint of life and satisfactory performance.*

Note: The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce soft x-rays which can constitute a health hazard, unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

AVERAGE PLATE CHARACTERISTICS



Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

Electronic TUBES

1X2-B

DIODE

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 1X2-B is a miniature filamentary diode designed for use in television receivers as the high-voltage rectifier to supply power to the anode of the television picture tube. The 1X2-B is intended primarily for use in fly-back types of power supplies. Except for increased peak inverse voltage ratings, the 1X2-B is identical to the 1X2-A.

GENERAL

ELECTRICAL

Cathode—Coated Filament

Filament Voltage, AC or DC	1.25*	Volts
Filament Current	0.2	Amperes
Direct Interelectrode Capacitances, approximate†		
Plate to Filament	1.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Miniature Button 9-Pin
Top Cap—C1-2 or C1-33, Skirted Miniature

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE§

DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

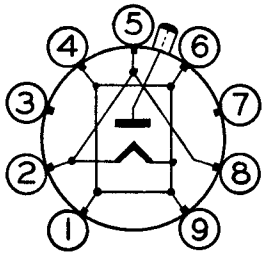
Peak Inverse Plate Voltage		
DC Component	18000	Volts
Total DC and Peak	22000π	Volts
Steady-State Peak Plate Current	45	Milliamperes
DC Output Current	0.5	Milliamperes

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib=7.0 Milliamperes DC	100	Volts

GENERAL ELECTRIC

BASING DIAGRAM



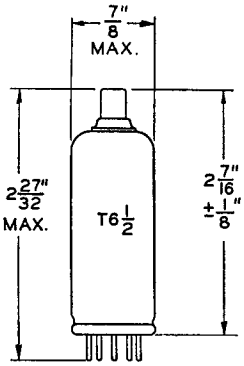
RETMA 9Y

TERMINAL CONNECTIONS

Pin 1—Filament and Internal Shield
Pin 2—Filament
Pin 3—No Connection‡
Pin 4—Same as Pin 1
Pin 5—Same as Pin 2
Pin 6—Same as Pin 1
Pin 7—No Connection‡
Pin 8—Same as Pin 2
Pin 9—Same as Pin 1
Cap —Plate

‡ May be used as tie-point for filament dropping resistor or may be connected to filament. Do not connect to any other circuits.

PHYSICAL DIMENSIONS



RETMA 6-7

* Under no circumstances should the filament voltage be less than 1.05 volts or more than 1.45 volts.

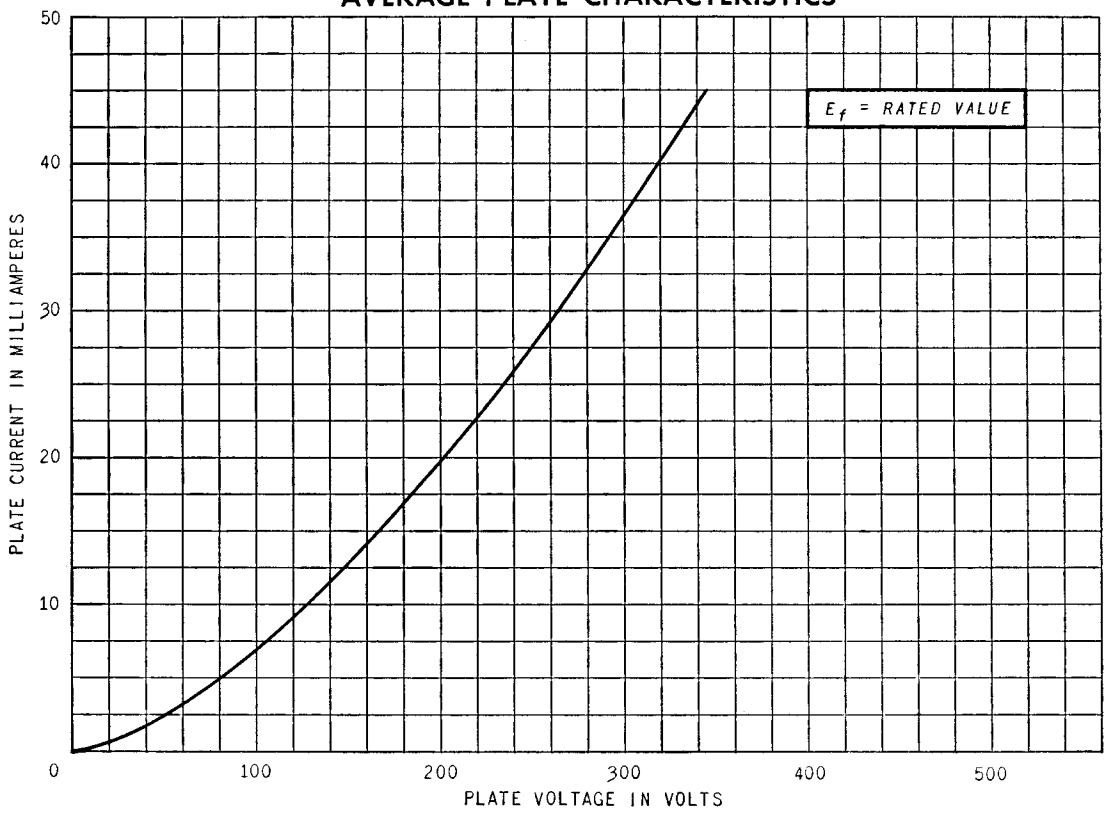
† Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

π Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment controls should not cause the rated value to be exceeded.

Note: The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce soft x-rays which can constitute a health hazard unless such tubes are adequately shielded. The need for this precaution should be considered in equipment design. Relatively simple shielding should prove adequate.

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

PRINTED IN U.S.A.

DESCRIPTION AND RATING

2AF4 Triode. Identical to the 6AF4 except for heater ratings and addition of a controlled heater-warm-up characteristic. Refer to the 6AF4 Description and Rating sheet for complete data.

2AF4-A Triode. Identical to the 6AF4-A except for heater ratings and addition of a controlled heater-warm-up characteristic. Refer to the 6AF4-A Description and Rating sheet for complete data.

2BN4 Triode. Identical to the 6BN4 except for heater ratings and addition of a controlled heater-warm-up characteristic. Refer to the 6BN4 Description and Rating sheet for complete data.

2CY5 Tetrode. Identical to the 6CY5 except for the following ratings:

Heater Voltage, AC or DC	2.4 Volts
Heater Current	0.6 ±6% Amperes
Heater Warm-up Time*	11 Seconds

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

Refer to the 6CY5 Description and Rating sheet for complete data.

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Compactron Diode

2AS2-A

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

■ COLOR TV TYPE ■ 24000 VOLTS DC ■ 1.5 MILLIAMPERES DC ■ X-RADIATION RATING

The 2AS2-A is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube.

The 2AS2-A features built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC ★	2.5±0.4	Volts
Heater Current ●	0.33	Amperes
Direct Interelectrode Capacitances, approximate ▲		
Plate to Heater, Cathode, and Internal Shield:		
p to (h+k+i.s.)	1.4	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Top Cap - C1-34, C1-49 or C1-50, Small
Outline Drawing

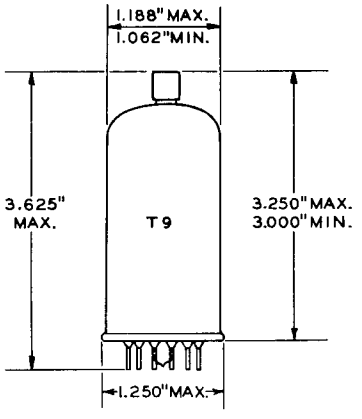
Maximum Bulb Diameter	1.188	Inches
Maximum Seal Diameter	1.250	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.625	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE♦—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	24000	Volts
Total DC and Peak (Absolute-Maximum Value)	30000	Volts
Steady-State Peak Plate Current	80	Milliamperes
DC Output Current	1.5	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value) §	2.9	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.1	Volts

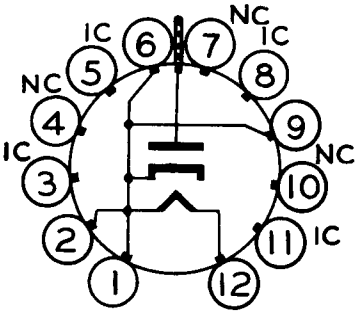
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS ⊕

Pin 1 - Heater, Cathode and Internal Shield
Pin 2 - Heater, Cathode and Internal Shield
Pin 3 - Internal Connection - Do Not Use
⊕ Pin 4 - No Connection
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Heater, Cathode and Internal Shield
⊕ Pin 7 - No Connection
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Heater, Cathode and Internal Shield
⊕ Pin 10 - No Connection
Pin 11 - Internal Connection - Do Not Use
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12EW

GENERAL ELECTRIC

Supersedes PI Sheet dated 8-69

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes	60	Volts

X-RADIATION RATING♦

X-radiation, maximum	25	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 25 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation of the 2AS2-A outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

WARNING

X-RADIATION

The high voltages associated with the 2AS2-A result in production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide for this shielding.

Precautions must be exercised during the servicing of equipment employing the 2AS2-A to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 2AS2-A is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 2AS2-A in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 2.5 volts.

▲ Without external shield.

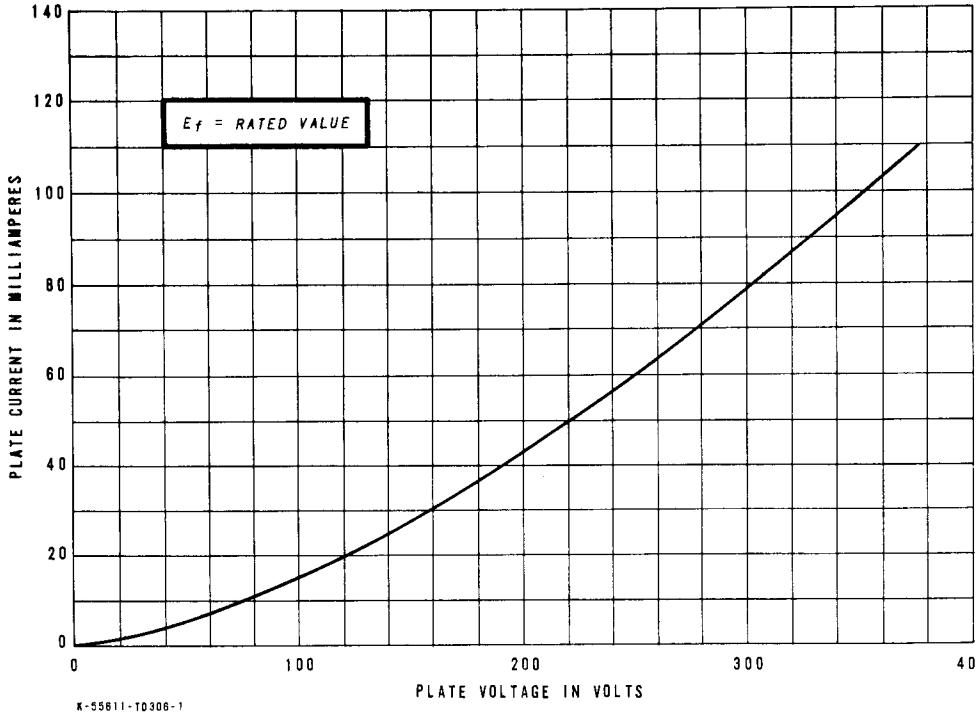
♦ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ **CAUTION** - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 2.9 volts may result in the production of X-radiation in excess of the maximum rated limit of 25 mR/hr.

⊕ Socket terminals 4, 7, and 10 may be used as tie points for components at or near heater potential.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Diode

2AV2

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

The 2AV2 is a miniature filamentary diode designed for use in television receivers as the high-voltage rectifier in flyback types of power supplies.

GENERAL

ELECTRICAL

Cathode - Coated Filament

Filament Characteristics and Ratings

Filament Voltage, AC or DC*	1.8±0.27	Volts
Filament Current‡	0.225	Amperes

Direct Interelectrode Capacitances, approximate§

Plate to Filament (p to f)	0.8	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

Maximum Diameter	0.875	Inches
Minimum Diameter	0.750	Inches
Maximum Over-all Length	2.187	Inches
Maximum Seated Height	1.937	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE¶

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

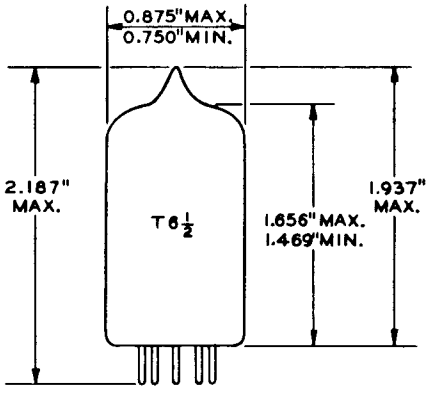
Peak Inverse Plate Voltage		
DC Component	7000	Volts
Total DC and Peak (Absolute-Maximum Value)	8250	Volts
Steady-State Peak Plate Current	50	Milliamperes
DC Output Current	0.6	Milliamperes

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

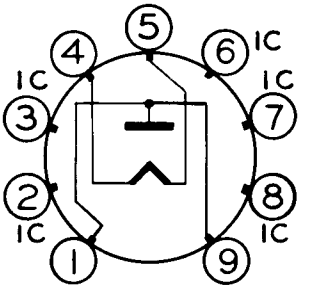


EIA 6-2

TERMINAL CONNECTIONS

Pin 1 - Plate
#Pin 2 - Internal Connection - Do Not Use
#Pin 3 - Internal Connection - Do Not Use
Pin 4 - Filament
Pin 5 - Filament
#Pin 6 - Internal Connection - Do Not Use
#Pin 7 - Internal Connection - Do Not Use
#Pin 8 - Internal Connection - Do Not Use
Pin 9 - Plate

BASING DIAGRAM



EIA 9U

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate
Ib = 1.0 Milliamperes . . . . . 20 Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

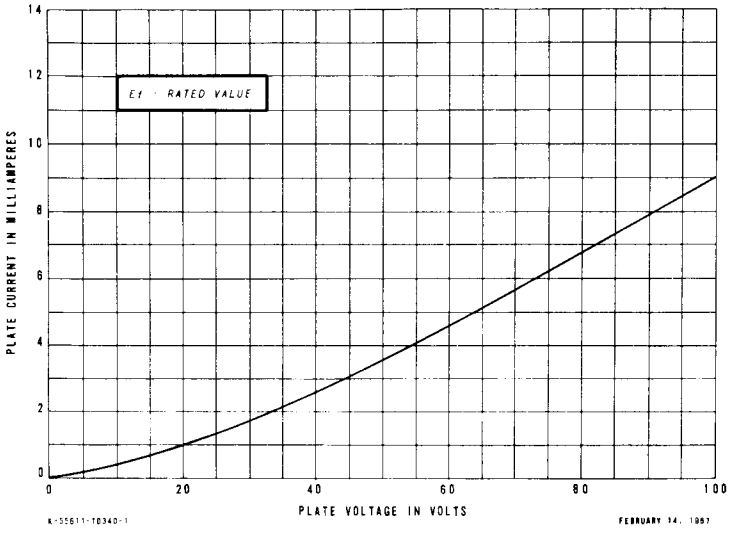
‡ Heater current of a bogey tube at Ef = 1.8 volts.

§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

Socket terminals 2, 3, 6, 7, and 8 should not be used as tie points for external-circuit components.

AVERAGE PLATE CHARACTERISTICS



The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release No. 468

February 1, 1946

sponsor:
General Electric Co.

RMA TYPE 2B22

The 2B22 is a high-perveance diode of the disk-seal type. It is used as a detector or monitor at frequencies up to 1500 megacycles.

GENERAL CHARACTERISTICS

Number of Electrodes	2

Electrical

Cathode - Indirectly Heated	
Heater Voltage	6.3 Volts
Heater Current	0.75 Amperes
Average Characteristics	
Plate Voltage, Ib = 20 ma	6.0 Volts
Direct Interelectrode Capacitance	
Cathode-plate	2.20 Micromicrofarads

Mechanical

Type of Cooling - Convection	
Maximum Seal Temperature	200 C
Base Description	6-pin Octal
Mounting Position	Any
Net Weight, approximate	3 Ounces
Shipping Weight, approximate	3 Pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Detector

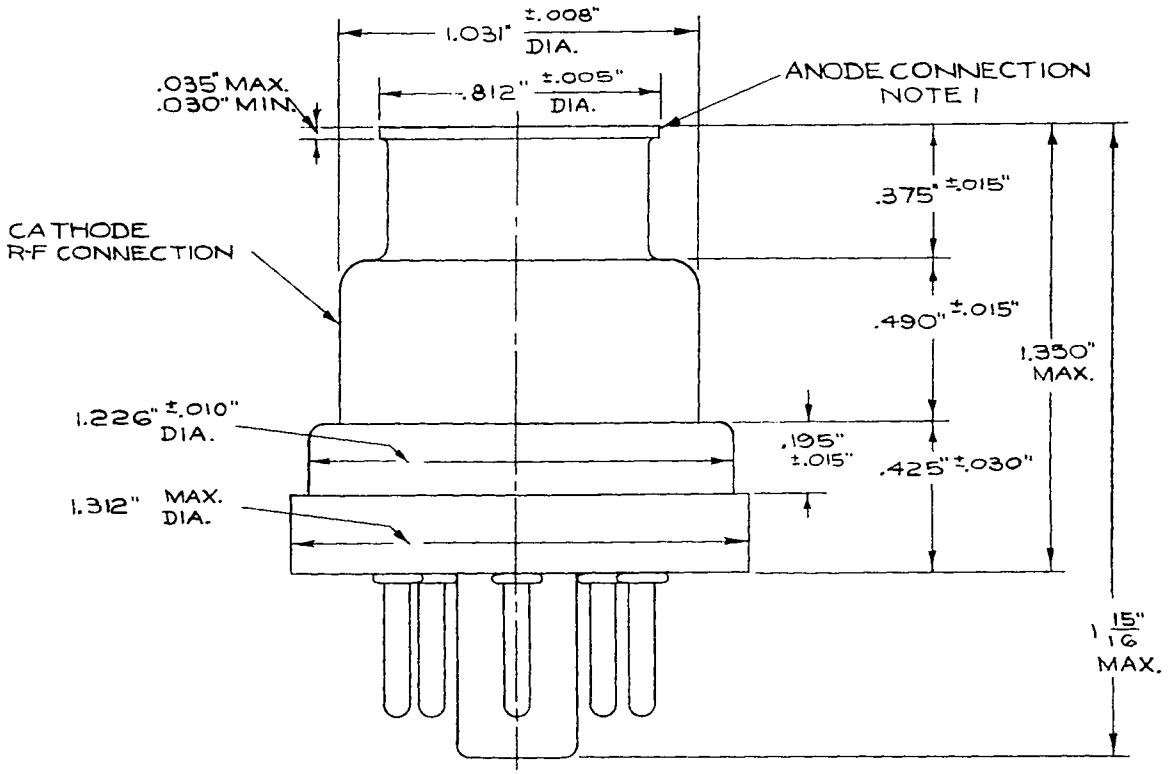
	Typical Operation	Maximum Ratings
Peak Plate Voltage		100 *Volts
Peak Cathode Current		0.7 *Amperes
Peak Inverse Voltage		300 Volts
Average Cathode Current	5	20 Milliamperes
Output Voltage	50	150 Volts d-c
Load Resistance	10000	Ohms

* Tube shall not operate more than 5 microseconds in a 100-microsecond interval.

December 24, 1945.

RMA TYPE

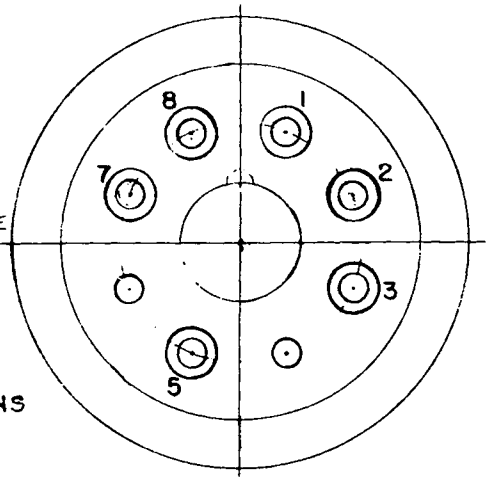
2B22



NOTE 1
GLASS WILL NOT PROTRUDE BEYOND EDGE OF ANODE CONNECTION

NOTE 2
MAX. ECCENTRICITY OF THE ℄ OF THE ANODE CONNECTION WITH THE ℄ OF THE R-F CATHODE .020"

NOTE 3
EXPOSED METAL PARTS PLATED WITH 100 MSI SILVER EXCEPT BASE PINS



PIN	CONNECTION
1.	INTERNAL CONNECTION
2.	HEATER
3.	CATHODE
5.	CATHODE
7.	HEATER
8.	CATHODE

Electronic TUBES

2B3

DIODE

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 2B3 is a filamentary diode designed for use in television receivers as the high-voltage rectifier to supply power to the anode of the television picture tube. It is intended primarily for use in flyback types of power supplies. Primarily, the 2B3 differs from the 1B3-GT by incorporating higher filament ratings which in many cases will permit the tube to be operated directly from the flyback transformer without the use of a filament dropping resistor.

GENERAL

ELECTRICAL

Cathode—Coated Filament

Filament Voltage, AC or DC	1.75*	Volts
Filament Current	0.25	Amperes
Direct Interelectrode Capacitances, approximate†		
Plate to Filament	1.3	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B6-8, Intermediate-Shell Octal 6-Pin
or B6-60, Short Intermediate-Shell Octal 6-Pin
Top Cap—C1-34, Small

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE§

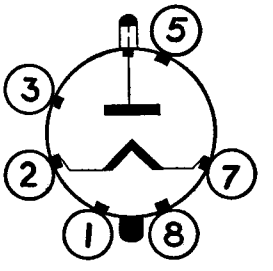
DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage		
DC Component	22000	Volts
Total DC and Peak	27000	Volts
Steady-State Peak Plate Current	50	Milliamperes
DC Output Current	0.5	Milliamperes

Design-Maximum Ratings are the limiting values, expressed with respect to bogie tubes, at which satisfactory tube life can be expected to occur. In order to obtain satisfactory circuit performance, therefore, the equipment designer must establish the circuit design so that no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to the combined effect of supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and any other variation associated with the equipment or the environment of the equipment.

GENERAL ELECTRIC

BASING DIAGRAM

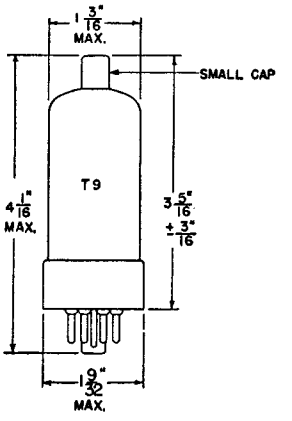


KEY
RETMA 8HC

TERMINAL CONNECTIONS

Pin 1—Internal Connection—Do Not Use
Pin 2—Filament
Pin 3—No Connection‡
Pin 5—No Connection‡
Pin 7—Filament and Internal Shield
Pin 8—Internal Connection—Do Not Use
Cap —Plate
‡ May be used as tie point at filament potential. Do not connect to any other circuits.

PHYSICAL DIMENSIONS



AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate
Ib = 7.0 Milliamperes DC . . . . . 100 Volts

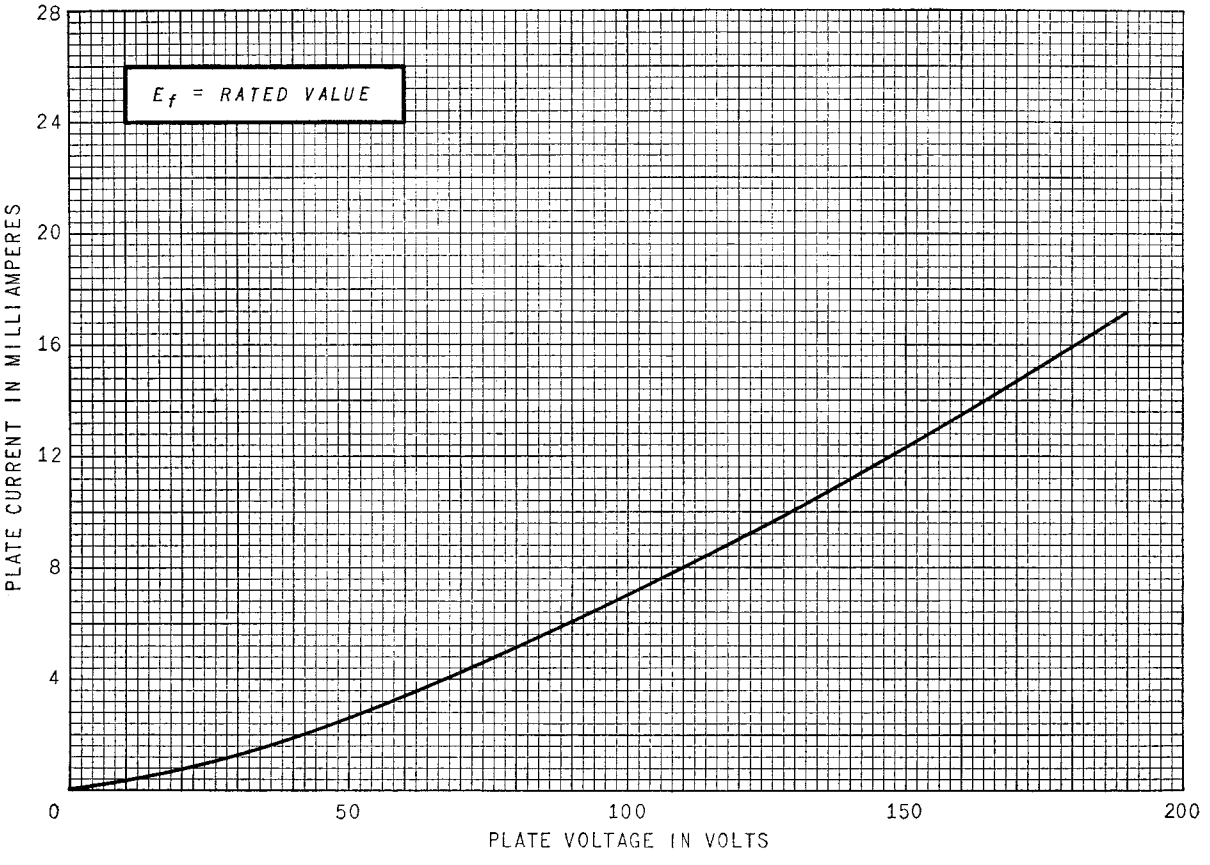
* Under no circumstances should the filament voltage be less than 1.5 volts or more than 2.0 volts.

† Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

Note: The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce soft x-rays which can constitute a health hazard unless such tubes are adequately shielded. The need for this precaution should be considered in equipment design. Relatively simple shielding should prove adequate.

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Compactron Diode

2BU2

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

■ COLOR TV TYPE ■ 24000 VOLTS DC ■ 1.5 MILLIAMPERES DC ■ X-RADIATION RATING

The 2BU2 is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube.

The 2BU2 features built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	2.5 ± 0.4	Volts
Heater Current ●	0.33	Amperes
Direct Interelectrode Capacitances, approximate ▲		
Plate to Heater, Cathode, and Internal Shield:		
p to (h+k+i.s.)	1.4	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Top Cap - C1-1, C1-34 or C1-49, Small
Outline Drawing

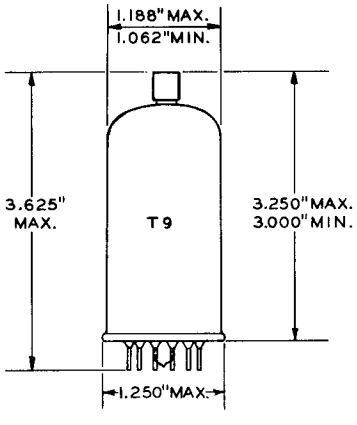
Maximum Bulb Diameter	1.188	Inches
Maximum Seal Diameter	1.250	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.625	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE ♦—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	24000	Volts
Total DC and Peak (Absolute-Maximum Value)	30000	Volts
Steady-State Peak Plate Current	80	Milliamperes
DC Output Current	1.5	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value) §	2.9	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.1	Volts

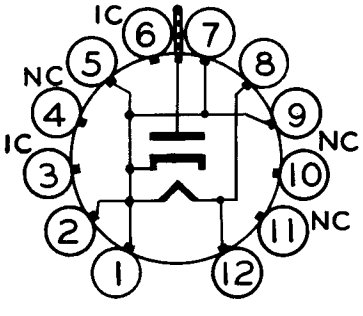
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS ⊕

Pin 1 - Heater, Cathode and Internal Shield
Pin 2 - Heater, Cathode and Internal Shield
Pin 3 - Internal Connection - Do Not Use
⊕ Pin 4 - No Connection
Pin 5 - Heater, Cathode and Internal Shield
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Heater, Cathode and Internal Shield
Pin 8 - Heater
Pin 9 - Heater, Cathode and Internal Shield
⊕ Pin 10 - No Connection
⊕ Pin 11 - No Connection
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12JB

GENERAL ELECTRIC

Supersedes PI Sheet dated 8-69

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate Ib = 7.0 Milliamperes	60	Volts

X-RADIATION RATING♦

X-radiation, maximum	0.5	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation of the 2BU2 outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

WARNING

X-RADIATION

Operation of the 2BU2 outside of the Absolute-Maximum Ratings indicated may produce soft X-rays above 0.5 milliroentgens per hour which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide required shielding.

Precautions must be exercised during the servicing of the equipment employing the 2BU2 to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 2BU2 is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 2BU2 in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 2.5 volts.

▲ Without external shield.

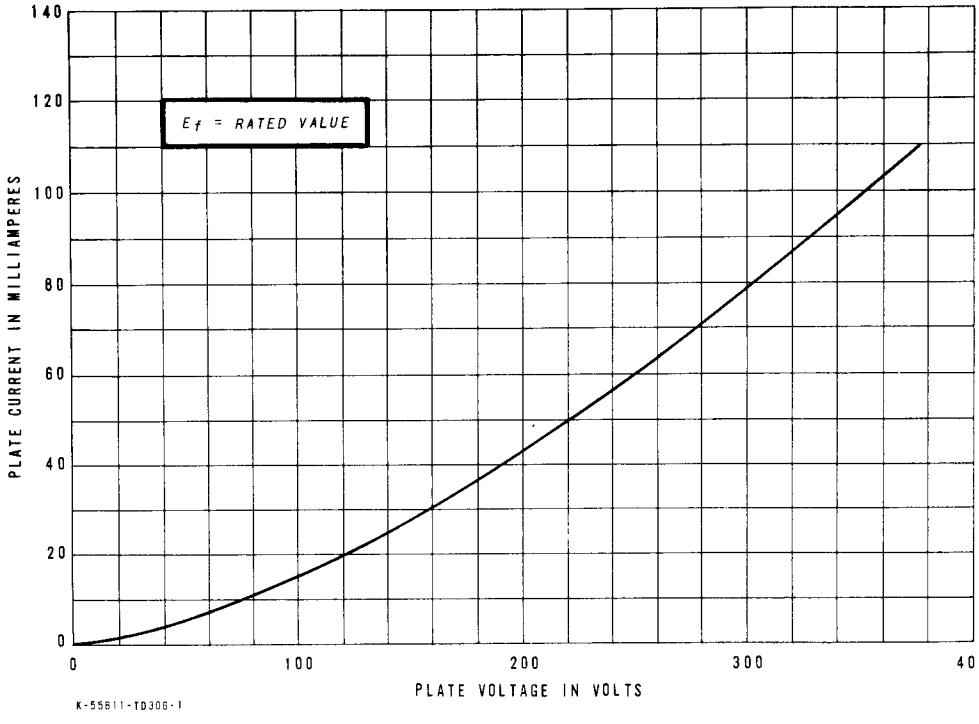
⊕ Socket terminals 4, 10 and 11 may be used as tie points for components at or near heater potential.

♦ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ **CAUTION** - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 2.9 volts may result in the production of X-radiation in excess of the maximum rated limit of 0.5mR/hr.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

2C39-B

PLANAR TRIODE



DESCRIPTION AND RATING

FOR GROUNDED-GRID OSCILLATOR AND AMPLIFIER SERVICE

Metal and Ceramic
High Transconductance
Low Interelectrode Capacitances
Shock Resistant

100 Watts Plate Dissipation

The 2C39-B is a metal-and-ceramic, high-mu triode designed for use as a grounded-grid oscillator or amplifier at frequencies as high as 2500 megacycles.

Features of the 2C39-B include planar electrode construction, high plate dissipation capability, excellent electrode isolation, low radio-frequency losses, high transconductance, and low interelectrode capacitances.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC	*	Volts
Heater Current at Ef = 6.3 volts	1.03†	Amperes
Direct Interelectrode Capacitances‡		
Grid to Plate: (g to p)	2.01	pf
Grid to Cathode: (g to k)	6.5	pf
Plate to Cathode: (p to k)	0.023	pf

MECHANICAL

Mounting Position—Any—Only Plate Flange to Be Used as a Socket Stop and Clamp

Net Weight, approximate	2	Ounces

Cooling
- Plate and Plate Seal—Conduction and Forced Air
- Grid and Cathode Seals—Conduction and Forced Air
- Recommended Air Flow Cowling—157-JAN
- Recommended Air Flow on Plate Radiator at Sea Level
  - Incoming Air Temperature 25C, Plate Dissipation
    - 100 Watts: 12.5 Cubic Feet Per Minute

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key-Down Conditions per Tube Without Amplitude Modulation§

Heater Voltage*	4.5 to 6.3	Volts
DC Plate Voltage	1000	Volts
Negative DC Grid Voltage	150	Volts
Peak Positive RF Grid Voltage	30	Volts
Peak Negative RF Grid Voltage	400	Volts
DC Grid Current	50	Milliamperes
DC Cathode Current	125	Milliamperes
Plate Dissipation	100	Watts
Grid Dissipation	2.0	Watts
Envelope Temperature at Hottest Point #	250	C

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEPHONY

Carrier Conditions per Tube For Use With a Maximum Modulation Factor of 1.0

Heater Voltage*	4.5 to 6.3	Volts
DC Plate Voltage¶	600	Volts
Negative DC Grid Voltage	150	Volts
Peak Positive RF Grid Voltage	30	Volts
Peak Negative RF Grid Voltage	400	Volts
DC Grid Current	50	Milliamperes
DC Cathode Current	100	Milliamperes
Plate Dissipation	70	Watts
Grid Dissipation	2.0	Watts
Envelope Temperature at Hottest Point #	250	C

Supersedes ET-T1054A dated 9-57

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Heater Voltage	6.3	Volts
Plate Voltage	600	Volts
Grid Voltage△		Volts
Amplification Factor	95	
Transconductance	24800	Micromhos
Plate Current	75	Milliamperes

RADIO FREQUENCY OSCILLATOR—CLASS C

Frequency	500	2500	Megacycles
Heater Voltage	6.0	5.0	Volts
DC Plate Voltage	900	900	Volts
DC Plate Current	90	90	Milliamperes
DC Grid Current	30	27	Milliamperes
DC Grid Voltage	−40	−22	Volts
Useful Power Output	40	17	Watts

* The equipment designer should design the equipment so that heater voltage is centered at some value within the range of 4.5 to 6.3 volts. Heater voltage variations about the center value should be kept as small as practical and should not, in any case, exceed ±5%. The optimum center value of heater voltage depends on the cathode current and on other parameters of circuit design and operation. For specific recommendations, contact your General Electric tube sales representative.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Measured in a special shielded socket.

§ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier conditions.

⁂ Where long life and reliable operation are important, lower envelope temperatures should be used.

¶ For modulation factors less than 1.0, a higher d-c plate voltage may be used if the sum of the peak positive audio voltage and the d-c plate voltage does not exceed 1200 volts.

△ Adjusted for Ib = 75 milliamperes.

INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
Ef = 6.3 volts	950	1030	1100	Milliamperes
Grid Voltage				
Ef = 6.3 volts, Eb = 600 volts, Ib = 75 ma	−1.3	−2.5	−3.5	Volts
Grid Voltage				
Ef = 6.3 volts, Eb = 600 volts, Ib = 1.0 ma	−7.0	−9.5	−15	Volts
Transconductance				
Ef = 6.3 volts, Eb = 600 volts, Ec adjusted for Ib = 75 ma	22000	24800	27500	Micromhos
Amplification Factor				
Ef = 6.3 volts, Eb = 600 volts, Ec adjusted for Ib = 75 ma	75	95	115	
Negative Grid Current				
Ef = 6.3 volts, Eb = 600 volts, Ec adjusted for Ib = 75 ma	.....	.....	3.0	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts, Polarity of applied d-c interelectrode voltage is such that no cathode emission results				
Grid to Cathode at 500 volts d-c	50	.....	.....	Megohms
Interelectrode Capacitances				
Grid to Plate: (g to p)	1.89	2.01	2.13	Picofarads
Grid to Cathode: (g to k)	6.0	6.5	7.0	Picofarads
Plate to Cathode: (p to k)	0.018	0.023	0.029	Picofarads

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

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SPECIAL PERFORMANCE TESTS

	Min.	Max.	
Oscillator Power Output Tubes are tested for power output as an oscillator under the following conditions: Ef = 5.0 volts; F = 2500 MC, min.; Eb = 1000 volts; Ib = 90 ma	15	....	Watts

Low Pressure Voltage Breakdown Test

Statistical sample tested for voltage breakdown at a pressure of 27 mm Hg. Tubes shall not give visual evidence of flashover when 1000 volts RMS, 60 cps, is applied between the plate and grid terminals.

DEGRADATION RATE TESTS

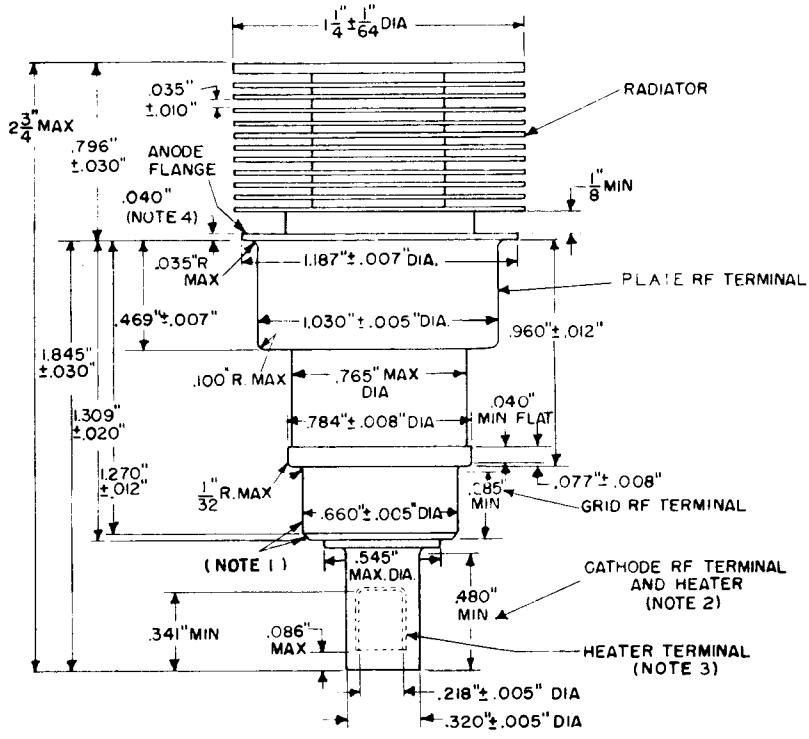
Shock

Statistical sample subjected to 5 input accelerations of approximately 400 G and 1.0 milliseconds duration in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine.

500-Hour Life Test

Statistical sample operated for 500 hours as an oscillator to evaluate changes in power output with life.

PHYSICAL DIMENSIONS

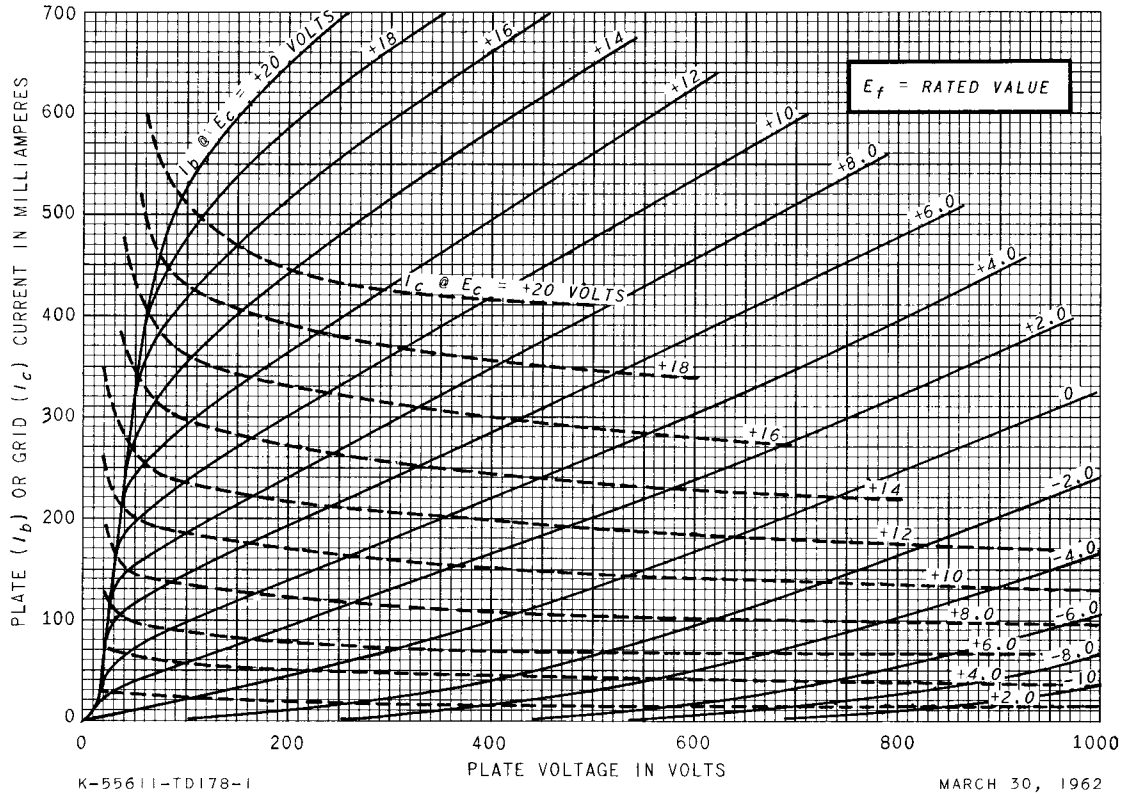


NOTES:

1. Solder not to extend radially beyond grid RF terminal.
2. Total indicated runout of the grid-contact surface and the cathode-contact surface with respect to the anode shall not exceed 0.020".
3. Total indicated runout of the cathode-contact surface with respect to the heater-contact surface shall not exceed 0.012".
4. Only this flange to be used as a socket stop and clamp.

¶ New pages 3 to 6 supersede old pages 3 and 4 dated 12-61.

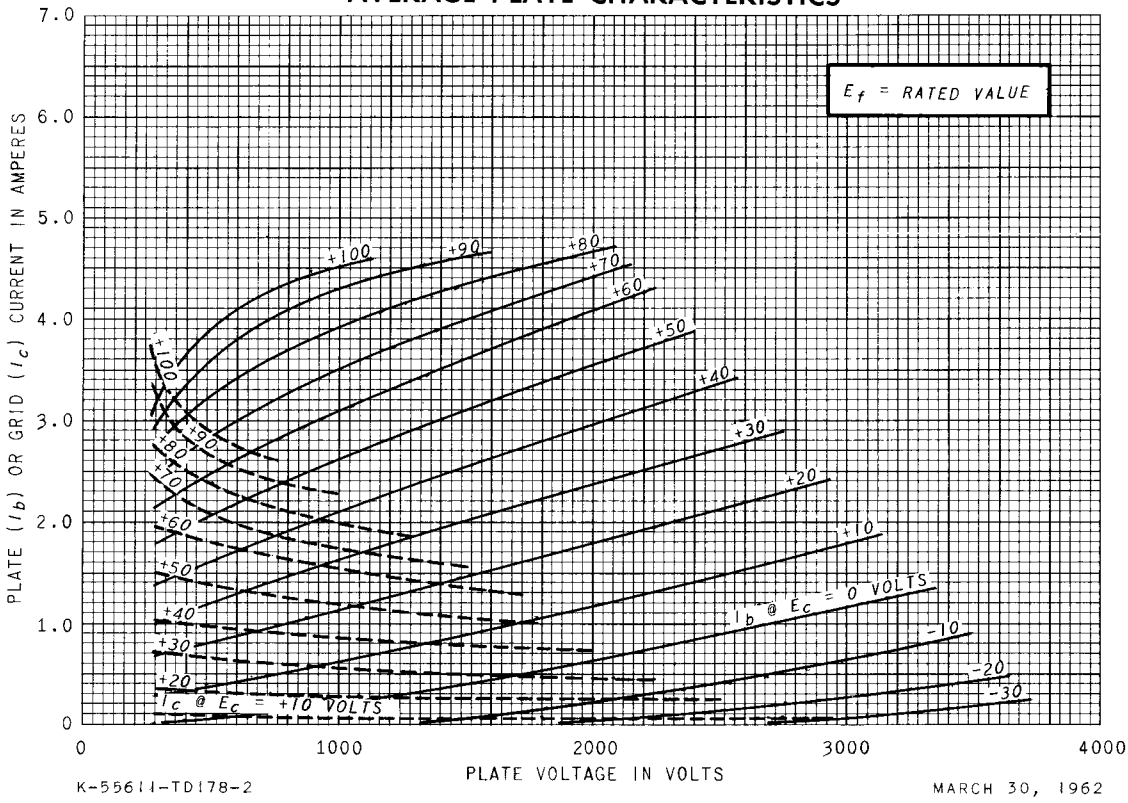
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD178-1

MARCH 30, 1962

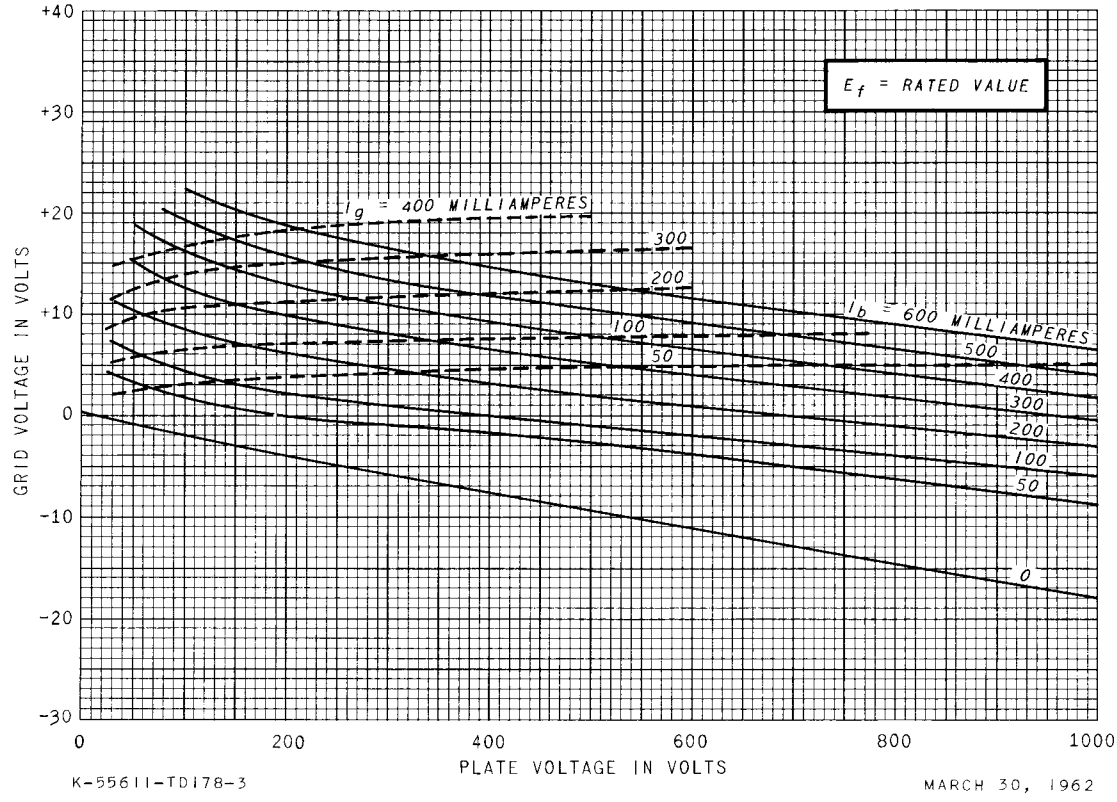
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD178-2

MARCH 30, 1962

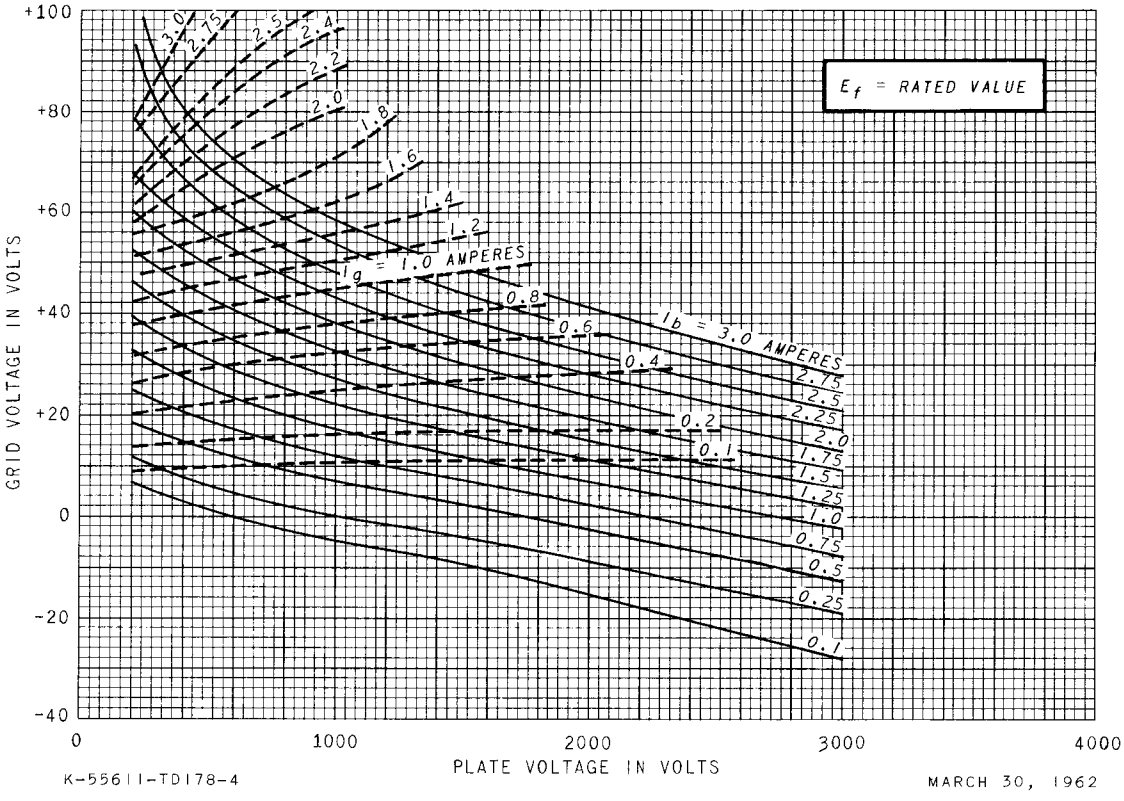
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



K-5561I-TDI78-3

MARCH 30, 1962

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



K-5561I-TDI78-4

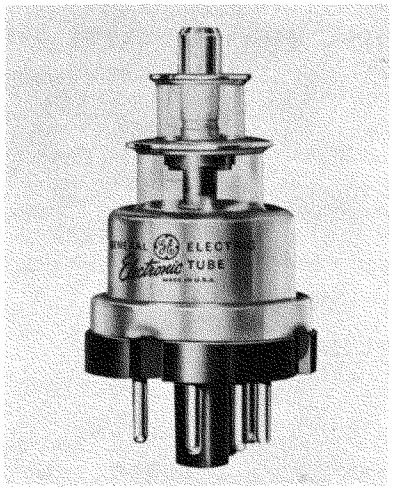
MARCH 30, 1962

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

2C40-A
PLANAR TRIODE



DESCRIPTION AND RATING

The 2C40-A is a triode of lighthouse construction designed for use as a CW oscillator, radio-frequency amplifier, or plate-pulsed oscillator at frequencies as high as 3370 megacycles.

The radio-frequency cathode connection is made through a disk-type capacitor which is incorporated in the tube. This results in a low-impedance radio-frequency path from the cathode to the external circuit.

The envelope construction results in low losses, provides convenient electrode contact surfaces, and enables the tube to fit easily into coaxial circuits.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	6.3 ± 0.3	Volts
Heater Current†	0.75	Amperes
Direct Interelectrode Capacitances‡		
Grid to Plate: (g to p)	1.3	pf
Grid to Cathode: (g to k)	2.15	pf
Plate to Cathode	0.03	pf
Cathode RF Connection to Cathode	100	pf

MECHANICAL

Mounting Position—Any		
Net Weight, approximate	1.2	Ounces
Cooling—Convection and Conduction		

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Radio-Frequency Power Amplifier or Oscillator—Class C		
Frequency	3370	Megacycles
DC Plate Voltage	500	Volts
DC Grid Voltage	−50	Volts
DC Plate Current	25	Milliamperes
DC Grid Current	8.0	Milliamperes
Plate Dissipation	6.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Cathode-Cathode RF Connection Voltage		
Cathode RF Connection Positive with Respect to Cathode	90	Volts
Cathode RF Connection Negative with Respect to Cathode	90	Volts
Envelope Temperature at Hottest Point	175	C

PLATE-PULSED OSCILLATOR

Cathode Heating Time, minimum	60	Seconds
Frequency	3370	Megacycles
Peak Positive-Pulse Plate Supply Voltage	1400	Volts
Duty Factor of Plate Pulse§	0.002	
Pulse Duration	1.5	Microseconds
Plate Current		
Average§	3.0	Milliamperes
Average During Plate Pulse	2.0	Amperes
Negative Grid Voltage		
Average During Plate Pulse	100	Volts
Grid Current		
Average§	1.5	Milliamperes
Average During Plate Pulse	1.0	Amperes
Plate Dissipation§	4.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Cathode-Cathode RF Connection Voltage		
Cathode RF Connection Positive with Respect to Cathode	90	Volts
Cathode RF Connection Negative with Respect to Cathode	90	Volts
Envelope Temperature at Hottest Point	175	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Heater Voltage	6.3	Volts	Amplification Factor	35	
Plate Voltage	250	Volts	Transconductance	5100	Micromhos
Cathode-Bias Resistor	200	Ohms	Plate Current	17	Milliamperes

RADIO-FREQUENCY OSCILLATOR

Frequency	3370	Megacycles	DC Grid Current, approximate	0.5	Milliamperes
DC Plate Voltage	250	Volts	DC Plate Current	20	Milliamperes
Grid Resistor	10000	Ohms	Power Output	75	Milliwatts
DC Grid Voltage	−5.0	Volts			

PLATE-PULSED OSCILLATOR

Frequency	3000	Megacycles
Duty Factor	0.001	
Pulse Duration	1.0	Microseconds
Peak Positive-Pulse Plate Supply Voltage	1400	Volts
Plate Current		
Average During Plate Pulse	1.0	Amperes
Useful Power Output		
Average	0.3	Watts
Average During Plate Pulse	300	Watts

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.
‡ Without external shield.
§ In any 500 microsecond interval.

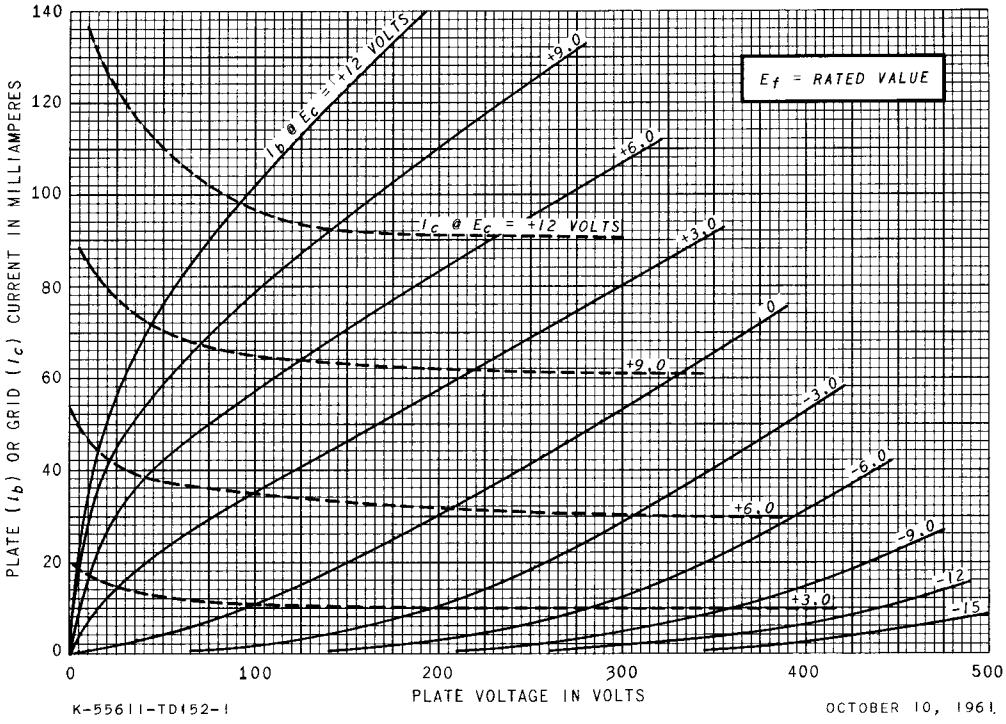
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The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

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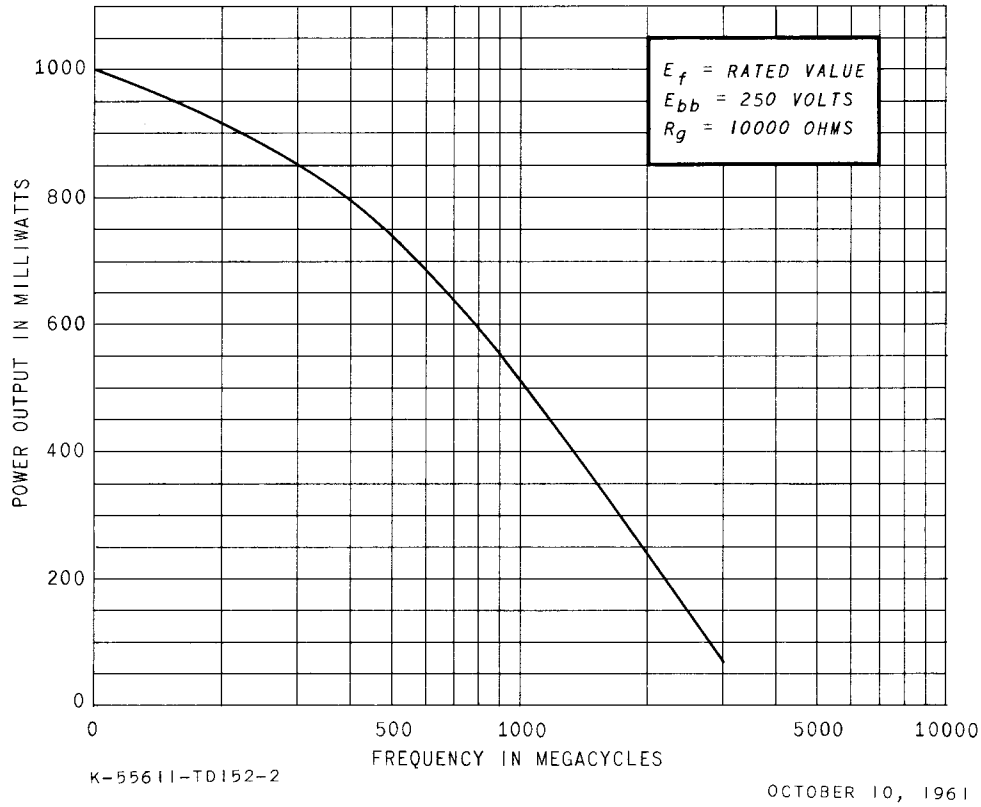
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD152-1

OCTOBER 10, 1961

POWER OUTPUT VS. FREQUENCY



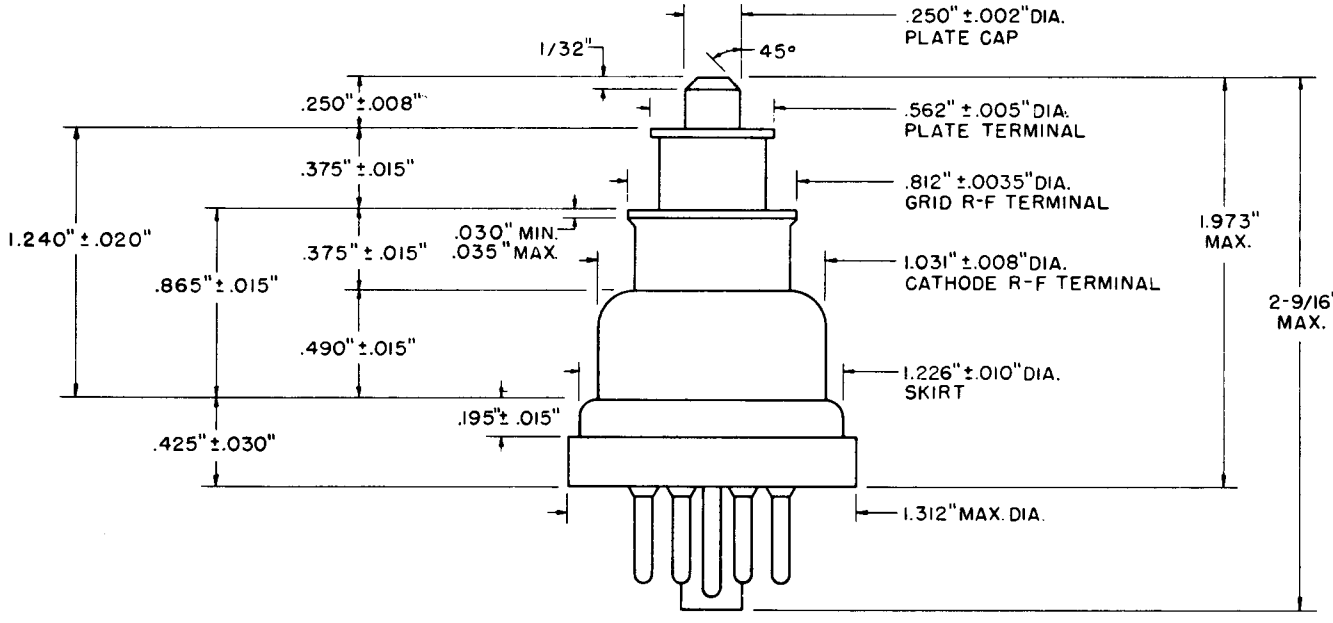
K-5561I-TD152-2

OCTOBER 10, 1961

NOTES:

1. Glass shall not protrude beyond edge of anode RF terminal or grid RF terminal.
2. Plate cap and grid RF terminal to be concentric with respect to the cathode RF terminal within 1/64 inch (run-out of 1/32 inch maximum).

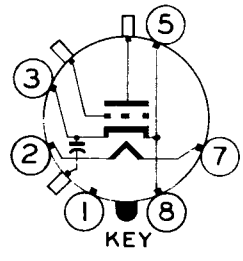
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pin 1—Internal Connection—Do Not Use
Pin 2—Heater
Pin 3—Cathode
Pin 5—Cathode
Pin 7—Heater
Pin 8—Cathode
Top Cap—Plate
Disk Terminal—Grid
Shell—Cathode RF Terminal

BASING DIAGRAM



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release No. 468

February 2, 1946

sponsor:
General Electric Co.

RMA TYPE

2C42

The 2C42 is a three-electrode tube of the disk-seal type designed for stable operation as a plate-pulsed oscillator at frequencies up to 1300 megacycles.

GENERAL CHARACTERISTICS

Number of Electrodes	3	

Electrical

Cathode - Indirectly Heated		
Heater Voltage	6.3	Volts
Heater Current	0.9	Amperes
Average Characteristics		
Amplification Factor	48	
Grid-Plate Transconductance, Ib = 22 ma	8000	Micromhos
Direct Interelectrode Capacitances		
Grid-Plate	1.7	Micromicrofarads
Grid-Cathode	2.9	Micromicrofarads
Plate-Cathode, maximum	0.05	Micromicrofarads
Cathode R-F Connection - Cathode	100	Micromicrofarads

Mechanical

Type of Cooling - Convection or Forced Air and conduction		
Maximum Seal Temperature	200	C
Base Description	6-pin Octal	
Mounting Position	Any	
Net Weight, approximate	3	Ounces
Shipping Weight, approximate	3	Pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Power Oscillator - Low Duty Cycle Plate Pulsed

	Typical Operation	Maximum Ratings	
Peak Anode Voltage	3000	3000	Volts
Grid Resistance	50		Ohms
D-c Plate Current, average	2.0		Milliamperes
Peak Cathode Current	2.5	4.0	Amperes
Pulse Width	1.0	3.0	Microseconds
Repetition Rate	1000		Pulses per Second
Plate Dissipation	4.25	12	Watts
Peak Power Output, approximate	1750		Watts
Frequency	1050	1300	Megacycles

Power Oscillator - High Duty Cycle Plate Pulsed

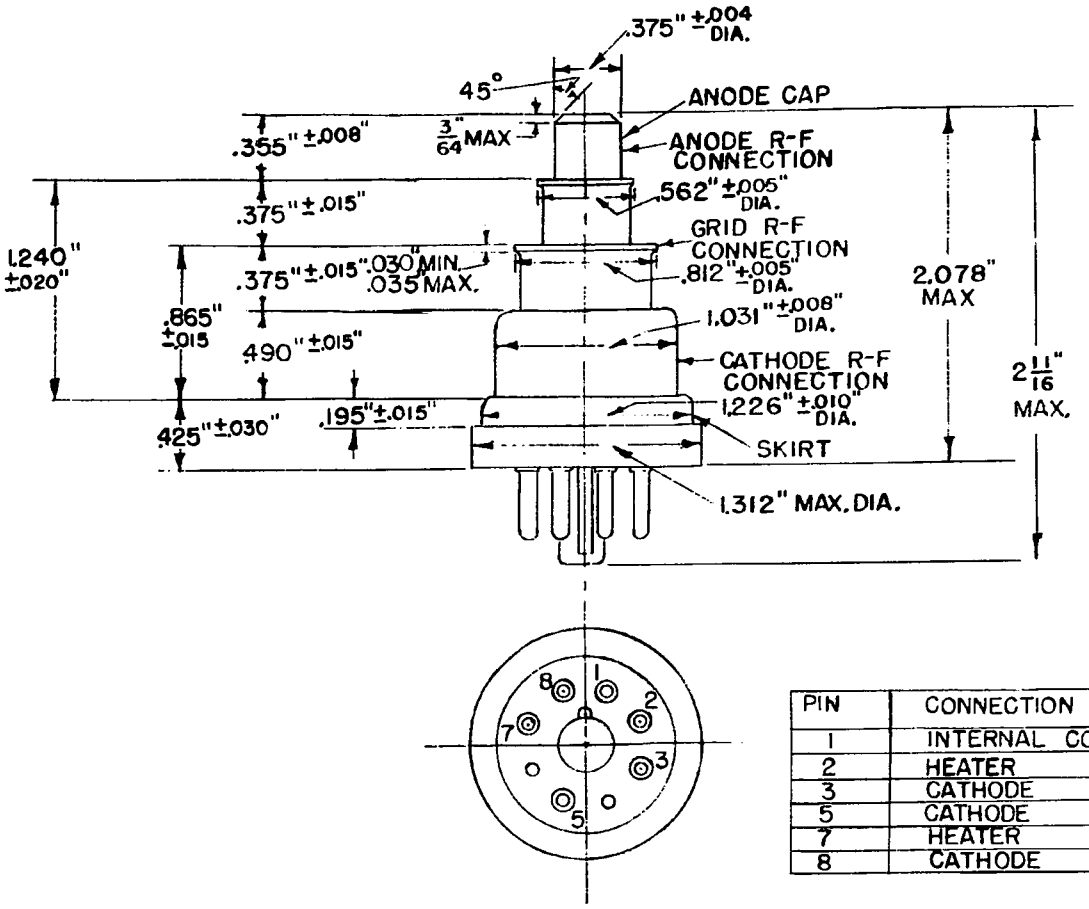
	Typical Operation	Maximum Ratings *	
Peak Anode Voltage	2000	2000	Volts
Grid Leak Resistance	50		Ohms
D-c Plate Current, average	7.2		Milliamperes
Peak Cathode Current	1.5	1.5	Amperes
Pulse Width	3.0	9.0	Microseconds
Repetition Rate	2000		Pulses per Second
Plate Dissipation	9.9	25	Watts
Peak Power Output, approximate	750		Watts
Frequency	1050	1300	Megacycles

* A useful tube life of approximately 150 hours can be expected at these maximum ratings.

December 24, 1945.

RMA TYPES

2C42 2C46



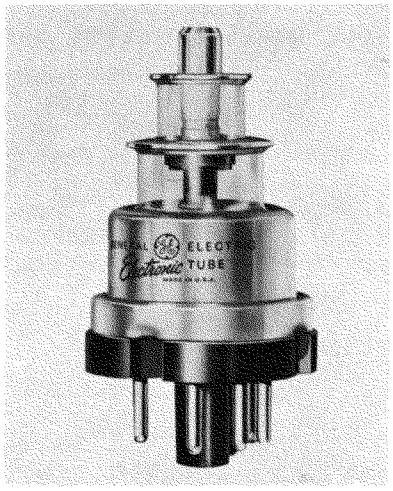
PIN	CONNECTION
1	INTERNAL CONNECTION
2	HEATER
3	CATHODE
5	CATHODE
7	HEATER
8	CATHODE

NOTE 1: GLASS SHALL NOT PROTRUDE BEYOND EDGE OF ANODE R-F CONNECTION OR GRID R-F CONNECTION

NOTE 2: EXPOSED METAL R-F PARTS TO BE PLATED WITH 100 MSI SILVER EXCEPT BASE PINS

NOTE 3: ANODE CAP, GRID R-F CONNECTION, AND CATHODE R-F CONNECTION TO BE CONCENTRIC WITH RESPECT TO EACH OTHER WITHIN $\frac{1}{64}$ IN.

2C43
PLANAR TRIODE



DESCRIPTION AND RATING

The 2C43 is a triode of lighthouse construction designed for use as a Class C radio-frequency amplifier or pulsed oscillator at frequencies as high as 3370 megacycles.

The radio-frequency cathode connection is made through a disk-type capacitor which is incorporated in the tube. This results in a low-impedance radio-frequency path from cathode to the external circuit.

The envelope construction results in low losses, provides convenient contact surfaces, and enables the tube to fit easily into coaxial circuits.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Characteristics and Ratings		
Heater Voltage, AC or DC	6.3 ± 0.3*	Volts
Heater Current	0.9†	Amperes
Direct Interelectrode Capacitances‡		
Grid to Plate: (g to p)	1.8	pf
Grid to Cathode: (g to k)	3.0	pf
Plate to Cathode: (p to k), maximum	0.04	pf
Cathode RF Connection to Cathode	100	pf

MECHANICAL

Mounting Position—Any		
Net Weight, approximate	1	Ounce
Cooling—Convection and Conduction		

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C

Frequency	1500	Megacycles
DC Plate Voltage	500	Volts
DC Plate Current	40	Milliamperes
DC Cathode Current	55	Milliamperes
Plate Dissipation	12	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Cathode-Cathode RF Connection Voltage		
Cathode RF Connection Positive with Respect to Cathode	90	Volts
Cathode RF Connection Negative with Respect to Cathode	90	Volts
Envelope Temperature at Hottest Point	175	C

PLATE-PULSED OSCILLATOR

Cathode Heating Time, minimum	60	Seconds
Frequency	3370	Megacycles
Peak Positive-Pulse Plate Supply Voltage	3500	Volts
Duty Factor of Plate Pulse	0.006	
Pulse Duration	10	Microseconds
Plate Current		
Average During Plate Pulse	2.75	Amperes
Cathode Current		
Average During Plate Pulse	4.0	Amperes
Plate Dissipation	12	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Cathode-Cathode RF Connection Voltage		
Cathode RF Connection Positive with Respect to Cathode	90	Volts
Cathode RF Connection Negative with Respect to Cathode	90	Volts
Envelope Temperature at Hottest Point	175	C

Supersedes ET-T1463 dated 9-57

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Heater Voltage	6.3	Volts
Plate Voltage	250	Volts
Cathode-Bias Resistor	100	Ohms
Amplification Factor	50	
Transconductance	8100	Micromhos
Plate Current	21	Milliamperes

PUSH-PULL CW OSCILLATOR, VALUES FOR TWO TUBES

Frequency	350	350	Megacycles
Heater Voltage	5.8	5.8	Volts
DC Plate Voltage	360	470	Volts
Grid Resistor	1000	1000	Ohms
DC Plate Current	28	38	Milliamperes
Power Output, approximate	4.7	9.0	Watts

PUSH-PULL RADIO-FREQUENCY POWER AMPLIFIER—CLASS C—PLATE MODULATED, VALUES FOR TWO TUBES

Frequency	300	Megacycles
Heater Voltage	5.8	Volts
DC Plate Voltage	350	Volts
Grid Resistor	1200	Ohms
DC Grid Voltage	−50	Volts
DC Grid Current, approximate	40	Milliamperes
DC Plate Current	48	Milliamperes
Driving Power, approximate	3	Watts
Power Output	10	Watts

PUSH-PULL FREQUENCY TRIPLER, VALUES FOR TWO TUBES

Output Frequency	300	Megacycles
Heater Voltage	5.8	Volts
DC Plate Voltage	350	Volts
Grid Resistor	2700	Ohms
DC Grid Voltage	−80	Volts
DC Grid Current, approximate	30	Milliamperes
DC Plate Current	50	Milliamperes
Driving Power, approximate	3	Watts
Power Output	4.4	Watts

PLATE-PULSED OSCILLATOR

Frequency	3370	Megacycles
Duty Factor	0.001	
Pulse Duration	1.0	Microseconds
Pulse Repetition Rate	1000	Pulses per Second
Peak Positive-Pulse Plate Supply Voltage	3000	Volts
Grid-Bias Resistor	100	Ohms
Plate Current		
Average	2.5	Milliamperes
Average During Plate Pulse	2.5	Amperes
Power Output		
Average During Plate Pulse	1.75	Kilowatts

* The equipment designer should design the equipment so that the heater voltage is centered at a value suitable for the application. Heater voltage variations about the center value should be kept as small as practical and should not, in any case, exceed ±5%. The optimum center value of heater voltage depends on the cathode current and on the other parameters of circuit design and operation. For specific recommendations, contact your General Electric tube sales representative.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

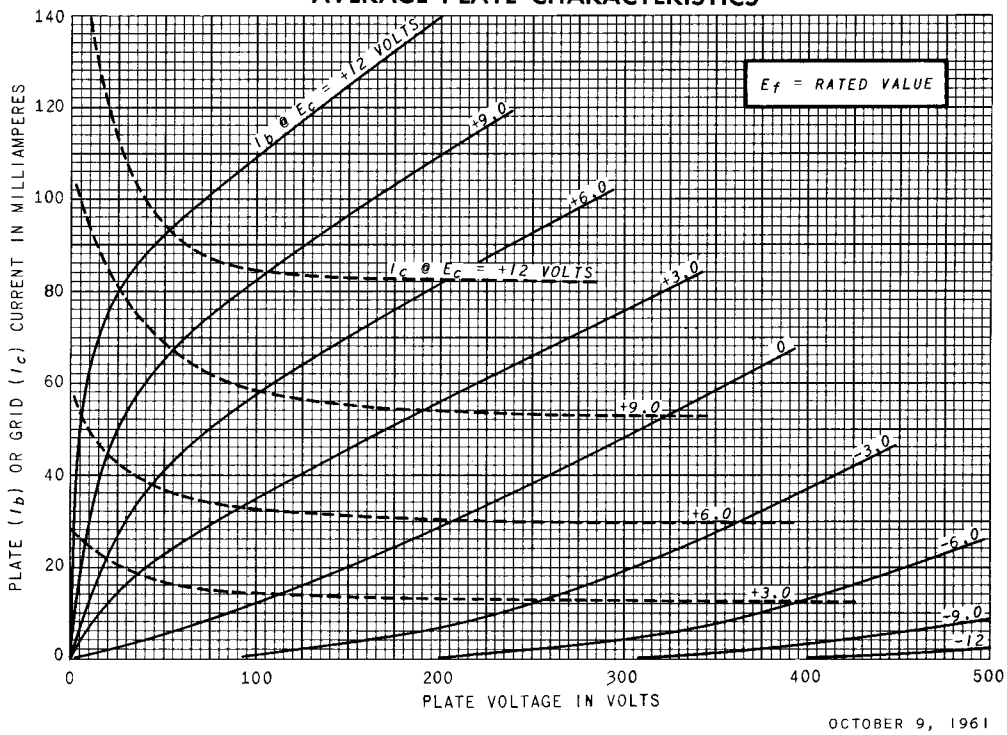
Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

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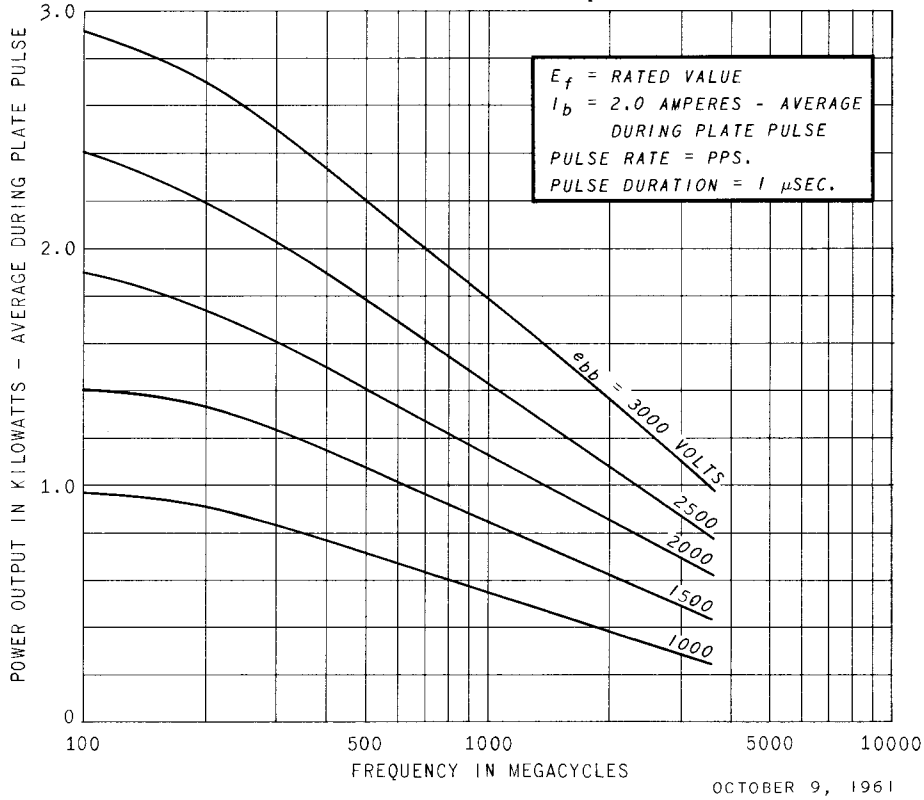
AVERAGE PLATE CHARACTERISTICS



OCTOBER 9, 1961

APPROXIMATE PLATE-PULSED OSCILLATOR PERFORMANCE

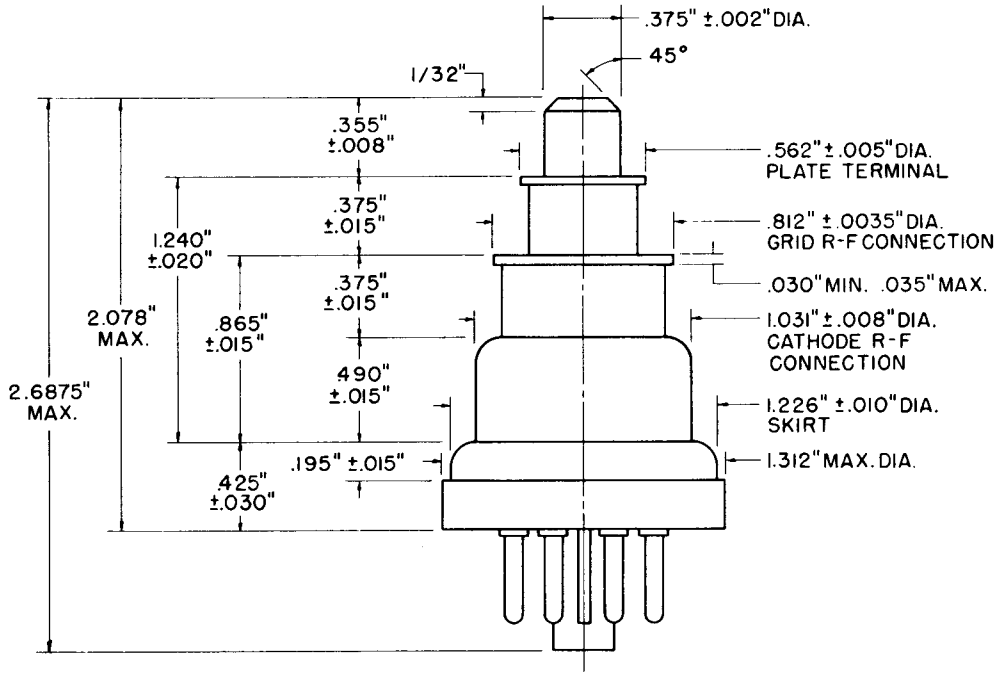
POWER OUTPUT VS. FREQUENCY



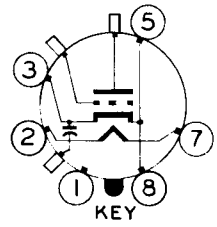
OCTOBER 9, 1961

NOTE 1
Glass shall not protrude beyond edge of plate terminal or grid RF connection.

NOTE 2
Plate terminal and grid RF connection to be concentric with respect to the cathode RF connection within 1/64 inch (runout 1/32 inch, maximum).



BASING DIAGRAM



TERMINAL CONNECTIONS

Pin	Connection
1	Internal Connection
2	Heater
3	Cathode
5	Cathode
7	Heater
8	Cathode

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release No. 468

February 1, 1946

sponsor:
General Electric Co.

RMA TYPE

2C46

The 2C46 is a three-electrode tube of the disk-seal type designed for use in a specific cavity for stable local-oscillator service between 1000 and 1200 megacycles.

GENERAL CHARACTERISTICS

Number of Electrodes	3

Electrical

Cathode - Indirectly Heated	
Heater Voltage	6.3 Volts
Heater Current	0.75 Amperes
Average Characteristics	
Amplification Factor	60
Grid-Plate Transconductance, Ib = 14 ma	3500 Micromhos
Direct Interelectrode Capacitances	
Grid-Plate	1.7 Micromicrofarads
Grid-Cathode	2.2 Micromicrofarads
Plate-Cathode, maximum	0.025 Micromicrofarads
Cathode R-F Connection - Cathode	175 Micromicrofarads

Mechanical

Type of Cooling - Convection and Conduction	
Maximum Seal Temperature	200 C
Base Description	6-pin Octal
Mounting Position	Any
Net Weight, approximate	3 Ounces
Shipping Weight, approximate	3 Pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

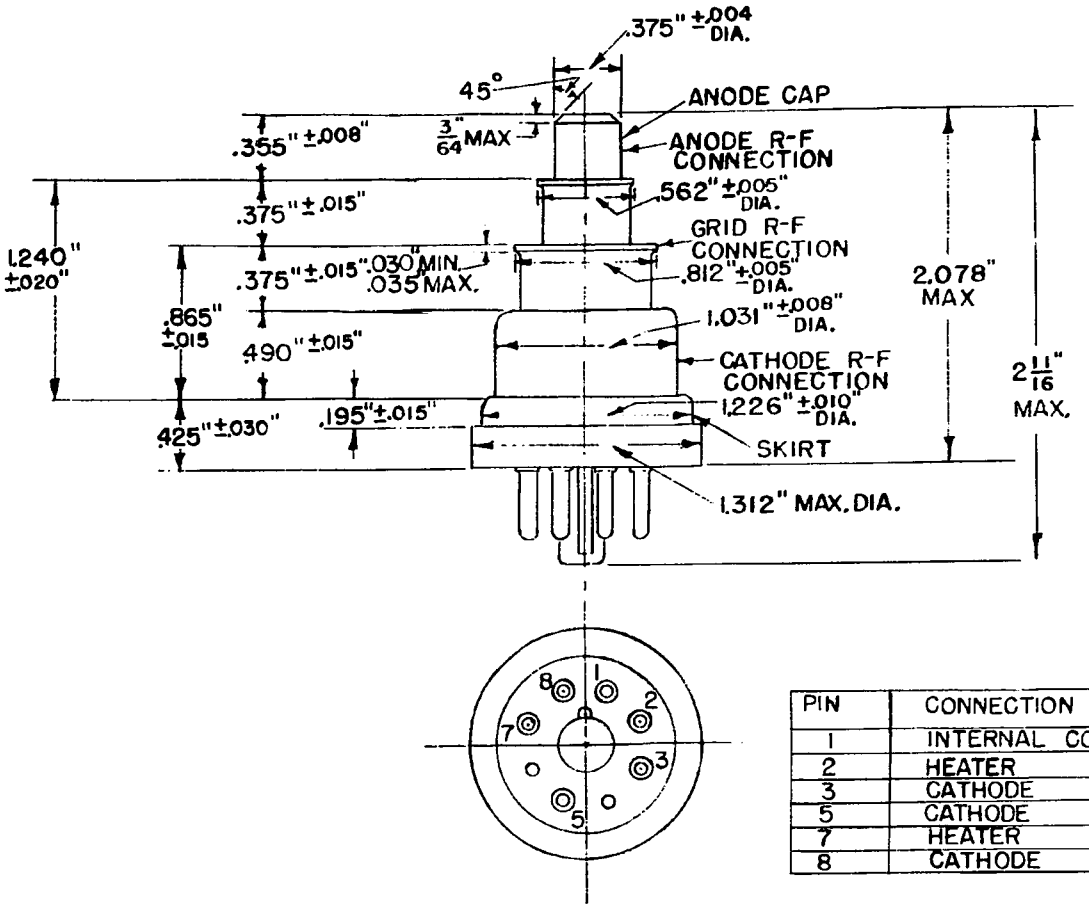
CW Oscillator

	Typical Operation	Maximum Ratings
D-c Plate Voltage	150	500 Volts
Grid Leak Resistance	0	Ohms
D-c Plate Current	8	40 Milliamperes
Plate Input	1.2	Watts
Plate Dissipation	1.18	12 Watts
Grid Current	3	Milliamperes
Power Output, approximate	20	Milliwatts
Frequency	1100	1300 Megacycles

December 24, 1945.

RMA TYPES

2C42 2C46



PIN	CONNECTION
1	INTERNAL CONNECTION
2	HEATER
3	CATHODE
5	CATHODE
7	HEATER
8	CATHODE

NOTE 1: GLASS SHALL NOT PROTRUDE BEYOND EDGE OF ANODE R-F CONNECTION OR GRID R-F CONNECTION

NOTE 2: EXPOSED METAL R-F PARTS TO BE PLATED WITH 100 MSI SILVER EXCEPT BASE PINS

NOTE 3: ANODE CAP, GRID R-F CONNECTION, AND CATHODE R-F CONNECTION TO BE CONCENTRIC WITH RESPECT TO EACH OTHER WITHIN $\frac{1}{64}$ IN.

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Diode

2CN3-B

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

- COLOR TV TYPE
- 30000 VOLTS DC
- 2.2 MILLIAMPERES DC
- DIFFUSION BONDED CATHODE
- X-RADIATION RATING

The 2CN3-B is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube. Features of the tube include a diffusion bonded cathode coating to minimize reverse emission failures, and X-radiation controls.

The diffusion bonded cathode coating practically eliminates one of the major failure mechanisms in high-voltage rectifiers, which is back-emission from the anode due to emissive particles being pulled from the cathode by the very high electrostatic field.

The 2CN3-B features built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	1.8±0.2	Volts
Heater Current‡	0.9	Amperes

Direct Interelectrode Capacitances, approximate§

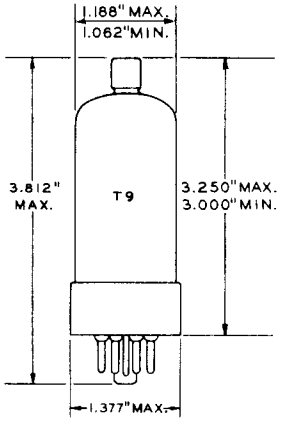
Plate to Heater, Cathode, and Internal Shield: p to (h + k + i.s.)	1.6	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - B8-118, Short Medium-Shell Octal 8-Pin
or B8-251, Ultra-Short Small-Wafer Octal 8-Pin
Top Cap - C1-1, C1-34, C1-49 or C1-50, Small
Outline Drawing

Maximum Diameter	1.377	Inches
Maximum Bulb Diameter	1.188	Inches
Maximum Over-all Length	3.812	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

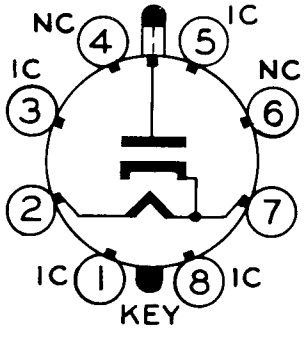
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pin 1 - Internal Connection - Do Not Use
Pin 2 - Heater
Pin 3 - Internal Connection - Do Not Use
#Pin 4 - No Connection
Pin 5 - Internal Connection - Do Not Use
#Pin 6 - No Connection
Pin 7 - Heater, Cathode, and Internal Shield
Pin 8 - Internal Connection - Do Not Use
Cap - Plate

BASING DIAGRAM



EIA 8MU

GENERAL ELECTRIC

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE¶—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	30000	Volts
Total DC and Peak (Absolute-Maximum Value)	38000	Volts
Steady-State Peak Plate Current	110	Milliamperes
DC Output Current	2.2	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value)£	2.0	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	1.6	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes	60	Volts

X-RADIATION RATING¶

X-radiation, maximum	25	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 25 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on data obtained with the use of the Victoreen RF survey meter with a 3 3/8 inch aperture. X-radiation is measured with the face of the meter at a distance of 4 3/4 inches from the external surface of the tube. This rating information is not necessarily applicable when a different radiation measuring instrument or aperture is used.

Operation of the 2CN3-B outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

X-RADIATION CHARACTERISTICS

The 2CN3-B will produce varying levels of X-radiation depending on operating conditions. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the maximum expected values indicated below for the different values of total DC and peak inverse voltage, with all other operating conditions remaining constant.

TOTAL DC AND PEAK INVERSE VOLTAGE	MAXIMUM EXPECTED X-RADIATION OUTPUT
38 KV (30 KV Maximum DC Component)	25.0 mR/hr
33 KV (27 KV Maximum DC Component)	3.0 mR/hr
30 KV (25 KV Maximum DC Component)	0.5 mR/hr

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

WARNING

X-RADIATION

The high voltages associated with the 2CN3-B result in production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide for this shielding.

Precautions must be exercised during the servicing of equipment employing the 2CN3-B to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 2CN3-B is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 2CN3-B in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 1.8 volts.

§ Without external shield.

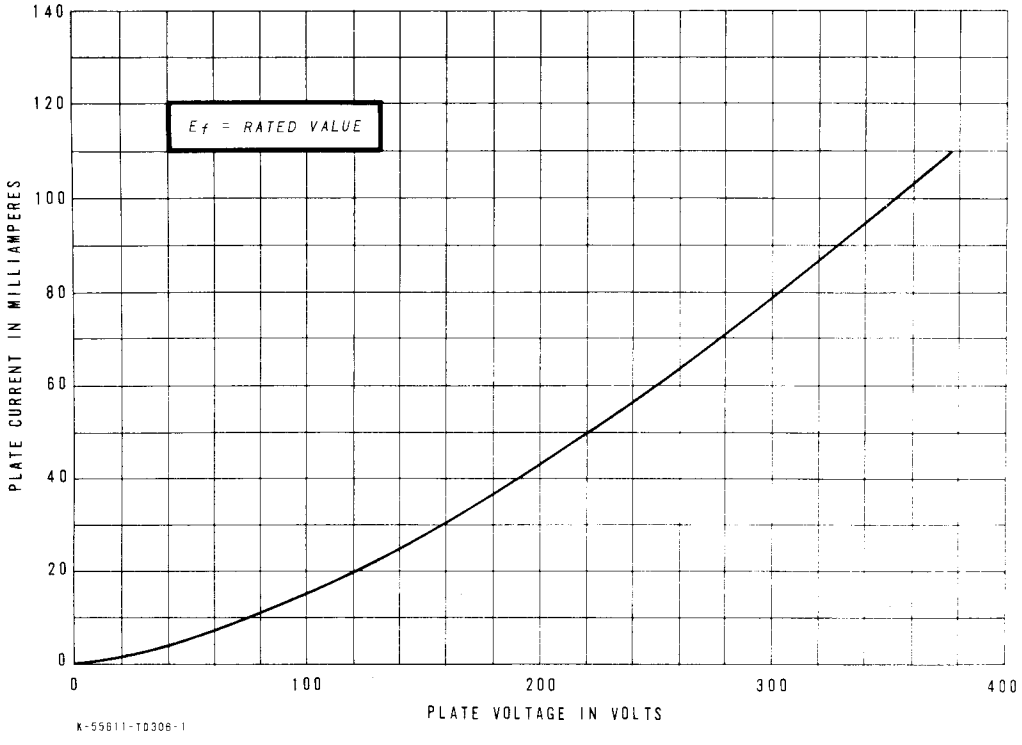
Socket terminals 4 and 6 may be used as tie points for components at or near heater potential.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¢ CAUTION - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 2.0 volts may result in the production of X-radiation in excess of the maximum rated limit of 25 mR/hr.

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AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

—PRODUCT INFORMATION—

2CY5 - 2GK5

2CY5 Tetrode. The 2CY5 is a miniature, sharp-cutoff tetrode designed for radio-frequency amplifier use in VHF television receivers.

Except for heater characteristics, the 2CY5 is identical to the 6CY5.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Chatacteristics and Ratings

Heater Voltage, AC or DC★	2.4	Volts
Heater Current●	0.6±0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds

2GK5 Frame-Grid Triode. The 2GK5 is a frame-grid, gain-controlled triode designed for use as a VHF RF amplifier.

Except for heater characteristics, the 2GK5 is identical to the 6GK5.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	2.3	Volts
Heater Current●	0.6±0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

Electronic TUBES

2FS5

"SHADOW-GRID" BEAM PENTODE

FOR VHF RF AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

Except for heater characteristics and ratings, the 2FS5 is identical to the 6FS5.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings (Design-Maximum Rating System)

Heater Voltage, AC or DC*	2.4	Volts
Heater Current†	0.6±0.04	Amperes
Heater Warm-up Time‡	11	Seconds

* Heater voltage at bogey heater current.

† For series heater operation, the equipment designer shall design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

‡ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Diode

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

3A3-C

■ COLOR TV TYPE ■ 30000 VOLTS DC ■ 2.0 MILLIAMPERES DC ■ X-RADIATION RATING

The 3A3-C is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube. It is primarily intended for use in flyback types of power supplies.

The 3A3-C voltage and current ratings are consistent with the requirements of present day color television applications.

The 3A3-C features built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	3.15±0.5	Volts
Heater Current‡	0.220	Amperes

Direct Interelectrode Capacitances, approximate§

Plate to Heater, Cathode, and Internal Shield: p to (h + k + i.s.)	1.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - B6-253, Ultra-Short Small-Wafer Octal 6-Pin
Top Cap - C1-49, Small
Outline Drawing

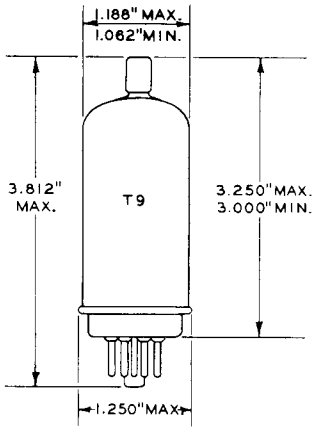
Maximum Bulb Diameter	1.188	Inches
Maximum Seal Diameter	1.250	Inches
Minimum Bulb Diameter	1.062	Inches
Maximum Over-all Length	3.812	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE¶—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	30000	Volts
Total DC and Peak (Absolute-Maximum Value)	38000	Volts
Steady-State Peak Plate Current	100	Milliamperes
DC Output Current	2.0	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value)#	3.65	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.65	Volts

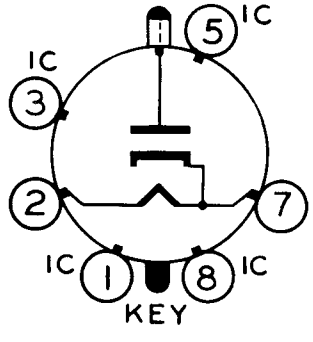
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS Δ

Pin 1 - Internal Connection - Do Not Use
Pin 2 - Heater
Pin 3 - Internal Connection - Do Not Use
Pin 5 - Internal Connection - Do Not Use
Pin 7 - Heater, Cathode, and Internal Shield
Pin 8 - Internal Connection - Do Not Use
Cap - Plate

BASING DIAGRAM



EIA 8EZ

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes	60	Volts

X-RADIATION RATING¶

X-radiation, maximum.	25	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 25 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on data obtained with the use of the Victoreen 440 RF survey meter with a 3 3/8 inch aperture. X-radiation is measured with the face of the meter at a distance of 4 3/4 inches from the external surface of the tube. This rating information is not necessarily applicable when a different radiation measuring instrument or aperture is used.

Operation of the 3A3-C outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

X-RADIATION CHARACTERISTICS

The 3A3-C will produce varying levels of X-radiation depending on operating conditions. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the maximum expected values indicated below for the different values of total DC and peak inverse voltage, with all other operating conditions remaining constant.

TOTAL DC AND PEAK INVERSE VOLTAGE	MAXIMUM EXPECTED X-RADIATION OUTPUT	
38 KV (30 KV Maximum DC Component)	25.0	mR/hr
33 KV (27 KV Maximum DC Component)	3.0	mR/hr
30 KV (25 KV Maximum DC Component)	0.5	mR/hr

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

WARNING

X-RADIATION

The high voltages associated with the 3A3-C result in production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide for this shielding.

Precautions must be exercised during the servicing of equipment employing the 3A3-C to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 3A3-C is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 3A3-C in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 3.15 volts.

§ Without external shield.

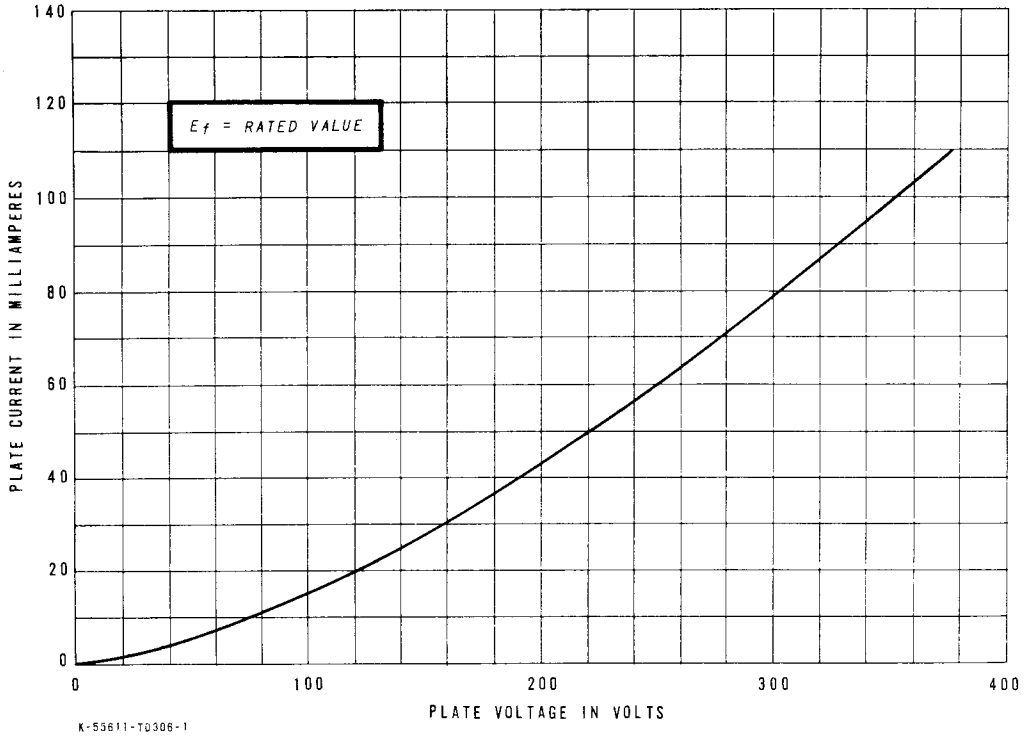
¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

CAUTION - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 3.65 volts may result in the production of X-radiation in excess of the maximum rated limit of 25 mR/hr.

Δ Pins 4 and 6 are omitted on Base B6-253. Socket terminals 4 and 6 may be used as tie points for components at or near heater potential.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

DESCRIPTION AND RATING

3AF4-A

3AF4-A Triode. Except for heater characteristics and ratings, the 3AF4-A is identical to the 6AF4-A.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Characteristics and Ratings		
Heater Voltage, AC or DC¶	3.2	Volts
Heater Current†	0.45 ± 0.03	Amperes
Heater Warm-up Time‡	11	Seconds

3AF4-B

3AF4-B Triode. Except for heater ratings and heater-cathode voltage ratings, the 3AF4-B is identical to the 6AF4-A. The 3AF4-B differs from the 3AF4-A in heater-cathode voltage ratings only.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Characteristics and Ratings		
Heater Voltage, AC or DC¶	3.2	Volts
Heater Current†	0.45 ± 0.03	Amperes
Heater Warm-up Time‡	11	Seconds

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	180	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	180	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

3AL5

3AL5 Double Diode. Except for heater ratings and heater-cathode voltage ratings, the 3AL5 is identical to the 6AL5.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Characteristics and Ratings		
Heater Voltage, AC or DC	3.15	Volts
Heater Current	0.6	Amperes
Heater Warm-up Time‡	11	Seconds

Supersedes ET-T1264A dated 12-56, ET-T881 dated 8-54, ET-T915 dated 3-55 and ET-T922 dated 3-55

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Heater-Cathode Voltage

Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-Center ratings are limiting values of operating conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube in average applications, making allowance for normal changes in operating conditions due to rated supply voltage variation (For an AC power source, 117 volts plus or minus 10% is accepted USA practice.), equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in tube characteristics.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply voltage.

3AU6

3AU6 Pentode. Except for heater characteristics and ratings, the 3AU6 is identical to the 6AU6 and 6AU6-A.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	3.15	Volts
Heater Current†	0.6 ± 0.04	Amperes
Heater Warm-up Time‡	11	Seconds

3AV6

3AV6 Duplex-Diode Triode. Except for heater characteristics and ratings, the 3AV6 is identical to the 6AV6.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	3.15	Volts
Heater Current†	0.6 ± 0.04	Amperes
Heater Warm-up Time‡	11	Seconds

FOOTNOTES

ϕ Heater voltage for a bogey tube at If = 0.3 amperes.

¶ Heater voltage for a bogey tube at If = 0.45 amperes.

* Heater voltage for a bogey tube at If = 0.6 amperes.

† For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

‡ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

3AT2

COMPACTRON DIODE

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 3AT2 is a compactron containing a heater-cathode type diode designed for use in television receivers as the high-voltage rectifier to supply power to the anode of the picture tube.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	3.15±0.32	Volts
Heater Current†	0.22	Amperes
Direct Interelectrode Capacitances, approximate‡		
Plate to Heater, Cathode, and Internal Shield: p to (h + k + i.s.)	1.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Top Cap - C1-34, Small
Outline Drawing - EIA 9-100

Maximum Diameter	1.188	Inches
Maximum Over-all Length	3.625	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

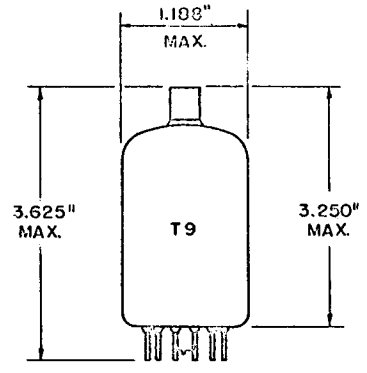
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

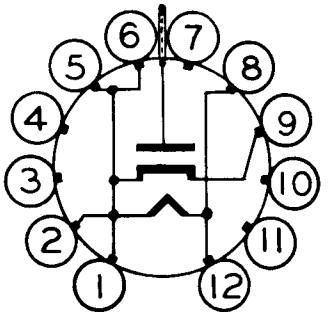


EIA 9-100

TERMINAL CONNECTIONS

Pin 1 - Heater, Cathode, and Internal Shield
Pin 2 - Heater, Cathode, and Internal Shield
Pin 3 - No Connection
Pin 4 - No Connection
Pin 5 - Heater, Cathode, and Internal Shield
Pin 6 - Heater, Cathode, and Internal Shield
Pin 7 - No Connection
Pin 8 - Heater
Pin 9 - Heater, Cathode, and Internal Shield
Pin 10 - No Connection
Pin 11 - No Connection
Pin 12 - Heater
Top Cap - Plate

BASING DIAGRAM



EIA 12EX

MAXIMUM RATINGS (Cont'd)

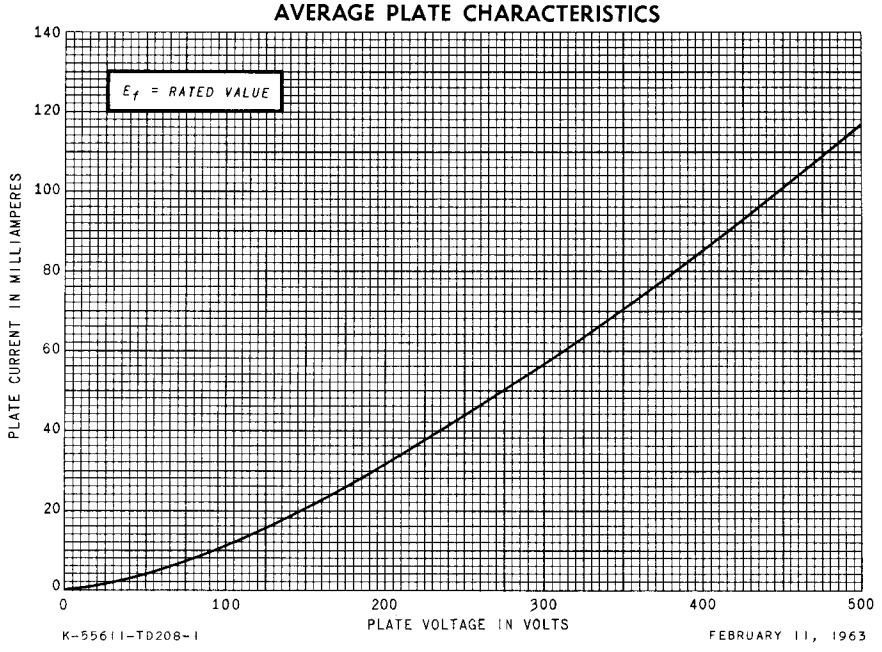
FLYBACK RECTIFIER SERVICE§ DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	30000	Volts
Steady-State Peak Plate Current	88	Milliamperes
DC Output Current	1.7	Milliamperes

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate Ib = 7.0 Milliamperes	77	Volts

AVERAGE PLATE CHARACTERISTICS



FOOTNOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 3.15 volts.

‡ Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

Note: The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce soft x-rays which can consititute a health hazard unless such tubes are adequately shielded. The need for this precaution should be considered in equipment design. Relatively simple shielding should prove adequate.

RECEIVING TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky

Compactron Diode

3AT2-B

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

■ COLOR TV TYPE ■ 30000 VOLTS DC ■ 1.7 MILLIAMPERES DC ■ X-RADIATION RATING

The 3AT2-B is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube. It is primarily intended for use in flyback types of power supplies.

The 3AT2-B voltage and current ratings are consistent with the requirements of present day color television applications.

The 3AT2-B features built-in X-radiation shielding and additional design and specifications controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	3.15 ± 0.5	Volts
Heater Current ●	0.22	Amperes

Direct Interelectrode Capacitances, approximate ♦

Plate to Heater, Cathode and Internal Shield:		
p to (h+k+i.s.)	1.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Top Cap - C1-1, C1-34, C1-49 or C1-50, Small
Outline Drawing

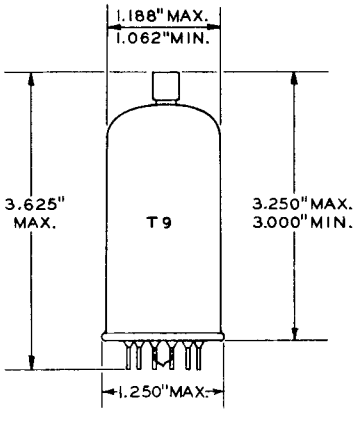
Maximum Bulb Diameter	1.188	Inches
Maximum Seal Diameter	1.250	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.625	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE⊕ —DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	30000	Volts
Total DC and Peak (Absolute-Maximum Value)	38000	Volts
Steady-State Peak Plate Current	88	Milliamperes
DC Output Current	1.7	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value) §	3.65	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.65	Volts

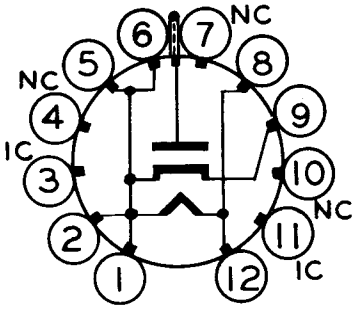
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS ▲

Pin 1 - Heater, Cathode and Internal Shield
Pin 2 - Heater, Cathode and Internal Shield
Pin 3 - Internal Connection - Do Not Use
▲ Pin 4 - No Connection
Pin 5 - Heater, Cathode and Internal Shield
Pin 6 - Heater, Cathode and Internal Shield
▲ Pin 7 - No Connection
Pin 8 - Heater
Pin 9 - Heater, Cathode and Internal Shield
▲ Pin 10 - No Connection
Pin 11 - Internal Connection - Do Not Use
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12FV

GENERAL ELECTRIC

Supersedes PI Sheet dated 9-69

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate Ib = 7.0 Milliamperes	60	Volts

X-RADIATION RATING⊕

X-radiation, maximum	25	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 25 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation of the 3AT2-B outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

X-RADIATION CHARACTERISTICS

The 3AT2-B will produce varying levels of X-radiation depending on operating conditions. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the maximum expected values indicated below for the different values of total DC and peak inverse voltage, with all other operating conditions remaining constant.

TOTAL DC AND PEAK INVERSE VOLTAGE	MAXIMUM EXPECTED X-RADIATION OUTPUT	
38 KV (30 KV Maximum DC Component)	25.0	mR/hr
33 KV (27 KV Maximum DC Component)	3.0	mR/hr
30 KV (25 KV Maximum DC Component)	0.5	mR/hr

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

WARNING

X-RADIATION

The high voltages associated with the 3AT2-B result in production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide for this shielding.

Precautions must be exercised during the servicing of equipment employing the 3AT2-B to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 3AT2-B is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 3AT2-B in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 3.15 volts.

♦ Without external shield.

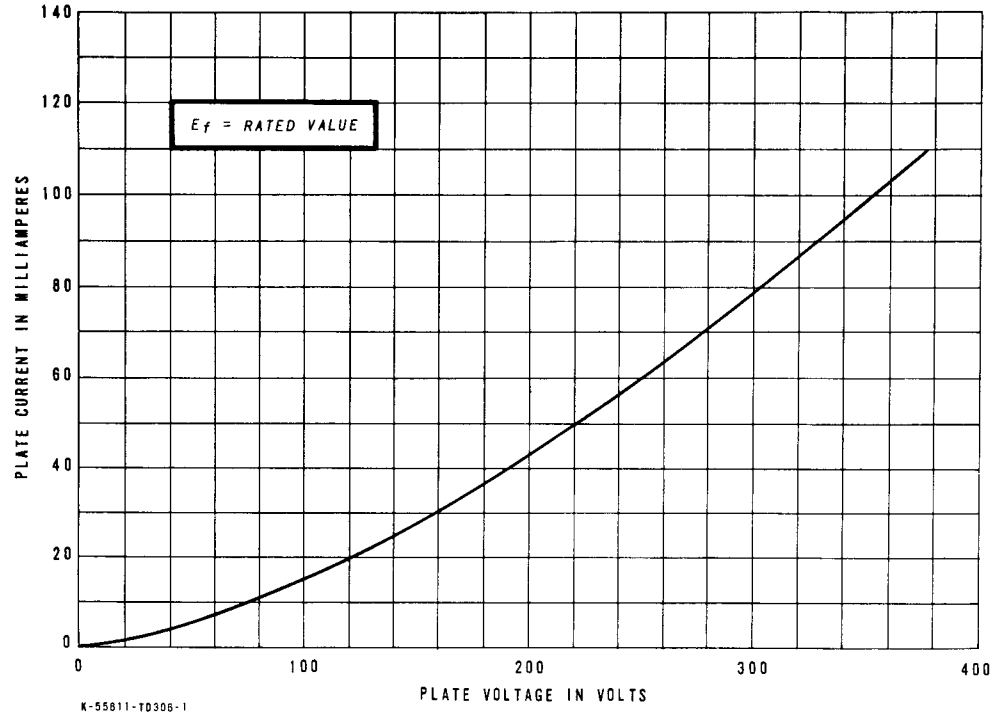
▲ Socket terminals 4, 7, and 10 may be used as tie points for components at or near heater potential.

⊕ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ **CAUTION** - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 3.65 volts may result in the production of X-radiation in excess of the maximum rated limit of 25 mR/hr.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

—PRODUCT INFORMATION—

Compactron Diode

3AW2-A

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

■ COLOR TV TYPE ■ 30000 VOLTS DC ■ 2.2 MILLIAMPERES ■ X-RADIATION RATING

The 3AW2-A is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube.

The 3AW2-A features built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	3.15±0.5	Volts
Heater Current●	0.35	Amperes

Direct Interelectrode Capacitances, approximate♦

Plate to Heater, Cathode, and Internal Shield:		
p to (h+k+i.s.)	1.6	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Top Cap - C1-34 or C1-49, Small
Outline Drawing

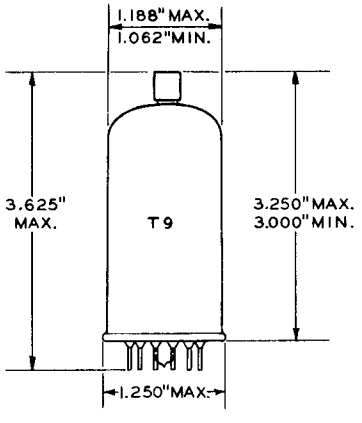
Maximum Bulb Diameter	1.188	Inches
Maximum Seal Diameter	1.250	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.625	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE⊕—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	30000	Volts
Total DC and Peak (Absolute-Maximum Value)	38000	Volts
Steady-State Peak Plate Current	110	Milliamperes
DC Output Current	2.2	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value)§	3.65	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.65	Volts

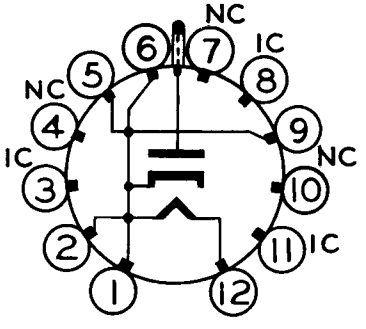
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS▲

Pin 1 - Heater, Cathode and Internal Shield
Pin 2 - Heater, Cathode and Internal Shield
Pin 3 - Internal Connection - Do Not Use
▲ Pin 4 - No Connection
Pin 5 - Heater, Cathode and Internal Shield
Pin 6 - Heater, Cathode and Internal Shield
▲ Pin 7 - No Connection
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Heater, Cathode and Internal Shield
▲ Pin 10 - No Connection
Pin 11 - Internal Connection - Do Not Use
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12HA

GENERAL ELECTRIC

Supersedes PI Sheet dated 8-69

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate Ib = 7.0 Milliamperes	60	Volts

X-RADIATION RATING⊕

X-radiation, maximum	25	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 25 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation of the 3AW2-A outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

X-RADIATION CHARACTERISTICS

The 3AW2-A will produce varying levels of X-radiation depending on operating conditions. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the maximum expected values indicated below for the different values of total DC and peak inverse voltage, with all other operating conditions remaining constant.

TOTAL DC AND PEAK INVERSE VOLTAGE	MAXIMUM EXPECTED X-RADIATION OUTPUT
38 KV (30 KV Maximum DC Component)	25.0 mR/hr
33 KV (27 KV Maximum DC Component)	3.0 mR/hr
30 KV (25 KV Maximum DC Component)	0.5 mR/hr

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

WARNING

X-RADIATION

The high voltages associated with the 3AW2-A result in production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide for this shielding.

Precautions must be exercised during the servicing of equipment employing the 3AW2-A to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 3AW2-A is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 3AW2-A in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 3.15 volts.

♦ Without external shield.

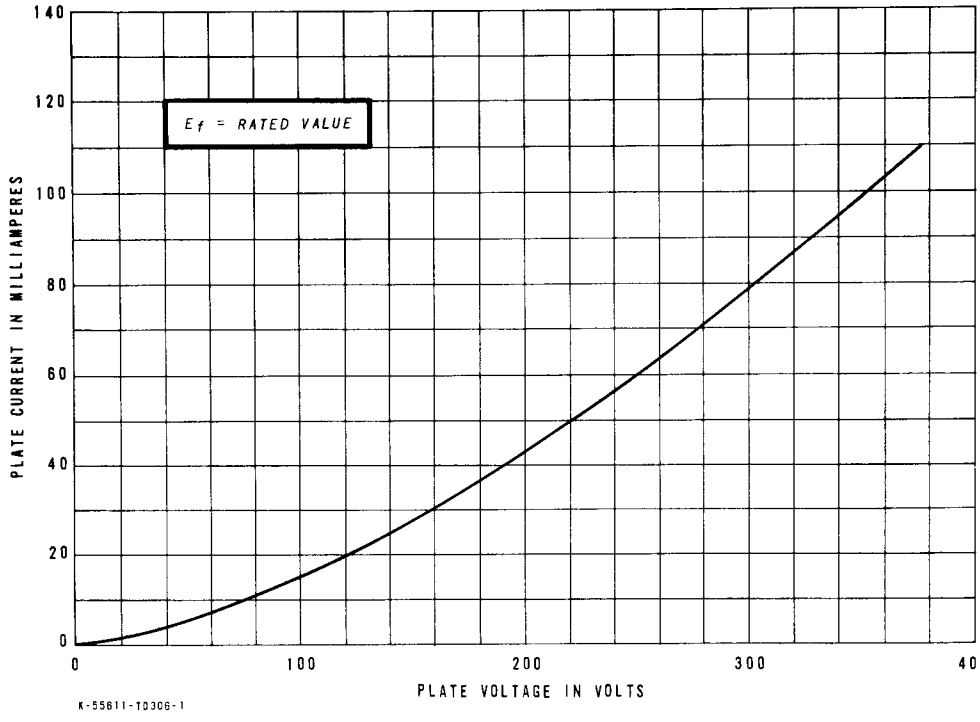
▲ Socket terminals 4, 7, and 10 may be used as tie points for components at or near heater potential.

⊕ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ **CAUTION** - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 3.65 volts may result in the production of X-radiation in excess of the maximum rated limit of 25 mR/hr.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

—PRODUCT INFORMATION—

Compactron Diode

3BN2-A

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

- COLOR TV TYPE
- 27000 VOLTS DC
- 1.7 MILLIAMPERES DC
- DIFFUSION BONDED CATHODE
- FAST WARM-UP
- X-RADIATION RATING

The 3BN2-A is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube. Features of the tube include fast operational warm-up, a diffusion bonded cathode coating to minimize reverse emission failures, and X-radiation controls.

The diffusion bonded cathode coating practically eliminates one of the major failure mechanisms in high-voltage rectifiers, which is back-emission from the anode due to emissive particles being pulled from the cathode by the very high electrostatic field.

The 3BN2-A features built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

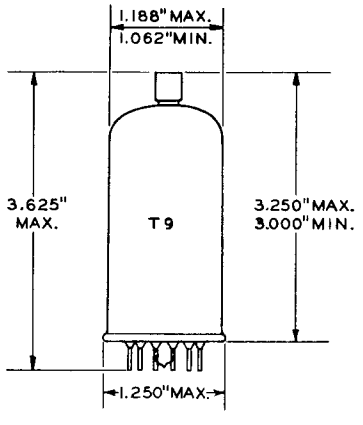
Heater Characteristics and Ratings		
Heater Voltage, AC or DC ★	3.15 ± 0.32	Volts
Heater Current ●	0.3	Amperes
Operational Warm-up Time ▲	4.0	Seconds
Direct Interelectrode Capacitances, approximate ♦		
Plate to Heater, Cathode, and Internal Shield:		
p to (h+k+i.s.)	1.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Top Cap - C1-34 or C1-49, Small
Outline Drawing

Maximum Bulb Diameter	1.188	Inches
Maximum Seal Diameter	1.250	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.625	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

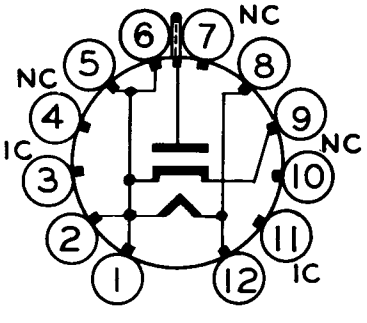
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS §

Pin 1 - Heater, Cathode, and Internal Shield
Pin 2 - Heater, Cathode, and Internal Shield
Pin 3 - Internal Connection - Do Not Use
§ Pin 4 - No Connection
Pin 5 - Heater, Cathode, and Internal Shield
Pin 6 - Heater, Cathode, and Internal Shield
§ Pin 7 - No Connection
Pin 8 - Heater
Pin 9 - Heater, Cathode, and Internal Shield
§ Pin 10 - No Connection
Pin 11 - Internal Connection - Do Not Use
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12FV

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE⊕—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Plate Voltage		
DC Component (Absolute-Maximum Value)	27000	Volts
Total DC and Peak (Absolute-Maximum Value)	30000	Volts
Steady-State Peak Plate Current	88	Milliamperes
DC Output Current	1.7	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value)□	3.65	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.65	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes	150	Volts

X-RADIATION RATING⊕

X-radiation, maximum	25	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 25 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation of the 3BN2-A outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

WARNING

X-RADIATION

The high voltages associated with the 3BN2-A result in production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide for this shielding.

Precautions must be exercised during the servicing of equipment employing the 3BN2-A to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 3BN2-A is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 3BN2-A in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 3.15 volts.

▲ The time required to reach 80 percent of rated d-c output voltage when used as a flyback rectifier.

♦ Without external shield.

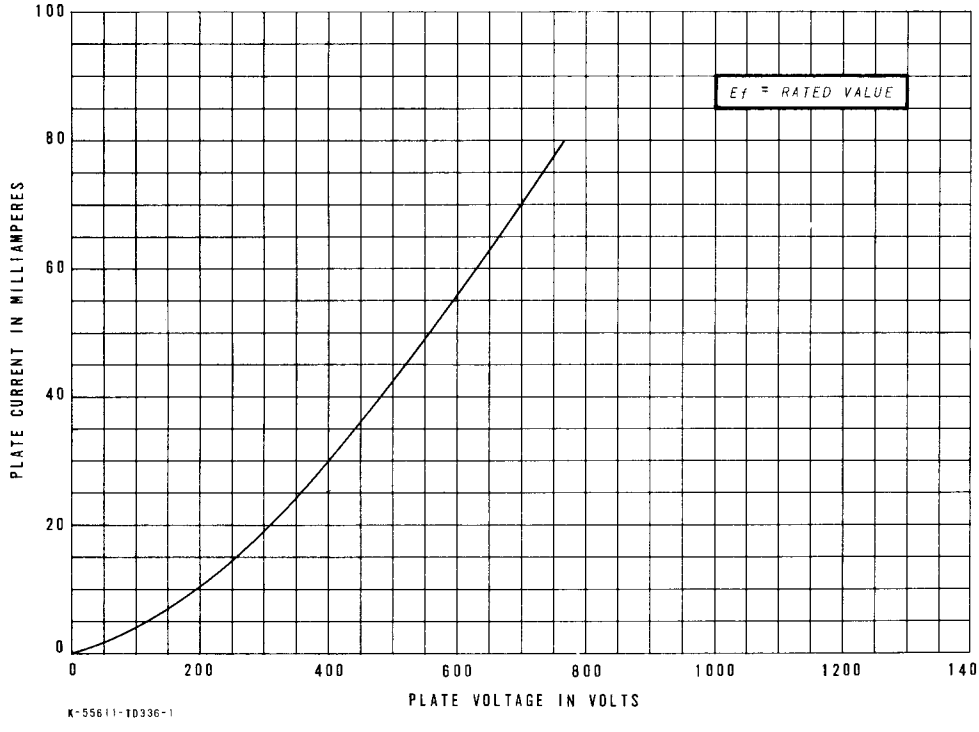
§ Socket terminals 4, 7, and 10 may be used as tie points for components at or near heater potential.

⊕ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

□ **CAUTION** - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 3.65 volts may result in the production of X-radiation in excess of the maximum rated limit of 25 mR/hr.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Compactron Diode

3BW2

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

- COLOR TV TYPE
- 30000 VOLTS DC
- 2.2 MILLIAMPERES DC
- DIFFUSION BONDED CATHODE
- X-RADIATION RATING

The 3BW2 is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube. Features of the tube include a diffusion bonded cathode coating to minimize reverse emission failures, and X-radiation controls.

The diffusion bonded cathode coating practically eliminates one of the major failure mechanisms in high-voltage rectifiers, which is back-emission from the anode due to emissive particles being pulled from the cathode by the very high electrostatic field.

The 3BW2 features built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	3.15 ± 0.5	Volts
Heater Current ●	0.48	Amperes

Direct Interelectrode Capacitances, approximate ♦

Plate to Heater, Cathode, and Internal Shield:

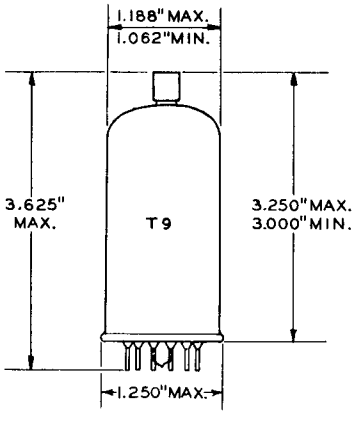
p to (h+k+i.s.)	1.6	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Top Cap - C1-49, Small
Outline Drawing

Maximum Bulb Diameter	1.188	Inches
Maximum Seal Diameter	1.250	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.625	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

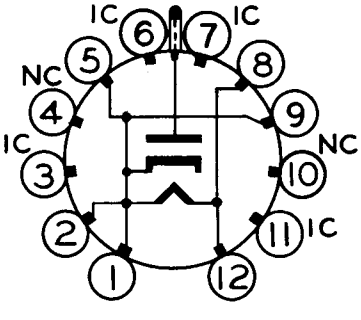
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS ▲

Pin 1 - Heater, Cathode and Internal Shield
Pin 2 - Heater, Cathode and Internal Shield
Pin 3 - Internal Connection - Do Not Use
▲ Pin 4 - No Connection
Pin 5 - Heater, Cathode and Internal Shield
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Internal Connection - Do Not Use
Pin 8 - Heater
Pin 9 - Heater, Cathode and Internal Shield
▲ Pin 10 - No Connection
Pin 11 - Internal Connection - Do Not Use
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12HY

GENERAL ELECTRIC

Supersedes PI Sheet dated 8-69

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE⊕—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	30000	Volts
Total DC and Peak (Absolute-Maximum Value)	38000	Volts
Steady-State Peak Plate Current	110	Milliamperes
DC Output Current	2.2	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value) §	3.65	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.65	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes	70	Volts

X-RADIATION RATING⊕

X-radiation, maximum	25	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 25 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation of the **3BW2** outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

X-RADIATION CHARACTERISTICS

The 3BW2 will produce varying levels of X-radiation depending on operating conditions. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the maximum expected values indicated below for the different values of total DC and peak inverse voltage, with all other operating conditions remaining constant.

TOTAL DC AND PEAK INVERSE VOLTAGE	MAXIMUM EXPECTED X-RADIATION OUTPUT	
38 KV (30 KV Maximum DC Component)	25.0	mR/hr
33 KV (27 KV Maximum DC Component)	3.0	mR/hr
30 KV (25 KV Maximum DC Component)	0.5	mR/hr

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

WARNING

X-RADIATION

The high voltages associated with the 3BW2 result in production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide for this shielding.

Precautions must be exercised during the servicing of equipment employing the 3BW2 to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 3BW2 is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 3BW2 in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 3.15 volts.

♦ Without external shield.

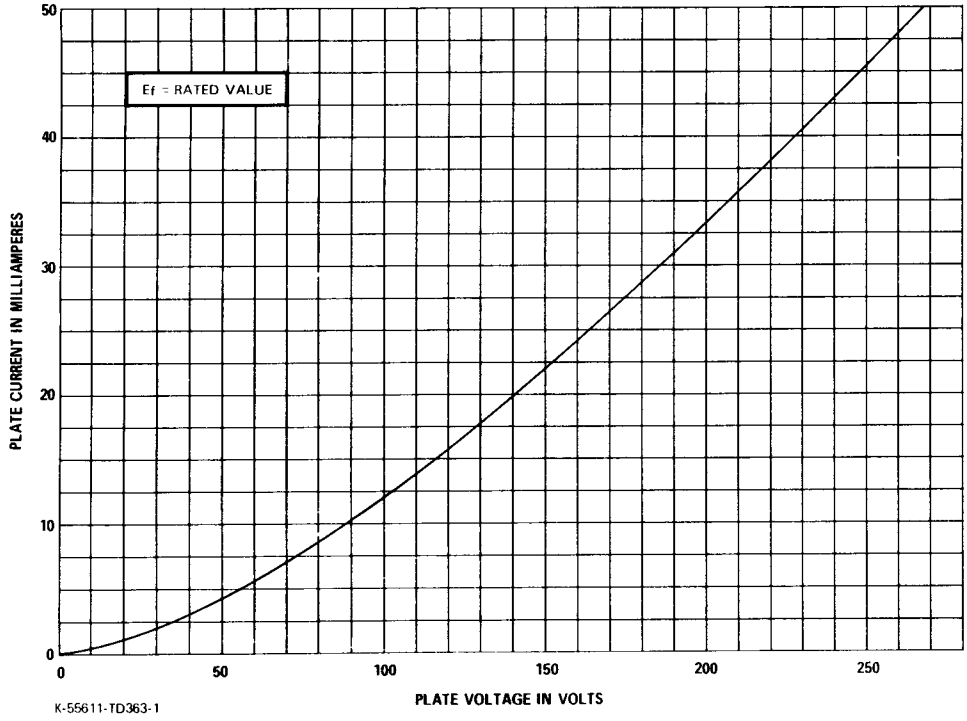
▲ Socket terminals 4 and 10 may be used as tie points for components at or near heater potential.

⊕ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ **CAUTION** - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 3.65 volts may result in the production of X-radiation in excess of the maximum rated limit of 25 mR/hr.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Pentode

3CB6

The 3CB6 is a miniature pentode designed for use as a radio-frequency or intermediate-frequency amplifier in television receivers. Features of the tube include high transconductance and low interelectrode capacitances. The suppressor and cathode terminals are brought out to separate base pins to permit the use of an unbypassed cathode-bias resistor to minimize the effects of regeneration.

Except for heater characteristics and heater-cathode voltage ratings, the 3CB6 is identical to the 6CB6-A.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	3.15	Volts
Heater Current‡	0.6±0.04	Amperes
Heater Warm-up Time, average§	11	Seconds

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
DC Component	200	Volts
Total DC and Peak	300	Volts

NOTES

* Heater voltage for a bogey tube at If = 0.6 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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Diode

3CN3-B

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

- COLOR TV TYPE
- 30000 VOLTS DC
- 2.2 MILLIAMPERES DC
- DIFFUSION BONDED CATHODE
- X-RADIATION RATING

The 3CN3-B is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube. Features of the tube include a diffusion bonded cathode coating to minimize reverse emission failures, and X-radiation controls.

The diffusion bonded cathode coating practically eliminates one of the major failure mechanisms in high-voltage rectifiers, which is back-emission from the anode due to emissive particles being pulled from the cathode by the very high electrostatic field.

The 3CN3-B features built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	3.15±0.5	Volts
Heater Current‡	0.48	Amperes

Direct Interelectrode Capacitances, approximate§

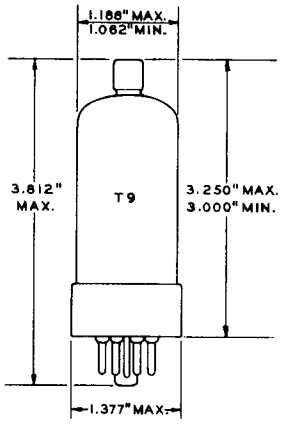
Plate to Heater, Cathode, and Internal Shield: p to (h + k + i.s.)	1.6	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - B8-118, Short Medium-Shell Octal 8-Pin
or B8-251, Ultra-Short Small-Wafer Octal 8-Pin
Top Cap - C1-49, Small
Outline Drawing

Maximum Diameter	1.377	Inches
Maximum Bulb Diameter	1.188	Inches
Maximum Over-all Length	3.812	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

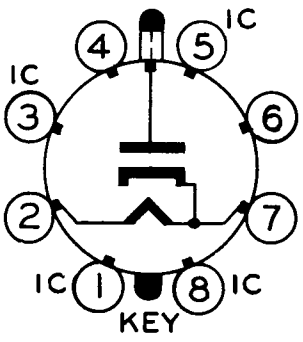
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pin 1 - Internal Connection - Do Not Use
Pin 2 - Heater
Pin 3 - Internal Connection - Do Not Use
#Pin 4 - No Connection
Pin 5 - Internal Connection - Do Not Use
#Pin 6 - No Connection
Pin 7 - Heater, Cathode, and Internal Shield
Pin 8 - Internal Connection - Do Not Use
Cap - Plate

BASING DIAGRAM



EIA 8MU

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE¶—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	30000	Volts
Total DC and Peak (Absolute-Maximum Value)	38000	Volts
Steady-State Peak Plate Current	110	Milliamperes
DC Output Current	2.2	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value)¢	3.65	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.65	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes	60	Volts

X-RADIATION RATING¶

X-radiation, maximum	25	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 25 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on data obtained with the use of the Victoreen 440 RF survey meter with a 3 3/8 inch aperture. X-radiation is measured with the face of the meter at a distance of 4 3/4 inches from the external surface of the tube. This rating information is not necessarily applicable when a different radiation measuring instrument or aperture is used.

Operation of the 3CN3-B outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

X-RADIATION CHARACTERISTICS

The 3CN3-B will produce varying levels of X-radiation depending on operating conditions. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the maximum expected values indicated below for the different values of total DC and peak inverse voltage, with all other operating conditions remaining constant.

TOTAL DC AND PEAK INVERSE VOLTAGE	MAXIMUM EXPECTED X-RADIATION OUTPUT
38 KV (30 KV Maximum DC Component)	25.0 mR/hr
33 KV (27 KV Maximum DC Component)	3.0 mR/hr
30 KV (25 KV Maximum DC Component)	0.5 mR/hr

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

WARNING

X-RADIATION

The high voltages associated with the 3CN3-B result in production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide for this shielding.

Precautions must be exercised during the servicing of equipment employing the 3CN3-B to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 3CN3-B is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 3CN3-B in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 3.15 volts.

§ Without external shield.

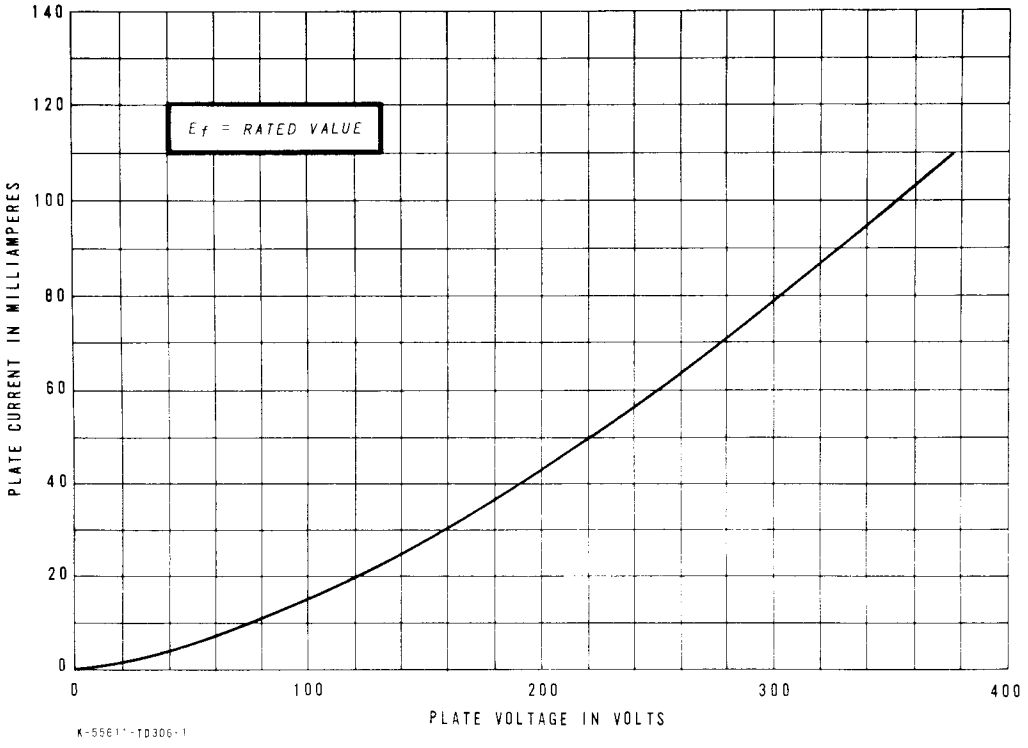
\# Socket terminals 4 and 6 may be used as tie points for components at or near heater potential.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¢ CAUTION - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 3.65 volts may result in the production of X-radiation in excess of the maximum rated limit of 25 mR/hr.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

TUBES

Heptode

3CS6

FOR GATED AMPLIFIER SERVICE

The 3CS6 is a miniature dual-control heptode designed primarily for use as a combined sync separator and sync clipper in television receivers. Each of the two independent control grids exhibits a sharp-cutoff characteristic.

Except for heater characteristics, the 3CS6 is identical to the 6CS6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	3.15	Volts
Heater Current‡	0.6±0.04	Amperes
Heater Warm-up Time, average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.6 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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PLANAR TRIODE



DESCRIPTION AND RATING

FOR GROUNDED-GRID OSCILLATOR, AMPLIFIER, AND FREQUENCY MULTIPLIER SERVICE

Metal and Ceramic — Pulse Rated
High Transconductance — Shock Resistant
100 Watts Plate Dissipation

The 3CX100A5 is a metal-and-ceramic, high-mu triode designed for use as a grounded-grid CW oscillator, amplifier, or frequency multiplier at frequencies as high as 2500 megacycles. In addition, it may be used as a plate-pulsed oscillator or amplifier at frequencies as high as 3000 megacycles.

Features of the 3CX100A5 include planar electrode construction, high plate dissipation capability, excellent electrode isolation, low radio-frequency losses, high transconductance, and low interelectrode capacitances.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Characteristics and Ratings		
Heater Voltage, AC or DC	*	Volts
Heater Current at Ef = 6.0 volts	1.0†	Amperes
Cathode Heating Time, minimum	60	Seconds
Direct Interelectrode Capacitances‡		
Grid to Plate: (g to p)	2.0	pf
Grid to Cathode: (g to k)	6.3	pf
Plate to Cathode:		
(p to k), maximum	0.035	pf

MECHANICAL

Mounting Position—Any—Only Plate Flange to be Used as a Socket Stop and Clamp		
Net Weight, approximate	2.5	Ounces
Cooling		
Plate and Plate Seal—Conduction and Forced Air		
Grid and Cathode Seals—Conduction and Forced Air		
Recommended Air Flow Cowling—157-JAN		
Recommended Air Flow on Plate Radiator at Sea Level		
Incoming Air Temperature 25C, Plate Dissipation 100 Watts	12.5	Cu.Ft.PerMin.

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key-Down Conditions Per Tube Without Amplitude Modulation§

Heater Voltage*	4.5 to 5.7	Volts
Frequency	2500	Megacycles
DC Plate Voltage	1000	Volts
Negative DC Grid Voltage	150	Volts
Peak Positive RF Grid Voltage	30	Volts
Peak Negative RF Grid Voltage	400	Volts
DC Grid Current	50	Milliamperes
DC Cathode Current	125	Milliamperes
Plate Dissipation	100	Watts
Grid Dissipation	2.0	Watts
Envelope Temperature at Hottest Point	300	C

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEPHONY

Carrier Conditions Per Tube For Use With a Maximum Modulation Factor of 1.0

Heater Voltage*	4.5 to 5.7	Volts
Frequency	2500	Megacycles
DC Plate Voltage¶	600	Volts
Negative DC Grid Voltage	150	Volts
Peak Positive RF Grid Voltage	30	Volts
Peak Negative RF Grid Voltage	400	Volts
DC Grid Current	50	Milliamperes
DC Cathode Current	100	Milliamperes
Plate Dissipation	70	Watts
Grid Dissipation	2.0	Watts
Envelope Temperature at Hottest Point	300	C

PLATE-PULSED OSCILLATOR OR AMPLIFIER

Heater Voltage*	5.7 to 6.0	Volts
Frequency	3000	Megacycles
Peak Positive-Pulse Plate Supply Voltage	3500	Volts
Duty Factor of Plate Pulse # △	0.0025	
Pulse Duration	3.0	Microseconds
Plate Current		
Average During Plate Pulse △**	3.0	Amperes
Negative Grid Voltage		
Average During Plate Pulse††	150	Volts
Grid Current		
Average During Plate Pulse	1.8	Amperes
Plate Dissipation △	27	Watts
Grid Dissipation △	2.0	Watts
Envelope Temperature at Hottest Point	300	C

⊕ *Supersedes pages 1 and 2 of D & R sheet for 3CX100A5 dated 12-61*

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Heater Voltage	6.0	Volts
Plate Voltage	600	Volts
Grid Voltage§§		Volts
Amplification Factor	100	
Transconductance	25000	Micromhos
Plate Current	70	Milliamperes

RADIO-FREQUENCY POWER AMPLIFIER

Frequency	500	Megacycles
DC Plate Voltage	900	Volts
DC Grid Voltage	−40	Volts
DC Plate Current	90	Milliamperes
DC Grid Current, approximate	30	Milliamperes
Driving Power, approximate	6	Watts
Useful Power Output	40	Watts

RADIO-FREQUENCY OSCILLATOR

Frequency	2500	Megacycles
DC Plate Voltage	1000	Volts
DC Grid Voltage, approximate	−22	Volts
DC Plate Current	90	Milliamperes
DC Grid Current	10	Milliamperes
Useful Power Output	17	Watts

PLATE-PULSED OSCILLATOR

Frequency	3000	Megacycles
Heater Voltage	5.8	Volts
Duty Factor	0.0025	
Pulse Duration	3.0	Microseconds
Peak Positive-Pulse Plate-Supply Voltage	3500	Volts
Plate Current Average During Plate Pulse	3.0	Amperes
Grid Current Average During Plate Pulse	1.8	Amperes
Useful Power Output Average During Plate Pulse	1.6	Kilowatts

* The equipment designer should design the equipment so that heater voltage is centered at some value within the range of 4.5 to 5.7 volts for CW operation, or 5.7 to 6.0 volts for pulse operation. Heater voltage variations about the center value should be kept as small as practical and should not, in any case, exceed ±5%. The optimum center value of heater voltage depends on the cathode current and on other parameters of circuit design and operation. For specific recommendations, contact your General Electric tube sales representative.

† Heater current of a bogey tube at Ef = 6.0 volts.

‡ Measured in a special shielded socket.

§ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

¶ For modulation factors less than 1.0, a higher d-c plate voltage may be used if the sum of the peak positive audio voltage and the d-c plate voltage does not exceed 1200 volts.

⁂ Applications with a duty factor greater than 0.0025 should be referred to your General Electric tube sales representative for recommendations.

△ In any 5000-microsecond interval.

** The regulation and/or series plate-supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 30 amperes.

†† The maximum instantaneous value should be within the range of +250 to −750 volts.

§§ Adjusted for Ib = 70 milliamperes.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

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INITIAL CHARACTERISTICS LIMITS

	Min.	Max.	
Heater Current			
Ef = 6.0 volts	0.90	1.05	Amperes
Grid Voltage			
Ef = 6.0 volts, Eb = 1000 volts, Ib = 100 ma	−2.0	−7.0	Volts
Grid Voltage			
Ef = 6.0 volts, Eb = 1000 volts, Ib = 1.0 ma	....	−25	Volts
Negative Grid Current			
Ef = 6.0 volts, Eb = 1000 volts, Ec adjusted for Ib = 100 ma	....	8.0	Microamperes
Interelectrode Leakage Resistance			
Ef = 6.0 volts, Polarity of applied d-c interelectrode voltage is such that no cathode emission results			
Grid to Cathode at 500 volts d-c	50	....	Megohms
Interelectrode Capacitances			
Grid to Plate: (g to p)	1.95	2.15	Picofarads
Grid to Cathode: (g to k)	5.6	7.0	Picofarads
Plate to Cathode: (p to k)	....	0.035	Picofarads

SPECIAL PERFORMANCE TESTS

	Min.	Max.	
Oscillator Power Output			
Tubes are tested for power output as an oscillator under the following conditions: Ef = 5.0 volts; F = 2500 MC, min.; Eb = 1000 volts; Ib = 90 ma	15	....	Watts
Pulsed-Oscillator Power Output			
Tubes are tested for power output as an oscillator under the following conditions: Ef = 5.8 volts; F = 3000 MC, min.; epy = 3500 volts; tp = 3.0 μsec. ±10%; Du = 0.0025 ±5%; Rg adjusted for Ib = 7.5 ma; Ec = −1.5 volts, max.; Ic = 4.5 ma, max.	4.0	....	Watts
Low Pressure Voltage Breakdown Test			
Statistical sample tested for voltage breakdown at a pressure of 54 mm Hg. Tubes shall not give visual evidence of flashover when 1000 volts RMS, 60 cps, is applied between the plate and grid terminals.			

DEGRADATION RATE TESTS

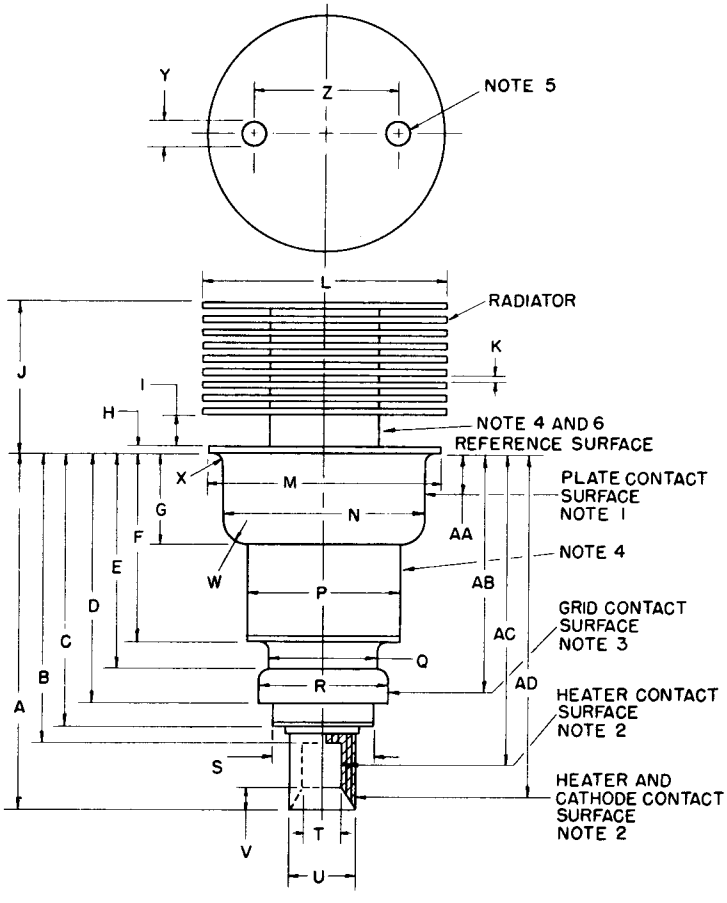
Shock

Statistical sample subjected to 5 impact accelerations of approximately 400 G and 0.5 milliseconds duration in each of three positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine.

500-Hour Life Test

Statistical sample operated for 500 hours as an oscillator to evaluate changes in power output with life.

PHYSICAL DIMENSIONS



DIMENSIONS FOR OUTLINE (INCHES)

Ref.	Minimum	Maximum
A	1.815	1.875
B	....	1.534
C	....	1.475
D	1.289	1.329
E	1.085	1.135
F	.880	.920
G	.462	.477
H	....	.040
I	.125	.185
J	.766	.826
K	.025	.046
L	1.234	1.264
M	1.180	1.195
N	1.025	1.035
P	.772	.792
Q	.541	.561
R	.655	.665
S	....	.545
T	.213	.223
U	.315	.325
V	....	.086
W	....	.100
X	....	.035
Y	.105	.145
Z	.650	.850

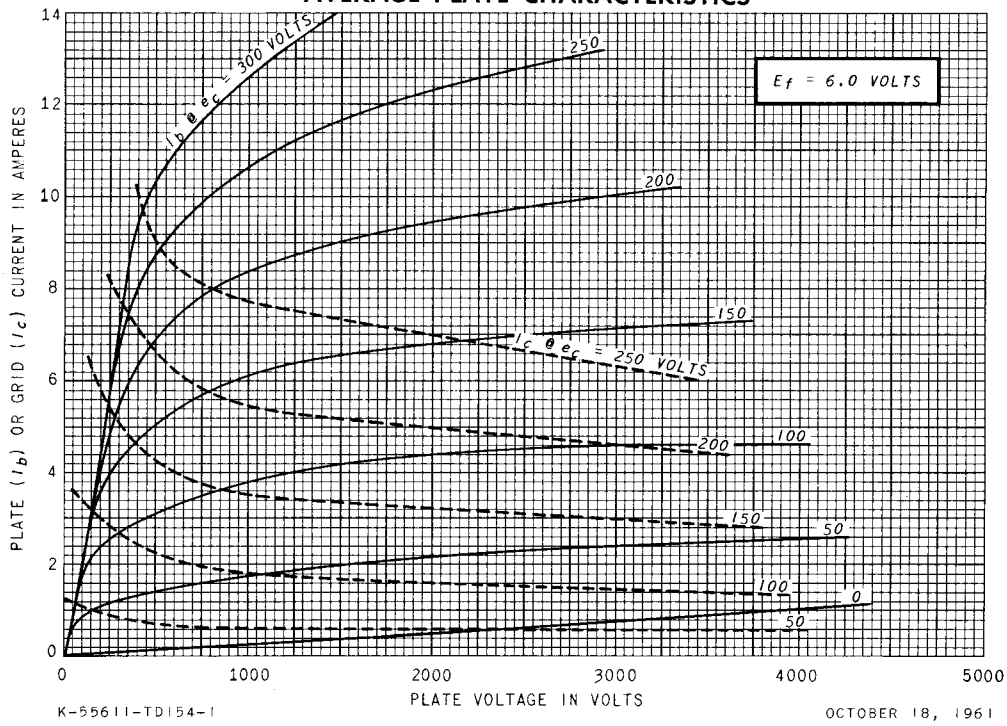
DIMENSIONS FOR ELECTRODE CONTACT AREA (INCHES)

Ref.	Dimension	Contact
AA	.198 ± .163	Plate
AB	1.225 ± .040	Grid
AC	1.631 ± .097	Heater
AD	1.645 ± .170	Cathode

NOTES

1. The total indicated runout of the plate contact surface with respect to the cathode contact surfaces will not exceed .020 inch.
2. The total indicated runout of the cathode contact surface with respect to the heater contact surfaces will not exceed .012 inch.
3. The total indicated runout of the grid contact surface with respect to the cathode contact surface will not exceed .020 inch.
4. Do not clamp or locate on this surface.
5. Hole provided for tube extractor through the top fin only.
6. Measure plate shank temperature on this surface.

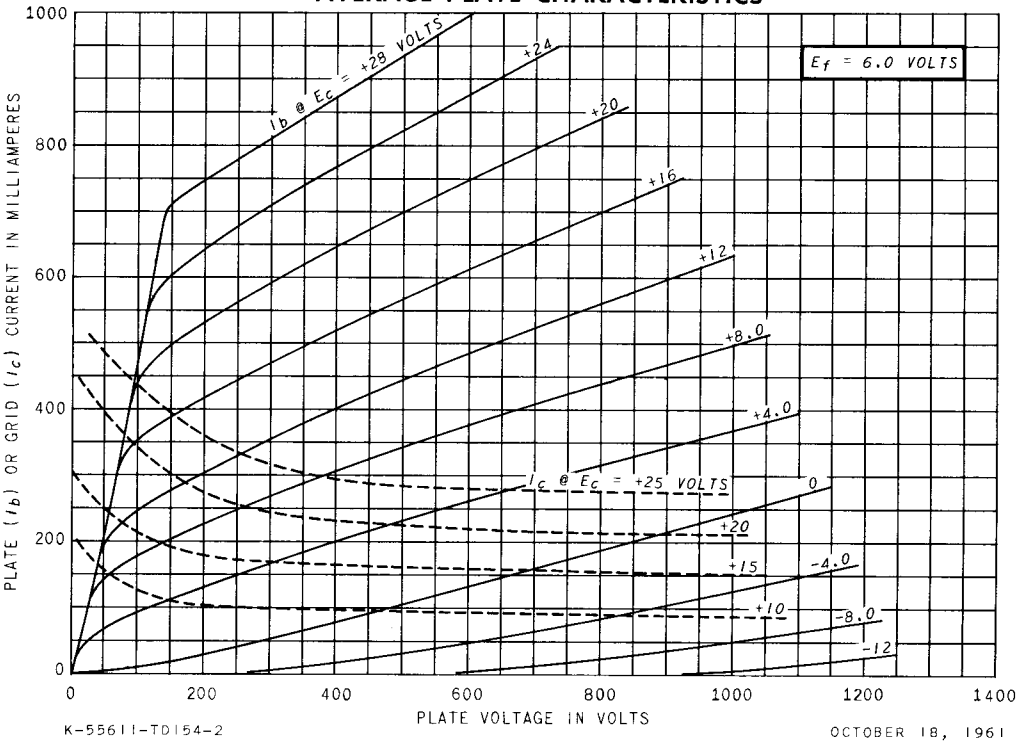
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD154-1

OCTOBER 18, 1961

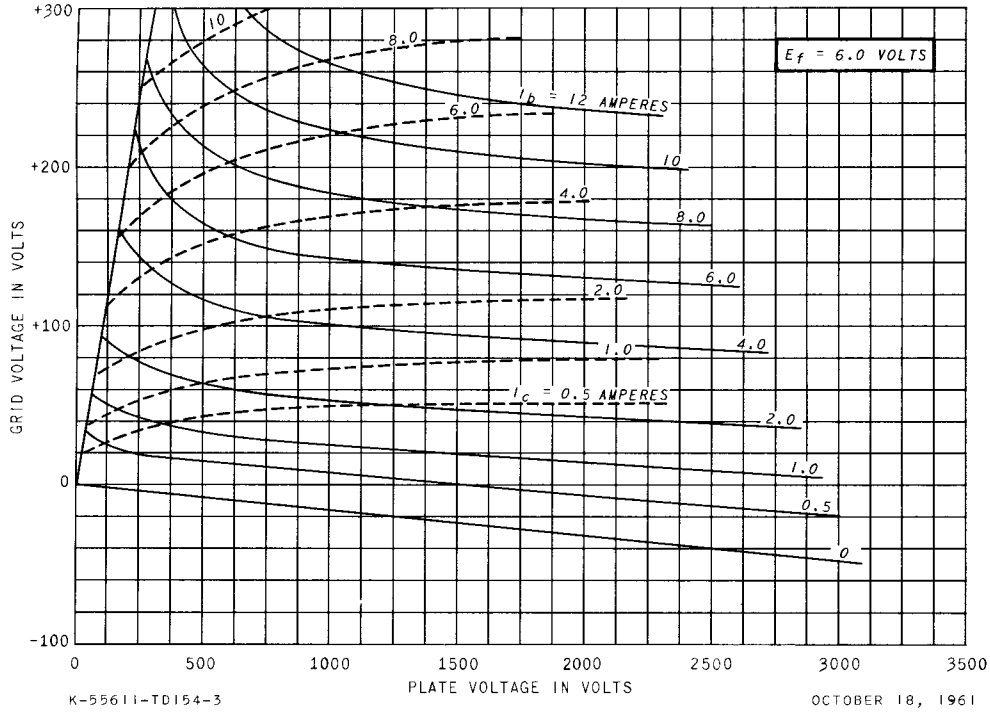
AVERAGE PLATE CHARACTERISTICS



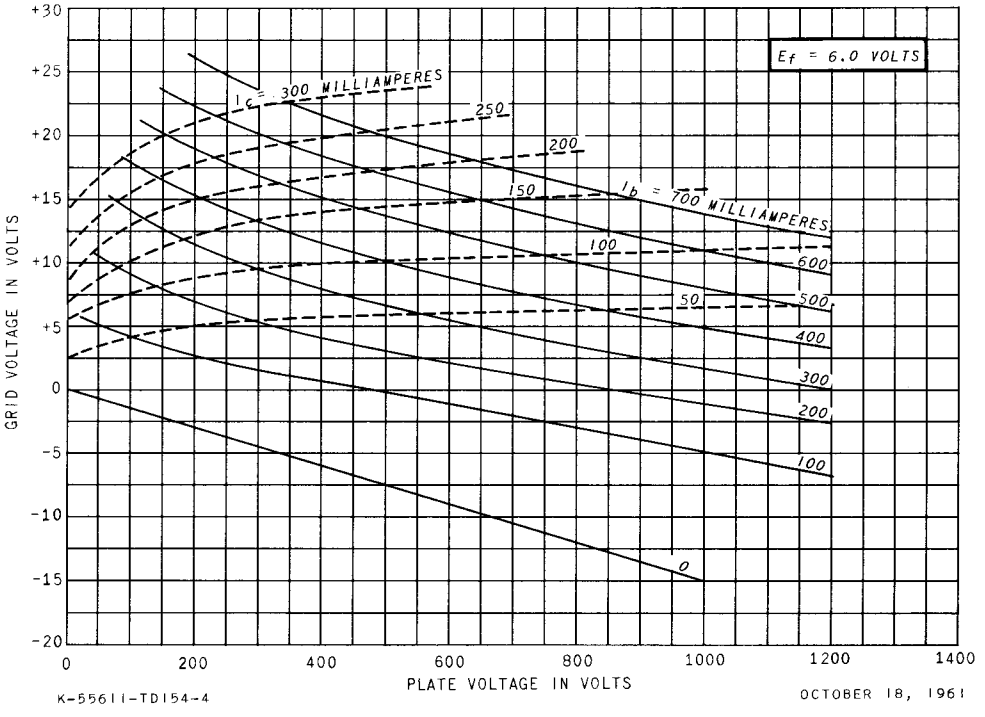
K-5561I-TD154-2

OCTOBER 18, 1961

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



AVERAGE CONSTANT-CURRENT CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Diode

3DA3

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

- COLOR TV TYPE
- 30000 VOLTS DC
- 2.2 MILLIAMPERES DC
- DIFFUSION BONDED CATHODE
- NEW RAPID WARM-UP HEATER-CATHODE DESIGN
- X-RADIATION RATING

The 3DA3 is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube. Features of the tube include fast operational warm-up, a diffusion bonded cathode coating to minimize reverse emission failures, and X-radiation controls.

A unique design feature of the 3DA3 is a new heater-cathode system which enables a more rapid heat transfer from the heater to the cathode with low thermal inertia. Aiding in this accomplishment is the use of a thinner, high-strength, bi-metal cathode sleeve and the development of associated process techniques which expedite thermal conductivity without impairing the inherent reliability of the tube.

The diffusion bonded cathode coating practically eliminates one of the major failure mechanisms in high-voltage rectifiers, which is back-emission from the anode due to emissive particles being pulled from the cathode by the very high electrostatic field.

The 3DA3 features built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	3.15±0.5	Volts
Heater Current‡	0.48	Amperes
Operational Warm-up Time§	4	Seconds

Direct Interelectrode Capacitances, approximate¶

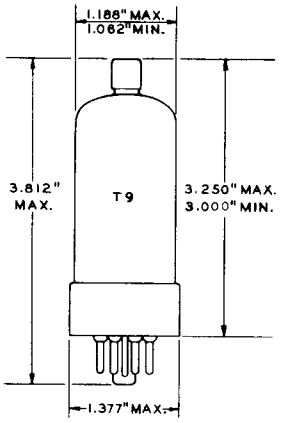
Plate to Heater, Cathode and Internal Shield:		
p to (h + k + i.s.)	1.6	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - B8-118, Short Medium-Shell Octal 8-Pin
or B8-251, Ultra-Short Small-Wafer Octal 8-Pin
Top Cap - C1-49, Small
Outline Drawing

Maximum Diameter	1.377	Inches
Maximum Bulb Diameter	1.188	Inches
Maximum Over-all Length	3.812	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

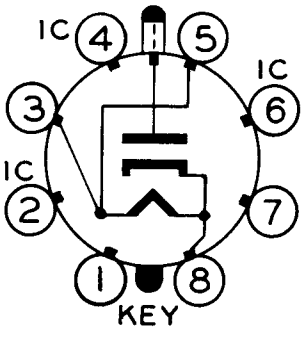
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

#Pin 1 - No Connection
Pin 2 - Internal Connection - Do Not Use
Pin 3 - Heater
Pin 4 - Internal Connection - Do Not Use
Pin 5 - Heater
Pin 6 - Internal Connection - Do Not Use
#Pin 7 - No Connection
Pin 8 - Heater, Cathode and Internal Shield
Cap - Plate

BASING DIAGRAM



EIA 8MY

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE△ — DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	30000	Volts
Total DC and Peak (Absolute-Maximum Value)	38000	Volts
Steady-State Peak Plate Current	110	Milliamperes
DC Output Current	2.2	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value)¢	3.65	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.65	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes	60	Volts

X-RADIATION RATING△

X-radiation, maximum	25	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 25 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on data obtained with the use of the Victoreen 440 RF survey meter with a 3 3/8 inch aperture. X-radiation is measured with the face of the meter at a distance of 4 3/4 inches from the external surface of the tube. This rating information is not necessarily applicable when a different radiation measuring instrument or aperture is used.

Operation of the 3DA3 outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Rainges are not exceeded.

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

X-RADIATION CHARACTERISTICS

The 3DA3 will produce varying levels of X-radiation depending on operating conditions. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the maximum expected values indicated below for the different values of total DC and peak inverse voltage, with all other operating conditions remaining constant.

TOTAL DC AND PEAK INVERSE VOLTAGE	MAXIMUM EXPECTED X-RADIATION OUTPUT
38 KV (30 KV Maximum DC Component)	25.0 mR/hr
33 KV (27 KV Maximum DC Component)	3.0 mR/hr
30 KV (25 KV Maximum DC Component)	0.5 mR/hr

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

WARNING

X-RADIATION

The high voltages associated with the 3DA3 result in production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide for this shielding.

Precautions must be exercised during the servicing of equipment employing the 3DA3 to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 3DA3 is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 3DA3 in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 3.15 volts.

§ The time required to reach 80 percent of rated d-c output voltage when used as a flyback rectifier.

¶ Without external shield.

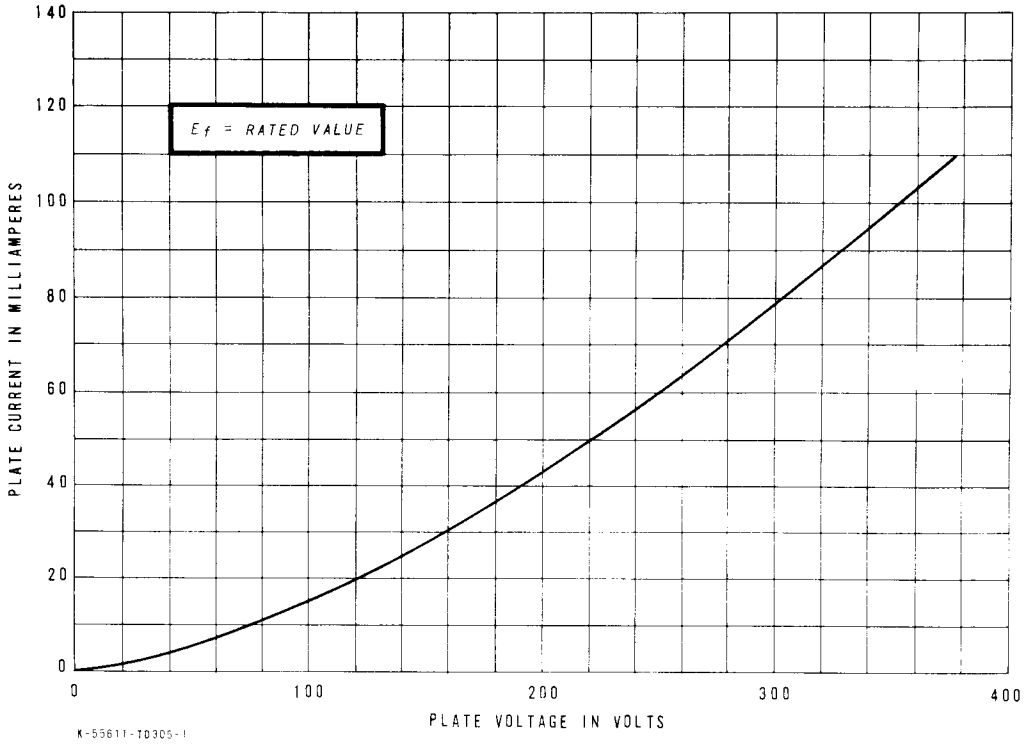
Socket terminals 1 and 7 may be used as tie points for components at or near heater potential.

Δ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¢ CAUTION - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 3.65 volts may result in the production of X-radiation in excess of the maximum rated limit of 25 mR/hr.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

Diode

3DB3

FOR TV HIGH-VOLTAGE
RECTIFIER APPLICATIONS

■ COLOR TV TYPE ■ 30000 VOLTS DC ■ 2.0 MILLIAMPERES DC ■ X-RADIATION RATING

The 3DB3 is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube.

The 3DB3 features built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	3.15±0.5	Volts
Heater Current‡	0.245	Amperes

Direct Interelectrode Capacitances, approximate§

Plate to Heater, Cathode, and Internal Shield:	
p to (h + k + i.s.)	1.5 pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - B8-118, Short Medium-Shell Octal 8-Pin or
B8-251, Ultra-Short Small-Wafer Octal 8-Pin
Top Cap - C1-49, Small
Outline Drawing

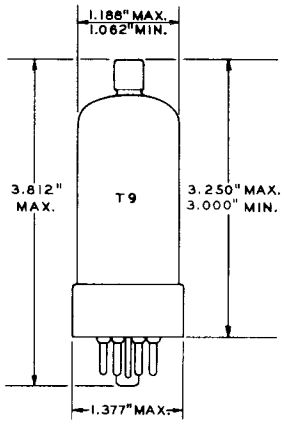
Maximum Diameter	1.377	Inches
Maximum Bulb Diameter	1.188	Inches
Maximum Over-all Length	3.812	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE¶—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	30000	Volts
Total DC and Peak (Absolute-Maximum Value)	38000	Volts
Steady-State Peak Plate Current	100	Milliamperes
DC Output Current	2.0	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value)¢	3.65	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.65	Volts

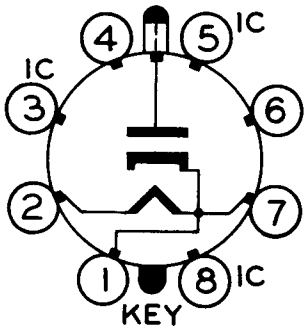
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pin 1 - Heater, Cathode, and Internal Shield
Pin 2 - Heater
Pin 3 - Internal Connection - Do Not Use
#Pin 4 - No Connection
Pin 5 - Internal Connection - Do Not Use
#Pin 6 - No Connection
Pin 7 - Heater, Cathode, and Internal Shield
Pin 8 - Internal Connection - Do Not Use
Cap - Plate

BASING DIAGRAM



EIA 8MX

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes	60	Volts

X-RADIATION RATING¶

X-radiation, maximum	25	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 25 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on data obtained with the use of the Victoreen 440 RF survey meter with a 3 3/8 inch aperture. X-radiation is measured with the face of the meter at a distance of 4 3/4 inches from the external surface of the tube. This rating information is not necessarily applicable when a different radiation measuring instrument or aperture is used.

Operation of the 3DB3 outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

X-RADIATION CHARACTERISTICS

The 3DB3 will produce varying levels of X-radiation depending on operating conditions. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the maximum expected values indicated below for the different values of total DC and peak inverse voltage, with all other operating conditions remaining constant.

TOTAL DC AND PEAK INVERSE VOLTAGE	MAXIMUM EXPECTED X-RADIATION OUTPUT	
38 KV (30 KV Maximum DC Component)	25.0	mR/hr
33 KV (27 KV Maximum DC Component)	3.0	mR/hr
30 KV (25 KV Maximum DC Component)	0.5	mR/hr

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

WARNING

X-RADIATION

The high voltages associated with the 3DB3 result in production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide for this shielding.

Precautions must be exercised during the servicing of equipment employing the 3DB3 to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 3DB3 is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 3DB3 in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 3.15 volts.

§ Without external shield.

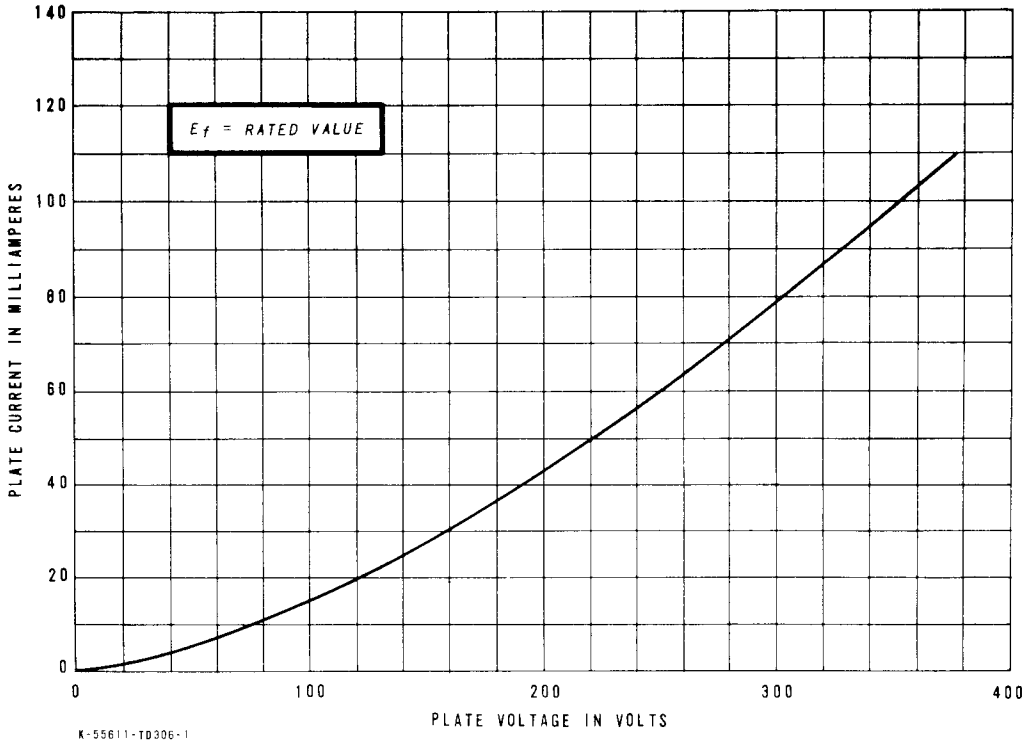
Socket terminals 4 and 6 may be used as tie points for components at or near heater potential.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¢ CAUTION - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 3.65 volts may result in the production of X-radiation in excess of the maximum rated limit of 25 mR/hr.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Diode

3DF3

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

- COLOR TV TYPE
- 30000 VOLTS DC
- 2.2 MILLIAMPERES DC
- DIFFUSION BONDED CATHODE
- X-RADIATION RATING

The 3DF3 is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube. Features of the tube include a diffusion bonded cathode coating to minimize reverse emission failures, and X-radiation controls.

The diffusion bonded cathode coating practically eliminates one of the major failure mechanisms in high-voltage rectifiers, which is back-emission from the anode due to emissive particles being pulled from the cathode by the very high electrostatic field.

The 3DF3 features built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*. . .	3.15±0.5	Volts
Heater Current‡	0.48	Amperes

Direct Interelectrode Capacitances, approximate§

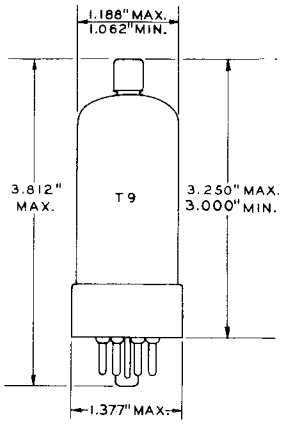
Plate to Heater, Cathode, and Internal Shield: p to (h + k + i.s.).	1.6	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - B8-118, Short Medium-Shell Octal 8-Pin
or B8-251, Ultra-Short Small-Wafer Octal 8-Pin
Top Cap - C1-49, Small
Outline Drawing

Maximum Diameter	1.377	Inches
Maximum Bulb Diameter	1.188	Inches
Maximum Over-all Length. . . .	3.812	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

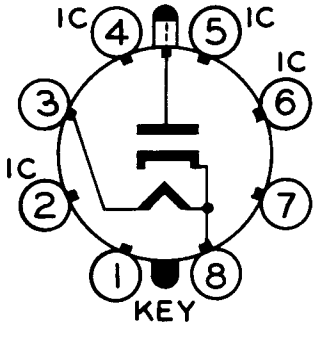
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

#Pin 1 - No Connection
Pin 2 - Internal Connection - Do Not Use
Pin 3 - Heater
Pin 4 - Internal Connection - Do Not Use
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
#Pin 7 - No Connection
Pin 8 - Heater, Cathode and Internal Shield
Cap - Plate

BASING DIAGRAM



EIA 8MT

GENERAL ELECTRIC

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE¶—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	30000	Volts
Total DC and Peak (Absolute-Maximum Value)	38000	Volts
Steady-State Peak Plate Current	110	Milliamperes
DC Output Current	2.2	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value)¢	3.65	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.65	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes	60	Volts

X-RADIATION RATING¶

X-radiation, maximum	25	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 25 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on data obtained with the use of the Victoreen 440 RF survey meter with a 3 3/8 inch aperture. X-radiation is measured with the face of the meter at a distance of 4 3/4 inches from the external surface of the tube. This rating information is not necessarily applicable when a different radiation measuring instrument or aperture is used.

Operation of the 3DF3 outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

X-RADIATION CHARACTERISTICS

The 3DF3 will produce varying levels of X-radiation depending on operating conditions. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the maximum expected values indicated below for the different values of total DC and peak inverse voltage, with all other operating conditions remaining constant.

TOTAL DC AND PEAK INVERSE VOLTAGE	MAXIMUM EXPECTED X-RADIATION OUTPUT
38 KV (30 KV Maximum DC Component)	25.0 mR/hr
33 KV (27 KV Maximum DC Component)	3.0 mR/hr
30 KV (25 KV Maximum DC Component)	0.5 mR/hr

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

WARNING

X-RADIATION

The high voltages associated with the 3DF3 result in production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide for this shielding.

Precautions must be exercised during the servicing of equipment employing the 3DF3 to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 3DF3 is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 3DF3 in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 3.15 volts.

§ Without external shield.

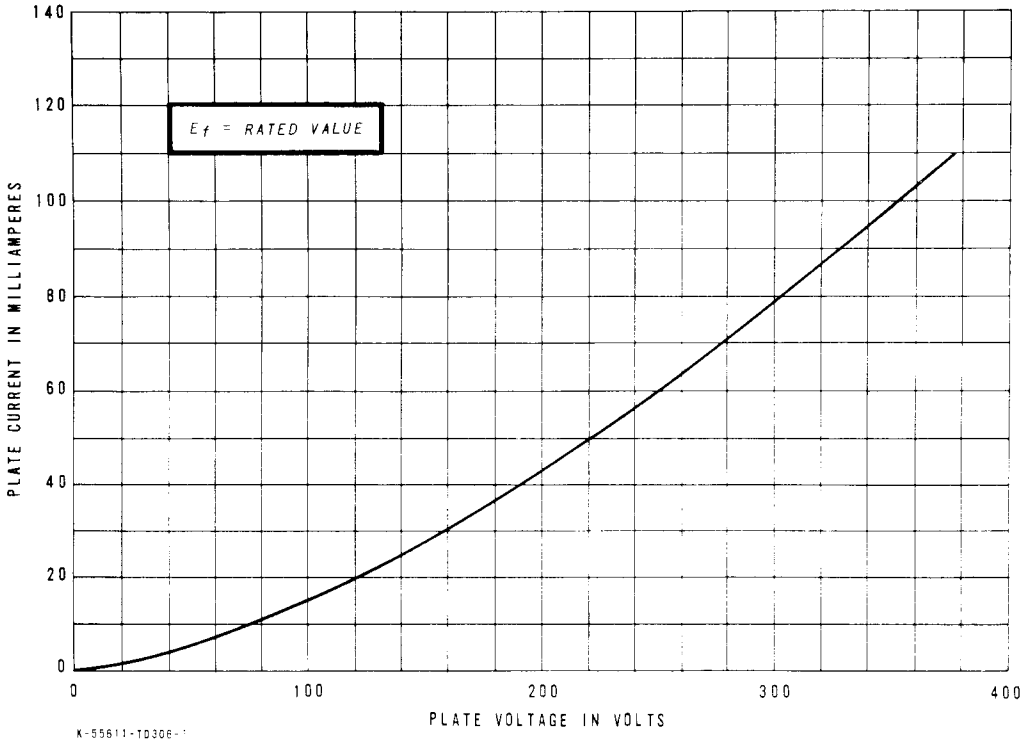
Socket terminals 1 and 7 may be used as tie points for components at or near heater potential.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¢ CAUTION - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 3.65 volts may result in the production of X-radiation in excess of the maximum rated limit of 25 mR/hr.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

Electronic TUBES

3DG4

TWIN DIODE

FOR FULL-WAVE POWER RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 3DG4 is a twin diode with directly heated cathode designed for use as a full-wave rectifier in the power supply of television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Directly Heated

Cathode-Heating Voltage, AC or DC	3.3 ± 10%	Volts
Cathode-Heating Current	3.8	Amperes

MECHANICAL

Mounting Position—Any
Envelope—T-12, Glass
Base—Short Medium-Shell Octal 5-Pin

MAXIMUM RATINGS

RECTIFIER SERVICE—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	1050	Volts
AC Plate-Supply Voltage per Plate—See Rating Chart I		
Steady-State Peak Plate Current per Plate	1200	Milliamperes
Transient Peak Plate Current per Plate, Maximum Duration 0.2 Second	6.5	Amperes
DC Output Current—See Rating Chart I		
Bulb Temperature at Hottest Point	200	C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

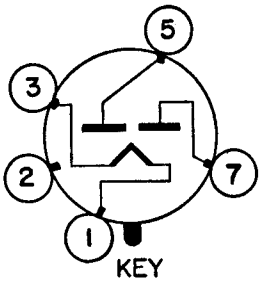
These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM



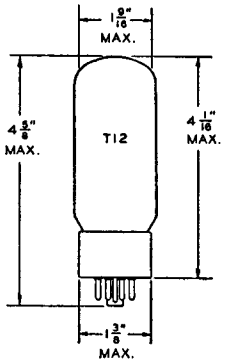
EIA 5DE

TERMINAL CONNECTIONS

Pin 1—Cathode*
Pin 2—Internal Connection—Do Not Use
Pin 3—Cathode*
Pin 5—Plate Number 2
Pin 7—Plate Number 1

* Opposite ends of the directly heated cathode are connected to pins 1 and 3. Cathode-heating voltage should be connected between these pins. Output current may be taken from either pin 1 or pin 3.

PHYSICAL DIMENSIONS



EIA 12-16

CHARACTERISTICS AND TYPICAL OPERATION

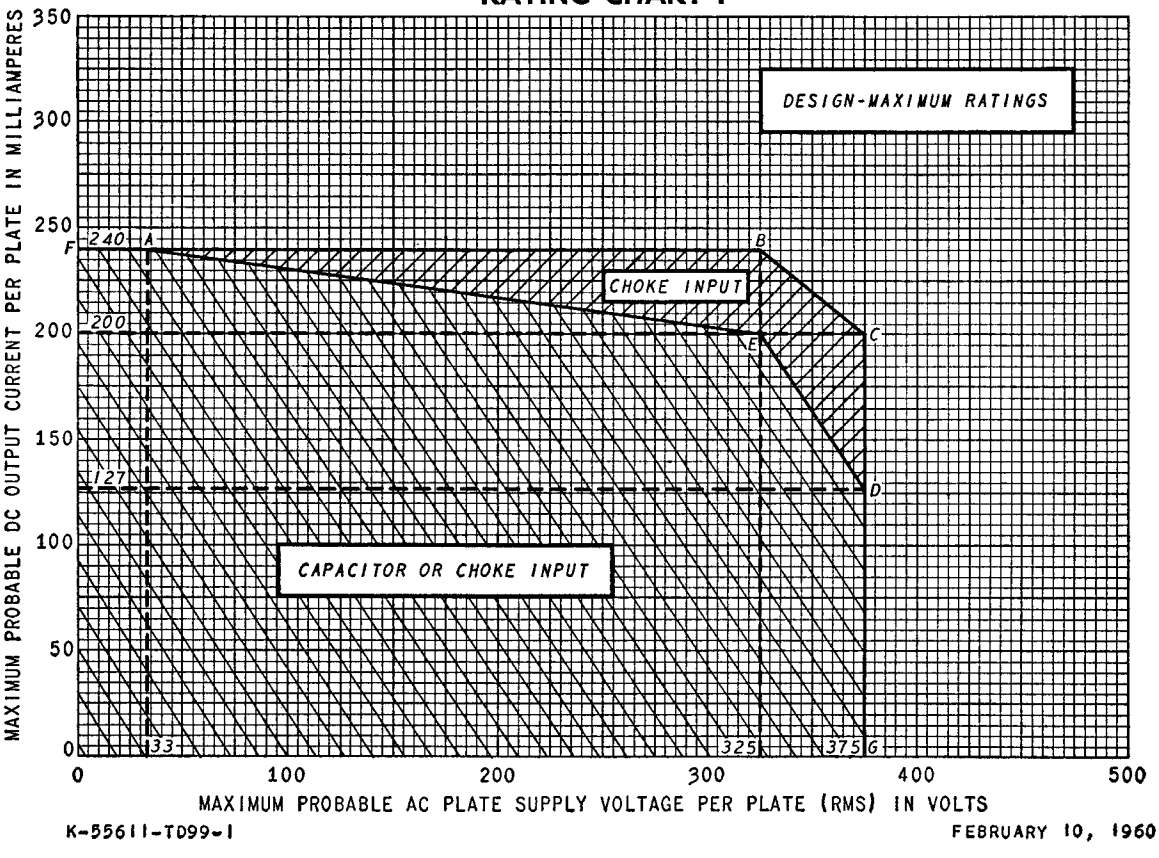
FULL-WAVE RECTIFIER	**Capacitor-Input Filter**	
AC Plate-Supply Voltage per Plate, RMS	275	Volts
Filter Input Capacitor	40	Microfarads
Total Plate-Supply Resistance per Plate	32	Ohms
DC Output Current	350	Milliamperes
DC Output Voltage at Filter Input	300	Volts
Tube Voltage Drop		
Ib = 350 Milliamperes DC per Plate	25	Volts

To simplify the application of the maximum ratings to circuit design, the Design-Maximum ratings are presented in chart form as Rating Charts I, II, and III. Rating Chart I presents the maximum ratings for a-c plate-supply voltage and d-c output current. Rating Chart II provides a convenient method for checking conformance with the maximum steady-state peak-plate-current rating. Rating Chart III offers a convenient method for checking conformance with the maximum transient peak-plate-current rating. Rating Chart I applies to both capacitor-input and choke-input filters, while Rating Charts II and III apply to capacitor-input filters only.

Operating points should be so selected that the boundary limits of a-c plate-supply voltage and d-c output current on Rating Chart I, and maximum d-c output current per plate and rectification efficiency on Rating Chart II, are not exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, and environmental conditions. On Rating Chart I the boundary FAEDG defines the limits for capacitor-input filter operation, and the boundary FABCDG defines the limits for choke-input filter operation.

Rating Chart III shows the minimum value of plate-supply resistance (R_s) required to remain within the transient peak-plate-current rating. The value of R_s should be such that it lies to the left of the line on Rating Chart III at the highest probable value of line voltage.

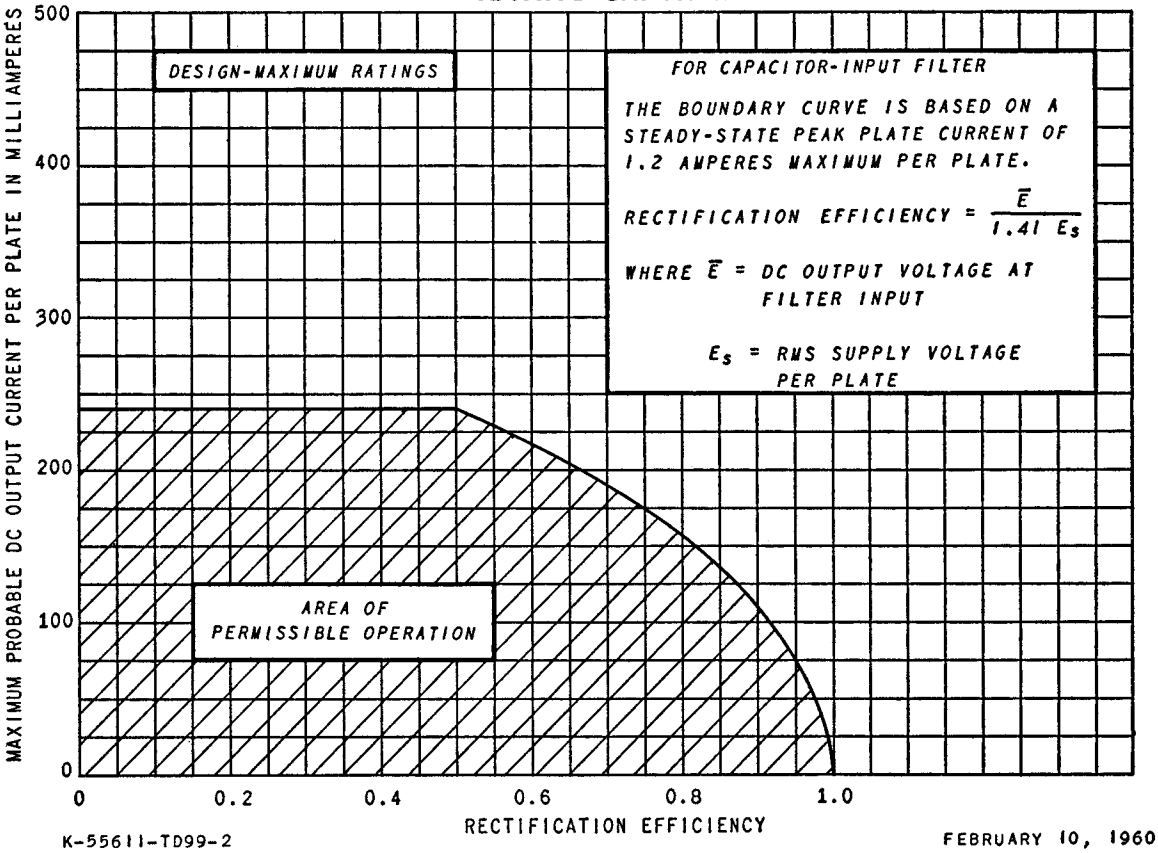
RATING CHART I



K-55611-T099-1

FEBRUARY 10, 1960

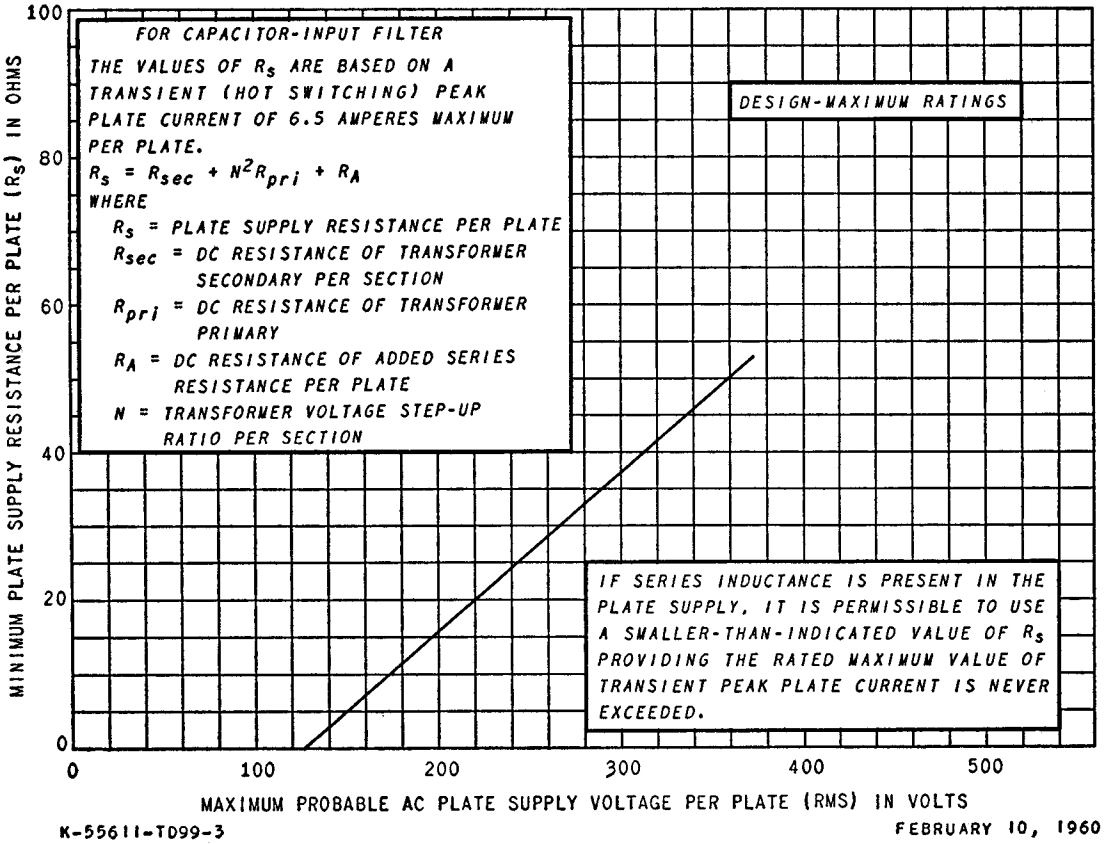
RATING CHART II



K-55611-TD99-2

FEBRUARY 10, 1960

RATING CHART III

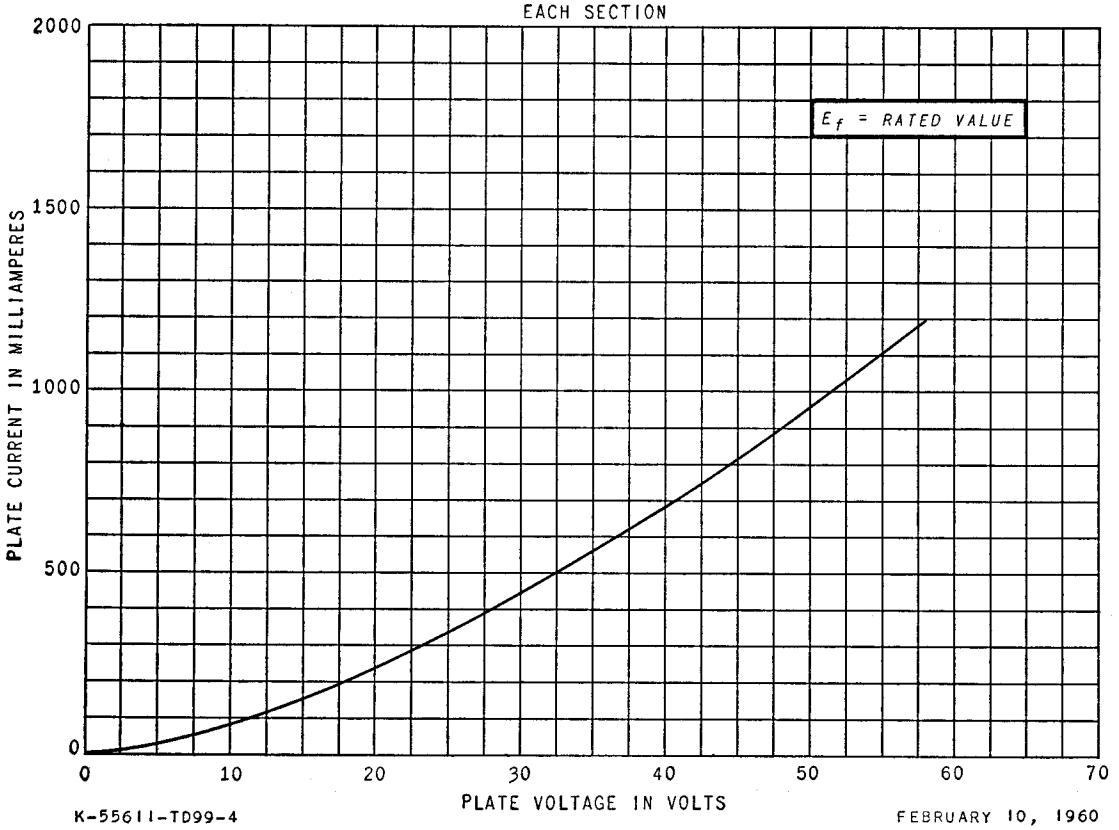


K-55611-TD99-3

FEBRUARY 10, 1960

AVERAGE PLATE CHARACTERISTICS

EACH SECTION

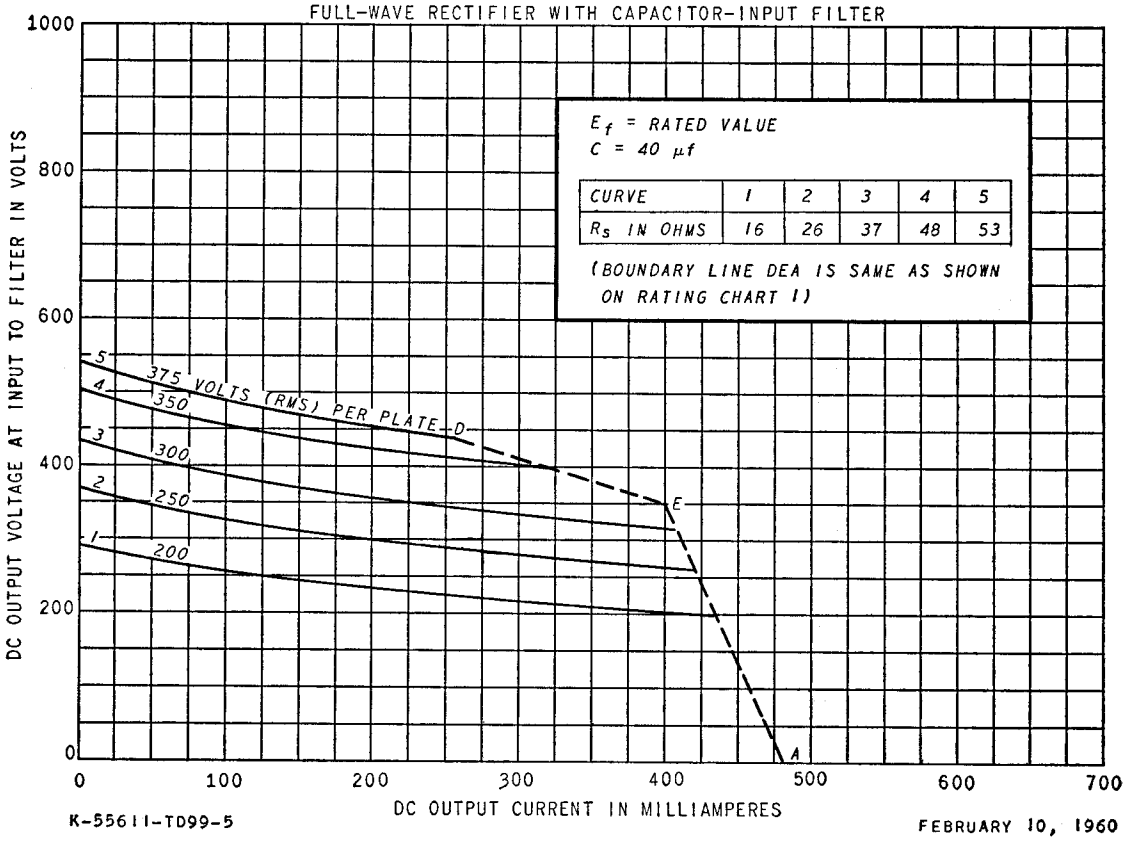


K-55611-TD99-4

FEBRUARY 10, 1960

OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

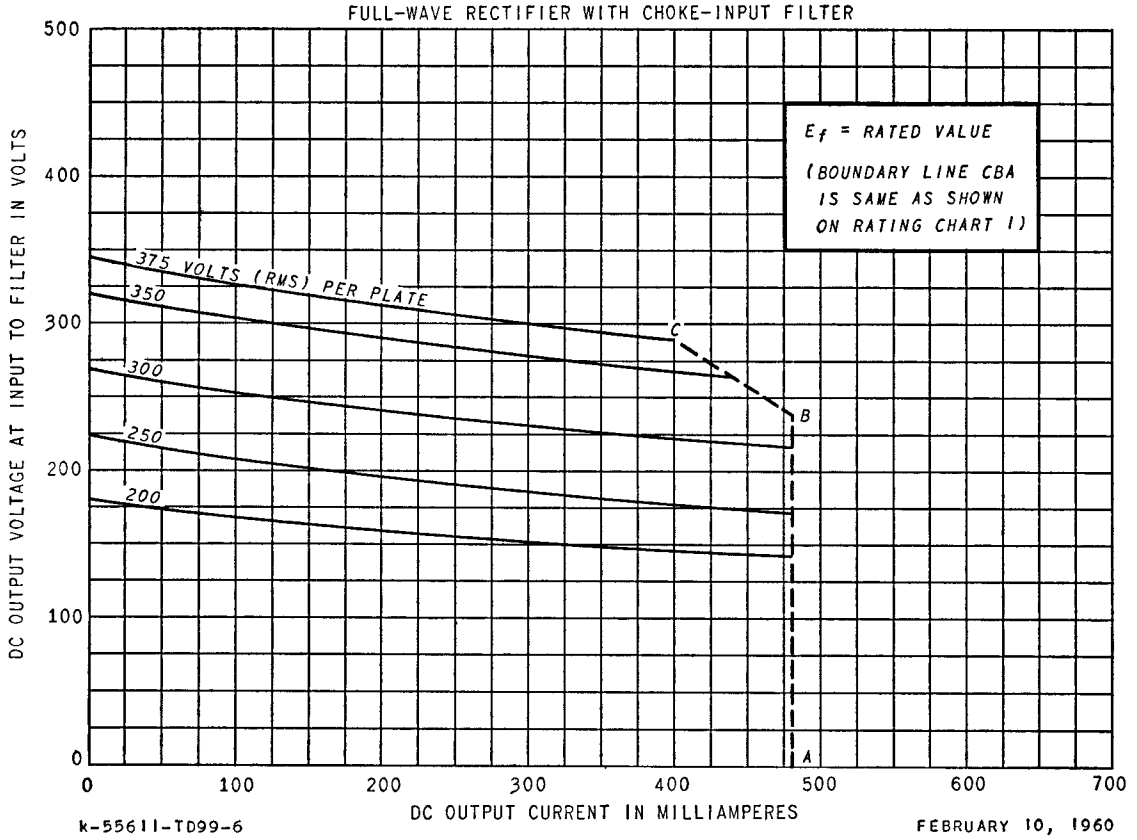


K-55611-TD99-5

FEBRUARY 10, 1960

OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER



k-55611-TD99-6

FEBRUARY 10, 1960

—PRODUCT INFORMATION—

Diode

3DH3

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

- **COLOR TV TYPE**
- **30000 VOLTS DC**
- **2.2 MILLIAMPERES DC**
- **DIFFUSION BONDED CATHODE**
- **X-RADIATION RATING**

The 3DH3 is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube. Features of the tube include a diffusion bonded cathode coating to minimize reverse emission failures, and X-radiation controls.

The diffusion bonded cathode coating practically eliminates one of the major failure mechanisms in high-voltage rectifiers, which is back-emission from the anode due to emissive particles being pulled from the cathode by the very high electrostatic field.

The 3DH3 features built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

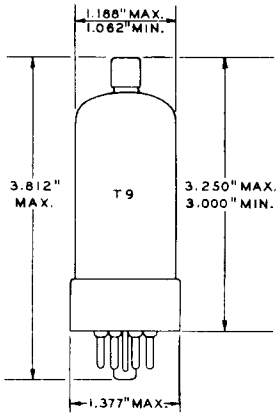
Heater Voltage, AC or DC ★	3.15 ± 0.5	Volts
Heater Current ●	0.48	Amperes
Direct Interelectrode Capacitances, approximate ♦		
Plate to Heater, Cathode, and Internal Shield:		
p to (h+k+i.s.)	1.6	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - B8-118, Short Medium-Shell Octal 8-Pin or
B8-251, Ultra-Short Small-Wafer Octal 8-Pin
Top Cap - C1-49, Small
Outline Drawing - EIA 9-161

Maximum Diameter	1.377	Inches
Maximum Bulb Diameter	1.188	Inches
Maximum Over-all Length	3.812	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

PHYSICAL DIMENSIONS

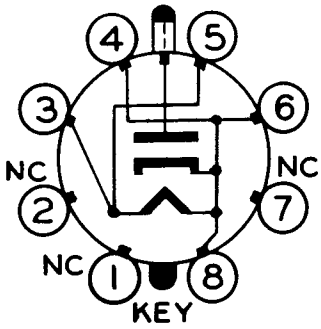


EIA 9-161

TERMINAL CONNECTIONS ▲

▲ Pin 1 - No Connection
▲ Pin 2 - No Connection
Pin 3 - Heater
Pin 4 - Heater, Cathode and Internal Shield
Pin 5 - Heater
Pin 6 - Heater, Cathode and Internal Shield
▲ Pin 7 - No Connection
Pin 8 - Heater, Cathode and Internal Shield
Cap - Plate

BASING DIAGRAM



EIA 8MN

GENERAL ELECTRIC

Supersedes PI Sheet dated 12-70

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE⊕—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	30000	Volts
Total DC and Peak (Absolute-Maximum Value)	38000	Volts
Steady-State Peak Plate Current	110	Milliamperes
DC Output Current	2.2	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value) §	3.65	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.65	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes	70	Volts

X-RADIATION RATING⊕

X-radiation, maximum	25	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 25 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation of the 3DH3 outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

X-RADIATION CHARACTERISTICS

The 3DH3 will produce varying levels of X-radiation depending on operating conditions. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the maximum expected values indicated below for the different values of total DC and peak inverse voltage, with all other operating conditions remaining constant.

TOTAL DC AND PEAK INVERSE VOLTAGE	MAXIMUM EXPECTED X-RADIATION OUTPUT
38 KV (30 KV Maximum DC Component)	25.0 mR/hr
33 KV (27 KV Maximum DC Component)	3.0 mR/hr
30 KV (25 KV Maximum DC Component)	0.5 mR/hr

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

WARNING

X-RADIATION

The high voltages associated with the 3DH3 result in production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide for this shielding.

Precautions must be exercised during the servicing of equipment employing the 3DH3 to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 3DH3 is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 3DH3 in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 3.15 volts.

♦ Without external shield.

▲ Socket terminals 1, 2 and 7 may be used as tie points for components at or near heater potential.

⊕ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ **CAUTION** - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 3.65 volts may result in the production of X-radiation in excess of the maximum rated limit of 25 mR/hr.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

Diode

3DJ3

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

- COLOR TV TYPE
- 30000 VOLTS DC
- 2.0 MILLIAMPERES DC
- DIFFUSION BONDED CATHODE
- X-RADIATION RATING

The 3DJ3 is a heater-cathode type diode designed for use in color television receivers as the high-voltage rectifier to supply power to the anode of the picture tube. Features of the tube include a diffusion bonded cathode coating to minimize reverse emission failures, and X-radiation controls.

The diffusion bonded cathode coating practically eliminates one of the major failure mechanisms in high-voltage rectifiers, which is back-emission from the anode due to emissive particles being pulled from the cathode by the very high electrostatic field.

The 3DJ3 features built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	3.15±0.5	Volts
Heater Current‡	0.3	Amperes

Direct Interelectrode Capacitances, approximate§

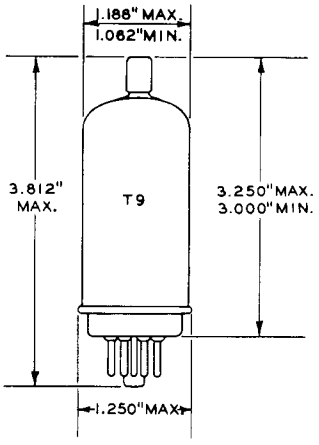
Plate to Heater, Cathode, and Internal Shield:		
p to (h + k + i.s.)	1.4	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - B8-251, Ultra-Short Small-Wafer Octal 8-Pin
Top Cap - C1-49, Small
Outline Drawing

Maximum Bulb Diameter	1.188	Inches
Maximum Seal Diameter	1.250	Inches
Minimum Bulb Diameter	1.062	Inches
Maximum Over-all Length	3.812	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

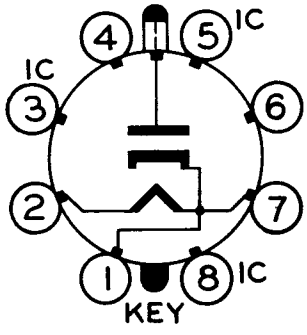
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pin 1 - Heater, Cathode and Internal Shield
Pin 2 - Heater
Pin 3 - Internal Connection - Do Not Use
#Pin 4 - No Connection
Pin 5 - Internal Connection - Do Not Use
#Pin 6 - No Connection
Pin 7 - Heater, Cathode and Internal Shield
Pin 8 - Internal Connection - Do Not Use
Cap - Plate

BASING DIAGRAM



EIA 8MX

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE¶ —DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	30000	Volts
Total DC and Peak (Absolute-Maximum Value)	38000	Volts
Steady-State Peak Plate Current	100	Milliamperes
DC Output Current	2.0	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value)¢	3.65	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.65	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate		
Ib = 7.0 Milliamperes	70	Volts

X-RADIATION RATING¶

X-radiation, maximum	25	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 25 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on data obtained with the use of the Victoreen 440 RF survey meter with a 3 3/8 inch aperture. X-radiation is measured with the face of the meter at a distance of 4 3/4 inches from the external surface of the tube. This rating information is not necessarily applicable when a different radiation measuring instrument or aperture is used.

Operation of the 3DJ3 outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

X-RADIATION CHARACTERISTICS

The 3DJ3 will produce varying levels of X-radiation depending on operating conditions. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the maximum expected values indicated below for the different values of total DC and peak inverse voltage, with all other operating conditions remaining constant.

TOTAL DC AND PEAK INVERSE VOLTAGE	MAXIMUM EXPECTED X-RADIATION OUTPUT
38 KV (30 KV Maximum DC Component).	25.0 mR/hr
33 KV (27 KV Maximum DC Component).	3.0 mR/hr
30 KV (25 KV Maximum DC Component).	0.5 mR/hr

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

WARNING

X-RADIATION

The high voltages associated with the 3DJ3 result in production of X-radiation which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide for this shielding.

Precautions must be exercised during the servicing of equipment employing the 3DJ3 to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 3DJ3 is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 3DJ3 in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 3.15 volts.

§ Without external shield.

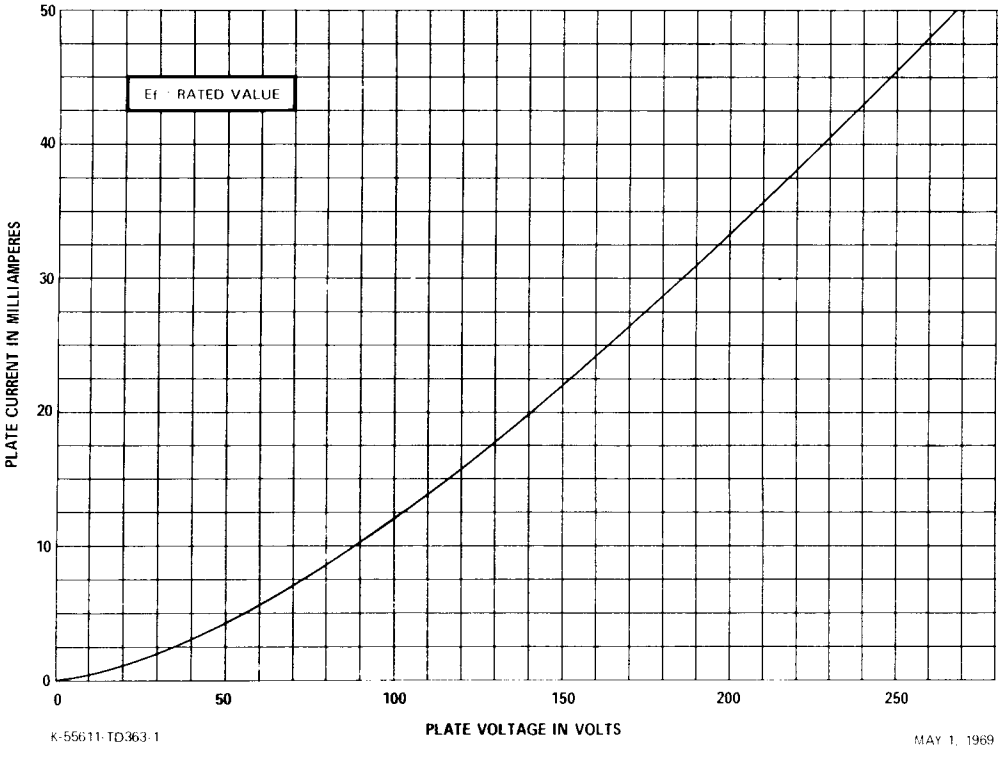
Socket terminals 4 and 6 may be used as tie points for components at or near heater potential.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¢ CAUTION - Operation of this tube for an extended period of time with the heater voltage above the absolute maximum rated value of 3.65 volts may result in the production of X-radiation in excess of the maximum rated limit of 25 mR/hr.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



K-55611-TD363-1

MAY 1, 1969

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONICS

3DK6 THROUGH 3FS5

DESCRIPTION AND RATING

3DK6

3DK6 Sharp-Cutoff Pentode. The 3DK6 is a miniature, sharp-cutoff pentode designed for use as a wide-band radio-frequency or intermediate-frequency amplifier in television receivers.

Except for heater characteristics, the 3DK6 is identical to the 6DK6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	3.15	Volts
Heater Current§	0.6±0.04	Amperes
Heater Warm-up Time, Average¶	11	Seconds

3DT6

3DT6 Sharp-Cutoff Pentode. The 3DT6 is a miniature, sharp-cutoff, dual-control pentode primarily intended for use as an FM detector in television receivers.

Except for heater characteristics, the 3DT6 is identical to the 6DT6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	3.15	Volts
Heater Current§	0.6±0.04	Amperes
Heater Warm-up Time, Average¶	11	Seconds

3DZ4

3DZ4 Triode. The 3DZ4 is a miniature, medium-mu triode designed for use as a UHF oscillator in television receivers.

Except for heater characteristics, the 3DZ4 is identical to the 6DZ4.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC‡	3.2	Volts
Heater Current§	0.45±0.03	Amperes
Heater Warm-up Time, Average¶	11	Seconds

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

3FS5

3FS5 "Shadow-grid" Beam Pentode. The 3FS5 is a miniature tube, similar in construction to a beam pentode, with an internally connected grid between the control grid and the screen grid, which serves to reduce the ratio of screen current to plate current. The tube is designed for use as a radio-frequency amplifier in VHF television receivers.

Except for heater characteristics, the 3FS5 is identical to the 6FS5.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC‡	2.9	Volts
Heater Current§	0.45±0.03	Amperes
Heater Warm-up Time, Average¶	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.6 amperes.

‡ Heater voltage for a bogey tube at If = 0.45 amperes.

§ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

¶ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Diode

3DR3

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

■ COLOR TV TYPE ■ 30000 VOLTS DC ■ 2.0 MILLIAMPERES DC ■ X-RADIATION RATING

The 3DR3 is a heater-cathode type diode designed for use in color television receivers as the high voltage rectifier to supply power to the anode of the picture tube.

Features of the tube include a protective shield of X-radiation absorbing material to reduce the X-radiation output to very low levels even under failure mode conditions of equipment misadjustment and/or circuit failure mode operation.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	3.15±0.5	Volts
Heater Current●	0.3	Amperes

Direct Interelectrode Capacitances, approximate▲

Plate to Heater, Cathode and Internal Shield:		
p to (h+k+i.s.)	1.9	pf

MECHANICAL

Operating Position - Any
Envelope - T-11, Glass with Bonded Shield
Base - Base - B8-264, Small-Wafer Octal 8-Pin
Top Cap - C1-51, Small
Outline Drawing

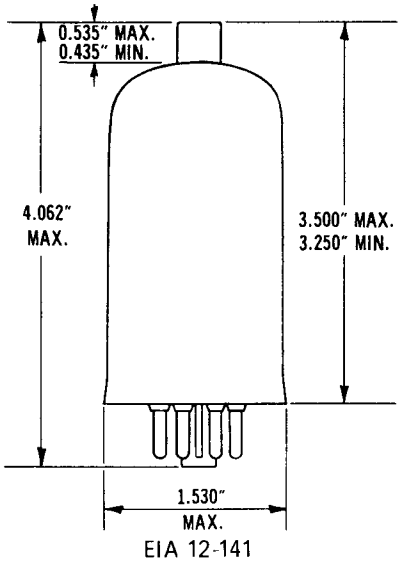
Maximum Envelope Diameter	1.530	Inches
Maximum Over all Length	4.062	Inches
Maximum Seated Height	3.500	Inches
Minimum Seated Height	3.250	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE§—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	30000	Volts
Total DC and Peak (Absolute-Maximum Value)⊕	38000	Volts
Steady-State Peak Plate Current	100	Milliamperes
DC Output Current	2.0	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value)⊕	3.65	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.65	Volts

PHYSICAL DIMENSIONS

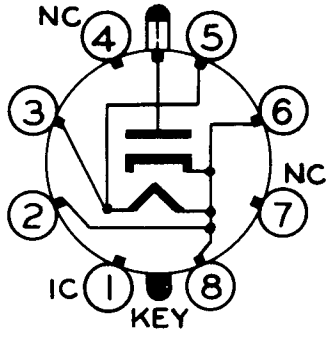


EIA 12-141

TERMINAL CONNECTIONS ♦

Pin 1 - Internal Connection - Do Not Use
Pin 2 - Heater, Cathode and Internal Shield
Pin 3 - Heater
♦ Pin 4 - No Connection
Pin 5 - Heater
Pin 6 - Heater, Cathode and Internal Shield
♦ Pin 7 - No Connection
Pin 8 - Heater, Cathode and Internal Shield
Cap - Plate

BASING DIAGRAM



EIA 8NL

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate
Ib = 7.0 Milliamperes ..... 70 Volts

X-RADIATION RATING §

MAXIMUM RATED OPERATING CONDITIONS

Total DC and Peak Inverse Voltage	Maximum X-Radiation Output
⊕ 38 KV	0.5 mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on the the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation at voltages outside of the Absolute-Maximum Ratings will cause permanent damage to the tube resulting in short life and/or catastrophic failure. Any tube known to have operated above 38 KV peak inverse voltage and/or 3.65 V heater voltage should be replaced with the latest version of the same tube type.

The X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, " Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein, except as noted under "X-Radiation Characteristics."

X-RADIATION CHARACTERISTICS

EQUIPMENT MISADJUSTMENT AND/OR CIRCUIT FAILURE MODE OPERATION

The 3DR3 is designed to limit X-radiation to 0.5 mR/hr provided its protective shield has not been removed or damaged. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the indicated value under equipment misadjustment and/or circuit failure mode operations of plate and heater voltage listed below.

Total DC and Peak Inverse Voltage	Maximum Heater Voltage	Maximum Expected X-Radiation Output
⊕41 KV	⊕4.8 V	0.5 mR/hr

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated with total DC and peak inverse voltage above 41 KV.

Operation at voltages outside of the Absolute-Maximum Ratings will cause permanent damage to the tube resulting in short life and/or catastrophic failure. Any tube known to have operated above 38 KV peak inverse voltage and/or 3.65 V heater voltage should be replaced with the latest version of the same tube type.

WARNING

X-RADIATION

X-radiation in excess of 0.5 mR/hr may constitute a health hazard on prolonged exposure at close range. Therefore, equipment design must provide for adequate shielding.

Operation of the 3DR3 with total DC and peak inverse voltage greater than 41 KV may result in radiation in excess of the "Maximum Expected X-Radiation Output" listed under "X-Radiation Characteristics."

Precautions must be exercised during servicing of equipment employing the 3DR3 to assure that the high voltage is adjusted to the recommended value and that the tube's protective shield is not damaged. **IF THE PROTECTIVE SHIELD IS REMOVED OR DAMAGED IN ANY WAY, THE 3DR3 MUST BE REPLACED WITH THE LATEST VERSION OF THE SAME TUBE TYPE.**

SHOCK HAZARD

The high voltages at which the 3DR3 is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and in the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 3DR3 in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

ARC TEST FOR HIGH VOLTAGE

The practice of checking for high voltage by drawing an arc from the top cap can permanently damage the protective shield which will necessitate replacing the tube.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 3.15 volts.

▲ Without external shield.

♦ Socket terminals 4 and 7 may be used as tie points for components at or near heater potential.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

℔ **CAUTION** - Operation at voltages outside of the Absolute-Maximum Ratings will cause permanent damage to the tube resulting in short life and/or catastrophic failure. Any tube known to have operated above 38 KV peak inverse voltage and/or 3.65 V heater voltage should be replaced with the latest version of the same tube type.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

—PRODUCT INFORMATION—

Diode

3DS3

FOR TV HIGH-VOLTAGE RECTIFIER APPLICATIONS

■ COLOR TV TYPE ■ 30000 VOLTS DC ■ 2.2 MILLIAMPERES DC ■ X-RADIATION RATING

The 3DS3 is a heater-cathode type diode designed for use in color television receivers as the high voltage rectifier to supply power to the anode of the picture tube.

Features of the tube include a protective shield of X-radiation absorbing material to reduce the X-radiation output to very low levels even under failure mode conditions of equipment misadjustment and/or circuit failure mode operation.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	3.15±0.5	Volts
Heater Current●	0.48	Amperes

Direct Interelectrode Capacitances, approximate▲

Plate to Heater, Cathode and Internal Shield:		
p to (h+k+i.s.)	1.9	pf

MECHANICAL

Operating Position - Any
Envelope - T-11, Glass with Bonded Shield
Base - Base - B8-264, Small-Wafer Octal 8-Pin
Top Cap - C1-51, Small
Outline Drawing

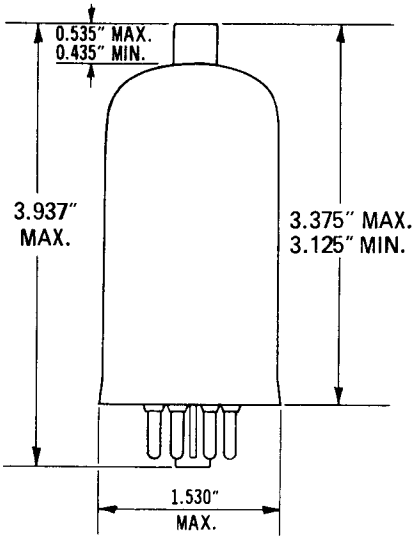
Maximum Envelope Diameter	1.530	Inches
Maximum Over-all Length	3.937	Inches
Maximum Seated Height	3.375	Inches
Minimum Seated Height	3.125	Inches

MAXIMUM RATINGS

FLYBACK RECTIFIER SERVICE§—DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Inverse Voltage		
DC Component (Absolute-Maximum Value)	30000	Volts
Total DC and Peak (Absolute-Maximum Value)⊕	38000	Volts
Steady-State Peak Plate Current	110	Milliamperes
DC Output Current	2.2	Milliamperes
Heater Voltage, AC or DC (Absolute-Maximum Value)⊕	3.65	Volts
Heater Voltage, AC or DC (Absolute-Minimum Value)	2.65	Volts

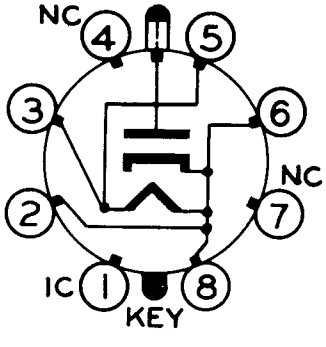
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS♦

Pin 1 - Internal Connection - Do Not Use
Pin 2 - Heater, Cathode and Internal Shield
Pin 3 - Heater
♦Pin 4 - No Connection
Pin 5 - Heater
Pin 6 - Heater, Cathode and Internal Shield
♦Pin 7 - No Connection
Pin 8 - Heater, Cathode and Internal Shield
Cap - Plate

BASING DIAGRAM



EIA 8NL

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate Ib = 7.0 Milliamperes	70	Volts

X-RADIATION RATING§

MAXIMUM RATED OPERATING CONDITIONS

Total DC and Peak Inverse Voltage	Maximum X-Radiation Output
⊕ 38 KV	0.5 mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation at voltages outside of the Absolute-Maximum Ratings will cause permanent damage to the tube resulting in short life and/or catastrophic failure. Any tube known to have operated above 38 KV peak inverse voltage and/or 3.65 V heater voltage should be replaced with the latest version of the same tube type.

The X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein, except as noted under "X-Radiation Characteristics."

X-RADIATION CHARACTERISTICS

EQUIPMENT MISADJUSTMENT AND/OR CIRCUIT FAILURE MODE OPERATION

The 3DS3 is designed to limit X-radiation to 0.5 mR/hr provided its protective shield has not been removed or damaged. Based on known attenuation factors of tube construction materials and accumulated sample test data taken initially and during life test, X-radiation output is not expected to exceed the indicated value under equipment misadjustment and/or circuit failure mode operations of plate and heater voltage listed below.

Total DC and Peak Inverse Voltage	Maximum Heater Voltage	Maximum Expected X-Radiation Output
⊕41 KV	⊕4.8 V	0.5 mR/hr

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated with total DC and peak inverse voltage above 41 KV.

Operation at voltages outside of the Absolute-Maximum Ratings will cause permanent damage to the tube resulting in short life and/or catastrophic failure. Any tube known to have operated above 38 KV peak inverse voltage and/or 3.65 V heater voltage should be replaced with the latest version of the same tube type.

WARNING

X-RADIATION

X-radiation in excess of 0.5 mR/hr may constitute a health hazard on prolonged exposure at close range. Therefore, equipment design must provide for adequate shielding.

Operation of the 3DS3 with total DC and peak inverse voltage greater than 41 KV may result in radiation in excess of the "Maximum Expected X-radiation Output" listed under "X-Radiation Characteristics."

Precautions must be exercised during servicing of equipment employing the 3DS3 to assure that the high voltage is adjusted to the recommended value and that the tube's protective shield is not damaged. **IF THE PROTECTIVE SHIELD IS REMOVED OR DAMAGED IN ANY WAY, THE 3DS3 MUST BE REPLACED WITH THE LATEST VERSION OF THE SAME TUBE TYPE.**

SHOCK HAZARD

The high voltages at which the 3DS3 is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and in the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 3DS3 in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

ARC TEST FOR HIGH VOLTAGE

The practice of checking for high voltage by drawing an arc from the top cap can permanently damage the protective shield which will necessitate replacing the tube.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 3.15 volts.

▲ Without external shield.

♦ Socket terminals 4 and 7 may be used as tie points for components at or near heater potential.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

⊕ **CAUTION** - Operation at voltages outside of the Absolute-Maximum Ratings will cause permanent damage to the tube resulting in short life and/or catastrophic failure. Any tube known to have operated above 38 KV peak inverse voltage and/or 3.65 V heater voltage should be replaced with the latest version of the same tube type.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

ELECTRONICS

3GK5 THROUGH 3HS8

DESCRIPTION AND RATING

3GK5

3GK5 Frame-Grid Triode. The 3GK5 is a miniature, frame-grid, gain-controlled triode designed for use as a VHF radio-frequency amplifier.

Except for heater characteristics, the 3GK5 is identical to the 6GK5.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC‡	2.8	Volts
Heater Current§	0.45±0.03	Amperes
Heater Warm-up Time, Average¶	11	Seconds

3HA5

3HA5 Triode. The 3HA5 is a miniature triode designed particularly for service in VHF television tuners as a grounded-cathode radio-frequency amplifier.

Except for heater characteristics, the 3HA5 is identical to the 6HA5.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC‡	2.7	Volts
Heater Current§	0.45±0.03	Amperes

3HM5

3HM5 Triode. The 3HM5 is a miniature triode designed particularly for service in VHF television tuners as a grounded-cathode radio-frequency amplifier.

Except for heater characteristics, the 3HM5 is identical to the 6HM5.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC‡	2.9	Volts
Heater Current§	0.45±0.03	Amperes
Heater Warm-up Time, Average¶	11	Seconds

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

3HS8

3HS8 Twin Pentode. The 3HS8 is a miniature, multisection tube that incorporates separate plates and number-3 grids for the two sections together with a common screen, number-1 grid, and cathode. The tube is intended for use as a combined sync-AGC tube in television receivers.

Except for heater characteristics, the 3HS8 is identical to the 6HS8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	3.15	Volts
Heater Current§	0.6±0.04	Amperes
Heater Warm-up Time, Average¶	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.6 amperes.

‡ Heater voltage for a bogey tube at If = 0.45 amperes.

§ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

¶ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBE

3V4
Description and Rating
PENTODE

The 3V4 is a miniature power-amplifier pentode designed for use in the power output stage of compact, battery-operated equipment. It is particularly useful in three-way portable receivers which employ 90-volt batteries. The filament is center-tapped to permit operation from either a 2.8-volt or 1.4-volt filament supply voltage.

GENERAL

Cathode - Coated Filament

	Series*	Parallel*	
Filament Voltage, D-C	2.8	1.4	Volts
Filament Current	0.05	0.1	Ampere

Envelope - T-5½, Glass
Base - E7-1, Miniature Button 7-Pin
Mounting Position - Any

Direct Interelectrode Capacitances +

Grid-Number 1 to Plate	0.2	μμf
Input	5.5	μμf
Output	3.8	μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES

	Series Filament*	Parallel Filament*	
Plate Voltage	90	90	Volts
Screen Voltage	90	90	Volts
D-C Cathode Current	6.0 §	12	Milliamperes

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

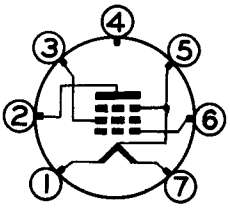
	Series Filament*	Parallel Filament*		
Plate Voltage	90	85	90	Volts
Screen Voltage	90	85	90	Volts
Grid-Number 1 Voltage	-4.5	-5	-4.5	Volts
Peak AF Grid-Number 1 Voltage	4.5	5	4.5	Volts
Plate Resistance, approximate	0.12	0.12	0.1	Megohm
Transconductance	2000	1975	2150	Micromhos
Zero-Signal Plate Current	7.7	6.9	9.5	Milliamperes
Zero-Signal Screen Current	1.7	1.5	2.1	Milliamperes
Load Resistance	10000	10000	10000	Ohms
Total Harmonic Distortion, approximate	7	10	7	Percent
Maximum-Signal Power Output	0.24	0.25	0.27	Watt

* *For series-filament operation the positive filament voltage is connected to pin 7, and the negative filament voltage is connected to pin 1. For parallel-filament operation the positive filament voltage is connected to pins 1 and 7 tied together, and the negative filament voltage is connected to pin 5. In each case, all voltages are referred to the negative terminal of the filament.*

§ *Value is for each filament section. With series-filament operation, a resistor must be connected across the negative filament section to bypass any cathode current in excess of the rated maximum. When other tubes in a series-filament arrangement contribute to the filament current of the 3V4, an additional shunting resistor may be required across the entire filament.*

\+ *Without external shield.*

BASING DIAGRAM

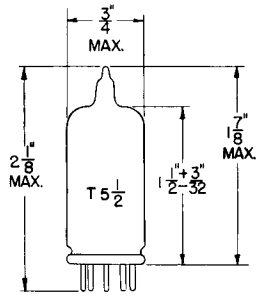


RTMA 6BX
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 - Filament
Pin 2 - Plate
Pin 3 - Grid Number 2 (Screen)
Pin 4 - No Connection
Pin 5 - Filament Center-Tap and Grid Number 3
Pin 6 - Grid Number 1
Pin 7 - Filament

PHYSICAL DIMENSIONS

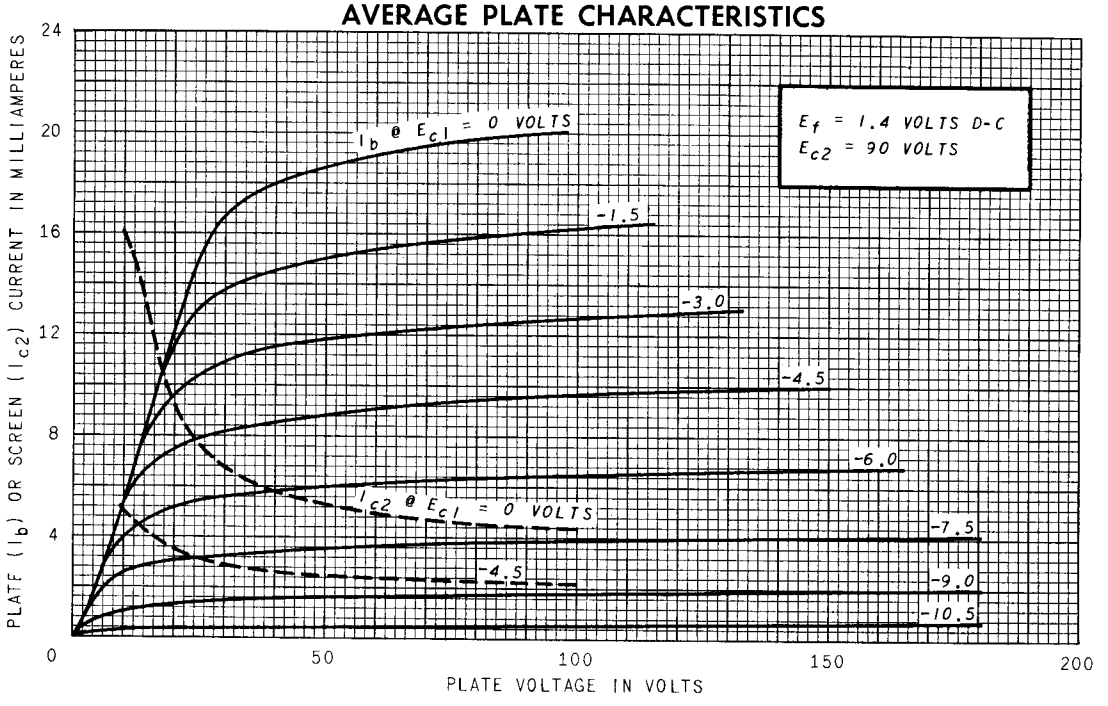


RTMA 5-2

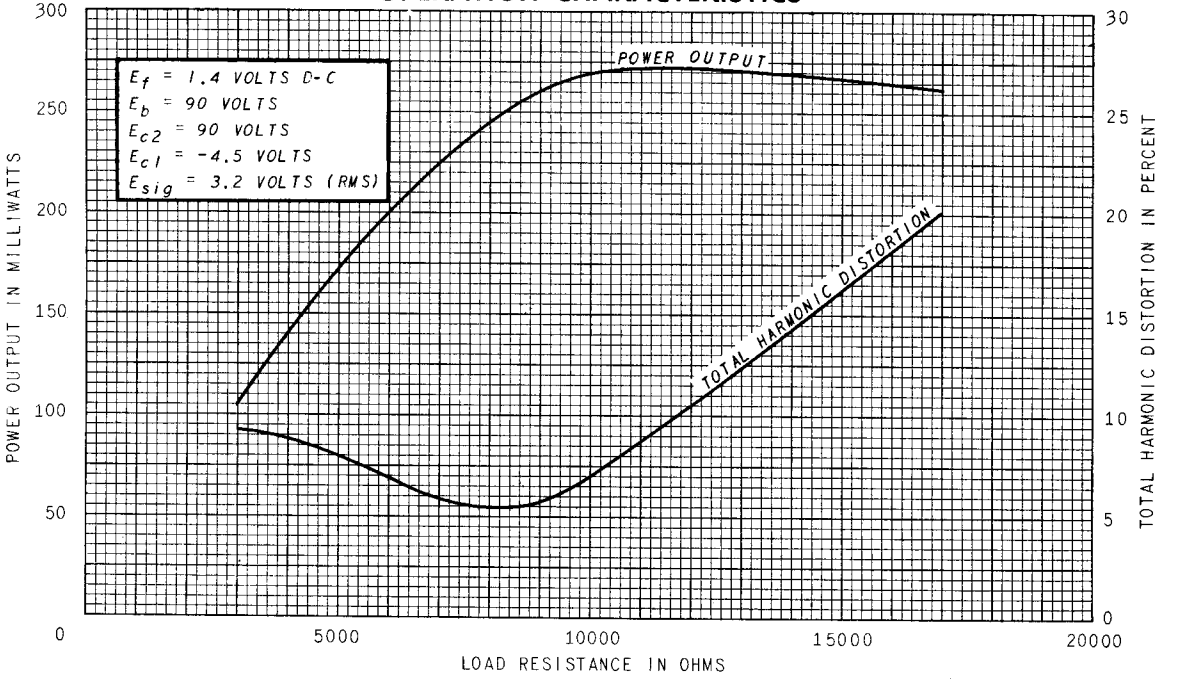
GENERAL ELECTRIC

Supersedes ET-T453A dated 3-50

AVERAGE PLATE CHARACTERISTICS



OPERATION CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

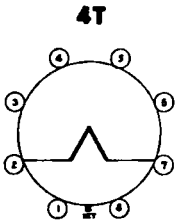
RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Sponsor:
General Electric Co.

Registration No. 356
November 15, 1943

TYPE 4A21

BALLAST TUBE



GENERAL CHARACTERISTICS

Electrical

Mean Current	1.62 Amperes
Mean Current Range*	1.59 to 1.65 Amperes
Voltage Range (±2% Current Variation)**	11 to 15 Volts

Mechanical

Filament	Iron Wire
Maximum Overall Height	4 Inches
Maximum Diameter	1-1/4 Inches
Base Description	M8-055
Basing	4T
Mounting Position	Any
Net Weight, Approx	1 Ounce

MAXIMUM RATINGS

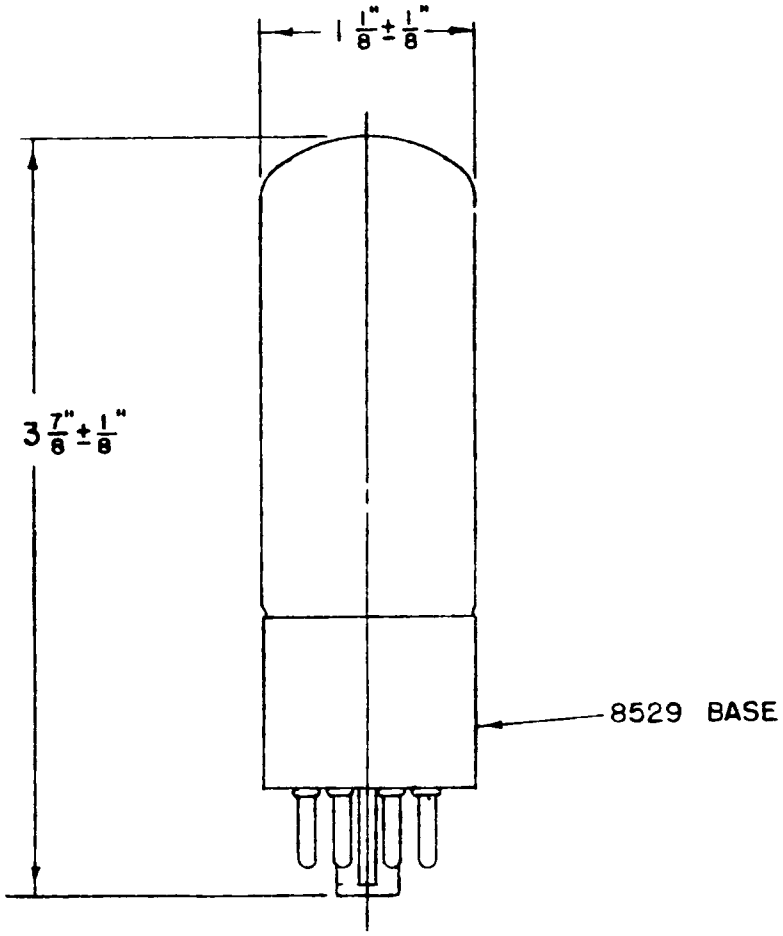
Current***	1.70 Amperes
Ambient Temperature Range	-30 to +80° C

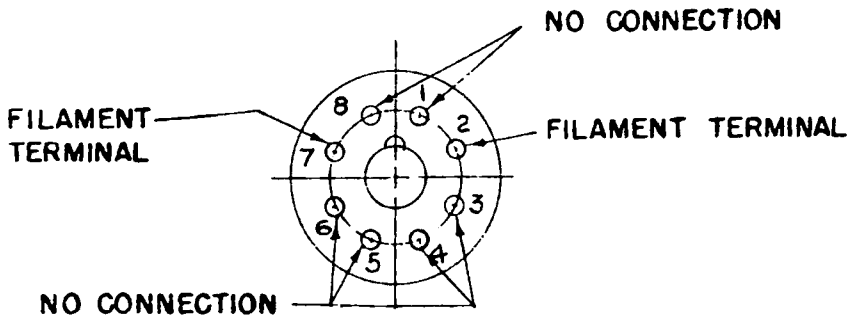
* Denotes maximum and minimum values of mean current to be expected in a lot of tubes, measured within the voltage range which gives a ±2 per cent current variation.

** In this range of voltage the current will not vary more than ±2 per cent of the mean current of the individual tube.

*** Denotes maximum continuous current which can be passed continuously through the tube without causing permanent damage.

RMA TYPE
4A21





ANNOUNCEMEMENT OF REGISTRATION

RELEASE NO. 356

4AU6—4BU8—4BZ6

DESCRIPTION AND RATING

4AU6

4AU6 Sharp-Cutoff Pentode. The 4AU6 is a miniature, sharp-cutoff pentode designed primarily for use as a high-gain radio-frequency or intermediate-frequency amplifier.

Except for heater characteristics, the 4AU6 is identical to the 6AU6-A.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	4.2	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, average§	11	Seconds

4BU8

4BU8 Twin Pentode. The 4BU8 is a miniature, multisection tube that incorporates separate plates and number-3 grids for the two sections together with a common screen, number-1 grid, and cathode. The tube is intended for use as a combined sync-AGC tube in television receivers.

Except for heater characteristics, the 4BU8 is identical to the 6BU8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	4.2	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, average§	11	Seconds

4BZ6

4BZ6 Semiremote-Cutoff Pentode. The 4BZ6 is a miniature, semiremote-cutoff pentode designed primarily for use as an intermediate-frequency amplifier in television receivers.

Except for heater characteristics, the 4BZ6 is identical to the 6BZ6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	4.2	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, average§	11	Seconds

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NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Type 4B27

Release No. 406

May 5, 1945

sponsor:
General Electric Co.

Gas-Filled Rectifier - Full-Wave

GENERAL CHARACTERISTICS

Electrical

Filament	
Voltage	2.5 Volts
Current	10 Amperes
Time Delay	5 Minutes

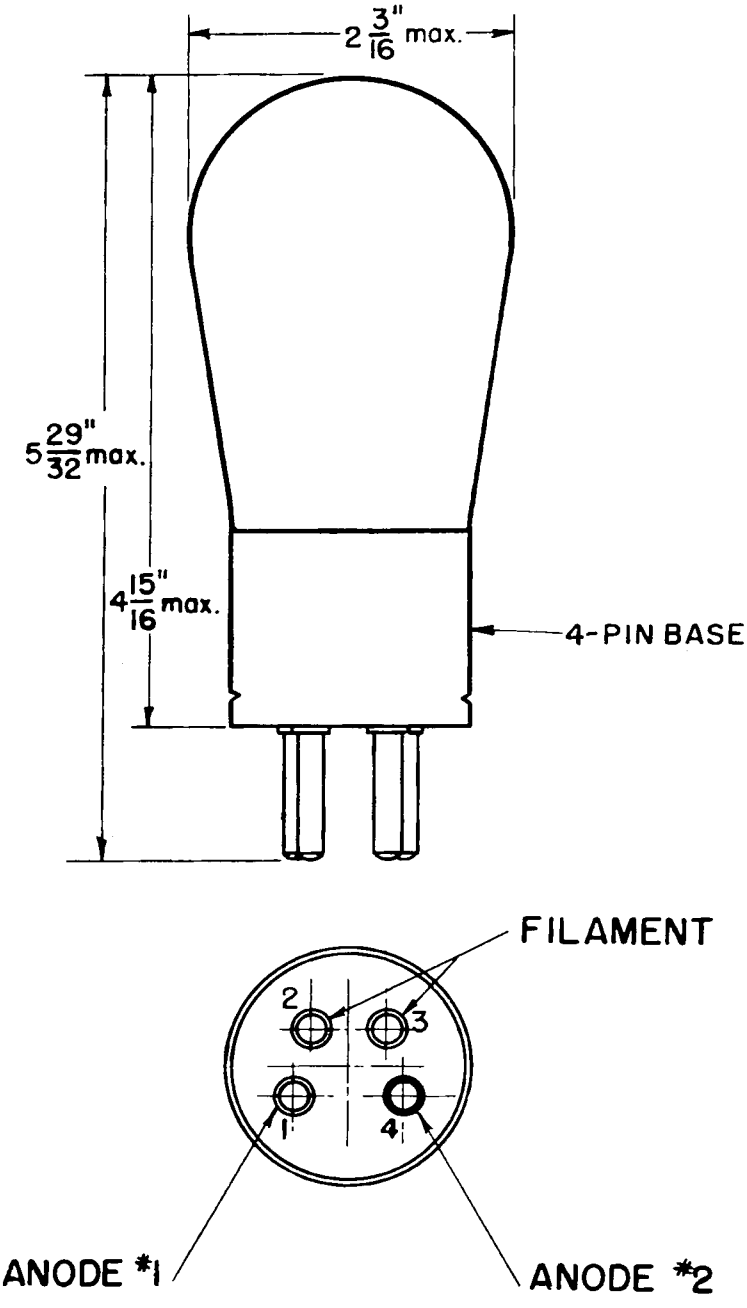
Mechanical

Type of Cooling	Convection
Base - See Outline	
Maximum Overall Dimensions	
Length	5.90 Inches
Diameter	2.20 Inches

MAXIMUM RATINGS

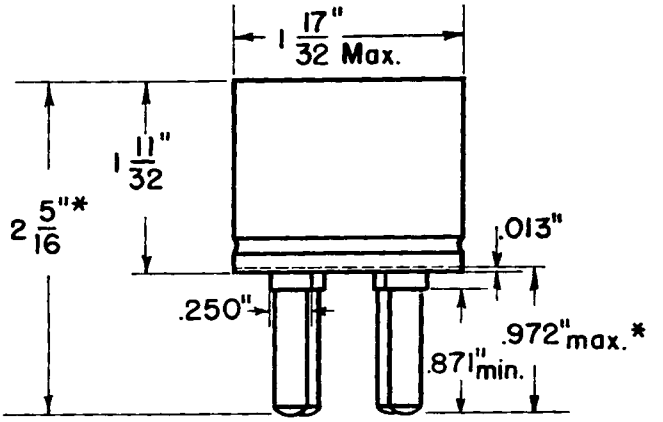
Condensed Mercury Temperature, Degrees C	90
Maximum Output	
Voltage	250 Volts average
Current	2.0 Amperes av.
	6.0 Amperes, peak
Pickup Voltage (Hot)	
Average	12.5 Volts d-c
Range	8-20 Volts d-c
Pickup Voltage (Cold)	
Average	14 Volts d-c
Range	8-24 Volts d-c
Arc Voltage (Hot)	
Average	9.0 Volts d-c
Range	6-15 Volts d-c
Arc Voltage (Cold)	
Average	12.5 Volts d-c
Range	7.5-20 Volts d-c
Maximum Peak Inverse Voltage	1000 Volts

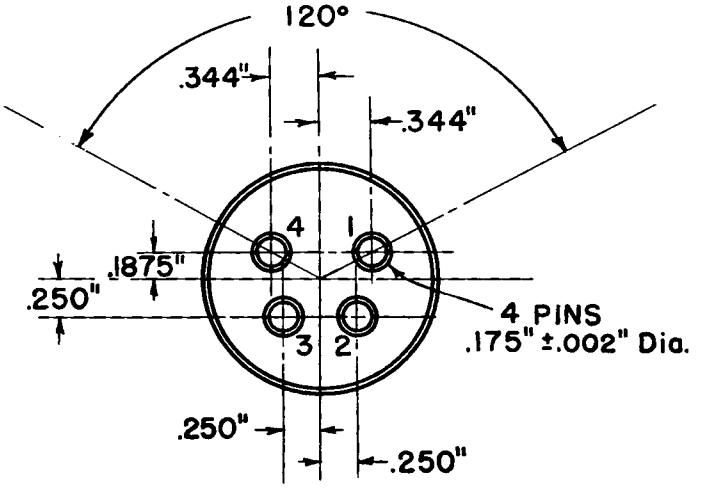
R.M.A. TYPE 4B27



BASE TYPE

A4–33





* On finished tube, add .060" for solder

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

TYPE 4B28

Release No. 393

November 30, 1944

(Gas Filled Rectifier)

sponsor:
General Electric Co.

GENERAL CHARACTERISTICS

Electrical

Filament: Thoriated Tungsten	
Voltage	2.2 ± 5% V a-c
Current	17 amp (approx.)
Pickup voltage (hot or cold)	
Average during life	12 volts d-c
Range	10 to 15 volts d-c
Arc Voltage (hot or cold)	
Average during life	7 volts d-c
Range	5 to 10 volts d-c

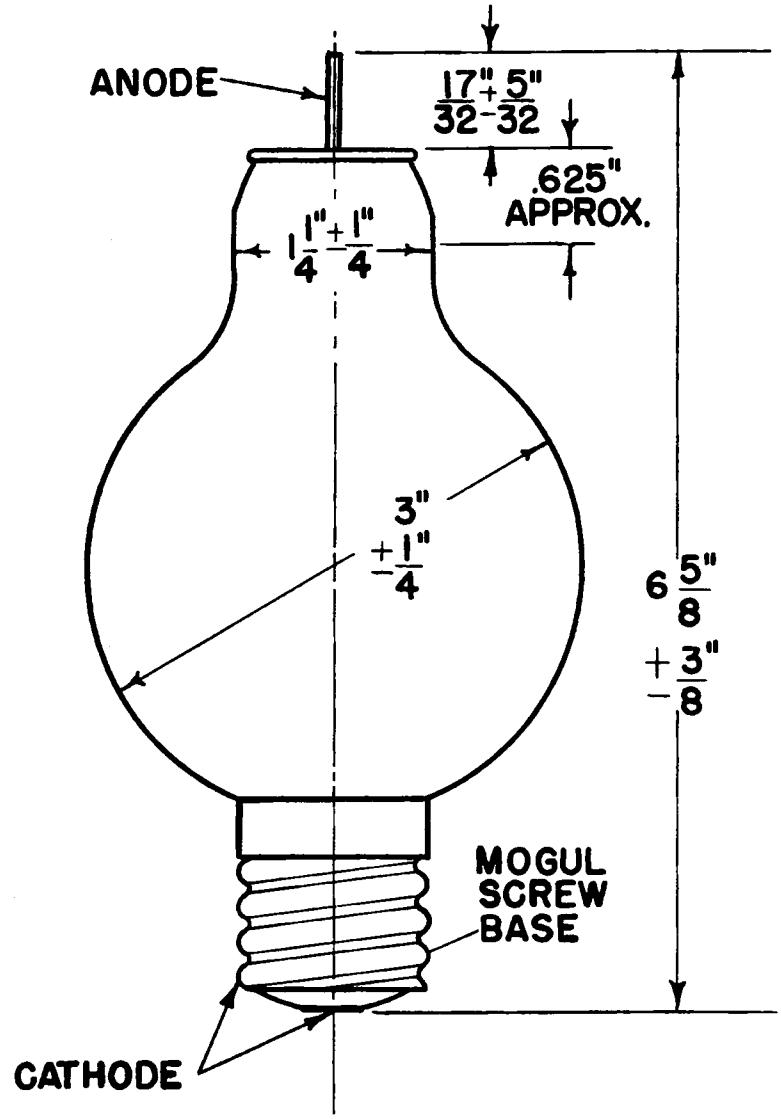
Mechanical

Type of cooling	Convection
Base	Mogul Screw
Maximum overall dimensions	
Length	7"
Diameter	3-1/4"

MAXIMUM RATINGS

Maximum Output	
Voltage	60 volts
Current	
Average	6.0 amps
Peak	36.0 amps
Maximum Peak Inverse Voltage	
Half wave, single phase	300 volts
Full Wave, single phase	200 volts

RMA TYPE 4B28



RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release No. 410

May 25, 1945

sponsor:
General Electric Co.

TYPE 4B35 *

Gas Filled Rectifier

General Characteristics

Electrical

Filament: Thoriated Tungsten

Voltage	2.0 ± 5% V.a-c
Current	13.5 amps (approx.)

Pick-up Voltage

Average	12.0 volts d-c
Range	9.5 to 15.0

Arc Voltage

Average	7.5 volts d-c
Range	5.0 to 9.5 volts d-c

Mechanical

Type of Cooling	Convection
Base	Skirted Medium Screw

Maximum Overall Dimensions

Length	4 3/16"
Diameter	2 3/16"

Maximum Ratings

Maximum Output

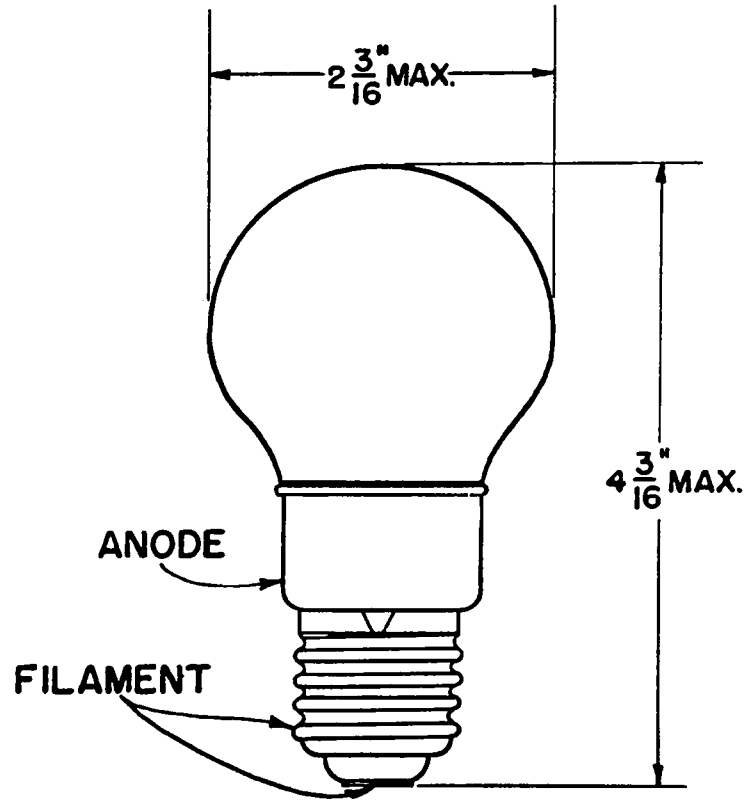
Voltage	75 V. d-c
Current	
Average	2.0 amperes
Peak	12.0 amperes
Maximum Peak Inverse Voltage (half-wave circuit)	275

*12X825

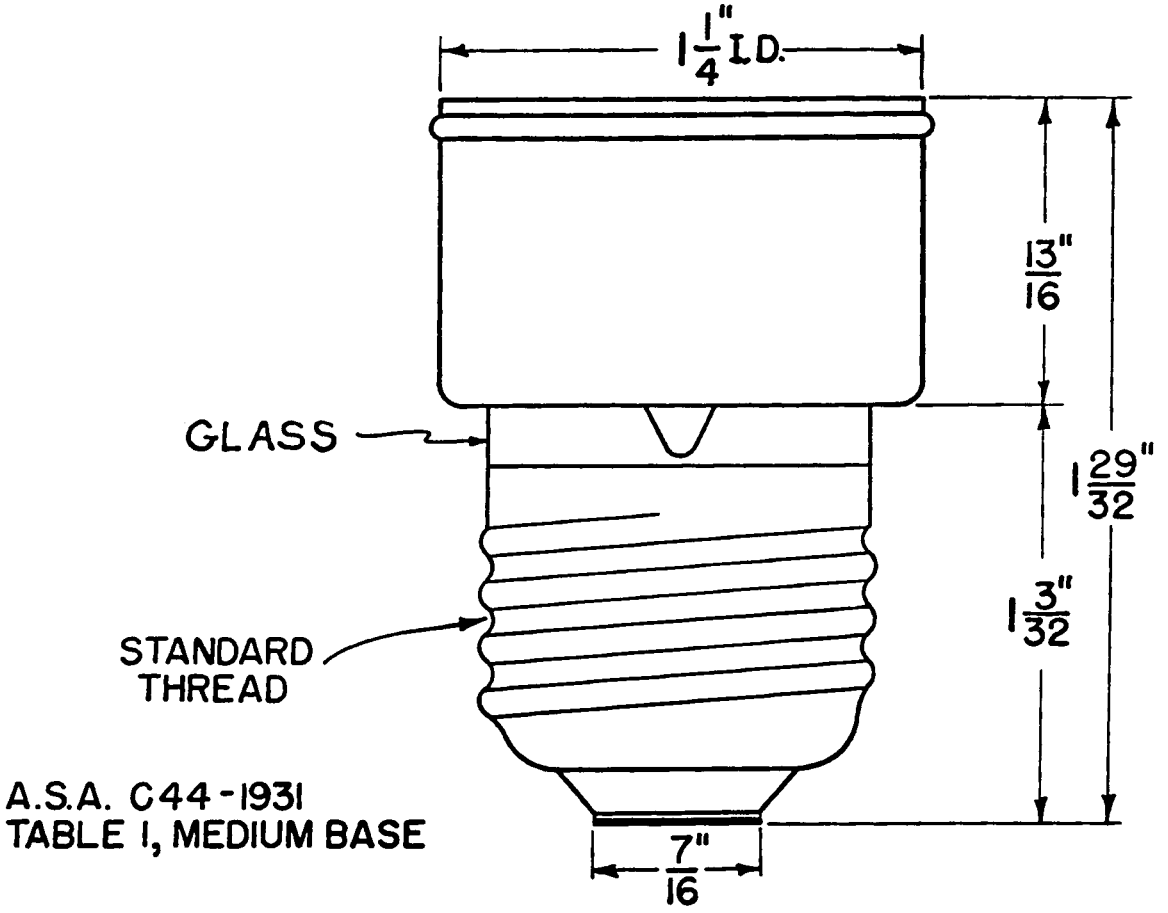
Release No. 410

May 25, 1945

RMA
TYPE 4B35



BASE FOR RMA TYPE 4B35



A.S.A. C44-1931
TABLE I, MEDIUM BASE

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release No. 410

May 25, 1945

sponsor:
General Electric Co.

TYPE 4B36 **

Gas Filled Rectifier*

General Characteristics

Electrical

Filament: Thoriated Tungsten

Voltage	2.0 ± 5% V. a-c
Current	12.0A. a-c (approx.)

Pick-up Voltage, volts d-c	Hot	Cold
Average	4.5	9.5
Minimum	2.5	8.0
Maximum	6.0	11.0

Arc Voltage

Average	6.0	7.5
Minimum	4.5	6.0
Maximum	7.5	9.0

Mechanical

Type of Cooling	Convection
Base	Skirted Medium Screw

Maximum Overall Dimensions

Length	4 21/32"
Diameter	2 3/16"

Maximum Ratings

Maximum Output

Voltage	20 volts d-c
Current	
Average	5.0 amperes
Peak	30.0 amperes
Maximum Peak Inverse Voltage (half-wave circuit)	90 volts
Condensed-Mercury Temperature	130° C

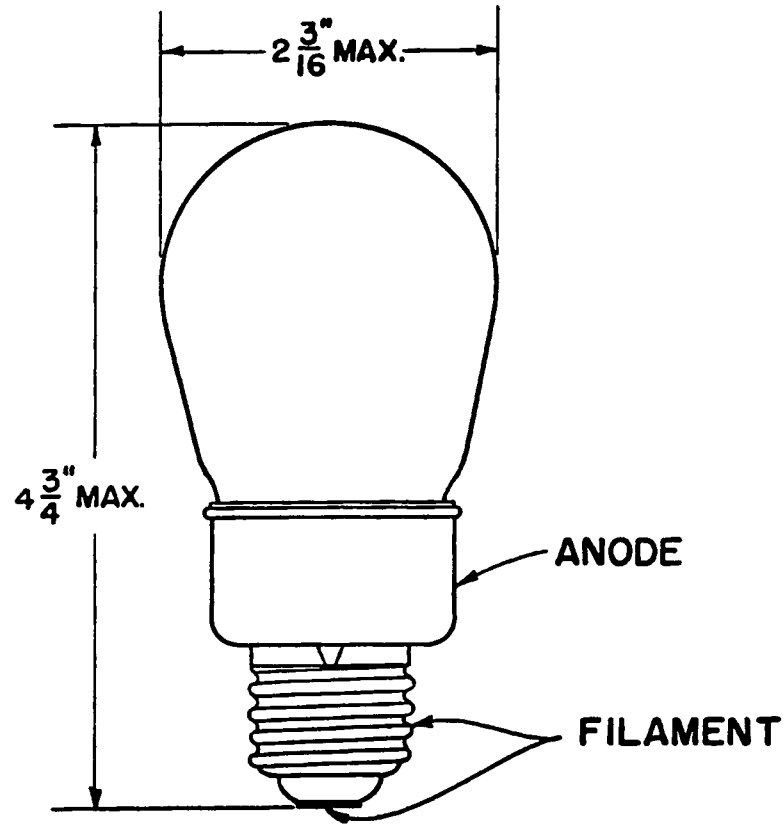
*Argon and Mercury Vapor

**20X672

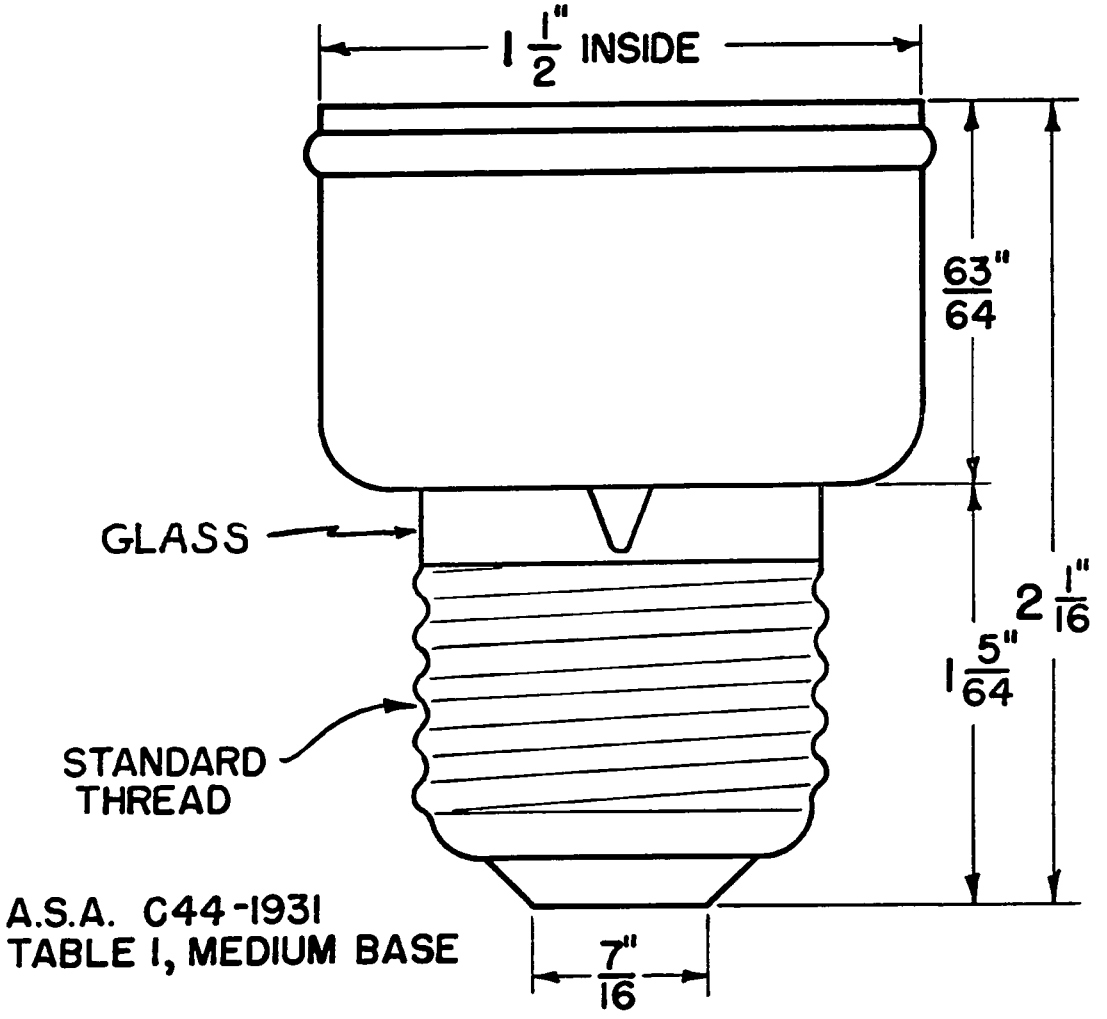
Release No. 410

May 25, 1945

RMA
TYPE 4B36



BASE FOR RMA TYPE 4B36



A.S.A. C44-1931
TABLE I, MEDIUM BASE

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

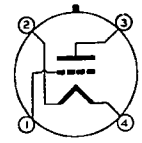
sponsor:
General Electric Co.

Registration No. 351
October 25, 1943

RMA TYPE 4C21

GENERAL PURPOSE TRIODE

4AZ



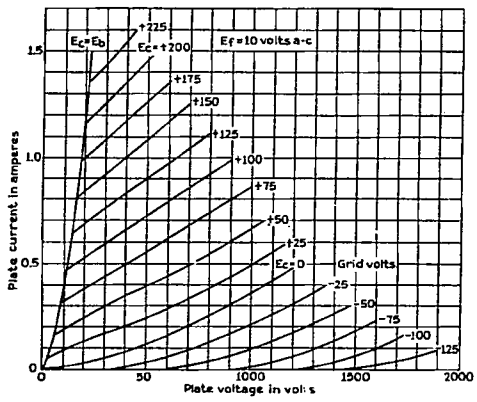
Salient Characteristics

ELECTRICAL

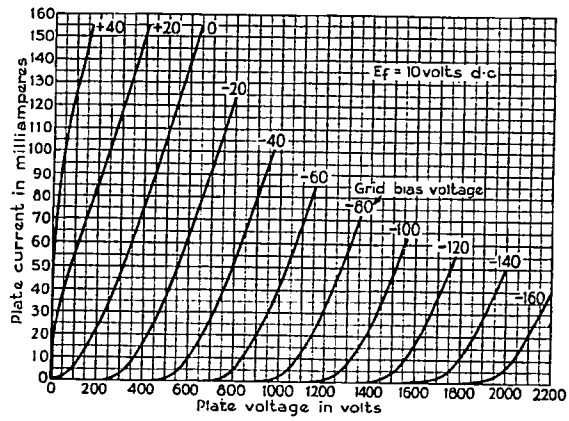
Filament Voltage	10 volts
Filament Current	3.25 amperes
Amplification Factor	12
Grid-plate Transconductance, I_b=60 ma	3600 micromhos
Grid Current; E_f=9 volts dc; E_b=250 volts dc; E_c=+100 volts dc	15 to 30 ma
Direct Interelectrode Capacitances	
Grid-plate	14.5 uuf
Input	6 uuf
Output	5.5 uuf
DC Plate Voltage	1250 volts (max)
Plate Dissipation	100 watts (max)

MECHANICAL

Bulb	T-18
Overall Height	7-7/8 inches (max)
Base	Jumbo 4 large pin
Basing	4AZ
Tube Mounting Position	Vertical; Base Down



Average Plate Characteristic



Average Plate Characteristic

Maximum Ratings and Typical Operating Conditions

CLASS A A-F AMPLIFIER AND MODULATOR

Filament Voltage			10			volts
DC Plate Voltage	750	1000	1250	1250	max	volts
Plate Dissipation				75	max	watts
DC Grid Voltage	-46	-61	-80			volts
Peak Grid Swing approx	41	56	75			volts
DC Plate Current	34	53	60			milliamperes
Plate Resistance	4400	3800	3600			ohms
Load Resistance	8800	7600	9200			ohms
Plate Power Output, 5% second harmonic	5.6	12	19.7			watts

CLASS B A-F POWER AMPLIFIER (TWO TUBES)

Filament Voltage		10			volts
DC Plate Voltage	1000	1250	1250	max	volts
Max Signal Plate Current, per tube*			0.175	max	amperes
DC Max Signal Plate Input, per tube*			220	max	watts
Plate Dissipation, per tube*			100	max	watts
DC Grid Voltage	-72	-95			volts
Peak AF Grid Input Voltage	380	410			volts
Zero Signal Plate Current	20	20			milliamperes
Max Signal Plate Current	320	320			milliamperes
Max Signal Driving Power, approx	7.5	8			watts
Effective Load, plate-to-plate	6900	9000			ohms
Max Signal Plate Power Output	200	260			watts

CLASS B R-F POWER AMPLIFIER

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Filament Voltage		10			volts
DC Plate Voltage	1000	1250	1250	max	volts
DC Grid Voltage	-72	-95			volts
DC Plate Current	0.130	0.106	0.150	max	amperes
Plate Input			150	max	watts
Plate Dissipation			100	max	watts
Peak RF Grid Input Voltage	125	125			volts
DC Grid Current, approx	5	1			milliamperes
Driving Power** approx	10	7.5			watts
Plate Power Output	40	42.5			watts

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR, PLATE MODULATED

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Filament Voltage	10				volts
DC Plate Voltage	750	1000	1000	max	volts
DC Grid Voltage	-200	-260	-400	max	volts
DC Plate Current	0.150	0.150	0.175	max	ampere
DC Grid Current, approx	0.035	0.035	0.050	max	ampere
Plate Input			175	max	watts
Plate Dissipation			67	max	watts
Peak RF Grid Input Voltage, approx	350	410			volts
Driving Power, approx	12	14			watts
Plate Power Output	65	100			watts

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR

Key down conditions per tube without modulation ***

Filament Voltage	10					volts
DC Plate Voltage	750	1000	1250	1250	max	volts
DC Grid Voltage	-135	-175	-225	-400	max	volts
DC Plate Current	0.150	0.150	0.150	0.175	max	ampere
DC Grid Current, approx	0.018	0.018	0.018	0.050	max	ampere
Plate Input				220	max	watts
Plate Dissipation				100	max	watts
Peak RF Grid Input Voltage, approx	275	315	375			volts
Driving Power, approx	5	6	7			watts
Plate Power Output	65	100	130			watts

* Averaged over any audio frequency cycle.
** At crest of audio-frequency cycle.
***Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

The normal value of grid leak, when the tube is used as an oscillator or r-f power amplifier (Class C), is in the neighborhood of 5000 ohms, although this may be replaced by a suitable fixed bias. If self-bias is used the cathode resistor should be approximately 1000 ohms.

The 4C21 can be operated at frequencies as high as 15 megacycles. It may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised (other maximum ratings are the same as shown above).

The tabulation below shows the highest percentage of maximum plate voltage and power input that should be used up to 80 megacycles for the various classes of service.

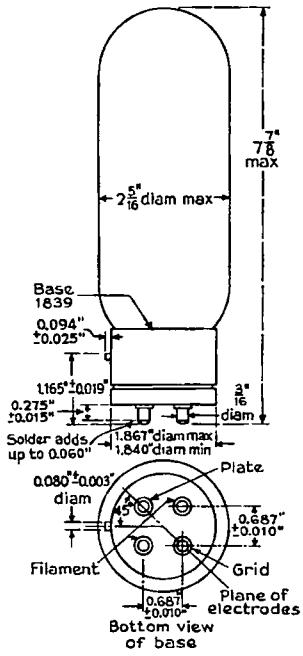
Special attention should be given to adequate ventilation of the bulb at these frequencies.

FREQUENCY	15	30	80	megacycles

PERCENTAGE OF MAXIMUM RATED PLATE VOLTAGE AND PLATE INPUT

Class B	100	88	70	per cent
Class C	100	80	50	per cent

The resonant frequency of the grid-plate circuit is approximately 100 megacycles.



DESCRIPTION AND RATING

4CB6

4CB6 Pentode. Except for heater ratings and heater-cathode ratings, the 4CB6 is identical to the 6CB6-A.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings		
Heater Voltage, AC or DC¶	4.2	Volts
Heater Current†	0.45 ± 0.03	Amperes
Heater Warm-up Time‡	11	Seconds

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
DC Component	200	Volts
Total DC and Peak	300	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

4CS6

4CS6 Heptode. Except for heater characteristics and ratings, the 4CS6 is identical to the 6CS6.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings		
Heater Voltage, AC or DC	4.2	Volts
Heater Current	0.45	Amperes
Heater Warm-up Time‡	11	Seconds

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4CY5

4CY5 Tetrode. Except for heater characteristics and ratings, the 4CY5 is identical to the 2CY5, 3CY5 and 6CY5.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings		
Heater Voltage, AC or DCϕ	4.5	Volts
Heater Current†	0.3 ± 0.02	Amperes
Heater Warm-up Time‡	11	Seconds

4DT6

4DT6 Pentode. Except for heater characteristics and ratings, the 4DT6 is identical to the 6DT6.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings		
Heater Voltage, AC or DC¶	4.2	Volts
Heater Current†	0.45 ± 0.03	Amperes
Heater Warm-up Time‡	11	Seconds

4EW6

4EW6 Pentode. Except for heater characteristics and ratings, the 4EW6 is identical to the 6EW6.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	4.2	Volts
Heater Current†	0.6 ± 0.04	Amperes
Heater Warm-up Time‡	11	Seconds

FOOTNOTES

ϕ Heater voltage for a bogey tube at If = 0.3 amperes.
¶ Heater voltage for a bogey tube at If = 0.45 amperes.
* Heater voltage for a bogey tube at If = 0.6 amperes.
† For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.
‡ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

OWENSBORO, KENTUCKY

4DE6—4DK6—4DT6

DESCRIPTION AND RATING

4DE6

4DE6 Pentode. The 4DE6 is a miniature, sharp-cutoff pentode designed especially for use as an intermediate-frequency amplifier in television receivers.

Except for heater characteristics, the 4DE6 is identical to the 6DE6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	4.2	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

4DK6

4DK6 Pentode. The 4DK6 is a miniature, sharp-cutoff pentode designed for use as a wide-band, radio-frequency or intermediate-frequency amplifier in television receivers.

Except for heater characteristics, the 4DK6 is identical to the 6DK6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	4.2	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

4DT6

4DT6 Pentode. The 4DT6 is a miniature, sharp-cutoff, dual-control pentode primarily intended for use as an FM detector in television receivers. It is also suitable for use in delay circuits, gain-controlled amplifier circuits, and mixer circuits.

Except for heater characteristics, the 4DT6 is identical to the 6DT6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	4.2	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

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NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

PROVISIONAL DATA.

from JETEC release #1702, July 30, 1956

4GP1 and 4GP11.

9 cm. electrostatic focus and deflection instrument cathode ray tube having a flat screen and one stage of post deflection acceleration suitable for use in high precision instruments.

Dimensions.

Overall length: 355 ± 5 mm.

Overall diameter: 90 ± 2 mm.

Base Connections (B14A Base) Medium shell diheptal.

1	2	3	4	5	6	7
h	k	g	a_1	a_2	N.P.	Y1
8	9	10	11	12	13	14
Y2	a_3	X2	X1	N.C.	N.P.	h

Side contact CT8 a_4

Heater

V_h	6.3	V
I_h	0.5	A

The heater is suitable for parallel operation only.

Maximum Ratings

V_{a4}	8	kV
	2 min.	kV
V_{a3}	4	kV
	1 min.	kV
V_{a2}	2	kV
V_{a1}	2.5	kV
	1 min.	kV
$-V_g$ (cathode hot)	0 min.	V
	200	V
V_g (cathode cold)	200	V
V_{h-k}	150	V
V_{x1-x2}	1	kV
R_{x-a3}	5	Mohms.

Cont'd.

THE GENERAL ELECTRIC CO. LTD OF ENGLAND.
Head Office: Magnet House, Kingsway, London, W.C.2

Maximum Ratings (Cont'd).

* Sx	$\frac{800}{V_{a3}}$	mm/V.
* Sy	$\frac{520}{V_{a3}}$	mm/V.
ϕ Sx	$\frac{620}{V_{a3}}$	mm/V.
ϕ Sy	$\frac{400}{V_{a3}}$	mm/V.

* $V_{a3} = V_{a4}$

ϕ $V_{a4} = 2V_{a3}$

R_{y-a3}	5	Mohms
R_{g-k}	2	Mohms

The maximum ratio between V_{a4} and V_{a3} is two.

Typical Operation.

V_{a4}	4.0	kV
V_{a3}	2.0	kV
V_{a2}	333	V
V_{a1}	2.0	kV
V_g (for cut-off)	-67	V
I_{a3}	1	microamp.
I_{screen}	5	microamps.
* S_x	0.32	mm/V.
* S_y	0.2	mm/V.
line width	0.3	mm/V.

Capacitance

C_{k-all}	8	pF
C_{g-all}	17	pF
C_{x1-x2}	2.5 approx.	pF
C_{y1-y2}	3 approx.	pF
C_{x1-all} } C_{x2-all} }	8 approx.	pF
C_{y1-all} } C_{y2-all} }	7.5 approx.	pF.

Cont'd.

Capacitance (Cont'd).

$C_{y1-x1 \text{ or } x2}$	0.1 approx.	pF
$C_{y2-x1 \text{ or } x2}$	0.2 approx.	pF

Screen Phosphor.

The 4GP1 has a green screen having an afterglow of 100 milliseconds.

The 4GP11 has a photographic blue screen having an afterglow of 1 millisecond.

Spot Centring.

The undeflected spot will fall within a radius of 5 mms. concentric with the tube face.

Screen Area.

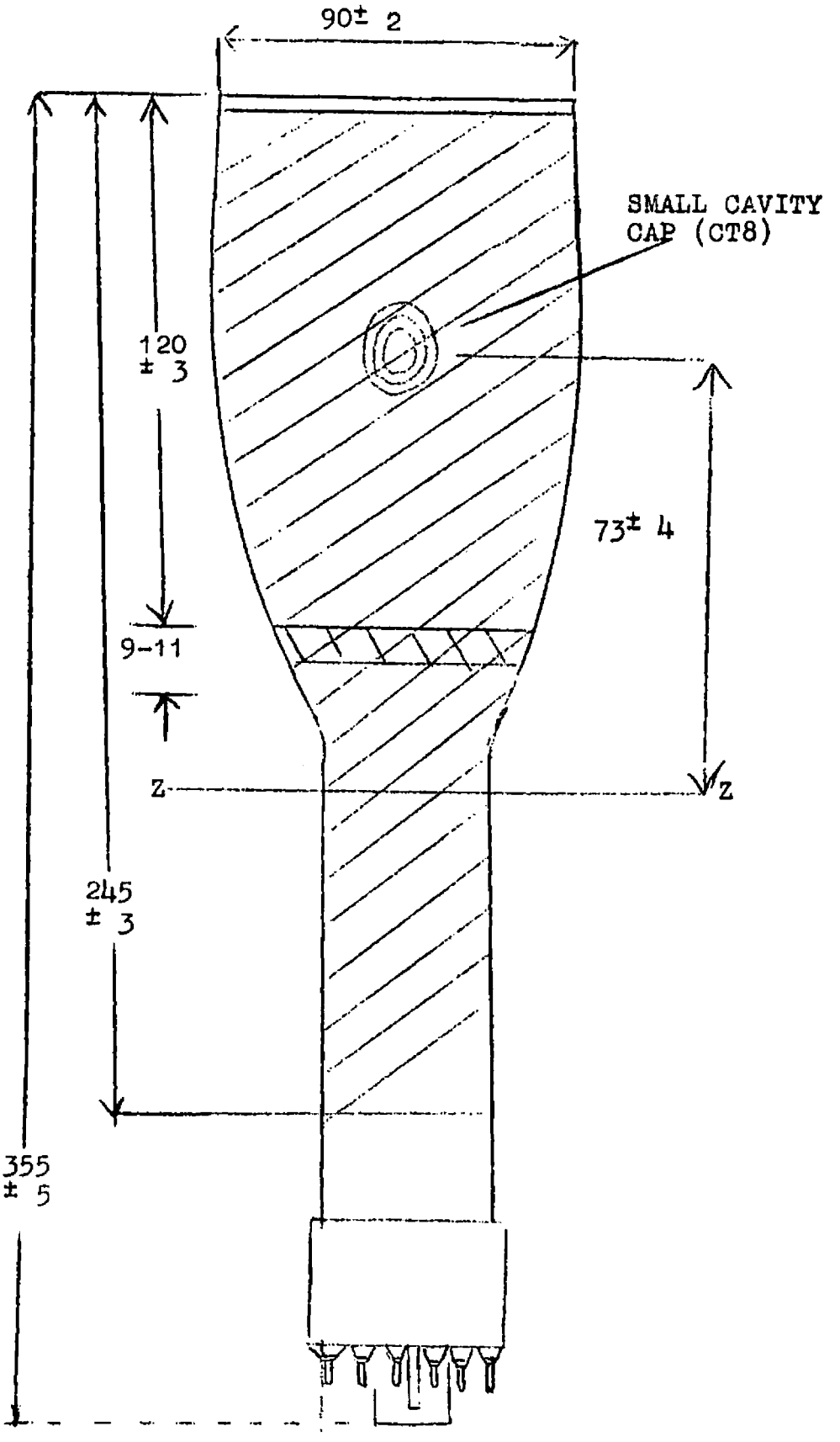
The minimum useful screen area is a circle radius 3.7 cms from the centre of the screen.

General.

The plate sensitivity for a deflection of less than 75% of the useful scan will not differ from the plate sensitivity for a deflection of 25% of the useful scan by more than 2%.

Orthogonality of deflection axis $\pm 1^{\circ}$.

Viewed from the screen end with the spigot upwards and a positive voltage on deflector plate X_1 the spot will move to the left. Viewed from the screen end with the spigot up a positive voltage on the deflector plate Y_1 the spot will move upwards.


90± 2
SMALL CAVITY
CAP (CT8)
120
± 3
73± 4
9-11
Z
Z
245
± 3
355
± 5

ELECTRONICS

4HA7

COMPACTRON DISSIMILAR DOUBLE TRIODE

DESCRIPTION AND RATING

The 4HA7 is a compactron containing a high-mu triode and a medium-mu triode.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	4.2	Volts
Heater Current‡	0.6±0.04	Amperes
Heater Warm-up Time, Average§	11	Seconds

Direct Interelectrode Capacitances¶

	Section 1	Section 2	
Grid to Plate: (g to p)	1.4	1.5	pf
Input: g to (h + k + i.s.)	1.9	1.7	pf
Output: p to (h + k + i.s.)	1.9	1.8	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-56

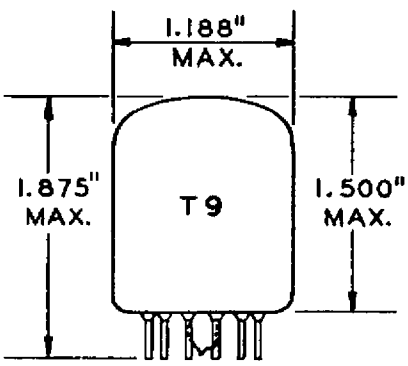
Maximum Diameter	1.188	Inches
Maximum Over-all Length	1.875	Inches
Maximum Seated Height	1.500	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Section 1	Section 2	
Plate Voltage	330	330	Volts
Positive DC Grid Voltage	0	0	Volts
Negative DC Grid Voltage	50	50	Volts
Plate Dissipation	2.75	0.3	Watts
DC Cathode Current	20	---	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts

PHYSICAL DIMENSIONS

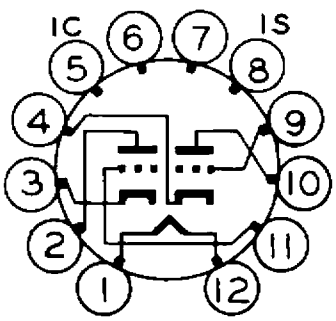


EIA 9-56

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate (Section 2)
Pin 3 - Cathode (Section 2)
Pin 4 - Cathode (Section 1)
Pin 5 - Internal Connection - Do Not Use
Pin 6 - No Connection
Pin 7 - No Connection
Pin 8 - Internal Shield
Pin 9 - Grid (Section 1)
Pin 10 - Plate (Section 1)
Pin 11 - Grid (Section 2)
Pin 12 - Heater

BASING DIAGRAM



EIA 12FQ

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GENERAL ELECTRIC

from JEDEC release #4449, Oct. 7, 1963

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Section 1	Section 2	
Plate Voltage	250	250	Volts
Grid Voltage	-8.5	-2.0	Volts
Amplification Factor	17	100	
Plate Resistance, approximate	7700	62500	Ohms
Transconductance	2200	1600	Micromhos
Plate Current	10.5	1.2	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	-24	---	Volts

NOTES

* Heater voltage for a bogey tube at If = 0.6 amperes.

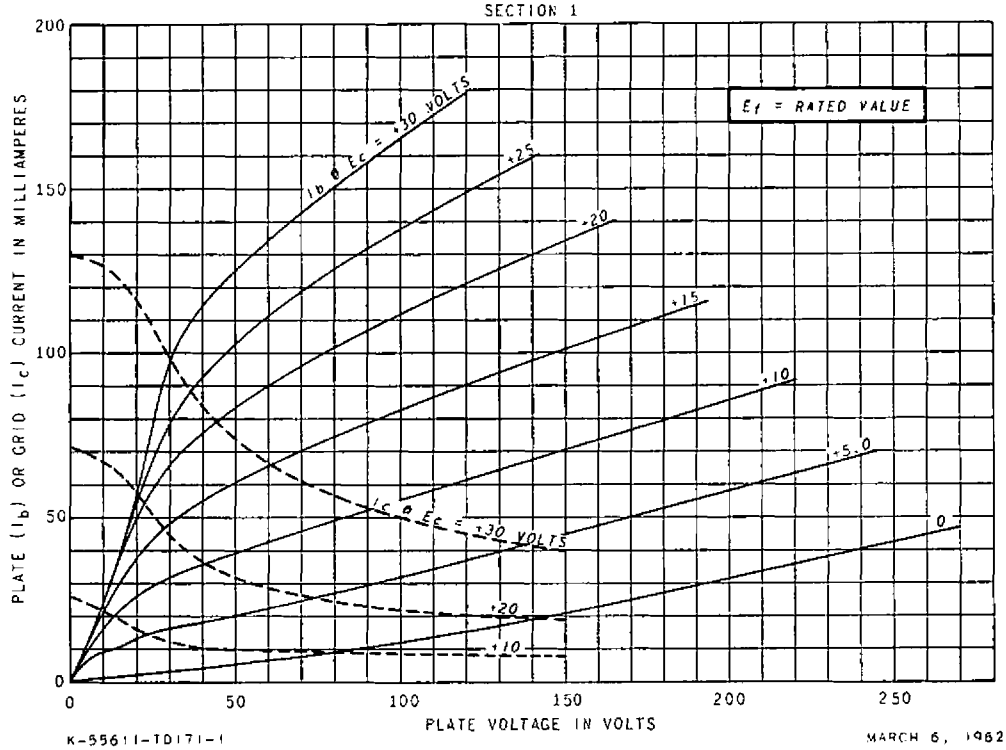
‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the sepcified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ Without external shield.

AVERAGE PLATE CHARACTERISTICS

SECTION 1

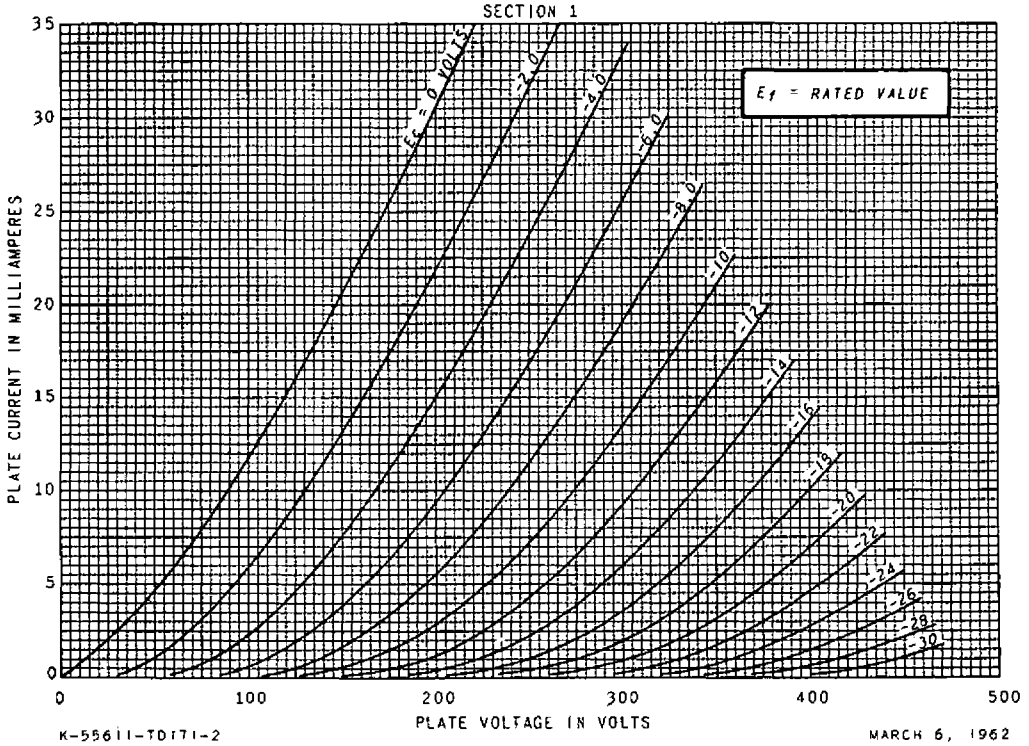


K-55611-TD171-1

MARCH 6, 1962

AVERAGE PLATE CHARACTERISTICS

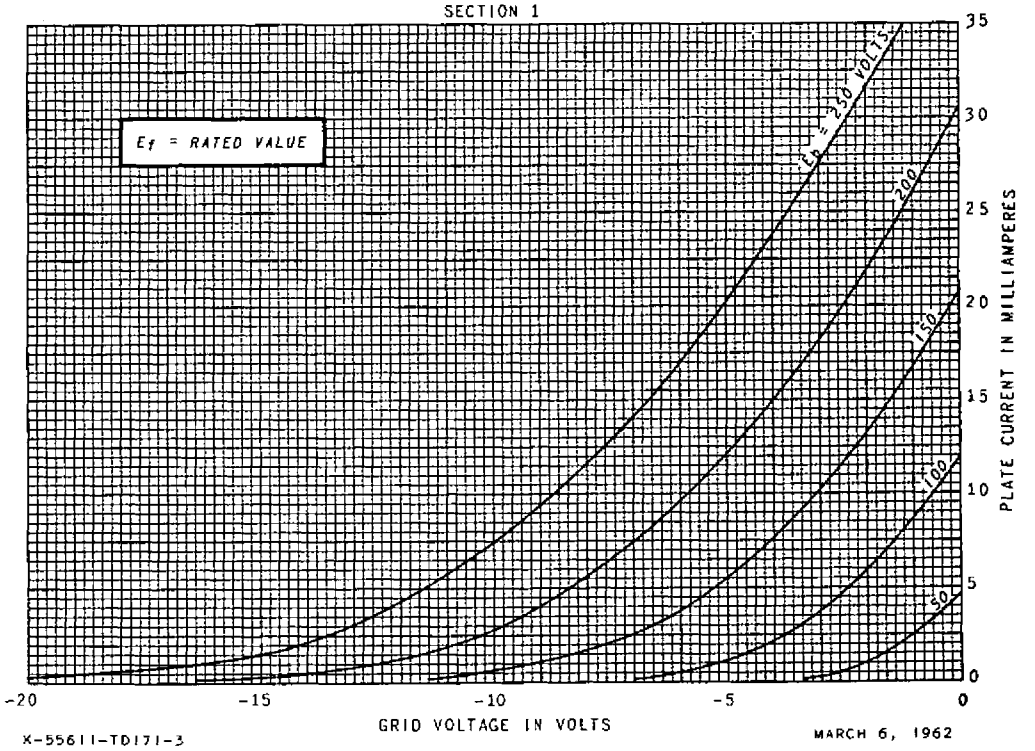
SECTION 1



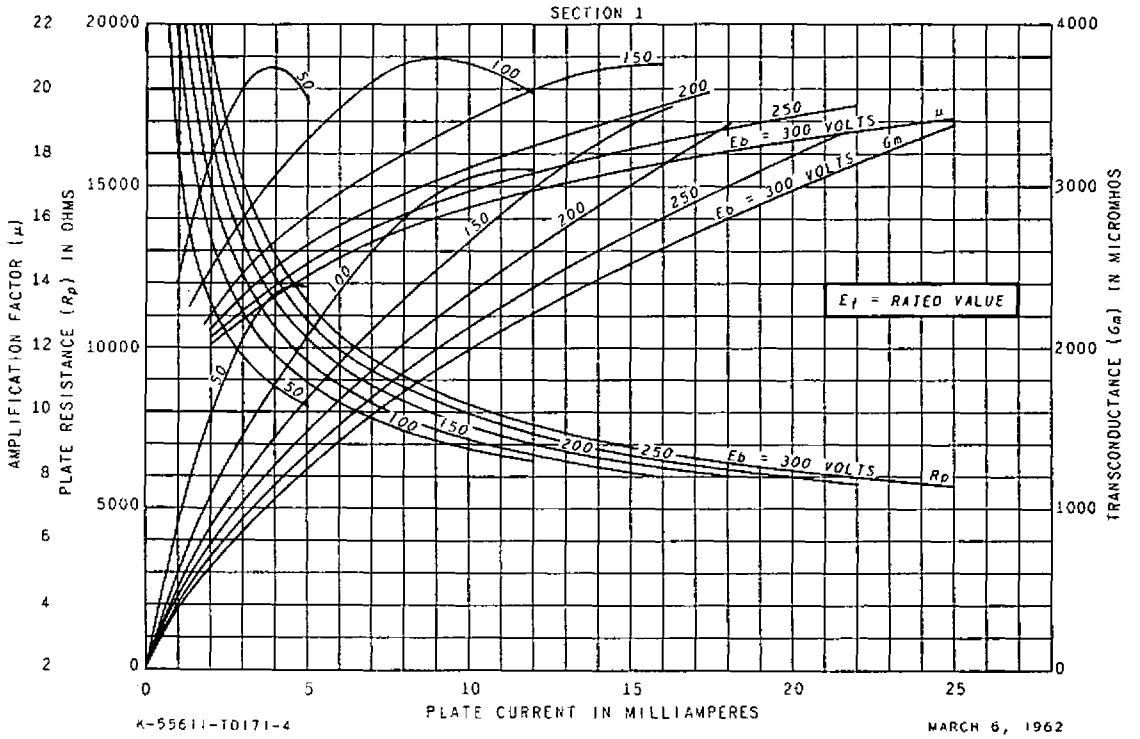
K-55611-TD171-2

MARCH 6, 1962

AVERAGE TRANSFER CHARACTERISTICS

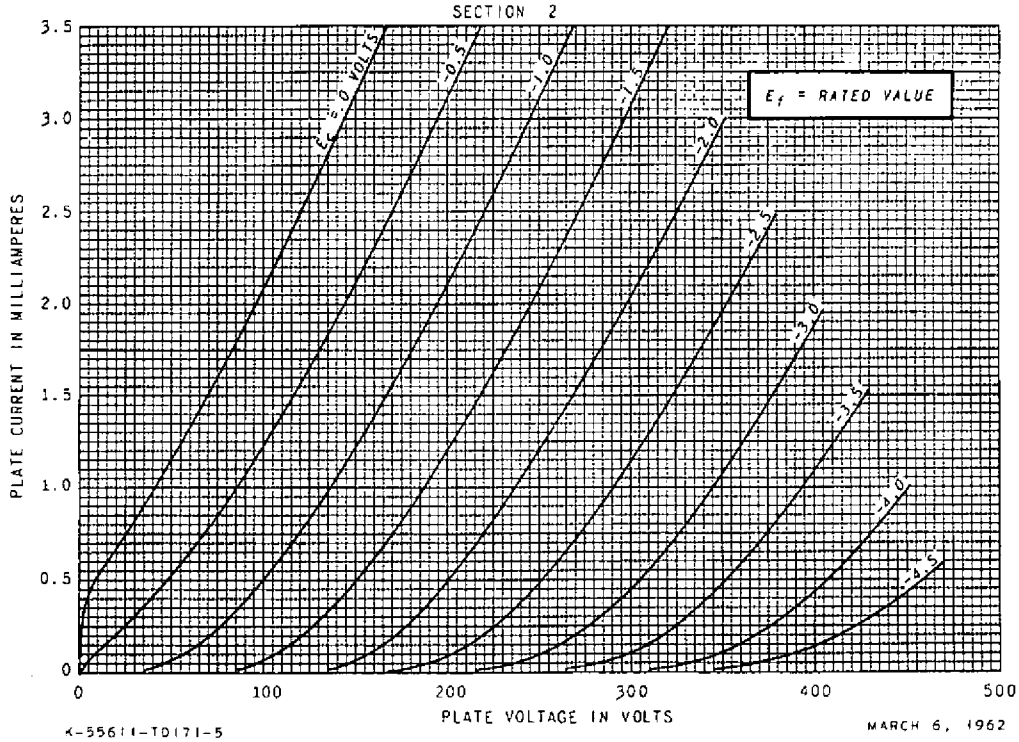


AVERAGE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

SECTION 2

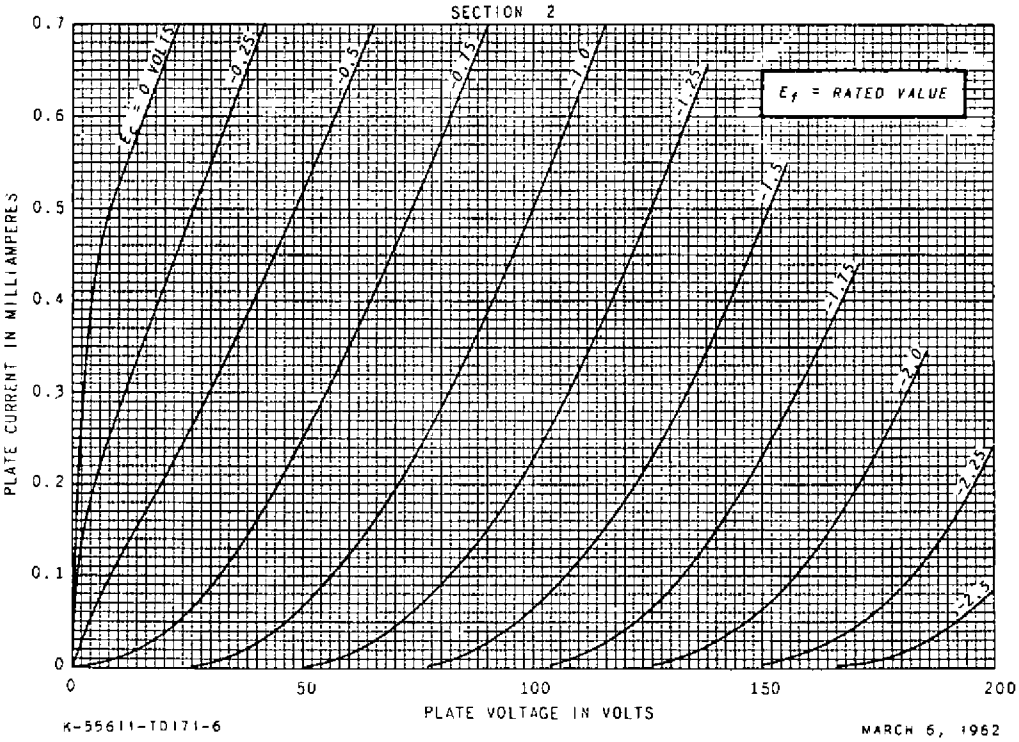


K-55611-TD171-5

MARCH 6, 1962

AVERAGE PLATE CHARACTERISTICS

SECTION 2

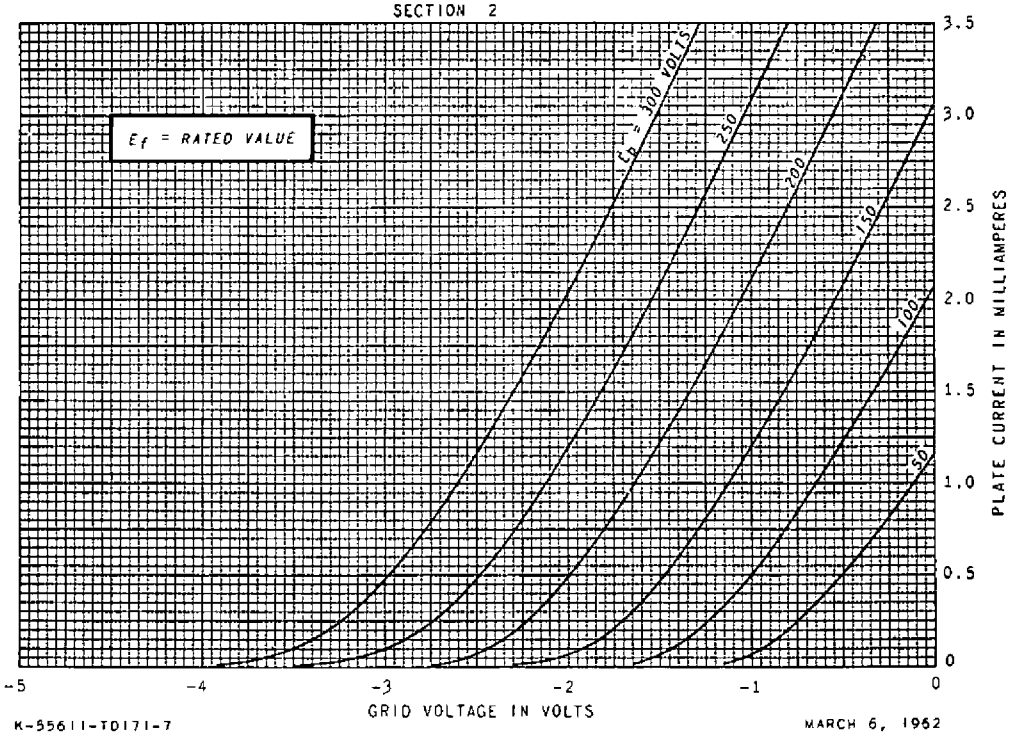


K-55611-TD171-6

MARCH 6, 1962

AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

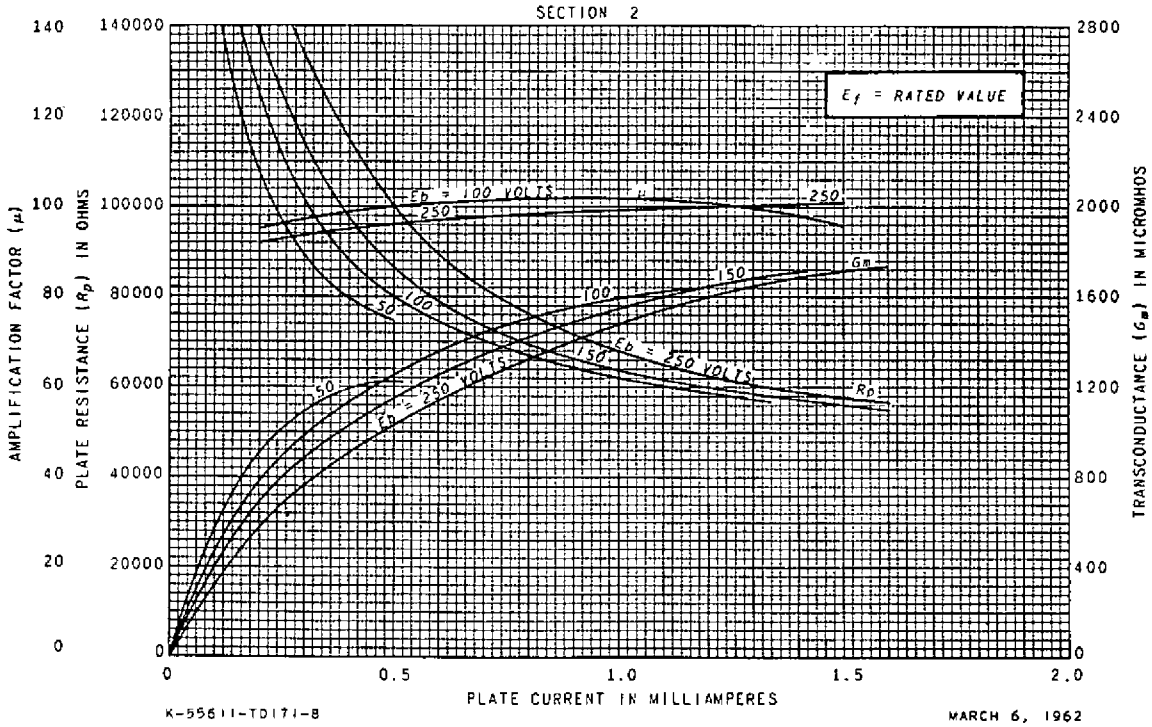


K-55611-TD171-7

MARCH 6, 1962

AVERAGE CHARACTERISTICS

SECTION 2



K-55611-TD171-8

MARCH 6, 1962

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

4JC6 — 4JD6

4JC6 Sharp-Cutoff Pentode. The 4JC6 is a miniature, frame-grid, sharp-cutoff pentode designed primarily for use in the intermediate-frequency amplifier stages of television receivers.

Except for heater characteristics and ratings, the 4JC6 is identical to the 6JC6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	4.5	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

4JD6 Sharp-Cutoff Pentode. The 4JD6 is a miniature, frame-grid, sharp-cutoff pentode designed primarily for use in the intermediate-frequency amplifier stages of television receivers.

Except for heater characteristics and ratings, the 4JD6 is identical to the 6JD6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	4.5	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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5AQ5
BEAM PENTODE

DESCRIPTION AND RATING

5AQ5 Beam Pentode. Except for heater characteristics and ratings, the 5AQ5 is identical to the 6AQ5-A.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	4.7	Volts
Heater Current†	0.6 ± 0.04	Amperes
Heater Warm-up Time‡	11	Seconds

FOOTNOTES

ϕ Heater voltage for a bogey tube at If = 0.3 amperes.
¶ Heater voltage for a bogey tube at If = 0.45 amperes.
* Heater voltage for a bogey tube at If = 0.6 amperes.
† For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.
‡ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

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Electronic TUBES

5AR4

TWIN DIODE

FOR FULL-WAVE POWER-RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 5AR4 is a heater-cathode twin diode designed for full-wave rectifier operation. High output current and small size make this tube especially suitable for compact amplifier designs.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	5.0 ± 10%	Volts
Heater Current	1.9	Amperes

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B5-10, Intermediate-Shell Octal 5-Pin

MAXIMUM RATINGS

RECTIFIER SERVICE—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	1700	Volts
AC Plate-Supply Voltage per Plate—See Rating Chart I		
Steady-State Peak Plate Current per Plate	825	Milliamperes
Transient Peak Plate Current per Plate, Maximum Duration 0.2 Second	3.7	Amperes
DC Output Current—See Rating Chart I		

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

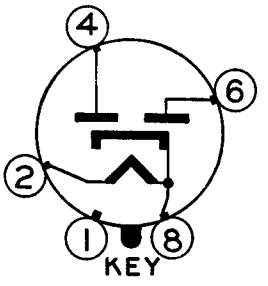
The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM

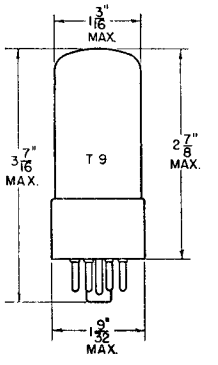


EIA 5DA

TERMINAL CONNECTIONS

Pin 1—Internal Connection
Pin 2—Heater
Pin 4—Plate Number 2
Pin 6—Plate Number 1
Pin 8—Heater and Cathode

PHYSICAL DIMENSIONS



EIA 9-15

CHARACTERISTICS AND TYPICAL OPERATION

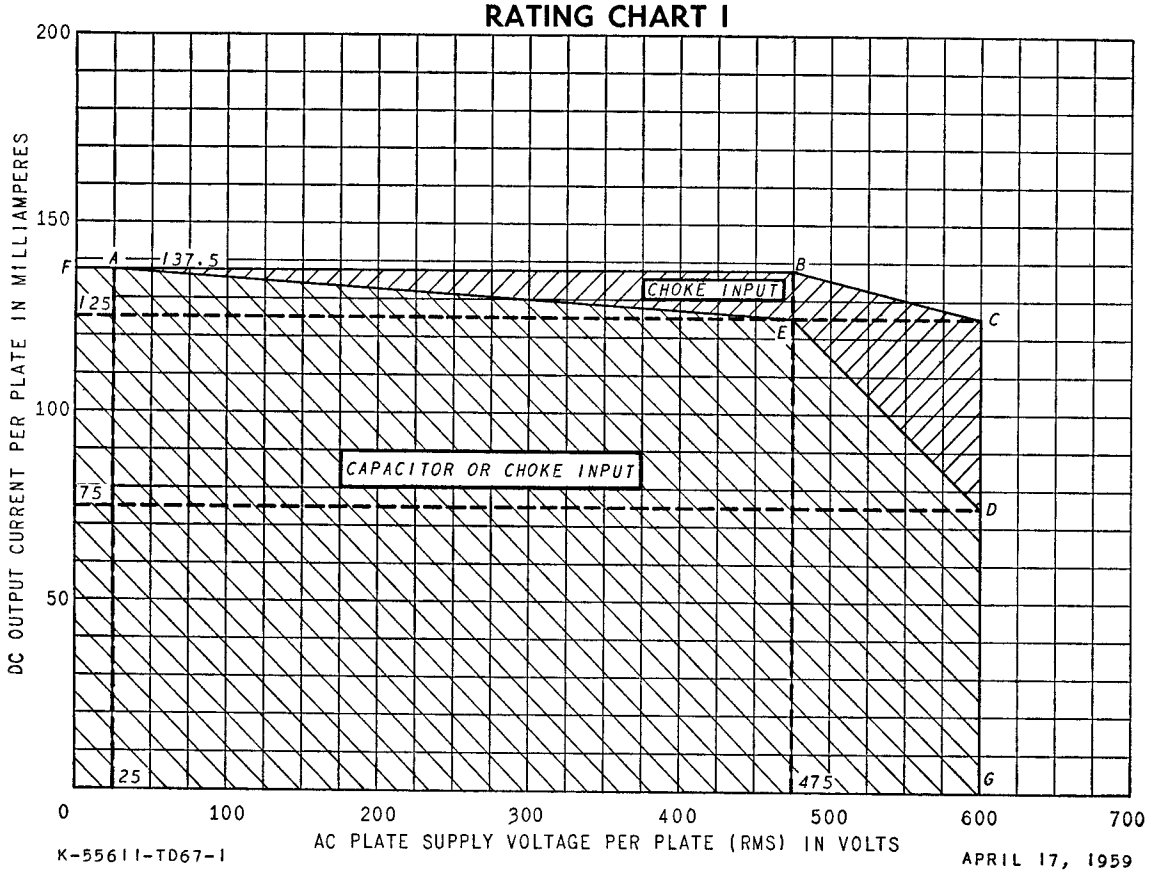
FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER			
AC Plate-Supply Voltage per Plate, RMS	450	550	Volts
Total Plate-Supply Resistance per Plate	160	200	Ohms
DC Output Current	225	160	Milliamperes
DC Output Voltage at Filter Input	475	620	Volts
FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER			
AC Plate-Supply Voltage per Plate, RMS	450	550	Volts
Filter Input Choke	10	10	Henrys
DC Output Current	250	225	Milliamperes
DC Output Voltage at Filter Input	375	465	Volts
Tube Voltage Drop			
Ib = 225 Milliamperes DC per Plate		17	Volts

To simplify the application of the maximum ratings to circuit design, the Design-Maximum ratings are presented in chart form as Rating Charts I, II, and III. Rating Chart I presents the maximum ratings for a-c plate supply voltage and d-c output current. Rating Chart II provides a convenient method for checking conformance with the maximum steady-state peak-plate-current rating. Rating Chart III offers a convenient method for checking conformance with the maximum transient peak-plate-current rating. Rating Chart I applies to both capacitor-input and choke-input filters, while Rating Charts II and III apply to capacitor-input filters only.

Operating points should be so selected that the boundary limits of a-c plate supply voltage and d-c output current on Rating Chart I, and maximum d-c output current per plate and rectification efficiency on Rating Chart II, are not exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, and environmental conditions. On Rating Chart I the boundary FAEDG defines the limits for capacitor-input filter operation, and the boundary FABCDG defines the limits for choke-input filter operation.

Rating Chart III shows the minimum value of plate supply resistance (R_s) required to remain within the transient peak-plate-current rating. The value of R_s should be such that it lies to the left of the line on Rating Chart III at the highest probable value of line voltage.

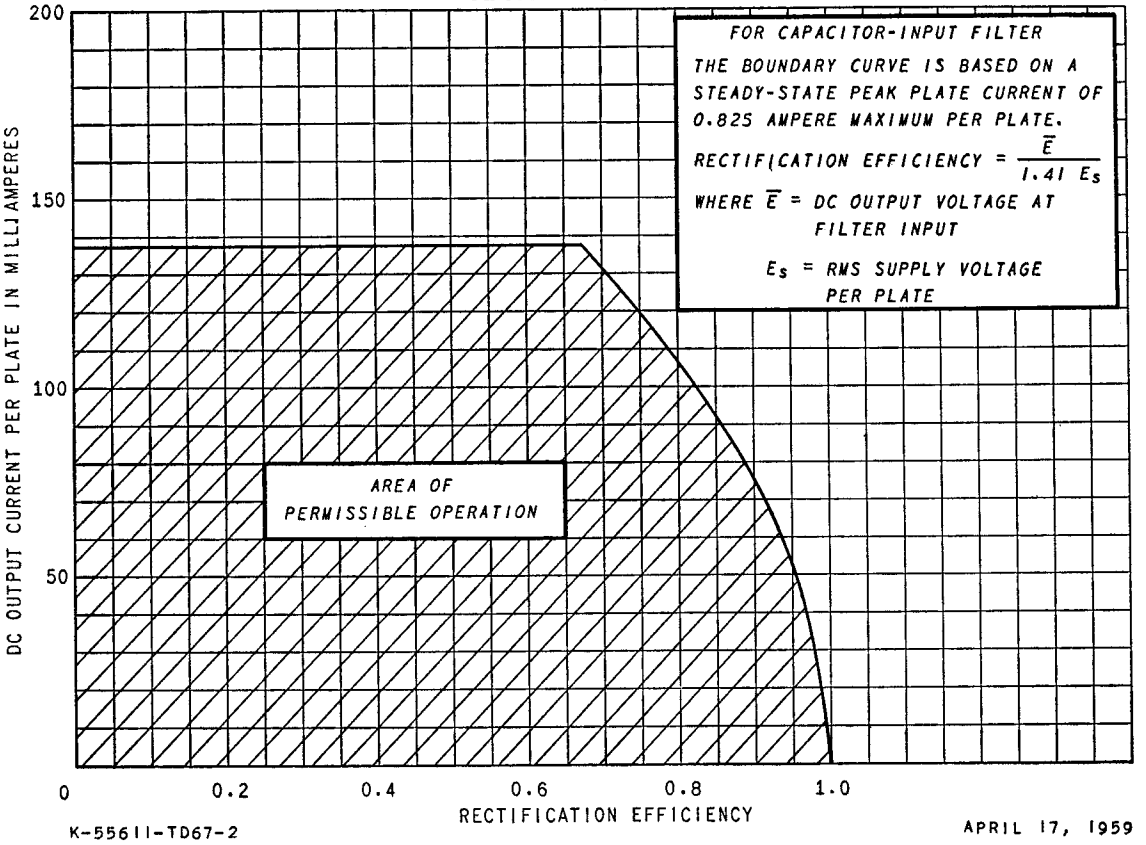
RATING CHART I



K-5561I-TD67-1

APRIL 17, 1959

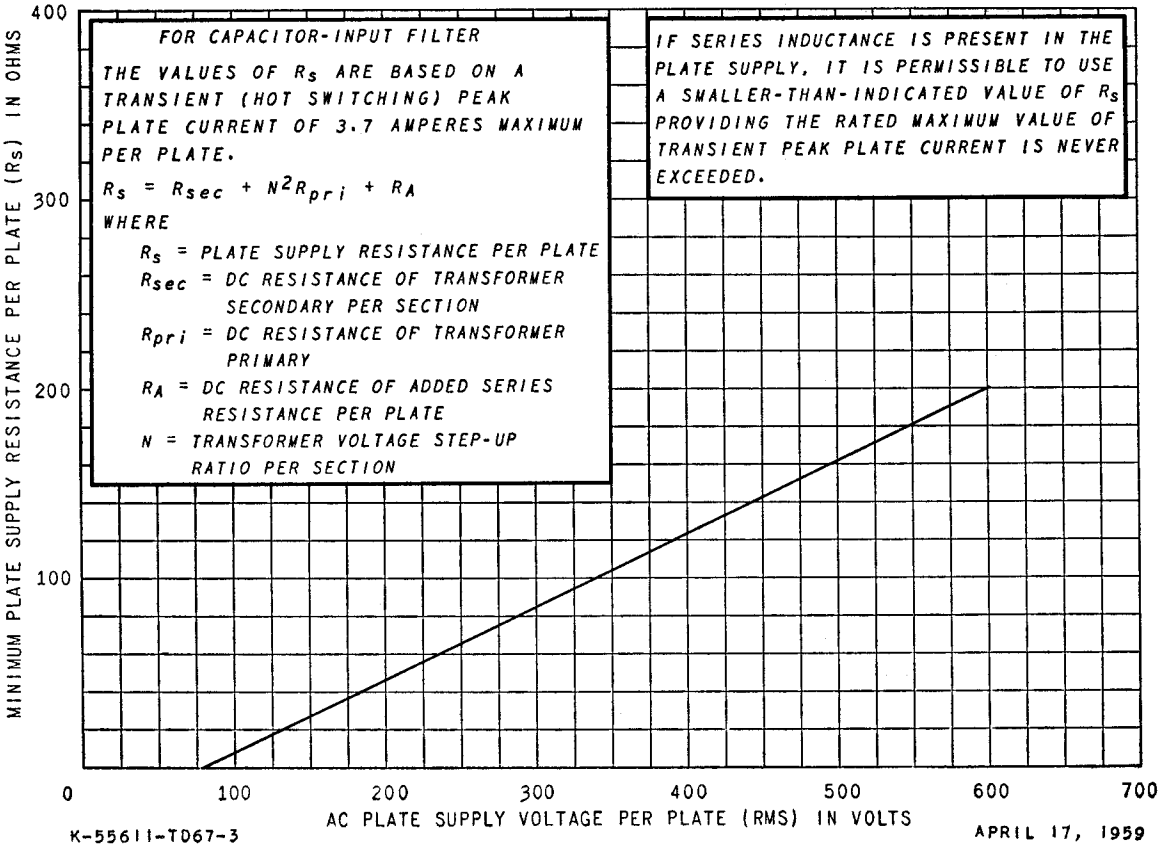
RATING CHART II



K-5561I-TD67-2

APRIL 17, 1959

RATING CHART III

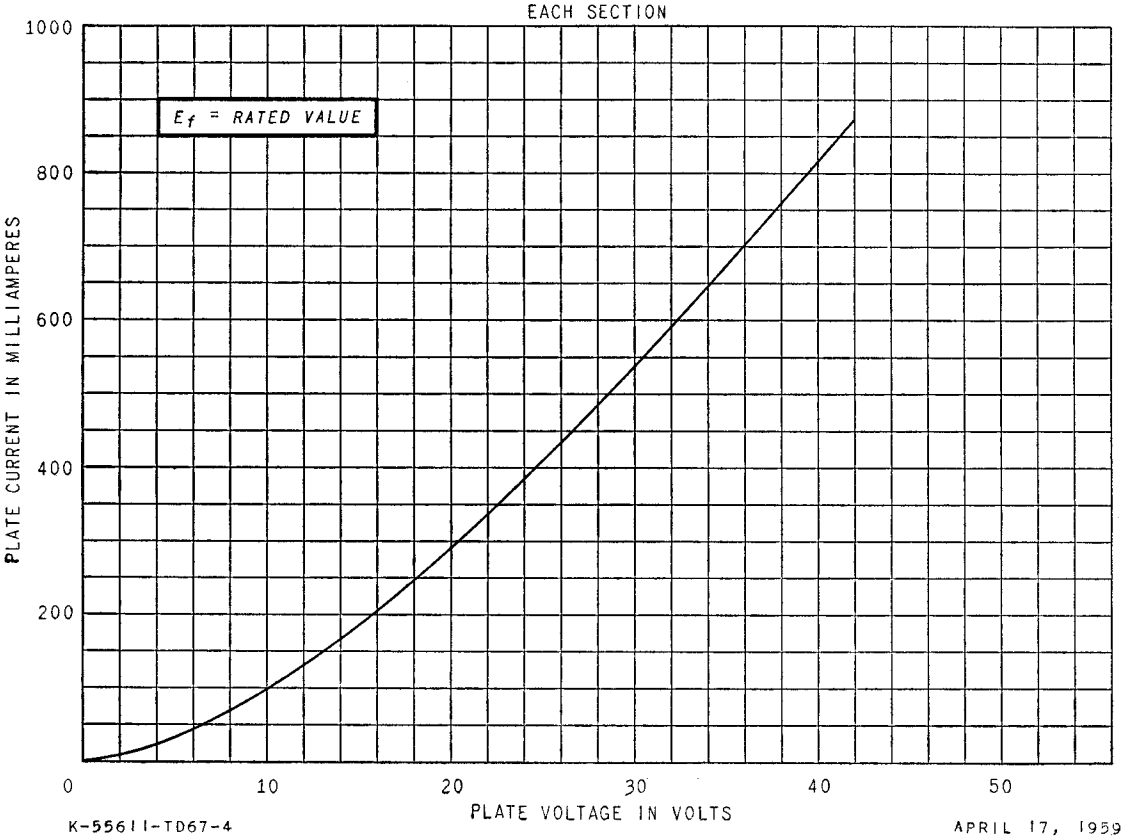


K-5561I-TD67-3

APRIL 17, 1959

AVERAGE PLATE CHARACTERISTICS

EACH SECTION

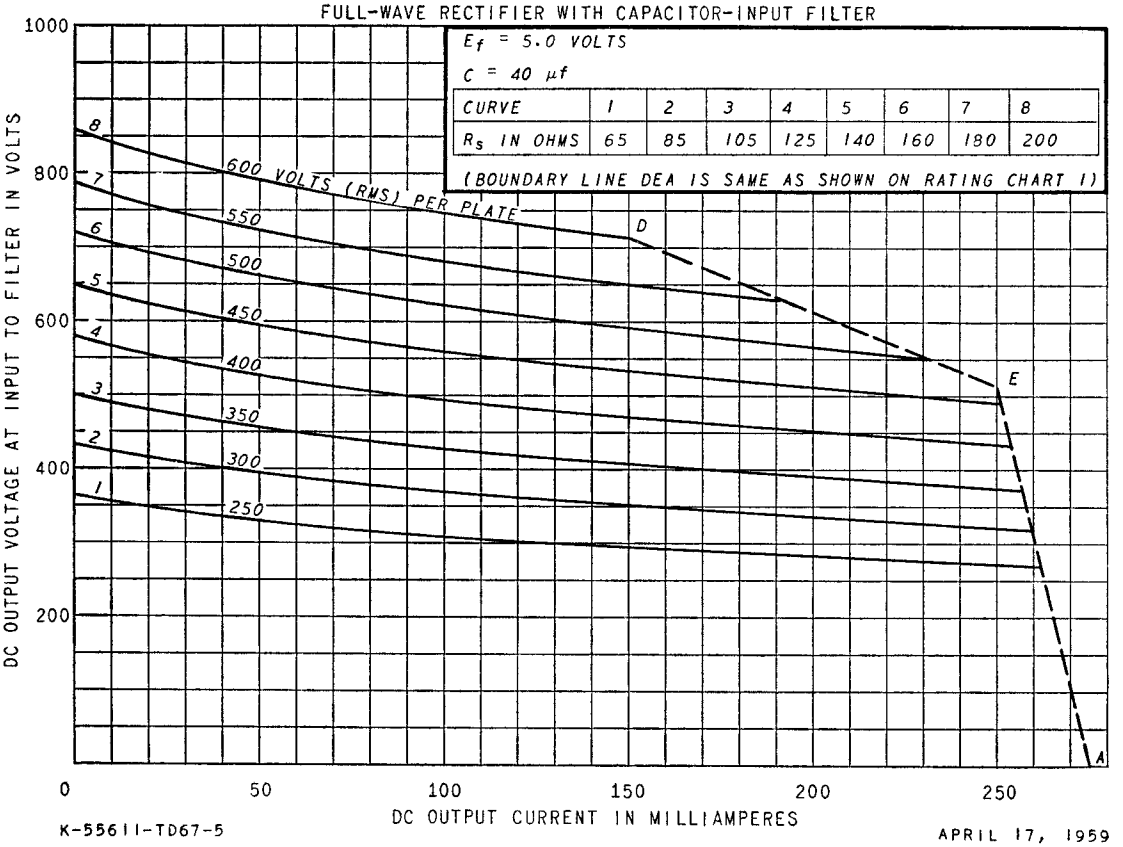


K-55611-TD67-4

APRIL 17, 1959

OPERATION CHARACTERISTICS

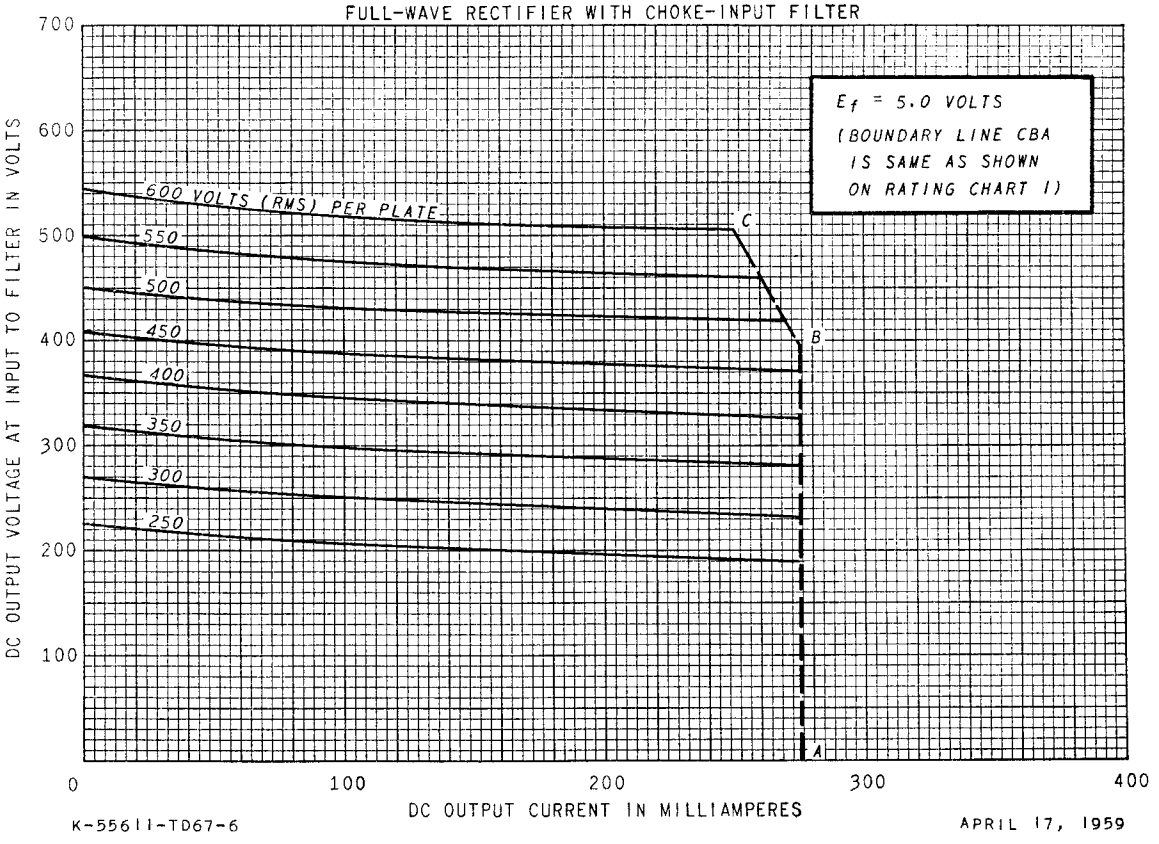
FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER



K-55611-TD67-5

APRIL 17, 1959

OPERATION CHARACTERISTICS



Electronic TUBES

5AU4

TWIN DIODE

FOR FULL-WAVE POWER RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 5AU4 is a filamentary full-wave high-vacuum rectifier designed for use in the power supply of television receivers and other equipments which have high output current requirements. In full-wave operation with a supply voltage of 300 volts RMS, the 5AU4 is capable of delivering a d-c output current of 350 milliamperes.

GENERAL

Cathode—Coated Filament		
Filament Voltage, AC or DC	5.0	Volts
Filament Current	3.75	Amperes
Envelope—T-12, Glass		
Base—B8-114, Octal 8-Pin		
Mounting Position—Vertical*		

MAXIMUM RATINGS

RECTIFIER SERVICE†—DESIGN-CENTER VALUE‡		
Peak Inverse Plate Voltage	1400	Volts
AC Plate-Supply Voltage per Plate—See Rating Chart 1§		
Steady-State Peak Plate Current per Plate	1075	Milliamperes
Transient Peak Plate Current per Plate, Maximum Duration 0.2 Second	5.25	Amperes
DC Output Current—See Rating Chart 1§		

CHARACTERISTICS AND TYPICAL OPERATION

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER			
AC Plate-Supply Voltage per Plate, RMS	300	400	Volts
Filter Input Capacitor	40	40	Microfarads
Total Plate-Supply Resistance per Plate	30	50	Ohms
DC Output Current	350	325	Milliamperes
DC Output Voltage at Filter Input	275	395	Volts
FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER			
AC Plate-Supply Voltage per Plate, RMS		500	Volts
Filter Input Choke		10	Henrys
DC Output Current		325	Milliamperes
DC Output Voltage at Filter Input		395	Volts

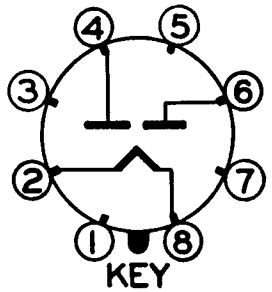
AVERAGE CHARACTERISTICS

Tube Voltage Drop		
I_b = 350 Milliamperes DC per Plate	50	Volts

GENERAL ELECTRIC

△Supersedes page 1 dated 2-54

BASING DIAGRAM

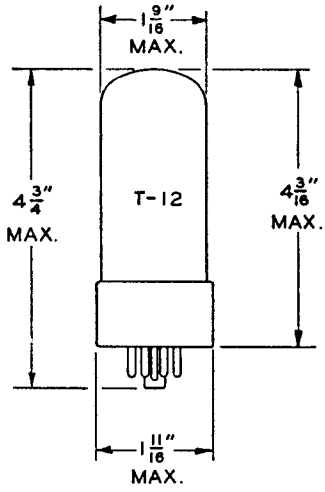


EIA 5T
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Filament
Pin 3—No Connection
Pin 4—Plate Number 2
Pin 5—No Connection
Pin 6—Plate Number 1
Pin 7—No Connection
Pin 8—Filament

PHYSICAL DIMENSIONS



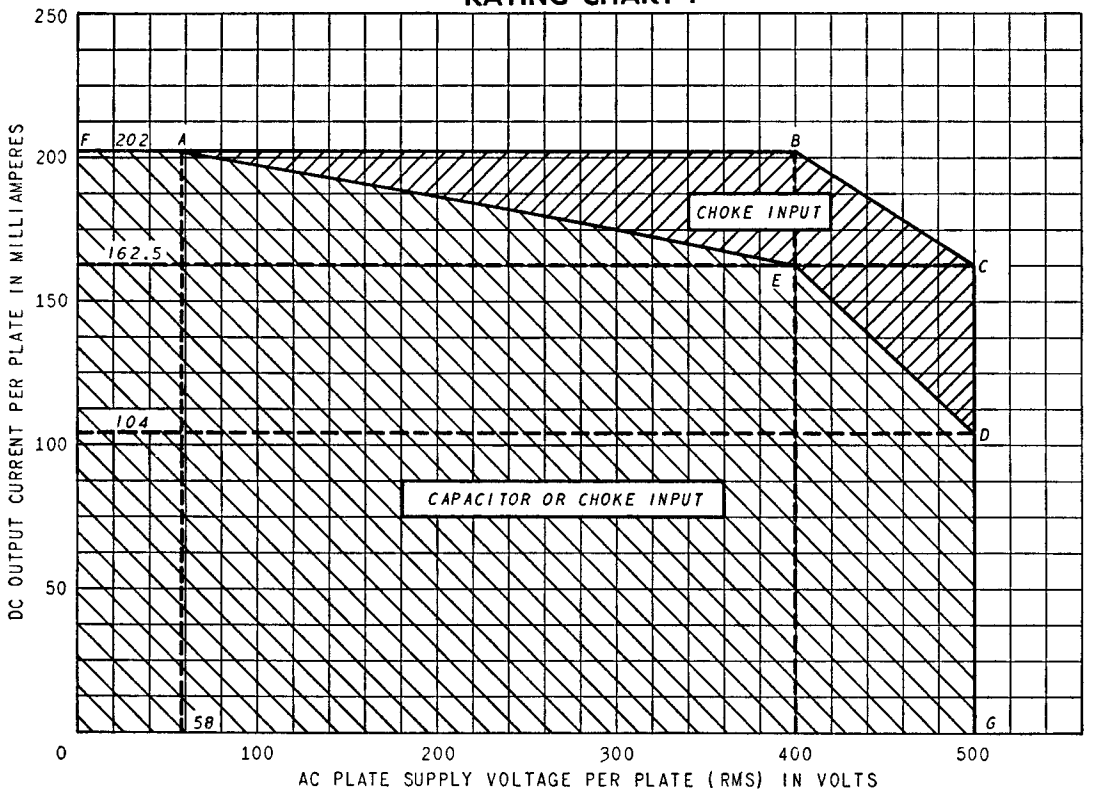
* Horizontal operation is permitted if pins 2 and 4 are in a vertical plane.

† For use with sinusoidal supply voltages within the frequency range of 25 to 1000 cycles per second.

‡ To simplify the application of the maximum ratings to circuit design, the electrical design-center maximum ratings are also presented in chart form as Rating Charts I, II, and III. Rating Chart I presents the maximum ratings for a-c plate supply voltage and d-c output current. Rating Chart II provides a convenient method for checking conformance with the maximum steady-state peak-plate-current rating. Rating Chart III offers a convenient method for checking conformance with the maximum transient peak-plate-current rating.
With a capacitor-input filter, the conditions of each of Rating Charts I, II, and III must be satisfied in order to obtain performance within all of the appropriate electrical maximum ratings. With a choke-input filter, operation within the indicated boundary of Rating Chart I will assure performance within all of the appropriate electrical maximum ratings.

§ The maximum ratings for a-c plate supply voltage and d-c output current are interrelated and are also dependent on whether a choke- or capacitor-input filter is employed. This relationship is shown in Rating Chart I. With a capacitor-input filter, the operating point of d-c output current and a-c supply voltage must fall within the curve FAEDG. With a choke-input filter, the operating point must fall within the curve FABCDG.

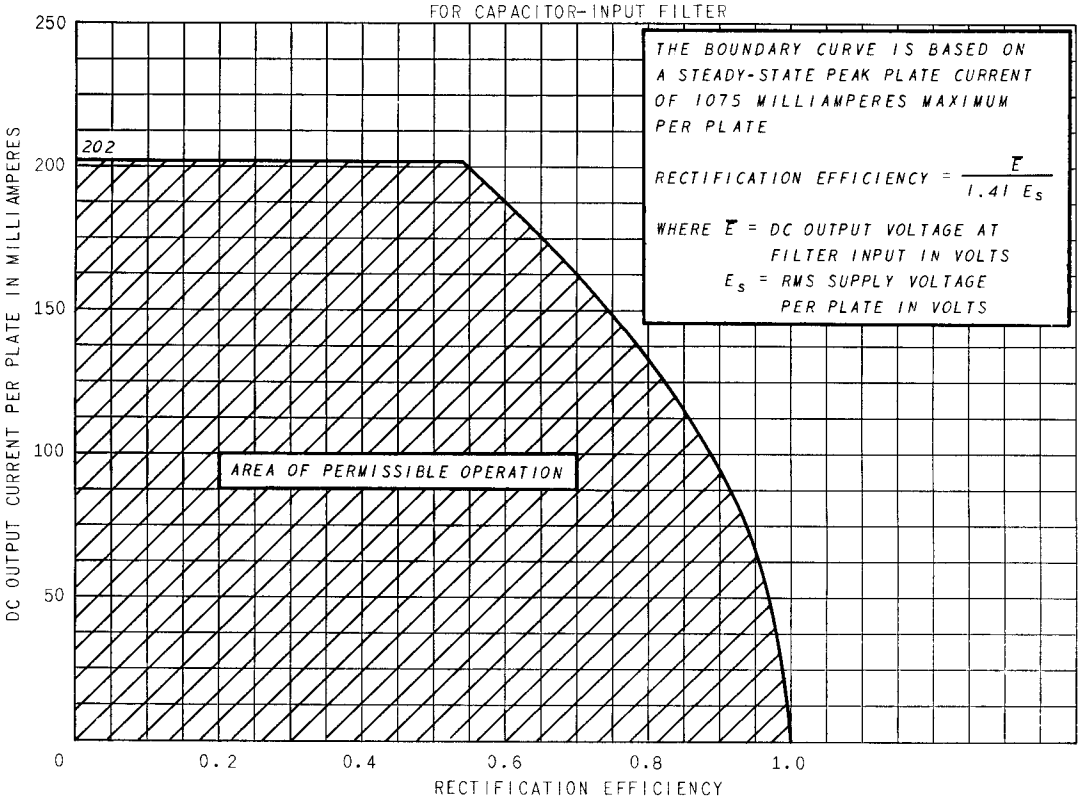
RATING CHART I



△*Supersedes page 2 dated 2-54*

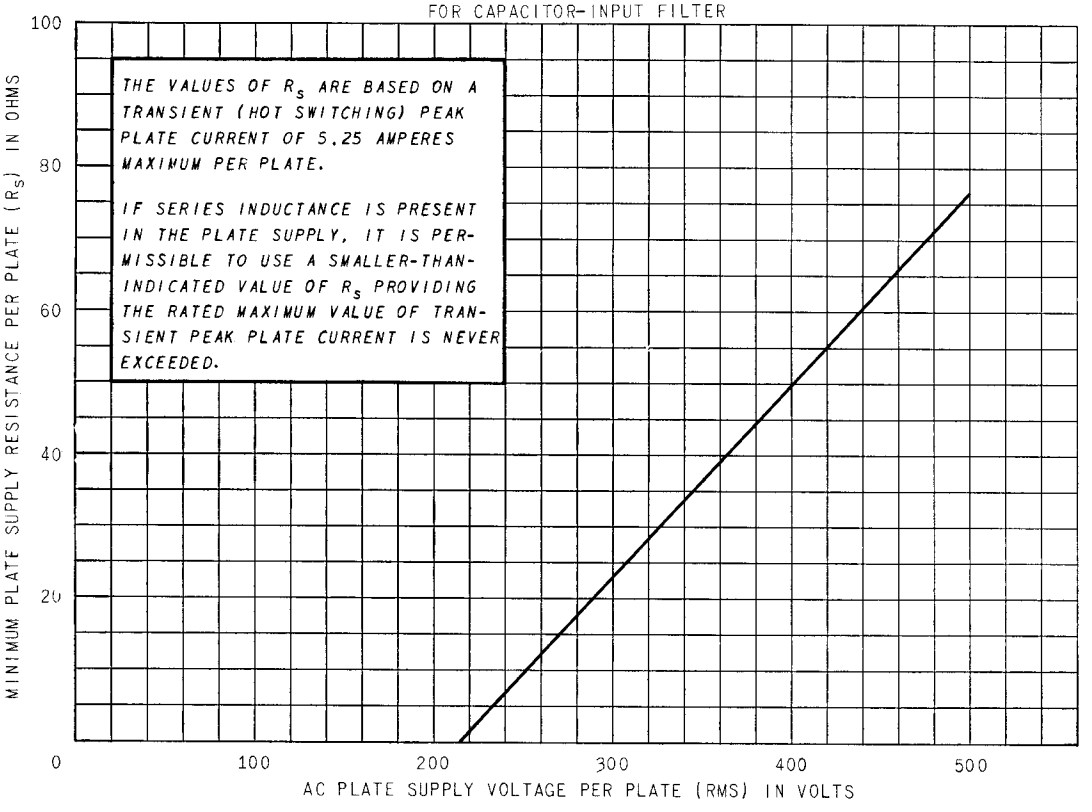
RATING CHART II

FOR CAPACITOR-INPUT FILTER



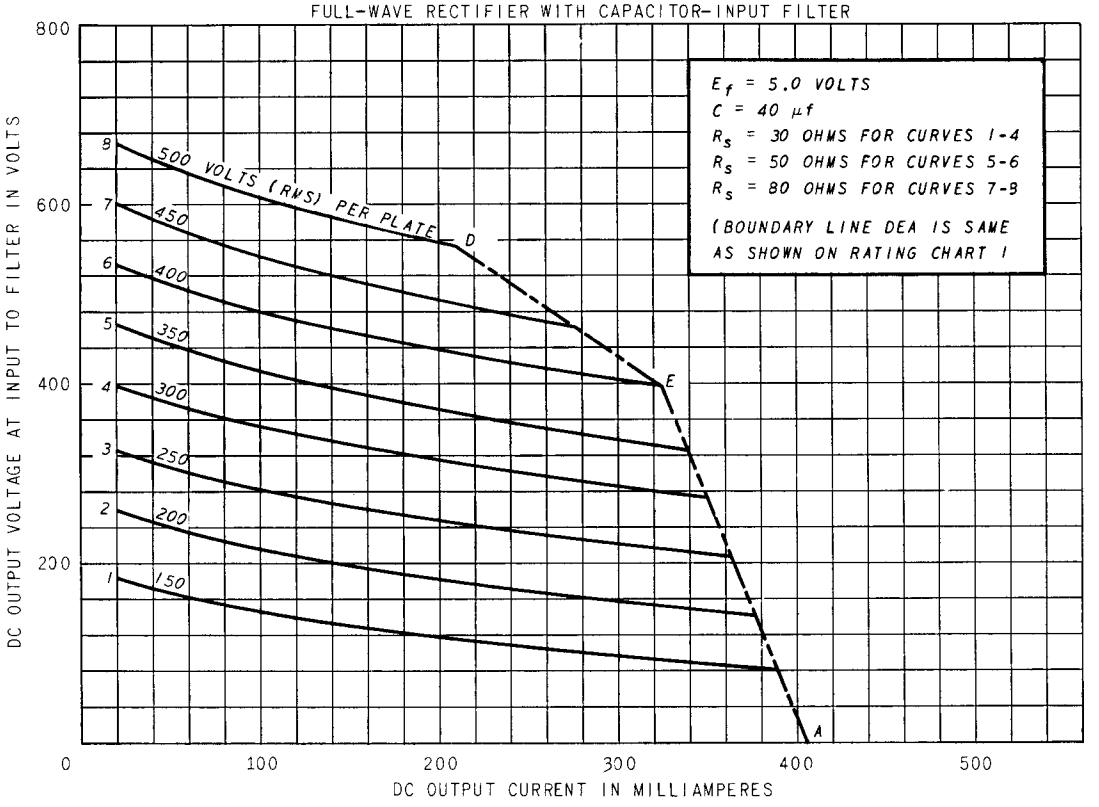
RATING CHART III

FOR CAPACITOR-INPUT FILTER



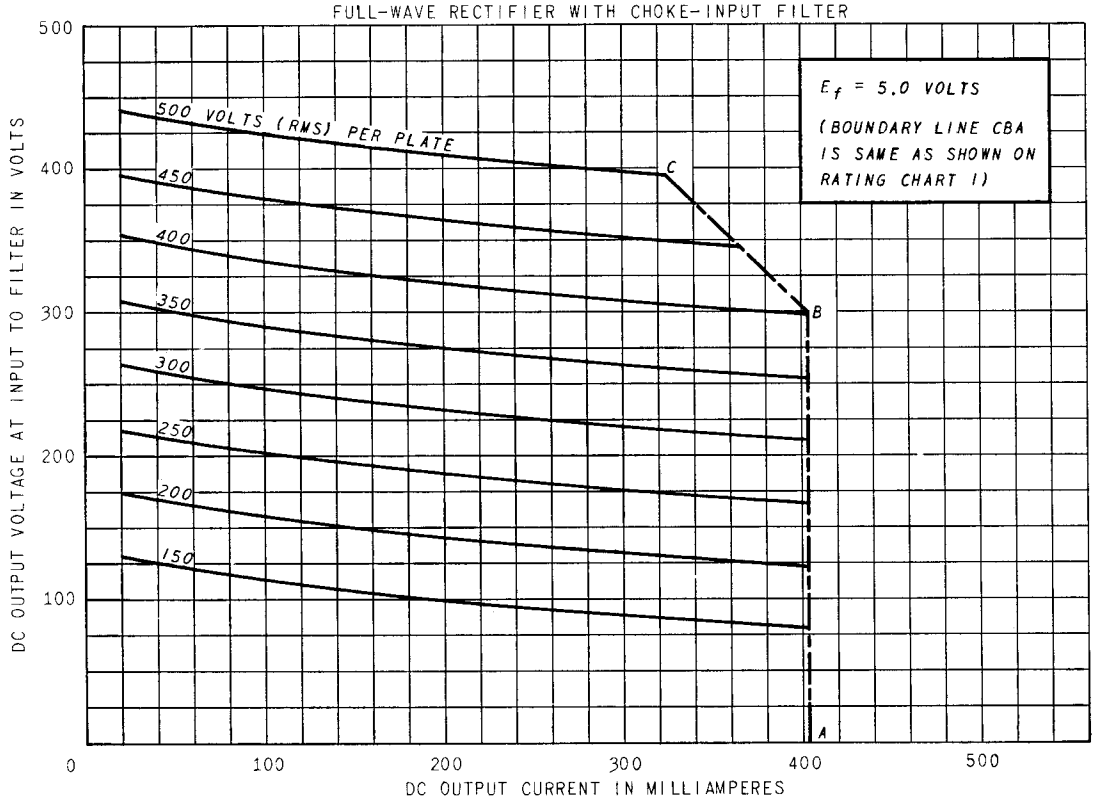
OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER



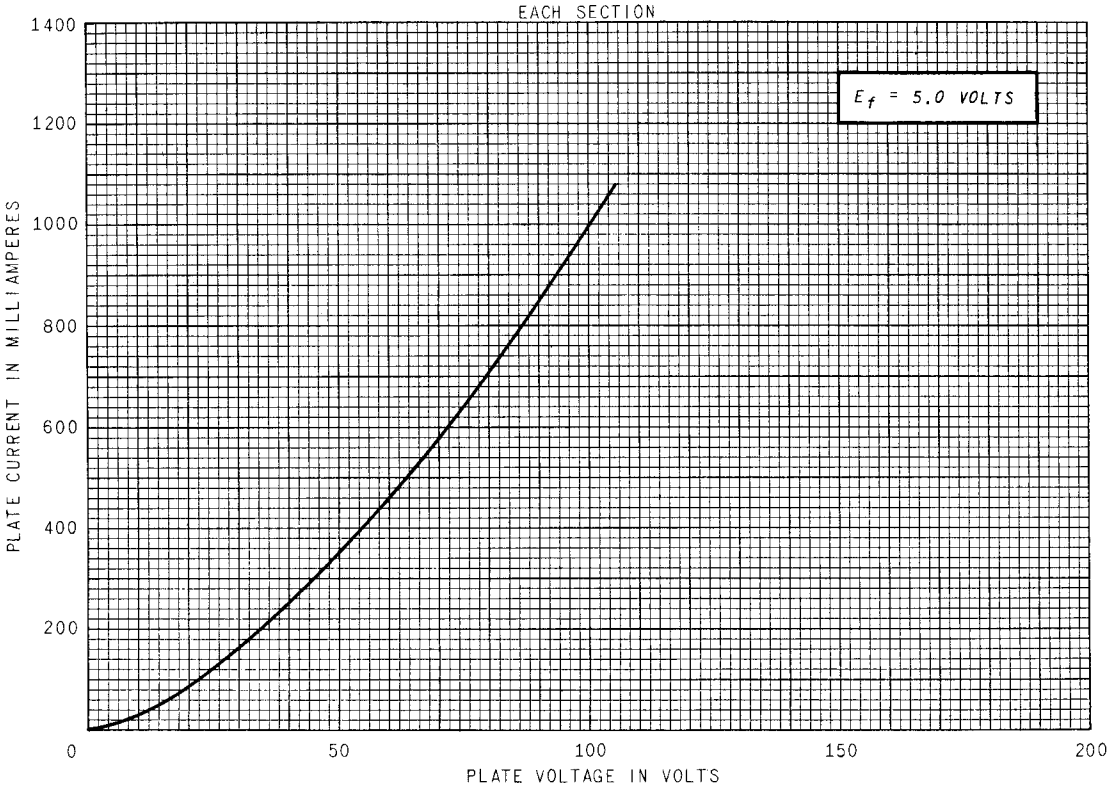
OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER



AVERAGE PLATE CHARACTERISTICS

EACH SECTION



ELECTRONICS DEPARTMENT

GENERAL ELECTRIC

5B24—Description and Rating

The 5B24 is a mercury-vapor, high-voltage, full-wave rectifier for use in charging 60-cell batteries, and for supplying power to operate magnetic chucks and small motors.

MAXIMUM RATINGS, Absolute Values

Maximum Peak Inverse Anode Voltage	1000	Volts
Maximum Cathode Current		
Peak	18	Amperes
Average	3	Amperes per Anode
Maximum Frequency	60	Cycles per Second

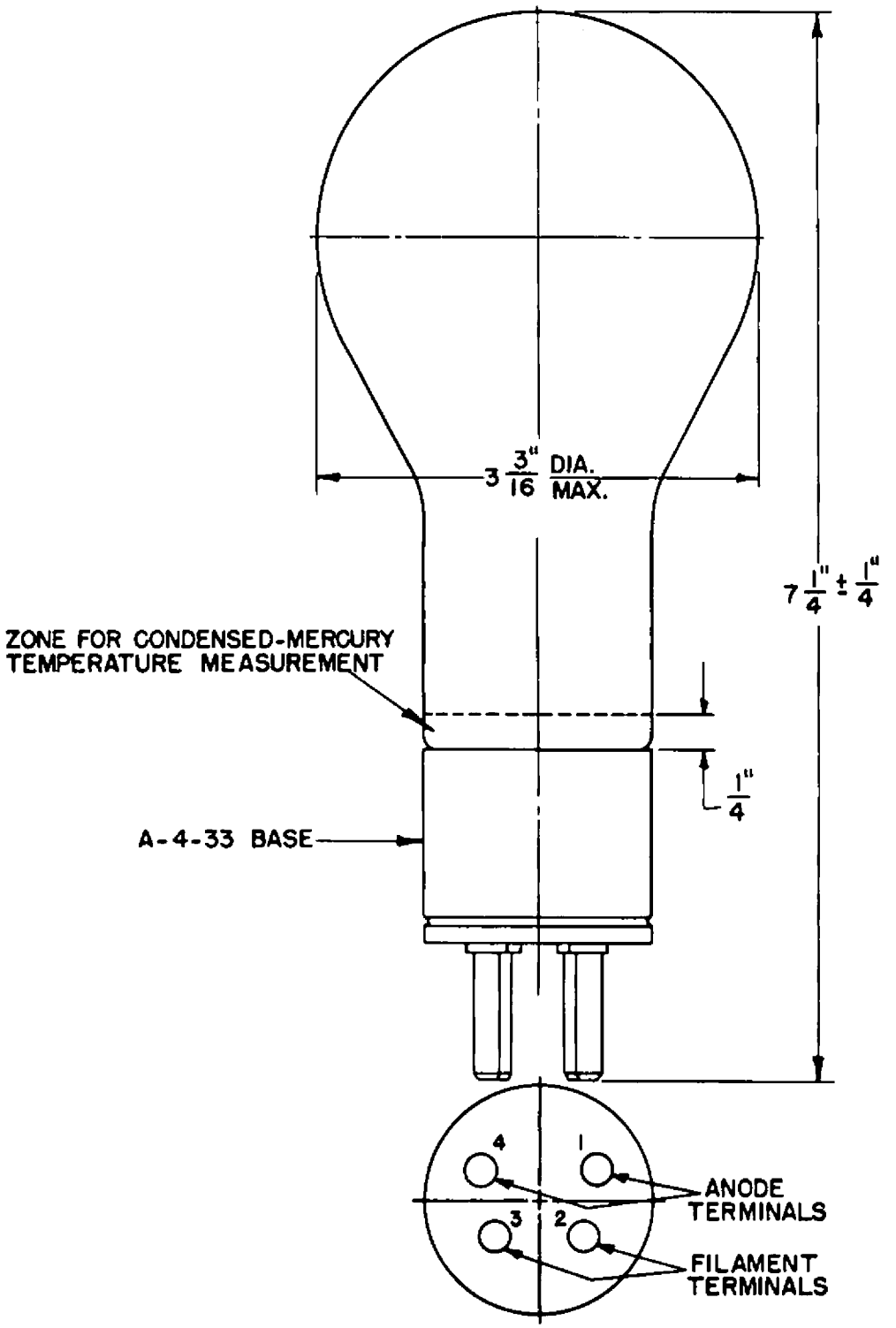
GENERAL

Electrical Data	Minimum	Bogey	Maximum	
Filament Voltage	2.375	2.5	2.625	Volts
Filament Current at 2.5 Volts		18	20	Amperes
Cathode Heating Time Required	300			Seconds
Initial Firing Voltage			20	Volts D-c
Recurrent Firing Voltage	8.5		20	Volts D-c
Anode Voltage Drop	7		15	Volts

Mechanical Data

Type of Cooling - Convection		
Mounting Position - Vertical, Base Down		
Net Weight, maximum	5	Ounces

from RMA release # 646, April 10, 1948



N15121AZ February 25, 1948

5B24 Outline

DESCRIPTION AND RATING

5BK7-A

5BK7-A Twin Triode. Except for heater characteristics and ratings, the 5BK7-A is identical to the 6BK7-B.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings		
Heater Voltage, AC or DC	4.7	Volts
Heater Current	0.6	Amperes
Heater Warm-up Time‡	11	Seconds

5BQ7-A

5BQ7-A Twin Triode. Except for heater characteristics and ratings, the 5BQ7-A is identical to the 6BQ7-A.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings		
Heater Voltage, AC or DC	5.6	Volts
Heater Current	0.45	Amperes
Heater Warm-up Time‡	11	Seconds

5BR8

5BR8 Triode-Pentode. Except for heater characteristics and ratings, the 5BR8 is identical to the 6BR8.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings		
Heater Voltage, AC or DC	4.7	Volts
Heater Current	0.6	Amperes
Heater Warm-up Time‡	11	Seconds

5BW8

5BW8 Duplex-Diode Pentode. Except for heater characteristics and ratings, the 5BW8 is identical to the 6BW8.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	4.7	Volts
Heater Current†	0.6 ± 0.04	Amperes
Heater Warm-up Time‡	11	Seconds

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

5CG8

5CG8 Triode-Pentode. Except for heater characteristics and ratings, the 5CG8 is identical to the 6CG8.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	4.7	Volts
Heater Current†	0.6 ± 0.04	Amperes
Heater Warm-up Time‡	11	Seconds

5CL8-A

5CL8-A Triode-Tetrode. Except for heater characteristics and ratings, the 5CL8-A is identical to the 6CL8-A.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings		
Heater Voltage, AC or DC	4.7	Volts
Heater Current†	0.6	Amperes
Heater Warm-up Time‡	11	Seconds

5CQ8

5CQ8 Triode-Tetrode. Except for heater characteristics and ratings, the 5CQ8 is identical to the 6CQ8.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC*	4.7	Volts
Heater Current†	0.6 ± 0.04	Amperes
Heater Warm-up Time‡	11	Seconds

FOOTNOTES

ϕ Heater voltage for a bogey tube at If = 0.3 amperes.
¶ Heater voltage for a bogey tube at If = 0.45 amperes.
* Heater voltage for a bogey tube at If = 0.6 amperes.
† For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.
‡ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

RECEIVING TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky

Electronic TUBES

5DH8

TRIODE-PENTODE

DESCRIPTION AND RATING

The 5DH8 is a miniature tube which contains a sharp-cutoff pentode and a high-mu triode in one envelope. The pentode section is intended for use as a video intermediate-frequency amplifier or as an audio intermediate-frequency amplifier. Provided the cathode is grounded, the triode section may be used as vertical oscillator, sync amplifier, sync separator, or sync clipper.

The 5DH8 features an internal connection between the pentode suppressor and the triode cathode, to enable the grounding of the suppressor when a cathode-bias resistor is employed for the pentode section. The tube also has a controlled heater warm-up characteristic which makes it especially suited for use in television receivers that employ 600-milliampere, series-connected heaters.

GENERAL

ELECTRICAL

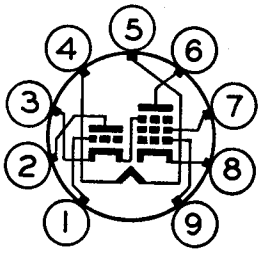
Cathode—Coated Unipotential

Heater Voltage, AC or DC	5.2 Volts
Heater Current	0.6 ± 6% Amperes
Heater Warm-up Time*	11 Seconds
Direct Interelectrode Capacitances†	
Pentode Section	
Grid-Number 1 to Plate, maximum	0.03 μμf
Input (Grid Number 1 to Cathode, Screen, and Heater)	6.5 μμf
Output (Plate to Cathode, Screen, Suppressor, Triode Cathode, Internal Shield, and Heater)	2.2 μμf
Plate to Cathode, Screen, and Heater	4.2 μμf
Triode Section	
Grid to Plate	1.6 μμf
Input (Grid to Cathode, Pentode Suppressor, Internal Shield and Heater)	2.4 μμf
Output (Plate to Cathode, Pentode Suppressor, Internal Shield, and Heater)	1.4 μμf
Pentode Grid Number 1 to Triode Plate	0.008 μμf
Triode Grid to Pentode Plate	0.005 μμf
Pentode Plate to Triode Plate	0.04 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

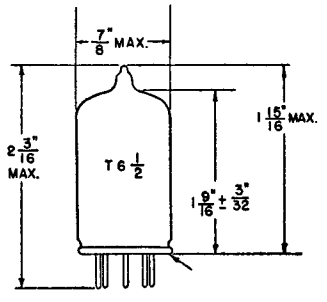


RETMA 9EG

TERMINAL CONNECTIONS

Pin 1—Triode Grid
Pin 2—Triode Plate
Pin 3—Triode Cathode, Pentode Grid Number 3 (Suppressor), and Internal Shield
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Plate
Pin 7—Pentode Grid Number 2 (Screen)
Pin 8—Pentode Cathode
Pin 9—Pentode Grid Number 1

PHYSICAL DIMENSIONS



RETMA 6-2

GENERAL ELECTRIC

MAXIMUM RATINGS

CLASS A_1 AMPLIFIER SERVICE—DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section	
Plate Voltage	300	300	Volts
Screen-Supply Voltage	300	...	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	2.2	2.0	Watts
Screen Dissipation	0.55	...	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

VERTICAL OSCILLATOR SERVICE‡, TRIODE SECTION—DESIGN-MAXIMUM VALUES

DC Plate Voltage	300	Volts
Peak Negative Grid Voltage	400	Volts
Plate Dissipation	1.0	Watts
DC Cathode Current	12	Milliamperes
Peak Cathode Current	35	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	2.2	Megohms
With Cathode Bias	2.2	Megohms
With Grid-Leak Bias	2.2	Megohms

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

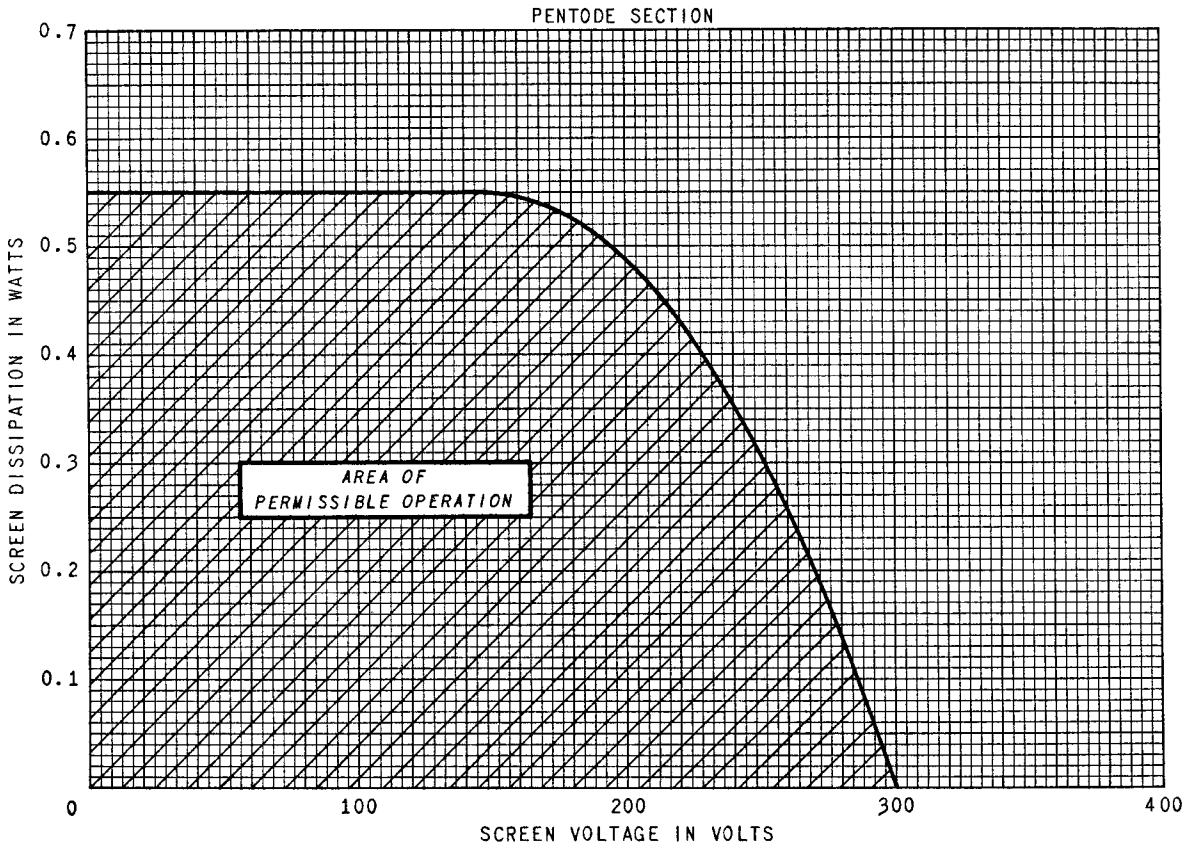
	Pentode Section	Triode Section	
Plate Voltage	125	250	Volts
Screen Voltage	125	...	Volts
Grid-Number 1 Voltage	.....	...	Volts
Cathode-Bias Resistor	56	390	Ohms
Amplification Factor	.....	53	
Plate Resistance, approximate	150000	12000	Ohms
Transconductance	8600	4400	Micromhos
Plate Current	13.5	7.3	Milliamperes
Screen Current	3.8	.....	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 10 Microamperes	.....	−10	Volts
Ib = 20 Microamperes	−6	.....	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

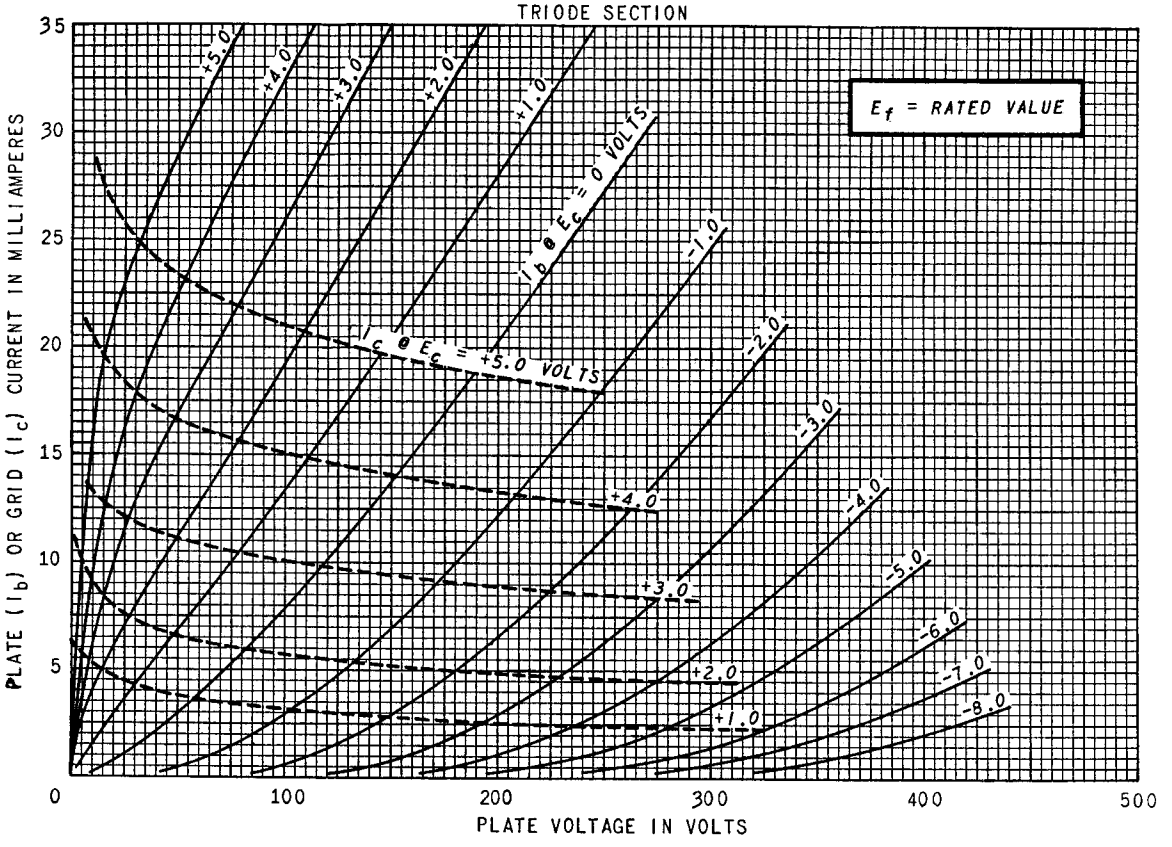
‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

SCREEN RATING CHART



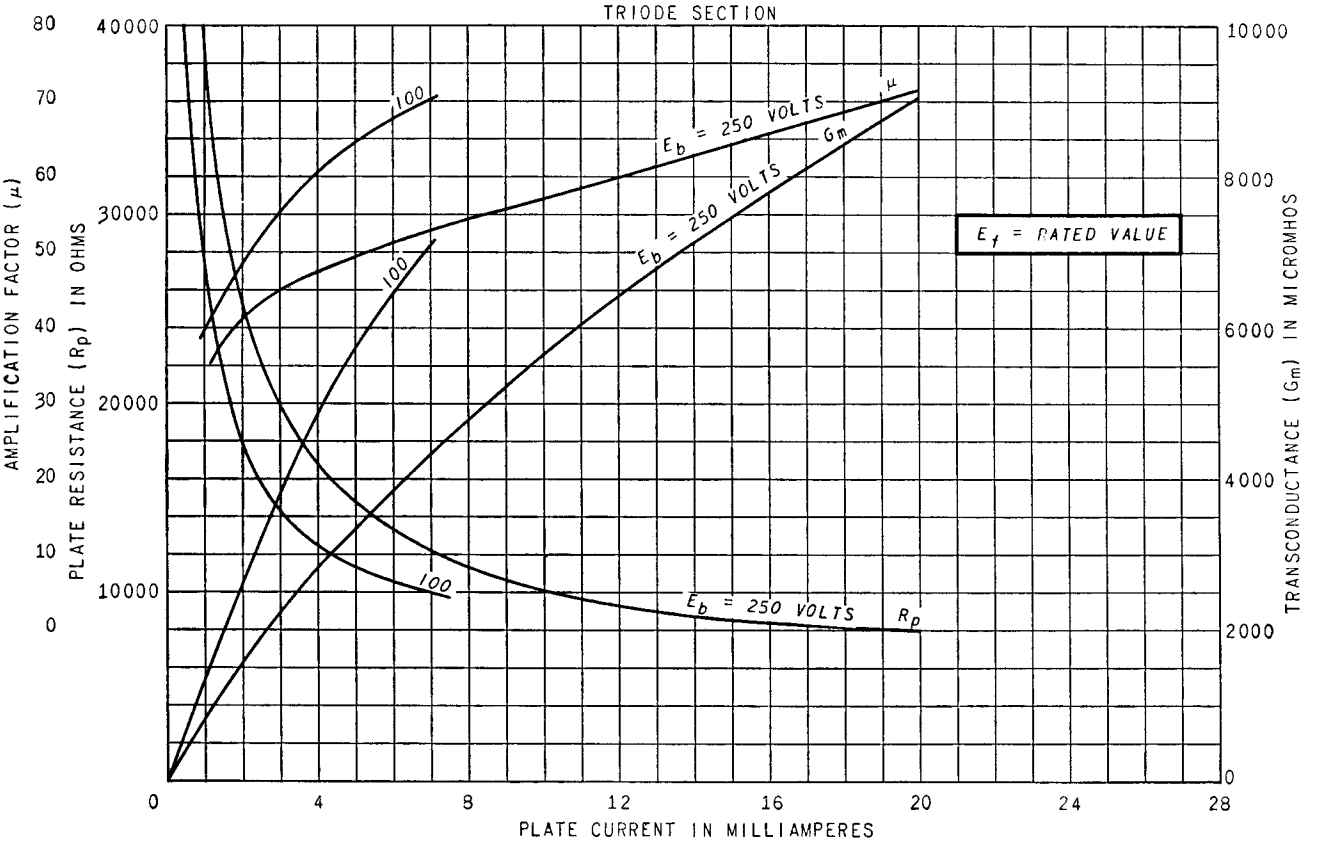
AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION



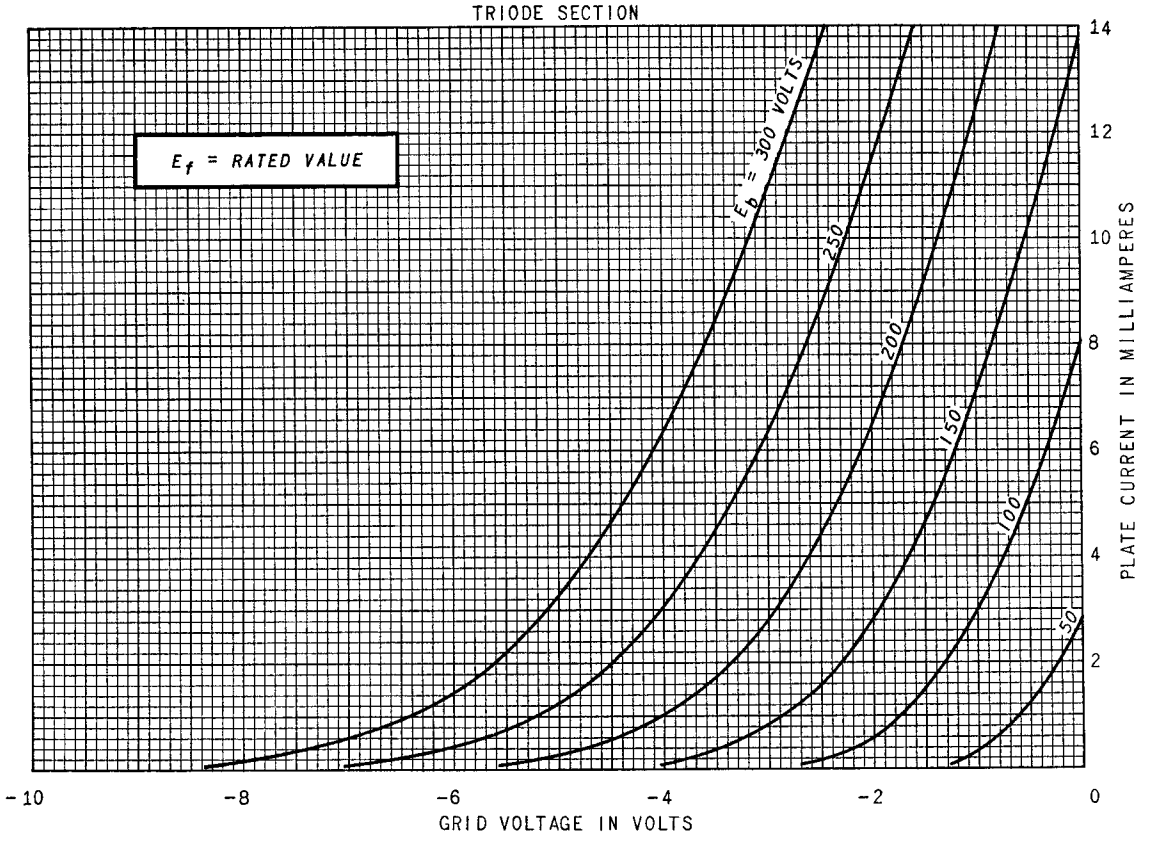
AVERAGE CHARACTERISTICS

TRIODE SECTION



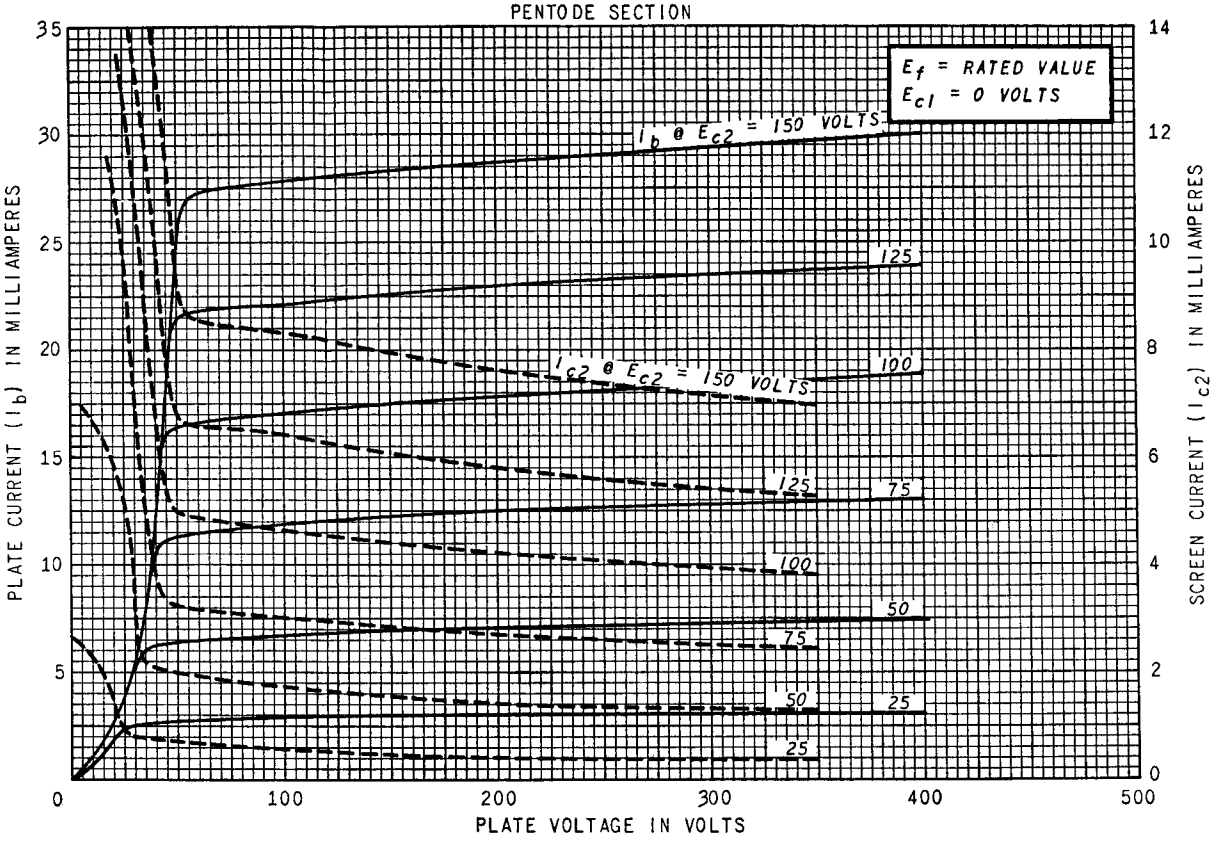
AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION



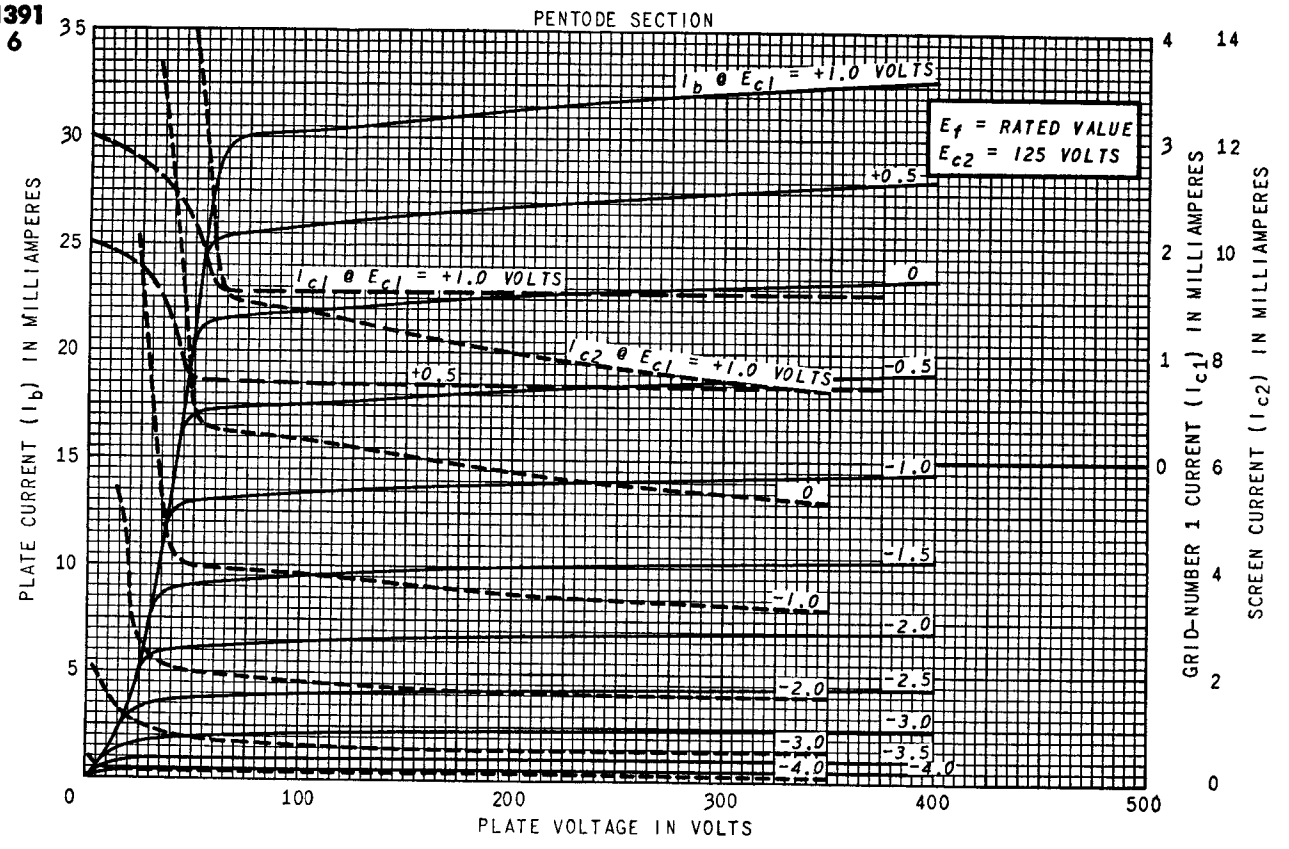
AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION



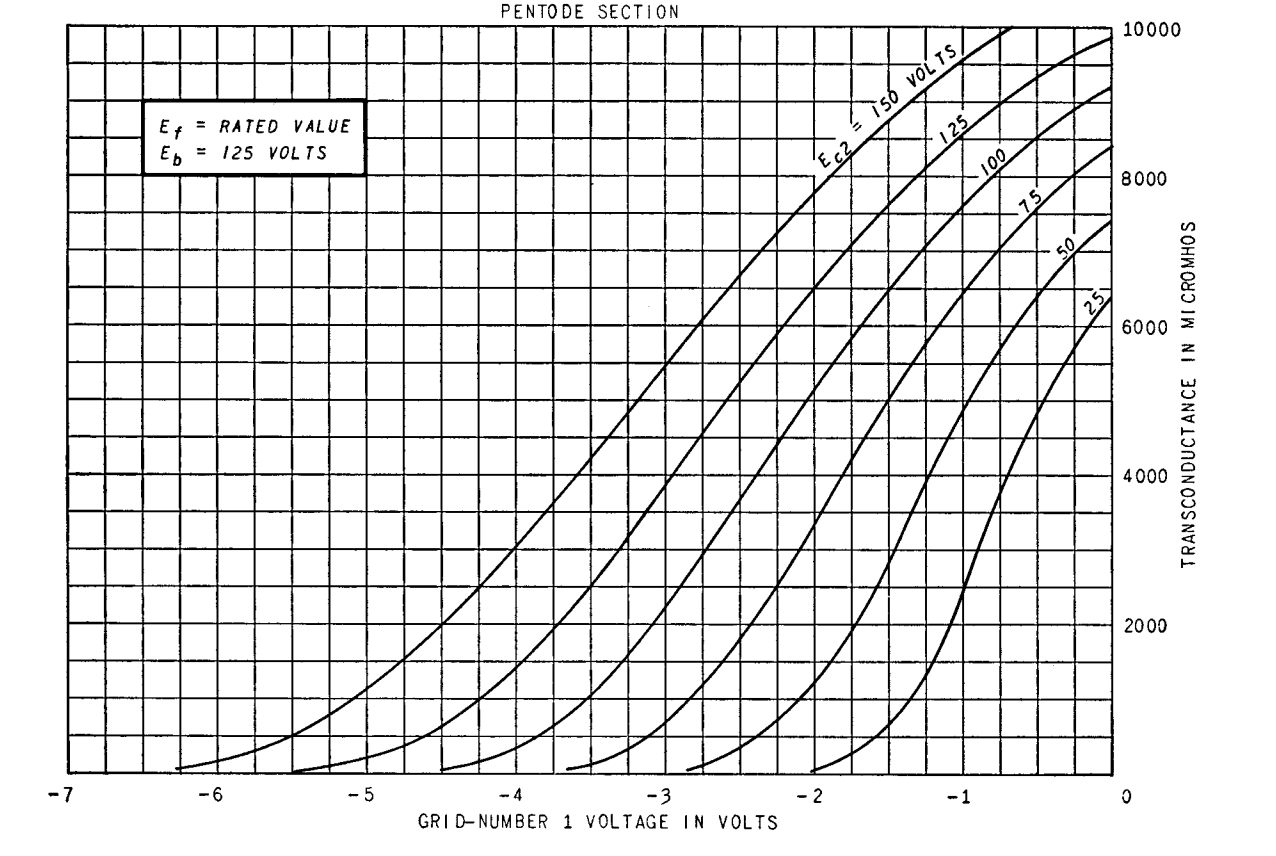
AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION



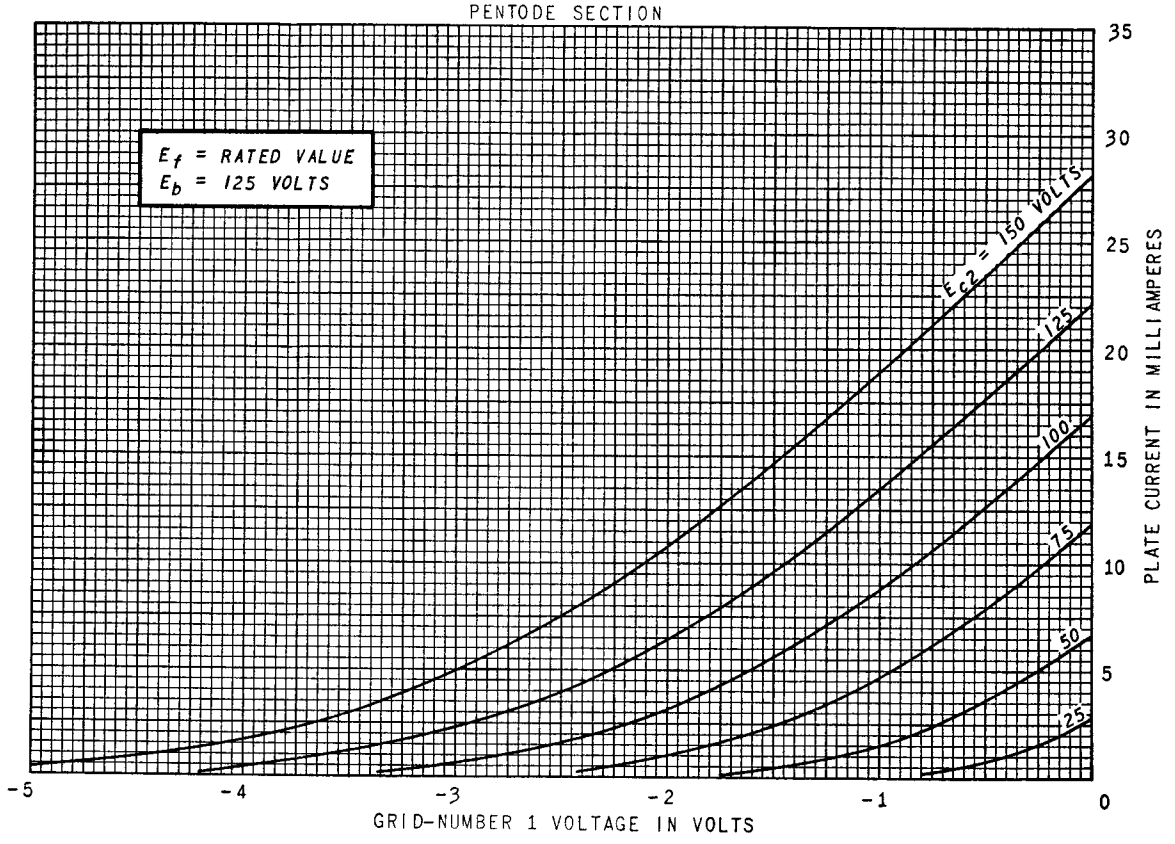
AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



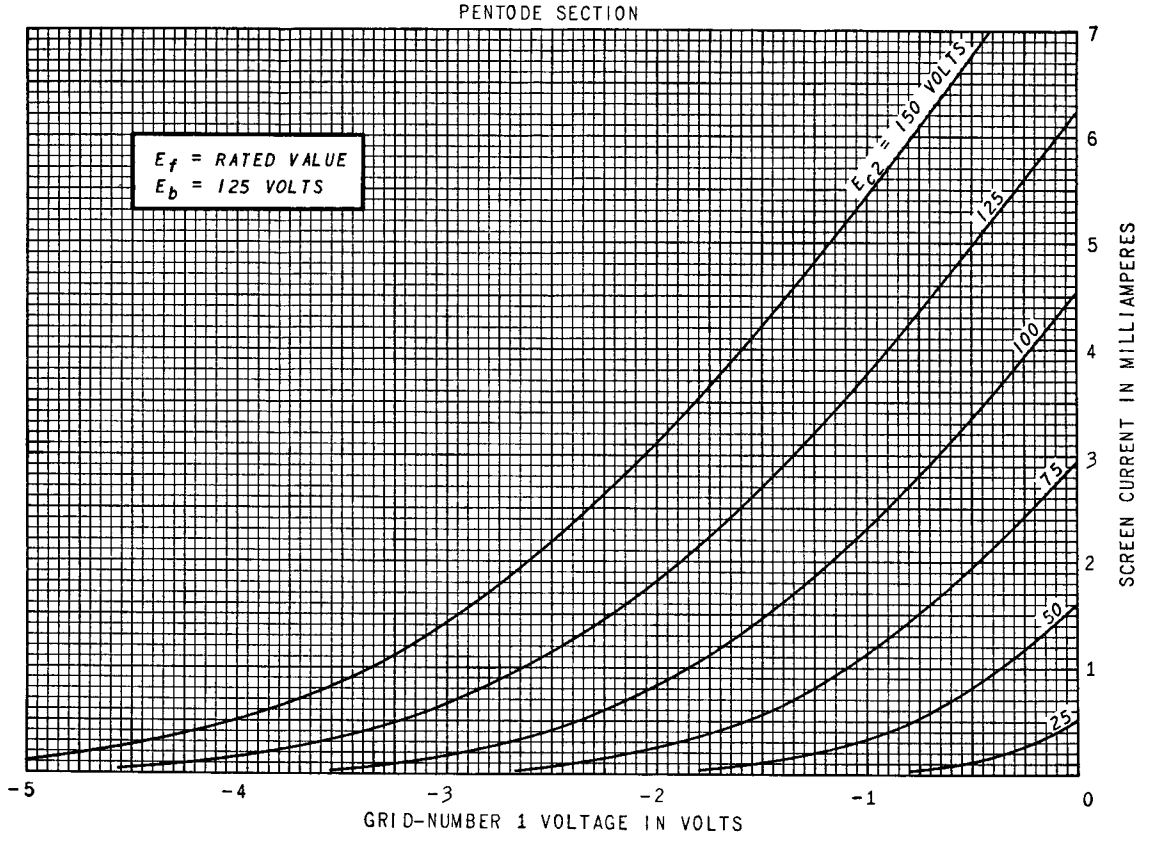
AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



CATHODE RAY TUBE

5 INCH ROUND, GLASS

FACEPLATE - SPHERICAL, GREY

FOCUS - ELECTROSTATIC

PERSISTENCE - SHORT

DEFLECTION - MAGNETIC

70-DEGREE DEFLECTION ANGLE

ALUMINIZED

DESCRIPTION & RATING

The 5DRP4 is an electrostatic-focus and magnetic-deflection cathode ray tube for radar applications. Particular features of this tube are its short over-all length and small neck diameter, which permits its use in less equipment space.

GENERAL

ELECTRICAL

Heater Voltage	6.3 Volts
Heater Current	0.3 ± 10% Amperes

Focusing Method - Electrostatic
Deflecting Method - Magnetic

Deflection Angle, approximate	70 Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	8 μμf
Grid No. 1 to All Other Electrodes	10 μμf
Grid No. 2 to All Other Electrodes	10 μμf

OPTICAL

Phosphor Number	P4
Fluorescent Color	White
Phosphorescent Color	White
Persistence	Short

from JEDEC release #3653, March 26, 1962

MECHANICAL

Over-all Length . . . . . 7 ± 1/4 Inches
Greatest Bulb Diameter. . . . . 4-15/16 ± 1/16 Inches

Minimum Useful Screen Diameter. . . . . 4-1/4 Inches

Bulb Contact - Recessed Small-Ball Cap, JETEC No. J1-22
Base - 9 Pin Miniature
Basing, JETEC Designation - Special
Bulb Contact Alignment
Plane of J1-22 Contact passes halfway between Pins #1 and #9 ± 10 Degrees
J1-22 Contact on same side as Pins #1 and #9.

Mounting Position - Any

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage . . . . . 10,000 Max Volts DC
Grid-No. 1 Voltage
Negative-Bias Value . . . . . 200 Max Volts DC
Positive-Bias Value . . . . . 0 Max Volts DC
Positive-Peak Value . . . . . 2 Max Volts
Grid-No. 2 Voltage . . . . . 630 Max Volts DC

Peak Heater-Cathode Voltage
Heater Negative With Respect to Cathode . . . . . 180 Max Volts
Heater Positive With Respect to Cathode . . . . . 180 Max Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage . . . . . 10,000 Volts DC
Grid-No. 1 Voltage # . . . . . -33 to -77 Volts DC
Grid-No. 2 Voltage # . . . . . 300 Volts DC
Line Width A ++ . . . . . 0.35 mm Max.
Spot Position ## . . . . . 10 mm
Focusing Anode Voltage
(100μA) . . . . . 0 to +400 Volts DC

Modulation (100μA) . . . . . .35 Volts DC Max.

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance . . . . . 1.5 Max Megohms

* The maximum ratings provide a ten percent safety factor in accordance with the standard design-center system of rating cathode ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

\# For visual extinction of undeflected focused spot.

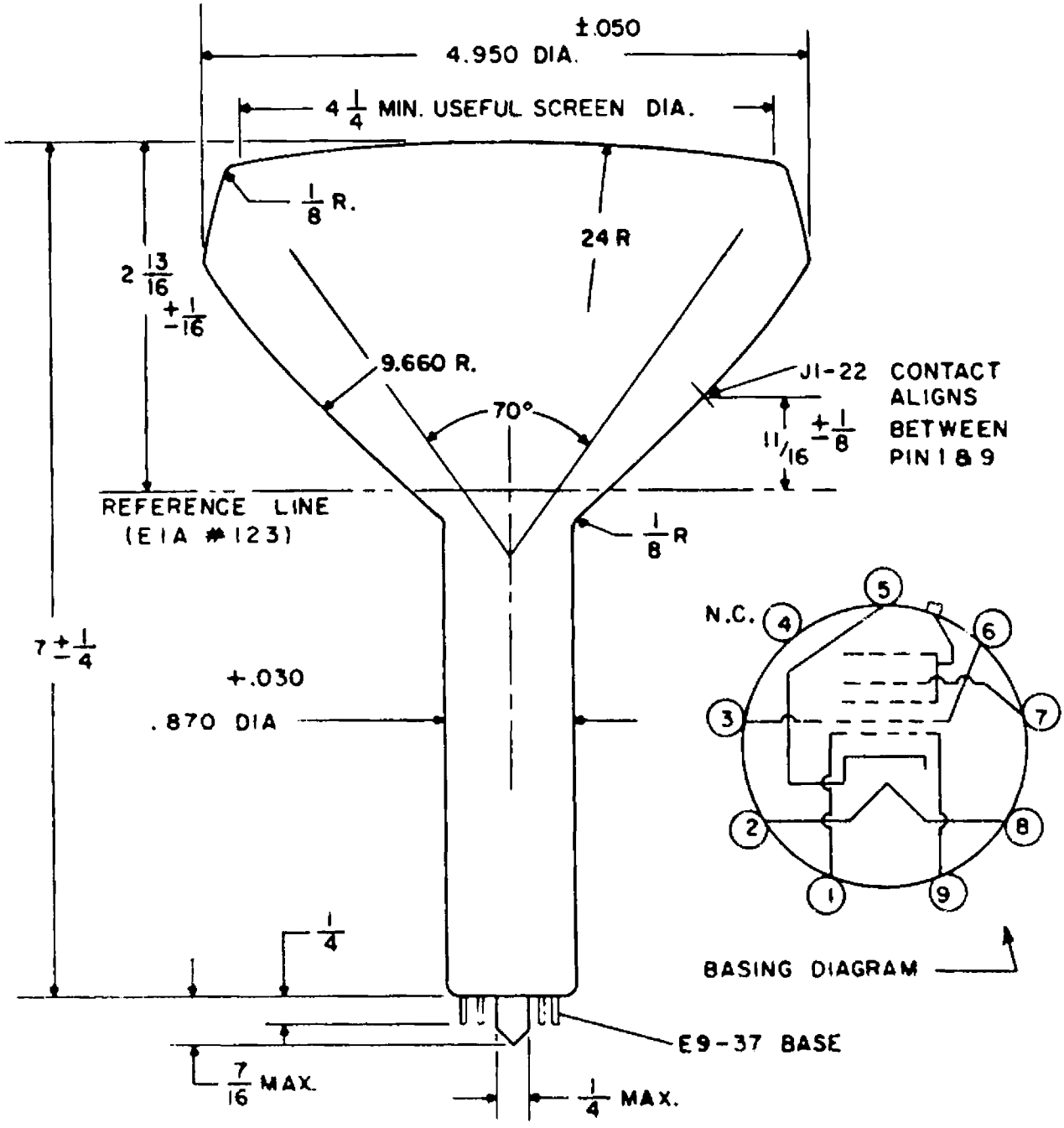
++ Measured in accordance with MIL-E-1C, paragraph 4.12.6.2 at an anode current of 100 microamperes.

The center of the undeflected, unfocused spot will fall within a circle of 10 millimeters radius concentric with the tube face.

Cathode Ray Tube Department

GENERAL ELECTRIC COMPANY

Syracuse, New York



PIN	CONNECTIONS
1	GRID #1
2	HEATER
3	GRID #2
4	NOT CONNECTED
5	CATHODE

PIN	CONNECTIONS
6	GRID #2
7	FOCUS
8	HEATER
9	GRID #1

DESCRIPTION AND RATING

5EA8 Triode-Pentode. Identical to the 6EA8 except for the following ratings:

Heater Voltage, AC or DC	4.7	Volts
Heater Current	0.6 ± 6%	Amperes
Heater Warm-up Time*	11	Seconds

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

5EU8 Triode-Pentode. Identical to the 6EU8 except for heater ratings. Refer to the 6EU8 Description and Rating sheet for complete data.

5GH8 Triode-Pentode. Identical to the 6GH8 except for heater ratings. Refer to the 6GH8 Description and Rating sheet for complete data.

5J6 Twin Triode. Identical to the 6J6 except for heater ratings and addition of a controlled heater-warm-up characteristic. Refer to the 6J6 Description and Rating sheet for complete data.

5T8 Triple-Diode Triode. Identical to the 6T8 except for heater ratings and addition of a controlled heater-warm-up characteristic. Refer to the 6T8 Description and Rating sheet for complete data.

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Electronic TUBES

5FP7-B

CATHODE-RAY TUBE

5-INCH ROUND, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
53-DEGREE DEFLECTION ANGLE
FACEPLATE—SPHERICAL, CLEAR
HIGH-RESOLUTION GUN
PERSISTENCE—LONG

DESCRIPTION AND RATING

The 5FP7-B is a 5-inch magnetic-focus and -deflection cathode-ray tube for radar and oscillographic applications that require a long persistence. A particular feature of this tube is the high-resolution electron gun which provides a small spot size, an improved spot shape, high resolution, and considerable depth of focus.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes

Focusing Method—Magnetic
Deflecting Method—Magnetic

Deflection Angle, approximate	53	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	8	μμf

OPTICAL

Phosphor Number—P7
Fluorescent Color—Blue-White
Phosphorescent Color—Yellow
Persistence—Long

Faceplate—Clear

MECHANICAL

Over-all Length	$11\frac{1}{8} \pm \frac{3}{8}$	Inches
Greatest Bulb Diameter	$4\frac{15}{16} \pm \frac{3}{32}$	Inches
Minimum Useful Screen Diameter	$4\frac{1}{4}$	Inches

Bulb Number, ASA Designation—J39½L
Bulb Contact—Recessed Small-ball Cap, JETEC No. J1-22
Base—Long Medium-shell Octal 8-Pin, JETEC No. B8-65
Basing, JETEC Designation—5AN
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 5 ± 10 Degrees
Mounting Position—Any

MAXIMUM RATINGS*

DESIGN-CENTER VALUES†

Anode Voltage‡	12,000 Max	Volts DC
Grid-No. 2 Voltage	700 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	180 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Grid-No. 1 Drive from Cutoff	65 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS*

Anode Voltage§	7000	Volts DC
Grid-No. 2 Voltage	250	Volts DC
Grid-No. 1 Voltage¶	−25 to −70	Volts DC
Focusing-Coil Currentϕ, approximate	115	Milliamperes DC
Line Width A♦	0.23	Millimeters
Spot Position▲	9	Millimeters

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5	Max Megohms

*All voltages are measured with respect to cathode.

†The maximum ratings provide a ten percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

‡Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

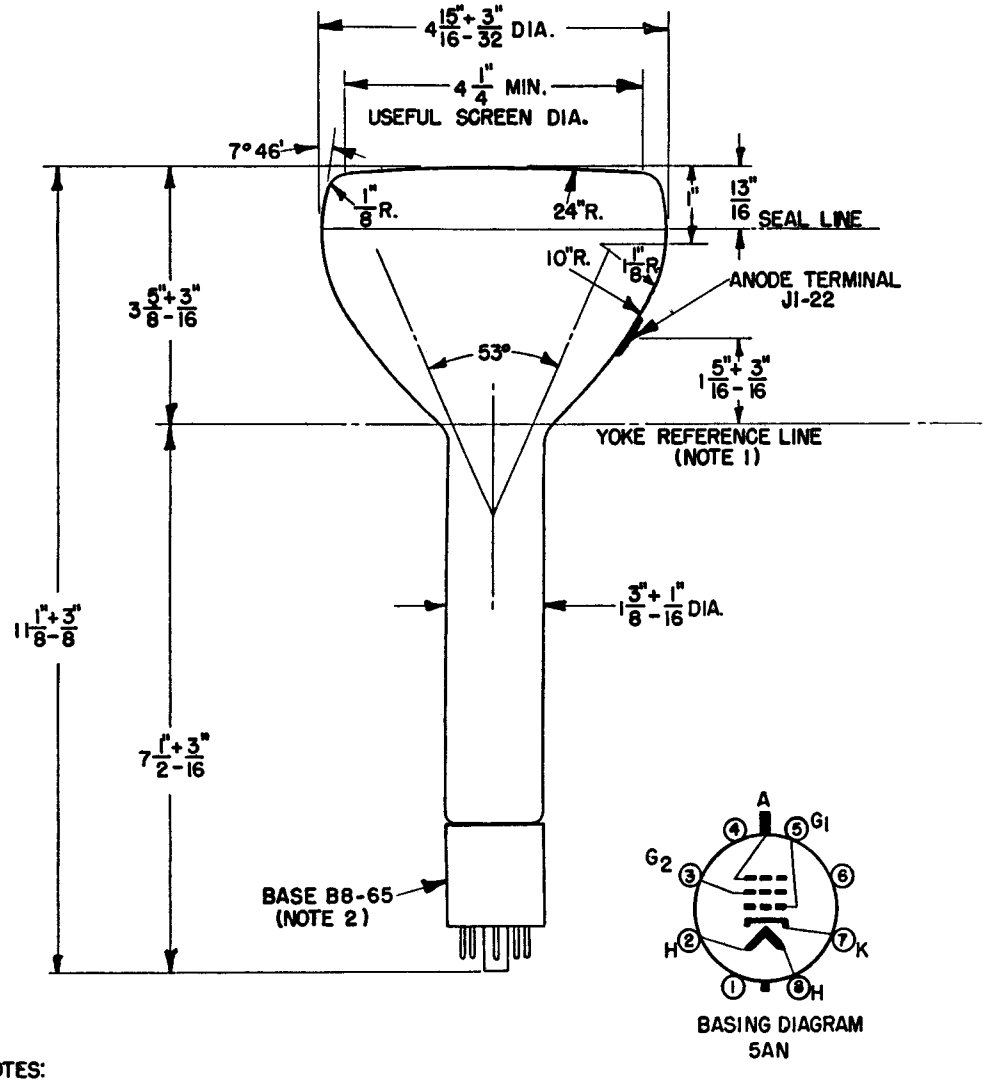
§Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 4000 volts.

¶For visual extinction of undeflected focused spot.

ϕFor RETMA focusing coil No. 106 with distance from the yoke reference line to center of air gap equal to 2¾ inches.

♦Measured in accordance with specification MIL-E-1C paragraph 4.12.6.2 at an anode current of 200 microamperes.

▲The center of the undeflected, unfocused spot will fall within a circle of 9 millimeters radius concentric with the tube face.



BASING DIAGRAM
5AN

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE POINT WHERE A GAGE 1.430 ±.003 INCHES INSIDE DIAMETER AND 2 INCHES IN LENGTH STOPS AGAINST THE CONE.
2. ANODE TERMINAL ALIGNS WITH PIN-NO. 5 ± 10 DEGREES.

Electronic TUBES

5FP14-A

CATHODE-RAY TUBE

5-INCH ROUND, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC

53-DEGREE DEFLECTION ANGLE
HIGH-RESOLUTION GUN
PERSISTENCE—MEDIUM LONG

DESCRIPTION AND RATING

The 5FP14-A is a magnetic-focus and -deflection cathode-ray tube for radar applications. It employs a high-resolution electron gun which affords an exceptionally narrow trace on the fluorescent screen.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes

Focusing Method—Magnetic
Deflecting Method—Magnetic

Deflection Angle, approximate	53	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	5.0	μμf
Grid-No. 1 to All Other Electrodes	8.0	μμf

OPTICAL

Phosphor Number—P14
Fluorescent Color—Purple
Phosphorescent Color—Orange
Persistence—Medium Long

Faceplate—Clear

MECHANICAL

Over-all Length	$11\frac{1}{8} \pm \frac{3}{8}$	Inches
Greatest Bulb Diameter	$4\frac{15}{16} \pm \frac{3}{32}$	Inches
Minimum Useful Screen Diameter	$4\frac{1}{4}$	Inches

Bulb Number, ASA Designation—J39-½L
Bulb Contact—Recessed Small-ball Cap, JETEC No. J1–22
Base—Medium-shell Octal 8-Pin, JETEC No. B8–11 or
Long Medium-shell Octal 8-Pin, JETEC No. B8-65
Basing—JETEC Designation—5AN
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 5 ±10 Degrees
Mounting Position—Any

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	8000 Max	Volts DC
Grid-No. 2 Voltage	700 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	180 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Grid-No. 1 Drive from Cutoff	65 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage	5000	Volts DC
Grid-No. 2 Voltage	250	Volts DC
Grid-No. 1 Voltage§	−25 to −70	Volts DC
Focusing-Coil Currentπ, approximate	97	Milliamperes DC
Line Width Aϕ	0.23	Max Millimeters
Spot Position▲	9	Millimeters

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

* The maximum ratings provide a ten percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

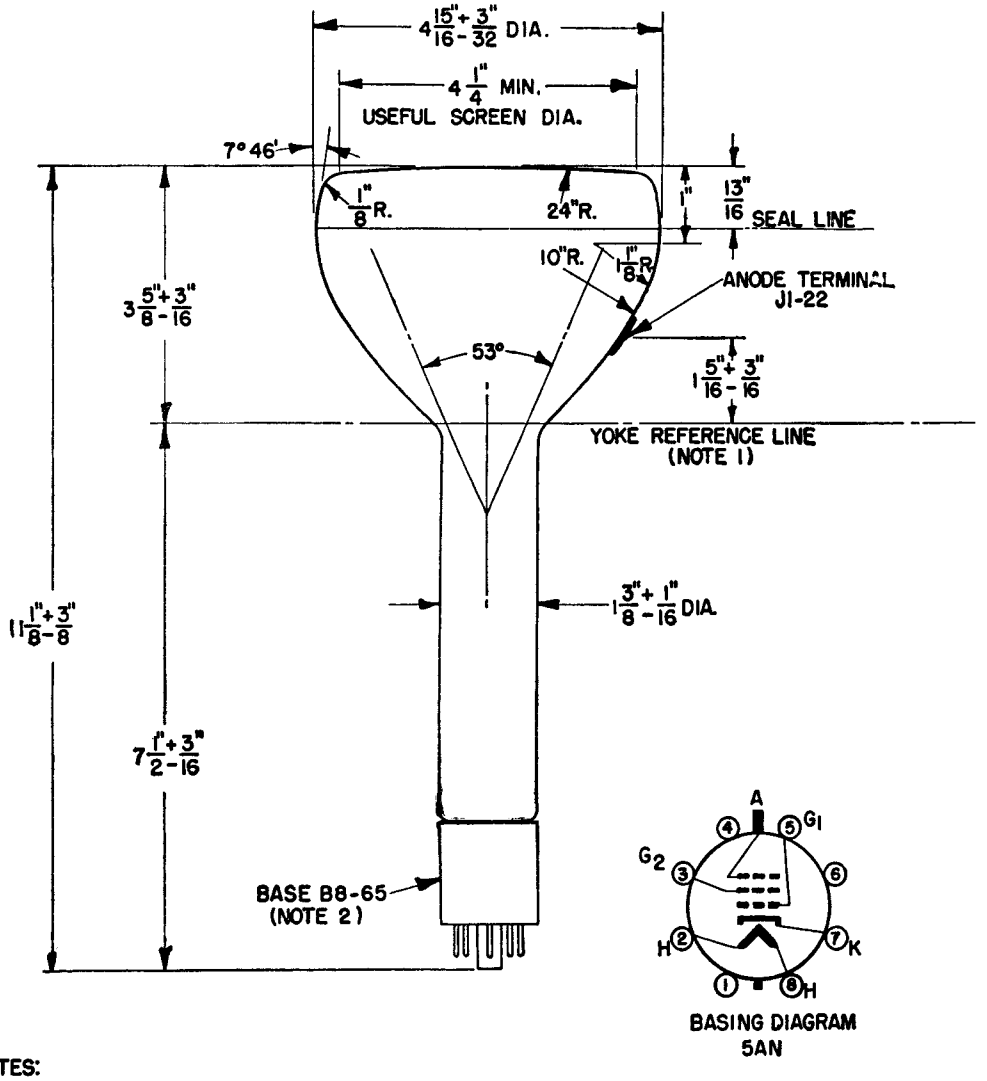
‡ Cathode should be returned to one side or to the midtap of the heater transformer winding.

§ For visual extinction of focused undeflected spot.

π For JETEC focusing coil No. 106 with distance from the yoke-reference-line to center-of-air-gap equal to 2¾ inches.

ϕ Measured in accordance with specification MIL-E-1B, paragraph 4.12.6.2 at an anode current of 200 microamperes.

▲ The center of the undeflected unfocused spot will fall within a circle of 9 millimeters radius concentric with the tube face.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE POINT WHERE A GAGE 1.430 ±.003 INCHES INSIDE DIAMETER AND 2 INCHES IN LENGTH STOPS AGAINST THE CONE.
2. ANODE TERMINAL ALIGNS WITH PIN-NO. 5 ± 10 DEGREES.

ELECTRONICS

5HA7

COMPACTRON DISSIMILAR DOUBLE TRIODE

DESCRIPTION AND RATING

The 5HA7 is a compactron containing a high-mu triode and a medium-mu triode. Except for heater characteristics, the 5HA7 is identical to the 4HA7.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	5.6	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

from JEDEC release #4449A, May 25, 1964

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RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release No. 462

January 5, 1946

sponsor:
General Electric Co.

RMA TYPE 5J29
Magnetron
(External Magnet Required)

GENERAL CHARACTERISTICS

Electrical

Filament - Tungsten		
Filament Voltage *		2.1 Volts
Filament Current	maximum	40 Amperes
Frequency		350-770 Megacycles
Field Strength		1500 Gauss

Mechanical

Dimensions (see outline K-8639335)

Type of Cooling	Liquid and Forced-air
Anode, liquid cooling	1 Quart Per Minute
Maximum Outlet Temperature	70 C

Seals

Forced-air cooling shall be provided so that the maximum seal temperature shall not exceed 150 C.

Mounting Position - Any

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

	Typical Operation		Maximum Ratings	
D-c Plate Voltage ≠	1400	1800	2500	Volts
Plate Dissipation			500	Watts
Plate Input	500	500	600	Watts
D-c Plate Current	360	280	450	Milliamperes
Conversion Efficiency, approximate	33	20		Per Cent
Power Output	165	100		Watts
Frequency	350	770		Megacycles
Duty	CW	CW		CW

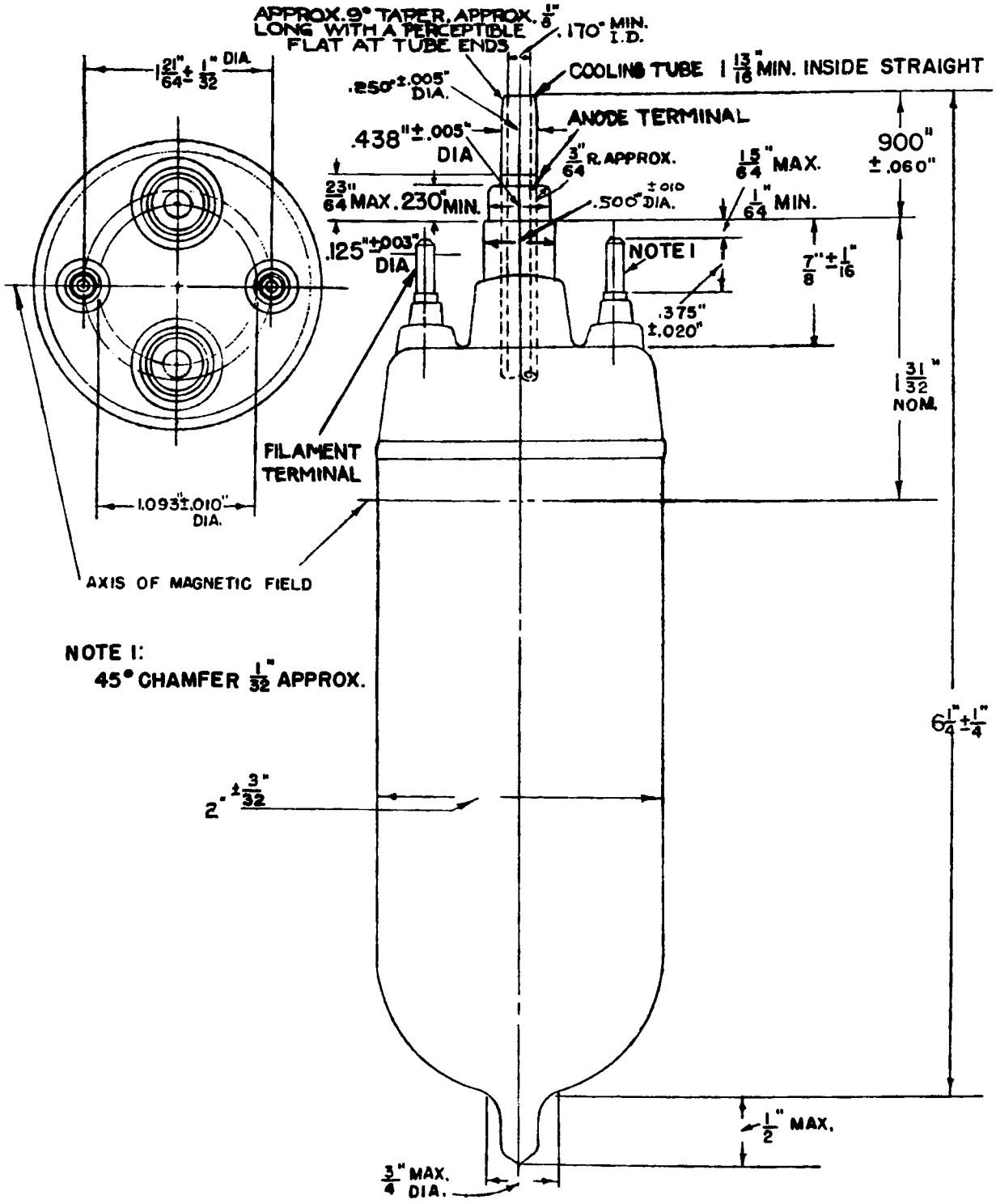
* The filament supply should provide 0 to 2.5 volts, continuously variable, at 40 amperes. In operation Ef should be adjusted to the lowest value consistent with optimum operation, then maintained accurately. During starting If should never exceed 60 amperes.

≠ The plate supply should have sufficiently poor regulation or series resistance to permit stable operation and prevent excessive plate dissipation. The tube should be operated with optimum loading at all times. Either overloading or insufficient loading may result in undesirable operation or damage to the tube due to excessive radio-frequency voltage across the seals.

Release No. 462

January 5, 1946

TYPE 5J29



RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release No. 462

January 5, 1946

sponsor:
General Electric Co.

RMA TYPE 5J30 Magnetron (External Magnet Required)

GENERAL CHARACTERISTICS

Electrical

Filament - Tungsten		
Filament Voltage *		2.1 Volts
Filament Current	maximum	40 Amperes
Frequency		10-375 Megacycles
Field Strength		1500 Gauss

Mechanical

Dimensions (see outline)

Type of Cooling	Liquid and Forced Air
Anode, liquid cooling	1 Quart Per Minute
Maximum Outlet Temperature	70 C

Seals

Forced-air cooling shall be provided so that the maximum seal temperature will not exceed 150 C.

Mounting Position - Any

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

	Typical Operation		Maximum Ratings	
D-c Plate Voltage ≠	1500	1750	2500	Volts
Plate Dissipation			400	Watts
Plate Input			600	Watts
D-c Plate Current	330	280	450	Milliamperes
Conversion Efficiency	20	40		Per Cent
Power Output	100	200		Watts
Frequency	10	375		Megacycles
Duty	CW	CW		CW

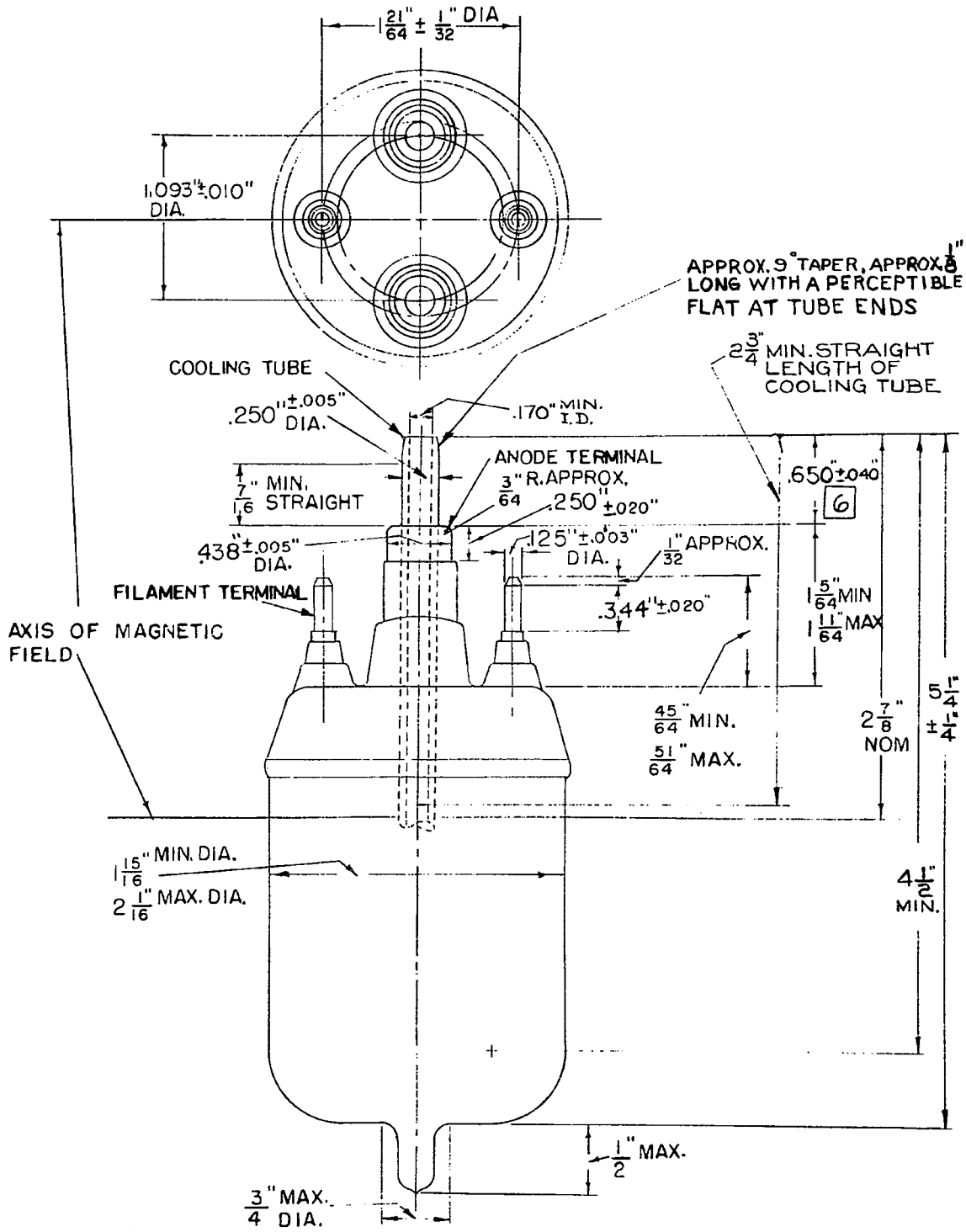
* The filament supply should provide 0 to 2.5 volts, continuously variable, at 40 amperes. In operation Ef should be adjusted to the lowest value consistent with optimum operation, then maintained accurately. During starting, If should never exceed 60 amperes.

≠ The plate supply should have sufficient regulation or series resistance to permit stable operation and to prevent excessive plate dissipation. The tube should be operated with optimum loading at all times. Either overloading or insufficient loading may result in undesirable operation or damage to the tube due to excessive radio-frequency voltage across the seals.

Release No. 462

January 5, 1946

TYPE 5J30



RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release No. 462

January 5, 1946

sponsor:
General Electric Co.

RMA TYPE
5J32
Magnetron
(External Magnet Required)

GENERAL CHARACTERISTICS

Electrical

Filament - Tungsten		
Filament Voltage *		2.1 Volts
Filament Current	maximum	40 Amperes
Frequency		90 to 450 Megacycles
Field Strength		1500 Gauss

Mechanical

Dimensions (See outline K-8639335)

Type of Cooling	Liquid and Forced-air
Anode, liquid cooling	1 Quart Per Minute
Maximum Outlet Temperature	70 C

Seals

Forced-air cooling shall be provided so that the maximum seal temperature shall not exceed 150 C.

Mounting Position - Any

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

	Typical Operation			Maximum Ratings	
D-C Plate Voltage ≠	1400	1600	2100	2500	Volts
Plate Dissipation				400	Watts
Plate Input	500	500	500	600	Watts
D-C Plate Current	350	310	240	450	Milliamperes
Conversion Efficiency, approximate	20	40	25		Per Cent
Power Output	100	200	125		Watts
Frequency	90	300	450		Megacycles
Duty	CW	CW	CW		CW

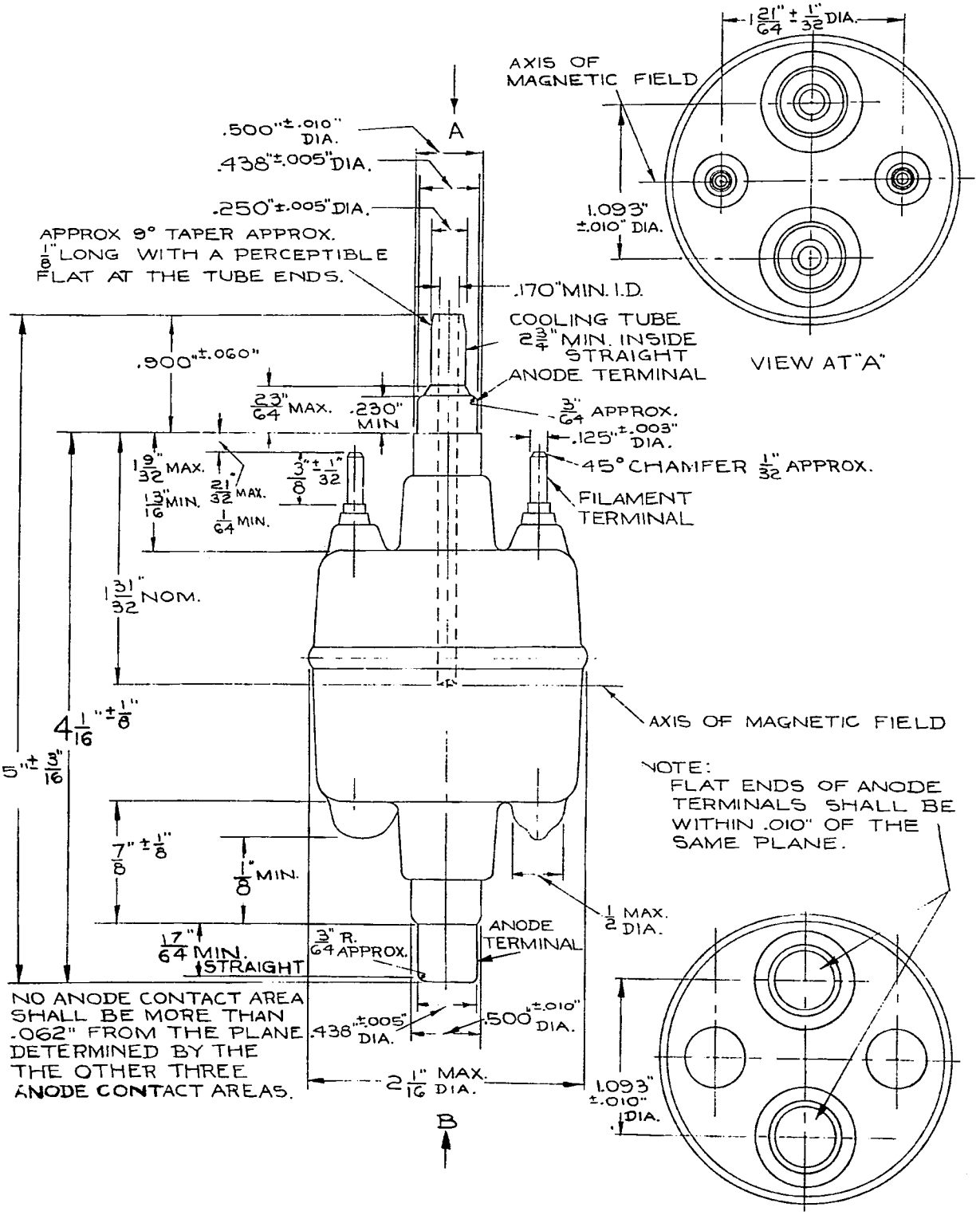
* The filament supply should provide 0 to 2.5 volts, continuously variable, at 40 amperes. In operation Ef should be adjusted to the lowest value consistent with optimum operation, then maintained accurately. During starting If should never exceed 60 amperes.

≠ The plate supply should have sufficiently poor regulation or series resistance to permit stable operation and prevent excessive plate dissipation. The tube should be operated with optimum loading at all times. Either overloading or insufficient loading may result in undesirable operation or damage to the tube due to excessive radio-frequency voltage across the seals.

Release No. 462

January 5, 1946

TYPE 5J32



RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release No. 462

January 5, 1946

sponsor:
General Electric Co.

RMA TYPE
5J33
Magnetron
(External Magnet Required)

GENERAL CHARACTERISTICS

Electrical

Filament - Tungsten		
Filament Voltage *		2.1 Volts
Filament Current	maximum	40 Amperes
Frequency		750 to 1150 Megacycles
Field Strength		1500 Gauss

Mechanical

Dimensions (See outline N-20501AZ)

Type of Cooling	Liquid and Forced-air
Anode, liquid cooling	2 Quarts Per Minute
Maximum Outlet Temperature	70 C

Seals

Forced-air cooling shall be provided so that the maximum seal temperature does not exceed 150 C.

Mounting Position - Any

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

	Typical Operation		Maximum Ratings	
D-C Plate Voltage ≠	1500	2200	2500	Volts
Plate Dissipation	360	630	700	Watts
Plate Input	600	880	900	Watts
D-C Plate Current	400	400	400	Milliamperes
Conversion Efficiency, approximate	40	30		Per Cent
Power Output	240	260		Watts
Frequency	750	1150		Megacycles
Duty				CW

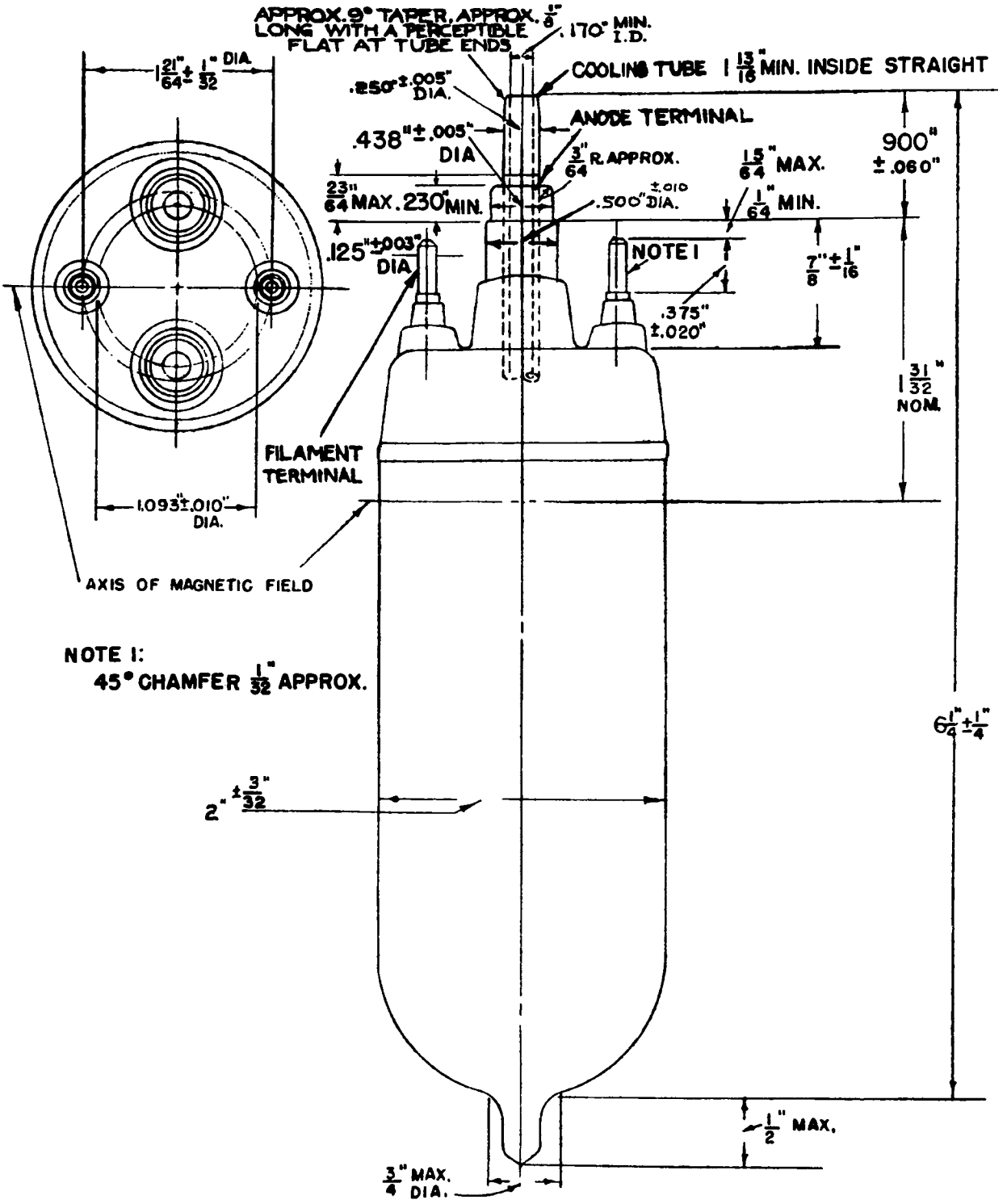
* The filament supply should provide 0 to 2.5 volts, continuously variable, at 40 amperes. In operation Ef should be adjusted to the lowest value consistent with optimum operation, then maintained accurately. During starting If should never exceed 60 amperes.

≠ The plate supply should have sufficiently poor regulation or series resistance to permit stable operation and prevent excessive plate dissipation. The tube should be operated with optimum loading at all times. Either overloading or insufficient loadin may result in undesirable operation or damage to the tube.

Release No. 462

January 5, 1946

TYPE 5J33



PRODUCT INFORMATION

5KZ8

Triode-Pentode

The 5KZ8 is a miniature tube containing a sharp-cutoff pentode and a medium-mu triode. It is intended primarily for service as a combined triode oscillator and pentode mixer in VHF television tuners.

Except for heater characteristics, the 5KZ8 is identical to the 6KZ8 and the 9KZ8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	4.7	Volts
Heater Current‡	0.6±0.04	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.6 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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DESCRIPTION AND RATING

CATHODE-RAY TUBE 5QP4

5-INCH ROUND, GLASS — DEFLECTION - MAGNETIC

FOCUS - MAGNETIC — FACEPLATE - CLEAR, METAL BACKED

The 5QP4 is a magnetic-focus and magnetic-deflection direct-view cathode-ray tube for industrial applications. A feature of this tube is a reflective metal-backed screen which reduces undesirable screen charging and increases high-light brightness.

TECHNICAL INFORMATION

GENERAL

Electrical

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Ampere
Focusing Method - Magnetic		
Deflecting Method - Magnetic		
Deflecting Angle, approximate	53	Degrees
Phosphor - P4, Sulfide Type		
Fluorescence - White		
Persistence - Short		
Faceplate - Clear		
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf

Mechanical

Over-all Length	11 1/8 ± 3/8	Inches
Greatest Diameter of Bulb	4 15/16 ± 3/32	Inches
Minimum Useful Screen Diameter	4 1/4	Inches

Anode Contact - Recessed Small-ball Cap, J1-22

Base - Long Medium-shell Octal 8-pin, B8-65

Basing - 5AN

Base Pin Connections

Pin 1 - No Connection	Pin 5 - Grid-No. 1
Pin 2 - Heater	Pin 6 - No Connection
Pin 3 - Grid-No. 2	Pin 7 - Cathode
Pin 4 - No Connection	Pin 8 - Heater

Anode Contact Alignment

Anode Contact Aligns With Pin-No. 5 ± 5 Degrees

Net Weight, approximate	1.5	Pounds

MAXIMUM RATINGS Design Center Values

Anode Voltage	12000 Max	Volts D-c
Grid-No. 2 Voltage	410 Max	Volts D-c
Grid-No. 1 Voltage		
Negative-bias Value	125 Max	Volts D-c
Positive-bias Value*	0 Max	Volts D-c
Positive-peak Value	2 Max	Volts

GENERAL ELECTRIC

from RTMA release #1054, Feb. 12, 1952

MAXIMUM RATINGS Design Center Values

Peak Heater-cathode Voltage†		
Heater Negative with Respect to Cathode		
During Warm-up Period Not to Exceed 15 Seconds	410 Max	Volts D-c
After Equipment Warm-up Period	125 Max	Volts D-c
Heater Positive with Respect to Cathode	125 Max	Volts D-c

JETEC COMPARATIVE CONDITIONS

Anode Voltage	12000	Volts
Grid-No. 2 Voltage	300	Volts
Grid-No. 1 Voltage‡	-28 to -72	Volts
Focusing-coil Current, approximate§	150	Milliamperes

RECOMMENDED OPERATING CONDITIONS

Anode Voltage◊ (Average Brightness = 20 Foot-Lamberts)	10000	Volts
Grid-No. 2 Voltage	300	Volts
Grid-No. 1 Voltage‡	-28 to -72	Volts
Focusing-coil Current (RTMA Coil No. 106 at 2 3/4 Inches), approximate	137	Milliamperes

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

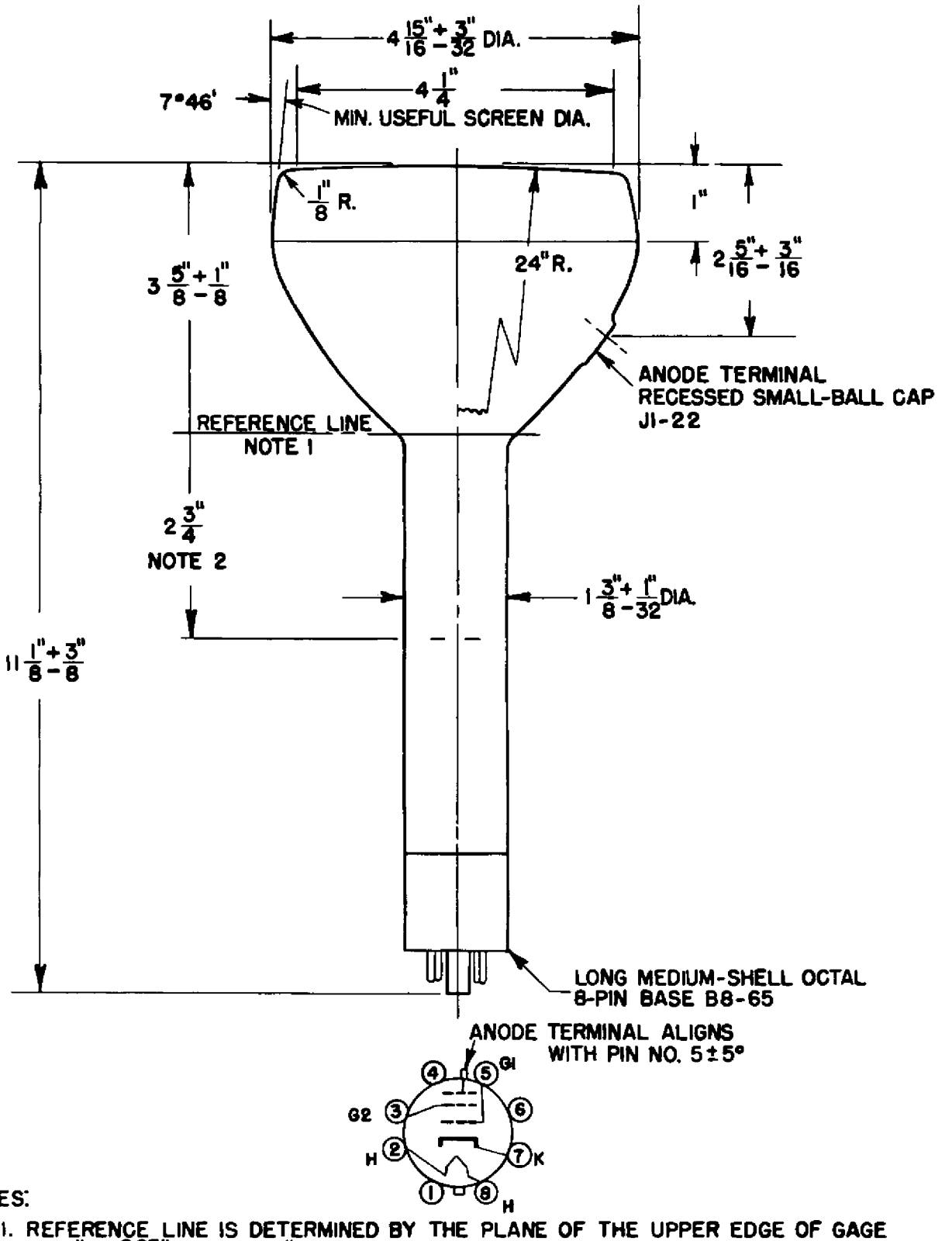
* At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode input power to 6 watts.

† Cathode should be returned to one side or to the midtap of the heater transformer winding.

‡ For visual extinction of undeflected focused spot.

§ For RTMA focusing coil No. 106 or equivalent, with the combined grid-No. 1 bias voltage and video-signal voltage adjusted to produce a high-light brightness of 20 foot-lamberts on a 2 7/8- by 3 7/8-inch picture area and with the distance from the reference line to center of air gap equal to 2 3/4 inches.

◊ Brilliance and definition decrease with decreasing anode voltage. In general the anode voltage should not be less than 5000 volts.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF GAGE 1.430" $^{+.003"}_{-.000"}$ ID AND 2" LONG WHEN THE GAGE IS RESTING ON THE BULB.
2. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.

N15197AZ January 22, 1952

5QP4
Outline

GENERAL ELECTRIC

ELECTRONICS DIVISION, TUBE DEPARTMENT

SCHENECTADY, NEW YORK

Electronic TUBES

5QP4-A

CATHODE-RAY TUBE

5-INCH ROUND, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
53-DEGREE DEFLECTION ANGLE
FACEPLATE—SPHERICAL, CLEAR
HIGH-RESOLUTION GUN
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 5QP4-A is a magnetic-focus and -deflection direct-view cathode-ray tube for use as a view-finder for television cameras. It has a high-resolution gun which affords an exceptionally narrow trace on the fluorescent screen. The screen is aluminized to increase light output, reduce undesirable screen charging, and prevent ion-spot blemish.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ±10%	Amperes

Focusing Method—Magnetic
Deflecting Method—Magnetic

Deflection Angle, approximate	53	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	8	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Clear

MECHANICAL

Over-all Length	11⅛ ±⅜	Inches
Greatest Bulb Diameter	$4\frac{15}{16} \pm \frac{3}{32}$	Inches
Minimum Useful Screen Diameter	4¼	Inches

Bulb Number, ASA Designation—J39½L
Bulb Contact—Recessed Small-ball Cap, JETEC No. J1-22
Base—Long Medium-shell Octal 8-Pin, JETEC No. B8-65
Basing, JETEC Designation—5AN
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 5 ±10 Degrees

Mounting Position—Any

GENERAL ELECTRIC

from JETEC release #1556, Dec. 27, 1955

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	12,000	Max Volts DC
Grid-No. 2 Voltage	700	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	180	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Grid-No. 1 Drive from Cutoff	65	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	180	Max Volts
Heater Positive with Respect to Cathode	180	Max Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage‡	10,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage§	−33 to −77	Volts DC
Focusing-Coil Current, approximateπ	137	Milliamperes DC
Line Width A▲	0.16	Millimeters

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5	Max Megohms

* The maximum ratings provide a ten percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes; that is, the tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

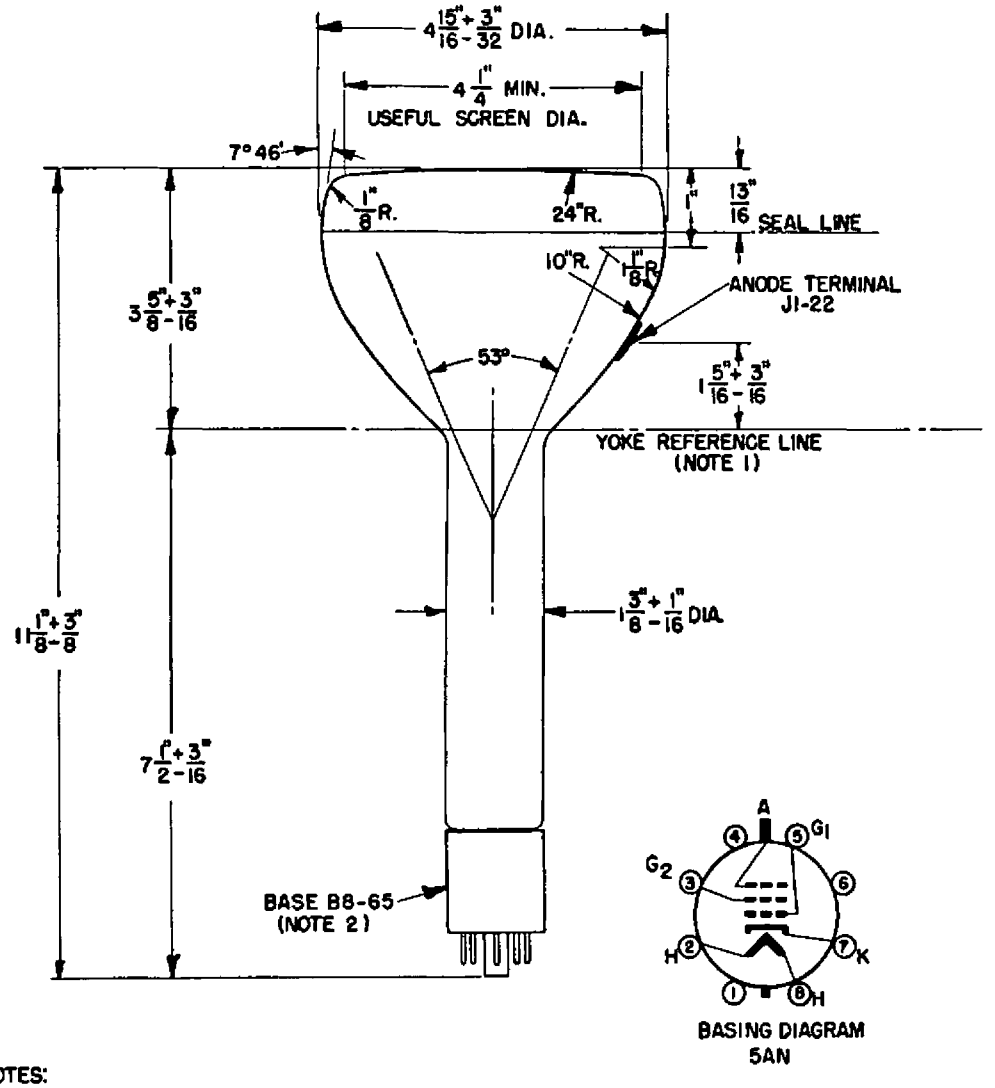
† Anode and Grid-No. 3 which are connected together within the tube are referred to herein as anode.

‡ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 5,000 volts.

§ For visual extinction of undeflected focused spot.

π For JETEC focusing coil No. 106 with distance from the yoke reference line to center of air gap equal to 2¾ inches.

▲Measured in accordance with MIL-E-1B, paragraph 4.12.6.2 at an anode current of 200 microamperes.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE POINT WHERE A GAGE 1.430 ±.003 INCHES INSIDE DIAMETER AND 2 INCHES IN LENGTH STOPS AGAINST THE CONE.
2. ANODE TERMINAL ALIGNS WITH PIN-NO. 5 ± 10 DEGREES.

K-69087-72A651

6-24-55



TELEVISION PICTURE TUBE

DESCRIPTION

The 5TP4 is a five-inch electrostatic-focus and magnetic-deflection projection picture tube for television applications. It is designed for use with a reflective optical system. Features of this tube are a reflective metal-backed screen which gives improved brightness, picture contrast and detail, and an external conductive coating on the neck which acts as a corona shield when grounded.

TECHNICAL INFORMATION

GENERAL

Electrical

Heater voltage	6.3	volts
Heater current	0.6 ± 10%	ampere
Focusing method—electrostatic		
Deflecting method—magnetic		
Deflecting angle	50 max	degrees
Phosphor—P4		
Fluorescence—white		
Persistence—medium		
Direct interelectrode capacitances, approximate		
Cathode to all other electrodes	5	uuf
Grid No. 1 to all other electrodes	7	uuf
External conductive coating to anode capacitance, approximate	300	uuf

GE Electronic TUBE

GENERAL ELECTRIC

Supersedes ET-T-419A dated 10-47

TECHNICAL INFORMATION (CONT'D)

Mechanical

Over-all length . . . . . $11\frac{3}{4} \pm \frac{3}{8}$ inches
Greatest bulb diameter . . . . . $5 \pm \frac{1}{8}$ inches
Minimum useful screen diameter . . . . . $4\frac{1}{2}$ inches
Anode contact—recessed small-cavity cap, J1-21
Base—small-shell duodecal 7-pin, B7-51
Basing—12C
Base pin connections

Pin 1—heater	Pin 7 —internal connection
Pin 2—grid No. 1	Pin 10—grid No. 2
Pin 6—anode No. 1	Pin 11—cathode
	Pin 12—heater

Anode contact alignment
Anode No. 2 contact aligns with vacant pin No. 3 position ±30 degrees

MAXIMUM RATINGS Design Center Values

Anode No. 2 voltage	27000 max	volts d-c
Anode No. 1 voltage	6000 max	volts d-c
Grid No. 2 voltage	350 max	volts d-c
Grid No. 1 voltage		
Negative-bias value	150 max	volts d-c
Positive-bias value	0 max	volt d-c
Positive-peak value	2 max	volts
Peak heater-cathode voltage*		
Heater negative with respect to cathode		
During warm-up period not to exceed 15 seconds	410 max	volts d-c
After equipment warm-up period	175 max	volts d-c
Heater positive with respect to cathode	10 max	volts d-c

RECOMMENDED OPERATING CONDITIONS

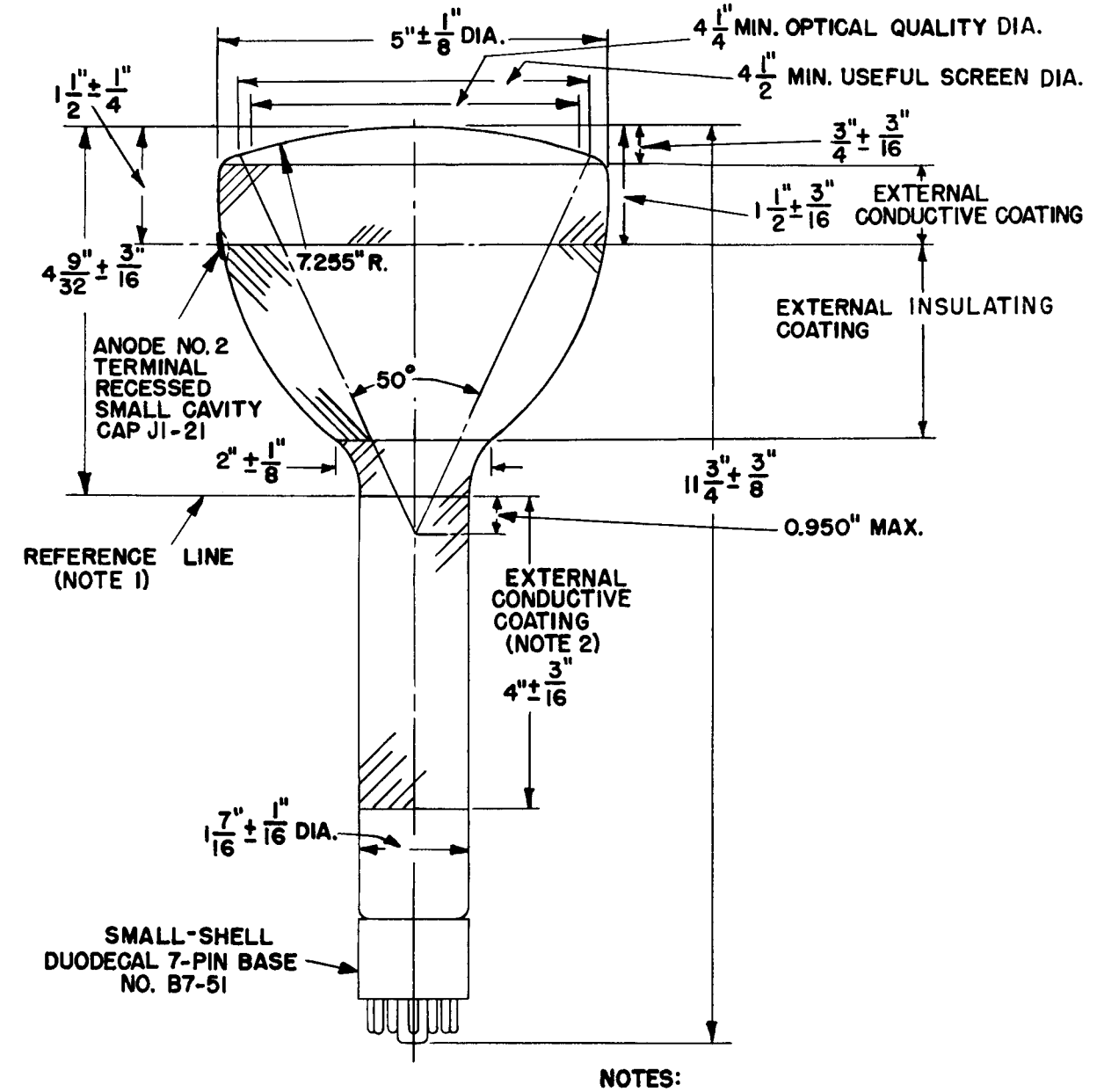
Anode No. 2 voltage	27000	volts
Anode No. 1 voltage	4320 to 5400	volts
Grid No. 2 voltage	200	volts
Grid No. 1 voltage**	−42 to −98	volts
Anode No. 2 current	200	microamperes
Anode No. 1 current	75 max	microamperes
Grid No. 2 current	−15 to +15 max	microamperes

MAXIMUM CIRCUIT VALUES

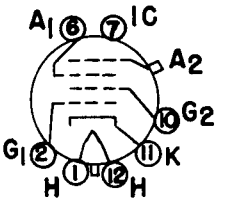
Grid No. 1 circuit resistance	1.5 max	megohms

*Cathode should be returned to one side or to the midtap of the heater transformer winding.
**For visual extinction of undeflected focused spot.

OUTLINE
5TP4



ANODE-NO. 2 TERMINAL ALIGNS WITH VACANT PIN-NO. 3 POSITION ± 30°



BASING DIAGRAM

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE LINE GAGE (RTMA NO. 112) WHEN THE GAGE IS RESTING ON THE GLASS CONE.
2. EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

N-20103AZ

1-26-51

Electronic TUBES

5U4-GB

TWIN DIODE

FOR FULL-WAVE POWER RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 5U4-GB is a filamentary twin diode designed for use as a full-wave rectifier in the power supply of television receivers or other equipment which have high direct-current requirements. The 5U4-GB employs a straight-sided T-12 envelope and may be used as a replacement for either the 5U4-G or 5U4-GA.

GENERAL

ELECTRICAL

Cathode—Coated Filament
Filament Voltage, AC or DC . . . . . 5.0 Volts
Filament Current . . . . . 3.0 Amperes

MECHANICAL

Mounting Position—Vertical*
Envelope—T-12, Glass
Base—B5-121 or B5-113, Short Medium Shell Octal 5-Pin
or B5-127, Flared Medium Shell Octal 5-Pin
or B8-118, Short Medium Shell Octal 8-Pin

MAXIMUM RATINGS

RECTIFIER SERVICE—DESIGN-CENTER VALUES†

Peak Inverse Plate Voltage . . . . . 1550 Volts
AC Plate-Supply Voltage per Plate—See Rating Chart I‡
Steady-State Peak Plate Current per Plate . . . . . 1000 Milliamperes
Transient Peak Plate Current per Plate,
Maximum Duration 0.2 Second . . . . . 4.6 Amperes
DC Output Current—See Rating Chart I‡

CHARACTERISTICS AND TYPICAL OPERATION

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

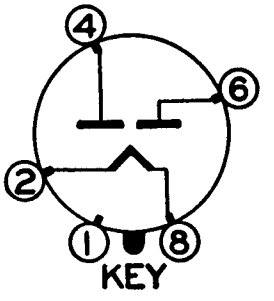
AC Plate-Supply Voltage per Plate, RMS	300	450 Volts
Filter Input Capacitor	40	40 Microfarads
Total Plate-Supply Resistance per Plate	21	67 Ohms
DC Output Current	300	275 Milliamperes
DC Output Voltage at Filter Input	290	460 Volts

FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER

AC Plate-Supply Voltage per Plate, RMS . . . . . 550 Volts
Filter Input Choke . . . . . 10 Henrys
DC Output Current . . . . . 275 Milliamperes
DC Output Voltage at Filter Input . . . . . 440 Volts
Tube Voltage Drop
Ib = 275 Milliamperes DC per Plate . . . . . 50 Volts

GENERAL ELECTRIC

BASING DIAGRAM

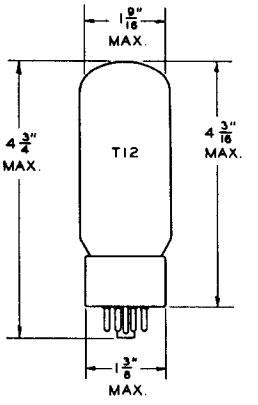


RETMA 5T

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Filament
Pin 4—Plate Number 2
Pin 6—Plate Number 1
Pin 8—Filament

PHYSICAL DIMENSIONS



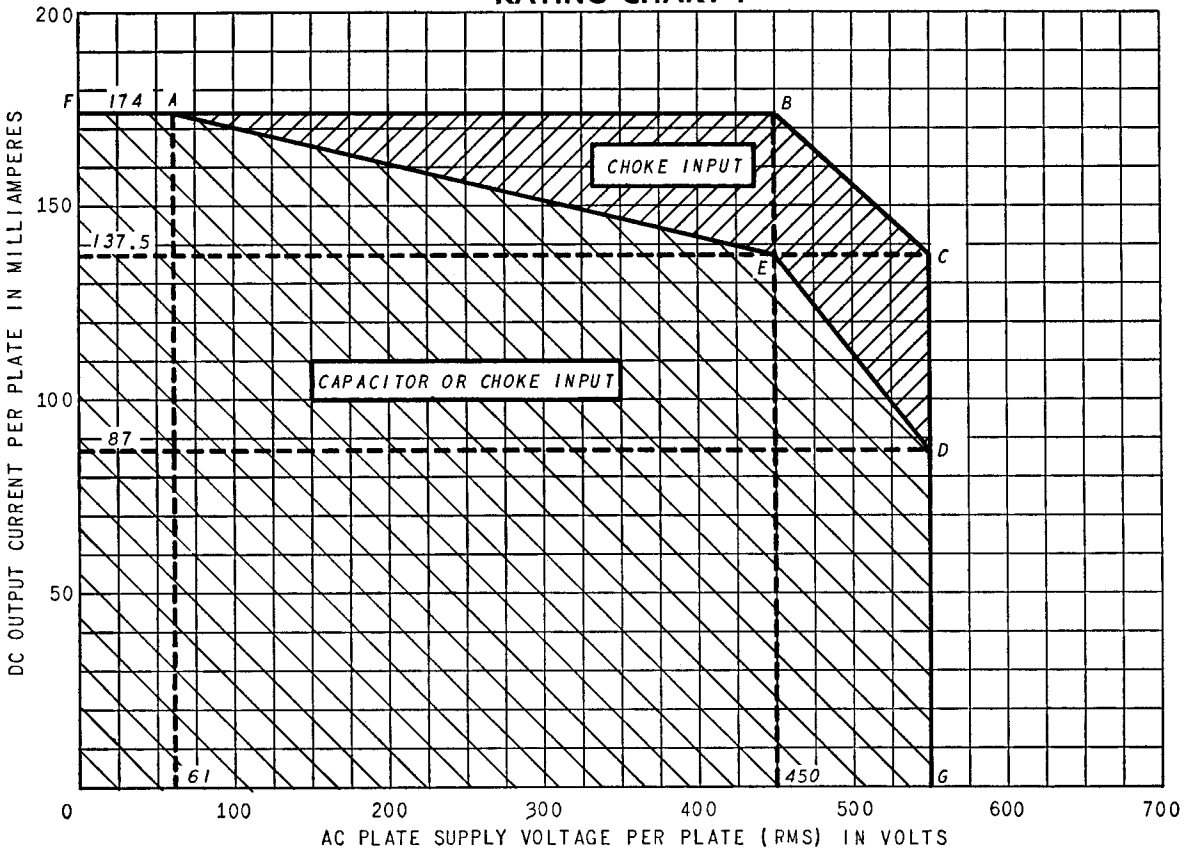
* Horizontal operation is permitted if pins 1 and 4 are in a vertical plane.

† To simplify the application of the maximum ratings to circuit design, the electrical design-center maximum ratings are also presented in chart form as Rating Charts I, II, and III. Rating Chart I presents the maximum ratings for a-c plate supply voltage and d-c output current. Rating Chart II provides a convenient method for checking conformance with the maximum steady-state peak-plate-current rating. Rating Chart III offers a convenient method for checking conformance with the maximum transient peak-plate-current rating. With a capacitor-input filter, the conditions of each of Rating Charts I, II, and III must be satisfied; with a choke-input filter, operation must be within the indicated boundary of Rating Chart I.

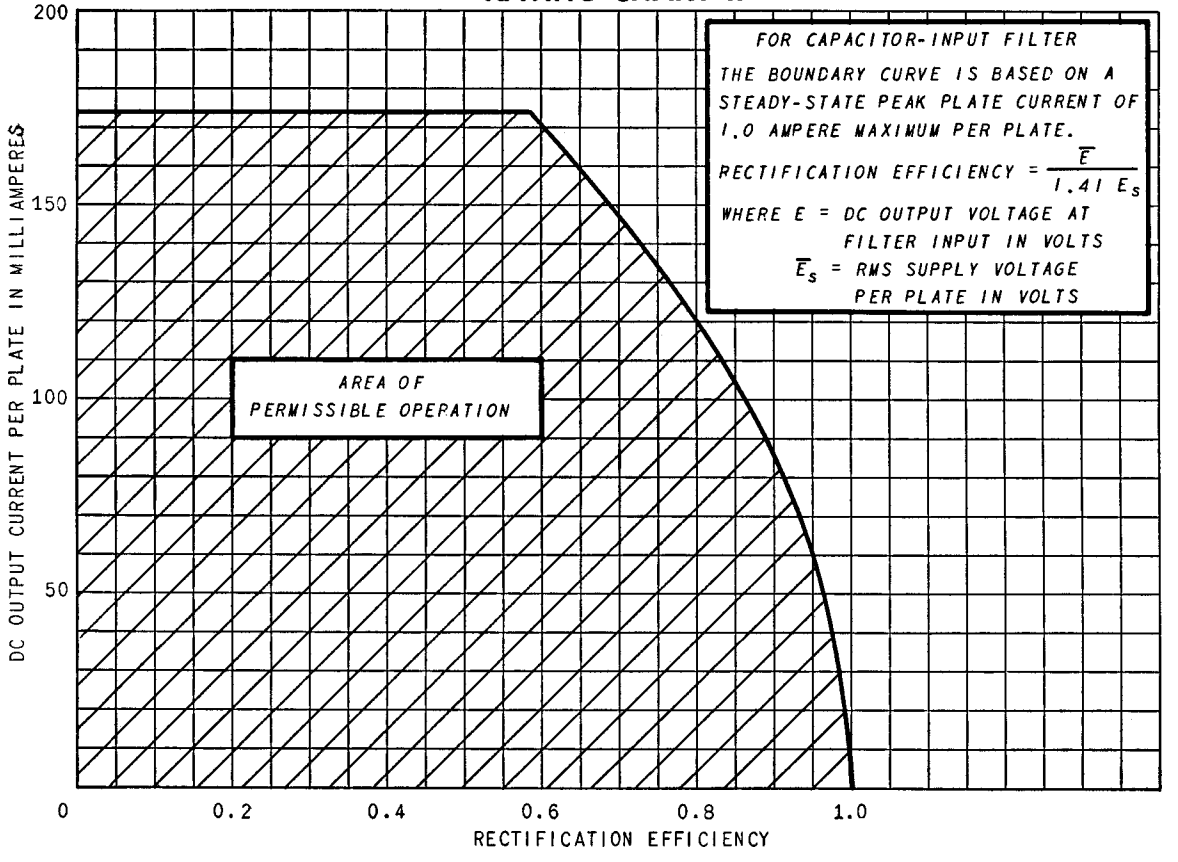
‡ The maximum ratings for a-c plate supply voltage and d-c output current are interrelated and are also dependent on whether a choke- or capacitor-input filter is employed. This relationship is shown in Rating Chart I. With a capactor-input filter, the operating point of d-c output current and a-c supply voltage must fall within the curve FAEDG. With a choke-input filter, the operating point must fall within the curve FABCDG.

NOTE: The indicated values of a-c plate-supply voltage shown throughout the data are measured without load.

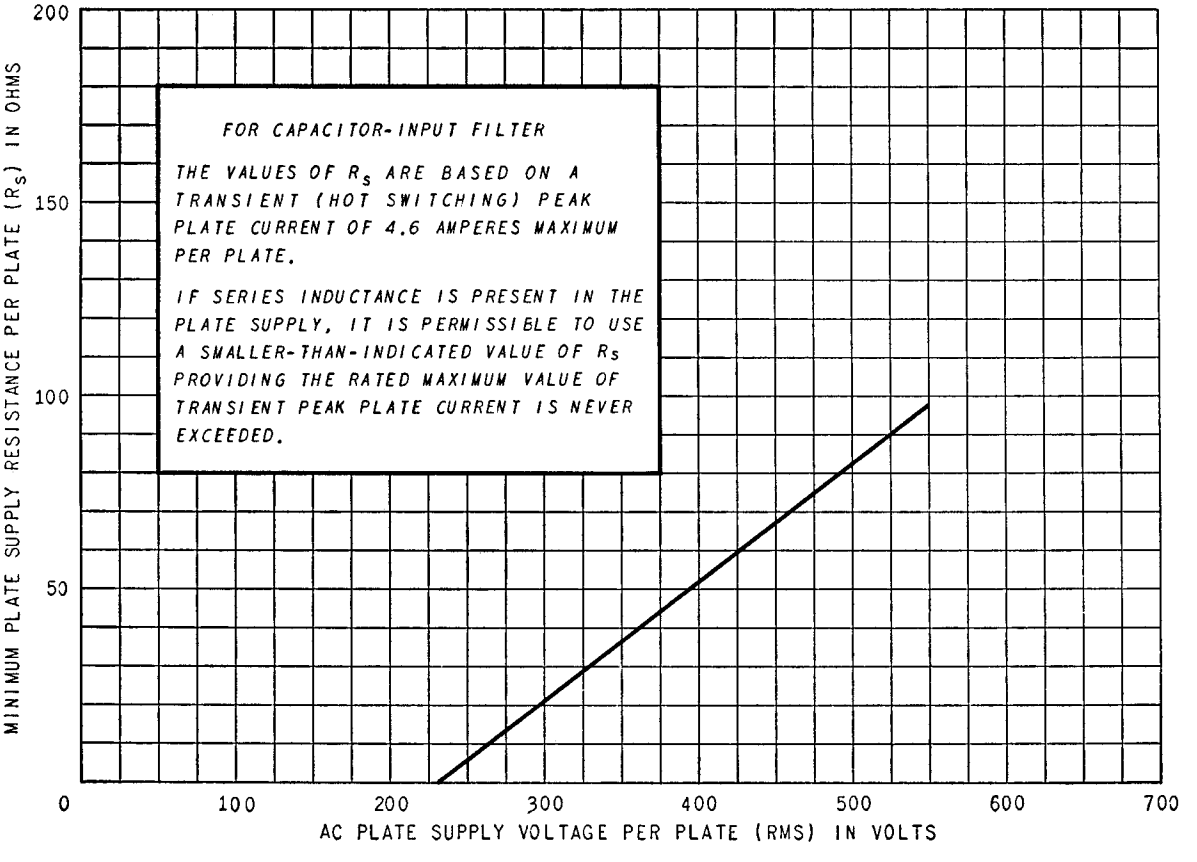
RATING CHART I



RATING CHART II

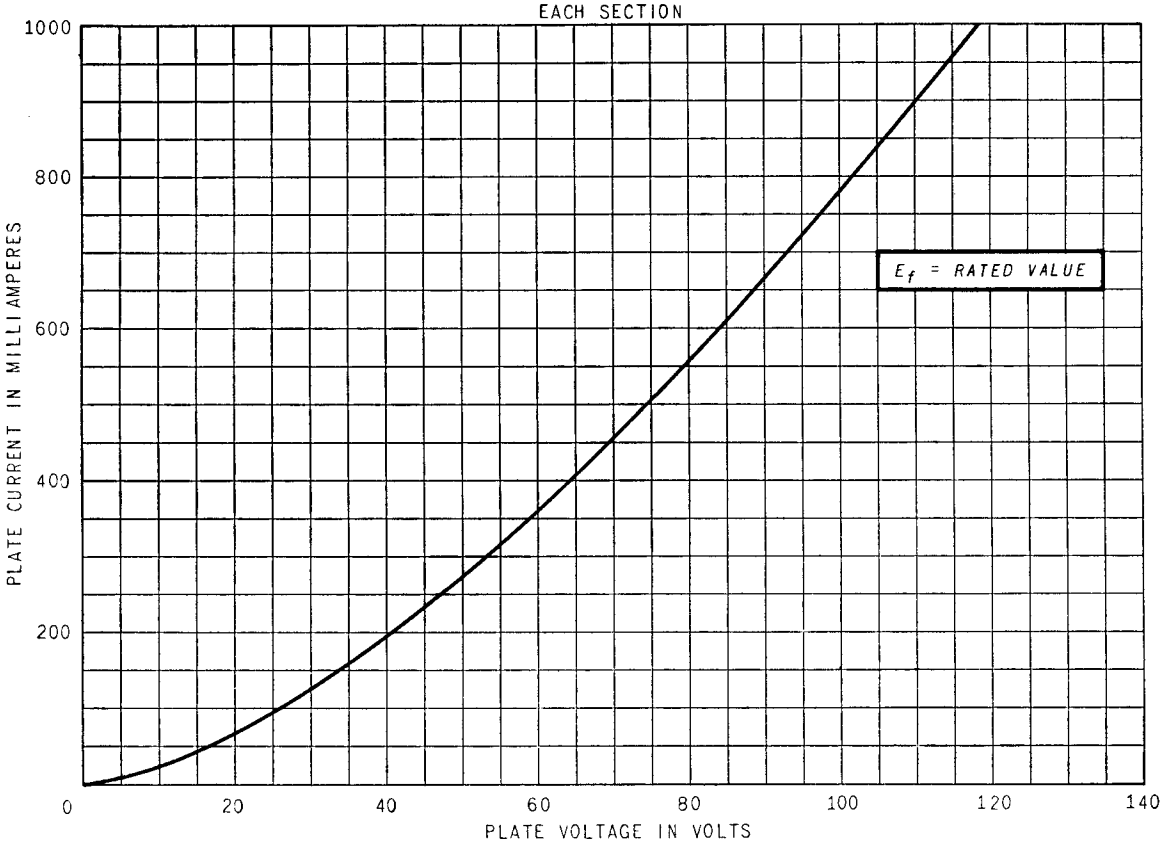


RATING CHART III



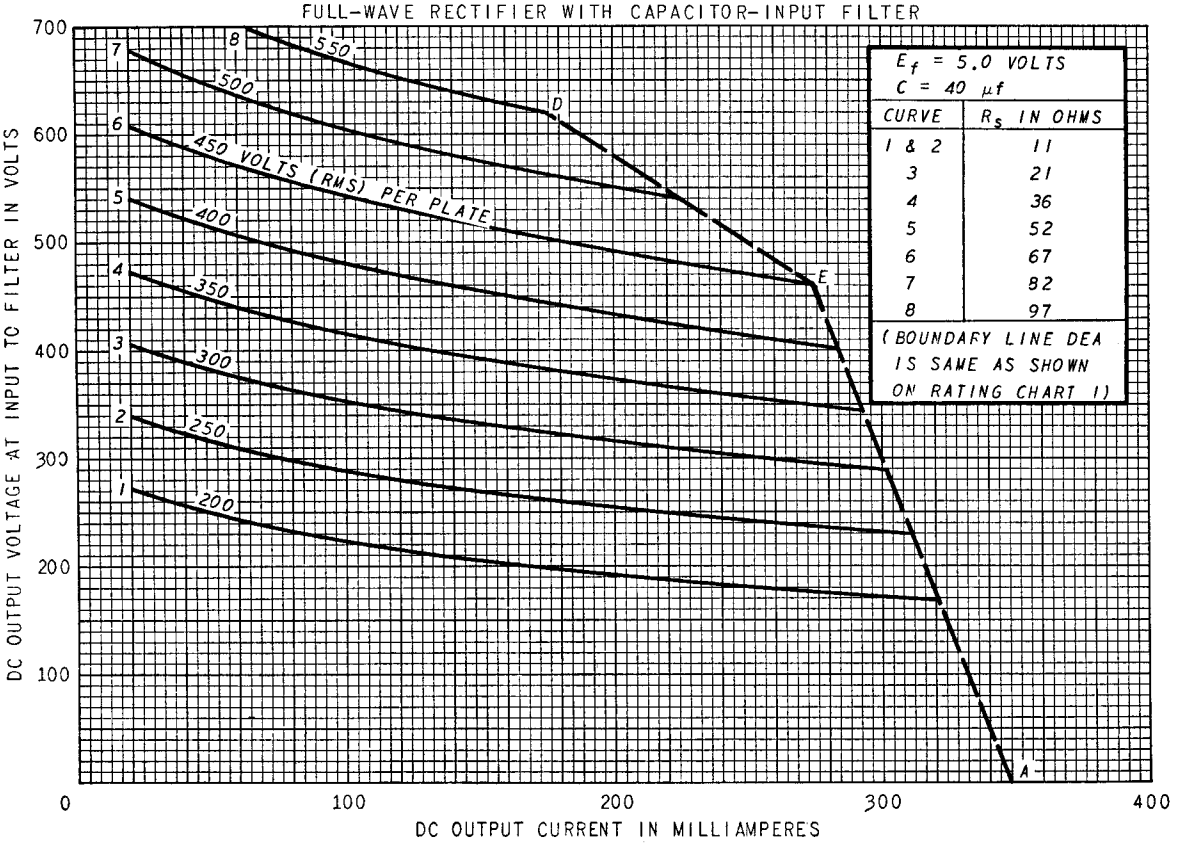
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



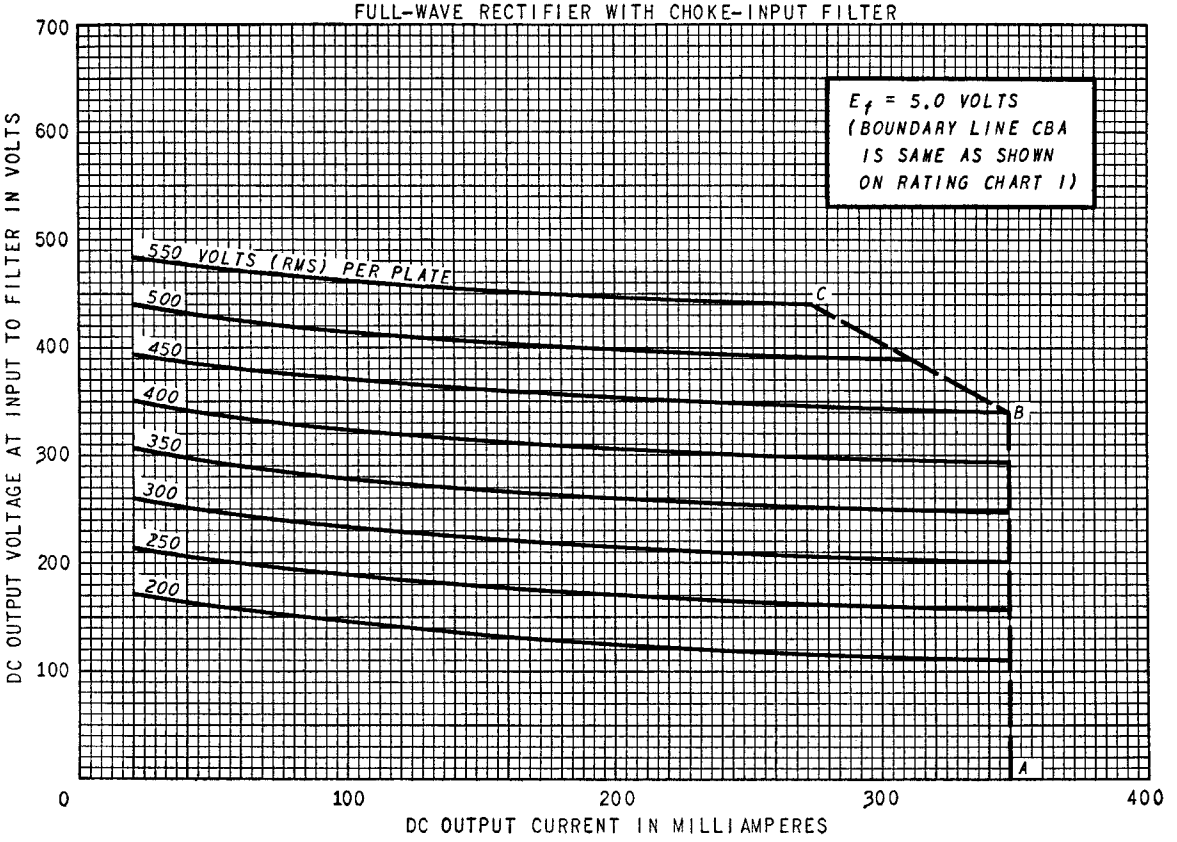
OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER



OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER



Electronic TUBES

5V3

TWIN DIODE

FOR FULL-WAVE POWER RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 5V3 is a filamentary twin diode designed for use as a full-wave rectifier in the power supply of color television receivers or other equipment that has high direct-current requirements.

GENERAL

ELECTRICAL

Cathode—Coated Filament

Filament-Voltage, AC or DC	5.0 ± 10%	Volts
Filament-Current	3.8	Amperes

MECHANICAL

Mounting Position—Vertical*
Envelope—T-12, Glass
Base—B8-118, Short Medium-Shell Octal 8-Pin

MAXIMUM RATINGS

RECTIFIER SERVICE—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	1550	Volts
AC Plate-Supply Voltage, per Plate—See Rating Chart I, page 3		
Steady-State Peak Plate Current, per Plate	1.3	Amperes
Transient Peak Plate Current, per Plate, Maximum Duration 0.2 Second	6.0	Amperes
DC Output Current—See Rating Chart I, page 3		

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

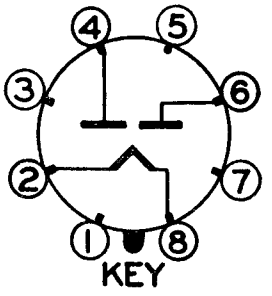
These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM

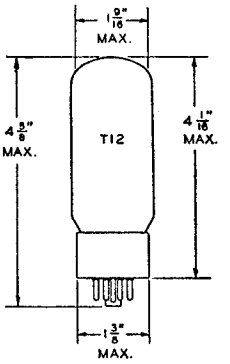


EIA 5T

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Filament
Pin 3—No Connection
Pin 4—Plate Number 2
Pin 5—No Connection
Pin 6—Plate Number 1
Pin 7—No Connection
Pin 8—Filament

PHYSICAL DIMENSIONS



EIA 12-16

CHARACTERISTICS AND TYPICAL OPERATION

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

AC Plate-Supply Voltage, per Plate, RMS	300	425	Volts
Filter Input Capacitor	40	40	Microfarads
Total Plate-Supply Resistance, per Plate	24	56	Ohms
DC Output Current	380	350	Milliamperes
DC Output Voltage at Filter Input	285	430	Volts

FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER

AC Plate-Supply Voltage, per Plate, RMS	500	Volts
Filter Input Choke	10	Henrys
DC Output Current	350	Milliamperes
DC Output Voltage at Filter Input	385	Volts
Tube Voltage Drop		
Ib = 350 Milliamperes DC per Plate	47	Volts

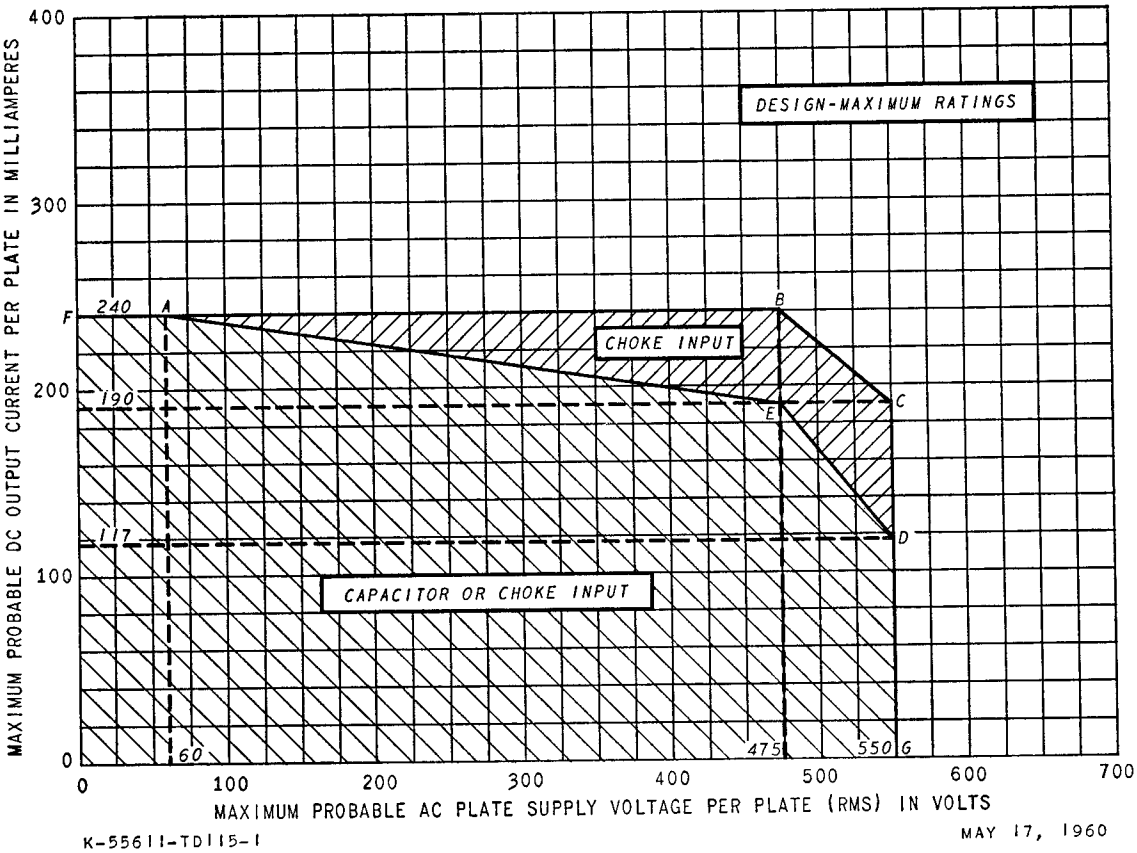
* Horizontal operation is permitted if pins 2 and 4 are in a vertical plane.

To simplify the application of the maximum ratings to circuit design, the Design-Maximum ratings are presented in chart form as Rating Charts I, II, and III. Rating Chart I presents the maximum ratings for a-c plate supply voltage and d-c output current. Rating Chart II provides a convenient method for checking conformance with the maximum steady-state peak-plate-current rating. Rating Chart III offers a convenient method for checking conformance with the maximum transient peak-plate-current rating. Rating Chart I applies to both capacitor-input and choke-input filters, while Rating Charts II and III apply to capacitor-input filters only.

Operating points should be so selected that the boundary limits of a-c plate supply voltage and d-c output current on Rating Chart I, and maximum d-c output current per plate and rectification efficiency on Rating Chart II, are not exceeded with a bogey tube under the worst probable conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, and environmental conditions. On Rating Chart I the boundary FAEDG defines the limits for capacitor-input filter operation, and the boundary FABCDG defines the limits for choke-input filter operation.

Rating Chart III shows the minimum value of plate-supply resistance (R_s) required to remain within the transient peak-plate-current rating. The value of R_s should be such that it lies to the left of the line on Rating Chart III at the highest probable value of line voltage.

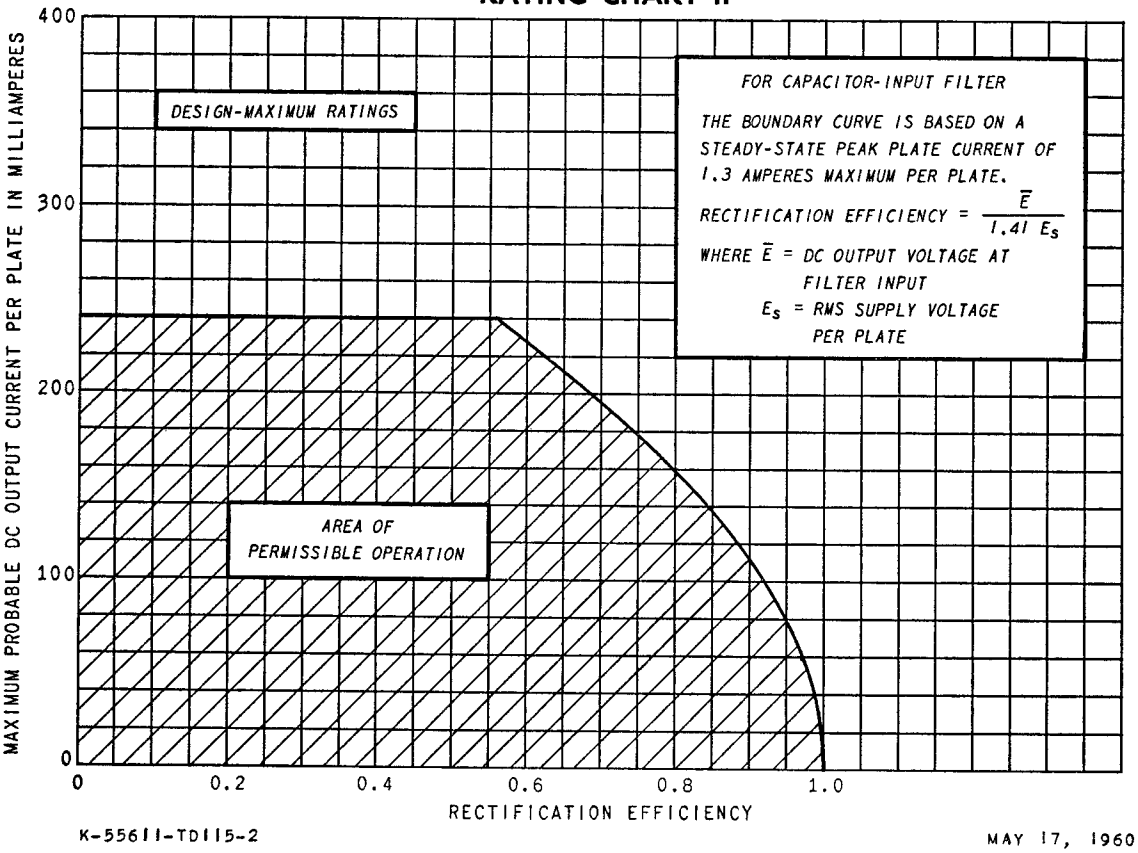
RATING CHART I



K-55611-TD115-1

MAY 17, 1960

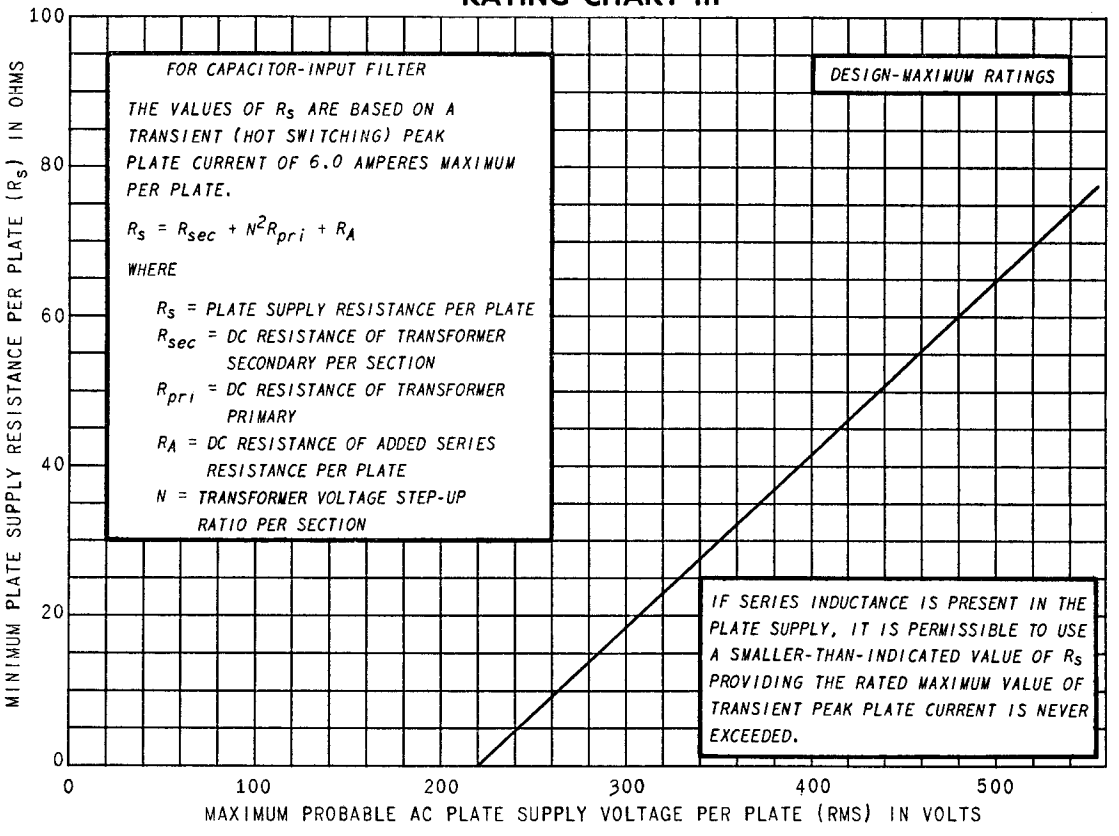
RATING CHART II



K-55611-TD115-2

MAY 17, 1960

RATING CHART III

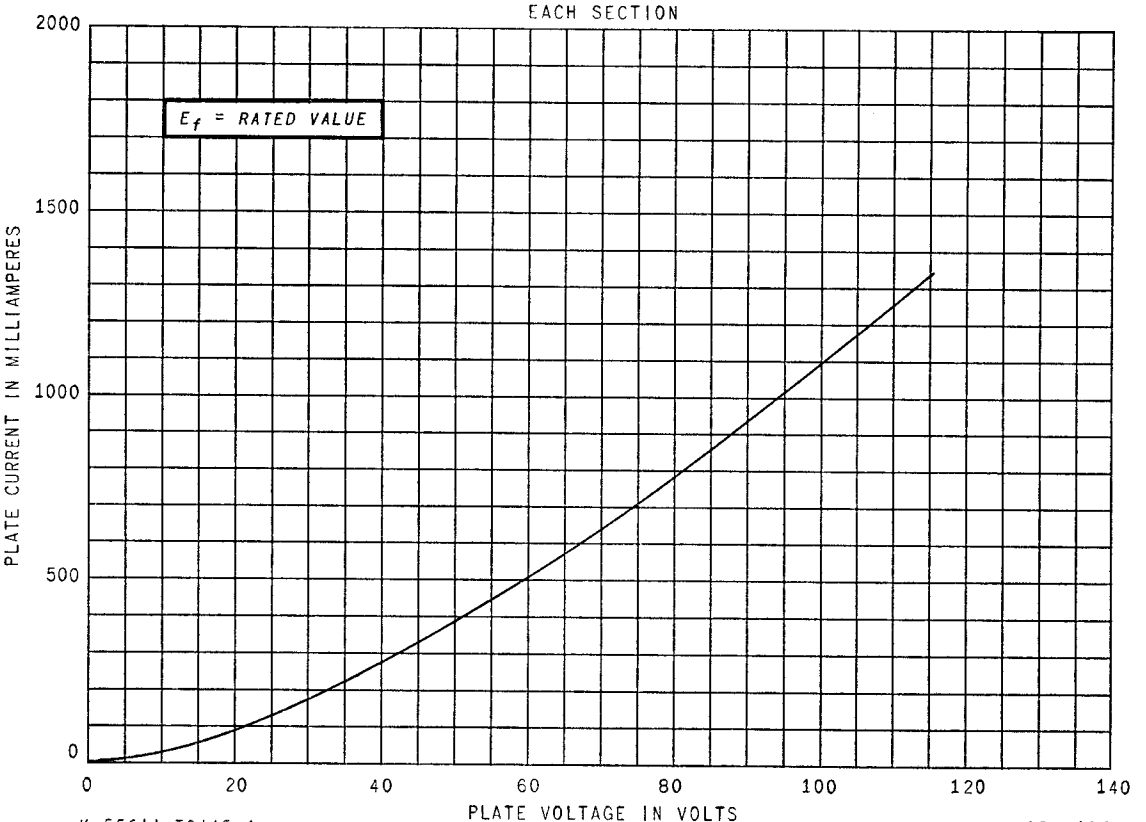


K-5561I-TD1I5-3

MAY 17, 1960

AVERAGE PLATE CHARACTERISTICS

EACH SECTION

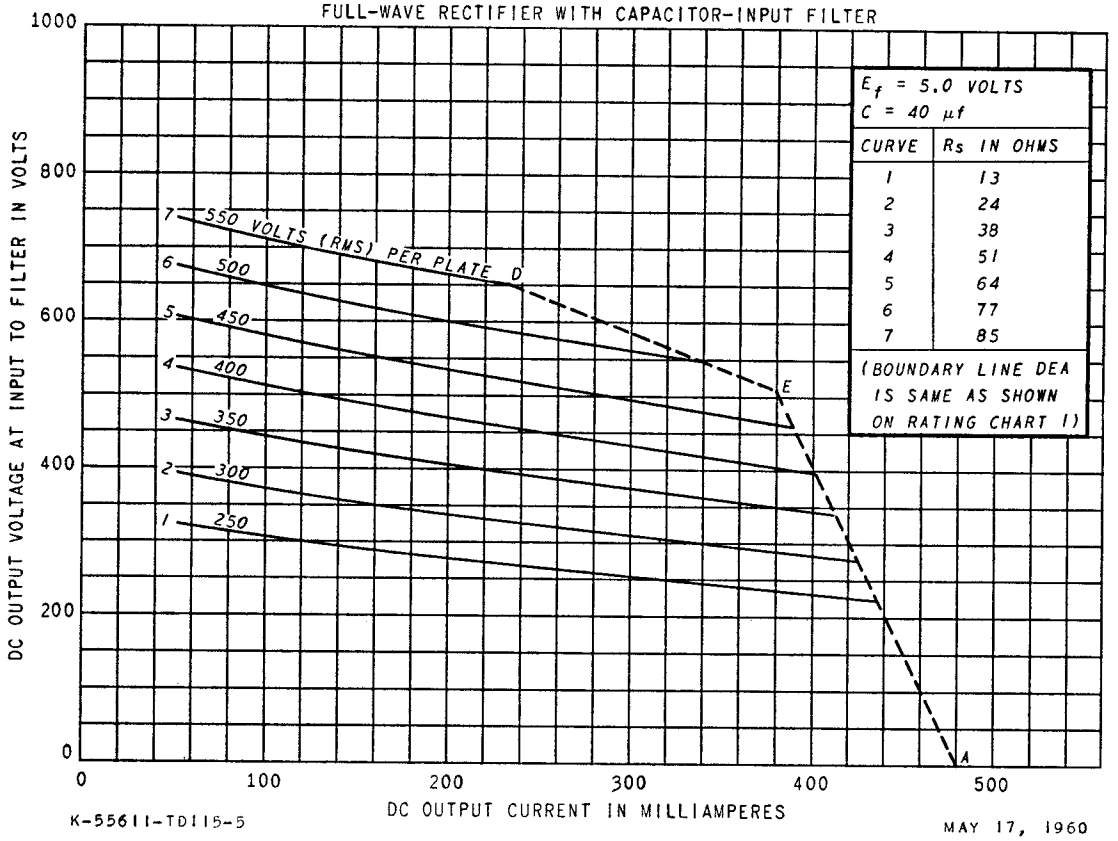


K-5561I-TD1I5-4

MAY 17, 1960

OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

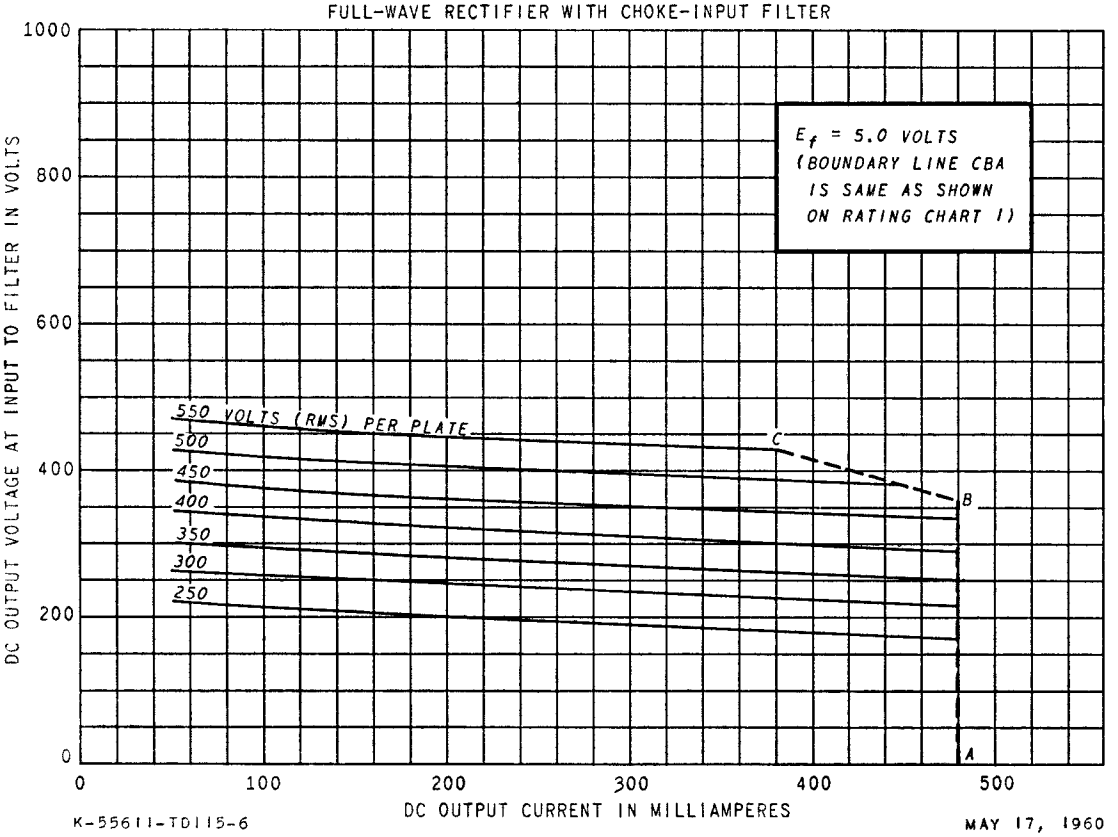


K-55611-TD115-5

MAY 17, 1960

OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER



K-55611-TD115-6

MAY 17, 1960

Electronic TUBES

5V4-GA

TWIN DIODE

FOR FULL-WAVE POWER-RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 5V4-GA is a high-vacuum rectifier intended for use in full-wave applications. The tube incorporates an indirectly heated cathode which is internally connected to the heater. Except for the use of a straight-sided T-12 envelope, the 5V4-GA is identical to the 5V4-G.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	5.0	Volts
Heater Current	2.0	Amperes

MECHANICAL

Mounting Position—Any

Envelope—T-12, Glass

Base—B5-15, Medium-Shell Octal 5-Pin
or B5-121, Short-Medium-Shell Octal 5-Pin

MAXIMUM RATINGS

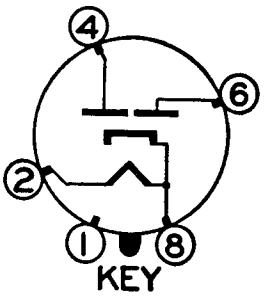
RECTIFIER SERVICE—DESIGN-CENTER VALUES

Peak Inverse Plate Voltage	1400	Volts
AC Plate-Supply Voltage per Plate, RMS		
For Capacitor-Input Filter	375	Volts
For Choke-Input Filter	500	Volts
Steady-State Peak Plate Current per Plate	525	Milliamperes
Transient Peak Plate Current per Plate, Maximum Duration 0.2 Second	3.5	Amperes
DC Output Current	175	Milliamperes

CHARACTERISTICS AND TYPICAL OPERATION

FULL-WAVE RECTIFIER	Capacitor-Input Filter	Choke-Input Filter	
AC Plate-Supply Voltage per Plate, RMS	375	500	Volts
Filter Input Capacitor	10	....	Microfarads
Filter Input Choke	....	4	Henrys
Total Effective Plate-Supply Impedance per Plate	100	....	Ohms
DC Output Current	175	175	Milliamperes
DC Output Voltage at Filter Input	410	410	Volts
Tube Voltage Drop Ib = 175 Milliamperes DC per Plate	25		Volts

BASING DIAGRAM

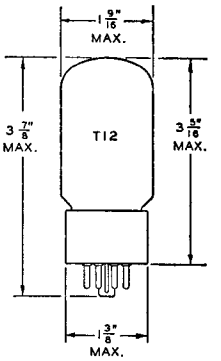


RETMA 5L

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Heater
Pin 4—Plate Number 2
Pin 6—Plate Number 1
Pin 8—Heater and Cathode

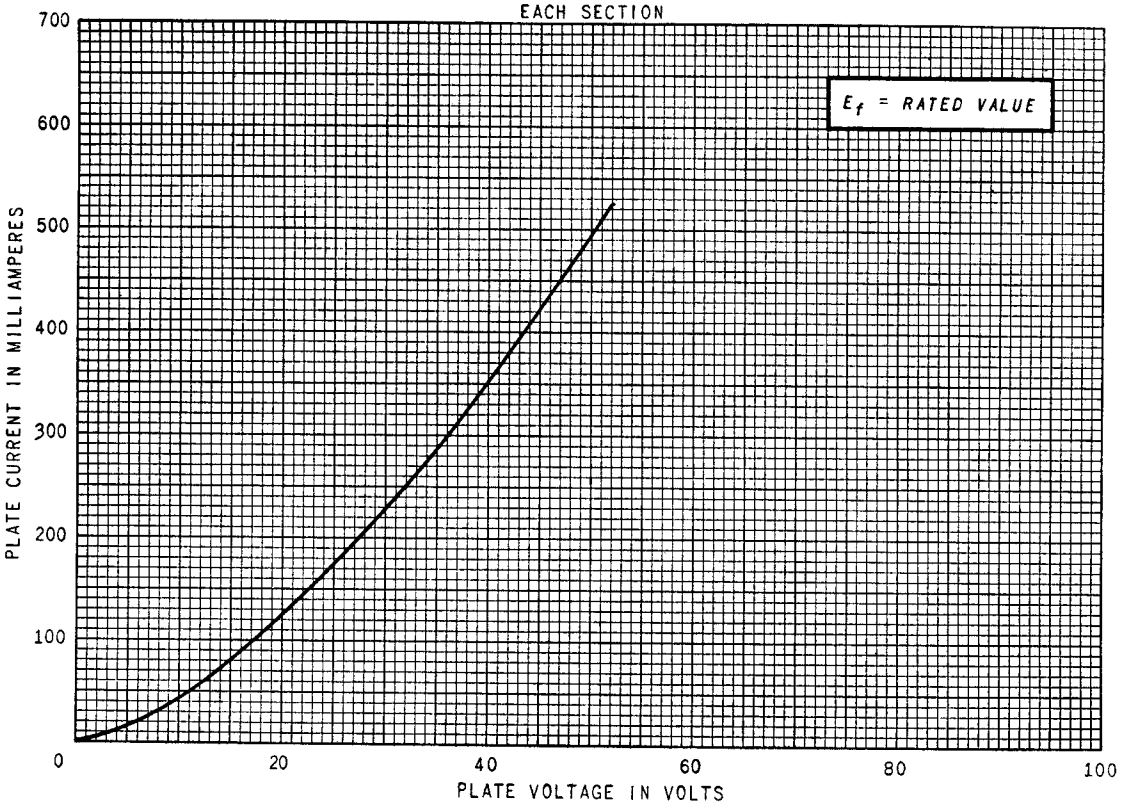
PHYSICAL DIMENSIONS



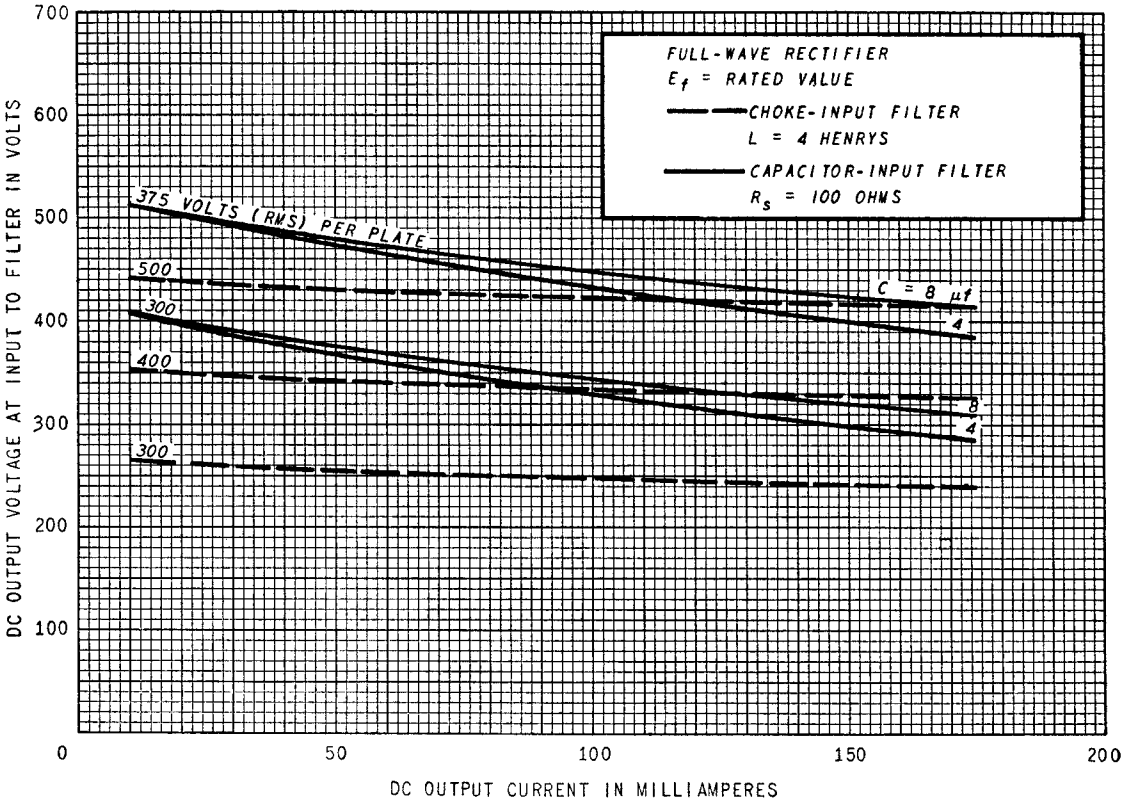
GENERAL ELECTRIC

AVERAGE PLATE CHARACTERISTICS

EACH SECTION



OPERATION CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

5Y3-GT

TWIN DIODE

FOR FULL-WAVE POWER RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 5Y3-GT is a filamentary twin-diode designed for full-wave rectifier operation in power supplies that have d-c output current requirements up to approximately 125 milliamperes.

GENERAL

ELECTRICAL

Cathode—Coated Filament

Filament Voltage, AC or DC	5.0 Volts
Filament Current	2.0 Amperes

MECHANICAL

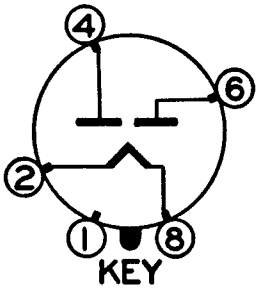
Mounting Position—Vertical*
Envelope—T-9, Glass
Base—B5-10, Intermediate Shell Octal 5-Pin
or B5-62, Short Intermediate Shell Octal 5-Pin

MAXIMUM RATINGS

RECTIFIER SERVICE—DESIGN-CENTER VALUES†

Peak Inverse Plate Voltage	1400	Volts
AC Plate-Supply Voltage per Plate—See Rating Chart I‡		
Steady-State Peak Plate Current per Plate	440	Milliamperes
Transient Peak Plate Current per Plate, Maximum Duration 0.2 Second	2.5	Amperes
DC Output Current—See Rating Chart I‡		

BASING DIAGRAM

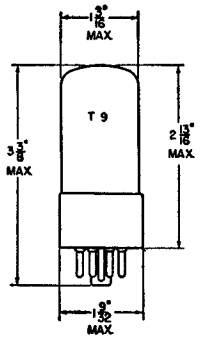


RETMA 5T

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Filament
Pin 4—Plate Number 2
Pin 6—Plate Number 1
Pin 8—Filament

PHYSICAL DIMENSIONS



RETMA 9–13 OR 9–42

GENERAL ELECTRIC

Supersedes ET-T250B, dated 6-50

CHARACTERISTICS AND TYPICAL OPERATION

FULL-WAVE RECTIFIER

	Capacitor-Input Filter	Choke Input Filter	
AC Plate-Supply Voltage per Plate, RMS	350	500	Volts
Filter Input Capacitor	20	...	Microfarads
Filter Input Choke	...	10	Henrys
Total Plate-Supply Resistance per Plate	50	...	Ohms
DC Output Current	125	125	Milliamperes
DC Output Voltage at Filter Input	360	380	Volts

Tube Voltage Drop

I_b = 125 Milliamperes DC per Plate ..... 50 Volts

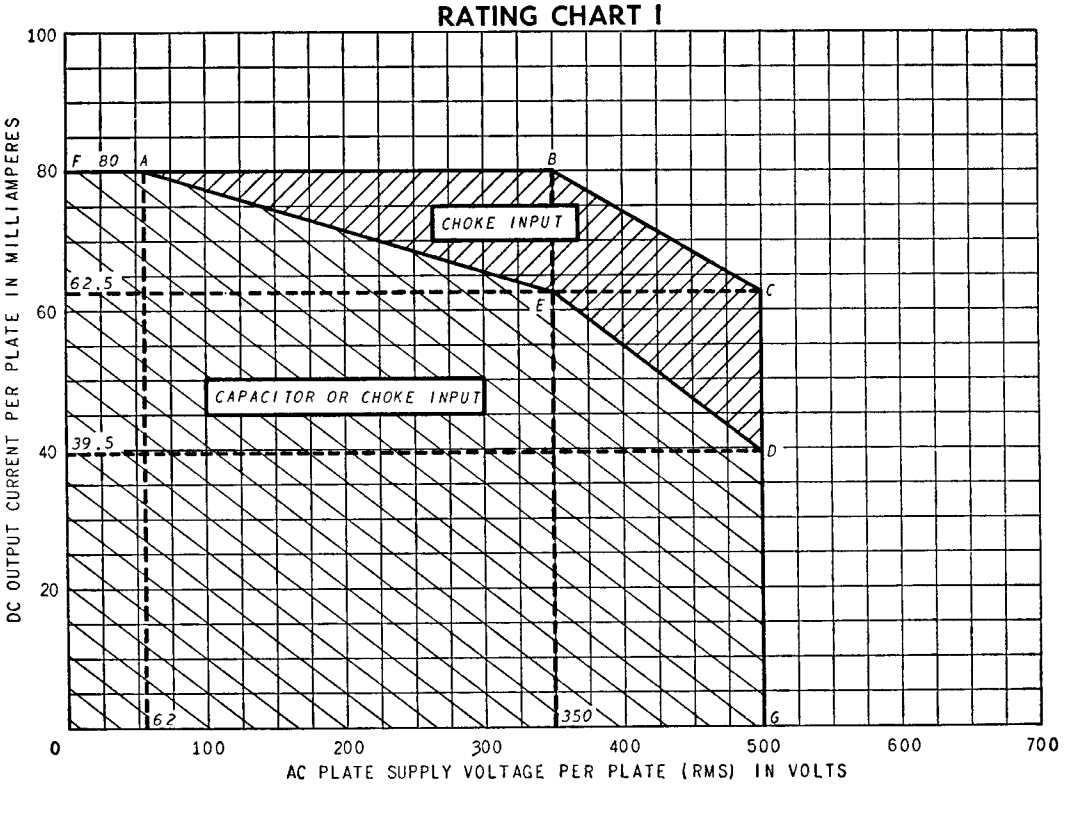
* Horizontal operation is permitted if pins 2 and 4 are in a vertical plane.

† To simplify the application of the maximum ratings to circuit design, the electrical design-center maximum ratings are also presented in chart form as Rating Charts I, II, and III. Rating Chart I presents the maximum ratings for a-c plate supply voltage and d-c output current. Rating Chart II provides a convenient method for checking conformance with the maximum steady-state peak-plate-current rating. Rating Chart III offers a convenient method for checking conformance with the maximum transient peak-plate-current rating.
With a capacitor-input filter, the conditions of each of Rating Charts I, II, and III must be satisfied; with a choke-input filter, operation must be within the indicated boundary of Rating Chart I.

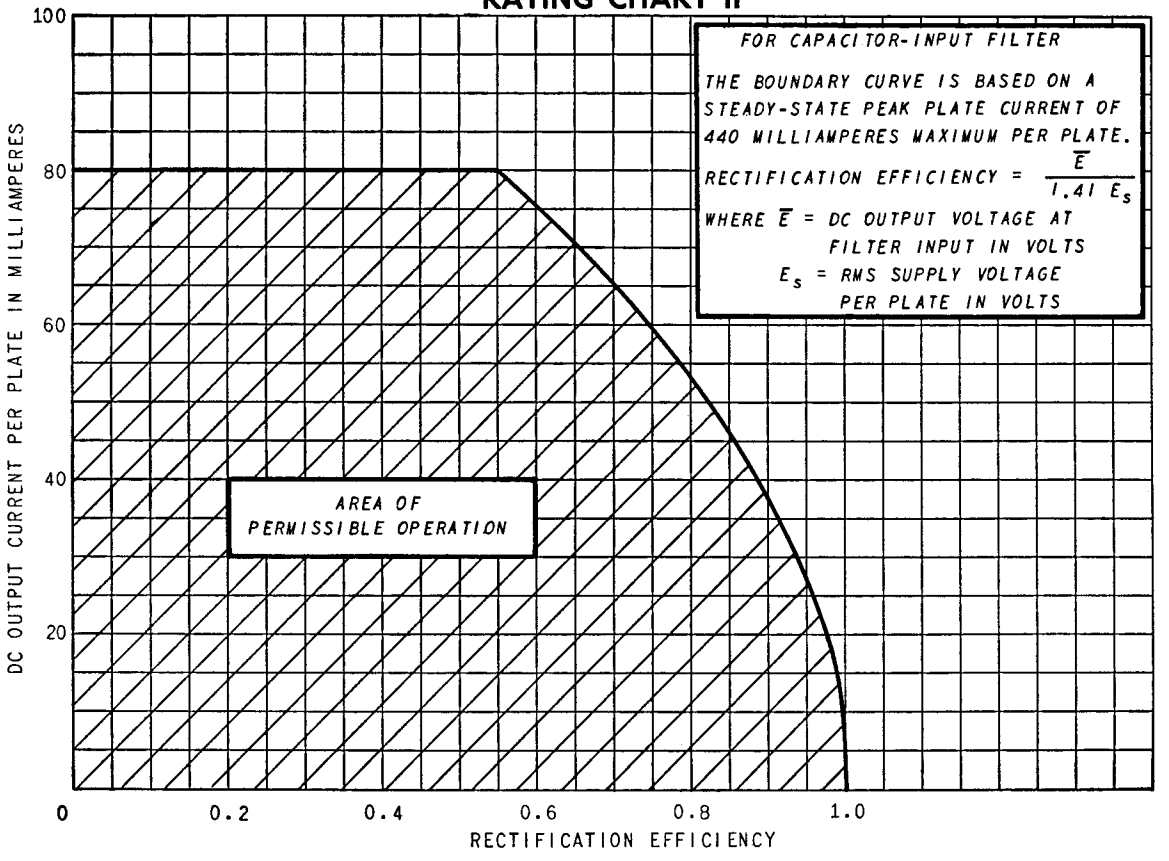
‡ The maximum ratings for a-c plate supply voltage and d-c output current are interrelated and are also dependent on whether a choke- or capacitor-input filter is employed. This relationship is shown in Rating Chart I. With a capacitor-input filter, the operating point of d-c output current and a-c supply voltage must fall within the curve FAEDG. With a choke-input filter, the operating point must fall within the curve FABCDG.

Note: The indicated values of a-c plate supply voltage shown throughout the data are measured without load.

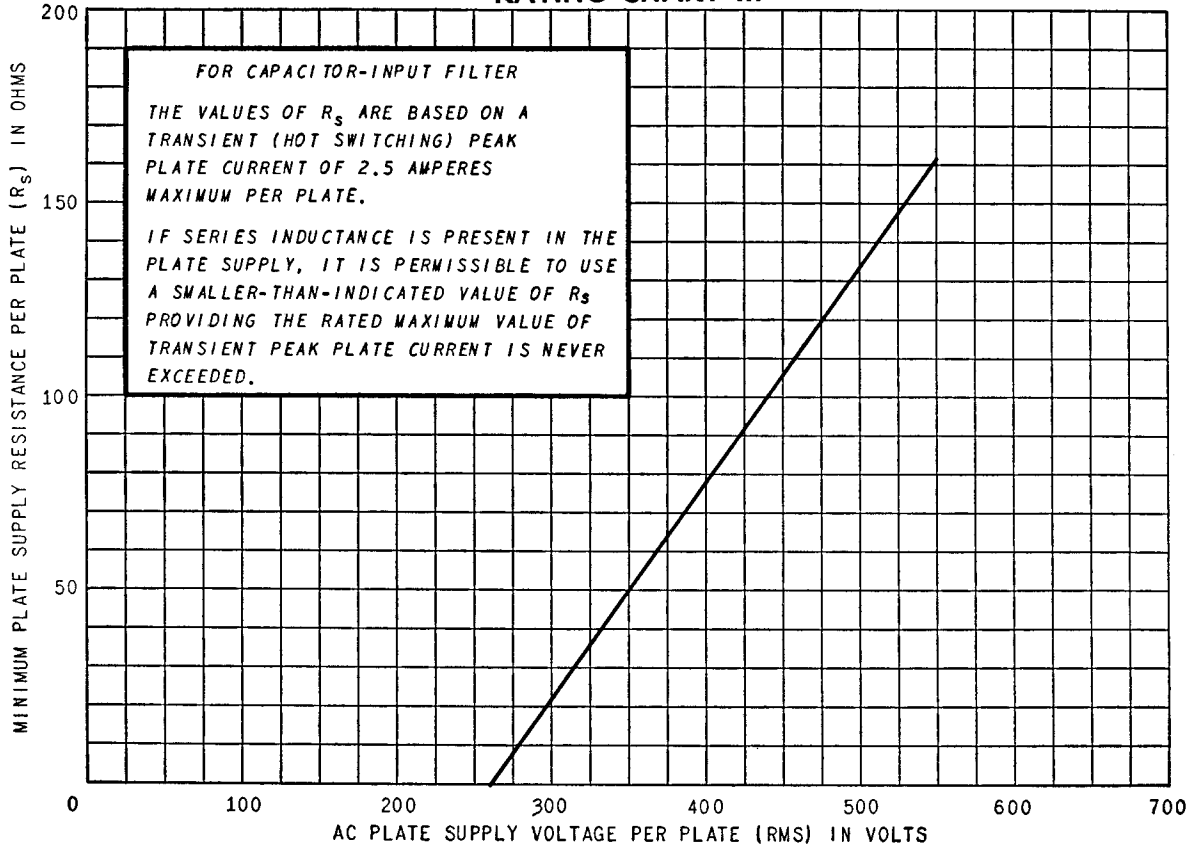
RATING CHART I



RATING CHART II

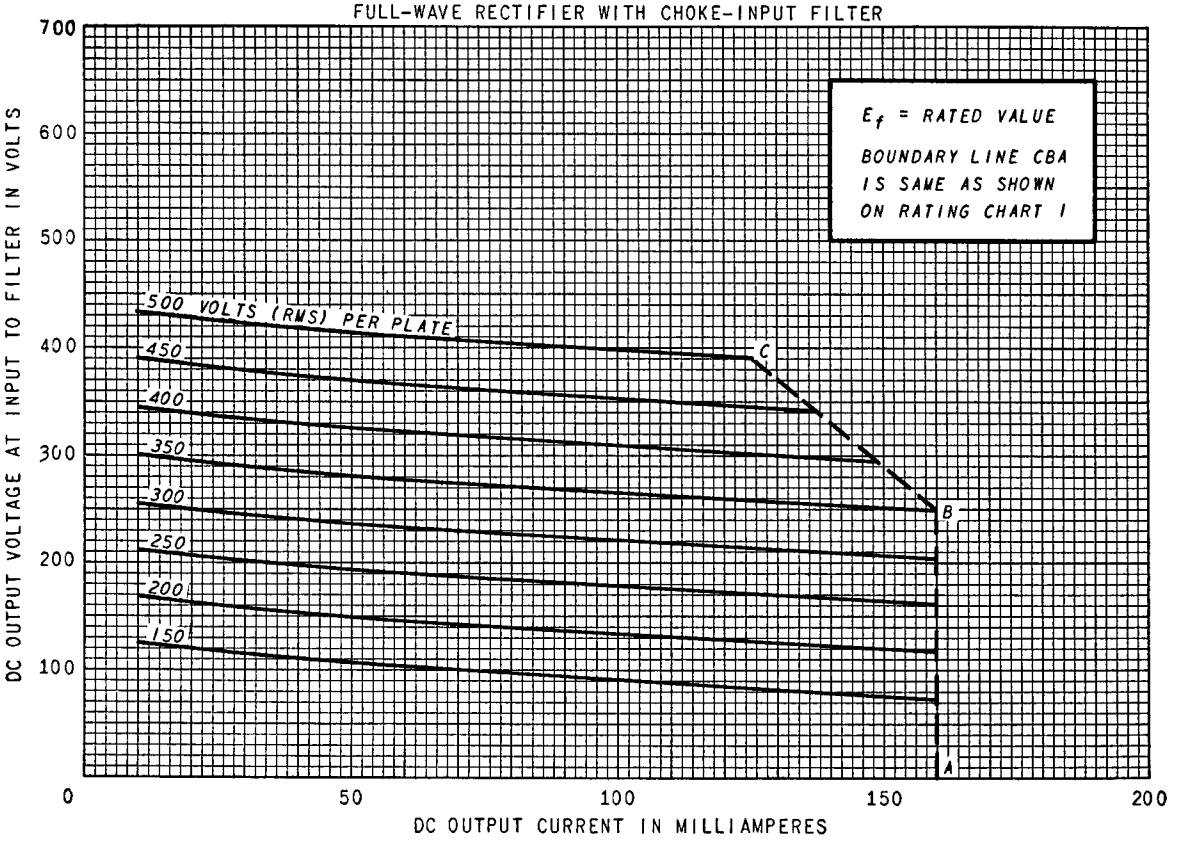


RATING CHART III



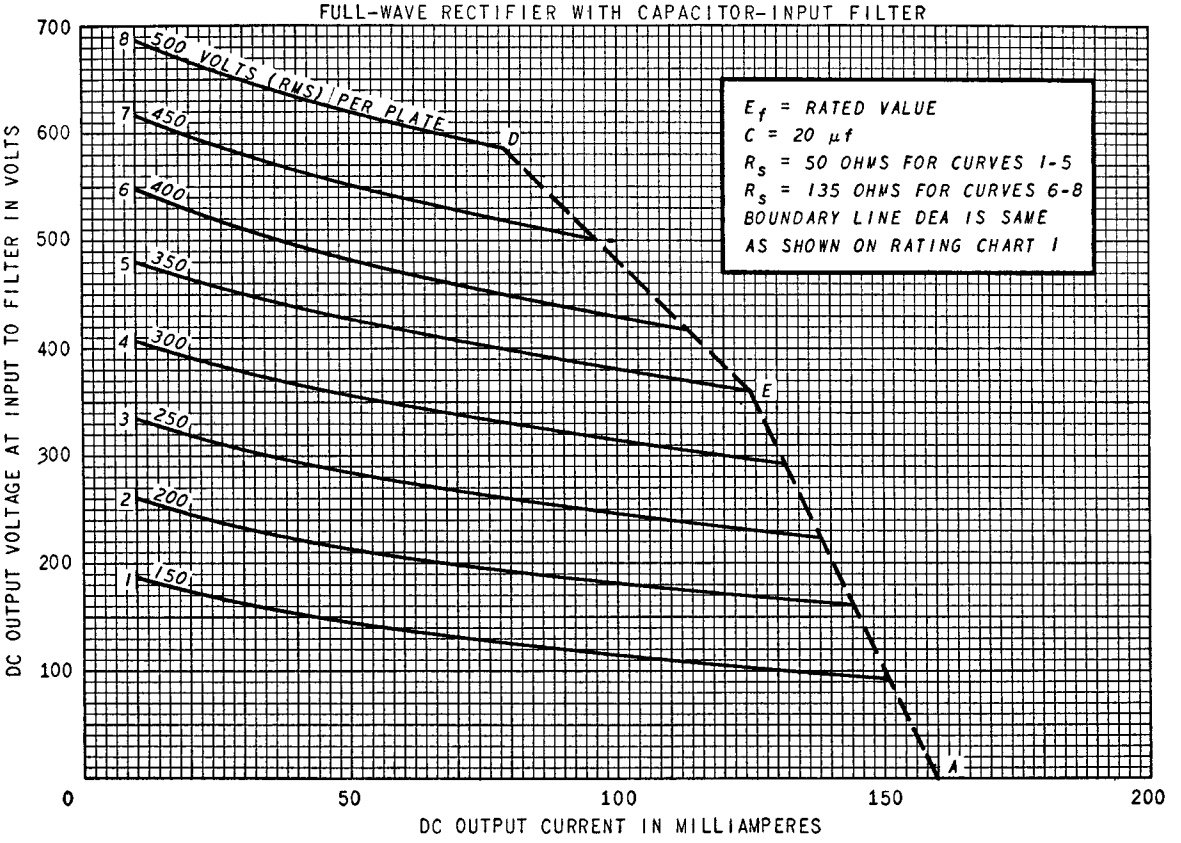
OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER

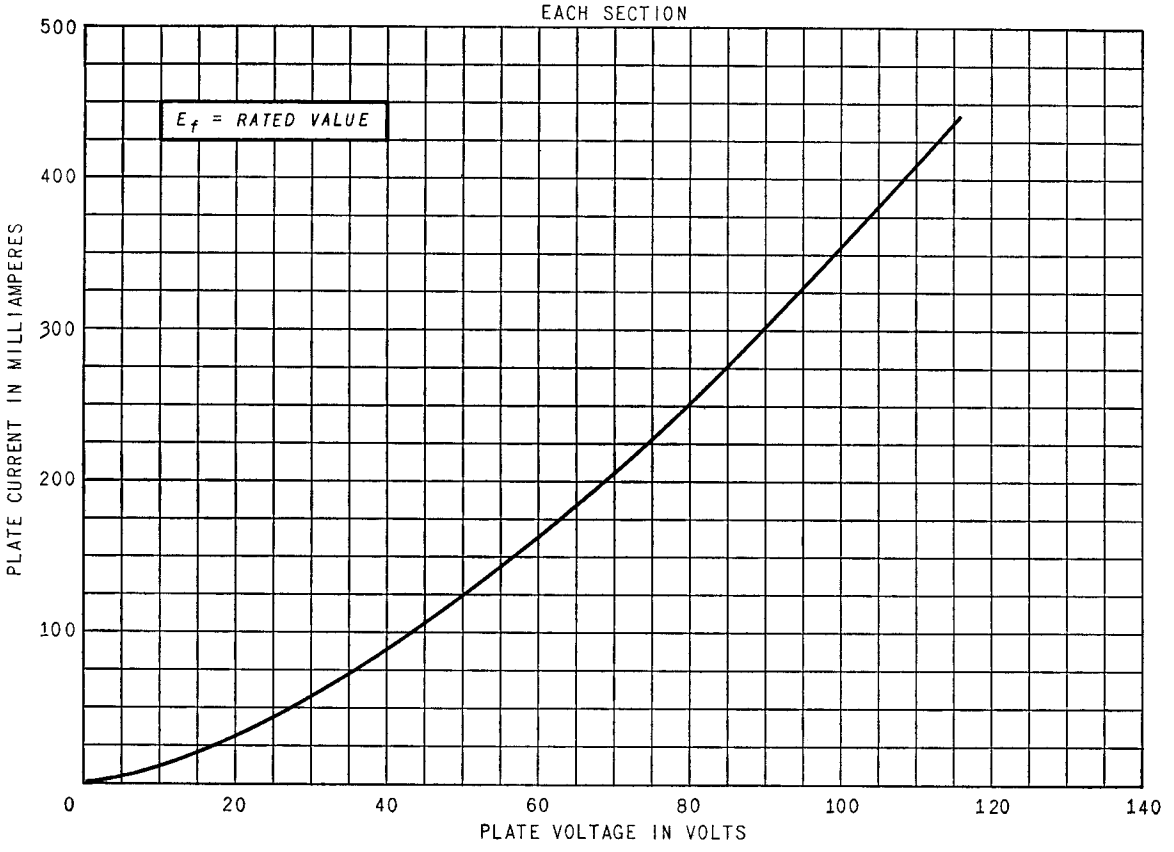


OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER



AVERAGE PLATE CHARACTERISTICS



DESCRIPTION AND RATING

The 6AB4 is a miniature triode designed for use as a grounded-grid radio-frequency amplifier, frequency converter, or oscillator at frequencies below approximately 300 megacycles.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Voltage, AC or DC . . . . . 6.3 Volts
Heater Current . . . . . 0.15 Amperes
Direct Interelectrode Capacitances

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

	With Shield*	Without Shield
Grid to Plate: (g to p)	1.5	1.5 pf
Input: g to (h+k)	2.2	2.2 pf
Output: p to (h+k)	1.4	0.5 pf
Heater to Cathode: (h to k)	2.9	2.9 pf
Plate to Cathode: (p to k)	0.20	0.24 pf
Grounded-Grid Input: k to (h+g)	5.2	5.0 pf
Grounded-Grid Output: p to (h+g)	2.6	1.7 pf

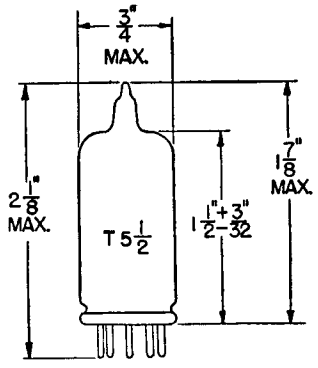
MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage . . . . . 300 Volts
Negative DC Grid Voltage . . . . . 50 Volts
Plate Dissipation . . . . . 2.5 Watts

Heater-Cathode Voltage
Heater Positive with Respect to Cathode . . 90 Volts
Heater Negative with Respect to Cathode . 90 Volts

PHYSICAL DIMENSIONS

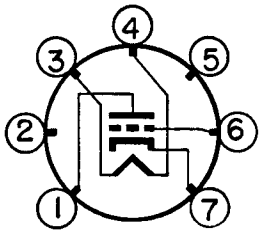


EIA 5-2

TERMINAL CONNECTIONS

Pin 1—Plate
Pin 2—No Connection
Pin 3—Heater
Pin 4—Heater
Pin 5—No Connection
Pin 6—Grid
Pin 7—Cathode

BASING DIAGRAM



EIA 5CE

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	100	250	Volts
Cathode-Bias Resistor	270	200	Ohms
Amplification Factor	60	60	
Plate Resistance, approximate	15000	10900	Ohms
Transconductance	4000	5500	Micromhos
Plate Current	3.7	10	Milliamperes
Grid Voltage, approximate			
Ib = 10 Microamperes	−5	−12	Volts

* With external shield (EIA 316) connected to pin 7.

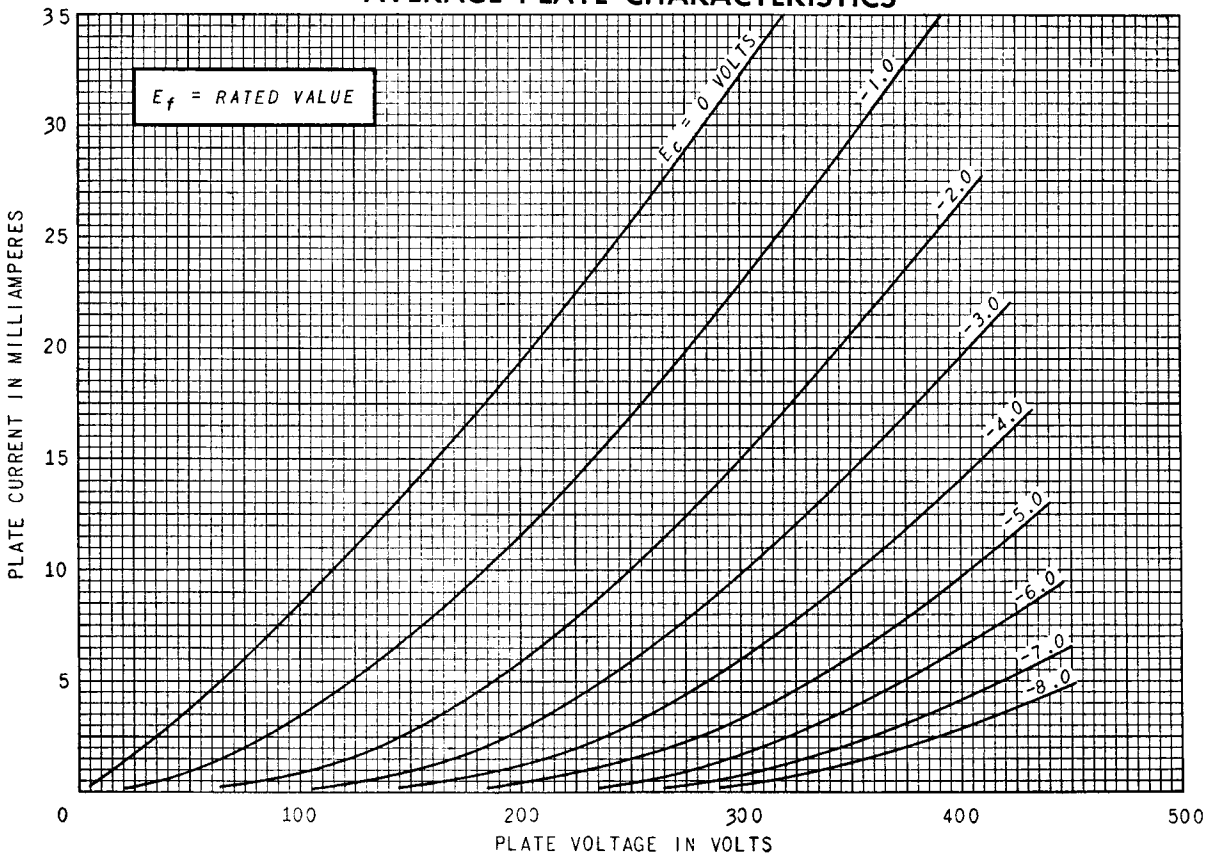
Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under normal conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube in average applications, making allowance for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

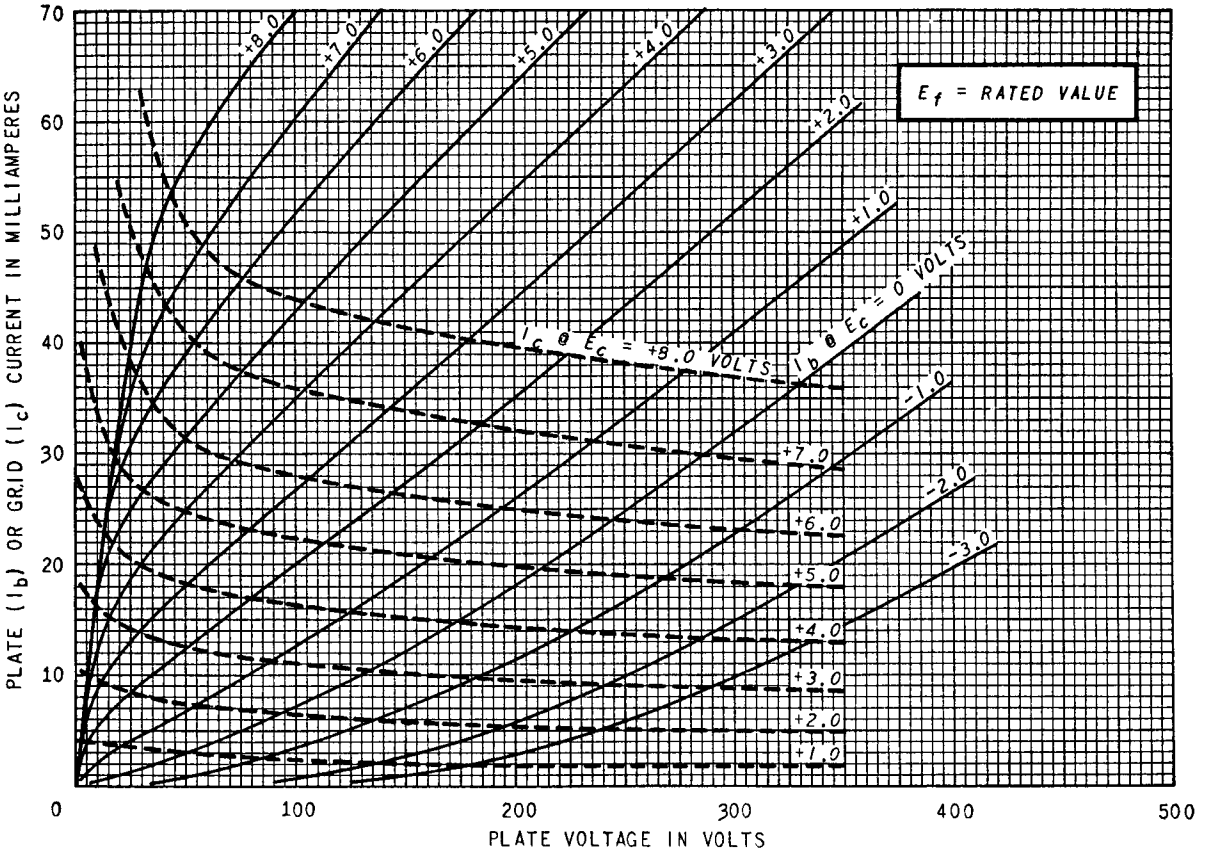
The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube under normal operating conditions at the stated normal supply voltage.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

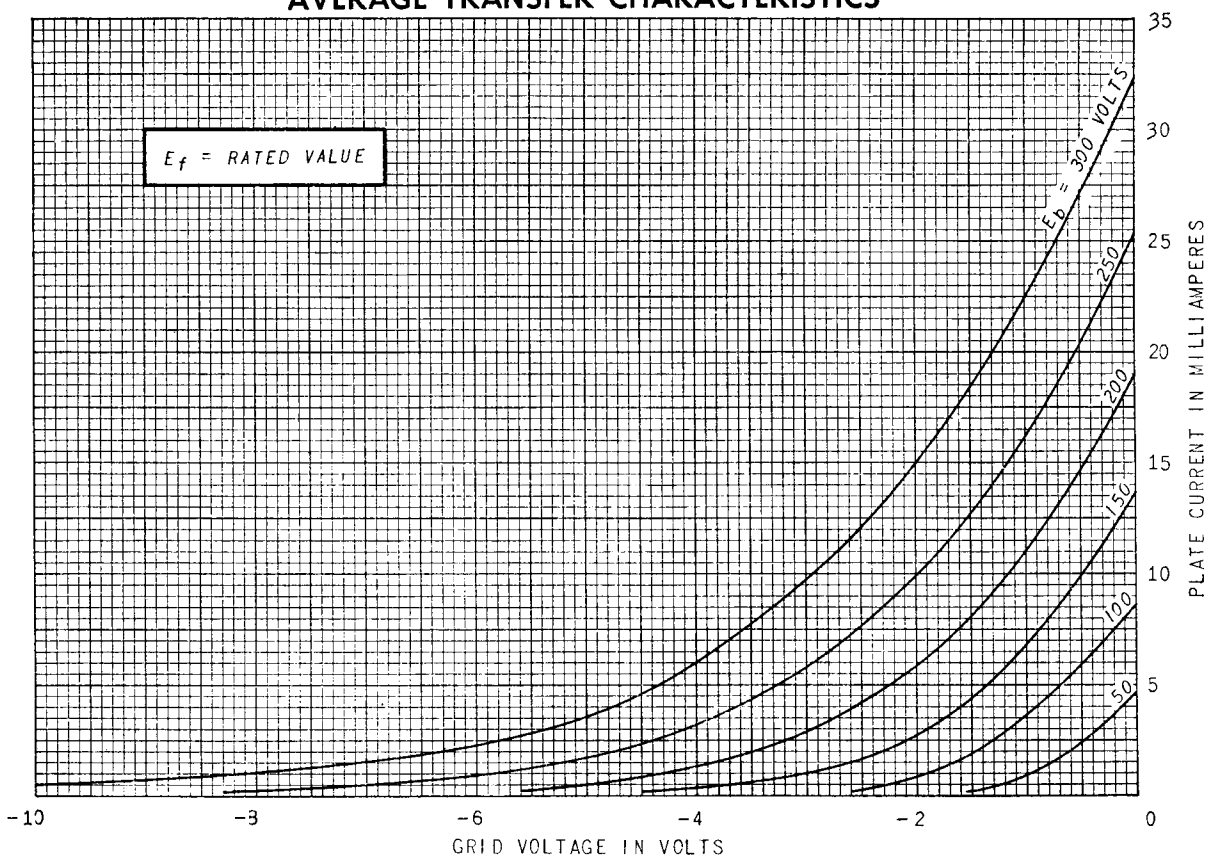
AVERAGE PLATE CHARACTERISTICS



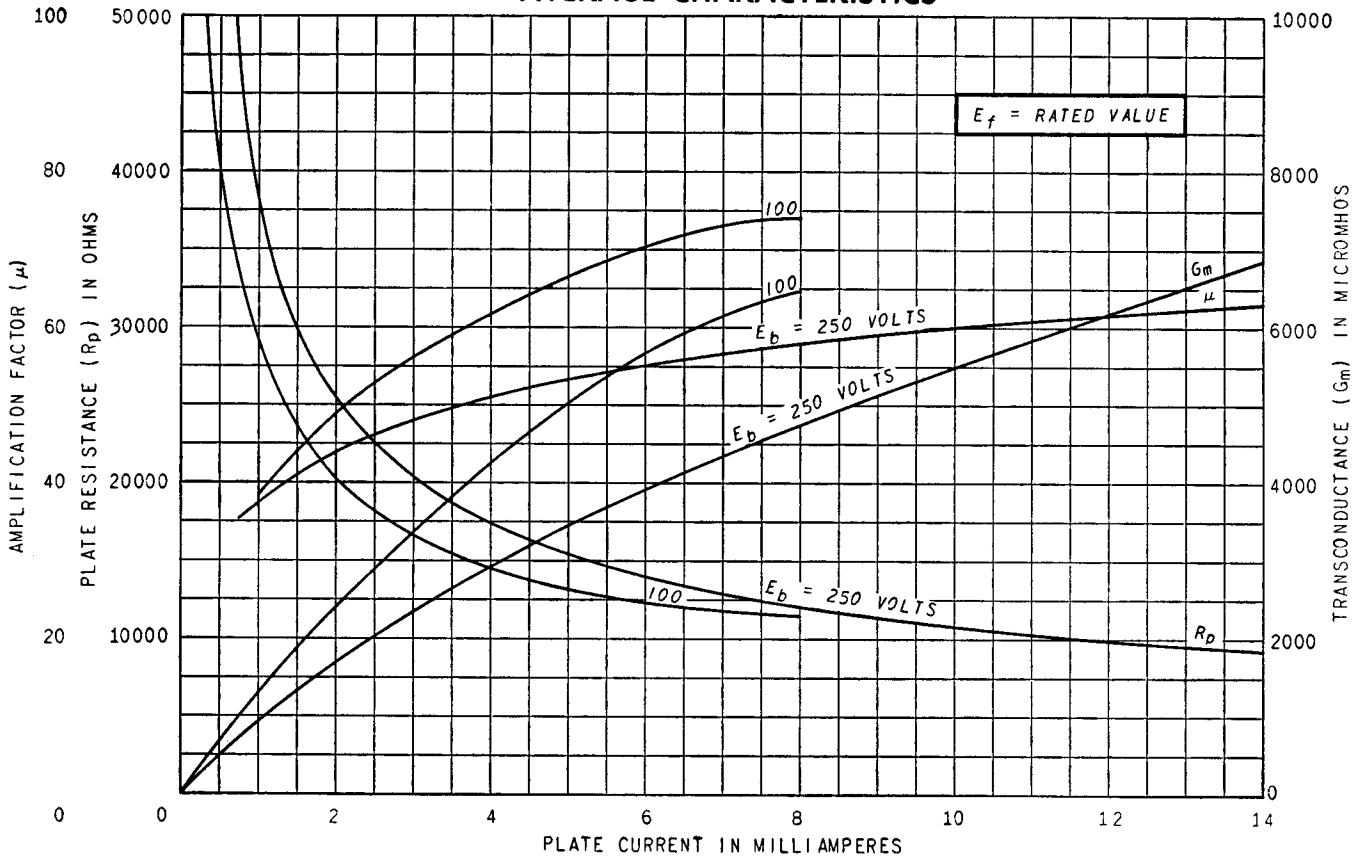
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

PRODUCT INFORMATION

6AC10

Compactron Triple Triode

The 6AC10 is a compactron containing three high-mu triodes. It is designed for use primarily as a color-difference amplifier in color television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

	Series Circuit*	Parallel Circuit‡	
Heater Voltage, AC or DC	6.3	6.3±0.6§	Volts
Heater Current	0.6±0.04¶	0.6△	Amperes
Heater Warm-up Time, Average#	11	---	Seconds

Direct Interelectrode Capacitances**

	Section 1	Section 2	Section 3	
Grid to Plate: (g to p)	1.3	1.2	1.2	pf
Input: g to (h + k)	2.4	2.6	2.6	pf
Output: p to (h + k)	0.22	0.30	0.44	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

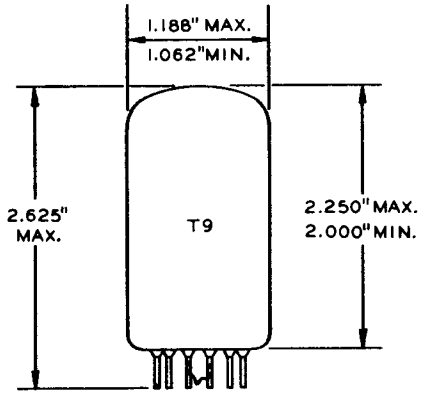
Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330	Volts
Plate Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance	0.5	Megohms

PHYSICAL DIMENSIONS

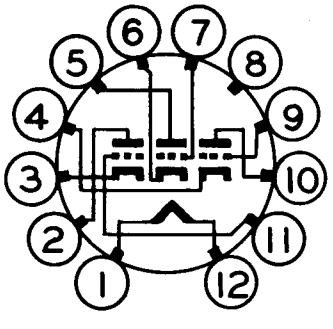


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate (Section 3)
Pin 3 - Cathode (Section 3)
Pin 4 - Cathode (Section 1)
Pin 5 - Plate (Section 2)
Pin 6 - Cathode (Section 2)
Pin 7 - Grid (Section 2)
Pin 8 - No Connection
Pin 9 - Grid (Section 1)
Pin 10 - Plate (Section 1)
Pin 11 - Grid (Section 3)
Pin 12 - Heater

BASING DIAGRAM



EIA 12FE

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage	200	Volts
Cathode-Bias Resistor	150	Ohms
Amplification Factor	62	
Plate Resistance, approximate	10700	Ohms
Transconductance	5800	Micromhos
Plate Current	9.0	Milliamperes
Grid Voltage, approximate		
Ib = 100 Microamperes	-5	Volts

NOTES

* Operated with the heater in series with the heaters of other tubes having the same bogey heater current.

‡ Operated with the heater in parallel with the heaters of other tubes having the same bogey heater voltage.

§ For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

¶ For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

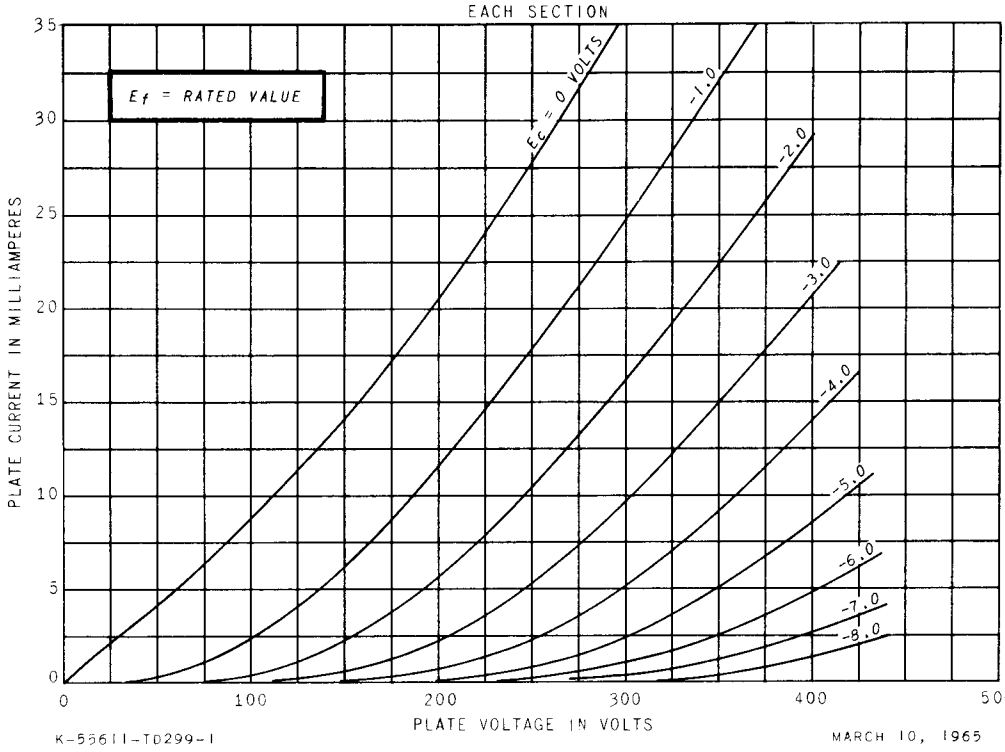
Δ Heater current of a bogey tube at Ef = 6.3 volts.

\# The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

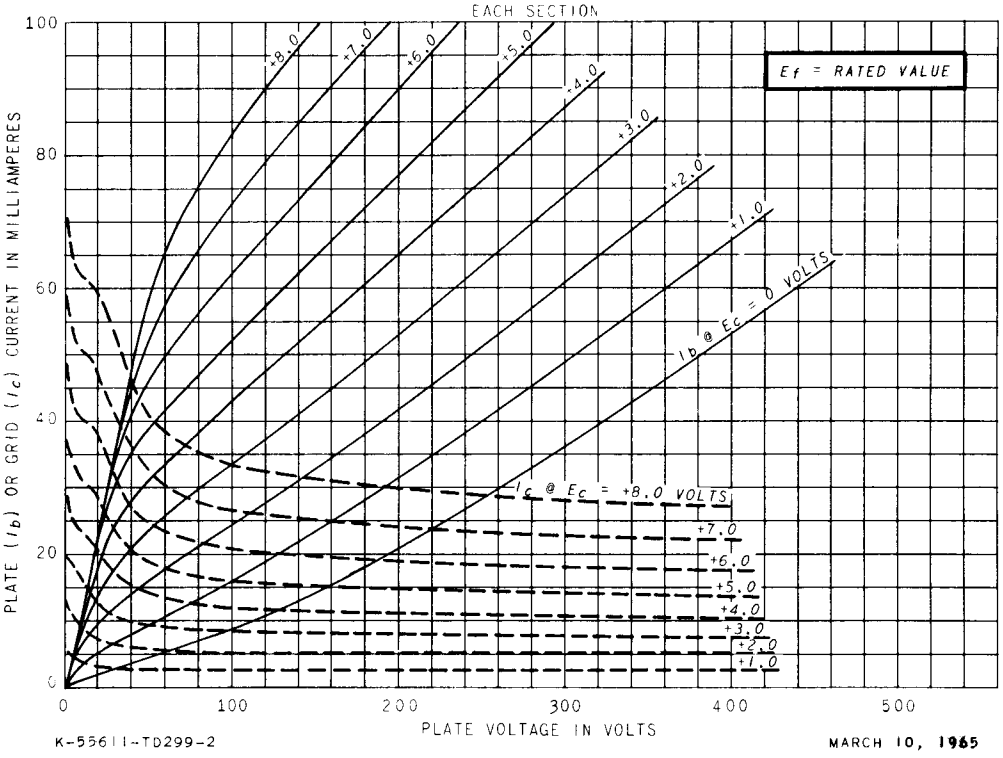
** Without external shield.

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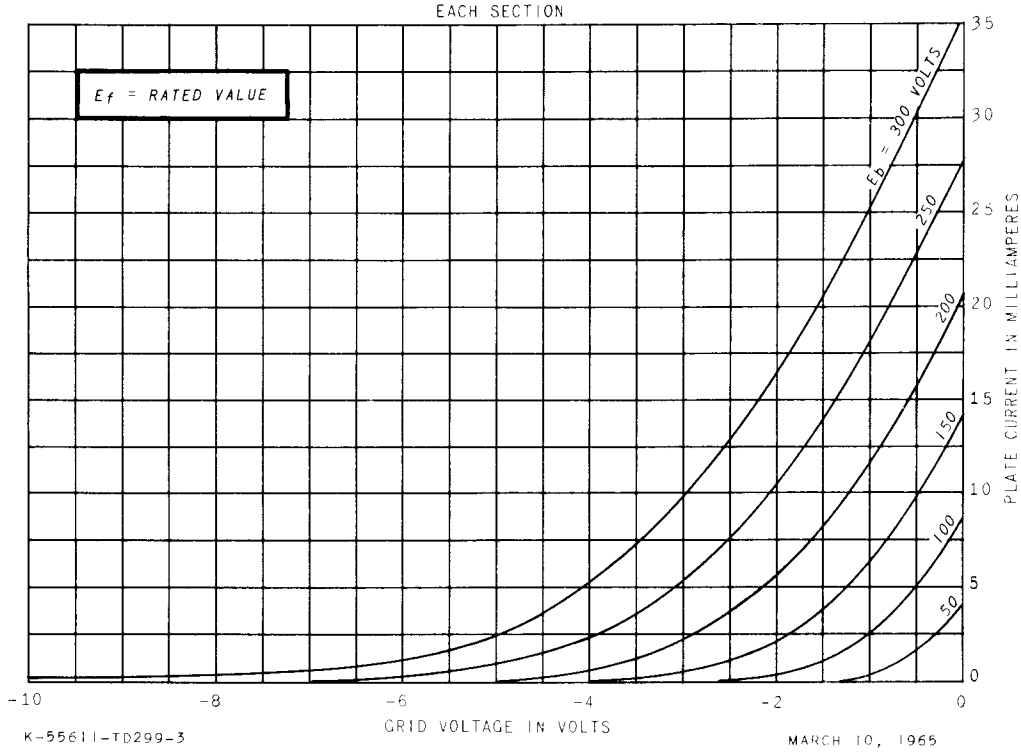
AVERAGE PLATE CHARACTERISTICS



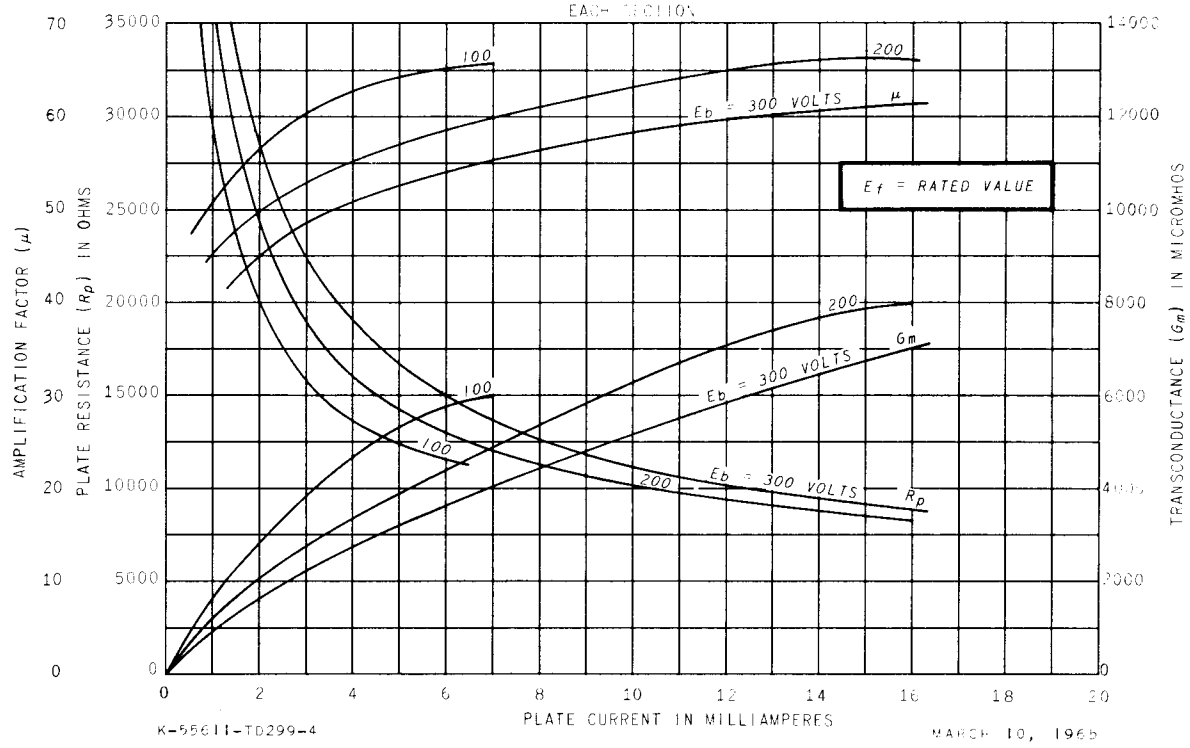
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBE

6AC7

Description and Rating

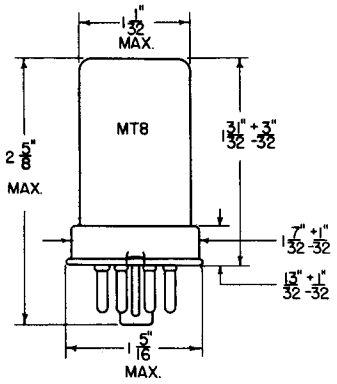
RADIO-FREQUENCY AMPLIFIER PENTODE

GENERAL DESCRIPTION

Principal Application: The 6AC7 is a sharp-cutoff high-transconductance pentode intended for service as a wide-band video or radio-frequency amplifier. It is also suitable for use as a mixer or oscillator at low frequencies, but it is not recommended for low-level audio-frequency applications unless the heater voltage is obtained from a d-c source. The use of cathode-bias is recommended.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.45 Ampere
Envelope	MT-8, Metal Shell
Base	B8-21, Small Wafer Octal 8-Pin
Mounting Position	Any
Direct Interelectrode Capacitances: #	
Grid 1 to Plate (Max)	0.015 μμf
Input	11 μμf
Output	5 μμf

PHYSICAL DIMENSIONS

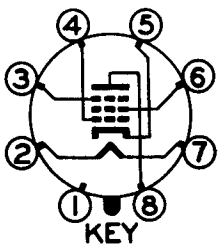


RTMA 8-I

TERMINAL CONNECTIONS

Pin 1 - Shell and Internal Shield
Pin 2 - Heater
Pin 3 - Grid Number 3 (Suppressor)
Pin 4 - Grid Number 1
Pin 5 - Cathode
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Heater
Pin 8 - Plate

BASING DIAGRAM



RTMA 8N
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES

Plate Voltage	300	Volts
Screen Supply Voltage	300	Volts
Screen Voltage	150	Volts
Plate Dissipation	3.0	Watts
Screen Dissipation	0.38	Watt
Heater-Cathode Voltage	90	Volts
Grid Circuit Resistance: *		
With Fixed Screen Voltage	0.25	Megohm
With Series Screen Resistor	0.5	Megohm

 # With pin 1 connected to pin 5

** For maximum voltage conditions and with cathode bias*

Supersedes ET-T263 dated 6-46

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

	Condition 1 +	Condition 2 ++	
Plate Voltage	300	300	Volts
Suppressor Voltage **	0	0	Volts
Screen Supply Voltage	---	300	Volts
Screen Voltage	150	---	Volts
Screen Resistor	---	60000	Ohms
Cathode Bias Resistor (Minimum) ##	160	160	Ohms
Plate Resistance (Approx)	1.0	1.0	Megohm
Transconductance	9000	9000	Micromhos
Plate Current	10	10	Milliamperes
Screen Current	2.5	2.5	Milliamperes

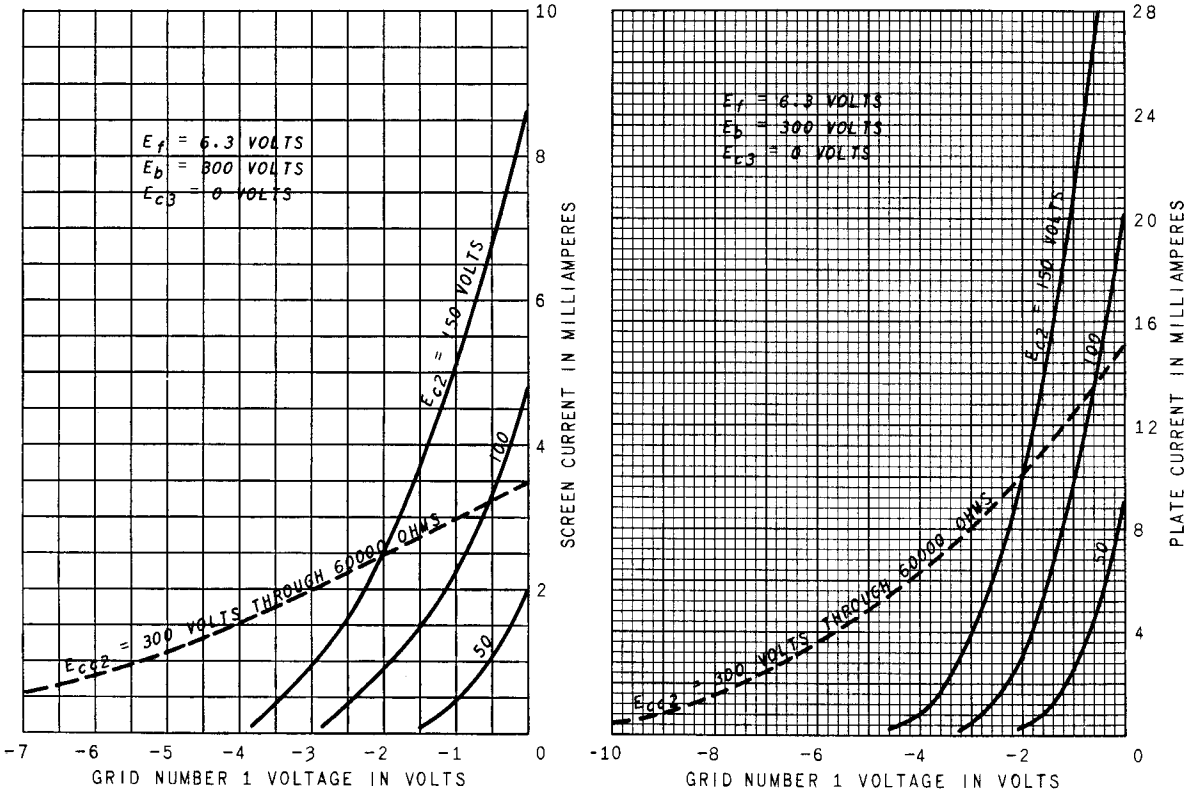
+ *When a fixed screen voltage is used, as shown in condition 1, a sharp-cutoff characteristic is obtained.*

++ *When a screen resistor is used, as shown in condition 2, an extended-cutoff characteristic is obtained which may be utilized in applications where the gain is controlled by variation of the grid bias.*

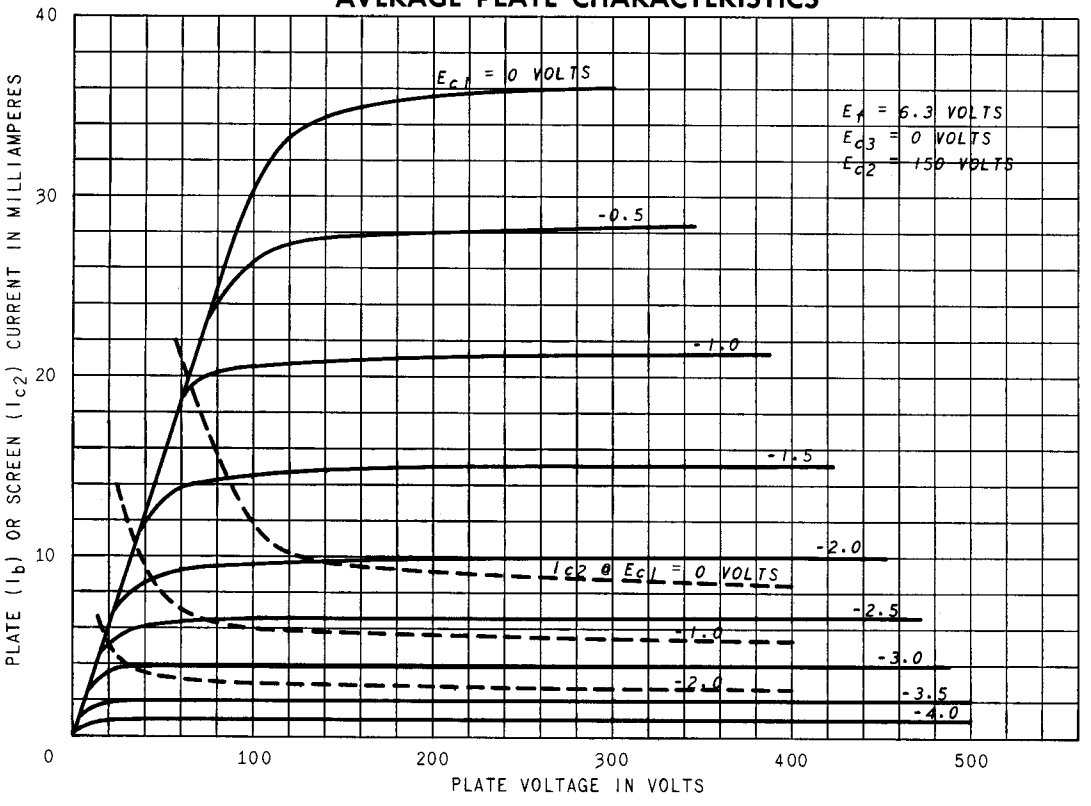
** *In r-f and i-f stages, the suppressor should be connected directly to ground to minimize feedback.*

The cathode bias resistor should be adjusted to give a plate current of 10 Milliamperes.

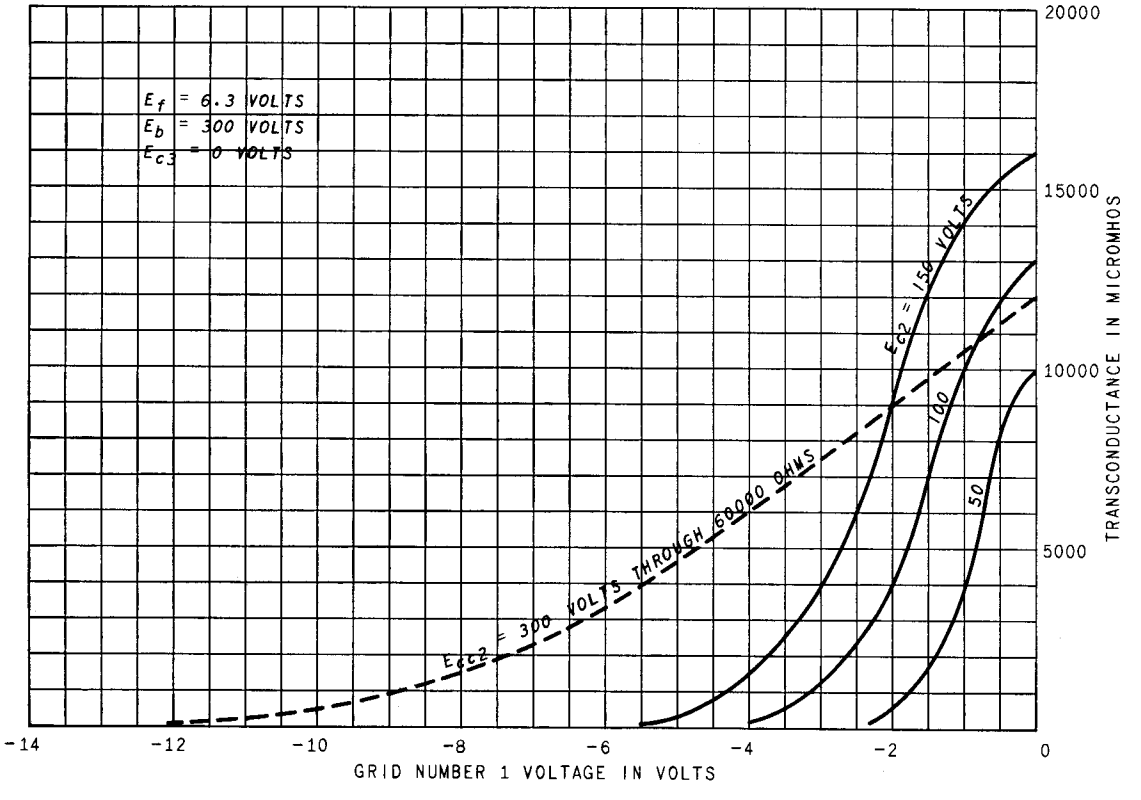
AVERAGE CHARACTERISTICS



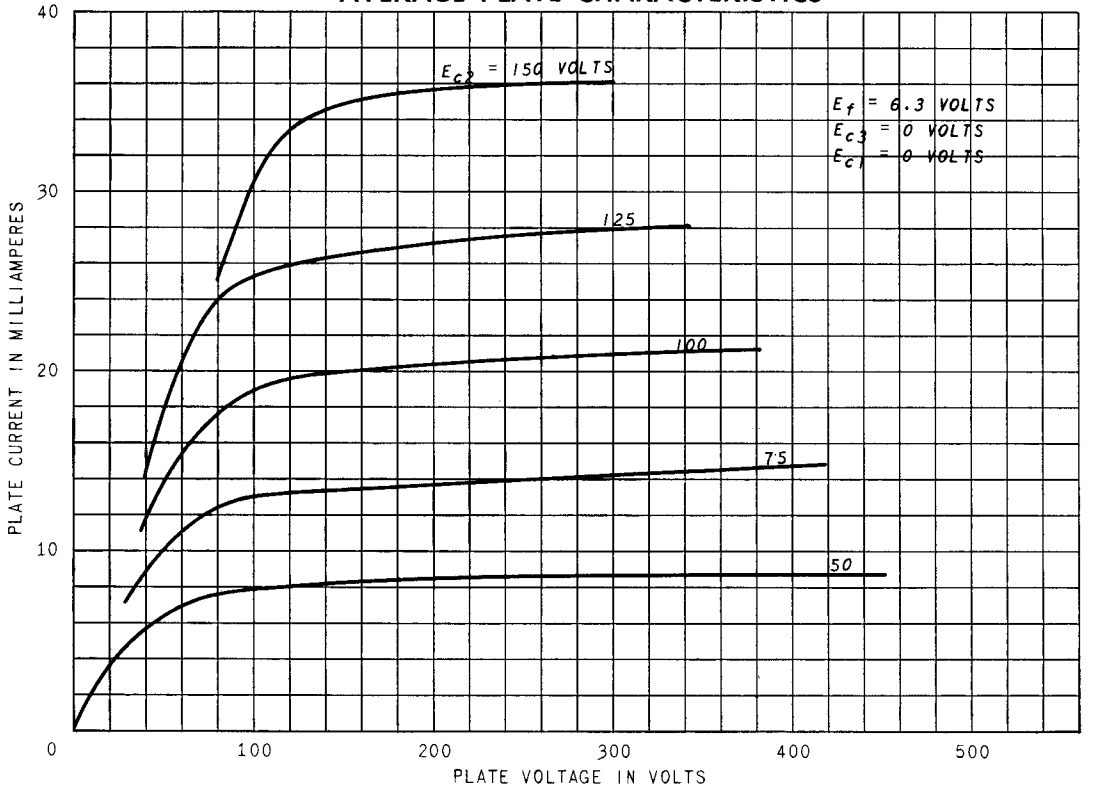
AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

Compactron
Dissimilar Double Pentode

6AD10-A

■ COLOR TV TYPE ■ 12 WATTS PLATE DISSIPATION ■ AUDIO POWER PENTODE ■ 5 WATTS AUDIO OUTPUT ■ FM DETECTOR

The 6AD10-A is a compactron containing a sharp-cutoff, dual-control pentode (Section 2) and a power pentode (Section 1). The dual-control pentode is intended for use as an FM detector and the power pentode as an audio-frequency output amplifier in color television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	6.3±0.6	Volts
Heater Current ●	1.05	Amperes

Direct Interelectrode Capacitances, approximate ▲

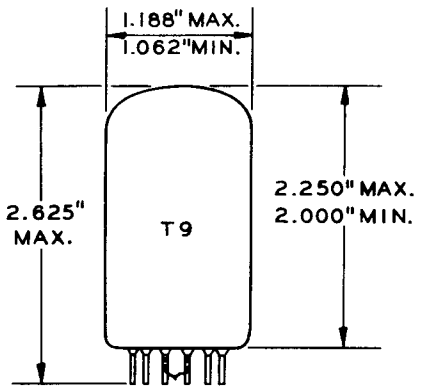
Section 1		
Grid-Number 1 to Plate: (1g1 to 1p)	0.26	pf
Input: 1g1 to (h+1k+1g2+b.p.+2k+i.s.)	11	pf
Output: 1p to (h+1k+1g2+b.p.+2k+i.s.)	11	pf
Section 2		
Grid-Number 1 to Plate: (2g1 to 2p)	0.038	pf
Grid-Number 3 to Plate: (2g3 to 2p)	3.0	pf
Grid-Number 1 to All Except Plate: 2g1 to (h+2k+2g2+2g3+i.s.)	7.0	pf
Grid-Number 3 to All: 2g3 to (h+2k+2g1+2g2+2p+i.s.)	8.0	pf
Section 2 (Cont'd)		
Grid-Number 1 to Grid-Number 3: (2g1 to 2g3)	0.13	pf
Coupling		
Plate, Section 1 to Plate, Section 2 (1p to 2p)	0.18	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

PHYSICAL DIMENSIONS

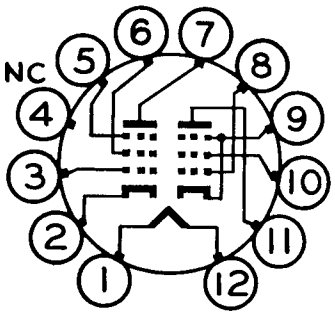


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode (Section 2) and Internal Shield
Pin 3 - Grid-Number 1 (Section 2)
Pin 4 - No Connection
Pin 5 - Grid-Number 3 (Suppressor) (Section 2)
Pin 6 - Grid-Number 2 (Screen) (Section 2)
Pin 7 - Plate (Section 2)
Pin 8 - Grid-Number 1 (Section 1)
Pin 9 - Cathode and Beam Plates (Section 1)
Pin 10 - Grid-Number 2 (Screen) (Section 1)
Pin 11 - Plate (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12EZ

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Section 1

Plate Voltage	300	Volts
Screen Voltage	300	Volts
Plate Dissipation	12	Watts
Screen Dissipation	2.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	0.5	Megohms

Section 2

Plate Voltage	300	Volts
Positive Suppressor Voltage	25	Volts
Negative Suppressor Voltage	100	Volts
Screen Supply Voltage	300	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
Plate Dissipation	1.7	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 3 Circuit Resistance	0.68	Megohms
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.22	Megohms
With Cathode Bias	0.47	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Section 1

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	-8.0	Volts
Peak AF Grid-Number 1 Voltage	8.0	Volts
Plate Resistance, approximate	100000	Ohms
Transconductance	6500	Micromhos
Zero-Signal Plate Current	35	Milliamperes
Maximum-Signal Plate Current	39	Milliamperes
Zero-Signal Screen Current	2.5	Milliamperes
Maximum-Signal Screen Current	7.0	Milliamperes
Load Resistance	5000	Ohms
Total Harmonic Distortion, approximate	10	Percent
Maximum-Signal Power Output	4.2	Watts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

AVERAGE CHARACTERISTICS

Section 2

Plate Voltage	150	Volts
Suppressor Voltage	0	Volts
Screen Voltage	100	Volts
Cathode-Bias Resistor	180	Ohms
Plate Resistance, approximate	0.11	Megohms
Grid-Number 1 Transconductance	2500	Micromhos
Grid-Number 3 Transconductance	850	Micromhos
Plate Current	2.8	Milliamperes
Screen Current	3.4	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 20 Microamperes	−4.0	Volts
Grid-Number 3 Voltage, approximate Ib = 20 Microamperes	−3.0	Volts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

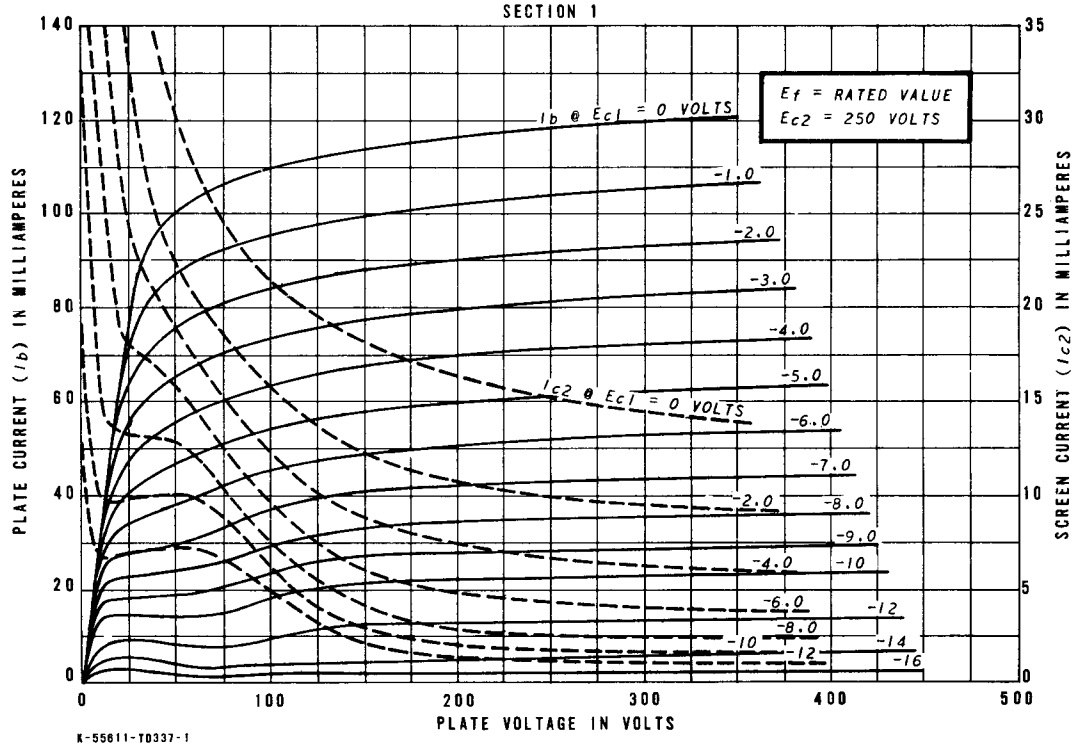
● Heater current of a bogey at Ef = 6.3 volts.

▲ Without external shield.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

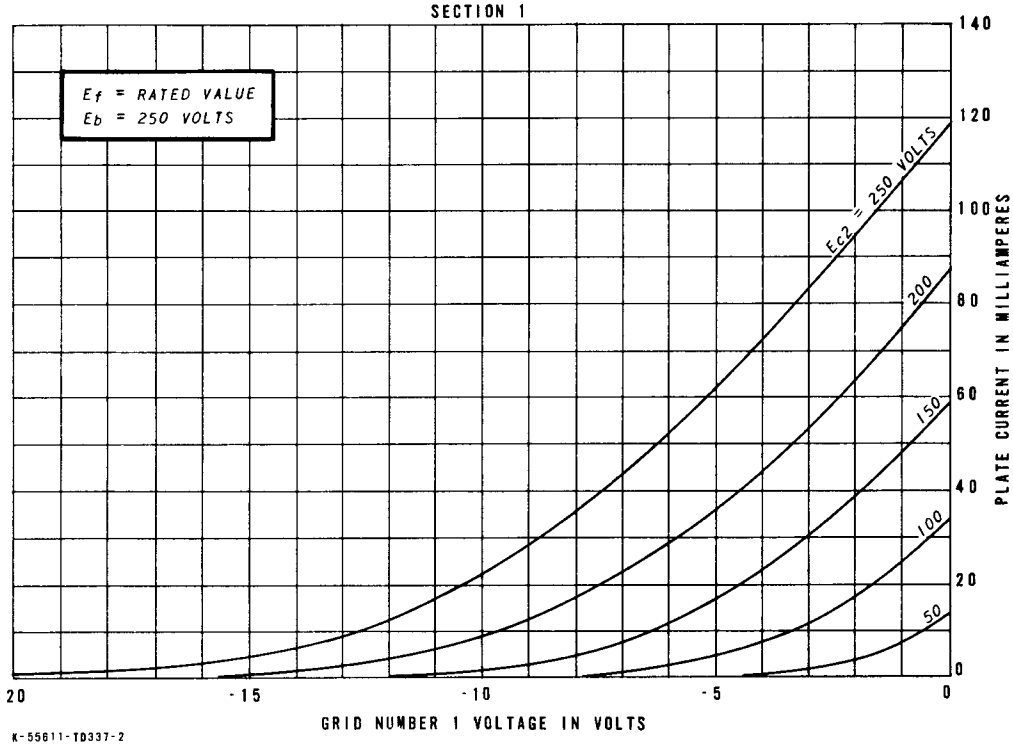
AVERAGE PLATE CHARACTERISTICS

SECTION 1



AVERAGE TRANSFER CHARACTERISTICS

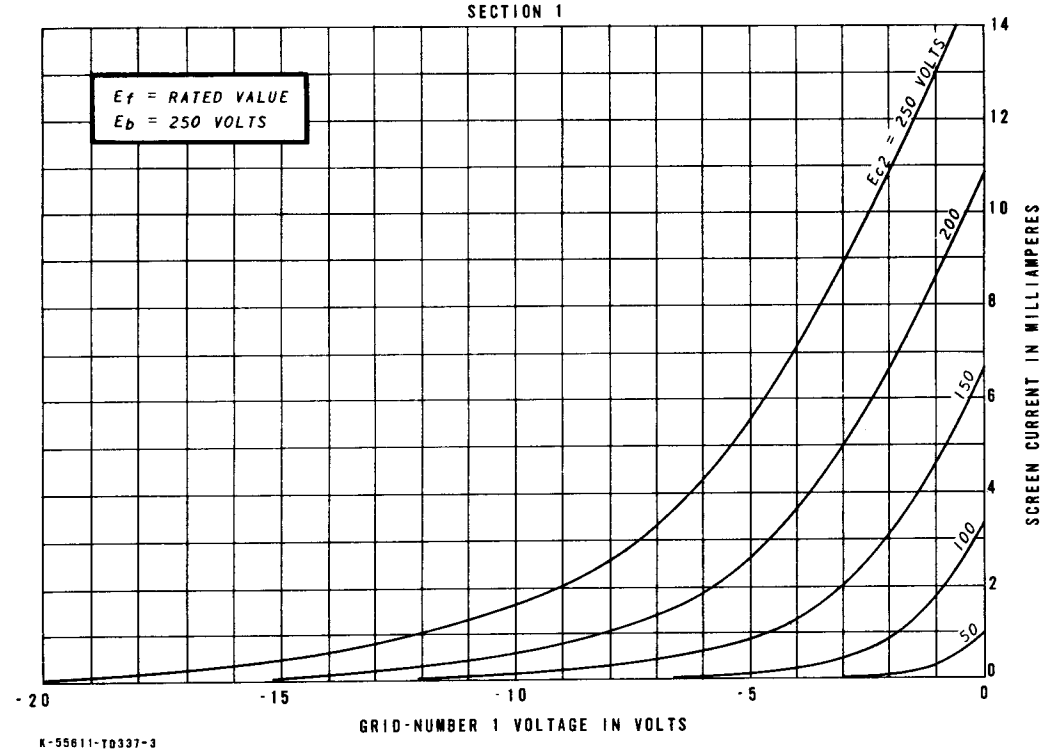
SECTION 1



K-55611-TD337-2

AVERAGE TRANSFER CHARACTERISTICS

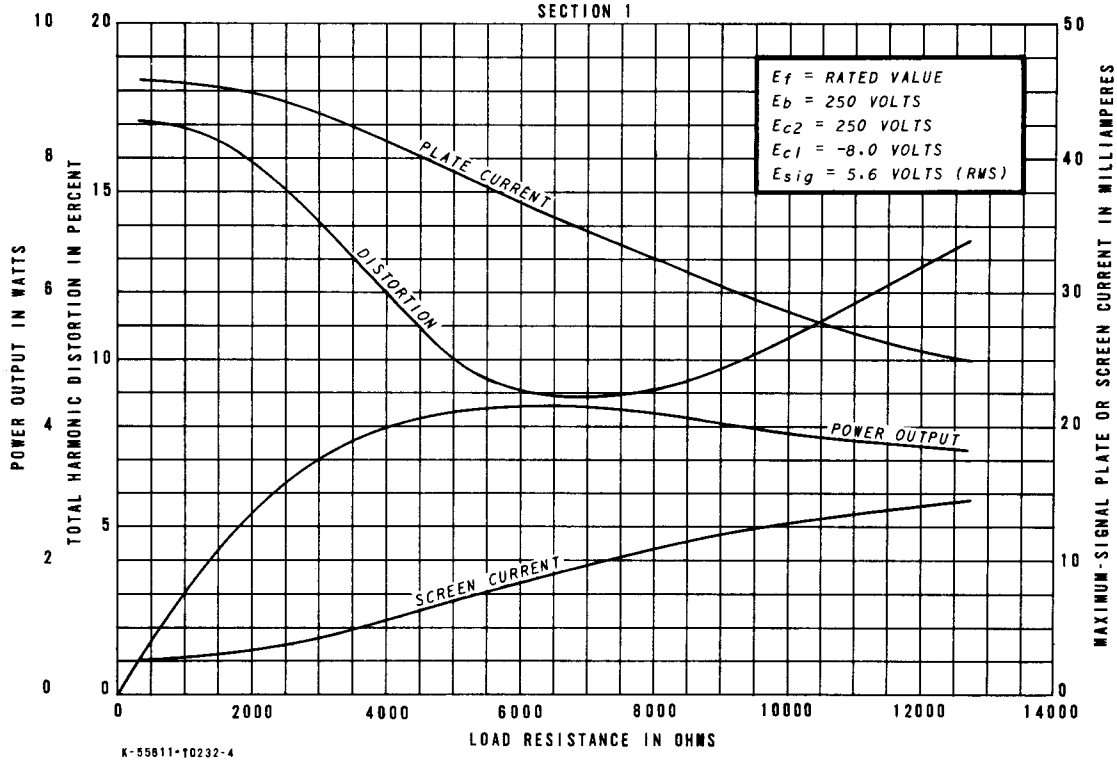
SECTION 1



K-55611-TD337-3

OPERATION CHARACTERISTICS

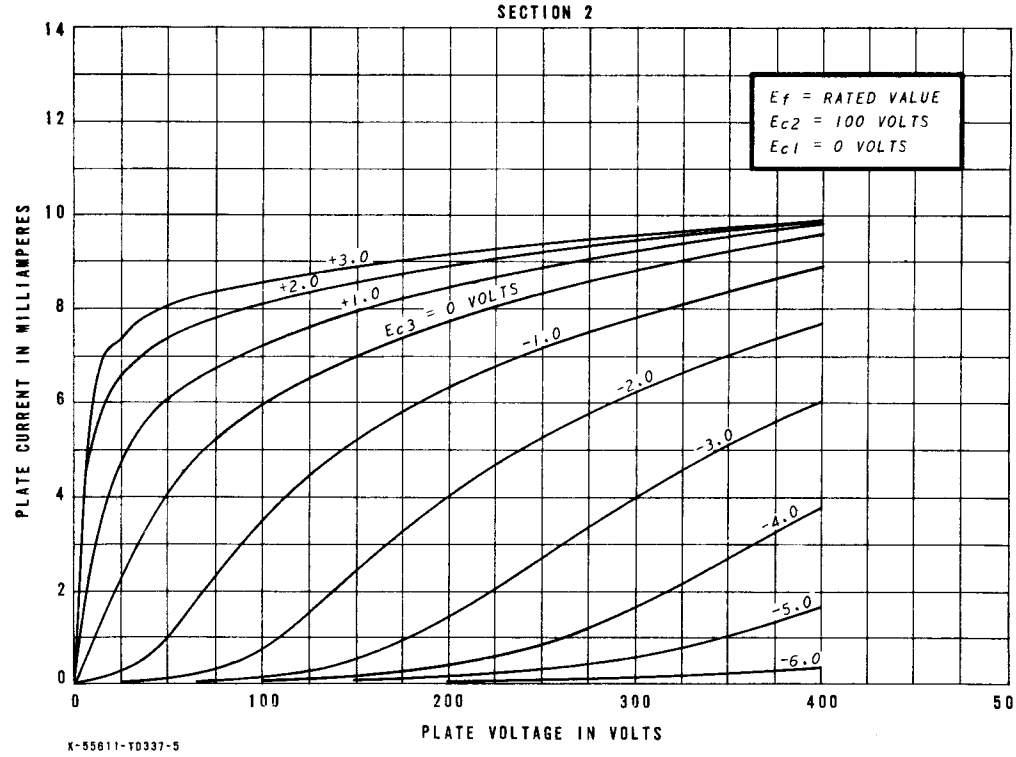
SECTION 1



K-55611-T0232-4

AVERAGE PLATE CHARACTERISTICS

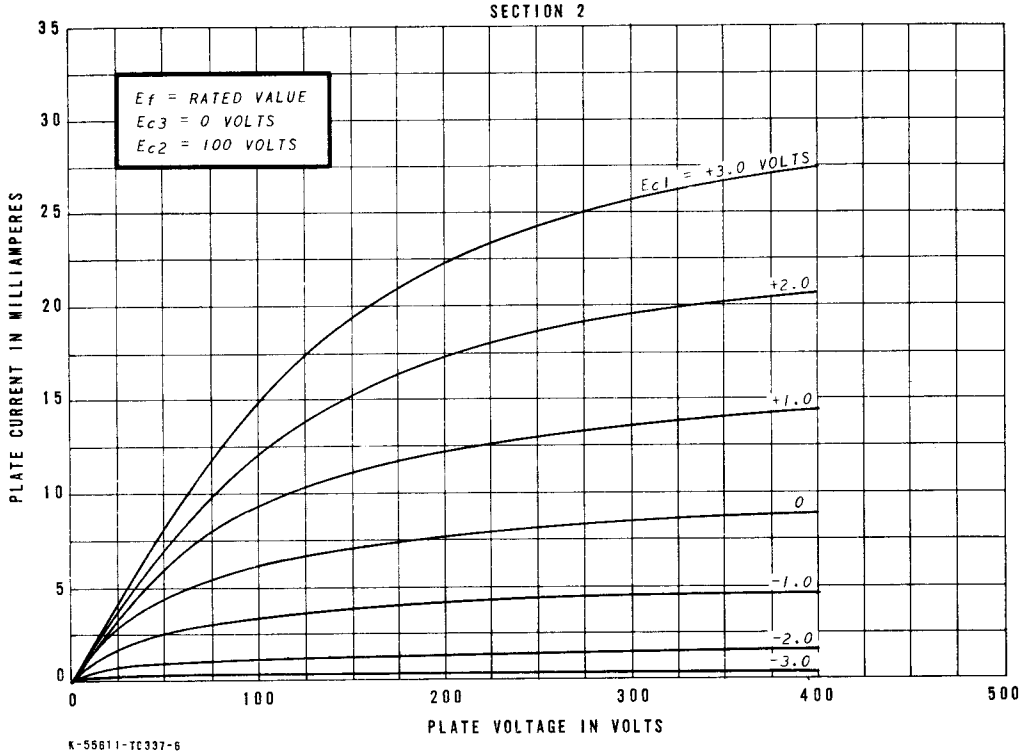
SECTION 2



K-55611-T0337-5

AVERAGE PLATE CHARACTERISTICS

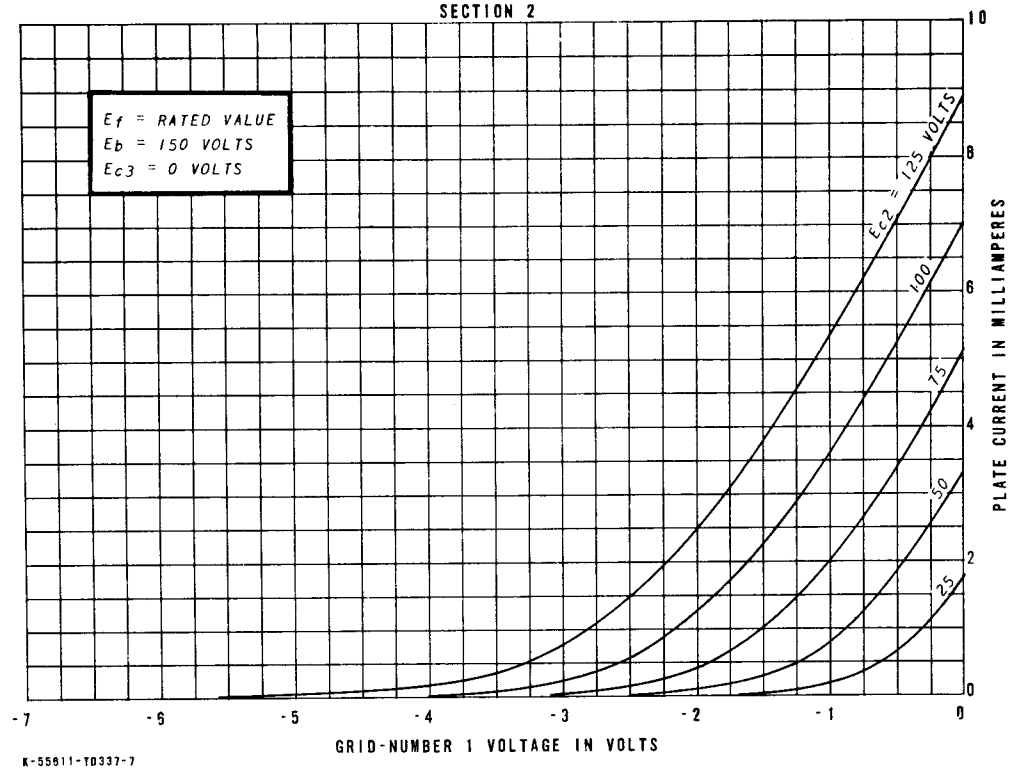
SECTION 2



K-55611-TC337-6

AVERAGE TRANSFER CHARACTERISTICS

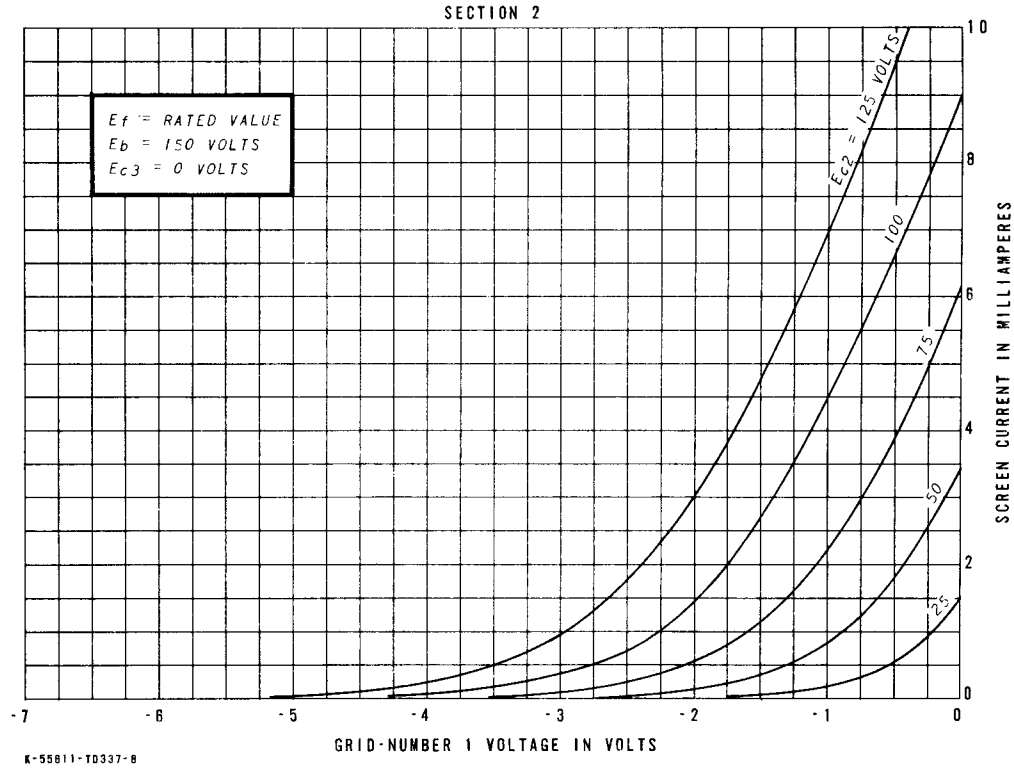
SECTION 2



K-55611-TD337-7

AVERAGE TRANSFER CHARACTERISTICS

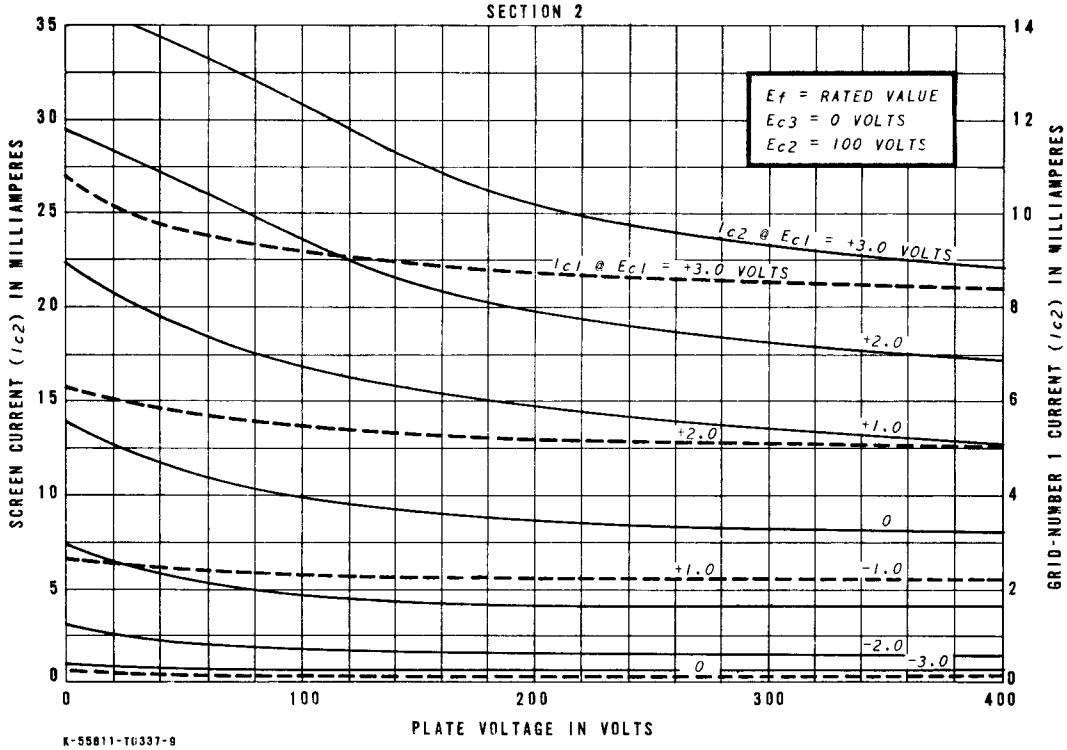
SECTION 2



K-55811-T0337-8

AVERAGE CHARACTERISTICS

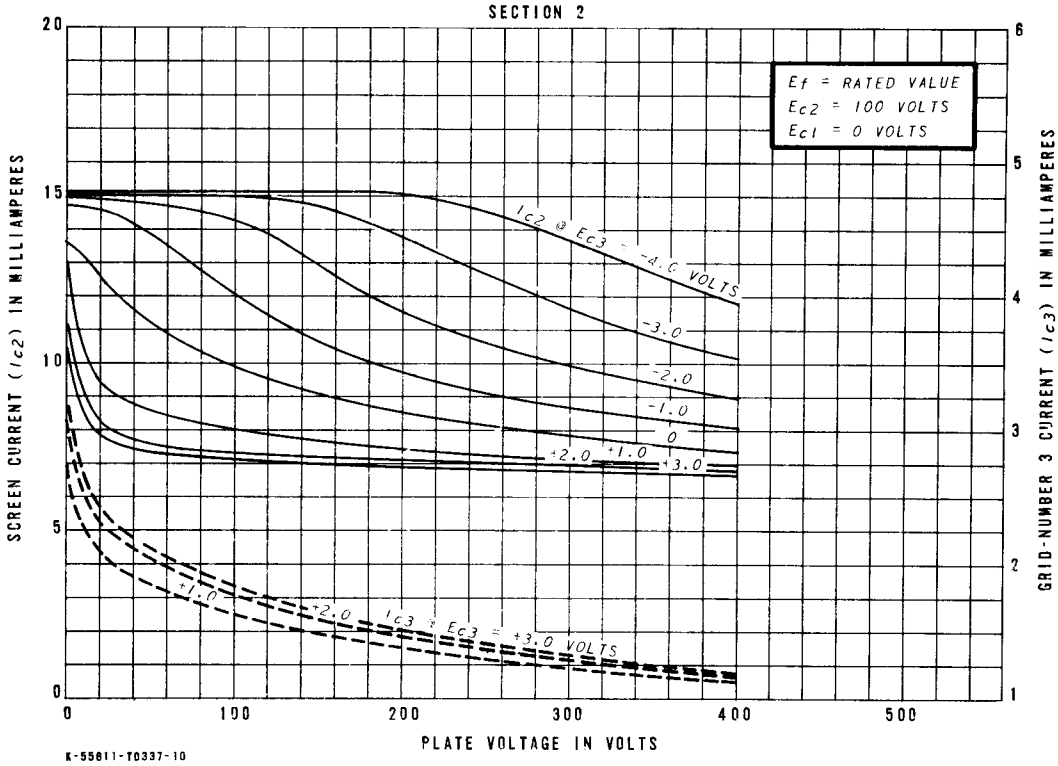
SECTION 2



K-55811-T0337-9

AVERAGE CHARACTERISTICS

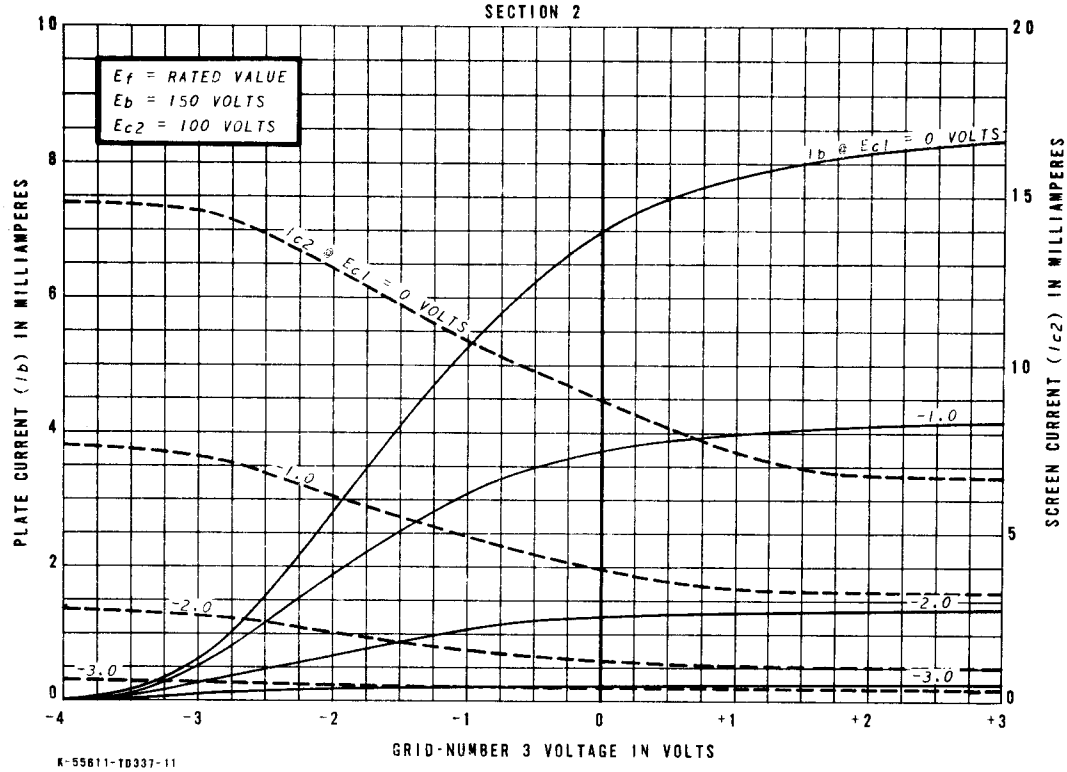
SECTION 2



K-55611-T0337-10

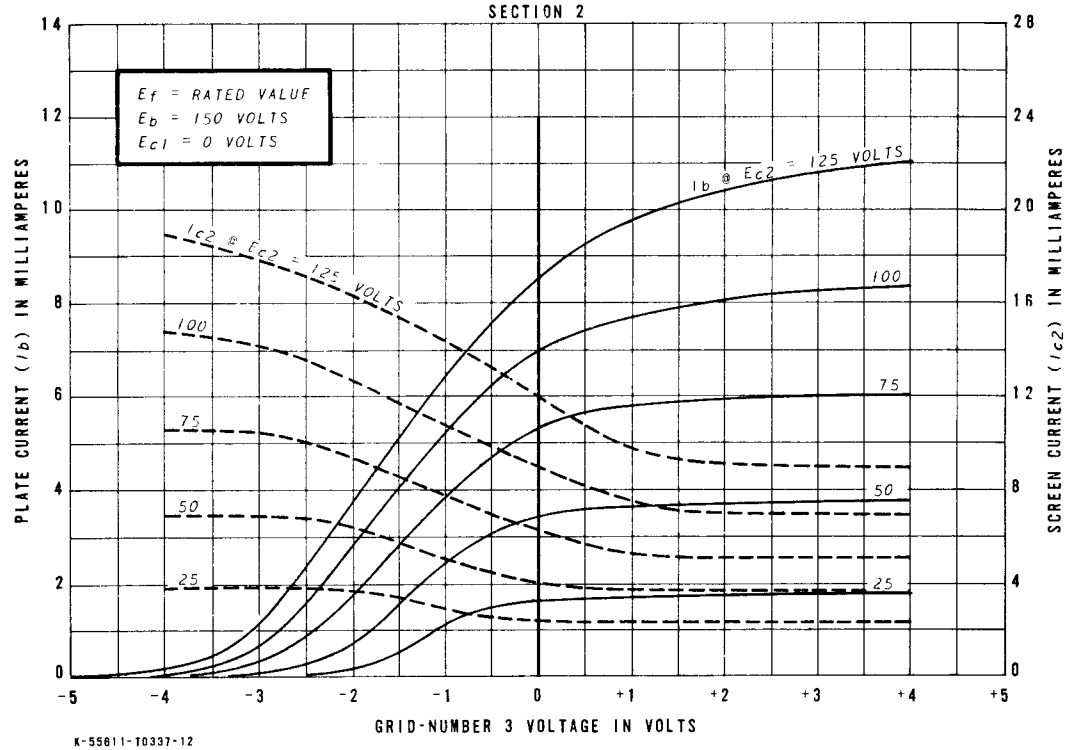
AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

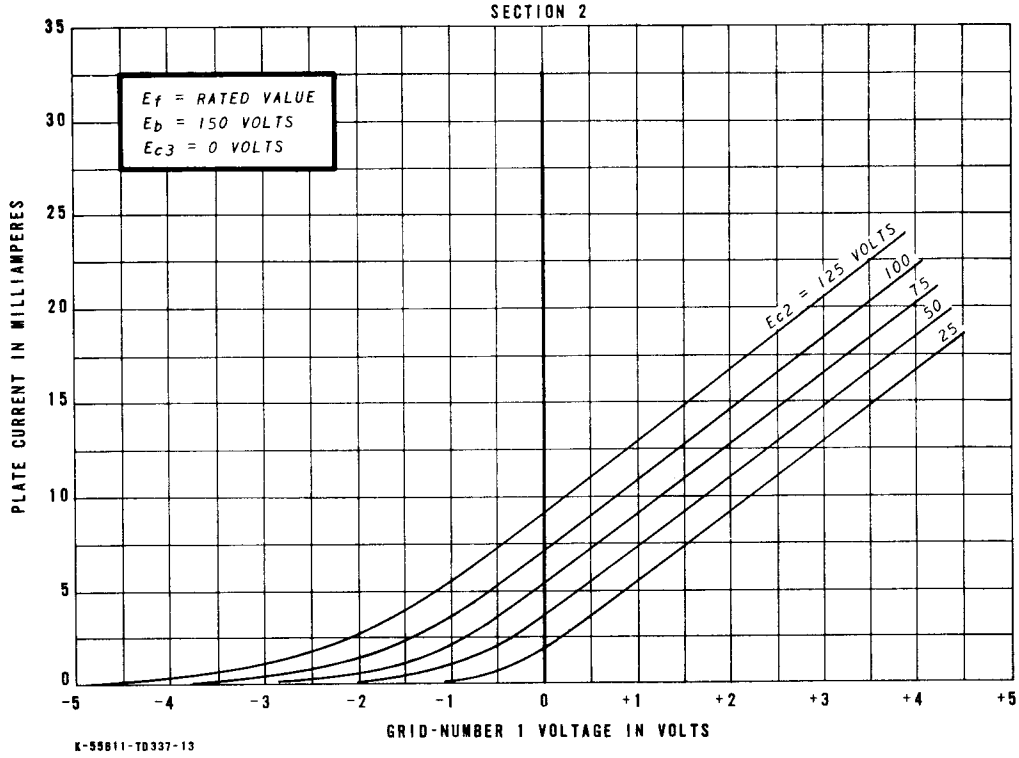


K-55611-T0337-11

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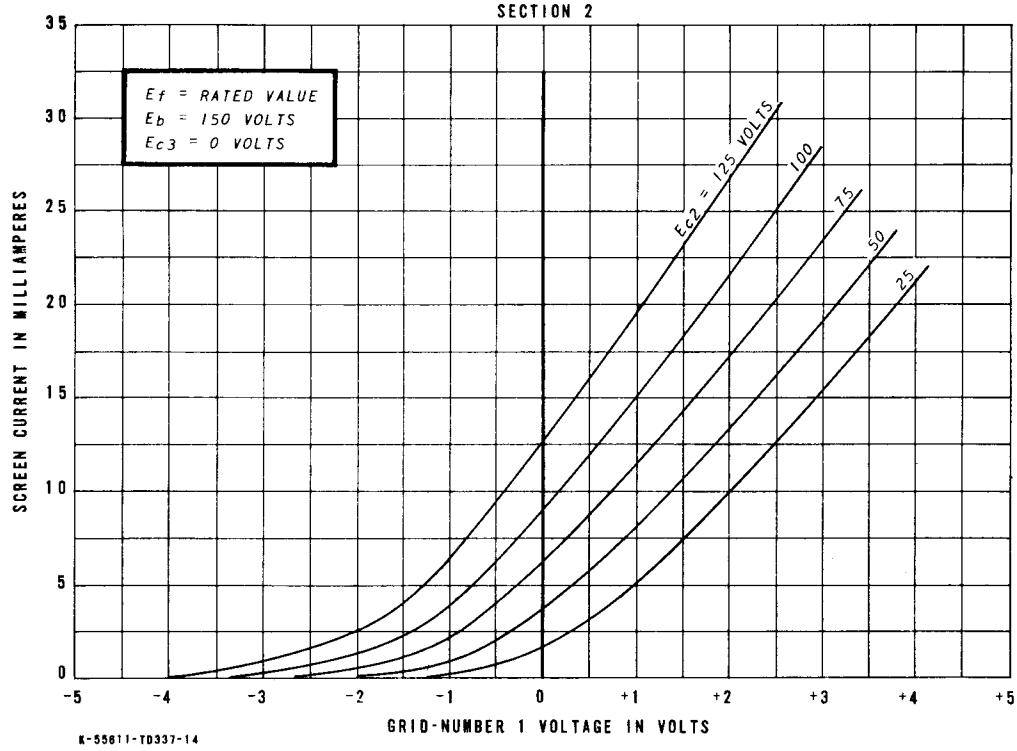


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

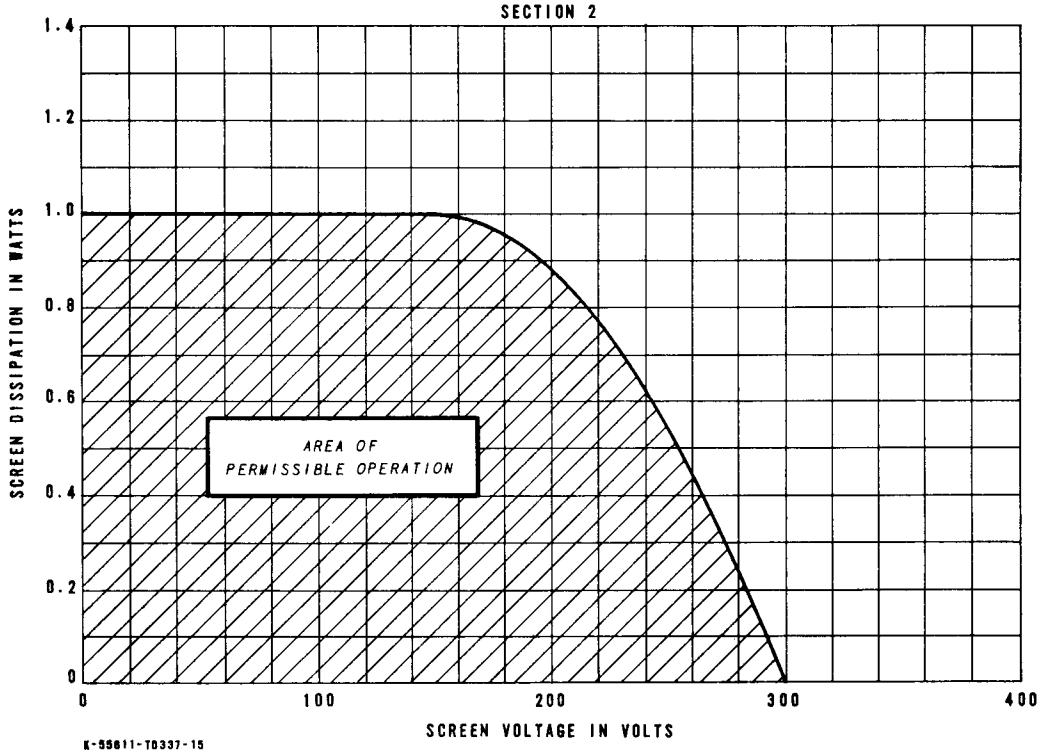
SECTION 2



K-55611-TD337-14

SCREEN RATING CHART

SECTION 2



K-55611-TD337-15

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

6AF11

DISSIMILAR-DOUBLE-TRIODE PENTODE

DESCRIPTION AND RATING

The 6AF11 is a compactron containing a high-mu triode, a medium-mu triode, and a sharp-cutoff pentode. The high-mu triode is intended for AGC keyer service, the low-mu triode for sync separator service, and the pentode for video amplifier service in television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	1.05	Amperes

Direct Interelectrode Capacitances‡

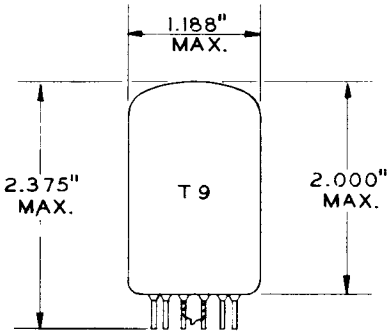
Triode (Section 1)		
Grid to Plate: (T1g to T1p)	1.9	pf
Input: T1g to (T1k+T2k+Pk+Pg3+h+i.s.)	3.0	pf
Output: T1p to (T1k+T2k+Pk+Pg3+h+i.s.)	2.2	pf
Triode (Section 2)		
Grid to Plate: (T2g to T2p)	3.6	pf
Input: T2g to (T2k+Pk+Pg3+h+i.s.)	2.4	pf
Output: T2p to (T2k+Pk+Pg3+h+i.s.)	3.8	pf
Pentode		
Grid-Number 1 to Plate: (Pg1 to Pp)	0.12	pf
Input: Pg1 to (T2k+Pk+Pg2+Pg3+h+i.s.)	.10	pf
Output: Pp to (T2k+Pk+Pg2+Pg3+h+i.s.)	4.5	pf
Pentode Plate to Triode Plate (Section 2):		
(Pp to T2p), maximum	0.045	pf
Triode Plate (Section 1) to Triode Plate (Section 2):		
(T1p to T2p), maximum	0.06	pf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—E12-70, Button 12-Pin
Outline Drawing—EIA 9-58

Maximum Diameter	1.188	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches

PHYSICAL DIMENSIONS

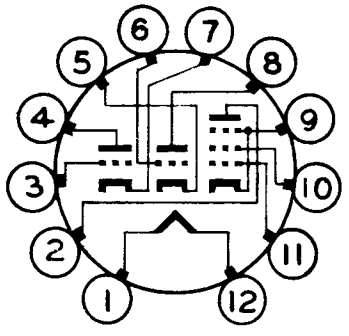


EIA 9-58

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—Pentode Plate
Pin 3—Triode Grid (Section 2)
Pin 4—Triode Plate (Section 2)
Pin 5—Triode Cathode (Section 1)
Pin 6—Triode Grid (Section 1)
Pin 7—Triode Cathode and Internal Shield (Section 2)
Pin 8—Triode Plate (Section 1)
Pin 9—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 10—Pentode Grid Number 2 (Screen)
Pin 11—Pentode Grid Number 1
Pin 12—Heater

BASING DIAGRAM



EIA 12DP

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	330	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	5.0	Watts
Screen Dissipation	1.25	Watts

Triode (Section 1)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.1	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Pentode Section

Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	1.0	Megohms

Triode (Section 2)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Resepct to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	50	200	Volts
Screen Voltage	150	150	Volts
Grid-Number 1 Voltage	0	.....	Volts
Cathode-Bias Resistor	...	100	Ohms
Plate Resistance, approximate	...	68000	Ohms
Transconductance	...	11000	Micromhos
Plate Current	55	24	Milliamperes
Screen Current	18	4.8	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 100 Microamperes	...	−10	Volts

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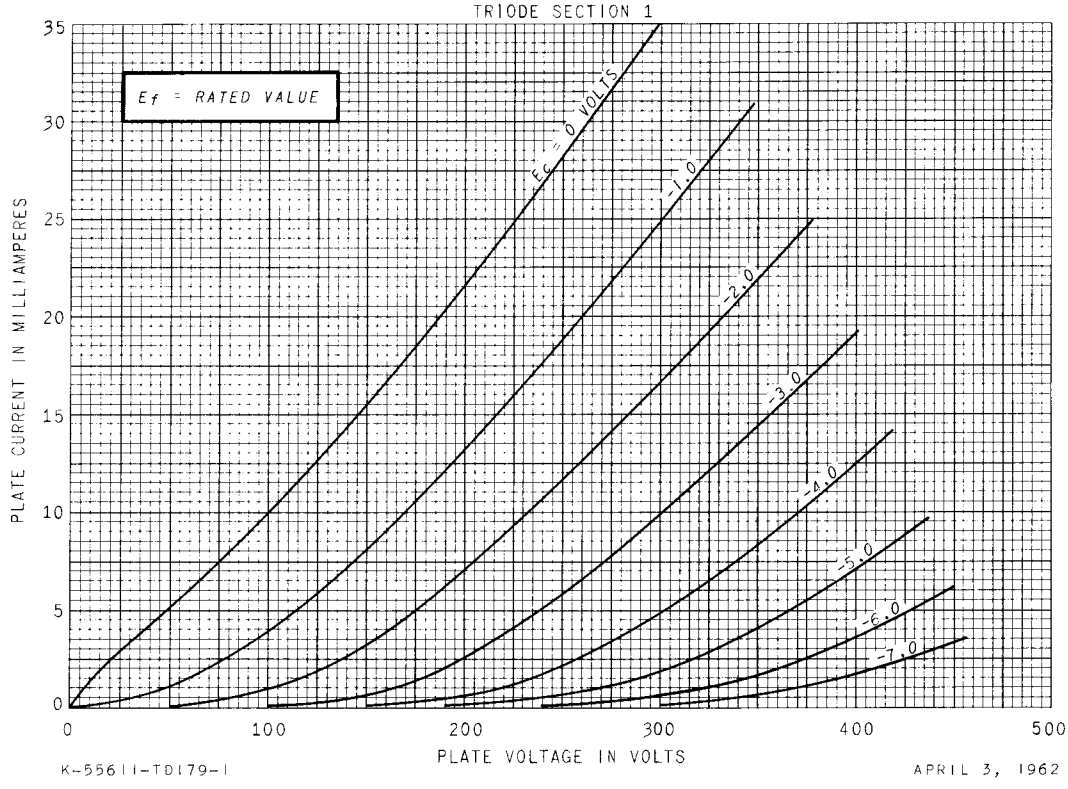
CHARACTERISTICS AND TYPICAL OPERATION (Continued)

Triode (Section 1)		
Plate Voltage	200	Volts
Grid Voltage	−2.0	Volts
Amplification Factor	68	
Plate Resistance, approximate	12400	Ohms
Transconductance	5500	Micromhos
Plate Current	7.0	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	−5.5	Volts

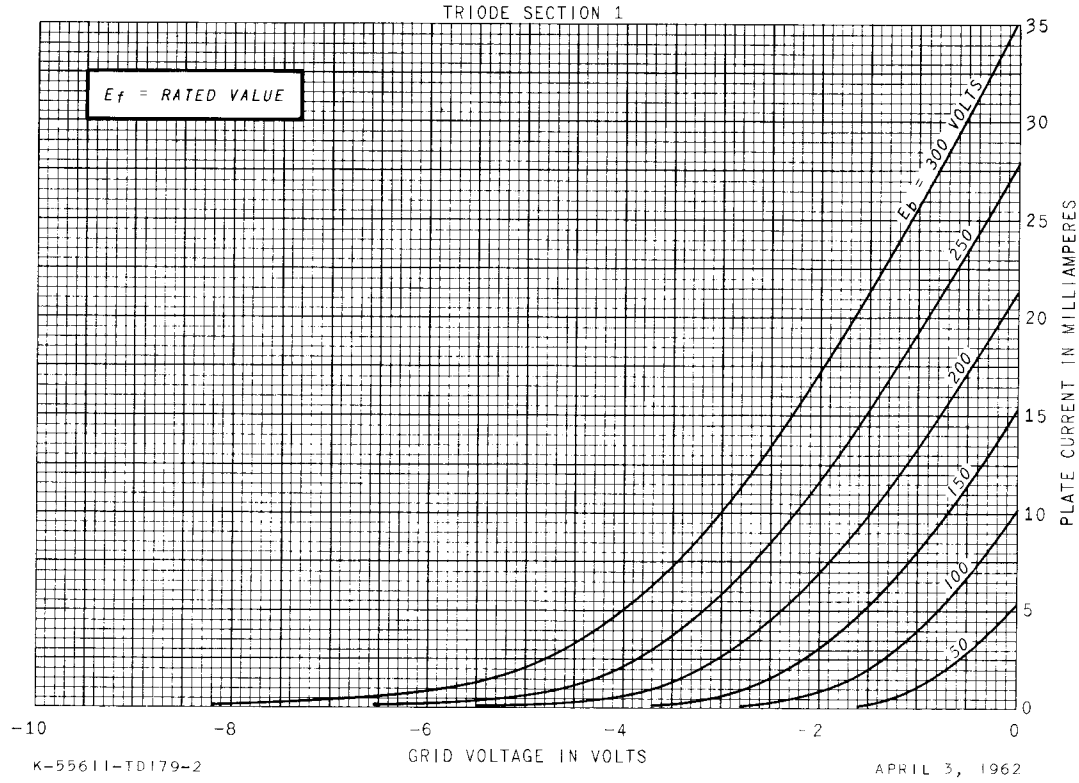
Triode (Section 2)		
Plate Voltage	200	Volts
Cathode-Bias Resistor	220	Ohms
Amplification Factor	41	
Plate Resistance, approximate	9400	Ohms
Transconductance	4400	Micromhos
Plate Current	9.2	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes	−6.5	Volts

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.
† Heater current of a bogey tube at Ef = 6.3 volts.
‡ Without external shield.

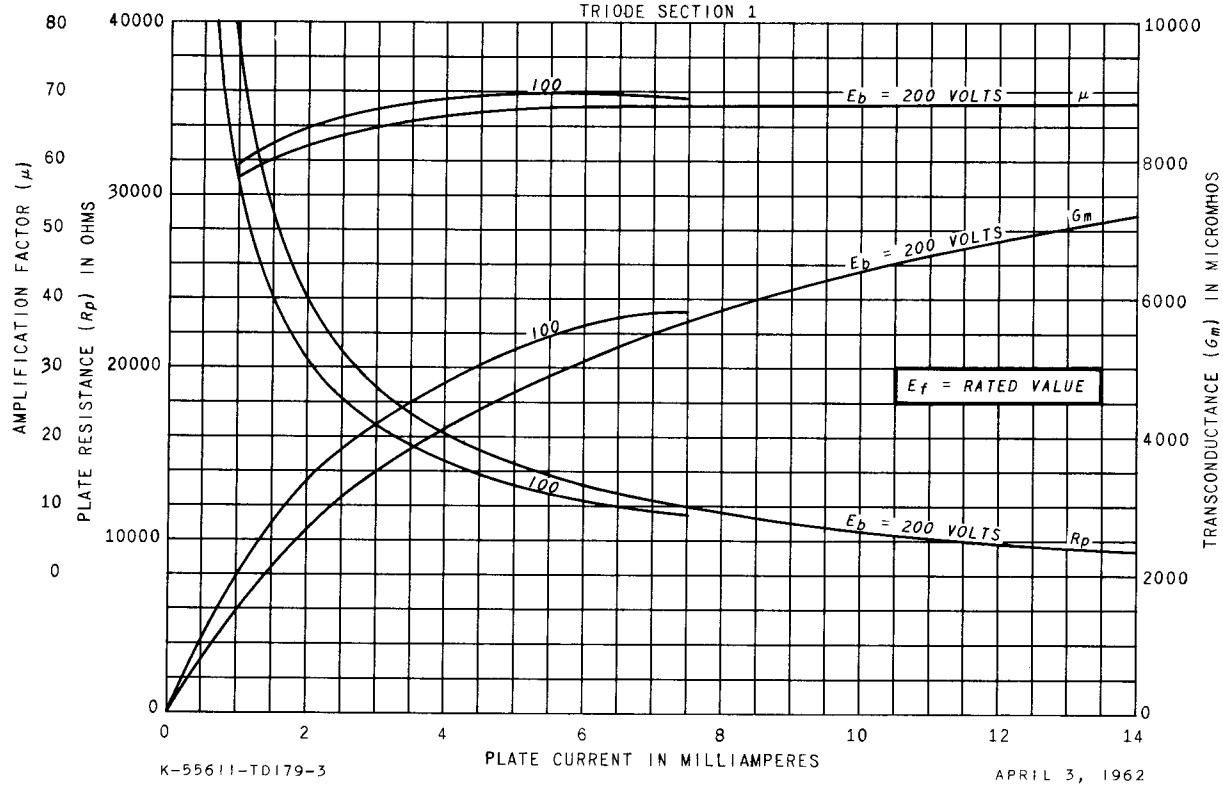
AVERAGE PLATE CHARACTERISTICS



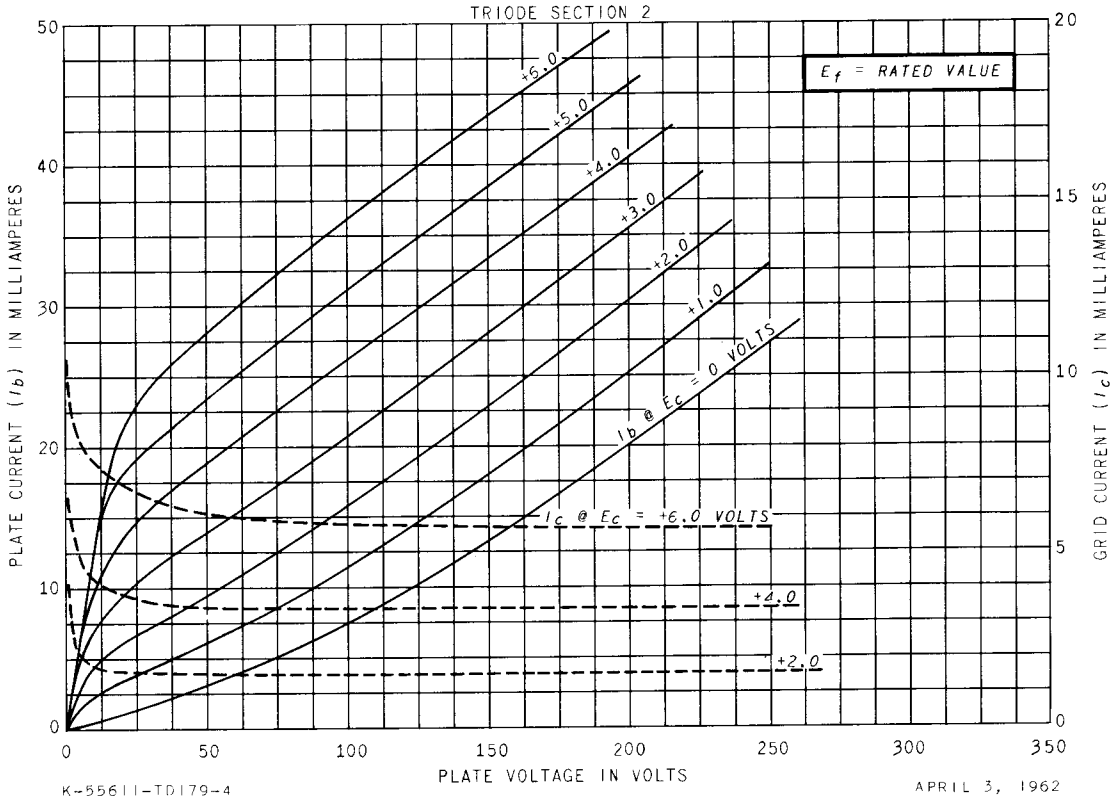
AVERAGE TRANSFER CHARACTERISTICS



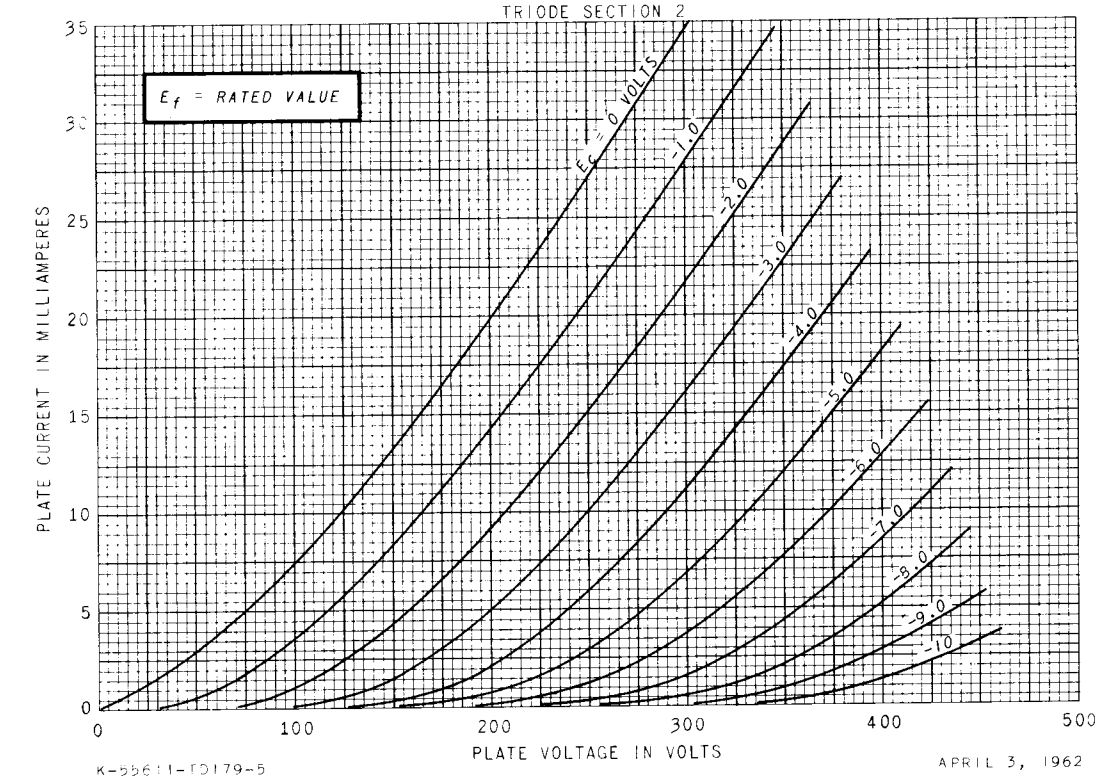
AVERAGE CHARACTERISTICS



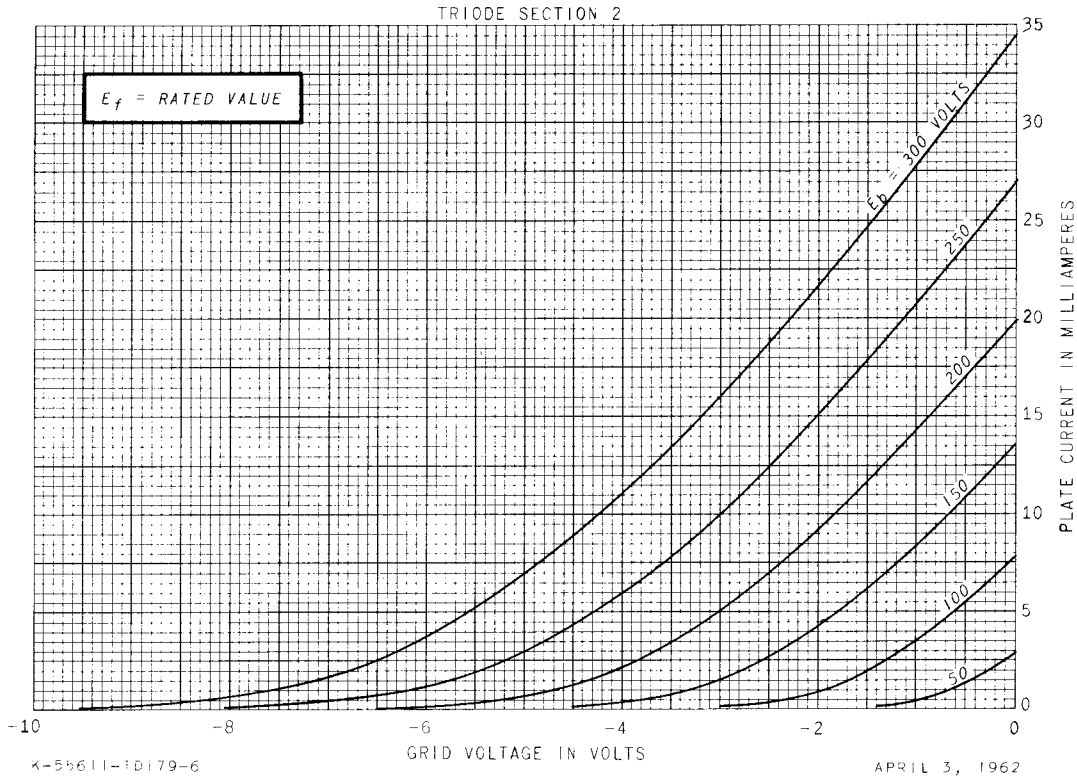
AVERAGE PLATE CHARACTERISTICS



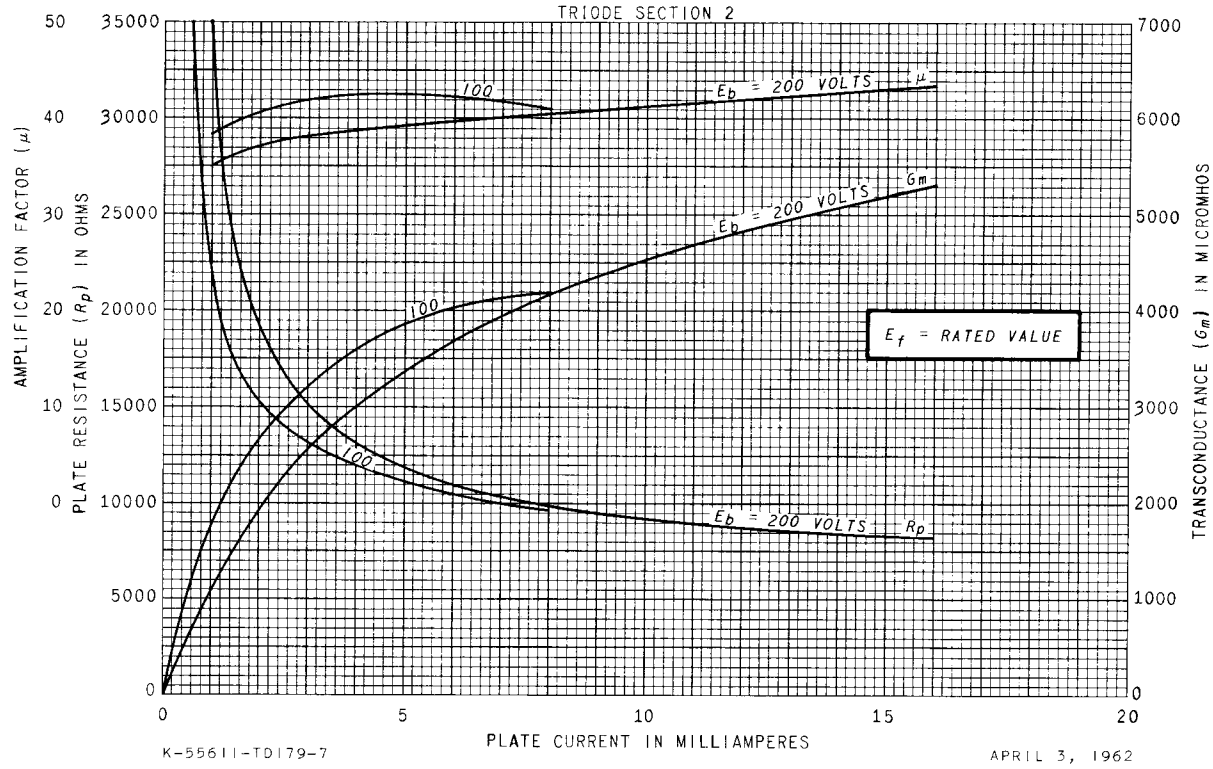
AVERAGE PLATE CHARACTERISTICS



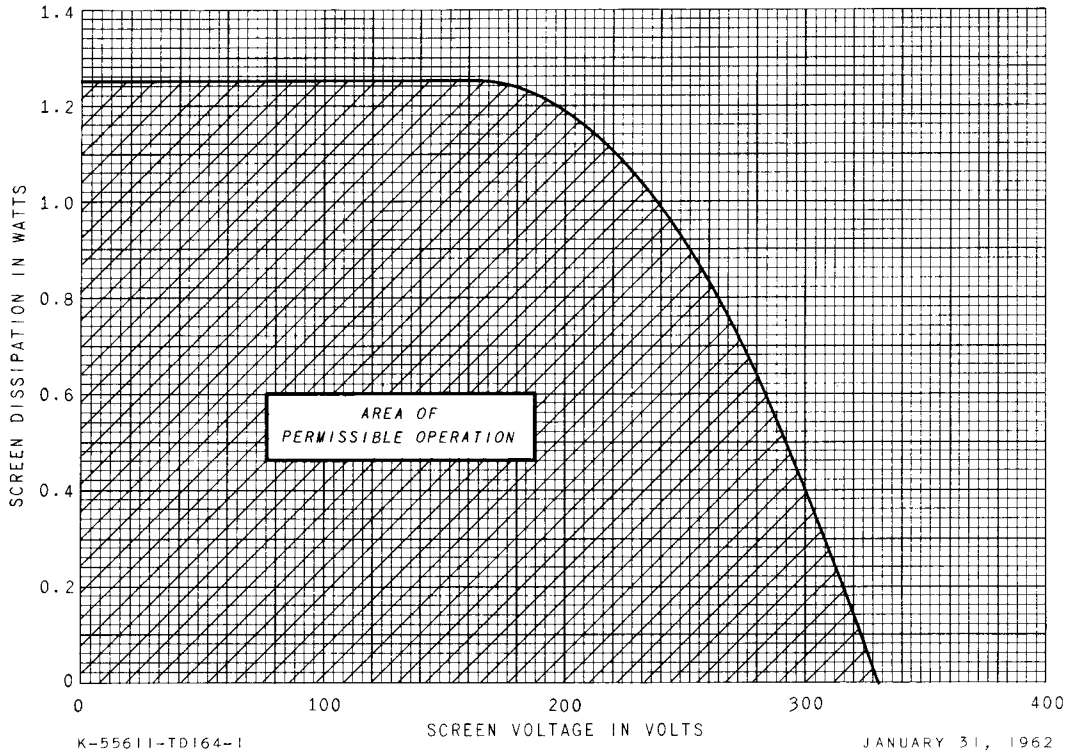
AVERAGE TRANSFER CHARACTERISTICS



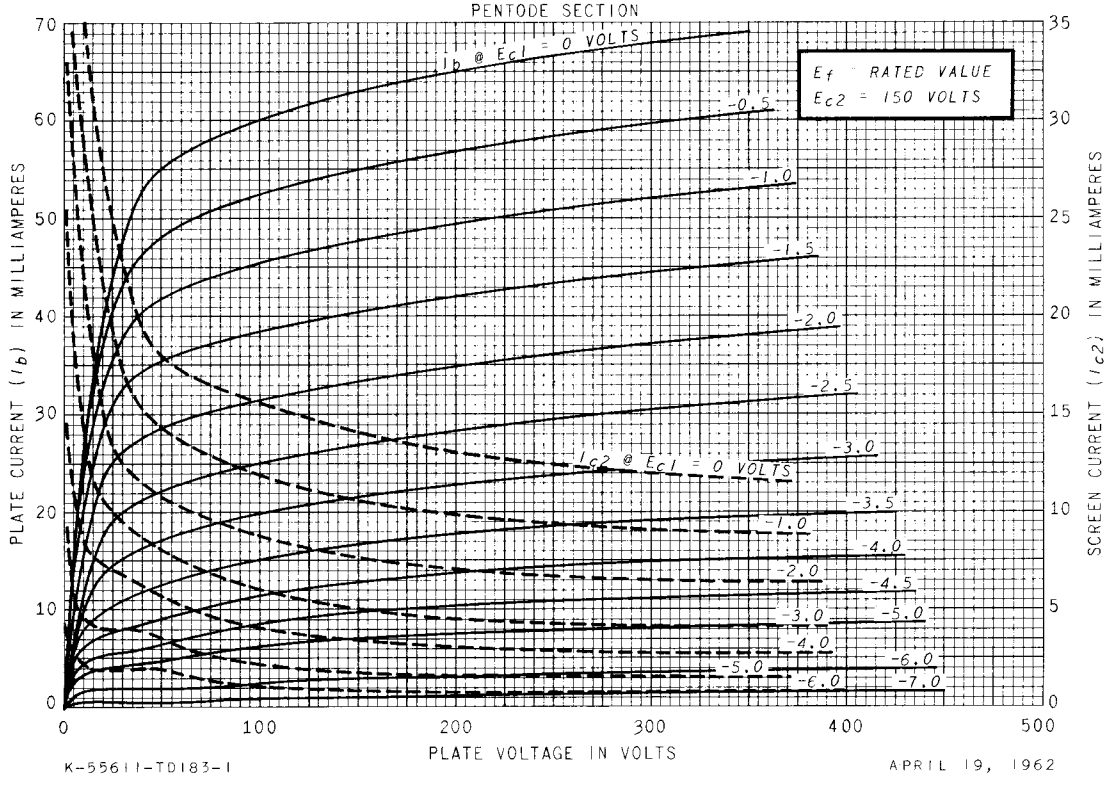
AVERAGE CHARACTERISTICS



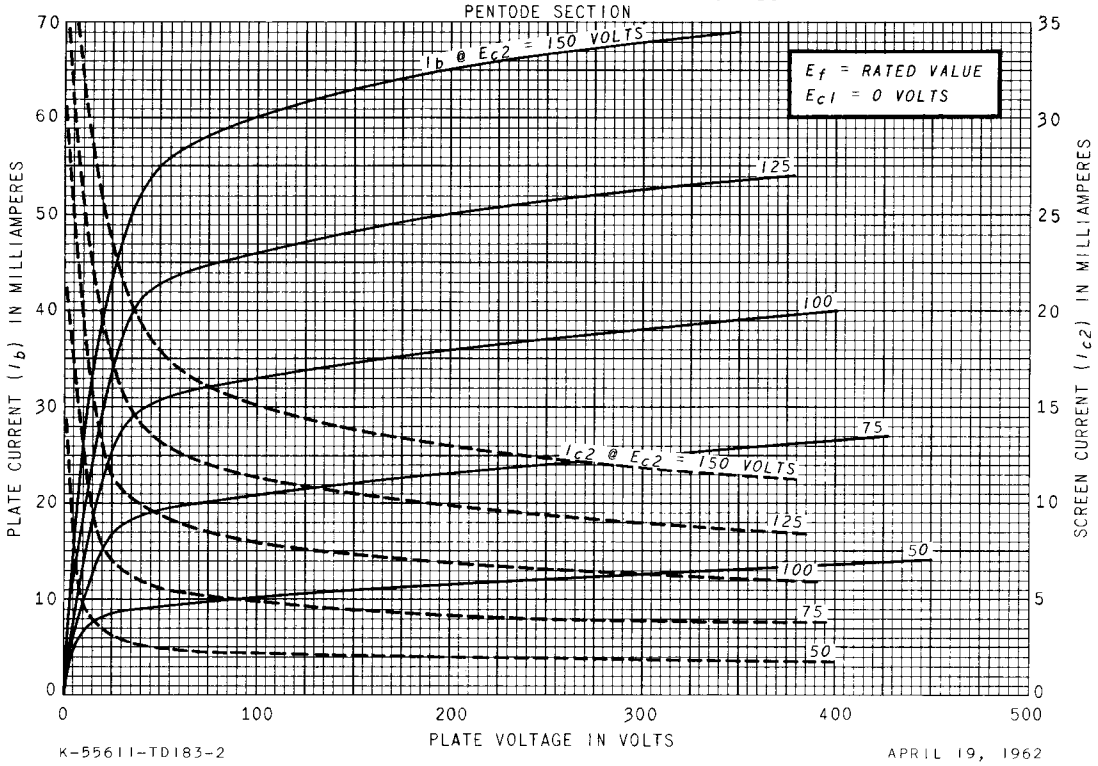
SCREEN RATING CHART



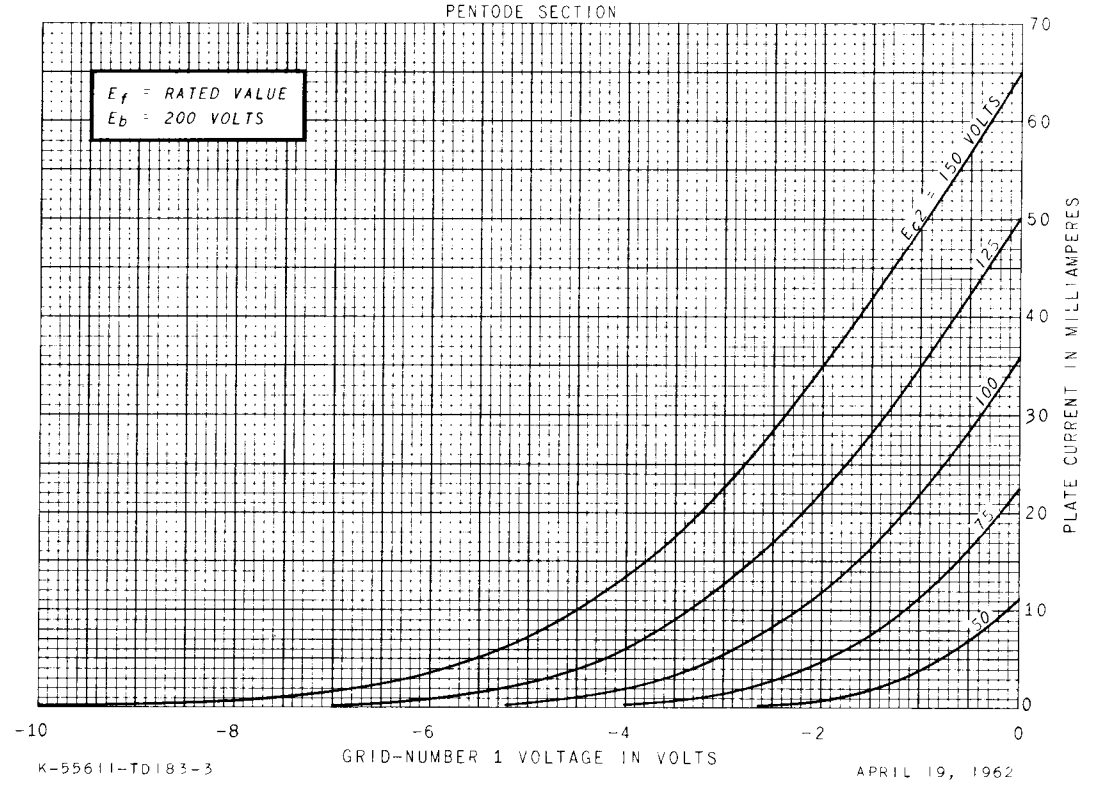
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

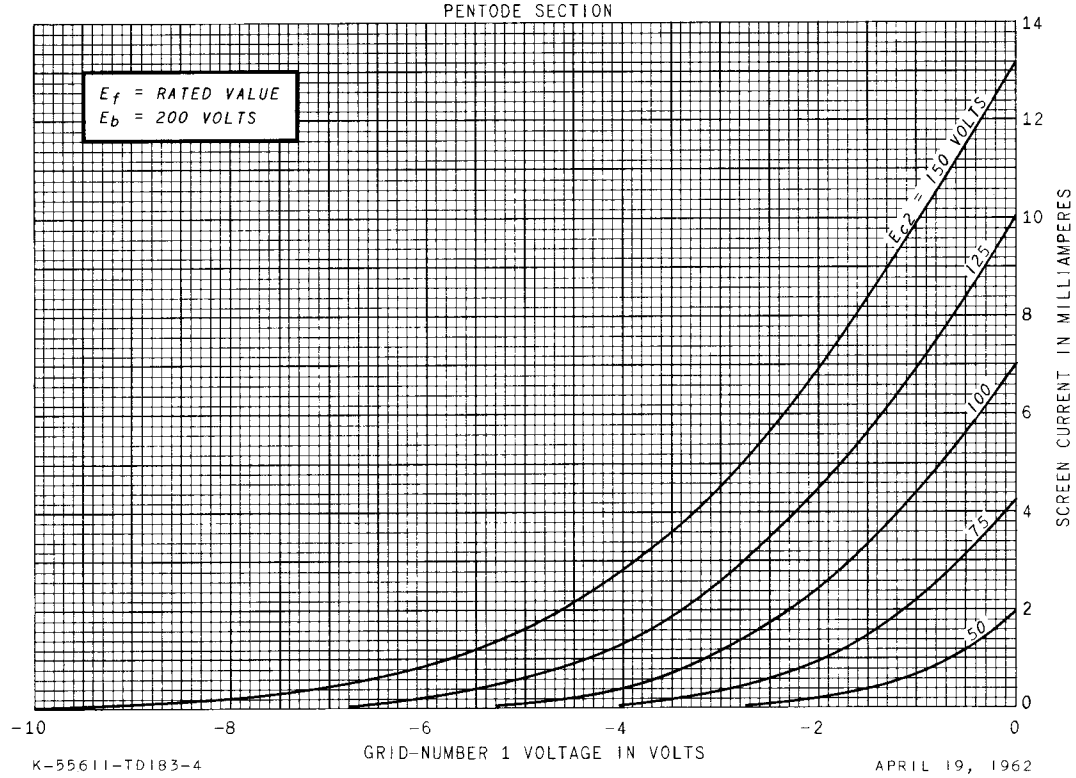


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

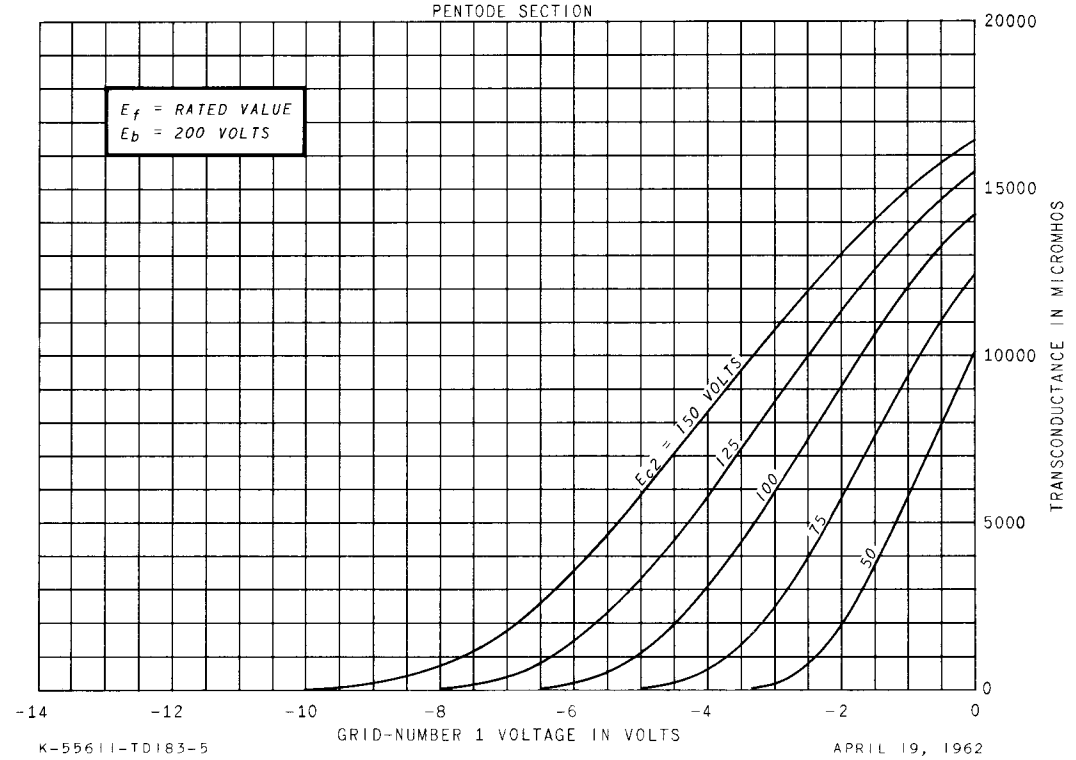


K-55611-TD183-4

APRIL 19, 1962

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



K-55611-TD183-5

APRIL 19, 1962

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

6AF3

DIODE

FOR TV DAMPING-DIODE APPLICATIONS

DESCRIPTION AND RATING

The 6AF3 is a miniature, heater-cathode type diode for service as the damping diode in the horizontal-deflection circuit of television receivers. It will withstand high pulse voltages between the heater and cathode and high inverse pulse voltages between the plate and cathode.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	1.2	Amperes
Direct Interelectrode Capacitances, approximate*		
Cathode to Plate and Heater	9.0	μμf
Plate to Cathode and Heater	6.0	μμf
Heater to Cathode	2.8	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

TV DAMPER SERVICE—DESIGN-MAXIMUM VALUES†

Peak Inverse Plate Voltage	4500	Volts
Plate Dissipation	6.0	Watts
Steady-State Peak Plate Current	750	Milliamperes
DC Output Current	185	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	1000	Volts
Total DC and Peak	4500	Volts
Bulb Temperature at Hottest Point	210	C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

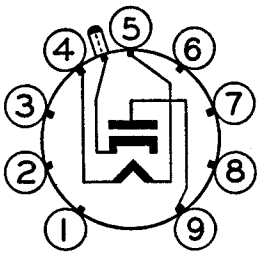
The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM

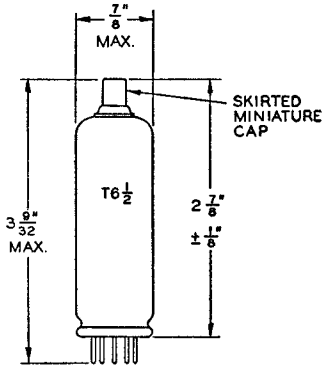


EIA 9CB

TERMINAL CONNECTIONS

Pin 1—Internal Connection
Pin 2—Internal Connection
Pin 3—Internal Connection
Pin 4—Heater
Pin 5—Heater
Pin 6—Internal Connection
Pin 7—Internal Connection
Pin 8—Internal Connection
Pin 9—Plate
Cap—Cathode

PHYSICAL DIMENSIONS



EIA 6-8

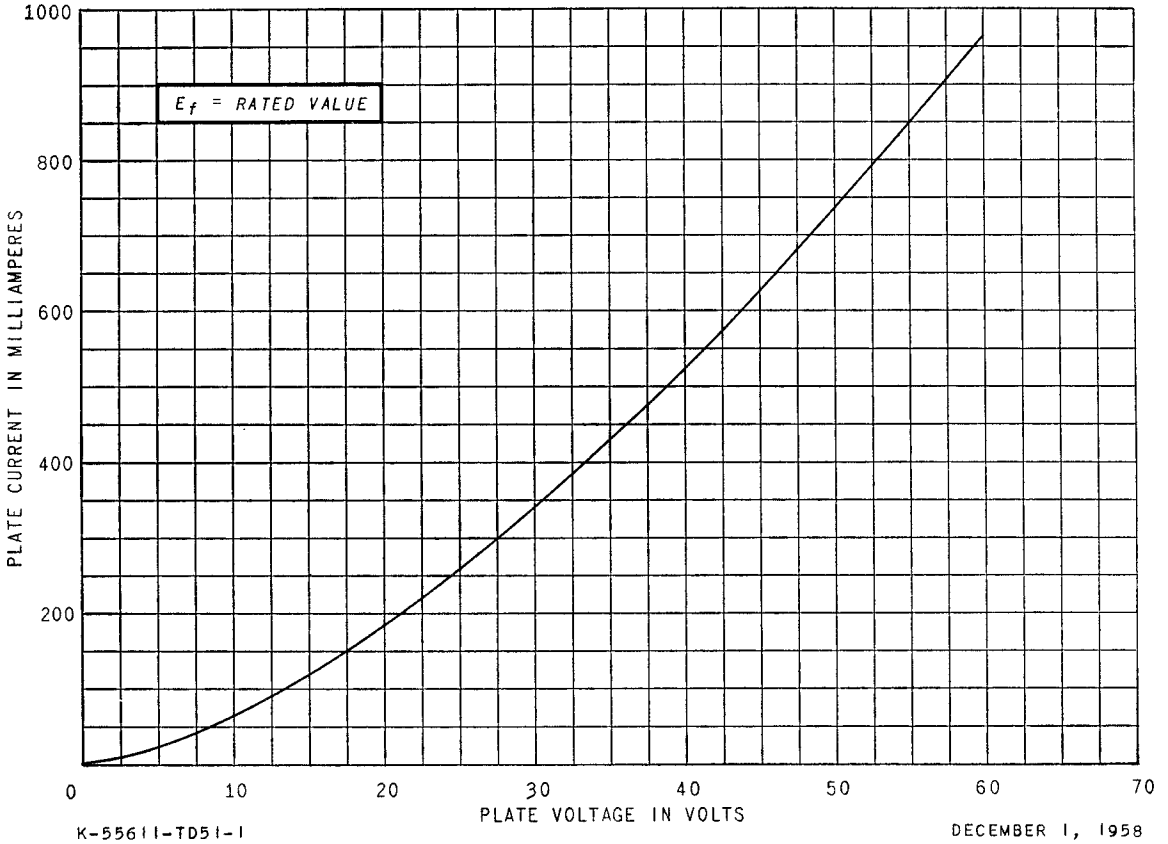
AVERAGE CHARACTERISTICS

Tube Voltage Drop
I_b = 340 Milliamperes DC ..... 30 Volts

* Without external shield.

† For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

AVERAGE PLATE CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6AF4—2AF4

TRIODE

FOR UHF OSCILLATOR APPLICATIONS

DESCRIPTION AND RATING

The 6AF4 is a miniature medium-mu triode designed for use as a UHF oscillator in television receivers. Features of the tube include low interelectrode capacitances, low internal lead inductances, and short transit time.

Except for heater ratings, the 2AF4 is essentially equivalent to the 6AF4. In addition, the 2AF4 incorporates a controlled heater warm-up characteristic which makes it especially suited for use in television receivers that employ 600-milliampere, series-connected heaters.

GENERAL

ELECTRICAL	2AF4	6AF4
Cathode—Coated Unipotential		
Heater Voltage, AC or DC	2.35	6.3 ± 10% Volts
Heater Current	0.6 ± 6%	0.225 Amperes
Heater Warm-up Time*	11	.... Seconds
Direct Interelectrode Capacitances†		
Grid to Plate		1.9 μμf
Input		2.2 μμf
Output		1.4 μμf
Heater to Cathode‡		2.2 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

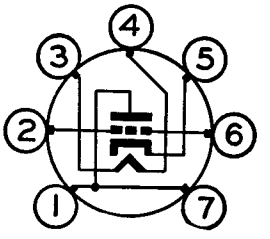
MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	150 Volts
Negative DC Grid Voltage	50 Volts
Plate Dissipation	2.5 Watts
DC Grid Current	2.0 Milliamperes
DC Cathode Current	22 Milliamperes
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	
DC Component	25 Volts
Total DC and Peak	50 Volts
Heater Negative with Respect to Cathode	
Total DC and Peak	50 Volts

Design Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur. To obtain satisfactory circuit performance, therefore, the equipment designer must establish the circuit design so that no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

BASING DIAGRAM

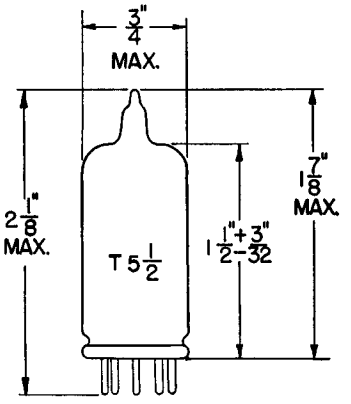


RETMA 7DK

TERMINAL CONNECTIONS

Pin 1—Plate
Pin 2—Grid Number 1
Pin 3—Heater
Pin 4—Heater
Pin 5—Cathode
Pin 6—Grid Number 1
Pin 7—Plate

PHYSICAL DIMENSIONS



RETMA 5-2

GENERAL ELECTRIC

Supersedes ET-T784, dated 8-51

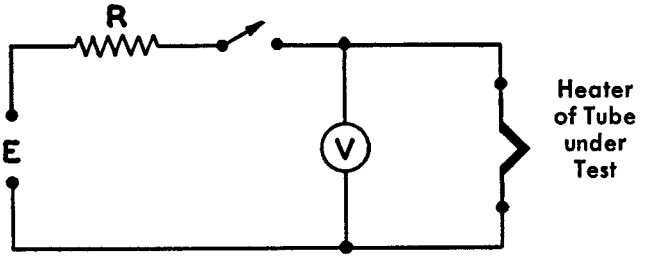
CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	80 Volts
Cathode-Bias Resistor	150 Ohms
Amplification Factor	13.5
Plate Resistance, approximate	2100 Ohms
Transconductance	6500 Micromhos
Plate Current	17.5 Milliamperes

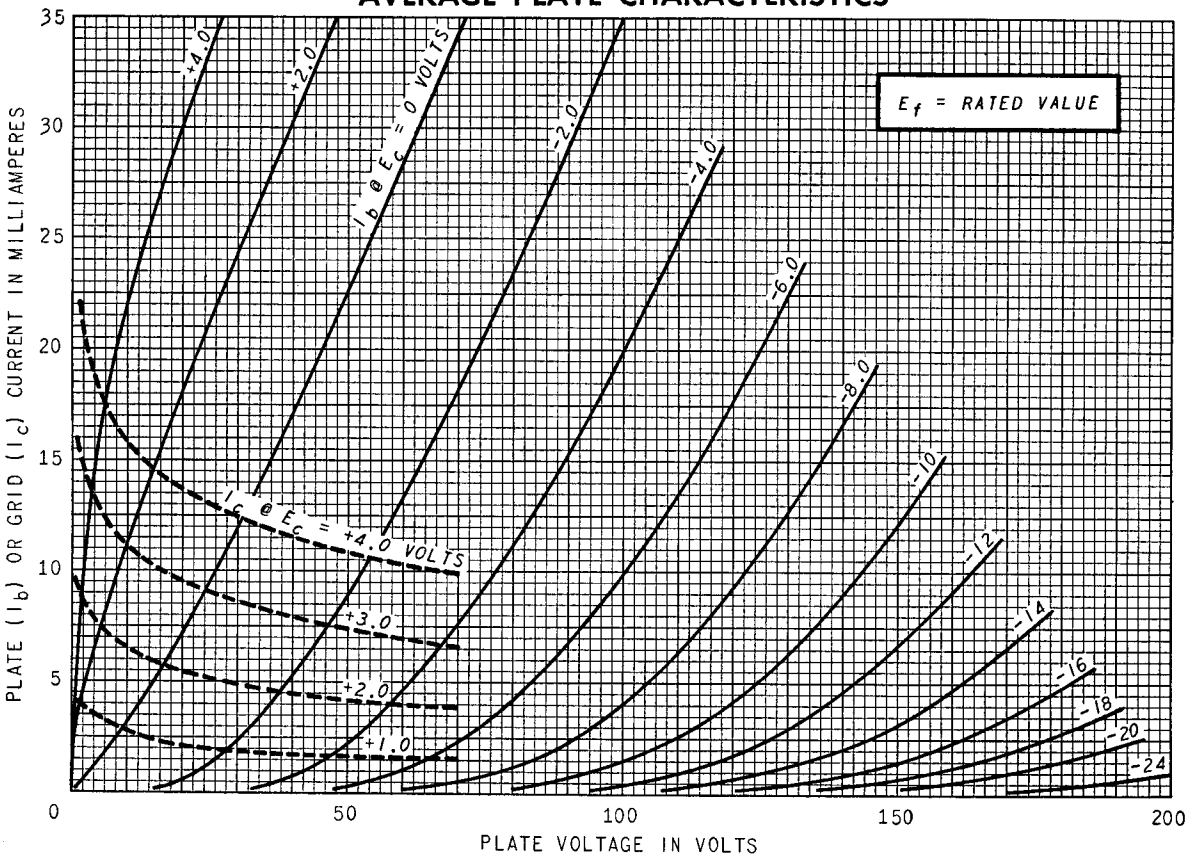
UHF OSCILLATOR SERVICE§	2AF4	6AF4
Plate Supply Voltage	100	100 Volts
Plate Resistor	220	220 Ohms
Grid Resistor	10000	10000 Ohms
Plate Current	17.5	17 Milliamperes
Frequency	1000	1000 Megacycles
Grid Current	700	750 Microamperes

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals (V) to increase from zero to the heater test voltage (V_1). For this type, E = 9.32 volts (RMS or DC), V_1 = 1.87 volts (RMS or DC), and R = 11.8 ohms.

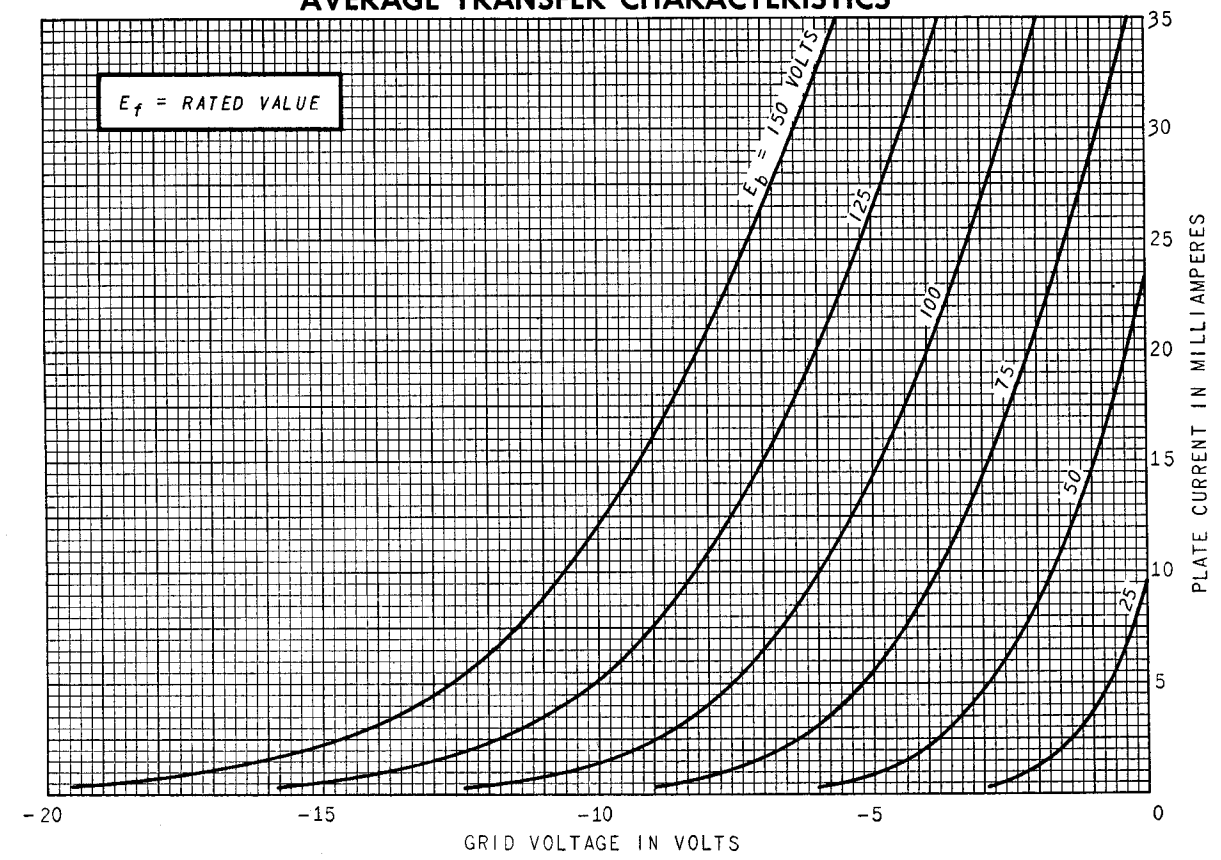


† With external shield (RETMA 316) connected to pin 5 unless otherwise indicated.
‡ With external shield (RETMA 316) connected to pin 1.
§ Measured in JETEC standard UHF oscillator No. 400.

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBES

6AF4-A—2AF4-A—3AF4-A

TRIODE

FOR UHF OSCILLATOR APPLICATIONS

DESCRIPTION AND RATING

The 6AF4-A is a miniature medium-mu triode designed for use as a UHF oscillator in television receivers. Features of the tube include low interelectrode capacitances, low internal lead inductances, and short transit time.

The 2AF4-A and 3AF4-A are essentially equivalent to the 6AF4-A, except for heater ratings. In addition, the 2AF4-A and 3AF4-A incorporate a controlled heater-warm-up characteristic which makes them especially suited for use in television receivers that employ series-connected heaters.

Except for bulb length, the 6AF4-A and 2AF4-A are identical to the 6AF4 and 2AF4.

GENERAL

ELECTRICAL	2AF4-A	3AF4-A	6AF4-A	
Cathode—Coated Unipotential				
Heater Voltage, AC or DC	2.35	3.2	6.3 ± 10%	Volts
Heater Current	0.6 ± 6%	0.45	0.225	Amperes
Heater Warm-up Time*	11	11	....	Seconds
Direct Interelectrode Capacitances†				
Grid to Plate			1.9	μμf
Input			2.2	μμf
Output			1.4	μμf
Heater to Cathode‡			2.2	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

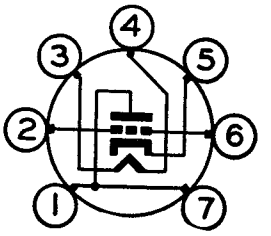
MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	150 Volts
Negative DC Grid Voltage	50 Volts
Plate Dissipation	2.5 Watts
DC Grid Current	2.0 Milliamperes
DC Cathode Current	22 Milliamperes
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	
DC Component	25 Volts
Total DC and Peak	50 Volts
Heater Negative with Respect to Cathode	
Total DC and Peak	50 Volts

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur. To obtain satisfactory circuit performance, therefore, the equipment designer must establish the circuit design so that no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

BASING DIAGRAM

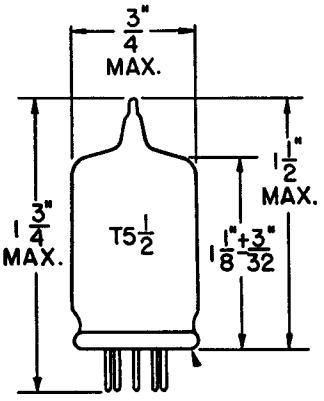


RETMA 7DK

TERMINAL CONNECTIONS

Pin 1—Plate
Pin 2—Grid
Pin 3—Heater
Pin 4—Heater
Pin 5—Cathode
Pin 6—Grid
Pin 7—Plate

PHYSICAL DIMENSIONS



RETMA 5-1

GENERAL ELECTRIC

Supersedes ET-T1257, dated 1-56

CHARACTERISTICS AND TYPICAL OPERATION

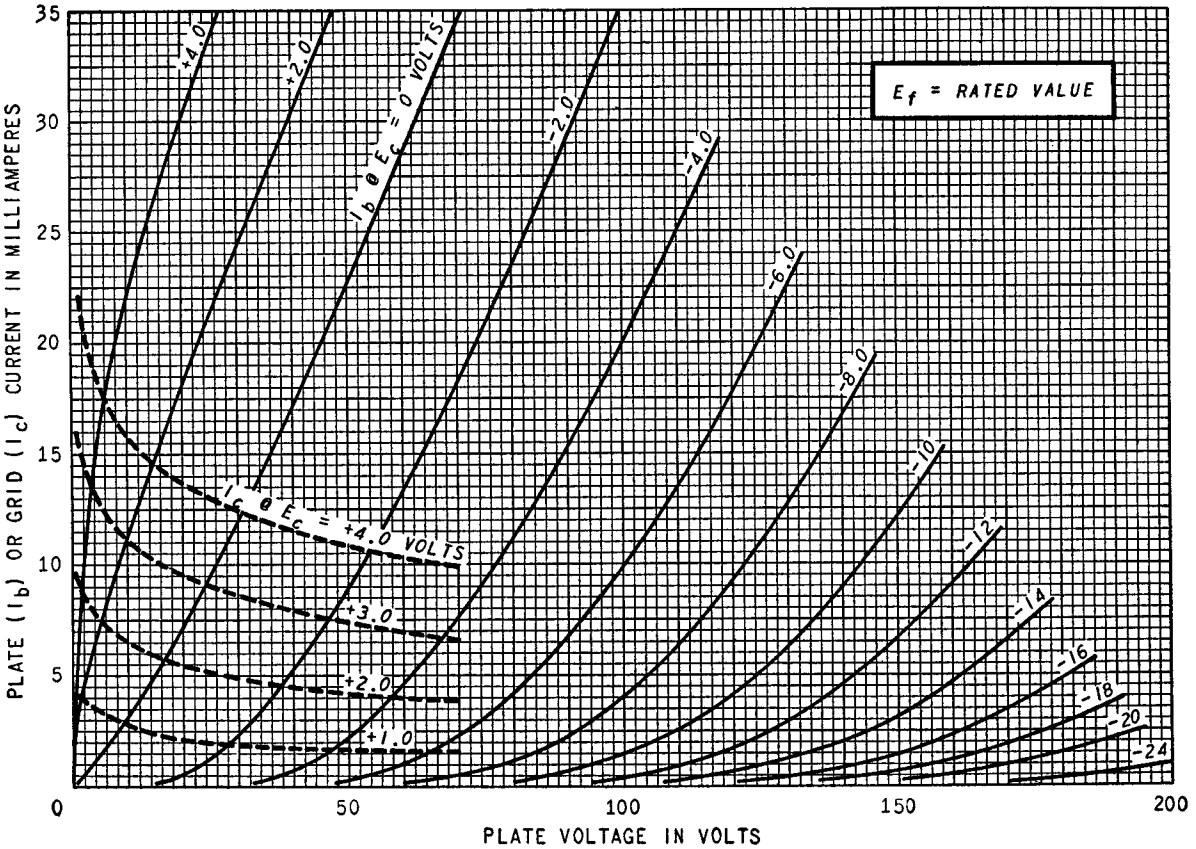
AVERAGE CHARACTERISTICS

Plate Voltage	80 Volts
Cathode-Bias Resistor	150 Ohms
Amplification Factor	13.5
Plate Resistance, approximate	2100 Ohms
Transconductance	6500 Micromhos
Plate Current	17.5 Milliamperes

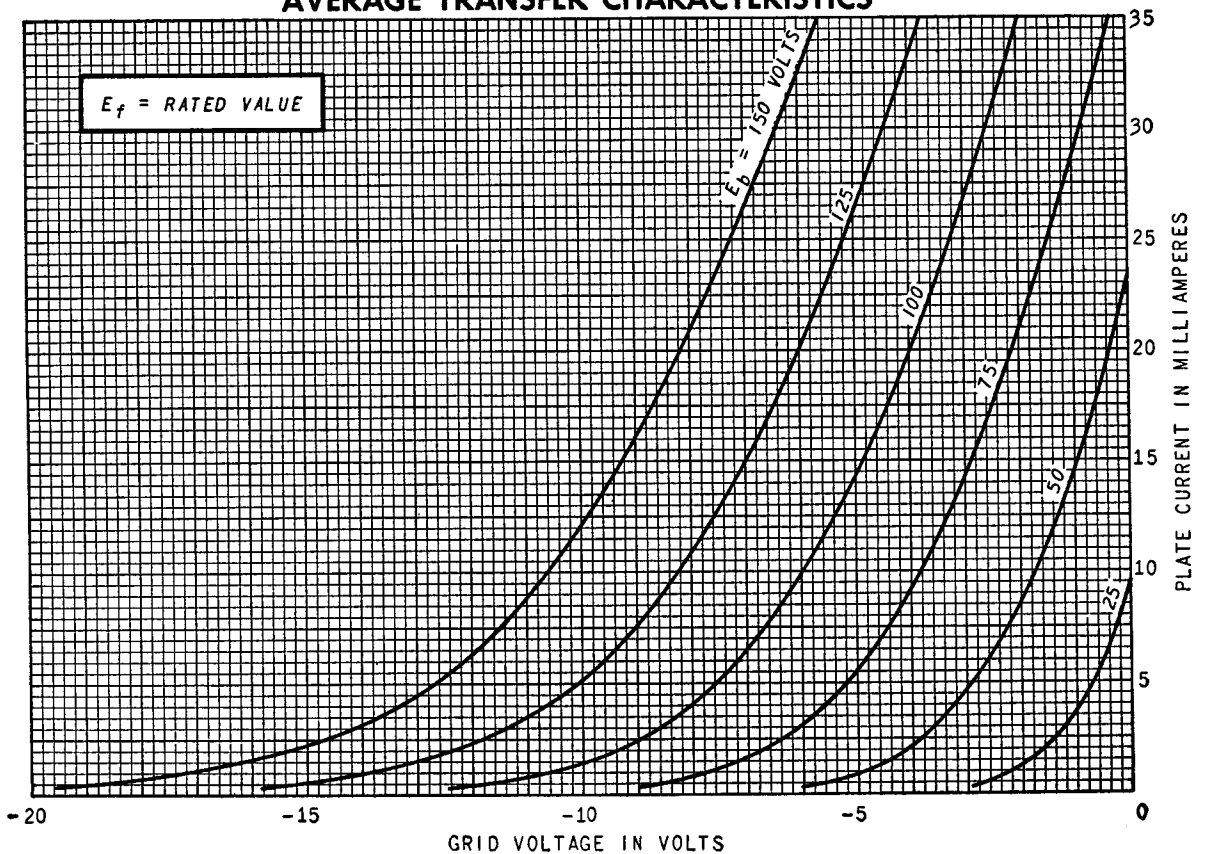
UHF OSCILLATOR SERVICE§	2AF4-A 3AF4-A	6AF4-A
Plate Supply Voltage	100	100 Volts
Plate Resistor	220	220 Ohms
Grid Resistor	10000	10000 Ohms
Plate Current	17.5	17 Milliamperes
Frequency	1000	1000 Megacycles
Grid Current	700	750 Microamperes

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.
† With external shield (RETMA 316) connected to pin 5 unless otherwise indicated.
‡ With external shield (RETMA 316) connected to pin 1.
§ Measured in JETEC standard UHF oscillator No. 400.

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



COMPACTRON DUPLEX-DIODE TWIN TRIODE

DESCRIPTION AND RATING

The 6AG11 is a compactron containing two high-mu triodes and two diodes, primarily designed for FM stereo multiplex service.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.75	Amperes
Direct Interelectrode Capacitances‡		
Triode, Each Section		
Grid to Plate: (g to p)	1.8	pf
Input: g to (h+k)	3.8	pf
Output: p to (h+k)	0.24	pf
Diode, Each Section		
Plate to Cathode and Heater: p to (h+k)	2.2	pf
Cathode to Heater and Plate: k to (h+p)	5.5	pf
Triode Grid to Diode Plate, maximum: (Tg to Dp)	0.1	pf
Triode Grid, Section 1 to Triode Grid, Section 2, maximum: (1Tg to 2Tg)	0.01	pf
Triode Plate, Section 1 to Triode Plate, Section 2: (1Tp to 2Tp)	0.5	pf

MECHANICAL

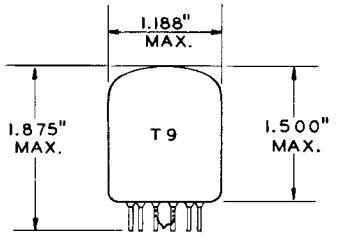
Operating Position—Any		
Envelope—T-9, Glass		
Base—E12-70, Button 12-Pin		
Outline Drawing—EIA 9-56		
Maximum Diameter	1.188	Inches
Maximum Over-all Length	1.875	Inches
Maximum Seated Height	1.500	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330	Volts
Plate Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Diode Current for Continuous Operation, Each Diode	5.0	Milliamperes

PHYSICAL DIMENSIONS

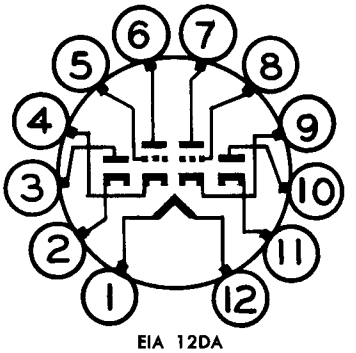


EIA 9-56

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—Diode Cathode (Section 2)
Pin 3—Diode Plate (Section 2)
Pin 4—Triode Cathode (Section 2)
Pin 5—Triode Grid (Section 2)
Pin 6—Triode Plate (Section 2)
Pin 7—Triode Plate (Section 1)
Pin 8—Triode Grid (Section 1)
Pin 9—Triode Cathode (Section 1)
Pin 10—Diode Plate (Section 1)
Pin 11—Diode Cathode (Section 1)
Pin 12—Heater

BASING DIAGRAM



EIA 12DA

MAXIMUM RATINGS (CONT'D)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage	125	Volts
Grid Voltage	−1.0	Volts
Amplification Factor	66	
Plate Resistance, approximate	8500	Ohms
Transconductance	7800	Micromhos
Plate Current	7.5	Milliamperes
Grid Voltage, approximate Ib = 30 Microamperes	−5	Volts
Average Diode Current, Each Diode With 5.0 Volts DC Applied	18	Milliamperes

NOTES

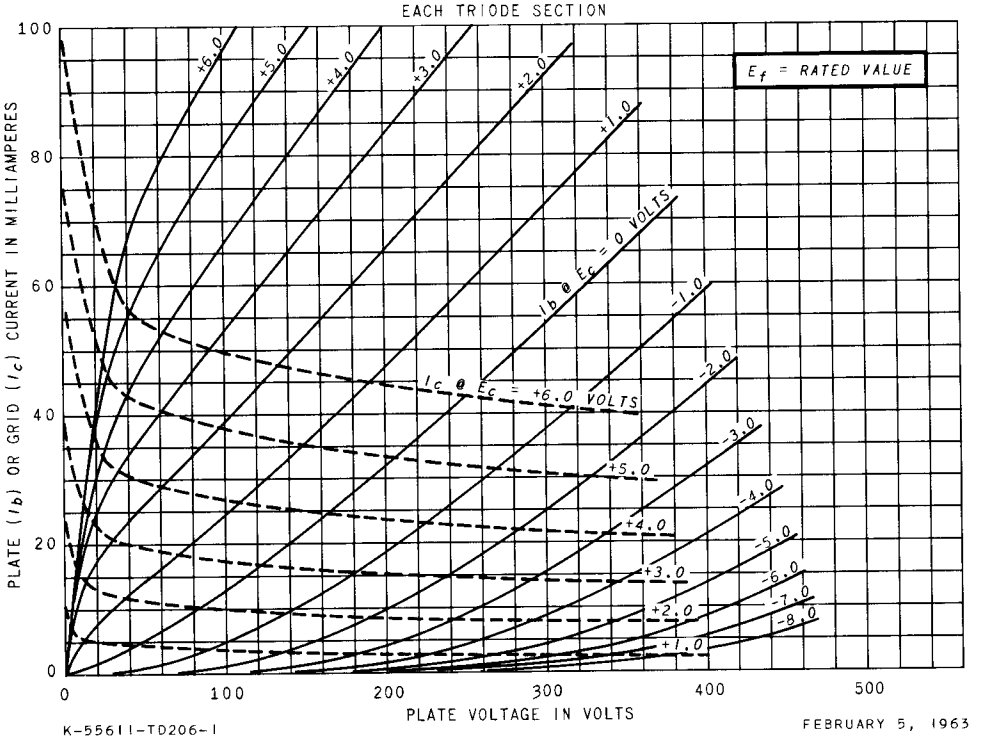
* The equipment designer should design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current for a bogey tube at Ef = 6.3 volts.

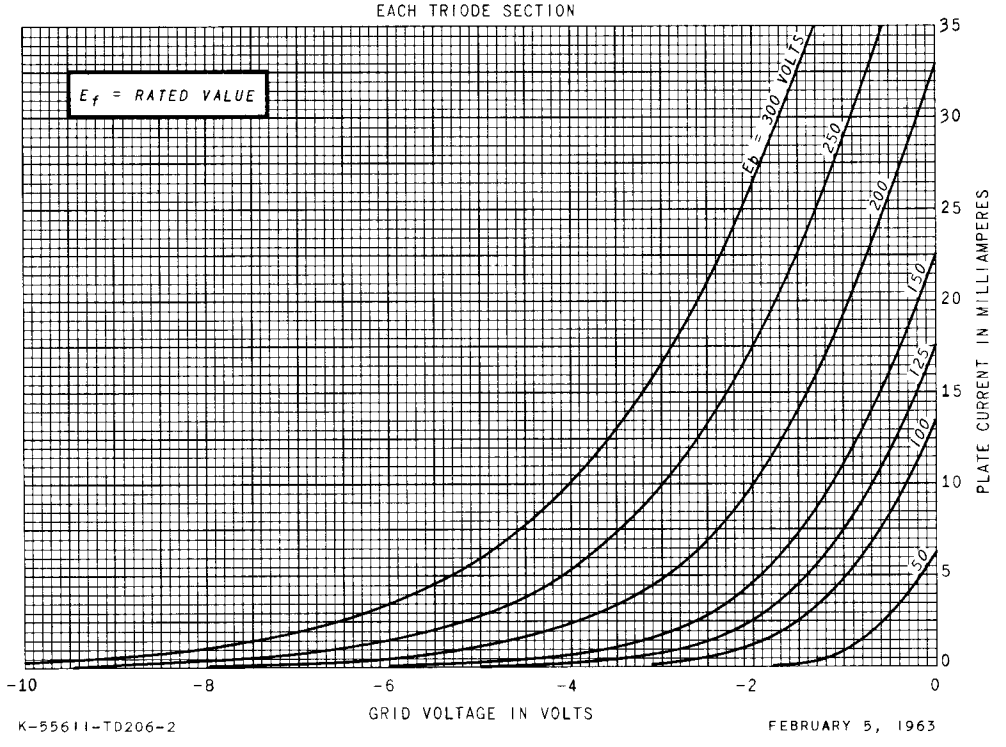
‡ Without external shield.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS

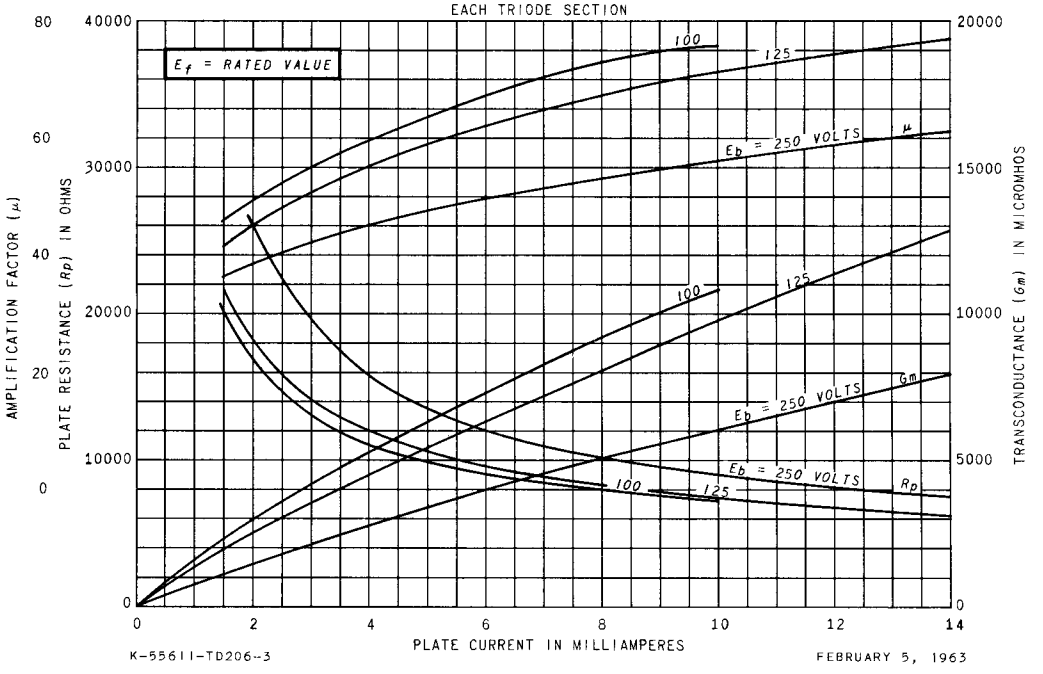


AVERAGE TRANSFER CHARACTERISTICS



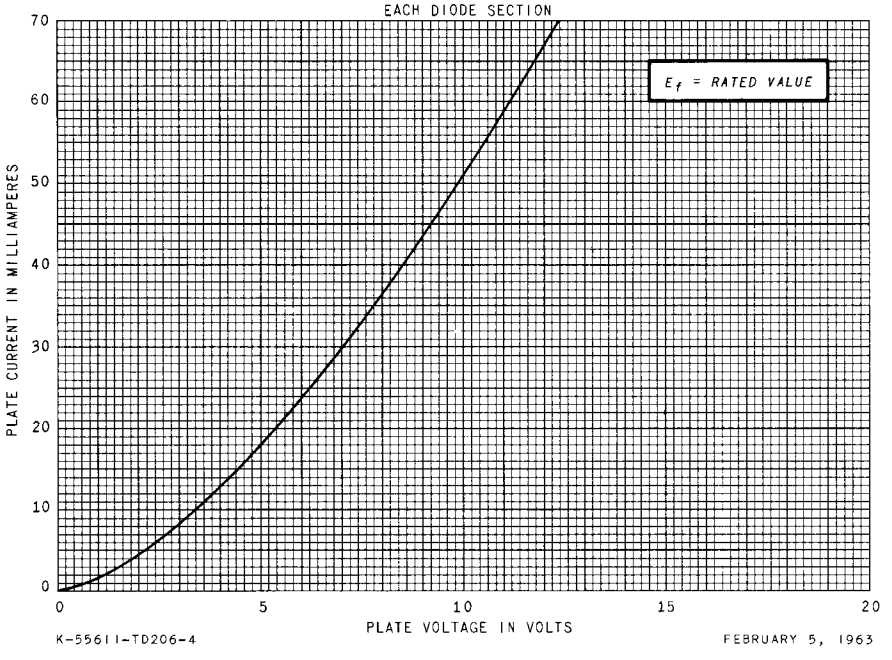
AVERAGE CHARACTERISTICS

EACH TRIODE SECTION



AVERAGE PLATE CHARACTERISTICS

EACH DIODE SECTION



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBE
KEN-RAD

6AG5

Description and Rating

RADIO-FREQUENCY AMPLIFIER PENTODE

GENERAL DESCRIPTION

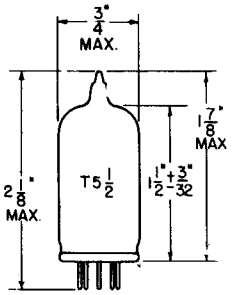
Principal Application: The 6AG5 is a miniature sharp-cutoff pentode designed for use as an intermediate-frequency amplifier or radio-frequency amplifier up to frequencies of approximately 400 megacycles. The tube features high transconductance and low input and output capacitances. The use of two cathode leads facilitates isolation of the input and output circuits and thus minimizes degeneration.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.3 Ampere
Envelope	T-5½ Glass
Base	E7-1, Miniature Button 7-Pin
Mounting Position	Any

Direct Interelectrode Capacitances:

	With Shield#	Without Shield	
Pentode Connection			
Grid 1 to Plate (Max)	0.020	0.030	μμf
Input	6.6	6.5	μμf
Output	3.1	1.8	μμf
Triode Connection*			
Grid to Plate	2.5	2.5	μμf
Input	3.6	3.6	μμf
Output	4.3	3.0	μμf

PHYSICAL DIMENSIONS

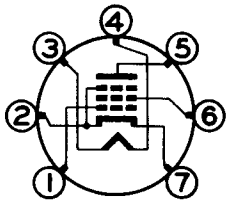


RTMA 5-2

TERMINAL CONNECTIONS

Pin 1 - Grid Number 1
Pin 2 - Cathode, Internal Shield, and Grid Number 3
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Cathode, Internal Shield, and Grid Number 3

BASING DIAGRAM



RTMA 7BD
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES:

	Triode Connection*	Pentode Connection	
Plate Voltage	300	300	Volts
Screen Supply Voltage	---	300	Volts
Screen Voltage	---	150	Volts
Positive D-C Grid Number 1 Voltage	0	0	Volts
Plate Dissipation	2.5	2.0	Watts
Screen Dissipation	---	0.5	Watt
Heater-Cathode Voltage	90	90	Volts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

	Triode Connection*		Pentode Connection			
Plate Voltage	250	180	100	125	250	Volts
Screen Voltage	---	---	100	125	150	Volts
Cathode Bias Resistor	820	330	180	100	180	Ohms
Amplification Factor	42	45	---	---	---	
Plate Resistance (Approx)	0.01	0.008	0.6	0.5	0.8	Megohm
Transconductance	3800	5700	4500	5100	5000	Micromhos
Plate Current	5.5	7.0	4.5	7.2	6.5	Milliamperes
Screen Current	---	---	1.4	2.1	2.0	Milliamperes
Grid Number 1 Voltage (Approx) for I_b = 10 Microamperes	---	---	-5	-6	-8	Volts

 # With external shield #316 connected to pin 7

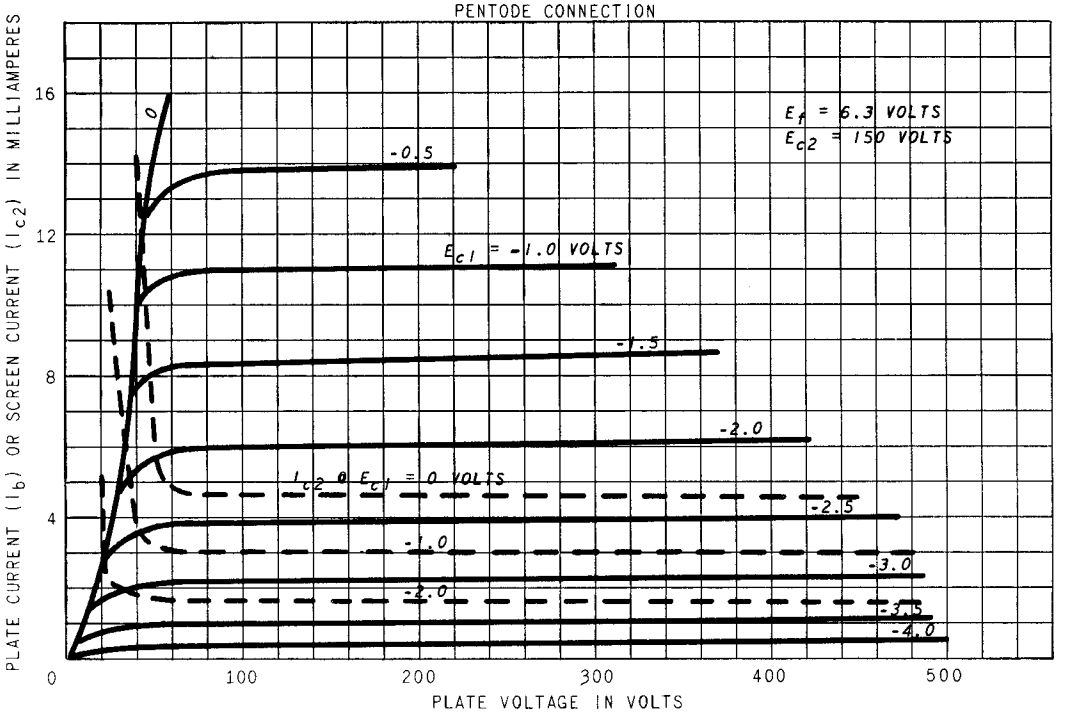
** For triode connection, connect grid 2 to plate.*

GENERAL ELECTRIC

Supersedes ET-T267 dated 9-46

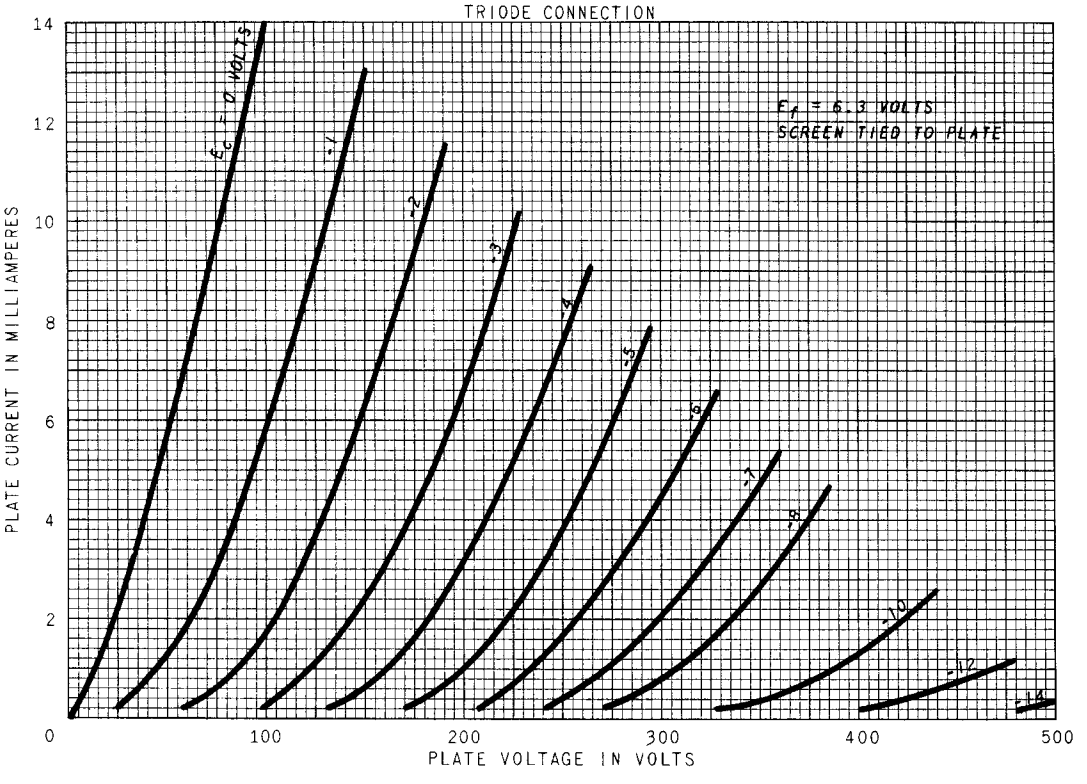
AVERAGE PLATE CHARACTERISTICS

PENTODE CONNECTION



AVERAGE PLATE CHARACTERISTICS

TRIODE CONNECTION



Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

ET-T267A
3-51

Electronic TUBES

6AG7

PENTODE

DESCRIPTION AND RATING

The 6AG7 is a metal, power-amplifier pentode primarily designed for use in the output stage of video amplifiers. The tube is capable of operating at high plate current levels and exhibits high transconductance and high power sensitivity.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.65	Ampere
Direct Interelectrode Capacitances		
Grid to Plate: (g1 to p), maximum	0.06	μμf
Input: g1 to (h+k+g2+g3+s)	13	μμf
Output: p to (h+k+g2+g3+s)	7.5	μμf
Grid-Number 1 to Grid-Number 2: (g1 to g2), approximate	5.8	μμf
Grid-Number 1 to Cathode: (g1 to k), approximate	5.2	μμf
Heater to Cathode: (h to k), approximate	10.7	μμf

MECHANICAL

Mounting Position—Any
Envelope—MT-8, Metal Shell
Base—B8-21, Small Wafer Octal 8-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	300	Volts
Screen Voltage	300	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	9.0	Watts
Screen Dissipation	1.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	1.0	Megohms

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all tubes.

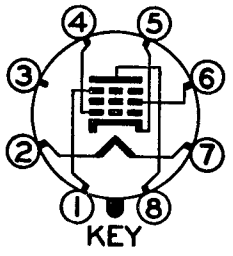
The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply-voltage.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

Supersedes ET-T268A dated 2-51

BASING DIAGRAM

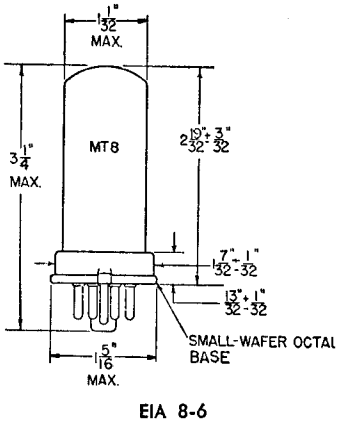


EIA 8Y

TERMINAL CONNECTIONS

Pin 1—Shell and Grid Number 3 (Suppressor)
Pin 2—Heater
Pin 3—No Connection
Pin 4—Grid Number 1
Pin 5—Cathode
Pin 6—Grid Number 2 (Screen)
Pin 7—Heater
Pin 8—Plate

PHYSICAL DIMENSIONS



EIA 8-6

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	300	Volts
Screen Voltage	150	Volts
Grid-Number 1 Voltage	−3.0	Volts
Peak AF Grid-Number 1 Voltage	3.0	Volts
Plate Resistance, approximate	130,000	Ohms
Transconductance	11,000	Micromhos
Zero-Signal Plate Current	30	Milliamperes
Maximum-Signal Plate Current	30.5	Milliamperes
Zero-Signal Screen Current	7.0	Milliamperes
Maximum-Signal Screen Current	9.0	Milliamperes
Load Resistance	10,000	Ohms
Total Harmonic Distortion, approximate	7	Percent
Maximum-Signal Power Output	3	Watts

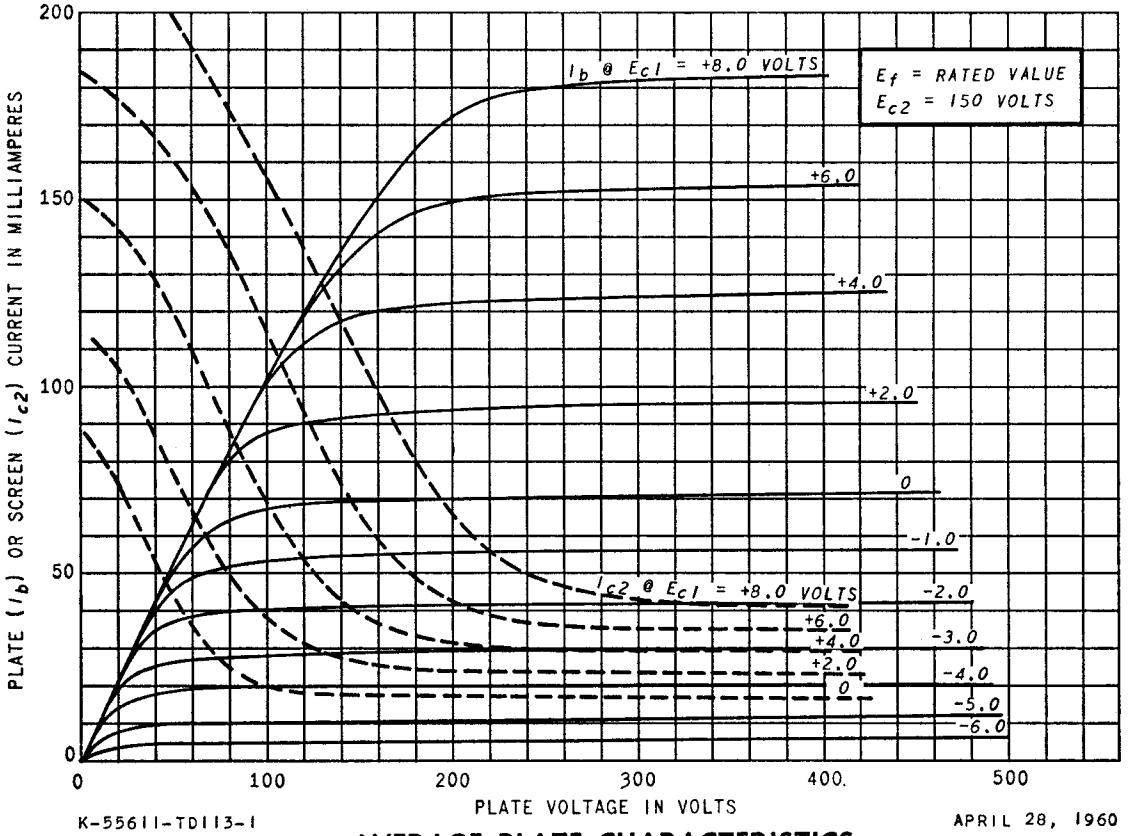
CLASS A_1 VIDEO VOLTAGE AMPLIFIER

4—Megacycle Bandwidth.

	Grid-Leak* Bias	Cathode Bias	
Plate Supply Voltage	300	300	Volts
Screen Voltage	115†	125‡	Volts
Grid-Number 1 Voltage	0**	−2.0	Volts
Grid-Number 1 Resistor, minimum	0.25	———	Megohm
Grid-Number 1 Resistor, maximum	0.5	———	Megohm
Cathode-Bias Resistor	——	57	Ohms
Cathode Bypass Capacitor, approximate	——	250	Microfarads
Grid-Number 1 Signal Voltage, peak to peak	4.0	4.0	Volts
Zero-Signal Plate Current	45	28	Milliamperes
Zero-Signal Screen Current	13	7.0	Milliamperes
Load Resistance	3500	3500	Ohms
Output Voltage, peak to peak	135	140	Volts

* Intended for use where d-c restoration is accomplished in the grid circuit of the 6AG7.
† Obtained from a regulated power supply.
‡ Obtained from the plate supply voltage through a screen-dropping resistor of 25,000 ohms.
**Zero-signal value.

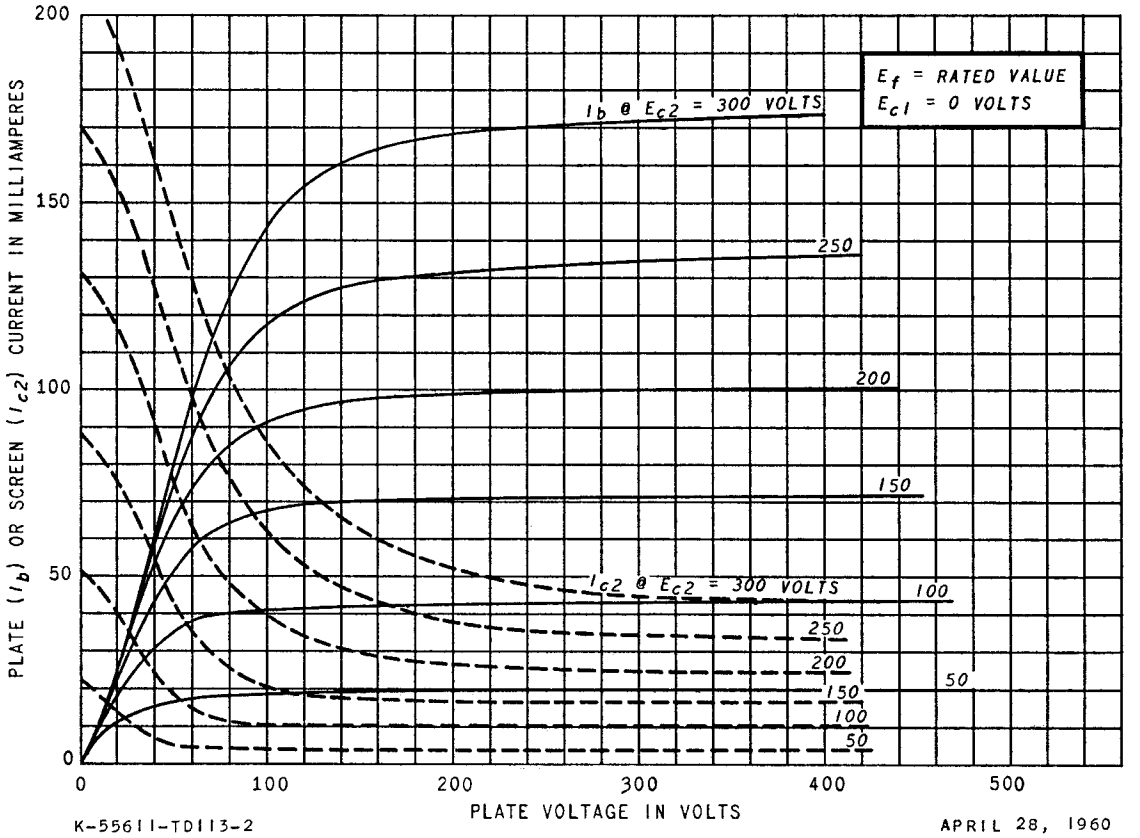
AVERAGE PLATE CHARACTERISTICS



K-55611-TD113-1

APRIL 28, 1960

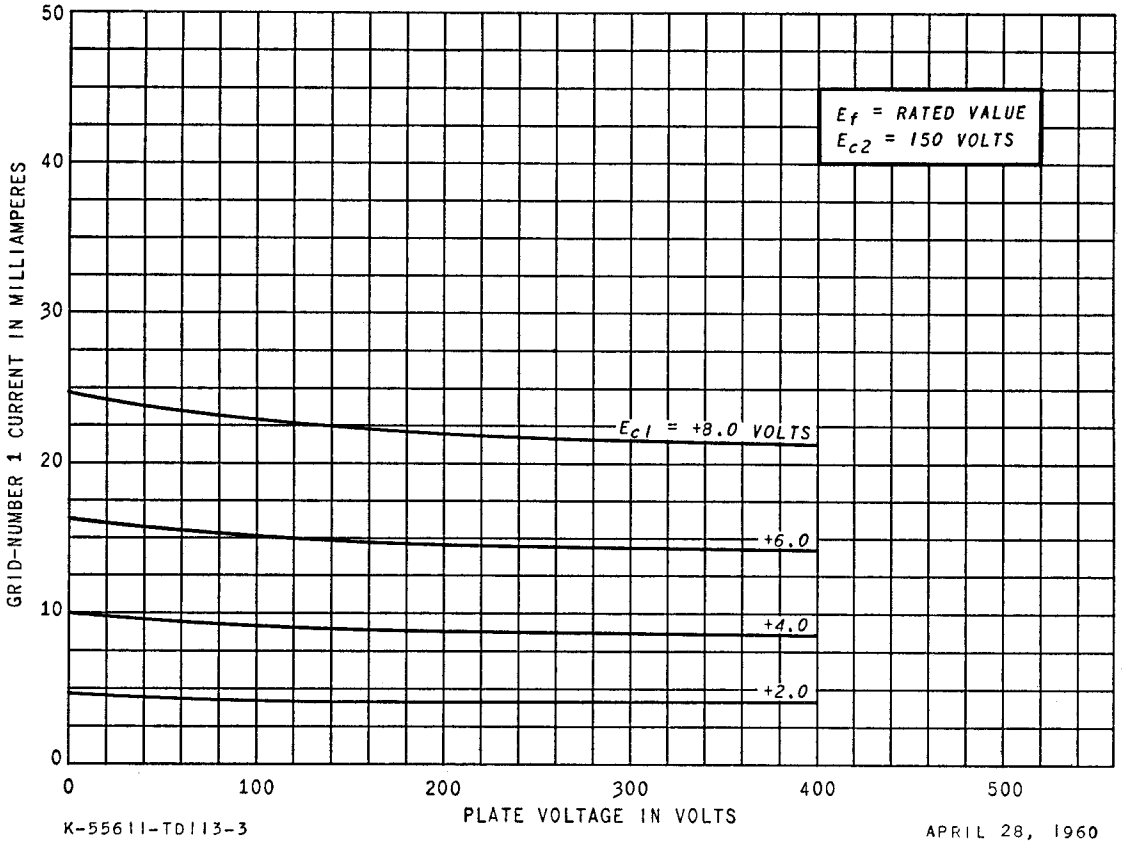
AVERAGE PLATE CHARACTERISTICS



K-55611-TD113-2

APRIL 28, 1960

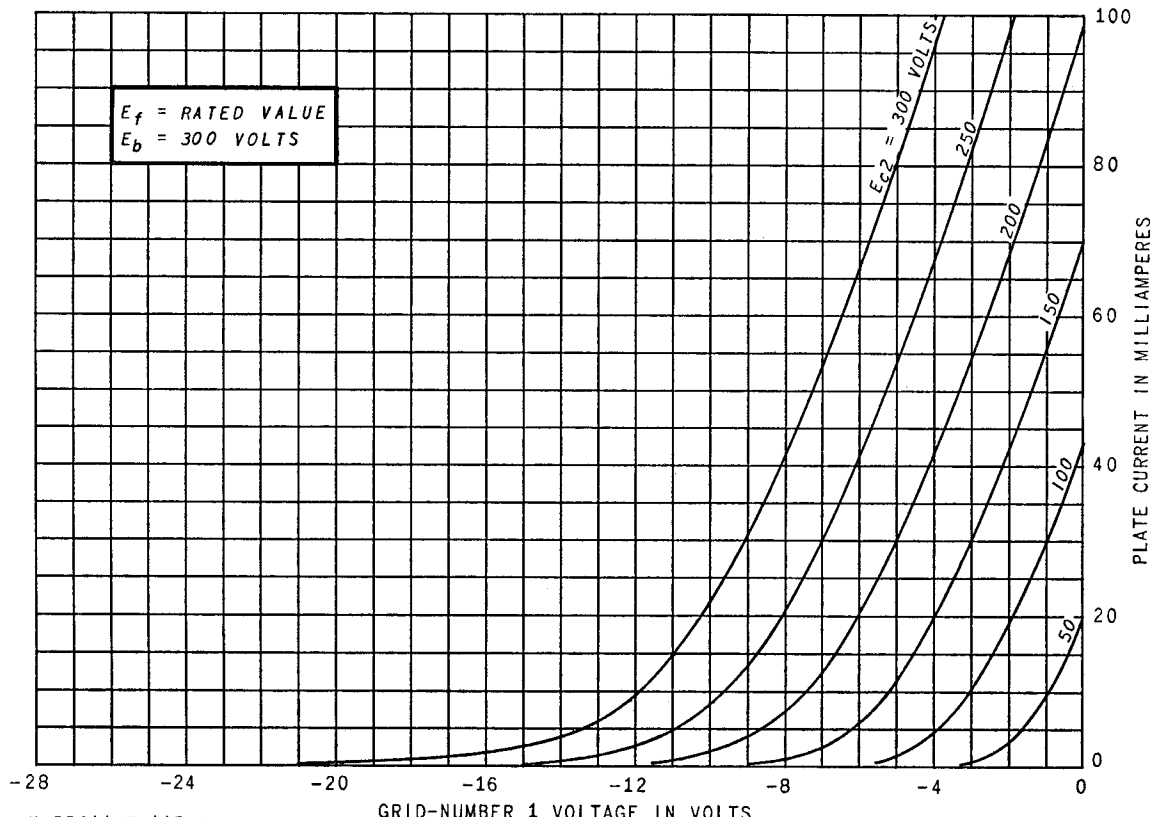
AVERAGE CHARACTERISTICS



K-55611-TD113-3

APRIL 28, 1960

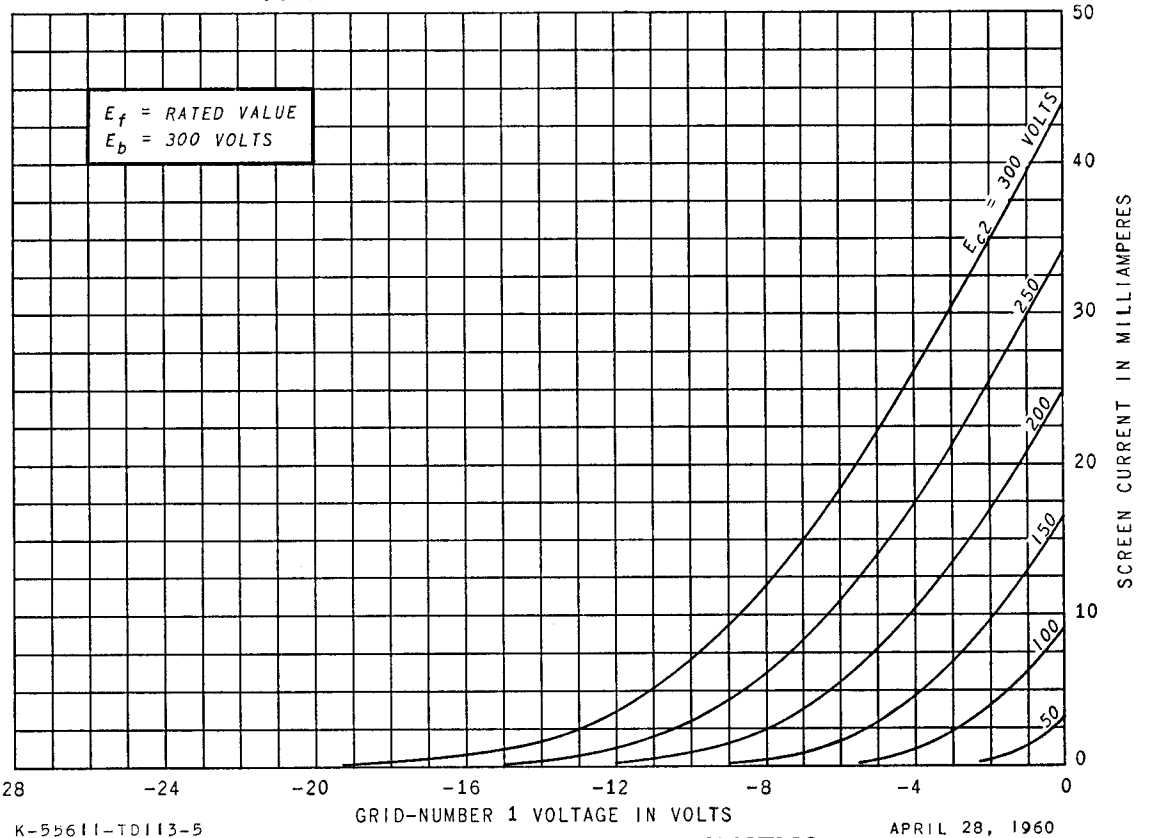
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD113-4

APRIL 28, 1960

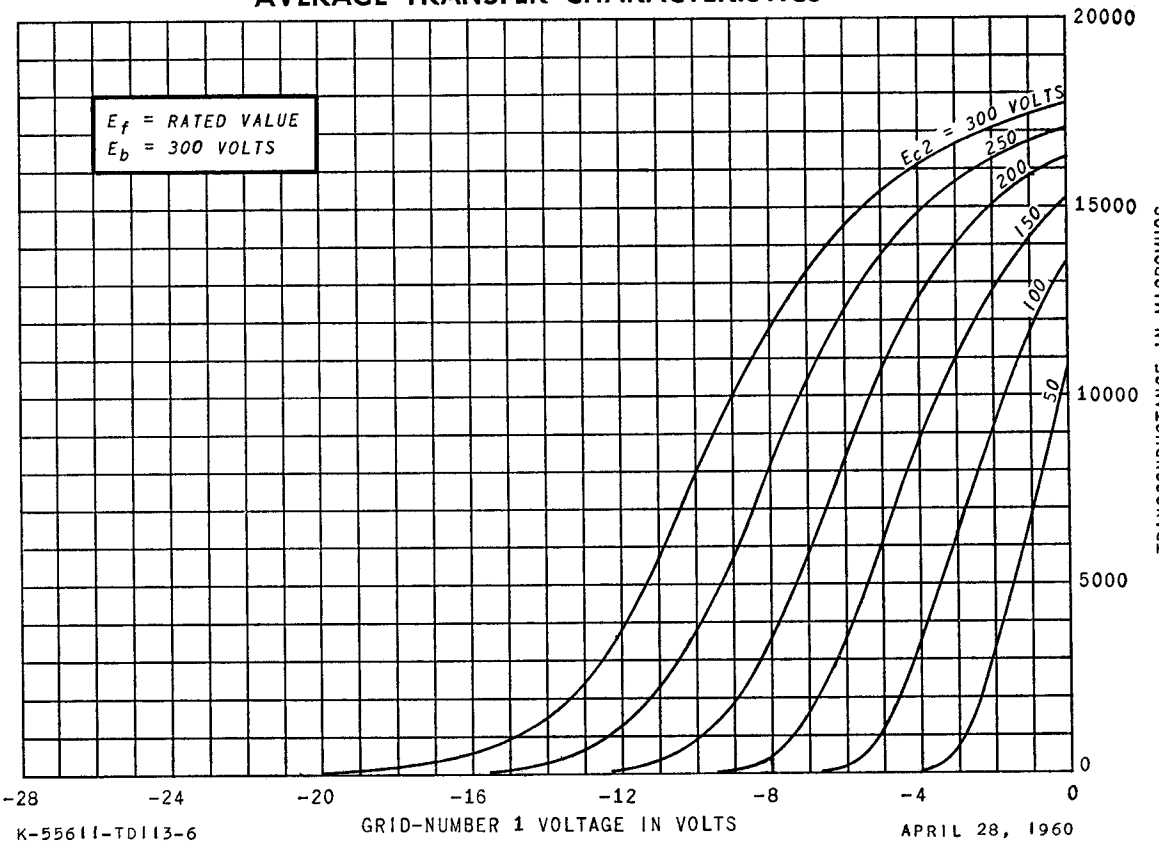
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TDII3-5

APRIL 28, 1960

AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TDII3-6

APRIL 28, 1960

Compactron Triode-Pentode

6AG9

The 6AG9 is a compactron containing a sharp-cutoff, high-transconductance, frame-grid pentode and a triode. The pentode is intended for video amplifier service and the triode for AGC amplifier service in color television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.82	Amperes

Direct Interelectrode Capacitances§

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.16	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.)	17	pf
Output: Pp to (h + Pk + Pg2 Pg3 + i.s.)	6.5	pf

Triode Section

Grid to Plate: (Tg to Tp)	2.8	pf
Input: Tg to (h + Tk + i.s.)	3.6	pf
Output: Tp to (h + Tk + i.s.)	2.2	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

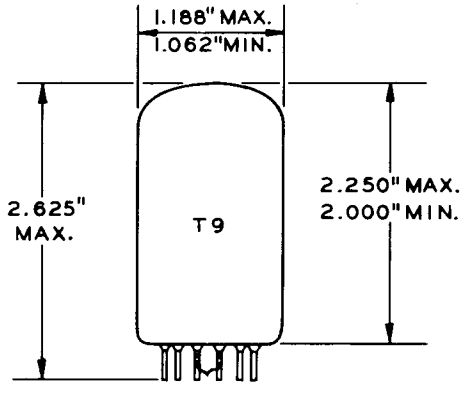
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

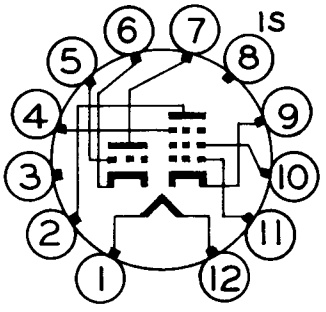


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Pentode Plate
Pin 3 - No Connection
Pin 4 - Pentode Grid Number 3 (Suppressor)
Pin 5 - Triode Grid
Pin 6 - Triode Cathode
Pin 7 - Triode Plate
Pin 8 - Internal Shield
Pin 9 - Pentode Cathode
Pin 10 - Pentode Grid Number 2 (Screen)
Pin 11 - Pentode Grid Number 1
Pin 12 - Heater

BASING DIAGRAM



EIA 12HE

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Voltage	200	---	Volts
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	10	1.1	Watts
Screen Dissipation	1.5	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	0.5	Megohms
With Cathode Bias	0.25	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS		Pentode Section	Triode Section	
Plate Voltage	55	250	150	Volts
Screen Voltage	125	150	---	Volts
Grid-Number 1 Voltage	0	---	---	Volts
Cathode-Bias Resistor	---	56	350	Ohms
Amplification Factor	---	---	39	
Plate Resistance, approximate	---	40000	8500	Ohms
Transconductance	---	30000	4600	Micromhos
Plate Current	56	28	6.2	Milliamperes
Screen Current	21	5.6	---	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 20 Microamperes	---	---	-7	Volts
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	---	-5.4	---	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

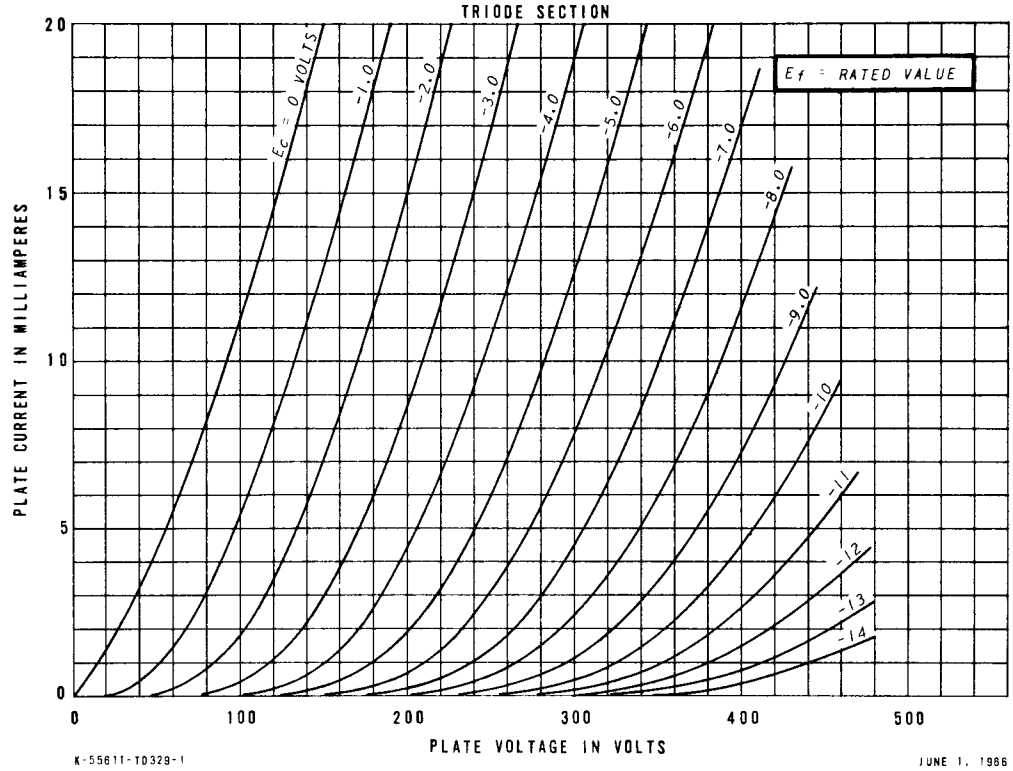
‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION

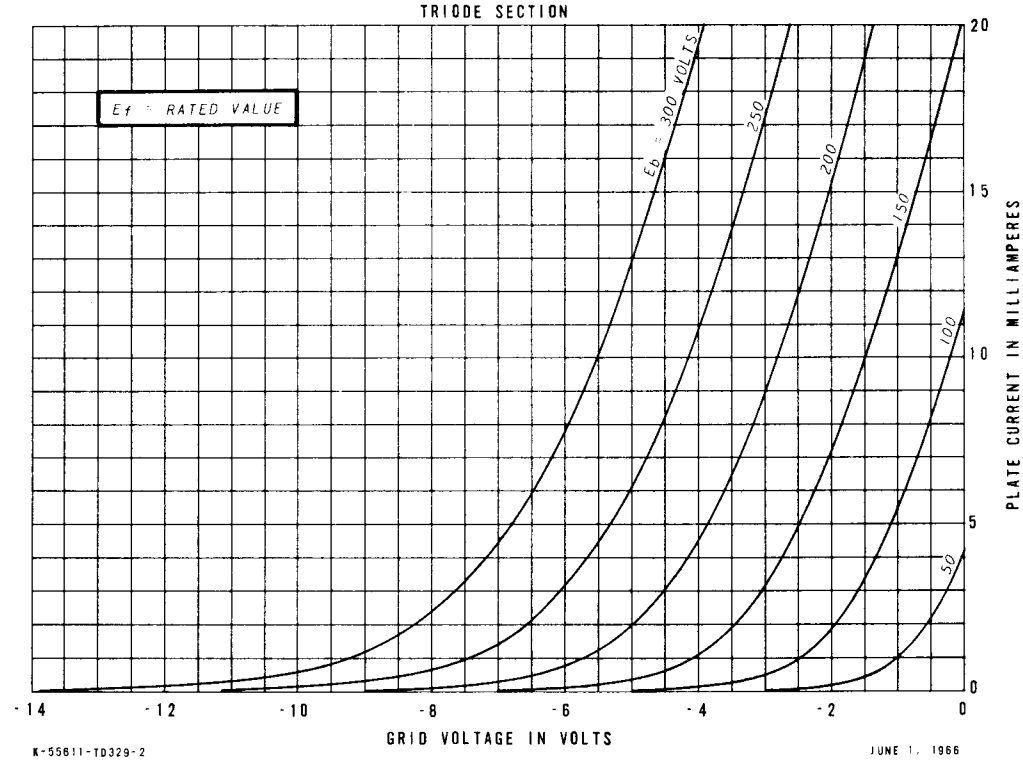


K-5561I-TD329-1

JUNE 1, 1966

AVERAGE TRANSFER CHARACTERISTICS

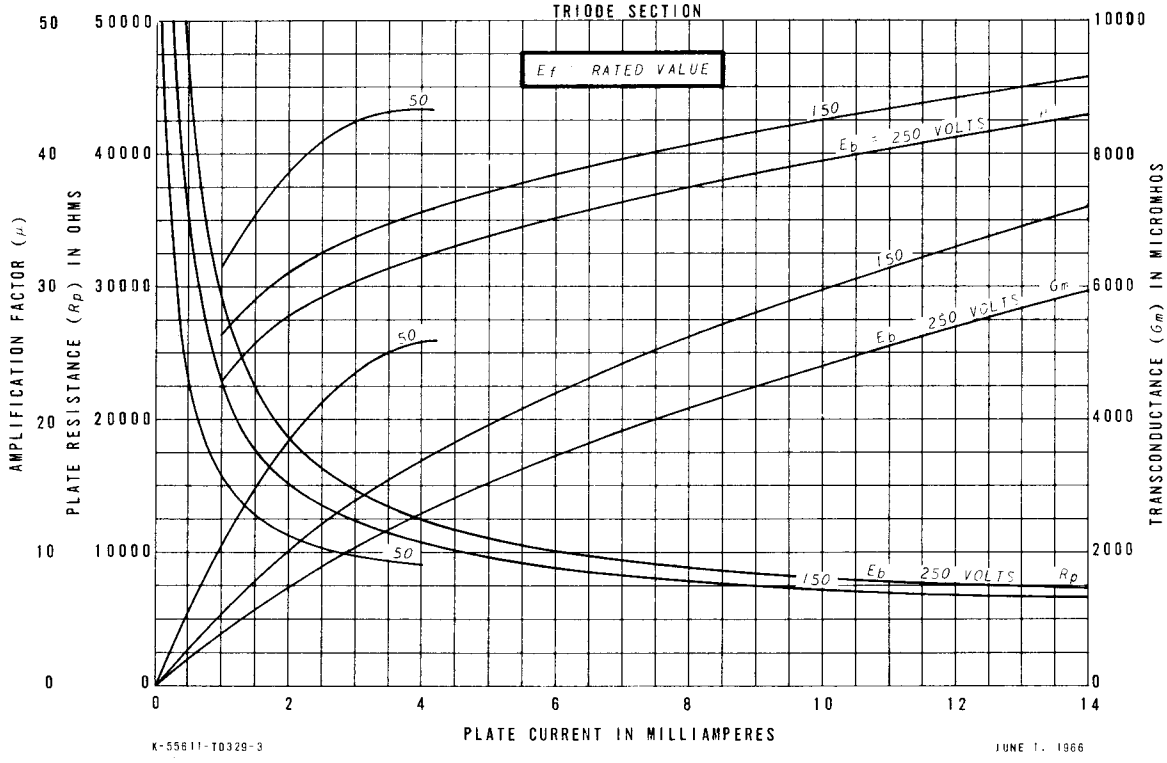
TRIODE SECTION



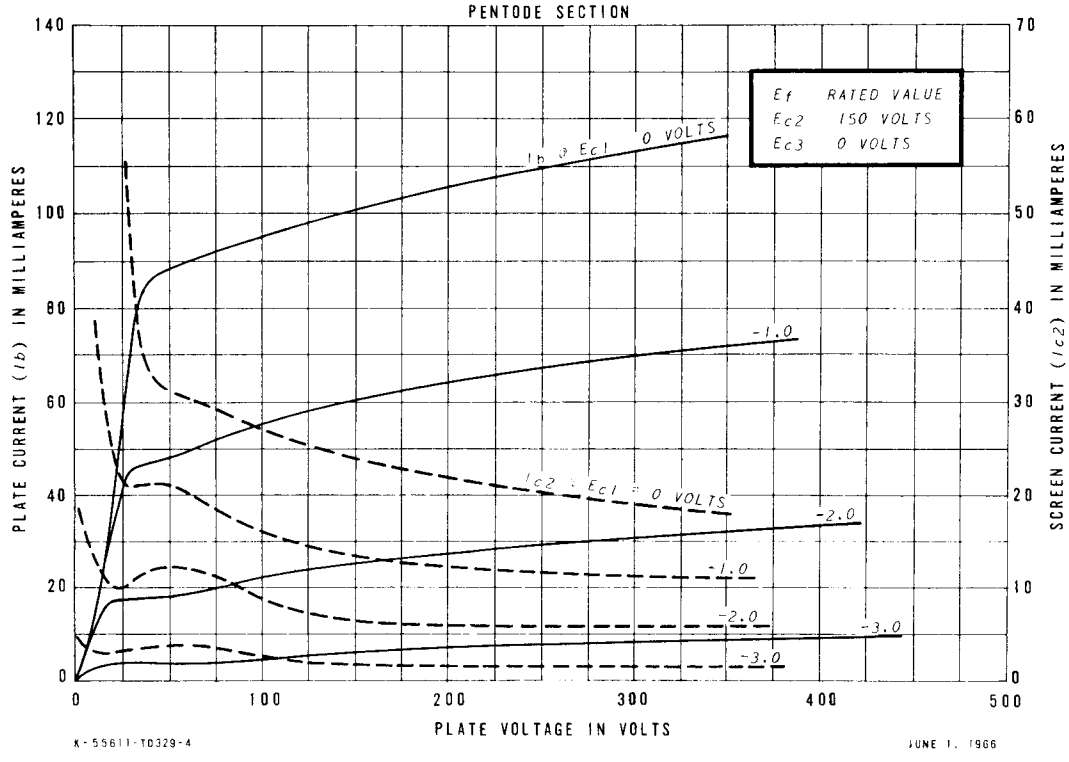
K-5561I-TD329-2

JUNE 1, 1966

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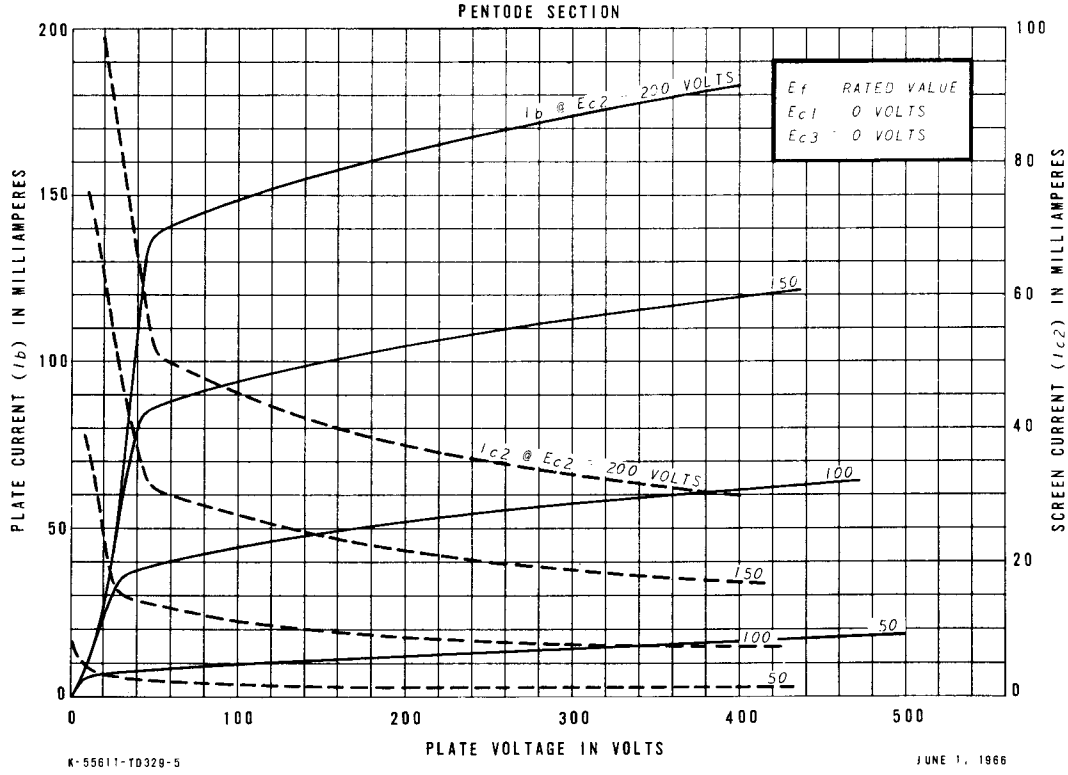


AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

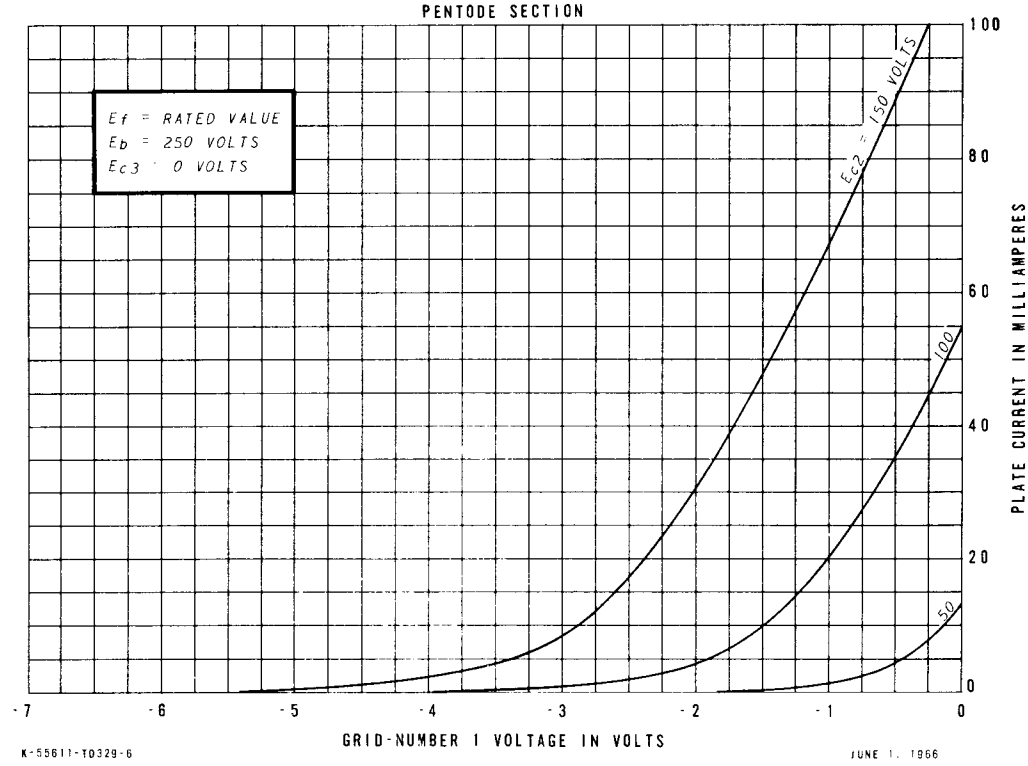


K-55611-TD329-5

JUNE 1, 1966

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

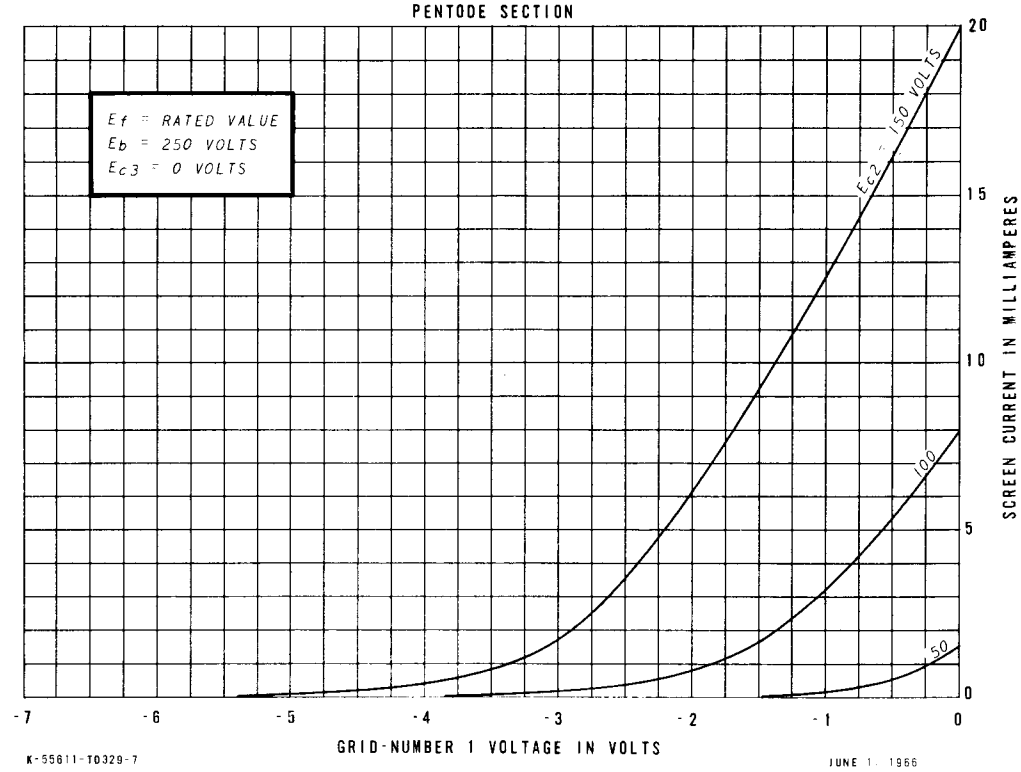


K-55611-TD329-6

JUNE 1, 1966

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

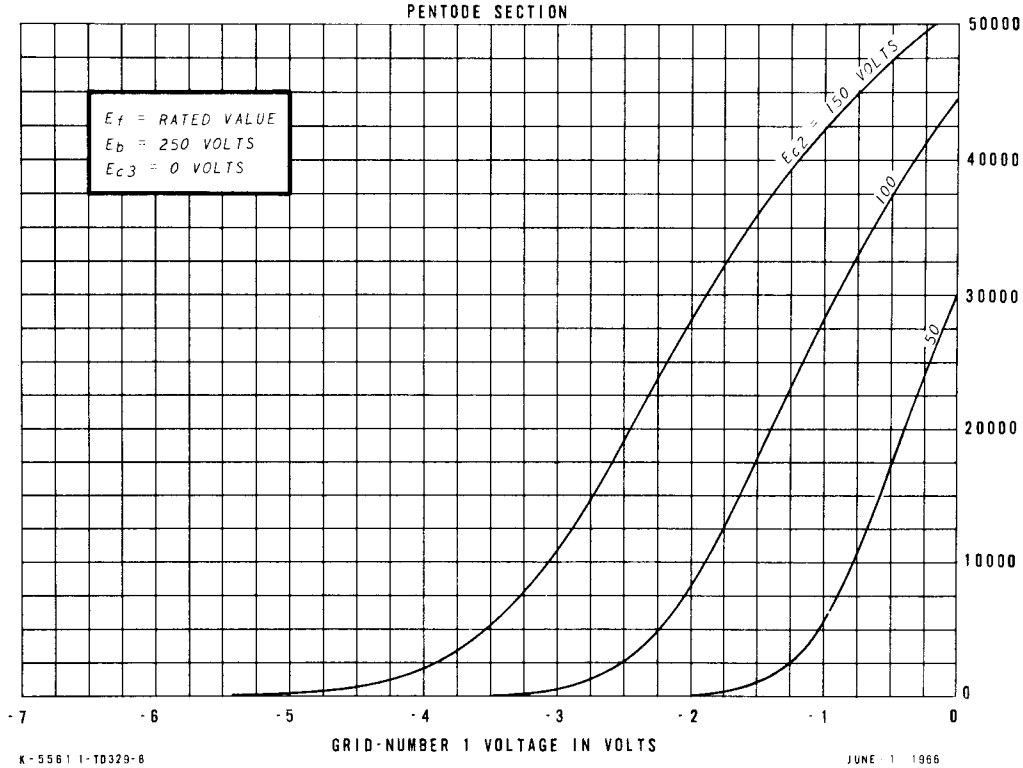


K-55611-T0329-7

JUNE 1, 1966

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



K-55611-T0329-8

JUNE 1, 1966

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBE

6AH4-GT
Description and Rating

TRIODE

FOR TV VERTICAL-DEFLECTION AMPLIFIER APPLICATIONS

The 6AH4-GT is a low-mu triode designed primarily for use as a vertical deflection amplifier in television receivers. The tube features high plate current at low plate voltages and is capable of withstanding the high pulse voltages normally encountered in this application. The 6AH4-GT, when operated from relatively low plate-supply voltages, is capable of deflecting fully large-deflection-angle picture tubes.

GENERAL

Cathode - Coated Unipotential		
Heater Voltage, A-C or D-C	6.3	Volts
Heater Current	0.75	Ampere
Envelope - T-9, Glass		
Base - B6-60, Short Intermediate Shell Octal 6-Pin		
Mounting Position - Any		

Direct Interelectrode Capacitances, approximate

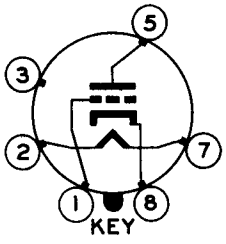
	With Shield*	Without Shield	
Grid to Plate	4.2	4.4	μμf
Input	7.5	7.0	μμf
Output	3.2	1.7	μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

	Vertical Deflection Amplifier†	
D-C Plate Voltage	500	Volts
Peak Positive Pulse Plate Voltage‡	2000	Volts
Positive D-C Grid Voltage	0	Volts
Peak Negative Grid Voltage	200	Volts
Plate Dissipation§	7.5	Watts
D-C Cathode Current	60	Milliamperes
Peak Cathode Current	180	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
D-C Component	100	Volts
Total D-C and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total D-C and Peak	200	Volts
Grid Circuit Resistance		
With Cathode Bias	2.2	Megohms

BASING DIAGRAM

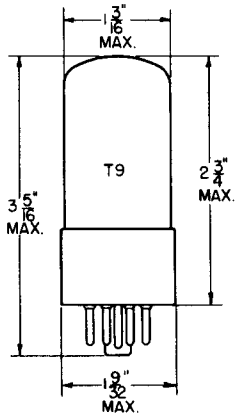


RTMA 8EL
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 - Grid
Pin 2 - Heater
Pin 3 - No Connection
Pin 5 - Plate
Pin 7 - Heater
Pin 8 - Cathode

PHYSICAL DIMENSIONS



RTMA 9-41

GENERAL ELECTRIC

Supersedes ET-T810 dated 1-53

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	250	250	Volts
Grid Voltage	-33	-23	Volts
Amplification Factor	---	8.0	
Plate Resistance, approximate	---	1780	Ohms
Transconductance	---	4500	Micromhos
Plate Current	5.0	30	Milliamperes
Grid Voltage, approximate, I_b = 0.5 Milliampere	---	-40	Volts

VERTICAL DEFLECTION AMPLIFIER ▽

Plate Voltage	240	Volts
Cathode-Bias Resistor #	1100	Ohms
Grid Input Voltage, approximate		
Sawtooth Component	52	Volts
Negative Peaking Component	87	Volts
D-C Cathode Current	22	Milliamperes
Peak Cathode Current	62	Milliamperes
Plate Output Voltage, approximate		
Sawtooth Component	150	Volts
Peak Positive Pulse Component	900	Volts

* *With external shield (RTMA 308) connected to cathode.*

† *For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice for Television Stations; Federal Communications Commission". The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.*

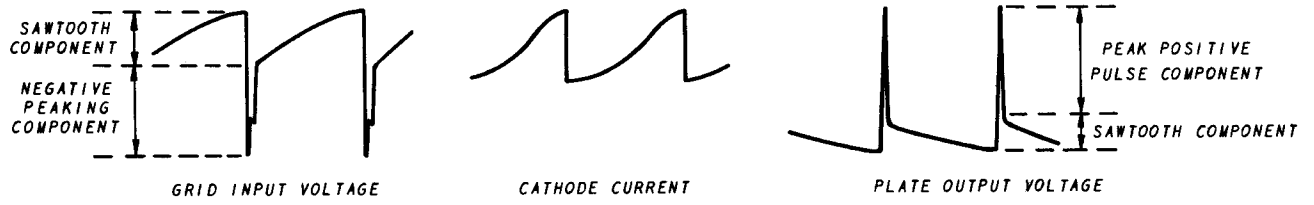
‡ *Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.*

§ *In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.*

▽ *For use in conjunction with a 70-degree picture tube operating at an anode voltage of 15 kilovolts.*

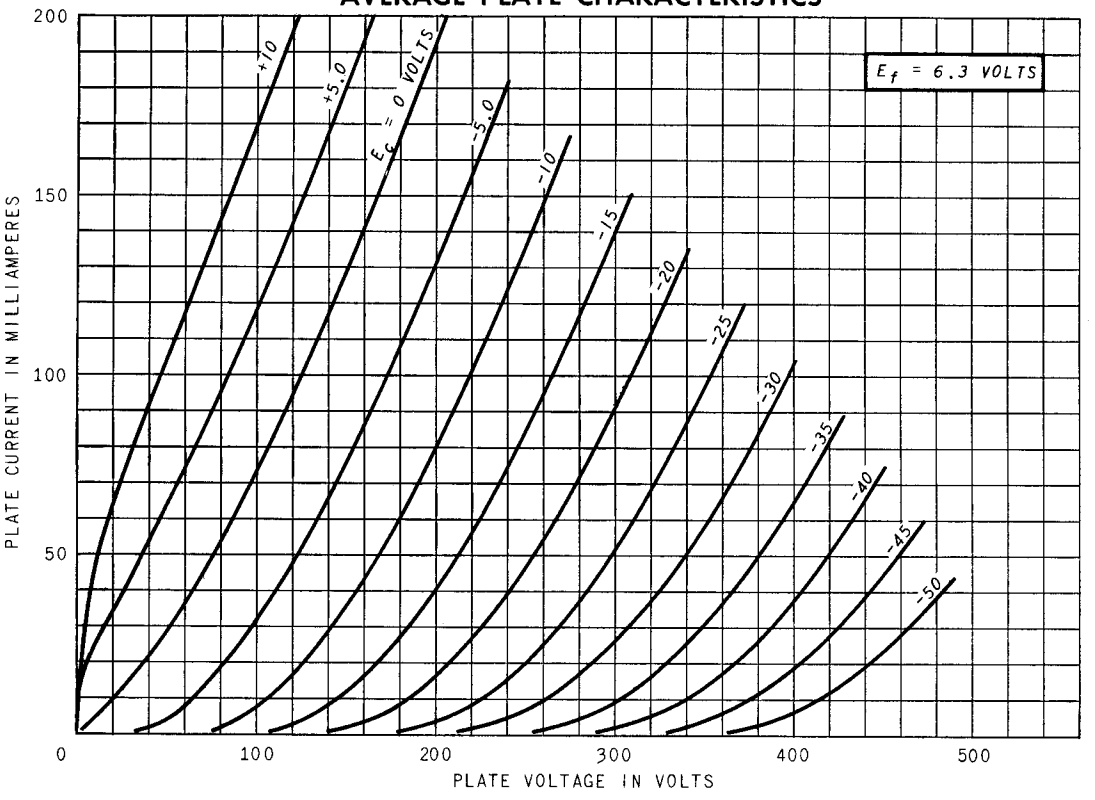
\# *Typical value of total cathode resistance for optimum linearity.*

TYPICAL WAVEFORMS OF VERTICAL DEFLECTION AMPLIFIER

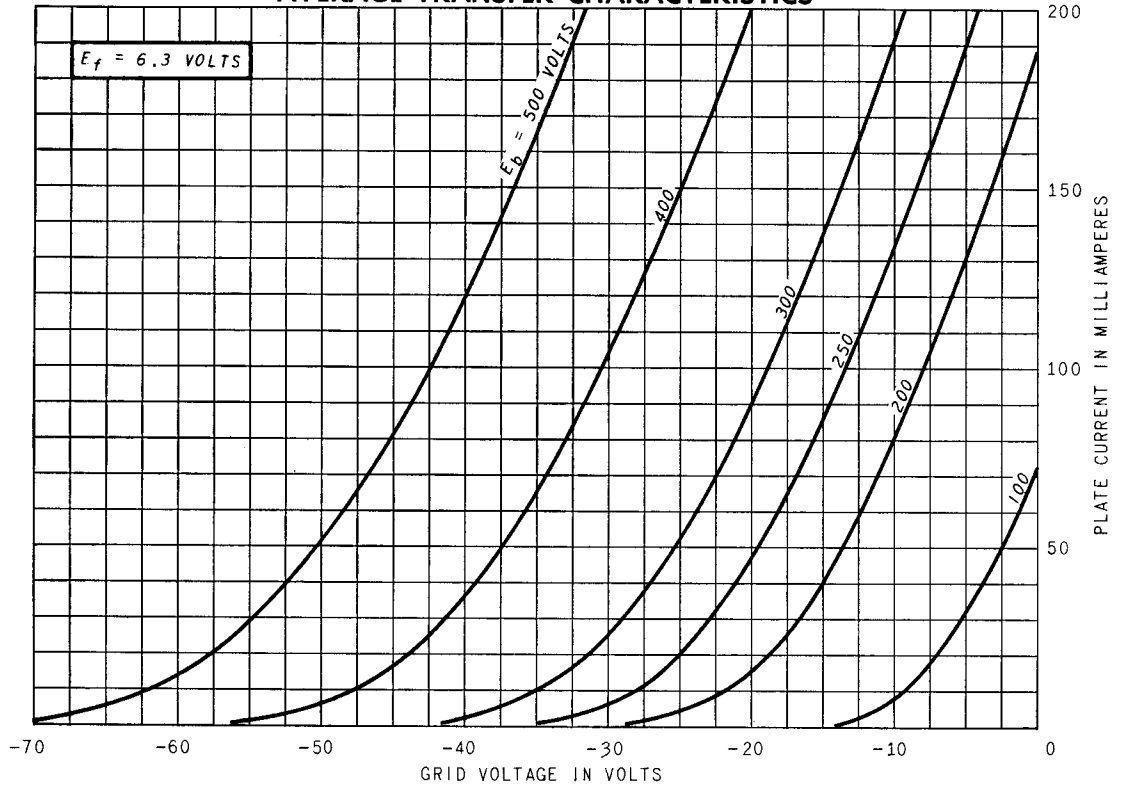


GRID INPUT VOLTAGE — CATHODE CURRENT — PLATE OUTPUT VOLTAGE

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBE
KEN-RAD

6AH6

Description and Rating

RADIO-FREQUENCY AMPLIFIER PENTODE

GENERAL DESCRIPTION

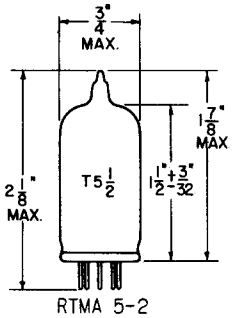
Principal Application: The 6AH6 is a miniature sharp-cutoff pentode. Its high transconductance and low input and output capacitances adapt it to use as a wide-band amplifier or as a reactance tube.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.45 Ampere
Envelope	T-5½, Glass
Base	E7-1, Miniature Button 7-Pin
Mounting Position	Any

Direct Interelectrode Capacitances:

	Without Shield	With Shield#	
Grid 1 to Plate (Max)	0.030	0.020	μμf
Input	10	10	μμf
Output	2.0	3.6	μμf

PHYSICAL DIMENSIONS

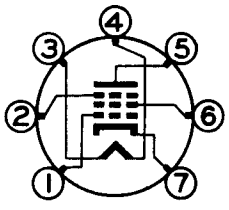


RTMA 5-2

TERMINAL CONNECTIONS

Pin 1 - Grid Number 1
Pin 2 - Grid Number 3 (Suppressor)
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Cathode

BASING DIAGRAM



RTMA 7CC
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES:

Plate Voltage	300	Volts
Screen Supply Voltage	300	Volts
Screen Voltage	150	Volts
Plate Dissipation	3.2	Watts
Screen Dissipation	0.4	Watt
Cathode Current	13	Milliamperes
Heater-Cathode Voltage	90	Volts

CHARACTERISTICS AND TYPICAL OPERATION

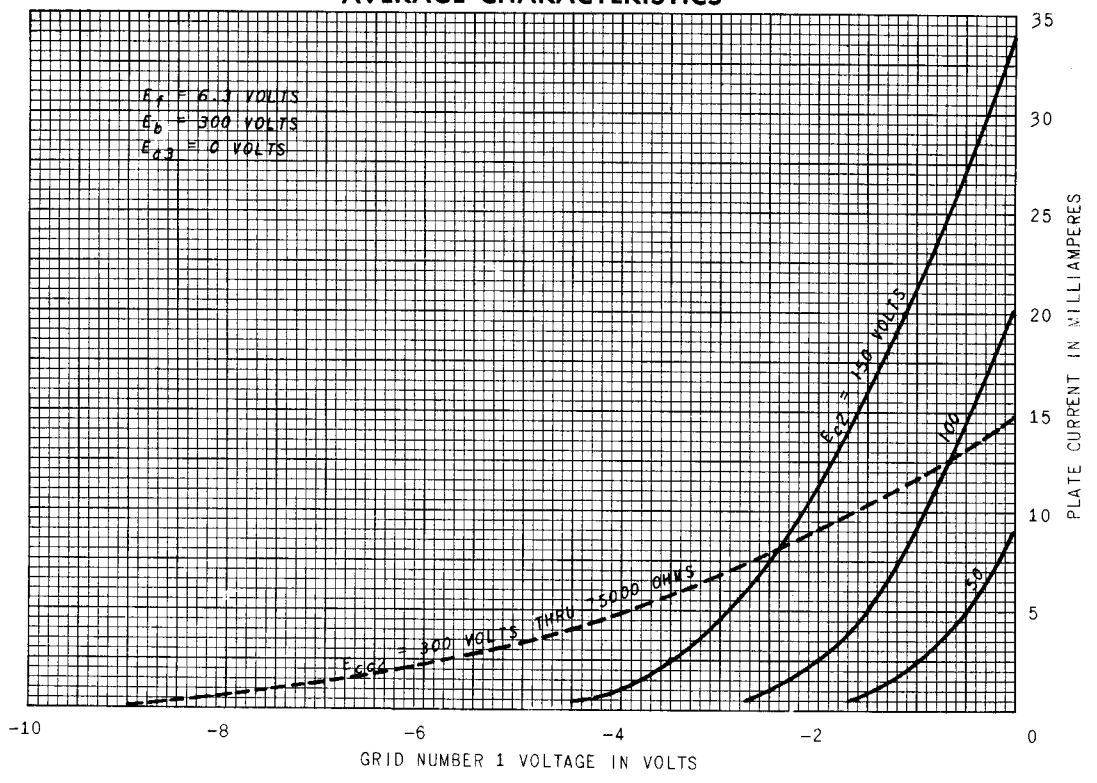
CLASS A_1 AMPLIFIER

	Pentode Connection	Triode Connection**	
Plate Voltage	300	150	Volts
Suppressor Voltage*	0	---	Volts
Screen Voltage	150	---	Volts
Cathode Bias Resistor	160	160	Ohms
Amplification Factor	---	40	
Plate Resistance (Approx)	0.5	0.0036	Megohm
Transconductance	9000	11000	Micromhos
Plate Current	10	12.5	Milliamperes
Screen Current	2.5	---	Milliamperes
Grid Number 1 Voltage (Approx) for I_b = 10 Microamperes	-7	-7	Volts

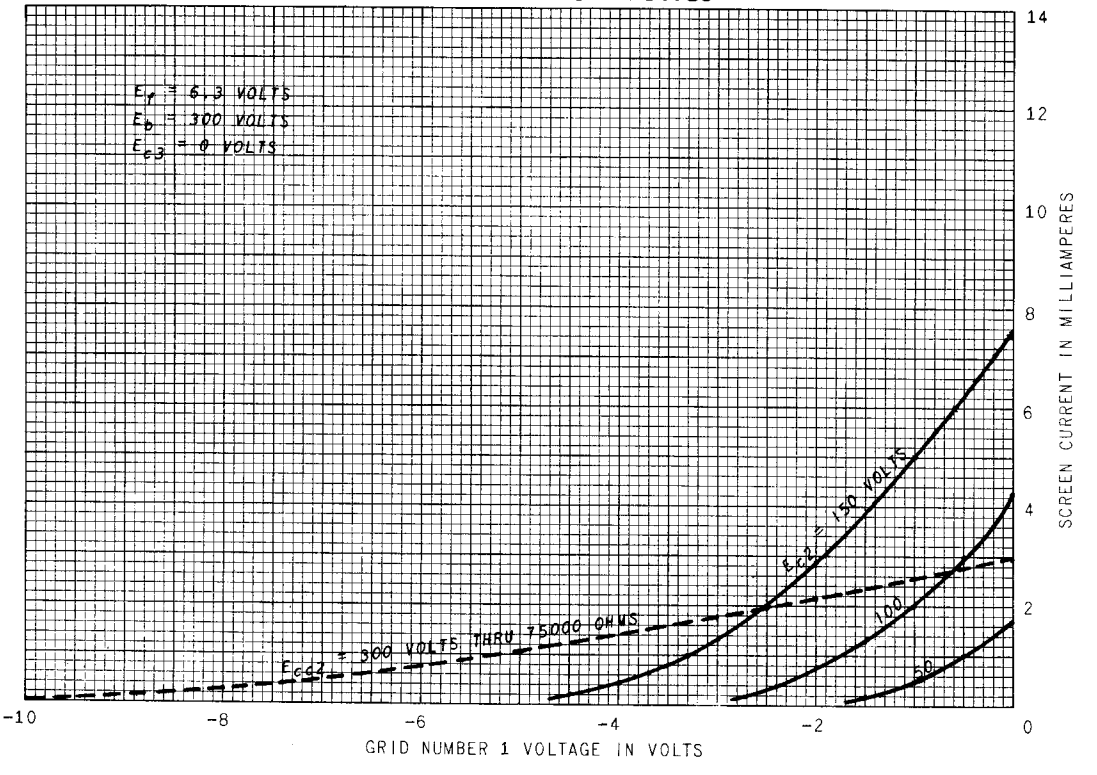
 # With external shield #316 connected to pin 7
** Pin 2 connected to pin 7 at socket*
*** For triode connection, connect grids 2 and 3 to plate.*

Note: Grid number 3 has practically no control characteristics, and it is not intended to be used as a control electrode. Its transconductance to the plate approximates 2 micromhos and the mu is 0.7 to 1.0.

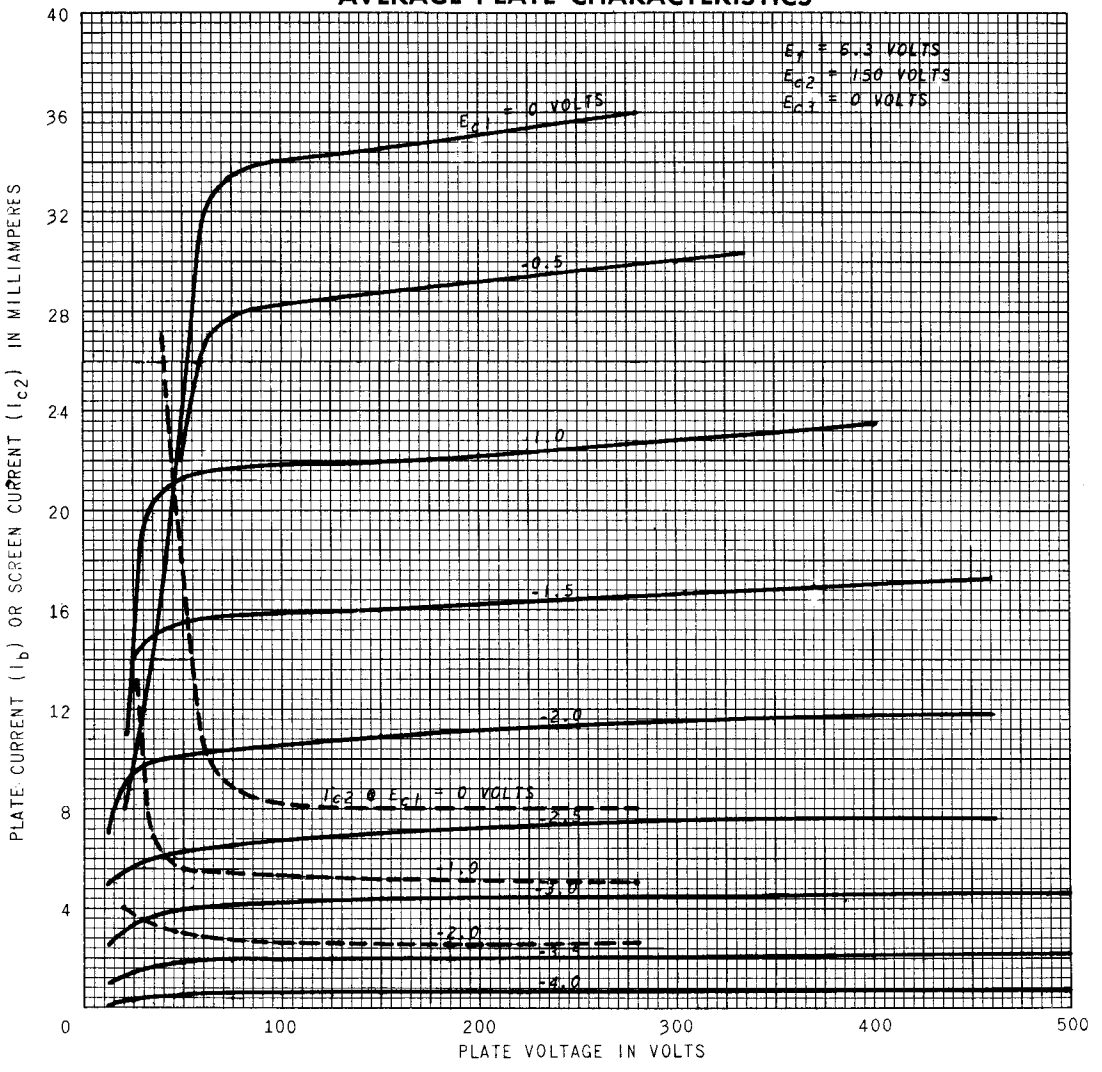
AVERAGE CHARACTERISTICS



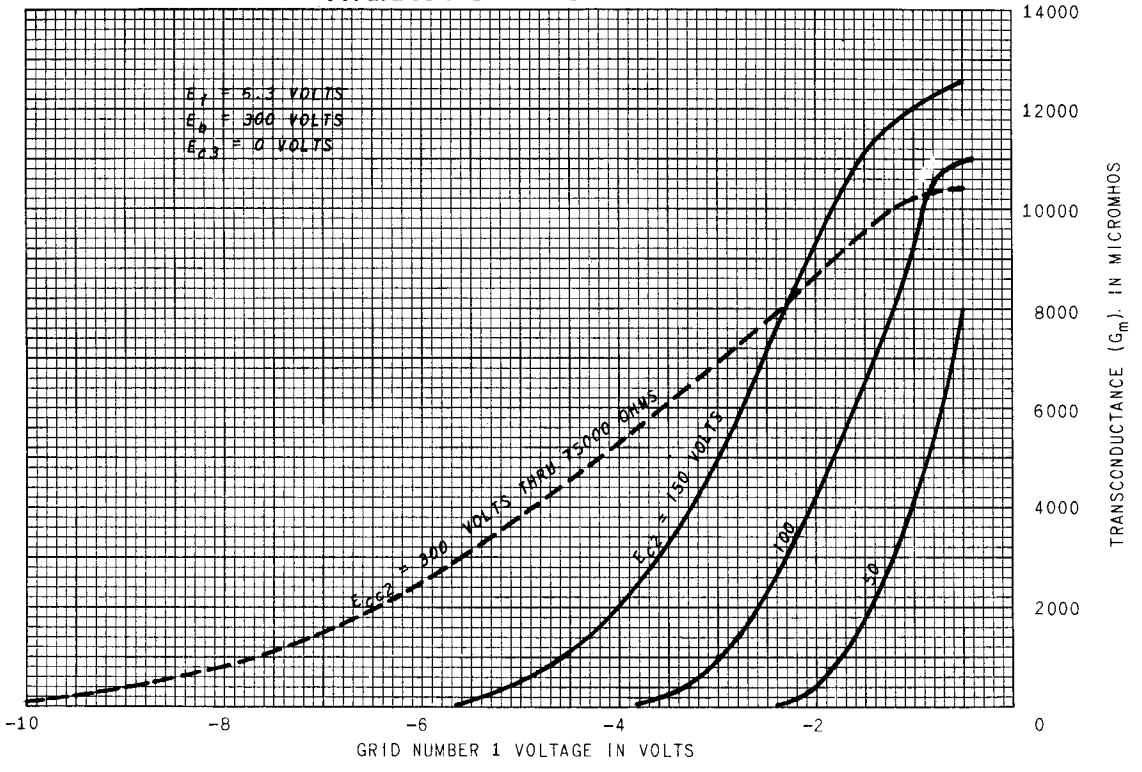
AVERAGE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

Compactron Triode-Pentode

6AH9

- COLOR TV TYPE
- FRAME-GRID VIDEO PENTODE
- 10 WATTS PLATE DISSIPATION
- MULTI-FUNCTION
- 21000 MICROMHOS
- MEDIUM-MU TRIODE

The 6AH9 is a compactron containing a medium-mu triode and a sharp-cutoff, frame-grid pentode. The pentode is designed primarily for video amplifier service and the triode for color blanker or general purpose applications in color television receivers

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current•	0.9	Amperes

Direct Interelectrode Capacitances♦

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.15	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.)	15	pf
Output: Pp to (h + Pk + Pg2 + Pg3 + i.s.)	6.0	pf

Triode Section

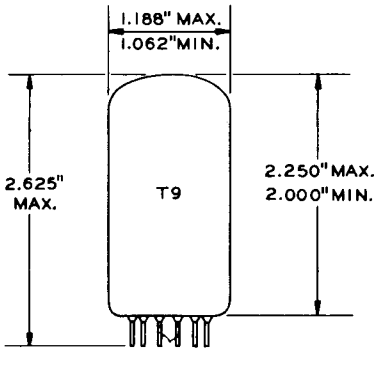
Grid to Plate: (Tg to Tp)	3.7	pf
Input: Tg to (h + Tk)	2.4	pf
Output: Tp to (h + Tk)	0.4	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

PHYSICAL DIMENSIONS

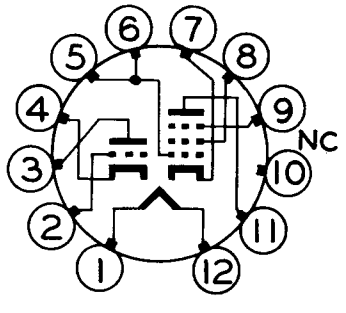


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Triode Grid
Pin 3 - Triode Plate
Pin 4 - Triode Cathode
Pin 5 - Pentode Grid Number 1
Pin 6 - Pentode Grid Number 1
Pin 7 - Pentode Cathode
Pin 8 - Pentode Grid Number 2 (Screen)
Pin 9 - Pentode Grid Number 3 (Suppressor) and Internal Shield
Pin 10 - No Connection
Pin 11 - Pentode Plate
Pin 12 - Heater

BASING DIAGRAM



EIA 12HJ

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES	Pentode Section	Triode Section	
Plate Voltage	400	330	Volts
Suppressor Voltage	0	---	Volts
Screen Supply Voltage	330	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0▲	0	Volts
Plate Dissipation	10	2.0	Watts
Screen Dissipation	1.0	---	Watts
Heater-Cathode Voltage			
Heater Positive with respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	1.0	Megohms
With Cathode Bias	0.25	---	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Pentode Section		Triode Section	
Plate Voltage	50	250	250	Volts
Screen Voltage	125	150	---	Volts
Grid-Number 1 Voltage	0§	0	-9.0	Volts
Cathode-Bias Resistor	---	122	---	Ohms
Amplification Factor	---	---	20	
Plate Resistance, approximate	---	55000	7500	Ohms
Transconductance	---	21000	2750	Micromhos
Plate Current	76	25	8.0	Milliamperes
Screen Current	32	6.0	---	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 100 Microamperes	---	-7.2	-18	Volts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

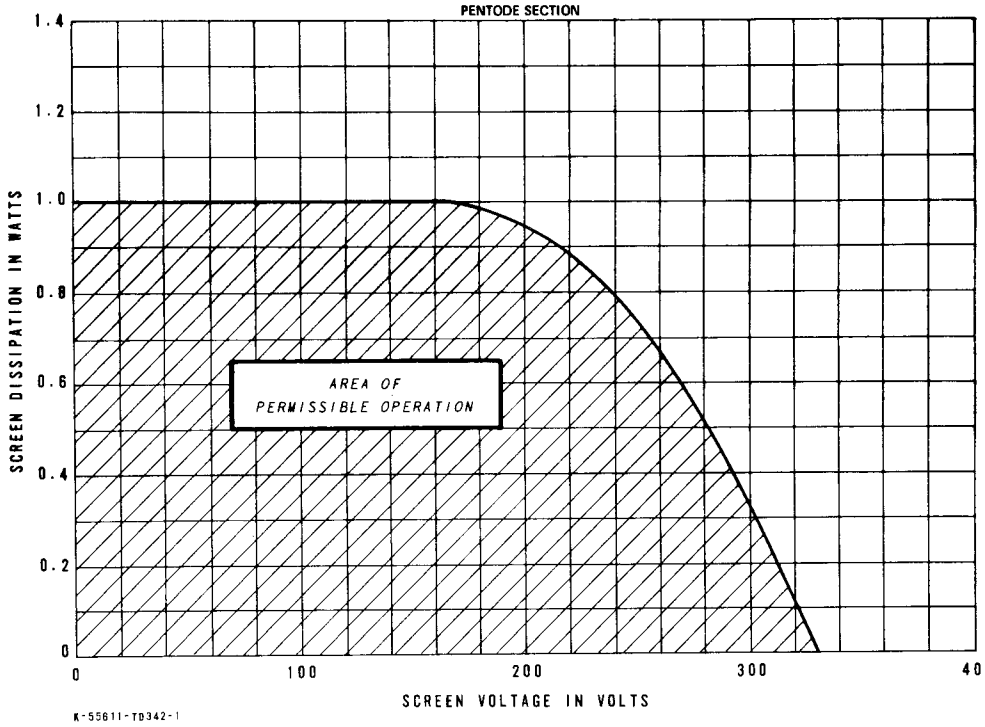
♦ Without external shield.

▲ Control grid to cathode spacing of the pentode section of this tube is of such low order of magnitude as to preclude the use of voltage between these elements of more than 50 volts dc or peak ac in commercial tube checkers and shorts-indicating devices, particularly where mechanical excitation of the tube is employed.

§ Applied for short interval (two seconds maximum) so as not to damage tube.

SCREEN RATING CHART

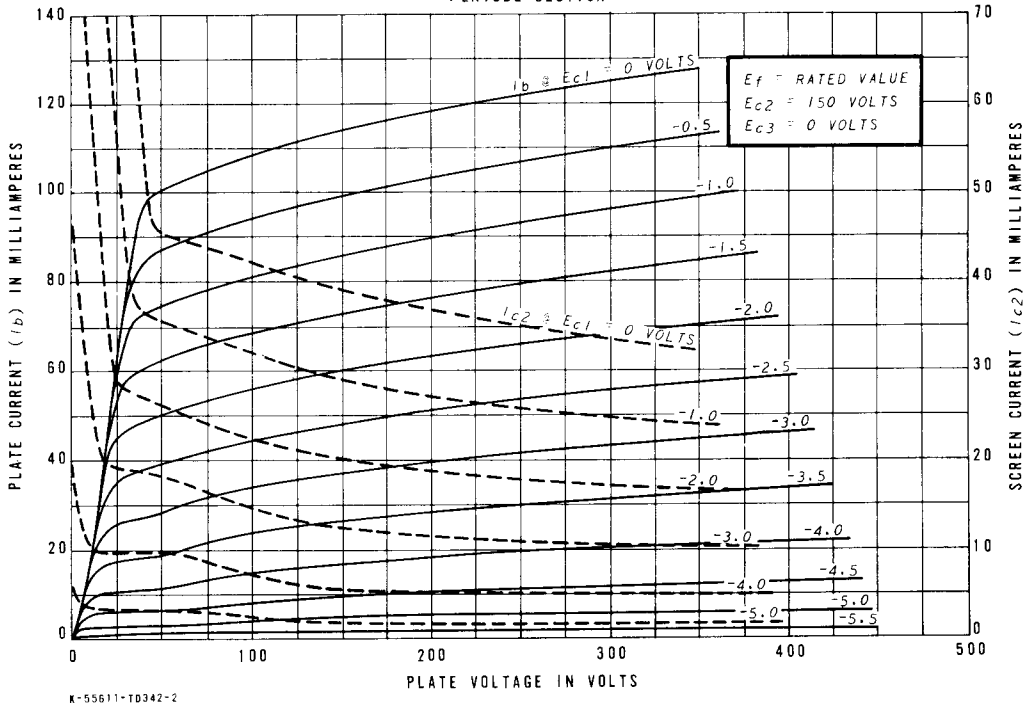
PENTODE SECTION



K-55611-TD342-1

AVERAGE PLATE CHARACTERISTICS

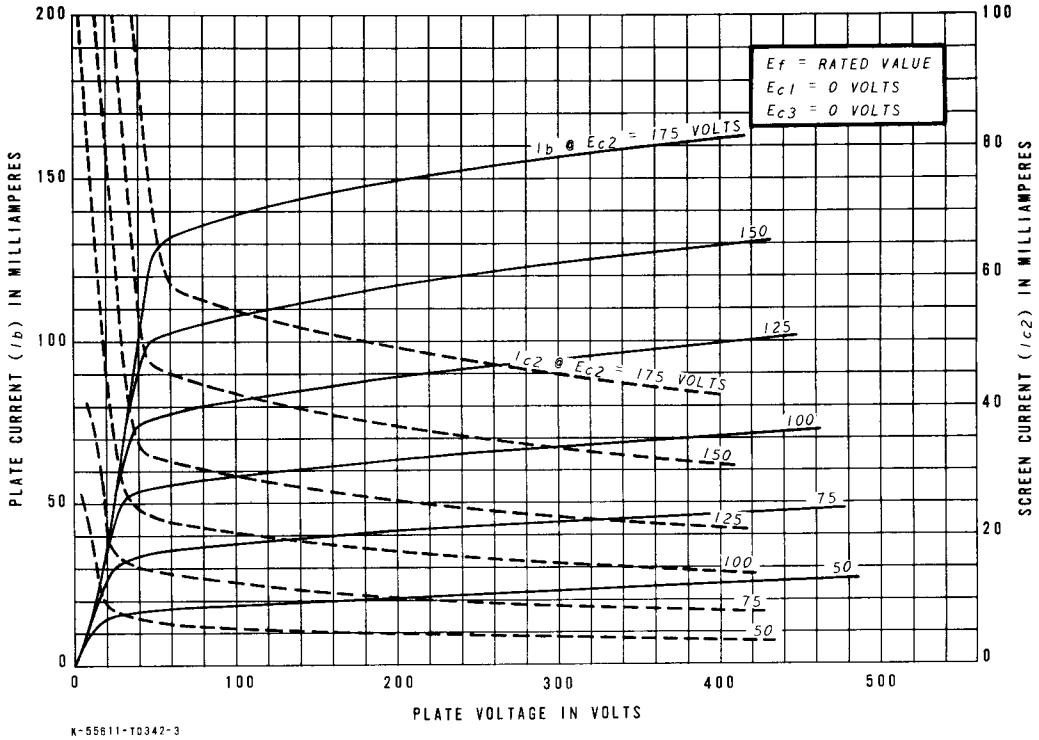
PENTODE SECTION



K-55611-TD342-2

AVERAGE PLATE CHARACTERISTICS

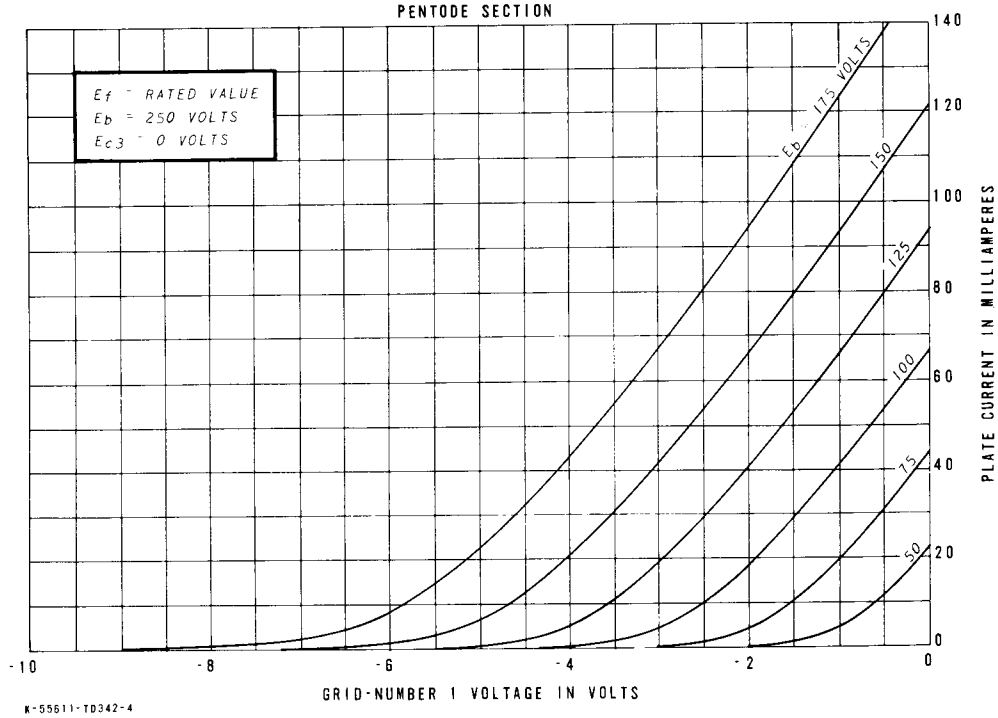
PENTODE SECTION



K-55611-TD342-3

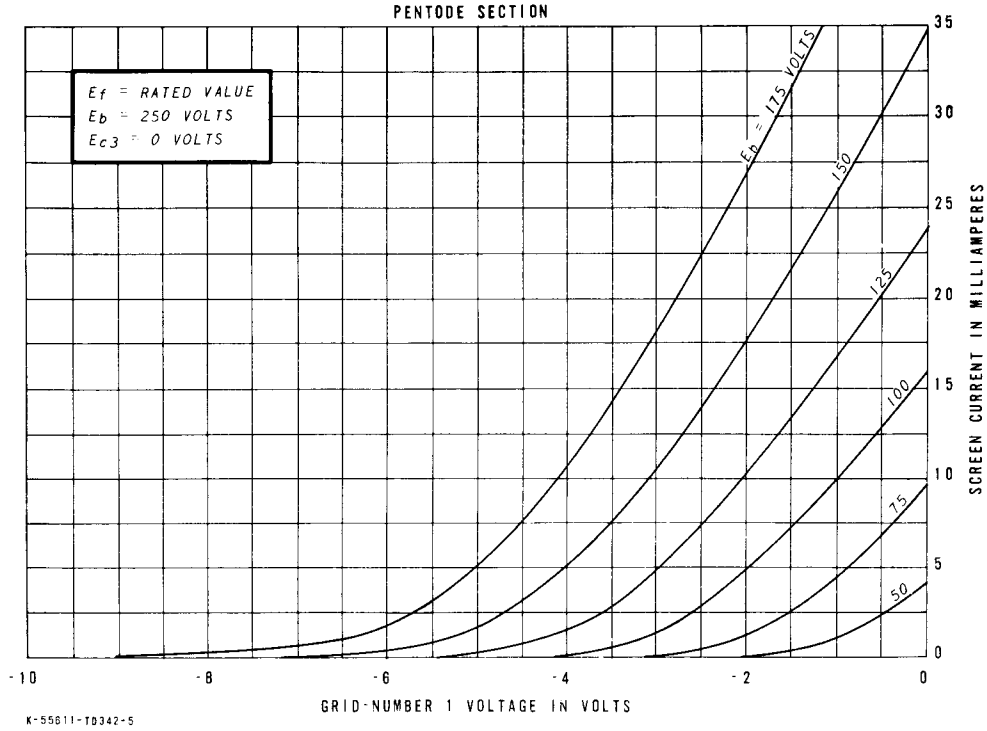
AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



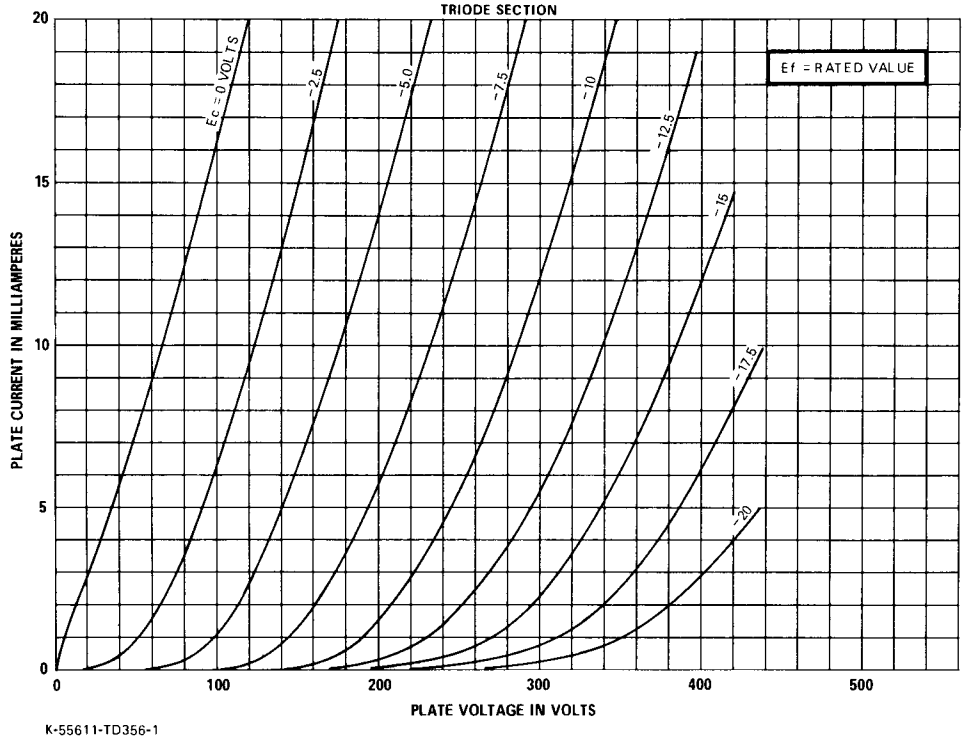
K-55611-TD342-4

AVERAGE TRANSFER CHARACTERISTICS



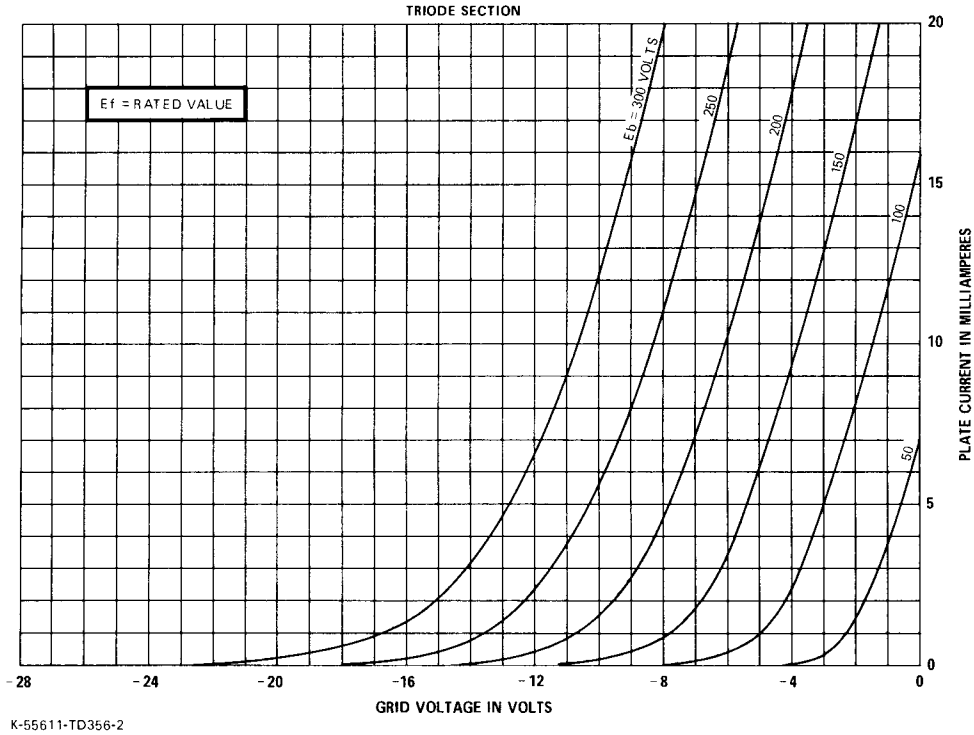
K-55611-TD342-5

AVERAGE PLATE CHARACTERISTICS



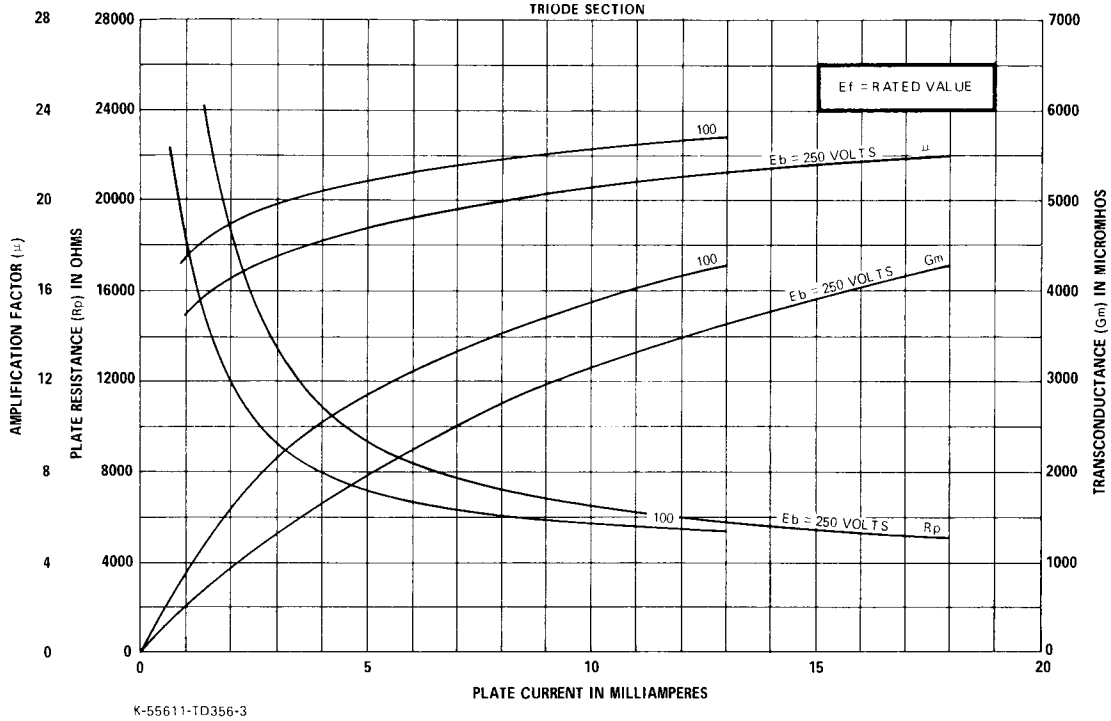
K-55611-TD356-1

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD356-2

AVERAGE CHARACTERISTICS



K-55611-TD356-3

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Compactron Triple Triode

6AK10

- COLOR TV TYPE
- IMPROVED LINEARITY
- HIGH GAIN
- TRANSCONDUCTANCE = 7000 MICROMHOS
- AMPLIFICATION FACTOR = 53

The 6AK10 is a compactron containing three high-mu triodes. It is designed primarily for service as a color-difference amplifier in color television receivers and is particularly suited for use with solid-state demodulators.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★ ..... 6.3 ± 0.6 Volts

Heater Current● ..... 0.9 Amperes

Direct Interelectrode Capacitances, approximate♦

	Section 1	Section 2	Section 3	
Grid to Plate: (g to p)	3.2	3.0	3.0	pf
Input: g to (h + k)	4.2	4.2	4.2	pf
Output: p to (h + k)	0.3	0.4	0.54	pf

MECHANICAL

Operating Position - Any

Envelope - T-9, Glass

Base - E12-70, Button 12-Pin

Outline Drawing - EIA 9-59

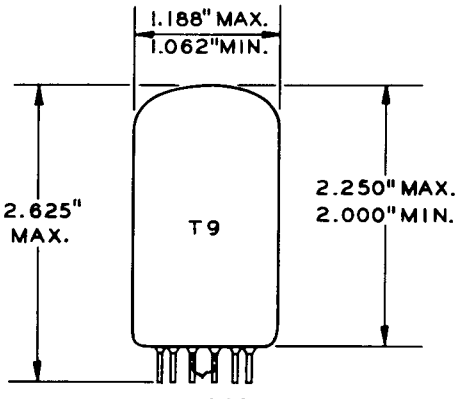
Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330	Volts
Plate Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance	0.5	Megohms

PHYSICAL DIMENSIONS

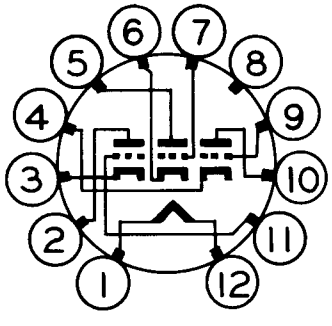


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate (Section 3)
Pin 3 - Cathode (Section 3)
Pin 4 - Cathode (Section 1)
Pin 5 - Plate (Section 2)
Pin 6 - Cathode (Section 2)
Pin 7 - Grid (Section 2)
Pin 8 - No Connection
Pin 9 - Grid (Section 1)
Pin 10 - Plate (Section 1)
Pin 11 - Grid (Section 3)
Pin 12 - Heater

BASING DIAGRAM



EIA 12FE

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MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage	200	Volts
Cathode-Bias Resistor	230	Ohms
Amplification Factor	53	
Plate Resistance, approximate	7500	Ohms
Transconductance	7000	Micromhos
Plate Current	10	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes	−7	Volts

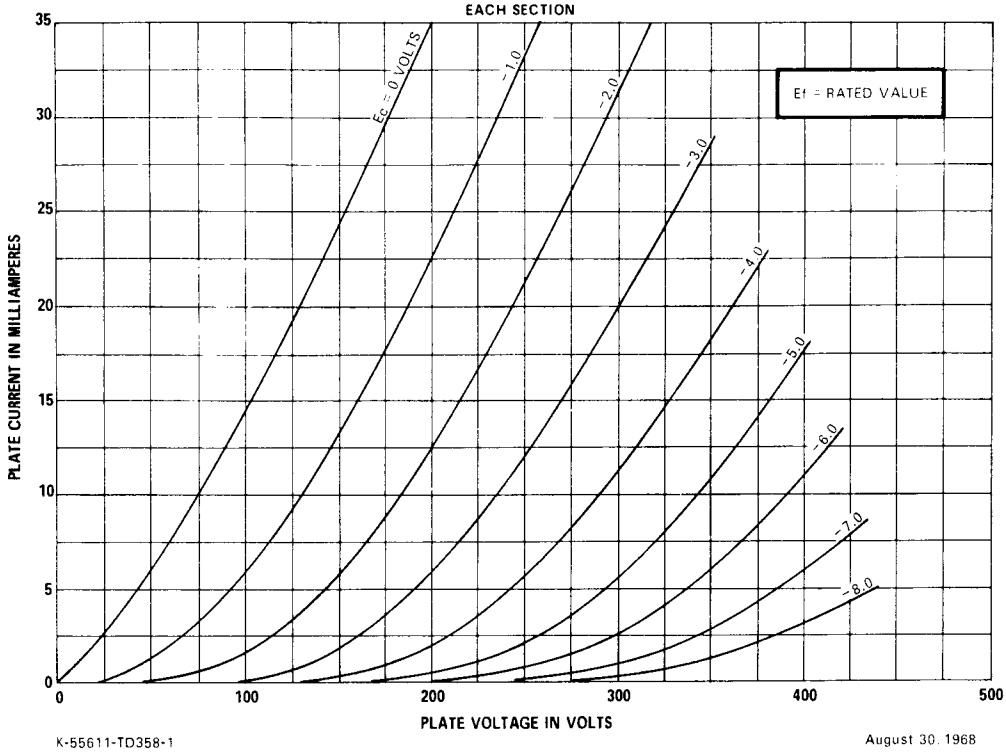
NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

♦ Without external shield.

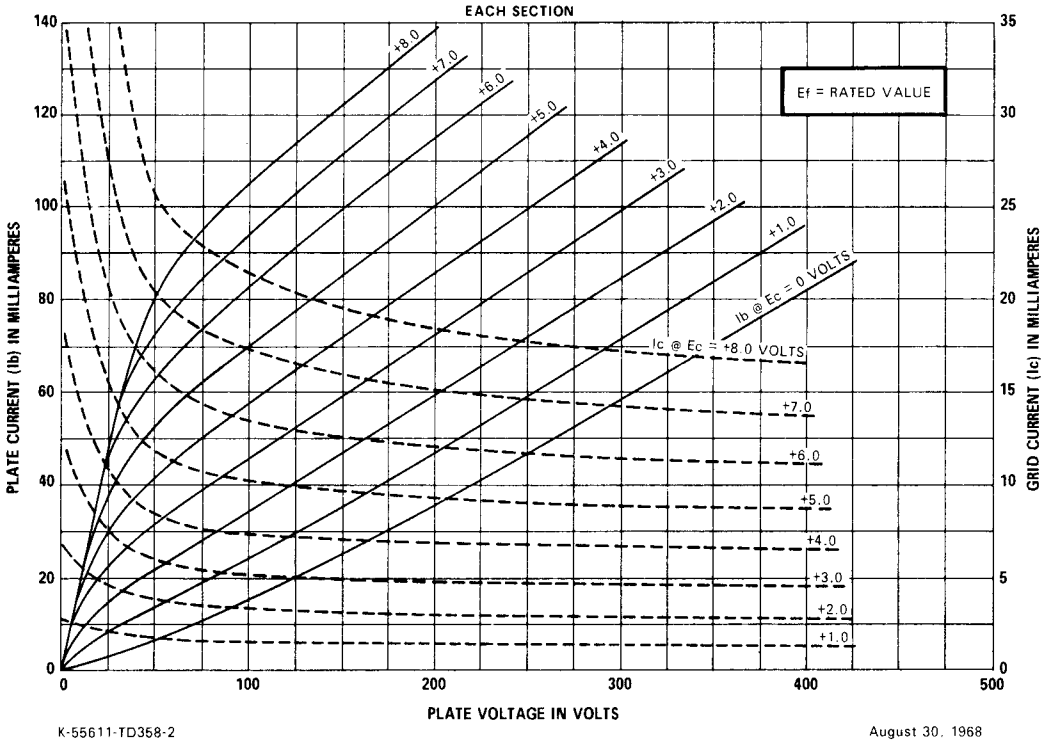
AVERAGE PLATE CHARACTERISTICS



K-55611-TD358-1

August 30, 1968

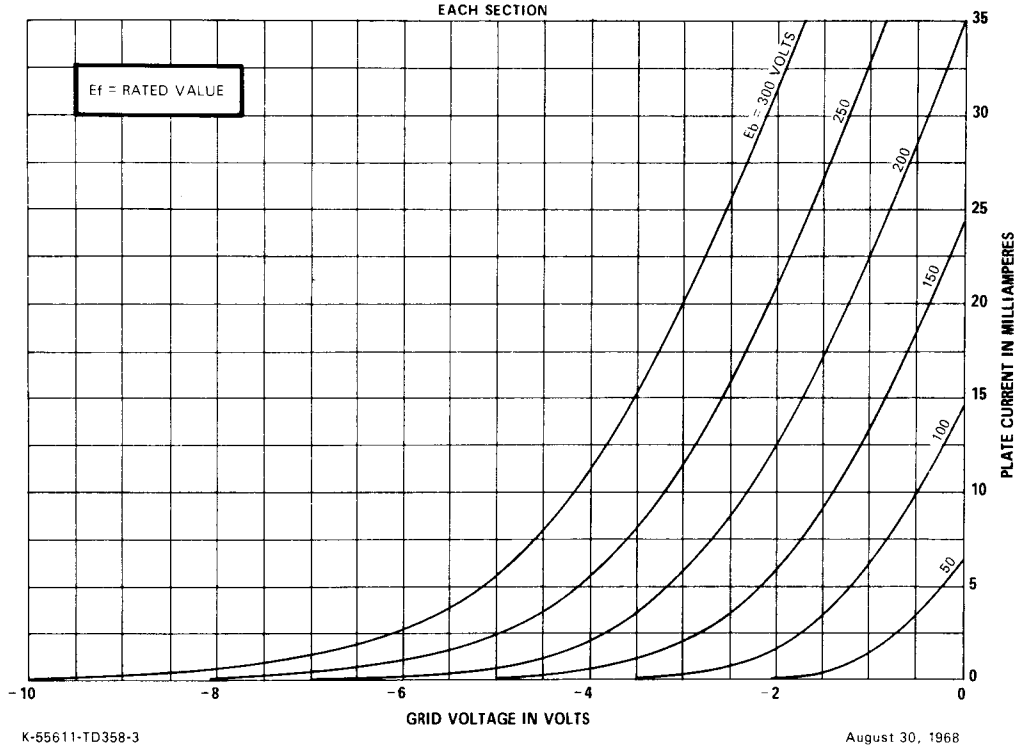
AVERAGE PLATE CHARACTERISTICS



K-55611-TD358-2

August 30, 1968

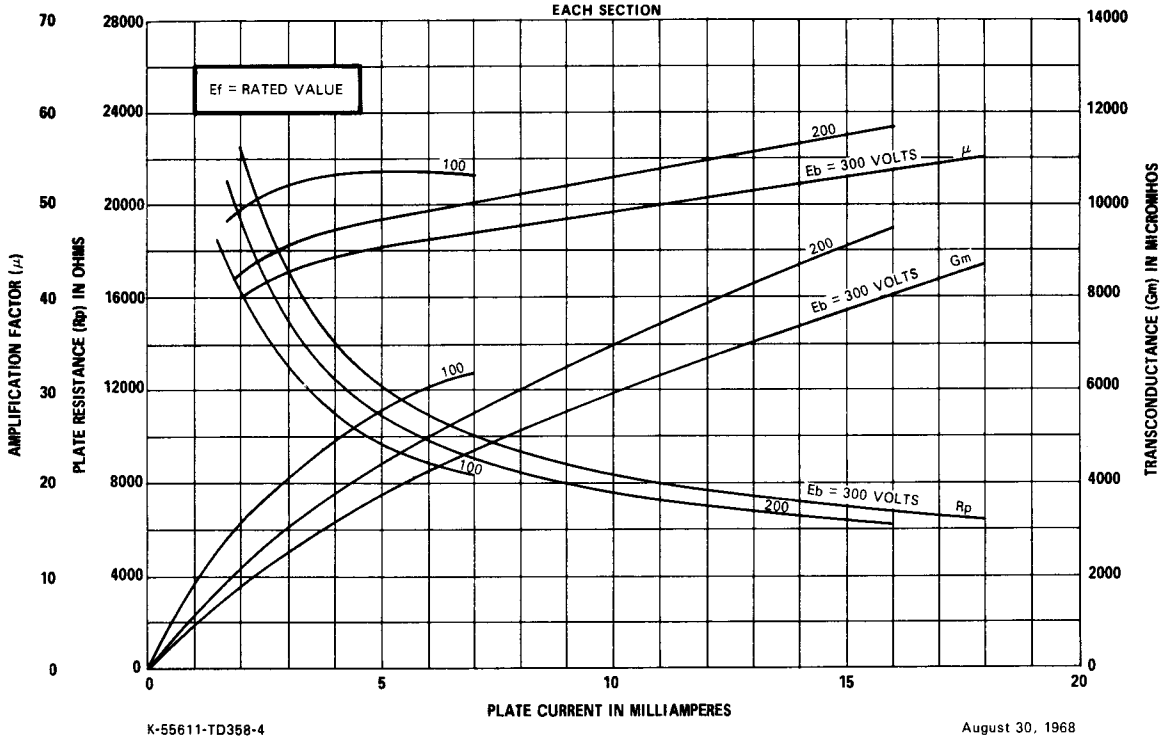
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD358-3

August 30, 1968

AVERAGE CHARACTERISTICS



K-55611-TD358-4

August 30, 1968

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

—PRODUCT INFORMATION—

Compactron Dissimilar-Double-Triode Pentode

6AK9

- COLOR TV TYPE
- MULTI-FUNCTION
- VERTICAL OUTPUT PENTODE
- 10 WATTS PLATE DISSIPATION
- VERTICAL OSCILLATOR
- SYNC CLIPPER

The 6AK9 is a multifunction compactron containing two dissimilar triodes and a beam pentode. The pentode section is suitable for vertical-deflection amplifier service in medium-sized color television receivers. Triode Section 2 (pins 2, 3 and 7) has an amplification factor of 20 and is especially suited for vertical oscillator use. Triode Section 1 has an amplification factor of 43 and is well suited for sync-clipper applications.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	1.6	Amperes

Direct Interelectrode Capacitances§

Triode (Section 1)

Grid to Plate: (T1g to T1p)	3.2	pf
Input: T1g to (h + k + Pb.p.)	3.2	pf
Output: Tp to (h + k + Pb.p.)	0.56	pf

Triode (Section 2)

Grid to Plate: (T2g to T2p)	3.6	pf
Input: T2g to (h + k + Pb.p.)	2.2	pf
Output: T2p to (h + k + Pb.p.)	0.6	pf

Pentode Section

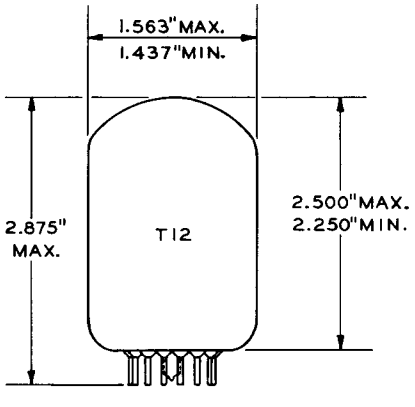
Grid-Number 1 to Plate: (Pg1 to Pp)	0.22	pf
Input: Pg1 to (h + k + Pg2 + Pb.p.)	12	pf
Output: Pp to (h + k + Pg2 + Pb.p.)	8.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing - EIA 12-56

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches
Minimum Seated Height	2.250	Inches

PHYSICAL DIMENSIONS

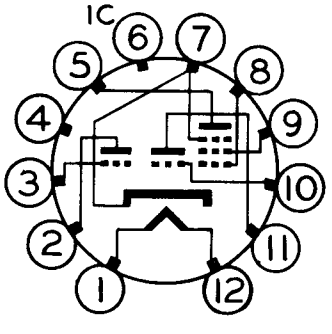


EIA 12-56

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Triode Plate (Section 2)
Pin 3 - Triode Grid (Section 2)
Pin 4 - No Connection
Pin 5 - Pentode Plate
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Cathode and Pentode Beam Plates
Pin 8 - Pentode Grid Number 1
Pin 9 - Pentode Grid Number 2 (Screen)
Pin 10 - Triode Grid (Section 1)
Pin 11 - Triode Plate (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12GZ

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Pentode Section—Vertical Deflection Amplifier Service#

DC Plate Voltage	350	Volts
Peak Pulse Plate Voltage	2500	Volts
Screen Voltage	250	Volts
Peak Negative Grid-Number 1 Voltage	150	Volts
Plate Dissipation	10	Watts
Screen Dissipation	2.0	Watts
Total DC Plate and Screen Current	80	Milliamperes
Total Peak Plate and Screen Current	245	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	1.0	Megohms
With Degenerative Bias△	2.2	Megohms

Triode (Section 1)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.25	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.5	Megohms

Triode (Section 2)—Vertical Oscillator Service#

DC Plate Voltage	330	Volts
Peak Negative Grid Voltage	400	Volts
Plate Dissipation	1.0	Watts
DC Plate Current	20	Milliamperes
Peak Plate Current	70	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	1.0	Megohms
With Degenerative Bias△	2.2	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	60	150	Volts
Screen Voltage	125	150	Volts
Grid-Number 1 Voltage	0¢	-14	Volts
Plate Resistance, approximate	---	16400	Ohms
Transconductance	---	6200	Micromhos
Plate Current	140	49	Milliamperes
Screen Current	18	3.5	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	---	-33	Volts

Triode (Section 1)

Plate Voltage	150	Volts
Grid Voltage	-2.0	Volts
Amplification Factor	43	
Plate Resistance, approximate	11000	Ohms
Transconductance	3900	Micromhos
Plate Current	5.4	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	-5.7	Volts

Triode (Section 2)

Plate Voltage	150	Volts
Grid Voltage	-5.0	Volts
Amplification Factor	20	
Plate Resistance, approximate	8500	Ohms
Transconductance	2350	Micromhos
Plate Current	5.5	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	-11	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

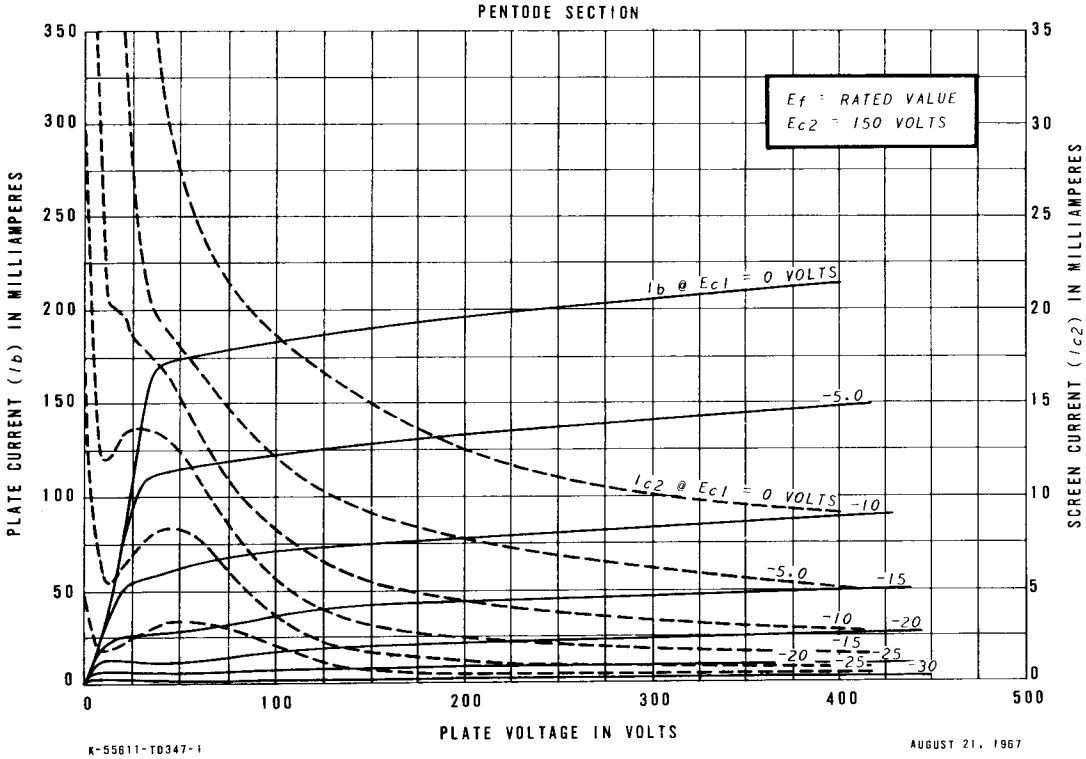
\# For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

Δ Degenerative bias is defined as bias derived wholly from a cathode resistor or any feedback system which achieves an equivalent reduction in gain.

¢ Applied for short interval (two seconds maximum) so as not to damage tube.

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

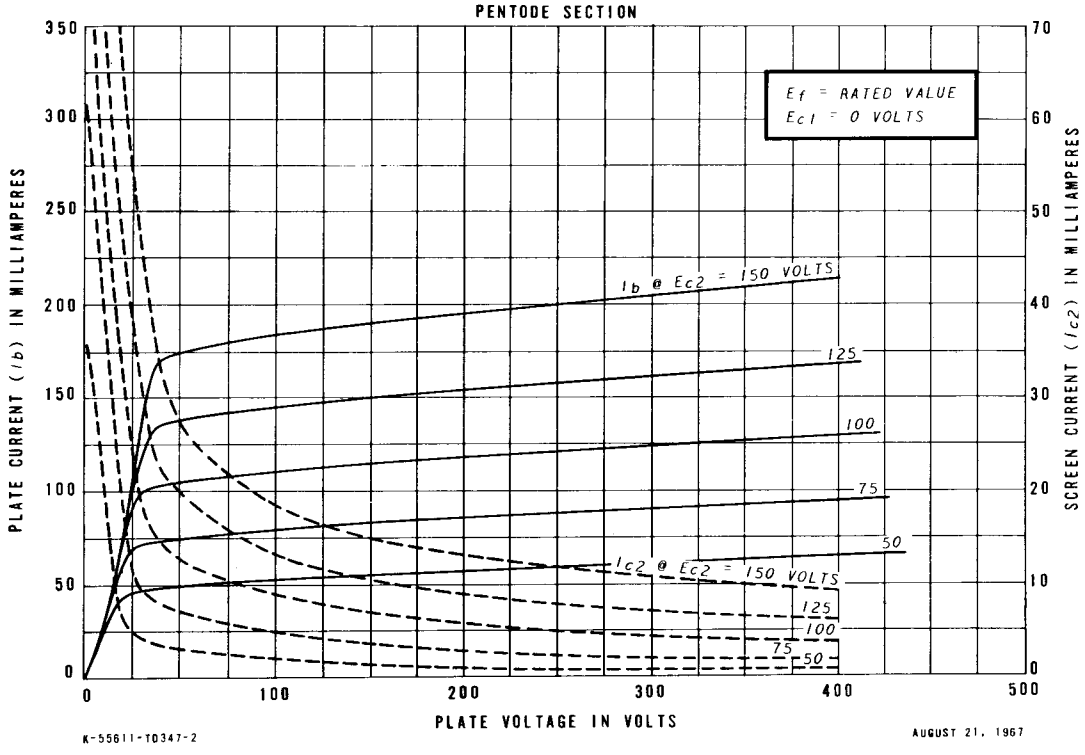


K-55611-T0347-1

AUGUST 21, 1967

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

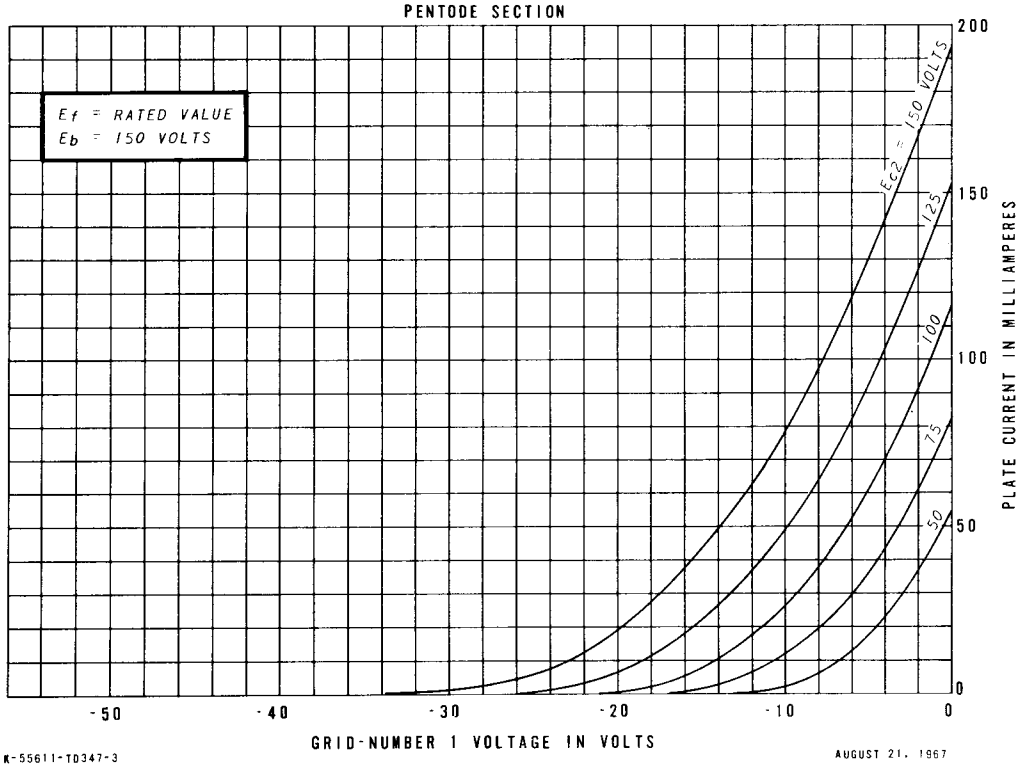


K-55611-T0347-2

AUGUST 21, 1967

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

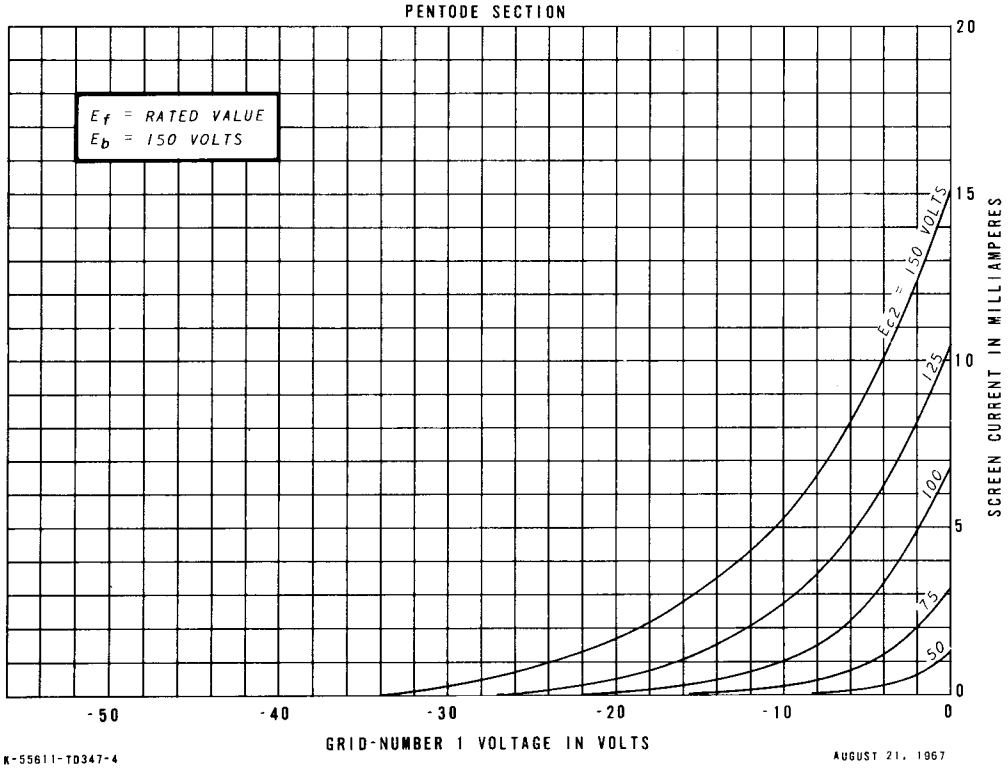


K-55611-TD347-3

AUGUST 21, 1967

AVERAGE TRANSFER CHARACTERISTICS

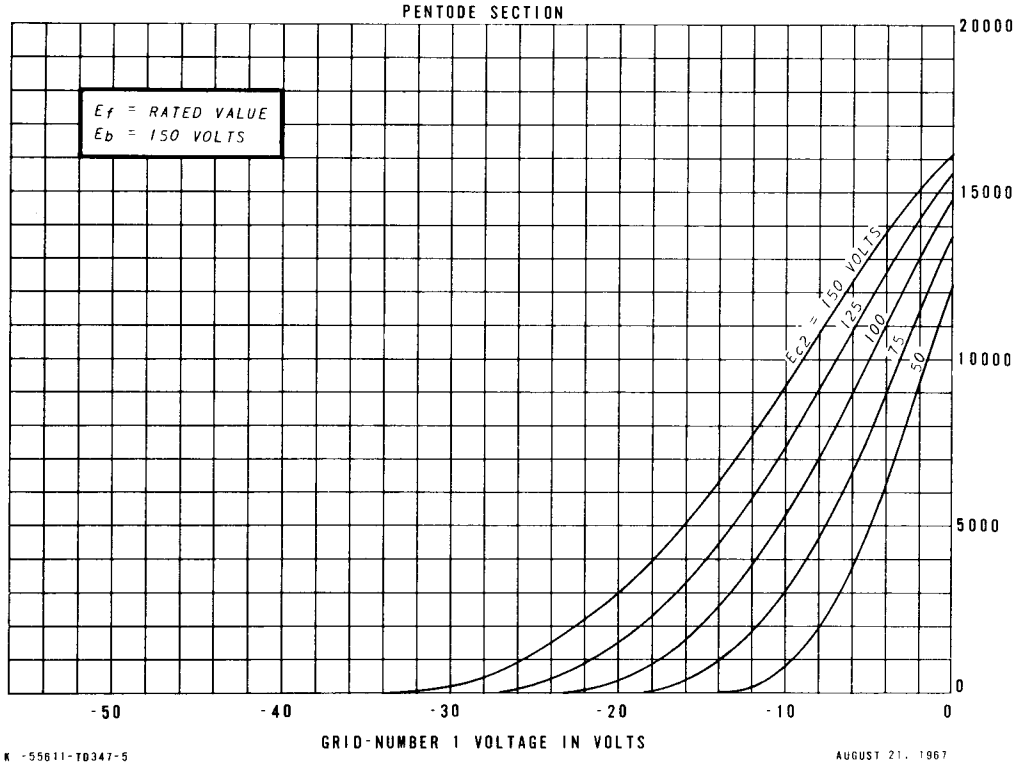
PENTODE SECTION



K-55611-TD347-4

AUGUST 21, 1967

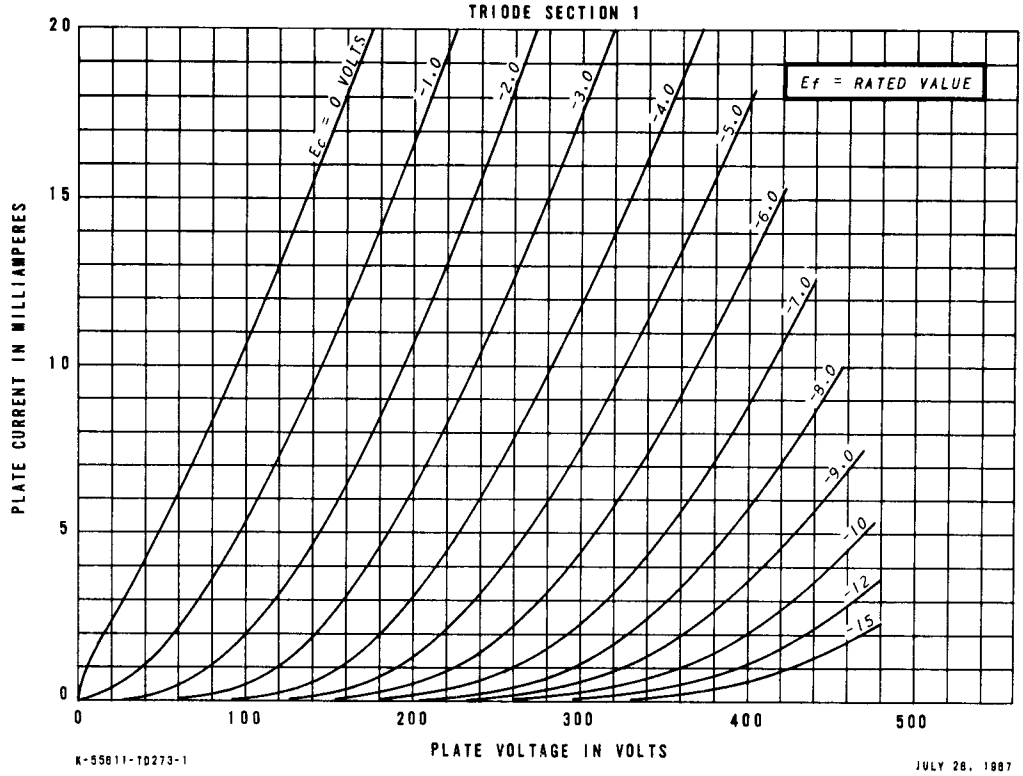
AVERAGE TRANSFER CHARACTERISTICS



K-55611-T0347-5

AUGUST 21, 1967

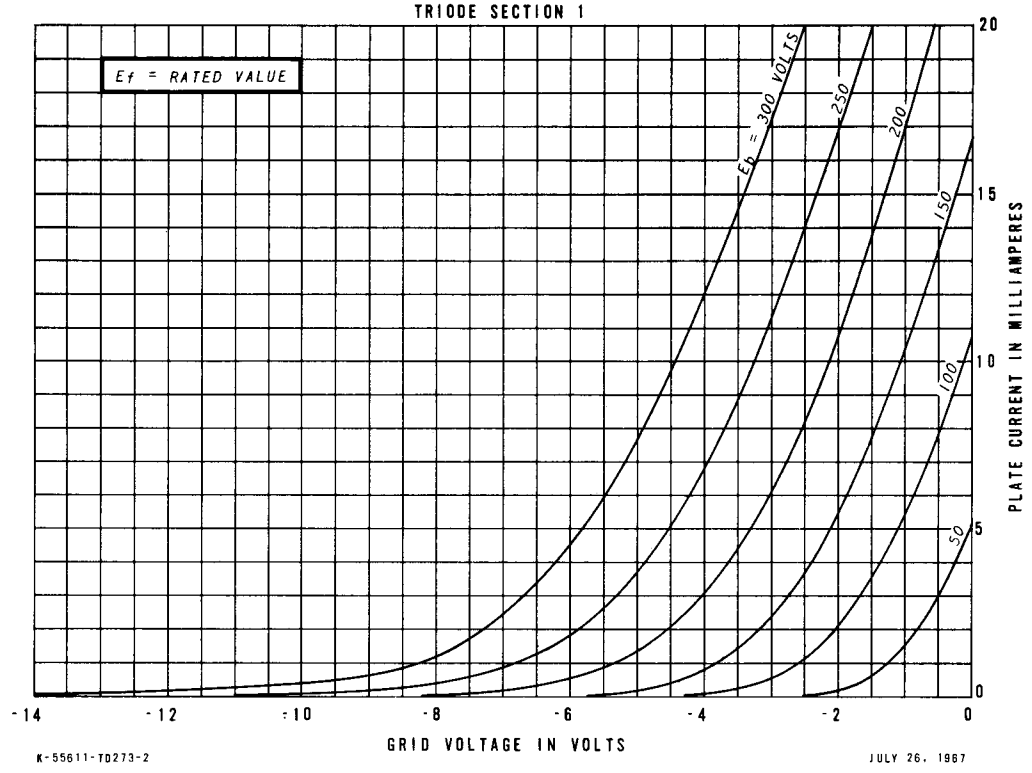
AVERAGE PLATE CHARACTERISTICS



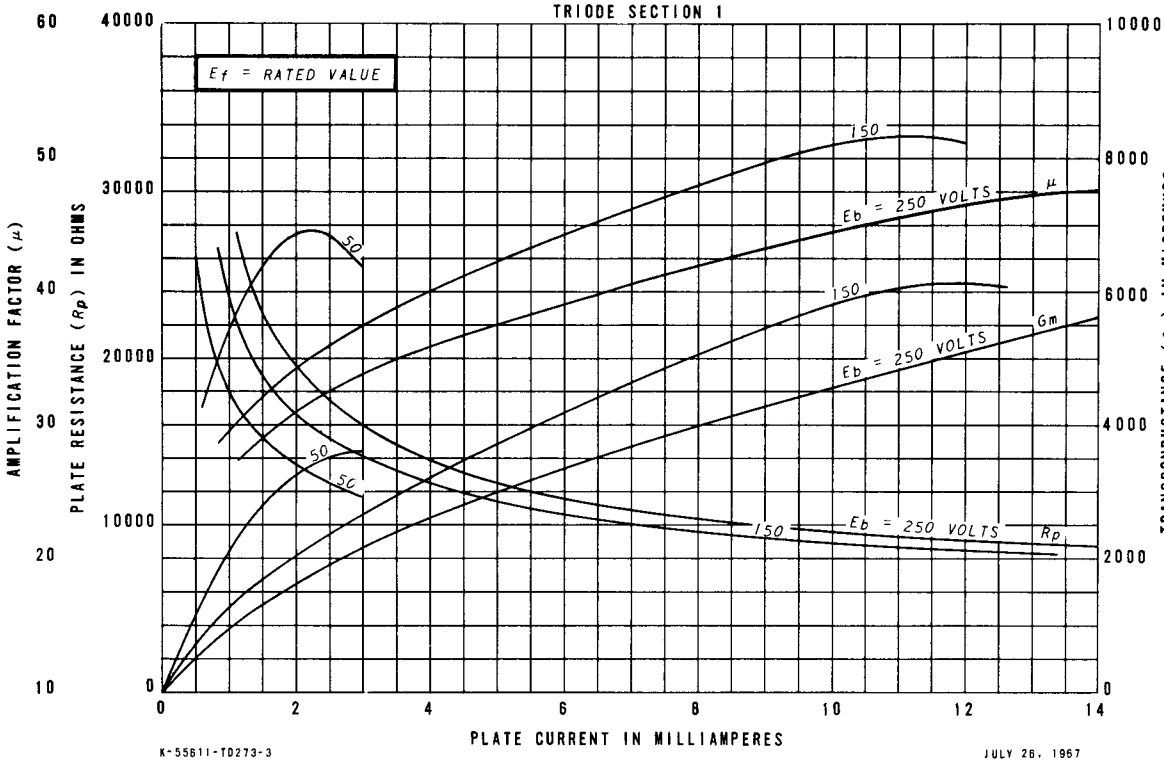
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JULY 28, 1967

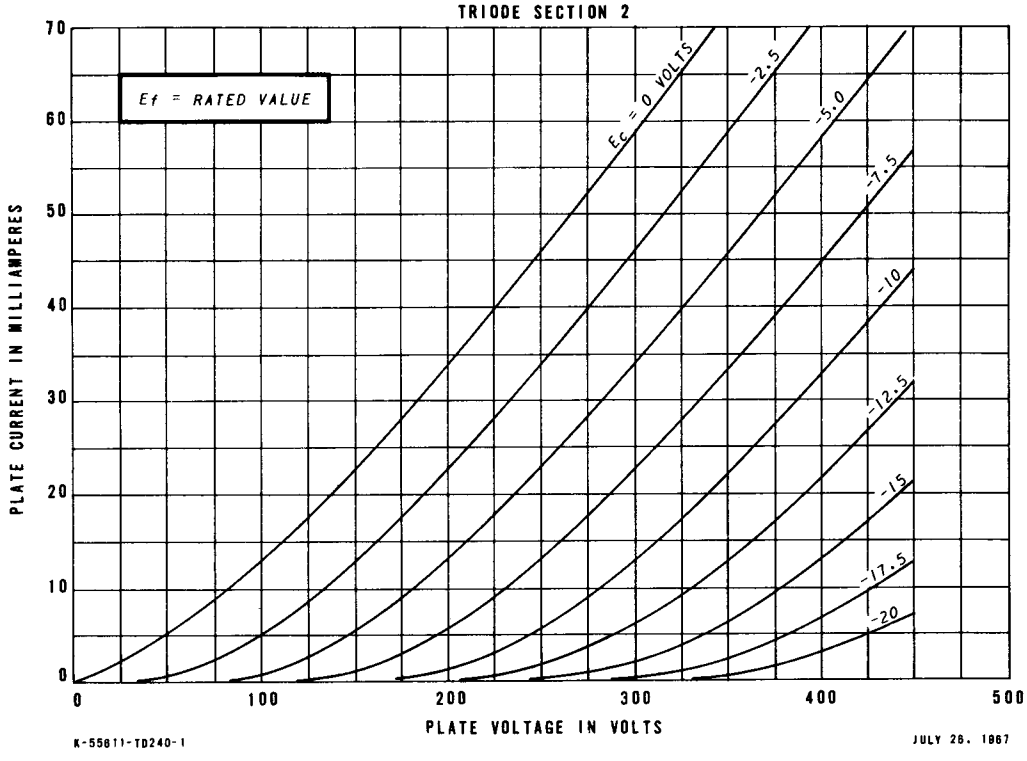
AVERAGE TRANSFER CHARACTERISTICS



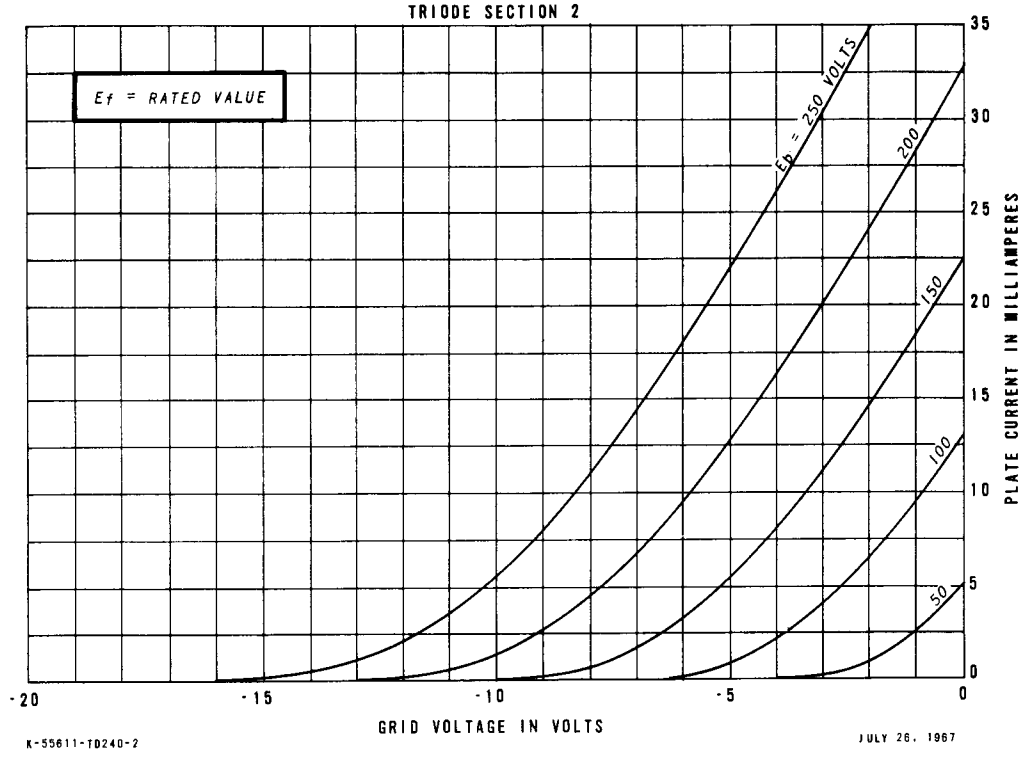
AVERAGE CHARACTERISTICS



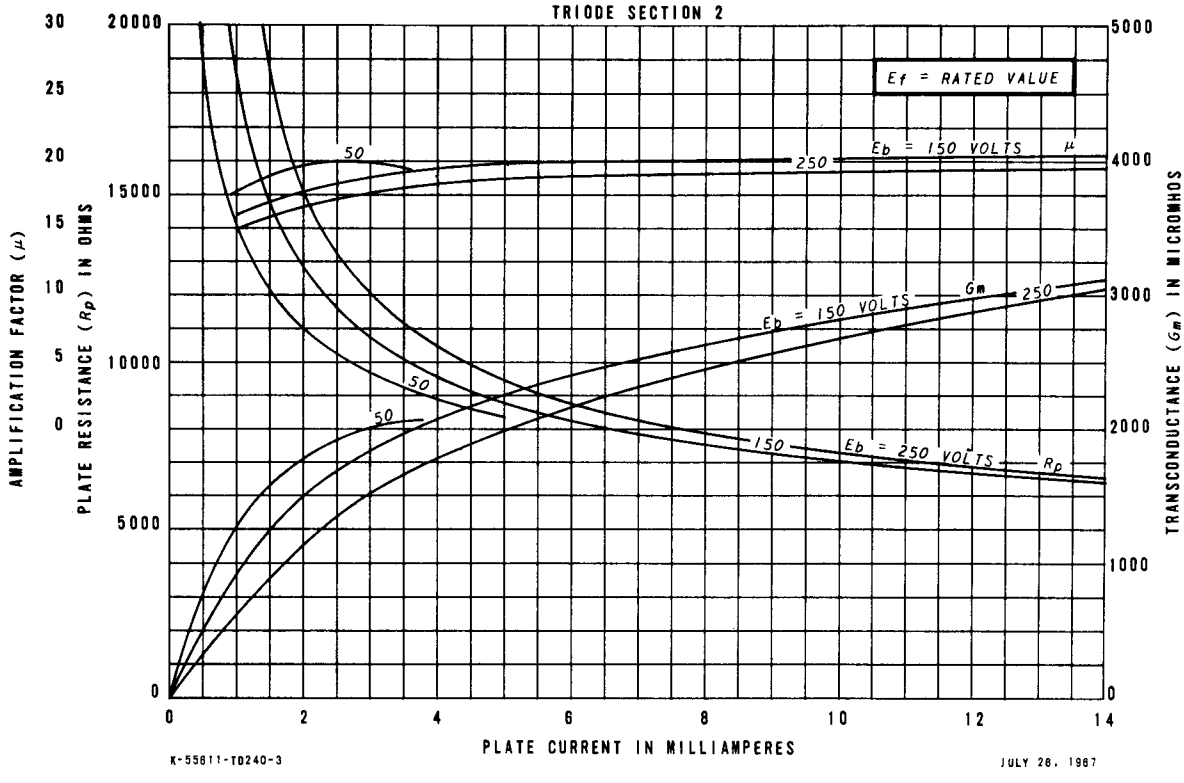
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

Electronic TUBES

6AL5—3AL5—12AL5

TWIN DIODE

DESCRIPTION AND RATING

The 6AL5 is a miniature high-perveance twin diode in which separate cathodes are provided for the two sections. The 6AL5 is suited for a wide variety of applications which include service as a detector in FM and television circuits, automatic-gain-control rectifier, or a low-current power rectifier. Each diode can be used independently of the other or combined in parallel or full-wave arrangements. The resonant frequency of each section of the 6AL5 is approximately 700 megacycles.

The 3AL5, 6AL5 and 12AL5 are alike except for heater ratings and heater-cathode voltage ratings. In addition, the 3AL5, as a result of its controlled heater warm-up characteristic, is suited for use in television receivers which employ series-connected heaters. When the 3AL5 is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

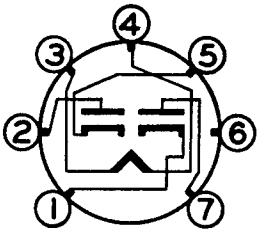
	3AL5	6AL5	12AL5	
Heater Voltage, AC or DC	3.15	6.3	12.6	Volts
Heater Current	0.6	0.3	0.15	Amperes
Heater Warm-up Time*	11	..	....	Seconds

	With Shield†	Without Shield	
Direct Interelectrode Capacitances			
Plate-No. 1 to Cathode-No. 1, Heater, and Internal Shield	3.2	2.5	μμf
Plate-No. 2 to Cathode-No. 2, Heater, and Internal Shield	3.2	2.5	μμf
Cathode-No. 1 to Plate-No. 1, Heater, and Internal Shield	3.6	3.4	μμf
Cathode-No. 2 to Plate-No. 2, Heater, and Internal Shield	3.6	3.4	μμf
Plate-No. 1 to Plate-No. 2, maximum	.0.026	0.068	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

BASING DIAGRAM

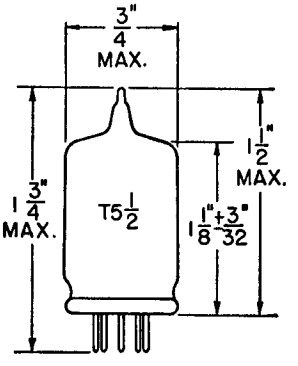


RETMA 6BT

TERMINAL CONNECTIONS

Pin 1—Cathode (Section 1)
Pin 2—Plate (Section 2)
Pin 3—Heater
Pin 4—Heater
Pin 5—Cathode (Section 2)
Pin 6—Internal Shield
Pin 7—Plate (Section 1)

PHYSICAL DIMENSIONS



RETMA 5-1

GENERAL ELECTRIC

Supersedes ET-T269C dated 1-50 and ET-T703 dated 12-49

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Peak Inverse Plate Voltage		330	Volts
AC Plate-Supply Voltage per Plate, RMS		117	Volts
Steady-State Peak Plate Current per Plate		54	Milliamperes
DC Output Current per Plate		9.0	Milliamperes
Heater-Cathode Voltage	**3AL5**	**6AL5, 12AL5**	
Heater Positive with Respect to Cathode			
DC Component	100	...	Volts
Total DC and Peak	200	330	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	330	Volts

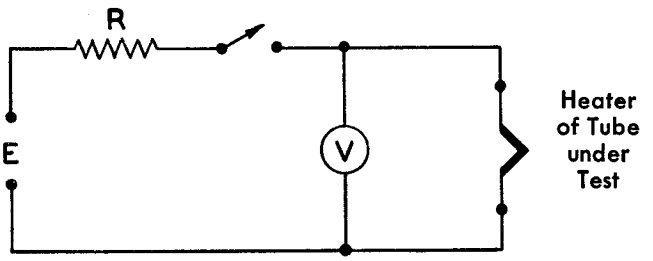
CHARACTERISTICS AND TYPICAL OPERATION

HALF-WAVE RECTIFIER

AC Plate-Supply Voltage per Plate, RMS	117	Volts
Total Plate-Supply Resistance per Plate	300	Ohms
DC Output Current per Plate	9.0	Milliamperes
Tube Voltage Drop		
I_b = 60 Milliamperes DC per Plate	10	Volts

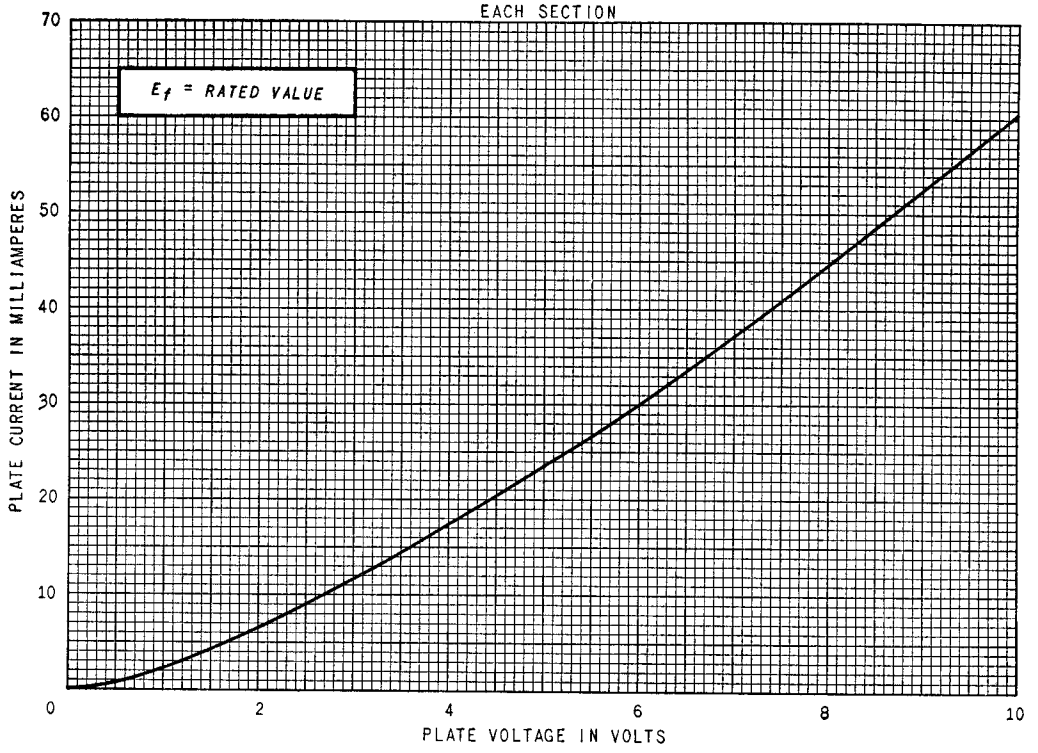
* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E = 12.5 volts (RMS or DC), V_1 = 2.5 volts (RMS or DC), and R = 15.8 ohms.

† With external shield (RETMA 316) connected to pin 6.



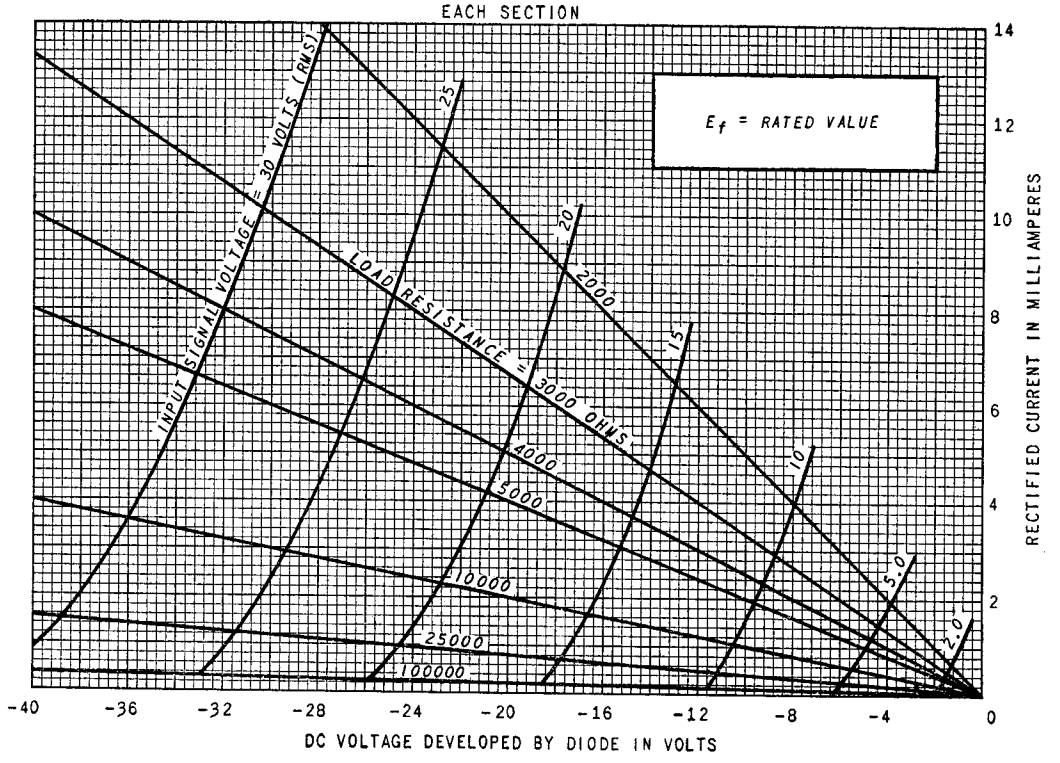
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



OPERATION CHARACTERISTICS

EACH SECTION



Electronic TUBE

6AL7-GT

Description and Rating

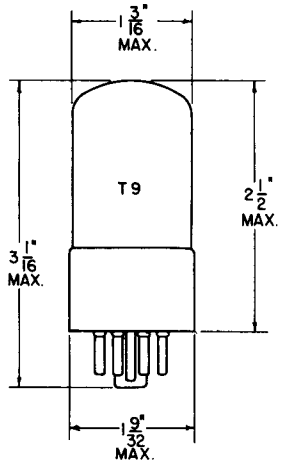
ELECTRON-RAY INDICATOR

GENERAL DESCRIPTION

Principal Application: The 6AL7-GT is an electron-ray indicator designed especially for use in AM-FM receivers. Through its use, precise tuning of either FM or AM signals is easily accomplished without the use of additional tubes or circuit components.

Cathode:	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.15 Ampere
Envelope:	T-9, Glass
Base:	B8-6, Intermediate Shell Octal 8-Pin or B8-46, Short Intermediate Shell Octal 8-Pin
Mounting Position:	Any

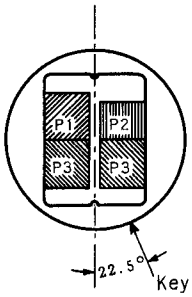
PHYSICAL DIMENSIONS



RTMA 9-7 or 9-39

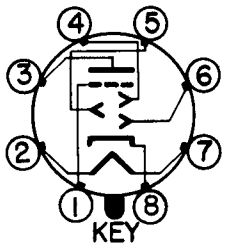
TERMINAL CONNECTIONS

Pin 1 - Grid
Pin 2 - Heater
Pin 3 - Target
Pin 4 - Deflection Electrode Number 2
Pin 5 - Deflection Electrode Number 3
Pin 6 - Deflection Electrode Number 1
Pin 7 - Heater
Pin 8 - Cathode



Pattern areas P_1, P_2, and P_3 are produced and controlled by deflection electrodes number 1, 2, and 3 respectively.

BASING DIAGRAM



RTMA 8CH
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES:

Target Voltage (Maximum)	365	Volts
Target Voltage (Minimum)	220	Volts
Heater-Cathode Voltage	90	Volts

CHARACTERISTICS AND TYPICAL OPERATION

INDICATOR SERVICE

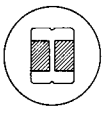
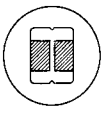
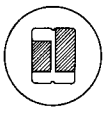
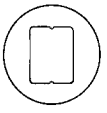
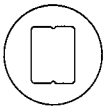
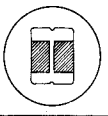
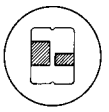
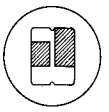
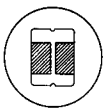
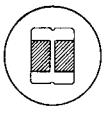
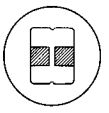
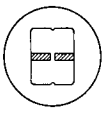
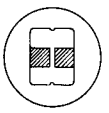
Target Voltage	315	Volts
Deflection Electrode Number 1 Voltage	0	Volts
Deflection Electrode Number 2 Voltage	0	Volts
Deflection Electrode Number 3 Voltage	0	Volts
Grid Voltage *	0	Volts
Cathode Bias Resistor	3300	Ohms
Deflection Sensitivity (Approx) for First Millimeter Deflection #	1.0	mm/Volt
Grid Voltage (Approx) for Fluorescence Cutoff	-7.0	Volts

** The grid should be connected to the cathode when not used for fluorescence control.*

 # For deflection electrodes number 1 and 2

Supersedes ET-T270A dated 11-46

PATTERN SEQUENCE DURING TUNING

CONTROL VOLTAGE SOURCE	SIGNAL	CIRCUIT (SEE FIGURE)	OFF CHANNEL (−)	ON CHANNEL OFF TUNE (−)	ON TUNE	ON CHANNEL OFF TUNE (+)	OFF CHANNEL (+)
DISCRIMINATOR	FM	1 AND 2					
DISCRIMINATOR AND SQUELCH	FM	3					
DISCRIMINATOR AND LIMITER	FM	4					
AVC	AM	5					

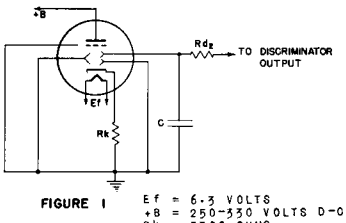


FIGURE 1

Ef = 6.3 VOLTS
+B = 250-330 VOLTS D-C
Rk = 3300 OHMS
Rd2 = 1.0 MEGOHM
C = 0.05 MICROFARAD

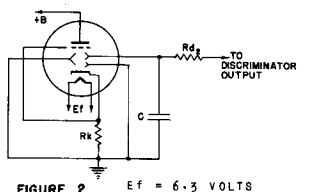


FIGURE 2

Ef = 6.3 VOLTS
+B = 250-330 VOLTS D-C
Rk = 3300 OHMS
Rd2 = 1.0 MEGOHM
C = 0.05 MICROFARAD

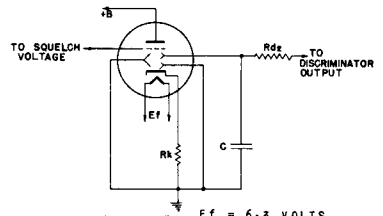


FIGURE 3

Ef = 6.3 VOLTS
+B = 250-330 VOLTS D-C
Rk = 3300 OHMS
Rd2 = 1.0 MEGOHM
C = 0.05 MICROFARAD
SQUELCH VOLTAGE:
0 VOLTS - "ON TUNE"
-6 VOLTS (APPROX) - "OFF CHANNEL"

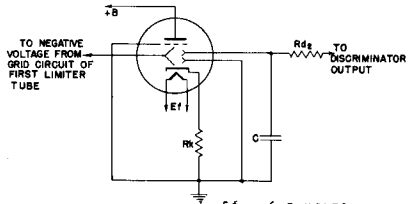


FIGURE 4

Ef = 6.3 VOLTS
+B = 250-330 VOLTS D-C
Rk = 3300 OHMS
Rd2 = 1.0 MEGOHM
C = 0.05 MICROFARAD

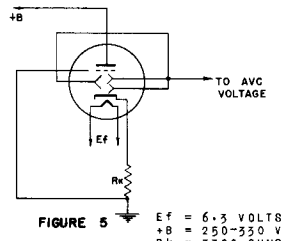


FIGURE 5

Ef = 6.3 VOLTS
+B = 250-330 VOLTS D-C
Rk = 3300 OHMS

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

Electronic TUBES

6AM4

TRIODE

FOR UHF MIXER AND AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6AM4 is a miniature high-mu triode designed for use as a grounded-grid mixer or amplifier in television receivers that operate in the ultra-high-frequency region. Its sharp-cutoff and high transconductance, coupled with its excellent isolation between input and output, make the 6AM4 well suited for grounded-grid mixer or amplifier service over the entire range of VHF-UHF television frequencies.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC		6.3	Volts
Heater Current		0.225	Amperes
Direct Interelectrode Capacitances	**With Shield***	**Without Shield**	
Plate to Cathode	0.16	0.16	μμf
Cathode to Grid and Heater	4.6	4.4	μμf
Plate to Grid and Heater	2.8	2.4	μμf
Heater to Cathode	1.8	1.8	μμf

MECHANICAL

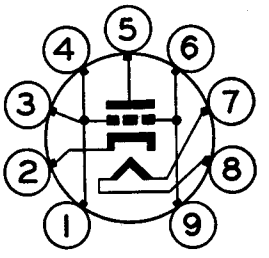
Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button, 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	200	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	80	Volts
Heater Negative with Respect to Cathode†	80	Volts

BASING DIAGRAM

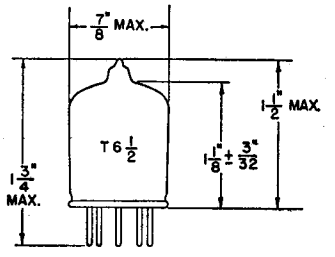


RETMA 9BX

TERMINAL CONNECTIONS

Pin 1—Grid
Pin 2—Cathode
Pin 3—Grid
Pin 4—Grid
Pin 5—Plate
Pin 6—Grid
Pin 7—Heater
Pin 8—Heater
Pin 9—Grid

PHYSICAL DIMENSIONS



RETMA 6-1

GENERAL ELECTRIC

Supersedes ET-T806, dated 5-52

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

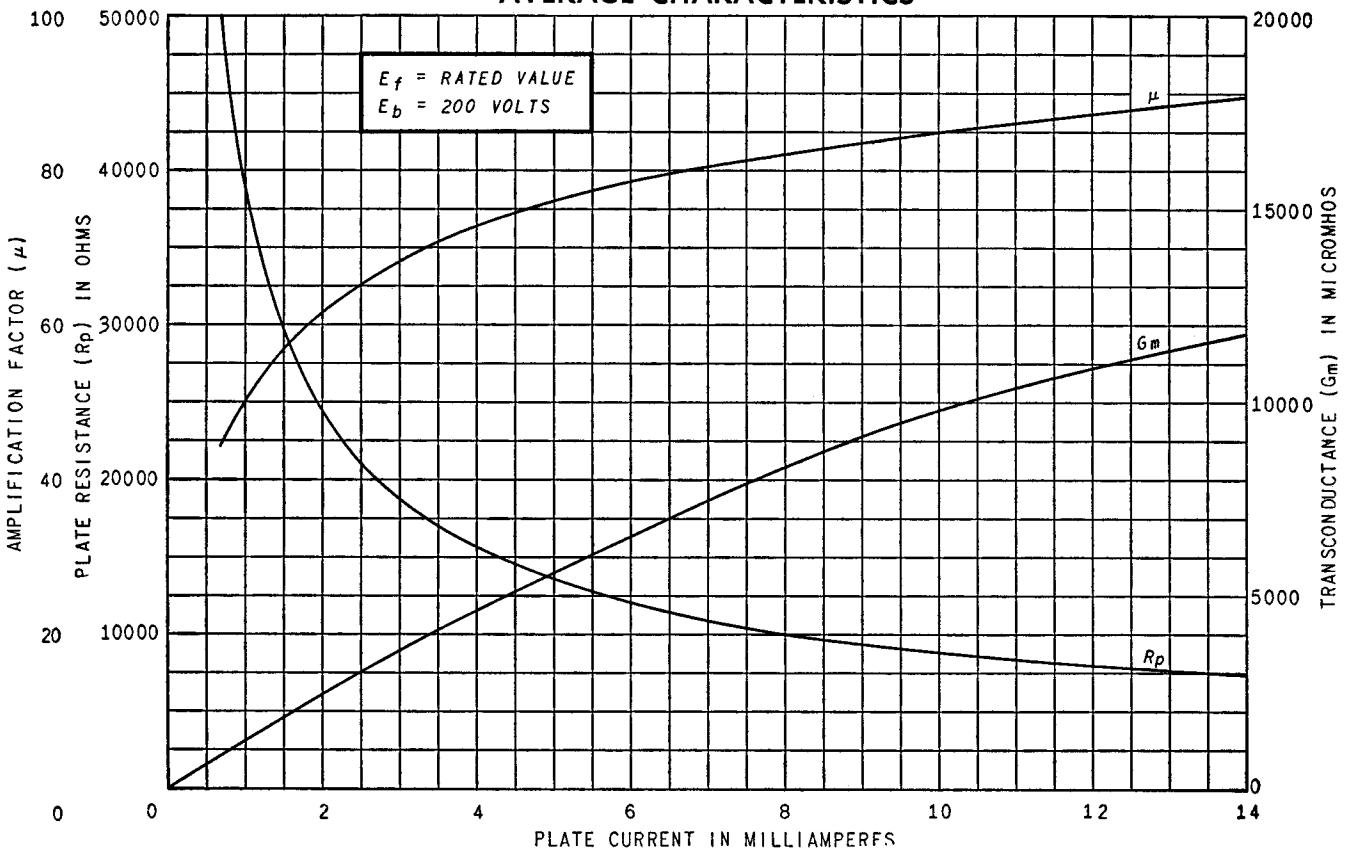
Plate Voltage	200	Volts
Cathode-Bias Resistor	100	Ohms
Amplification Factor	85	
Plate Resistance, approximate	8700	Ohms
Transconductance	9800	Micromhos
Plate Current	10	Milliamperes
Grid Voltage, approximate		
Ib = 10 Microamperes	−6.5	Volts

* With external shield (RETMA 315) connected to grid.

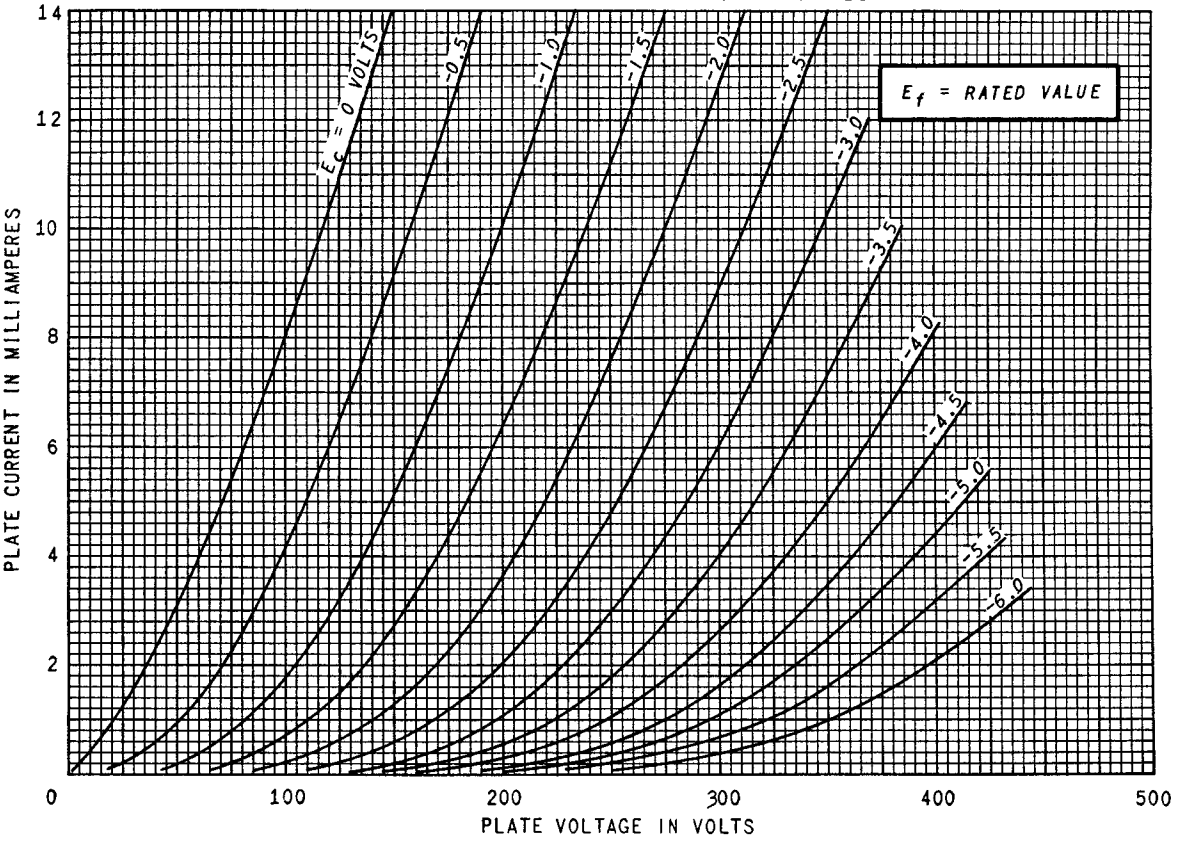
† When the tube is used in a cascode amplifier with a second tube and the two tubes are connected in series, this voltage may be as high as 250 volts maximum under cutoff conditions.

Note: When the 6AM4 is used in grounded-grid operation at high frequencies, all five grid terminals should be grounded to minimize the effects of grid-lead inductance.

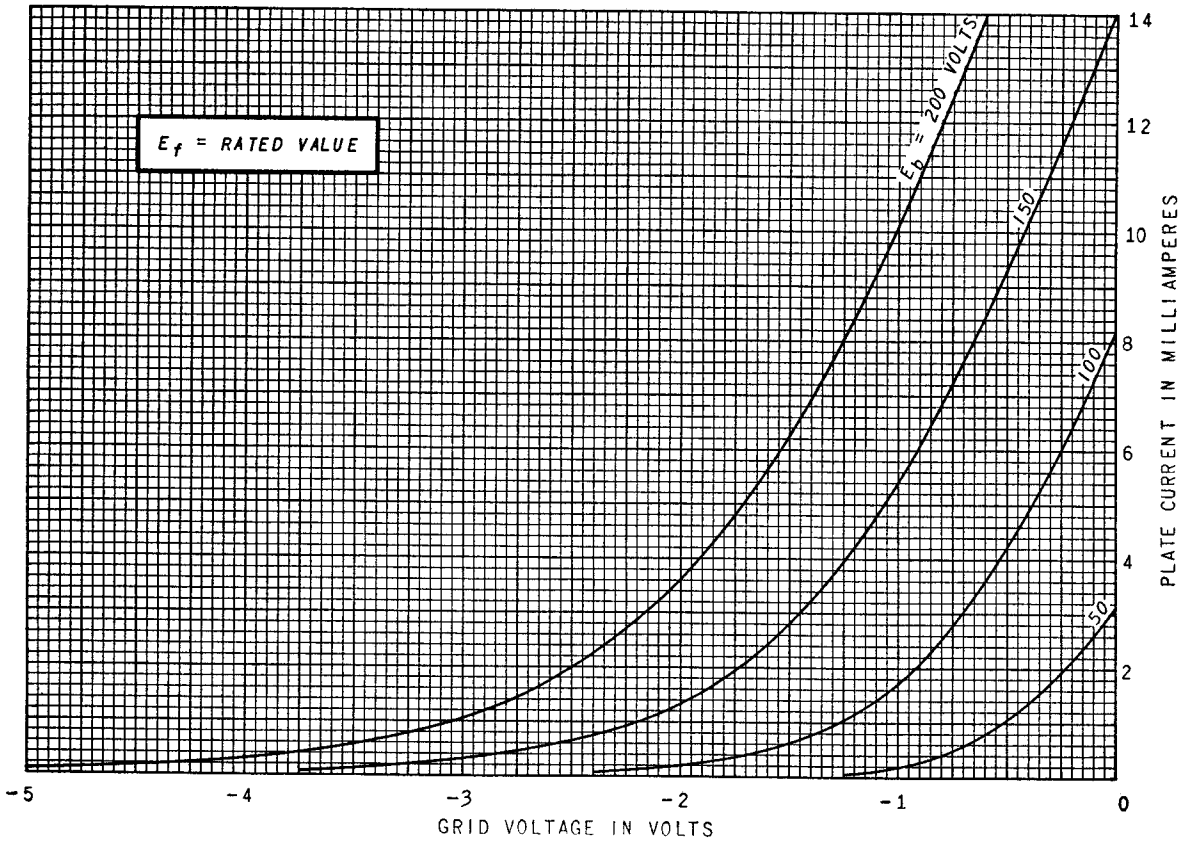
AVERAGE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBE
KEN-RAD

6AN5
Description and Rating

BEAM POWER AMPLIFIER

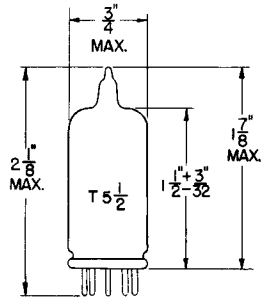
GENERAL DESCRIPTION

Principal Application: The 6AN5 is a miniature beam-power amplifier designed for use as a wide-band radio-frequency or video power amplifier in equipments with relatively low plate supply voltages. The tube is capable of operation at high plate current levels and exhibits a high transconductance.

Cathode:	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.45 Ampere
Envelope:	T-5½, Glass
Base:	E7-1, Miniature Button 7-Pin

Mounting Position:	Any	
Direct Interelectrode Capacitances: #		
Grid 1 to Plate (Max)	0.075	μμf
Input	9.0	μμf
Output	4.8	μμf

PHYSICAL DIMENSIONS

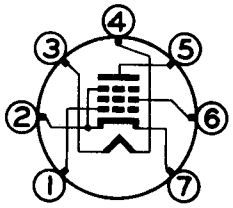


RTMA 5-2

TERMINAL CONNECTIONS

Pin 1 - Grid Number 1
Pin 2 - Cathode and Beam Plates
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Cathode and Beam Plates

BASING DIAGRAM



RTMA 7BD
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES:

Plate Voltage	120	300	Volts
Screen Voltage	120	300	Volts
Plate Dissipation	4.2	1.70	Watts
Screen Dissipation	1.4	0.56	Watts
Cathode Current	50	20	Milliamperes
Bulb Temperature at Any Point	140	140	Centigrade
Grid Number 1 Circuit Resistance			
With Fixed Bias *	0.1	0.1	Megohm
With Cathode Bias	0.1	0.1	Megohm

CHARACTERISTICS AND TYPICAL OPERATION

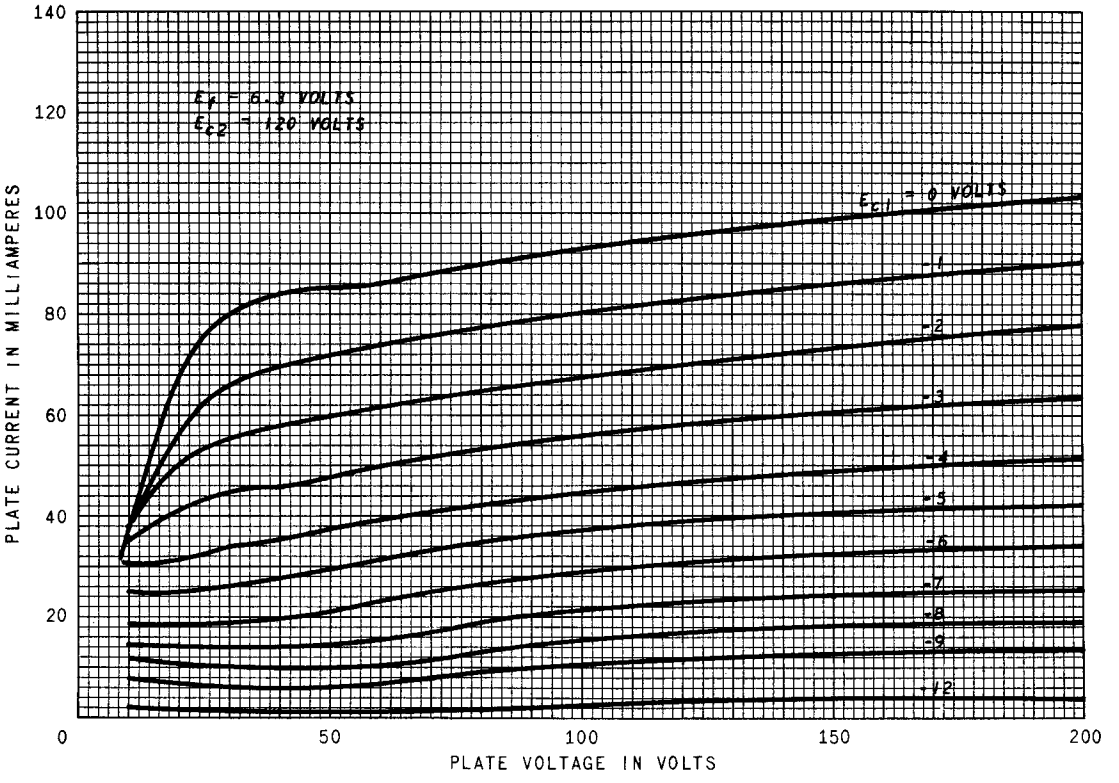
CLASS A_1 AMPLIFIER

Plate Voltage	120	Volts
Screen Voltage	120	Volts
Cathode Bias Resistor	120	Ohms
Plate Resistance (Approx)	12500	Ohms
Transconductance	8000	Micromhos
Plate Current	35	Milliamperes
Screen Current	12	Milliamperes
Load Resistance	2500	Ohms
Power Output (Approx)	1.3	Watts
Plate Current (Max) for E_{c1} = -20 Volts	1.0	Milliampere

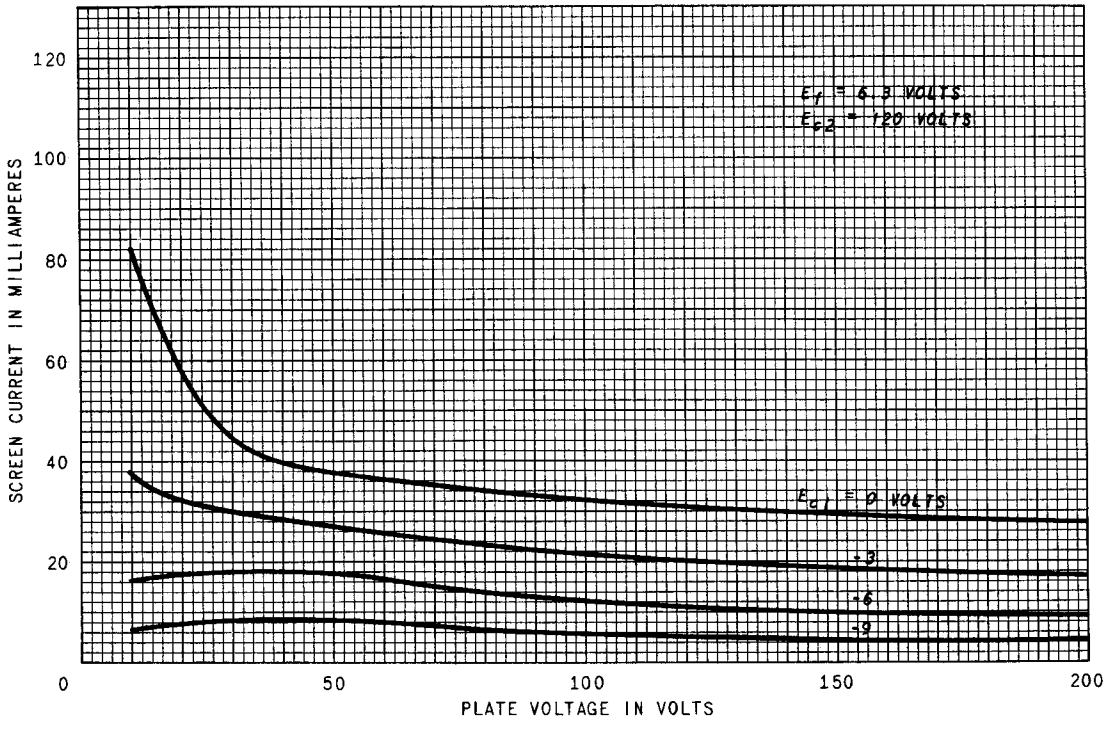
 # With external shield #316 connected to cathode

** Fixed bias operation is recommended only when the plate and screen dissipation is less than 70 percent of the design-center maximum ratings.*

AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



Tube Department, Electronics Division

GENERAL ELECTRIC

Schenectady, N. Y.

Electronic TUBES

6AQ5—5AQ5

BEAM PENTODE

DESCRIPTION AND RATING

The 6AQ5 is a miniature beam-power pentode designed for use in the audio-frequency power output stage of television and radio receivers. It may also be used as a triode-connected vertical deflection amplifier in television receivers. Within its maximum ratings, the performance of the 6AQ5 is equivalent to that of the 6V6-GT.

Except for heater ratings, the 5AQ5 is identical to the 6AQ5. In addition, the 5AQ5, as a result of its controlled heater warm-up characteristic, is especially suited for use in television receivers which employ series-connected heaters. When the 5AQ5 is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

GENERAL

ELECTRICAL

	5AQ5	6AQ5	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	4.7	6.3	Volts
Heater Current	0.6	0.45	Ampere
Heater Warm-up Time*	11	....	Seconds
Direct Interelectrode Capacitances, approximate†			
Grid-Number 1 to Plate		0.4	μμf
Input		8.0	μμf
Output		8.5	μμf

MECHANICAL

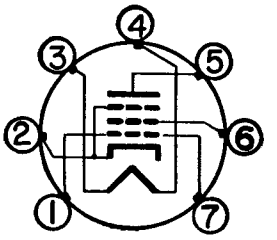
Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

	Class A1 Amplifier	Vertical-Deflection Amplifier‡ (Triode Connection)§	
DC Plate Voltage	250	250	Volts
Peak Positive Pulse Plate Voltage		1100π	Volts
Screen Voltage	250	...	Volts
Peak Negative Grid-Number 1 Voltage		250	Volts
Plate Dissipation	12	9.0▲	Watts
Screen Dissipation	2.0	...	Watts
DC Cathode Current		35	Milliamperes
Peak Cathode Current		105	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	...	Megohms
With Cathode Bias	0.5	2.2	Megohms
Bulb Temperature at Hottest Point	250	250	C

BASING DIAGRAM

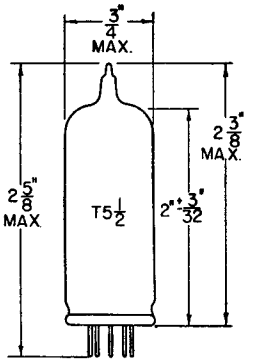


RETMA 7BZ

TERMINAL CONNECTIONS

Pin 1—Grid-Number 1
Pin 2—Cathode and Beam Plates
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid-Number 2 (Screen)
Pin 7—Grid-Number 1

PHYSICAL DIMENSIONS



RETMA 5-3

GENERAL ELECTRIC

Supersedes ET-T271D dated 6-53

CLASS A_1 AMPLIFIER

Plate Voltage	180	250	Volts
Screen Voltage	180	250	Volts
Grid-Number 1 Voltage	−8.5	−12.5	Volts
Peak AF Grid-Number 1 Voltage	8.5	12.5	Volts
Plate Resistance, approximate	58000	52000	Ohms
Transconductance	3700	4100	Micromhos
Zero-Signal Plate Current	29	45	Milliamperes
Maximum-Signal Plate Current	30	47	Milliamperes
Zero-Signal Screen Current	3.0	4.5	Milliamperes
Maximum-Signal Screen Current	4.0	7.0	Milliamperes
Load Resistance	5500	5000	Ohms
Total Harmonic Distortion, approximate	8	8	Percent
Maximum-Signal Power Output	2.0	4.5	Watts

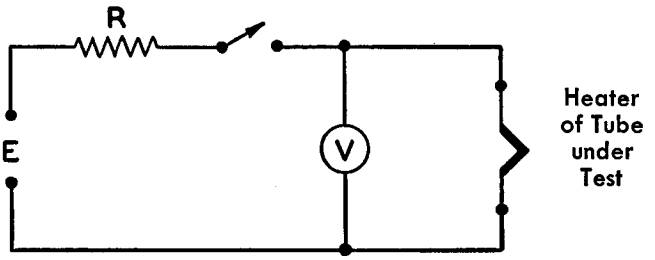
PUSH-PULL CLASS AB_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	−15	Volts
Peak AF Grid-to-Grid Voltage	30	Volts
Zero-Signal Plate Current	70	Milliamperes
Maximum-Signal Plate Current	79	Milliamperes
Zero-Signal Screen Current	5.0	Milliamperes
Maximum-Signal Screen Current	13	Milliamperes
Effective Load Resistance, Plate-to-Plate	10000	Ohms
Total Harmonic Distortion	5	Percent
Maximum-Signal Power Output	10	Watts

AVERAGE CHARACTERISTICS, TRIODE CONNECTION§

Plate Voltage	250	Volts
Grid-Number 1 Voltage	−12.5	Volts
Amplification Factor	9.5	
Plate Resistance, approximate	1970	Ohms
Transconductance	4800	Micromhos
Plate Current	49.5	Milliamperes
Grid-Number 1 Voltage, approximate I_b = 0.5 Milliampere	−37	Volts

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E = 18.7 volts (RMS or DC), V_1 = 3.73 volts (RMS or DC), and R = 23.5 ohms.

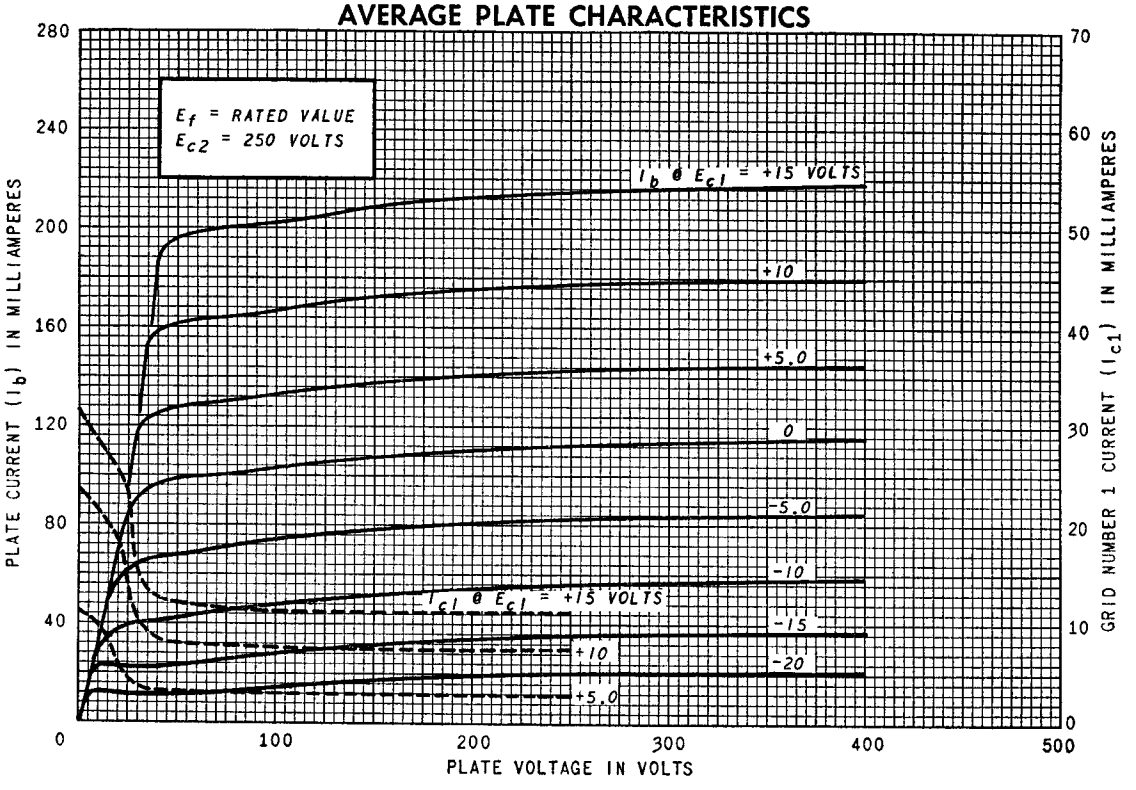


† Without external shield.
‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.
§ With screen tied to plate.

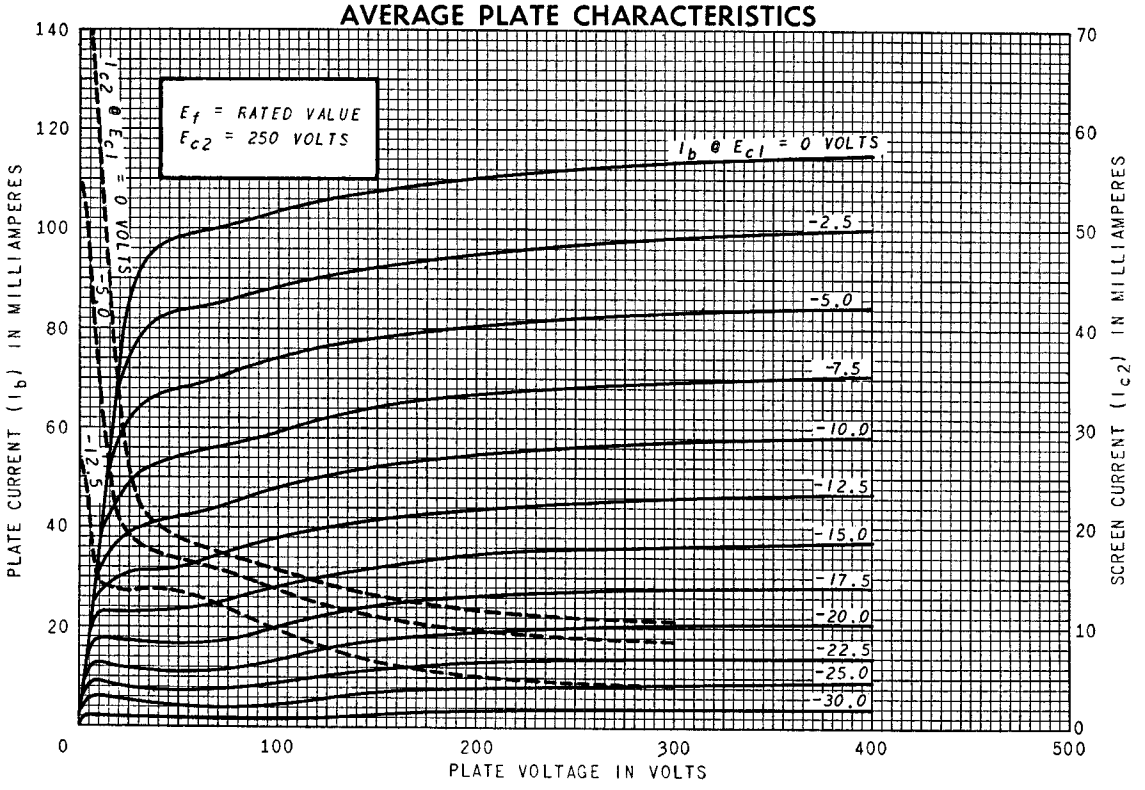
π Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

▲ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

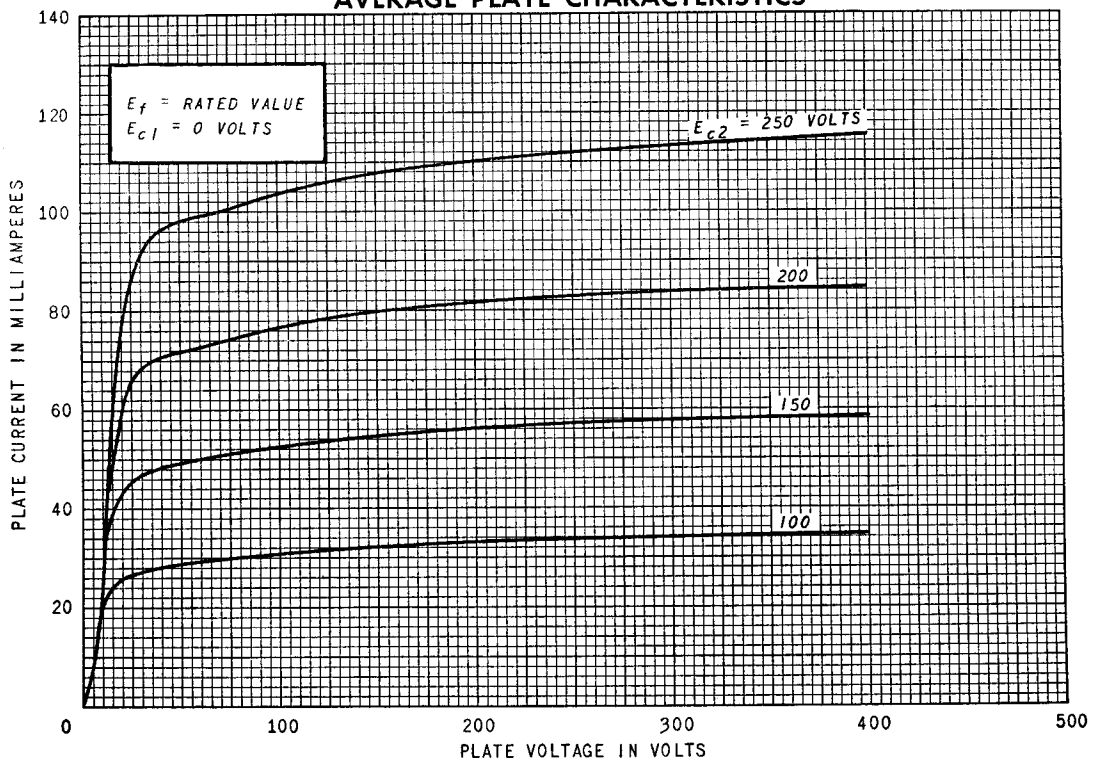
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

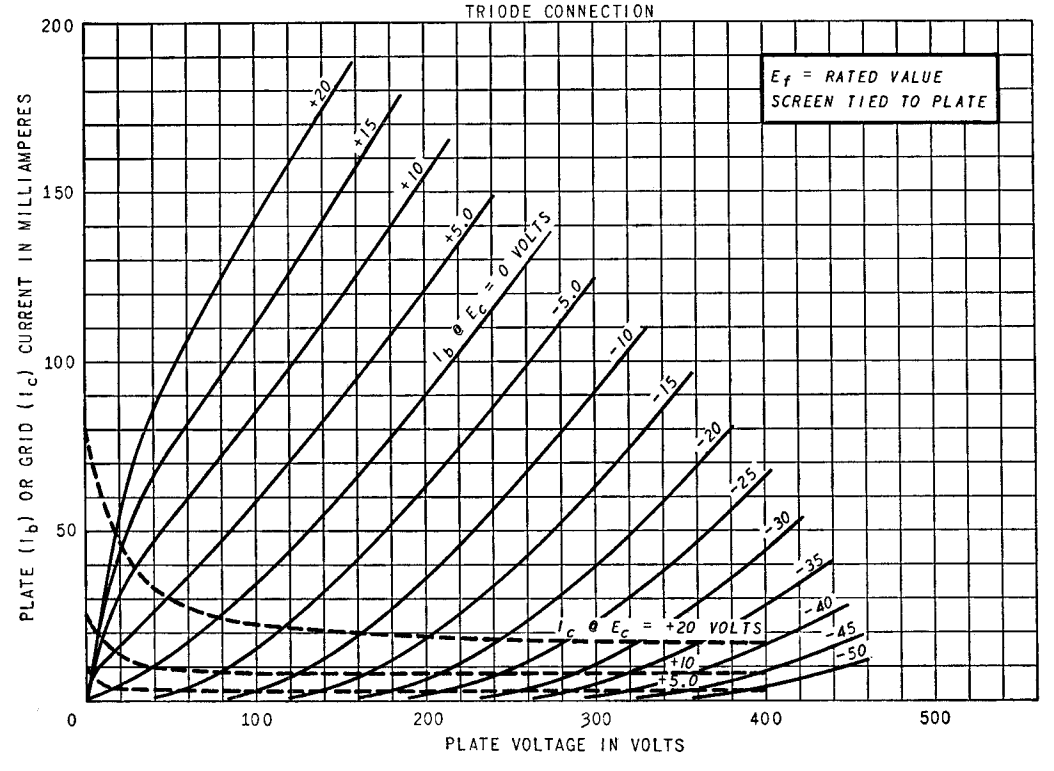


AVERAGE PLATE CHARACTERISTICS

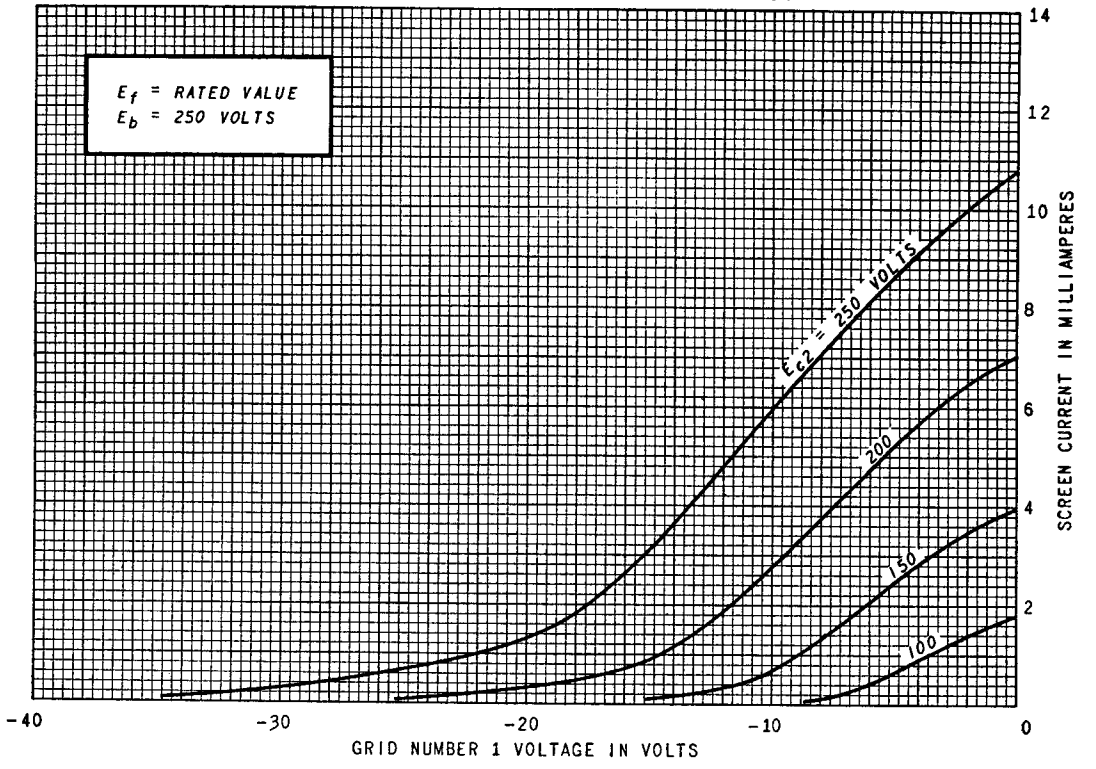


AVERAGE PLATE CHARACTERISTICS

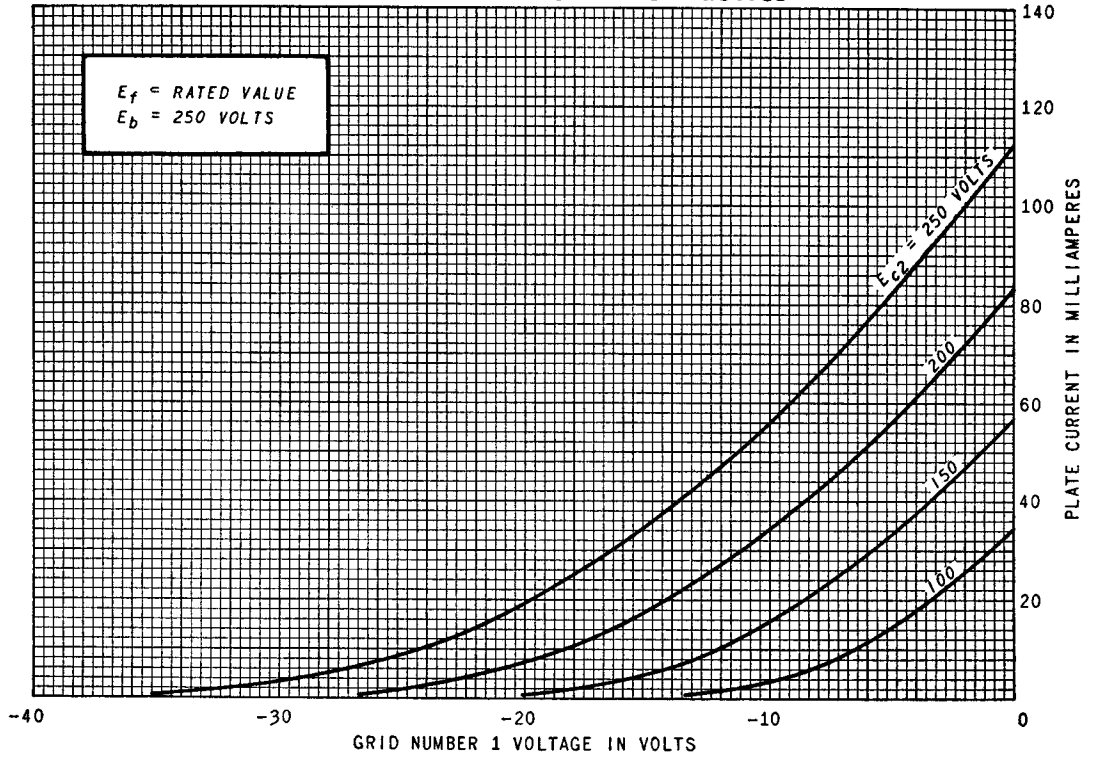
TRIODE CONNECTION



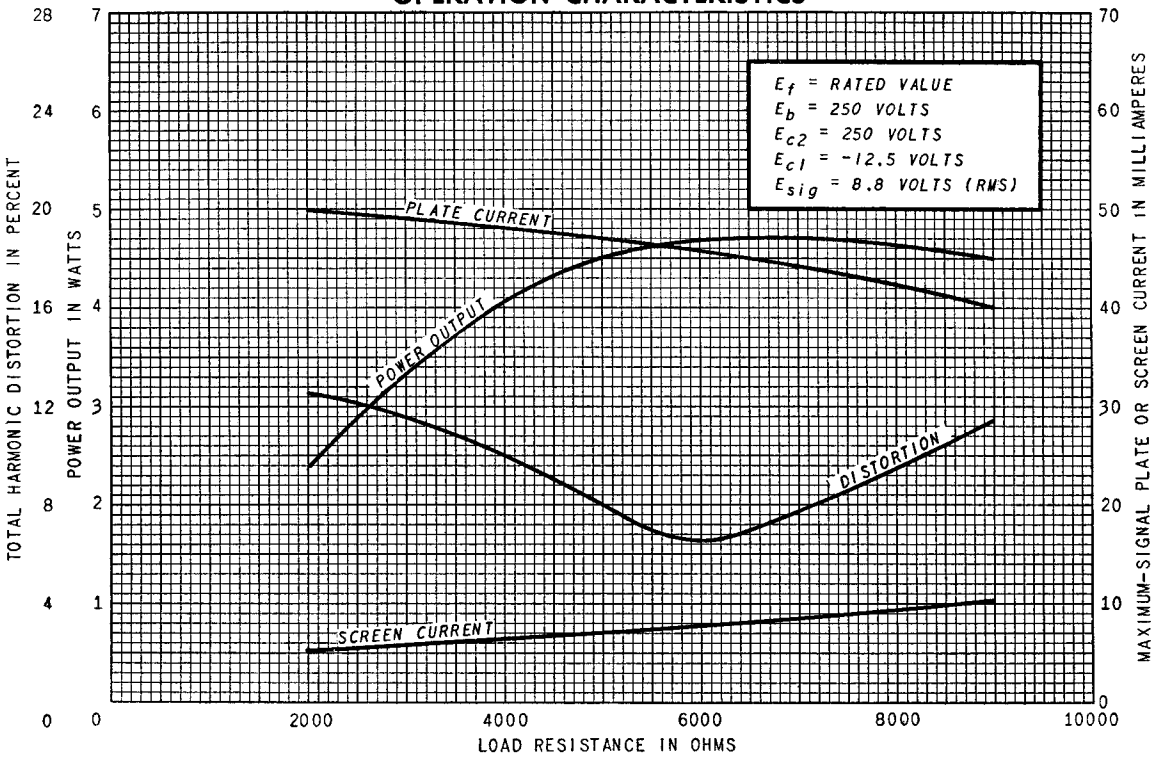
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



OPERATION CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

6AQ5-A
BEAM PENTODE

DESCRIPTION AND RATING

The 6AQ5-A is a miniature beam-power pentode designed for use in the audio-frequency power output stage of television and radio receivers. It may also be used as a triode-connected vertical deflection amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings	Series Heater Operation	Parallel Heater Operation	
Heater Voltage, AC or DC	6.3	6.3 ± 0.6†	Volts
Heater Current	0.45 ± 0.03*	0.45‡	Amperes
Heater Warm-up Time§	11	.....	Seconds

Direct Interelectrode Capacitances, approximate¶

Grid-Number 1 to Plate: (g1 to p)	0.4	pf
Input: g1 to (h+k+g2+b.p.)	8.0	pf
Output: p to (h+k+g2+b.p.)	8.5	pf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin
Outline Drawing—EIA 5-3

Maximum Diameter	¾	Inches
Maximum Over-all Length	2⅝	Inches
Maximum Seated Height	2⅜	Inches

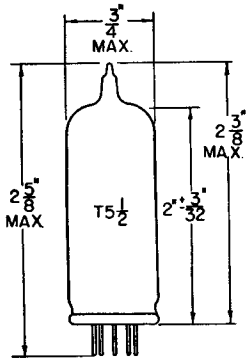
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

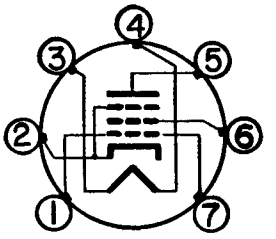


EIA 5-3

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode and Beam Plates
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Grid Number 1

BASING DIAGRAM



EIA 7BZ

GENERAL ELECTRIC

Supersedes ET-T1288 dated 4-56

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Class A_1 Amplifier	Vertical-Deflection Amplifier ✱ (Triode Connection) △	
DC Plate Voltage	275	275	Volts
Peak Positive Pulse Plate Voltage	...	1100	Volts
Screen Voltage	275	....	Volts
Peak Negative Grid-Number 1 Voltage	...	275	Volts
Plate Dissipation	12	10**	Watts
Screen Dissipation	2.0	....	Watts
DC Cathode Current	...	40	Milliamperes
Peak Cathode Current	...	115	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	....	Megohms
With Cathode Bias	0.5	2.2	Megohms
Bulb Temperature at Hottest Point	250	250	C

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	180	250	Volts
Screen Voltage	180	250	Volts
Grid-Number 1 Voltage	−8.5	−12.5	Volts
Peak AF Grid-Number 1 Voltage	8.5	12.5	Volts
Plate Resistance, approximate	58000	52000	Ohms
Transconductance	3700	4100	Micromhos
Zero-Signal Plate Current	29	45	Milliamperes
Maximum-Signal Plate Current	30	47	Milliamperes
Zero-Signal Screen Current	3.0	4.5	Milliamperes
Maximum-Signal Screen Current	4.0	7.0	Milliamperes
Load Resistance	5500	5000	Ohms
Total Harmonic Distortion, approximate	8	8	Percent
Maximum-Signal Power Output	2.0	4.5	Watts

PUSH-PULL CLASS AB_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	−15	Volts
Peak AF Grid-to-Grid Voltage	30	Volts
Zero-Signal Plate Current	70	Milliamperes
Maximum-Signal Plate Current	79	Milliamperes
Zero-Signal Screen Current	5.0	Milliamperes
Maximum-Signal Screen Current	13	Milliamperes
Effective Load Resistance, Plate-to-Plate	10000	Ohms
Total Harmonic Distortion, approximate	5	Percent
Maximum-Signal Power Output	10	Watts

AVERAGE CHARACTERISTICS, TRIODE CONNECTION △

Plate Voltage	250	Volts
Grid-Number 1 Voltage	−12.5	Volts
Amplification Factor	9.5	
Plate Resistance, approximate	1970	Ohms
Transconductance	4800	Micromhos
Plate Current	49.5	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 0.5 Milliamperes	−37	Volts

* For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

† For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

¶ Without external shield.

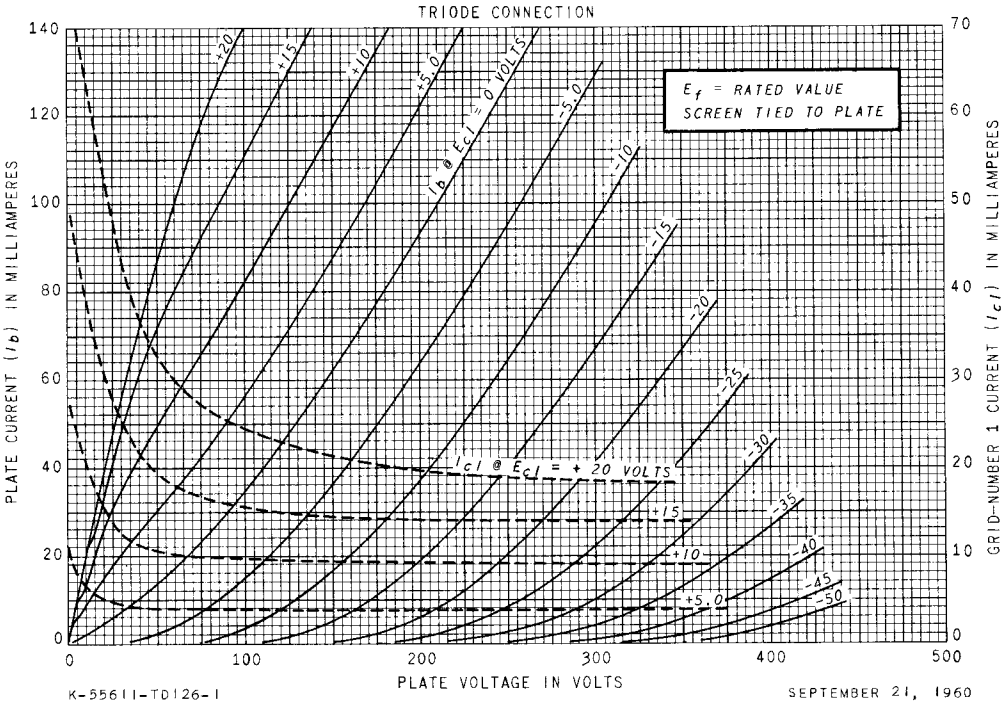
⁂ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

△ With screen tied to plate.

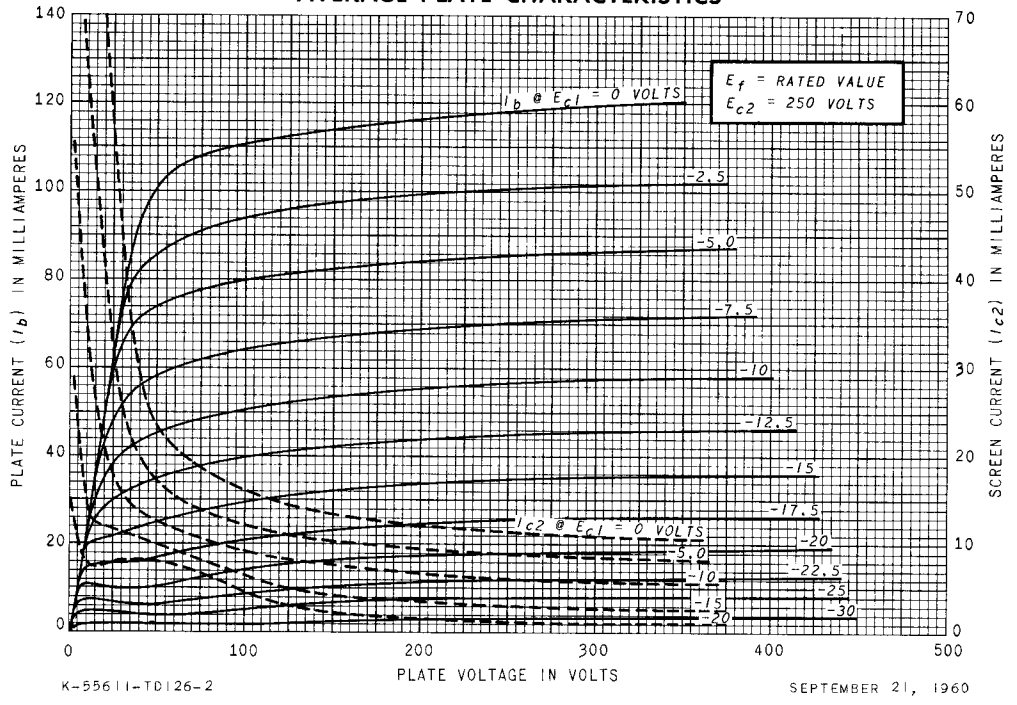
** In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

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AVERAGE PLATE CHARACTERISTICS



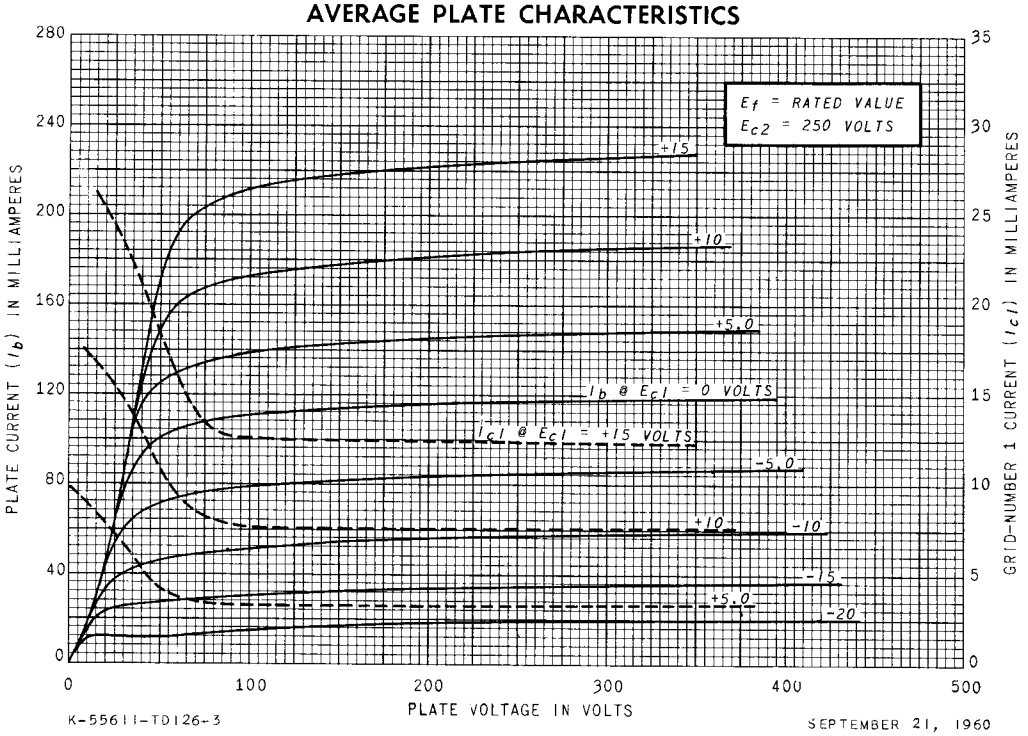
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD126-2

SEPTEMBER 21, 1960

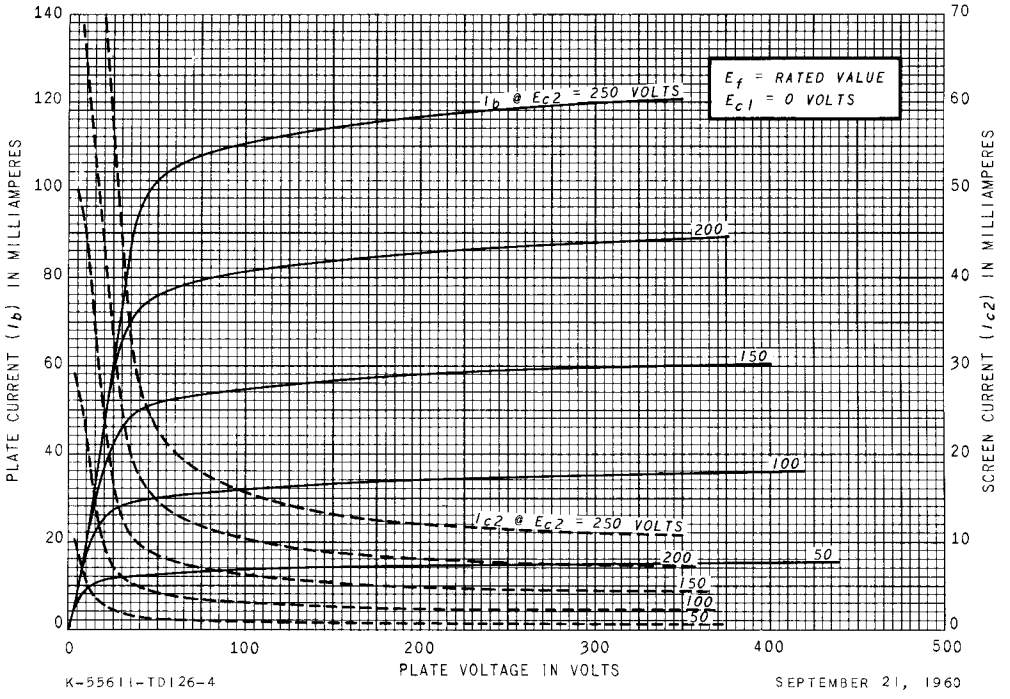
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD126-3

SEPTEMBER 21, 1960

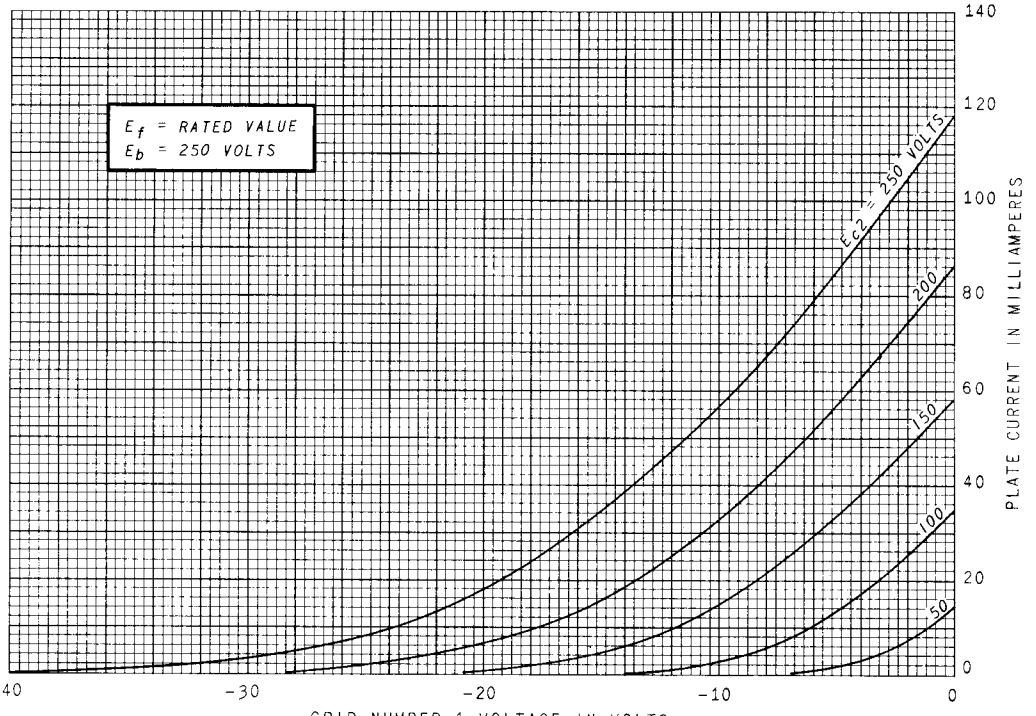
AVERAGE PLATE CHARACTERISTICS



K-55611-TD126-4

SEPTEMBER 21, 1960

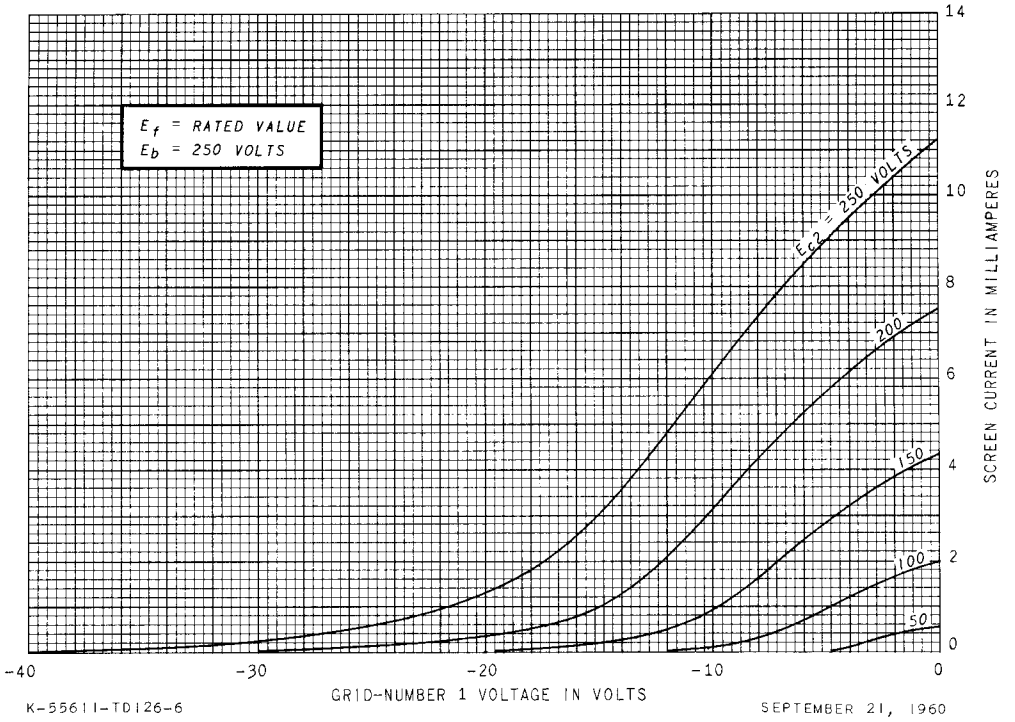
AVERAGE TRANSFER CHARACTERISTICS



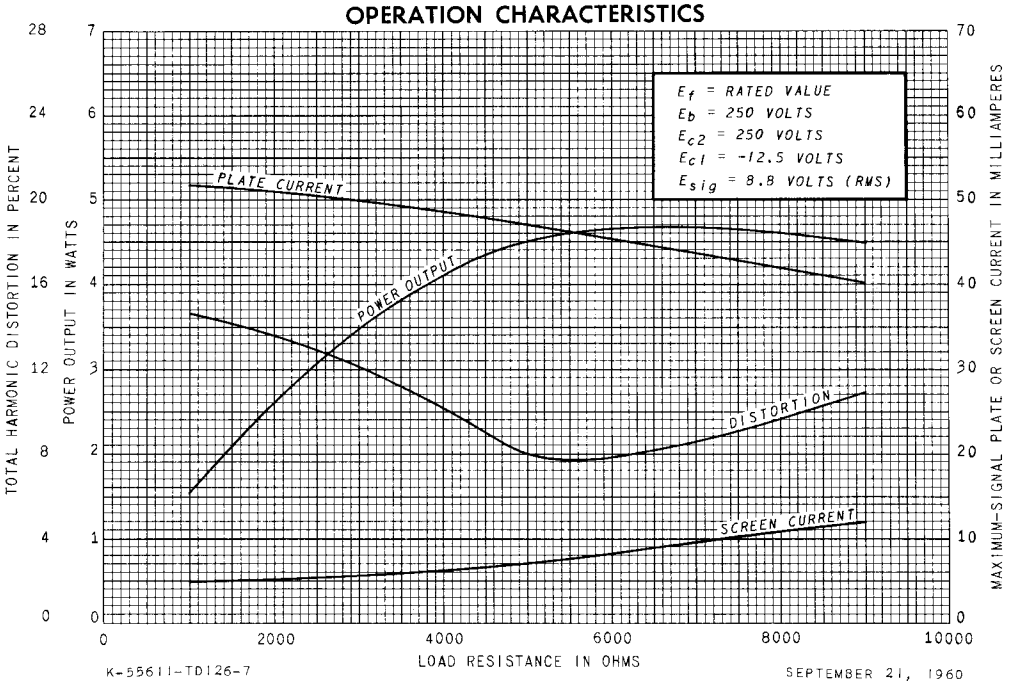
K-55611-TD126-5

SEPTEMBER 21, 1960

AVERAGE TRANSFER CHARACTERISTICS



OPERATION CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBE
KEN-RAD

6AQ7-GT

Description and Rating

DUPLEX-DIODE TRIODE

GENERAL DESCRIPTION

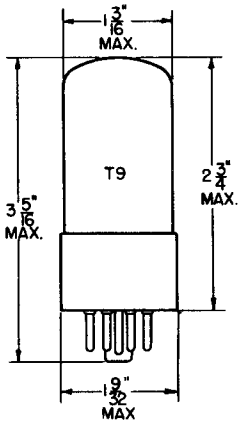
Principal Application: The 6AQ7-GT is a duplex-diode high-mu triode in which separate cathodes are provided for the diode and triode sections. The tube is designed for service as a combined FM detector and audio amplifier in circuits which require the separated cathodes.

Cathodes	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.3 Ampere
Envelope	T-9, Glass
Base	B8-6, Intermediate Shell Octal 8-Pin
	or B8-46, Short Intermediate Shell Octal 8-Pin
Mounting Position	Any

Direct Interelectrode Capacitances:

Grid to Triode Plate #	3.0	μμf
Triode Input #	2.8	μμf
Triode Output #	3.2	μμf
Grid to Diode Cathode (Max) #	0.25	μμf
Diode 1 Plate to Diode Cathode *	2.2	μμf
Diode 2 Plate to Diode Cathode *	2.4	μμf
Diode 1 Plate to Diode 2 Plate *	0.5	μμf

PHYSICAL DIMENSIONS

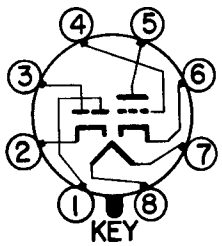


RTMA 9-11 or 9-41

TERMINAL CONNECTIONS

Pin 1 - Diode Number 2 Plate
Pin 2 - Diode Cathode
Pin 3 - Diode Number 1 Plate
Pin 4 - Triode Grid
Pin 5 - Triode Plate
Pin 6 - Triode Cathode
Pin 7 - Heater
Pin 8 - Heater

BASING DIAGRAM



RTMA 8CK
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES:

Plate Voltage	250	Volts
Positive D-C Grid Voltage	0	Volts
Plate Dissipation	1.0	Watt
Heater-Cathode Voltage	90	Volts
Diode Current for Continuous Operation (Each Diode)	0.9	Milliampere

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	100	250	Volts
Grid Voltage	-1	-2	Volts
Amplification Factor	79	70	
Plate Resistance (Approx)	64000	44000	Ohms
Transconductance	1250	1600	Micromhos
Plate Current	1.1	2.3	Milliamperes

Average Diode Current: (Each Diode)
Measured with 10 Volts D-C Applied . . . . . 4.0 . . . . . Milliamperes

 # With external shield #308 connected to triode cathode

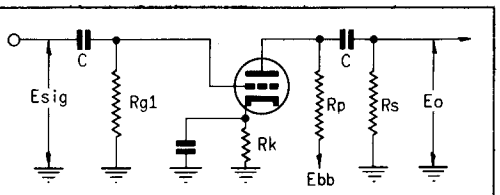
** With external shield #308 connected to diode cathode*

GENERAL ELECTRIC

Supersedes ET-T273 dated 4-46

CLASS A RESISTANCE-COUPLED AMPLIFIER

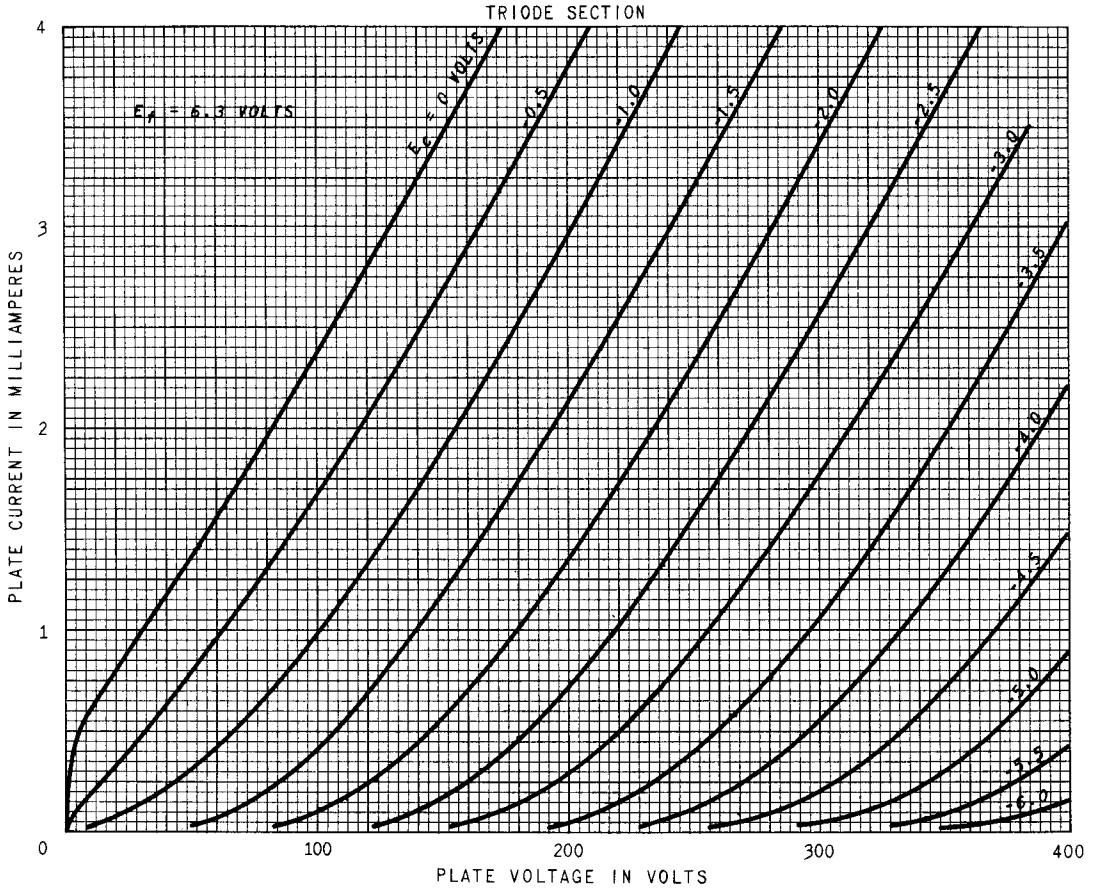
Rp Meg	Rg1 Meg	Rs Meg	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	*	0.10	4300	21	6.0	2200	27	20	1800	30	36
0.10	*	0.24	4700	25	7.5	2400	32	26	2200	34	49
0.24	*	0.24	7100	28	8.5	4300	36	26	3600	38	47
0.24	*	0.51	7800	32	11	4700	40	30	3900	42	56
0.51	*	0.51	11500	33	10	7500	42	28	6200	45	51
0.51	*	1.0	12500	38	12	8200	45	35	6800	48	60
0.24	10	0.24	0	32	5.0	0	40	19	0	43	38
0.24	10	0.51	0	36	7.0	0	45	25	0	49	48
0.51	10	0.51	0	37	6.5	0	47	23	0	50	43
0.51	10	1.0	0	40	9.5	0	49	28	0	53	53



Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum rms voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts rms output. 3. For zero-bias data generator impedance is negligible. *Value of Rg1 is non-critical.

AVERAGE PLATE CHARACTERISTICS



Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

ELECTRONICS

6AR11
COMPACTRON TWIN PENTODE

DESCRIPTION AND RATING

The 6AR11 is a compactron containing two remote-cutoff pentodes. It is designed primarily for intermediate-frequency amplifier service in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.8	Amperes

Direct Interelectrode Capacitances§

Section 1

Grid-Number 1 to Plate: (1g1 to 1p)	0.026	pf
Input: 1g1 to (1k + 1g2 + 1g3 + h + i.s.)	10	pf
Output: 1p to (1k + 1g2 + 1g3 + h + i.s.)	2.8	pf

Section 2

Grid-Number 1 to Plate: (2g1 to 2p)	0.026	pf
Input: 2g1 to (2k + 2g2 + 2g3 + 1g3 + h + i.s.)	10	pf
Output: 2p to (2k + 2g2 + 2g3 + 1g3 + h + i.s.)	3.0	pf

Coupling

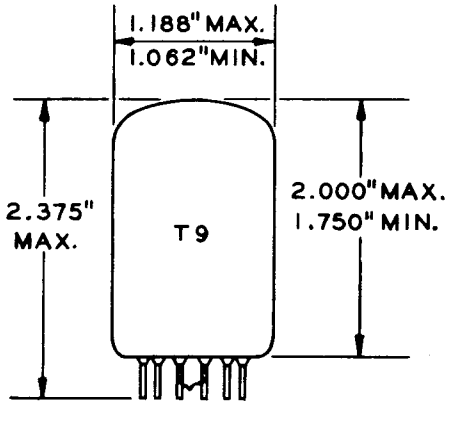
Plate to Plate: (1p to 2p), maximum	0.016	pf
Grid-Number 1, Section 1, to Plate, Section 2: (1g1 to 2p), maximum	0.002	pf
Grid-Number 1, Section 2, to Plate, Section 1: (2g1 to 1p), maximum	0.004	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

PHYSICAL DIMENSIONS

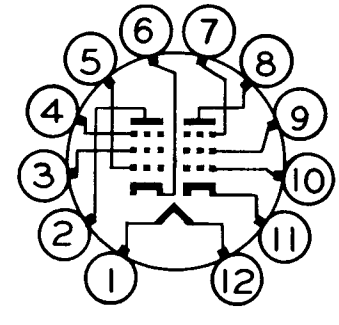


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate (Section 2)
Pin 3 - Grid Number 2 (Screen) (Section 2)
Pin 4 - Grid Number 3 (Suppressor) (Section 2)
Pin 5 - Grid Number 1 (Section 2)
Pin 6 - Cathode (Screen 2)
Pin 7 - Grid Number 3 (Suppressor) (Section 1) and Internal Shield
Pin 8 - Plate (Section 1)
Pin 9 - Grid Number 2 (Screen) (Section 1)
Pin 10 - Grid Number 1 (Section 1)
Pin 11 - Cathode (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12DM

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, Each Section

Plate Voltage	330	Volts
Suppressor Voltage	0	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	3.1	Watts
Screen Dissipation	0.65	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, Each Section

Plate Voltage	125	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Plate Resistance, approximate	0.2	Megohms
Transconductance	10500	Micromhos
Plate Current	11	Milliamperes
Screen Current	3.5	Milliamperes
Grid-Number 1 Voltage, approximate		
Gm = 50 Micromhos	-15	Volts

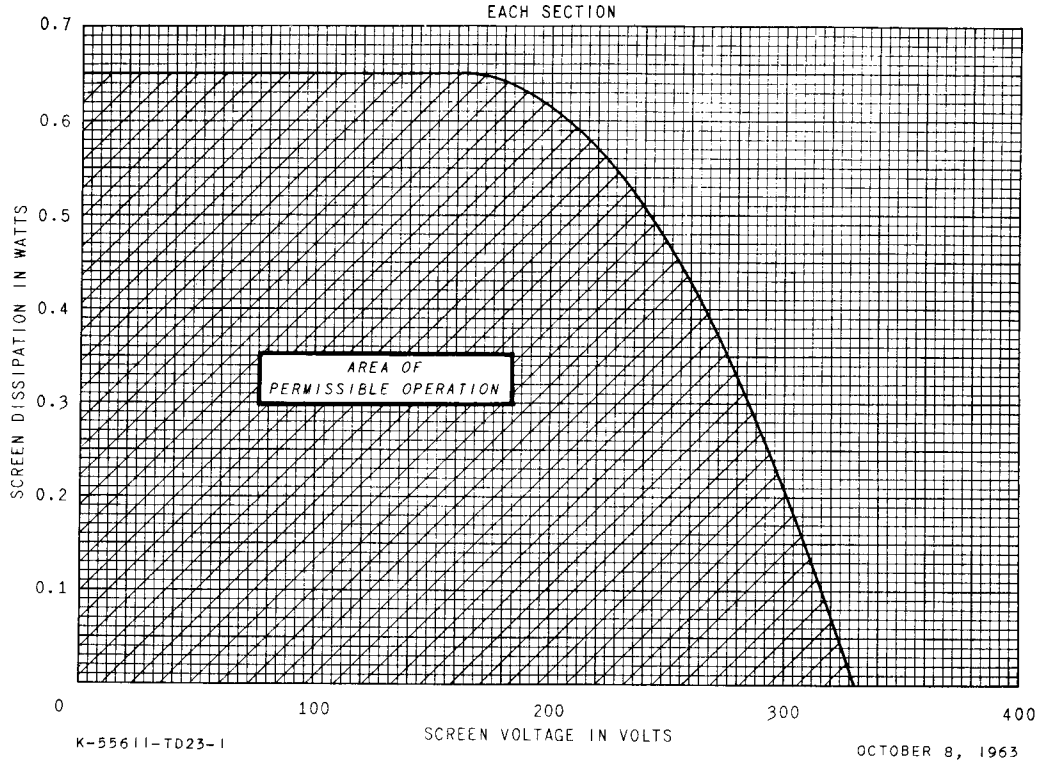
NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

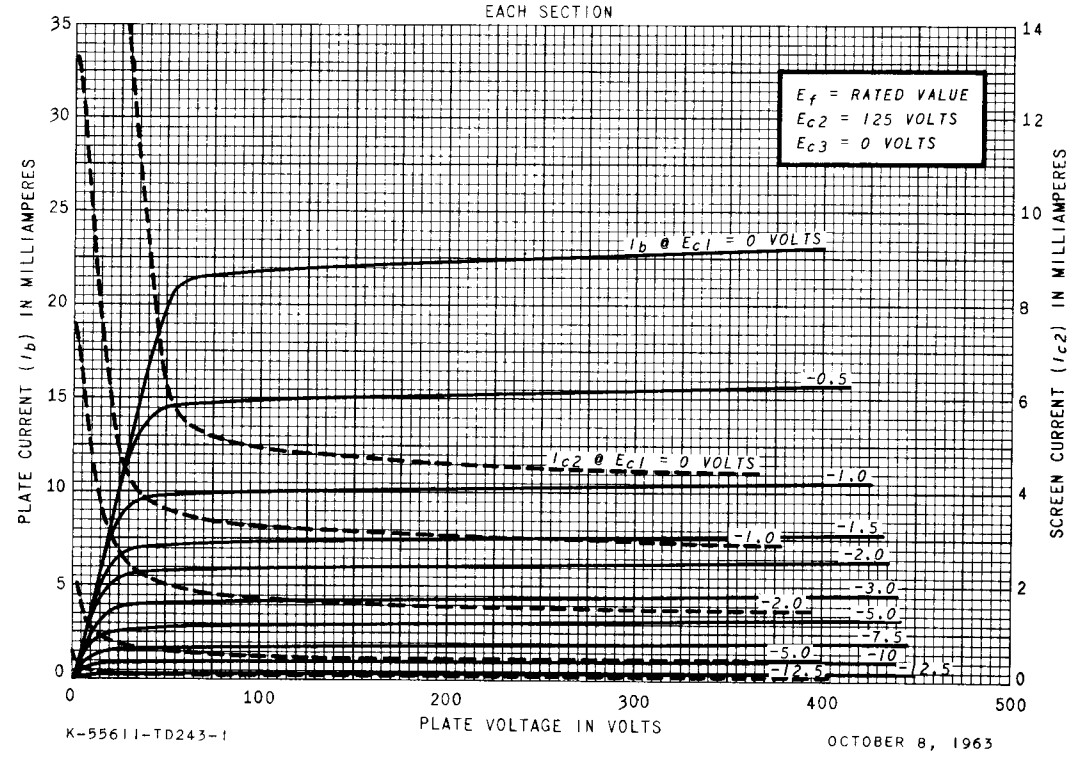
‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ With external shield (EIA 309) connected to cathode of section under test.

SCREEN RATING CHART

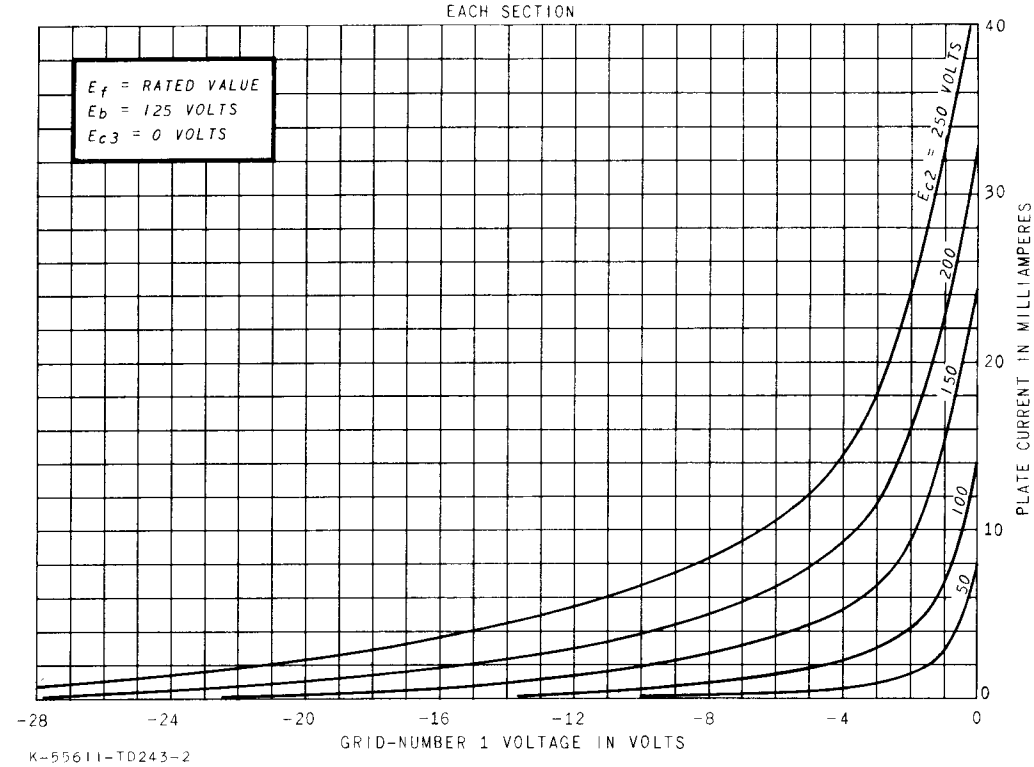


AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

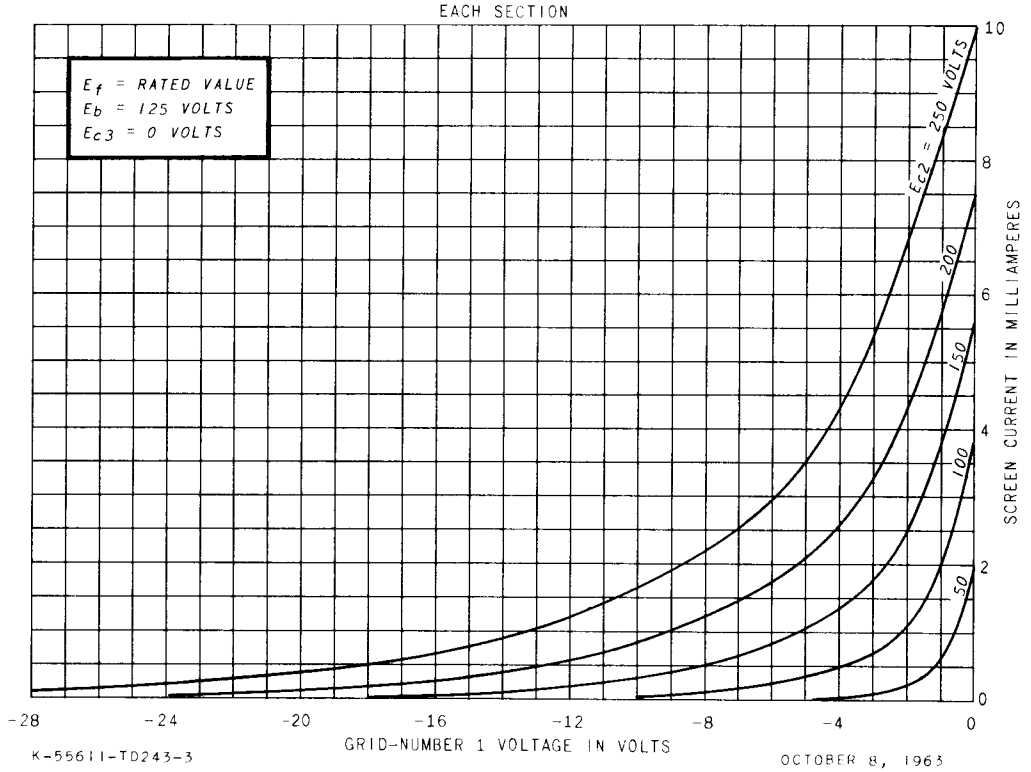
EACH SECTION



K-55611-TD243-2

AVERAGE TRANSFER CHARACTERISTICS

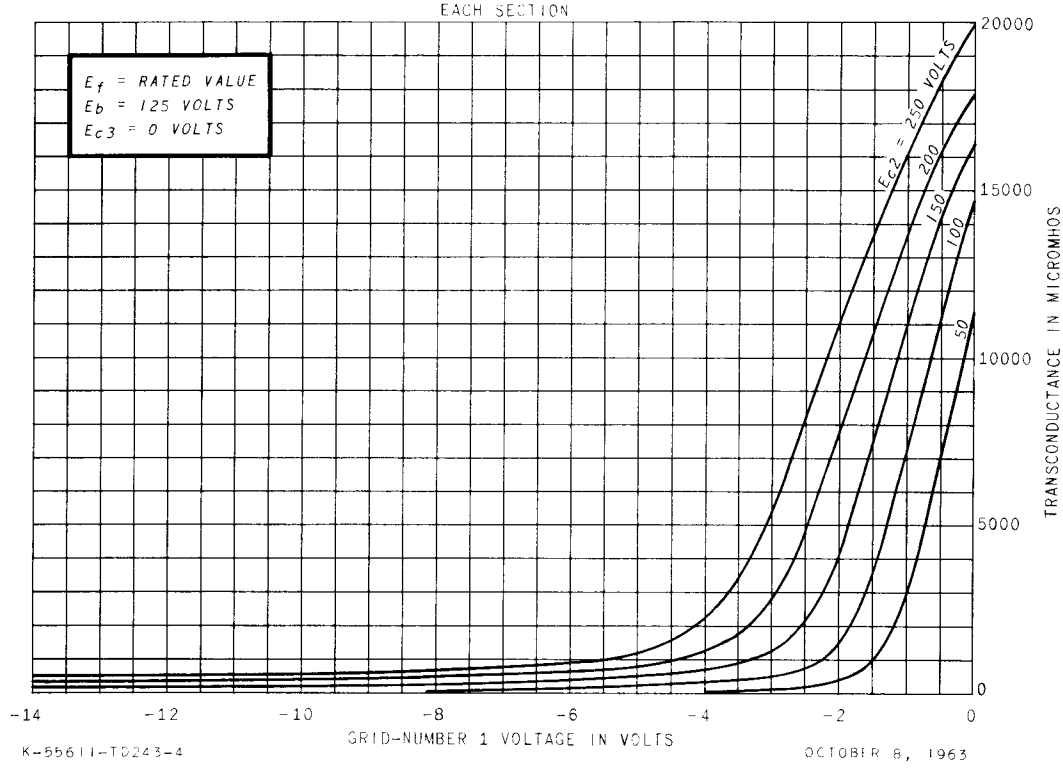
EACH SECTION



K-55611-TD243-3

OCTOBER 8, 1963

AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

6AR8

SHEET-BEAM TUBE

FOR TV SYNCHRONOUS DETECTOR AND BURST GATE APPLICATIONS

DESCRIPTION AND RATING

The 6AR8 is a miniature double-plate sheet-beam tube which incorporates a pair of balanced deflectors to direct the electron beam to either of the two plates and a control grid to vary the intensity of the beam. The resulting unique characteristics of this tube make it especially suited for service as a synchronous detector in color television receivers. In this application, relatively large, balanced output signals of both positive and negative polarities are developed which eliminate the need for phase-inversion functions in the matrix circuits. Other features of the 6AR8 synchronous detector circuit include low oscillator injection power requirements, freedom from the space-charge coupling effects which are present in dual-control pentodes and heptodes, linear output voltages, insensitiveness to variations in oscillator amplitude over a wide range, and a high ratio of plate to accelerator current. The 6AR8 is also suitable for service in the burst gate circuit of color TV receivers and a variety of other switching and gating applications.

GENERAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.3	Amperes
Envelope—T-6½, Glass		
Base—E9-1, Small Button 9-Pin		
Mounting Position—Any		

Direct Interelectrode Capacitances, approximate*

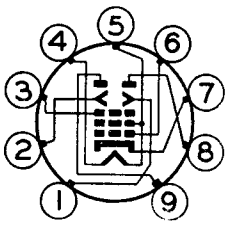
Deflector-Number 1 to All	4.8	μμf
Deflector-Number 2 to All	4.8	μμf
Grid-Number 1 to All Except Plates	7.5	μμf
Plate-Number 1 to All	5.0	μμf
Plate-Number 2 to All	5.0	μμf
Grid-Number 1 to Deflector-Number 1, maximum	0.040	μμf
Grid-Number 1 to Deflector-Number 2, maximum	0.060	μμf
Plate-Number 1 to Plate-Number 2	0.4	μμf
Deflector-Number 1 to Deflector-Number 2	0.38	μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate-Number 1 Voltage	300	Volts
Plate-Number 2 Voltage	300	Volts
Accelerator Voltage	300	Volts
Peak Positive Deflector-Number 1 Voltage	150	Volts
Peak Negative Deflector-Number 1 Voltage	150	Volts
Peak Positive Deflector-Number 2 Voltage	150	Volts
Peak Negative Deflector-Number 2 Voltage	150	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate-Number 1 Dissipation	2.0	Watts
Plate-Number 2 Dissipation	2.0	Watts
DC Cathode Current	30	Milliamperes
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.25	Megohms

BASING DIAGRAM



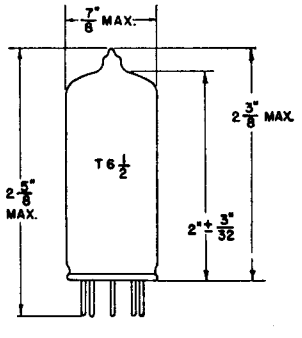
RETMA 9DP

BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1—Deflector Number 2
Pin 2—Deflector Number 1
Pin 3—Accelerator
Pin 4—Heater
Pin 5—Heater, Internal Shield, and Focus Electrodes†
Pin 6—Grid Number 1 (Control Grid)
Pin 7—Cathode
Pin 8—Plate Number 2
Pin 9—Plate Number 1

PHYSICAL DIMENSIONS



RETMA 6-3

GENERAL ELECTRIC

Supersedes ET-T840, dated 2-54

CHARACTERISTICS AND TYPICAL OPERATION

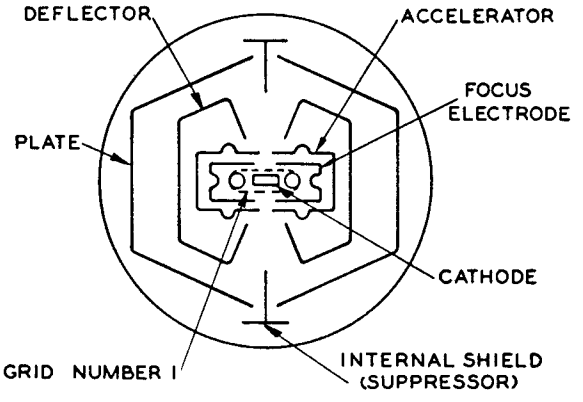
AVERAGE CHARACTERISTICS WITH DEFLECTORS GROUNDED

Plate-Number 1 Voltage	250	Volts
Plate-Number 2, Connected to Plate-Number 1 Accelerator Voltage	250	Volts
Deflector-Number 1 Voltage	0	Volts
Deflector-Number 2 Voltage	0	Volts
Cathode-Bias Resistor	300	Ohms
Total Plate Current	10	Milliamperes
Accelerator Current	0.4	Milliamperes
Grid-Number 1 Transconductance	4000	Micromhos
Grid-Number 1 Voltage, approximate I_b (total) = 10 Microamperes	−14	Volts

AVERAGE DEFLECTOR CHARACTERISTICS

Plate-Number 1 Voltage	250	Volts
Plate-Number 2 Voltage	250	Volts
Accelerator Voltage	250	Volts
Cathode-Bias Resistor	300	Ohms
Deflector Switching Voltage, maximum‡	20	Volts
Deflector-Bias Voltage for Minimum Deflector Switching Voltage‡	−8	Volts
Voltage Difference between Deflectors for $I_{b1} = I_{b2}$, approximate	0	Volts
Plate-Number 1 Current, maximum $E_{d1} = -15$ Volts, $E_{d2} = +15$ Volts	1.0	Milliamperes
Plate-Number 2 Current, maximum $E_{d1} = +15$ Volts, $E_{d2} = -15$ Volts	1.0	Milliamperes
Deflector-Number 1 Current, maximum $E_{d1} = +25$ Volts, $E_{d2} = -25$ Volts	0.5	Milliamperes
Deflector-Number 2 Current, maximum $E_{d1} = -25$ Volts, $E_{d2} = +25$ Volts	0.5	Milliamperes

* Without external shield.
† Pin 5 should be connected directly to ground.
‡ Deflector switching voltage is defined as the total voltage change on either deflector with an equal and opposite change on the other deflector required to switch the plate current from one plate to the other.
Note: The 6AR8 should be so located in the receiver that it is not subjected to stray magnetic fields.



CROSS-SECTION SCHEMATIC DIAGRAM OF THE 6AR8

OPERATING CONSIDERATIONS FOR THE 6AR8

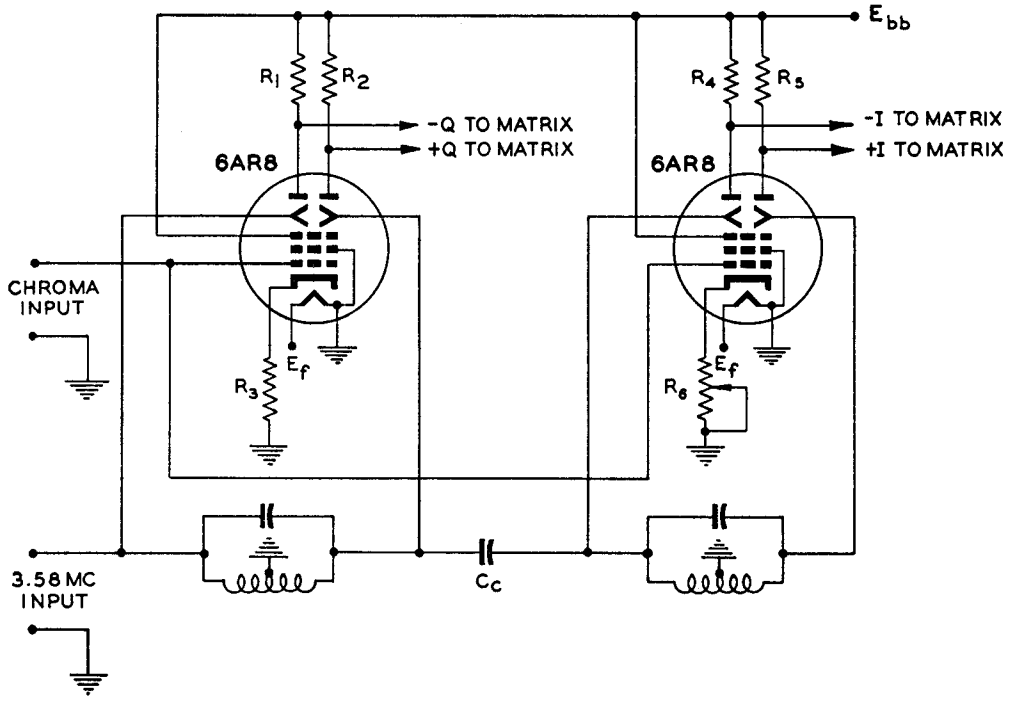
A cross-section schematic diagram of the construction of the 6AR8 is shown. In this tube, the electrons pass from the cathode to either of the two plates in the form of a planar beam or "sheet." Before the electron stream emerges from the openings in the accelerator structure, it is acted on by the focus electrodes and the control grid. The focus electrode tends to converge the electrons into the required sheet beam, while the conventional grid-number 1 structure which surrounds the cathode serves to control the intensity of the beam.

Between the accelerator and the plates the electron beam passes between the deflector electrodes. Depending on the voltages applied to the deflectors, the beam will be directed entirely to either one or the other of the two plates or proportioned between them. The internal shield, located between the two plates, acts to suppress the interchange of secondary-emission electrons between the plates. The suppressor and the focus electrodes are internally connected to one side of the heater.

In normal operation, positive d-c voltages are applied to the accelerator and plates, and signal voltages are applied to the deflectors and control grid. The frequency of the signal applied to the deflectors determines the rate at which the plate current is switched between the two plates; the grid-number 1 voltage varies the magnitude of the plate current. The interesting tube characteristics which result from the unique construction of the 6AR8 are indicated by the average tube characteristic curves which follow. The tube may be considered as equivalent to a voltage-controlled single-pole double-throw switch through which a current, the magnitude of which is also voltage-controlled, flows.

If both plates and the accelerator are operated at +250 volts and a cathode-bias resistor of 300 ohms is employed, the deflectors require a peak switching voltage of 20 volts (or a peak voltage difference between deflectors of 40 volts) maximum to switch the plate current from one plate to the other. In a practical circuit, however, in which the deflectors are driven in push-pull with the center-tap of the source grounded, a somewhat higher value of deflector drive voltage must be used. The increased drive voltage is required to allow for those tubes in which the switching characteristics are somewhat offset with respect to zero voltage difference between deflectors.

For an accelerator voltage of +250 volts, the minimum deflector switching voltage occurs at a d-c deflector bias of approximately −8 volts; however, the d-c deflector bias is not particularly critical for focus as the deflection sensitivity



CIRCUIT DIAGRAM OF TWO 6AR8 TUBES USED AS SYNCHRONOUS DETECTORS

OPERATING CONSIDERATIONS FOR THE 6AR8 (Cont'd)

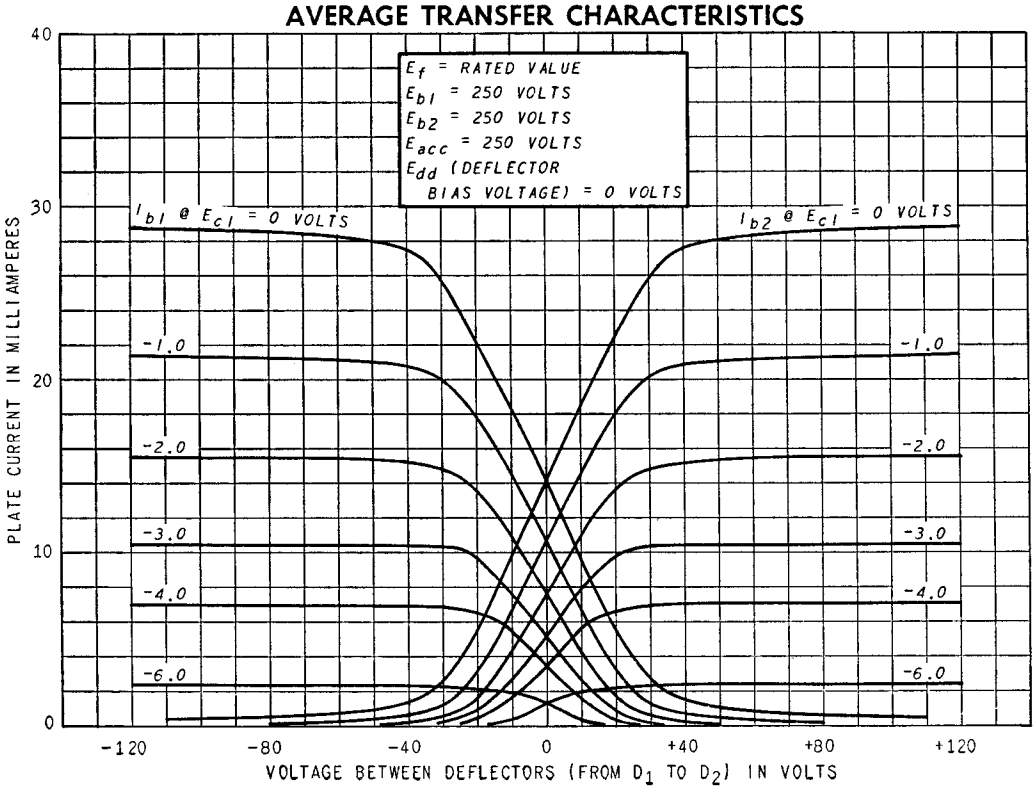
characteristic exhibits a broad maximum. Care should be exercised, nevertheless, to assure that defocusing effects are not present whenever the tube is operated at conditions other than those recommended.

The circuit diagram for two 6AR8 tubes employed as synchronous detectorsπ in a color television receiver is shown. In this arrangement, positive voltages are applied directly to the accelerator grids and through load resistors R1, R2, R4 and R5 to each of the plates. The chrominance signal is applied to the control grid of each tube. The 3.58-megacycle reference signal is applied in push-pull between the deflectors of each tube. The small coupling capacitor, Cc, between the tuned driving circuits provides the necessary 90-degree phase shift for the I and Q detectors. Also each tube is biased with a cathode resistor, R3 and R6; resistor R6 is variable so that the relative gains of the two demodulators can be adjusted.

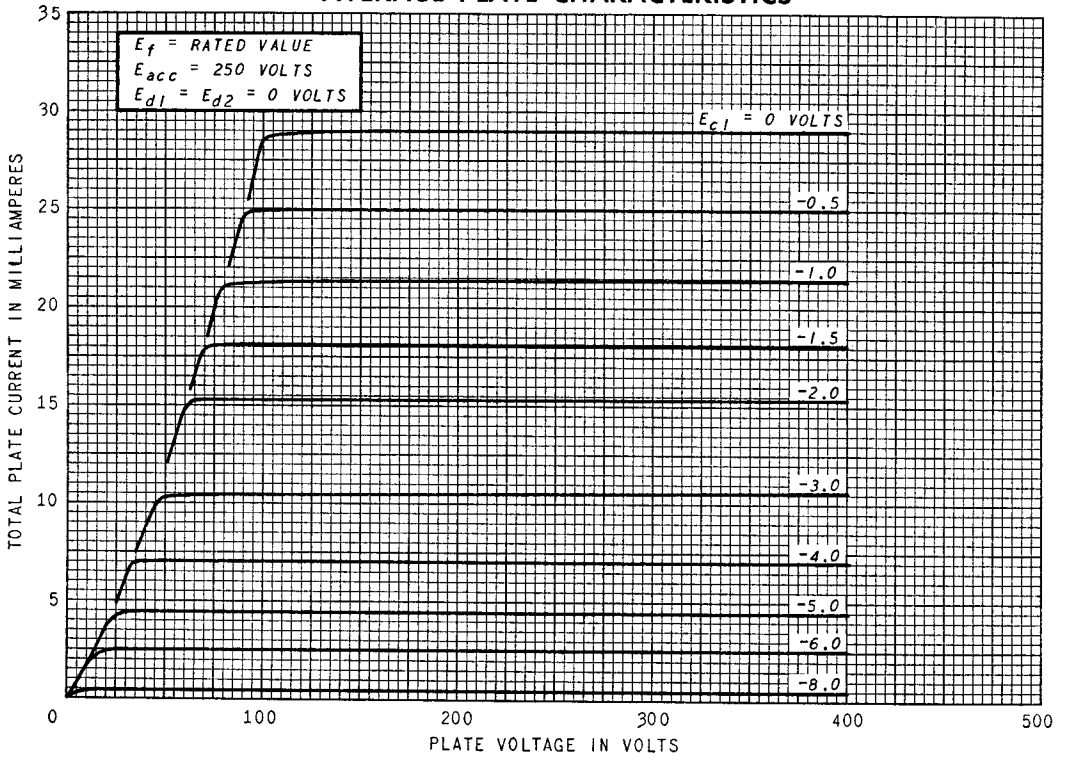
In principle, the 6AR8 circuit is a product-demodulator type of synchronous detector; however, because the circuit uses a double-plate sheet-beam tube rather than a dual-control pentode or heptode, certain significant operating features result. First the 6AR8 circuit is capable of delivering relatively large and balanced output voltages which exhibit good linearity. Because output voltages are available of both positive and negative polarities, the need for the incorporation of phase-inverter circuits in the matrix section of the color receiver is completely eliminated. Also, providing the oscillator reference voltage is adequate to switch the plate currents between the two plates, the circuit is insensitive to variations in the amplitude of the oscillator voltage over a wide range. Furthermore, unlike the pentode or heptode synchronous detector circuits in which the third grid is driven positive by the oscillator reference voltage, the deflectors of the 6AR8 require very little excitation power. Consequently, less power is required from the 3.85-megacycle reference oscillator in the sheet-beam tube circuit.

Another feature is that space-charge coupling effects, which are inherently present in dual-control pentodes and heptodes, are unnoticeable in the 6AR8. Also, unlike most dual-control pentodes and heptodes in which the screen current is an appreciable percent of the plate current, the accelerator current of the 6AR8 is less than one-twentieth of its plate current.

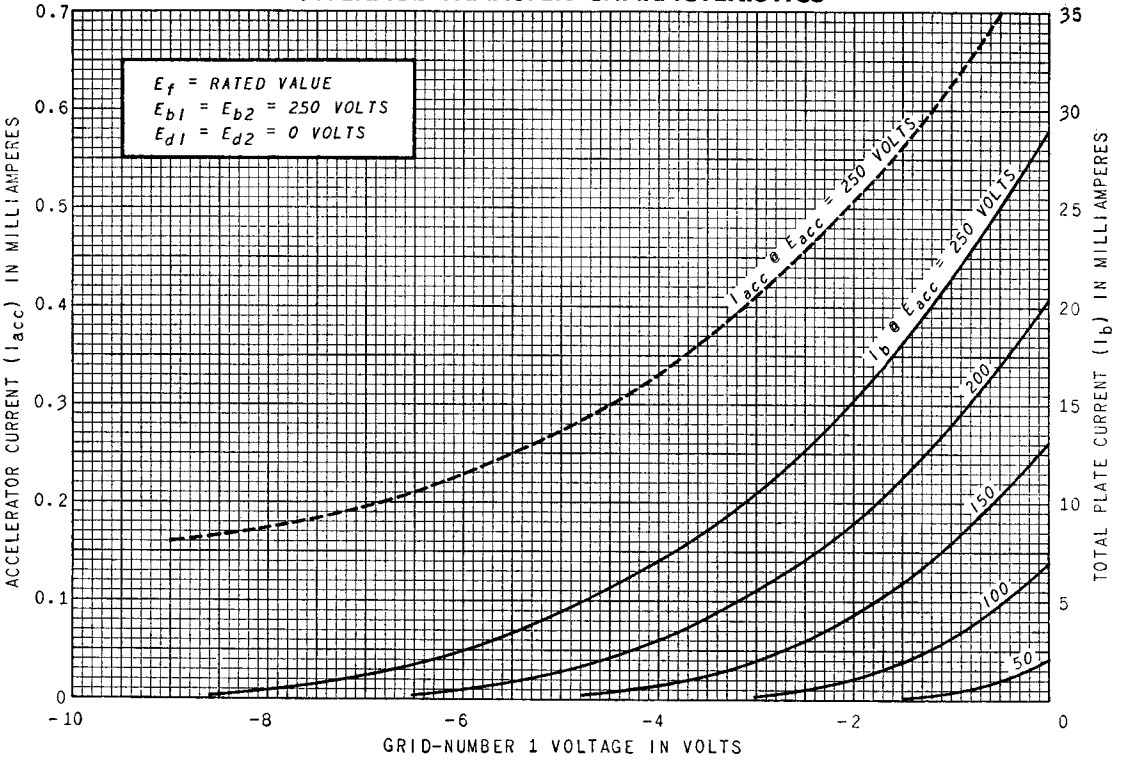
π R. Adler and C. Heuer, "Color Decoder Simplifications Based on a Beam-Deflection Tube," Trans. IRE, PGBTR-5, Jan. 1954.



AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBES

6AS5

BEAM PENTODE

DESCRIPTION AND RATING

The 6AS5 is a miniature beam pentode designed primarily for use in the audio-frequency power output stage of automobile receivers. The tube is capable of delivering a relatively high power output at low plate and screen voltages.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.8	Amperes
Direct Interelectrode Capacitances, approximate*		
Grid-Number 1 to Plate	0.6	μμf
Input	12	μμf
Output	6.3	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

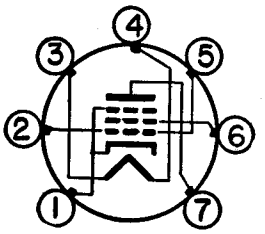
DESIGN-CENTER VALUES

Plate Voltage	150	Volts
Screen Voltage	117	Volts
Plate Dissipation	5.5	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.5	Megohms

GENERAL ELECTRIC

Supersedes ET-T600A, dated 9-51

BASING DIAGRAM

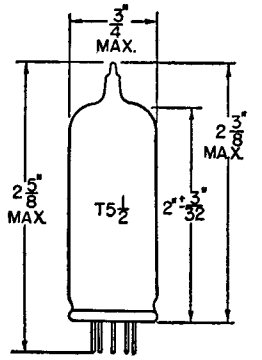


RETMA 7CV

TERMINAL CONNECTIONS

Pin 1—Cathode and Beam Plates
Pin 2—Grid Number 1
Pin 3—Heater
Pin 4—Heater
Pin 5—Grid Number 1
Pin 6—Grid Number 2 (Screen)
Pin 7—Plate

PHYSICAL DIMENSIONS



RETMA 5-3

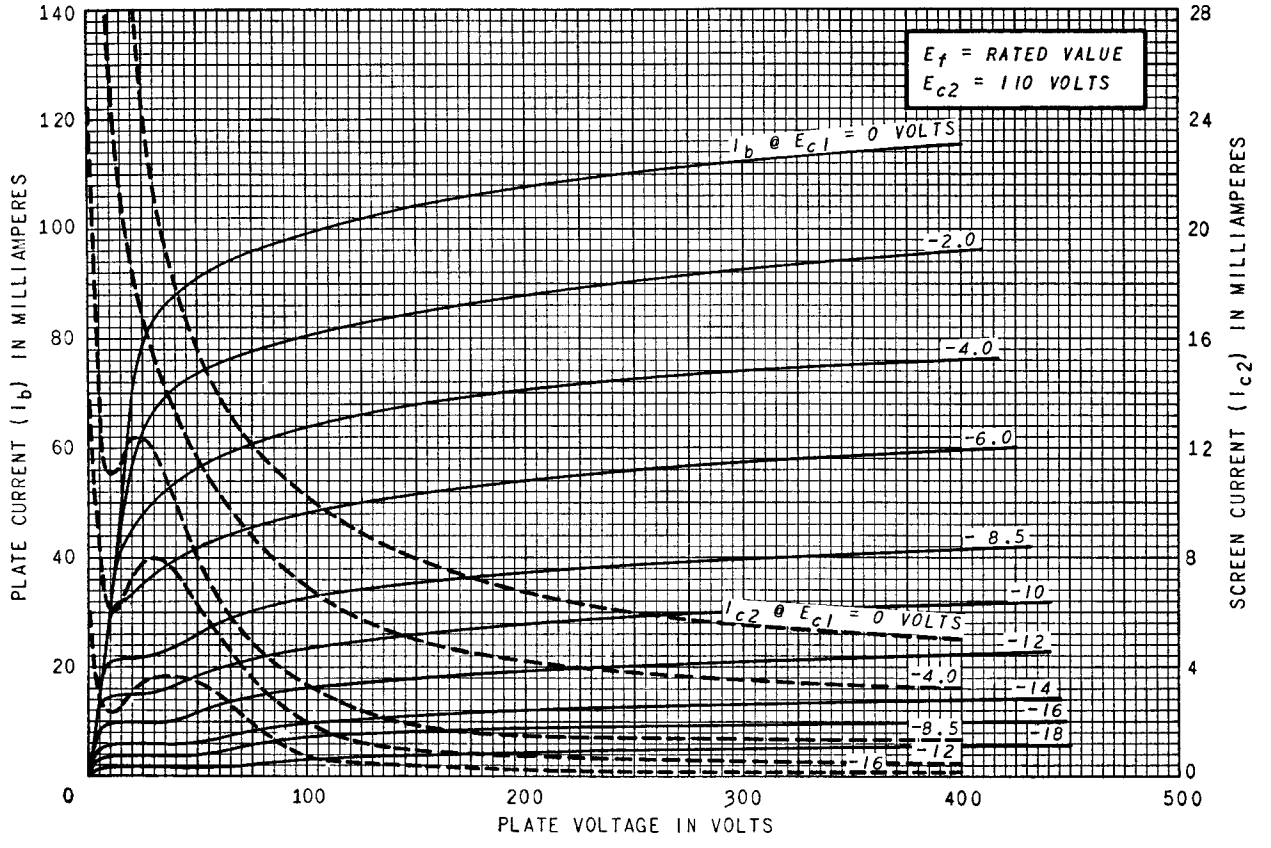
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

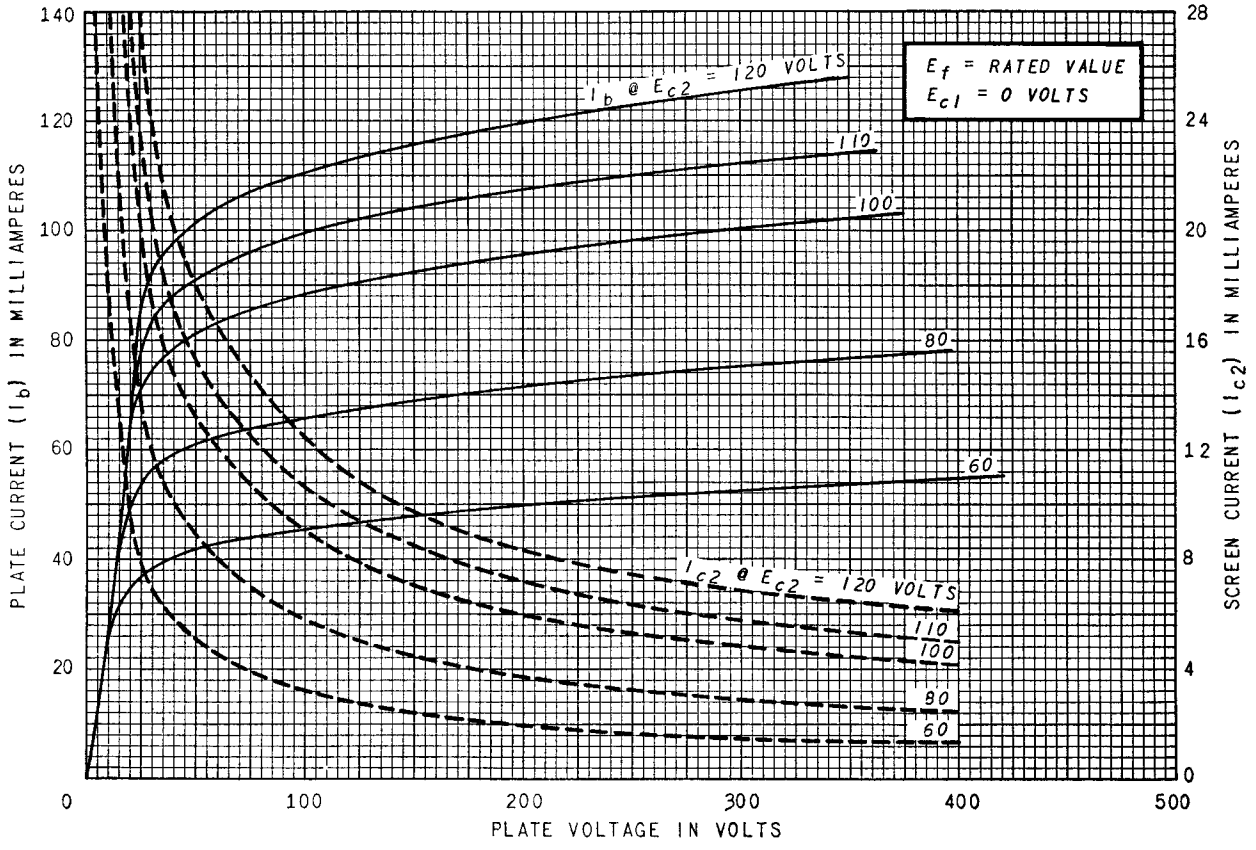
Plate Voltage	150	Volts
Screen Voltage	110	Volts
Grid-Number 1 Voltage	−8.5	Volts
Peak AF Grid-Number 1 Voltage	8.5	Volts
Transconductance	5600	Micromhos
Zero-Signal Plate Current	35	Milliamperes
Maximum-Signal Plate Current	36	Milliamperes
Zero-Signal Screen Current	2.0	Milliamperes
Maximum-Signal Screen Current	6.5	Milliamperes
Load Resistance	4500	Ohms
Total Harmonic Distortion, approximate	10	Percent
Maximum-Signal Power Output	2.2	Watts

* Without external shield.

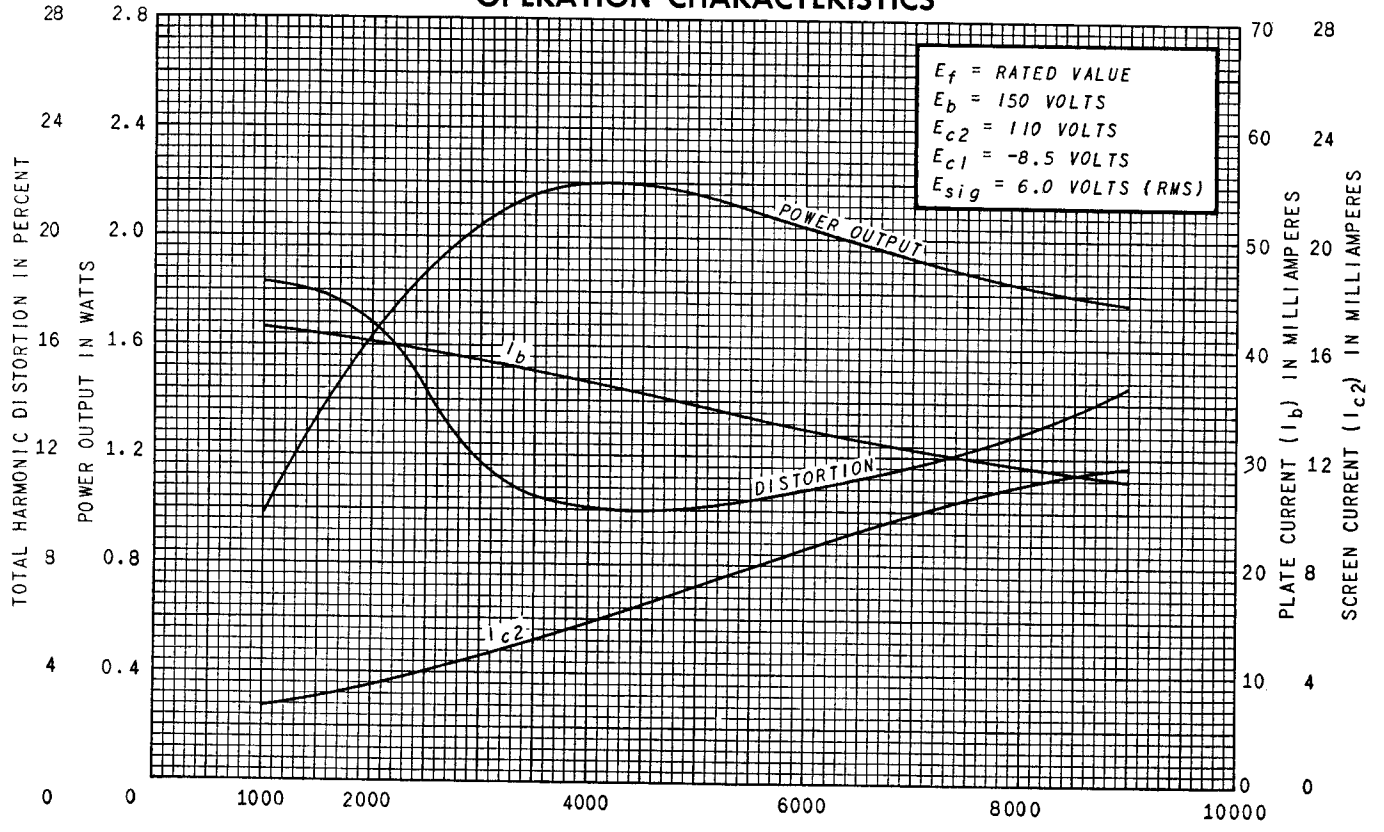
AVERAGE PLATE CHARACTERISTICS



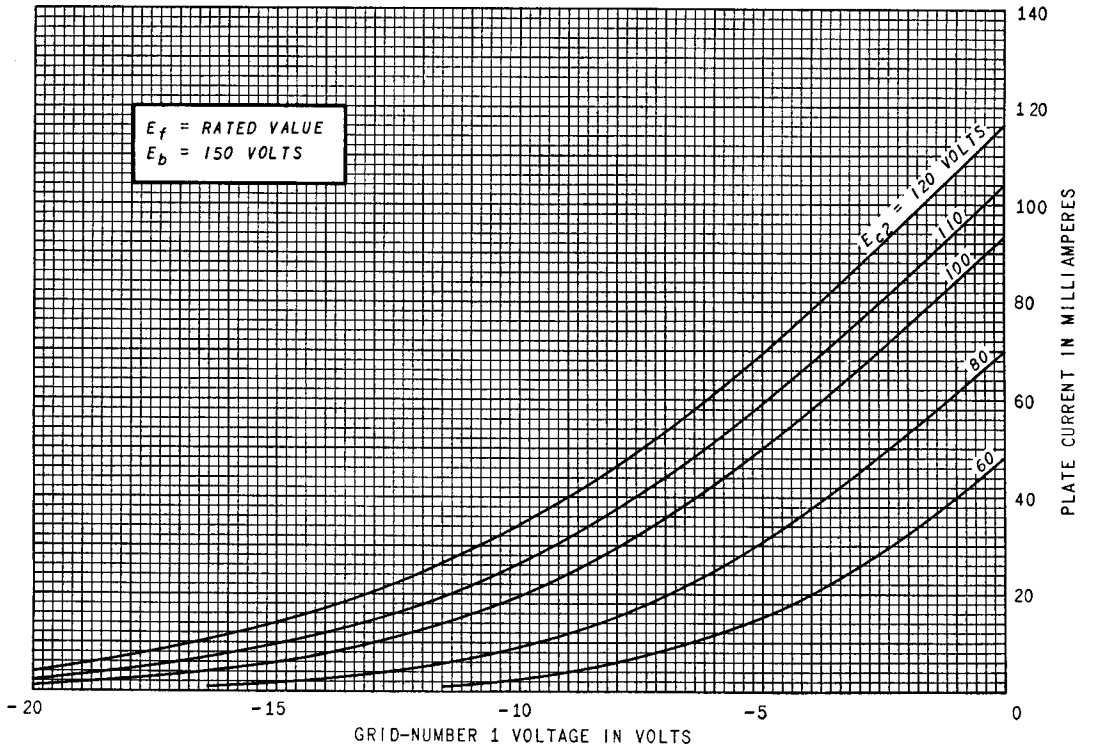
AVERAGE PLATE CHARACTERISTICS



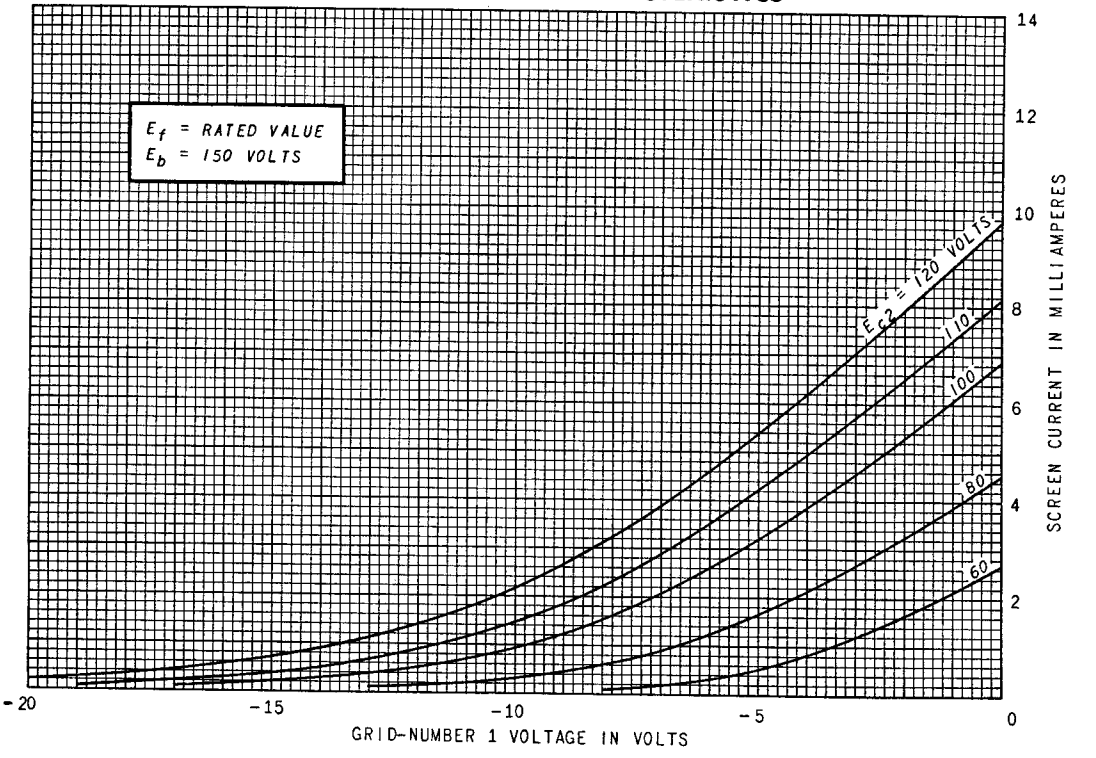
OPERATION CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBE
KEN-RAD

6AS6

Description and Rating

RADIO-FREQUENCY-AMPLIFIER PENTODE

GENERAL DESCRIPTION

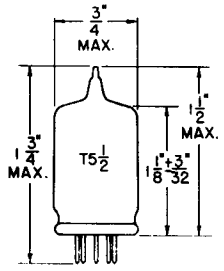
Principal Application: The 6AS6 is a miniature sharp-cut-off pentode whose control grid and suppressor grid can be used as independent control elements. The 6AS6 is suitable for use in gated amplifiers, gain-controlled amplifiers, delay circuits, and mixer circuits.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.175 Ampere
Envelope	T-5½ Glass
Base	E7-1, Miniature Button 7-Pin
Mounting Position	Any

Direct Interelectrode Capacitances: #

Grid 1 to Plate (Max)	0.02	μμf
Input (Grid 1 to All)	4.0	μμf
Input (Grid 3 to All)	3.4	μμf
Output	3.0	μμf
Coupling (Grid 1 to Grid 3)(Max)	0.15	μμf

PHYSICAL DIMENSIONS

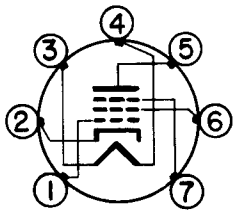


RMA 5-1

TERMINAL CONNECTIONS

Pin 1 - Grid Number 1
Pin 2 - Cathode and Internal Shield
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Grid Number 3 (Suppressor)

BASING DIAGRAM



RMA 7CM
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES:

Plate Voltage	180	Volts
Screen Voltage	140	Volts
Positive Suppressor Grid Voltage	27	Volts
Plate Dissipation	1.7	Watts
Screen Dissipation	0.75	Watt
Total Cathode Current	18	Milliamperes
Heater-Cathode Voltage	90	Volts
Bulb Temperature	120	°C

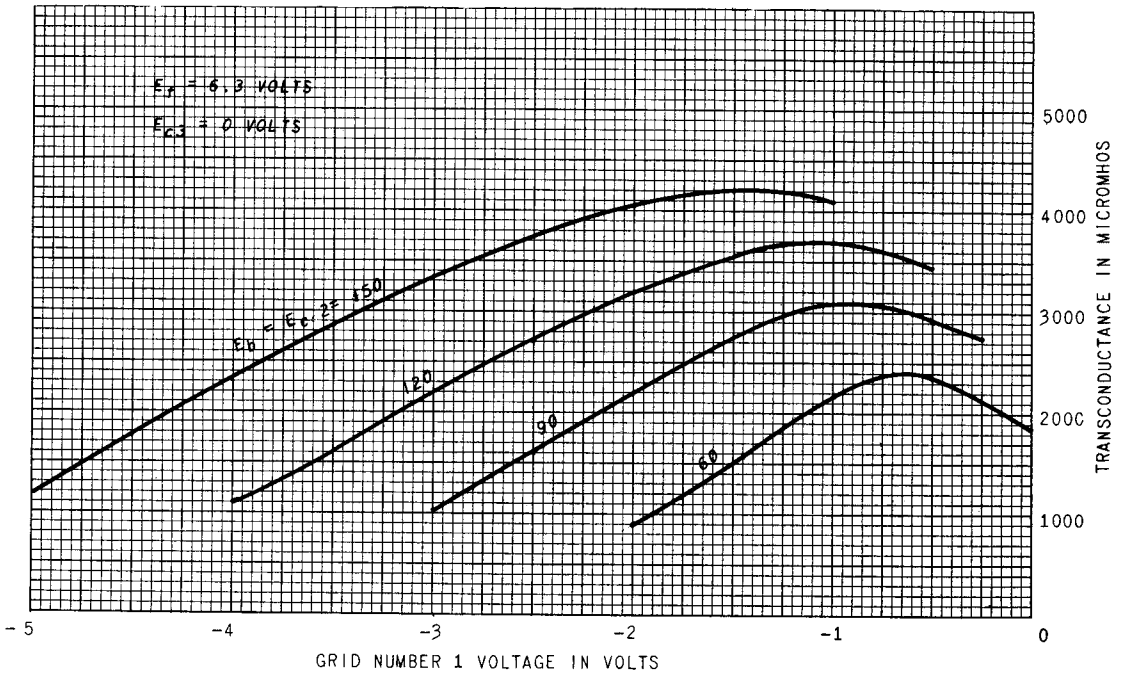
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

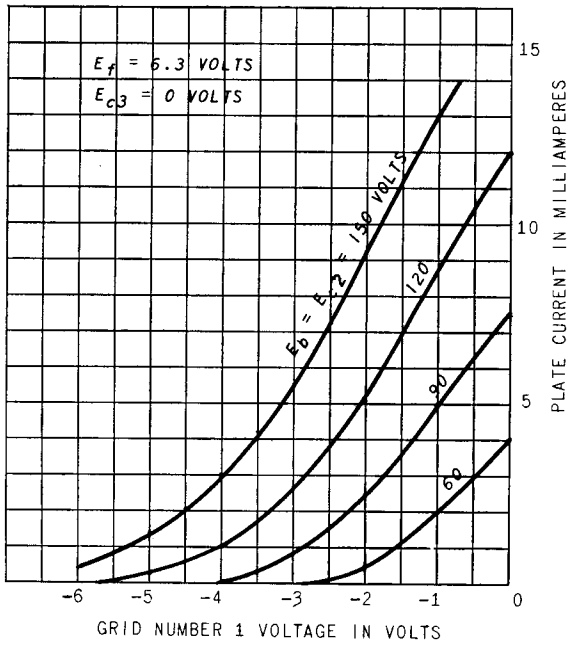
Plate Voltage	120	120	Volts
Screen Voltage	120	120	Volts
Suppressor Voltage	-3	0	Volts
Grid Number 1 Bias Voltage	-2	-2	Volts
Plate Current	3.6	5.2	Milliamperes
Screen Current	4.8	3.5	Milliamperes
Transconductance (Grid Number 1)	1850	3200	Micromhos
Transconductance (Suppressor)	810	470	Micromhos
Plate Resistance (Approx)	---	0.11	Megohm
Grid Number 1 Voltage for I_b = 10 Microamperes	---	-7.5	Volts
Grid Number 3 Voltage for I_b = 10 Microamperes	-10	---	Volts

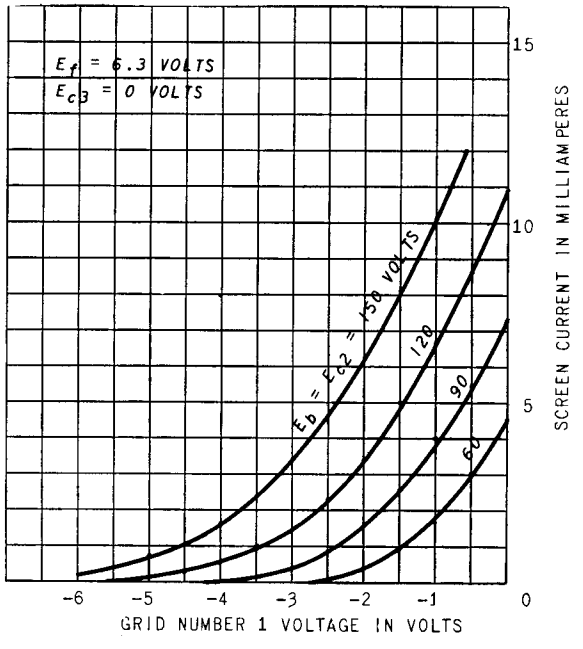
 # With external shield connected to pin 2

AVERAGE CHARACTERISTICS

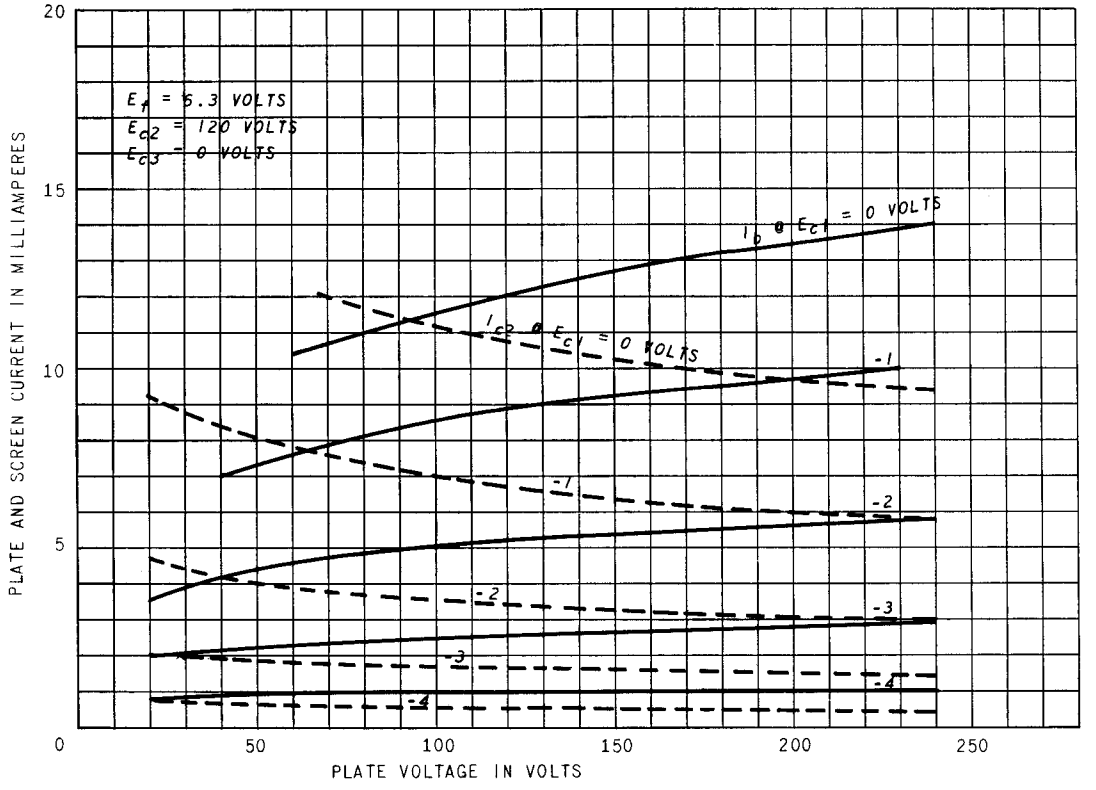


AVERAGE CHARACTERISTICS

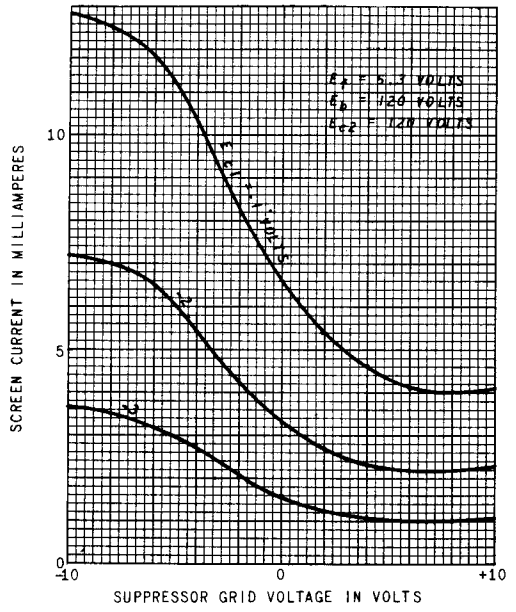


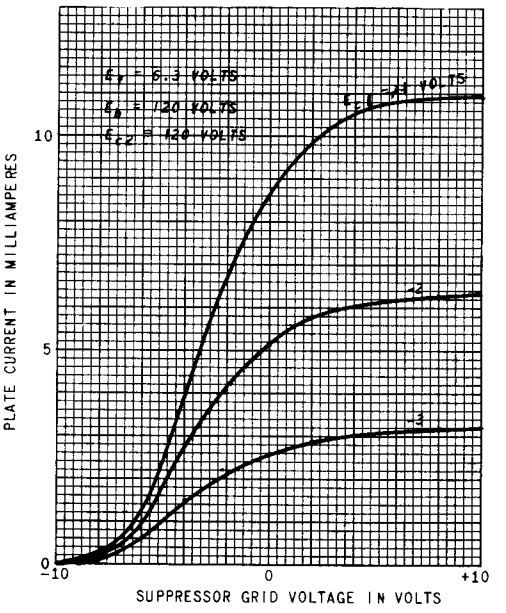


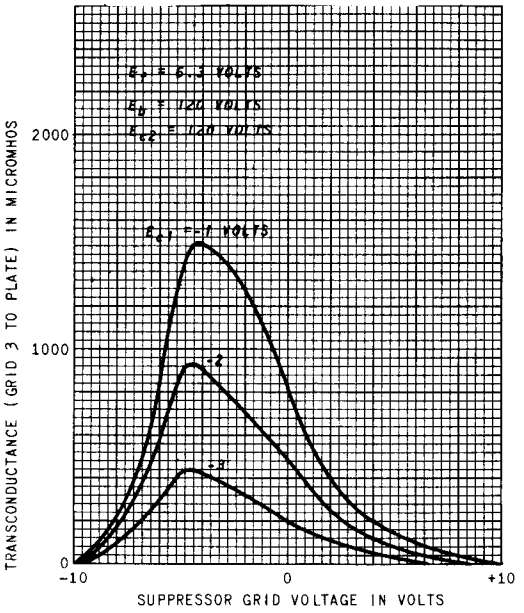
AVERAGE PLATE CHARACTERISTICS

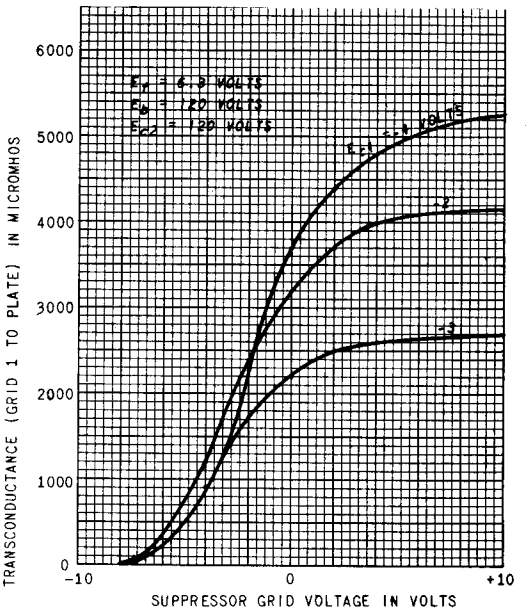


AVERAGE CHARACTERISTICS









Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

Electronic TUBES

6AS7-GA

TWIN TRIODE

DESCRIPTION AND RATING

The 6AS7-GA is a low-mu twin triode designed primarily for service as a series regulator tube in d-c power supplies. Except for the use of a T-12 envelope, the 6AS7-GA is identical to the 6AS7-G.

GENERAL

ELECTRICAL

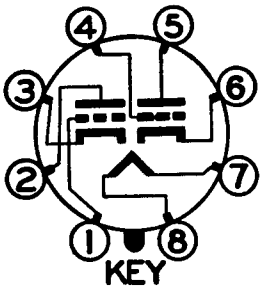
Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 Volts
Heater Current	2.5 Amperes
Direct Interelectrode Capacitances, approximate*	
Grid to Plate, Each Section	7.5 μμf
Input, Each Section	6.5 μμf
Output, Each Section	2.2 μμf
Heater to Cathode, Each Section	7.0 μμf
Grid to Grid	0.5 μμf
Plate to Plate	1.9 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-12, Glass
Base—B8-110, Short Medium-Shell Octal 8-Pin

BASING DIAGRAM

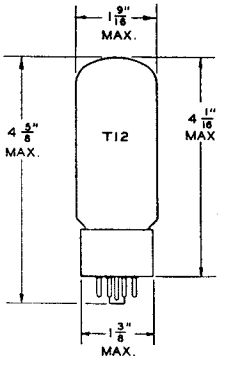


RETMA 8BD

TERMINAL CONNECTIONS

Pin 1—Grid (Section 2)
Pin 2—Plate (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Grid (Section 1)
Pin 5—Plate (Section 1)
Pin 6—Cathode (Section 1)
Pin 7—Heater
Pin 8—Heater

PHYSICAL DIMENSIONS



GENERAL ELECTRIC

MAXIMUM RATINGS

DC AMPLIFIER SERVICE
DESIGN-CENTER VALUES, EACH SECTION

Plate Voltage	250	Volts
Plate Dissipation	13	Watts
Plate Current	125	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	300	Volts
Heater Negative with Respect to Cathode	300	Volts
Grid-Circuit Resistance		
With Cathode-Bias†	1.0	Megohm

BOOSTER SCANNING SERVICE‡
DESIGN-CENTER VALUES, EACH SECTION

Peak Inverse Plate Voltage	1700	Volts
Plate Dissipation	13	Watts
Plate Current	125	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	300	Volts
Heater Negative with Respect to Cathode	300	Volts
Grid-Circuit Resistance		
With Cathode-Bias†	1.0	Megohm

CHARACTERISTICS AND TYPICAL OPERATION

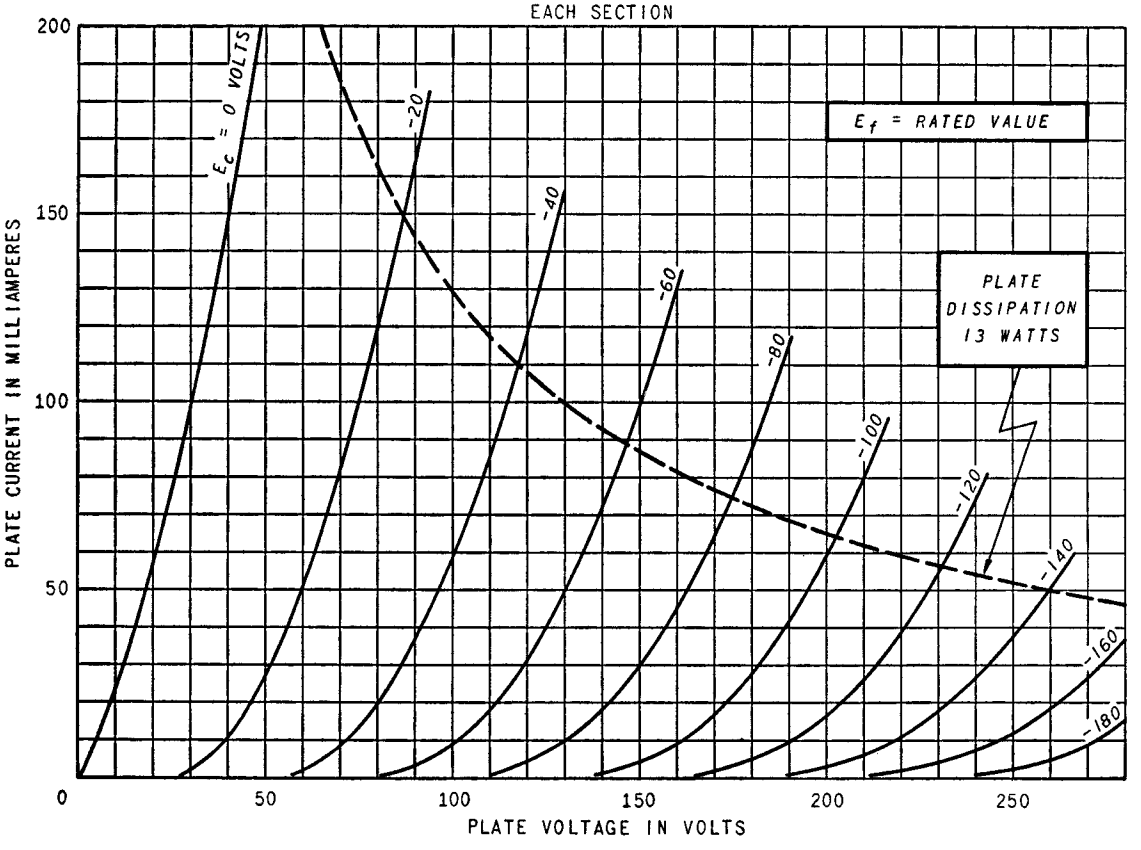
AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage	135	Volts
Cathode-Bias Resistor	250	Ohms
Amplification Factor	2.0	
Plate Resistance, approximate	280	Ohms
Transconductance	7000	Micromhos
Plate Current	125	Milliamperes

* Without external shield.
† Operation with fixed bias is not recommended.
‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

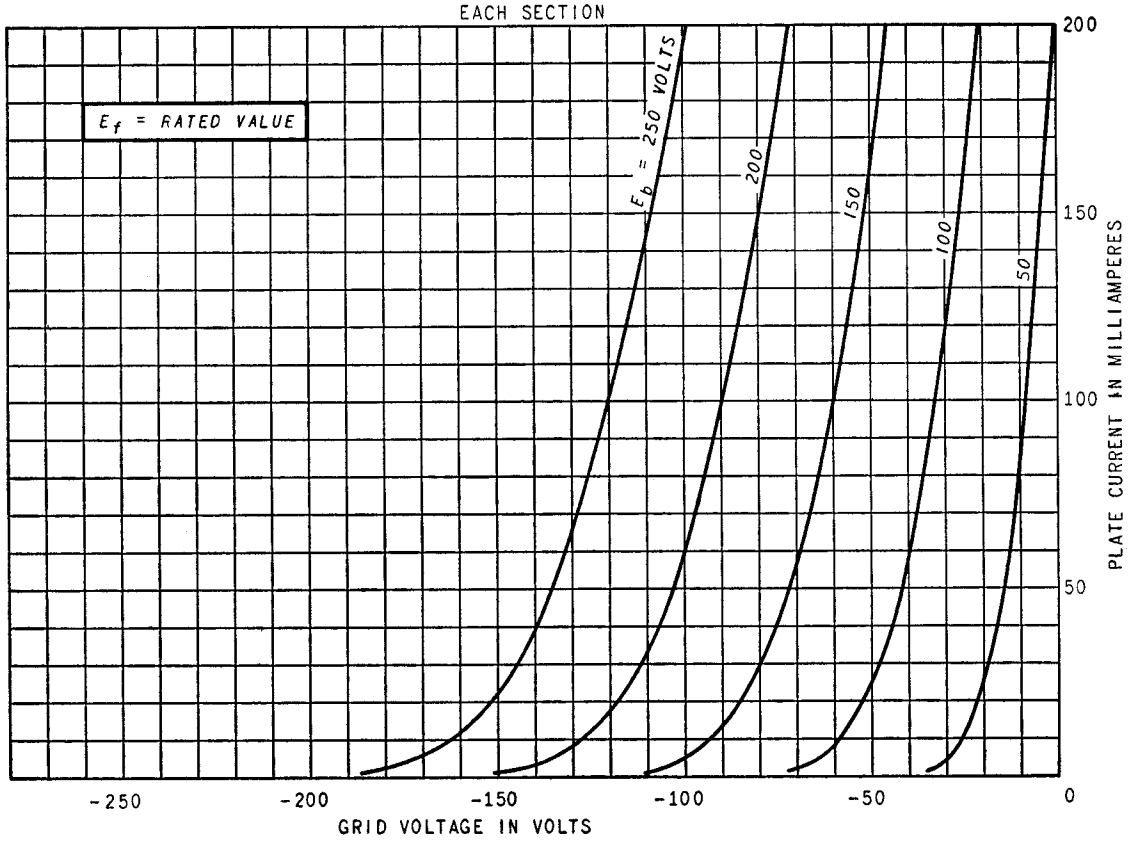
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION



Electronic TUBES

6AS7-GYB

TWIN TRIODE

DESCRIPTION AND RATING

The 6AS7-GYB is a low-mu twin triode primarily designed for service as a series-regulator tube in d-c power supplies. The tube differs from the 6AS7-GA in having controlled zero-bias plate current and a low-loss phenolic base.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3	Volts
Heater Current	2.5	Amperes
Direct Interelectrode Capacitances, approximate†		
Grid to Plate, Each Section	7.5	μμf
Input, Each Section	6.5	μμf
Output, Each Section	2.2	μμf
Heater to Cathode, Each Section	7.0	μμf
Grid to Grid	0.5	μμf
Plate to Plate	1.9	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-12, Glass
Base—B8-110, Short Medium-Shell Octal 8-Pin Micanol

MAXIMUM RATINGS

DC AMPLIFIER SERVICE—DESIGN-CENTER VALUES, EACH SECTION

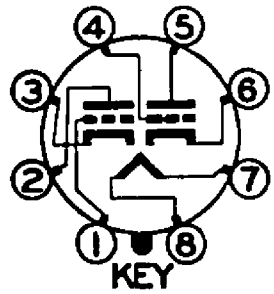
Plate Voltage	250	Volts
Plate Dissipation	13	Watts
DC Plate Current	125	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	300	Volts
Heater Negative with Respect to Cathode	300	Volts
Grid-Circuit Resistance		
With Cathode Bias‡	1.0	Megohms

Cont'd on Page 2

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM

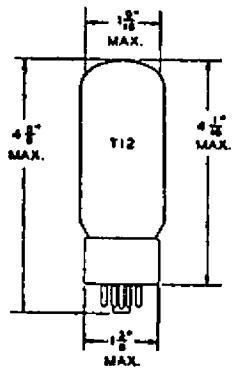


EIA 8BD

TERMINAL CONNECTIONS

Pin 1—Grid (Section 2)
Pin 2—Plate (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Grid (Section 1)
Pin 5—Plate (Section 1)
Pin 6—Cathode (Section 1)
Pin 7—Heater
Pin 8—Heater

PHYSICAL DIMENSIONS



EIA 12-16

from JEDEC release #2906, Aug. 1, 1960

MAXIMUM RATINGS (Cont'd)

BOOSTER SCANNING SERVICE§—DESIGN-CENTER VALUES, EACH SECTION

Peak Inverse Plate Voltage	1700	Volts
Plate Dissipation	13	Watts
Plate Current	125	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	300	Volts
Heater Negative with Respect to Cathode	300	Volts
Grid-Circuit Resistance		
With Cathode-Bias‡	1.0	Megohms

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all tubes.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply-voltage.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage	40	135	Volts
Grid Voltage	0	——	Volts
Cathode-Bias Resistor	——	250	Ohms
Amplification Factor	——	2.0	
Plate Resistance, approximate	——	280	Ohms
Transconductance	——	7000	Micromhos
Plate Current	150	125	Milliamperes

INITIAL CHARACTERISTICS LIMITS

	Minimum	Maximum	
Heater Current			
Ef = 6.3 volts	2.26	2.75	Amperes
Plate Current, Each Section			
Ef = 6.3 volts, Ebb = 135 volts, Rk = 250 ohms (bypassed)	100	150	Milliamperes
Zero-Bias Plate Current, Each Section			
Ef = 6.3 volts, Eb = 40 volts, Ec = 0	110	190	Milliamperes
Transconductance, Each Section			
Ef = 6.3 volts, Ebb = 135 volts, Rk = 250 ohms (bypassed)	5800	8200	Micromhos
Amplification Factor, Each Section			
Ef = 6.3 volts, Ebb = 135 volts, Rk = 250 ohms (bypassed)	1.4	2.6	
Negative Grid Current, Each Section			
Ef = 6.3 volts, Ebb = 135 volts, Rk = 250 ohms (bypassed), Rg = 1.0 meg	——	2.0	Microamperes

† Without external shield.

‡ Operation with fixed bias is not recommended.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

Electronic TUBES

6AT6—12AT6

DUPLEX-DIODE TRIODE

DESCRIPTION AND RATING

The 6AT6 is a miniature, duplex-diode, high-mu triode designed for use as a combined detector, amplifier, and automatic-volume-control tube.

Except for heater ratings, the 12AT6 is identical to the 6AT6.

GENERAL

ELECTRICAL

	6AT6	12AT6	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	6.3	12.6	Volts
Heater Current	0.3	0.15	Ampere
Direct Interelectrode Capacitances	With Shield*	Without Shield	
Triode Grid to Plate	2.0	2.0	μμf
Triode Input	2.2	2.2	μμf
Triode Output	1.2	0.8	μμf
Grid to Diode-Number 2 Plate, maximum	0.04	0.04	μμf

MECHANICAL

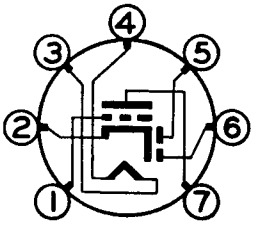
Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	300	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	0.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Diode Current for Continuous Operation, Each Diode	1.0	Milliamperes

BASING DIAGRAM

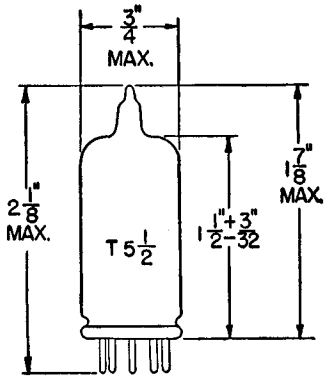


RETMA 7BT

TERMINAL CONNECTIONS

Pin 1—Triode Grid
Pin 2—Cathode
Pin 3—Heater
Pin 4—Heater
Pin 5—Diode Number 2 Plate
Pin 6—Diode Number 1 Plate
Pin 7—Triode Plate

PHYSICAL DIMENSIONS



RETMA 5-2

GENERAL ELECTRIC

Supersedes ET-T275B, dated 11-50

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

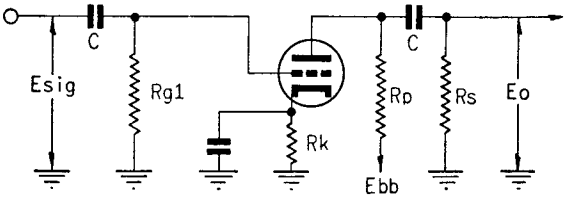
Plate Voltage	100	250	Volts
Grid Voltage	−1.0	−3.0	Volts
Amplification Factor	70	70	
Plate Resistance, approximate	54000	58000	Ohms
Transconductance	1300	1200	Micromhos
Plate Current	0.8	1.0	Milliamperes
Average Diode Current, Each Diode With 10 Volts DC Applied	—	2.0	Milliamperes

* With external shield (RETMA 316) connected to pin 2.

CLASS A RESISTANCE-COUPLED AMPLIFIER

TRIODE SECTION

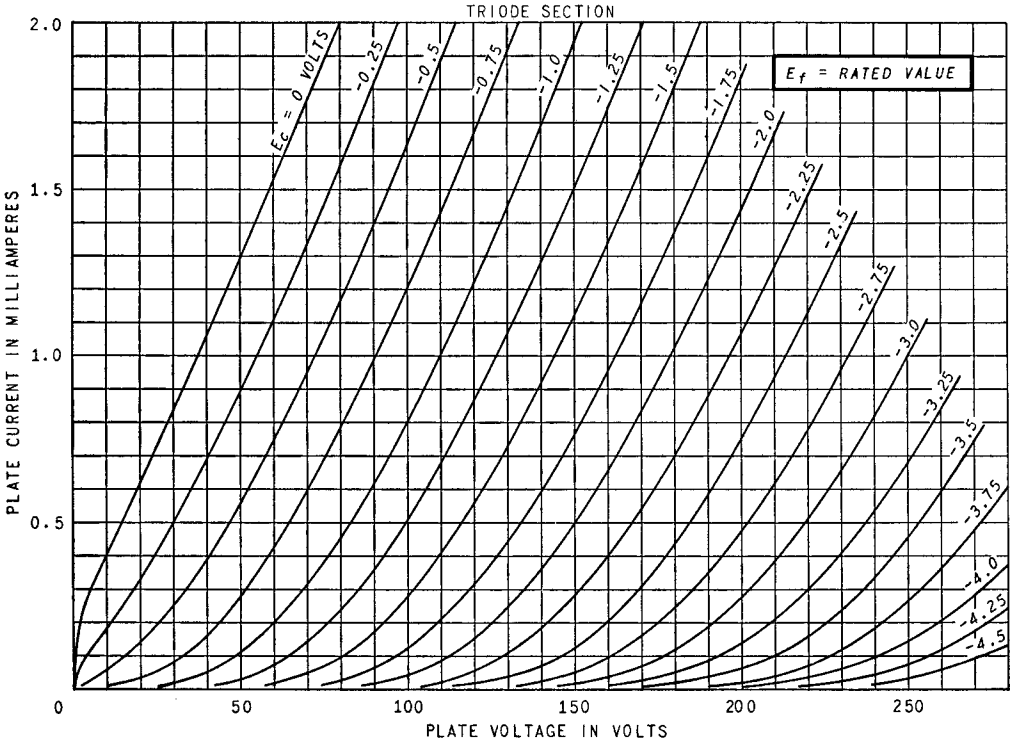
Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	0.10	0.10	5700	21	7.0	2400	29	18	1800	33	35
0.10	0.24	0.10	6100	26	9.0	2700	34	23	2000	38	42
0.24	0.24	0.10	9100	30	10	4300	40	24	3000	44	43
0.24	0.51	0.10	10000	34	13	4700	45	31	3300	49	52
0.51	0.51	0.10	15000	37	14	7500	47	28	5600	51	50
0.51	1.0	0.10	16000	40	16	8200	50	35	6200	55	60
0.24	0.24	10	0	31	5.0	0	44	49	0	48	40
0.24	0.51	10	0	37	7.0	0	49	25	0	52	52
0.51	0.51	10	0	39	7.5	0	51	22	0	54	44
0.51	1.0	10	0	42	10	0	54	28	0	58	56



Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

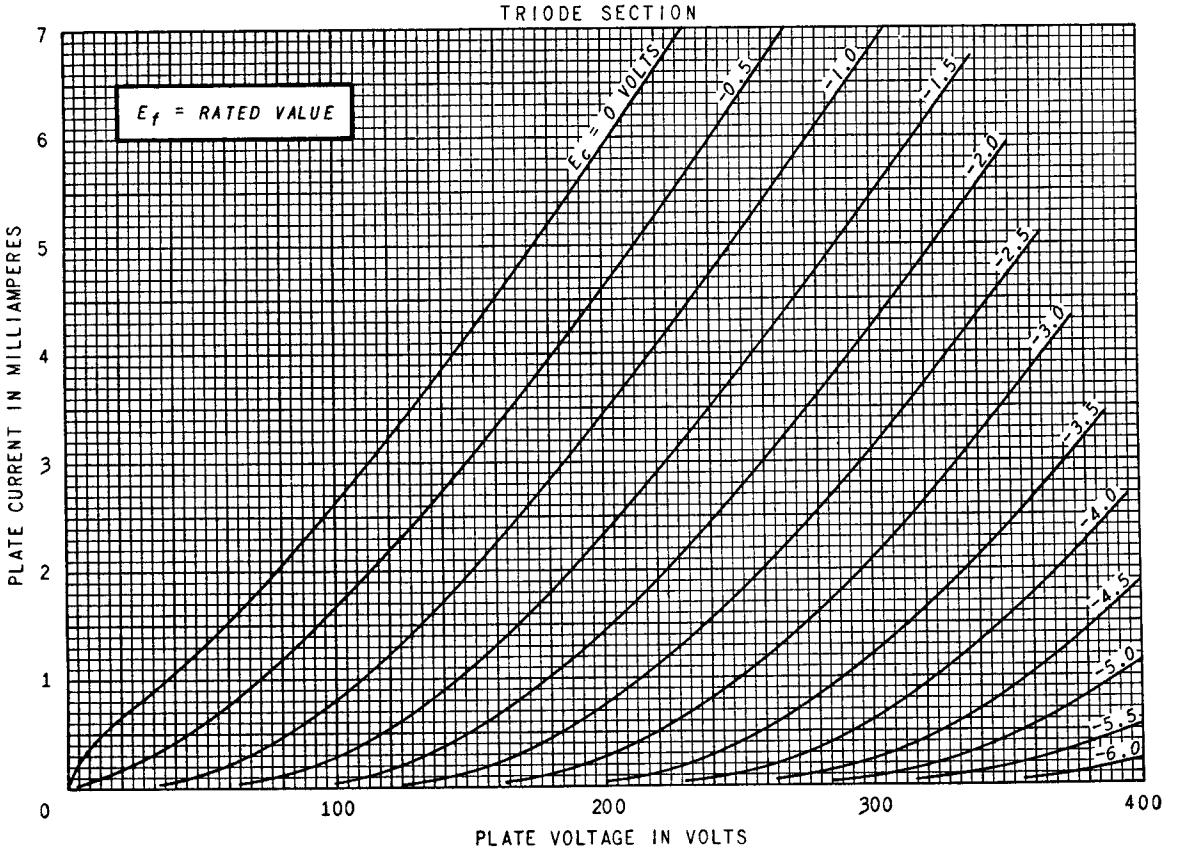
Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

AVERAGE PLATE CHARACTERISTICS



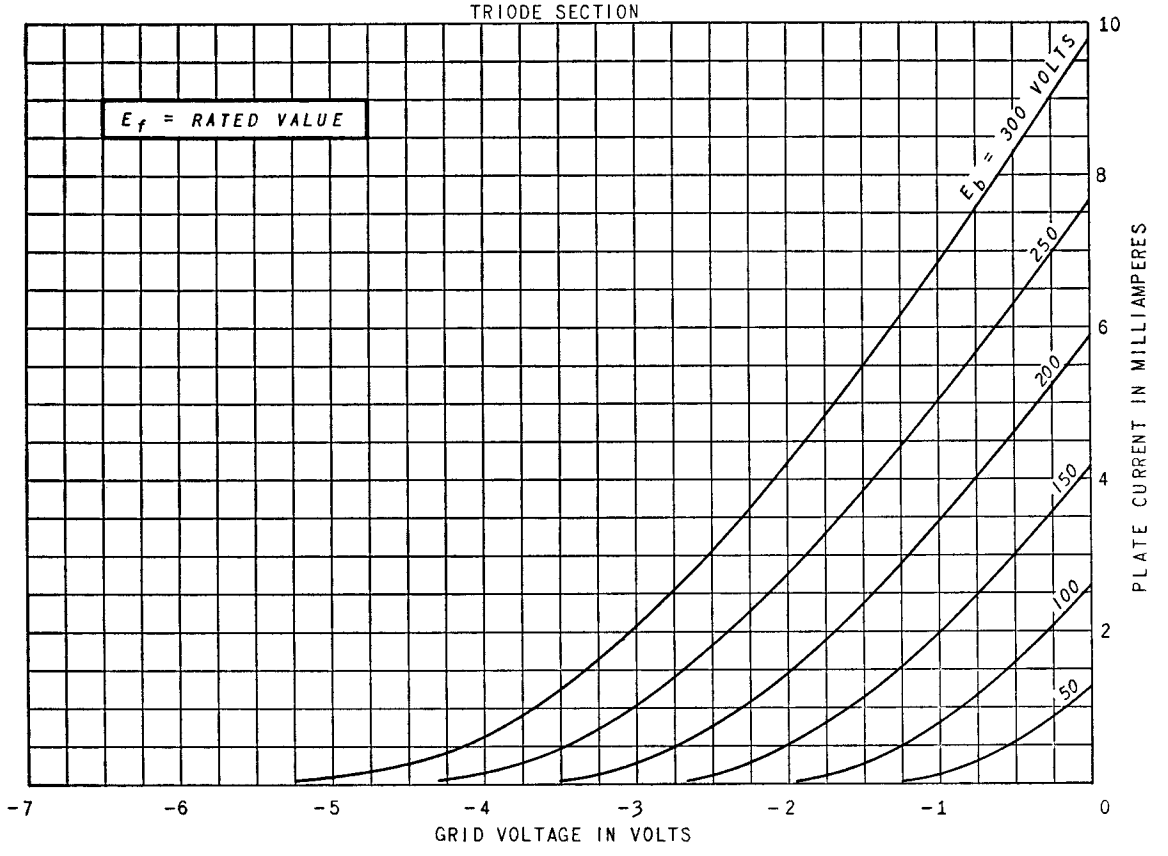
AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION



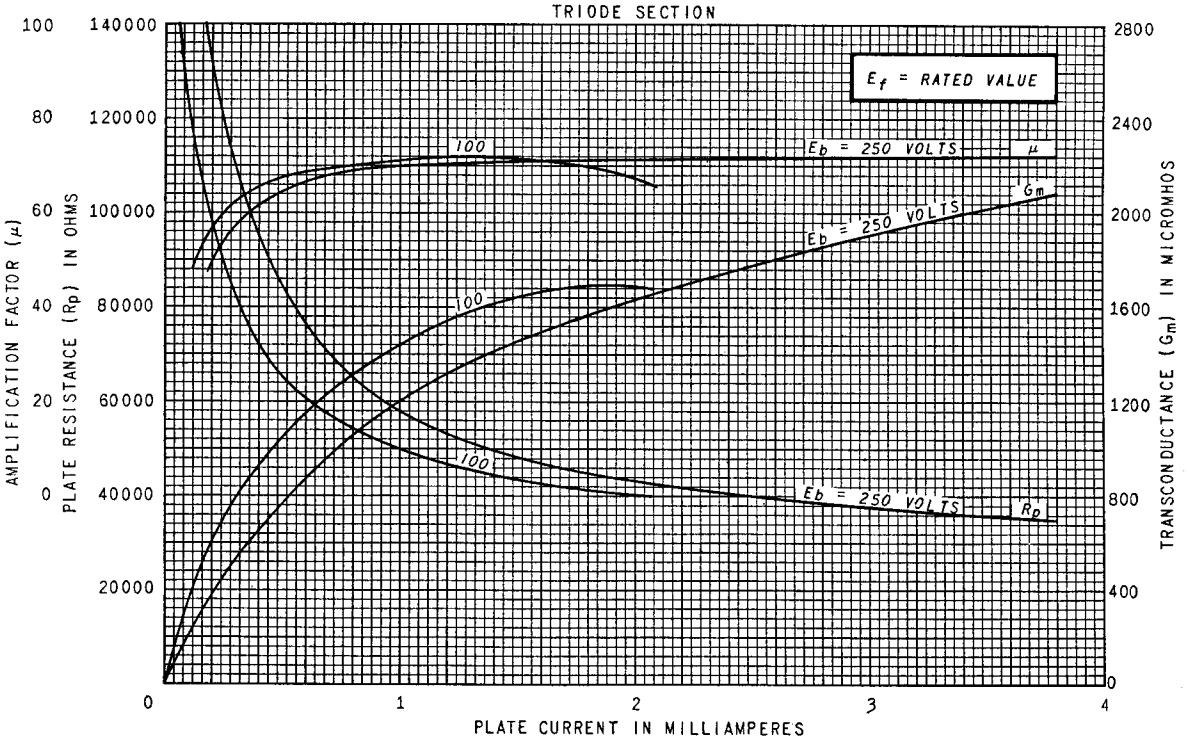
AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION



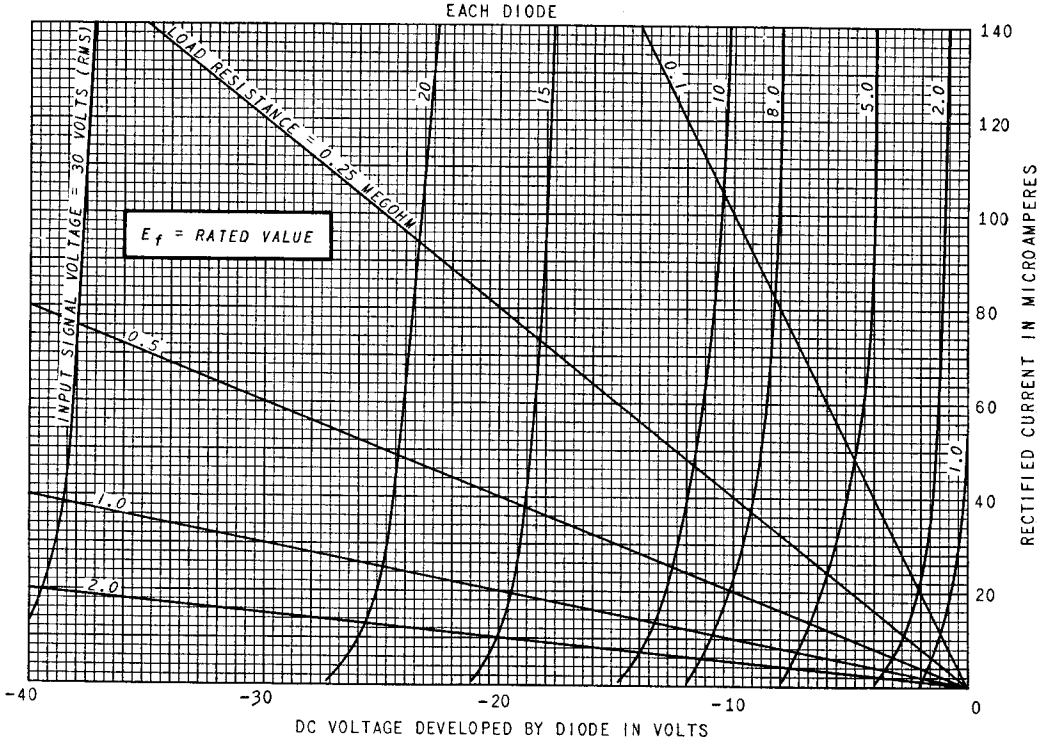
AVERAGE CHARACTERISTICS

TRIODE SECTION



OPERATION CHARACTERISTICS

EACH DIODE



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6AU4-GTA—19AU4-GTA

DIODE

FOR TV DAMPING DIODE APPLICATIONS

DESCRIPTION AND RATING

The 6AU4-GTA is a single heater-cathode type diode intended for service as the damping diode in the horizontal-deflection circuit of television receivers. Its high output current capabilities make the tube particularly well suited for operation in conjunction with the 6CD6-GA in autotransformer deflection systems. Except for increased maximum d-c output current and peak plate current ratings, the 6AU4-GTA is identical to the 6AU4-GT.

The 19AU4-GTA differs from the 6AU4-GTA by incorporating different heater ratings. In addition, the 19AU4-GTA as a result of its controlled heater warm-up characteristic, is especially suited for use in television receivers which employ series-connected heaters. When used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

GENERAL

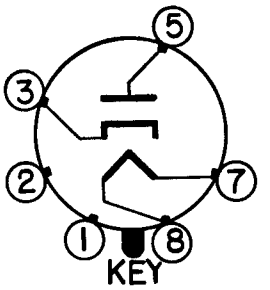
ELECTRICAL

	6AU4-GTA	19AU4-GTA
Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3	18.9 Volts
Heater Current	1.8	0.6 Amperes
Heater Warm-up Time*	...	11 Seconds
Direct Interelectrode Capacitances, approximate†		
Cathode to Plate and Heater	11.5 μμf	
Plate to Cathode and Heater	8.5 μμf	
Heater to Cathode	4.0 μμf	

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B5-85 or B6-60, Short Intermediate Shell Octal

BASING DIAGRAM

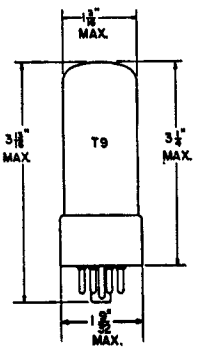


RETMA 4CG

TERMINAL CONNECTIONS

Pin 1—No Connection‡
Pin 2—Internal Connection
Do Not Use
Pin 3—Cathode
Pin 5—Plate
Pin 7—Heater
Pin 8—Heater
‡ Pin 1 omitted on base B5-85

PHYSICAL DIMENSIONS



RETMA 9-44

GENERAL ELECTRIC

MAXIMUM RATINGS

TV DAMPER SERVICE§
DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

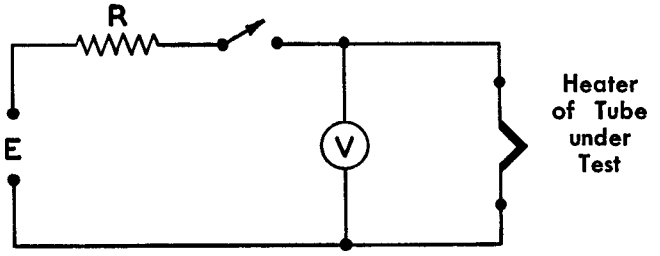
Peak Inverse Plate Voltage	4500π	Volts
Plate Dissipation	6.0	Watts
Steady-State Peak Plate Current	1150	Milliamperes
DC Output Current	190	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	900	Volts
Total DC and Peak	4500π	Volts

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
I_b=350 Milliamperes DC	25	Volts

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E=75 volts (RMS or DC), V_1=15.0 volts (RMS or DC), and R=94.5 ohms.

† Without external shield.

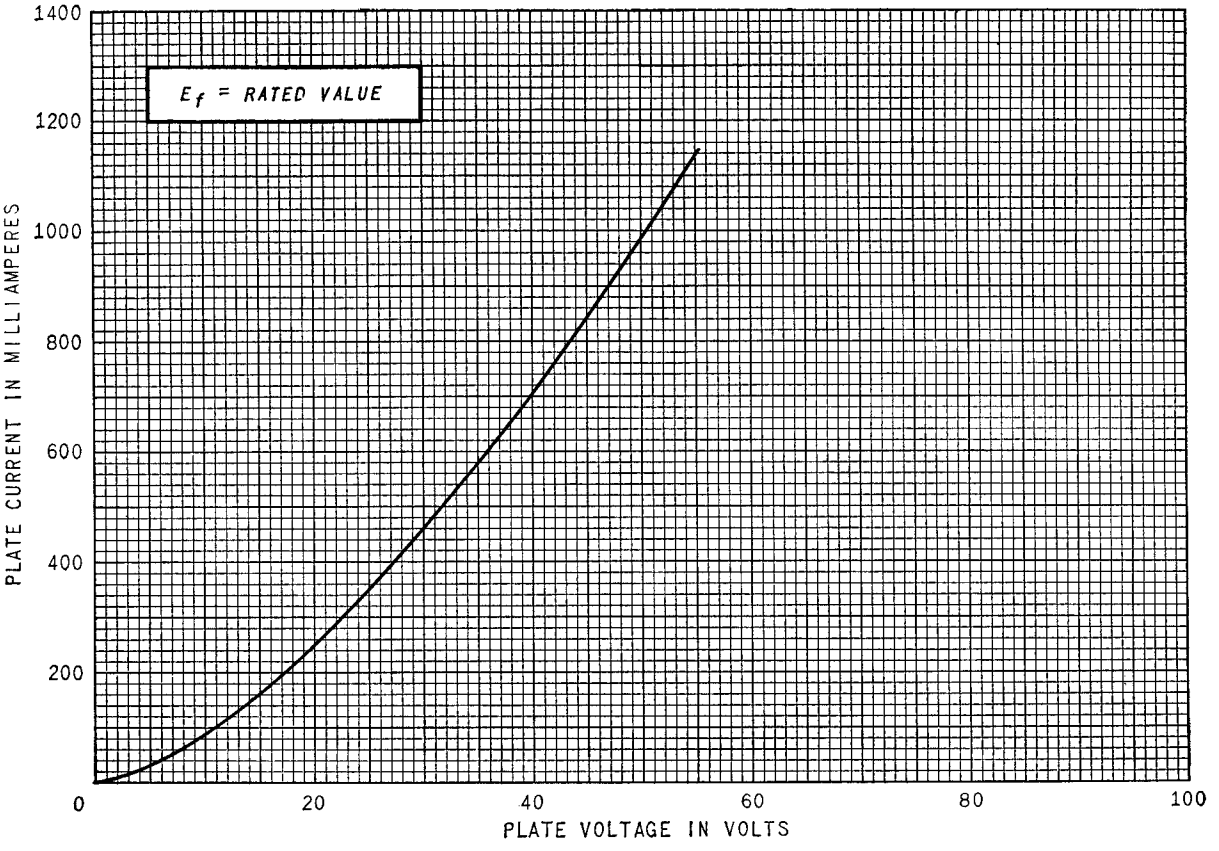


§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

π Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause rated value to be exceeded.

Note: Socket terminals 1, 2, 4, and 6 should not be used. Operation of this tube as a power rectifier is not recommended.

AVERAGE PLATE CHARACTERISTICS



6AU6-A—3AU6—12AU6

PENTODE

DESCRIPTION AND RATING

The 6AU6-A is a miniature sharp-cutoff pentode primarily designed for use as a high-gain radio-frequency or intermediate-frequency amplifier. Its low grid-plate capacitance and high transconductance make it especially suited for high-frequency wide-band applications.

Except for heater ratings, the 3AU6 and 12AU6 are identical to the 6AU6-A.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	3AU6	6AU6-A	12AU6	
Heater Voltage, AC or DC	3.15	6.3±10%	12.6±10%	Volts
Heater Current	0.6±6%	0.3	0.15	Amperes
Heater Warm-up Time*	11	11	—	Seconds

Direct Interelectrode Capacitances	With Shield†	Without Shield	
Pentode Connection			
Grid-Number 1 to Plate, maximum (g1 to P)	0.0035	0.0035	μμf
Input: g1 to (H+K+g2+g3+IS)	5.5	5.5	μμf
Output: P to (H+K+g2+g3+IS)	5.0	5.0	μμf
Triode Connection‡			
Grid-Number 1 to Plate: g1 to (P+g2+g3+IS)	2.6	2.6	μμf
Input: g1 to (H+K)	3.2	3.2	μμf
Output: (P+g2+g3+IS) to (H+K)	8.5	1.2	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES	Pentode Connection	Triode Connection‡	
Plate Voltage	330	275	Volts
Screen-Supply Voltage	330	—	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.5	3.5	Watts
Screen Dissipation	0.75	—	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

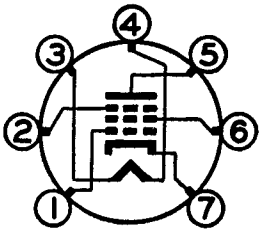
The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

Supersedes ET-T916, dated 3-55

BASING DIAGRAM

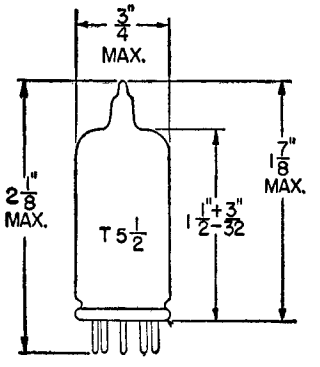


EIA 7BK

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Internal Shield and Grid Number 3 (Suppressor)
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Cathode

PHYSICAL DIMENSIONS



EIA 5-2

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER		Pentode Connection		Triode Connection‡	
Plate Voltage	100	250	250	250	Volts
Suppressor, Connected to Cathode at Socket					
Screen Voltage	100	125	150	——	Volts
Cathode-Bias Resistor	150	100	68	330	Ohms
Amplification Factor	——	——	——	36	
Plate Resistance, approximate	0.5	1.5	1.0	——	Megohms
Transconductance	3900	4500	5200	4800	Micromhos
Plate Current	5.0	7.6	10.6	12.2	Milliamperes
Screen Current	2.1	3.0	4.3	——	Milliamperes
Grid-Number 1 Voltage, approximate					
Ib = 10 Microamperes	−4.2	−5.5	−6.5	——	Volts

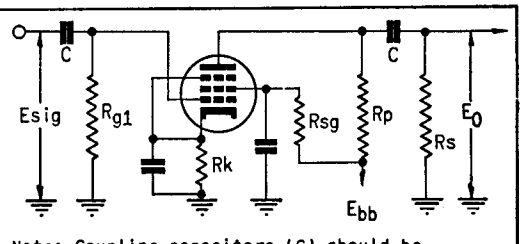
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (EIA 316) connected to pin 7.

‡ With screen and suppressor connected to plate.

CLASS A RESISTANCE-COUPLED AMPLIFIER

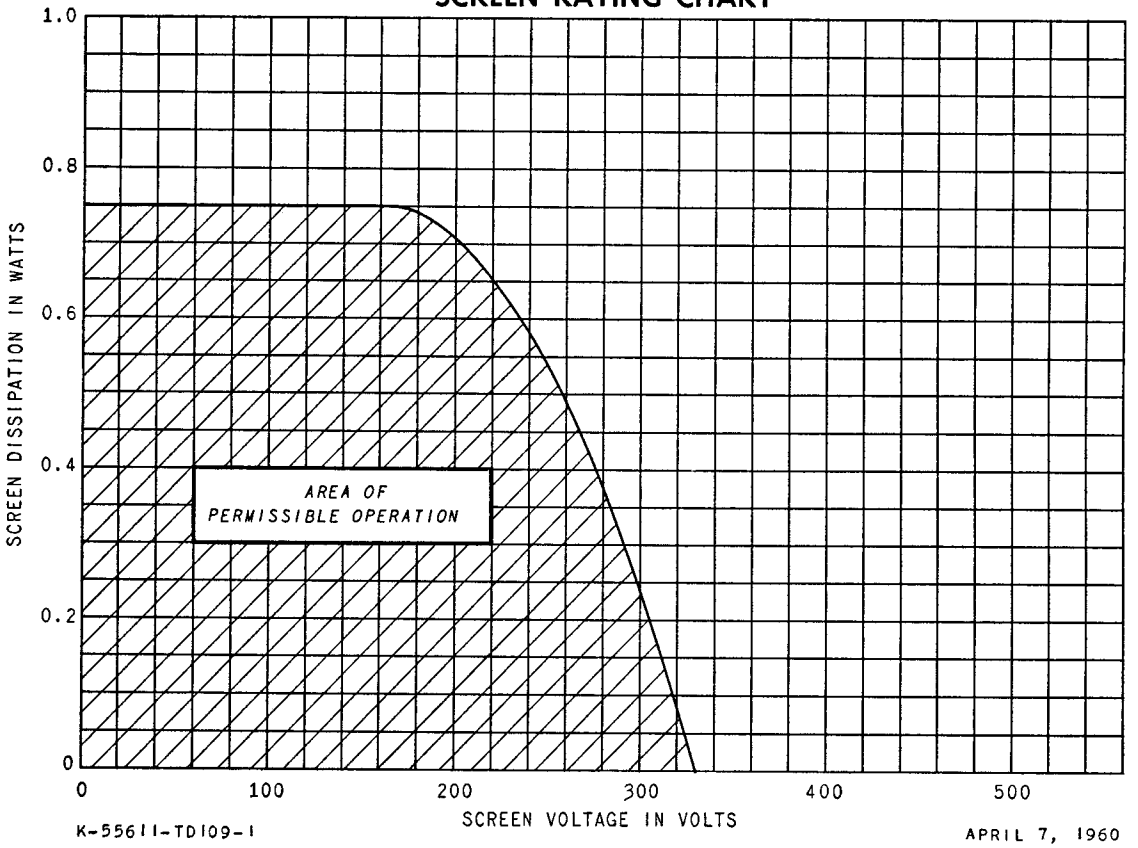
Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts				Ebb = 180 Volts				Ebb = 300 Volts			
			Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo
0.10	0.10	0.1	960	0.1	68	13	610	0.2	96	27	480	0.2	120	47
0.10	0.24	0.1	1000	0.2	93	16	630	0.2	130	35	480	0.2	160	60
0.24	0.24	0.1	2900	0.3	88	12	1700	0.4	120	25	820	0.6	200	44
0.24	0.51	0.1	3600	0.4	110	14	1800	0.5	170	31	960	0.7	240	53
0.51	0.51	0.1	5300	0.9	110	10	4000	0.9	160	23	2100	1.1	230	38
0.51	1.0	0.1	4600	1.1	125	12	3800	1.1	200	25	1800	1.3	300	44
0.24	0.24	10	0	0.4	100	12	0	0.5	160	25	0	0.5	210	44
0.24	0.51	10	0	0.5	120	14	0	0.6	180	31	0	0.7	270	52
0.51	0.51	10	0	0.9	120	11	0	1.1	200	22	0	1.2	280	38
0.51	1.0	10	0	1.0	145	12	0	1.1	240	25	0	1.3	350	42



Note: Coupling capacitors (C) should be adjusted to give desired frequency response. Rk and Rsg should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

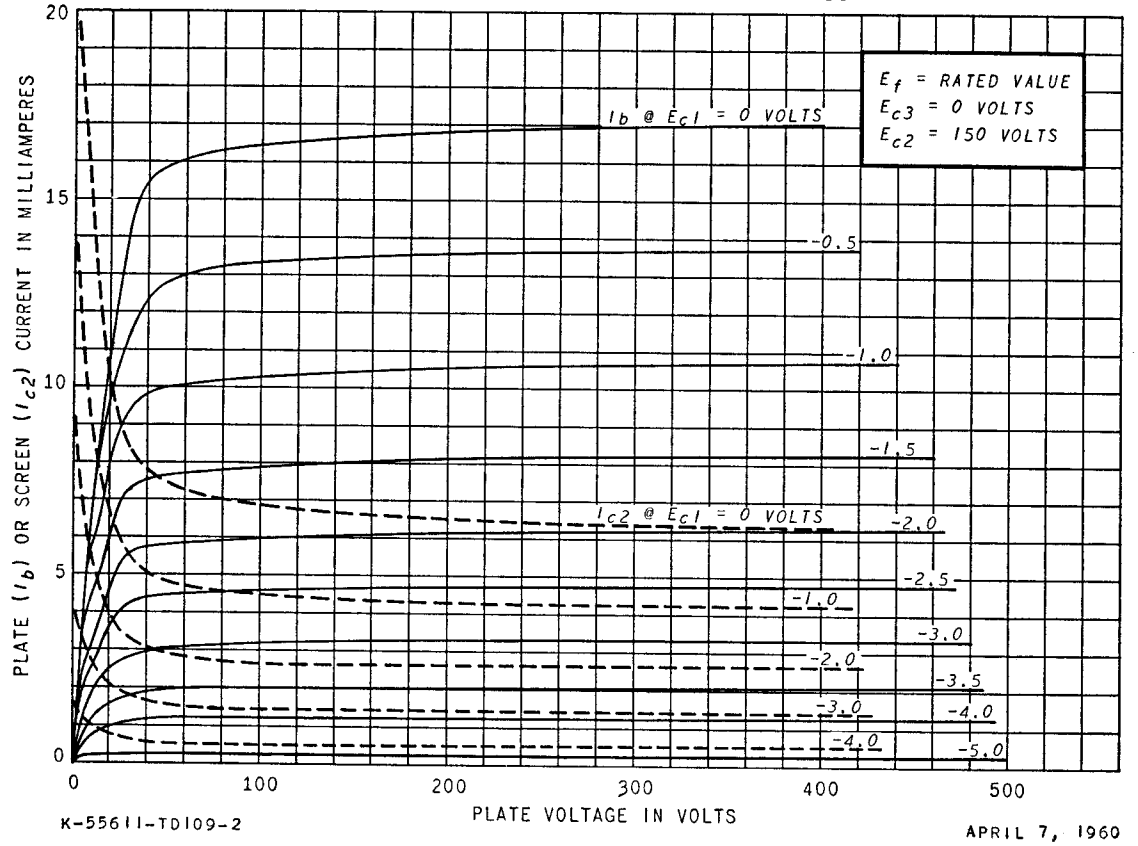
SCREEN RATING CHART



K-55611-TD109-1

APRIL 7, 1960

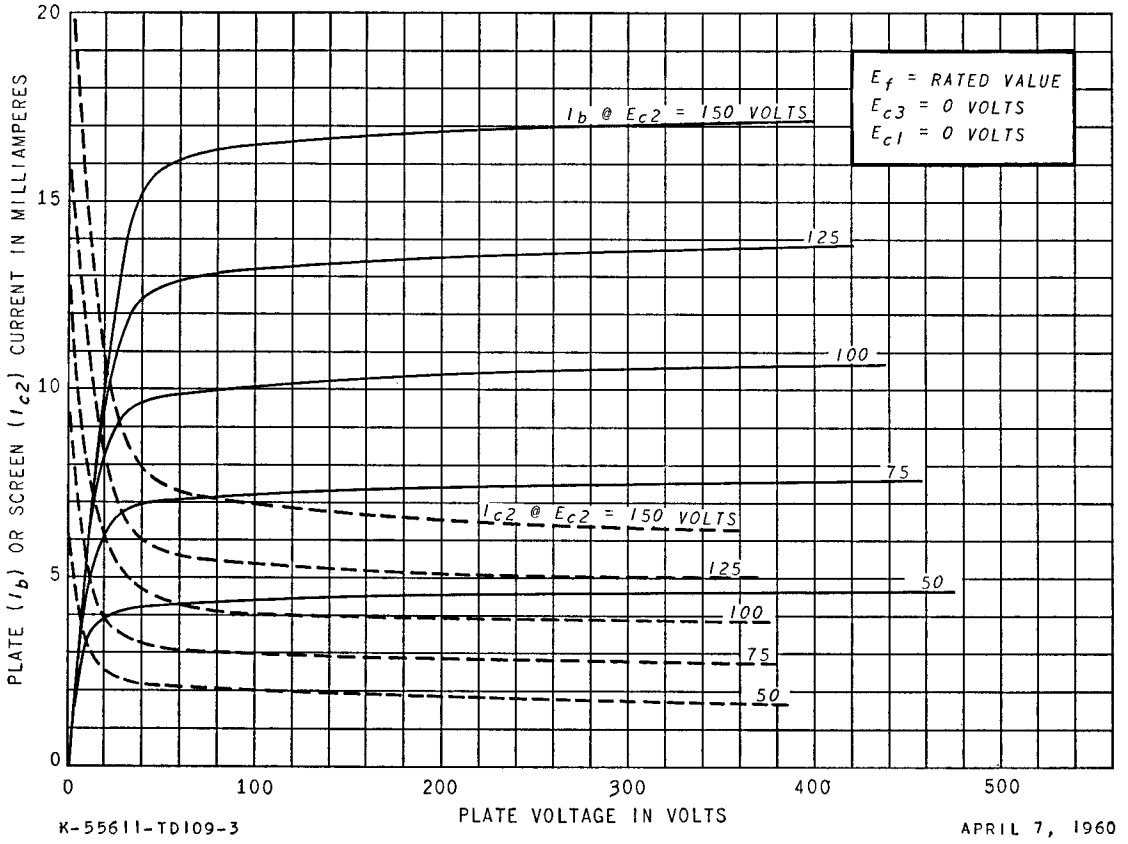
AVERAGE PLATE CHARACTERISTICS



K-55611-TD109-2

APRIL 7, 1960

AVERAGE PLATE CHARACTERISTICS

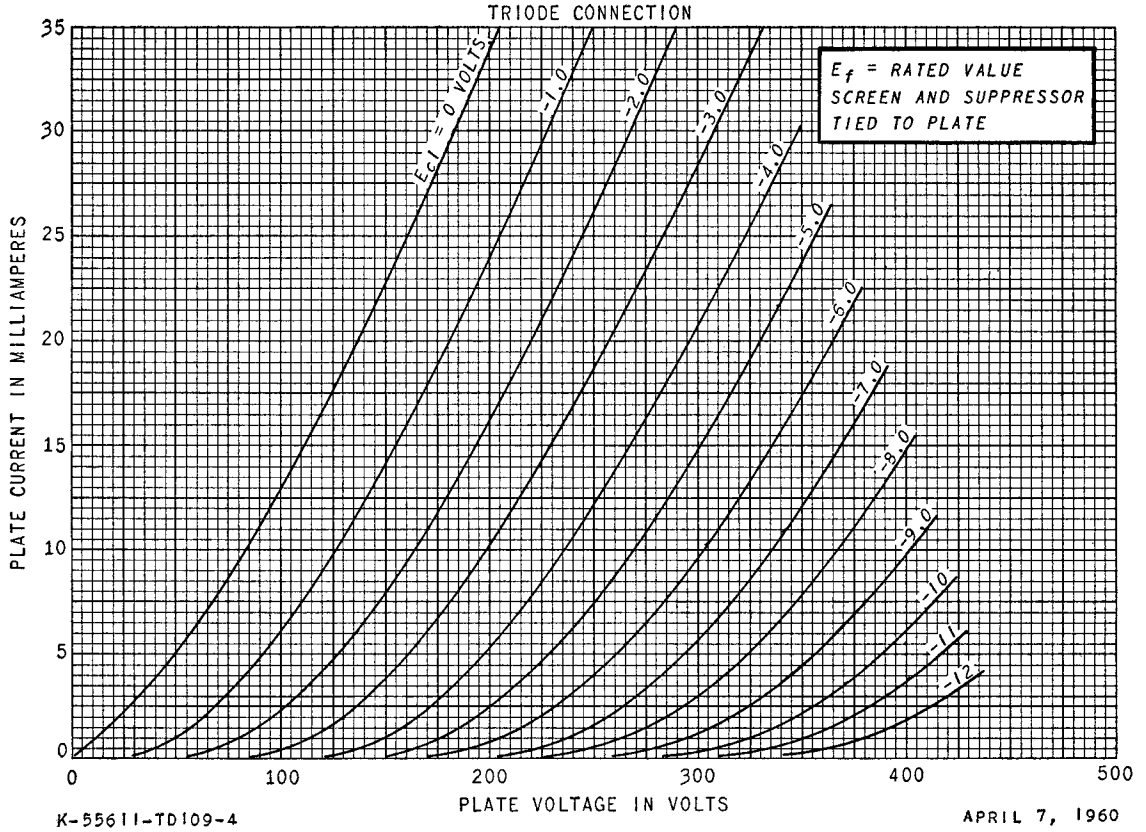


K-55611-TD109-3

APRIL 7, 1960

AVERAGE PLATE CHARACTERISTICS

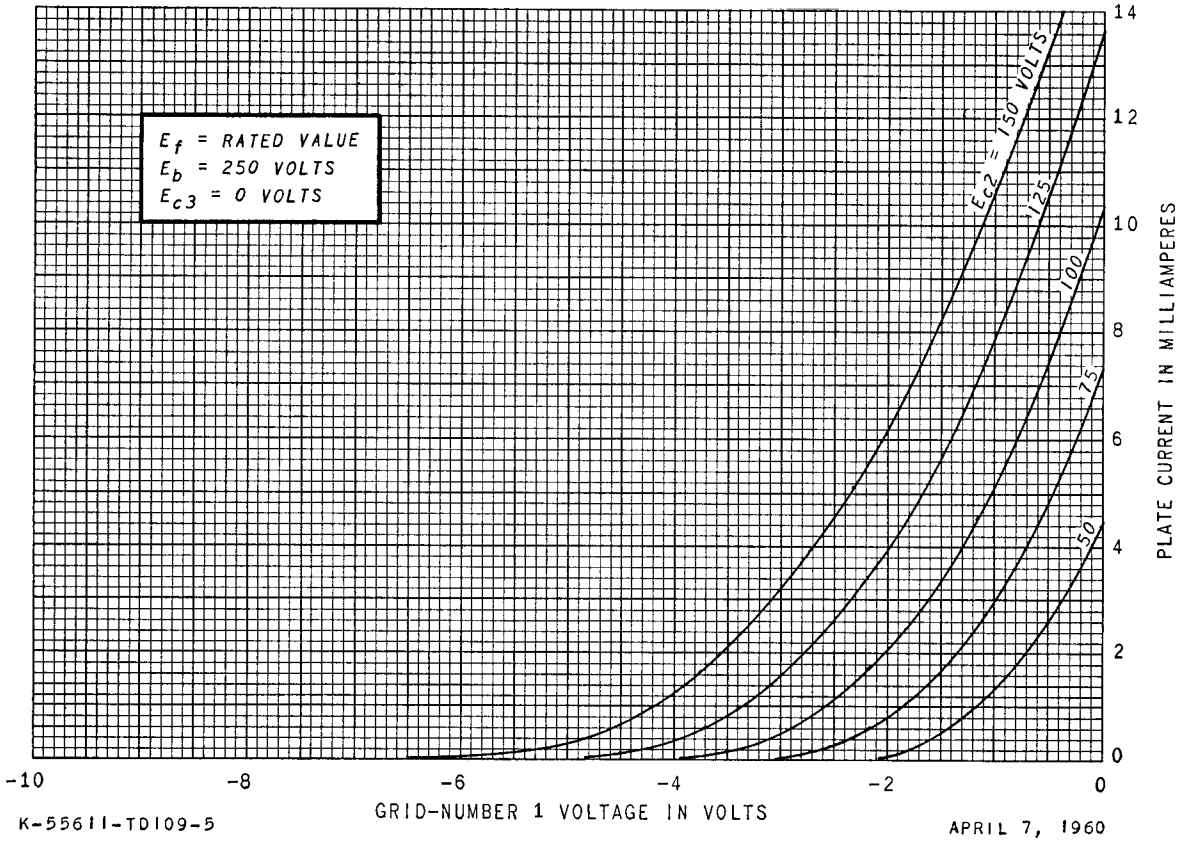
TRIODE CONNECTION



K-55611-TD109-4

APRIL 7, 1960

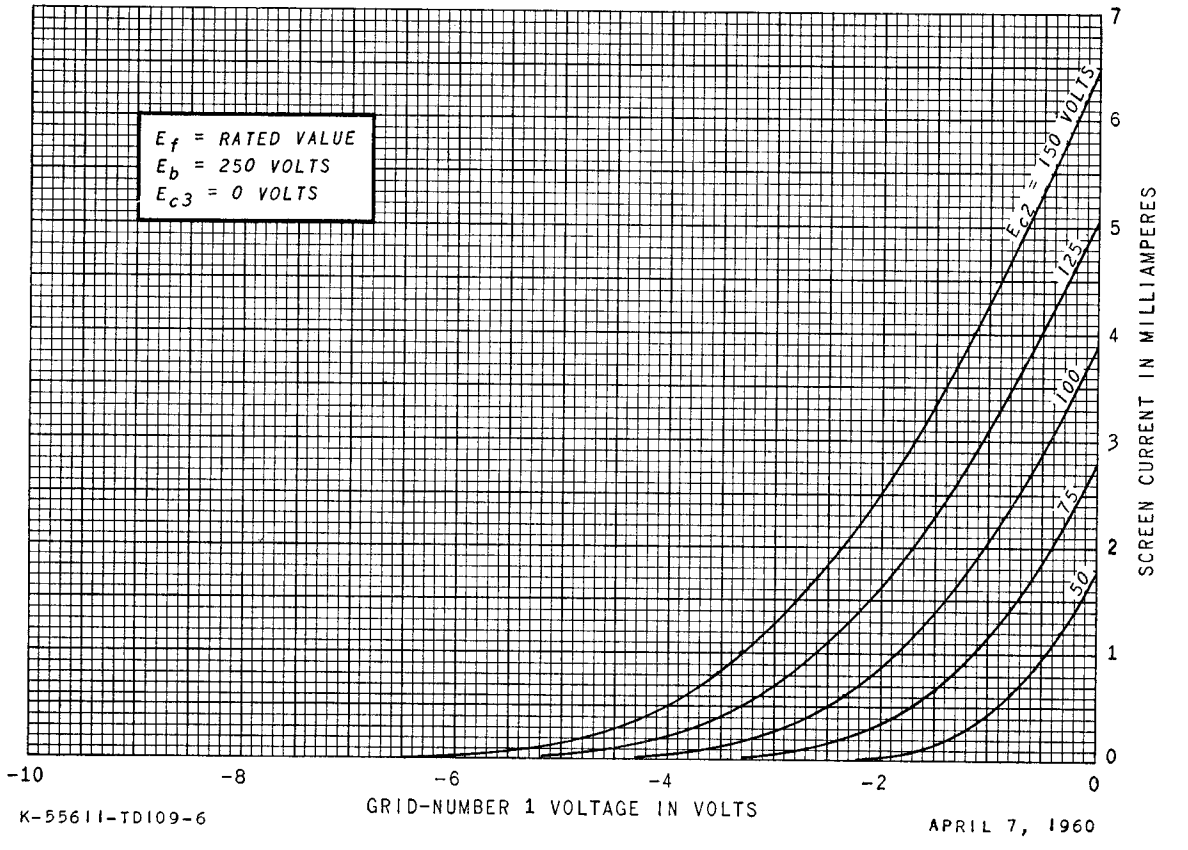
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TDI09-5

APRIL 7, 1960

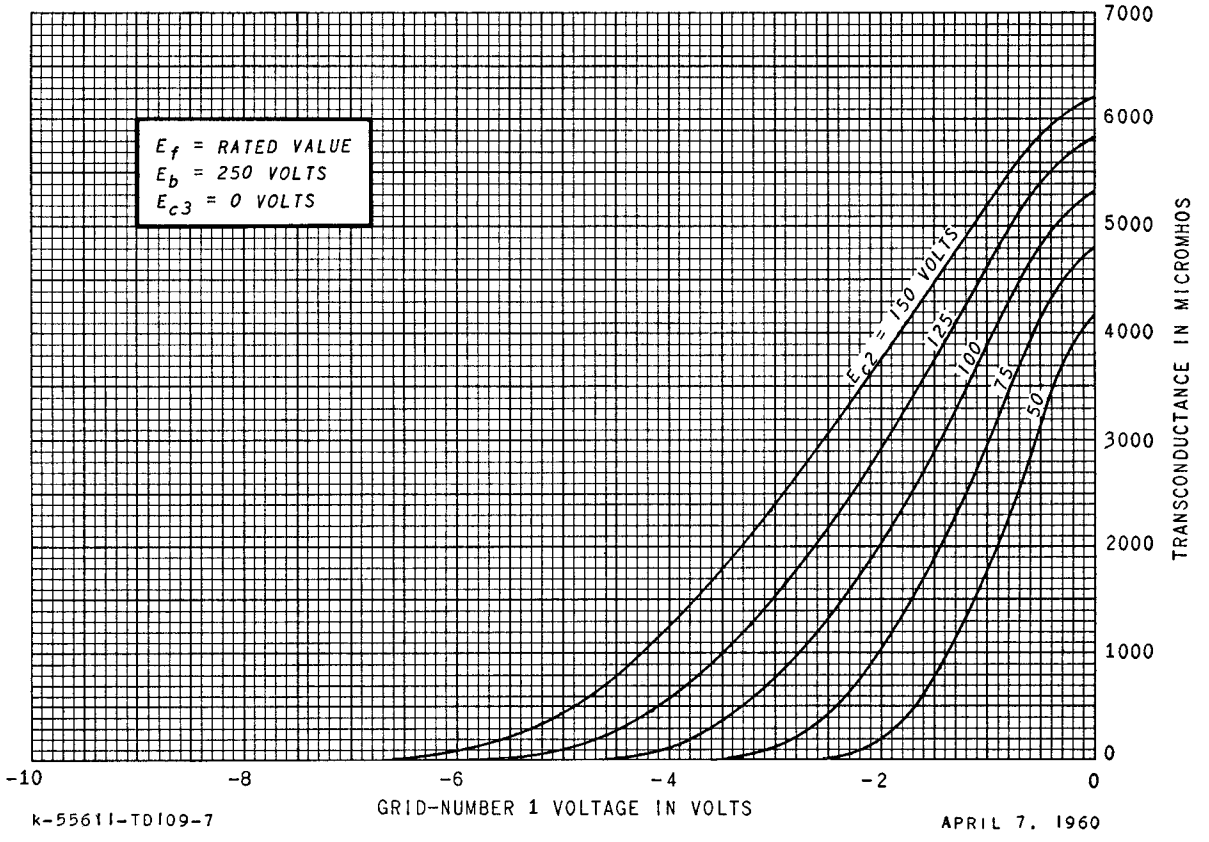
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TDI09-6

APRIL 7, 1960

AVERAGE TRANSFER CHARACTERISTICS



k-55611-TD109-7

APRIL 7, 1960

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6AU8-A

TRIODE—PENTODE

DESCRIPTION AND RATING

The 6AU8-A is a general-purpose miniature tube which contains a sharp-cut-off pentode and a medium-mu triode in one envelope. Each section has a separate cathode and is electrically independent.

The tube is suitable for a wide variety of general-purpose applications in both monochrome and color television receivers. The high figure of merit of the pentode section makes it particularly suited for service as a video amplifier, video intermediate-frequency amplifier, and sound intermediate-frequency amplifier. The triode section is intended for use as a sync amplifier, separator, or clipper, or as a sweep oscillator. The triode section may also be connected as a diode for video-detector applications, which adds to the over-all versatility of the tube.

In addition, the 6AU8-A, as a result of its controlled heater warm-up characteristic, is especially suited for use in television receivers that employ series-connected heaters. The 6AU8-A differs from the 6AU8 primarily by incorporating a controlled plate-knee characteristic.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Voltage, AC or DC . . . . . 6.3 Volts
Heater Current . . . . . 0.6 Amperes
Heater Warm-up Time* . . . . . 11 Seconds
Direct Interelectrode Capacitances†
- Pentode Section
  - Grid-Number 1 to Plate . . . . . 0.06 μμf
  - Input . . . . . 7.5 μμf
  - Output . . . . . 3.4 μμf
- Triode Section
  - Grid to Plate . . . . . 2.2 μμf
  - Input . . . . . 2.6 μμf
  - Output . . . . . 0.34 μμf
- Pentode Grid-Number 1 to Triode Plate, maximum . . . . . 0.006 μμf
- Triode Grid to Pentode Plate, maximum . . . . . 0.022 μμf
- Pentode Plate to Triode Plate, maximum . . . . . 0.12 μμf

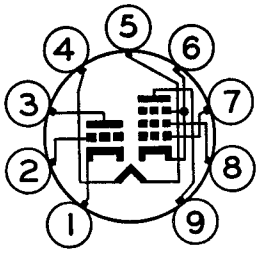
MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES	Pentode Section	Triode Section	
Plate Voltage	300	300	Volts
Screen-Supply Voltage	300	....	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.0	2.5	Watts
Screen Dissipation	1.0	....	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

BASING DIAGRAM

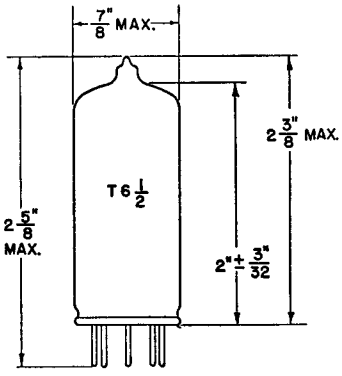


EIA 9DX

TERMINAL CONNECTIONS

Pin 1—Triode Cathode
Pin 2—Triode Grid
Pin 3—Triode Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 7—Pentode Grid Number 1
Pin 8—Pentode Grid Number 2 (Screen)
Pin 9—Pentode Plate

PHYSICAL DIMENSIONS



EIA 6-3

GENERAL ELECTRIC

Supersedes ET-T1406, dated 2-57

CHARACTERISTICS AND TYPICAL OPERATION

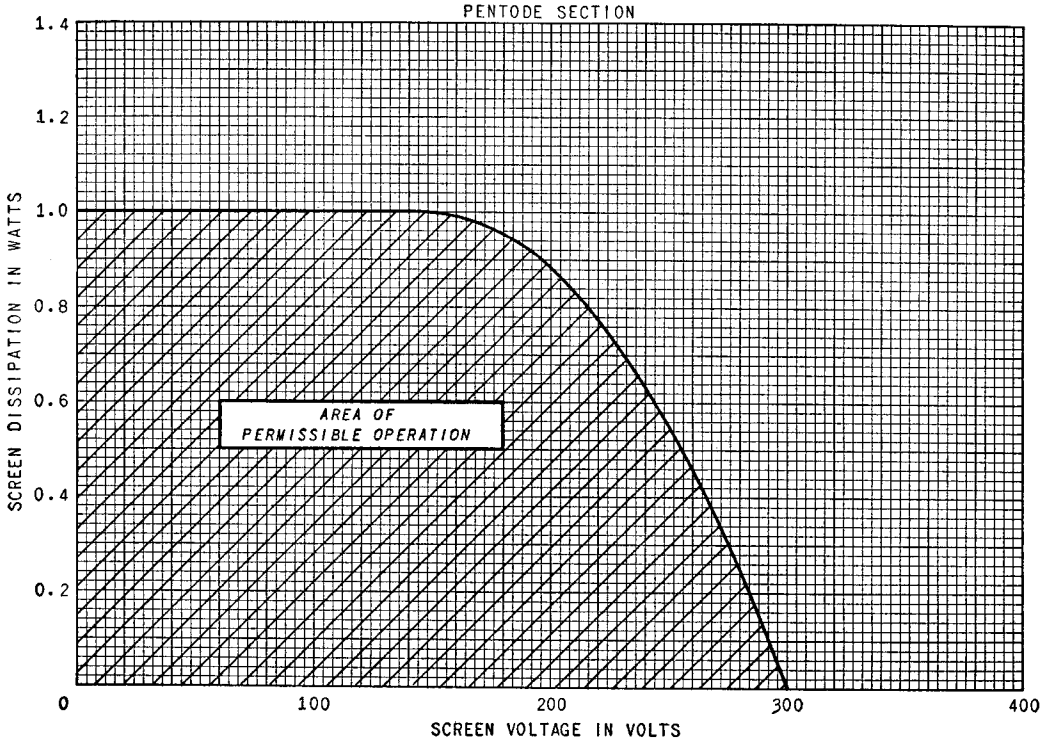
AVERAGE CHARACTERISTICS	Pentode Section		Triode Section	
Plate Voltage	200	40	150	Volts
Screen Voltage	125	125	....	Volts
Grid Voltage	....	0	....	
Cathode-Bias Resistor	82	....	150	Ohms
Amplification Factor	....	....	43	
Plate Resistance, approximate	100,000	....	8100	Ohms
Transconductance	8000	....	5300	Micromhos
Plate Current	17	30	9.5	Milliamperes
Screen Current	3.4	10.6	....	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	−7.5	....	−6.5	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

Note: The triode section of the 6AU8-A may be diode-connected and employed as a high-perveance diode in video detector applications. The diode operation can be obtained either with the triode grid connected to the triode plate and the combination operated as the plate of the diode, or with the triode plate grounded and the triode grid operated as the plate of the diode.

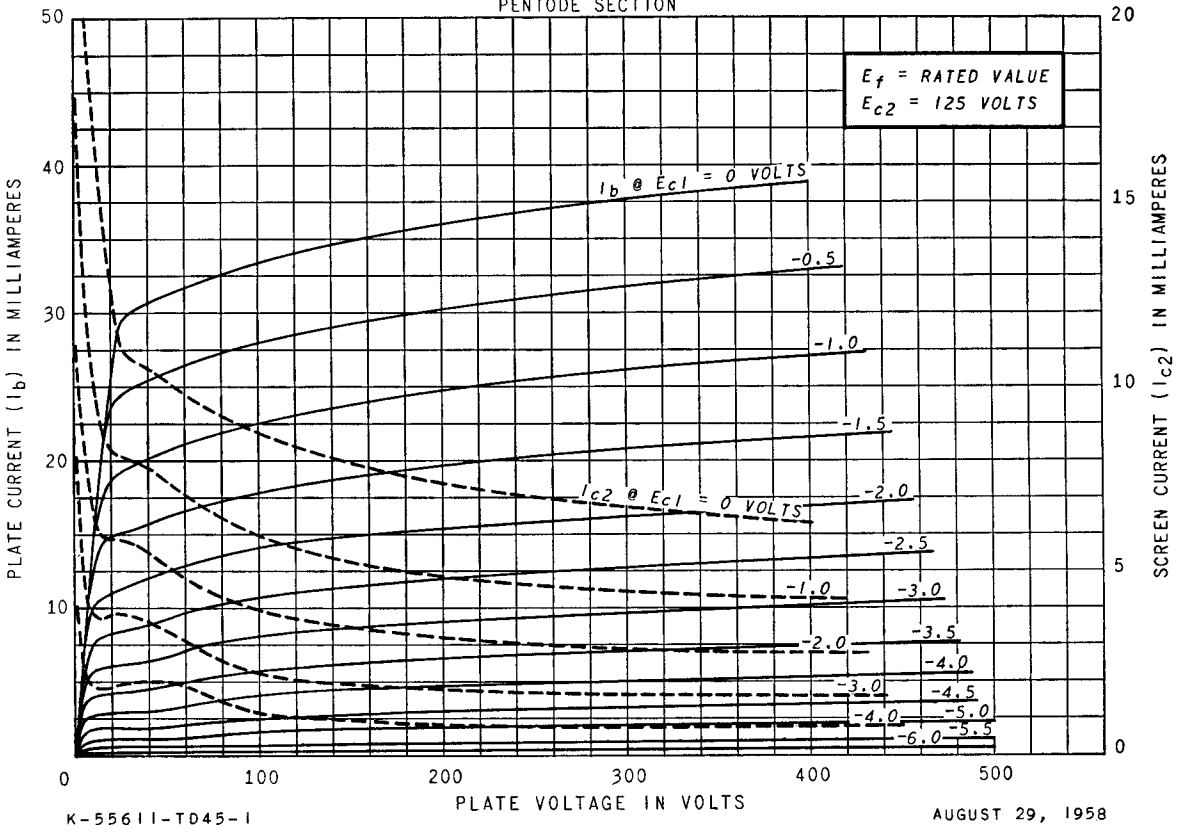
SCREEN RATING CHART



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AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

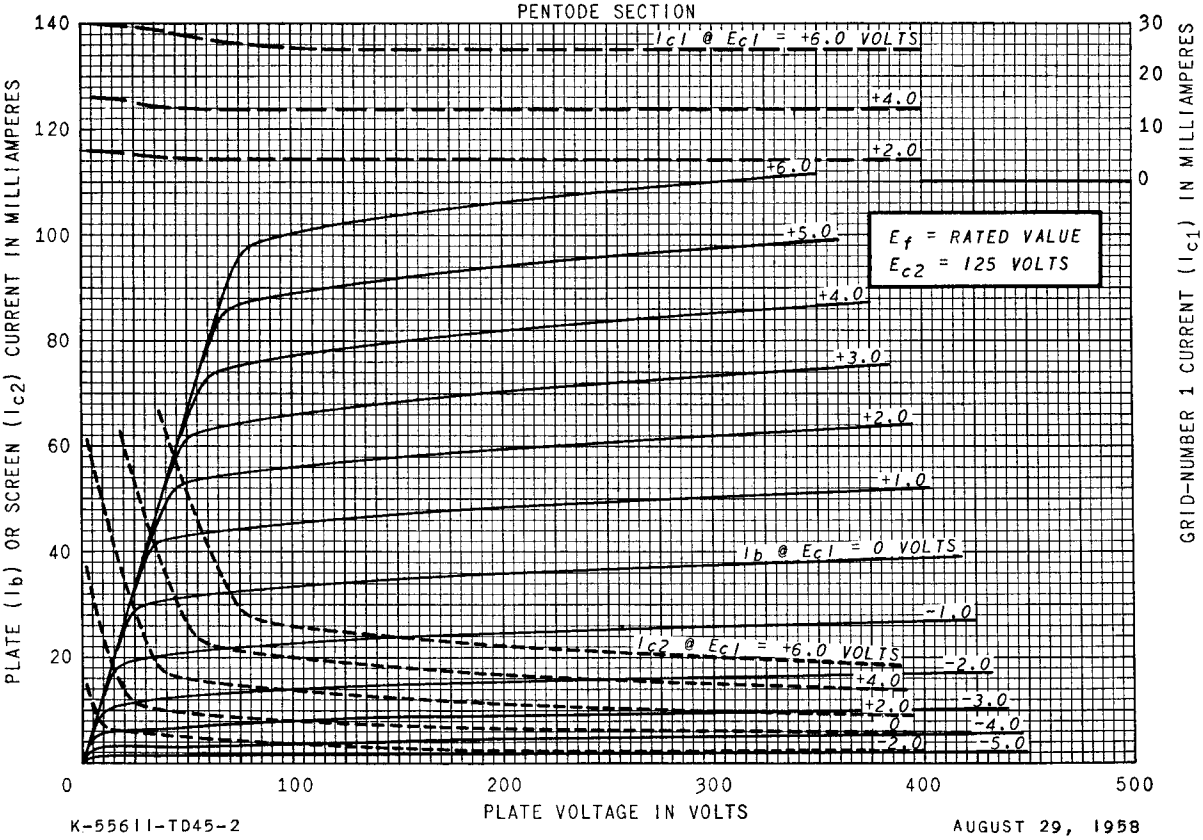


K-55611-TD45-1

AUGUST 29, 1958

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

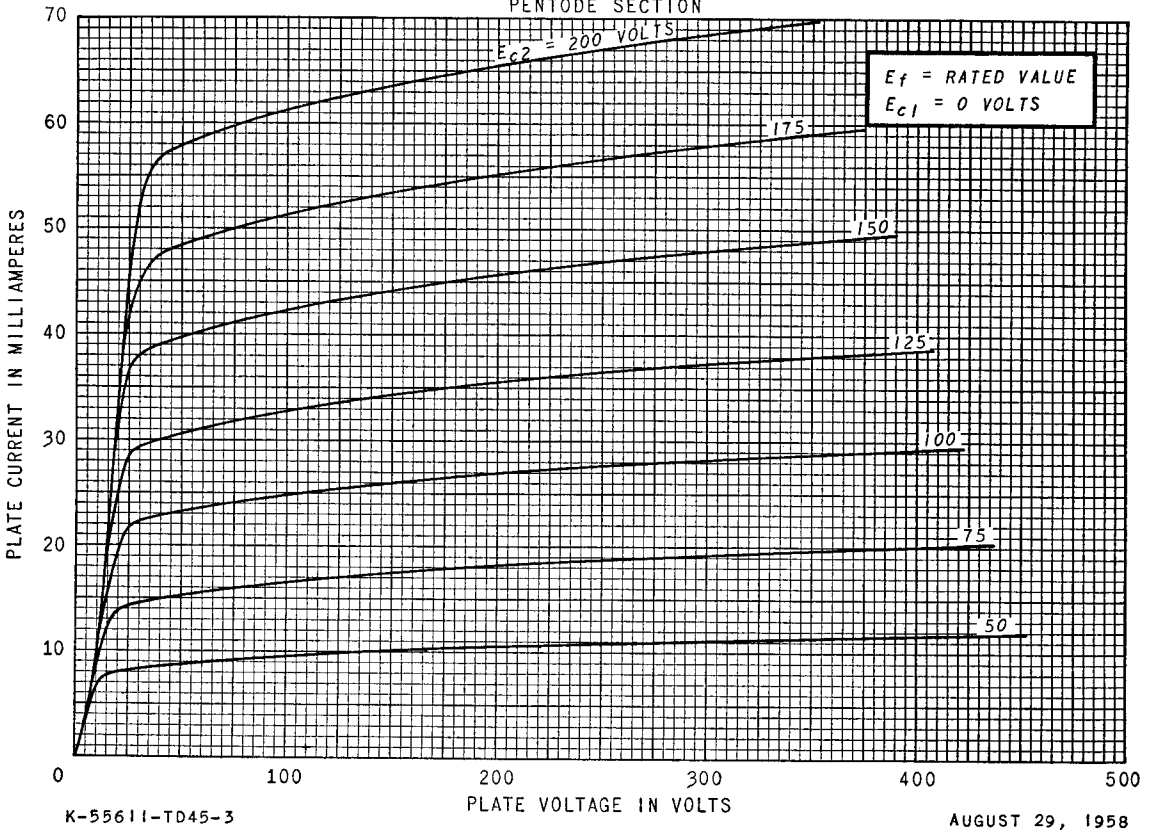


K-55611-TD45-2

AUGUST 29, 1958

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

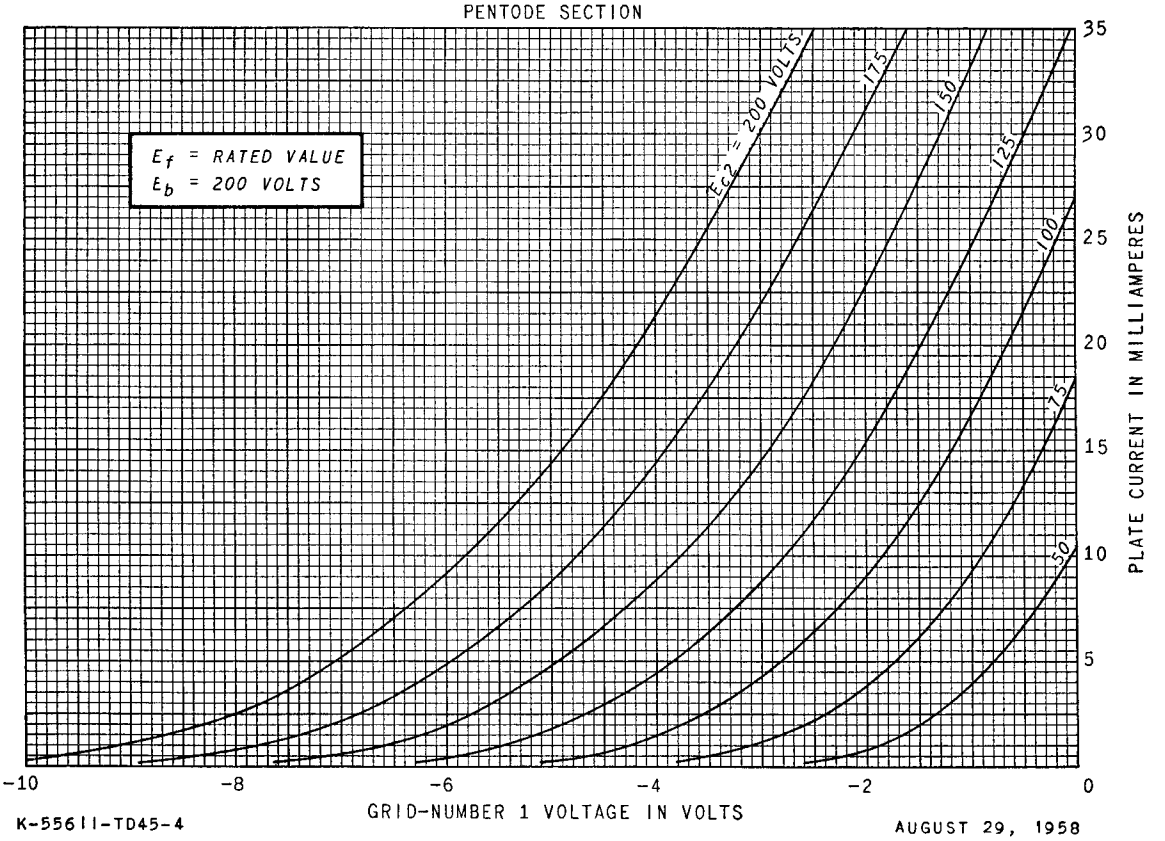


K-5561I-TD45-3

AUGUST 29, 1958

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

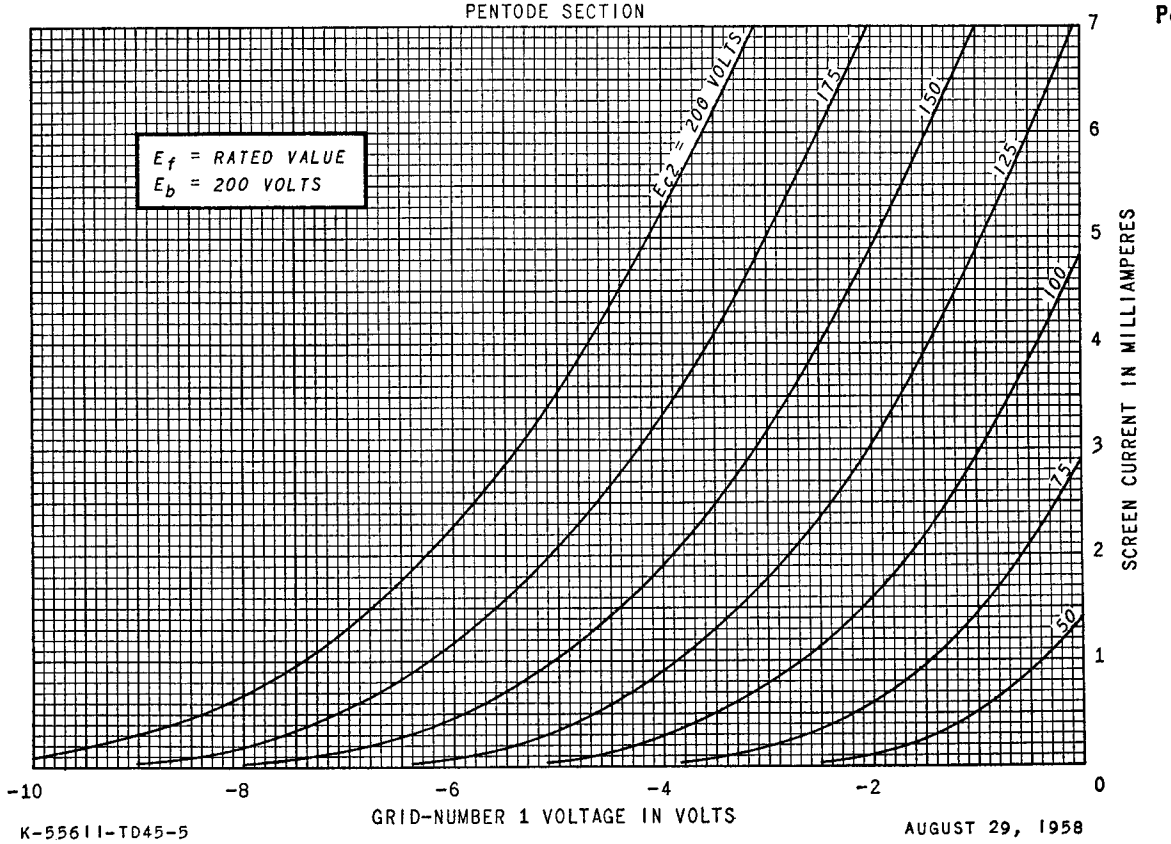


K-5561I-TD45-4

AUGUST 29, 1958

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

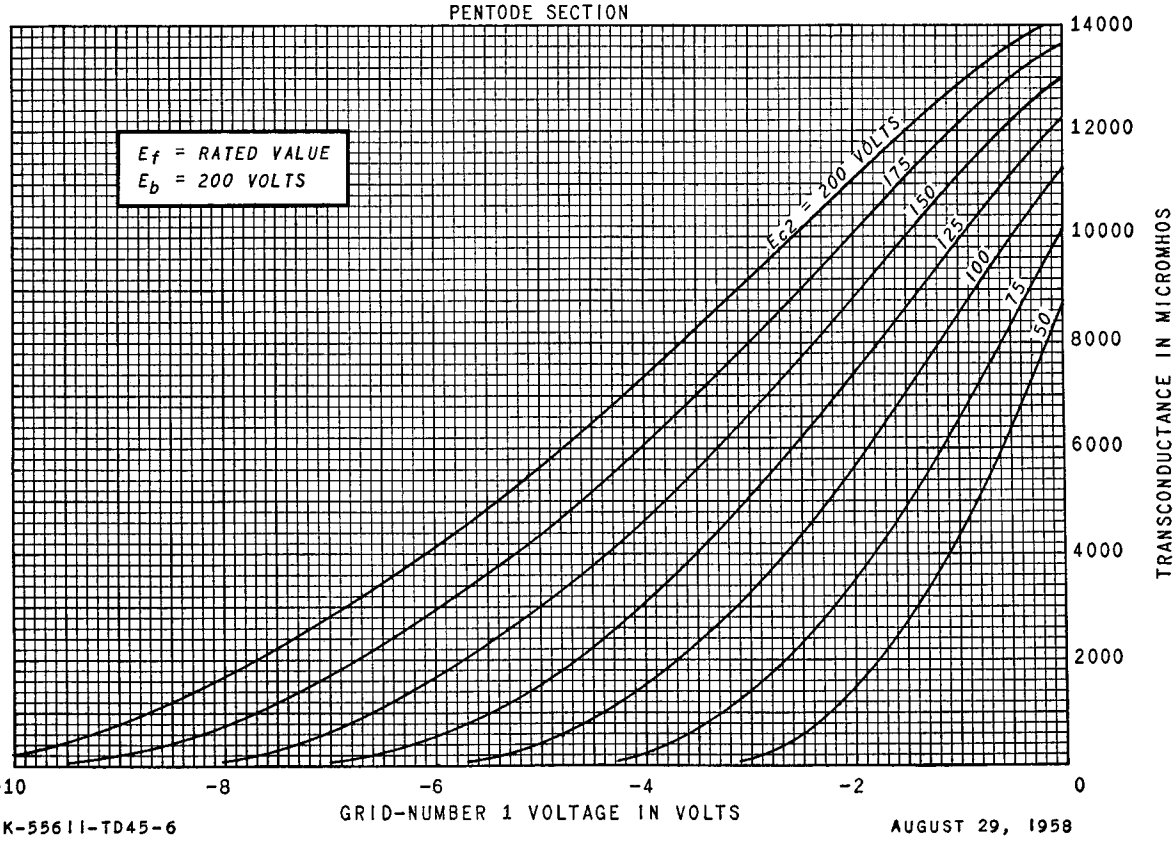


K-55611-TD45-5

AUGUST 29, 1958

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

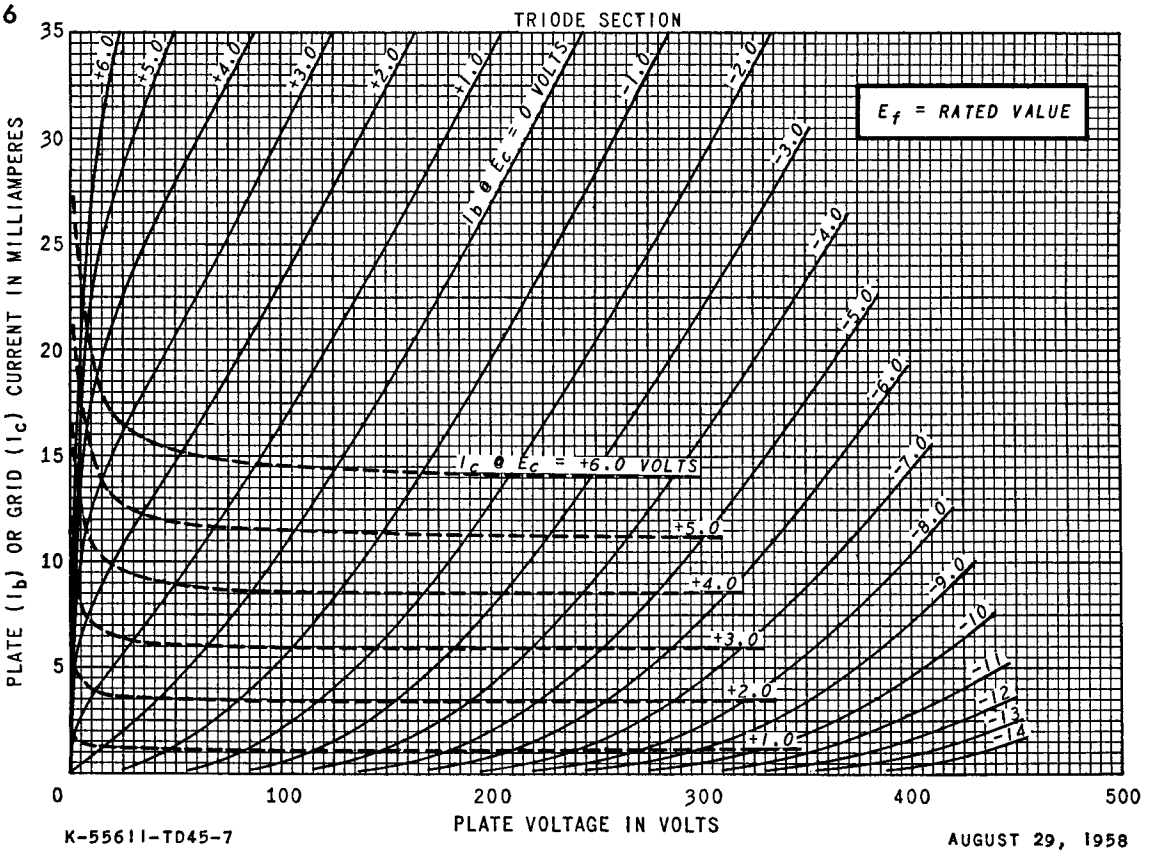


K-55611-TD45-6

AUGUST 29, 1958

AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION

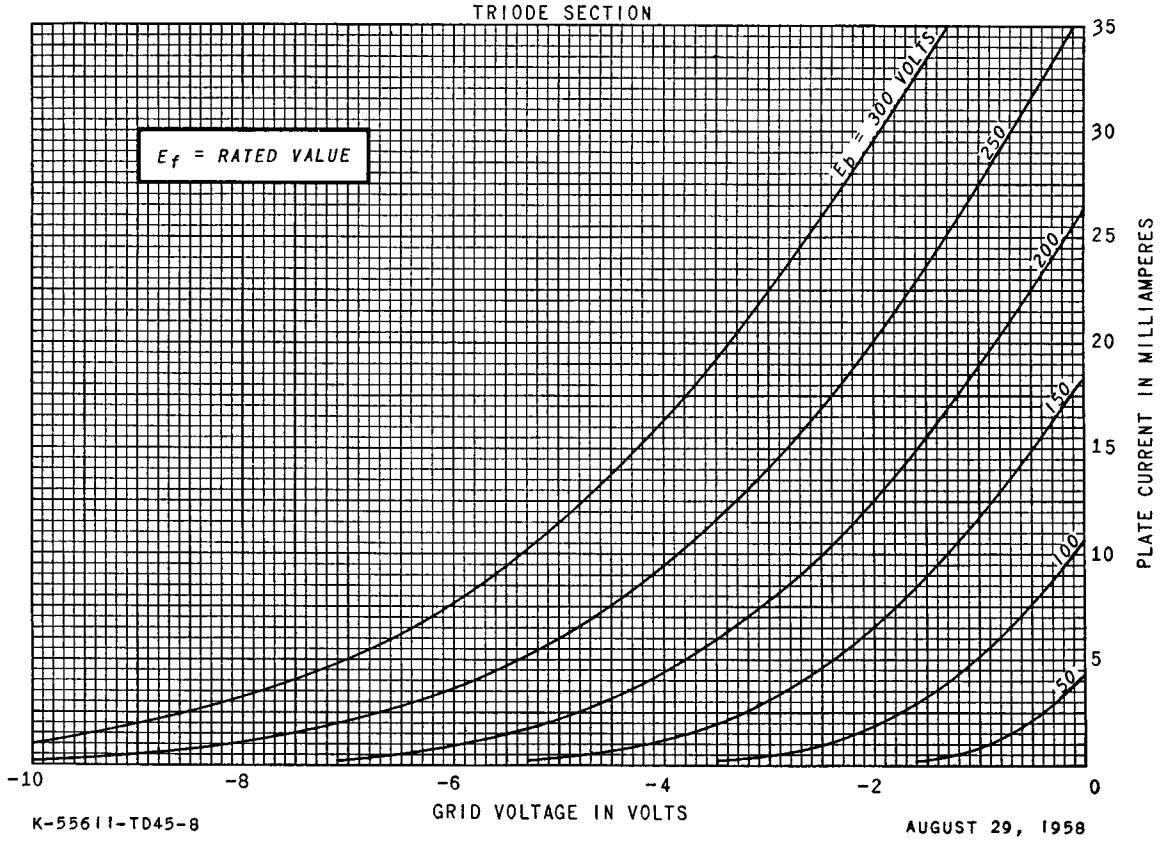


K-55611-TD45-7

AUGUST 29, 1958

AVERAGE TRANSFER CHARACTERISTICS

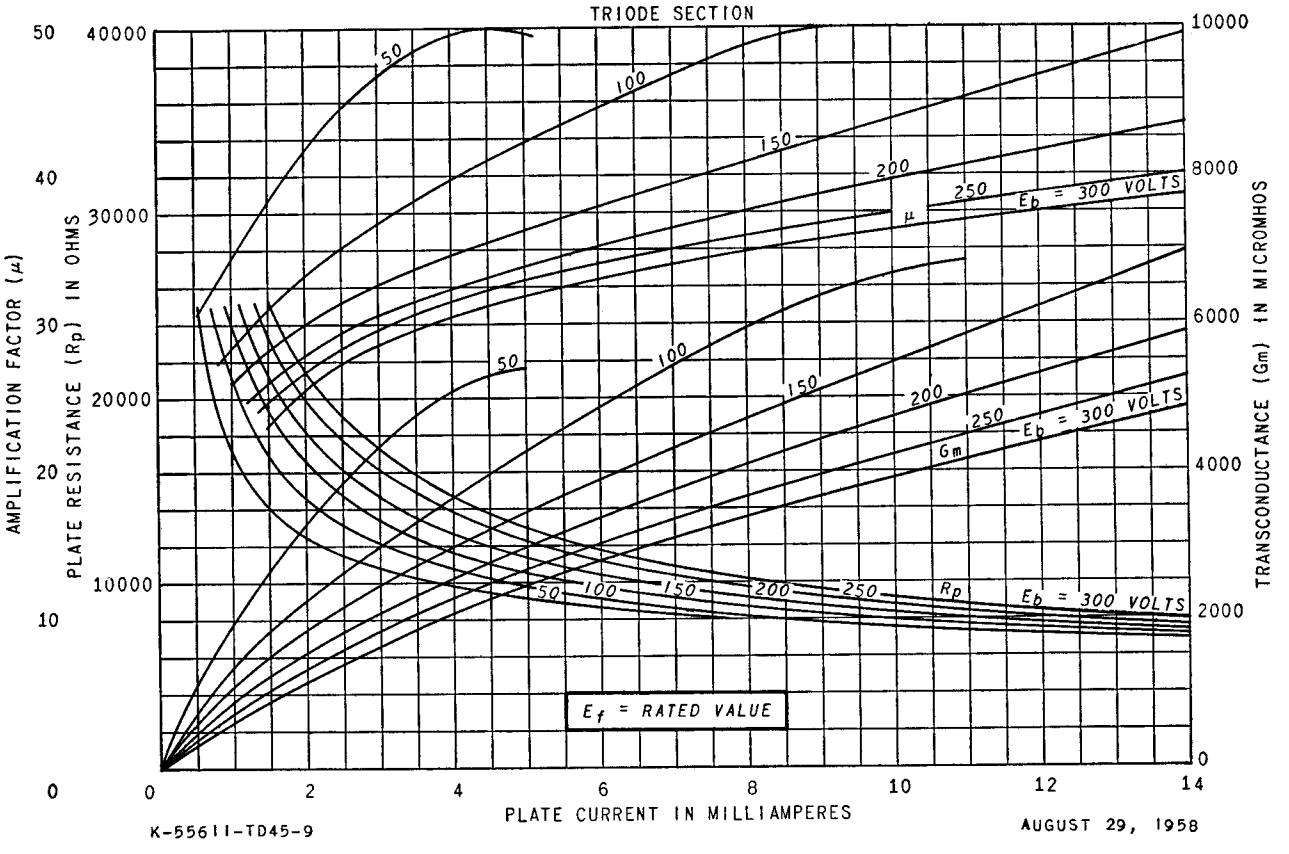
TRIODE SECTION



K-55611-TD45-8

AUGUST 29, 1958

AVERAGE CHARACTERISTICS



6AV11

COMPACTRON TRIPLE TRIODE

DESCRIPTION AND RATING

The 6AV11 is a compactron containing three medium-mu triodes suitable for general-purpose amplifier, phase inverter, or oscillator applications.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC†	6.3 ± 0.6	Volts
Heater Current‡	0.6	Amperes

Direct Interelectrode Capacitances§

	Section 1	Section 2	Section 3	
Grid to Plate (g to p)	1.2	1.2	1.2	pf
Input: g to (h+k+i.s.)	1.9	1.9	1.9	pf
Output: p to (h+k+i.s.)	1.8	0.7	2.0	pf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—E12-70, Button 12-Pin
Outline Drawing—EIA 9-56

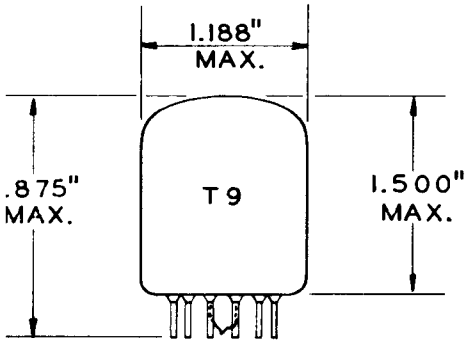
Maximum Diameter	1.188	Inches
Maximum Over-all Length	1.875	Inches
Maximum Seated Height	1.500	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330	Volts
Plate Dissipation	2.75	Watts
Total Plate Dissipation, All Plates	6.0	Watts
DC Cathode Current	20	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	1.0	Megohms

PHYSICAL DIMENSIONS

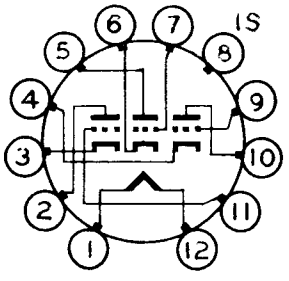


EIA 9-56

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—Plate (Section 3)
Pin 3—Cathode (Section 3)
Pin 4—Cathode (Section 1)
Pin 5—Plate (Section 2)
Pin 6—Cathode (Section 2)
Pin 7—Grid (Section 2)
Pin 8—Internal Shield
Pin 9—Grid (Section 1)
Pin 10—Plate (Section 1)
Pin 11—Grid (Section 3)
Pin 12—Heater

BASING DIAGRAM



EIA-12BY

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics, Each Section			
Plate Voltage	100	250	Volts
Grid Voltage	0	−8.5	Volts
Amplification Factor	20	17	
Plate Resistance, approximate	6500	7700	Ohms
Transconductance	3100	2200	Micromhos
Plate Current	11.8	10.5	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	....	−24	Volts

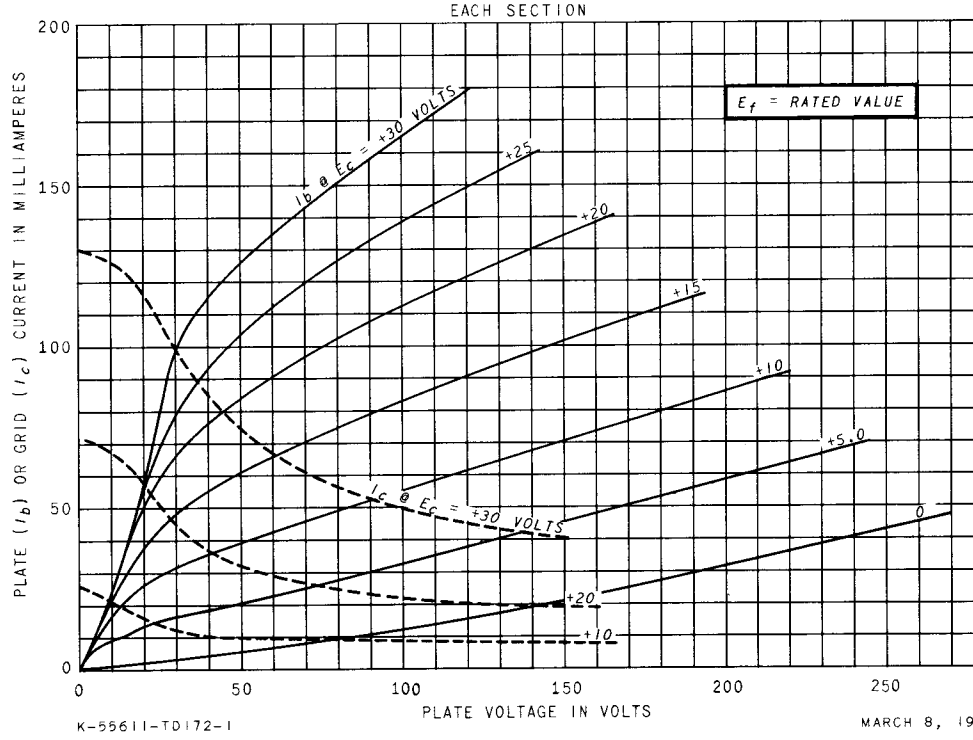
† The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

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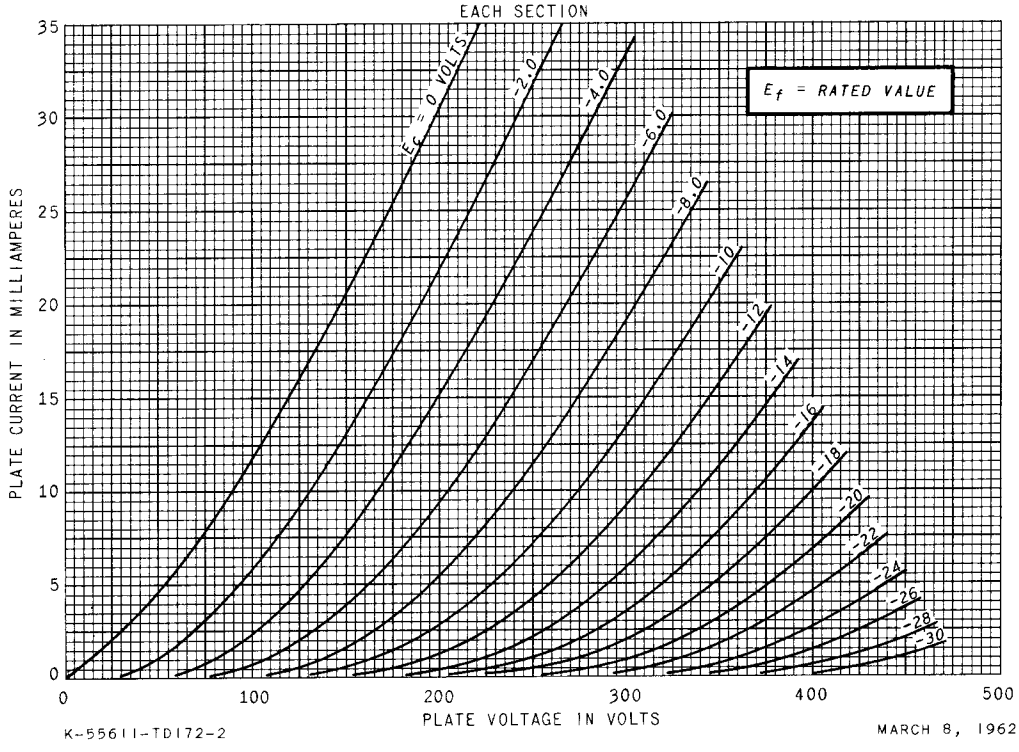
AVERAGE PLATE CHARACTERISTICS



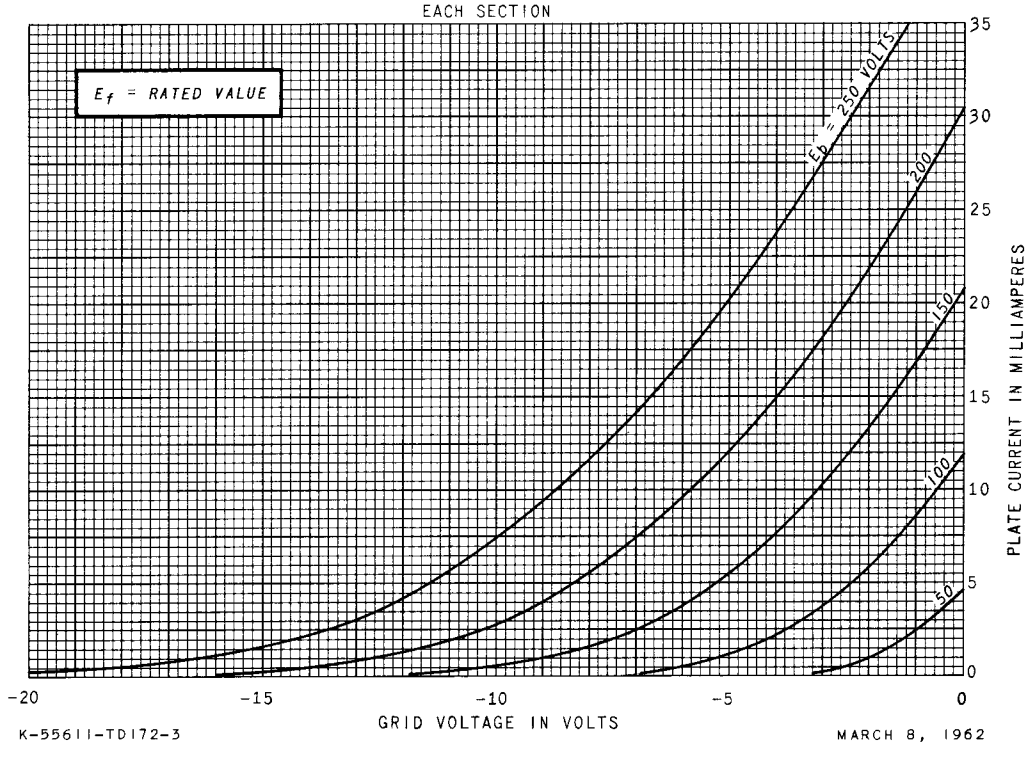
K-55611-TD172-1

MARCH 8, 1962

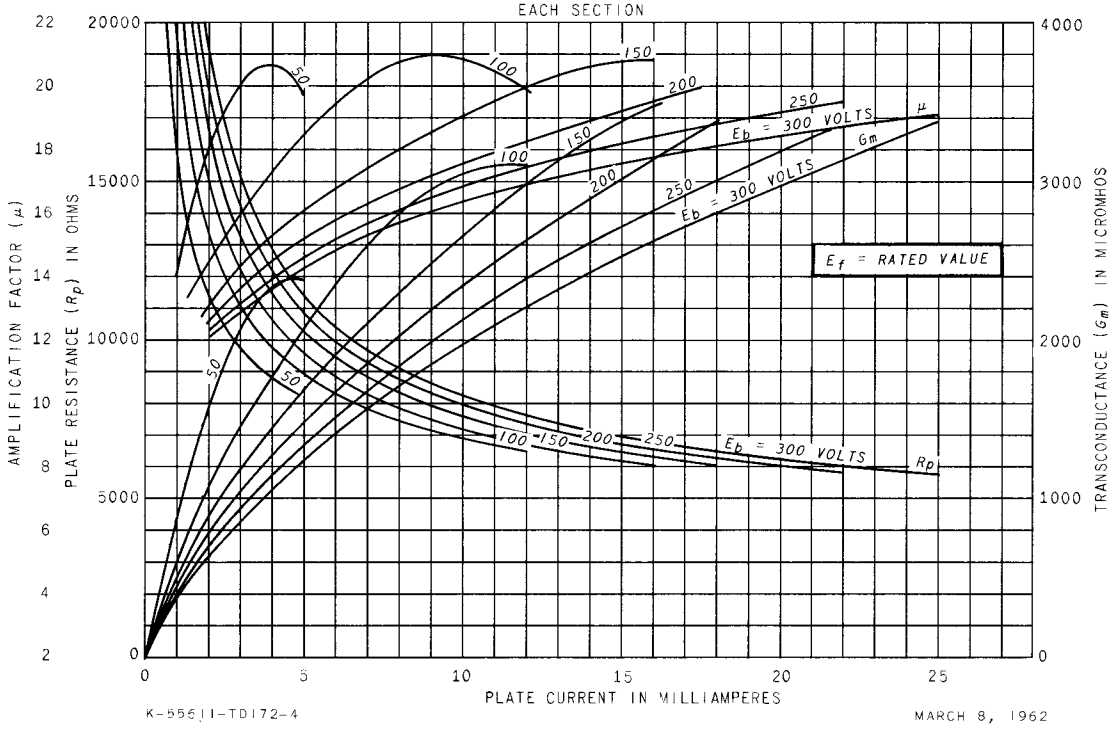
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

6AV5-GA—12AV5-GA
17AV5-GA—25AV5-GA

BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6AV5-GA is a beam pentode designed primarily for use as the horizontal-deflection amplifier in television receivers. The tube exhibits high perveance, high plate current at low plate and screen voltages, and a high ratio of plate to screen current.

Except for heater ratings, the 12AV5-GA, 17AV5-GA, and 25AV5-GA are identical to the 6AV5-GA. In addition, the 12AV5-GA and 17AV5-GA, which feature a controlled heater warm-up characteristic, are especially suited for use in television receivers with series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	6AV5-GA	12AV5-GA	17AV5-GA	25AV5-GA	
Heater Voltage, AC or DC	6.3	12.6	16.8	25.0	Volts
Heater Current	1.2	0.6	0.45	0.3	Amperes
Heater Warm-up Time*		11	11		Seconds
Direct Interelectrode Capacitances, approximate†					
Grid-Number 1 to Plate				0.5	μμf
Input				14	μμf
Output				7.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-11, or T-12, Glass
Base—B6-112 or B6-120, Short Medium-Shell Octal 6-Pin

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE‡

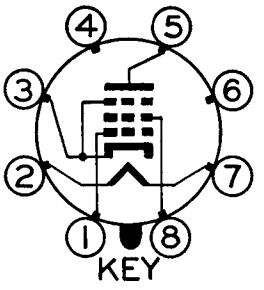
DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

DC Plate-Supply Voltage (Boost +DC Power Supply)	550	Volts
Peak Positive Pulse Plate Voltage	5500§	Volts
Peak Negative Pulse Plate Voltage	1250	Volts
Screen Voltage	175	Volts
Peak Negative Grid-Number 1 Voltage	300	Volts
Plate Dissipation△	11	Watts
Screen Dissipation	2.5	Watts
DC Cathode Current	110	Milliamperes
Peak Cathode Current	400	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	0.47	Megohms
Bulb Temperature at Hottest Point	210	C

GENERAL ELECTRIC

Supersedes ET-T902 dated 12-54

BASING DIAGRAM

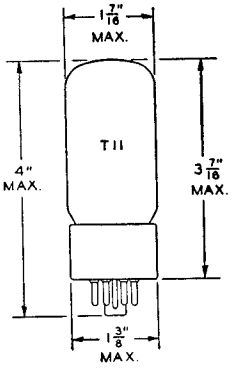


RETMA 6CK

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Heater
Pin 3—Cathode and Beam Plates
Pin 5—Plate
Pin 7—Heater
Pin 8—Grid Number 2 (Screen)

PHYSICAL DIMENSIONS



T-11 Version

T-12 version is identical except that the maximum bulb diameter is 1 5/16 inches.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	60	250	Volts
Screen Voltage	150	150	Volts
Grid-Number 1 Voltage	0◆	−22.5	Volts
Plate Resistance, approximate	—	14500	Ohms
Transconductance	—	5900	Micromhos
Plate Current	260	57	Milliamperes
Screen Current	26	2.1	Milliamperes
Grid-Number 1 Voltage, approximate I_b = 1.0 Milliampere	—	−43	Volts
Triode Amplification Factor**	—	4.3	

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

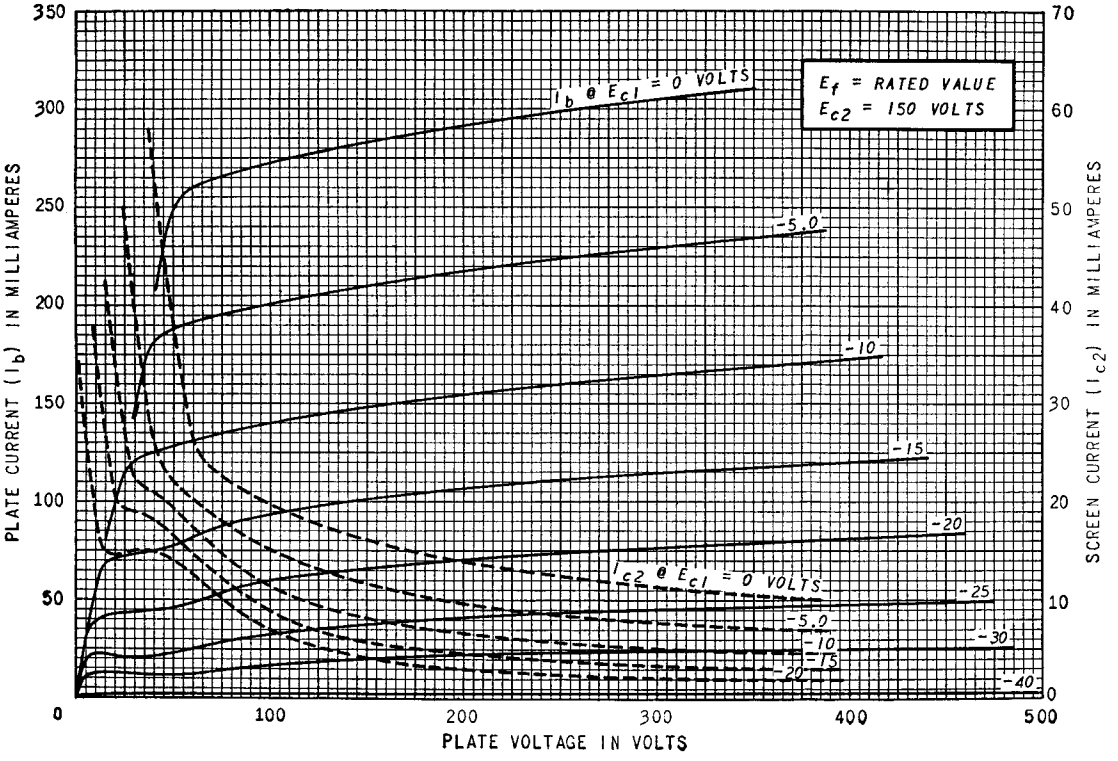
§ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

△In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

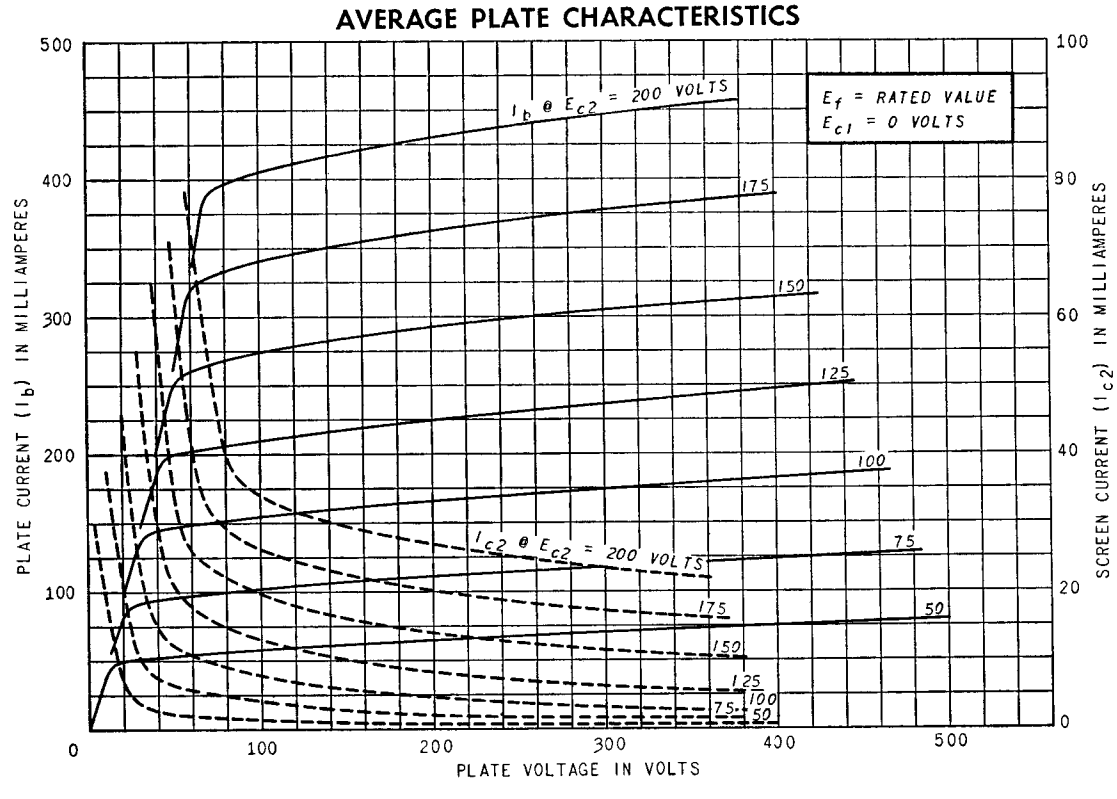
◆ Applied for short interval (two seconds maximum) so as not to damage tube.

**Triode connection (screen tied to plate) with Eb = Ec2 = 150 volts and Ec1 = −22.5 volts.

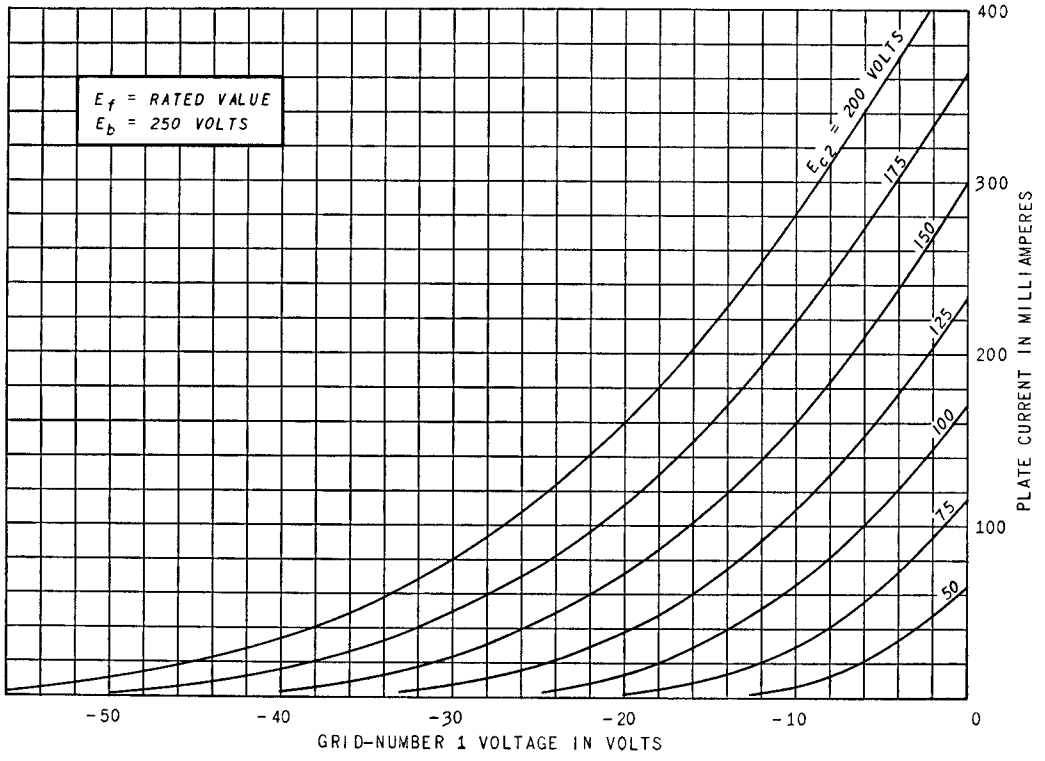
AVERAGE PLATE CHARACTERISTICS



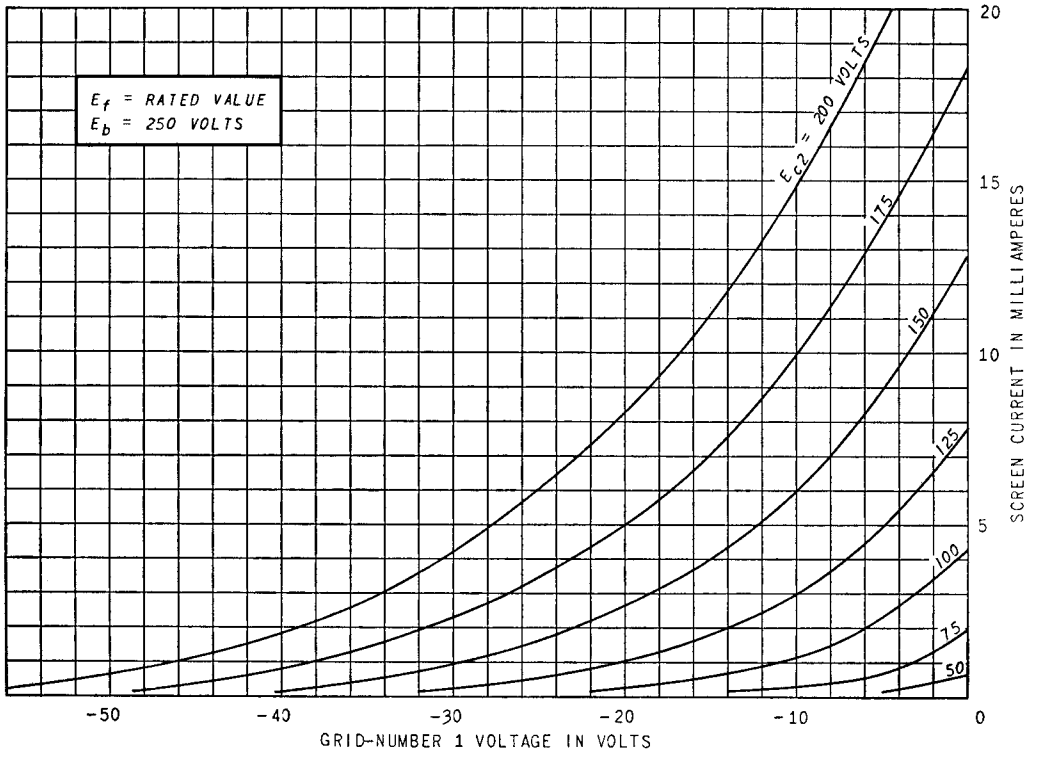
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6AV6—3AV6—12AV6

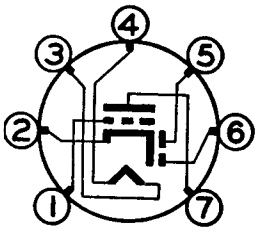
DUPLEX-DIODE TRIODE

DESCRIPTION AND RATING

The 6AV6 is a miniature duplex-diode, high-mu triode intended primarily for use as a combined detector, amplifier, and automatic-volume-control tube in radio receivers. The triode section incorporates a high amplification factor and is capable of providing a relatively large undistorted output voltage from a very small input signal.

The 3AV6, 6AV6, and 12AV6 are alike except for heater ratings and heater-cathode voltage ratings. The 12AV6 is particularly suited for use in a-c/d-c radio receivers. The 3AV6, as a result of its controlled heater warm-up characteristic, is especially well suited for use in television receivers which employ series-connected heaters. When the 3AV6 is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

BASING DIAGRAM



RETMA 7BT

TERMINAL CONNECTIONS

Pin 1—Triode Grid
Pin 2—Cathode
Pin 3—Heater
Pin 4—Heater
Pin 5—Diode Number 2 Plate
Pin 6—Diode Number 1 Plate
Pin 7—Triode Plate

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	3AV6	6AV6	12AV6
Heater Voltage, AC or DC	3.15	6.3	12.6 Volts
Heater Current	0.6	0.3	0.15 Amperes
Heater Warm-up Time*	11	...	....Seconds
Direct Interelectrode Capacitances	With Shield†		Without Shield
Triode Grid to Plate	2.0		2.0 μμf
Triode Input	2.2		2.2 μμf
Triode Output	1.2		0.8 μμf
Grid to Diode-Number 2 Plate, maximum	0.04		0.04 μμf

Mechanical

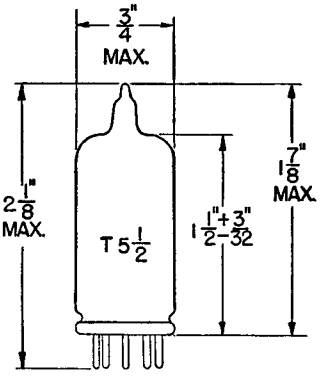
Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage		300	Volts
Positive DC Grid Voltage		0	Volts
Plate Dissipation		0.5	Watts
Heater-Cathode Voltage	3AV6	6AV6 12AV6	
Heater Positive with Respect to Cathode			
DC Component	100	...	Volts
Total DC and Peak	200	90	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	90	Volts
Diode Current for Continuous Operation, Each Diode	1.0	1.0	Milliamperes

PHYSICAL DIMENSIONS



RETMA 5-2

GENERAL ELECTRIC

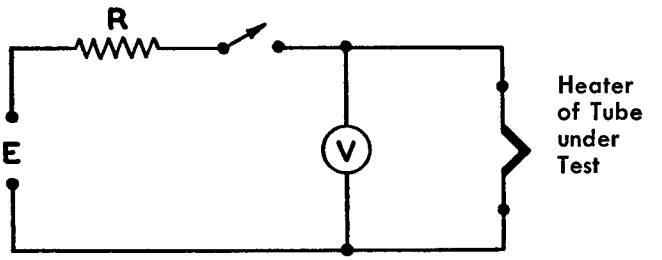
Supersedes ET-T814, dated 6-53

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	100	250	Volts
Grid Voltage	−1	−2	Volts
Amplification Factor	100	100	
Plate Resistance, approximate	80000	62500	Ohms
Transconductance	1250	1600	Micromhos
Plate Current	0.5	1.2	Milliamperes
Average Diode Current, Each Diode With 10 Volts DC Applied		2.0	Milliamperes

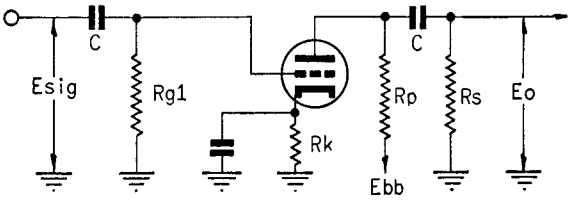
* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals (V) to increase from zero to the heater test voltage (V_1). For this type, E = 12.5 volts (RMS or DC), V_1 = 2.5 volts (RMS or DC), and R = 15.8 ohms.



† With external shield (RETMA 316) connected to pin 2.

CLASS A RESISTANCE-COUPLED AMPLIFIER

Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	0.10	0.10	1400	31	3.9	900	41	12	780	45	24
0.10	0.24	0.10	1600	37	5.4	1100	47	16	910	52	34
0.24	0.24	0.10	2500	39	5.0	2000	51	14	1500	56	30
0.24	0.51	0.10	3400	43	6.6	2300	55	19	1700	60	38
0.51	0.51	0.10	5800	45	5.6	4000	55	16	2800	61	31
0.51	1.0	0.10	7100	47	7.3	4600	58	20	3500	63	40
0.24	0.24	10	0	34	3.3	0	50	13	0	60	28
0.24	0.51	10	0	41	4.6	0	56	17	0	64	37
0.51	0.51	10	0	39	4.2	0	55	15	0	65	30
0.51	1.0	10	0	42	5.4	0	61	18	0	67	37

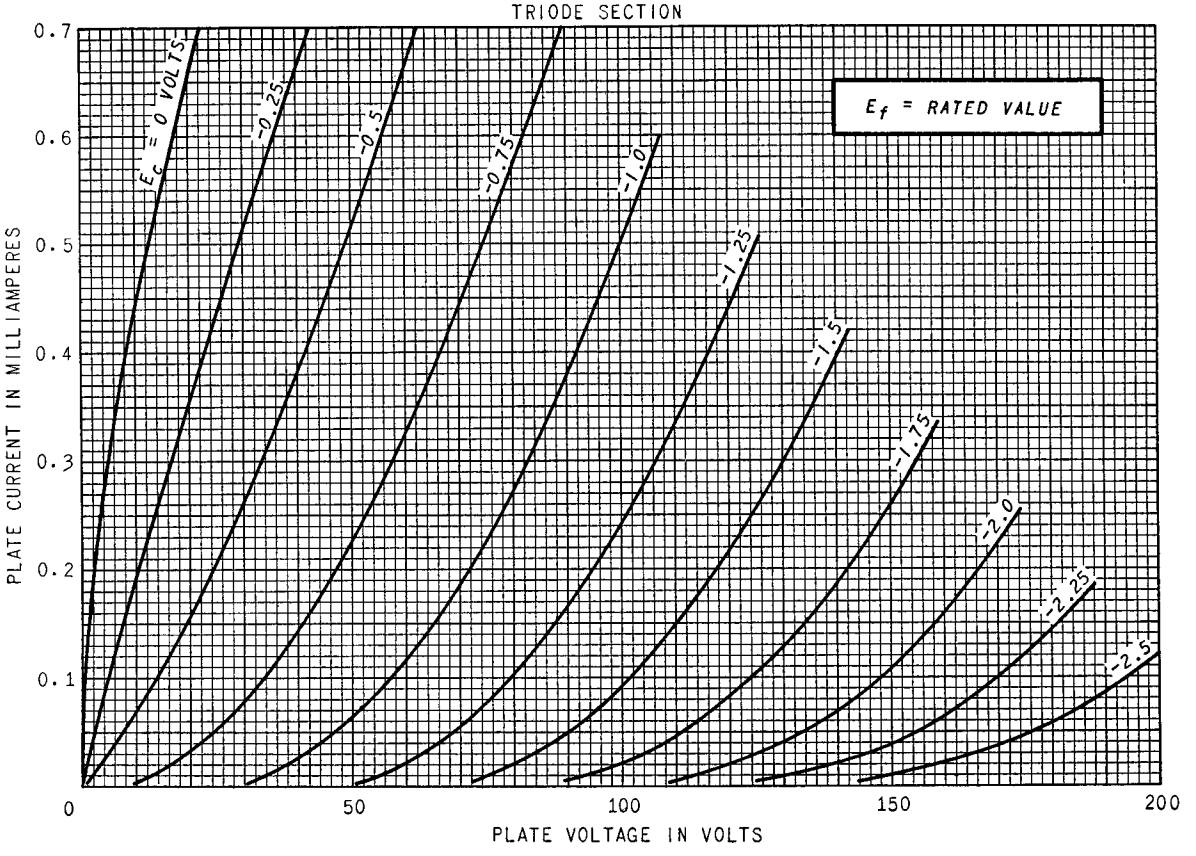


Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

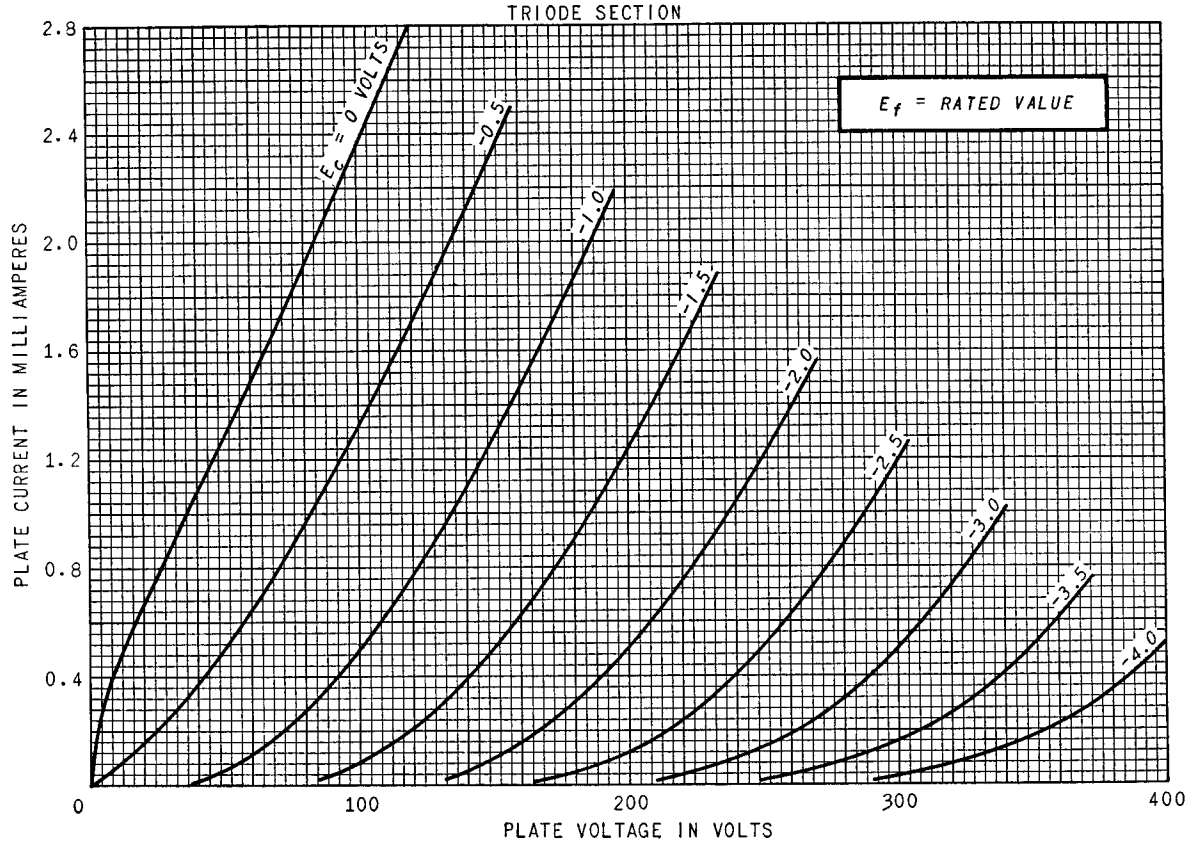
AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION

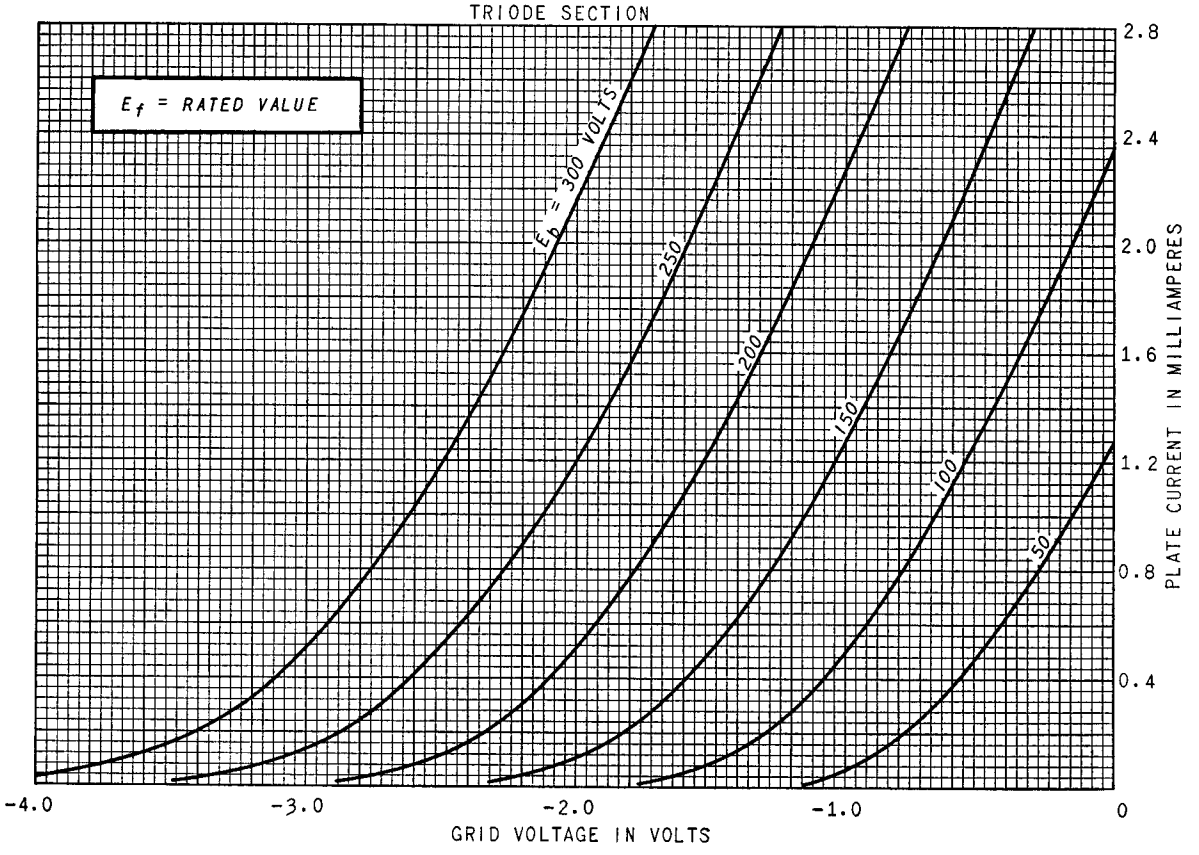


AVERAGE PLATE CHARACTERISTICS

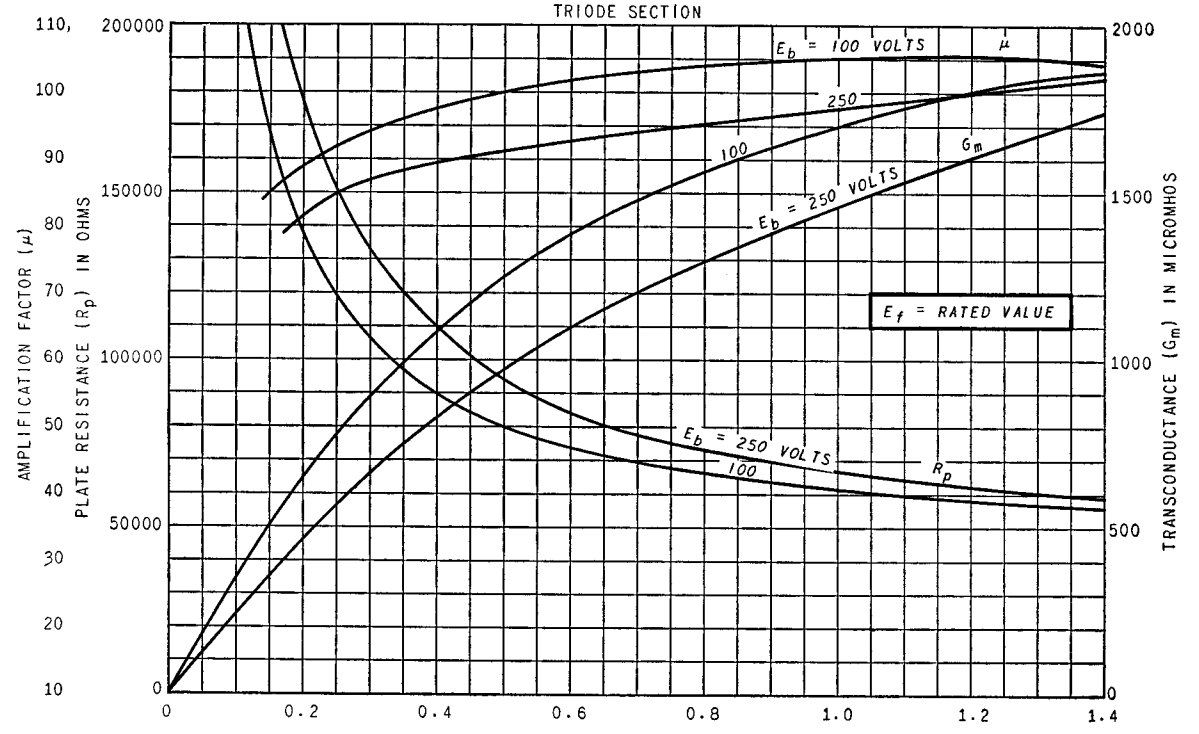
TRIODE SECTION



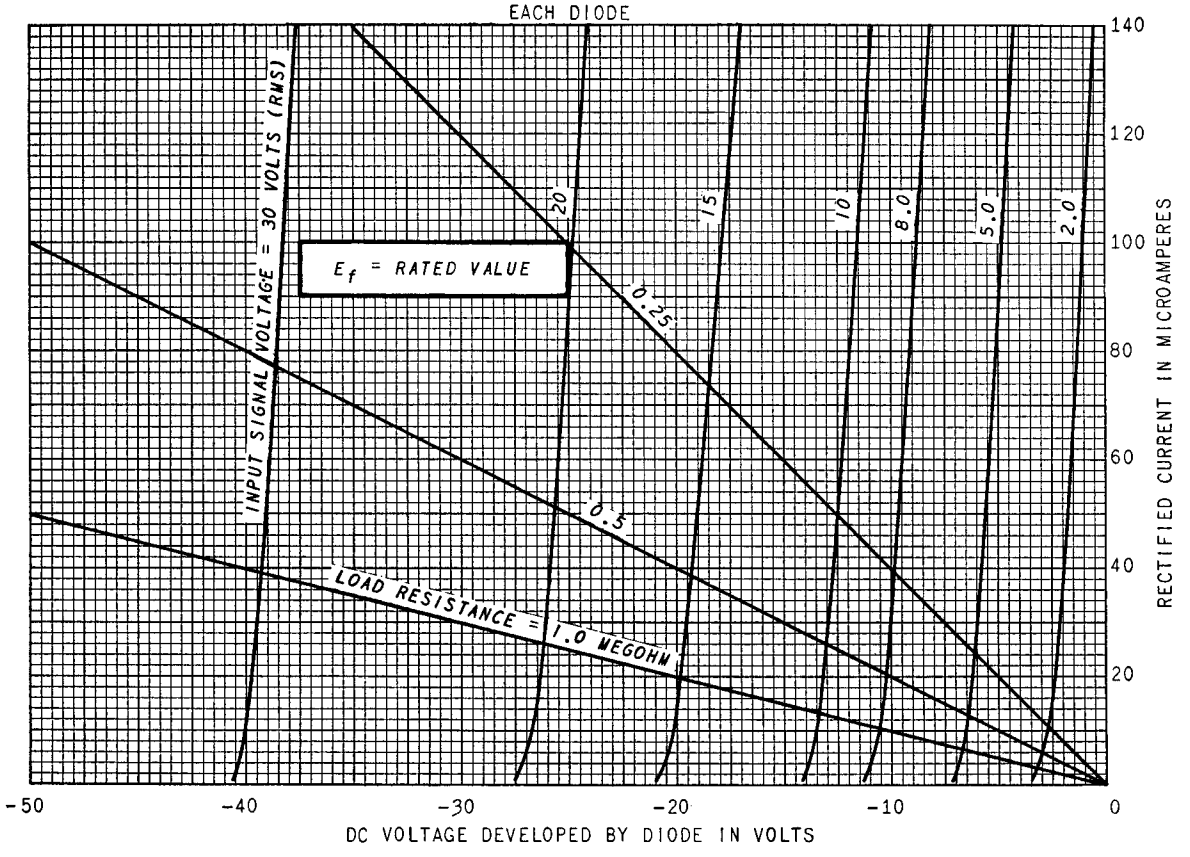
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



OPERATION CHARACTERISTICS



Electronic TUBES

6AW8-A—8AW8-A

TRIODE-PENTODE

DESCRIPTION AND RATING

The 6AW8-A is a miniature tube containing a high-mu triode and a sharp-cutoff pentode. The triode section is intended for service as a sync separator and the pentode section as a video amplifier. As a result of its controlled heater-warm-up characteristic, the 6AW8-A is especially suited for use in television receivers which employ 600-milliampere, series-connected heaters. The 6AW8-A differs from the 6AW8 by incorporating a controlled plate-knee characteristic.

Except for heater ratings, the 8AW8-A is identical to the 6AW8-A. It is specially designed for use in television receivers which employ 450-milliampere, series-connected heaters.

GENERAL

ELECTRICAL

	6AW8-A	8AW8-A	
Cathode—Coated Unipotential			
Heater Voltage	6.3	8.4	Volts
Heater Current	0.6	0.45	Amperes
Heater Warm-up Time*	11	11	Seconds
Direct Interelectrode Capacitances	With Shield†	Without Shield	
Pentode Section			
Grid-Number 1 to Plate	0.03	0.04	μμf
Input	10	10	μμf
Output	4.5	3.6	μμf
Triode Section			
Grid to Plate	2.2	2.2	μμf
Input	3.4	3.2	μμf
Output	1.7	0.32	μμf
Pentode Grid-Number 1 to Triode Plate	0.003	0.006	μμf
Triode Grid to Pentode Plate	0.006	0.016	μμf
Pentode Plate to Triode Plate	0.023	0.150	μμf

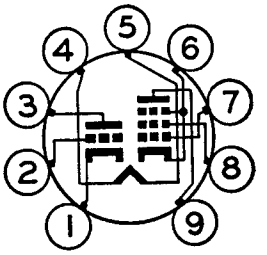
MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES	Pentode Section	Triode Section	
Plate Voltage	300	300	Volts
Screen-Supply Voltage	300	.....	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Negative DC Grid-Number 1 Voltage	50	.....	Volts
Plate Dissipation	3.25	1.0	Watts
Screen Dissipation	1.0	.....	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

BASING DIAGRAM

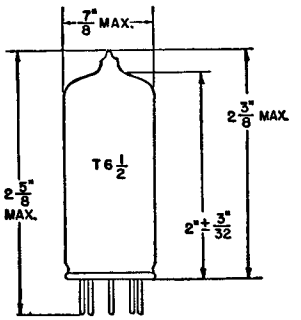


EIA 9DX

TERMINAL CONNECTIONS

Pin 1—Triode Cathode
Pin 2—Triode Grid
Pin 3—Triode Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 7—Pentode Grid Number 1
Pin 8—Pentode Grid Number 2 (Screen)
Pin 9—Pentode Plate

PHYSICAL DIMENSIONS



EIA 6-3

GENERAL ELECTRIC

△Supersedes pages 1 and 2, dated 6-56

TRIODE-PENTODE

DESCRIPTION AND RATING

The 6AW8-A is a miniature tube containing a high-mu triode and a sharp-cutoff pentode. The triode section is intended for service as a sync separator and the pentode section as a video amplifier. As a result of its controlled heater-warm-up characteristic, the 6AW8-A is especially suited for use in television receivers which employ 600-milliampere, series-connected heaters. The 6AW8-A differs from the 6AW8 by incorporating a controlled plate-knee characteristic.

GENERAL

ELECTRICAL

	Series Heater Operation	Parallel Heater Operation	
Cathode—Coated Unipotential			
Heater Characteristics and Ratings			
Heater Voltage, AC or DC	6.3*	6.3 ± 0.6‡	Volts
Heater Current	0.6 ± 0.04†	0.6§	Amperes
Heater Warm-up Time¶	11		Seconds

Direct Interelectrode Capacitances	With Shield#	Without Shield	
Pentode Section			
Grid-Number 1 to Plate: (Pg1 to Pp), maximum	0.04	0.05	pf
Input: Pg 1 to (h+Pk+Pg2+Pg3+i.s.)	10	10	pf
Output: Pp to (h+Pk+Pg2+Pg3+i.s.)	4.5	3.6	pf
Triode Section			
Grid to Plate: (Tg to Tp)	2.2	2.2	pf
Input: Tg to (h+Tk)	3.4	3.2	pf
Output: Tp to (h+Tk)	3.0	1.8	pf
Pentode Grid-Number 1 to Triode Plate: (Pg1 to Tp), maximum	0.005	0.008	pf
Pentode Plate to Triode Plate: (Pp to Tp), maximum	0.025	0.150	pf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

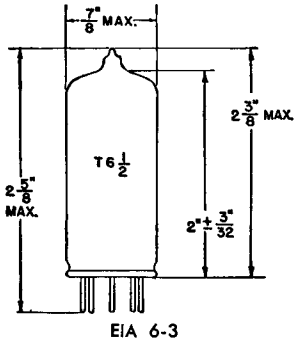
	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen-Supply Voltage	330	...	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.75	1.1	Watts
Screen Dissipation	1.1	...	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

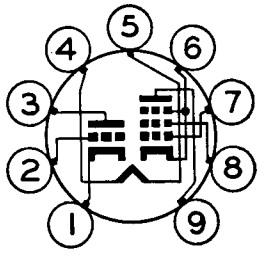


EIA 6-3

TERMINAL CONNECTIONS

Pin 1—Triode Cathode
Pin 2—Triode Grid
Pin 3—Triode Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 7—Pentode Grid Number 1
Pin 8—Pentode Grid Number 2 (Screen)
Pin 9—Pentode Plate

BASING DIAGRAM



EIA 9DX

GENERAL ELECTRIC

Supersedes ET-T1414 dated 9-57

CHARACTERISTICS AND TYPICAL OPERATION

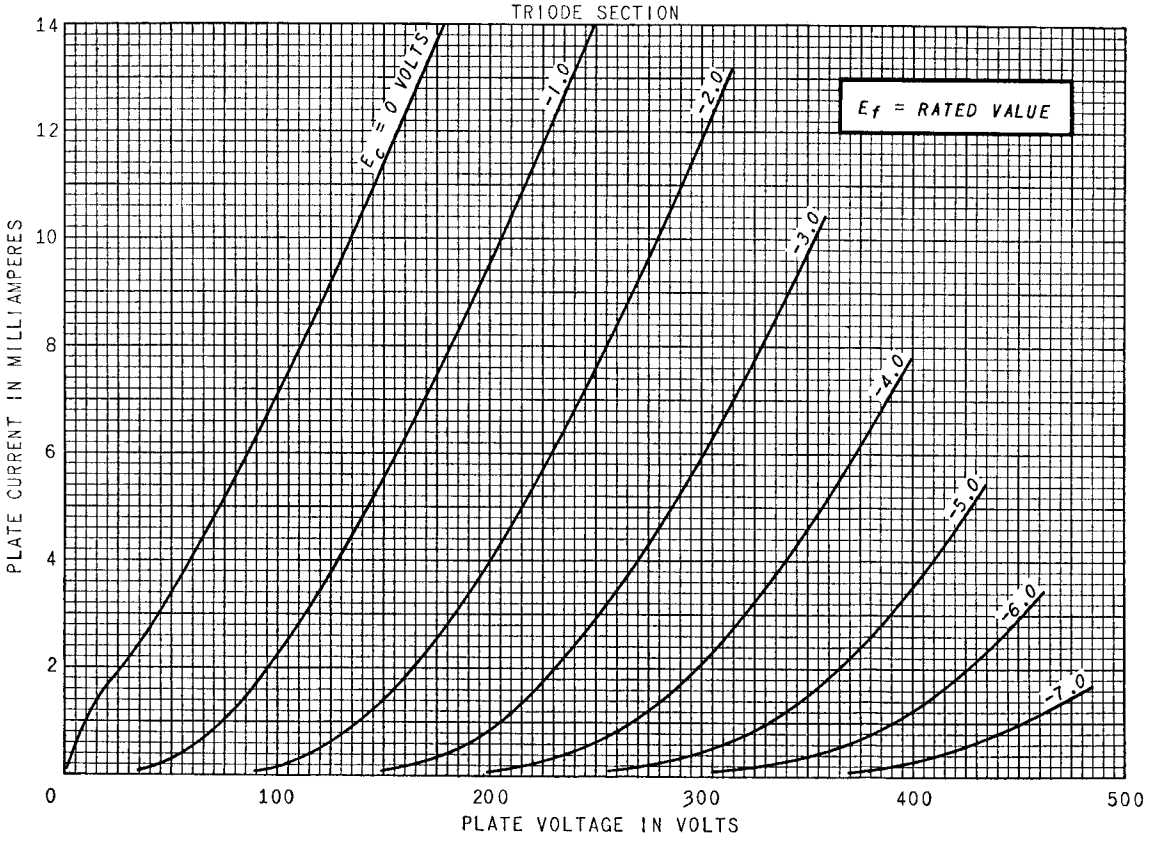
CLASS A_1 AMPLIFIER		**Pentode Section**	**Triode Section**	
Plate Voltage	65	200	200	Volts
Screen Voltage	150	150	....	Volts
Grid-Number 1 Voltage	0‡	....	−2.0	Volts
Cathode-Bias Resistor	....	180	....	Ohms
Amplification Factor	....	....	70	
Plate Resistance, approximate	....	400000	17500	Ohms
Transconductance	....	9000	4000	Micromhos
Plate Current	42	13	4.0	Milliamperes
Screen Current	12.5	3.5	....	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	....	−10	−5	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (EIA 315) connected to cathode of section under test.

‡ Applied for short interval (two seconds maximum) so as not to damage tube.

AVERAGE PLATE CHARACTERISTICS



CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER	Pentode Section	Triode Section	
Plate Voltage	65	150	200 Volts
Screen Voltage	150	150	.... Volts
Grid-Number 1 Voltage	0△	.....	−2.0 Volts
Cathode-Bias Resistor		150	.... Ohms
Amplification Factor		.....	70
Plate Resistance, approximate		200000	.... Ohms
Transconductance		9500	4000 Micromhos
Plate Current	46	15	4.0 Milliamperes
Screen Current	15	3.5	.... Milliamperes
Grid-Number 1 Voltage, approximate Ib = 20 Microamperes	...	−8	−5 Volts

FOOTNOTES

* Heater voltage for a bogey tube at If = 0.6 amperes.

† For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

‡ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

§ Heater current of a bogey tube at Ef = 6.3 volts.

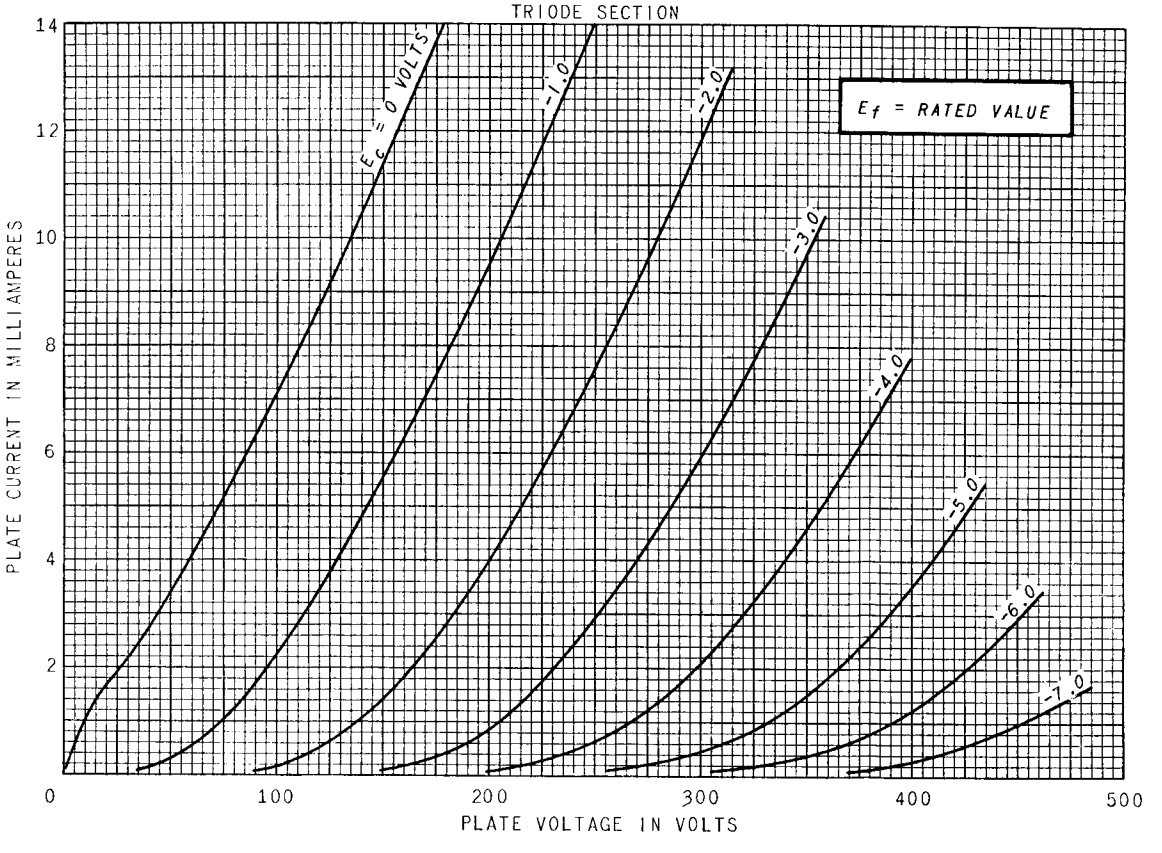
¶ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

With external shield (EIA 315) connected to cathode of section under test.

△Applied for short interval (two seconds maximum) so as not to damage tube.

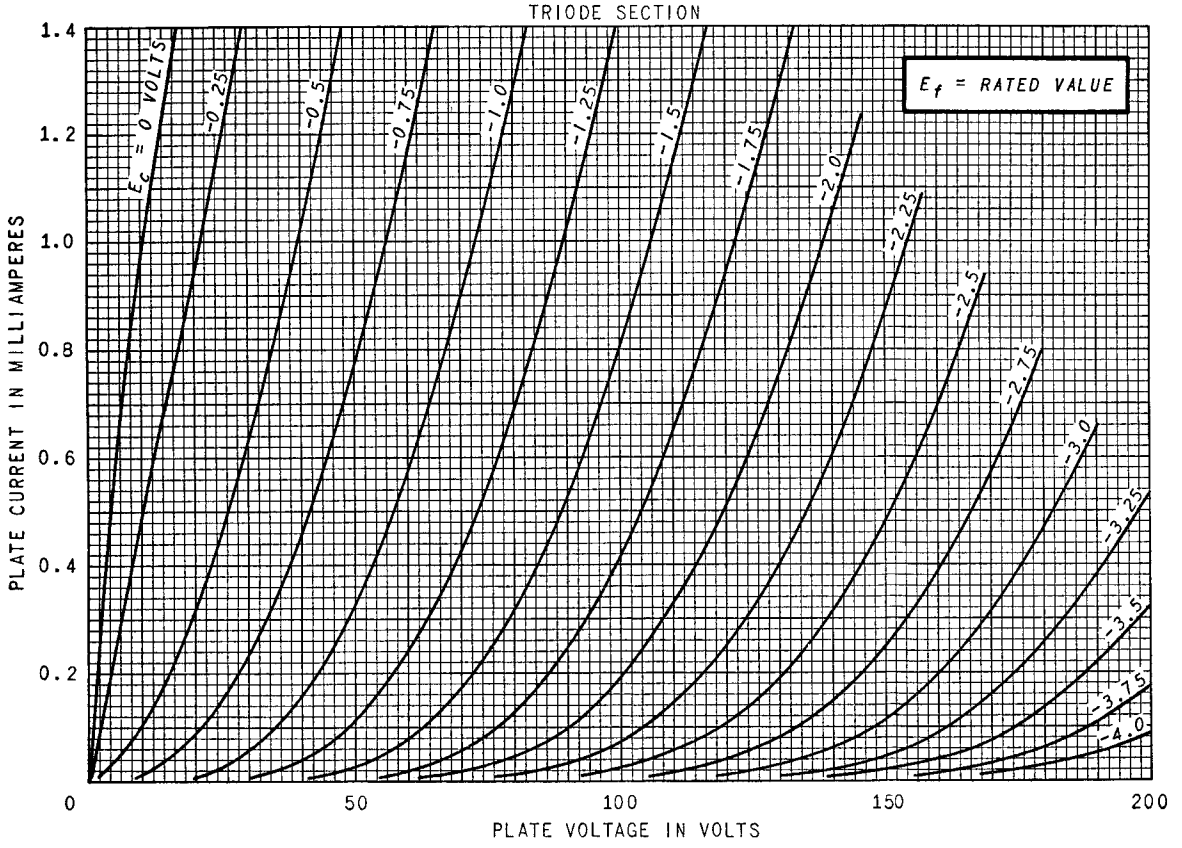
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AVERAGE PLATE CHARACTERISTICS



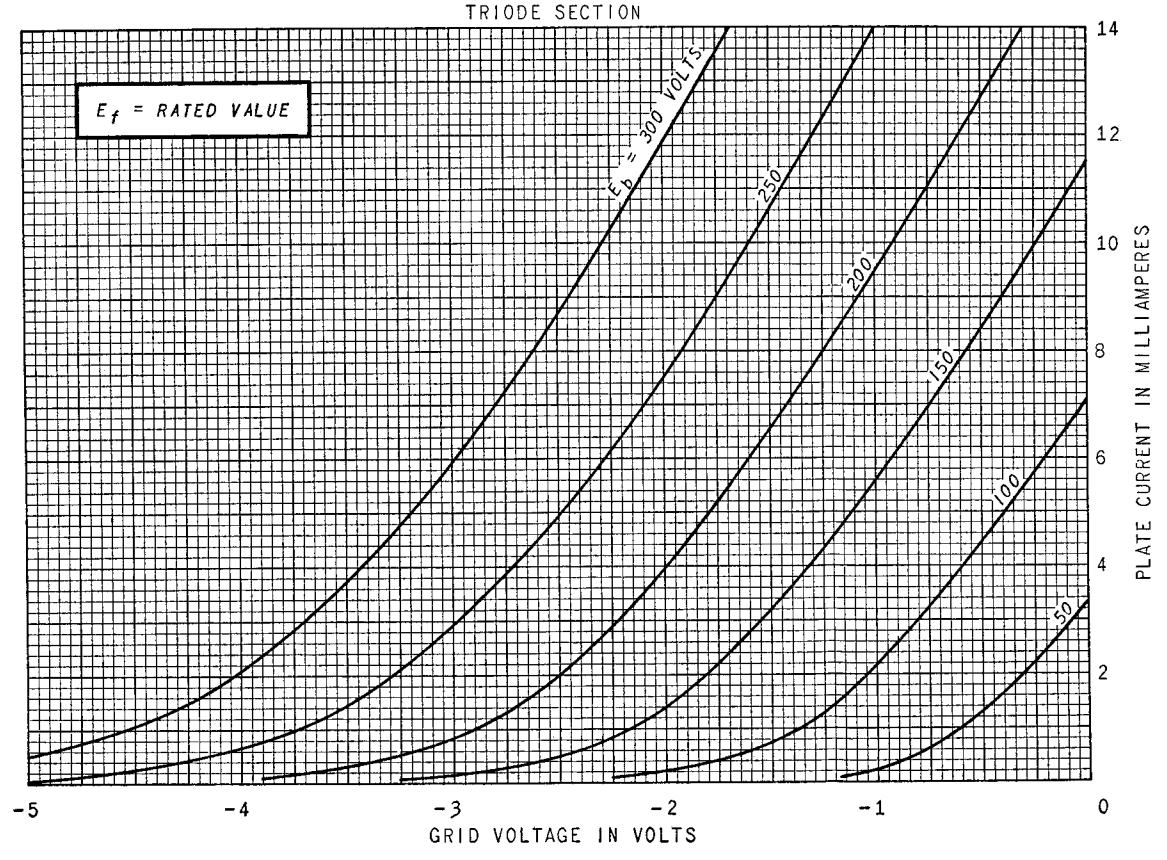
AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION

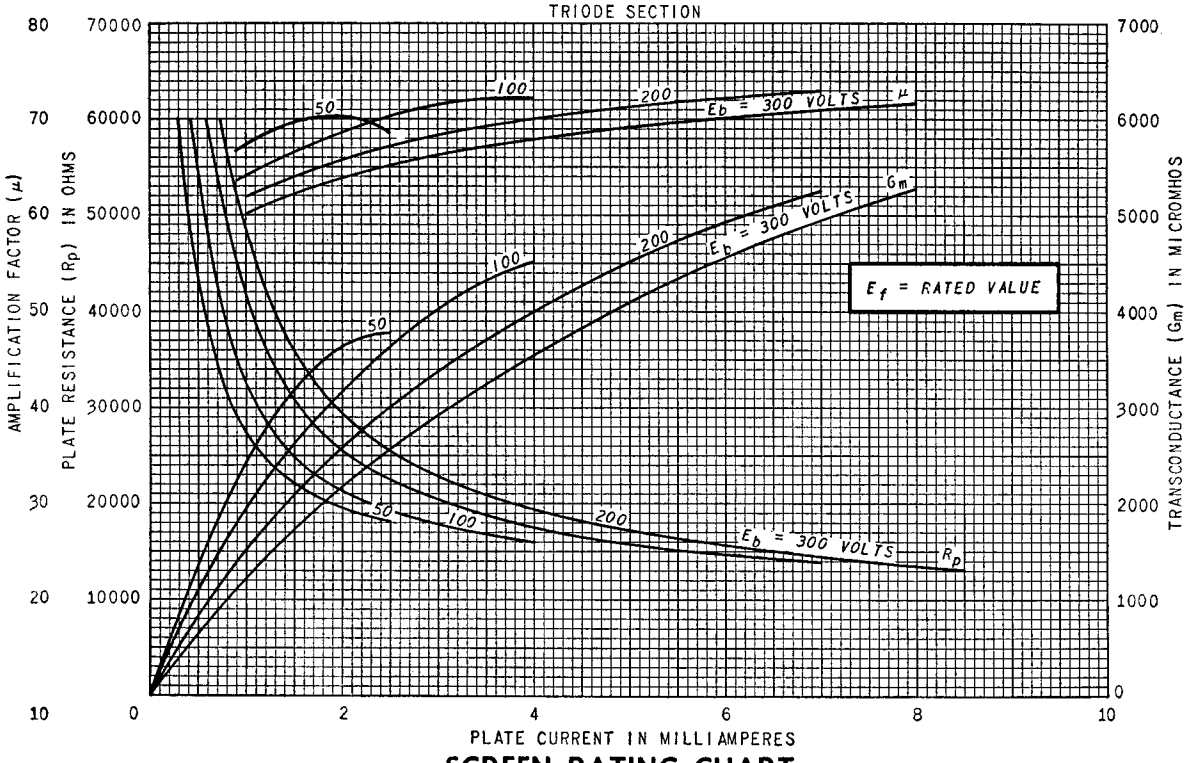


AVERAGE TRANSFER CHARACTERISTICS

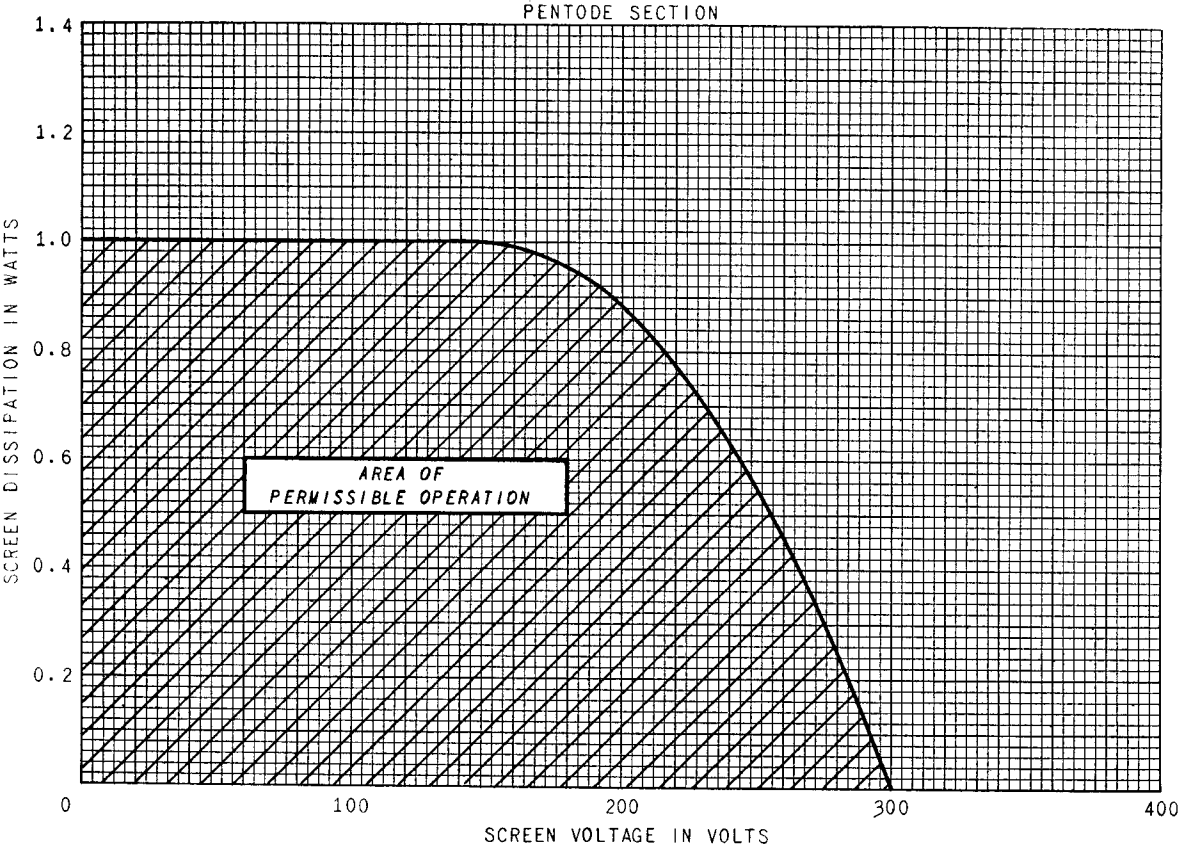
TRIODE SECTION



AVERAGE CHARACTERISTICS

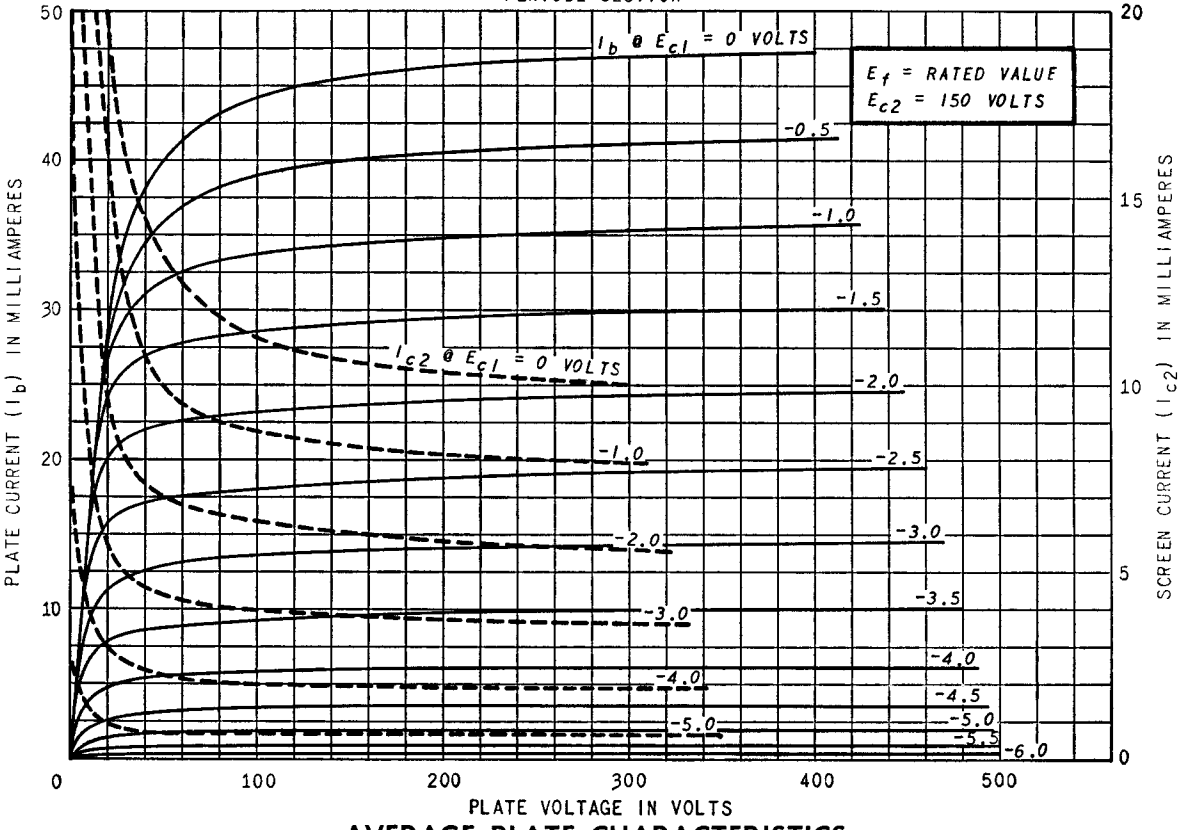


SCREEN RATING CHART



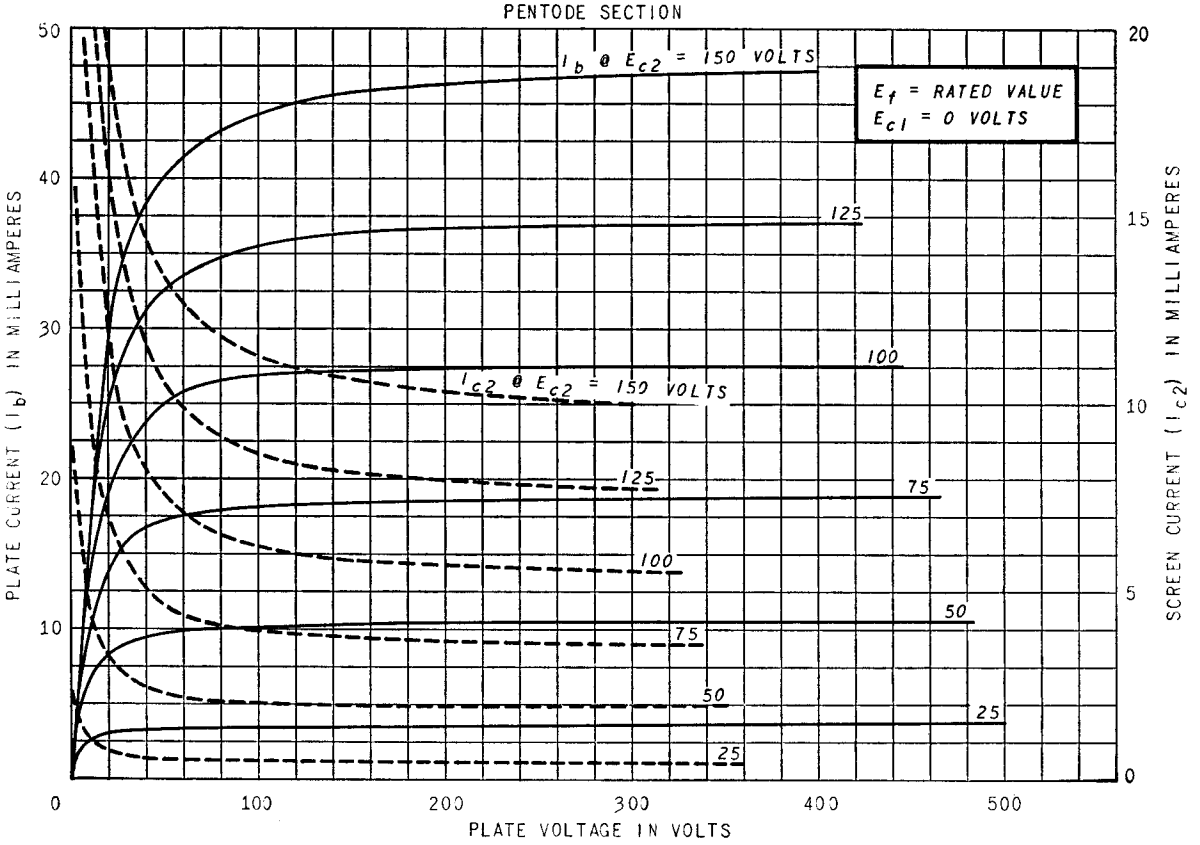
AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

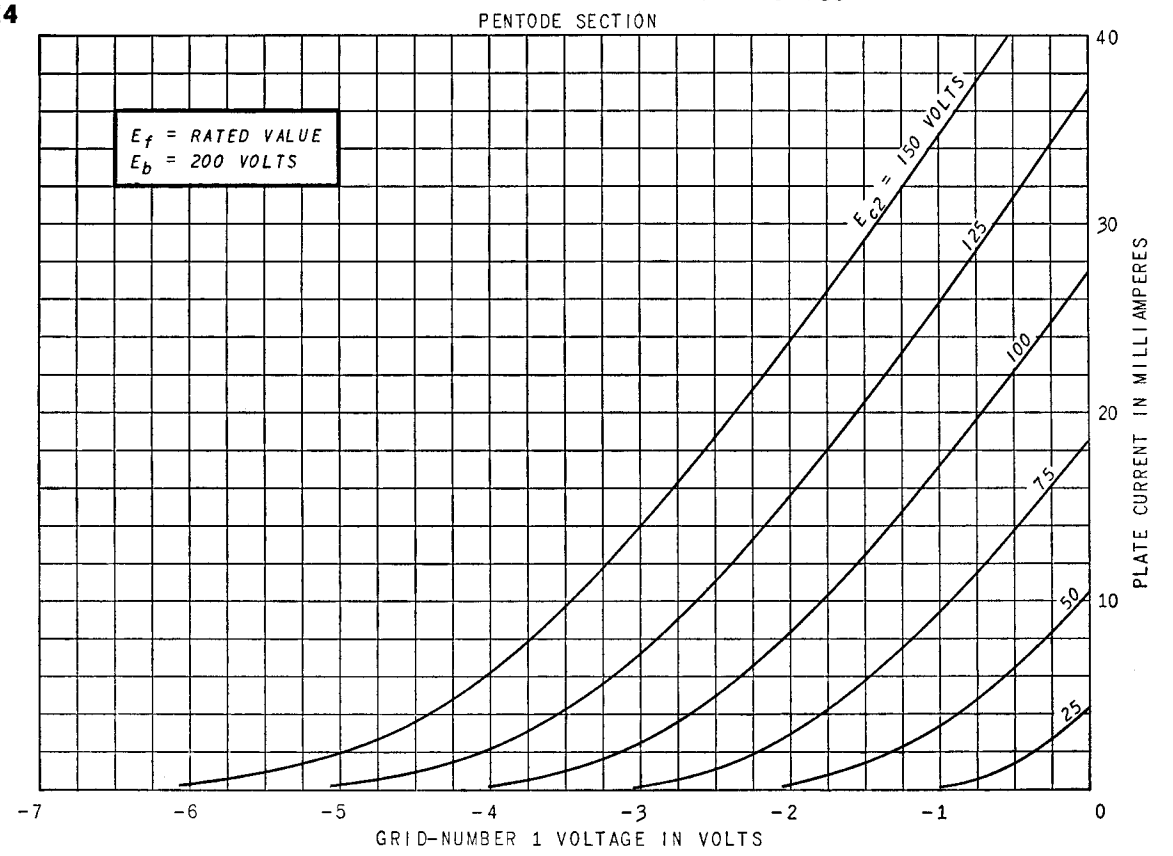


AVERAGE PLATE CHARACTERISTICS

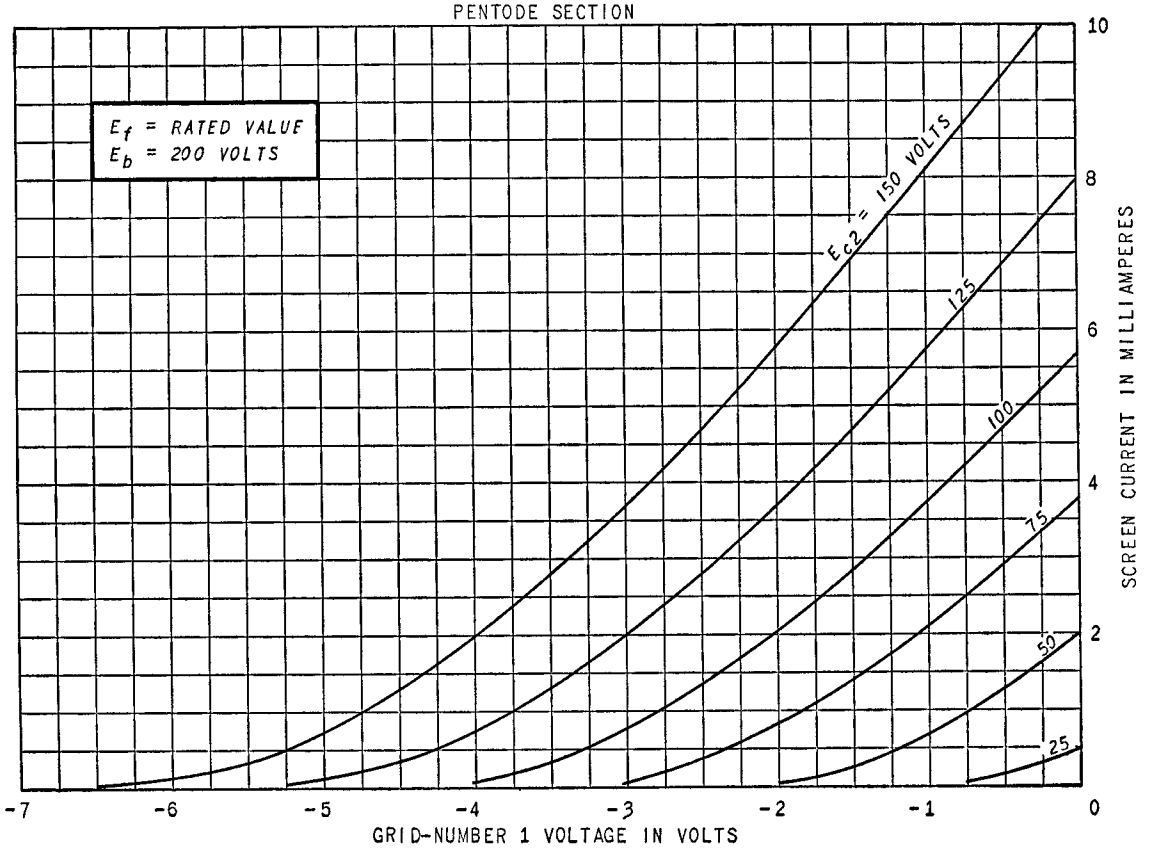
PENTODE SECTION



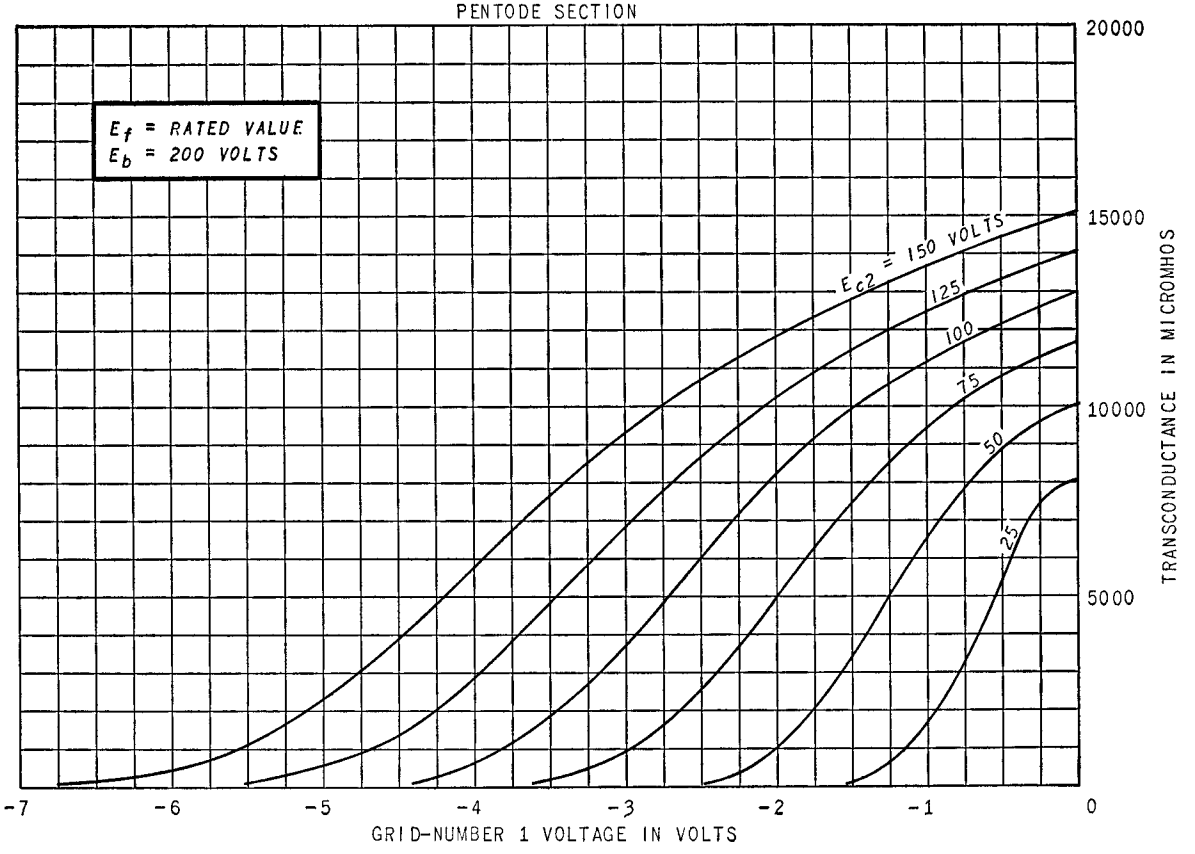
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBES

6AX3

DIODE

FOR TV DAMPING DIODE APPLICATIONS

DESCRIPTION AND RATING

The 6AX3 is a COMPACTRON device containing a single heater-cathode type diode. The tube is intended for service as the damping diode in the horizontal-deflection circuit of television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings (Design-Maximum Rating System)

Heater Voltage, AC or DC*	6.3 ± 0.6 Volts
Heater Current†	1.2 Amperes
Direct Interelectrode Capacitances, approximate‡	
Cathode to Plate and Heater: k to (p+h)	7.5 pf
Plate to Cathode and Heater: p to (k+h)	5.5 pf
Heater to Cathode: (h to k)	2.8 pf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—E12-70, Button 12-Pin

MAXIMUM RATINGS

TV DAMPER SERVICE—DESIGN-MAXIMUM VALUES§

Peak Inverse Plate Voltage	5000 Volts
Plate Dissipation	5.3 Watts
Steady-State Peak Plate Current	1000 Milliamperes
DC Output Current	165 Milliamperes
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	
DC Component	100 Volts
Total DC and Peak	300 Volts
Heater Negative with Respect to Cathode	
DC Component	900 Volts
Total DC and Peak	5000 Volts

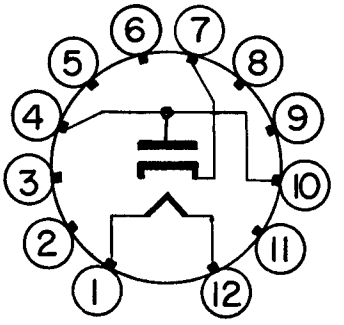
Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions. The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

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GENERAL ELECTRIC

BASING DIAGRAM

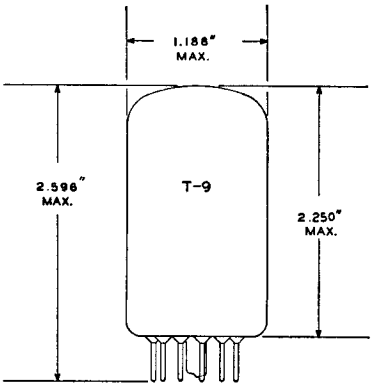


EIA 12BL

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—No Connection
Pin 3—No Connection
Pin 4—Plate
Pin 5—No Connection
Pin 6—No Connection
Pin 7—Cathode
Pin 8—No Connection
Pin 9—No Connection
Pin 10—Plate
Pin 11—No Connection
Pin 12—Heater

PHYSICAL DIMENSIONS



AVERAGE CHARACTERISTICS

Tube Voltage Drop

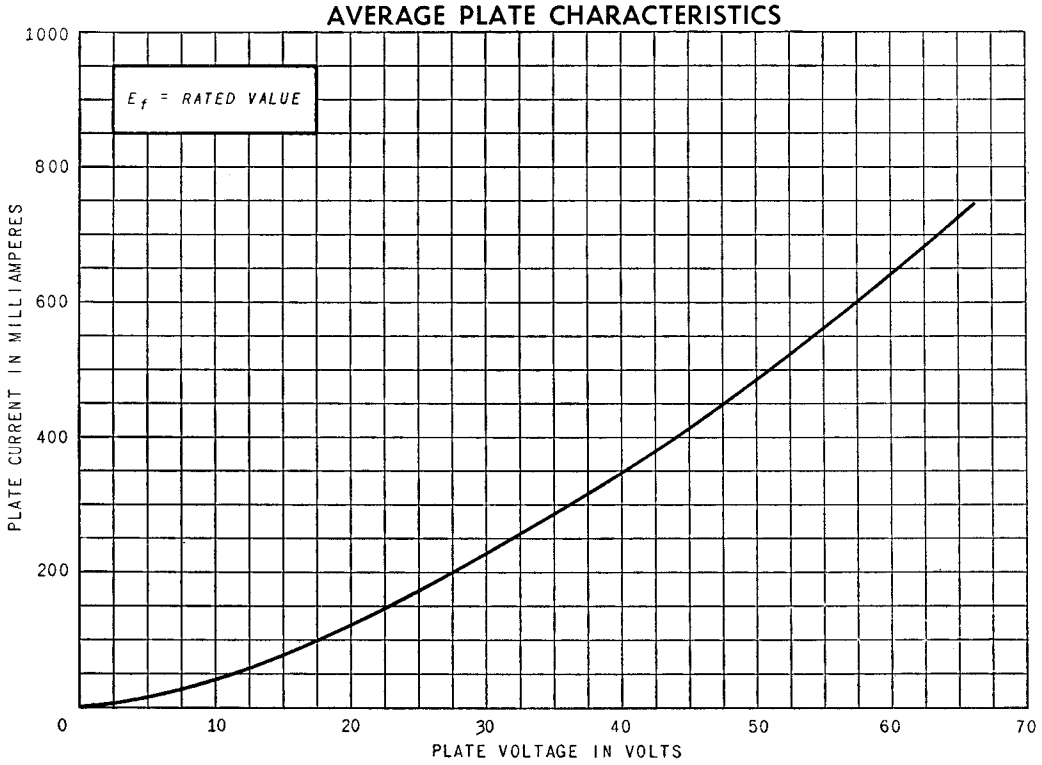
Ib = 250 Milliamperes DC. . . . . 32 Volts

* The equipment designer shall design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current at bogey heater voltage.

‡ Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

Electronic TUBES

6AX4-GTB

DIODE

FOR TV DAMPING DIODE APPLICATIONS

DESCRIPTION AND RATING

The 6AX4-GTB is a single heater-cathode type diode for service as the damping diode in the horizontal-deflection circuit of television receivers. It will withstand high pulse voltages between the heater and cathode and high inverse pulse voltages between the plate and cathode. These characteristics make the tube particularly useful in autotransformer deflection systems in which high pulse voltages are applied to the cathode of the damper tube.

The 6AX4-GTB is unilaterally interchangeable with the 6AX4-GT and 6AX4-GTA. It differs from the 6AX4-GTA in having a higher peak inverse plate voltage rating.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 Volts
Heater Current	1.2 Amperes
Direct Interelectrode Capacitances, approximate*	
Cathode to Plate and Heater	8.5 μμf
Plate to Cathode and Heater	5.0 μμf
Heater to Cathode	4.0 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B5-82, Intermediate-Shell Octal 5-Pin

MAXIMUM RATINGS

TV DAMPER SERVICE—DESIGN-MAXIMUM VALUES†

Allowable Heater Voltage	5.6 to 6.9 Volts
Peak Inverse Plate Voltage	5000 Volts
Plate Dissipation	5.3 Watts
Steady-State Peak Plate Current	1000 Milliamperes
DC Output Current	165 Milliamperes
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	
DC Component	100 Volts
Total DC and Peak	300 Volts
Heater Negative with Respect to Cathode	
DC Component	900 Volts
Total DC and Peak	5000 Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

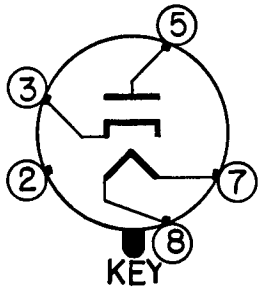
The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions

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GENERAL ELECTRIC

Supersedes ET-T1521, dated 3-59

BASING DIAGRAM

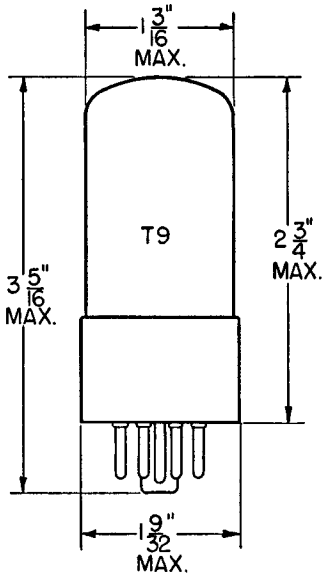


EIA 4CG

TERMINAL CONNECTIONS

Pin 2—No Connection
Pin 3—Cathode
Pin 5—Plate
Pin 7—Heater
Pin 8—Heater
Socket terminals 1, 2, 4, and 6 should not be used.

PHYSICAL DIMENSIONS



EIA 9-11

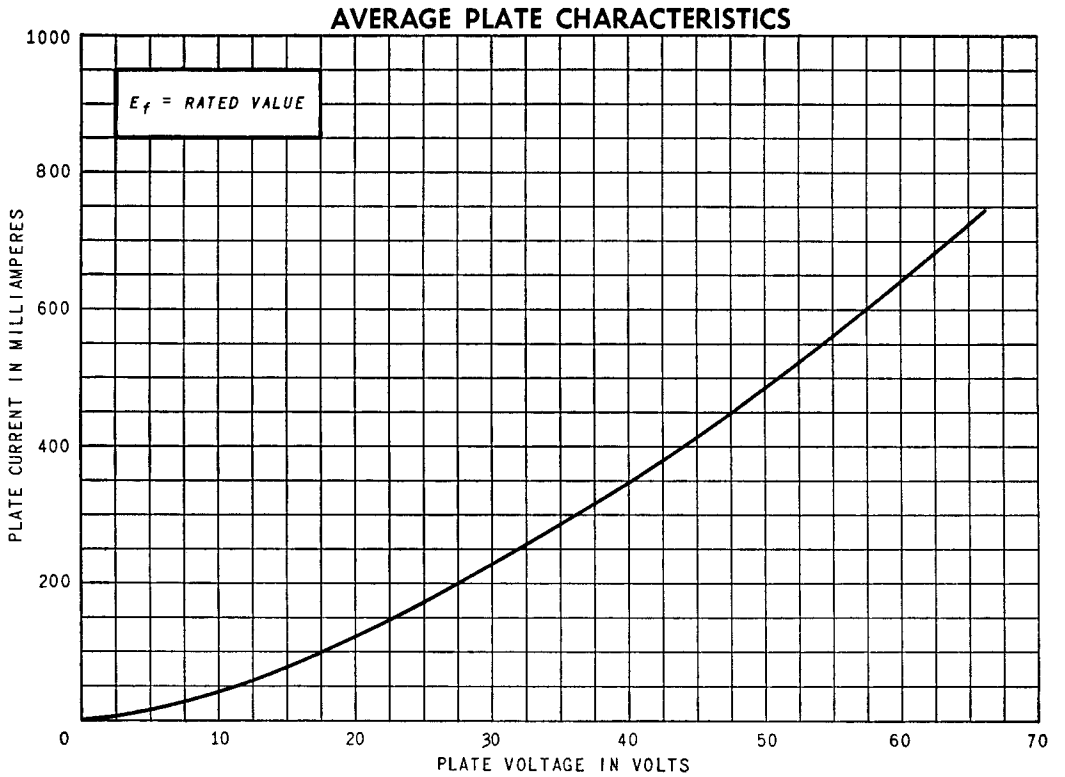
AVERAGE CHARACTERISTICS

Tube Voltage Drop
Ib = 250 Milliamperes DC. . . . . 32 Volts

* Without external shield.

† For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

Note: Operation of this tube as a power rectifier is not recommended.



ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.

PRINTED IN U.S.A.

COMPACTRON DUPLEX-DIODE TWIN TRIODE

DESCRIPTION AND RATING

The 6AY11 is a compactron containing two high-mu triodes and two diodes. The diodes are intended for FM detector service and the triodes for audio-frequency voltage amplifier service.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.69	Amperes

Direct Interelectrode Capacitances‡

Triode, Each Section		
Grid to Plate: (g to p)	2.2	pf
Input: g to (h+k)	2.0	pf
Output: p to (h+k)	0.22	pf
Diode, Each Section		
Plate to Cathode and Heater: p to (h+k)	2.0	pf
Cathode to Heater and Plate: k to (h+p)	5.5	pf
Triode Grid to Diode Plate, maximum	0.08	pf
Triode Grid, Section 1 to Triode Grid, Section 2, maximum	0.01	pf
Triode Plate, Section 1 to Triode Plate, Section 2	0.48	pf

MECHANICAL

Operating Position—Any
Envelope—T-9, Glass
Base—E12-70, Button 12-Pin
Outline Drawing—EIA 9-56

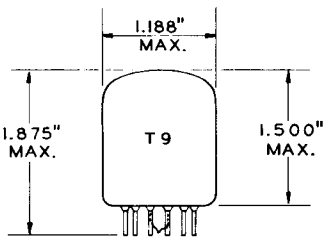
Maximum Diameter	1.188	Inches
Maximum Over-all Length	1.875	Inches
Maximum Seated Height	1.500	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Diode Current for Continuous Operation, Each Diode	5.0	Milliamperes

PHYSICAL DIMENSIONS

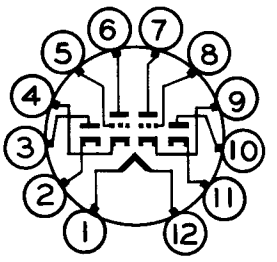


EIA 9-56

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—Diode Cathode (Section 2)
Pin 3—Diode Plate (Section 2)
Pin 4—Triode Cathode (Section 2)
Pin 5—Triode Grid (Section 2)
Pin 6—Triode Plate (Section 2)
Pin 7—Triode Plate (Section 1)
Pin 8—Triode Grid (Section 1)
Pin 9—Triode Cathode (Section 1)
Pin 10—Diode Plate (Section 1)
Pin 11—Diode Cathode (Section 1)
Pin 12—Heater

BASING DIAGRAM



EIA 12DA

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage	250	Volts
Grid Voltage	−2.0	Volts
Amplification Factor	100	
Plate Resistance, approximate	52700	Ohms
Transconductance	1900	Micromhos
Plate Current	1.2	Milliamperes
Average Diode Current, Each Diode With 5.0 Volts DC Applied	18	Milliamperes

NOTES

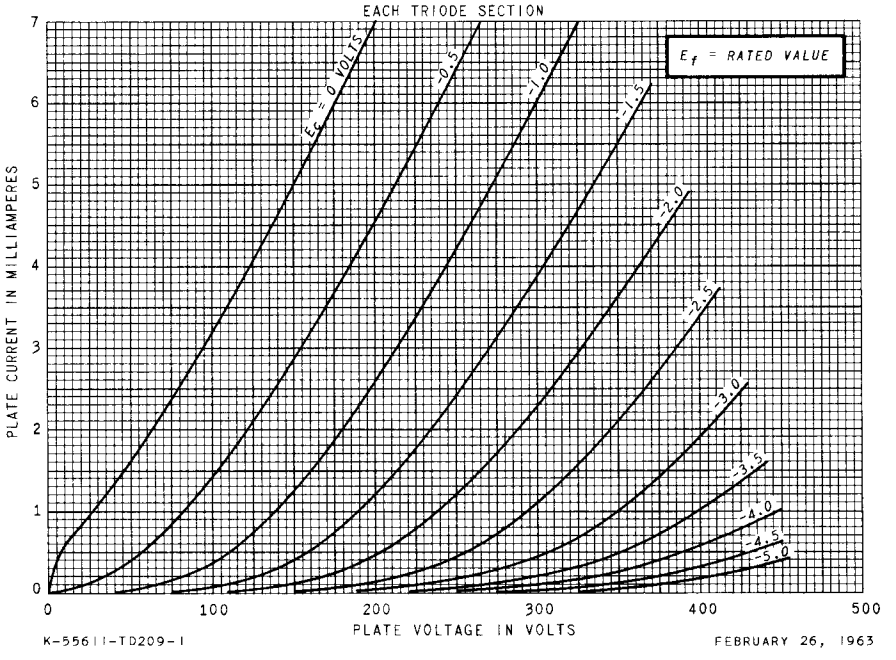
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

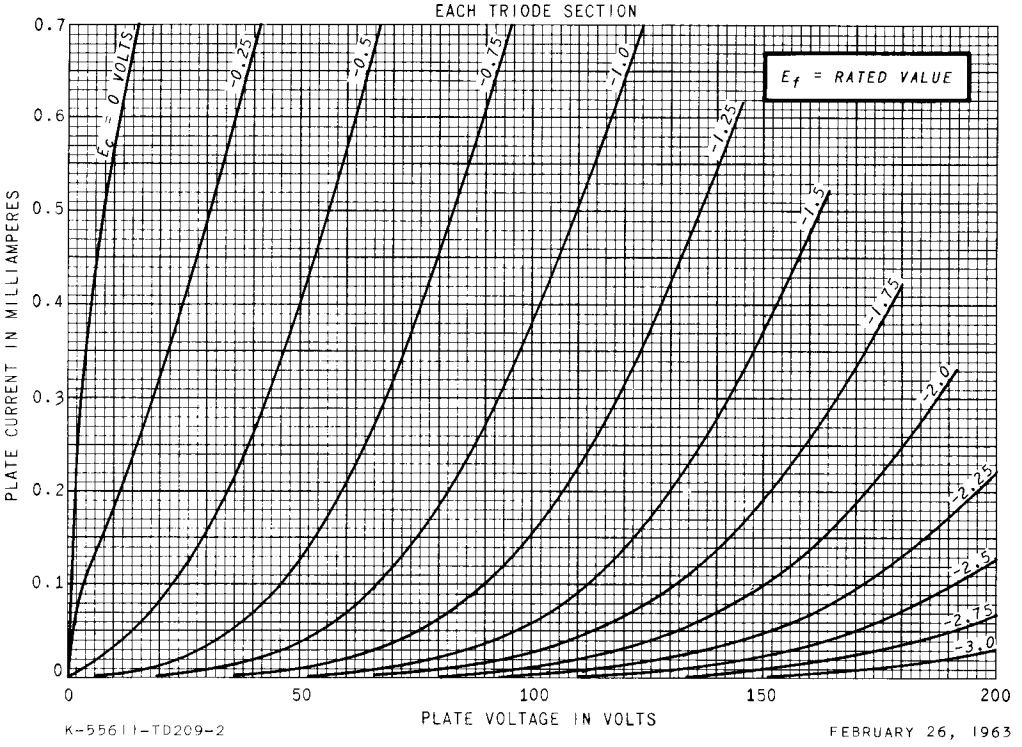
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AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

EACH TRIODE SECTION

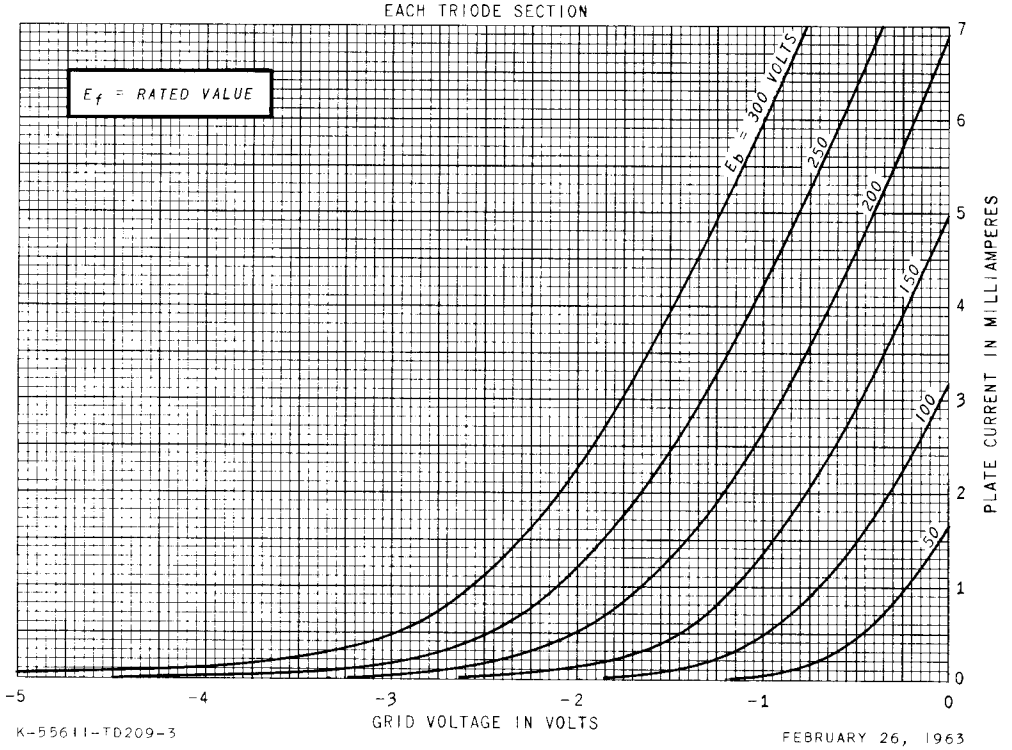


K-5561I-TD209-2

FEBRUARY 26, 1963

AVERAGE TRANSFER CHARACTERISTICS

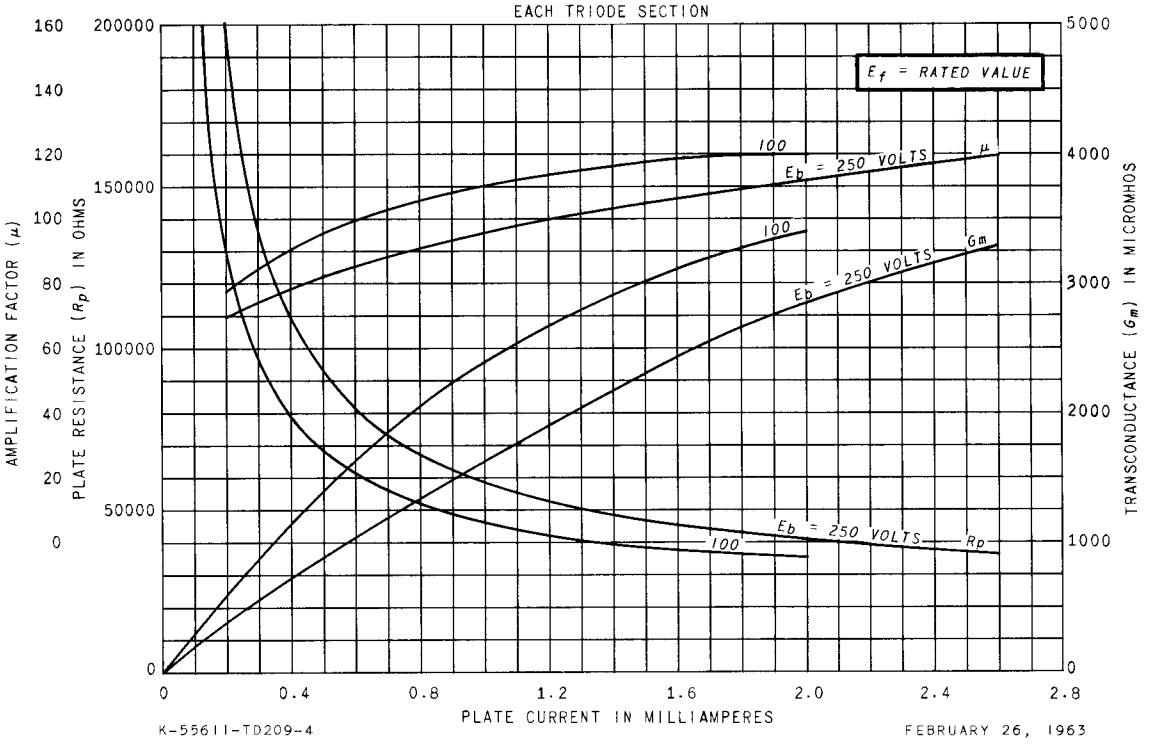
EACH TRIODE SECTION



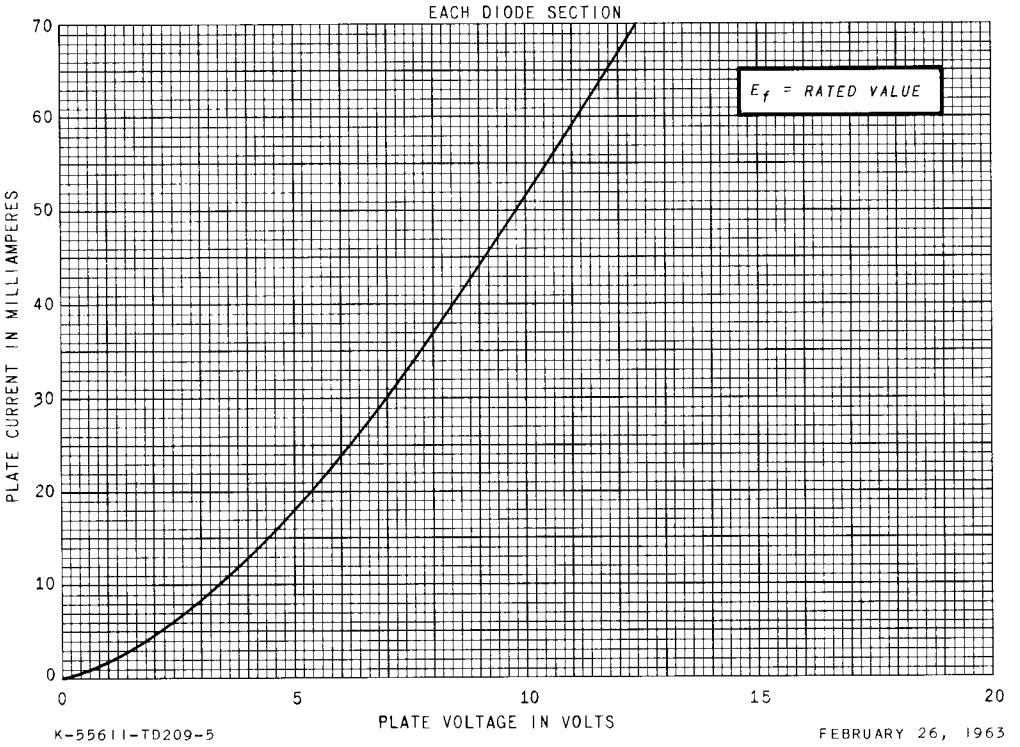
K-5561I-TD209-3

FEBRUARY 26, 1963

AVERAGE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

PRODUCT INFORMATION

6AY3-B

Diode

FOR TV DAMPING DIODE APPLICATIONS

The 6AY3-B is a single heater-cathode type diode designed for use as the damping diode in the horizontal-deflection circuit of television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	1.2	Amperes
Direct Interelectrode Capacitances, approximate§		
Cathode to Plate and Heater:		
k to (p + h)	9.0	pf
Plate to Cathode and Heater:		
p to (k + h)	6.5	pf
Heater to Cathode: (h to k)	2.8	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E9-89, Button 9-Pin
Outline Drawing

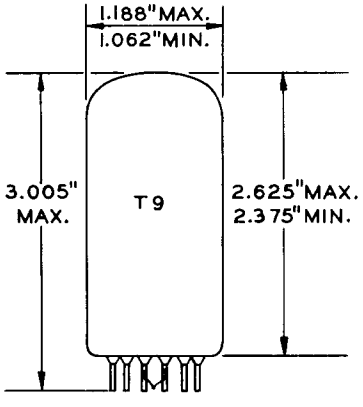
Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.005	Inches
Maximum Seated Height	2.625	Inches
Minimum Seated Height	2.375	Inches

MAXIMUM RATINGS

TV DAMPER SERVICE¶—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	5000	Volts
Plate Dissipation	6.5	Watts
Steady-State Peak Plate Current	1100	Milliamperes
DC Output Current	175	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	900	Volts
Total DC and Peak	5000	Volts

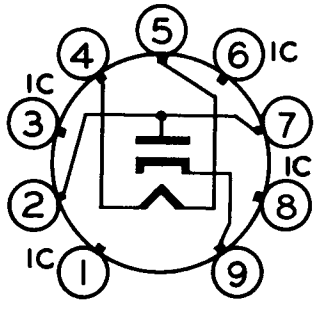
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pin 1 - Internal Connection - Do Not Use
Pin 2 - Plate
Pin 3 - Internal Connection - Do Not Use
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Plate
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Cathode

BASING DIAGRAM



EIA 9HP

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MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 350 Milliamperes DC.	32	Volts

NOTES

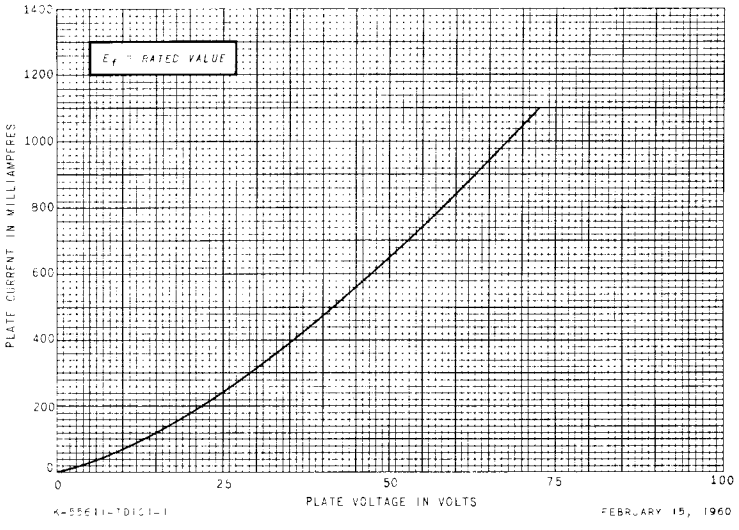
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

6B10

DUPLEX-DIODE TWIN TRIODE

FOR TV HORIZONTAL PHASE-DETECTOR AND HORIZONTAL OSCILLATOR APPLICATIONS

DESCRIPTION AND RATING

The 6B10 is a COMPACTRON device containing two diodes and two triodes. The triode sections have separate cathodes and the diode sections have a common cathode. The diodes are intended for horizontal phase-detector service and the triodes for horizontal oscillator service.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings (Design-Maximum Rating System)

	Series Heater Operation*	Parallel Heater Operation*	
Heater Voltage, AC or DC	6.3†	6.3 ± 0.6	Volts
Heater Current	0.6 ± 0.04	0.6‡	Ampere
Heater Warm-up Time§	11	——	Seconds

Direct Interelectrode Capacitances¶

	Section 1	Section 2	
Triode Grid to Plate: (Tg to Tp)	1.5	1.5	pf
Triode Input: Tg to (h+Tk+i.s.)	1.7	1.8	pf
Triode Output: Tp to (h+Tk+i.s.)	1.6	0.6	pf
Triode Plate to Plate: (T1p to T2p)	0.9		pf
Diode-Number 1 Plate to Diode Cathode, Heater, and Internal Shield: D1p to (Dk+h+i.s.)	1.9		pf
Diode-Number 2 Plate to Diode Cathode, Heater, and Internal Shield: D2P to (Dk+h+i.s.)	1.8		pf
Diode-Number 1 Plate to Diode-Number 2 Plate: (D1p to D2p)	0.7		pf
Triode Grid to Diode-Number 1 Plate: (Tg to D1p)	0.015	0.005	pf
Triode Grid to Diode-Number 2 Plate: (Tg to D2p)	0.02	0.005	pf

MECHANICAL

Mounting Position—Any

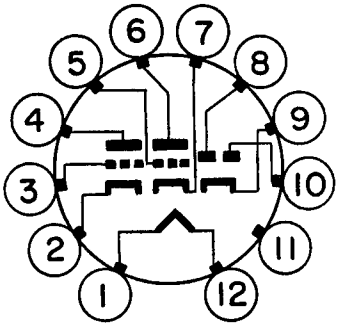
Envelope—T-9, Glass

Base—E12-70, Button 12-Pin

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GENERAL ELECTRIC

BASING DIAGRAM

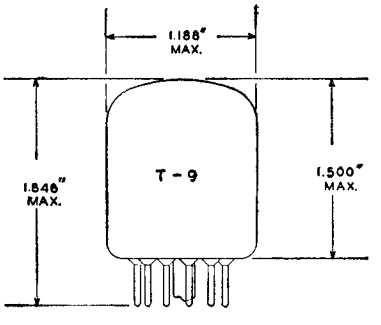


EIA 12BF

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—Triode Cathode (Section 2)
Pin 3—Triode Grid (Section 2)
Pin 4—Triode Plate (Section 2)
Pin 5—Triode Grid (Section 1)
Pin 6—Triode Plate (Section 1)
Pin 7—Triode Cathode (Section 1)
Pin 8—Diode Number 2 Plate
Pin 9—Diode Cathode
Pin 10—Diode Number 1 Plate
Pin 11—Internal Shield
Pin 12—Heater

PHYSICAL DIMENSIONS



EIA 9-56

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330 Volts
Plate Dissipation	3.0 Watts
DC Cathode Current	20 Milliamperes
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	
DC Component	100 Volts
Total DC and Peak	200 Volts
Heater Negative with Respect to Cathode	
Total DC and Peak	200 Volts
Grid-Circuit Resistance	
With Fixed Bias	0.25 Megohm
With Cathode Bias	1.0 Megohm
Diode Current for Continuous Operation, Each Diode	5.0 Milliamperes

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions. The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage	250 Volts
Grid Voltage	−8.0 Volts
Amplification Factor	18
Plate Resistance, approximate	7200 Ohms
Transconductance	2500 Micromhos
Plate Current	10 Milliamperes
Grid Voltage, approximate	
Ib = 50 Microamperes	−20 Volts
Average Diode Current, Each Diode	
With 5 Volts DC Applied	20 Milliamperes

* For parallel heater operation, the equipment designer shall design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. For series heater operation, the equipment designer shall design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

† Heater voltage at bogey heater current.

‡ Heater current at bogey heater voltage.

§ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

¶ Without external shield.

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

6BA6—3BA6—4BA6—12BA6

PENTODE

FOR RF AND IF AMPLIFIER APPLICATIONS

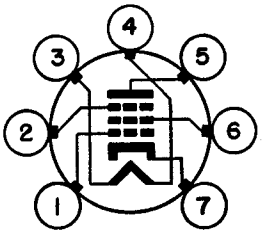
DESCRIPTION AND RATING

The 6BA6 is a miniature remote-cutoff pentode primarily designed for use as a high-gain radio-frequency or intermediate-frequency amplifier. Features include small size, low grid-plate capacitance, and high transconductance.

Except for heater ratings the 3BA6 and 4BA6 are identical to the 6BA6. In addition, they incorporate a controlled heater-warm-up characteristic which makes them especially suited for use in television receivers that employ series-connected heaters.

The 12BA6, which differs from the 6BA6 only in heater ratings and heater-cathode voltage ratings, is especially useful in a-c/d-c radio receivers.

BASIC DIAGRAM



RETMA 7CC

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Internal Shield and Grid Number 3 (Suppressor)
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Cathode

GENERAL

Electrical

Cathode—Coated Unipotential

	3BA6	4BA6	6BA6	12BA6	
Heater Voltage, AC or DC	3.15	4.2	6.3	12.6	Volts
Heater Current	0.6	0.45	0.3	0.15	Amperes
Heater Warm-up Time*	11	11	....	...	Seconds

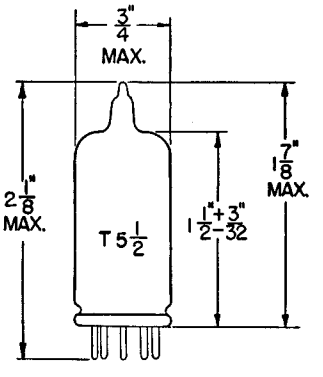
Direct Interelectrode Capacitances

	With Shield†	Without Shield	
Grid-Number 1 to Plate, maximum	0.0035	0.0035	μμf
Input	5.5	5.5	μμf
Output	5.5	5.0	μμf

Mechanical

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

PHYSICAL DIMENSIONS



RETMA 5-2

GENERAL ELECTRIC

Supersedes ET-T897 dated 9-54

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	300	Volts
Screen-Supply Voltage	300	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
Plate Dissipation	3.0	Watts
Screen Dissipation	0.6	Watts

	3BA6 4BA6 6BA6	12BA6	
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	...	Volts
Total DC and Peak	200	100	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	100	Volts

CHARACTERISTICS AND TYPICAL OPERATION

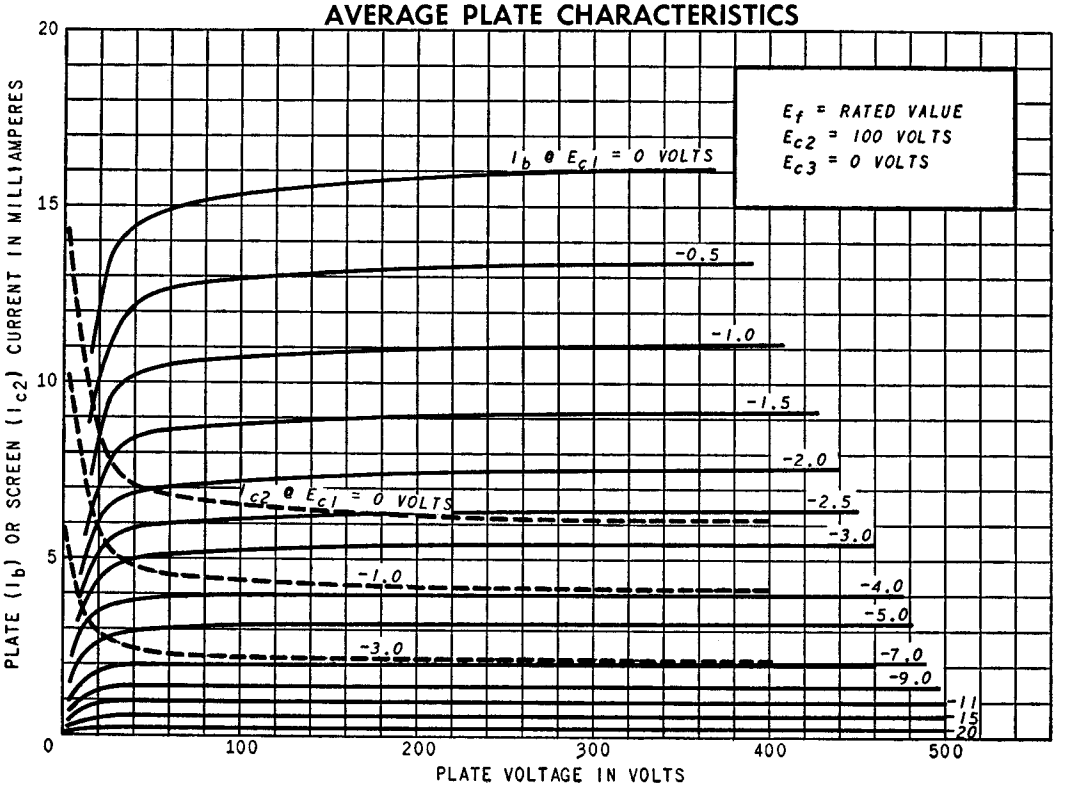
CLASS A_1 AMPLIFIER

Plate Voltage	100	250	Volts
Suppressor, Connected to Cathode at Socket			
Screen Voltage	100	100	Volts
Cathode-Bias Resistor	68	68	Ohms
Plate Resistance, approximate	0.25	1.0	Megohms
Transconductance	4300	4400	Micromhos
Plate Current	10.8	11	Milliamperes
Screen Current	4.4	4.2	Milliamperes
Grid-Number 1 Voltage, approximate			
G_m=40 Micromhos	−20	−20	Volts

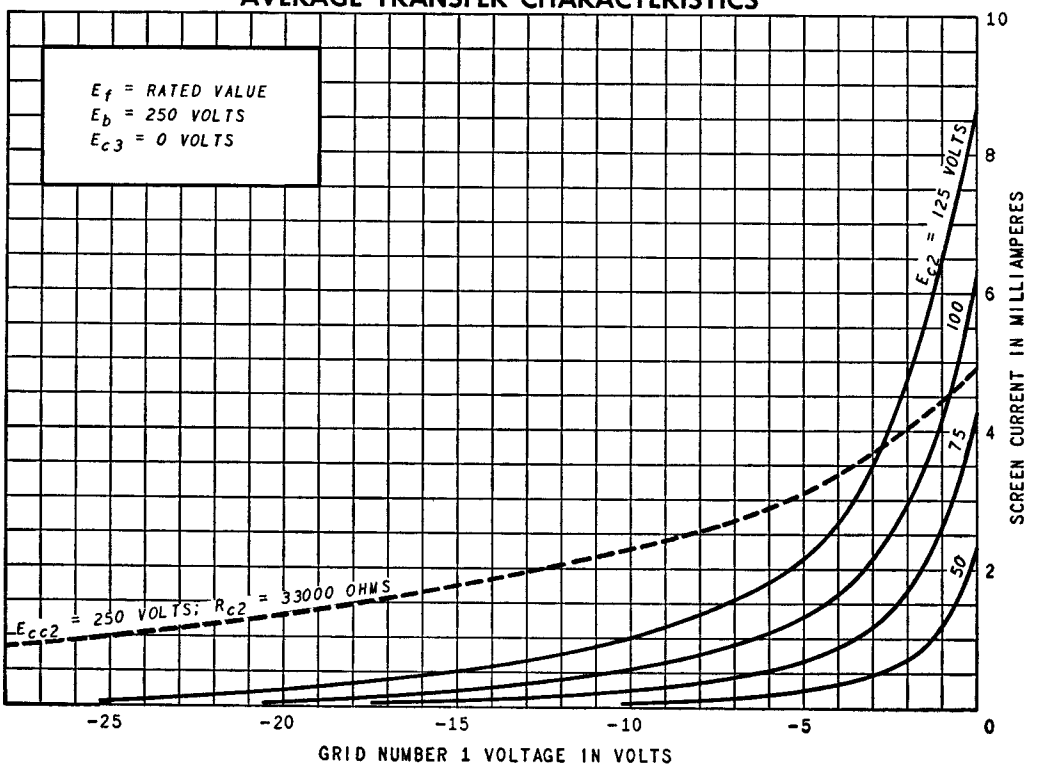
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (RETMA 316) connected to pin 7.

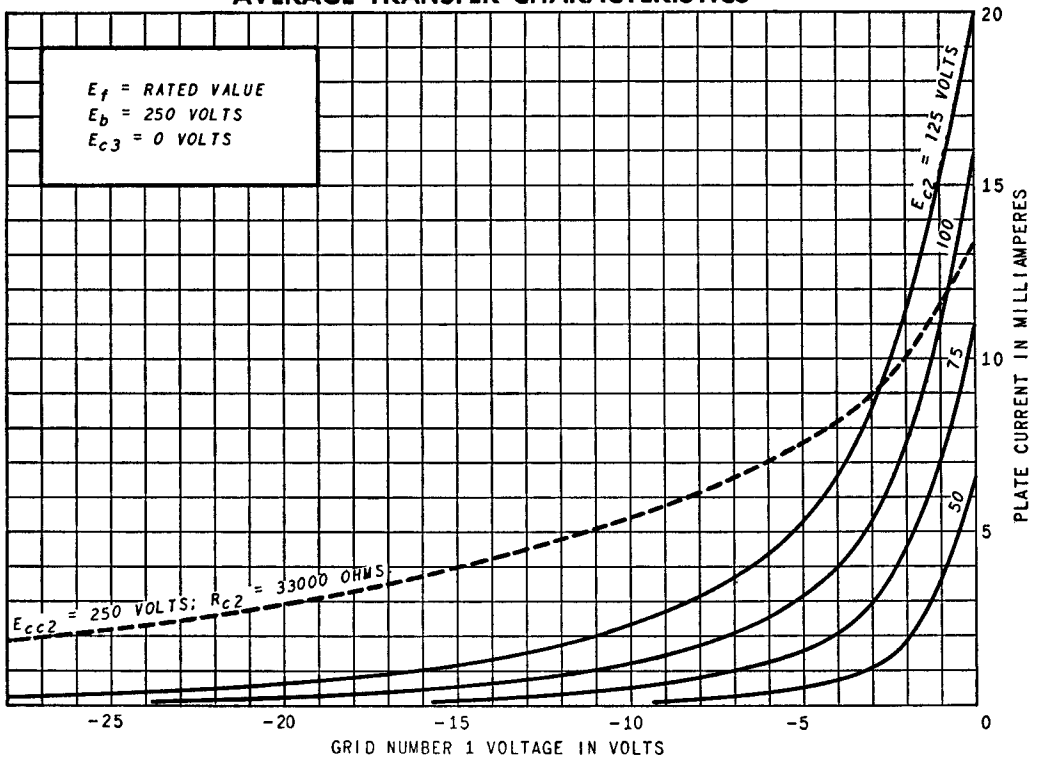
AVERAGE PLATE CHARACTERISTICS



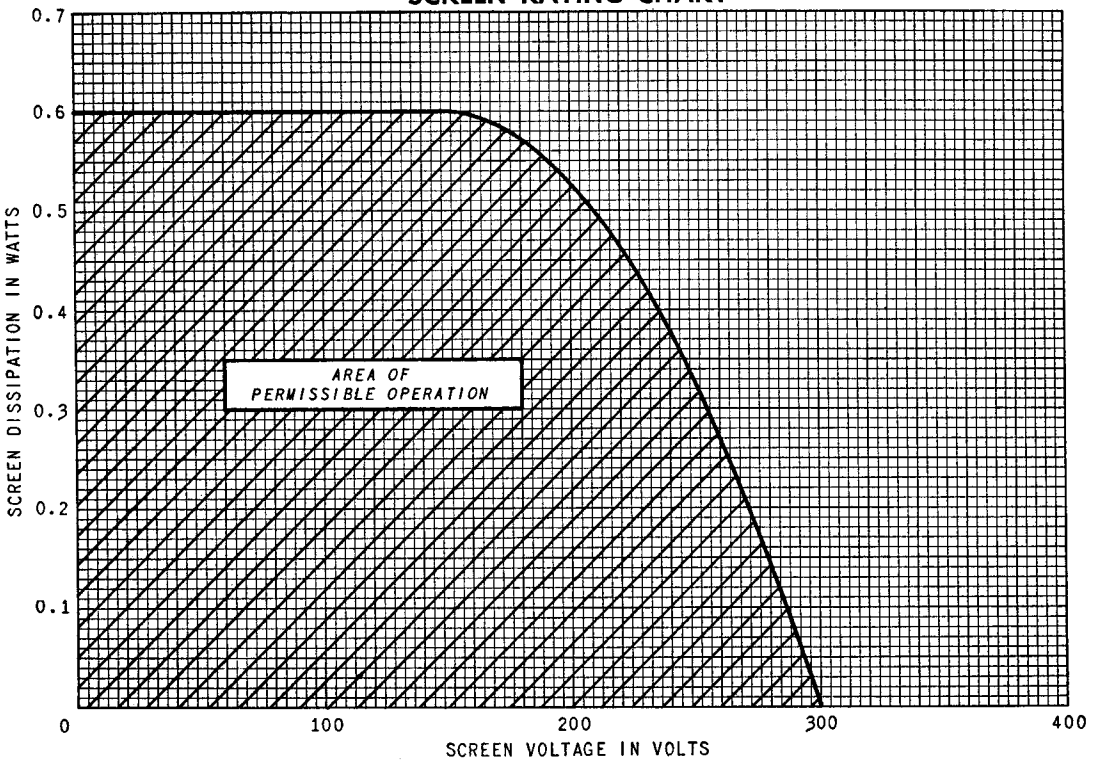
AVERAGE TRANSFER CHARACTERISTICS



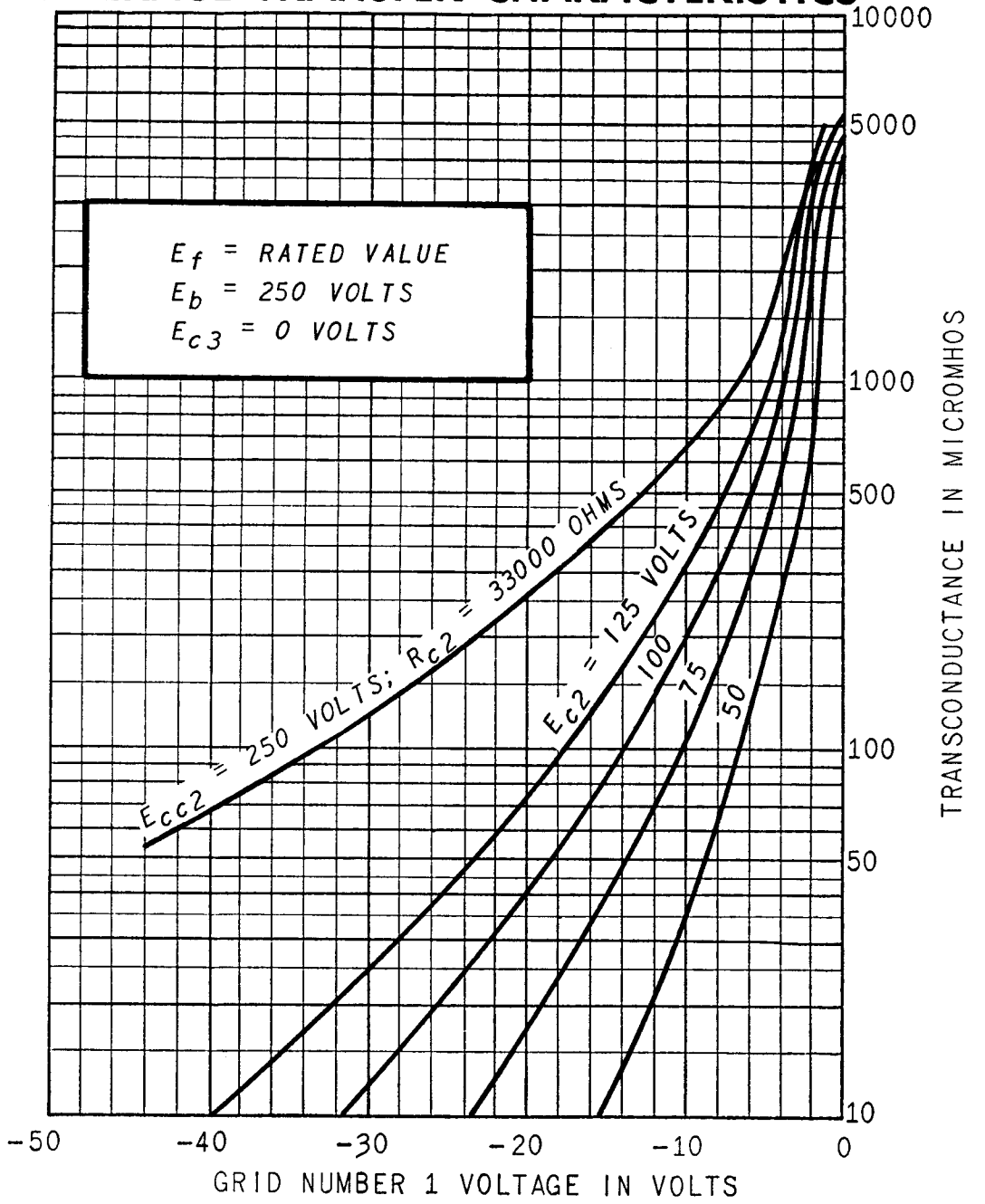
AVERAGE TRANSFER CHARACTERISTICS



SCREEN RATING CHART



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONICS

6BD11

COMPACTRON DISSIMILAR-DOUBLE-TRIODE PENTODE

DESCRIPTION AND RATING

The 6BD11 is a compactron containing a high-mu triode, a medium-mu triode, and a sharp-cutoff pentode. The high-mu triode is intended for general-purpose use, the medium-mu triode for sync separator service, and the pentode for video amplifier service.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

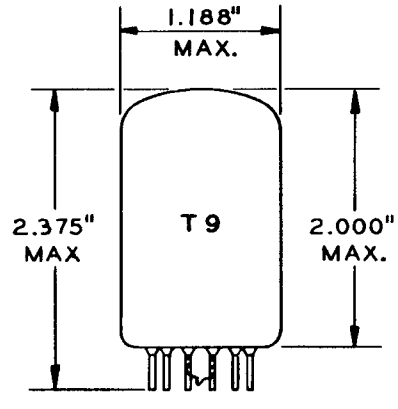
Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current†	1.05	Amperes
Direct Interelectrode Capacitances‡		
Triode (Section 1)		
Grid to Plate: (1Tg to 1Tp)	1.9	pf
Input: 1Tg to (1Tk + 2Tk + Pk + Pg3 + h + i.s.)	3.0	pf
Output: 1Tp to (1Tk + 2Tk + Pk + Pg3 + h + i.s.)	2.2	pf
Triode (Section 2)		
Grid to Plate: (2Tg to 2Tp)	3.6	pf
Input: 2Tg to (2Tk + Pk + Pg3 + h + i.s.)	2.4	pf
Output: 2Tp to (2Tk + Pk + Pg3 + h + i.s.)	3.8	pf
Pentode Section		
Grid-Number 1 to Plate: (Pg1 to Pp)	0.13	pf
Input: Pg1 to (2Tk + Pk + Pg2 + Pg3 + h + i.s.)	11	pf
Output: Pp to (2Tk + Pk + Pg2 + Pg3 + h + i.s.)	4.6	pf
Pentode Plate to Triode Plate (Section 2): (Pp to 2Tp), maximum	0.045	pf
Triode Plate (Section 1) to Triode Plate (Section 2): (1Tp to 2Tp), maximum	0.075	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches

PHYSICAL DIMENSIONS

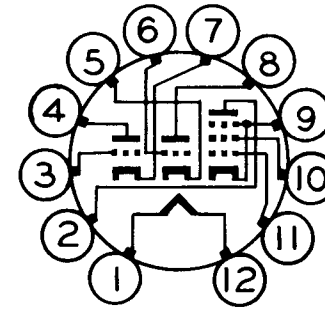


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Pentode Plate
Pin 3 - Triode Grid (Section 2)
Pin 4 - Triode Plate (Section 2)
Pin 5 - Triode Cathode (Section 1)
Pin 6 - Triode Grid (Section 1)
Pin 7 - Triode Cathode (Section 2) and Internal Shield
Pin 8 - Triode Plate (Section 1)
Pin 9 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 10 - Pentode Grid Number 2 (Screen)
Pin 11 - Pentode Grid Number 1
Pin 12 - Heater

BASING DIAGRAM



EIA 12DP

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Pentode Section

Plate Voltage	330	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	4.0	Watts
Screen Dissipation	1.1	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	1.0	Megohms
With Cathode Bias	1.0	Megohms

Triode (Section 1)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Triode (Section 2)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	35	135	Volts
Screen Voltage	135	135	Volts
Grid-Number 1 Voltage	0§	---	Volts
Cathode-Bias Resistor	---	100	Ohms
Plate Resistance, approximate	---	45000	Ohms
Transconductance	---	10400	Micromhos
Plate Current	34	17	Milliamperes
Screen Current	13	4.0	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	---	-6	Volts

Triode (Section 1)

Plate Voltage		200	Volts
Grid Voltage		-2.0	Volts
Amplification Factor		68	
Plate Resistance, approximate		12400	Ohms
Transconductance		5500	Micromhos
Plate Current		7.0	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes		-5.5	Volts

Triode (Section 2)

Plate Voltage		200	Volts
Cathode-Bias Resistor		220	Ohms
Amplification Factor		41	
Plate Resistance, approximate		9400	Ohms
Transconductance		4400	Micromhos
Plate Current		9.2	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes		-6.5	Volts

NOTES

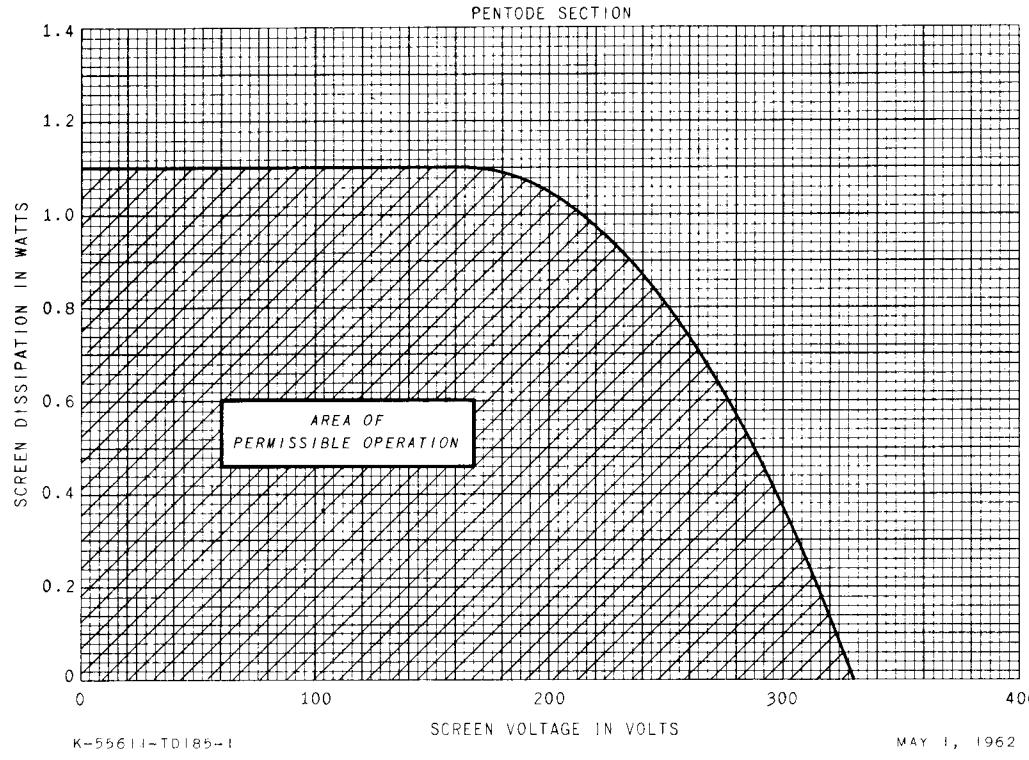
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

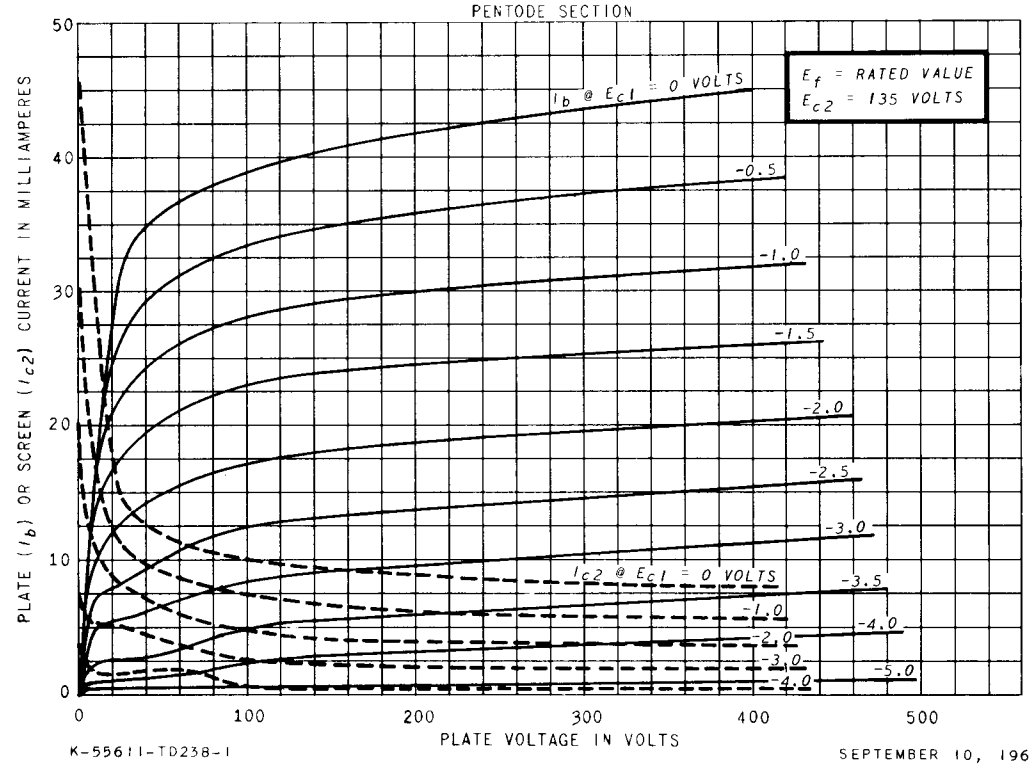
‡ Without external shield.

§ Applied for short interval (two seconds maximum) so as not to damage tube.

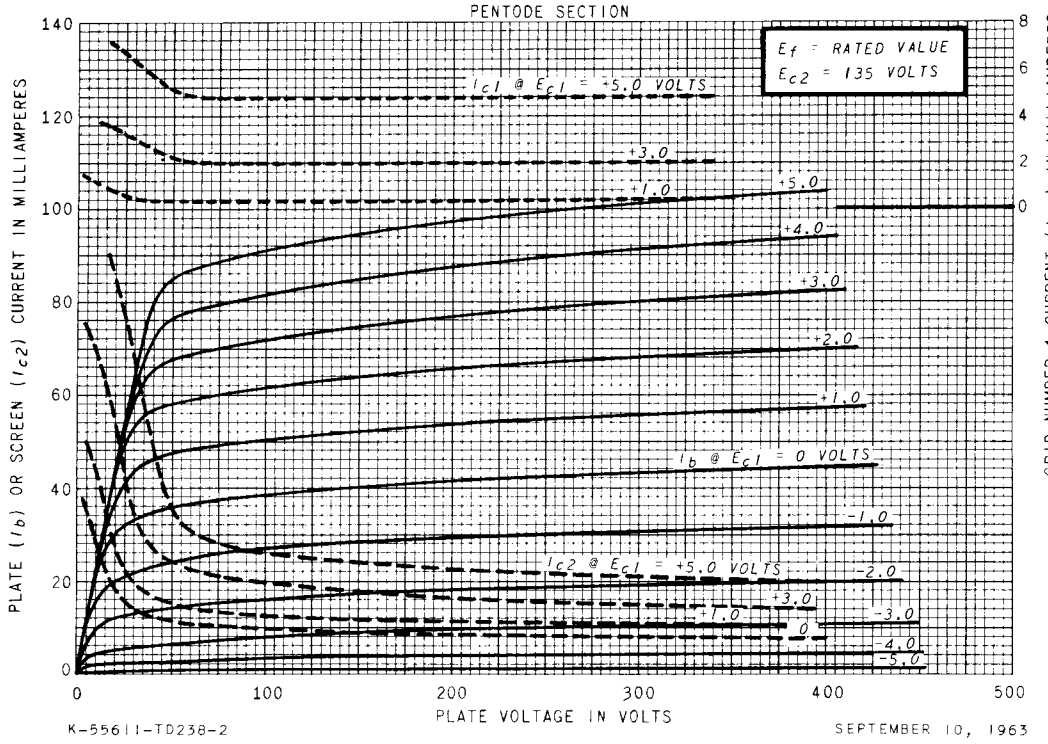
SCREEN RATING CHART



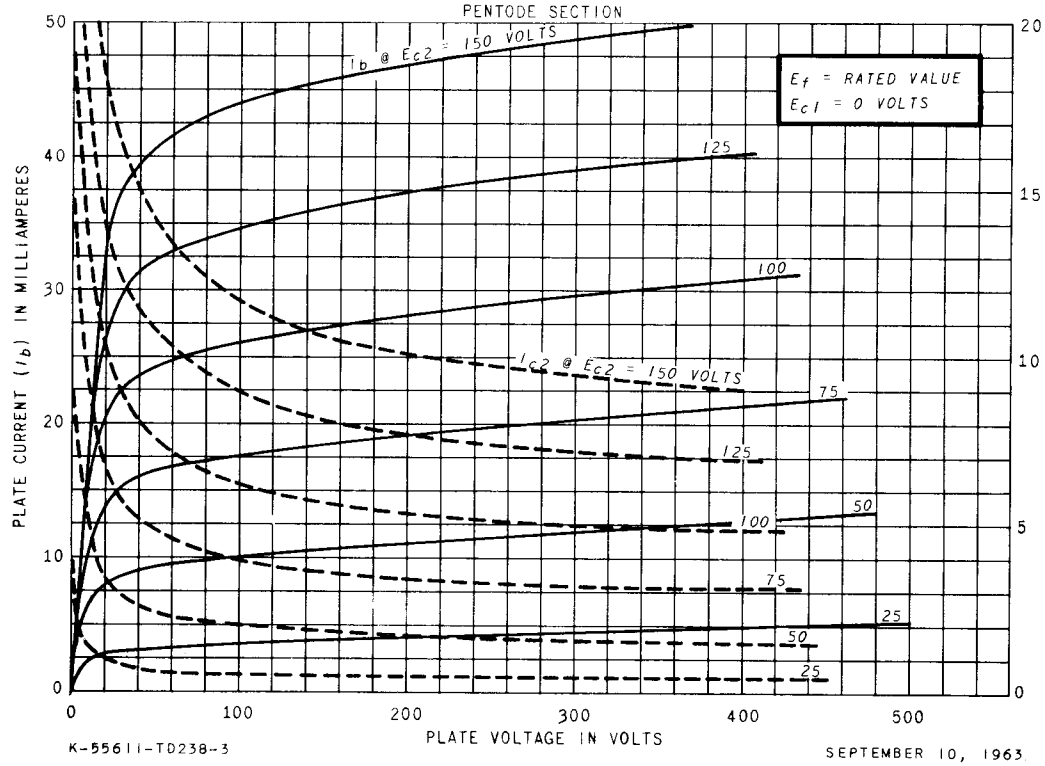
AVERAGE PLATE CHARACTERISTICS



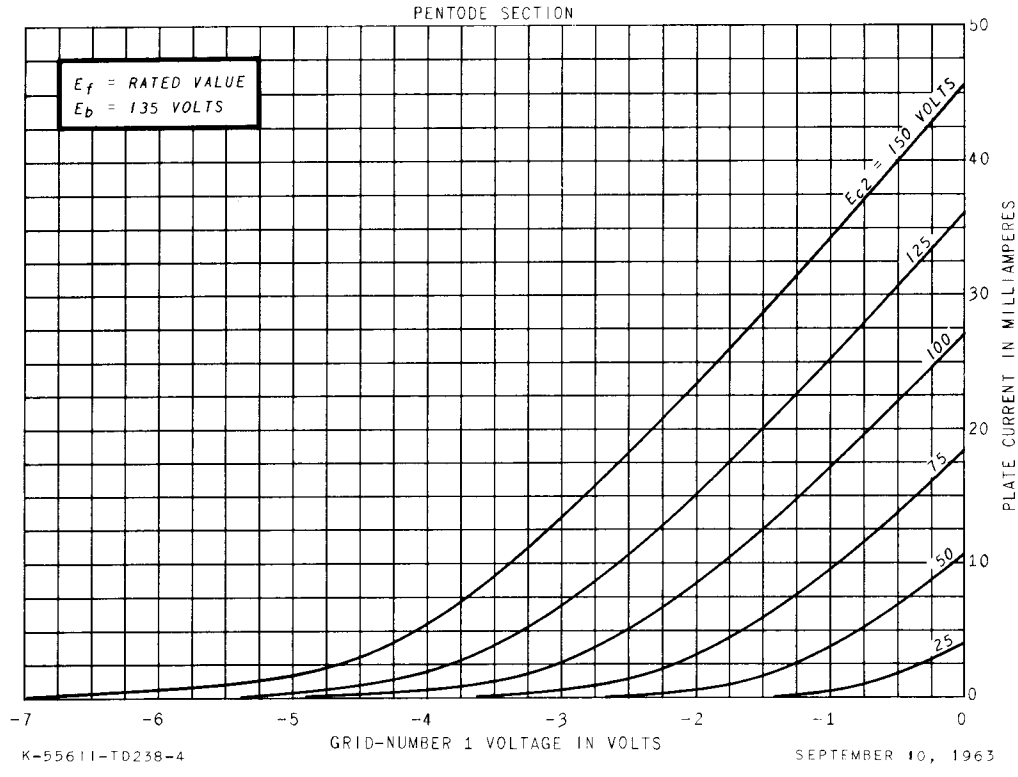
AVERAGE PLATE CHARACTERISTICS



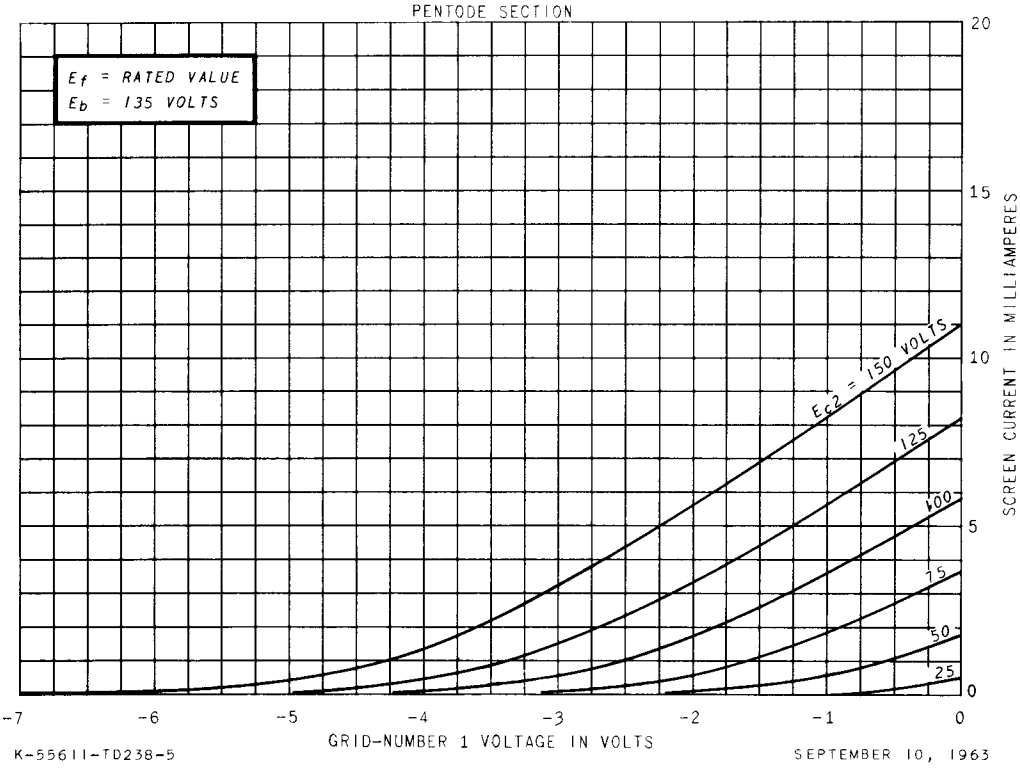
AVERAGE PLATE CHARACTERISTICS



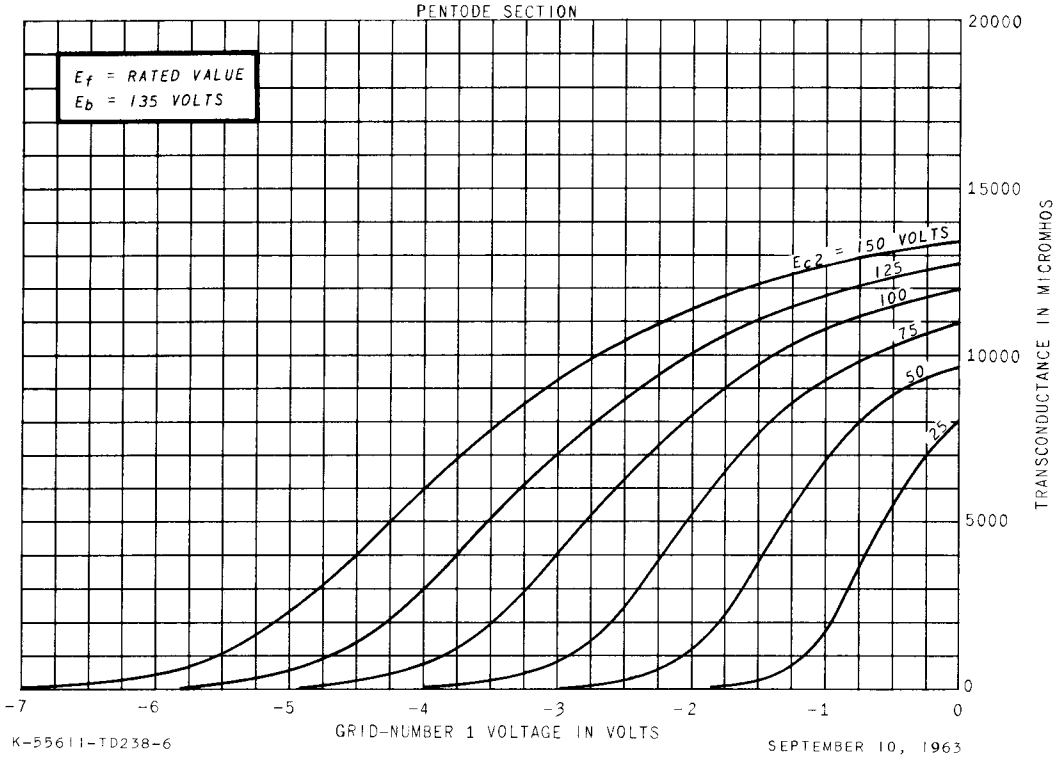
AVERAGE TRANSFER CHARACTERISTICS



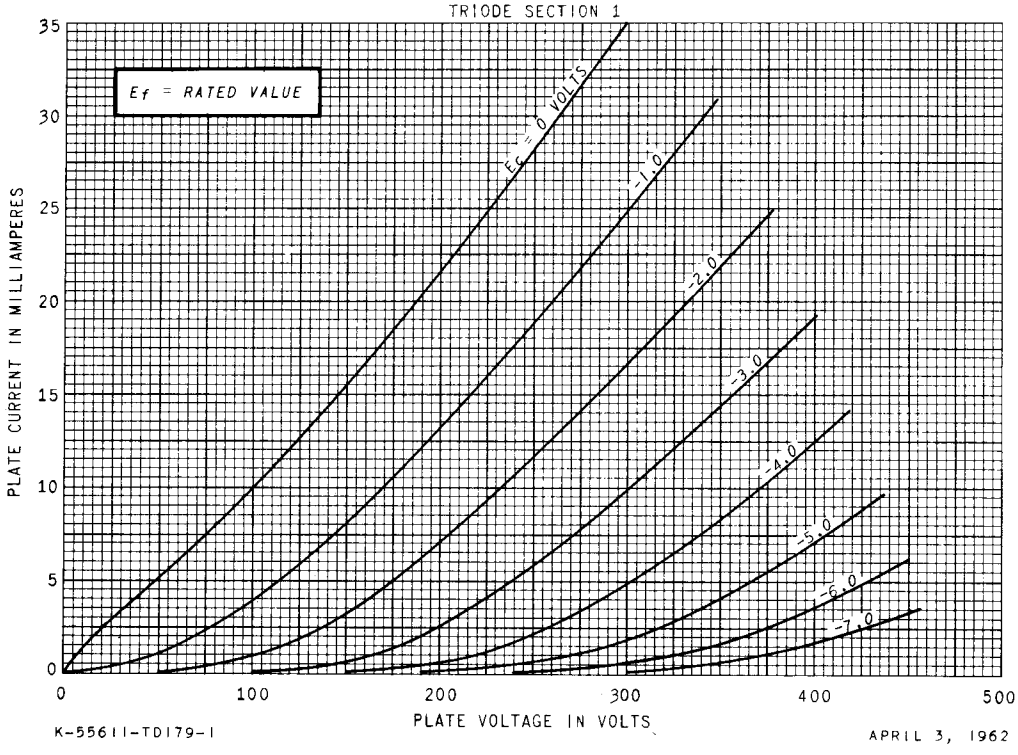
AVERAGE TRANSFER CHARACTERISTICS



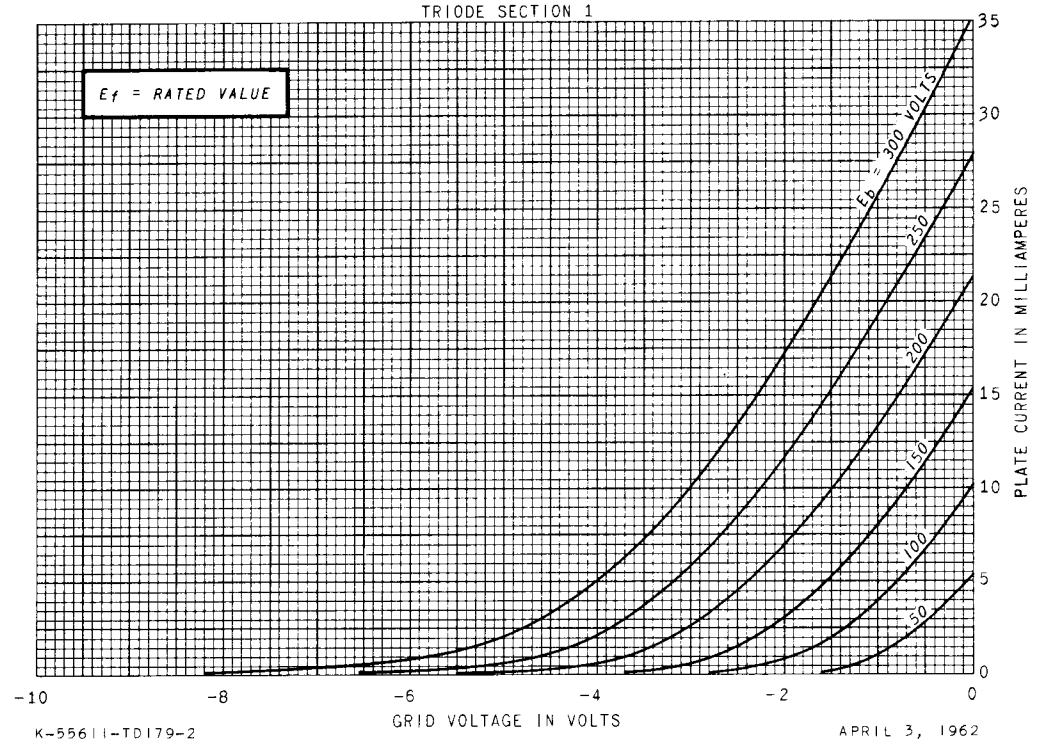
AVERAGE TRANSFER CHARACTERISTICS



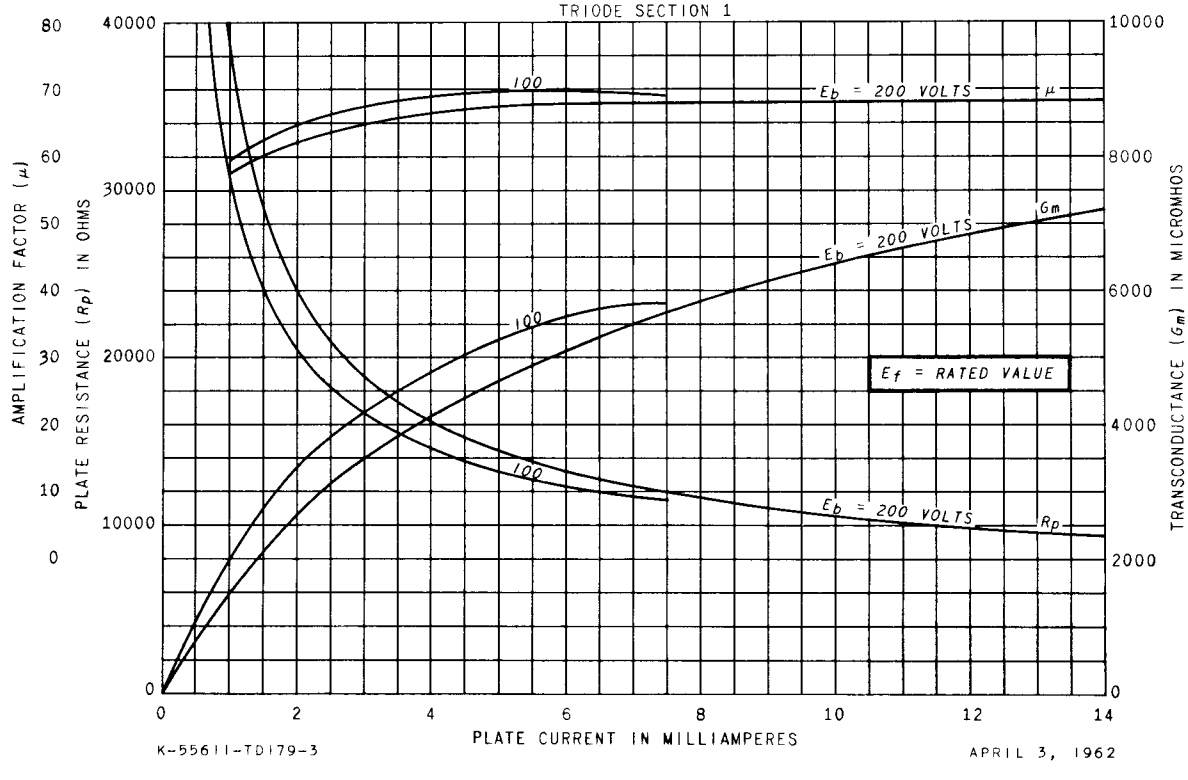
AVERAGE PLATE CHARACTERISTICS



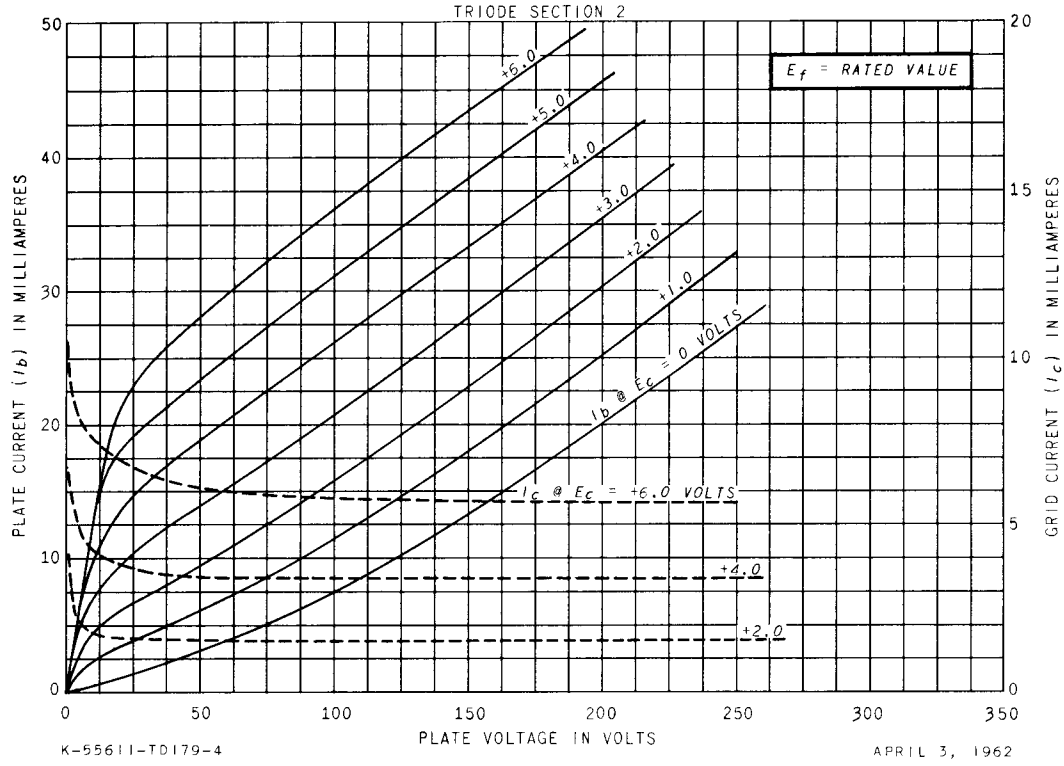
AVERAGE TRANSFER CHARACTERISTICS



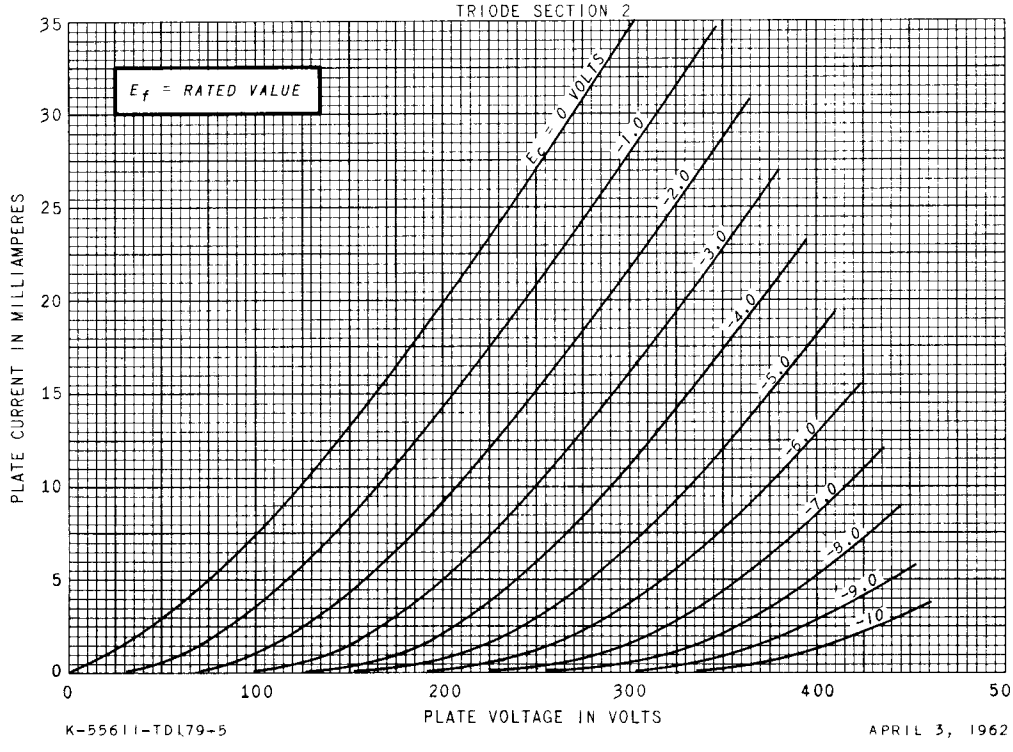
AVERAGE CHARACTERISTICS



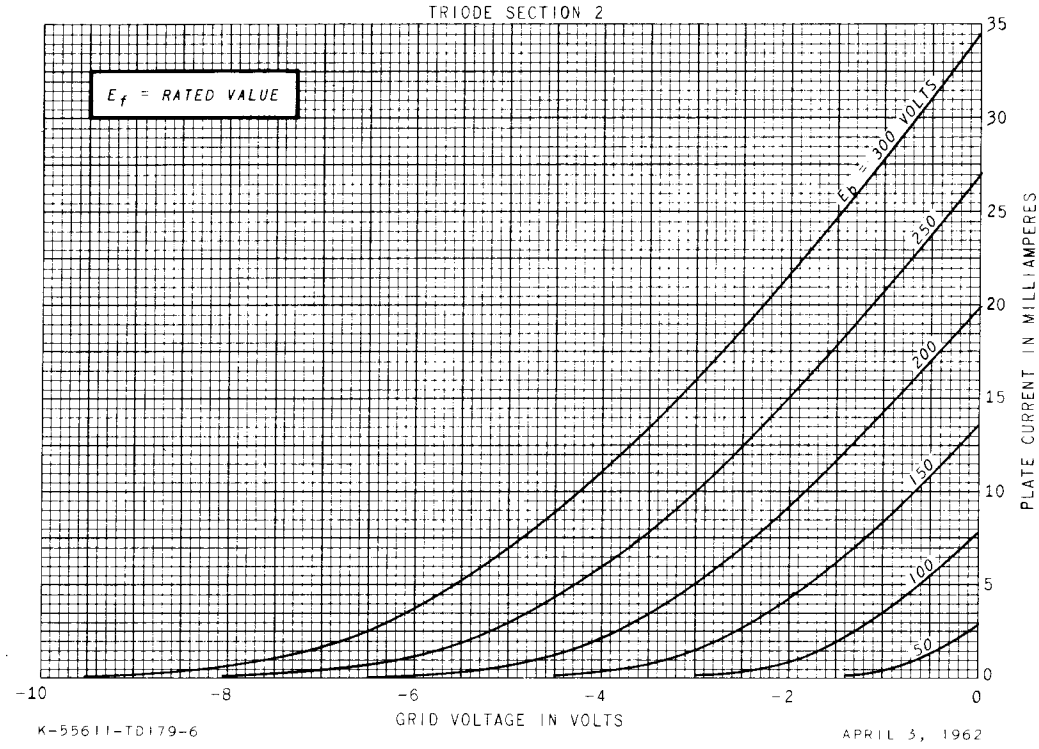
AVERAGE PLATE CHARACTERISTICS



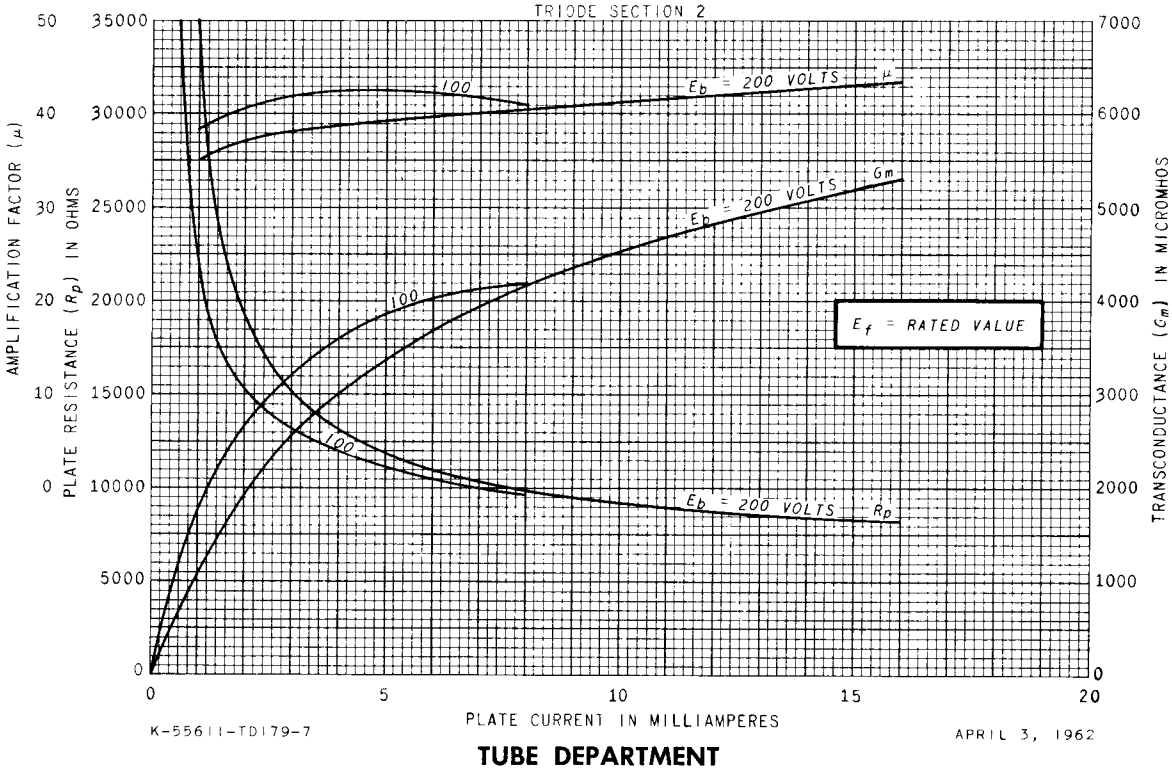
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

6BE3

COMPACTRON DIODE

FOR TV DAMPING DIODE APPLICATIONS

DESCRIPTION AND RATING

The 6BE3 is a compactron, single heater-cathode type diode intended for service as the damping diode in the horizontal deflection circuit of television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*. . .	6.3±0.6	Volts
Heater Current†	1.2	Amperes
Direct Interelectrode Capacitances, approximate‡		
Cathode to Plate and Heater:		
k to (p + h)	10	pf
Plate to Cathode and Heater:		
p to (k + h)	8.0	pf
Heater to Cathode: (h to k) . .	3.4	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-60

Maximum Diameter.	1.188	Inches
Maximum Over-all Length . .	2.875	Inches
Maximum Seated Height . . .	2.500	Inches

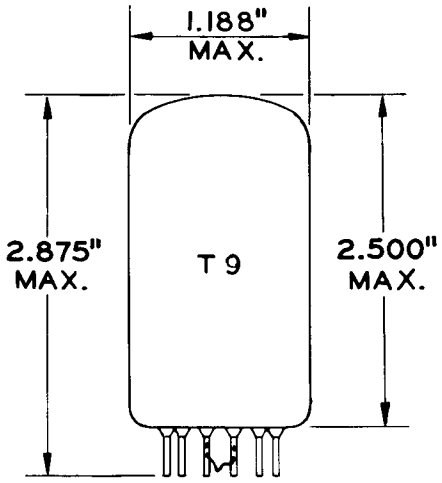
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

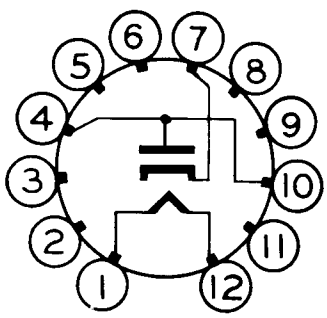


EIA 9-60

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - No Connection
Pin 3 - No Connection
Pin 4 - Plate
Pin 5 - No Connection
Pin 6 - No Connection
Pin 7 - Cathode
Pin 8 - No Connection
Pin 9 - No Connection
Pin 10 - Plate
Pin 11 - No Connection
Pin 12 - Heater

BASING DIAGRAM



EIA 12BL

MAXIMUM RATINGS (Cont'd)

TV DAMPER SERVICE—DESIGN-MAXIMUM VALUES §

Peak Inverse Plate Voltage	5000	Volts
Plate Dissipation	6.5	Watts
Steady-State Peak Plate Current	1200	Milliamperes
DC Output Current	200	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	900	Volts
Total DC and Peak	5000	Volts

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 350 Milliamperes DC	25	Volts

FOOTNOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

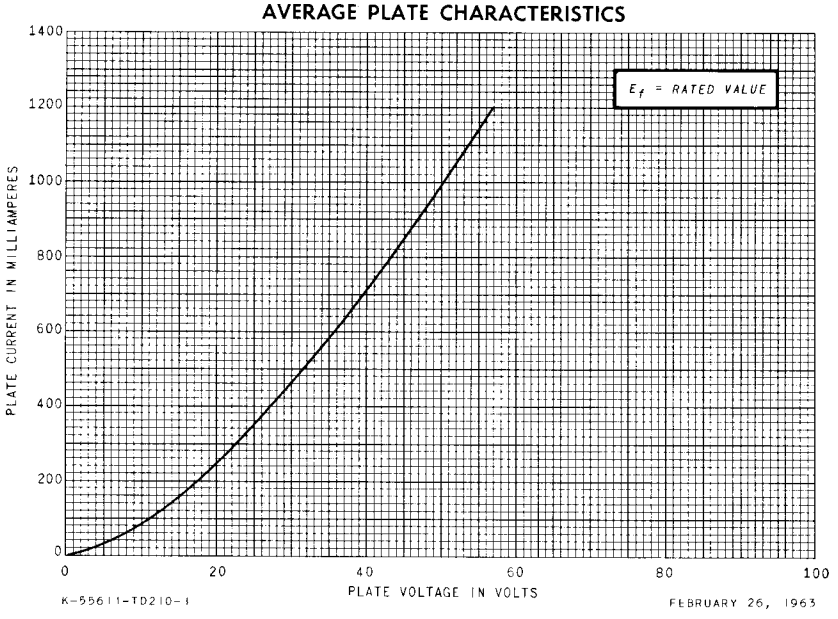
† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky

6BE6—3BE6—4BE6—12BE6

HEPTODE

FOR PENTAGRID CONVERTER APPLICATIONS

DESCRIPTION AND RATING

The 6BE6 is a miniature heptode primarily designed to perform the combined functions of the mixer and oscillator in superheterodyne circuits in both the standard broadcast and FM bands. Its performance in these applications is characterized by high conversion gain and a high degree of oscillator stability with variations in the applied automatic-volume-control bias voltage.

Except for heater ratings, the 3BE6 and 4BE6 are identical to the 6BE6. In addition, they incorporate a controlled heater-warm-up characteristic which makes them especially suited for use in radio or television receivers that employ series-connected heaters.

The 12BE6, which differs from the 6BE6 only in heater ratings and heater-cathode voltage ratings, is especially useful in a-c/d-c radio receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

	3BE6	4BE6	6BE6	12BE6	
Heater Voltage, AC or DC	3.15	4.2	6.3	12.6	Volts
Heater Current	0.6	0.45	0.3	0.15	Amperes
Heater Warm-up Time*	11	11	...	...	Seconds

Direct Interelectrode Capacitances	With Shield†	Without Shield	
Grid-Number 3 to All	7.0	7.0	μμf
Plate to All	13	8.0	μμf
Grid-Number 1 to All	5.5	5.5	μμf
Cathode to All Except Grid-Number 1	20	15	μμf
Grid-Number 3 to Plate, maximum	0.25	0.30	μμf
Grid-Number 1 to Grid-Number 3, maximum	0.15	0.15	μμf
Grid-Number 1 to Plate, maximum	0.05	0.1	μμf
Grid-Number 1 to Cathode	3.0	3.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

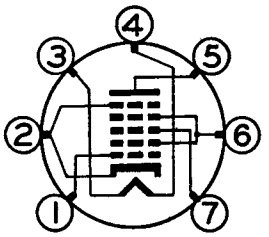
Plate Voltage	300	Volts
Screen-Supply Voltage	300	Volts
Screen Voltage	100	Volts
Positive DC Grid-Number 3 Voltage	0	Volts
Negative DC Grid-Number 3 Voltage	50	Volts
Plate Dissipation	1.0	Watts
Screen Dissipation	1.0	Watts
DC Cathode Current	14	Milliamperes

Heater-Cathode Voltage	3BE6 4BE6 6BE6	12BE6	
Heater Positive with Respect to Cathode			
DC Component	100	...	Volts
Total DC and Peak	200	100	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	100	Volts

GENERAL ELECTRIC

Supersedes ET-T891, dated 8-54

BASING DIAGRAM

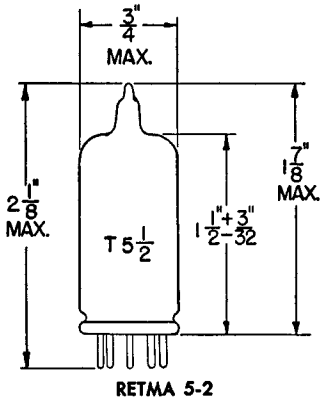


RETMA 7CH

TERMINAL CONNECTIONS

Pin 1—Grid Number 1 (Oscillator Grid)
Pin 2—Cathode and Grid Number 5
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grids Number 2 and 4 (Screen)
Pin 7—Grid Number 3 (Mixer Grid)

PHYSICAL DIMENSIONS



RETMA 5-2

CHARACTERISTICS AND TYPICAL OPERATION

CONVERTER SERVICE‡

Plate Voltage	100	250	Volts
Screen Voltage	100	100	Volts
Grid-Number 3 Voltage	−1.5	−1.5	Volts
Grid-Number 1 Voltage, RMS	10	10	Volts
Grid-Number 1 Resistance	20000	20000	Ohms
Plate Resistance, approximate	0.4	1.0	Megohms
Conversion Transconductance	455	475	Micromhos
Plate Current	2.6	2.9	Milliamperes
Screen Current	7.0	6.8	Milliamperes
Grid-Number 1 Current	0.5	0.5	Milliamperes
Cathode Current	10.1	10.2	Milliamperes
Grid-Number 3 Voltage, approximate G_c = 10 Micromhos	−30	−30	Volts
Grid-Number 3 Voltage, approximate G_c = 100 Micromhos	−6	−6	Volts

OSCILLATOR CHARACTERISTICS (NOT OSCILLATING)

Plate Voltage		100	Volts
Screen, Connected to Plate			
Grid-Number 3 Voltage		0	Volts
Grid-Number 1 Voltage		0	Volts
Amplification Factor§		20	
Transconductance§		7250	Micromhos
Cathode Current		25	Milliamperes
Grid-Number 1 Voltage, approximate I_b = 10 Microamperes		−11	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

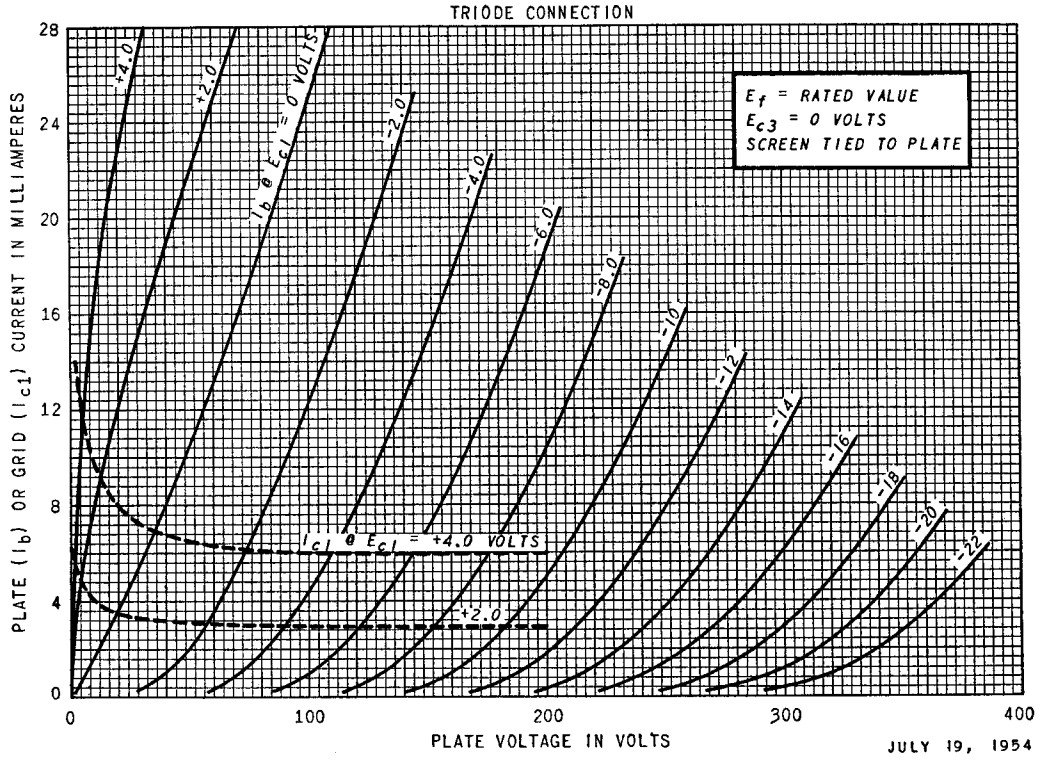
† With external shield (RETMA 316) connected to pin 2.

‡ Characteristics shown are obtained in the standard RETMA conversion conductance test set which uses separate excitation. The characteristics under these conditions correspond very closely with those obtained in a self-excited oscillatory circuit operating with zero bias.

§ Between grid number 1 and grids number 2 and 4 connected to plate.

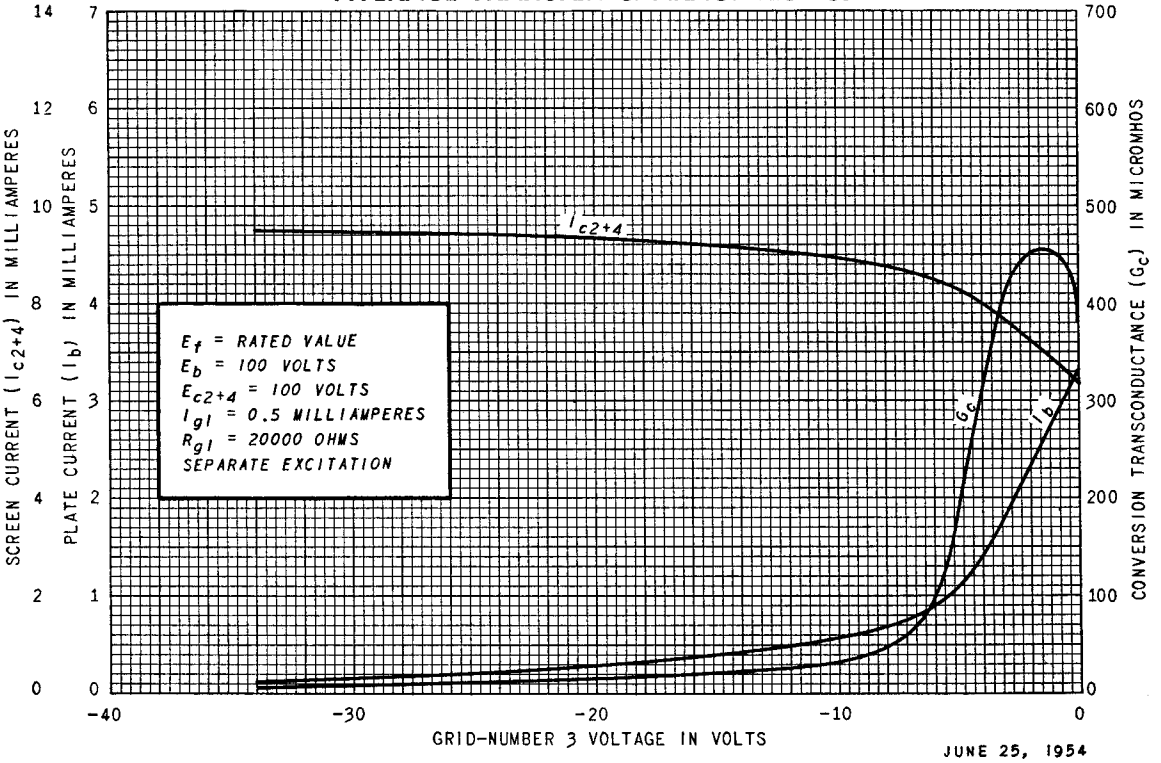
AVERAGE PLATE CHARACTERISTICS

TRIODE CONNECTION



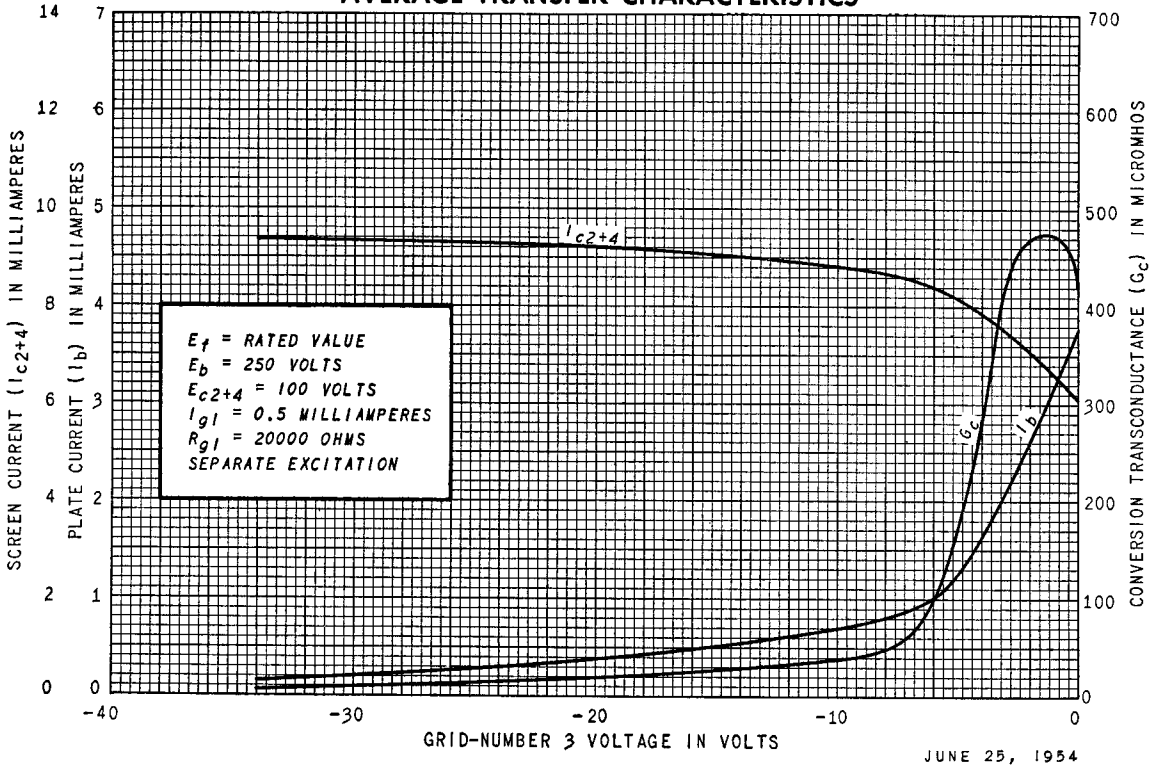
JULY 19, 1954

AVERAGE TRANSFER CHARACTERISTICS

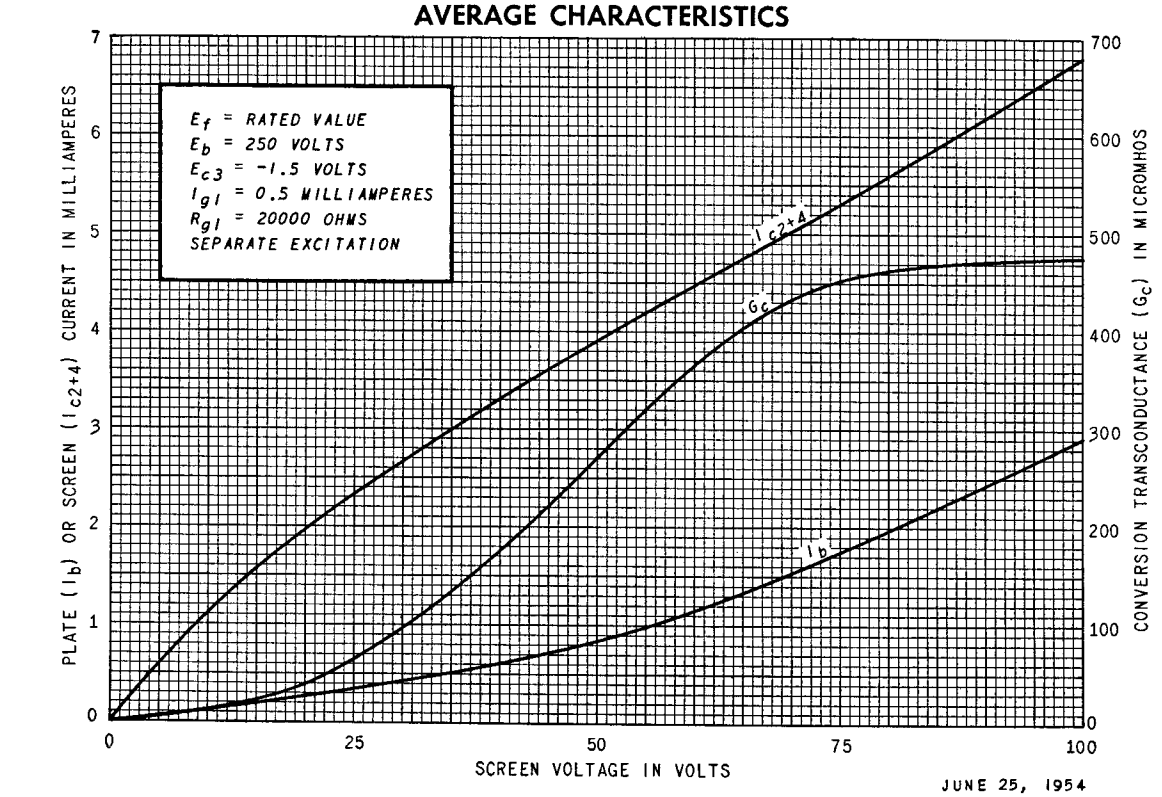


JUNE 25, 1954

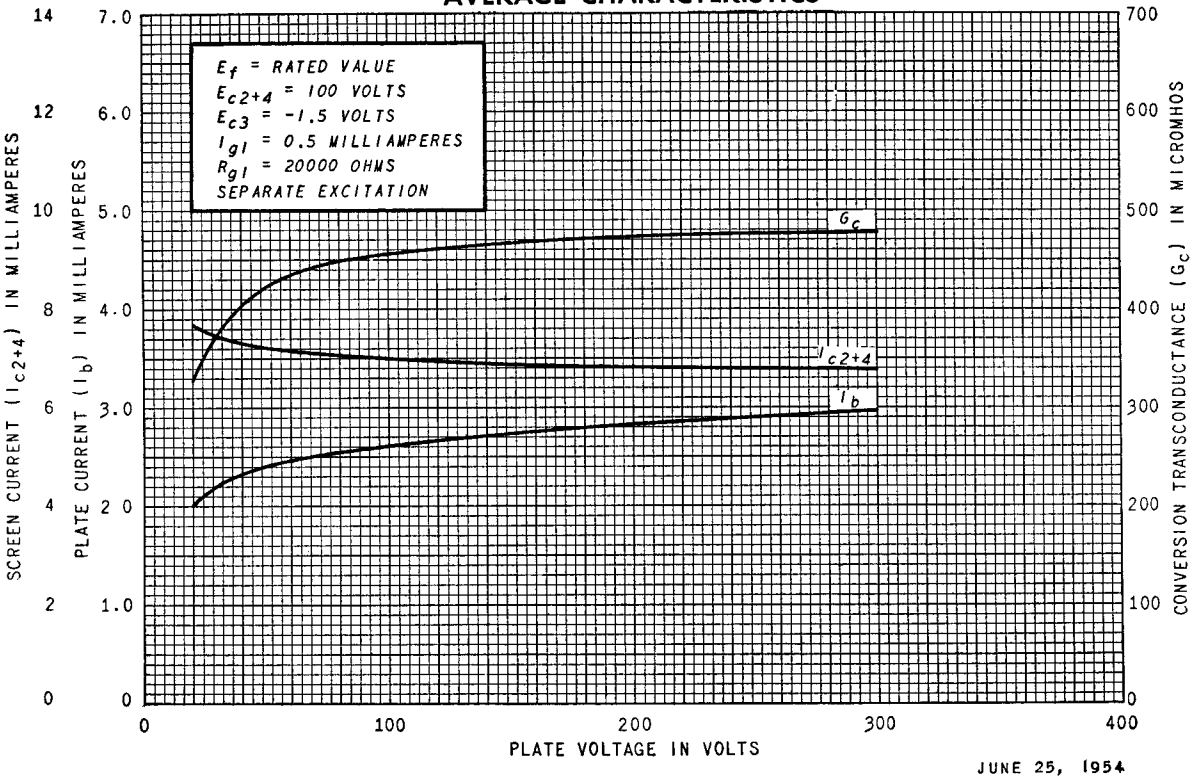
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS

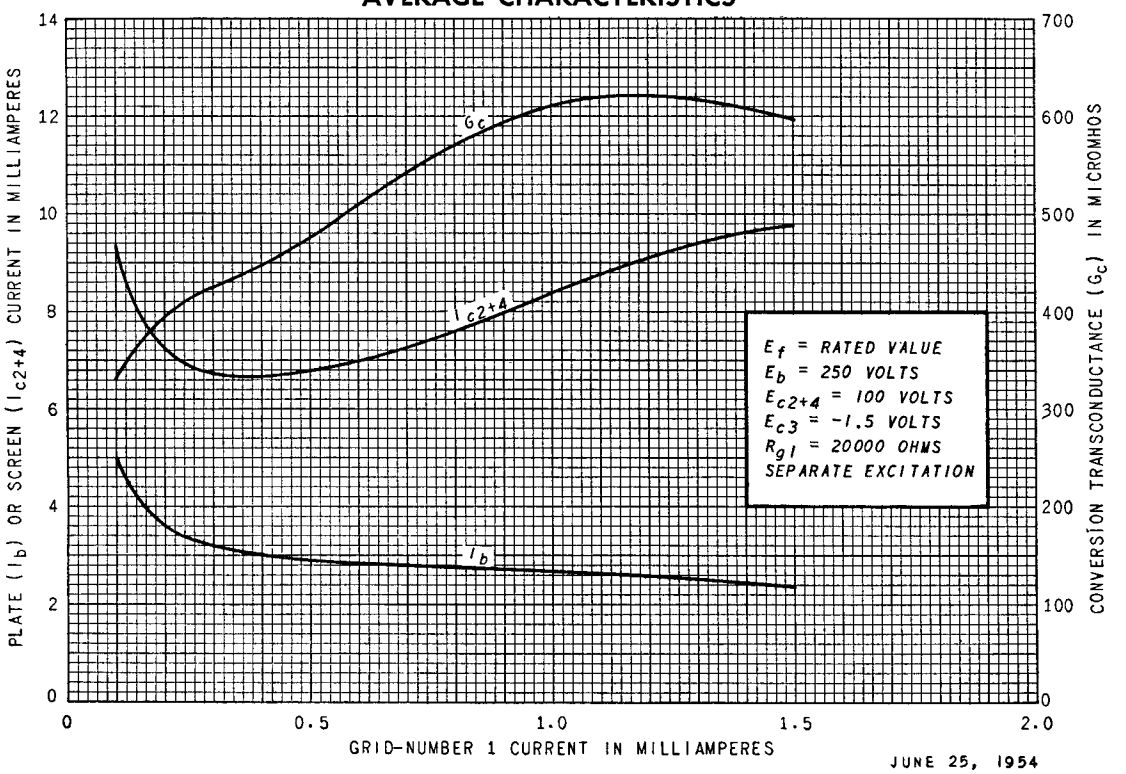


AVERAGE CHARACTERISTICS



JUNE 25, 1954

AVERAGE CHARACTERISTICS



JUNE 25, 1954

Compactron
Dissimilar Double Pentode

6BF11

- AUDIO POWER PENTODE
- QUADRATURE FM DETECTOR
- LOW HUM
- 140 VOLTS B+

The 6BF11 is a compactron containing a sharp-cutoff, dual-control pentode (Section 2) and a power pentode (Section 1). The dual-control pentode is intended for use as an FM detector and the power pentode as an audio-frequency output amplifier in television receivers. The power output pentode features relatively high dynamic plate resistance which results in minimizing hum currents in the plate circuit due to power supply ripple.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	1.2	Amperes

Direct Interelectrode Capacitances§

Section 1

Grid-Number 1 to Plate: (1g1 to 1p)	0.24	pf
Input: 1g1 to (h + 1k + 1g2 + b.p. + i.s.)	13	pf
Output: 1p to (h + 1k + 1g2 + b.p. + i.s.)	10	pf

Section 2

Grid-Number 1 to Plate: (2g1 to 2p)	0.036	pf
Grid-Number 3 to Plate: (2g3 to 2p)	3.2	pf
Grid-Number 1 to All Except Plate: 2g1 to (h + 2k + 2g2 + 2g3 + i.s.)	6.5	pf

Section 2 (Cont'd)

Grid-Number 3 to All: 2g3 to (h + 2k + 2g1 + 2g2 + 2p + i.s.)	8.0	pf
Grid-Number 1 to Grid-Number 3: (2g1 to 2g3)	0.11	pf

Coupling

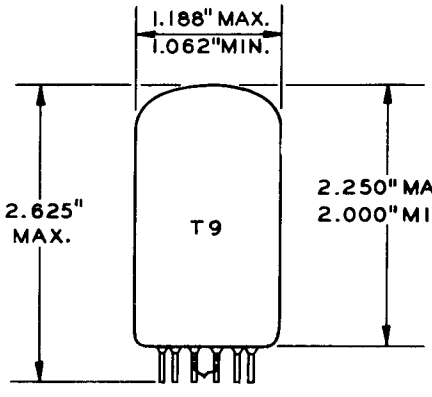
Plate (Section 2) to Plate (Section 2): (1p to 2p)	0.13	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

PHYSICAL DIMENSIONS

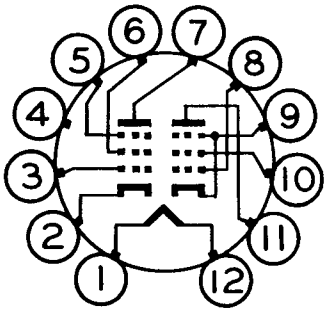


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode (Section 2) and Internal Shield
Pin 3 - Grid Number 1 (Section 2)
Pin 4 - No Connection
Pin 5 - Grid Number 3 (Suppressor) (Section 2)
Pin 6 - Grid Number 2 (Screen) (Section 2)
Pin 7 - Plate (Section 2)
Pin 8 - Grid Number 1 (Section 1)
Pin 9 - Cathode and Beam Plates (Section 1)
Pin 10 - Grid Number 2 (Screen) (Section 1)
Pin 11 - Plate (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12EZ

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

Supersedes 6BF11 D and R Sheet dated 12-63

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

SECTION 1

Plate Voltage	165	Volts
Screen Voltage	150	Volts
Plate Dissipation	6.5	Watts
Screen Dissipation	1.8	Watts
DC Cathode Current	65	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	0.5	Megohms

SECTION 2

Plate Voltage	330	Volts
Suppressor Voltage	28	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	1.7	Watts
Screen Dissipation	1.1	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

SECTION 1

Plate Voltage	145	Volts
Screen Voltage	110	Volts
Grid-Number 1 Voltage	-6.0	Volts
Peak AF Grid-Number 1 Voltage	6.0	Volts
Plate Resistance, approximate	30000	Ohms
Transconductance	8600	Micromhos
Zero-Signal Plate Current	36	Milliamperes
Maximum-Signal Plate Current	40	Milliamperes
Zero-Signal Screen Current	3.0	Milliamperes
Maximum-Signal Screen Current	9.0	Milliamperes
Load Resistance	3000	Ohms
Total Harmonic Distortion, approximate	10	Percent
Maximum-Signal Power Output	2.4	Watts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

AVERAGE CHARACTERISTICS

SECTION 2

Plate Voltage	150	Volts
Suppressor Voltage	0	Volts
Screen Voltage	100	Volts
Cathode-Bias Resistor	560	Ohms
Plate Resistance, approximate	0.15	Megohms
Grid-Number 1 Transconductance	1000	Micromhos
Grid-Number 3 Transconductance	400	Micromhos
Plate Current	1.3	Milliamperes
Screen Current	2.0	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	-4.5	Volts
Grid-Number 3 Voltage, approximate Ib = 10 Microamperes	-4.5	Volts

NOTES

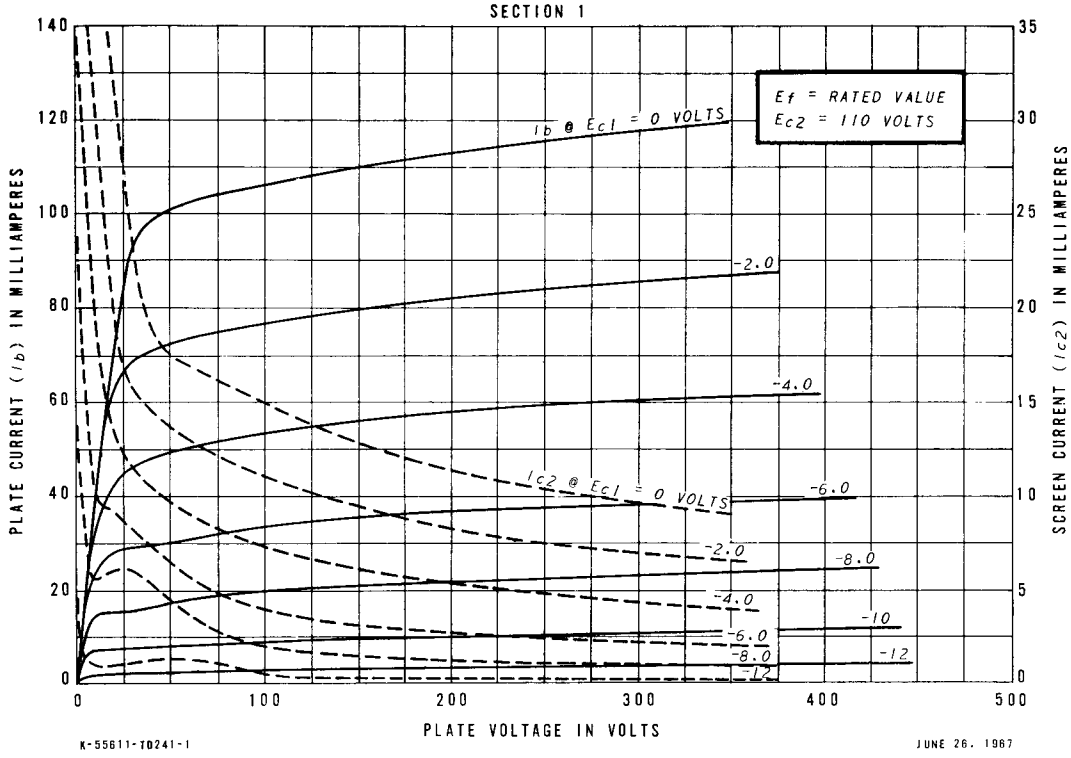
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

AVERAGE PLATE CHARACTERISTICS

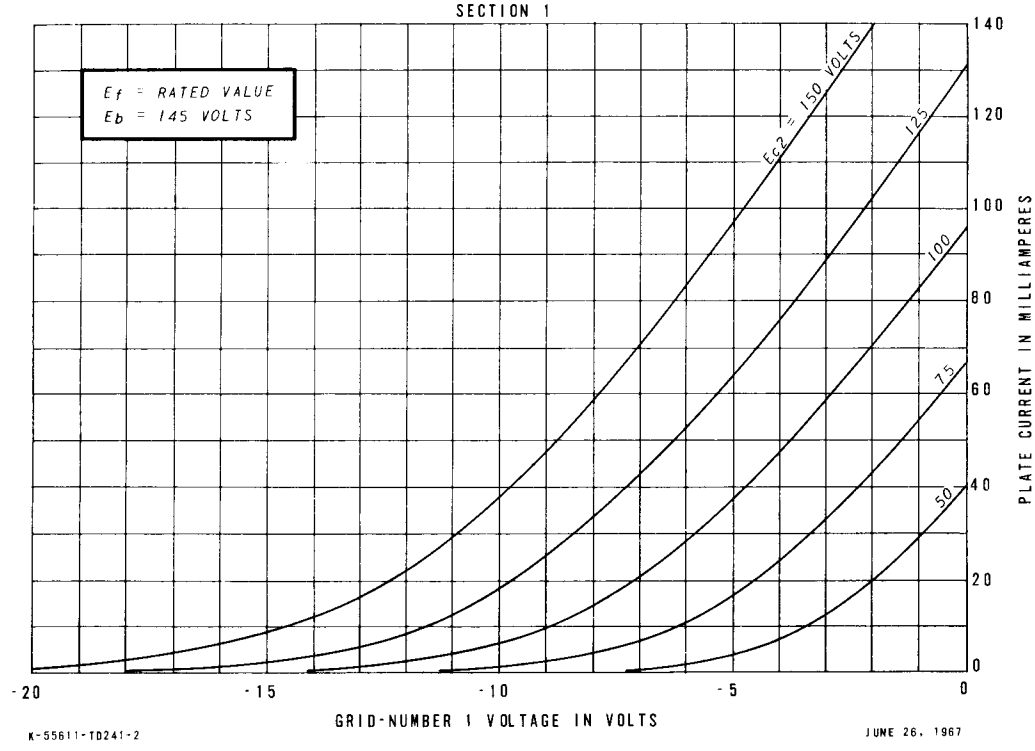
SECTION 1



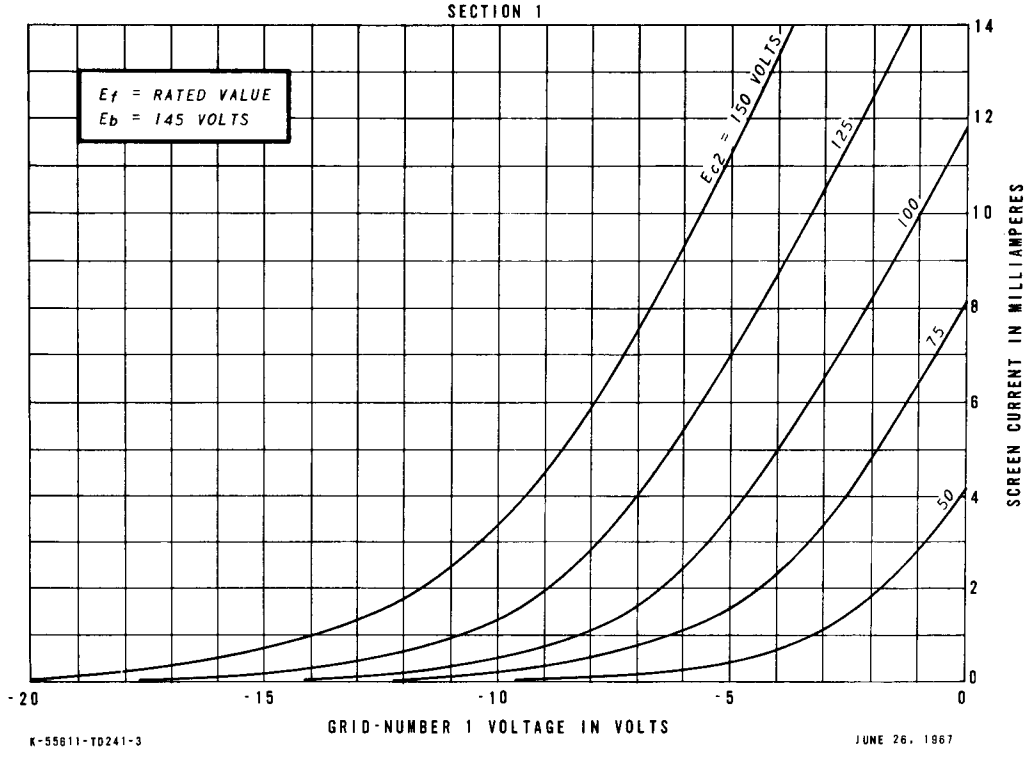
K-55611-T0241-1

JUNE 26, 1967

AVERAGE TRANSFER CHARACTERISTICS

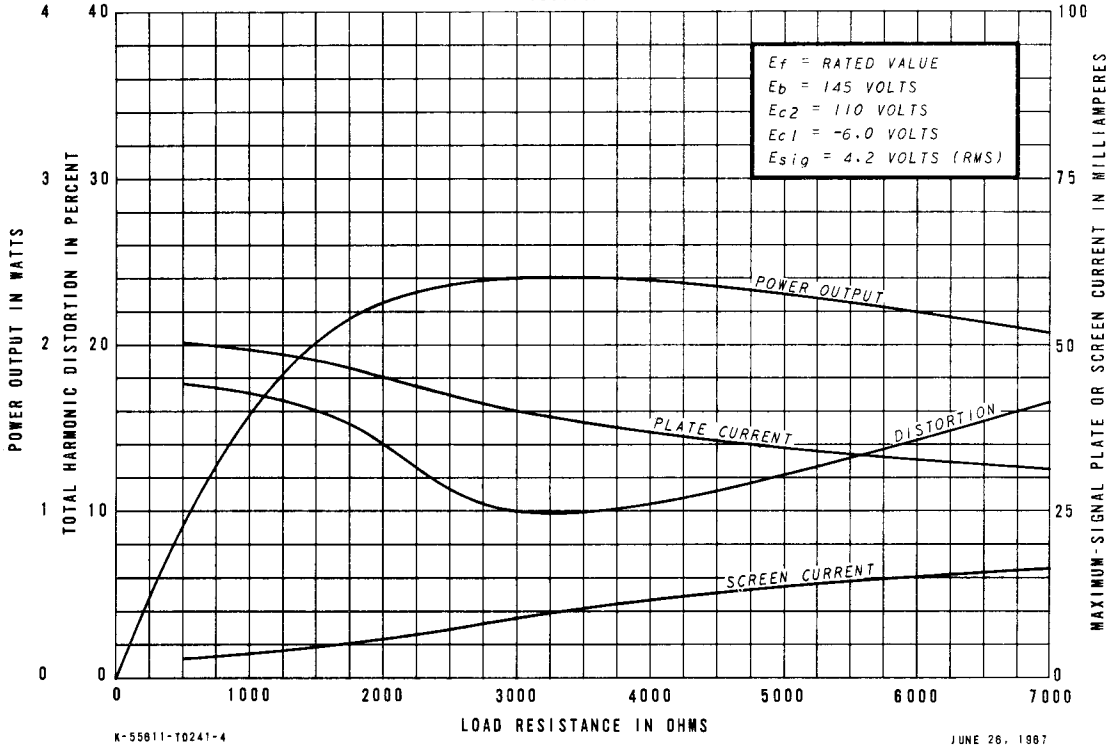


AVERAGE TRANSFER CHARACTERISTICS



OPERATION CHARACTERISTICS

SECTION 1

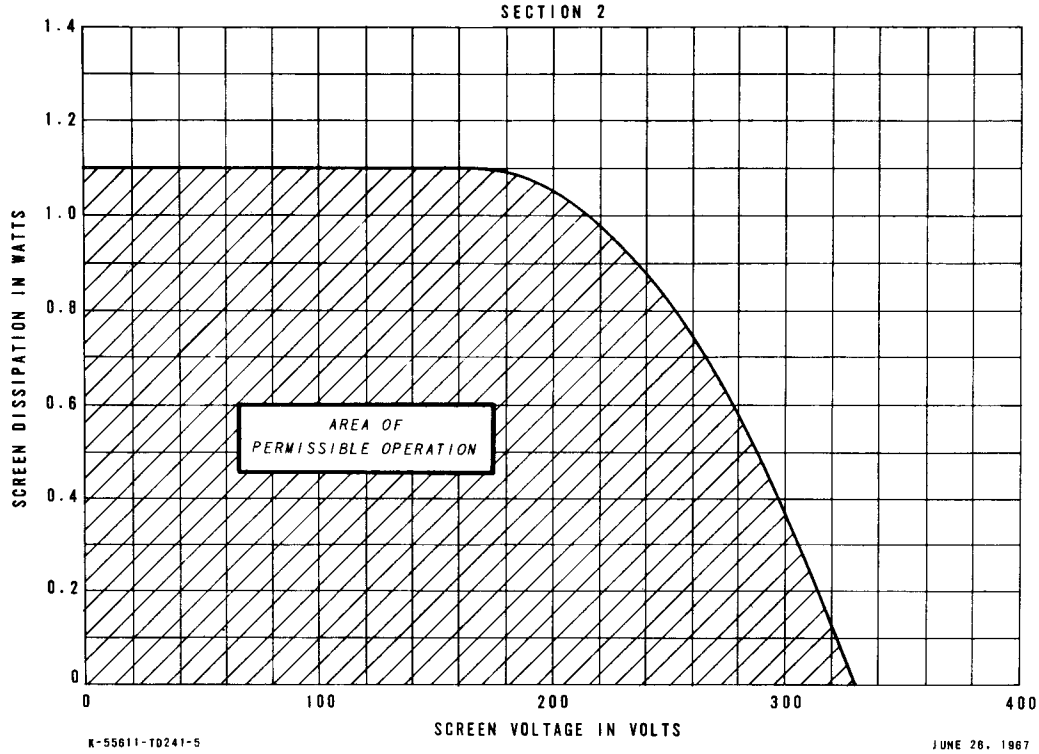


K-55611-T0241-4

JUNE 26, 1967

SCREEN RATING CHART

SECTION 2

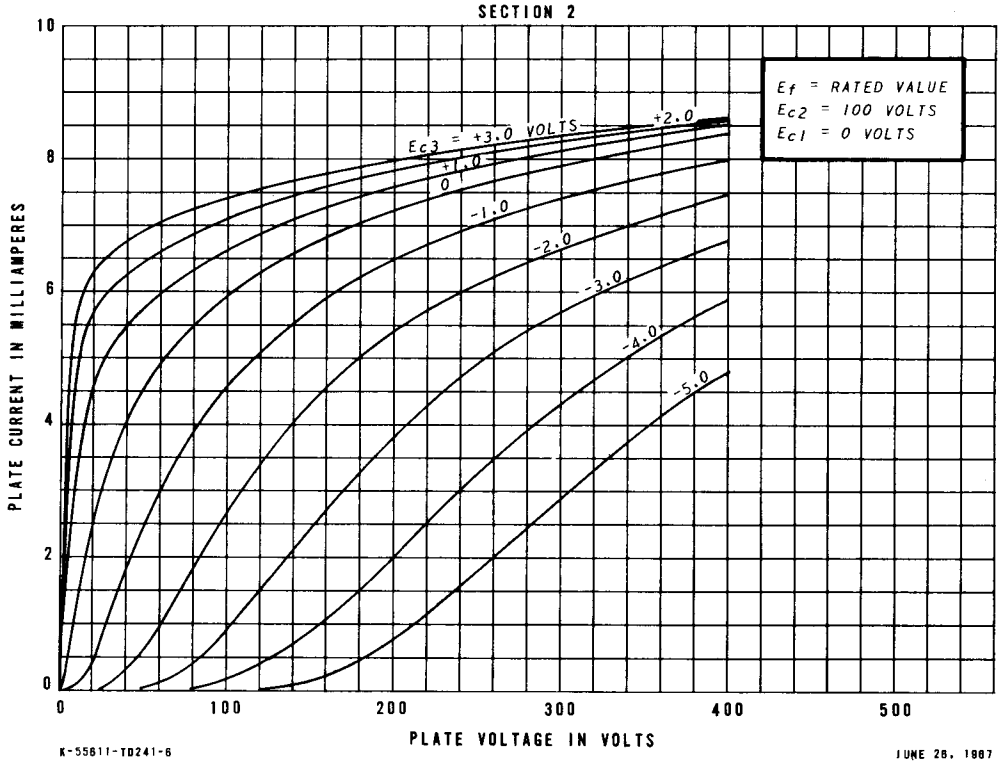


K-55611-T0241-5

JUNE 26, 1967

AVERAGE PLATE CHARACTERISTICS

SECTION 2

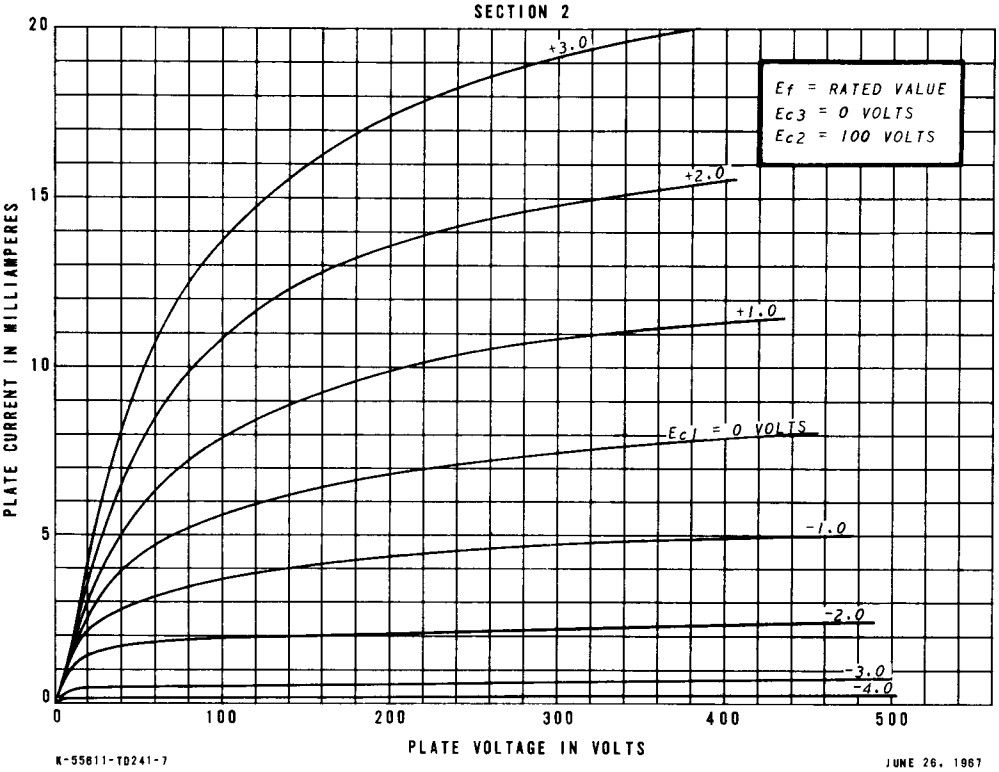


K-55811-TD241-6

JUNE 26, 1967

AVERAGE PLATE CHARACTERISTICS

SECTION 2

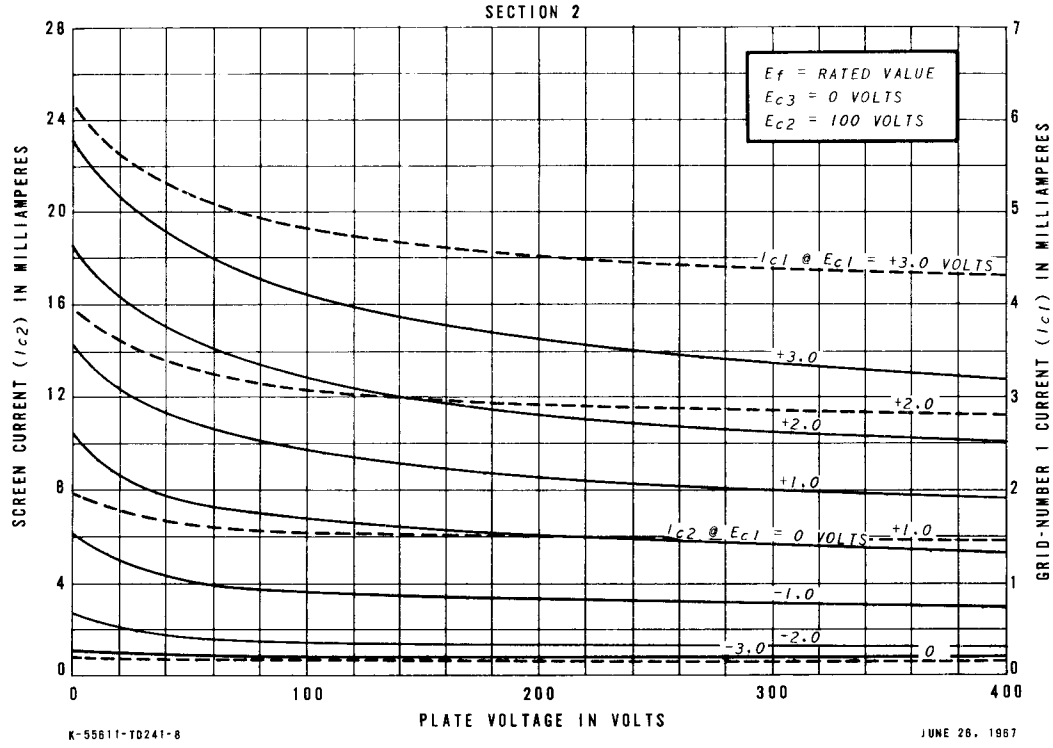


K-55811-TD241-7

JUNE 26, 1967

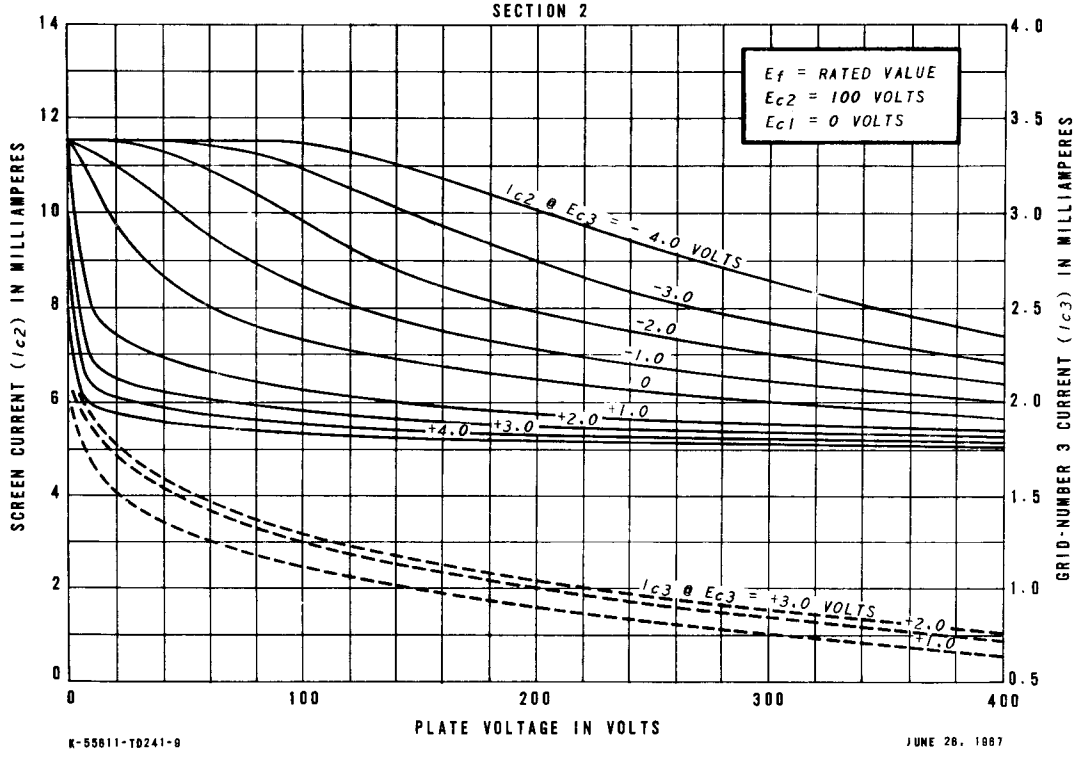
AVERAGE CHARACTERISTICS

SECTION 2

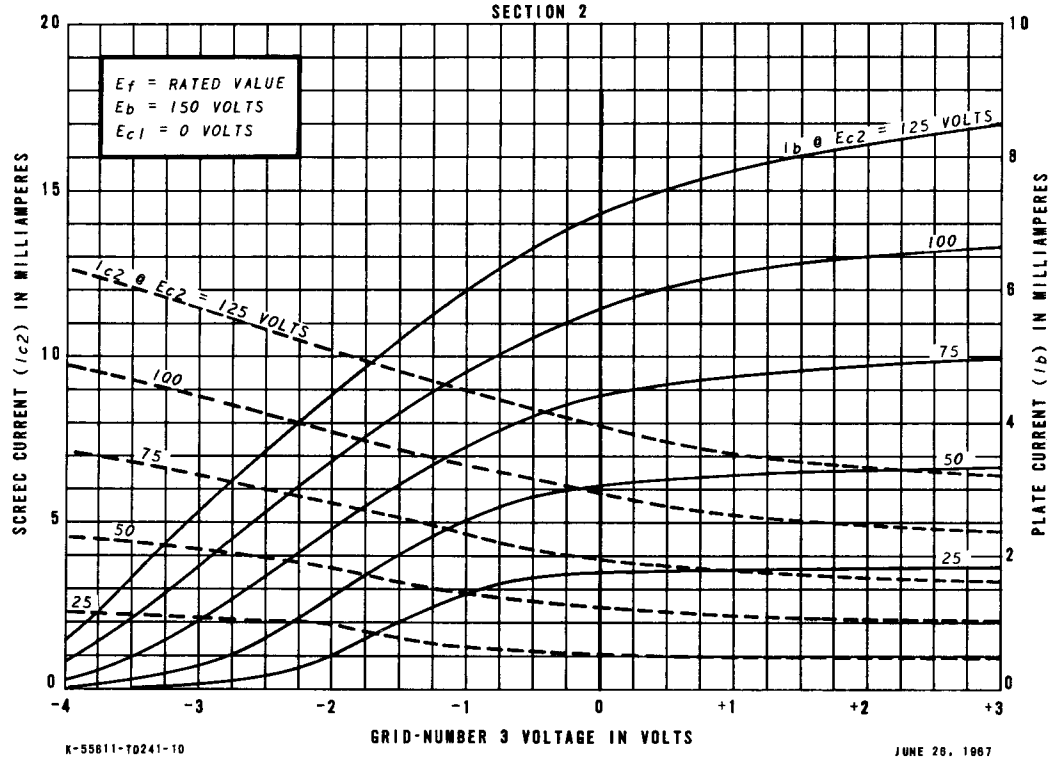


AVERAGE CHARACTERISTICS

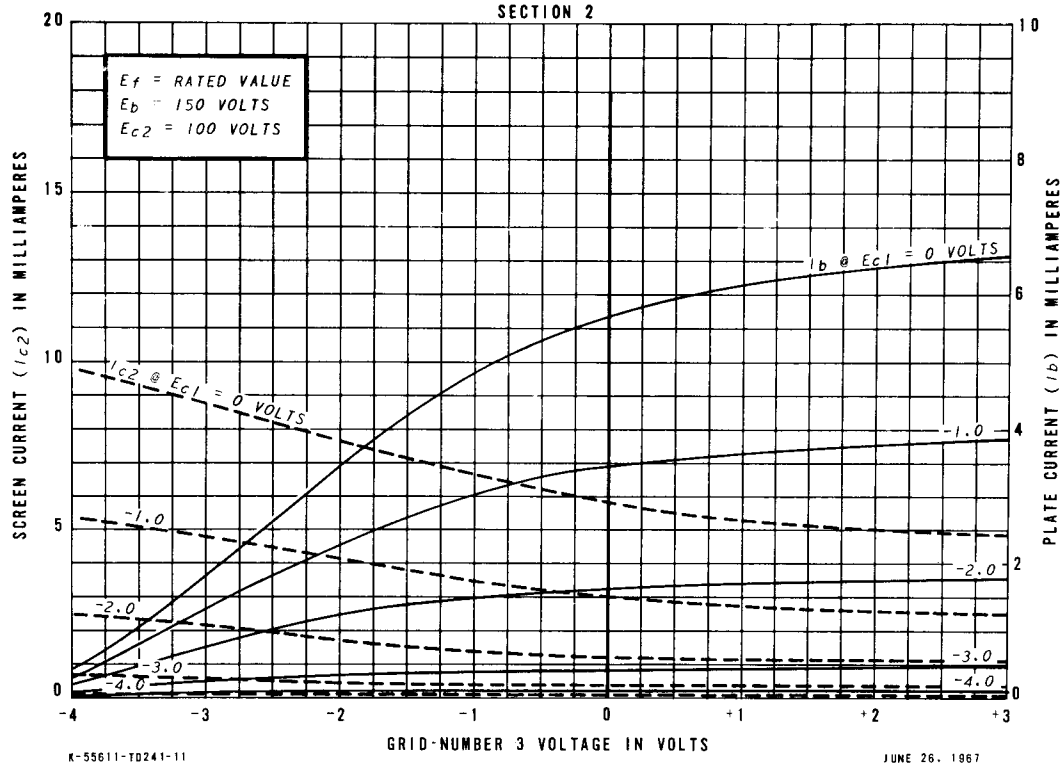
SECTION 2



AVERAGE TRANSFER CHARACTERISTICS

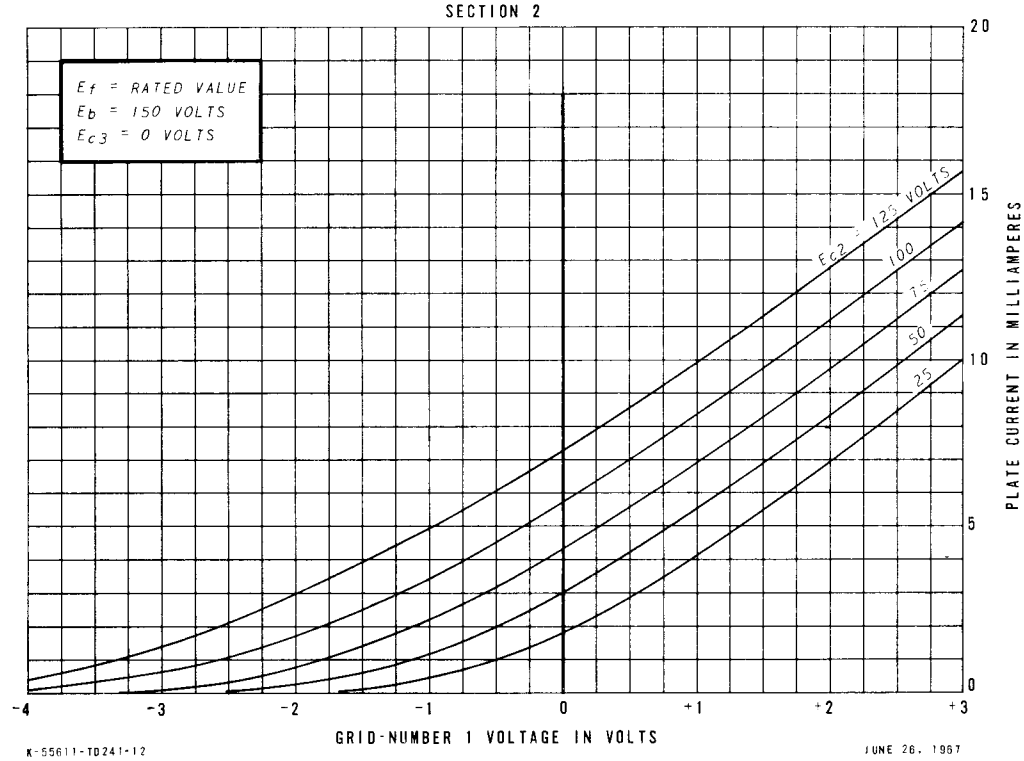


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

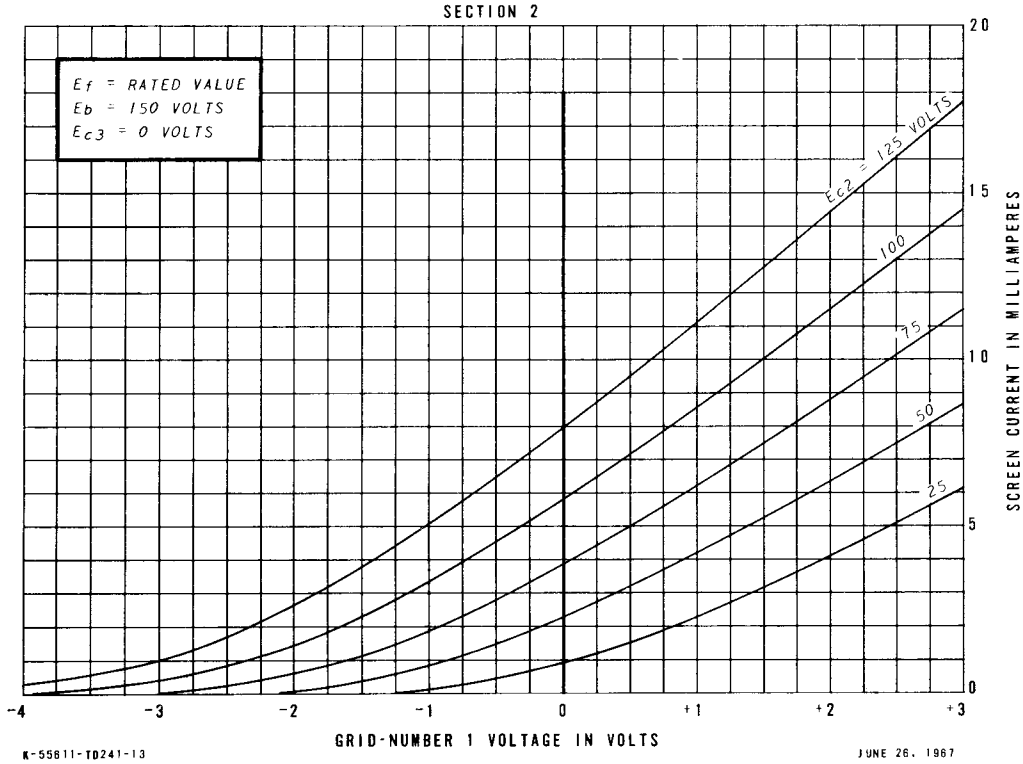


K-55611-TD241-12

JUNE 26, 1967

AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

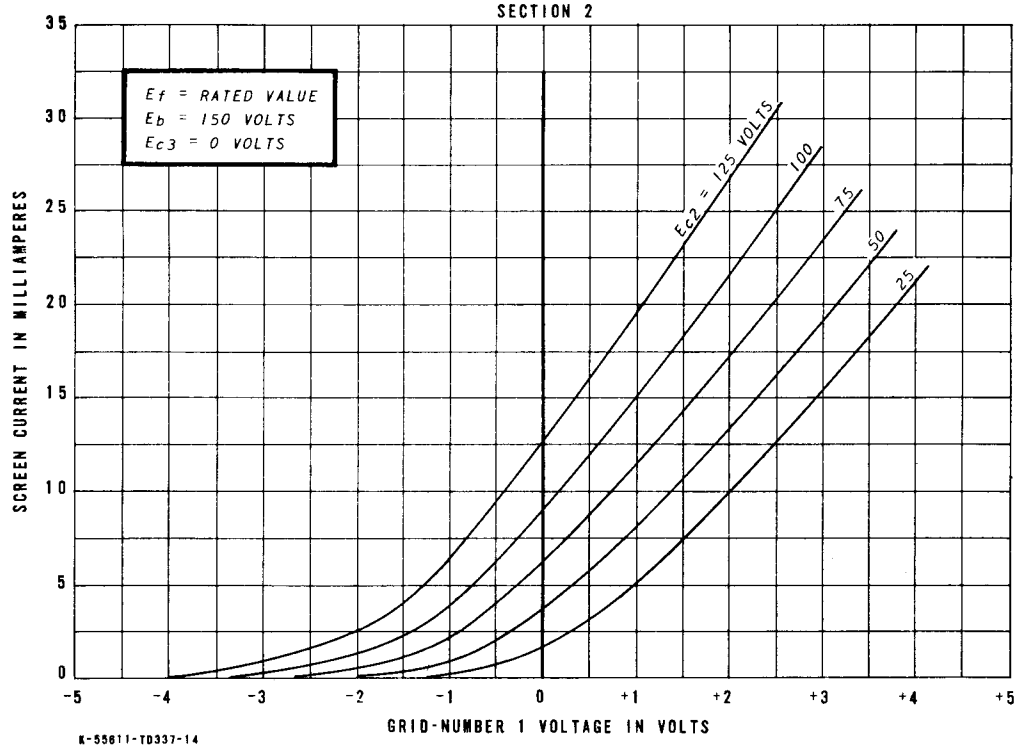


K-55611-TD241-13

JUNE 26, 1967

AVERAGE TRANSFER CHARACTERISTICS

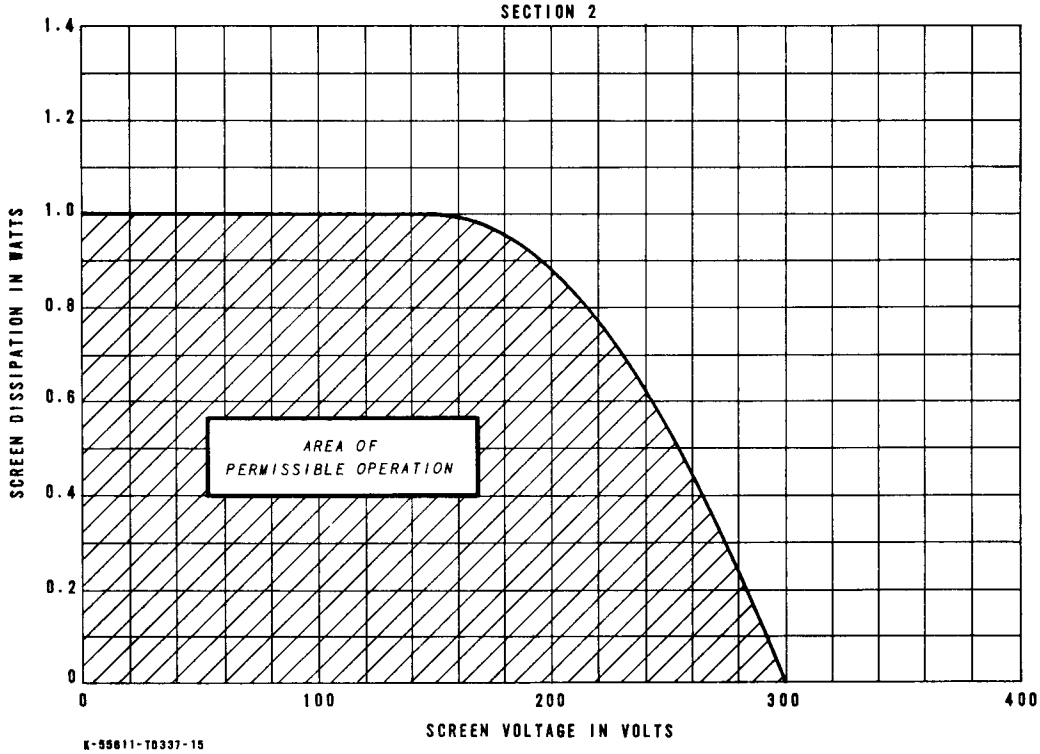
SECTION 2



K-55611-TD337-14

SCREEN RATING CHART

SECTION 2



K-55611-TD337-15

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

Electronic TUBE
KEN-RAD

6BF5

Description and Rating

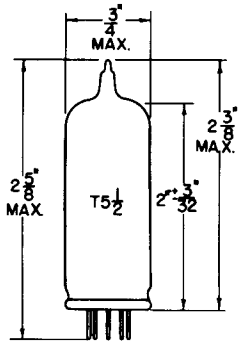
BEAM POWER AMPLIFIER

GENERAL DESCRIPTION

Principal Application: The 6BF5 is a miniature beam-power amplifier designed for use in the audio output stage of television and broadcast receivers. The 6BF5 features high sensitivity and is capable of delivering relatively high power output at low plate and screen voltages. When connected as a triode, the 6BF5 may be used as a vertical-deflection amplifier in television receivers.

Cathode	Coated Unipotential	Envelope	T-5½ Glass
Heater Voltage (A-C or D-C)	6.3 Volts	Base	E7-1, Miniature Button 7-Pin
Heater Current	1.2 Amperes	Mounting Position	Any

PHYSICAL DIMENSIONS

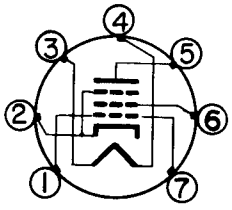


RMA 5-3

TERMINAL CONNECTIONS

Pin 1 - Grid Number 1
Pin 2 - Cathode and Beam Plates
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Grid Number 1

BASING DIAGRAM



RMA 7BZ
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES:

Plate Voltage	250	Volts
Peak Positive Pulse Plate Voltage *	700	Volts
Screen Voltage	250	Volts
Plate Dissipation		
For Class A_1 Amplifier Service	5.5	Watts
For Vertical-Deflection Amplifier Service	5.0	Watts
Screen Dissipation	1.25	Watts
Heater-Cathode Voltage	100	Volts
Grid Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohm
With Cathode Bias	0.5	Megohm
With Cathode Bias Resistor of 820 Ohms Minimum	2.2	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	110	Volts
Screen Voltage	110	Volts
Grid Number 1 Voltage	-7.5	Volts
Peak A-F Grid Number 1 Voltage	7.5	Volts
Plate Resistance (Approx)	10000	Ohms
Transconductance	7500	Micromhos
Zero-Signal Plate Current	49	Milliamperes
Maximum-Signal Plate Current	50	Milliamperes
Zero-Signal Screen Current	4	Milliamperes
Maximum-Signal Screen Current	8.5	Milliamperes
Load Resistance	2500	Ohms
Total Harmonic Distortion	9	Per Cent
Power Output	1.9	Watts

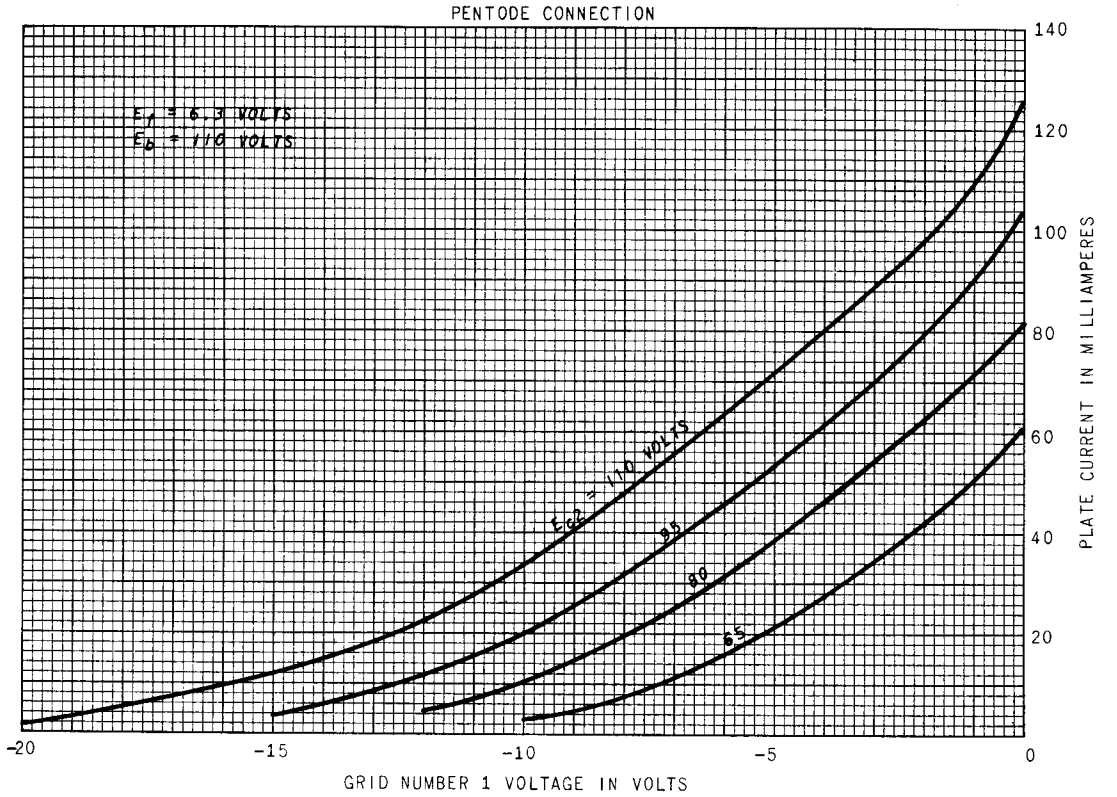
VERTICAL-DEFLECTION AMPLIFIER - TRIODE CONNECTION #

Plate Voltage	225	Volts
Catnode Bias Resistor	1200	Ohms
Grid Input Voltage		
Peak-to-Peak Sawtooth Component (Approx)	40	Volts
Negative Peaking Component (Approx).	56	Volts
Amplification Factor	6.7	
Transconductance	4200	Micromhos
Plate Current	20	Milliamperes
Plate Output Voltage		
Peak Positive Pulse Component (Approx)	500	Volts
Peak-to-Peak Sawtooth Component	140	Volts
Deflection Angle	53	Degrees
Picture Tube Anode Voltage	14	Kilovolts
Sweep Height (for 16-inch Picture Tube)	11½	Inches

** The duty cycle of the pulse voltage must not exceed 7% of one scanning cycle and the pulse duration must not exceed 1.2 milliseconds.*

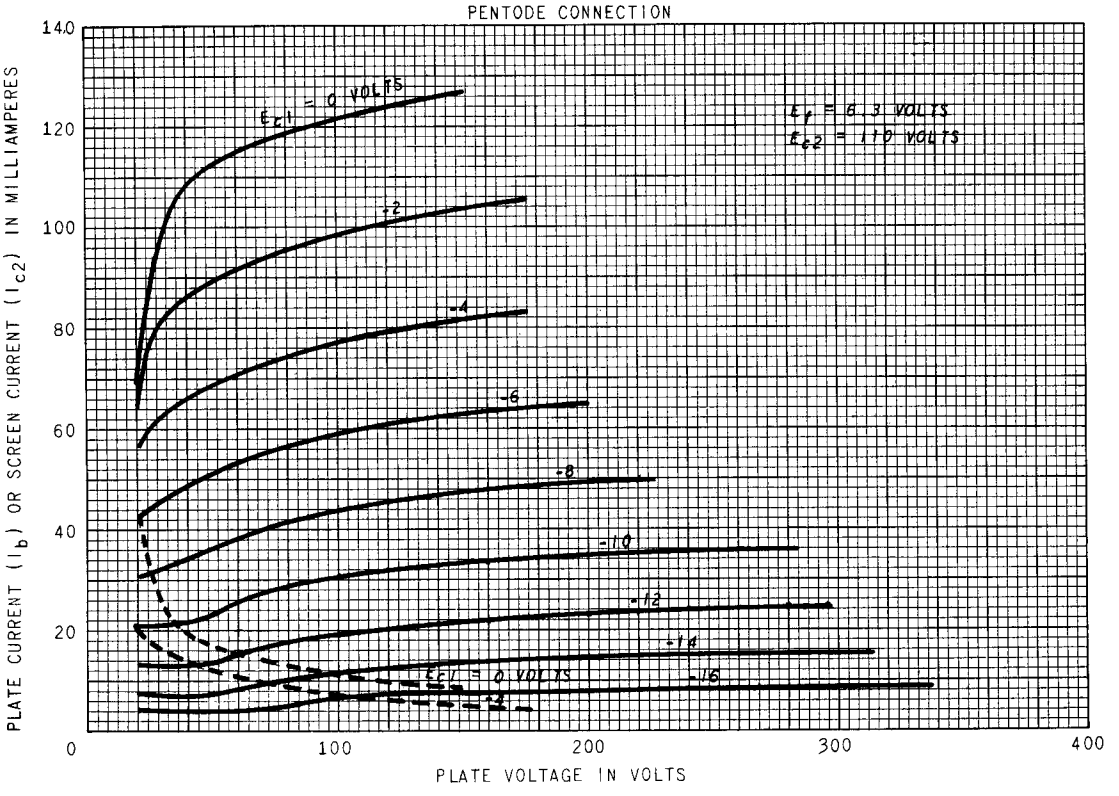
 # With screen tied to plate

AVERAGE CHARACTERISTICS



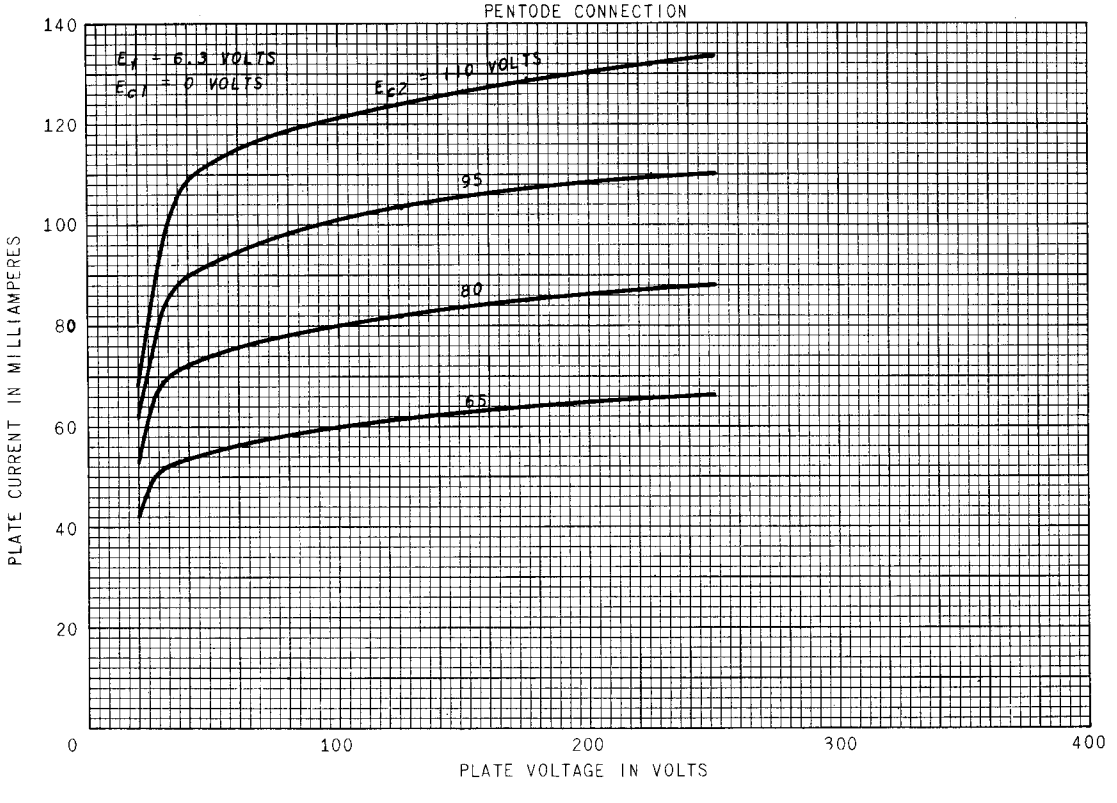
AVERAGE PLATE CHARACTERISTICS

PENTODE CONNECTION

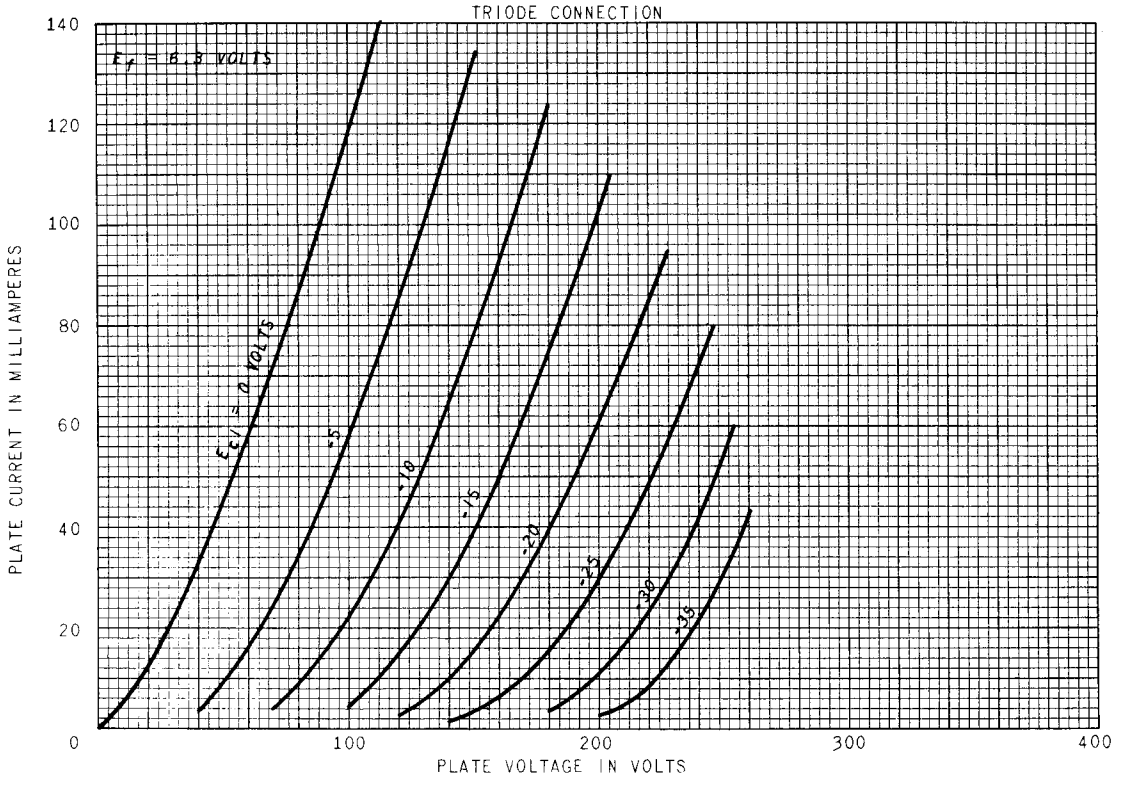


AVERAGE PLATE CHARACTERISTICS

PENTODE CONNECTION



AVERAGE PLATE CHARACTERISTICS



Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

Electronic TUBES

6BF6

Description and Rating

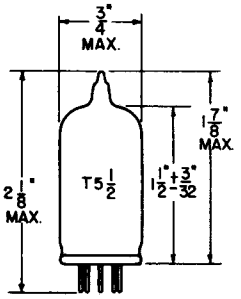
DUPLEX-DIODE TRIODE

GENERAL DESCRIPTION

Principal Application: The 6BF6 is a miniature duplex-diode, medium-mu triode. It is designed for use as a combined detector, amplifier and automatic-volume-control tube. Electrically the 6BF6 is similar to the metal type 6SR7.

Cathode	Coated Unipotential	Envelope	T-5½ Glass
Heater Voltage (A-C or D-C)	6.3 Volts	Base	E7-1 Miniature Glass-Button 7-Pin
Heater Current	0.3 Ampere	Mounting Position	Any

PHYSICAL DIMENSIONS

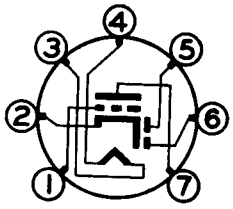


RMA 5-2

TERMINAL CONNECTIONS

Pin 1 - Triode Grid
Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Number 2 Diode Plate
Pin 6 - Number 1 Diode Plate
Pin 7 - Triode Plate

BASING DIAGRAM



RMA 7BT
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN-CENTER VALUES:

TRIODE SECTION

Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	90	Volts
Heater Positive with Respect to Cathode	90	Volts
Plate Voltage	300	Volts
Plate Dissipation	2.5	Watts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER: TRIODE SECTION

Plate Voltage	250	Volts
Grid Voltage	-9	Volts
Plate Resistance	8500	Ohms
Transconductance	1900	micromhos
Amplification Factor	16	
Plate Current	9.5	Milliamperes
Load Resistance	10000	Ohms
Total Harmonic Distortion	6.5	Per Cent
Power Output	300	Milliwatts

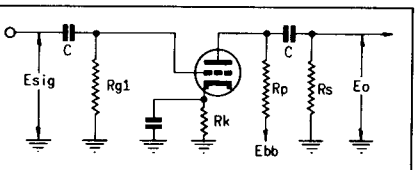
DIODE SECTIONS

Minimum Diode Current per Plate with 10 Volts D-C Applied	0.6	Milliampere

Note: Diode biasing of the triode unit of the 6BF6 is not suitable.

CLASS A RESISTANCE-COUPLED AMPLIFIER

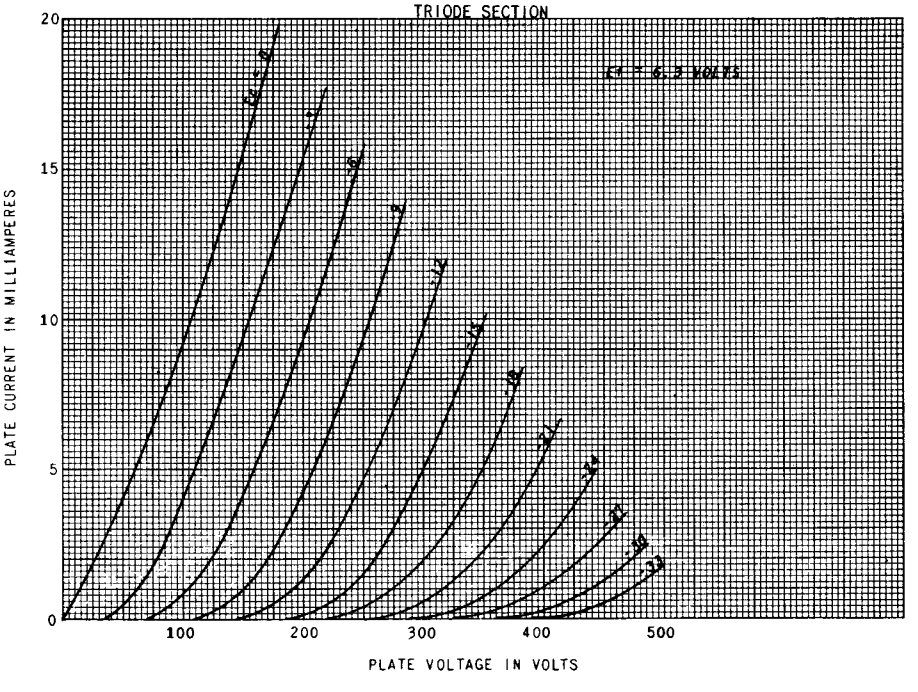
Rp Meg.	Rg1 Meg.	Rs Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
.047	*	.047	2200	9	14	2000	10	32	1800	10	58
.047	*	.0.1	2800	10	18	2500	10	42	2400	11	74
.047	*	0.22	3200	10	20	3000	11	47	2900	11	85
0.1	*	0.1	4100	10	13	3800	11	36	3600	12	65
0.1	*	0.22	5400	11	20	5100	11	47	5000	12	85
0.1	*	0.47	6800	11	24	6200	12	55	6200	12	96
0.22	*	0.22	8500	11	18	8000	12	41	7800	12	74
0.22	*	0.47	12000	11	23	11000	12	54	11000	12	95
0.22	*	1.0	14000	11	27	13000	12	69	13000	12	106



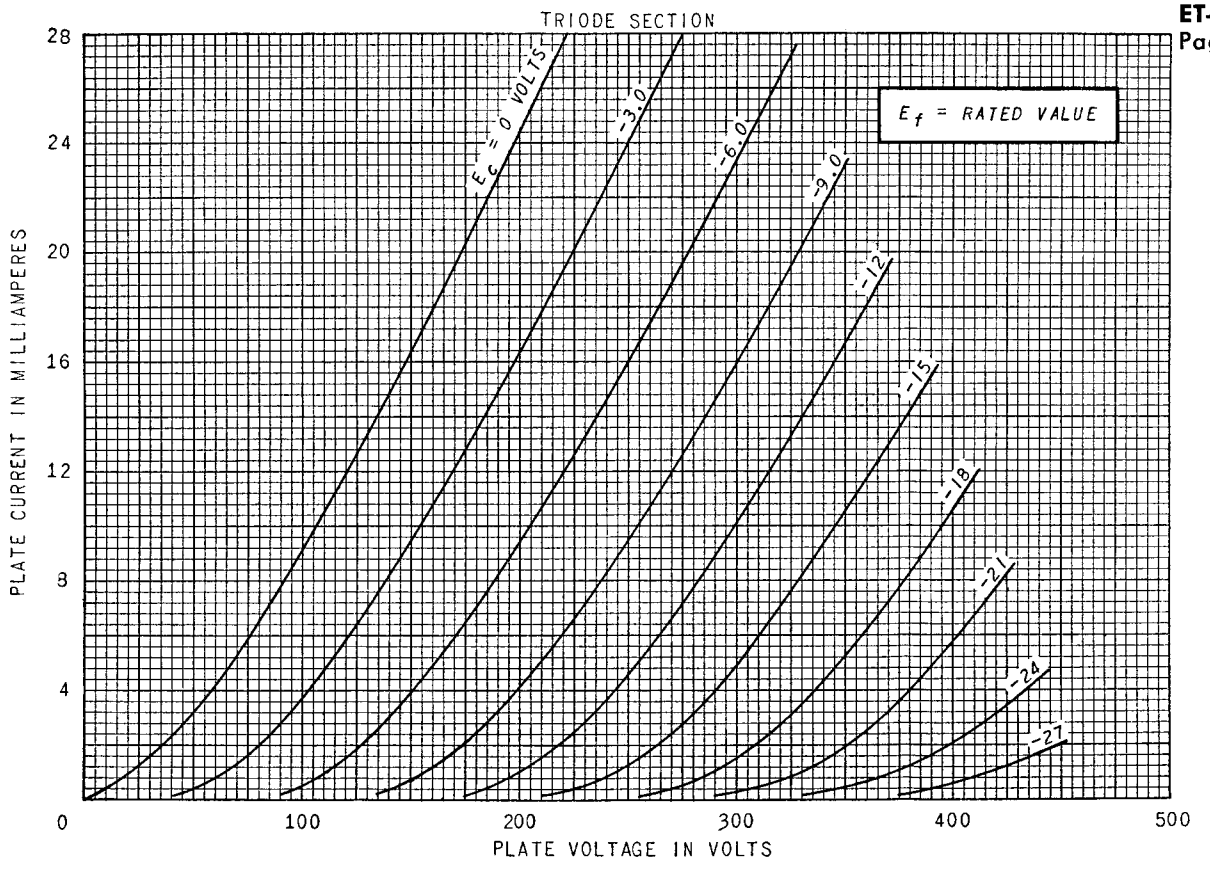
Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is peak output voltage given at the point where grid current begins to flow. 2. Gain measured at 5.0 volts RMS output. * Value of Rg1 is non-critical.

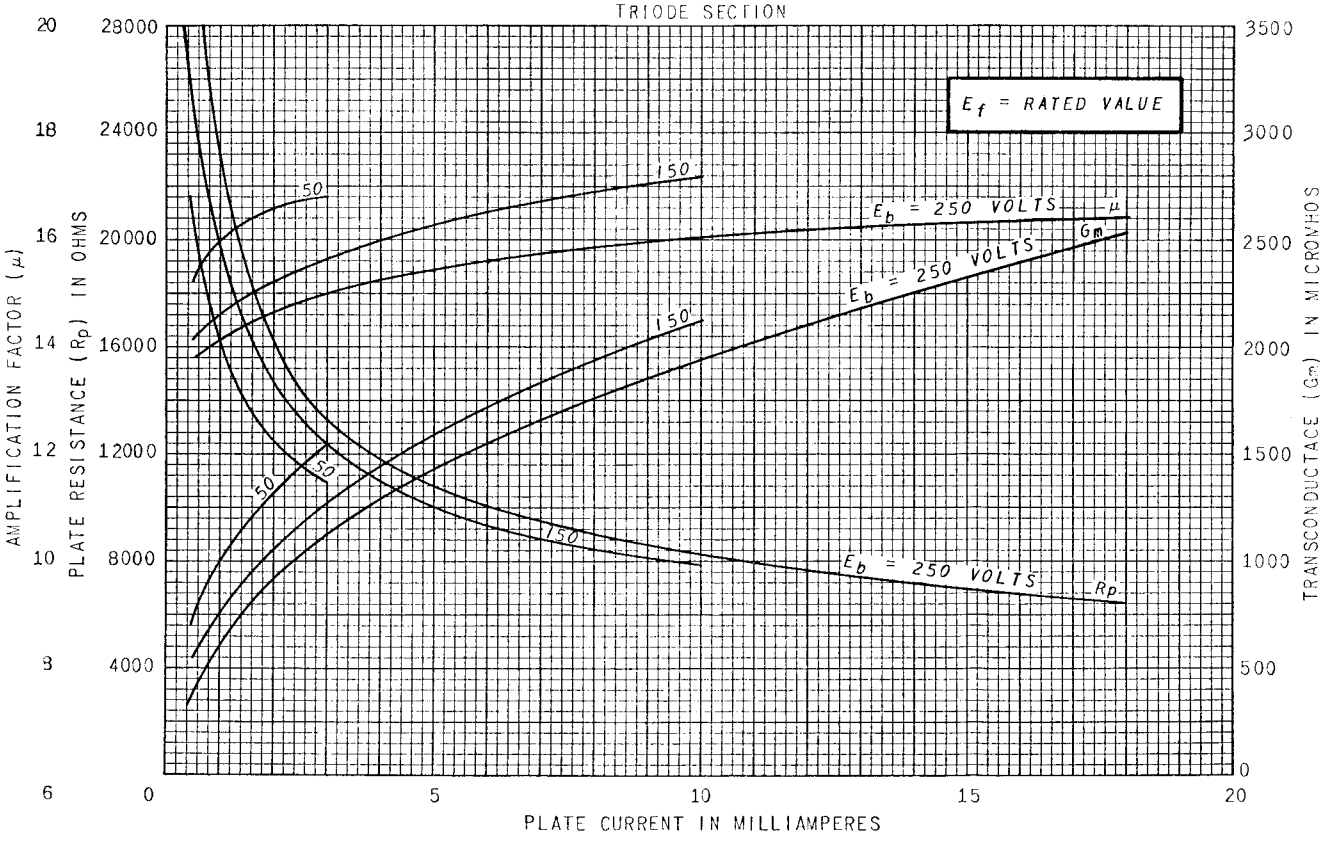
AVERAGE PLATE CHARACTERISTICS



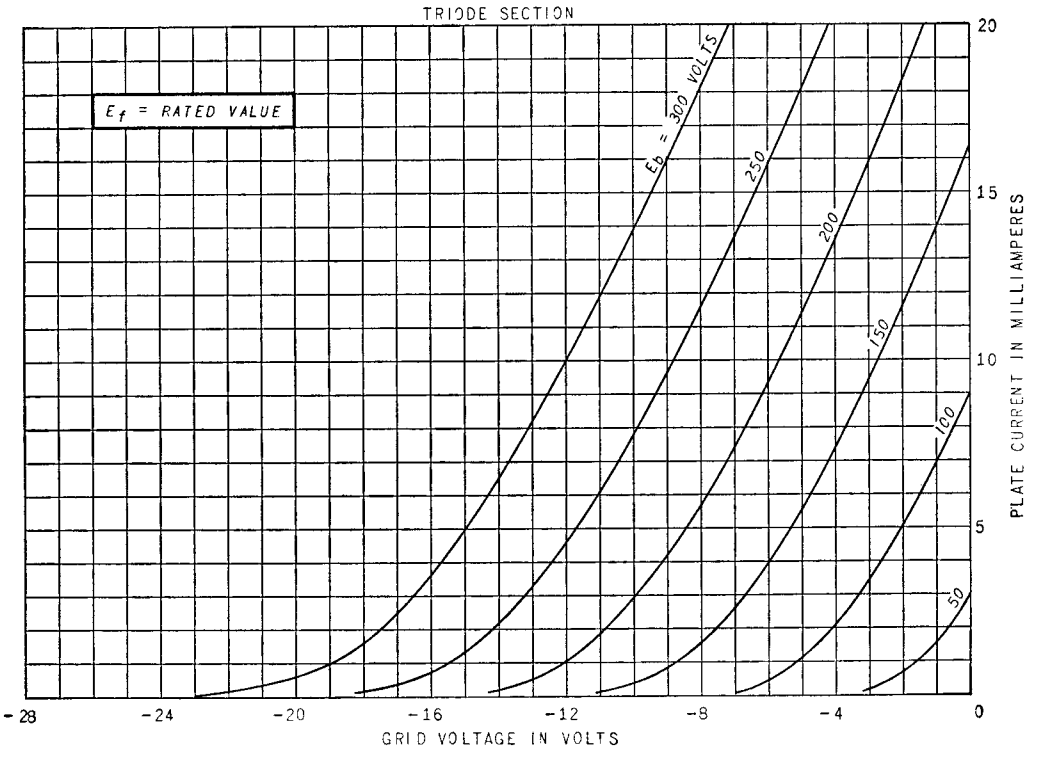
AVERAGE PLATE CHARACTERISTICS



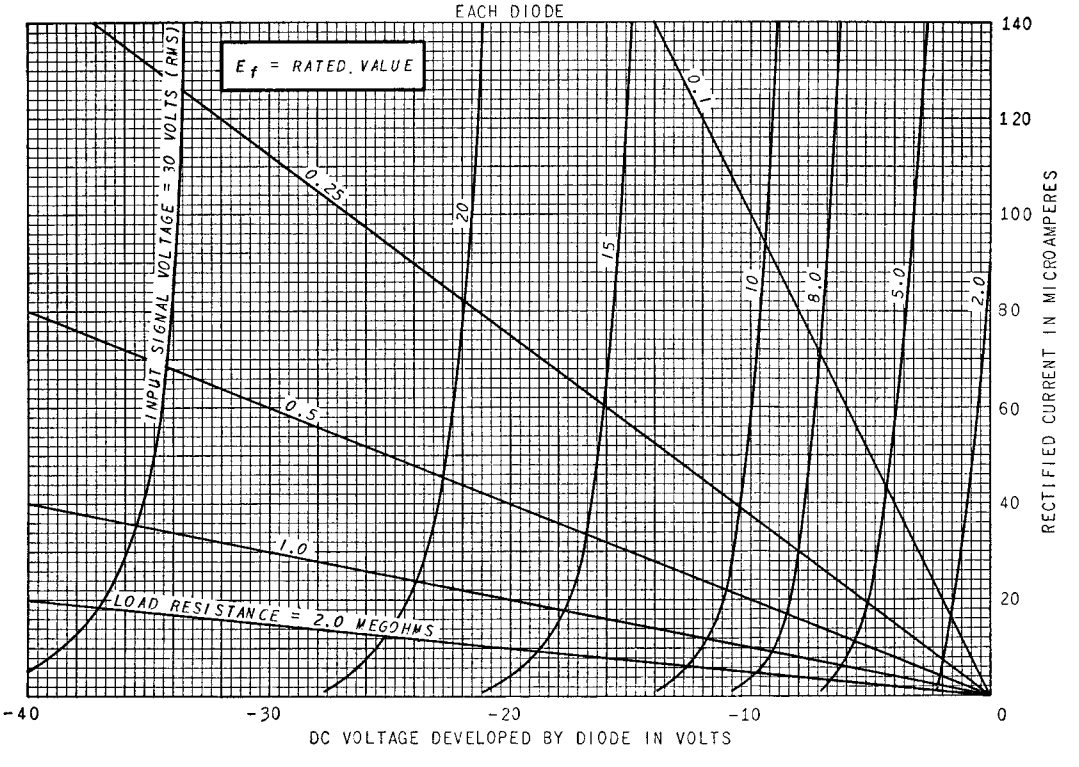
AVERAGE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



OPERATION CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

△Supersedes pages 3 and 4, dated 11-56.

from JEDEC release #3531,
Dec. 18, 1961

6BF8
SEXTUPLE DIODE

The 6BF8 is a miniature sextuple diode suitable for shunt-detector applications in which a number of input signals are encountered.

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current+	0.45	Amperes
Direct Interelectrode Capacitances‡		
Plate-Number 1 to Cathode and Heater	2.6	pf
Plate-Number 2 to Cathode and Heater	2.8	pf
Plate-Number 3 to Cathode and Heater	2.6	pf
Plate-Number 4 to Cathode and Heater	4.0	pf
Plate-Number 5 to Cathode and Heater	4.0	pf
Plate-Number 6 to Cathode and Heater	3.8	pf
Plate to All, Each Plate	4.4	pf

Mechanical

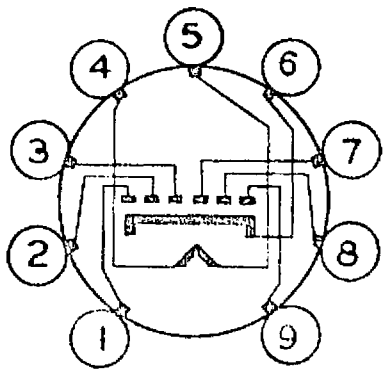
Mounting Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 3/16	Inches
Maximum Seated Height	1 15/16	Inches

TERMINAL CONNECTIONS

Pin 1 - Plate Number 6
Pin 2 - Plate Number 5
Pin 3 - Plate Number 4
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Cathode
Pin 7 - Plate Number 3
Pin 8 - Plate Number 2
Pin 9 - Plate Number 1

BASING DIAGRAM



EIA 9NX

ETR-2186

MAXIMUM RATINGS

Diode-Detector Service - Design-Maximum Values

Peak Inverse Plate Voltage	165	Volts
Peak Plate Current per Plate	11	Milliamperes
DC Output Current per Plate	2.2	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	100	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 5.0 Milliamperes DC per Plate	1.4	Volts

* The equipment designer should design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

\+ Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

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Electronic TUBES

6BG6-GA — 19BG6-GA

BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6BG6-GA is a beam-power pentode designed primarily for use as the horizontal deflection amplifier in television receivers. Electrically and physically, the 6BG6-GA is a replacement for the 6BG6-G; the 6BG6-GA differs primarily from the 6BG6-G by employing a straight-sided T-12 envelope.

Except for heater ratings, the 19BG6-GA is identical to the 6BG6-GA.

GENERAL

ELECTRICAL

	6BG6-GA	19BG5-GA
Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3	18.9 Volts
Heater Current	0.9	0.3 Amperes
Direct Interelectrode Capacitances, approximate*		
Grid-Number 1 to Plate		0.8 $\mu\mu$f
Input		11 $\mu\mu$f
Output		6.0 $\mu\mu$f

MECHANICAL

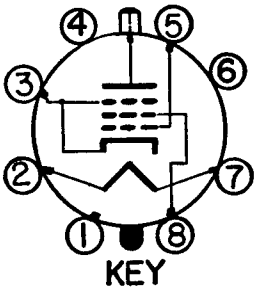
Mounting Position—Vertical†
Envelope—T-12, Glass
Base—B8-110, Short Medium Shell Octal 8-Pin
Top Cap—C1-1, Small

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE‡
DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

DC Plate-Supply Voltage (Boost+DC Power Supply)	700	Volts
Peak Positive Pulse Plate Voltage	6600§	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Screen Voltage	350	Volts
Peak Negative Grid-Number 1 Voltage	300	Volts
Plate Dissipationπ	20	Watts
Screen Dissipation	3.2	Watts
DC Cathode Current	110	Milliamperes
Peak Cathode Current	400	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	0.47	Megohms
Bulb Temperature at Hottest Point	210	C

BASING DIAGRAM

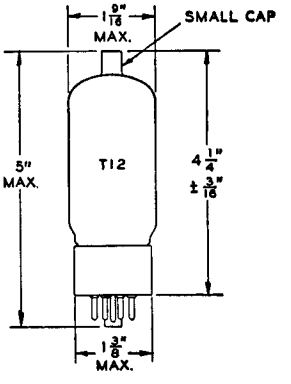


RETMA 5BT

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Heater
Pin 3—Cathode and Beam Plates
Pin 4—No Connection
Pin 5—Grid Number 1
Pin 6—No Connection
Pin 7—Heater
Pin 8—Grid Number 2 (Screen)
Cap—Plate

PHYSICAL DIMENSIONS



GENERAL ELECTRIC

Supersedes ET-T925, dated 4-55

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	60	250 Volts
Screen Voltage	250	250 Volts
Grid-Number 1 Voltage	0△	−15 Volts
Plate Resistance, approximate	...	25000 Ohms
Transconductance	...	6000 Micromhos
Plate Current	180	75 Milliamperes
Screen Current	18	4.0 Milliamperes
Grid-Number 1 Voltage, approximate $I_b = 1.0$ Milliampere	...	−45 Volts
Triode Amplification Factor♦	...	8.0

* Without external shield.

† Horizontal operation is permitted if pins 2 and 7 are in a vertical plane.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

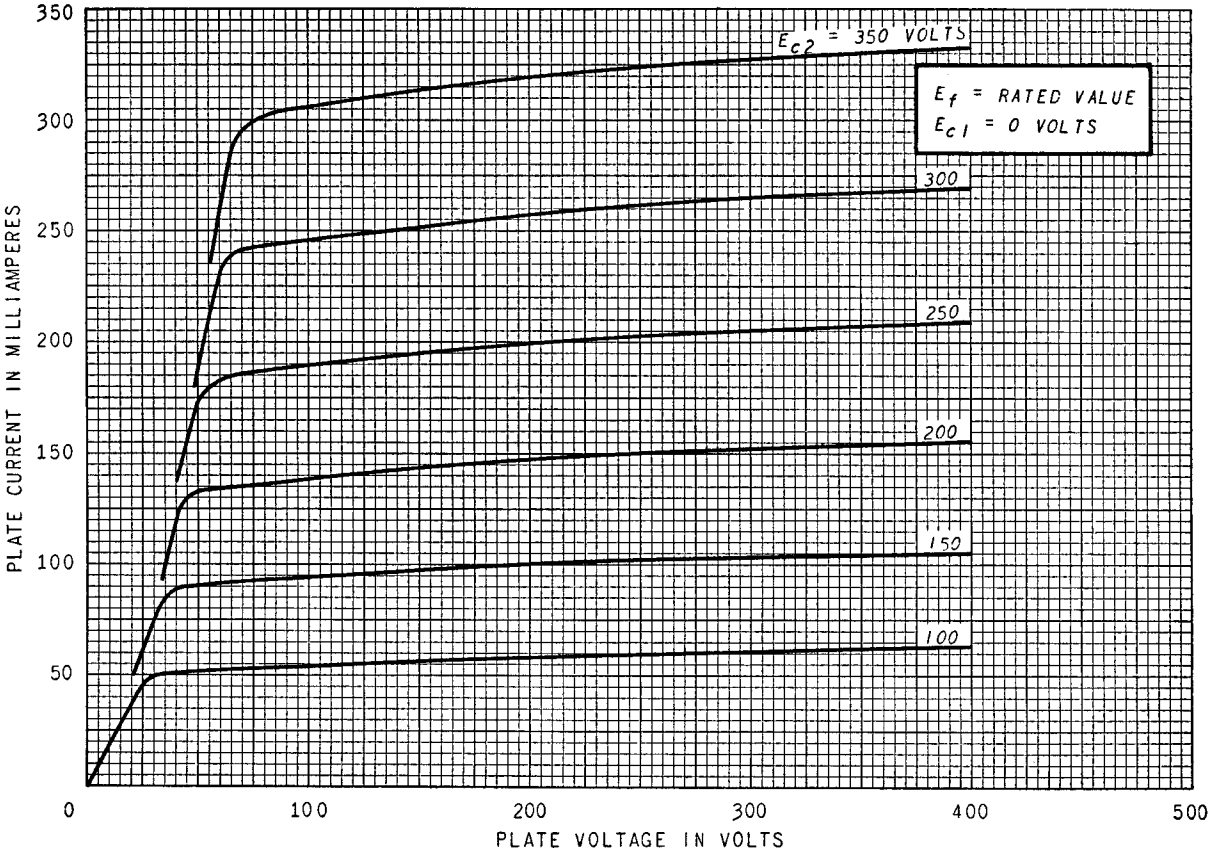
§ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply-voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

π In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

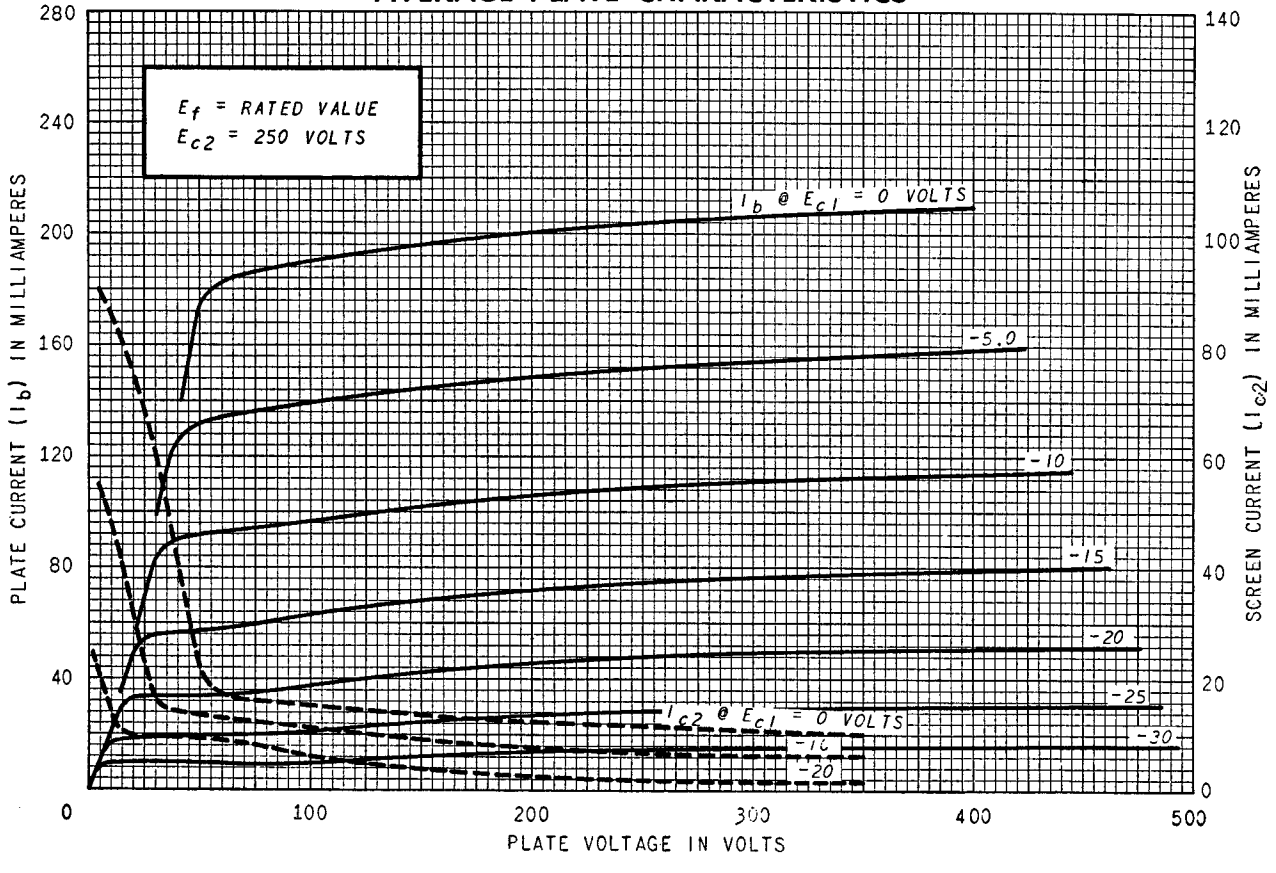
△Applied for very short interval so as not to damage tube.

♦ Triode connection (screen tied to plate) with Eb = Ec2 = 250 volts and Ec1 = −15 volts.

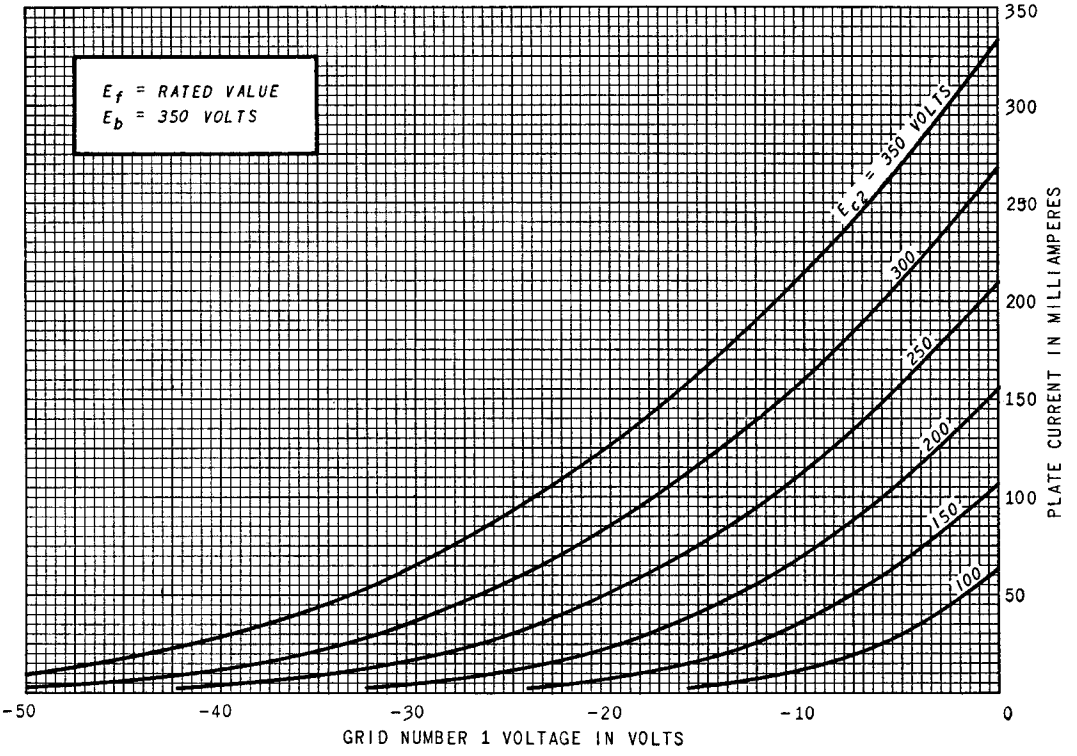
AVERAGE PLATE CHARACTERISTICS



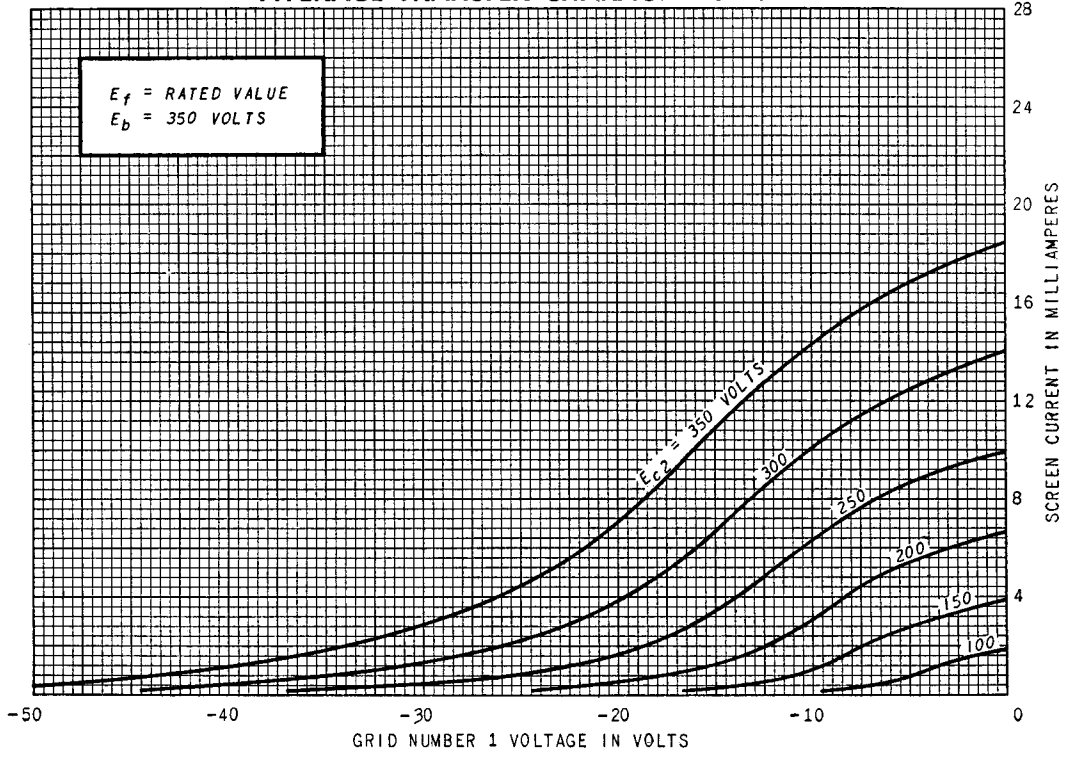
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

ELECTRONICS

6BH11

COMPACTRON TWIN-TRIODE PENTODE

DESCRIPTION AND RATING

The 6BH11 is in a compactron containing two medium-mu triodes and a sharp-cutoff pentode. The pentode is intended primarily for service as a horizontal-deflection oscillator and the triodes for general-purpose applications.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.8	Amperes

Direct Interelectrode Capacitances§

Triode (Section 1)

Grid to Plate: (T1g to T1p)	1.7	pf
Input: T1g to (T1k + Pk + Pg3 + i.s.)	3.2	pf
Output: T1p to (T1k + Pk + Pg3 + i.s.)	1.4	pf

Triode (Section 2)

Grid to Plate: (T2g to T2p)	1.8	pf
Input: T2g to (T2k + Pk + Pg3 + i.s.)	3.0	pf
Output: T2p to (T2k + Pk + Pg3 + i.s.)	0.6	pf

Pentode Section

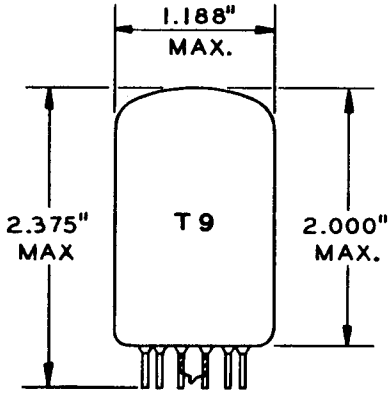
Grid-Number 1 to Plate: (Pg2 to Pp)	0.11	pf
Input: Pg1 to (Pk + Pg2 + Pg3 + i.s.)	5.5	pf
Output: Pp to (Pk + Pg2 + Pg3 + i.s.)	2.2	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches

PHYSICAL DIMENSIONS

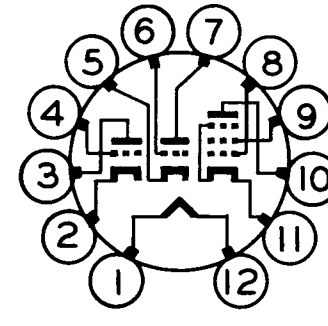


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Triode Cathode (Section 2)
Pin 3 - Triode Plate (Section 2)
Pin 4 - Triode Grid (Section 2)
Pin 5 - Triode Cathode (Section 1)
Pin 6 - Triode Grid (Section 1)
Pin 7 - Triode Plate (Section 1)
Pin 8 - Pentode Grid Number 1
Pin 9 - Pentode Grid Number 2 (Screen)
Pin 10 - Pentode Plate
Pin 11 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 12 - Heater

BASING DIAGRAM



EIA 12FP

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section Horizontal Oscillator Service¶	Each Triode Section	
DC Plate Voltage	350	330	Volts
Screen Supply Voltage	330	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Peak Negative Grid-Number 1 Voltage	175	---	Volts
Plate Dissipation	2.5	2.5	Watts
Screen Dissipation	0.55	---	Watts
DC Cathode Current	20	---	Milliamperes
Peak Cathode Current	300	---	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	2.2	2.2	Megohms
With Cathode Bias	2.2	2.2	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section	Each Triode Section	
Plate Voltage	125	125	Volts
Screen Voltage	125	---	Volts
Grid-Number 1 Voltage	-1.0	-1.0	Volts
Amplification Factor	---	46	
Plate Resistance, approximate	200000	5400	Ohms
Transconductance	7500	8500	Micromhos
Plate Current	12	13.5	Milliamperes
Screen Current	4.0	---	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 10 Microamperes	-8	-8	Volts

NOTES

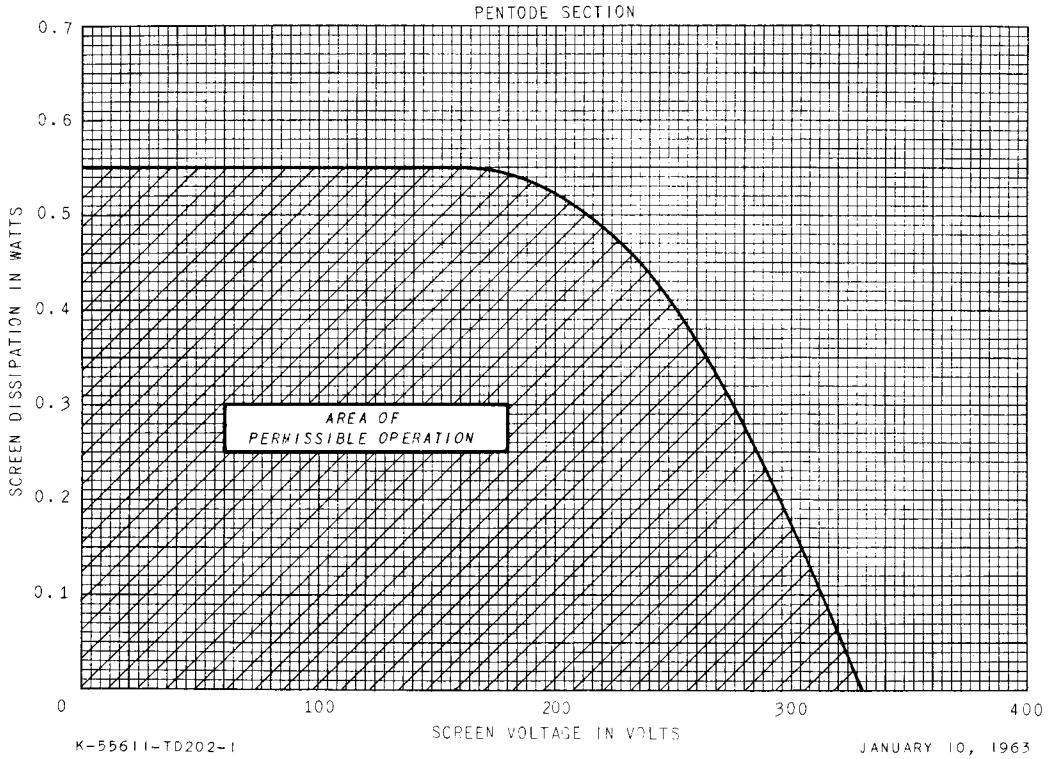
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

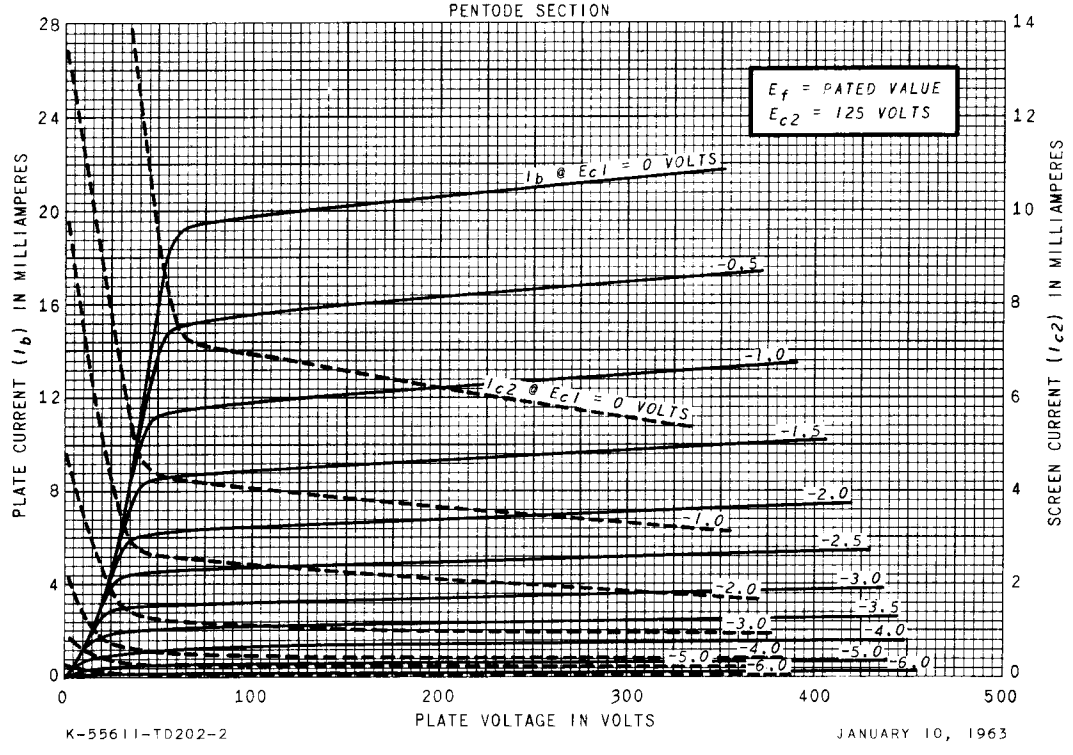
§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

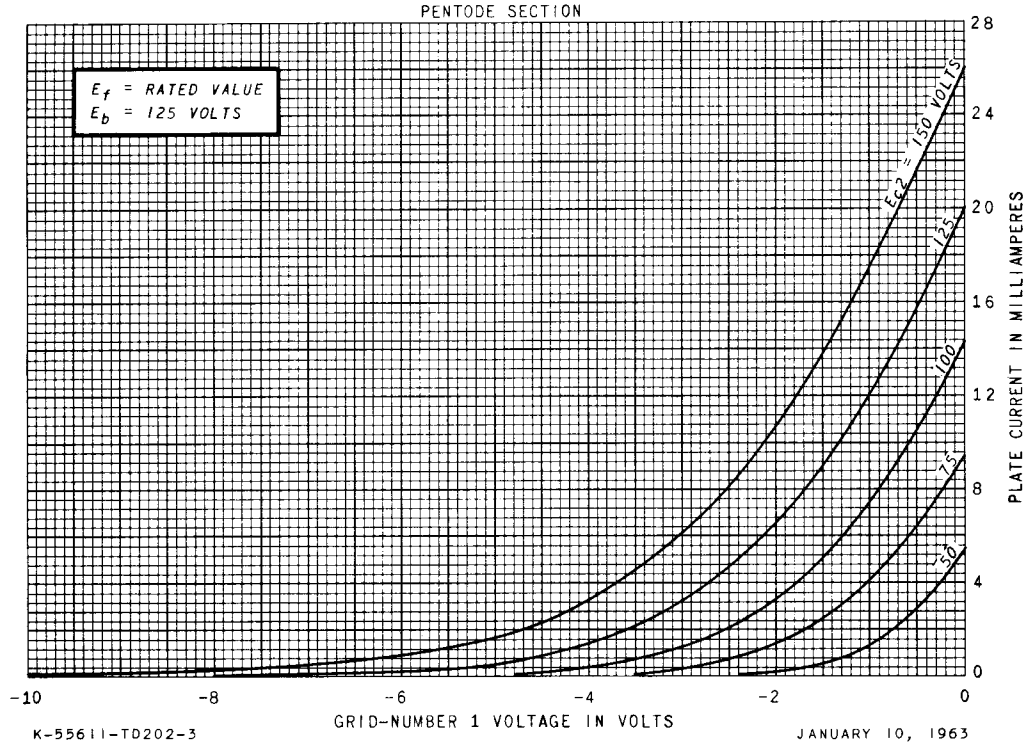
SCREEN RATING CHART



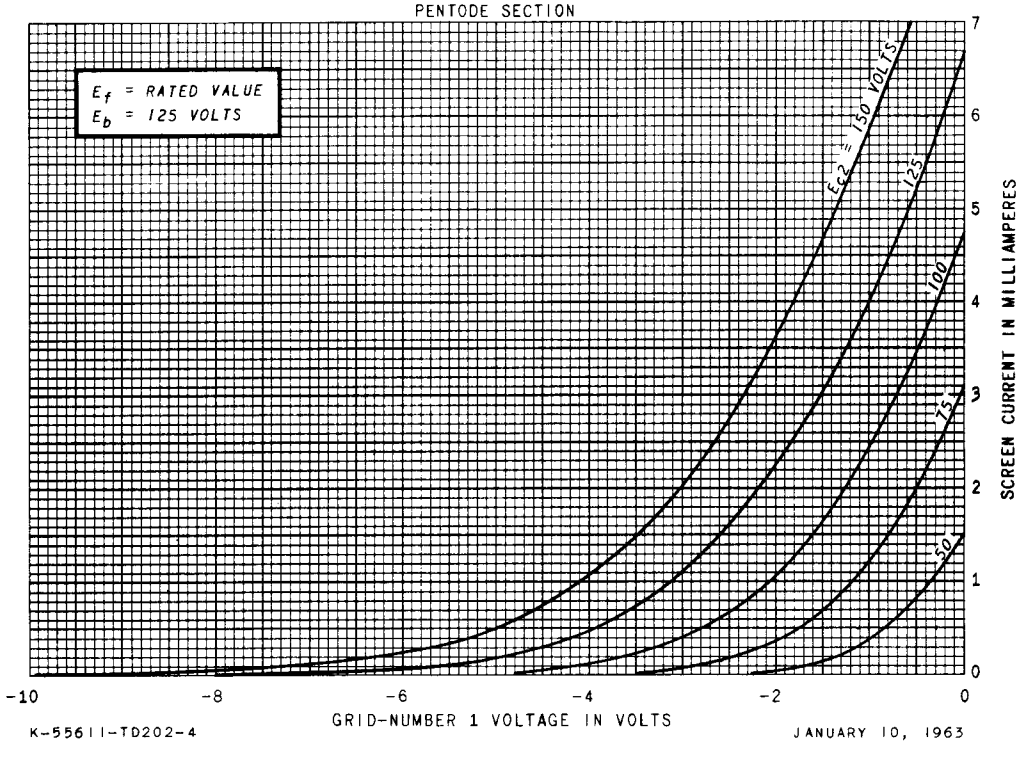
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

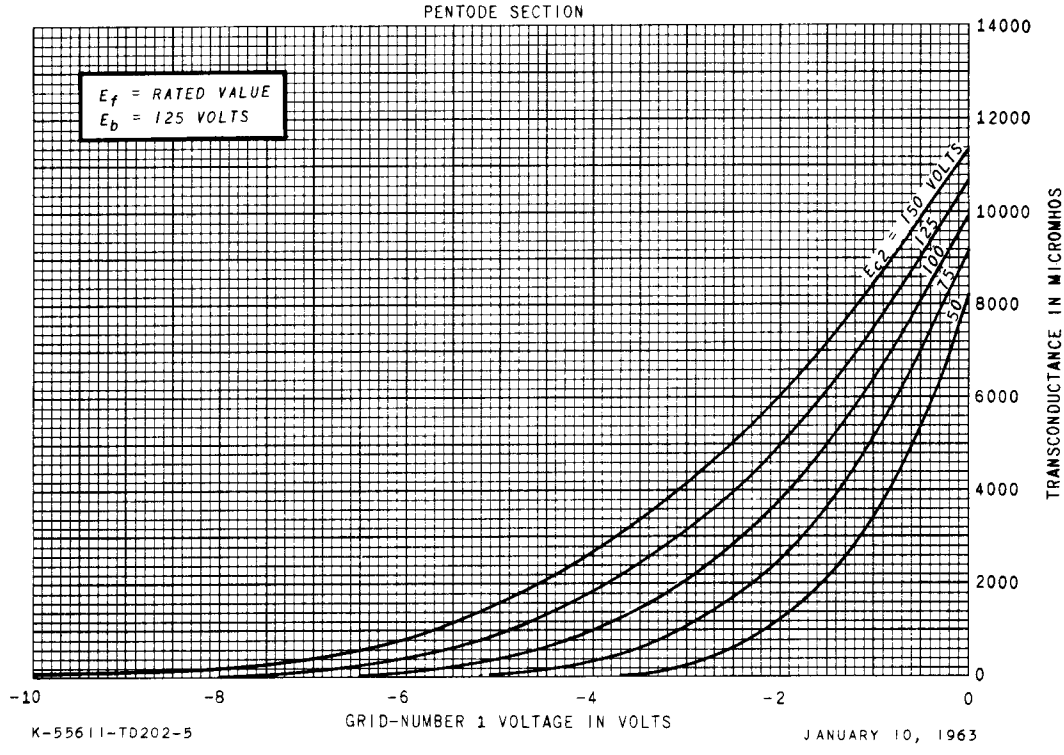


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

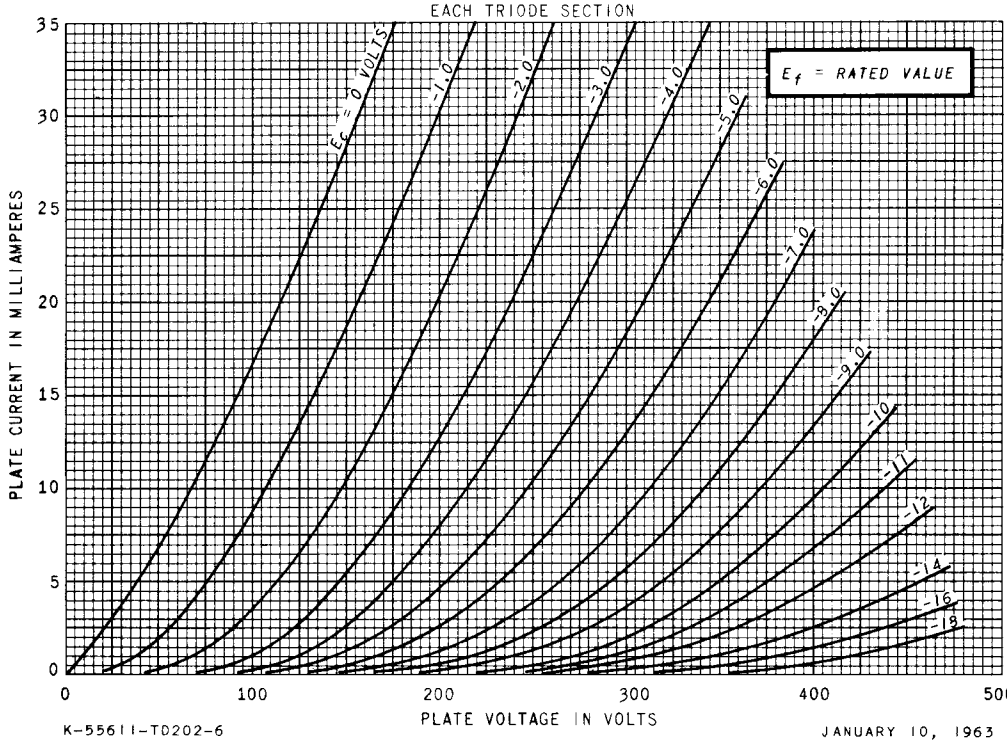


K-55611-TD202-5

JANUARY 10, 1963

AVERAGE PLATE CHARACTERISTICS

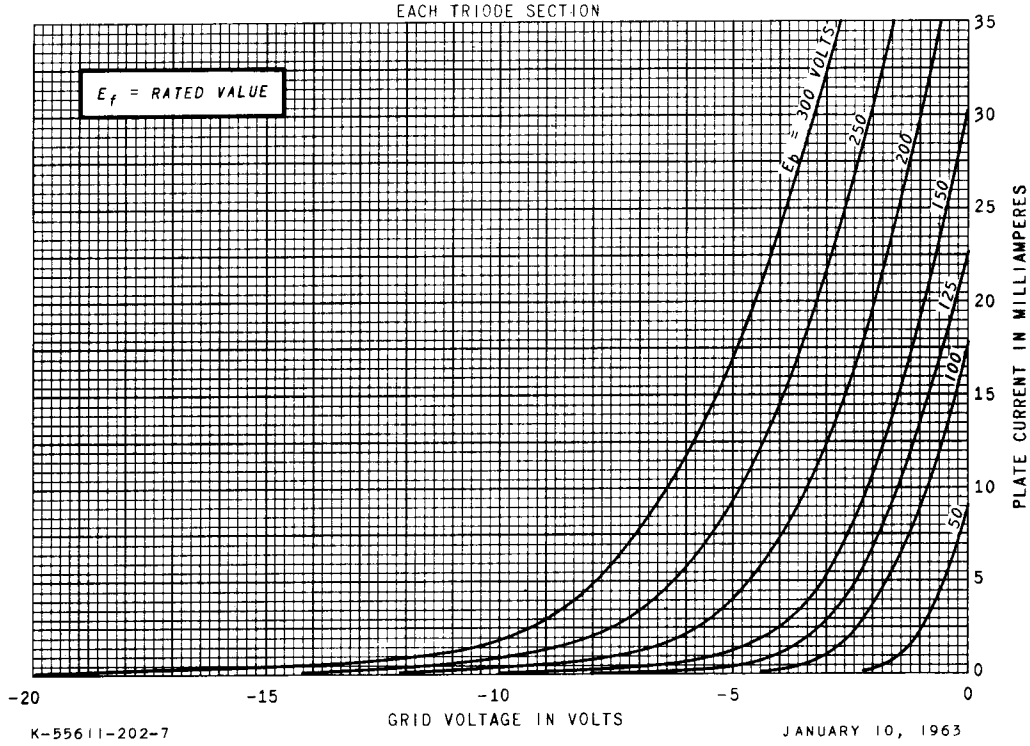
EACH TRIODE SECTION



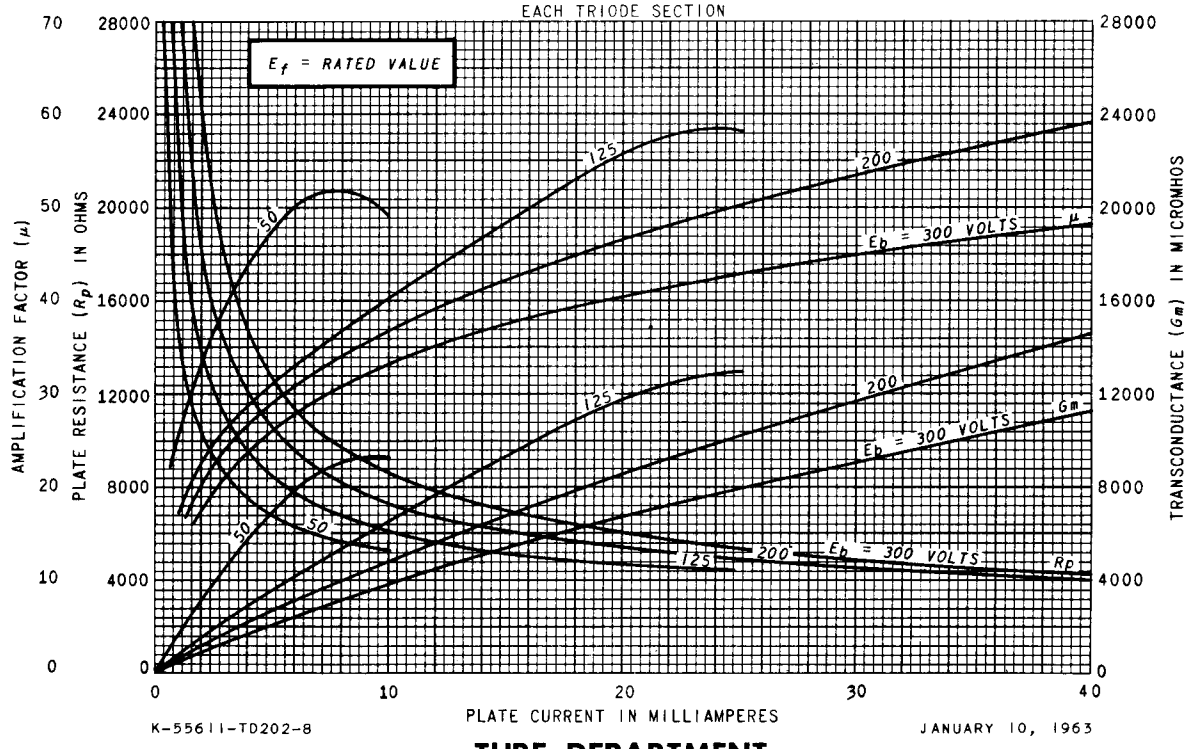
K-55611-TD202-6

JANUARY 10, 1963

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

6BH6

PENTODE

DESCRIPTION AND RATING

The 6BH6 is a miniature sharp-cutoff pentode primarily designed for use as a high-gain radio-frequency or intermediate-frequency amplifier. Features include low grid-plate capacitance, relatively high transconductance, and low heater current.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential			
Heater Voltage, AC or DC	6.3		Volts
Heater Current	0.15		Amperes
Direct Interelectrode Capacitances	**With Shield***	**Without Shield**	
Grid-Number 1 to Plate, maximum	0.0035	0.0035	μμf
Input	5.4	5.4	μμf
Output	4.4	4.4	μμf

MECHANICAL

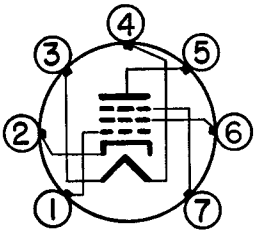
Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	300	Volts
Screen-Supply Voltage	300	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
Plate Dissipation	3.0	Watts
Screen Dissipation	0.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts

BASING DIAGRAM

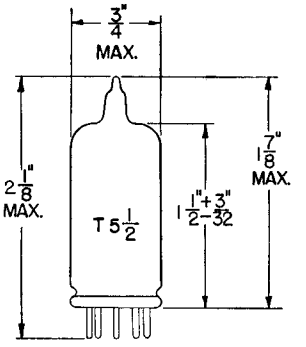


EIA 7CM

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Internal Shield and Grid Number 3 (Suppressor)

PHYSICAL DIMENSIONS



EIA 5-2

GENERAL ELECTRIC

Supersedes ET-T525A, dated 3-51

CHARACTERISTICS AND TYPICAL OPERATION

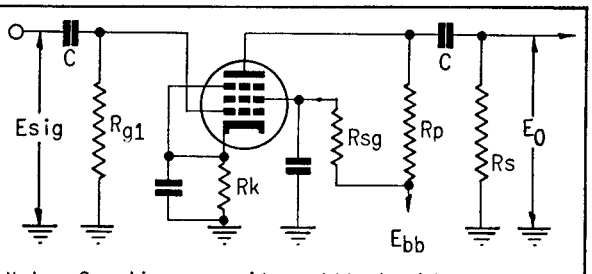
CLASS A_1 AMPLIFIER

Plate Voltage	100	250	Volts
Suppressor, Connected to Cathode			
Screen Voltage	100	150	Volts
Grid-Number 1 Voltage	−1.0	−1.0	Volts
Plate Resistance, approximate	0.7	1.4	Megohms
Transconductance	3400	4600	Micromhos
Plate Current	3.6	7.4	Milliamperes
Screen Current	1.4	2.9	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 10 Microamperes	−5	−7.7	Volts

* With external shield (EIA 316) connected to pins 2 and 7.

CLASS A RESISTANCE-COUPLED AMPLIFIER

Rp Meg.	Rs Meg.	R_{g1} Meg.	Ebb = 90 Volts				Ebb = 180 Volts				Ebb = 300 Volts			
			Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo
0.10	0.10	0.1	1000	0.09	57	14	740	0.13	88	29	490	0.18	105	44
0.10	0.24	0.1	1100	0.10	78	18	740	0.15	109	36	440	0.21	144	57
0.24	0.24	0.1	2700	0.31	77	13	1500	0.46	128	27	1300	0.47	156	43
0.24	0.51	0.1	3200	0.34	97	17	1800	0.49	159	33	1000	0.59	220	53
0.51	0.51	0.1	6600	0.68	96	13	3400	0.99	154	25	2000	1.40	228	41
0.51	1.0	0.1	6300	0.82	115	14	3900	1.00	194	29	1900	1.30	292	46
0.24	0.24	10	0	0.54	96	9.2	0	0.55	154	26	0	0.64	214	43
0.24	0.51	10	0	0.48	117	15	0	0.61	214	32	0	0.66	286	53
0.51	0.51	10	0	1.10	123	10	0	1.20	196	22	0	1.30	306	39
0.51	1.0	10	0	1.10	139	13	0	1.40	259	26	0	1.50	373	44

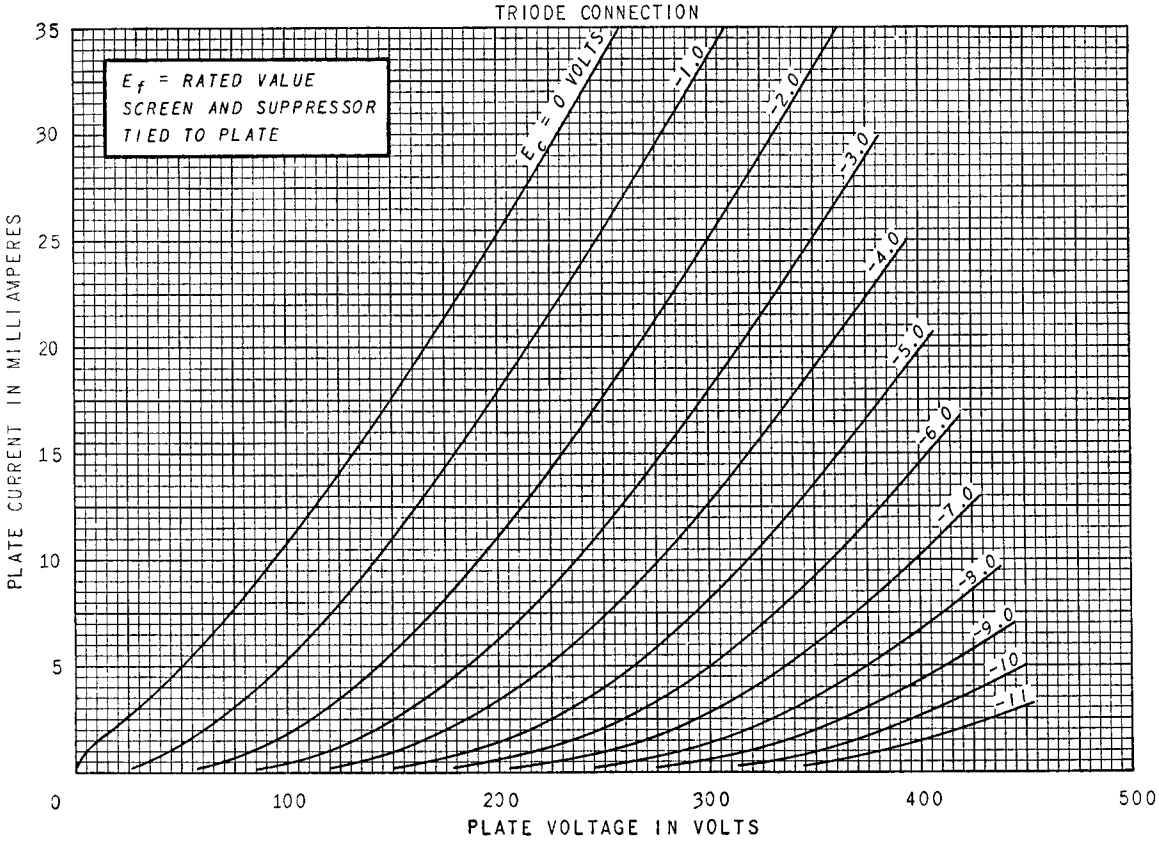


Note: Coupling capacitors (C) should be adjusted to give desired frequency response. Rk and Rsg should be adequately by-passed.

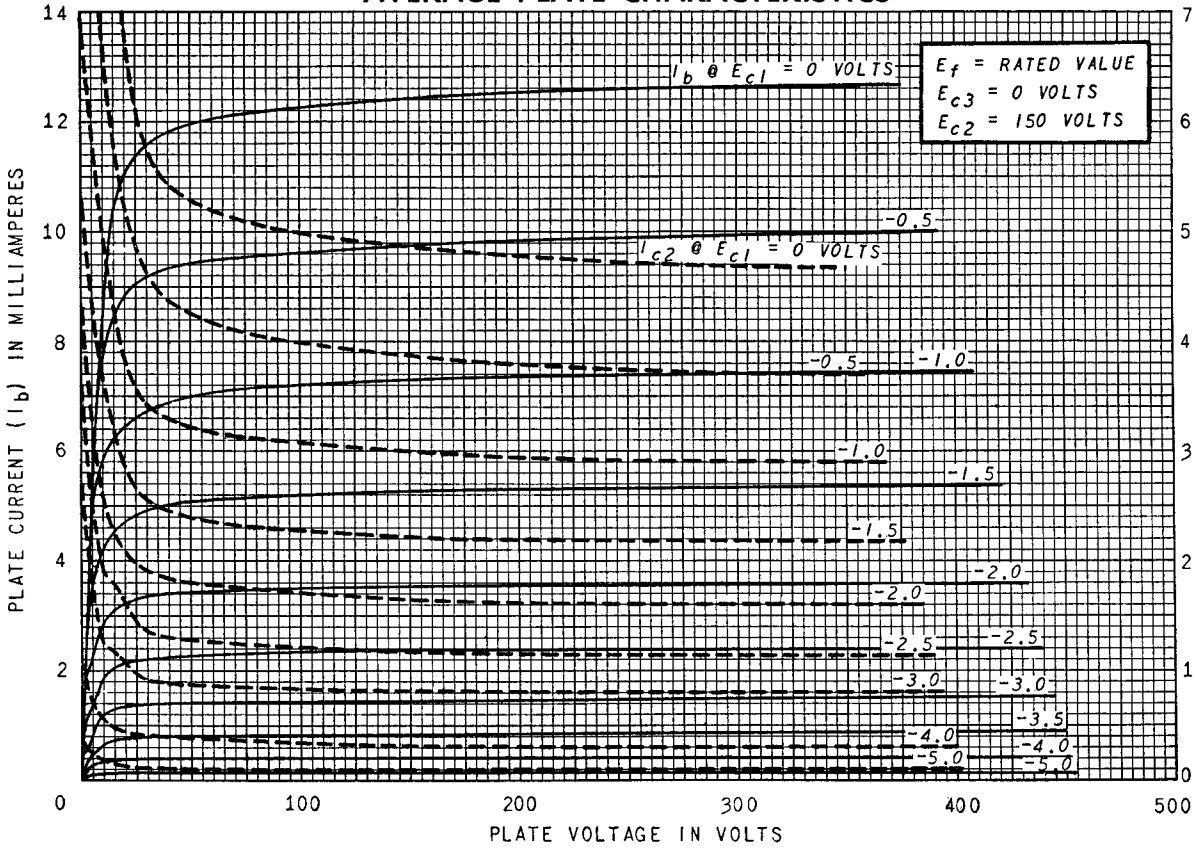
Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

AVERAGE PLATE CHARACTERISTICS

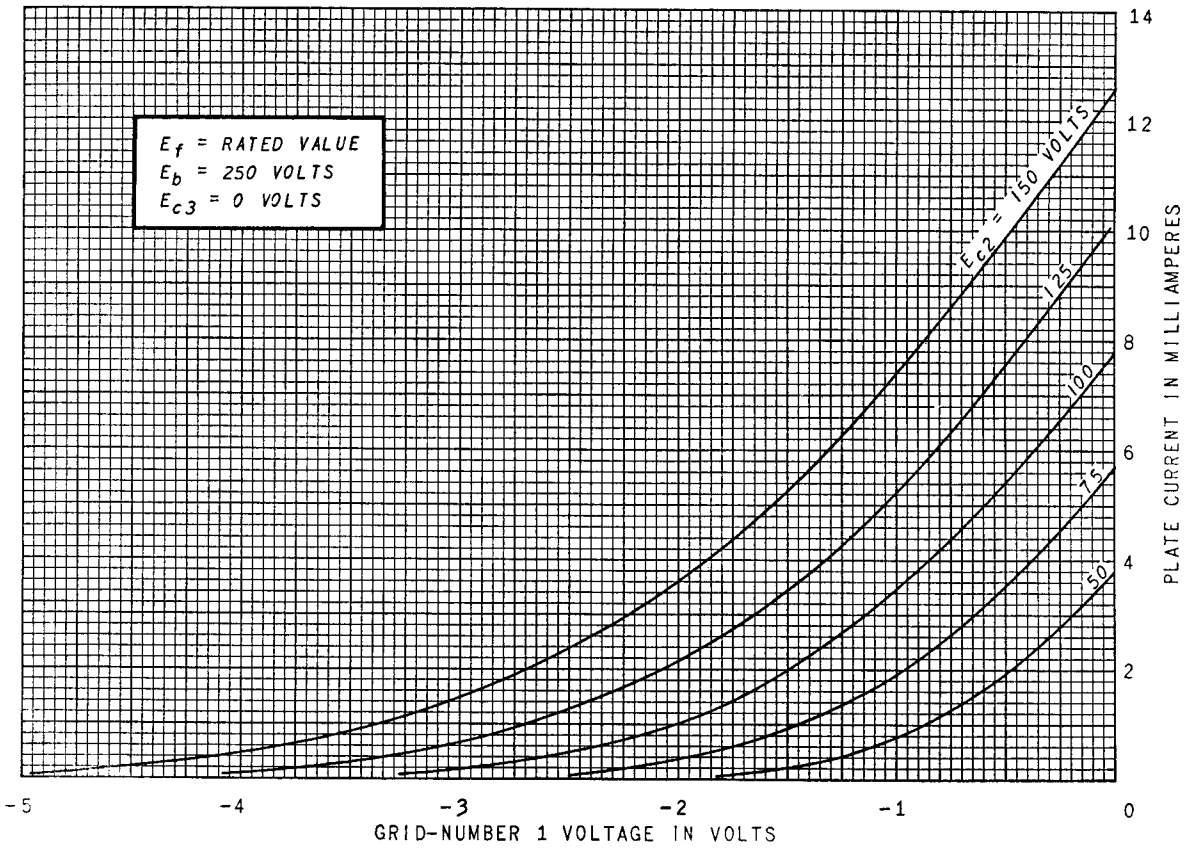
TRIODE CONNECTION



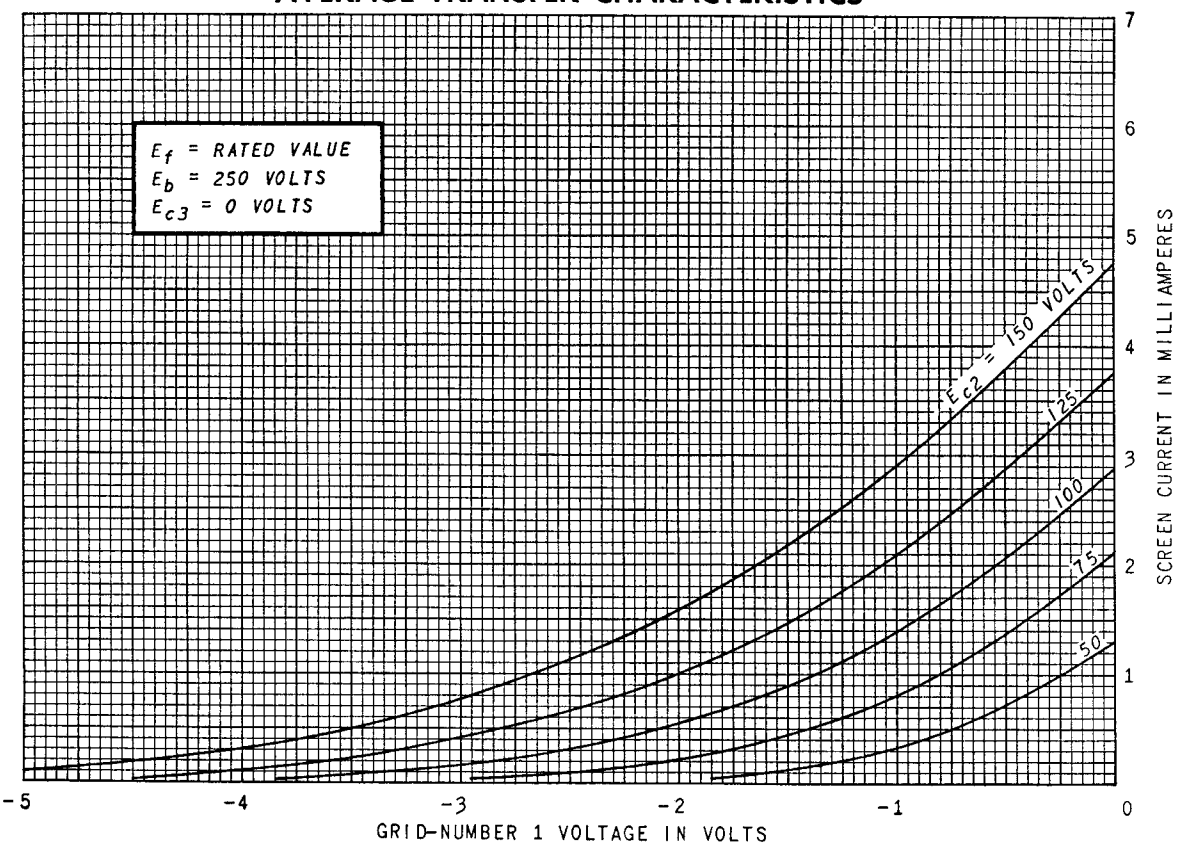
AVERAGE PLATE CHARACTERISTICS



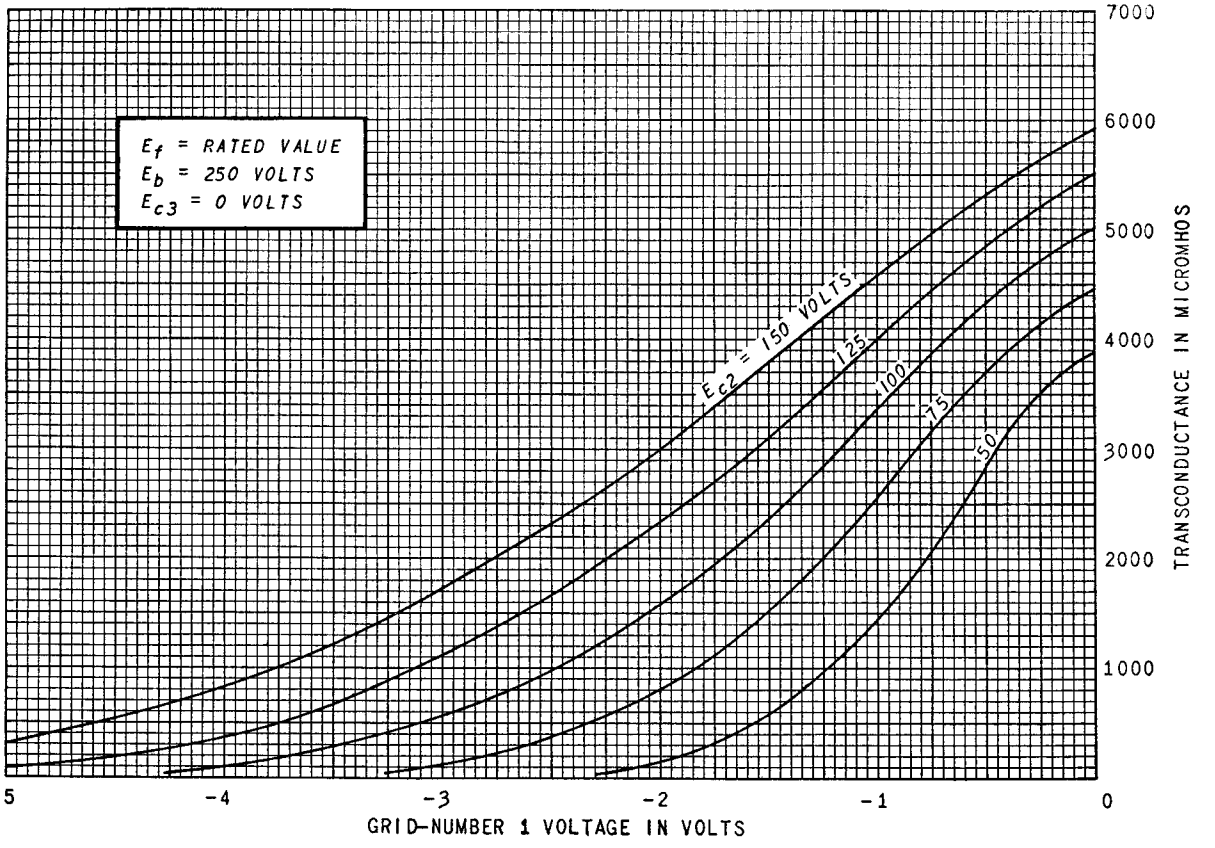
AVERAGE TRANSFER CHARACTERISTICS



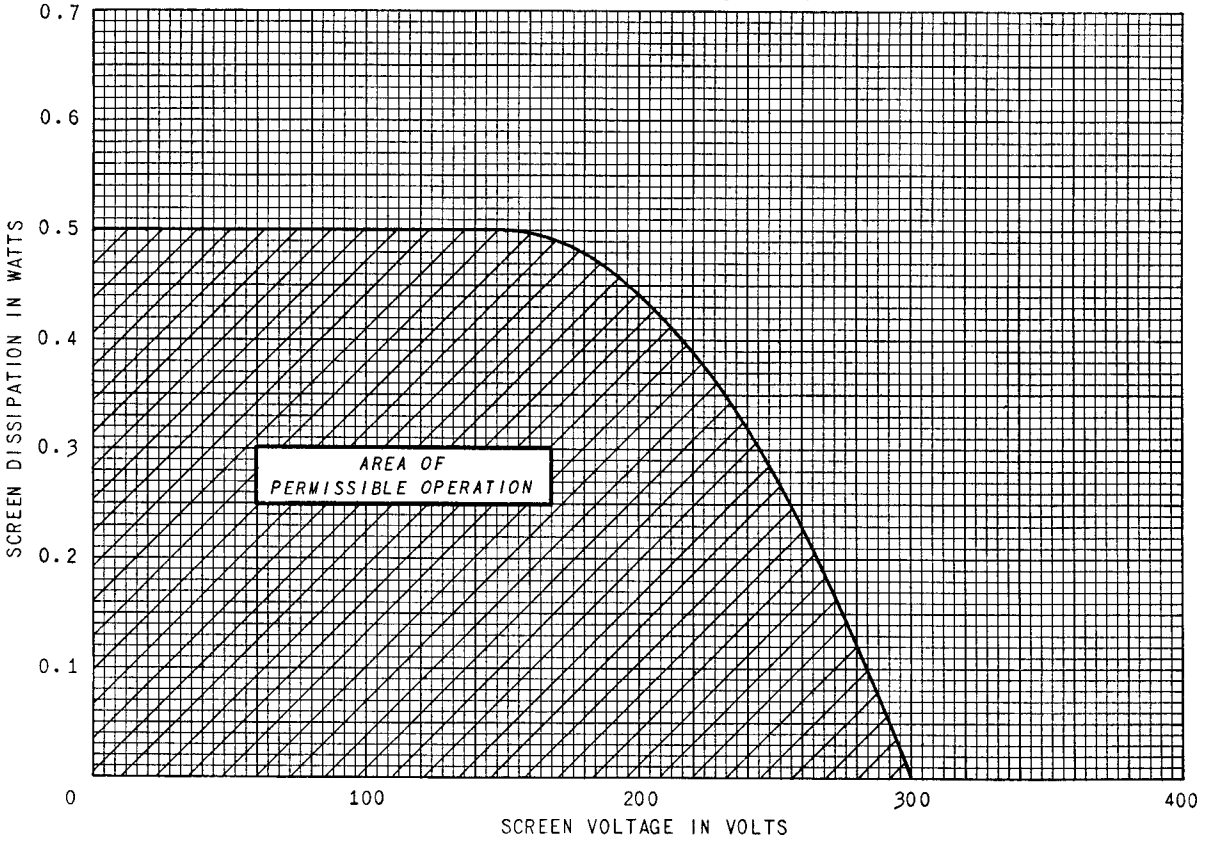
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



SCREEN RATING CHART



Electronic TUBES

6BH8

TRIODE-PENTODE

DESCRIPTION AND RATING

The 6BH8 is a general-purpose miniature tube which contains a sharp-cutoff pentode and a medium-mu triode in one envelope. Except for the electrical characteristics of the triode section, the 6BH8 is identical to the 6AU8. The triode section of the 6BH8 incorporates a lower amplification factor than the 6AU8 triode section and consequently may be used in applications where the lower amplification factor is desired.

Like the 6AU8, the tube is suitable for a wide variety of general-purpose applications in both monochrome and color television receivers. The high figure of merit of the pentode section makes it particularly suited for service as a video amplifier, video intermediate-frequency amplifier, and sound intermediate-frequency amplifier. The triode section is intended for use as a sync amplifier, separator, or clipper or as a sweep oscillator. The triode section may also be connected as a diode for video-detector applications, which adds to the over-all versatility of the tube.

In addition, the 6BH8, as a result of its controlled heater warm-up characteristic, is especially suited for use in television receivers which employ series-connected heaters. When the tube is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

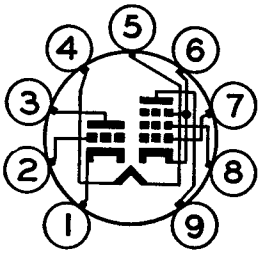
GENERAL

ELECTRICAL

Cathode—Coated Unipotential	
Heater Voltage, AC or DC	6.3 Volts
Heater Current	0.6 Amperes
Heater Warm-up Time*	11 Seconds
Direct Interelectrode Capacitances†	
Pentode Section	
Grid-Number 1 to Plate	0.046 μμf
Input	7 μμf
Output	2.4 μμf
Triode Section	
Grid to Plate	2.4 μμf
Input	2.6 μμf
Output	0.38 μμf
Pentode Grid-Number 1 to Triode Plate	0.004 μμf
Triode Grid to Pentode Plate	0.016 μμf
Pentode Plate to Triode Plate	0.095 μμf

GENERAL ELECTRIC

BASING DIAGRAM

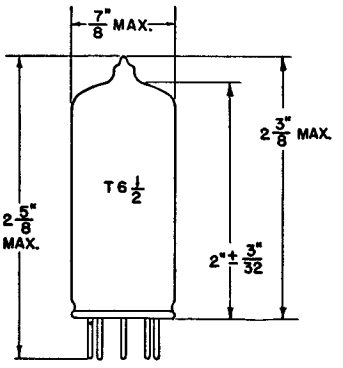


RETMA 9DX

TERMINAL CONNECTIONS

Pin 1—Triode Cathode
Pin 2—Triode Grid
Pin 3—Triode Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Cathode, Grid-No. 3 and Internal Shield
Pin 7—Pentode Grid-No. 1
Pin 8—Pentode Grid-No. 2 (Screen)
Pin 9—Pentode Plate

PHYSICAL DIMENSIONS



RETMA 6-3

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

	Pentode Section	Triode Section	
Plate Voltage	300	300	Volts
Screen-Supply Voltage	300	...	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.0	2.5	Watts
Screen Dissipation	1.0	...	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

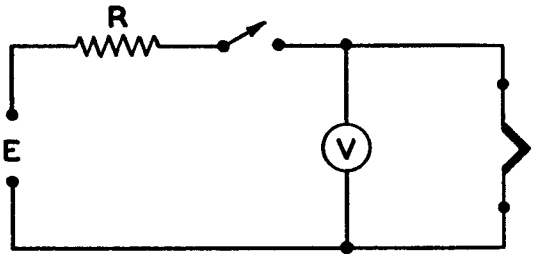
CLASS A_1 AMPLIFIER

	Pentode Section	Triode Section	
Plate Voltage	200	150	Volts
Screen Voltage	125	...	Volts
Grid-Number 1 Voltage	...	−5	Volts
Cathode-Bias Resistor	82	...	Ohms
Amplification Factor	...	17	
Plate Resistance, approximate	150000	5150	Ohms
Transconductance	7000	3300	Micromhos
Plate Current	15	9.5	Milliamperes
Screen Current	3.4	...	Milliamperes
Grid-Number 1 Voltage, approximate			
I_b = 100 Microamperes	−8	−14	Volts

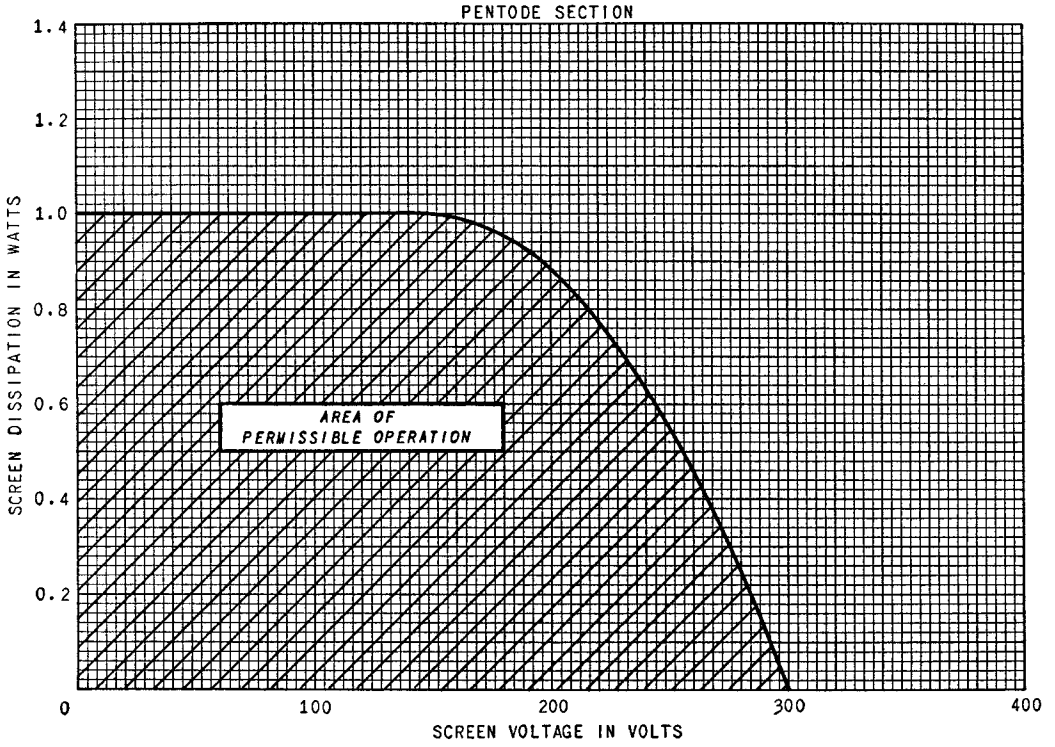
Note: The triode section of the 6BH8 may be diode-connected and employed as a high-perveance diode in video-detector applications. The diode operation can be obtained either with the triode grid connected to the triode plate and the combination operated as the plate of the diode, or with the triode plate grounded and the triode grid operated as the plate of the diode.

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E=25 volts (RMS or DC), V_1=5.0 volts (RMS or DC), and R=31.5 ohms.

† Without external shield.

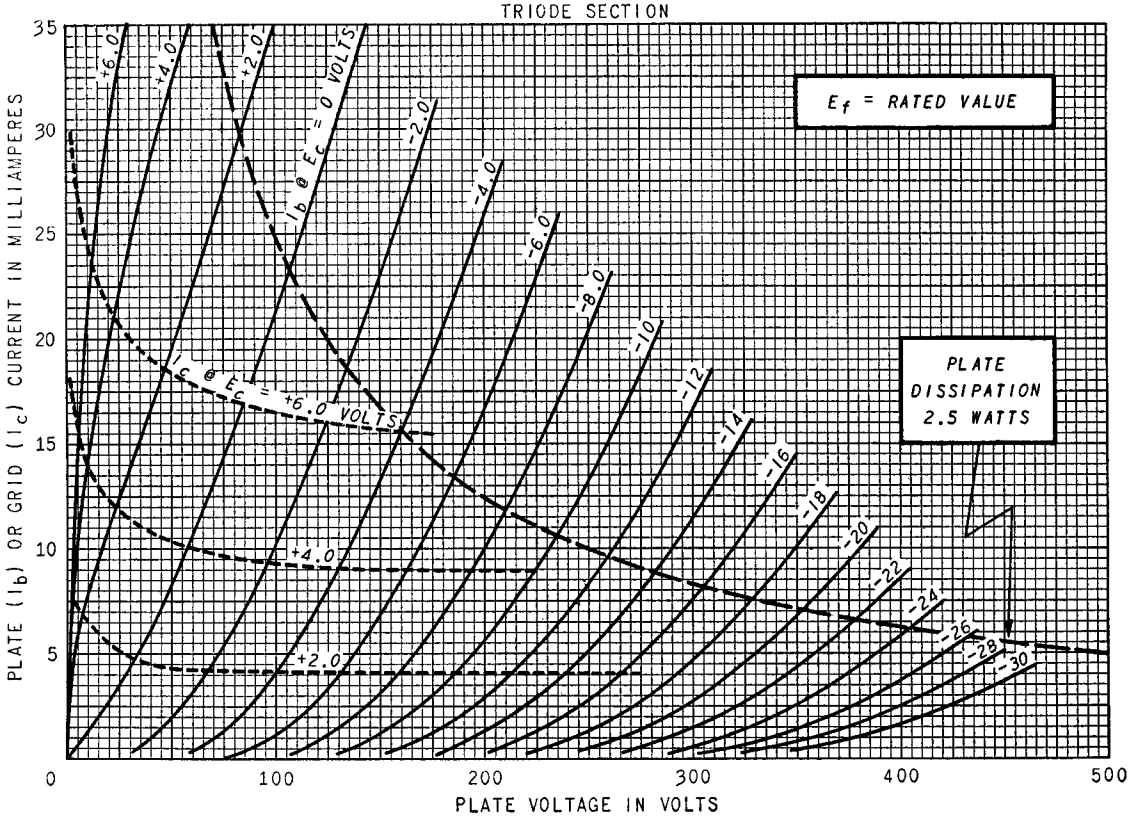


SCREEN RATING CHART



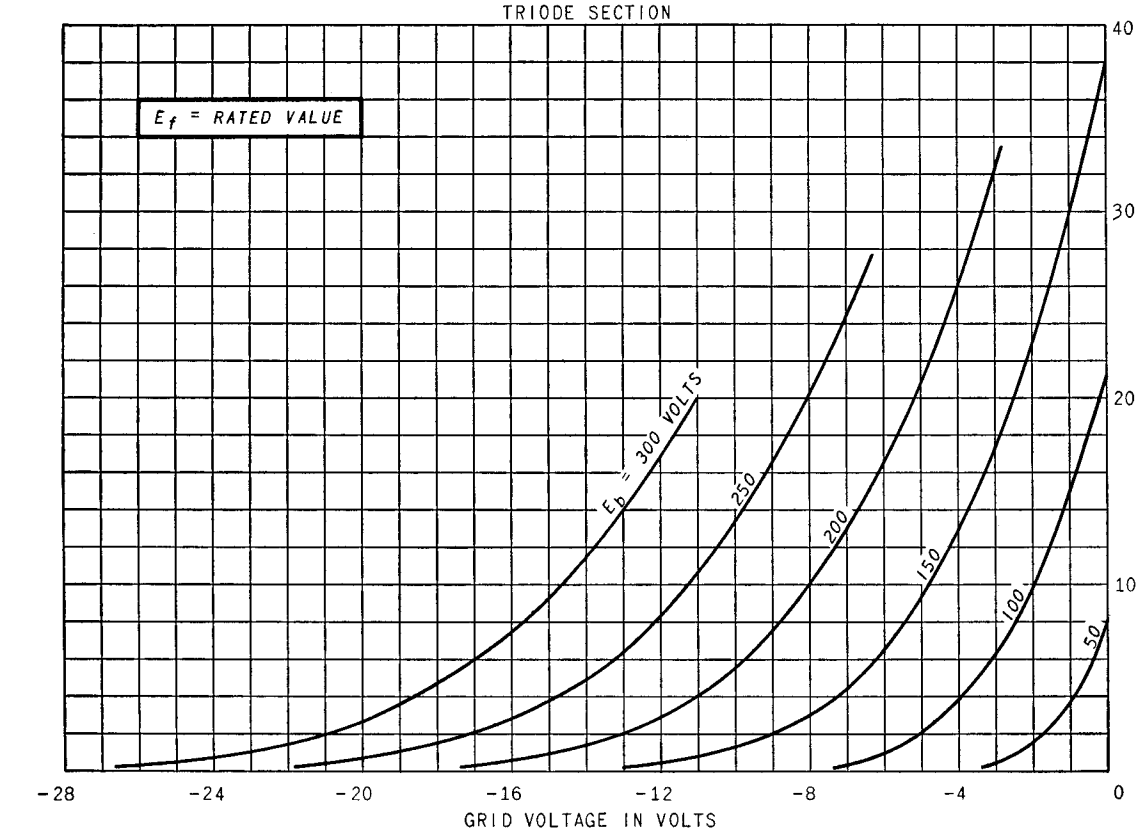
AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION



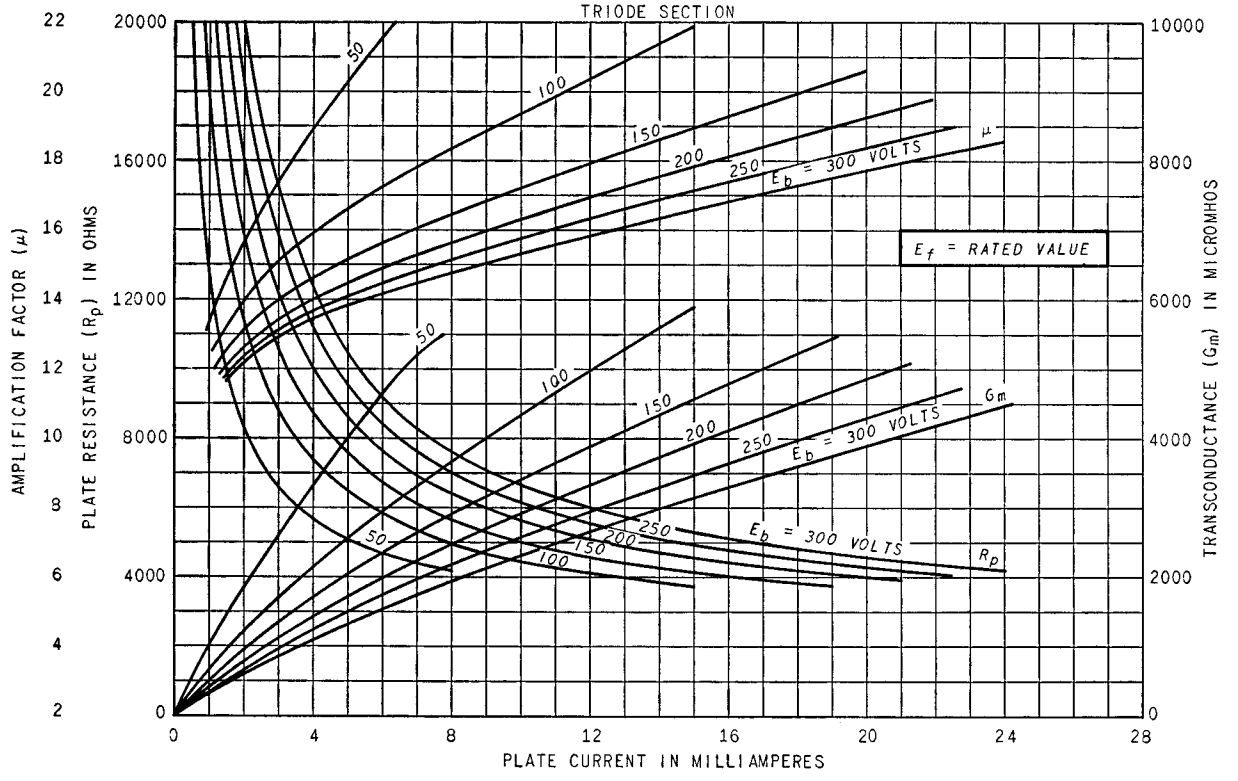
AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION



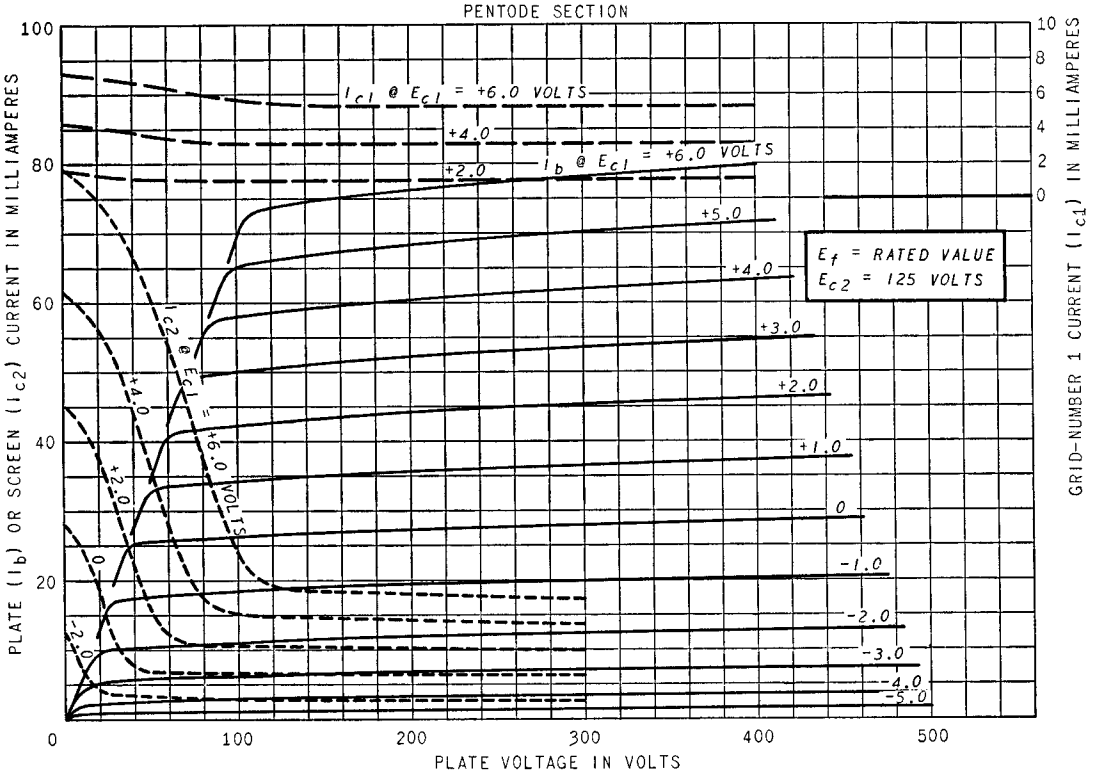
AVERAGE CHARACTERISTICS

TRIODE SECTION



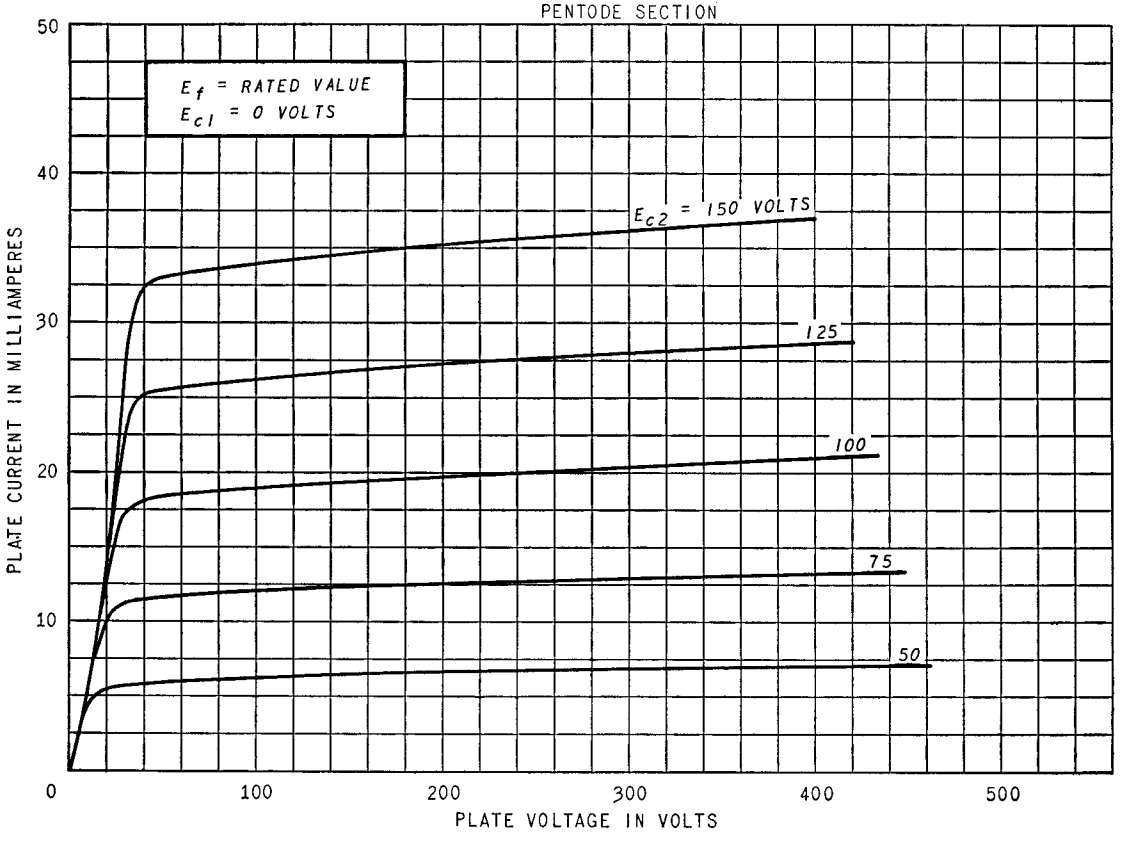
AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION



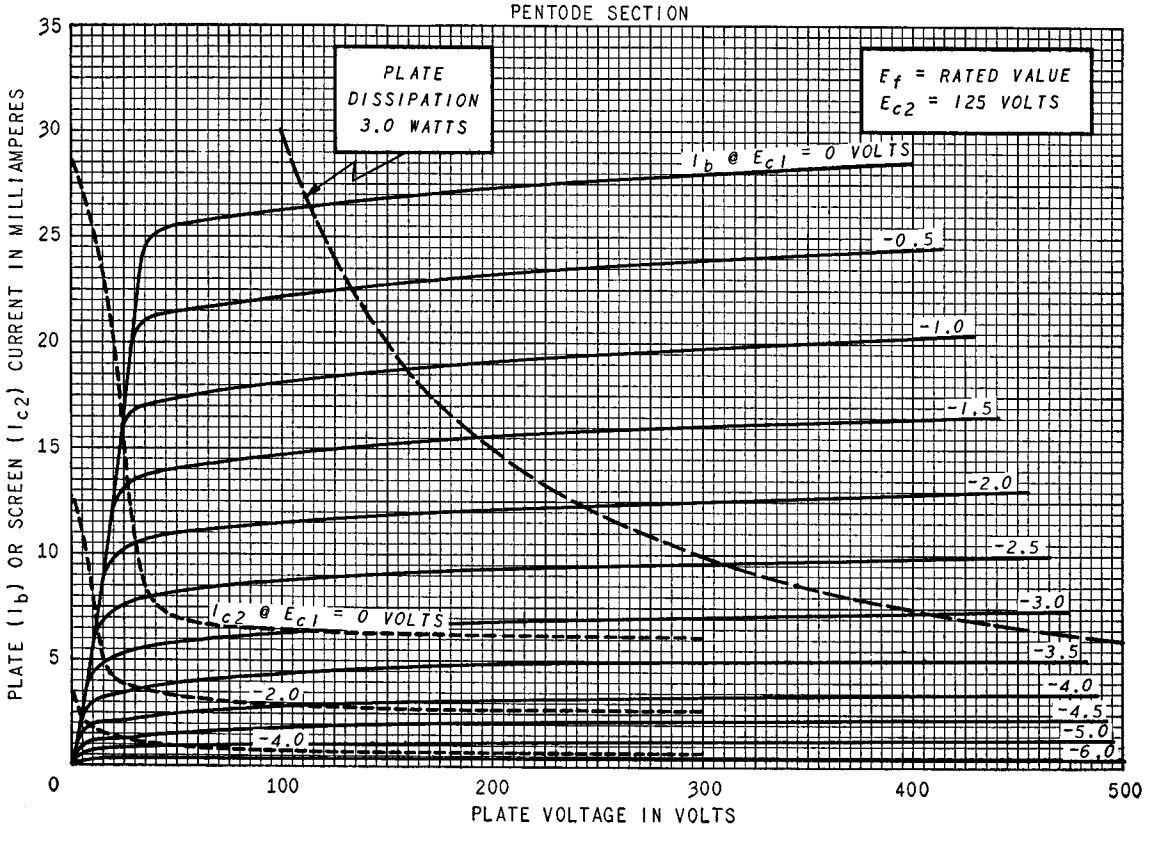
AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION



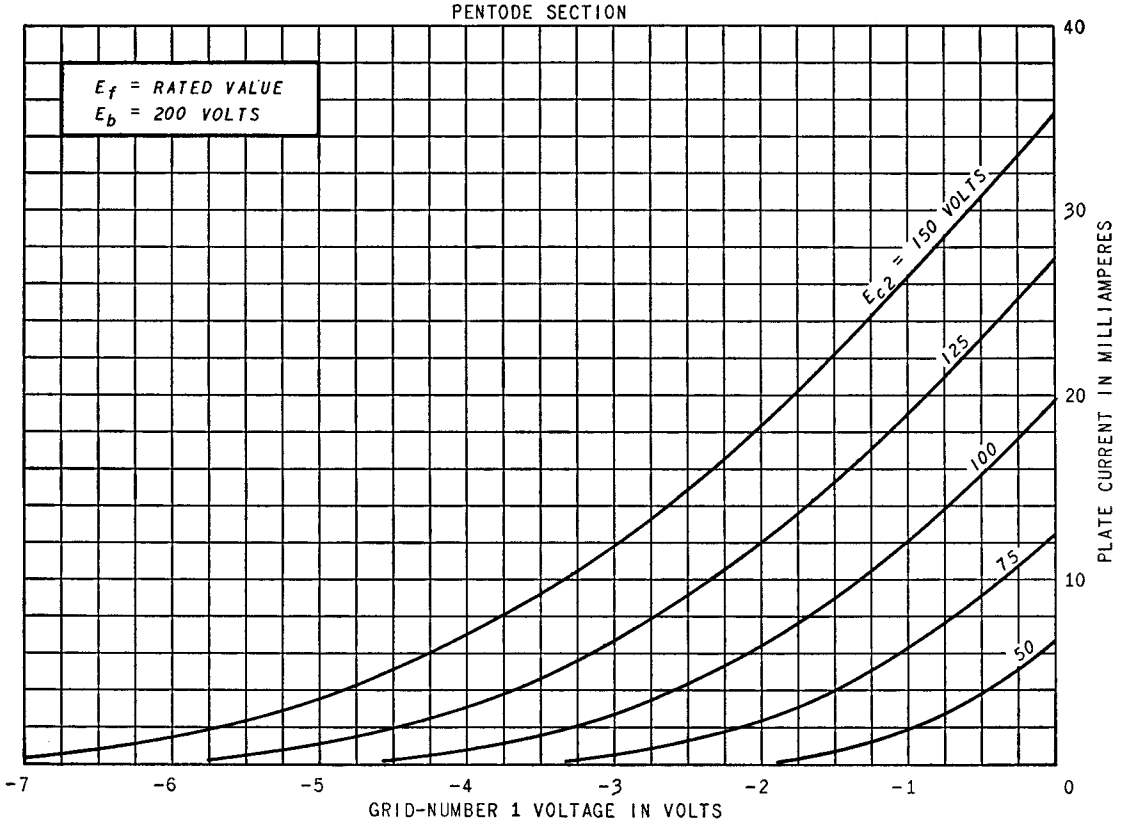
AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION



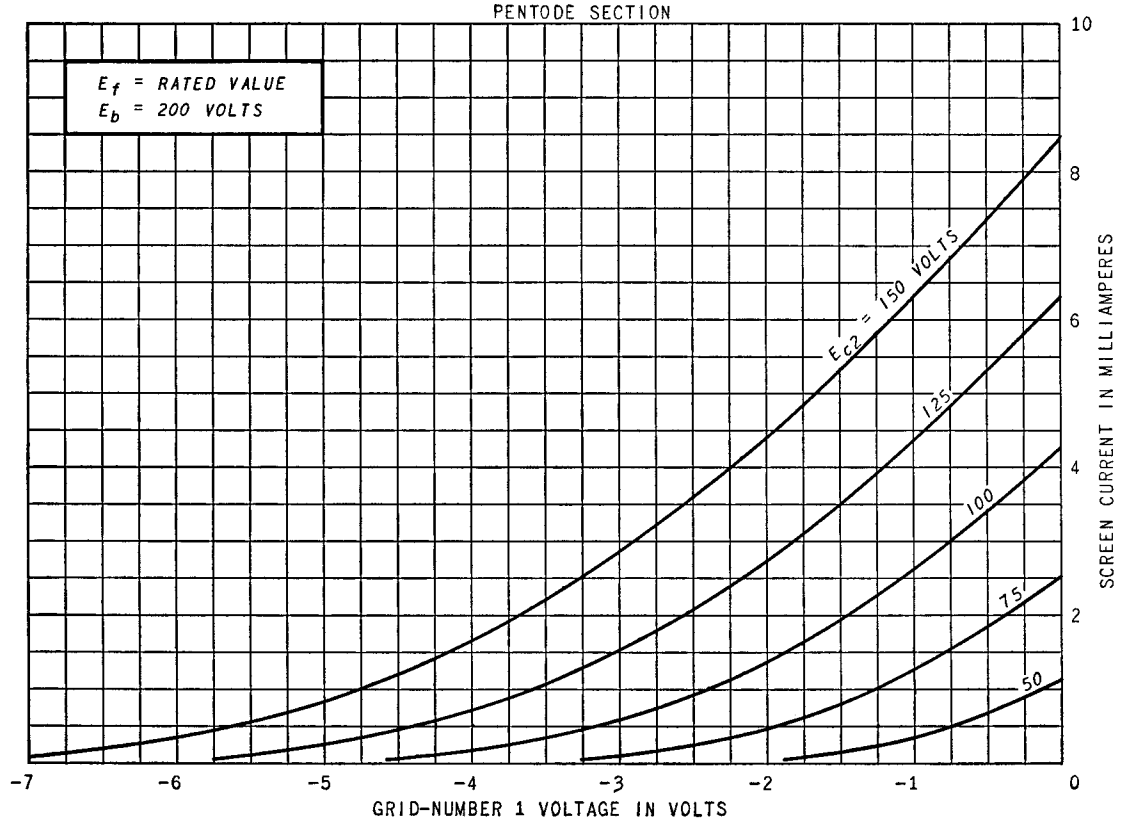
AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

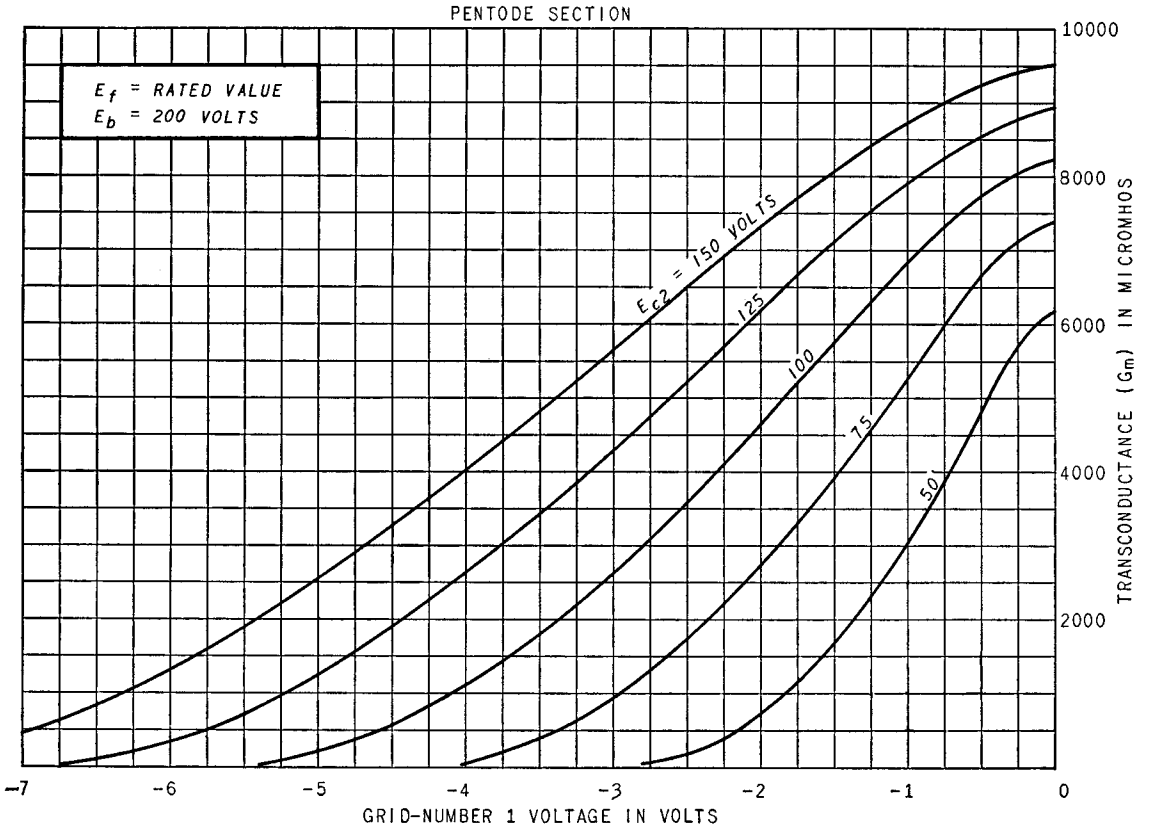


AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

PRINTED IN U.S.A.

ELECTRONICS

6BJ3

COMPACTRON DIODE

FOR TV DAMPING DIODE APPLICATIONS

DESCRIPTION AND RATING

The 6BJ3 is a compactron containing a single heater-cathode type diode. It is intended for service as the damping diode in the horizontal-deflection circuit of television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*. .	6.3±0.6	Volts
Heater Current†	.1.2	Amperes
Direct Interelectrode Capacitances, approximate‡		
Cathode to Plate and Heater:		
k to (p + h)	.8.0	pf
Plate to Cathode and Heater:		
p to (k + h)	.5.5	pf
Heater to Cathode: (h to k) .	.2.7	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter.	1.188	Inches
Maximum Over-all Length . .	2.625	Inches
Maximum Seated Height . . .	2.250	Inches

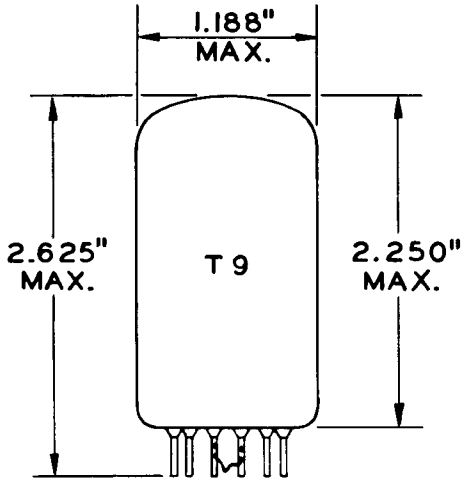
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

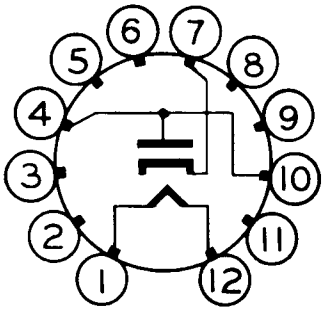


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - No Connection
Pin 3 - No Connection
Pin 4 - Plate
§Pin 5 - No Connection
§Pin 6 - No Connection
Pin 7 - Cathode
§Pin 8 - No Connection
§Pin 9 - No Connection
Pin 10 - Plate
Pin 11 - No Connection
Pin 12 - Heater

BASING DIAGRAM



EIA 12BL

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

TV DAMPER SERVICE - DESIGN-MAXIMUM VALUES ¶

Peak Inverse Plate Voltage	3300	Volts
Plate Dissipation	4.0	Watts
Steady-State Peak Plate Current	840	Milliamperes
DC Output Current	140	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	600	Volts
Total DC and Peak	3300	Volts

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 250 Milliamperes DC	21	Volts

FOOTNOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

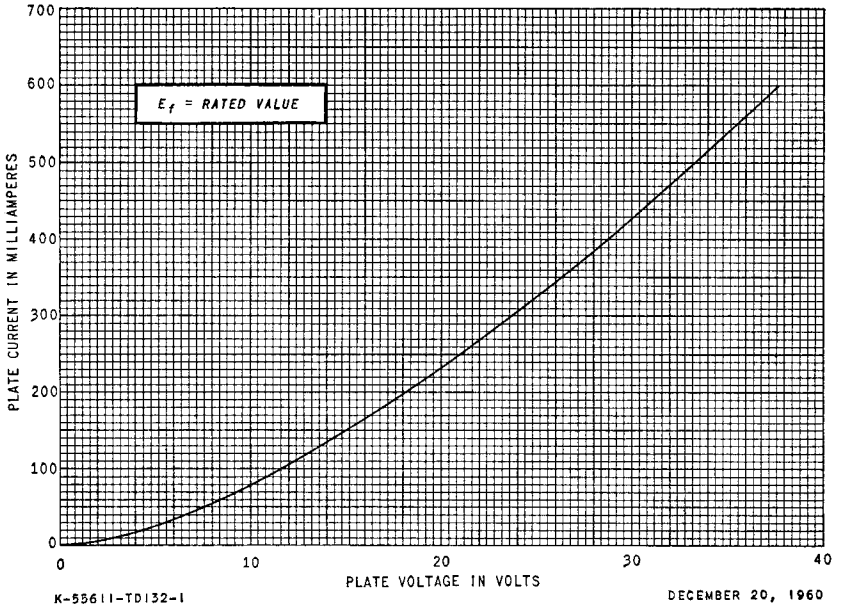
‡ Without external shield.

§ Socket terminals 5, 6, 8, and 9 should not be used as tie points.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



K-55611-TD132-1

DECEMBER 20, 1960

RECEIVING TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky

Electronic TUBES

6BJ6

PENTODE

DESCRIPTION AND RATING

The 6BJ6 is a miniature, remote-cutoff pentode designed primarily for use as a high-gain radio-frequency or intermediate-frequency amplifier. Features include low grid-plate capacitance, relatively high transconductance, and low heater current.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential			
Heater Voltage, AC or DC	6.3		Volts
Heater Current	0.15		Amperes
Direct Interelectrode Capacitances	**With Shield***	**Without Shield**	
Grid-Number 1 to Plate, maximum	0.0035	0.0035	μμf
Input	4.5	4.5	μμf
Output	5.5	5.5	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	300	Volts
Screen-Supply Voltage	300	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
Plate Dissipation	3.0	Watts
Screen Dissipation	0.6	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts

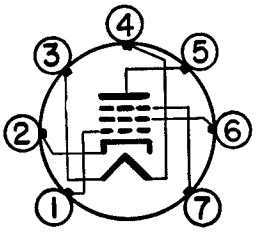
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	100	250	Volts
Suppressor, Connected to Cathode at Socket			
Screen Voltage	100	100	Volts
Grid-Number 1 Voltage	−1.0	−1.0	Volts
Plate Resistance, approximate	0.25	1.3	Megohms
Transconductance	3650	3600	Micromhos
Plate Current	9.0	9.2	Milliamperes
Screen Current	3.5	3.3	Milliamperes
Grid-Number 1 Voltage, approximate Gm = 10 Micromhos	−20	−20	Volts

* With external shield (RETMA 316) connected to pin 7.

BASING DIAGRAM

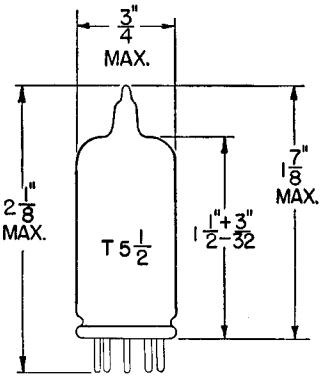


RETMA 7CM

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Internal Shield and Grid Number 3 (Suppressor)

PHYSICAL DIMENSIONS

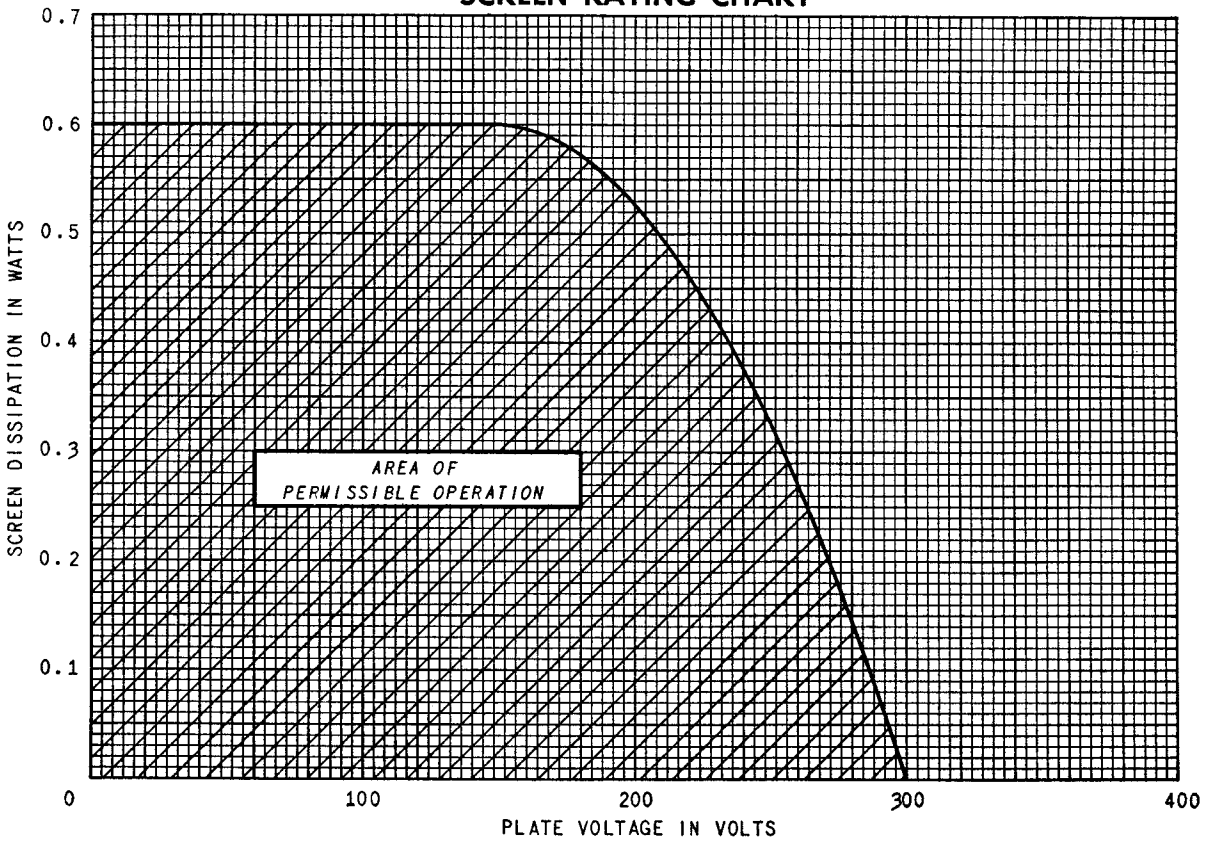


RETMA 5-2

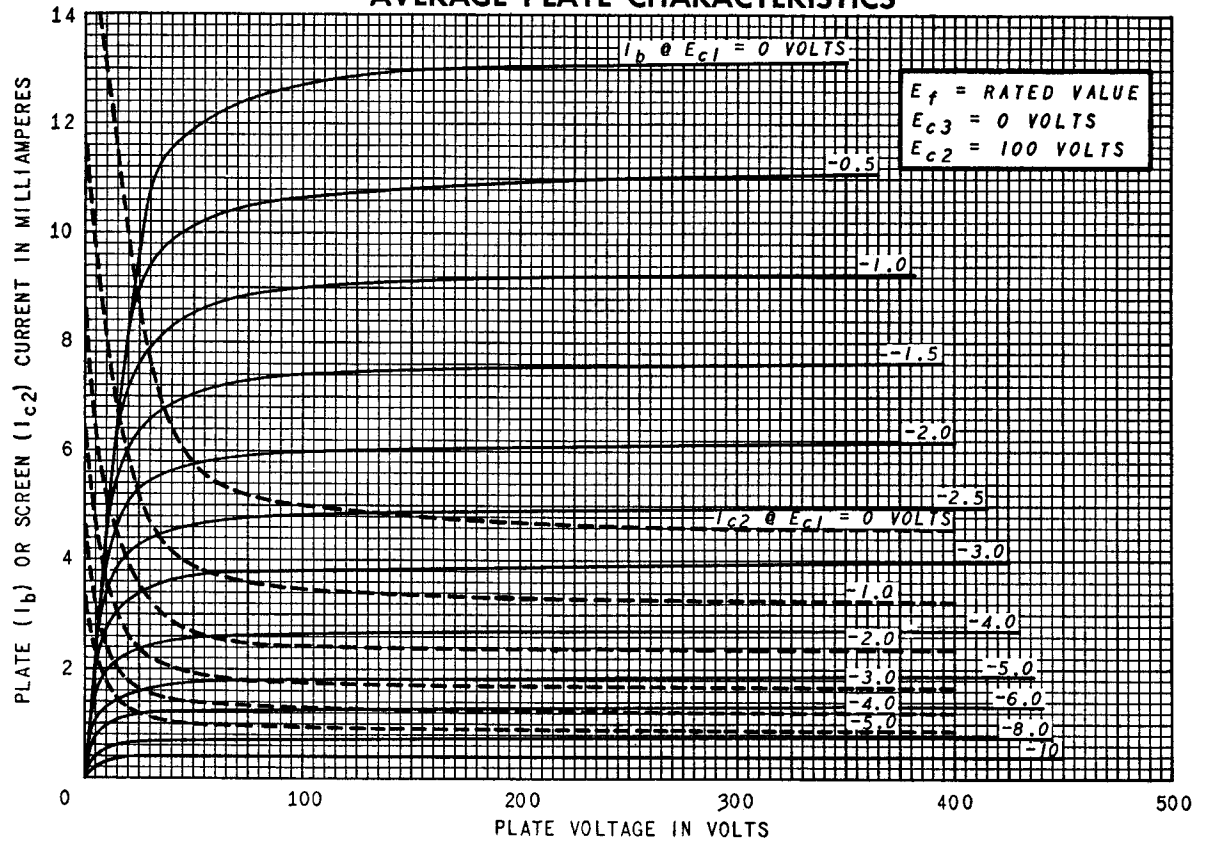
GENERAL ELECTRIC

Supersedes ET-T455A, dated 1-51

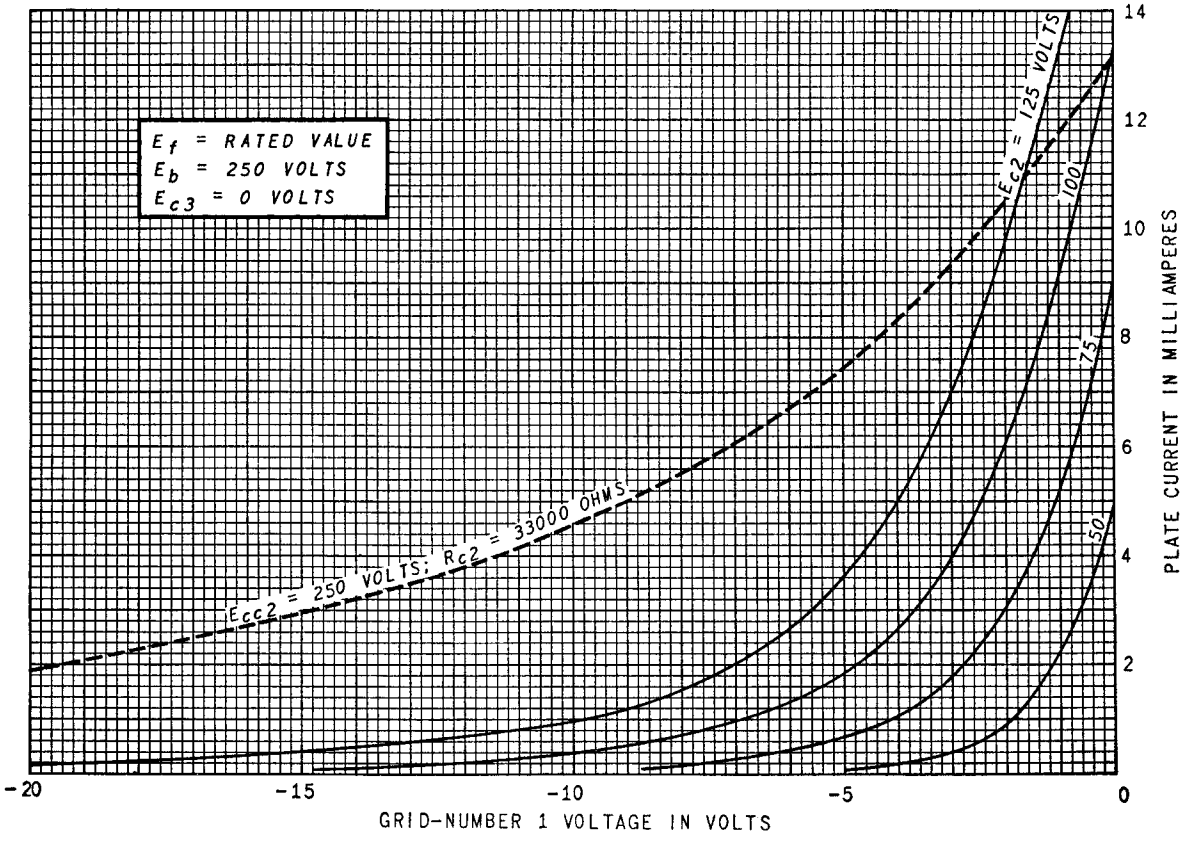
SCREEN RATING CHART



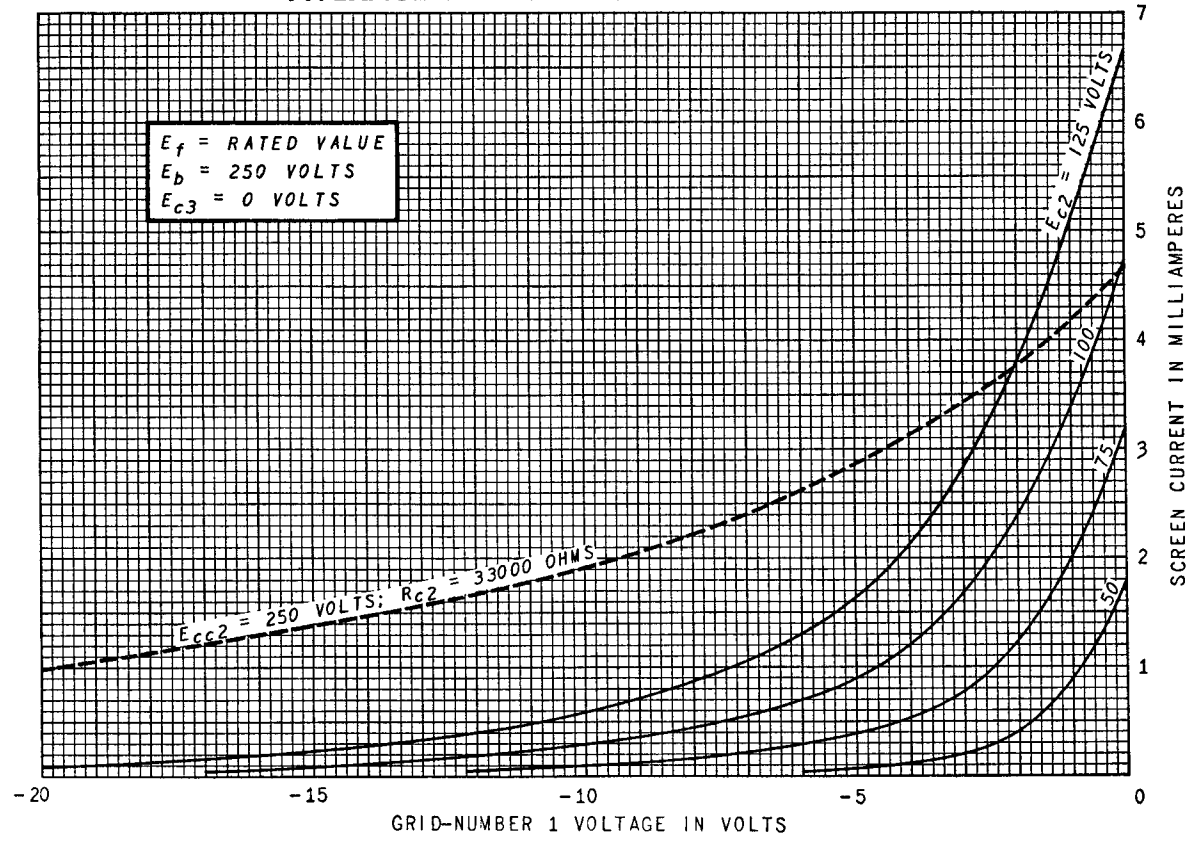
AVERAGE PLATE CHARACTERISTICS



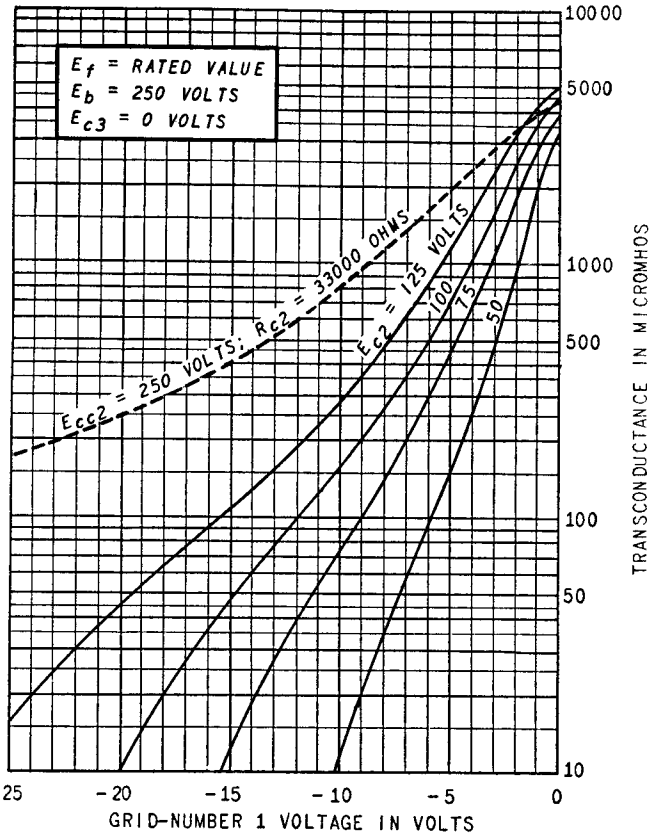
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6BJ7

TRIPLE DIODE

FOR TV DC-RESTORER APPLICATIONS

DESCRIPTION AND RATING

The 6BJ7 is a miniature, triple diode primarily intended for use as a d-c restorer in each of the three signal channels of color television receivers. For flexibility in circuit design, each diode incorporates a separate cathode. The electrical characteristics of each section of the 6BJ7 are similar to those of each section of the 6AL5.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.45	Amperes
Direct Interelectrode Capacitances*		
Plate-Number 1 to Cathode-Number 1, Heater, and Internal Shield	3.0	μμf
Plate-Number 2 to Cathode-Number 2, Heater, and Internal Shield	2.6	μμf
Plate-Number 3 to Cathode-Number 3, Heater, and Internal Shield	2.6	μμf
Cathode-Number 1 to Plate-Number 1, Heater and Internal Shield	4.0	μμf
Cathode-Number 2 to Plate-Number 2, Heater, and Internal Shield	3.8	μμf
Cathode-Number 3 to Plate-Number 3, Heater, and Internal Shield	4.0	μμf
Plate-Number 1 to Plate-Number 2	0.055	μμf
Plate-Number 2 to Plate-Number 3	0.036	μμf
Plate-Number 3 to Plate-Number 1	0.036	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

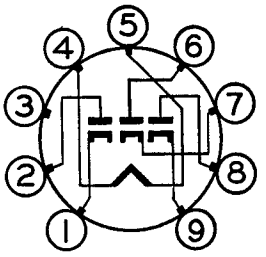
TV DC-RESTORER SERVICE
DESIGN-CENTER VALUES

Peak Inverse Plate Voltage	330	Volts
Peak Plate Current per Plate	10	Milliamperes
DC Output Current per Plate	1.0	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	330	Volts

GENERAL ELECTRIC

Supersedes ET-T827, dated 10-53

BASING DIAGRAM

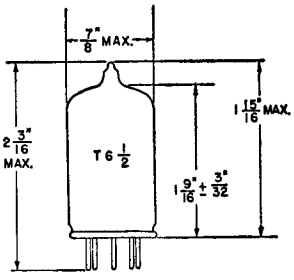


RETMA 9AX

TERMINAL CONNECTIONS

Pin 1—Cathode (Section 3)
Pin 2—Plate (Section 3)
Pin 3—Internal Shield
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 2)
Pin 7—Cathode (Section 2)
Pin 8—Plate (Section 1)
Pin 9—Cathode (Section 1)

PHYSICAL DIMENSIONS



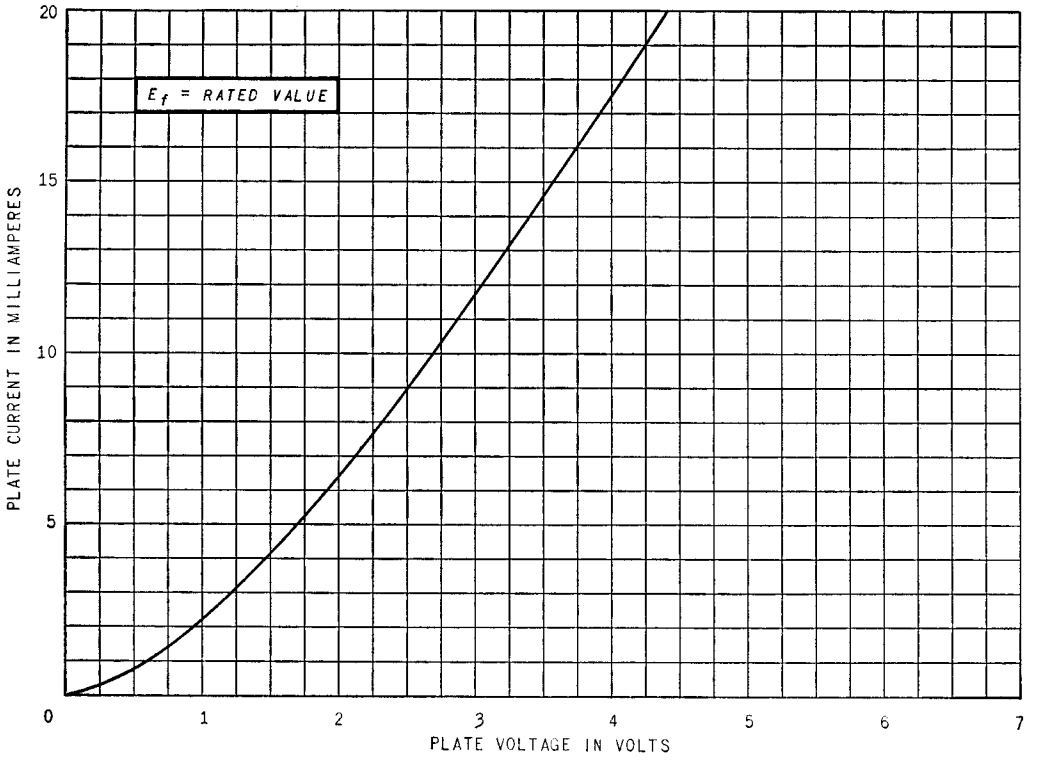
RETMA 6-2

AVERAGE CHARACTERISTICS

Tube Voltage Drop, Each Section
Ib = 10 Milliamperes DC..... 2.7 Volts

* Without external shield.

AVERAGE PLATE CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6BK5—12BK5—25BK5

BEAM PENTODE

DESCRIPTION AND RATING

The 6BK5 is a miniature beam pentode designed primarily for use in the audio-frequency power output stage of television and radio receivers in which only small driving voltages are available. Features of the tube include extremely high power sensitivity, high transconductance, and high plate efficiency.

Except for heater ratings and heater-cathode voltage ratings, the 12BK5 is identical to the 6BK5. The 12BK5, as a result of its controlled heater warm-up characteristic, is especially suited for use in television receivers which employ series-connected heaters. When the 12BK5 is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

The 25BK5 differs from the 6BK5 only in heater ratings.

GENERAL

ELECTRICAL

	6BK5	12BK5	25BK5	
Cathode—Coated Unipotential				
Heater Voltage, AC or DC	6.3	12.6	25.0	Volts
Heater Current	1.2	0.6	0.3	Amperes
Heater Warm-up Time*	...	11	...	Seconds
Direct Interelectrode Capacitances†				
Grid-Number 1 to Plate			0.6	μμf
Input			13	μμf
Output			5.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

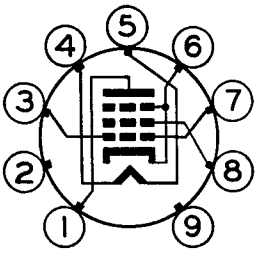
Plate Voltage	250	Volts
Screen Voltage	250	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	9.0	Watts
Screen Dissipation	2.5	Watts

Heater-Cathode Voltage	12BK5	6BK5, 25BK5	
Heater Positive with Respect to Cathode			
DC Component	100	.....	Volts
Total DC and Peak	200	100	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	100	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	0.1	Megohms
With Cathode Bias	0.5	0.5	Megohms

GENERAL ELECTRIC

Supersedes ET-T799, dated 11-51

BASING DIAGRAM

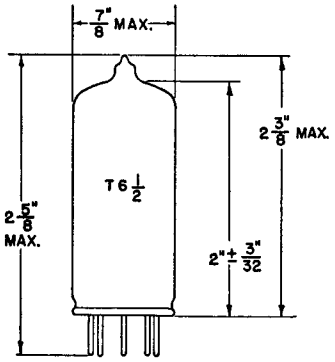


RETMA 9BQ

TERMINAL CONNECTIONS

Pin 1—Plate
Pin 2—No Connection
Pin 3—Grid Number 1
Pin 4—Heater
Pin 5—Heater
Pin 6—Cathode and Beam Plates
Pin 7—Grid Number 1
Pin 8—Grid Number 2 (Screen)
Pin 9—No Connection

PHYSICAL DIMENSIONS



RETMA 6-3

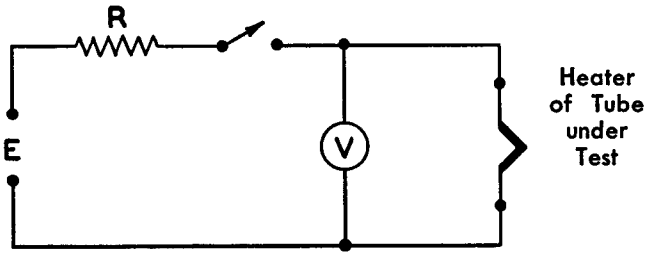
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

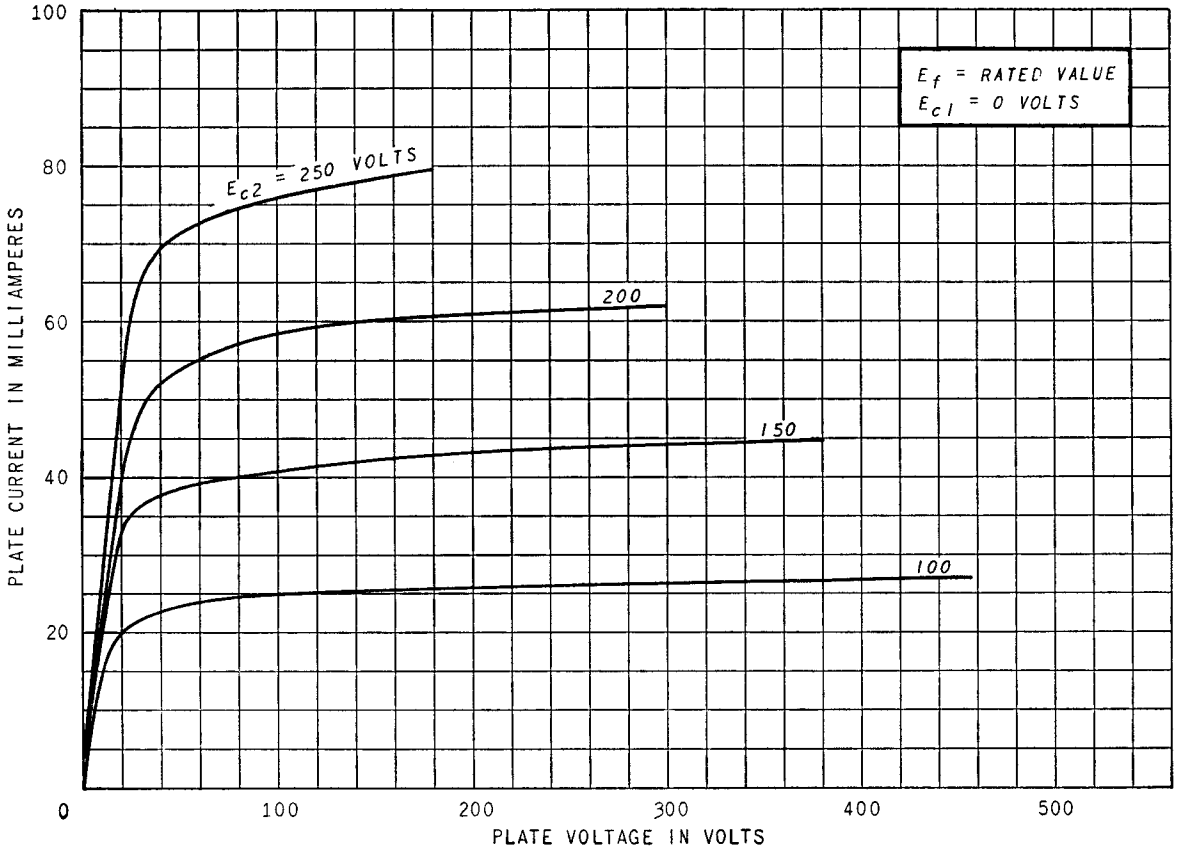
Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	−5.0	Volts
Peak AF Grid-Number 1 Voltage	5.0	Volts
Plate Resistance, approximate	100000	Ohms
Transconductance	8500	Micromhos
Zero-Signal Plate Current	35	Milliamperes
Maximum-Signal Plate Current, approximate	37	Milliamperes
Zero-Signal Screen Current	3.5	Milliamperes
Maximum-Signal Screen Current, approximate	10	Milliamperes
Load Resistance	6500	Ohms
Total Harmonic Distortion, approximate	7	Percent
Maximum-Signal Power Output	3.5	Watts

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E=50 volts (RMS or DC), V_1=10.0 volts (RMS or DC), and R=63 ohms.

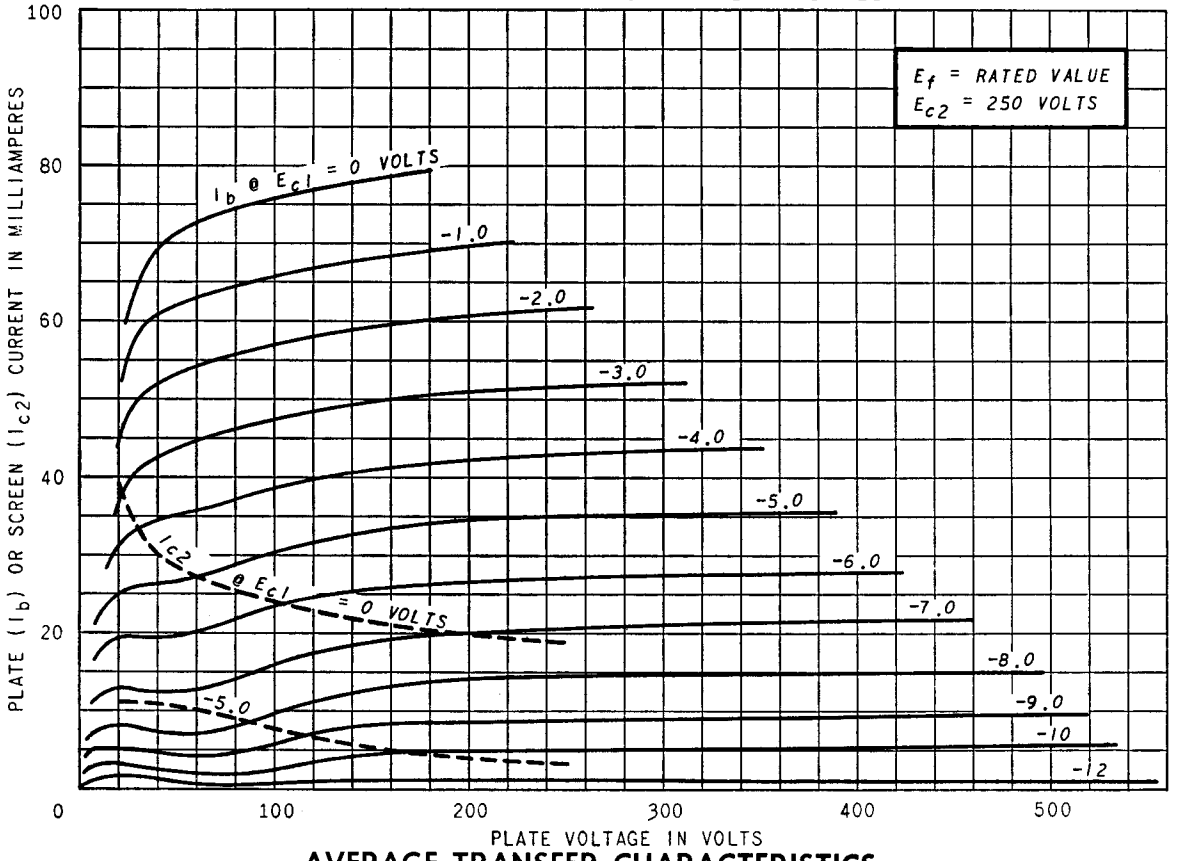
† Without external shield.



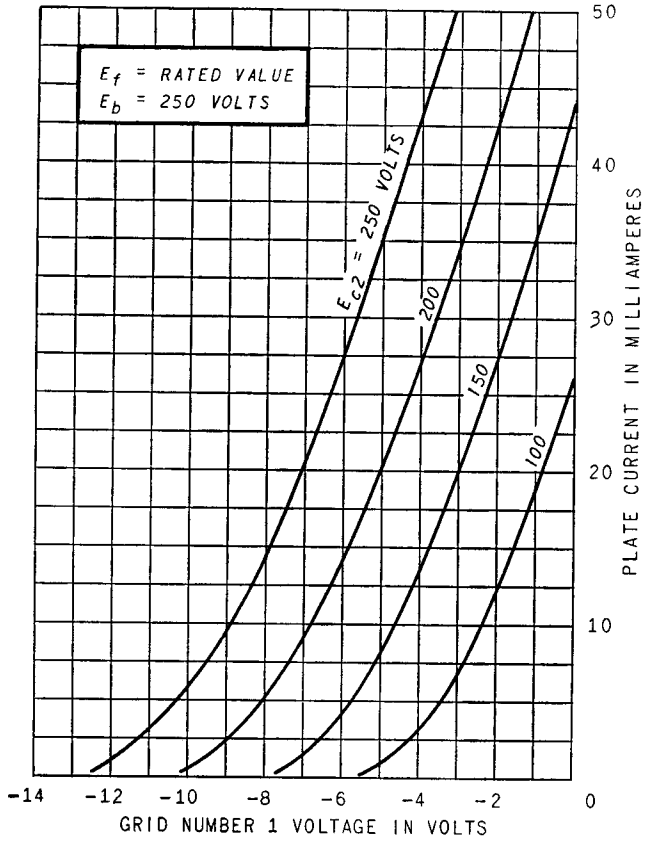
AVERAGE PLATE CHARACTERISTICS

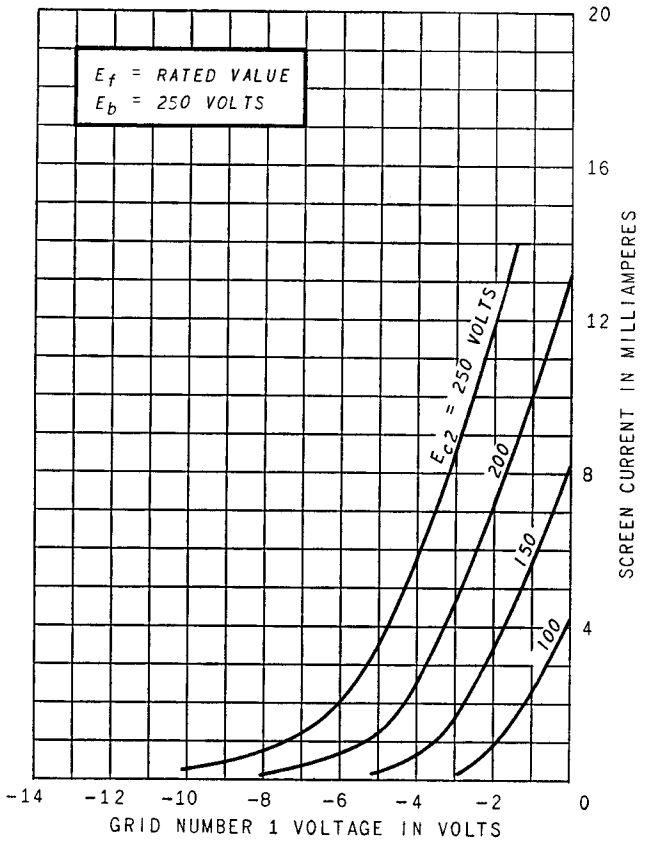


AVERAGE PLATE CHARACTERISTICS

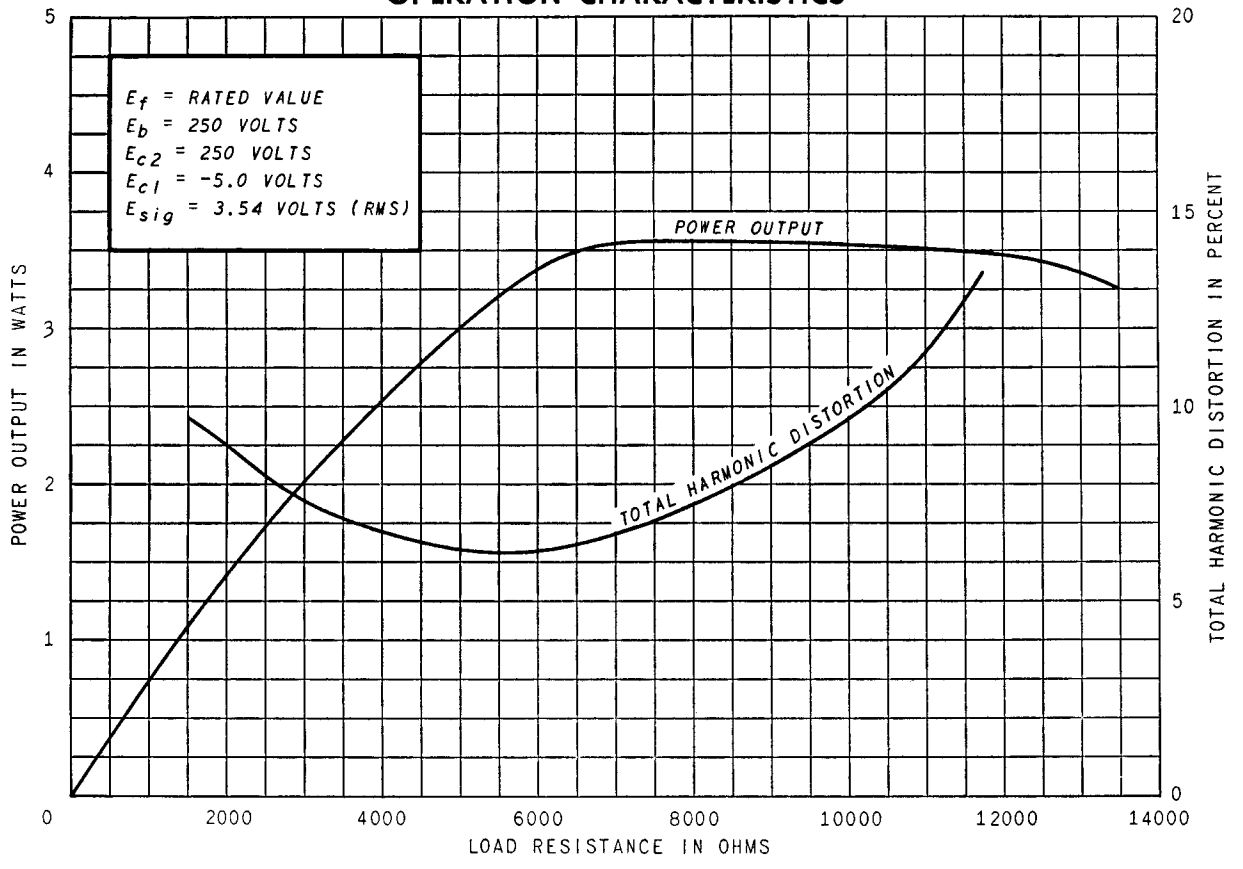


AVERAGE TRANSFER CHARACTERISTICS





OPERATION CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

6BK7-B

TWIN TRIODE

DESCRIPTION AND RATING

The 6BK7-B is a miniature twin triode designed primarily for use as a cascode amplifier at frequencies below approximately 300 megacycles. It is especially useful as the radio-frequency amplifier in very-high-frequency television tuners or as the intermediate-frequency preamplifier in ultra-high-frequency tuners. Its performance as a cascode amplifier is characterized by high gain and low noise figure. Electrically and physically, the 6BK7-B is a replacement for the 6BK7 and the 6BK7-A.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.45	Amperes
Heater Warm-up Time*	11	Seconds

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

Direct Interelectrode Capacitances†	Section 1	Section 2	
Grid to Plate: (g to p)	1.8	1.8	pf
Input: g to (h+k)	3.0	3.0	pf
Output: p to (h+k)	1.0	0.9	pf
Heater to Cathode: (h to k)	2.8	3.0	pf
Grid to Grid: (1g to 2g), maximum	0.004		pf
Plate to Plate: (1p to 2p), maximum	0.075		pf
Plate to Cathode: (p to k)	0.22	0.22	pf
Grounded-Grid Input: k to (h+g)	6.0	6.0	pf
Grounded-Grid Output: p to (h+g)	2.4	2.4	pf

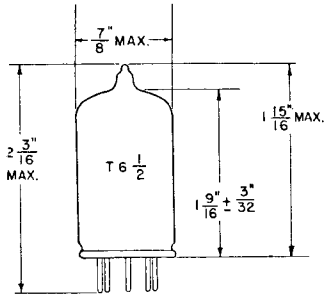
MAXIMUM RATINGS

DESIGN-CENTER VALUES, EACH SECTION

Plate Voltage	300	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	2.7	Watts

Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200§	Volts

PHYSICAL DIMENSIONS



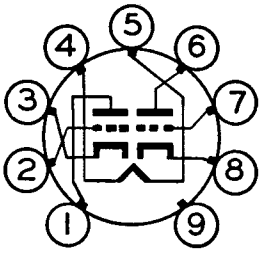
EIA 6-2

EIA 6-2

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Internal Shield‡

BASING DIAGRAM



EIA 9AJ

GENERAL ELECTRIC

Supersedes ET-T1259 dated 1-56

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	150	Volts
Cathode-Bias Resistor	56	Ohms
Amplification Factor	43	
Plate Resistance, approximate	4600	Ohms
Transconductance	9300	Micromhos
Plate Current	18	Milliamperes
Grid Voltage, approximate		
Ib = 10 Microamperes	−11	Volts
Noise Figure π	7	Decibels

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

‡ It is recommended that pin 9 be grounded.

§ When the tube is used as a cascode amplifier and the two sections are connected in series, this voltage may be as high as 300 volts maximum under cutoff conditions.

π As measured in a cascode amplifier which has a balanced 300-ohm input system and which operates at a plate supply voltage of 250 volts, a plate current of 18 milliamperes, a frequency of 200 megacycles, a stage bandwidth of 7 megacycles, and an effective noise bandwidth of 3.5 megacycles.

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under normal conditions.

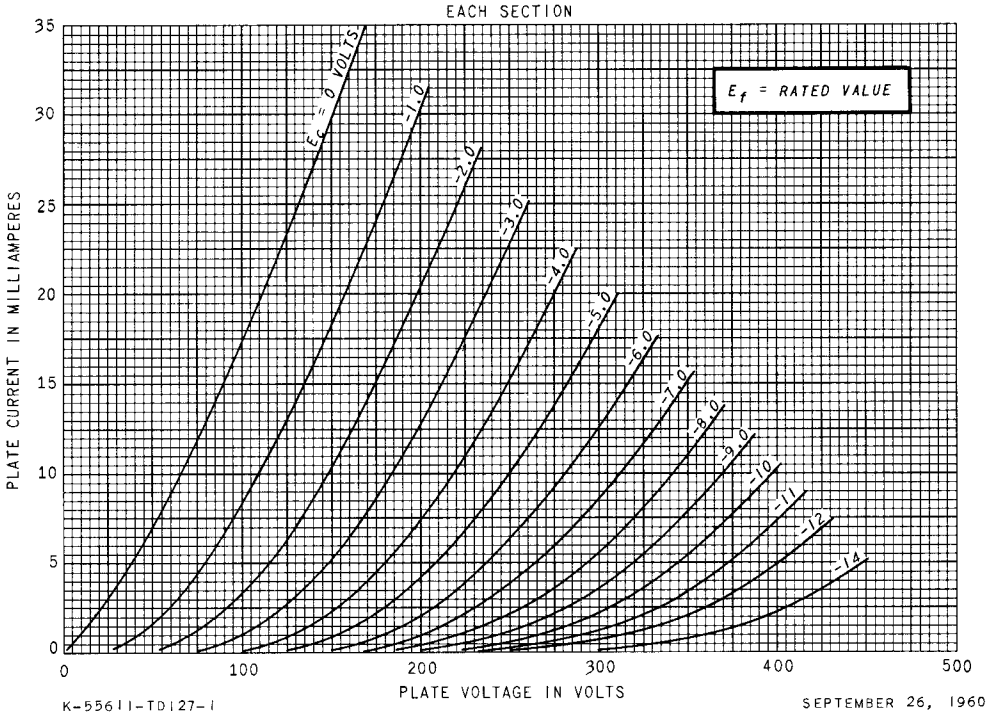
The tube manufacturer chooses these values to provide acceptable serviceability of the tube in average applications, making allowance for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube under normal operating conditions at the stated normal supply voltage.

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AVERAGE PLATE CHARACTERISTICS

EACH SECTION

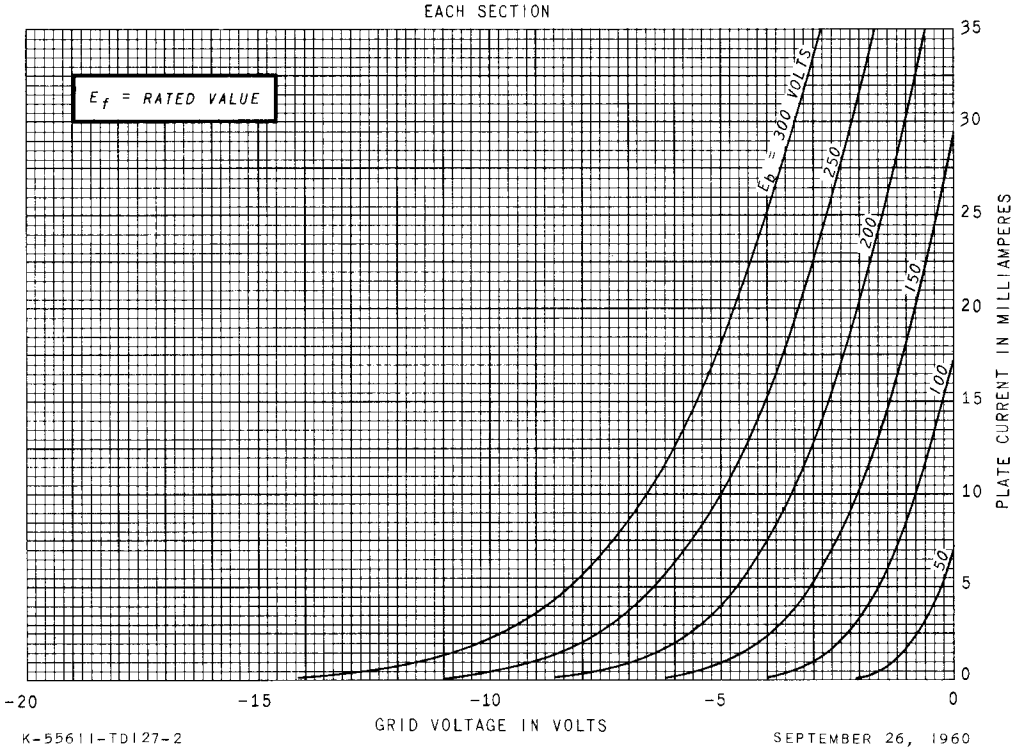


K-5561I-TDI27-1

SEPTEMBER 26, 1960

AVERAGE TRANSFER CHARACTERISTICS

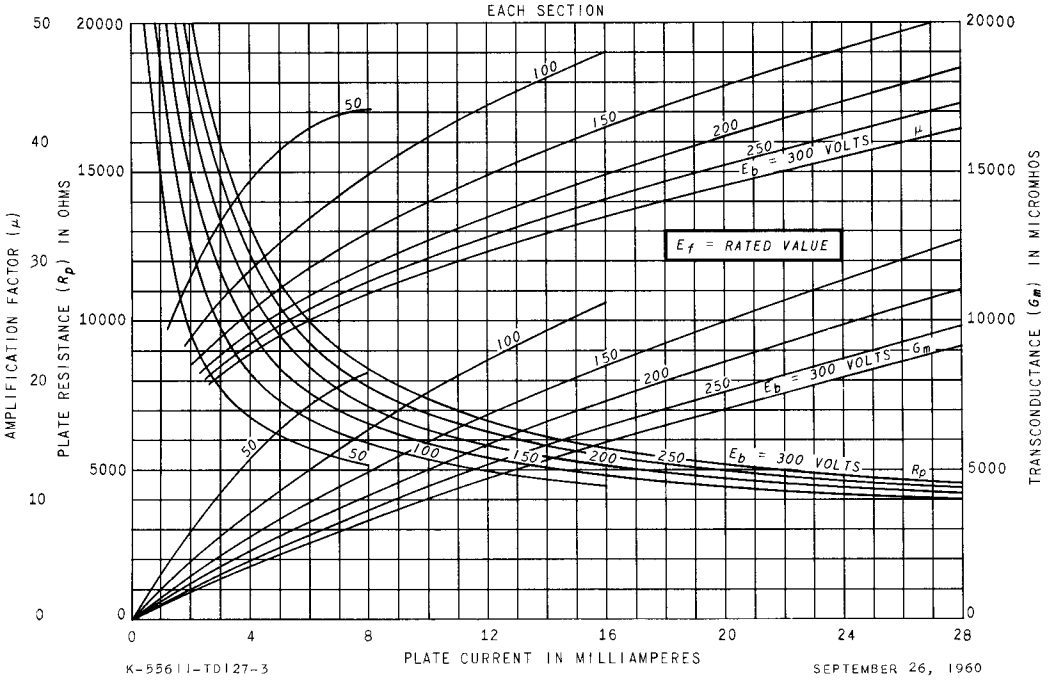
EACH SECTION



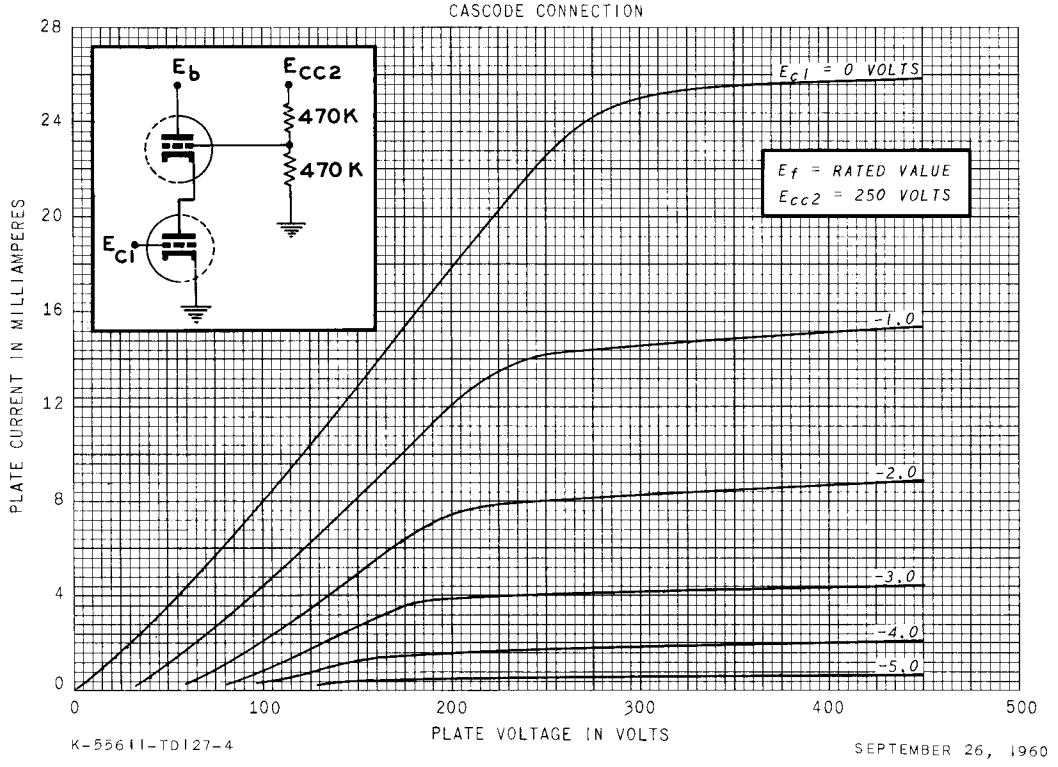
K-5561I-TDI27-2

SEPTEMBER 26, 1960

AVERAGE CHARACTERISTICS

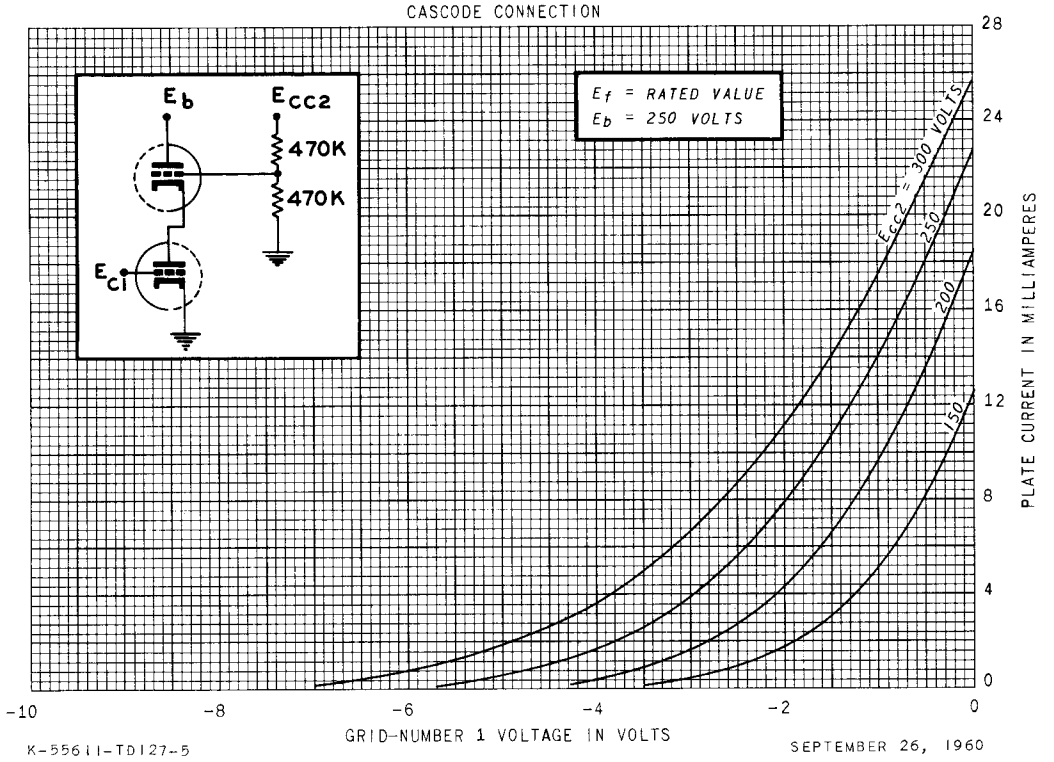


AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

CASCODE CONNECTION

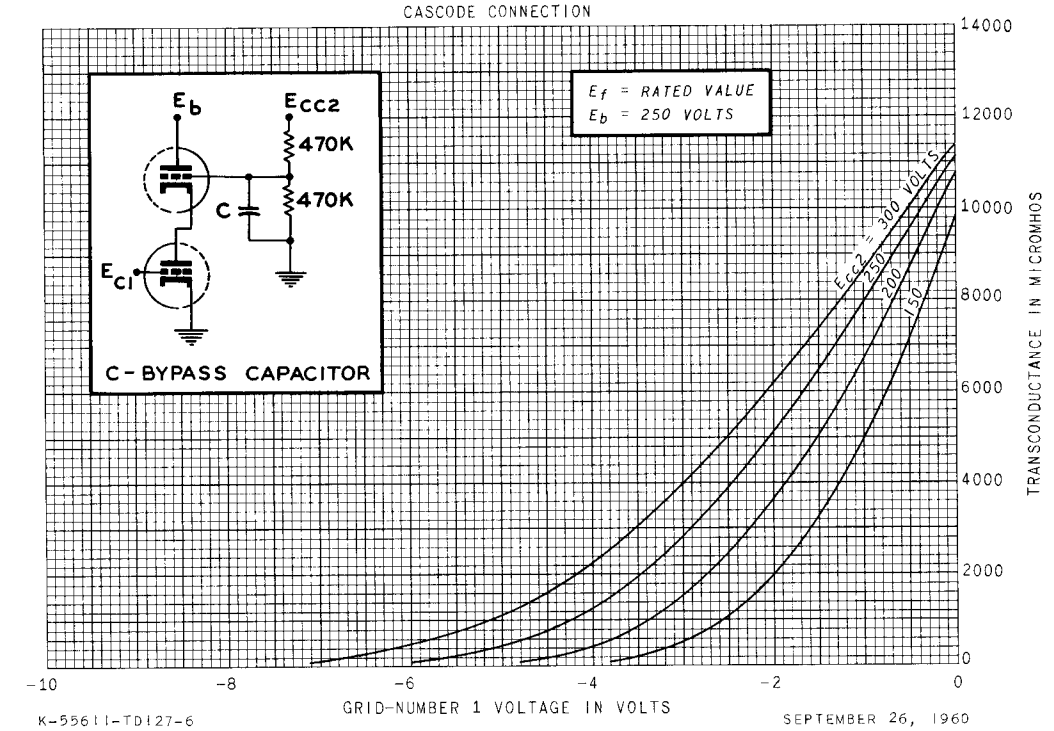


K-5561I-TD127-5

SEPTEMBER 26, 1960

AVERAGE TRANSFER CHARACTERISTICS

CASCODE CONNECTION



K-5561I-TD127-6

SEPTEMBER 26, 1960

Electronic TUBES

6BL7-GTA

TWIN TRIODE

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6BL7-GTA is a twin triode especially designed for use as a combined vertical deflection amplifier and vertical oscillator in television receivers. The 6BL7-GTA is interchangeable with the 6BL7-GT but differs from it in having an improved section 1 for increased life as an oscillator, and controlled zero-bias plate current in both sections.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3	Volts
Heater Current	1.5	Amperes

Direct Interelectrode Capacitances, approximate*

	Section 1	Section 2	
Grid to Plate	6.0	6.0	μμf
Input	4.2	4.6	μμf
Output	0.9	0.9	μμf

MECHANICAL

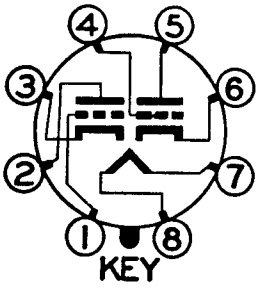
Mounting Position—Any
Envelope—T-9, Glass
Base—B8-58, Short Intermediate-Shell Octal 8-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED, EACH SECTION	Vertical Oscillator Service†‡	Vertical-Deflection Amplifier‡	
DC Plate Voltage	500	500	Volts
Peak Positive Pulse Plate Voltage	...	2000§	Volts
Peak Negative Grid Voltage	400	250	Volts
Plate Dissipation, Each Plate	10	10△	Watts
Total Plate Dissipation, Both Plates	12	12	Watts
DC Cathode Current	60	60	Milliamperes
Peak Cathode Current	210	210	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts

GENERAL ELECTRIC

BASING DIAGRAM

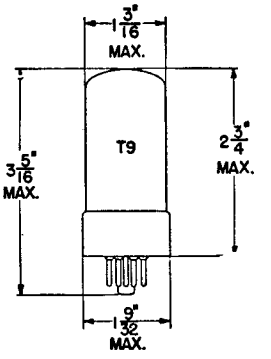


EIA 8BD

TERMINAL CONNECTIONS

Pin 1—Grid (Section 2)
Pin 2—Plate (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Grid (Section 1)
Pin 5—Plate (Section 1)
Pin 6—Cathode (Section 1)
Pin 7—Heater
Pin 8—Heater

PHYSICAL DIMENSIONS



EIA 9-41

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage	150	250	250	Volts
Grid Voltage	0	−17	−9.0	Volts
Amplification Factor	...	...	15	
Plate Resistance, approximate	...	...	2150	Ohms
Transconductance	...	...	7000	Micromhos
Plate Current	65	4.0	40	Milliamperes
Grid Voltage, approximate				
Ib = 50 Microamperes	...	...	−23	Volts

* Without external shield.

† Section 1 is recommended for vertical oscillator service.

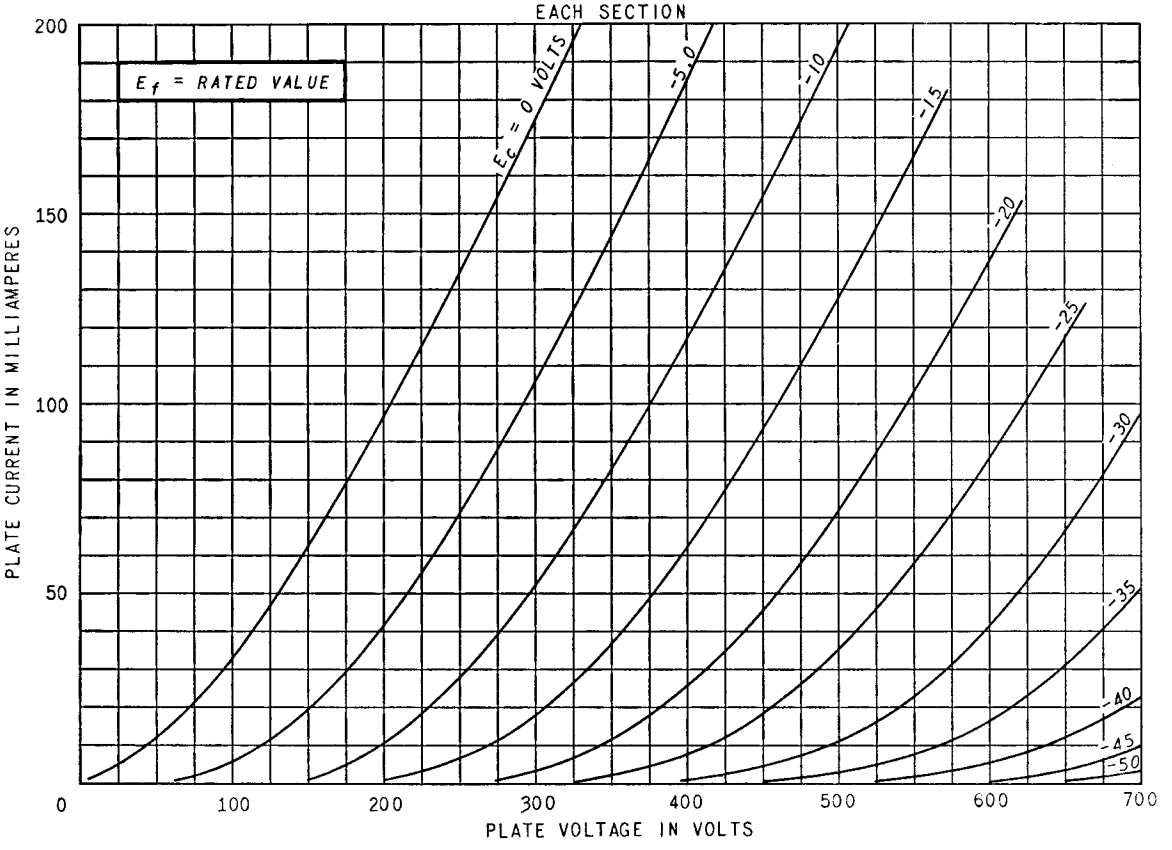
‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ Absolute-Maximum value.

△In stages operating with grid-leak bias, an adequate cathode bias resistor or other suitable means is required to protect the tube in the absence of excitation.

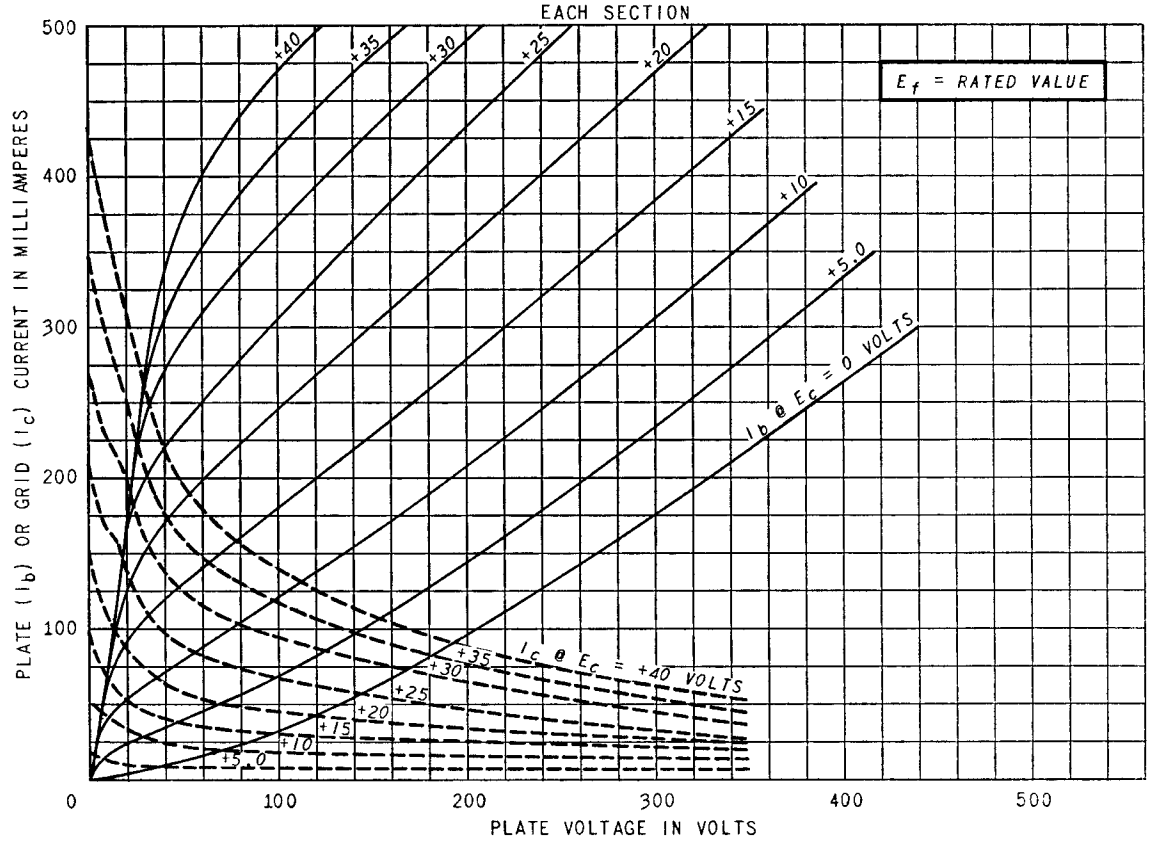
AVERAGE PLATE CHARACTERISTICS

EACH SECTION

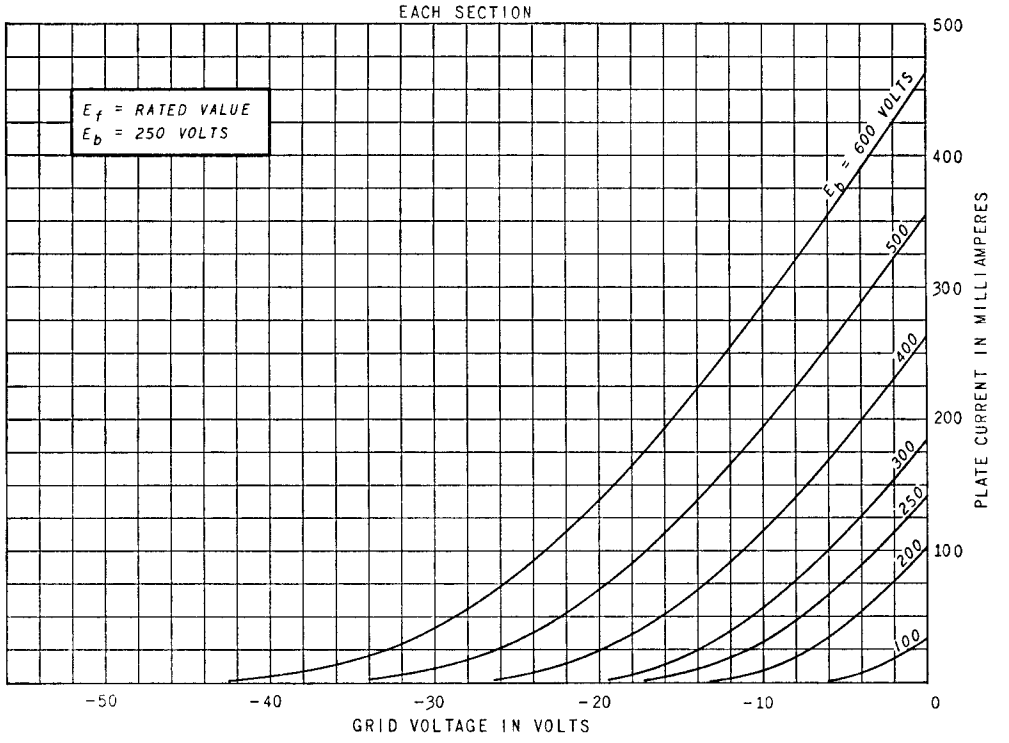


AVERAGE PLATE CHARACTERISTICS

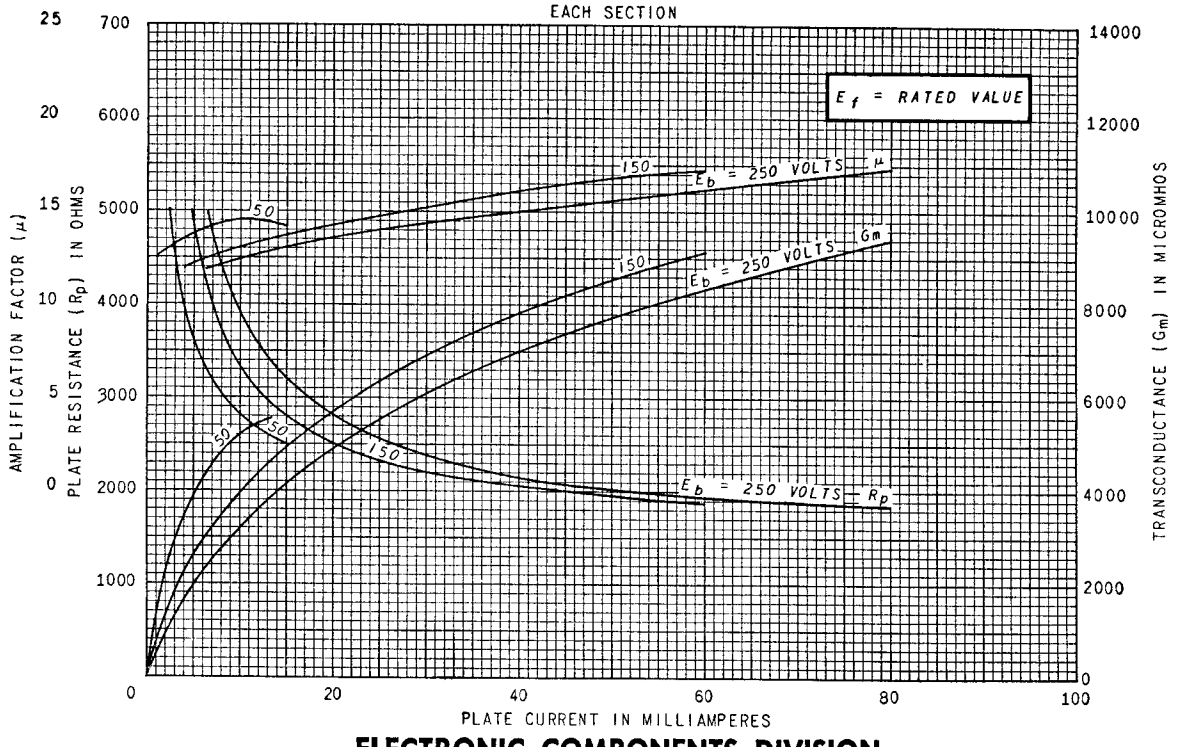
EACH SECTION



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

ELECTRONICS

6BN11

COMPACTRON TWIN PENTODE

DESCRIPTION AND RATING

The 6BN11 is a compactron containing two sharp-cutoff pentodes. It is intended primarily for intermediate-frequency amplifier service in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings.

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.8	Amperes

Direct Interelectrode Capacitances§

Section 1

Grid-Number 1 to Plate: (1g1 to 1p)	0.04	pf
Input: 1g1 to (h + 1k + 1g2 + 1g3 + 2g3 + i.s.)	12	pf
Output: 1p to (h + 1k + 1g2 + 1g3 + 2g3 + i.s.)	2.8	pf

Section 2

Grid-Number 1 to Plate: (2g1 to 2p)	0.03	pf
Input: 2g1 to (h + 2k + 2g2 + 2g3 + 1g3 + i.s.)	12	pf
Output: 2p to (h + 2k + 2g2 + 2g3 + 1g3 + i.s.)	2.8	pf

Coupling

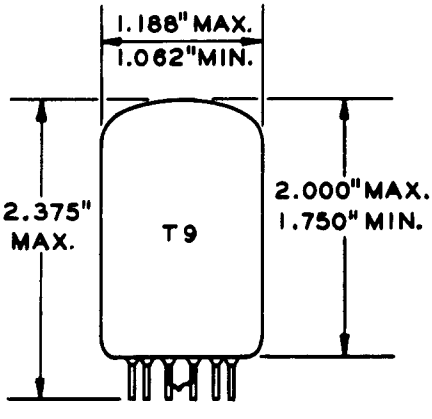
Cathode, Section 1 to Cathode, Section 2: (1k to 2k), maximum¶	0.02	pf
Grid-Number 1, Section 1 to Plate, Section 2: (1g1 to 2p), maximum	0.02	pf
Grid-Number 1, Section 2 to Plate, Section 1: (2g1 to 1p), maximum	0.003	pf
Plate, Section 1 to Plate, Section 2: (1p to 2p), maximum.	0.01	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

PHYSICAL DIMENSIONS

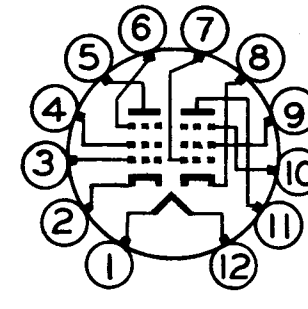


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode (Section 2)
Pin 3 - Grid Number 1 (Section 2)
Pin 4 - Grid Number 2 (Screen) (Section 2)
Pin 5 - Plate (Section 2)
Pin 6 - Grid Number 3 (Suppressor) and Internal Shield (Section 2)
Pin 7 - Grid Number 1 (Section 1)
Pin 8 - Cathode (Section 1)
Pin 9 - Grid Number 2 (Screen) (Section 1)
Pin 10 - Grid Number 3 (Suppressor) and Internal Shield (Section 1)
Pin 11 - Plate (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12GF

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, Each Section

Plate Voltage	330	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	3.1	Watts
Screen Dissipation	0.65	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	0.25	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, Each Section

Plate Voltage	125	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Plate Resistance, approximate	0.2	Megohms
Transconductance	13000	Micromhos
Plate Current	11	Milliamperes
Screen Current	3.8	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 20 Microamperes	-3	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

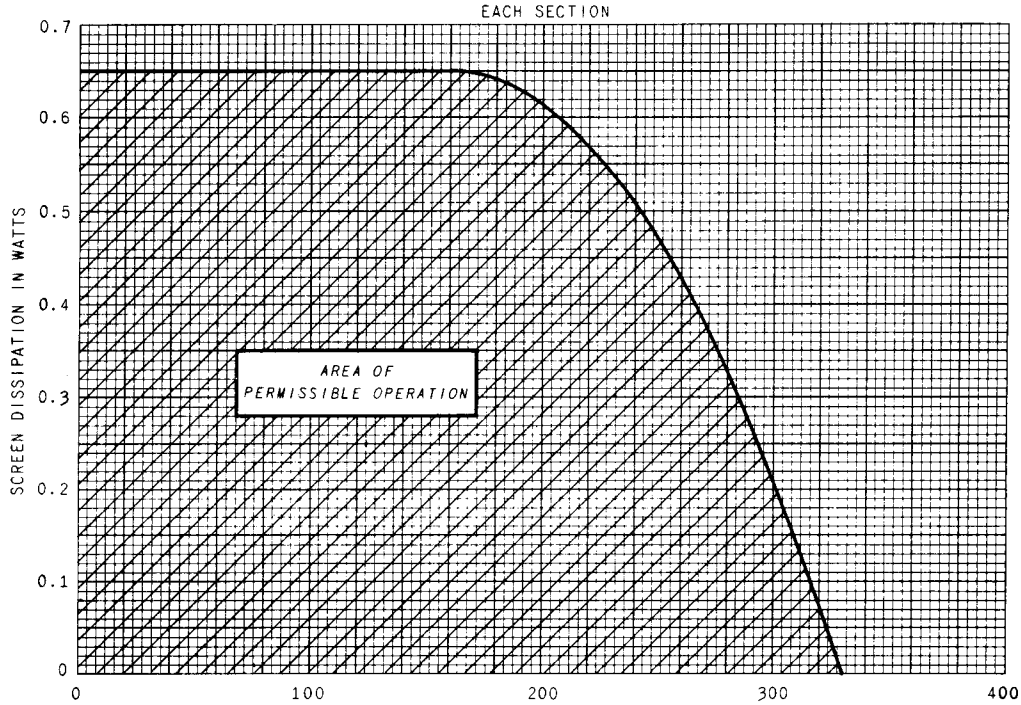
‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ With external shield (EIA 309) connected to cathode of section under test unless otherwise indicated.

¶ With external shield (EIA 309) connected to ground.

SCREEN RATING CHART

EACH SECTION

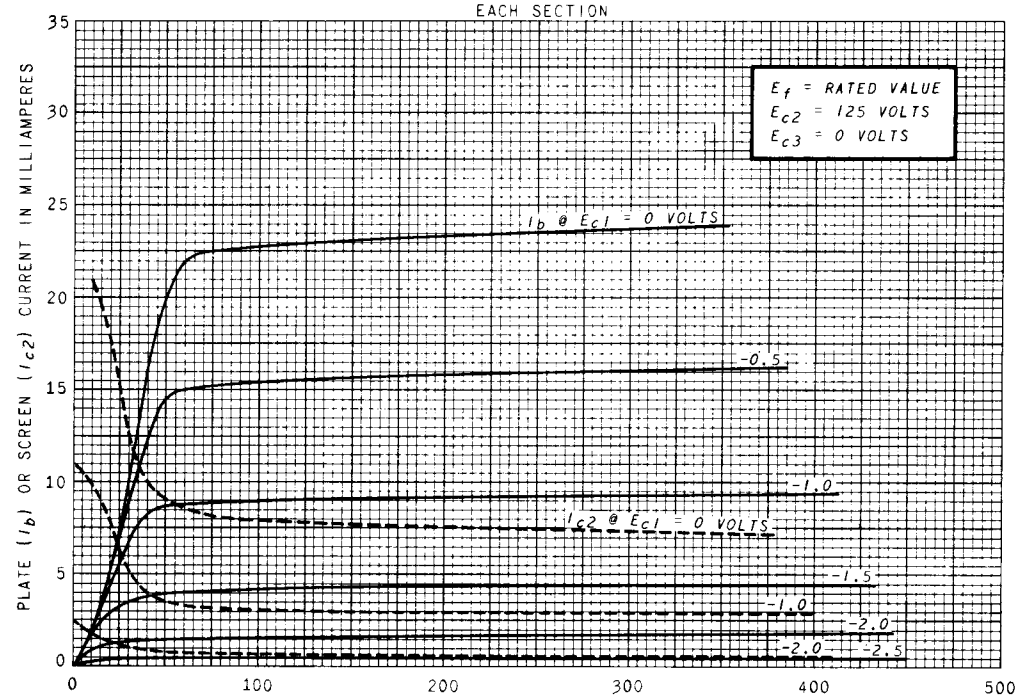


K-5561I-TD177-1

MARCH 21, 1962

AVERAGE PLATE CHARACTERISTICS

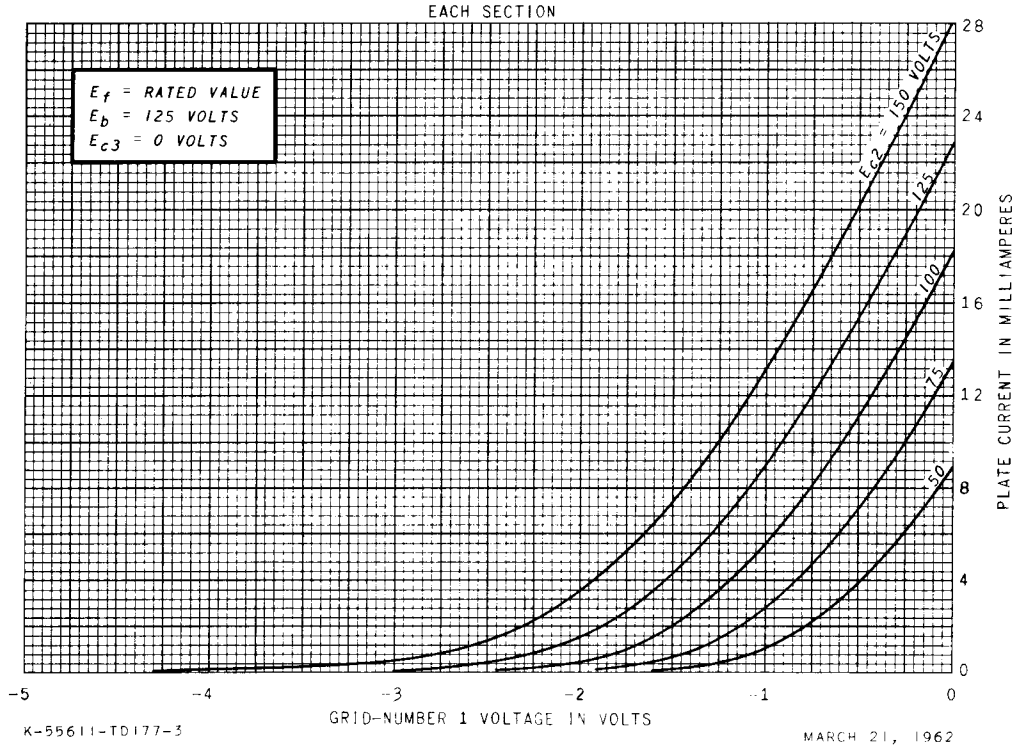
EACH SECTION



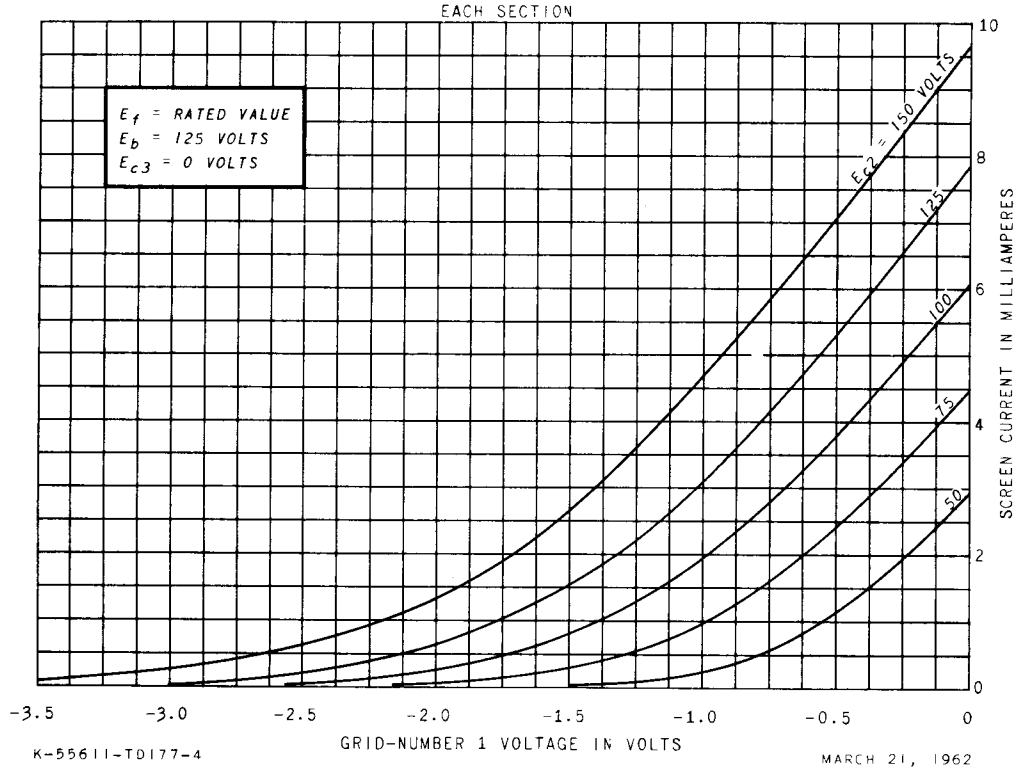
K-5561I-TD177-2

MARCH 21, 1962

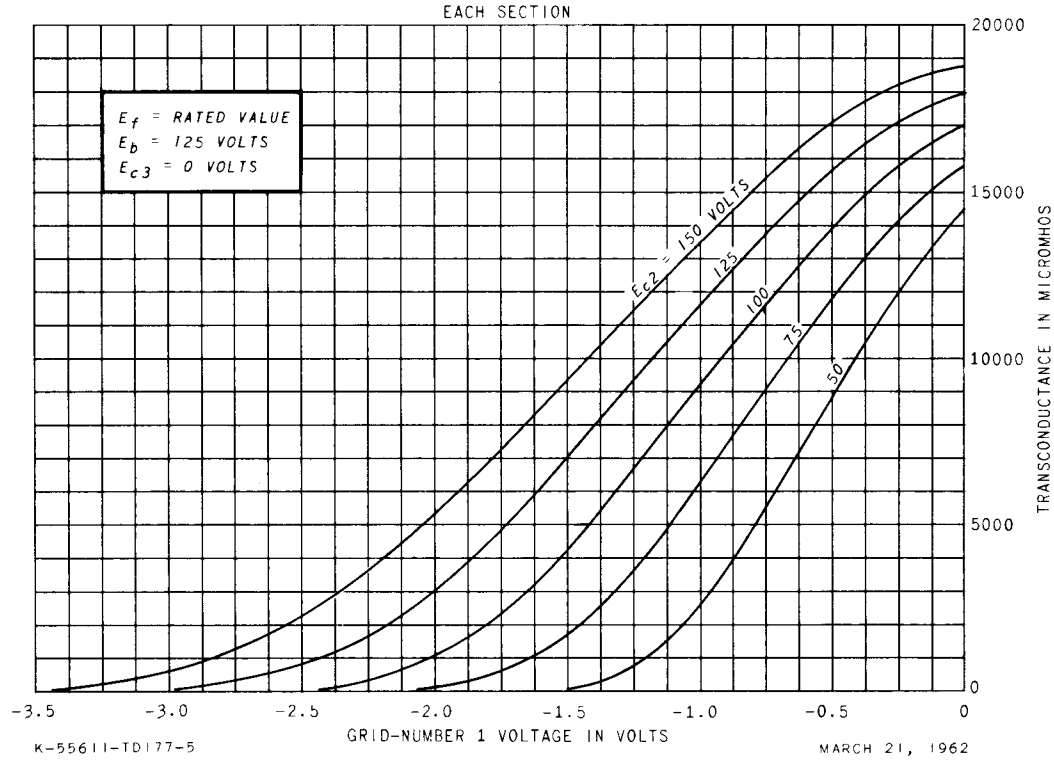
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

6BN4—2BN4—3BN4

TRIODE

FOR VHF TV RADIO-FREQUENCY AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6BN4 is a miniature medium-mu triode primarily intended for use as a radio-frequency amplifier in VHF television tuners. The electrical characteristics of the 6BN4 are similar to those of each section of the 6BZ7.

Except for heater ratings, the 2BN4 and 3BN4 are identical to the 6BN4. In addition, they incorporate a controlled heater-warm-up characteristic which makes them especially suited for use in television receivers that employ series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	2BN4	3BN4	6BN4
Heater Voltage, AC or DC	2.3	3.0	6.3 ± 10% Volts
Heater Current	0.6 ± 6%	0.45 ± 6%	0.2 Amperes
Heater Warm-up Time*	11	11	.... Seconds

Direct Interelectrode Capacitances†

Grid to Plate	1.2 μμf
Input	3.2 μμf
Output	1.4 μμf
Heater to Cathode	2.8 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

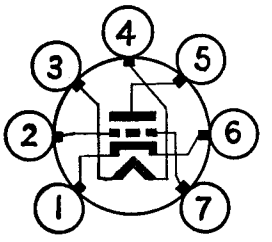
Plate Voltage	275 Volts
Positive DC Grid Voltage	0 Volts
Plate Dissipation	2.2 Watts
DC Cathode Current	22 Milliamperes
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	100 Volts
Heater Negative with Respect to Cathode	100 Volts
Grid Circuit Resistance	0.5 Megohms

Design Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur. To obtain satisfactory circuit performance, therefore, the equipment designer must establish the circuit design so that no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

GENERAL ELECTRIC

Supersedes ET-T992A, dated 4-56

BASING DIAGRAM

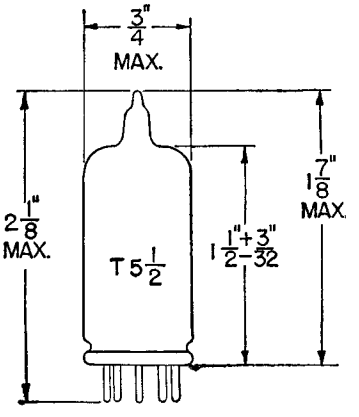


RETMA 7EG

TERMINAL CONNECTIONS

Pin 1—Cathode
Pin 2—Grid
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Cathode
Pin 7—Grid

PHYSICAL DIMENSIONS



RETMA 5-2

CHARACTERISTICS AND TYPICAL OPERATION

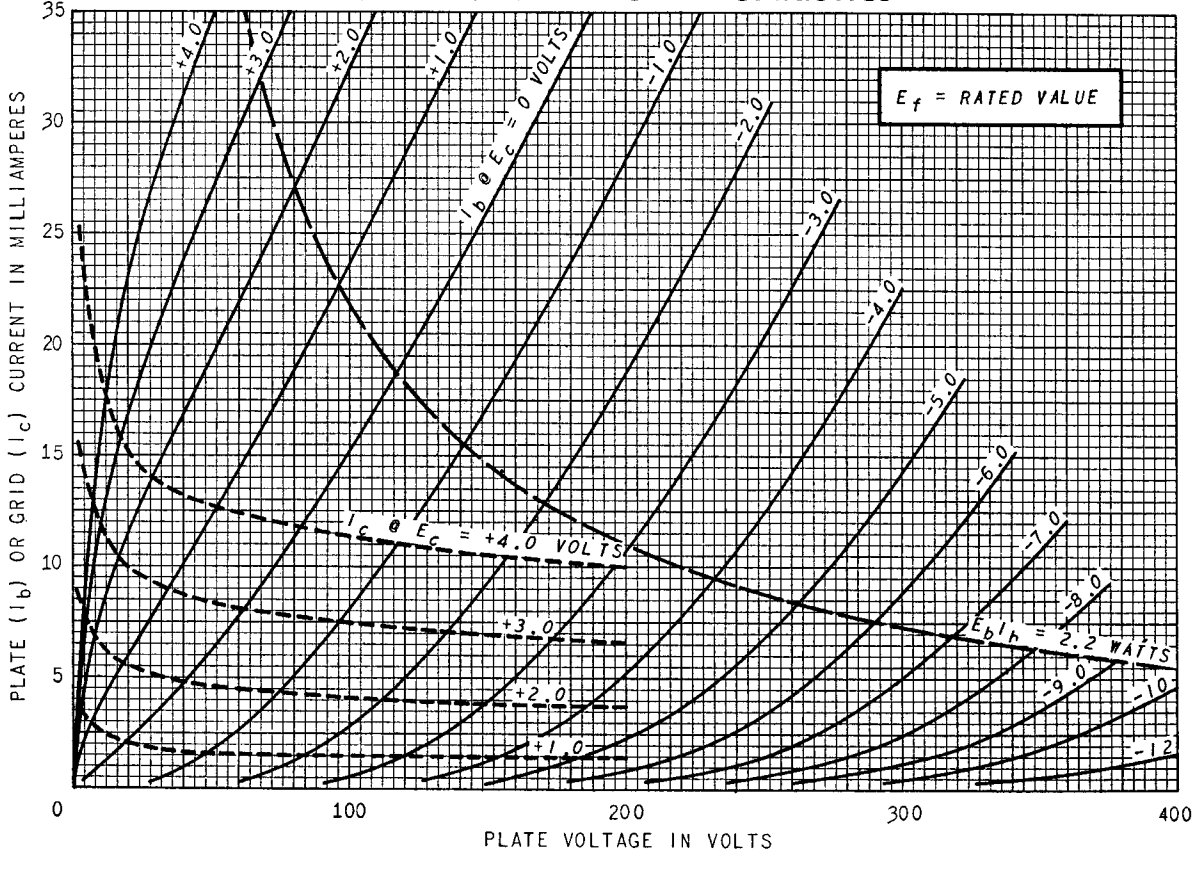
CLASS A_1 AMPLIFIER

Plate Voltage	150 Volts
Cathode-Bias Resistor	220 Ohms
Amplification Factor	43
Plate Resistance, approximate	6300 Ohms
Transconductance	6800 Micromhos
Plate Current	9.0 Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes	−6 Volts

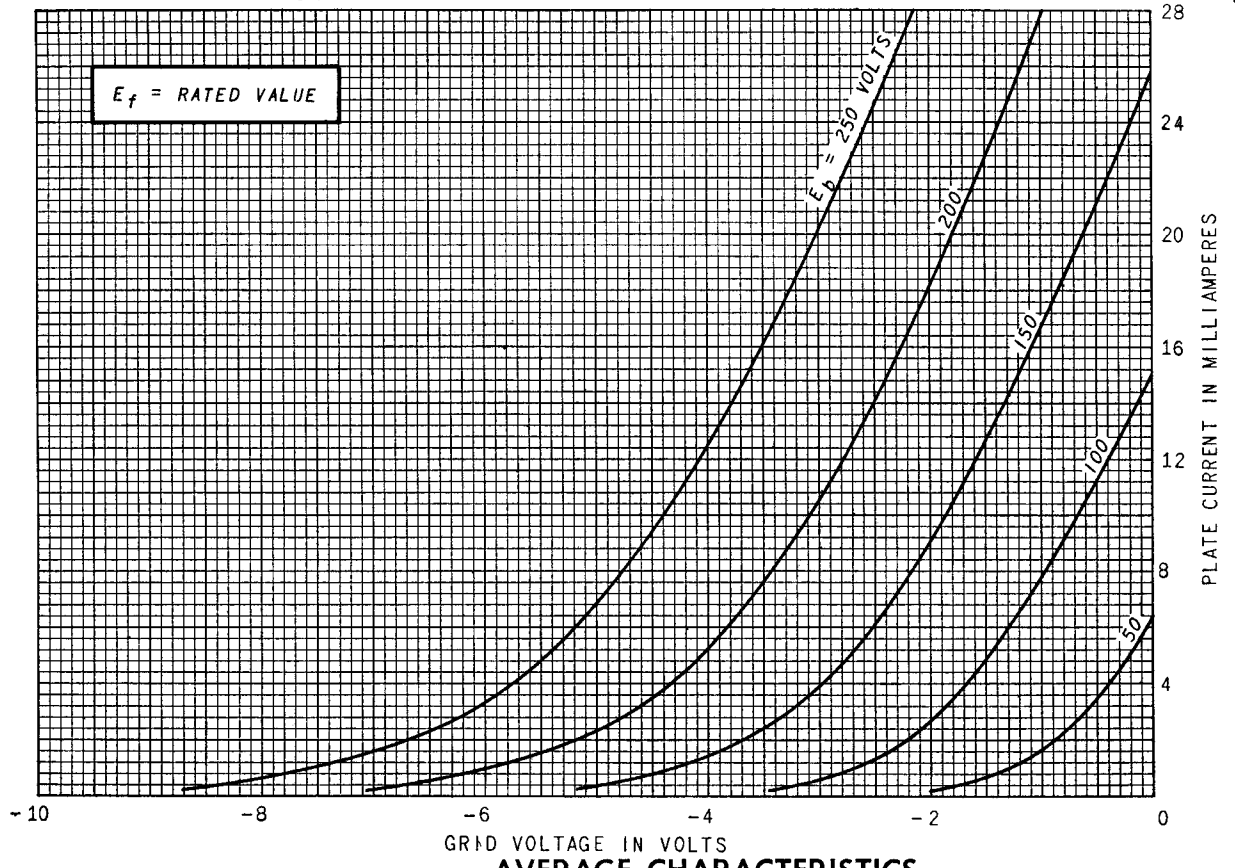
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (RETMA 316).

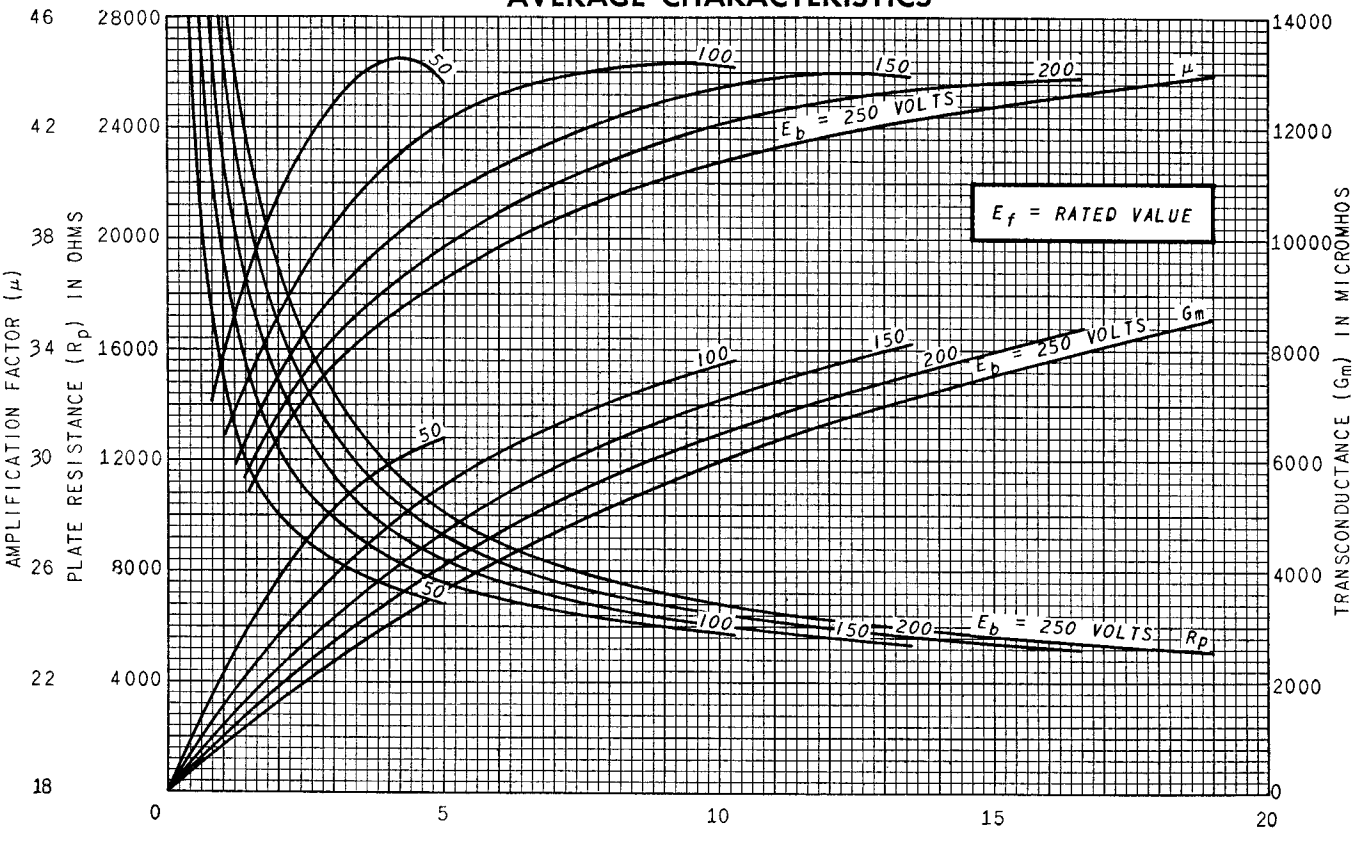
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



6BN6—3BN6
4BN6—12BN6

GATED-BEAM DISCRIMINATOR

FOR FM AND TV LIMITER AND DISCRIMINATOR APPLICATIONS

DESCRIPTION AND RATING

The 6BN6 is a miniature beam tube primarily designed to perform the combined functions of the limiter, discriminator, and audio-voltage amplifier in FM and intercarrier television receivers. Advantages inherent in this application of the 6BN6 include excellent performance, circuit simplicity, and ease of alignment. Additional applications of the tube include use as a limiter or as a sync-clipper.

Except for heater ratings and heater-cathode voltage ratings, the 3BN6 and 4BN6 are identical to the 6BN6. As a result of their controlled heater-warm-up characteristic, the 3BN6 and 4BN6 are especially suited for use in television receivers that employ series-connected heaters.

The 12BN6 is identical to the 6BN6 except for heater ratings.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

	3BN6	4BN6	6BN6	12BN6	
Heater Voltage, AC or DC	3.15	4.2	6.3	12.6	Volts
Heater Current	0.6	0.45	0.3	0.15	Amperes
Heater Warm-up Time*	11	11	...	...	Seconds

Direct Interelectrode Capacitances†

Grid-Number 1 to All	4.2	μμf
Grid Number 3 to All	3.3	μμf
Grid-Number 1 to Grid-Number 3, maximum	0.004	μμf

MECHANICAL

Mounting Position—Any
Envelope—T5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate-Supply Voltage	330	Volts
Accelerator Voltage	110	Volts
Peak Positive Limiter-Grid Voltage	60	Volts
DC Cathode Current	13	Milliamperes

Heater-Cathode Voltage	3BN6 4BN6	6BN6 12BN6	
Heater Positive with Respect to Cathode			
DC Component	100	...	Volts
Total DC and Peak	200	100	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	100	Volts

Design-Maximun ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

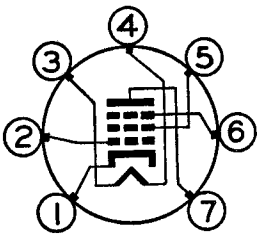
The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

Supersedes ET-T874, dated 7-54
△*Supersedes pages 1 and 2, dated 11-56.*

BASING DIAGRAM

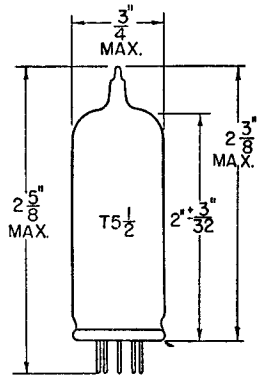


EIA 7DF

TERMINAL CONNECTIONS

Pin 1—Cathode, Focus Electrode, and Internal Shields
Pin 2—Grid Number 1 (Signal or Limiter)
Pin 3—Heater
Pin 4—Heater
Pin 5—Grid Number 2 (Accelerator)
Pin 6—Grid Number 3 (Quadrature)
Pin 7—Plate

PHYSICAL DIMENSIONS



EIA 5-3

CHARACTERISTICS AND TYPICAL OPERATION

LIMITER-DISCRIMINATOR SERVICE (SEE CIRCUIT DIAGRAM)

Input-Signal Center Frequency	10.7	10.7	4.5	Megacycles
Frequency Deviation	±75	±75	±25	Kilocycles
Plate-Supply Voltage	85	285	270	Volts
Plate Voltage	63	122	121	Volts
Accelerator Voltage	55	100	100	Volts
Cathode-Bias Resistor (Variable)‡	200–400	200–400	200–400	Ohms
Plate Load Resistor	85000	330000	330000	Ohms
Plate Linearity Resistor	470	1500	1000	Ohms
Integrating Capacitor	0.002	0.001	0.001	Microfarads
Coupling Capacitor	0.25	0.01	0.25	Microfarads
Minimum Signal Voltage for Limiting Action, RMS§	1.25	1.25	1.25	Volts
DC Plate Current	0.25	0.49	0.44	Milliamperes
Accelerator Current	4.1	9.8	10	Milliamperes
Input Signal Level for AM Rejection Adjustment‡	1.25	2.0	2.0	Volts
AM Rejection at Esig = 2.0 Volts, RMS	31	20	25	Decibels
AM Rejection at Esig = 3.0 Volts, RMS	30	29	30	Decibels
Total Harmonic Distortion	2.0	1.6	1.8	Percent
Peak Audio Output Voltage	6.0	16.6	16.8	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

‡ The cathode resistor should be adjusted for maximum AM rejection in the output of the limiter-discriminator stage at the specified signal level. AM rejection is measured with an applied signal containing 30-percent amplitude modulation and 30-percent frequency modulation.

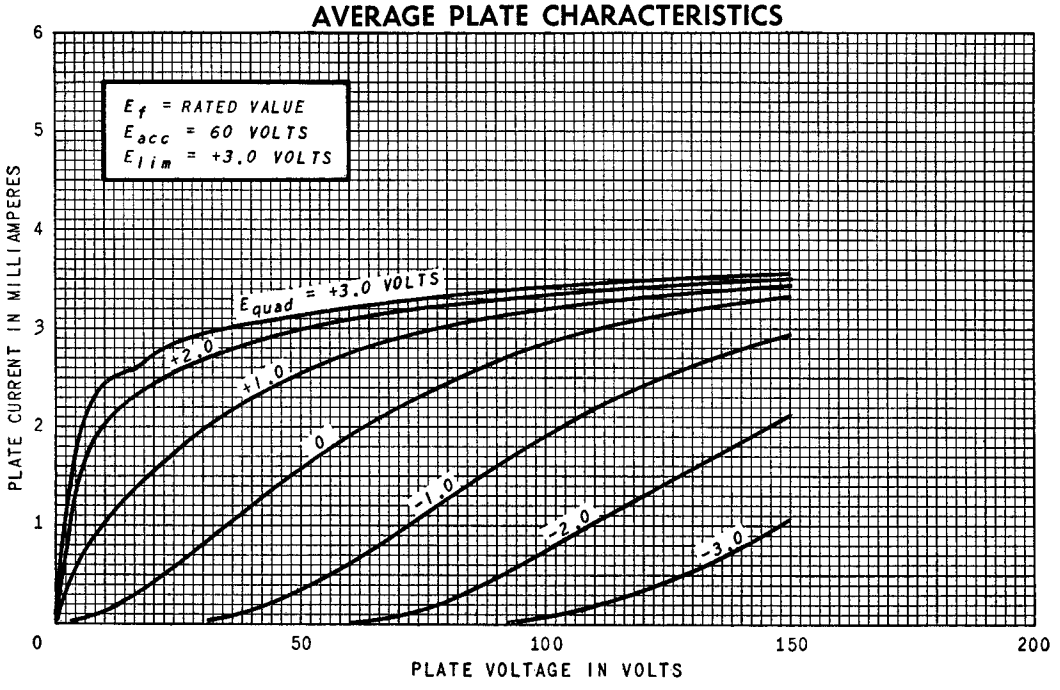
§ At signal levels above specified value, limiting is within ±2 decibels.

Adequate shielding between components of the limiter grid and the quadrature grid must be used to insure proper phasing of the voltage developed on the quadrature grid.

Standard de-emphasis requirements for FM are included.

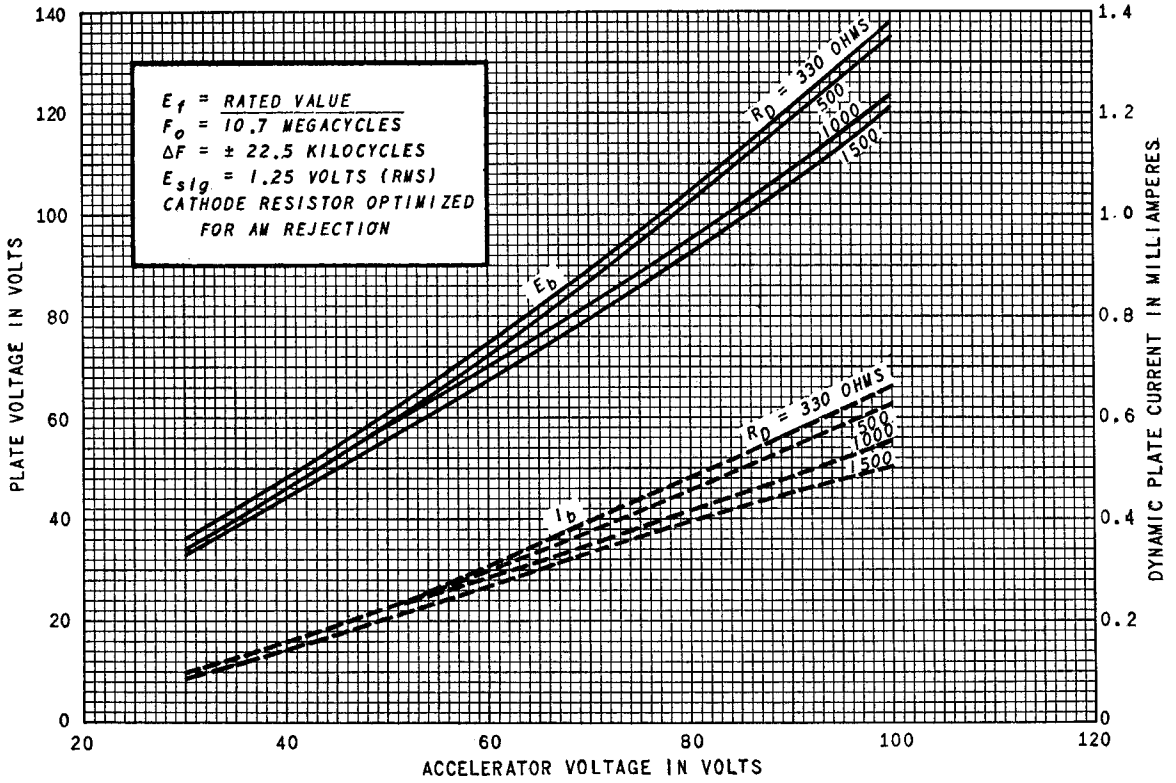
The Q of the quadrature grid circuit should be high enough to develop a minimum of 4 volts (RMS) signal with 2 volts (RMS) of the center-frequency signal applied to the limiter grid. It is recommended that the coil be shunted by a minimum of 10 $\mu\mu$f. The capacitance may be composed of tube input capacitance, stray capacitance, and distributed capacitance, as well as physical capacitance.

AVERAGE PLATE CHARACTERISTICS

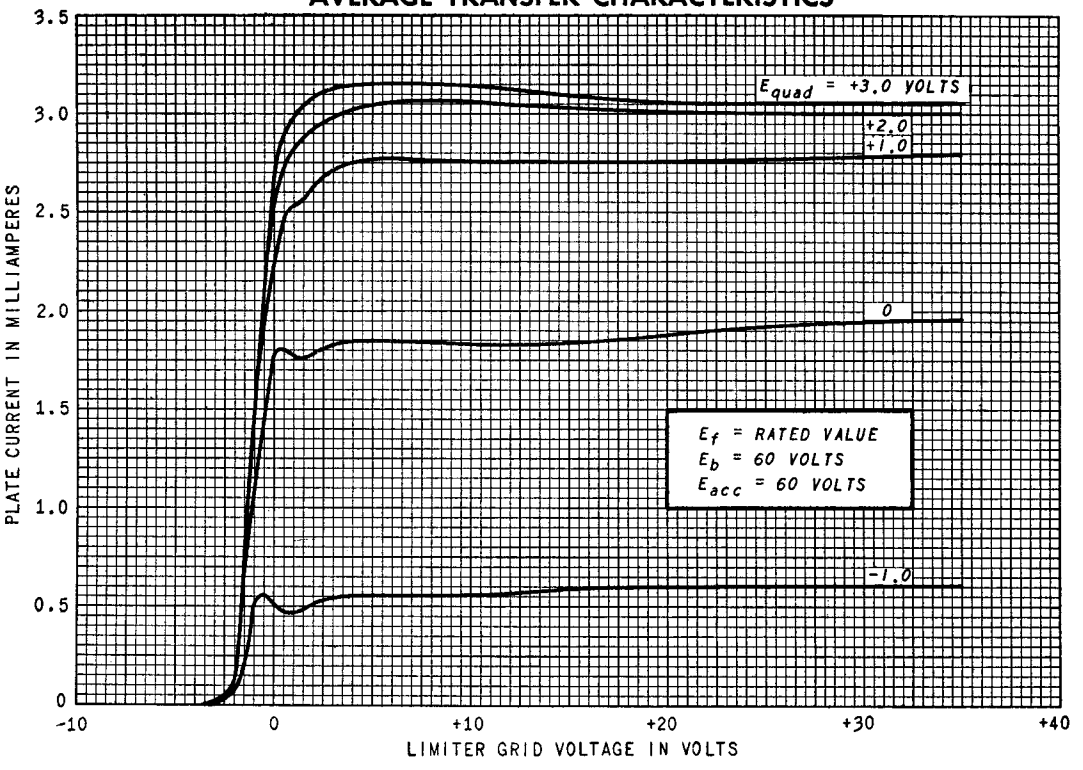


OPERATION CHARACTERISTICS

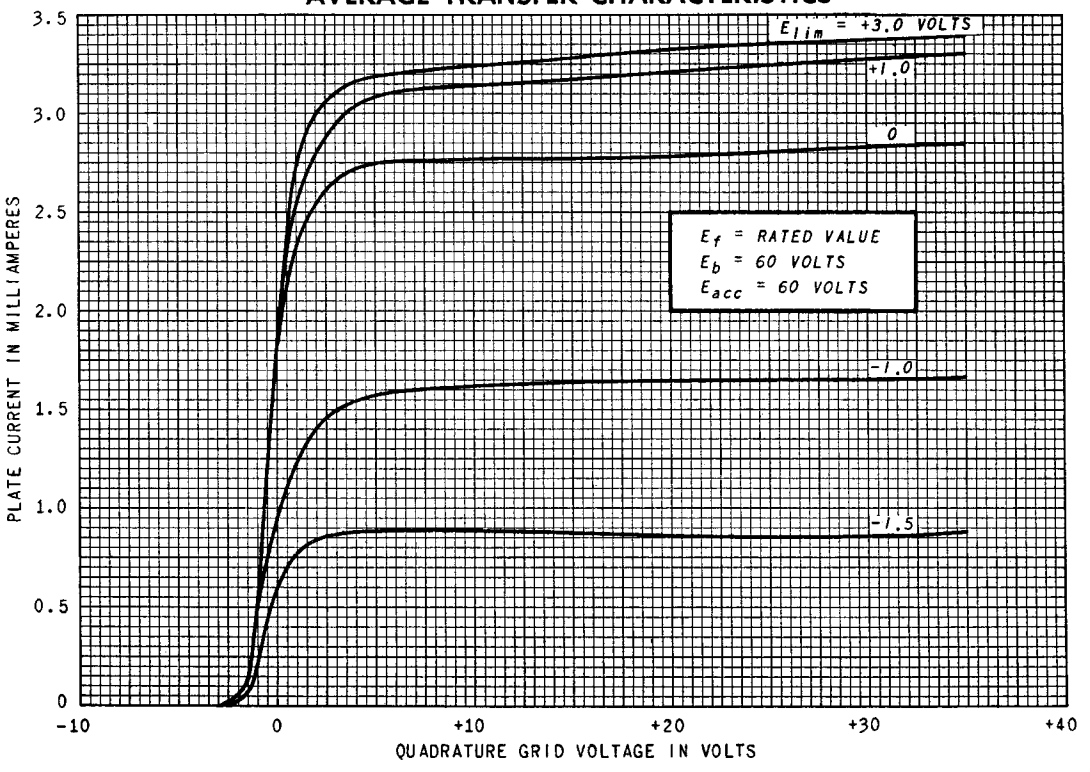
To obtain the optimum dial-tuning characteristic (a symmetrical discriminator response curve) in FM applications, it is essential that the ratio of plate current with no signal to plate current with an unmodulated signal should equal unity. After a value of accelerator voltage is chosen, the plate voltage applied to the tube should be chosen as indicated by the following graph in order to realize this unity ratio of plate current. The graph also shows the average dynamic plate current that is flowing under the specified plate and accelerator voltage conditions. The plate load resistor should be chosen to drop the plate supply voltage to the specified plate voltage.



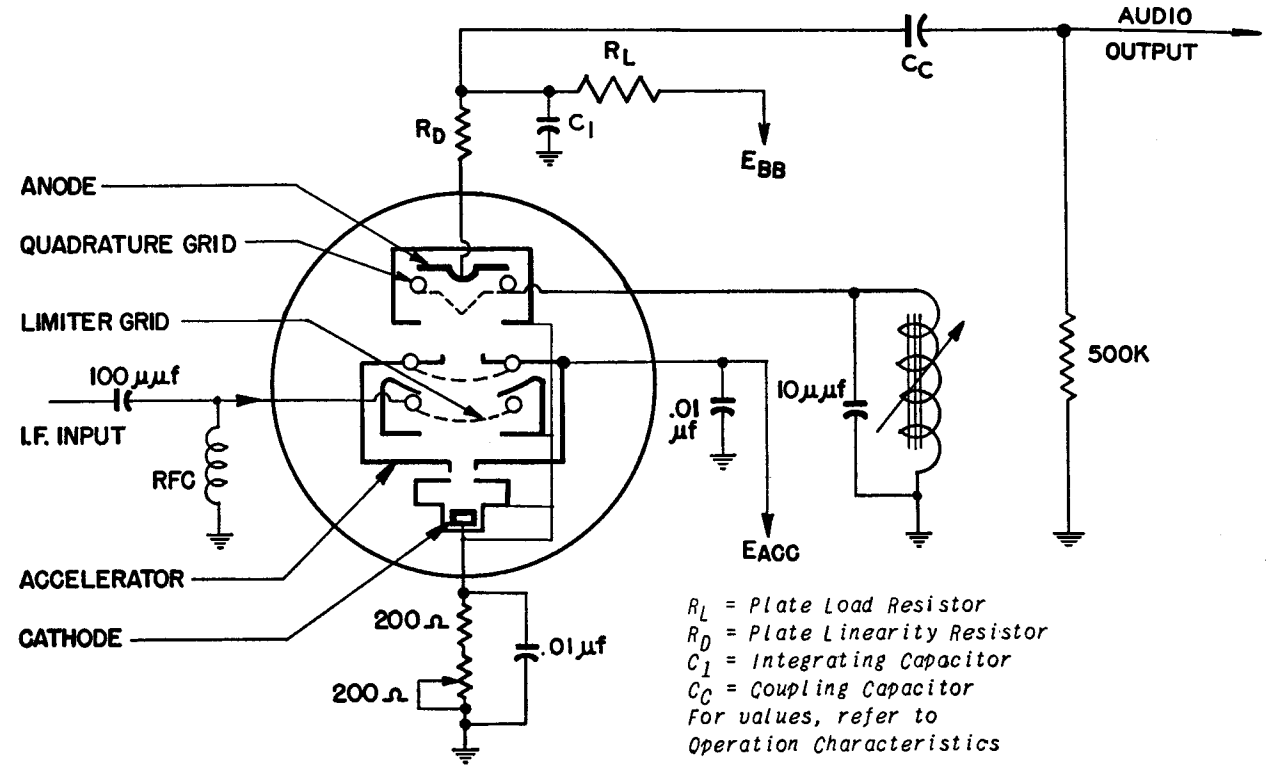
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



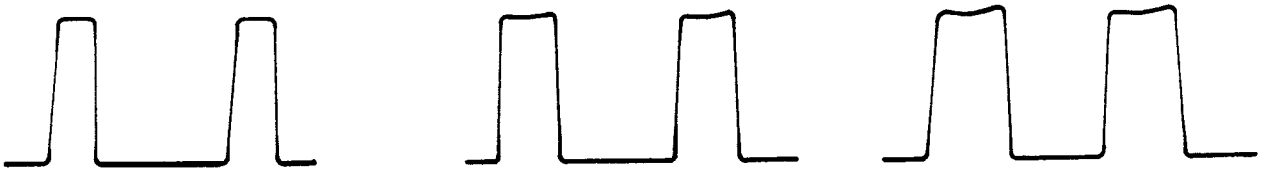
SCHEMATIC DIAGRAM SHOWING TYPICAL CIRCUIT AND INTERNAL CONSTRUCTION OF THE 6BN6



R_L = *Plate Load Resistor*
R_D = *Plate Linearity Resistor*
C_1 = *Integrating Capacitor*
C_C = *Coupling Capacitor*
For values, refer to Operation Characteristics

WAVEFORMS OF PLATE CURRENT

f = *frequency of applied signal*
f_0 = *center-frequency of applied signal*



$f > f_0$ $\quad$ $f = f_0$ $\quad$ $f < f_0$

Electronic TUBES

6BQ5–8BQ5

PENTODE

FOR AF POWER AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6BQ5 is a power-amplifier pentode designed for use in the audio-frequency power-output stage of television and radio receivers and in high-fidelity amplifiers.

Except for heater ratings, the 8BQ5 is identical to the 6BQ5.

GENERAL

ELECTRICAL

	6BQ5	8BQ5	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	6.3	8.0	Volts
Heater Current	0.76	0.6	Amperes
Heater Warm-up Time*	....	11	Seconds
Direct Interelectrode Capacitances†			
Grid-Number 1 to Plate, maximum		.5	μμf
Input		10.8	μμf
Output		6.5	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	300	Volts
Screen Voltage	300	Volts
Negative DC Grid-Number 1 Voltage	100	Volts
Plate Dissipation	12	Watts
Screen Dissipation (Continuous)	2.0	Watts
Screen Dissipation (Peaks of Speech and Music)	4.0	Watts
DC Cathode Current	65	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	100	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.3	Megohms
With Cathode Bias	1.0	Megohms

Design-Center ratings are limiting values of operating conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

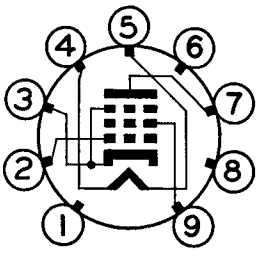
The tube manufacturer chooses these values to provide acceptable serviceability of the tube in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation (For an AC power source, 117 volts plus or minus 10% is accepted USA practice.), equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in tube characteristics.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply voltage.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM

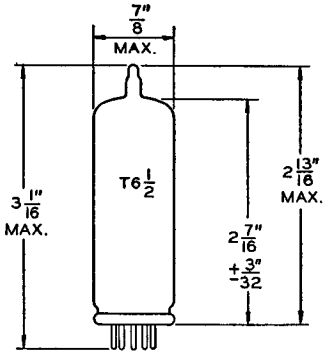


EIA 9CV

TERMINAL CONNECTIONS

Pin 1—Internal Connection
Pin 2—Grid Number 1
Pin 3—Cathode and Grid Number 3 (Suppressor)
Pin 4—Heater
Pin 5—Heater
Pin 6—Internal Connection
Pin 7—Plate
Pin 8—Internal Connection
Pin 9—Grid Number 2 (Screen)

PHYSICAL DIMENSIONS



EIA 6-4

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	−7.3	Volts
Plate Resistance, approximate	40000	Ohms
Transconductance	11300	Micromhos
Plate Current	48	Milliamperes
Screen Current	5.5	Milliamperes
Amplification Factor (Grid-Number 1 to Grid-Number 2)	19.5	

CLASS A_1 AMPLIFIER

Plate Voltage	250	250	250	250	Volts
Screen Voltage	250	250	250	210	Volts
Grid-Number 1 Voltage	−7.3	−7.3	−8.4	−6.4	Volts
Peak AF Grid-Number 1 Voltage	6.1	6.2	4.95	4.8	Volts
Zero-Signal Plate Current	48	48	36	36	Milliamperes
Maximum-Signal Plate Current	49.5	50.6	36.8	36.6	Milliamperes
Zero-Signal Screen Current	5.5	5.5	4.1	3.9	Milliamperes
Maximum-Signal Screen Current	10.8	10	8.5	7.3	Milliamperes
Load Resistance	5200	4500	7000	7000	Ohms
Total Harmonic Distortion, approximate	10	10	10	10	Percent
Maximum-Signal Power Output	5.7	5.7	4.2	4.3	Watts

PUSH-PULL CLASS AB_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	250	300	Volts
Screen Voltage	250	300	Volts
Cathode-Bias Resistor	130	130	Ohms
Peak AF Grid-to-Grid Voltage	22.6	28.2	Volts
Zero-Signal Plate Current	62	72	Milliamperes
Maximum-Signal Plate Current	75	92	Milliamperes
Zero-Signal Screen Current	7.0	8.0	Milliamperes
Maximum-Signal Screen Current	15	22	Milliamperes
Effective Load Resistance, Plate-to-Plate	8000	8000	Ohms
Total Harmonic Distortion	3	4	Percent
Maximum-Signal Power Output	11	17	Watts

PUSH-PULL CLASS B AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	250	300	Volts
Screen Voltage	250	300	Volts
Grid-Number 1 Voltage	−11.6	−14.7	Volts
Peak AF Grid-to-Grid Voltage	22.6	28.2	Volts
Zero-Signal Plate Current	20	15	Milliamperes
Maximum-Signal Plate Current	75	92	Milliamperes
Zero-Signal Screen Current	2.2	1.6	Milliamperes
Maximum-Signal Screen Current	15	22	Milliamperes
Effective Load Resistance, Plate-to-Plate	8000	8000	Ohms
Total Harmonic Distortion	3	4	Percent
Maximum-Signal Power Output	11	17	Watts

CLASS A_1 AMPLIFIER, TRIODE CONNECTION‡

Plate Voltage	250	Volts
Cathode-Bias Resistor	270	Ohms
Peak AF Grid-Number 1 Voltage	9.5	Volts
Zero-Signal Plate Current	34	Milliamperes
Maximum-Signal Plate Current	36	Milliamperes
Load Resistance	3500	Ohms
Total Harmonic Distortion, approximate	9	Percent
Maximum-Signal Power Output	1.95	Watts

CHARACTERISTICS AND TYPICAL OPERATION (Continued)

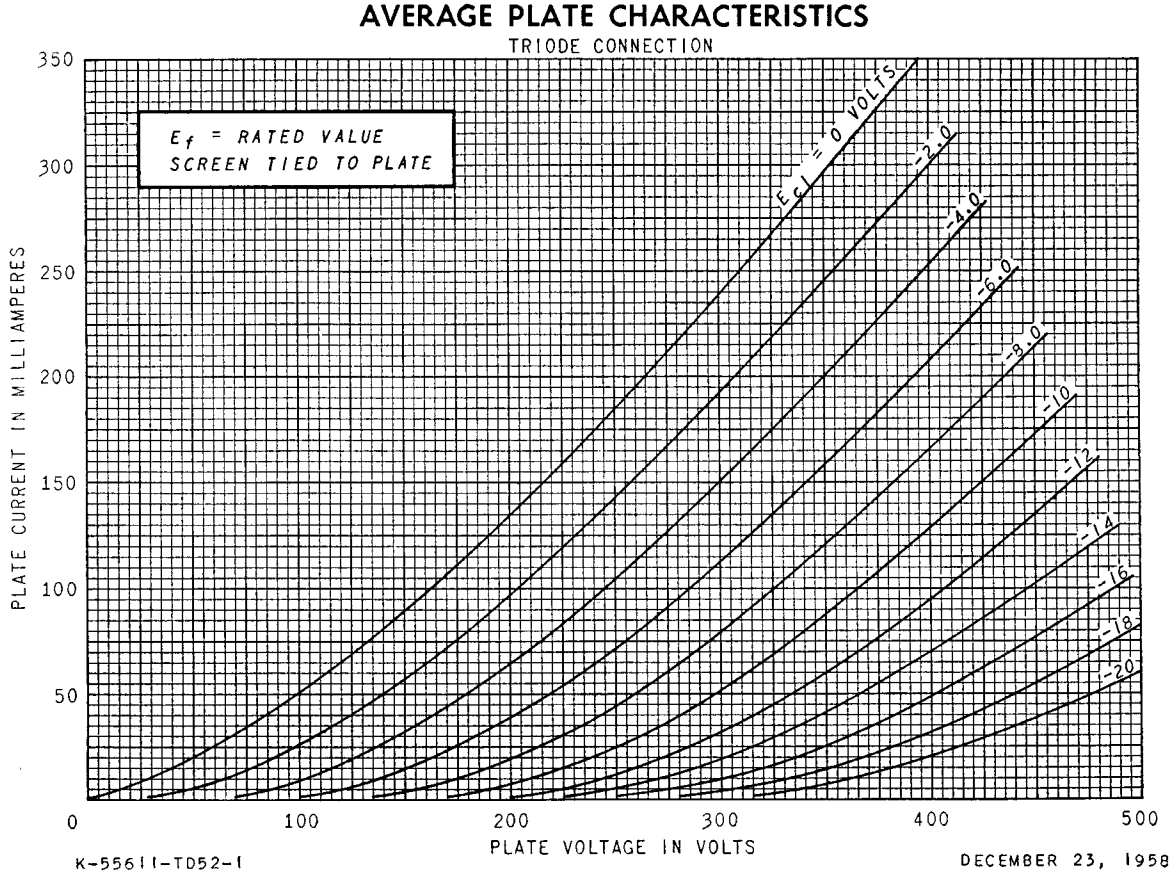
PUSH-PULL CLASS AB_1 AMPLIFIER TRIODE CONNECTION, VALUES FOR TWO TUBES‡

Plate Voltage	250	300	Volts
Cathode-Bias Resistor	270	270	Ohms
Peak AF Grid-to-Grid Voltage	23.4	28.2	Volts
Zero-Signal Plate Current	40	48	Milliamperes
Maximum-Signal Plate Current	43.4	52	Milliamperes
Effective Load Resistance, Plate-to-Plate	10000	10000	Ohms
Total Harmonic Distortion	2.5	2.5	Percent
Maximum-Signal Power Output	3.4	5.2	Watts

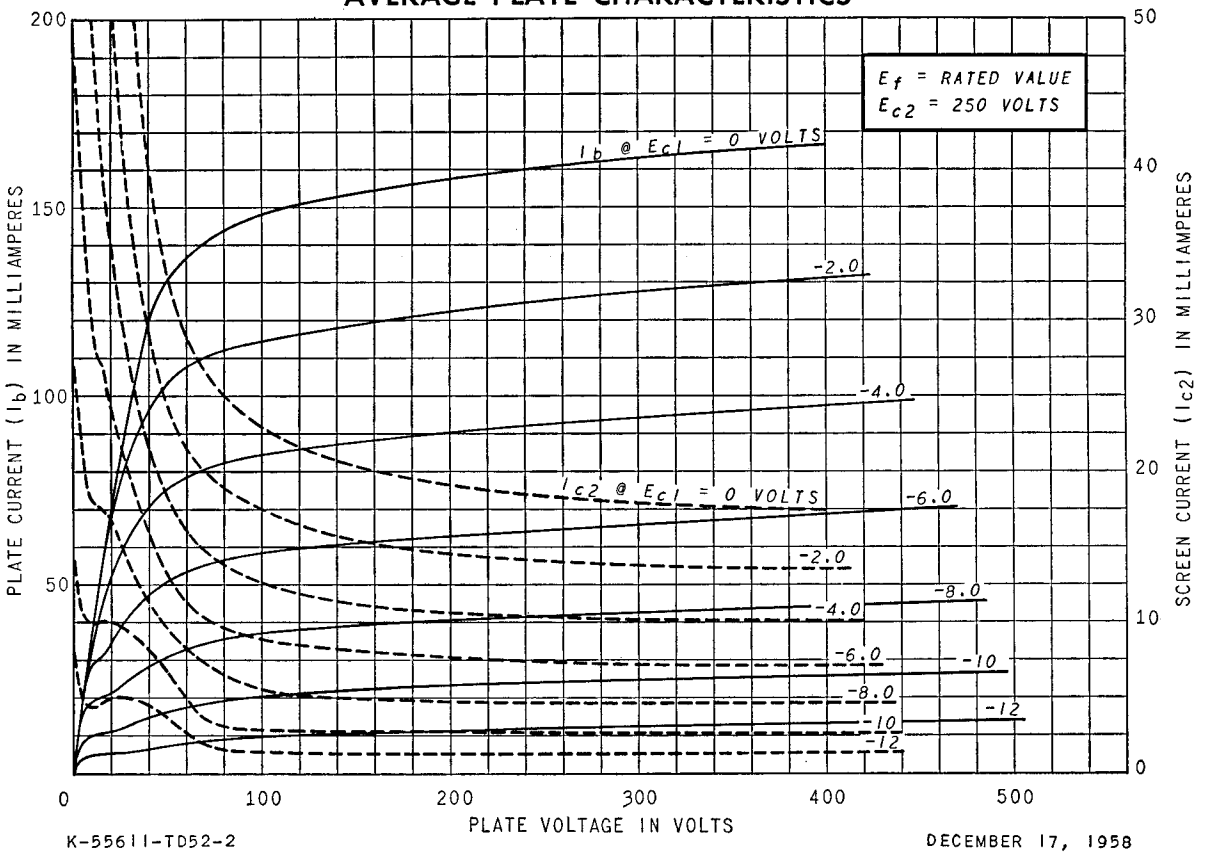
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

‡ With screen tied to plate.



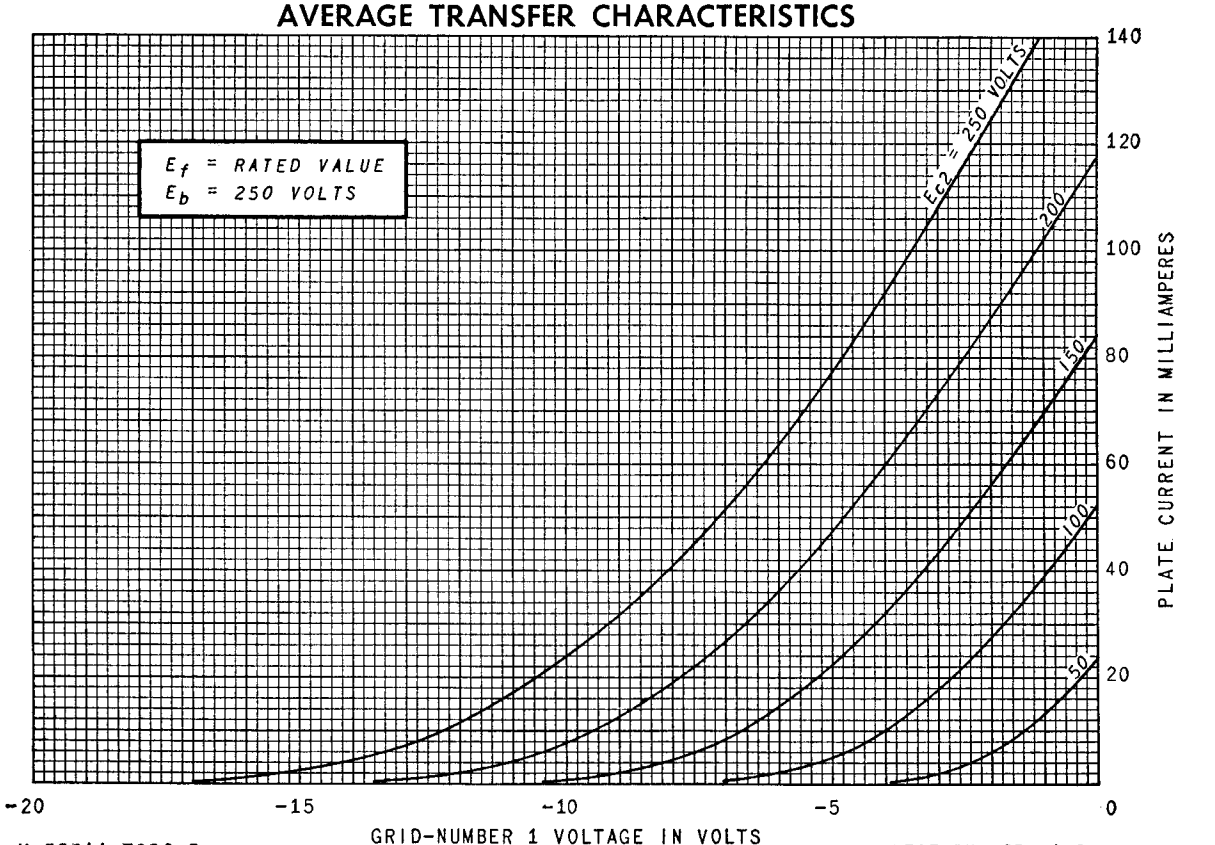
AVERAGE PLATE CHARACTERISTICS



K-55611-TD52-2

DECEMBER 17, 1958

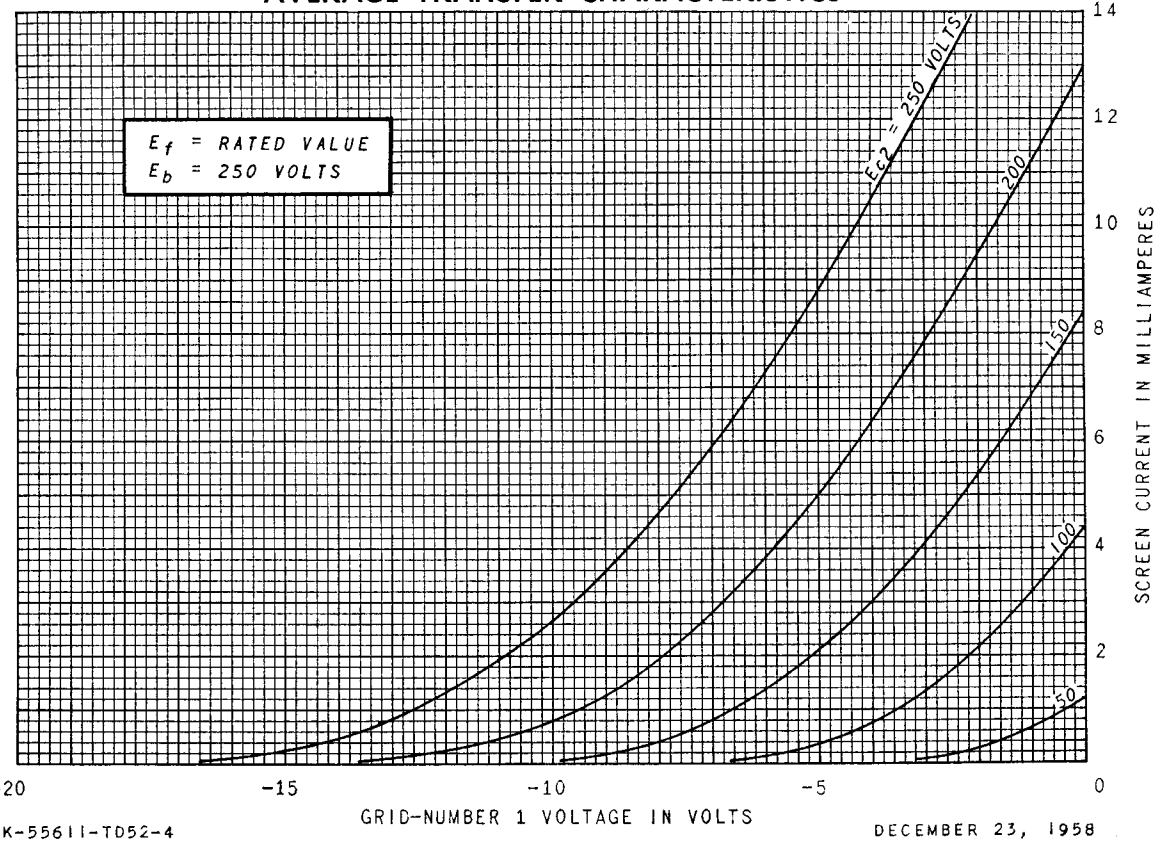
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD52-3

DECEMBER 23, 1958

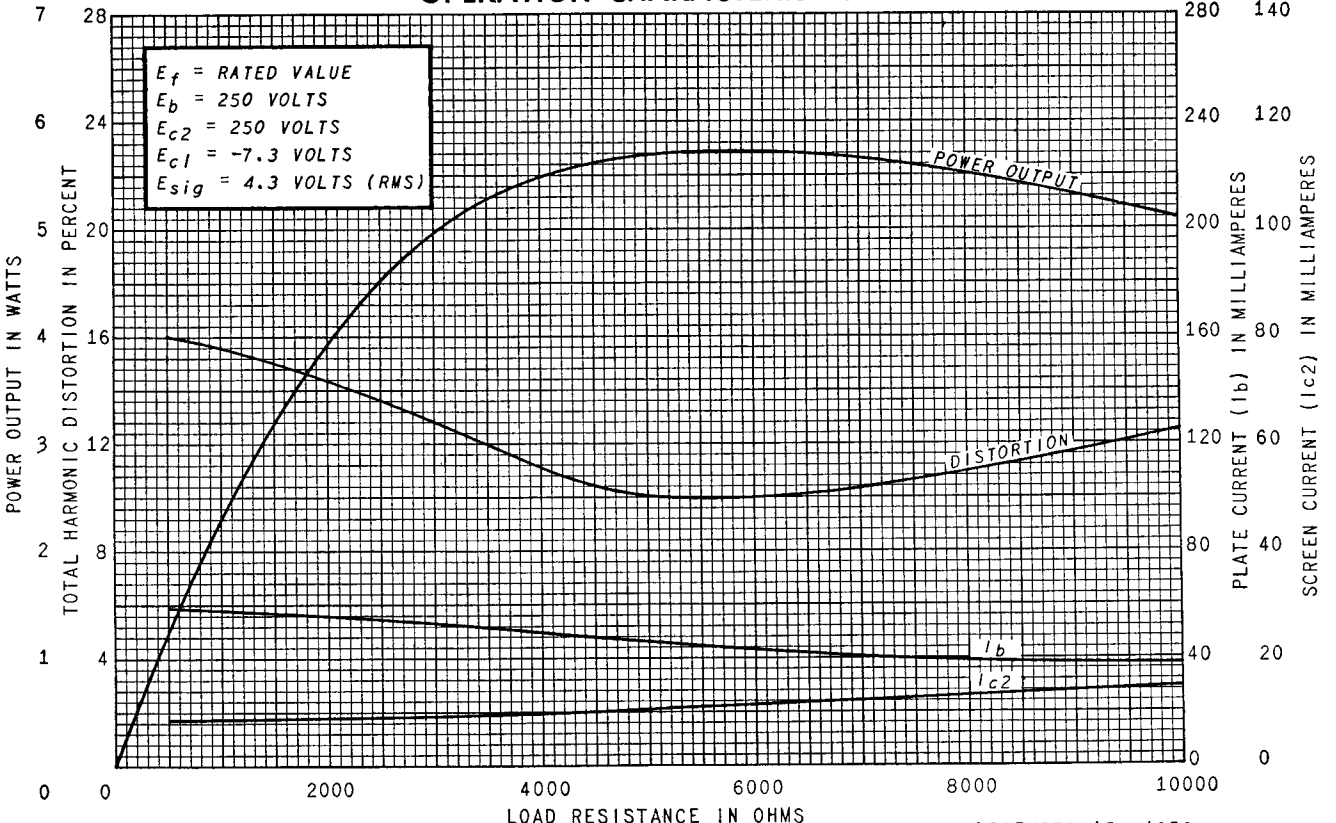
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD52-4

DECEMBER 23, 1958

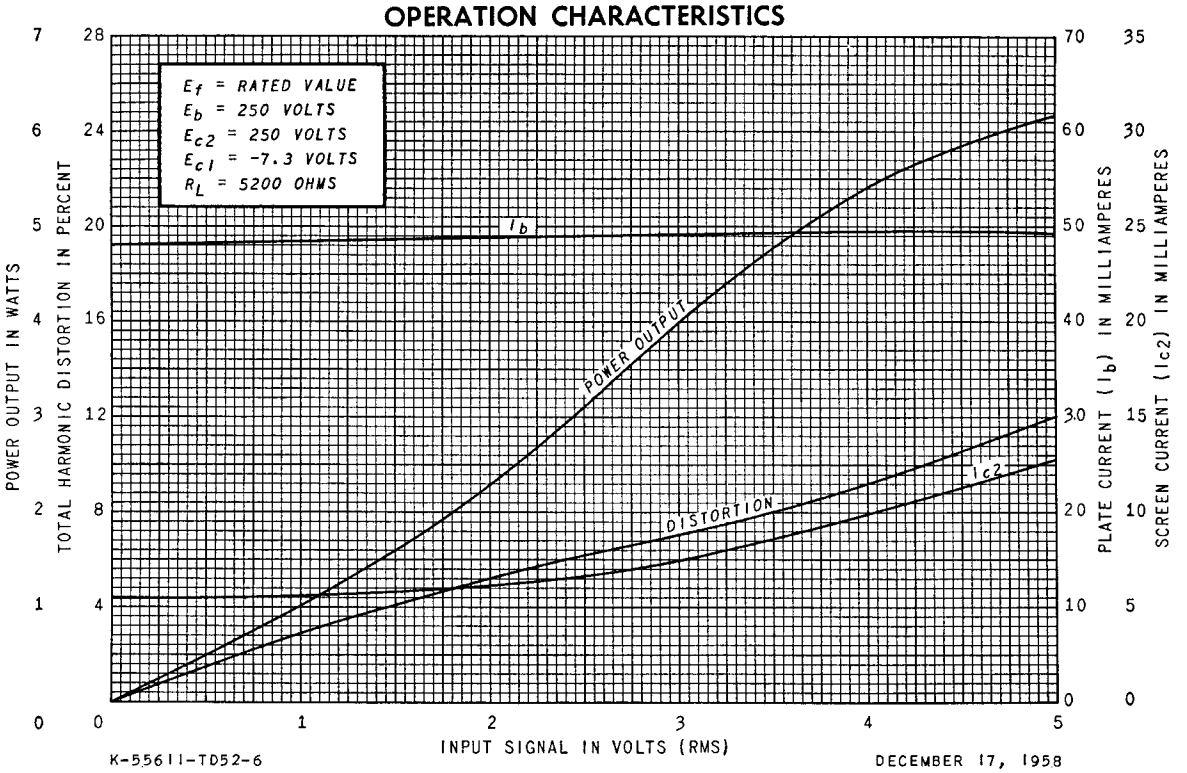
OPERATION CHARACTERISTICS



K-55611-TD52-5

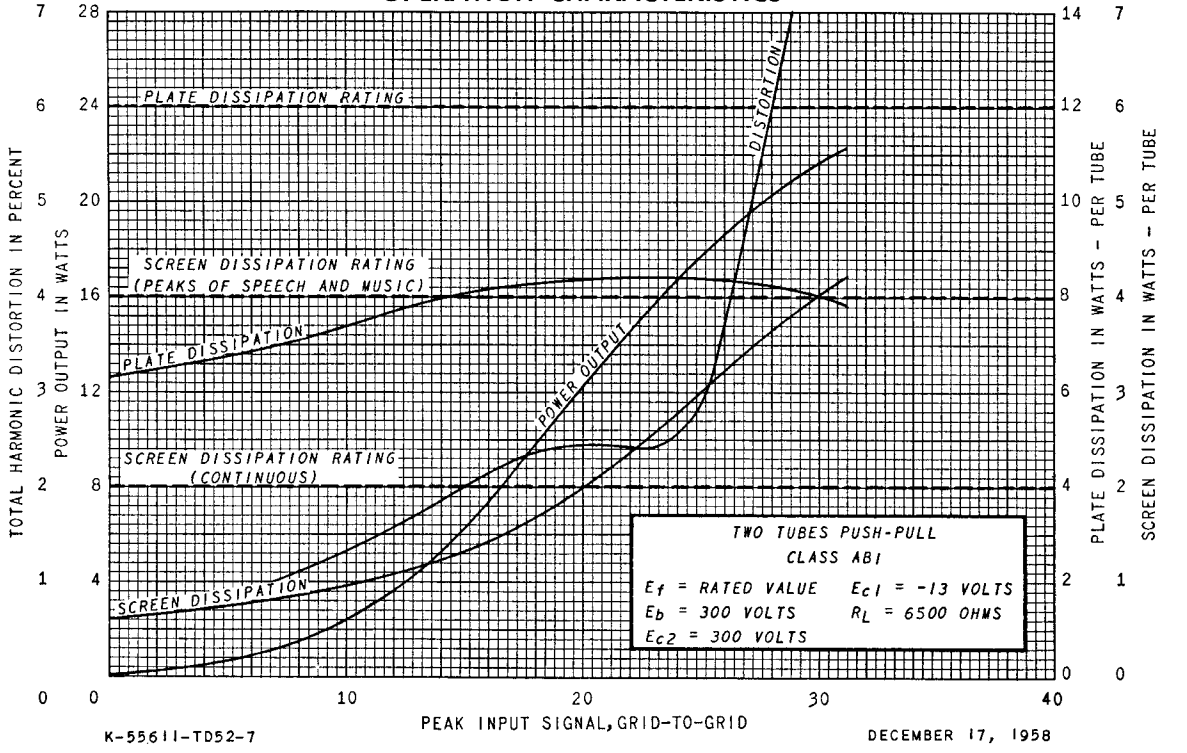
DECEMBER 17, 1958

OPERATION CHARACTERISTICS



K-55611-TD52-6 DECEMBER 17, 1958

OPERATION CHARACTERISTICS



K-55611-TD52-7 DECEMBER 17, 1958

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

6BQ6-GA—12BQ6-GA—25BQ6-GA

BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6BQ6-GA is a beam-power pentode designed primarily for use as horizontal-deflection amplifier in television receivers. The tube exhibits high perveance, high plate current at low plate and screen voltages, and a high ratio of plate to screen current.

Except for heater ratings, the 12BQ6-GA and 25BQ6-GA are identical to the 6BQ6-GA. In addition, the 12BQ6-GA features a controlled heater warm-up characteristic to make it especially suited for use in television receivers which employ 600-milliampere, series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	6BQ6-GA	12BQ6-GA	25BQ6-GA	
Heater Voltage, AC or DC	6.3	12.6	25.0	Volts
Heater Current	1.2	0.6	0.3	Amperes
Heater Warm-up Time*	—	11	—	Seconds
Direct Interelectrode Capacitances†				
Grid-Number 1 to Plate		0.6		μμf
Input		15		μμf
Output		7.0		μμf

MECHANICAL

Mounting Position—Any
Envelope—T-11 or T-12, Glass
Base—B7-12, Medium Shell Octal 7-Pin or B7-111 or B7-119, Short Medium Shell Octal 7-Pin or B6-122, Short Medium Shell Octal 6-Pin.
Top Cap—C1-3 or C1-33, Skirted Miniature

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE‡

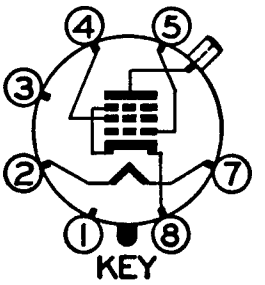
DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

DC Plate-Supply Voltage (Boost + DC Power Supply)	600	Volts
Peak Positive Pulse Plate Voltage	6000§	Volts
Peak Negative Pulse Plate Voltage	1250	Volts
Screen Voltage	200	Volts
Peak Negative Grid-Number 1 Voltage	300	Volts
Plate Dissipation△	11	Watts
Screen Dissipation	2.5	Watts
DC Cathode Current	110	Milliamperes
Peak Cathode Current	400	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	0.47	Megohms
Bulb Temperature at Hottest Point	220	C

GENERAL ELECTRIC

Supersedes ET-T837, dated 2-54

BASING DIAGRAM

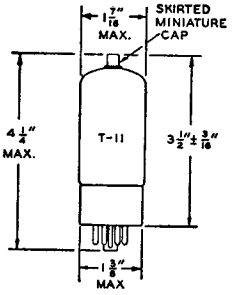


RETMA 6AM

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Heater
Pin 3—No Connection
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates
Cap —Plate
Pin 1 omitted on Base Number B6-122.

PHYSICAL DIMENSIONS



T-11 Version

T-12 version is identical except that the maximum bulb diameter is $1\frac{9}{16}$ inches.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	60	250	Volts
Screen Voltage	150	150	Volts
Grid-Number 1 Voltage	0¶	−22.5	Volts
Plate Resistance, approximate	—	14500	Ohms
Transconductance	—	5900	Micromhos
Plate Current	260	57	Milliamperes
Screen Current	26	2.1	Milliamperes
Grid-Number 1 Voltage, approximate I_b = 1.0 Milliampere	—	−43	Volts
Triode Amplification Factor**	—	4.3	

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

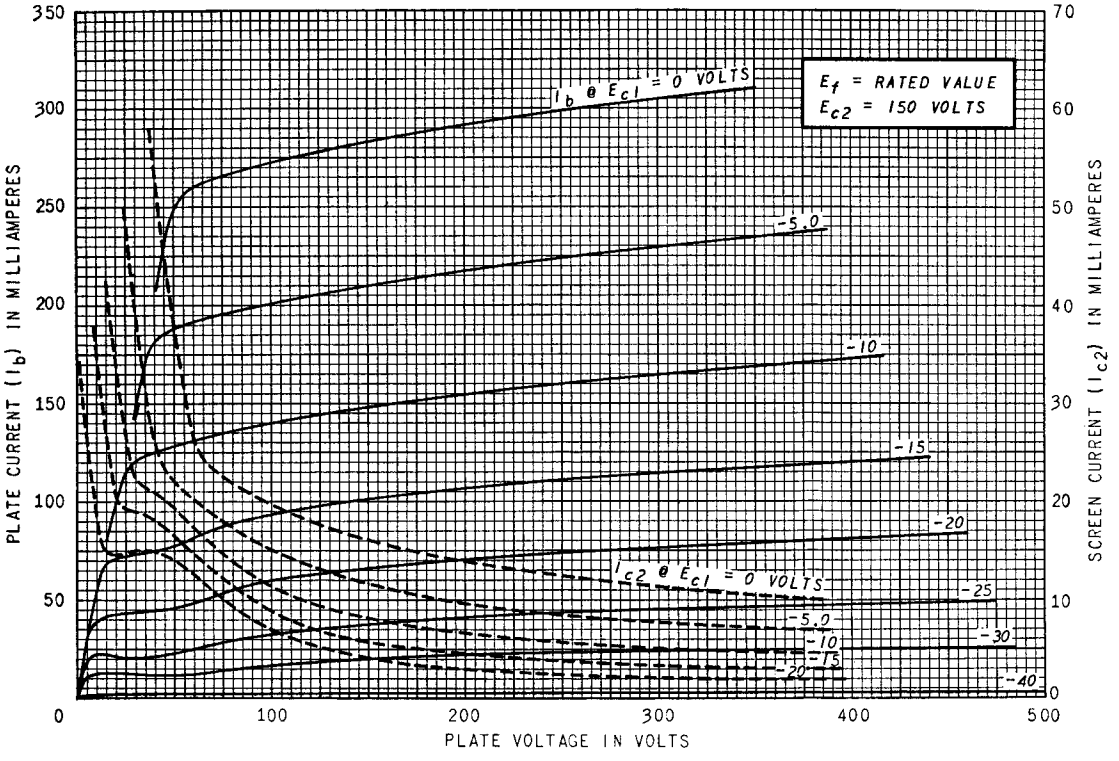
§ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

△In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

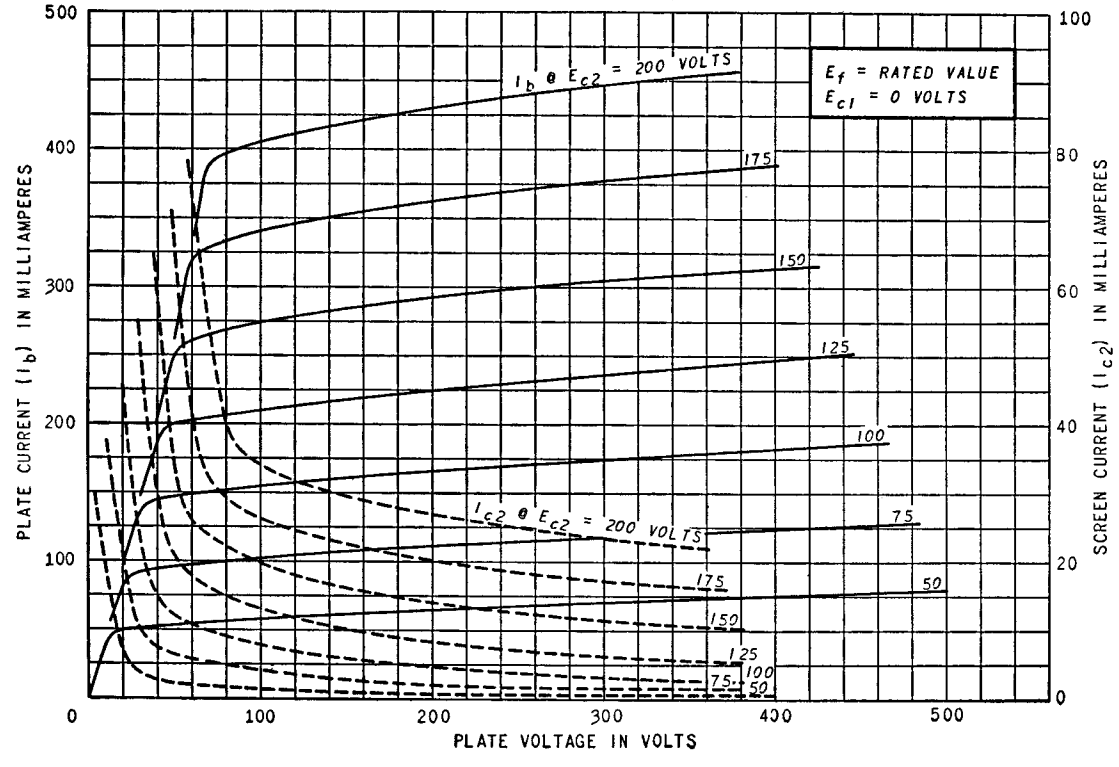
¶ Applied for short interval (two seconds maximum) so as not to damage tube.

**Triode connection (screen tied to plate) with $E_b = E_{c2} = 150$ volts and $E_{c1} = -22.5$ volts.

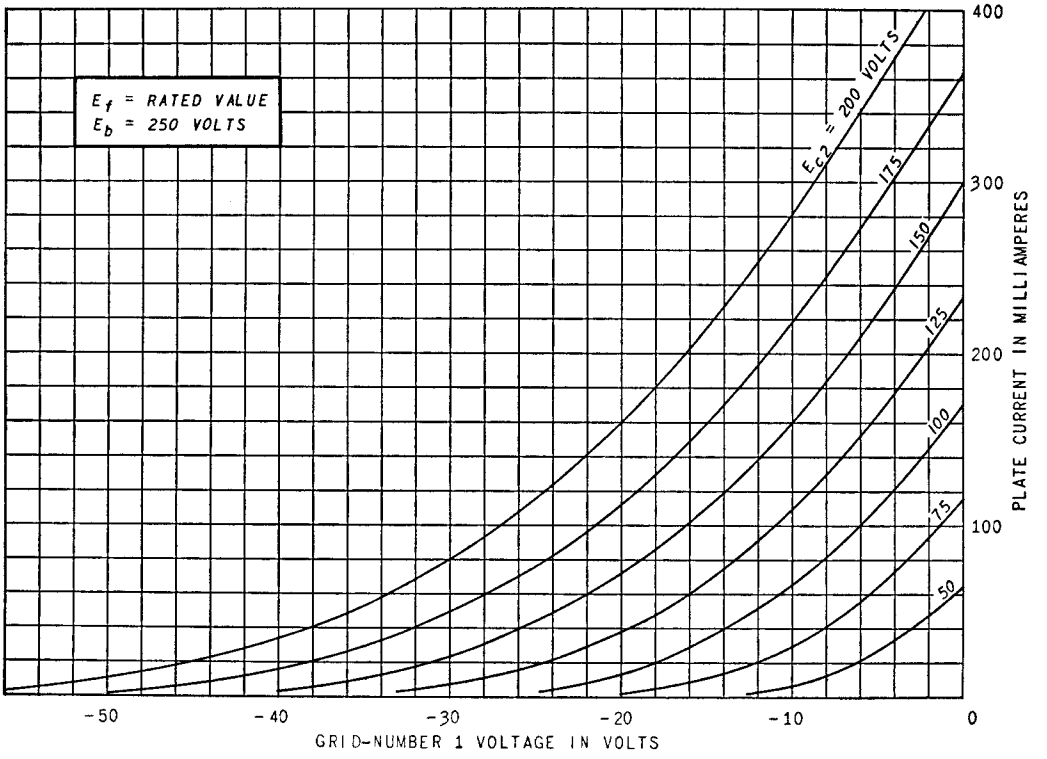
AVERAGE PLATE CHARACTERISTICS



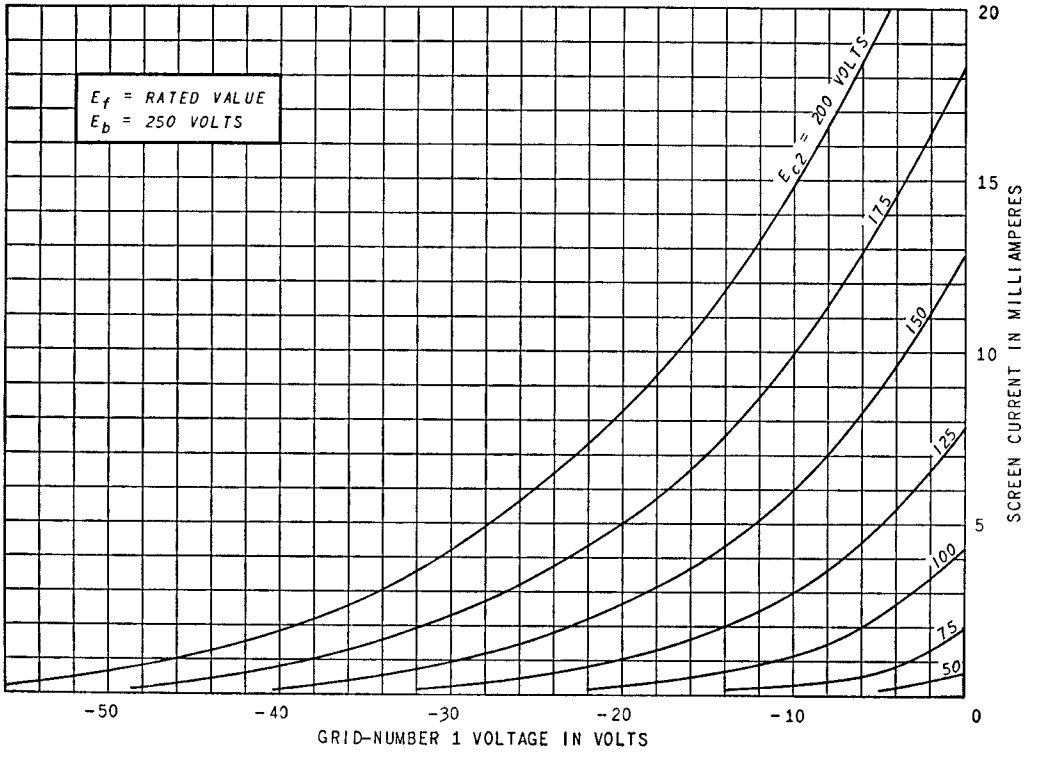
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6BQ6-GTB

BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6BQ6-GTB is a beam-power pentode designed primarily for use as horizontal-deflection amplifier in television receivers. The tube exhibits high perveance, high plate current at low plate and screen voltages, and a high ratio of plate-to-screen current.

GENERAL

ELECTRICAL

	6BQ6-GTB	
Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3	Volts
Heater Current	1.2	Amperes
Direct Interelectrode Capacitances*		
Grid-Number 1 to Plate	0.6	μμf
Input	15	μμf
Output	7.0	μμf

MECHANICAL

Mounting Position—Any
Envelope T-9
Base—B6-81, or B7-7 Intermediate-Shell Octal 6- or 7-Pin or B6-84, or B7-59 Short Intermediate-Shell Octal 6- or 7-Pin.
Top Cap—C1-3 or C1-33, Skirted Miniature

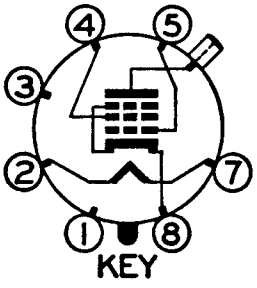
MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE†
DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

DC Plate-Supply Voltage (Boost + DC Power Supply)	600	Volts
Peak Positive Pulse Plate Voltage	6000‡	Volts
Peak Negative Pulse Plate Voltage	1250	Volts
Screen Voltage	200	Volts
Peak Negative Grid-Number 1 Voltage	300	Volts
Plate Dissipation§	11	Watts
Screen Dissipation	2.5	Watts
DC Cathode Current	110	Milliamperes
Peak Cathode Current	400	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	0.47	Megohms
Bulb Temperature at Hottest Point	220	C

GENERAL ELECTRIC

BASING DIAGRAM

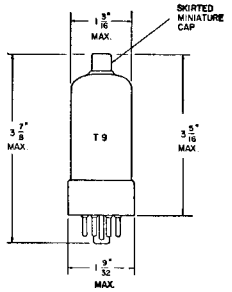


EIA 6AM

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Heater
Pin 3—No Connection
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates
Cap —Plate
Pin 1 omitted on Bases B6-81 and B6-84.

PHYSICAL DIMENSIONS



EIA 9-49
or 9-50

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	60	250	Volts
Screen Voltage	150	150	Volts
Grid-Number 1 Voltage	0△	−22.5	Volts
Plate Resistance, approximate	—	14500	Ohms
Transconductance	—	5900	Micromhos
Plate Current	260	57	Milliamperes
Screen Current	26	2.1	Milliamperes
Grid-Number 1 Voltage, approximate $I_b = 1.0$ Milliampere	—	−43	Volts
Triode Amplification Factor¶	—	4.3	

* Without external shield.

† For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

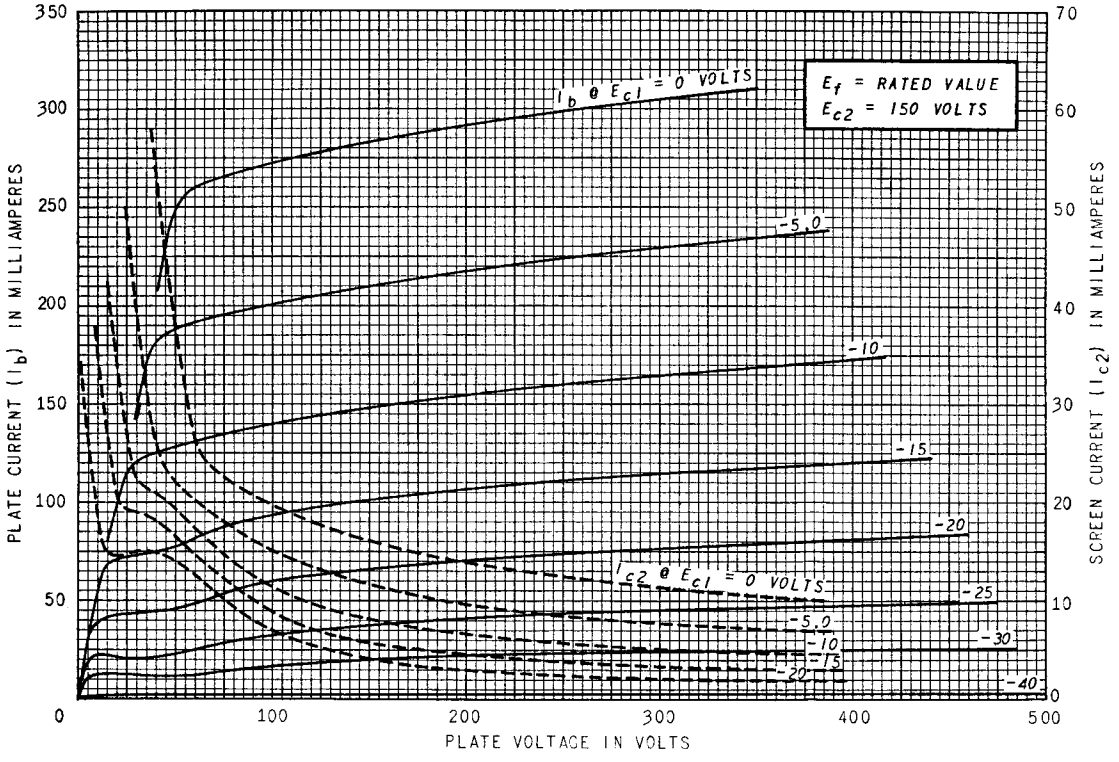
‡ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

§ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

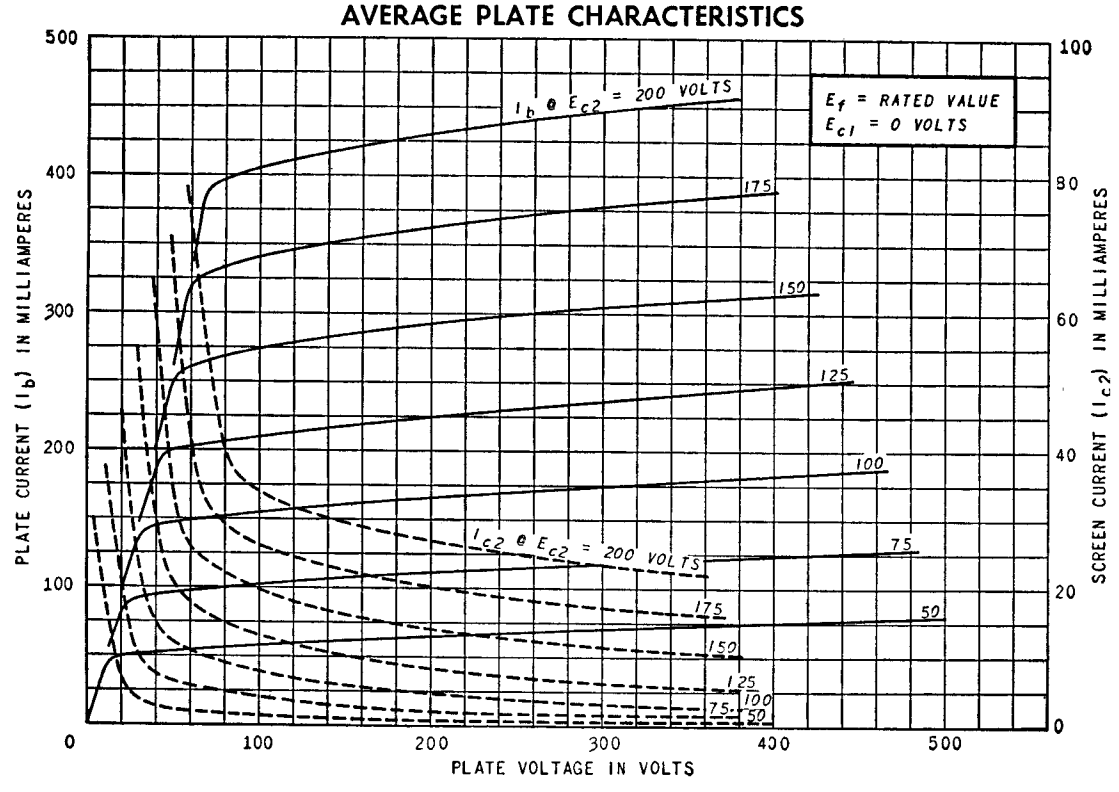
△Applied for short interval (two seconds maximum) so as not to damage tube.

¶ Triode connection (screen tied to plate) with $E_b = E_{c2} = 150$ volts and $E_{c1} = -22.5$ volts.

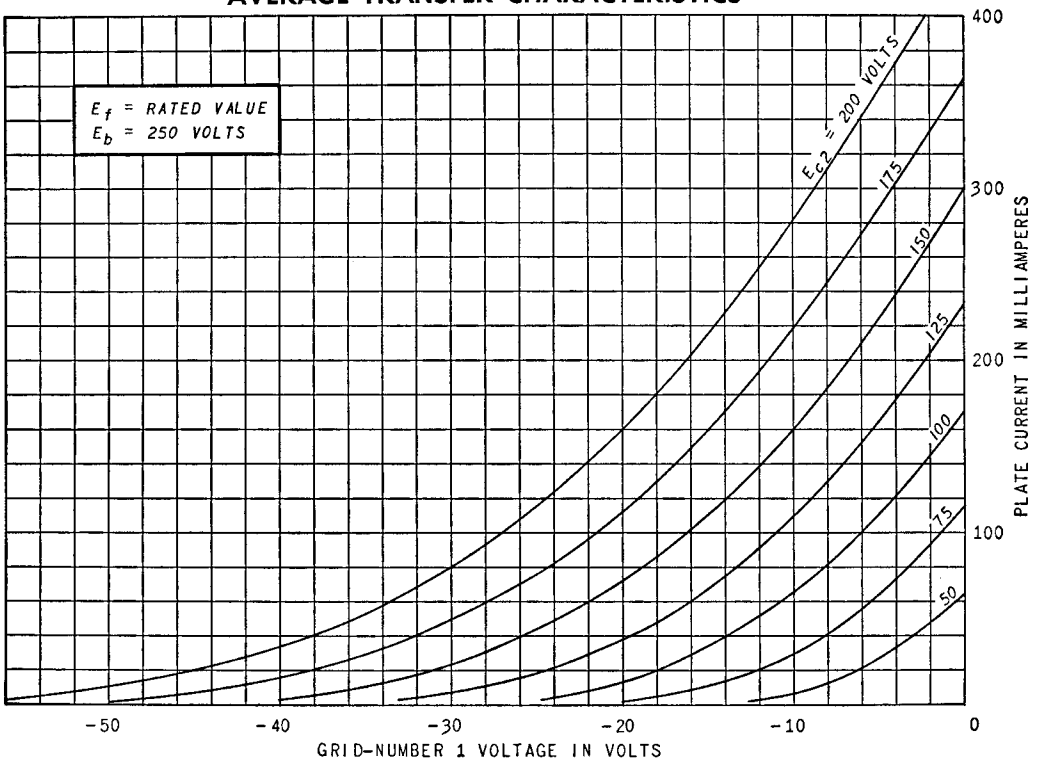
AVERAGE PLATE CHARACTERISTICS



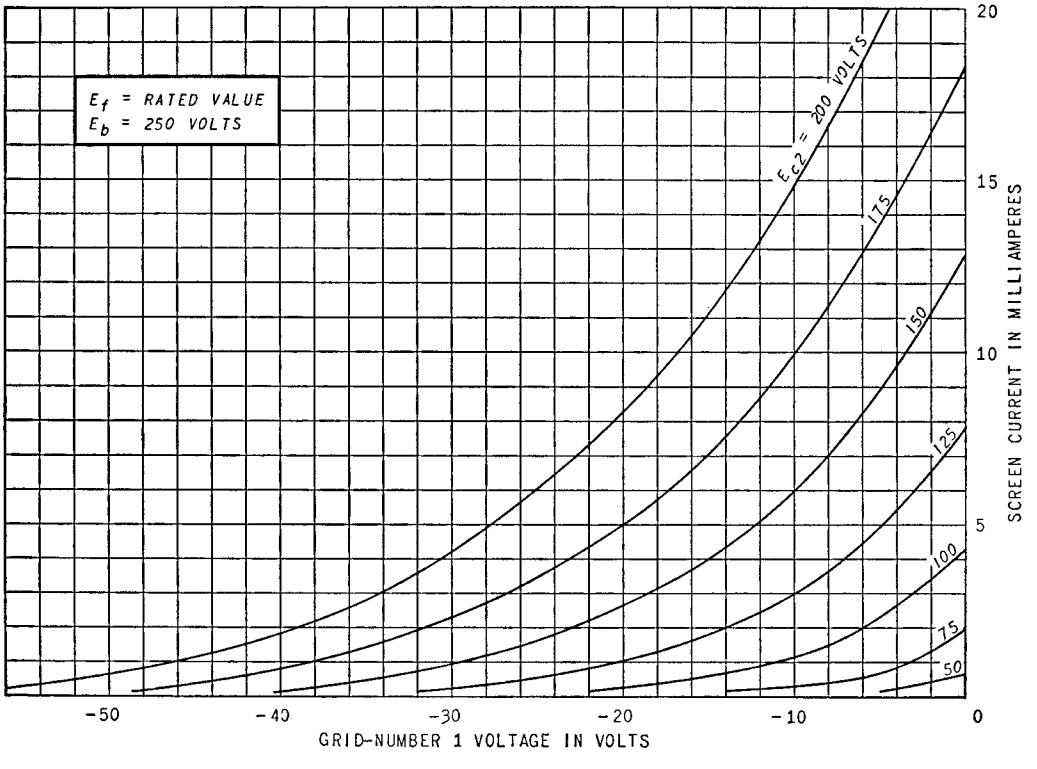
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6BQ7-A—4BQ7-A—5BQ7-A

TWIN TRIODE

FOR VHF CASCODE AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6BQ7-A is a miniature, medium-mu twin triode primarily designed for use as a cascode, radio-frequency amplifier in very-high-frequency television tuners. In this application, its performance is characterized by high gain and low noise figure. An internal shield provides isolation between the two triode sections.

Except for heater ratings, the 4BQ7-A and 5BQ7-A are identical to the 6BQ7-A. In addition, as a result of their controlled heater warm-up characteristic, they are especially suited for use in television receivers that employ series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

	4BQ7-A	5BQ7-A	6BQ7-A	
Heater Voltage, AC or DC	4.2	5.6	6.3	Volts
Heater Current	0.6	0.45	0.4	Amperes
Heater Warm-up Time*	11	11	....	Seconds

Direct Interelectrode Capacitances†	Section 1	Section 2	
Grid to Plate	1.2	1.2	μμf
Input	2.6	....	μμf
Output	1.2	....	μμf
Heater to Cathode	2.6	2.6	μμf
Plate to Plate, maximum	0.01		μμf
Plate (Section 2) to Plate and Grid (Section 1), maximum	0.024		μμf
Plate to Cathode	0.12	0.12	μμf
Grounded-Grid Input		5.0	μμf
Grounded-Grid Output		2.2	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

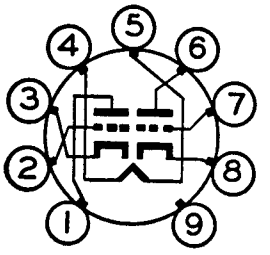
DESIGN-CENTER VALUES, EACH SECTION

Plate Voltage	250§	Volts
Plate Dissipation	2.0	Watts
DC Cathode Current	20	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200§	Volts
Grid Circuit Resistance	0.5	Megohms

GENERAL ELECTRIC

Supersedes ET-T852A, dated 1-56

BASING DIAGRAM



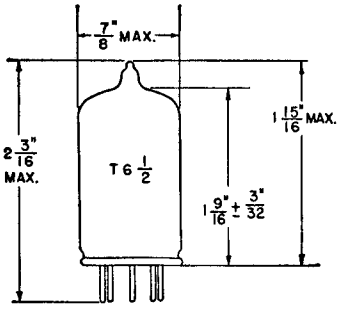
RETMA 9AJ

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Internal Shield‡

‡ It is recommended that pin 9 be grounded.

PHYSICAL DIMENSIONS



RETMA 6-2

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	150	Volts
Cathode-Bias Resistor	220	Ohms
Amplification Factor	38	
Plate Resistance, approximate	5900	Ohms
Transconductance	6400	Micromhos
Plate Current	9.0	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes	−6.5	Volts

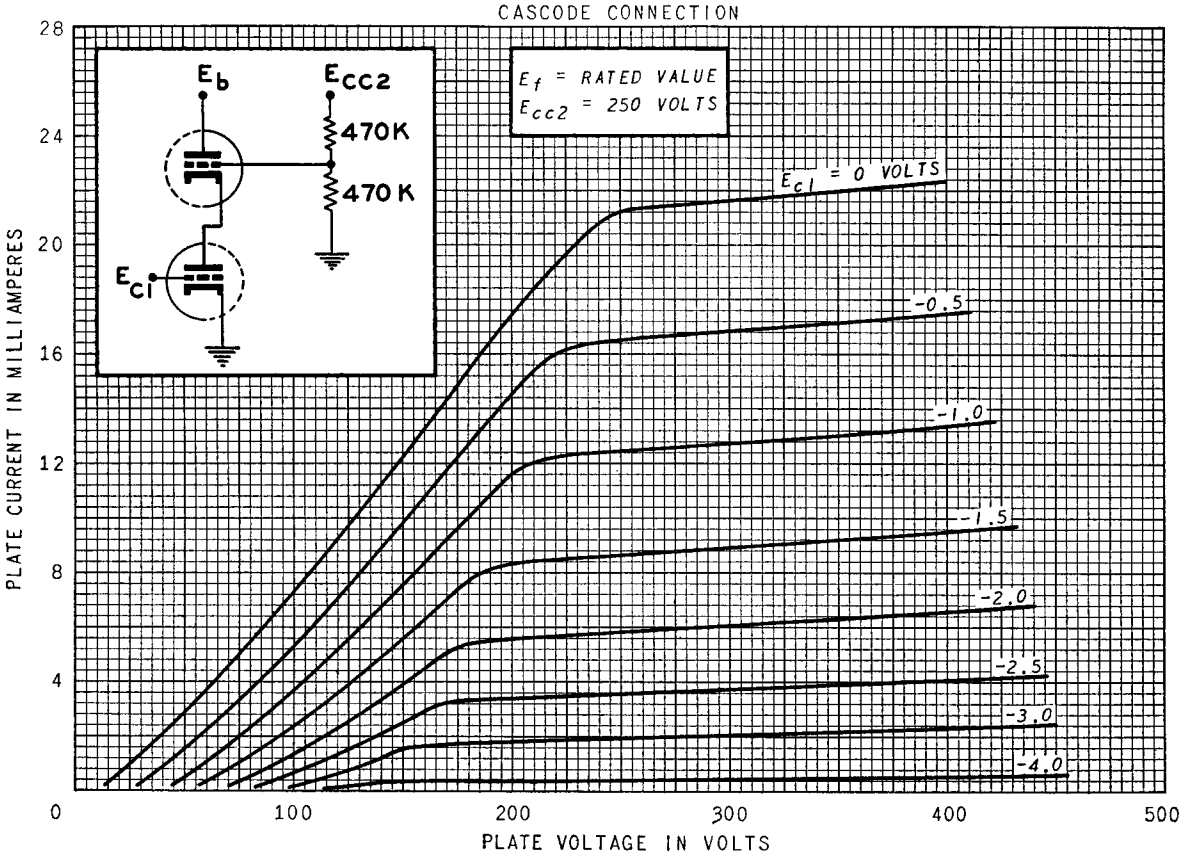
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (RETMA 315) connected to pin 9.

§ When the tube is used as a cascode amplifier and the two sections are connected in series, this voltage may be as high as 300 volts maximum under cutoff conditions.

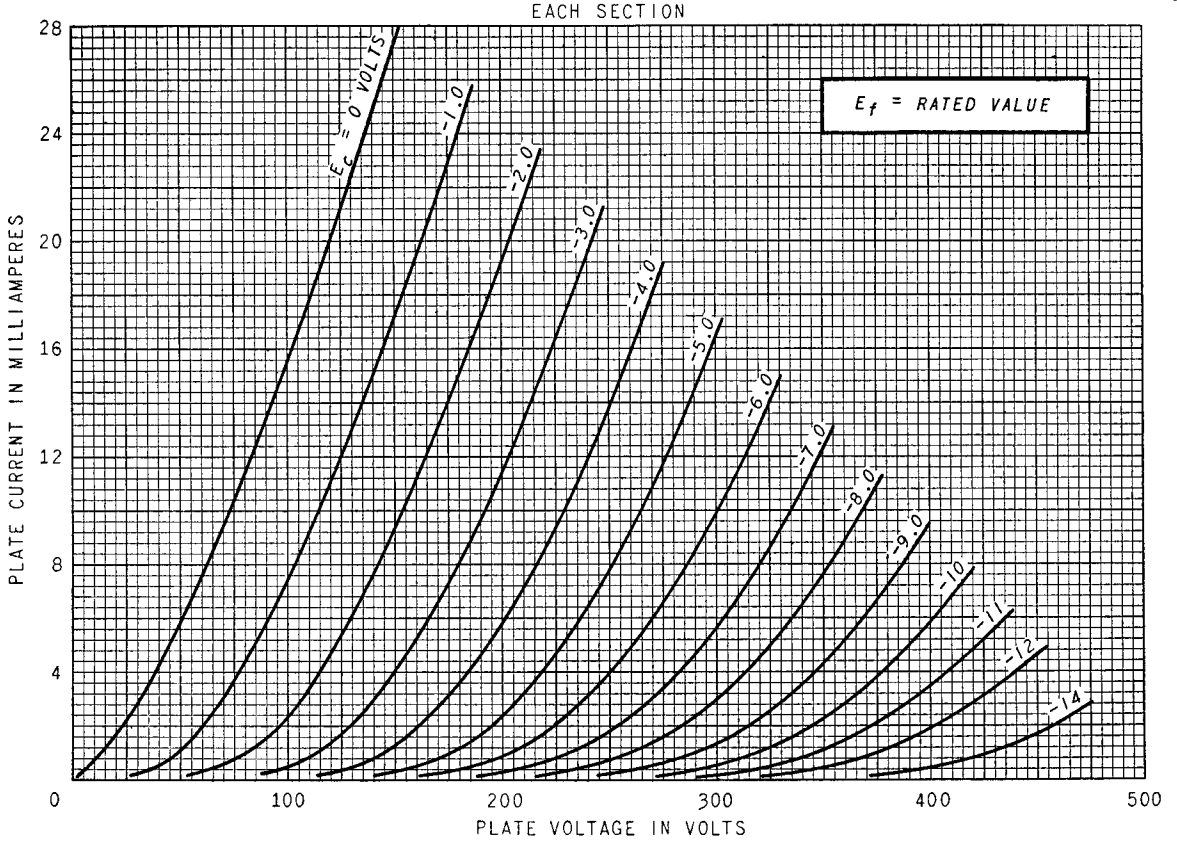
AVERAGE PLATE CHARACTERISTICS

CASCODE CONNECTION



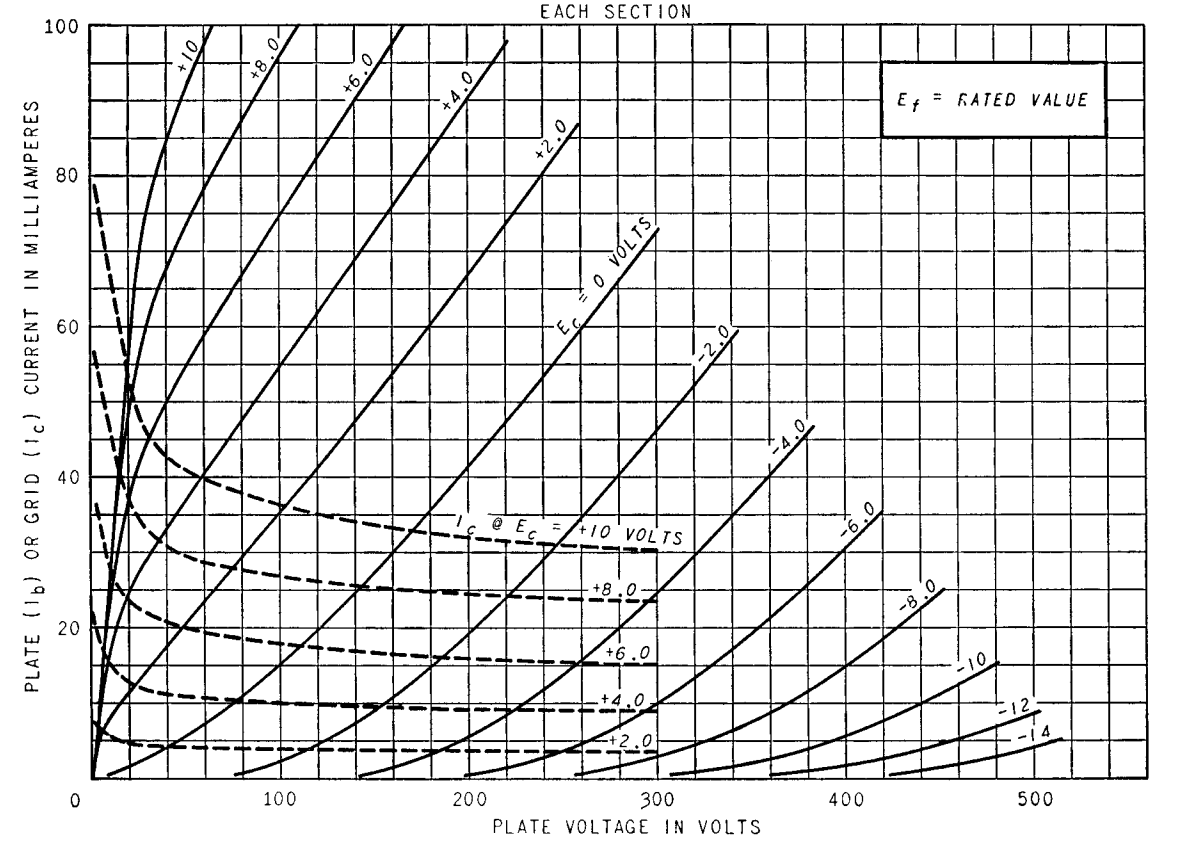
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



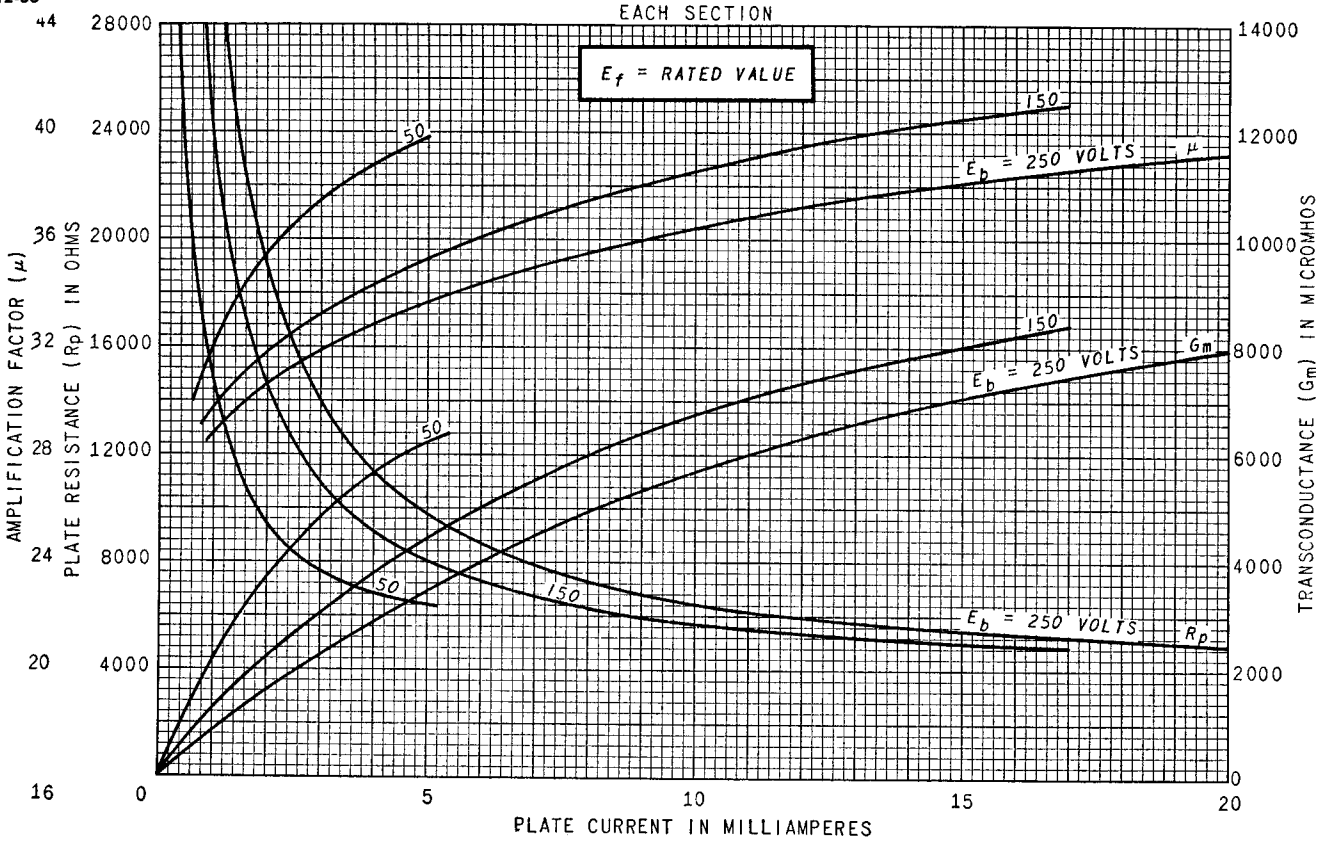
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



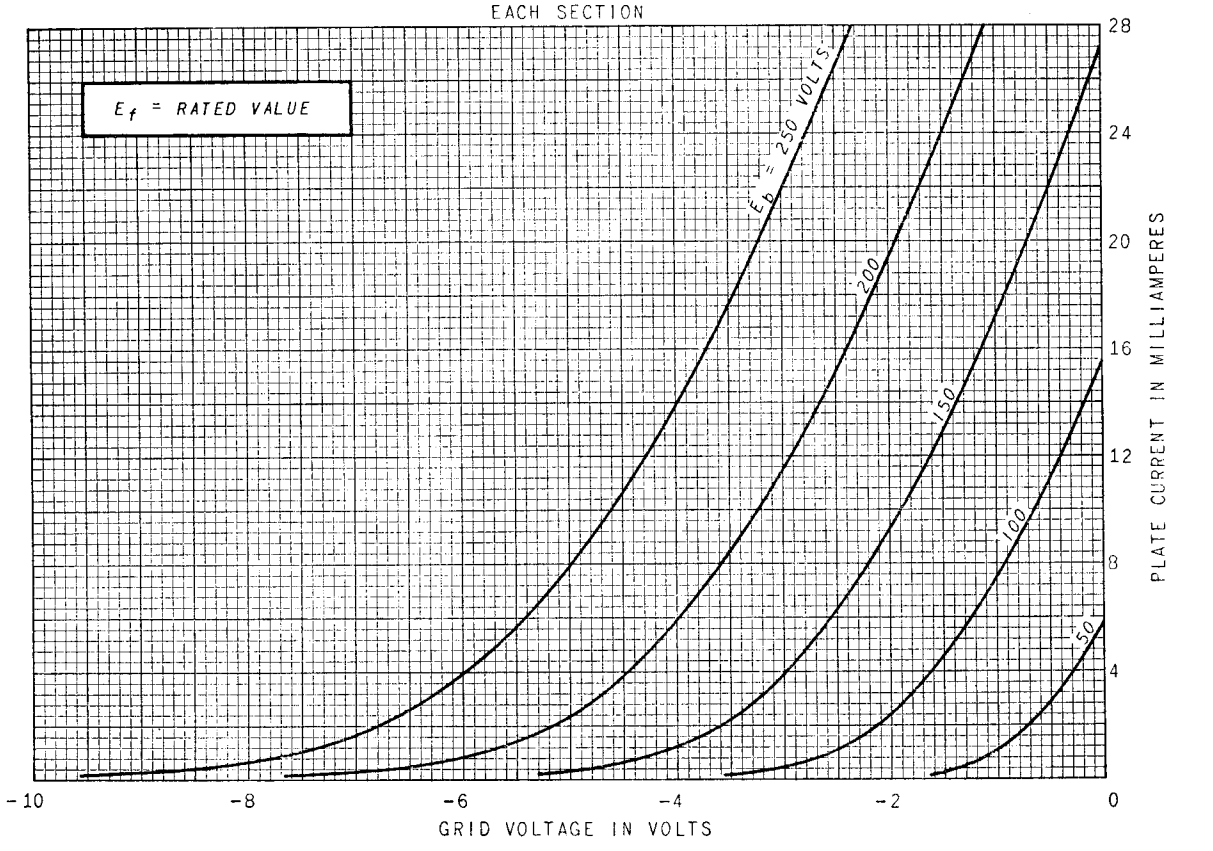
AVERAGE CHARACTERISTICS

EACH SECTION



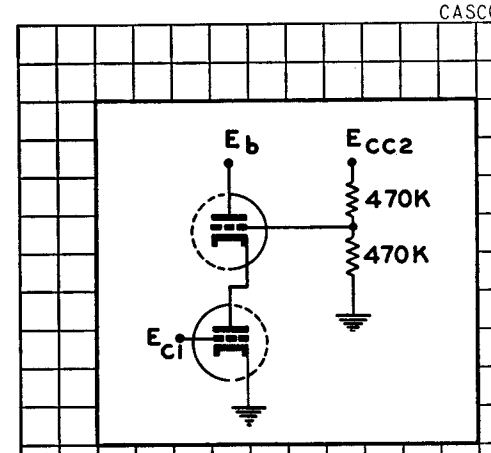
AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION



AVERAGE TRANSFER CHARACTERISTICS

CASCODE CONNECTION



E_f = RATED VALUE
E_b = 250 VOLTS

E_{cc2} = 250 VOLTS
200
150
100
50

PLATE CURRENT IN MILLIAMPERES

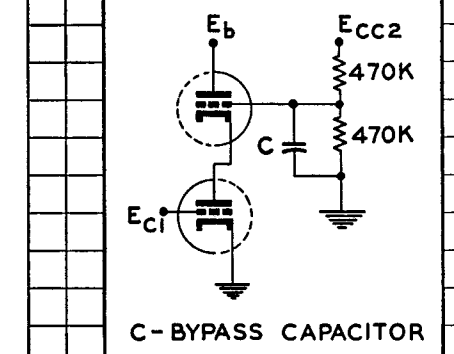
20
15
10
5
0

-7 -6 -5 -4 -3 -2 -1 0

GRID-NUMBER 1 VOLTAGE IN VOLTS

AVERAGE TRANSFER CHARACTERISTICS

CASCODE CONNECTION



E_f = RATED VALUE
E_b = 250 VOLTS

E_{cc2} = 250 VOLTS
200
150
100
50

TRANSCONDUCTANCE (G_m) IN MICROMHOS

10000
8000
6000
4000
2000

-7 -6 -5 -4 -3 -2 -1 0

GRID-NUMBER 1 VOLTAGE IN VOLTS

Electronic TUBES

6BR8 — 5BR8

TRIODE-PENTODE

FOR VHF CONVERTER APPLICATIONS

DESCRIPTION AND RATING

The 6BR8 is a miniature tube which contains a sharp-cutoff pentode and a medium-mu triode in one envelope. It is intended primarily for service as a combined triode oscillator and pentode mixer in VHF television tuners although the tube is also suitable for a wide variety of general-purpose applications in both monochrome and color television receivers. Except for basing arrangement and direct interelectrode capacitances, the 6BR8 is identical to the 6U8.

The 5BR8 is a 600-milliampere version of the 6BR8 which differs only in heater ratings. The 5BR8 exhibits a controlled heater warm-up characteristic which makes it particularly suited for use in television receivers which employ 600-milliampere series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	5BR8	6BR8	
Heater Voltage, AC or DC	4.7	6.3	Volts
Heater Current	0.6	0.45	Amperes
Heater Warm-up Time*	11	....	Seconds
Direct Interelelectrode Capacitances	With† Shield	Without Shield	
Pentode Section			
Grid-Number 1 to Plate, maximum	0.008	0.015	μμf
Input	5.0	5.0	μμf
Output	3.5	2.6	μμf
Triode Section			
Grid to Plate	1.8	1.8	μμf
Input	2.5	2.5	μμf
Output	1.0	0.4	μμf
Heater to Cathode, Each Section	3.0‡	3.0	μμf

MECHANICAL

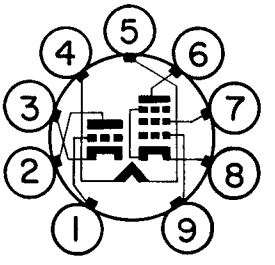
Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES	Pentode Section	Triode Section	
Plate Voltage	300	300	Volts
Screen-Supply Voltage	300	....	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	2.8	2.7	Watts
Screen Dissipation	0.5	....	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode	200	200	Volts
Heater Negative with Respect to Cathode	200	200	Volts

GENERAL ELECTRIC

BASING DIAGRAM

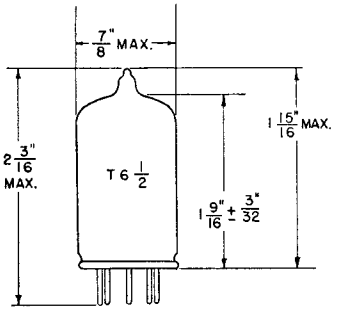


RETMA 9FA

TERMINAL CONNECTIONS

Pin 1—Triode Grid
Pin 2—Triode Plate
Pin 3—Triode Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Plate
Pin 7—Pentode Grid Number 2 (Screen)
Pin 8—Pentode Cathode, Grid Number 3 and Internal Shield
Pin 9—Pentode Grid Number 1

PHYSICAL DIMENSIONS



RETMA 6-2

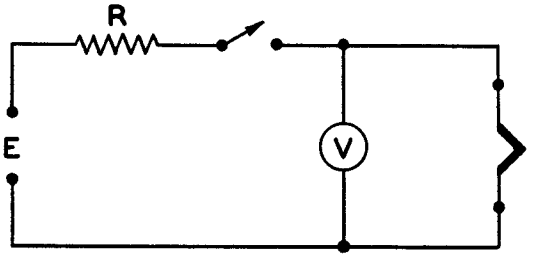
CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Pentode Section	Triode Section	
Plate Voltage	250	150	Volts
Screen Voltage	110	...	Volts
Cathode-Bias Resistor	68	56	Ohms
Amplification Factor	...	40	
Plate Resistance, approximate	400000	5000	Ohms
Transconductance	5200	8500	Micromhos
Plate Current	10	18	Milliamperes
Screen Current	3.5	...	Milliamperes
Grid-Number 1 Voltage, approximate I_b = 10 Microamperes	−10	−12	Volts

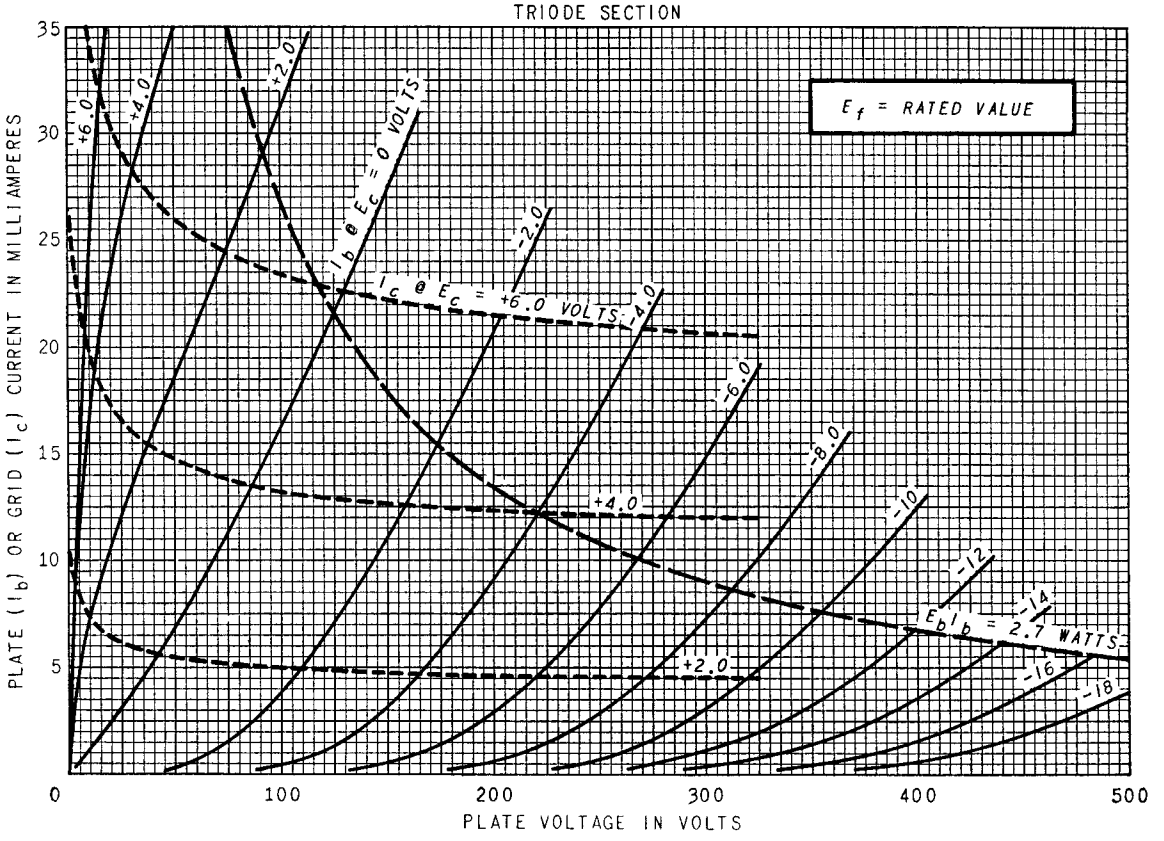
* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals (V) to increase from zero to the heater test voltage (V_1). For this type, E = 18.7 volts (RMS or DC), V_1 = 3.73 volts (RMS or DC), and R = 23.5 ohms.

† With external shield (RETMA 315) connected to cathode of section under test unless otherwise indicated.

‡ With external shield (RETMA 315) connected to ground.

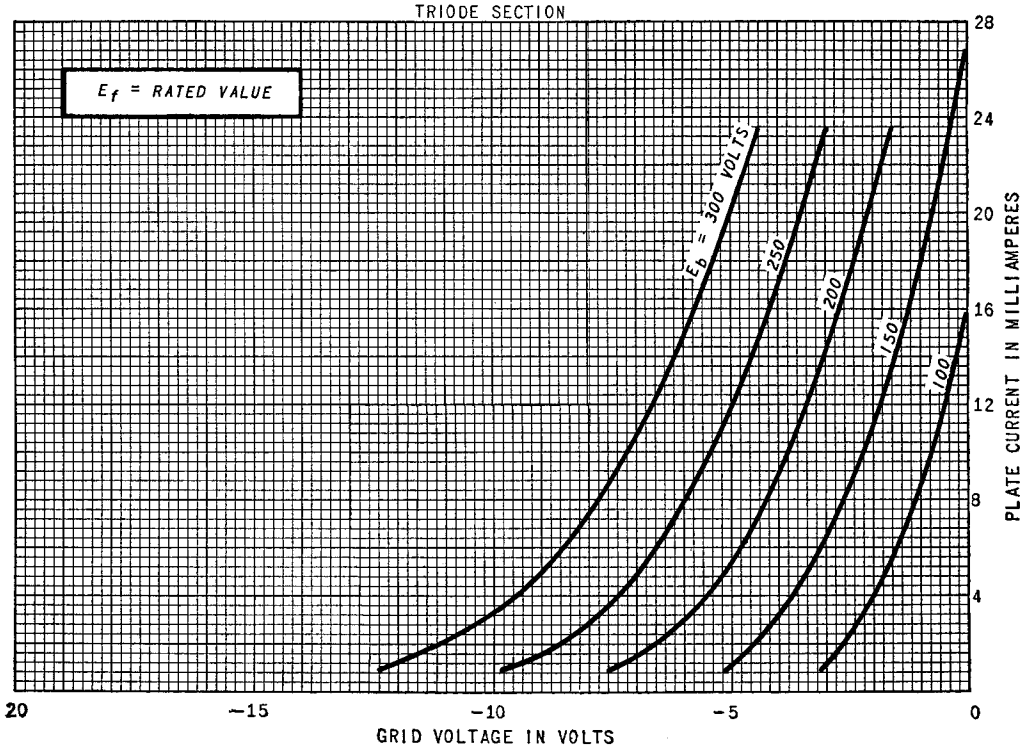


AVERAGE PLATE CHARACTERISTICS



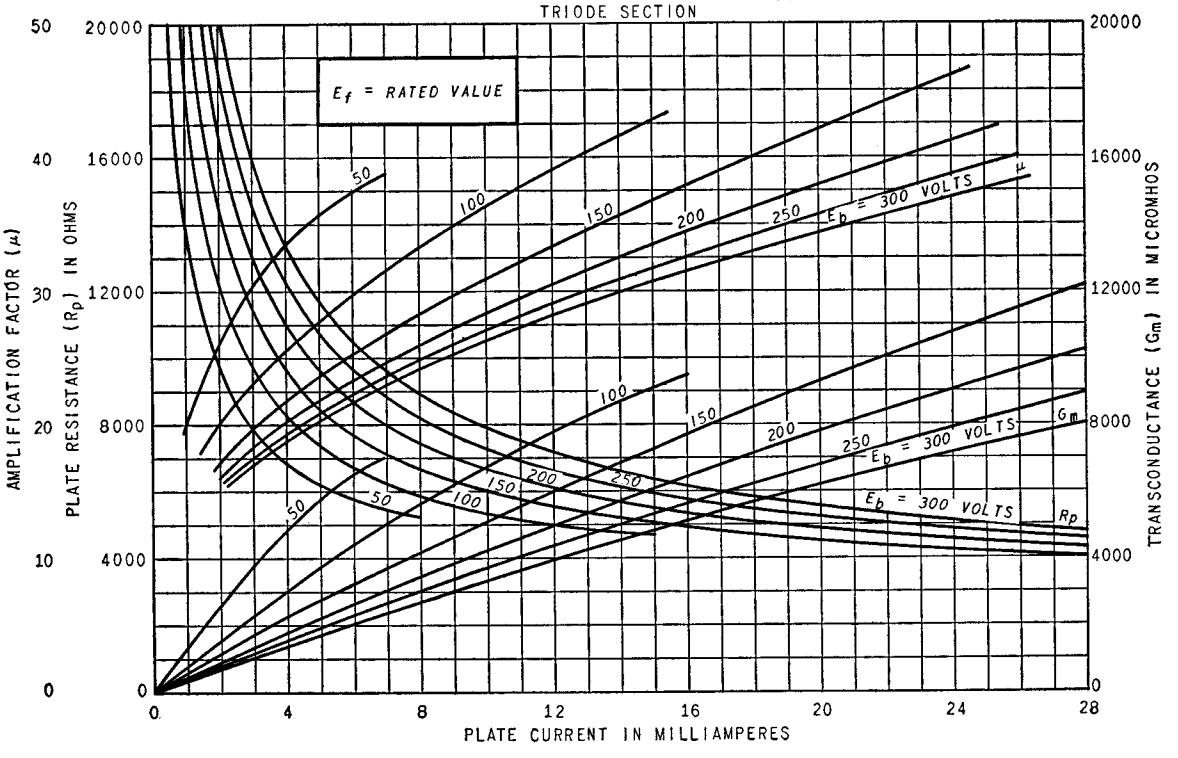
AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION

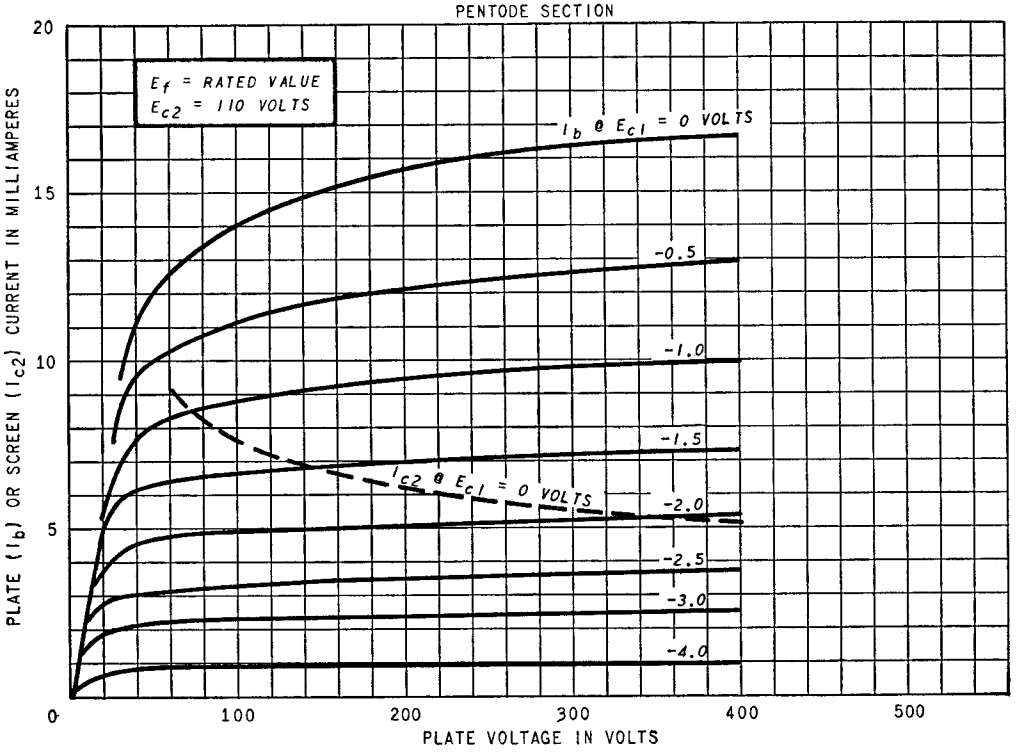


AVERAGE CHARACTERISTICS

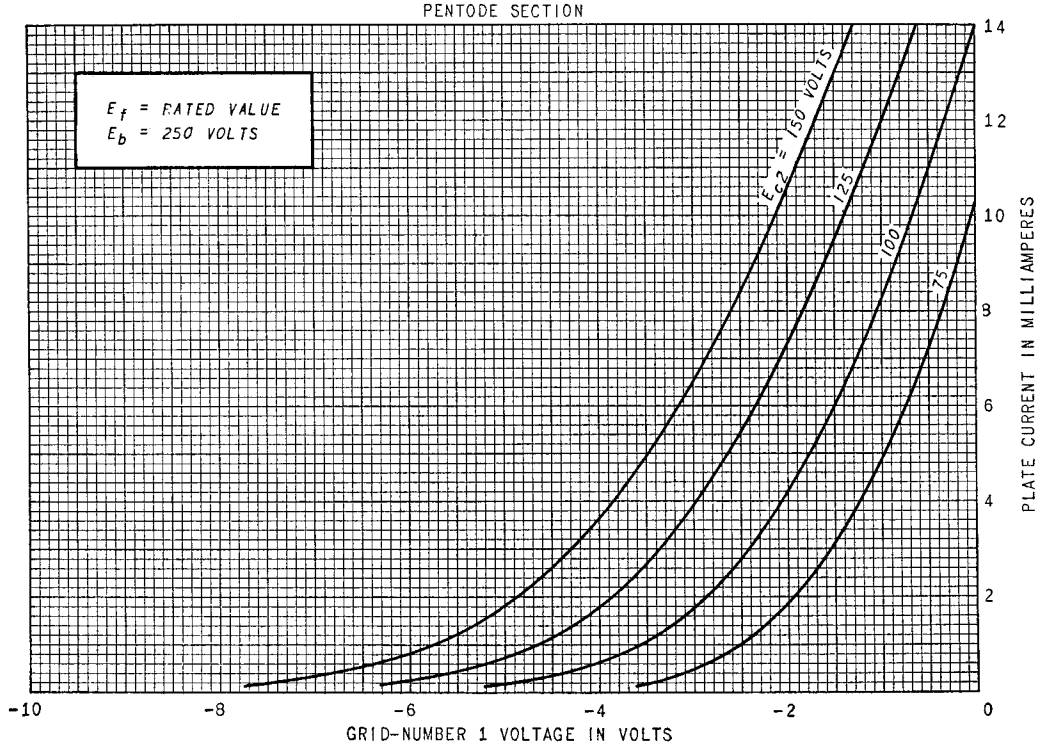
TRIODE SECTION



AVERAGE PLATE CHARACTERISTICS

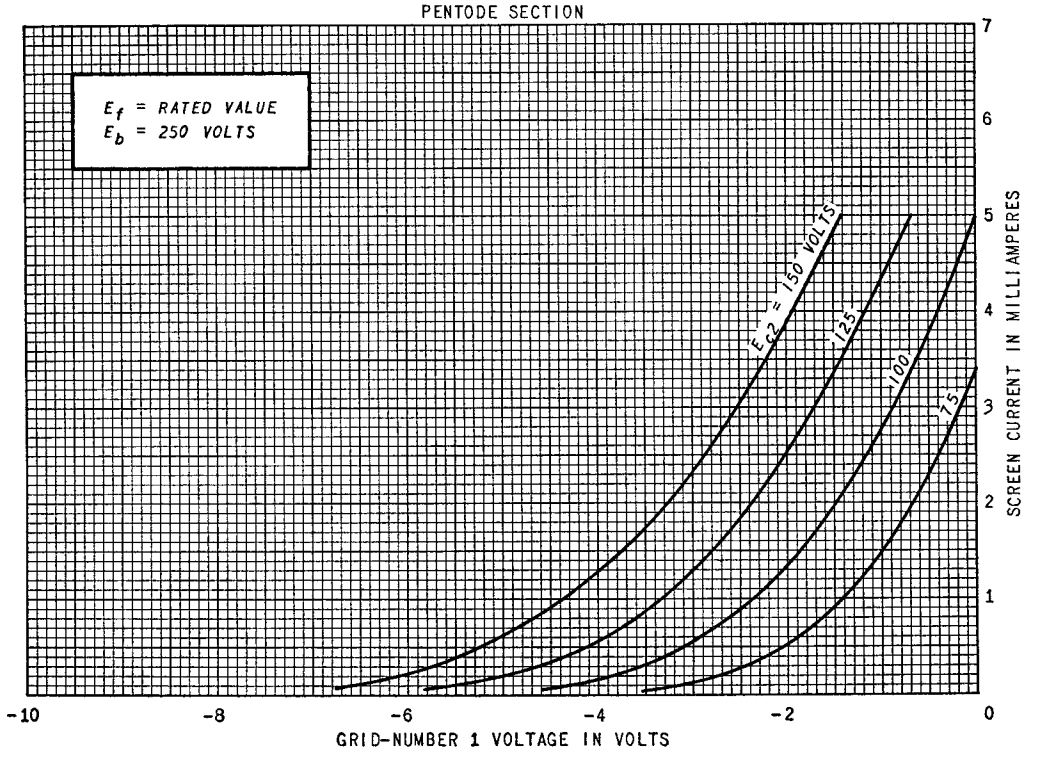


AVERAGE TRANSFER CHARACTERISTICS



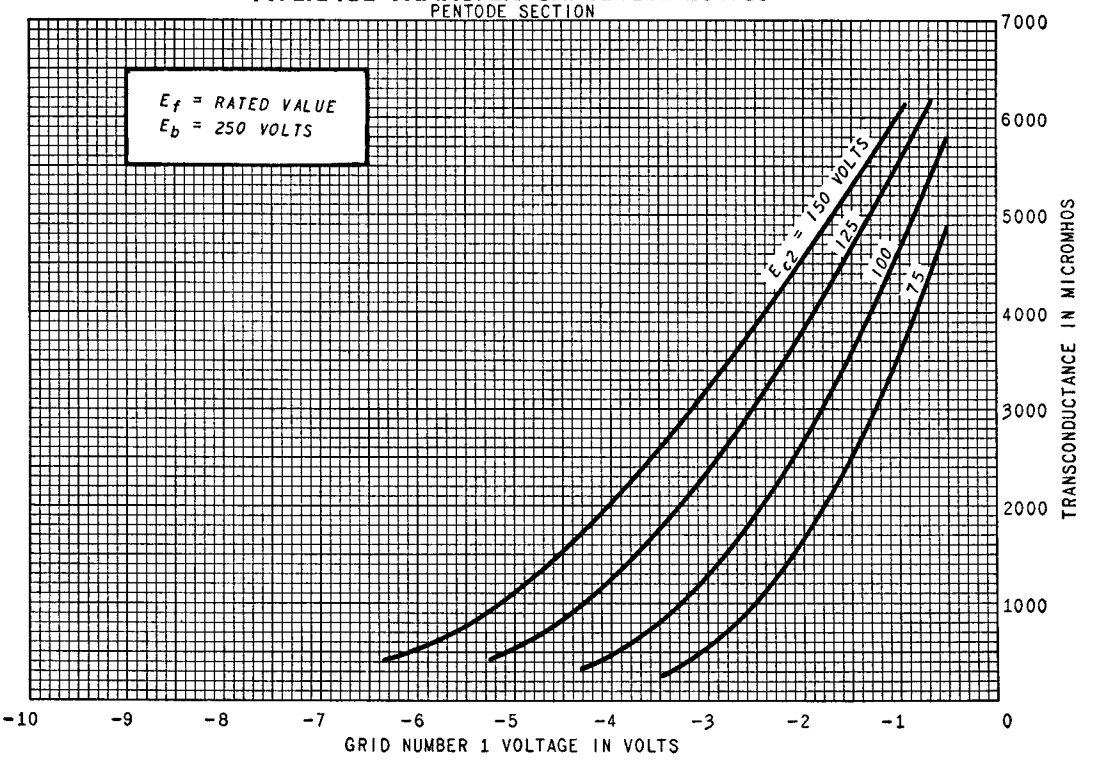
AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

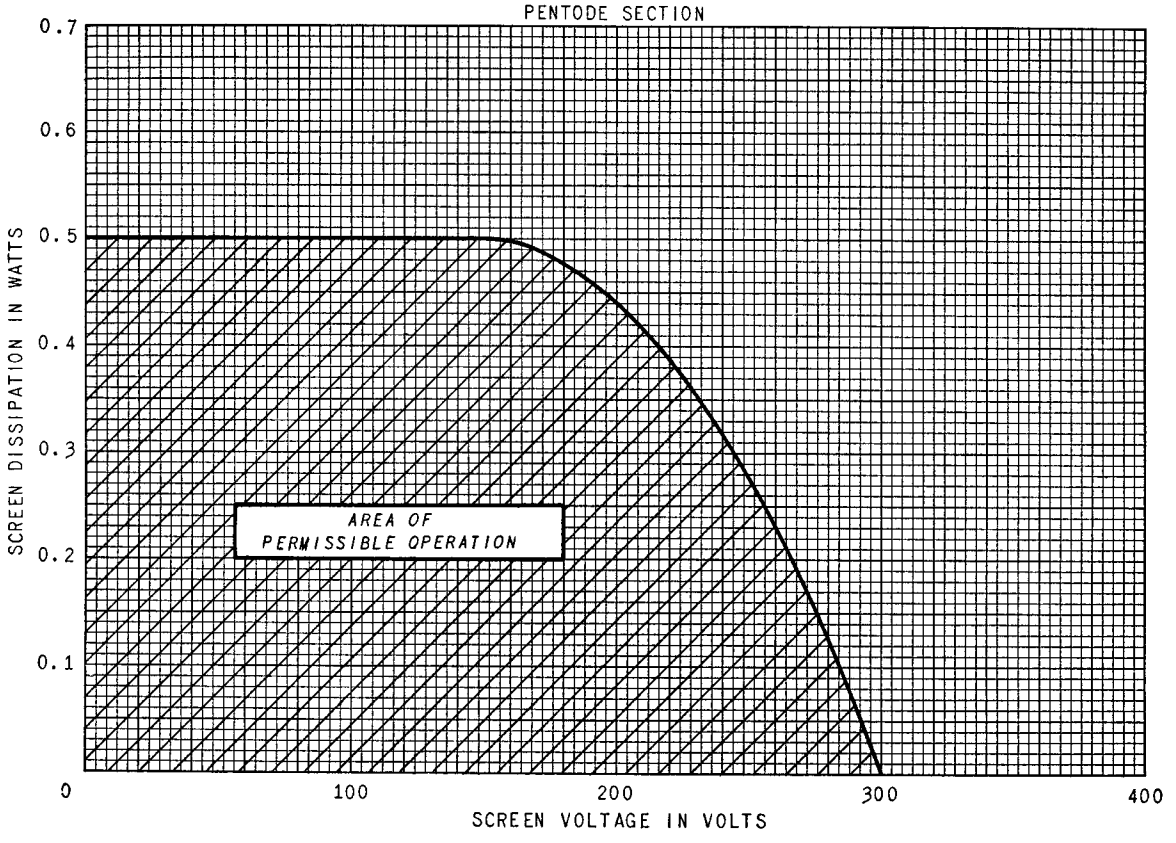


AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



SCREEN RATING CHART



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6BS8—4BS8

TWIN TRIODE

FOR VHF CASCODE AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6BS8 is a miniature, medium-mu twin triode designed for use as a VHF cascode amplifier. In this application, section two (pins 1, 2, and 3) is intended for the input section.

Except for heater ratings, the 4BS8 is identical to the 6BS8. In addition, the 4BS8 incorporates a controlled heater-warm-up characteristic which makes it especially suited for use in television receivers that employ series-connected heaters.

GENERAL

ELECTRICAL

	4BS8	6BS8	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	4.2	6.3	Volts
Heater Current	0.6	0.4	Amperes
Heater Warm-up Time*	11	....	Seconds
Direct Interelectrode Capacitances†	Section 1	Section 2	
Grid to Plate	1.15	1.15	μμf
Input	2.6	....	μμf
Output	1.35	....	μμf
Heater to Cathode	2.6	2.7	μμf
Plate Section 2, to Plate and Grid, Section 1, maximum	0.024		μμf
Plate to Plate, maximum	0.01		μμf
Plate to Cathode, maximum	0.15	0.15	μμf
Grounded-Grid Input		4.95	μμf
Grounded-Grid Output		2.27	μμf

MECHANICAL

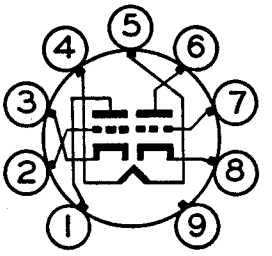
Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES EACH SECTION

Plate Voltage	150	Volts
Plate Dissipation	2.0	Watts
DC Cathode Current	20	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance	0.5	Megohms

BASING DIAGRAM

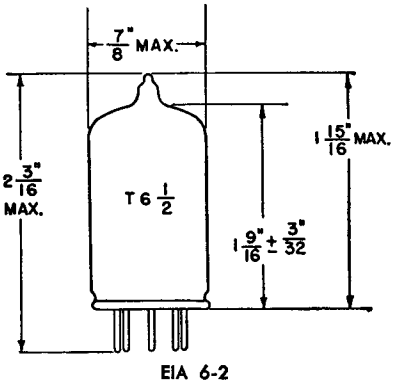


EIA 9AJ

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Internal Shield

PHYSICAL DIMENSIONS



EIA 6-2

GENERAL ELECTRIC

Supersedes ET-T1355A, dated 8-56

△Supersedes pages 1 and 2, dated 8-56

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	150	Volts
Cathode-Bias Resistor	220	Ohms
Amplification Factor	36	
Plate Resistance, approximate	5000	Ohms
Transconductance	7200	Micromhos
Plate Current	10	Milliamperes
Grid Voltage, approximate‡		
Ib = 10 Microamperes	−7	Volts

CASCODE AMPLIFIER

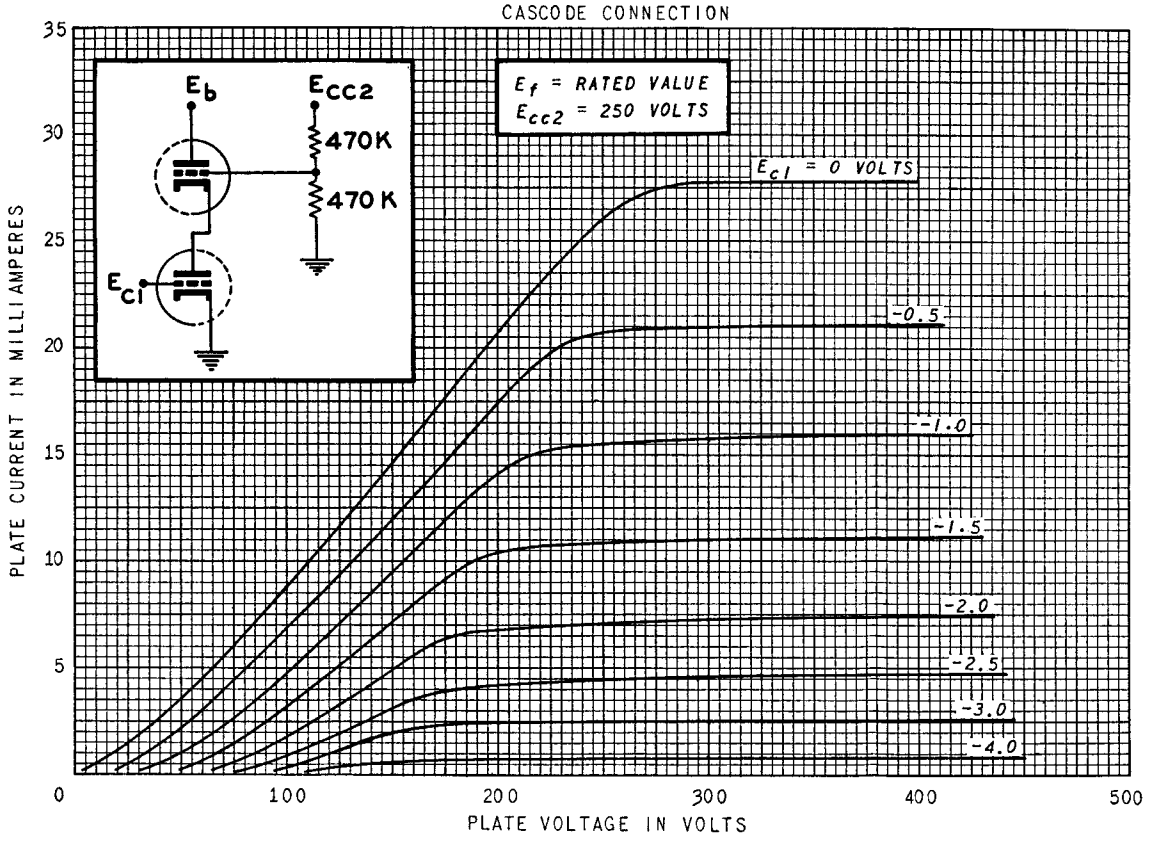
Plate-Supply Voltage	250	Volts
Grid Voltage	−1.0	Volts
Transconductance	10000	Micromhos
Plate Current	16	Milliamperes
Grid Voltage, approximate		
G_m = 50 Micromhos	−6	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (EIA-315) connected to pin 9.

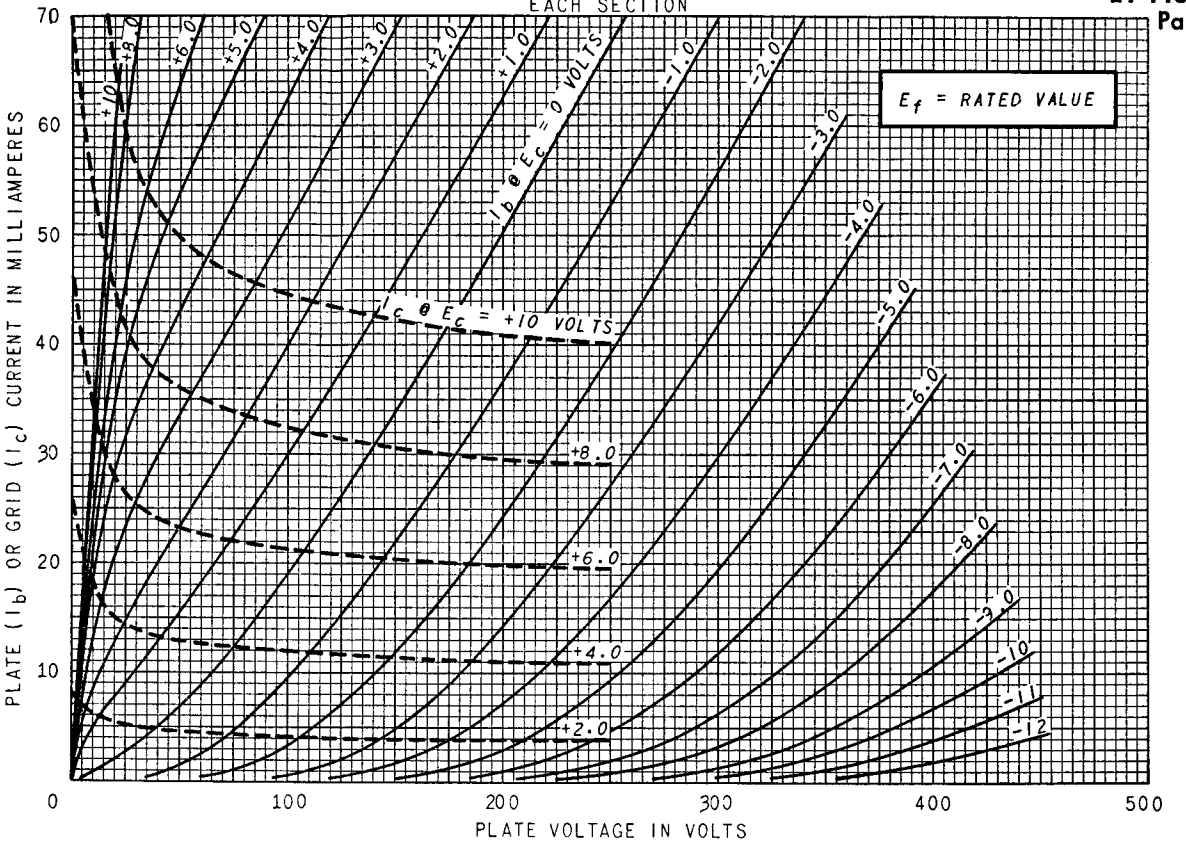
‡ Section two only.

AVERAGE PLATE CHARACTERISTICS



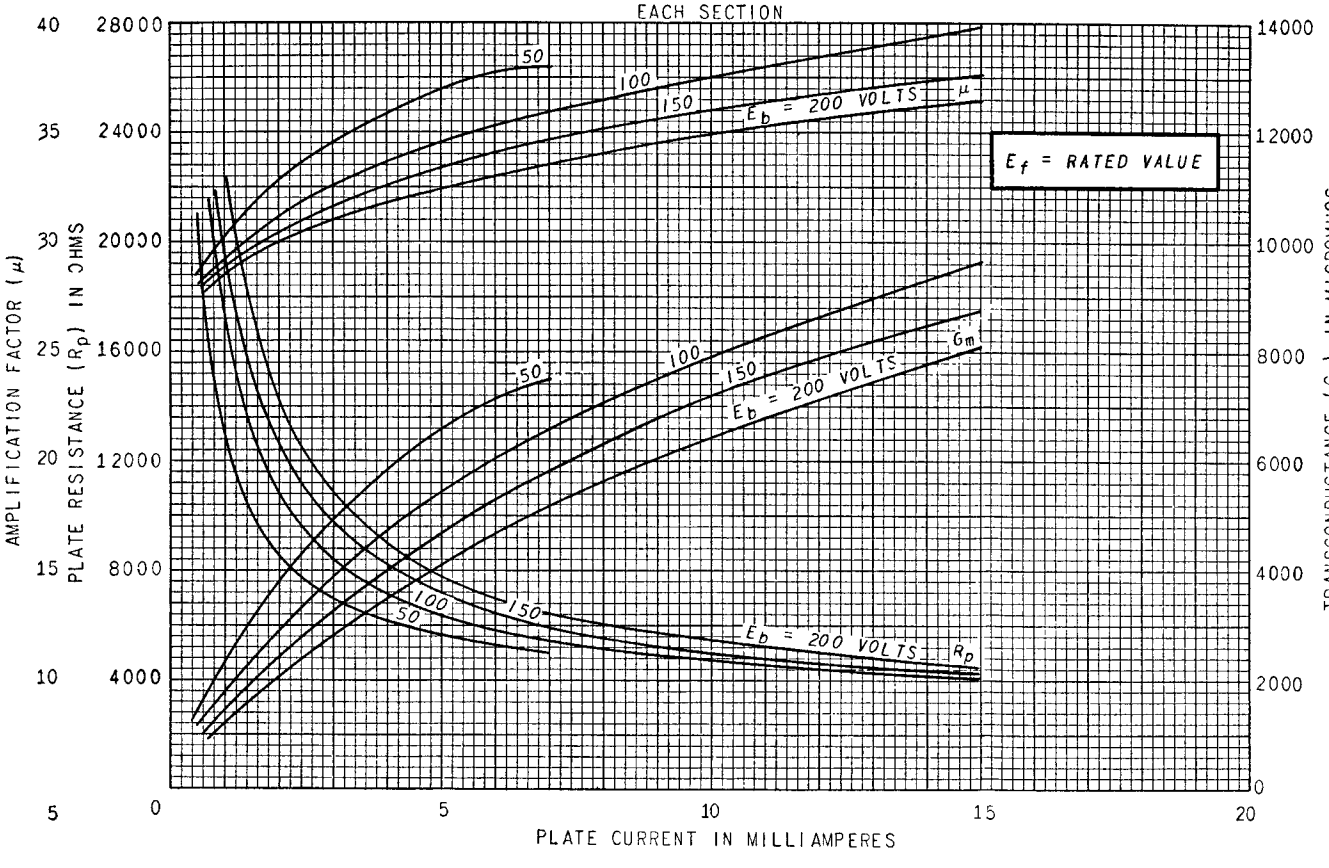
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



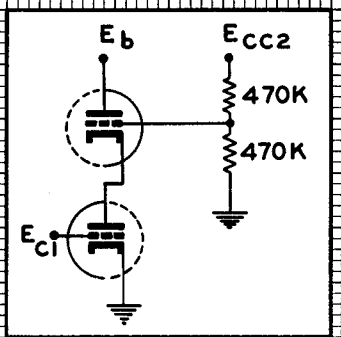
AVERAGE CHARACTERISTICS

EACH SECTION



AVERAGE TRANSFER CHARACTERISTICS

CASCODE CONNECTION



E_f = RATED VALUE
E_b = 250 VOLTS

E_{cc2} = 250 VOLTS
200
150
100
50

PLATE CURRENT IN MILLIAMPERES

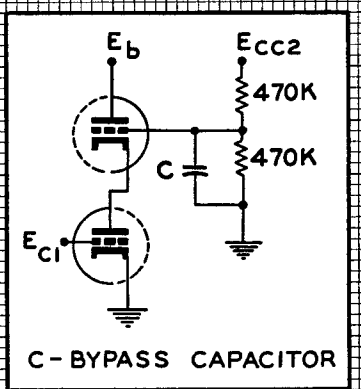
28
24
20
16
12
8
4

-5 -4 -3 -2 -1 0

GRID-NUMBER 1 VOLTAGE IN VOLTS

AVERAGE TRANSFER CHARACTERISTICS

CASCODE CONNECTION



E_f = RATED VALUE
E_b = 250 VOLTS

E_{cc2} = 250 VOLTS
200
150
100
50

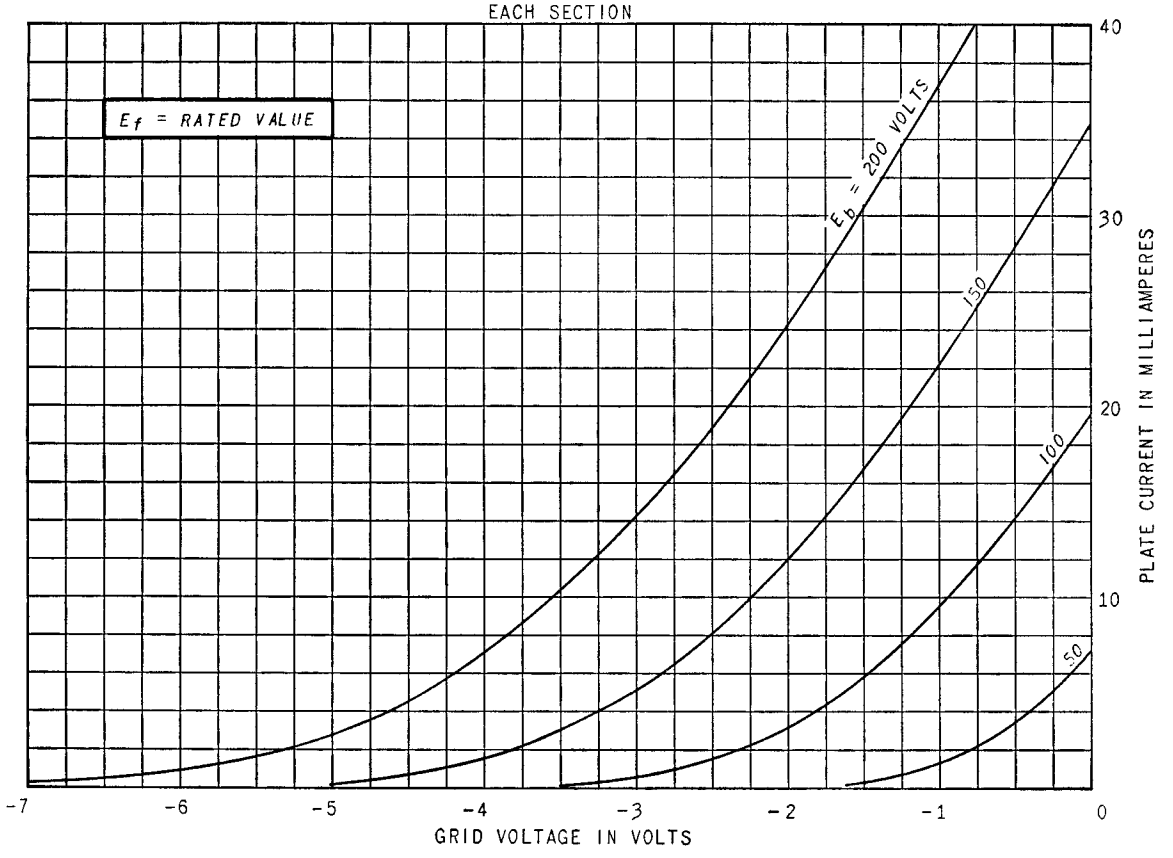
TRANSCONDUCTANCE IN MICROMHOS

14000
12000
10000
8000
6000
4000
2000

-5 -4 -3 -2 -1 0

GRID-NUMBER 1 VOLTAGE IN VOLTS

AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBES

6BU8 — 3BU8 — 4BU8

TWIN PENTODE

DESCRIPTION AND RATING

The 6BU8 is a miniature multisection tube that incorporates separate plates and number-3 grids for the two sections together with a common screen, number-1 grid, and cathode. The tube is intended for use as a combined sync-AGC tube in television receivers. In this service, when used in conjunction with suitable circuitry, one section of the 6BU8 functions as sync separator and sync clipper, while the other section is used to generate the automatic-gain-control voltage. In addition, by utilizing the common number-1 grid, noise pulses can be suppressed from both synchronizing and automatic-gain-control circuits.

Except for heater ratings, the 3BU8 and 4BU8 are identical to the 6BU8. In addition, they incorporate a controlled heater warm-up characteristic which makes them especially suited for use in television receivers that employ series-connected heaters.

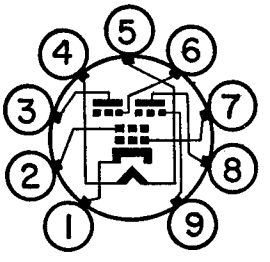
GENERAL

ELECTRICAL	3BU8	4BU8	6BU8	
Cathode—Coated Unipotential				
Heater Voltage, AC or DC	3.15	4.2	6.3 ± 10%	Volts
Heater Current	0.6 ± 6%	0.45 ± 6%	0.3	Amperes
Heater Warm-up Time*	11	11	...	Seconds
Direct Interelectrode Capacitances, approximate†				
Grid-Number 3 to Plate, Each Section			1.9	μμf
Grid-Number 1 to All			6.0	μμf
Grid-Number 3 (Each Section) to All			3.6	μμf
Plate (Each Section) to All			3.0	μμf
Grid-Number 3 (Section 1) to Grid-Number 3 (Section 2), maximum			0.015	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

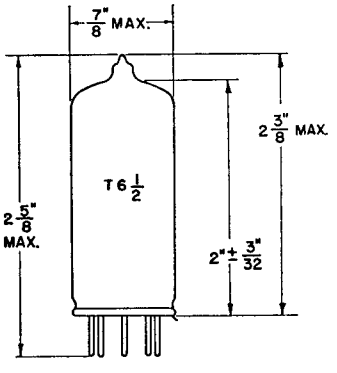


EIA 9FG

TERMINAL CONNECTIONS

Pin 1—Cathode
Pin 2—Grid Number 2 (Screen) and Internal Shield
Pin 3—Plate (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Grid Number 3 (Section 2)
Pin 7—Grid Number 1
Pin 8—Plate (Section 1)
Pin 9—Grid Number 3 (Section 1)

PHYSICAL DIMENSIONS



EIA 6–3

GENERAL ELECTRIC

Supersedes ET-T980, dated 12-55

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage, Each Section	300 Volts
Screen Voltage	150 Volts
Positive DC Grid-Number 3 Voltage, Each Section	3.0 Volts
Negative DC Grid-Number 3 Voltage, Each Section	50 Volts
Peak Positive Grid-Number 3 Voltage, Each Section	50 Volts
Negative DC Grid-Number 1 Voltage	50 Volts
Plate Dissipation, Each Section	1.1 Watts
Screen Dissipation	0.75 Watts
DC Cathode Current	12 Milliamperes
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	
DC Component	100 Volts
Total DC and Peak	200 Volts
Heater Negative with Respect to Cathode	
Total DC and Peak	200 Volts
Grid-Number 1 Circuit Resistance	0.5 Megohms
Grid-Number 3 Circuit Resistance, Each Section	0.5 Megohms

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur. To obtain satisfactory circuit performance, therefore, the equipment designer must establish the circuit design so that no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, BOTH SECTIONS OPERATING

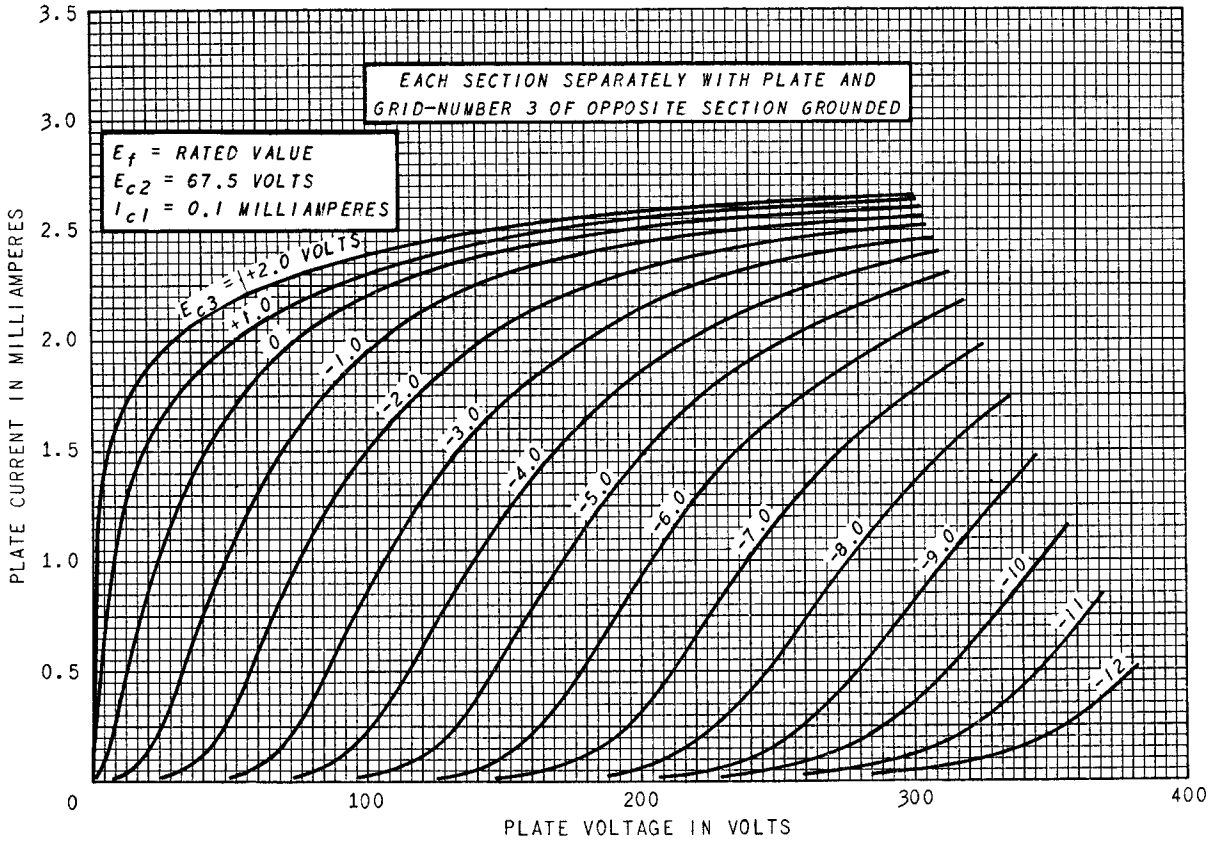
Plate Voltage, Each Section	100	100 Volts
Screen Voltage	67.5	67.5 Volts
Grid-Number 3 Voltage, Each Section	−10	0 Volts
Grid-Number 1 Voltage	‡	‡
Plate Current, Each Section		2.2 Milliamperes
Screen Current	6.5	3.3 Milliamperes
Cathode Current	6.6	7.8 Milliamperes

AVERAGE CHARACTERISTICS, EACH SECTION SEPARATELY WITH PLATE AND GRID-NUMBER 3 OF OPPOSITE SECTION GROUNDED

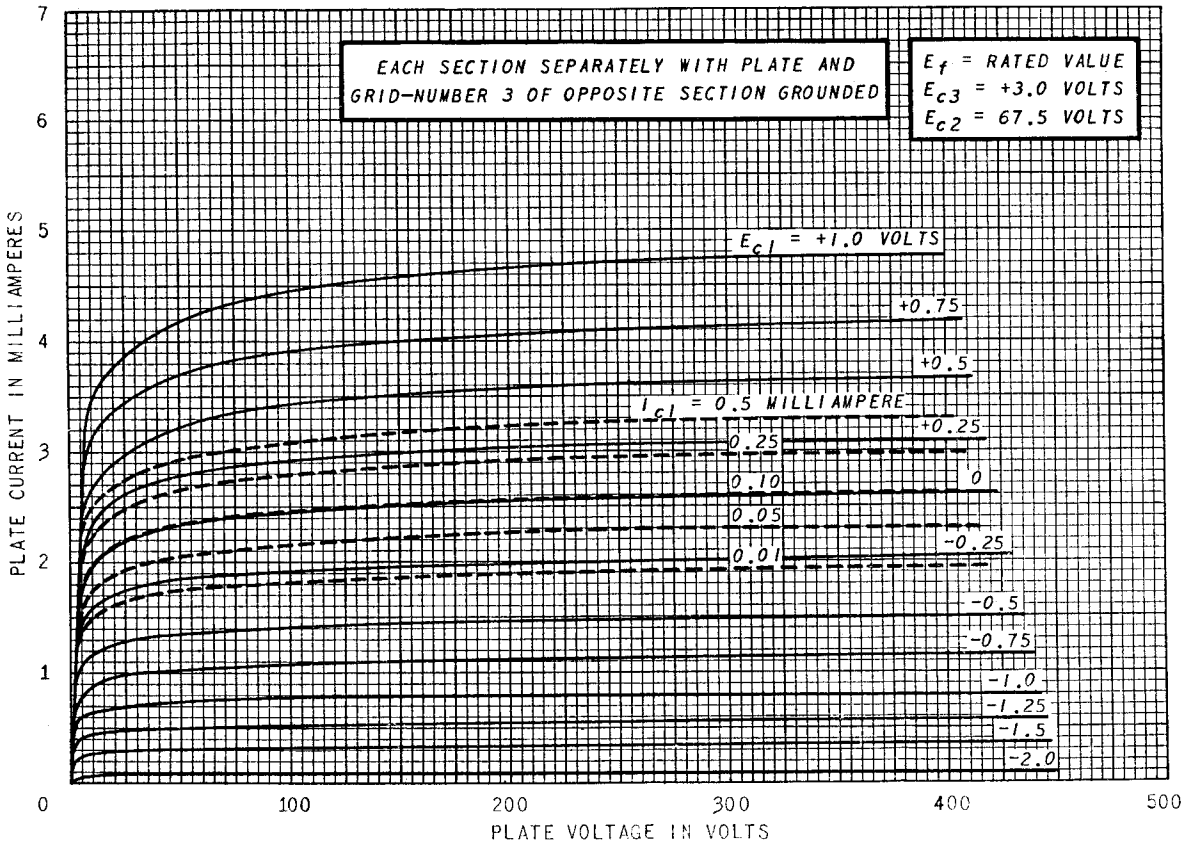
Plate Voltage	100	100 Volts
Screen Voltage	67.5	67.5 Volts
Grid-Number 3 Voltage	0	0 Volts
Grid-Number 1 Voltage	0	‡ Volts
Grid-Number 3 Transconductance		180 Micromhos
Grid-Number 1 Transconductance	1500	. . . Micromhos
Plate Current		2.2 Milliamperes
Grid-Number 3 Voltage, approximate Ib = 100 Microamperes		−4.5 Volts
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes		−2.3 Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.
† Without external shield.
‡ With grid current adjusted for 100 microamperes d-c.

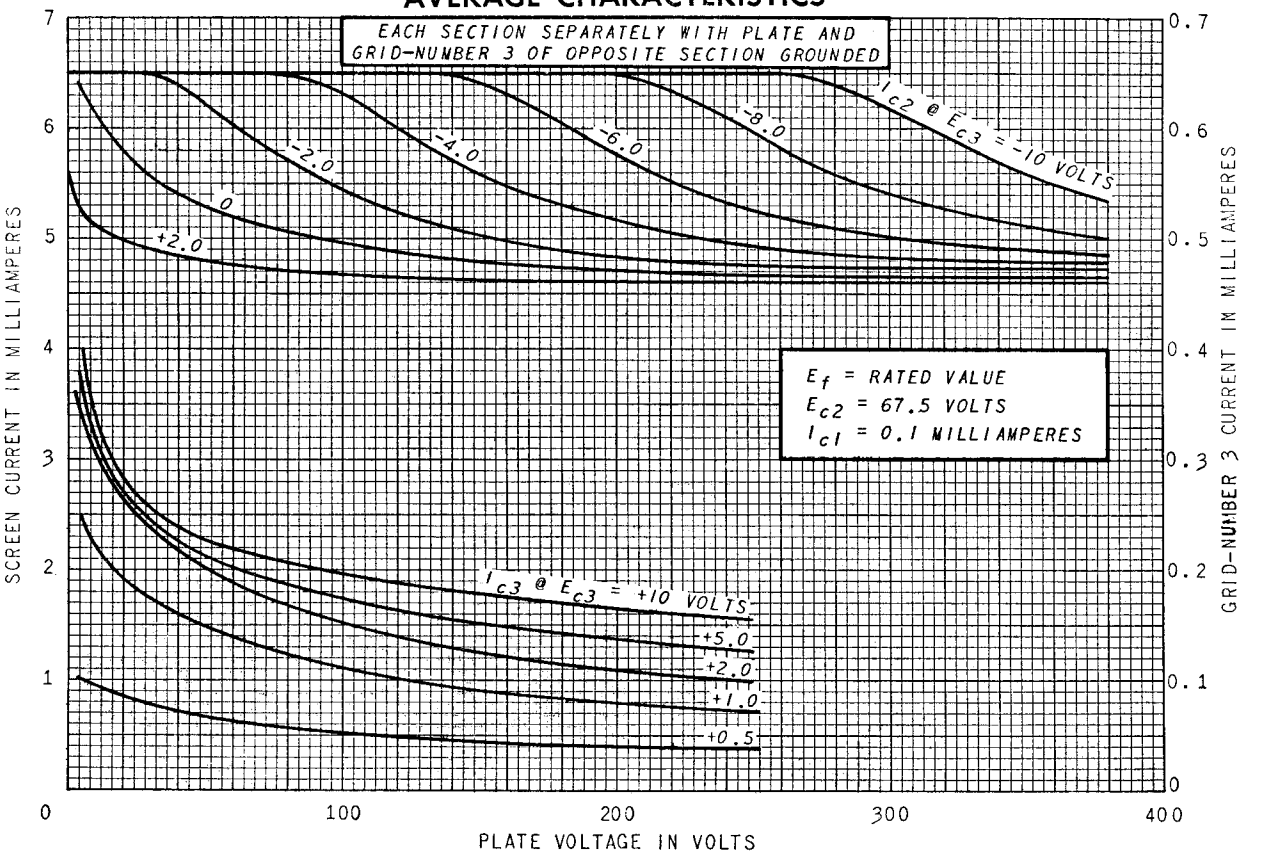
AVERAGE PLATE CHARACTERISTICS



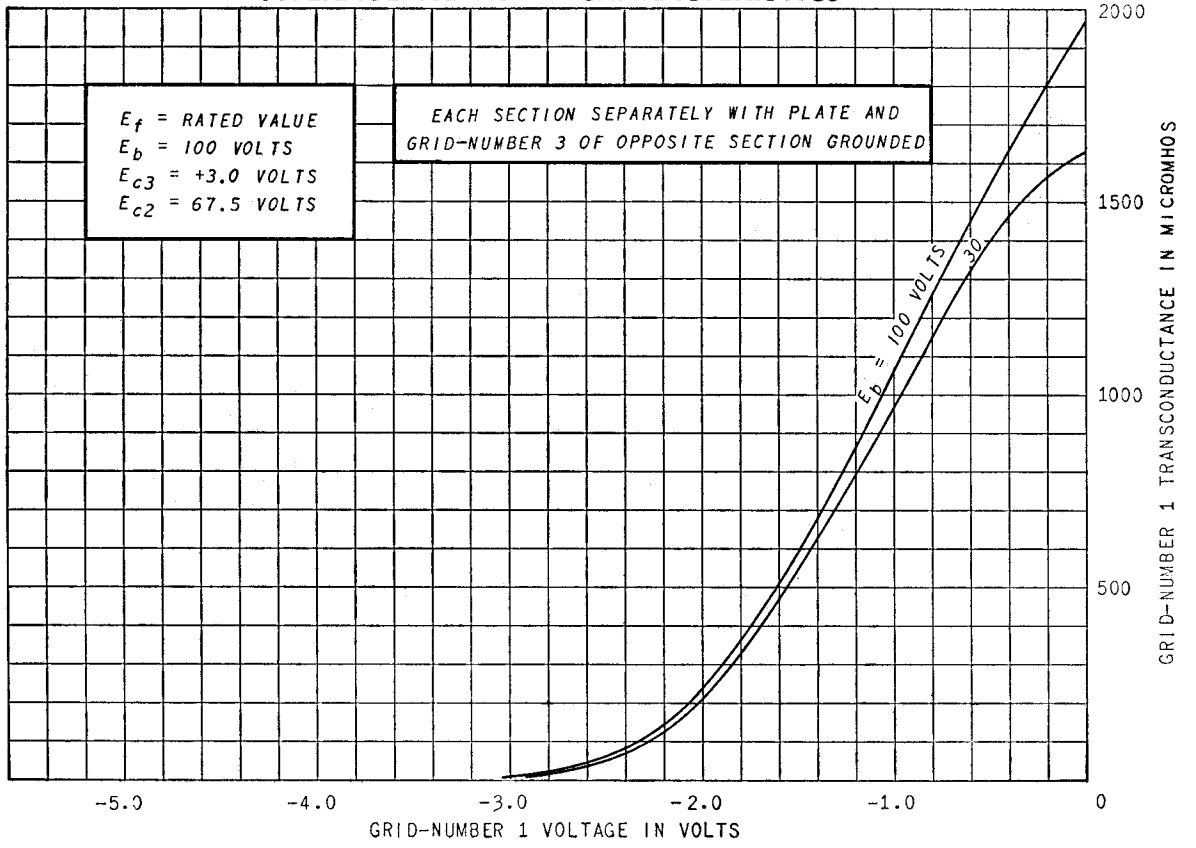
AVERAGE PLATE CHARACTERISTICS



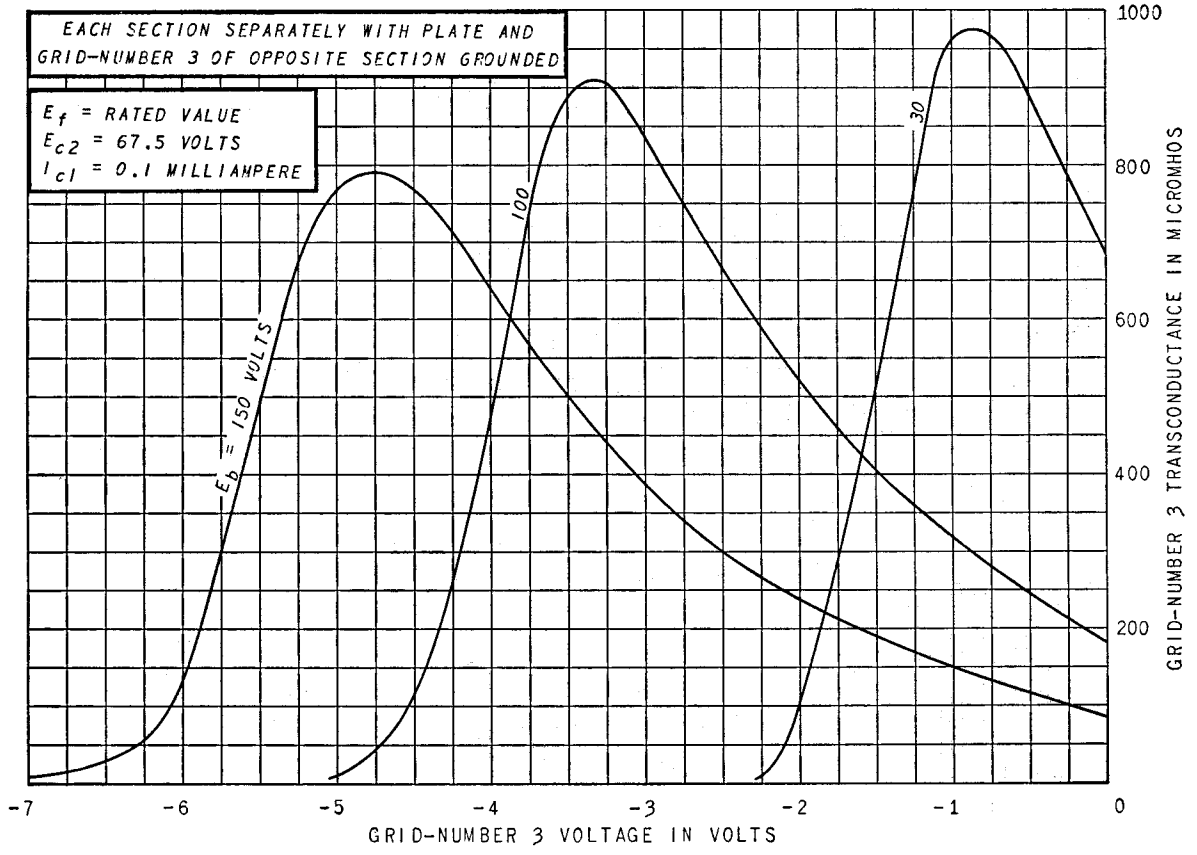
AVERAGE CHARACTERISTICS



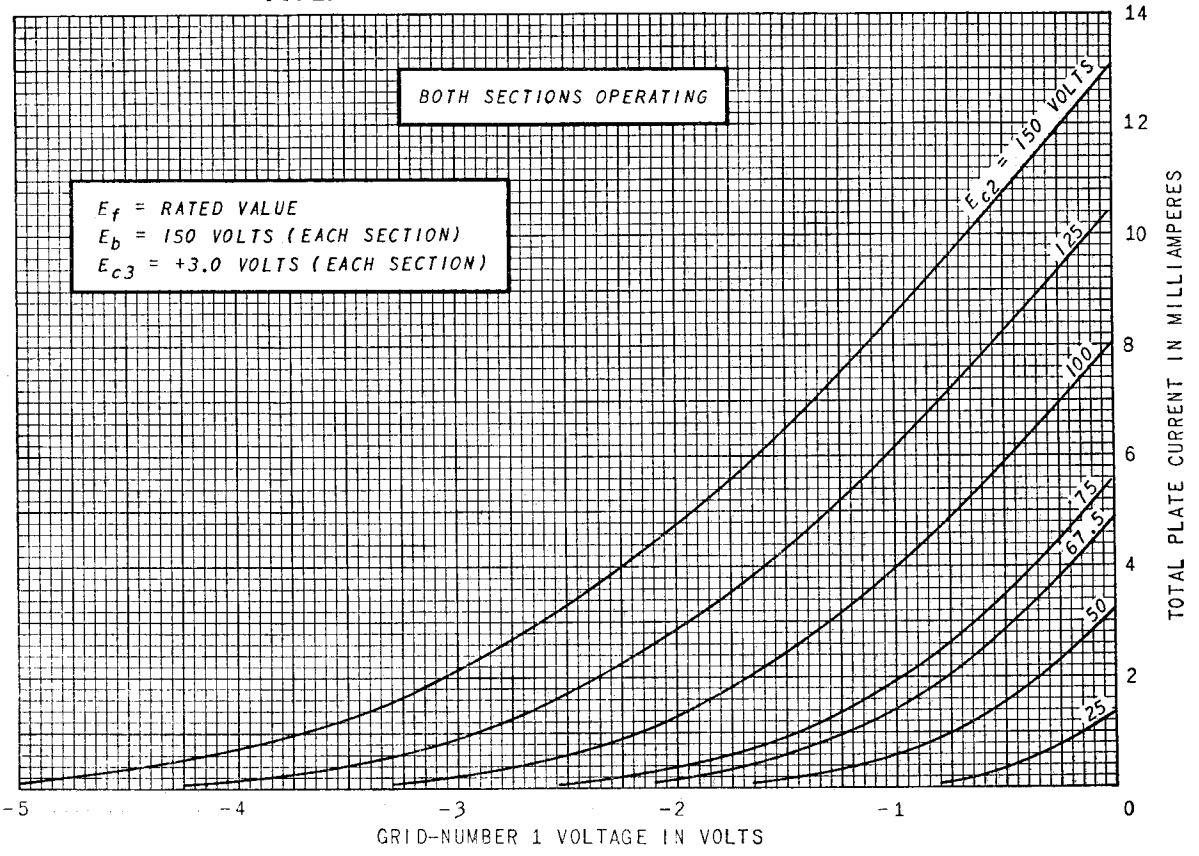
AVERAGE TRANSFER CHARACTERISTICS



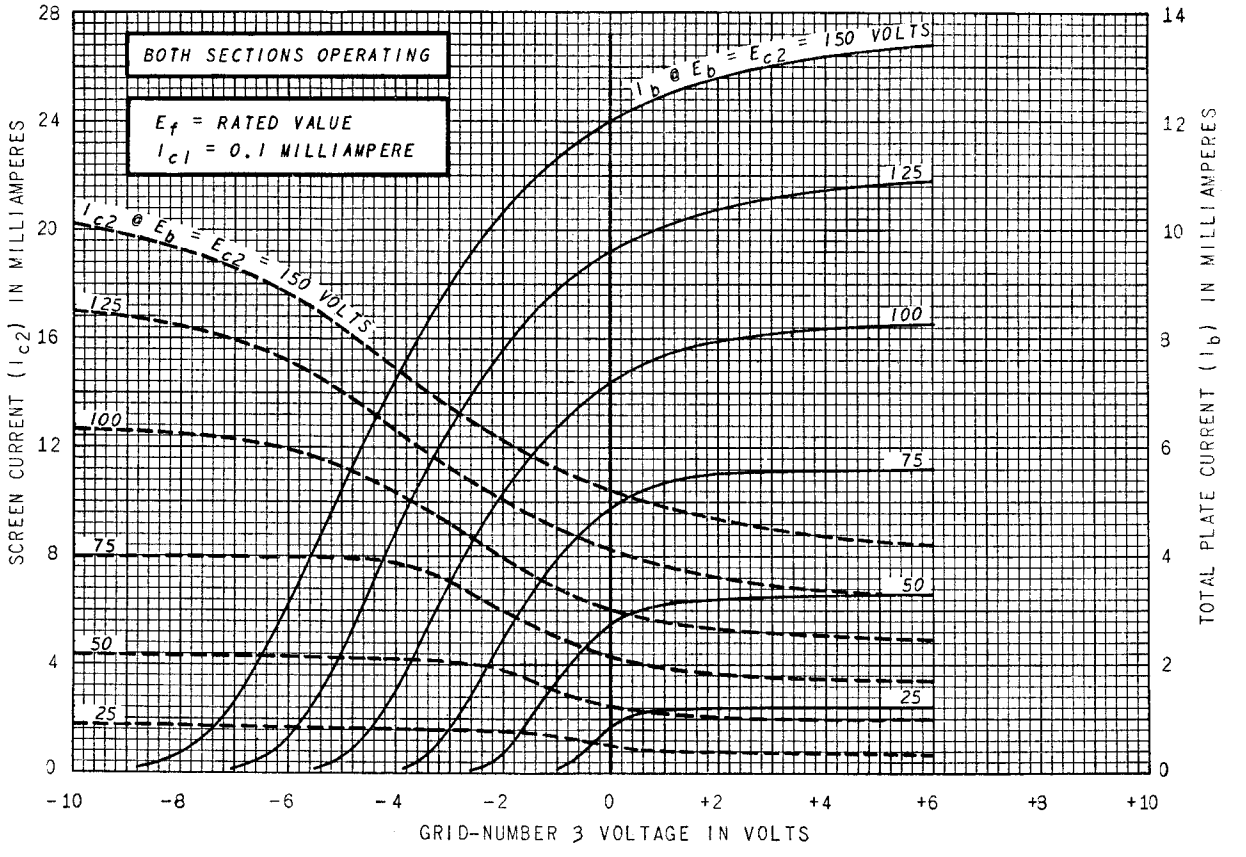
AVERAGE TRANSFER CHARACTERISTICS



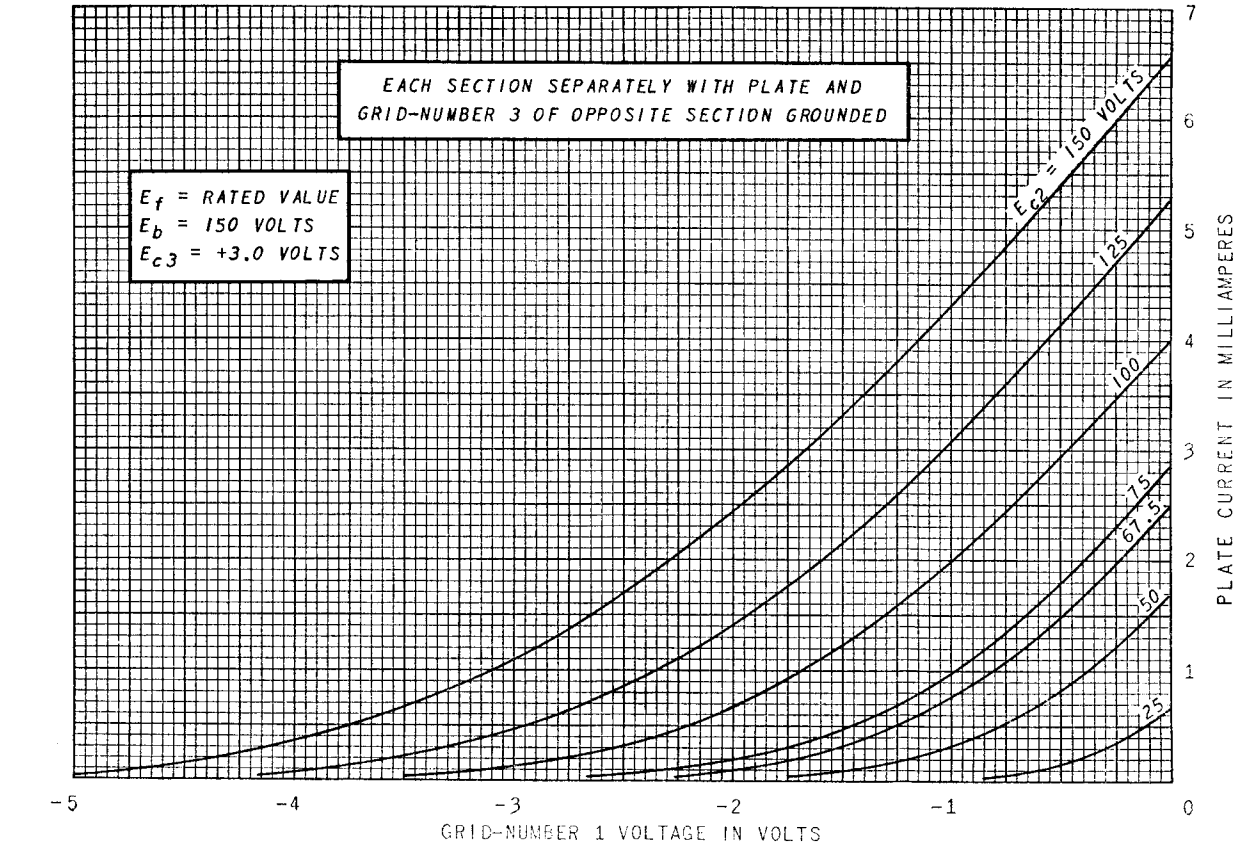
AVERAGE TRANSFER CHARACTERISTICS



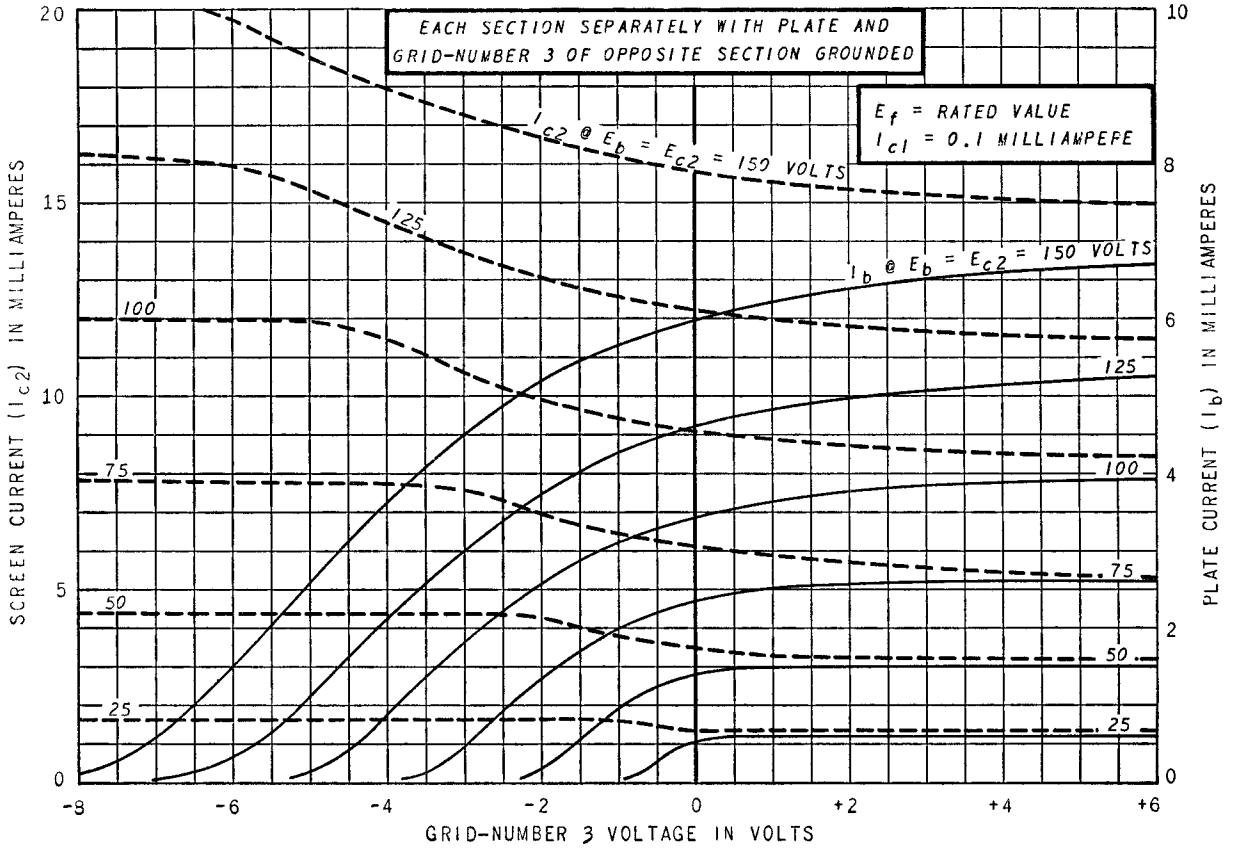
AVERAGE TRANSFER CHARACTERISTICS



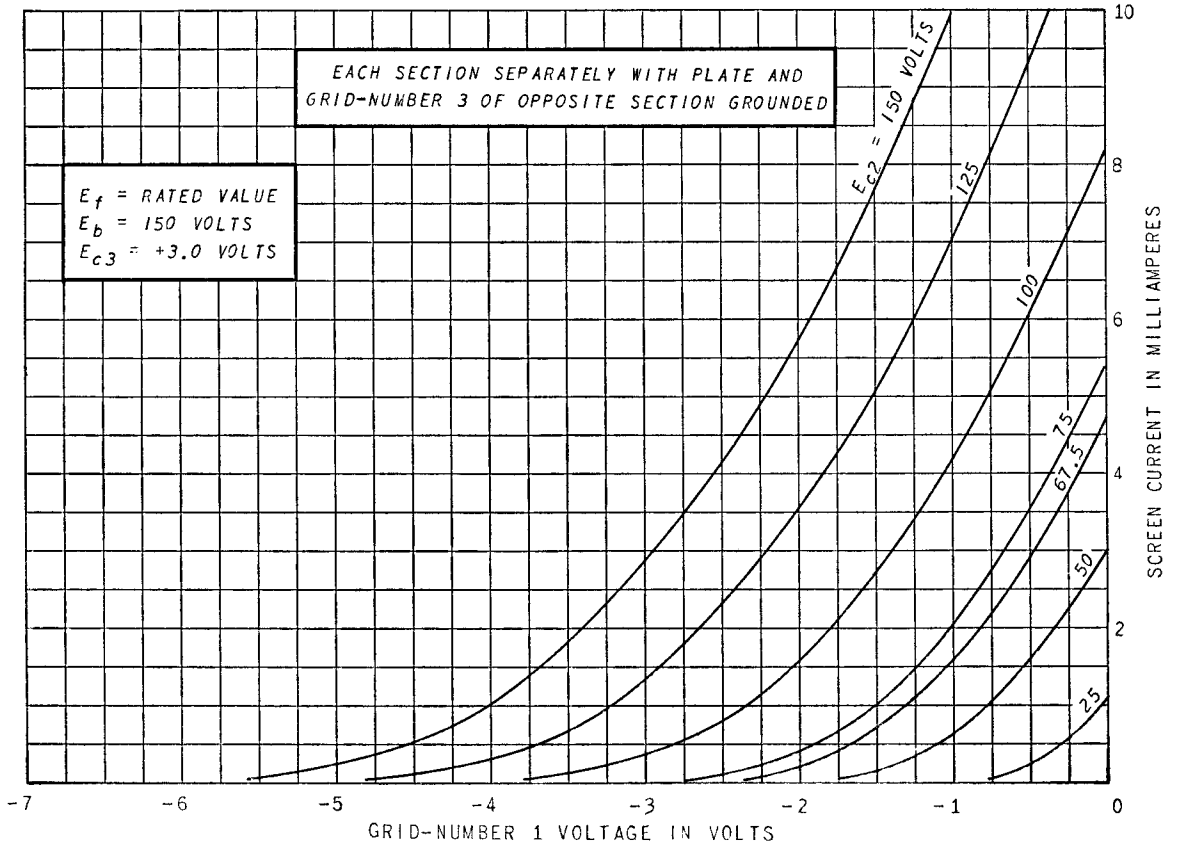
AVERAGE TRANSFER CHARACTERISTICS



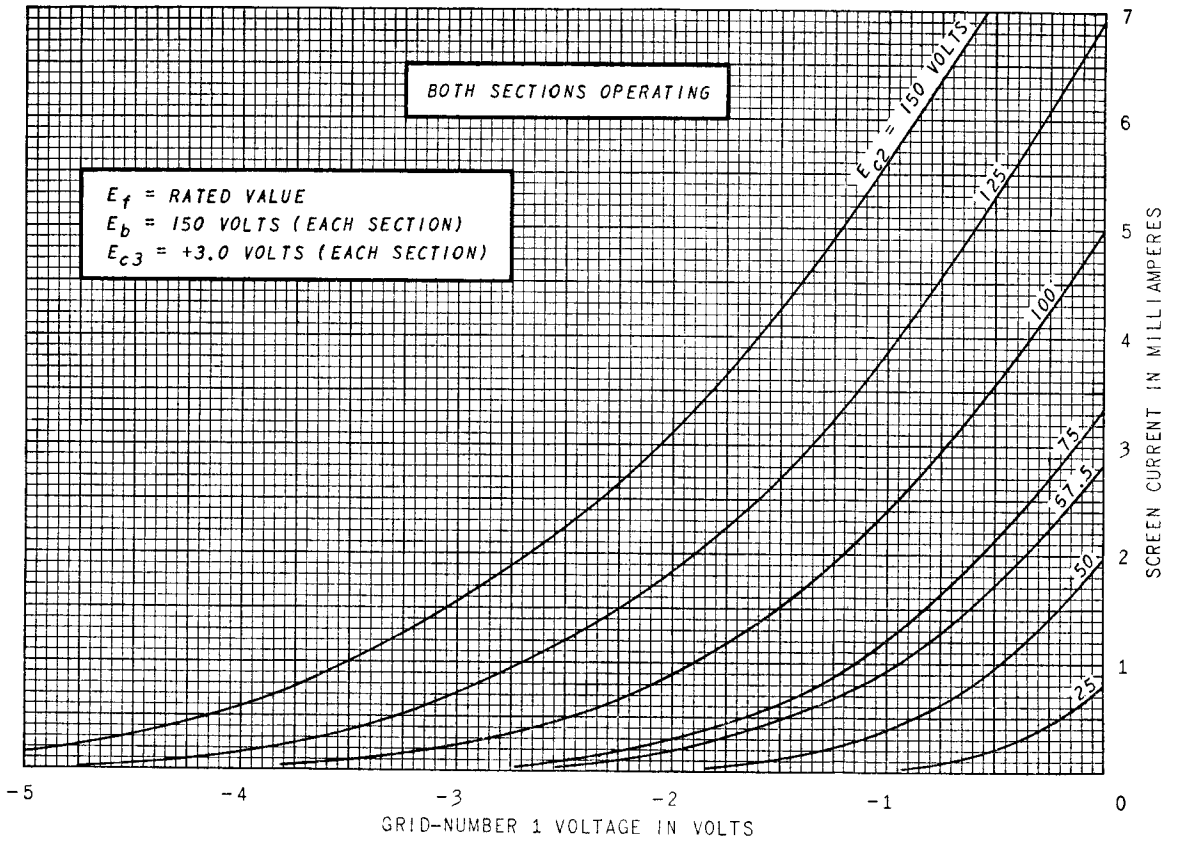
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Compactron Twin Pentode

6BV11

FOR COLOR DEMODULATOR APPLICATIONS

- COLOR TV TYPE
- DUAL-CONTROL
- LOW LEVEL COLOR DEMODULATORS

The 6BV11 is a compactron containing twin, dual-control, sharp-cutoff pentodes designed for use as color demodulators in color television receivers. Grids 1 and 3 may be used as independent control electrodes.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.9	Amperes

Direct Interelectrode Capacitances, Each Section§

Grid-Number 1 to Plate: (g1 to p)	0.10	pf
Grid-Number 3 to Plate: (g3 to p)	3.2	pf
Input: g1 to (h + k + g2 + g3 + i.s.)	7.5	pf
Grid-Number 3 to All: g3 to (h + k + g1 + g2 + p + i.s.)	7.5	pf
Grid-Number 1 to Grid-Number 3: (g1 to g3)	0.10	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

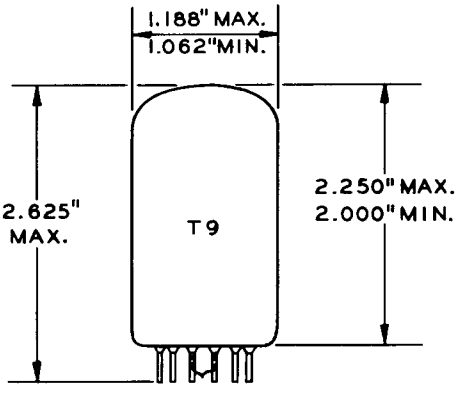
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

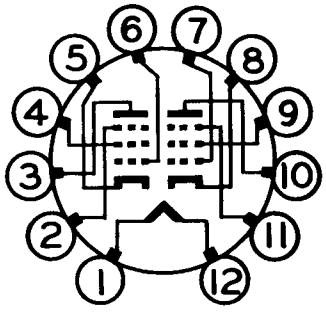


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Grid Number 3 (Suppressor) (Section 2)
Pin 3 - Plate (Section 2)
Pin 4 - Grid Number 2 (Screen) (Section 2)
Pin 5 - Cathode (Section 2)
Pin 6 - Grid Number 1 (Section 2)
Pin 7 - Grid Number 1 (Section 1)
Pin 8 - Cathode (Section 1)
Pin 9 - Grid Number 2 (Screen) (Section 1)
Pin 10 - Plate (Section 1)
Pin 11 - Grid Number 3 (Suppressor) (Section 1)
Pin 12 - Heater and Internal Shield

BASING DIAGRAM



EIA 12HB

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	300	Volts
Grid-Number 3 Voltage		
Positive Value (DC and Peak)	25	Volts
Negative Value (DC and Peak)	100	Volts
Screen-Supply Voltage	300	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
Plate Dissipation	1.7	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.22	Megohms
With Cathode Bias	0.47	Megohms
Grid-Number 3 Circuit Resistance	0.68	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

Plate Supply Voltage	150	Volts
Grid-Number 3 Supply Voltage	0	Volts
Screen Supply Voltage	100	Volts
Cathode-Bias Resistor	180	Ohms
Amplification Factor, Grid-Number 3 to Plate	70	
Plate Resistance, approximate	0.2	Megohms
Transconductance, Grid-Number 1 to Plate	3700	Micromhos
Transconductance, Grid-Number 3 to Plate	400	Micromhos
Plate Current	3.6	Milliamperes
Screen Current	2.0	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 75 Microamperes	-3.0	Volts
Grid-Number 3 Voltage, approximate		
Ib = 85 Microamperes	-5.5	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

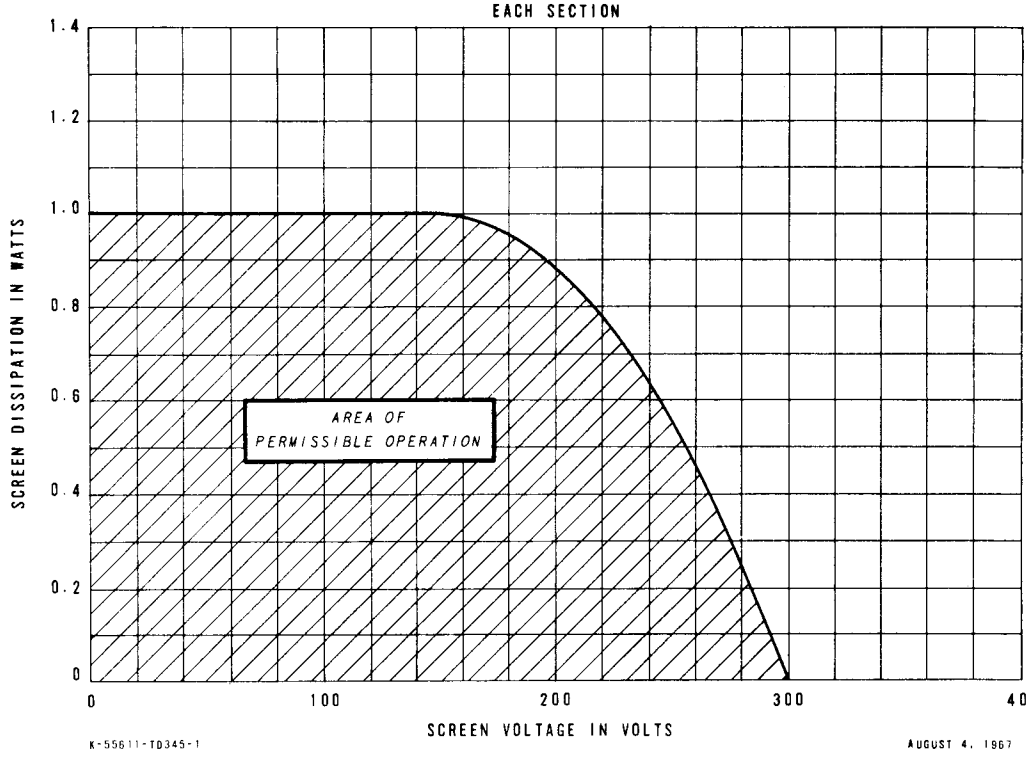
‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

SCREEN RATING CHART

EACH SECTION

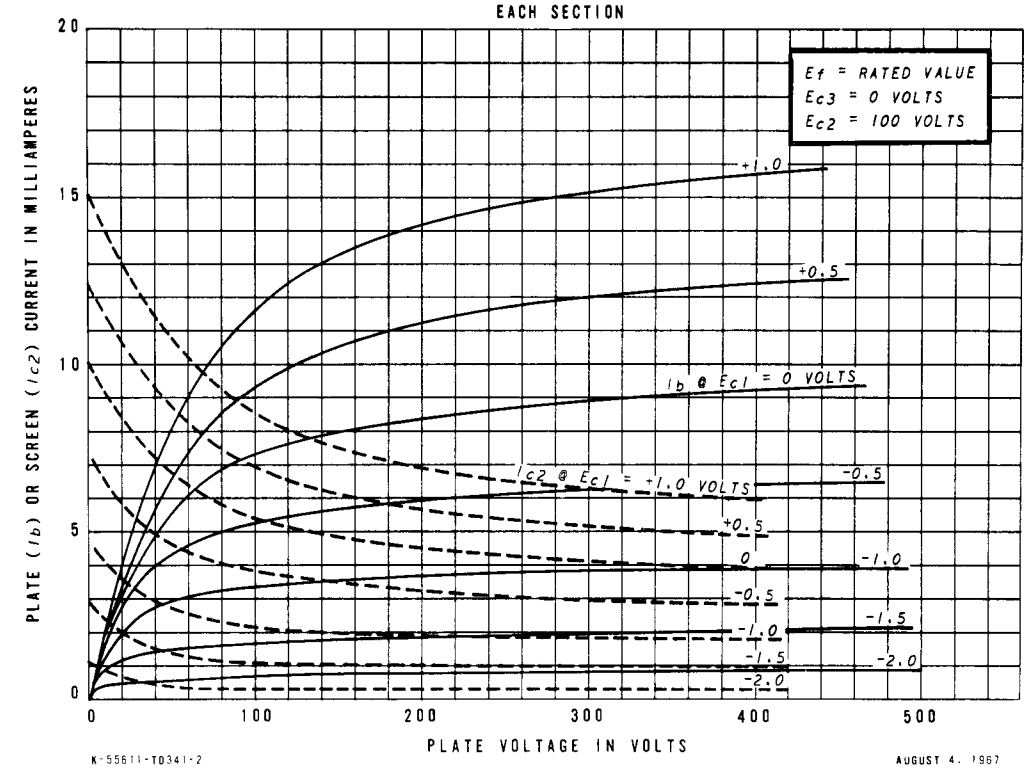


K-55611-TD345-1

AUGUST 4, 1967

AVERAGE PLATE CHARACTERISTICS

EACH SECTION

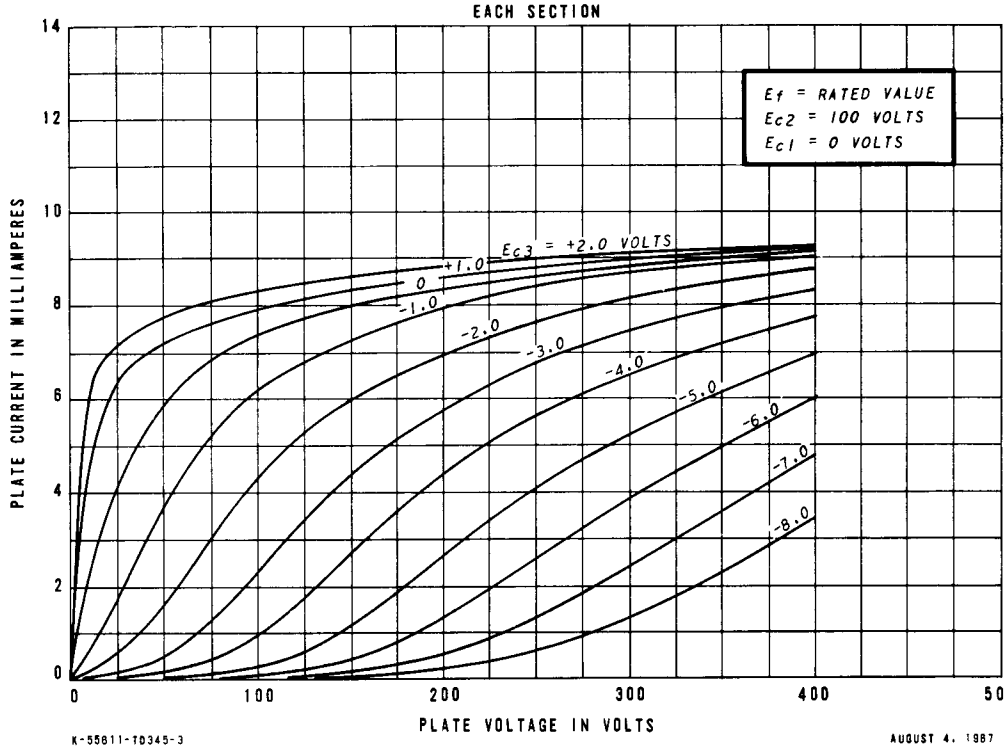


K-55611-TD341-2

AUGUST 4, 1967

AVERAGE PLATE CHARACTERISTICS

EACH SECTION

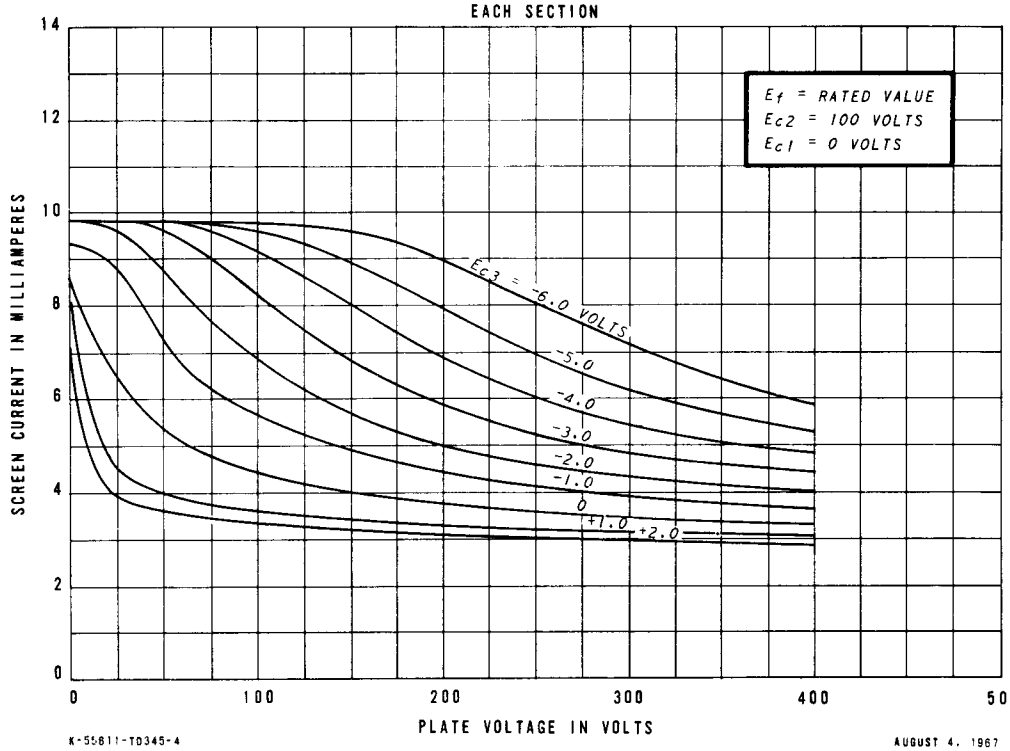


K-55811-TD345-3

AUGUST 4, 1967

AVERAGE CHARACTERISTICS

EACH SECTION

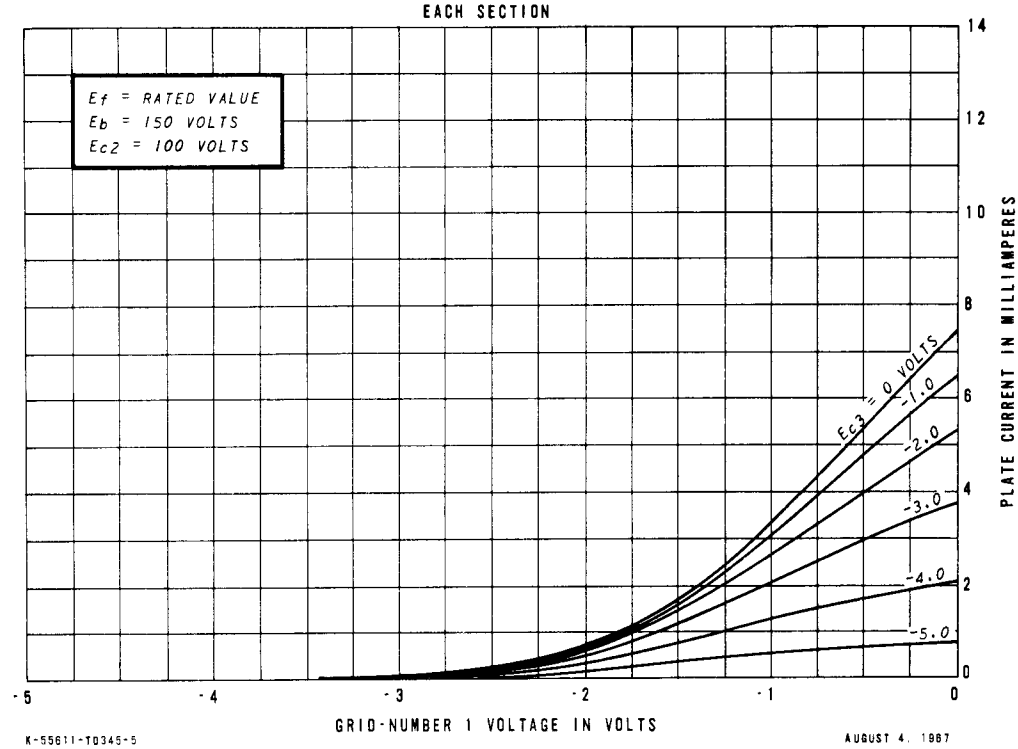


K-55811-TD345-4

AUGUST 4, 1967

AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION

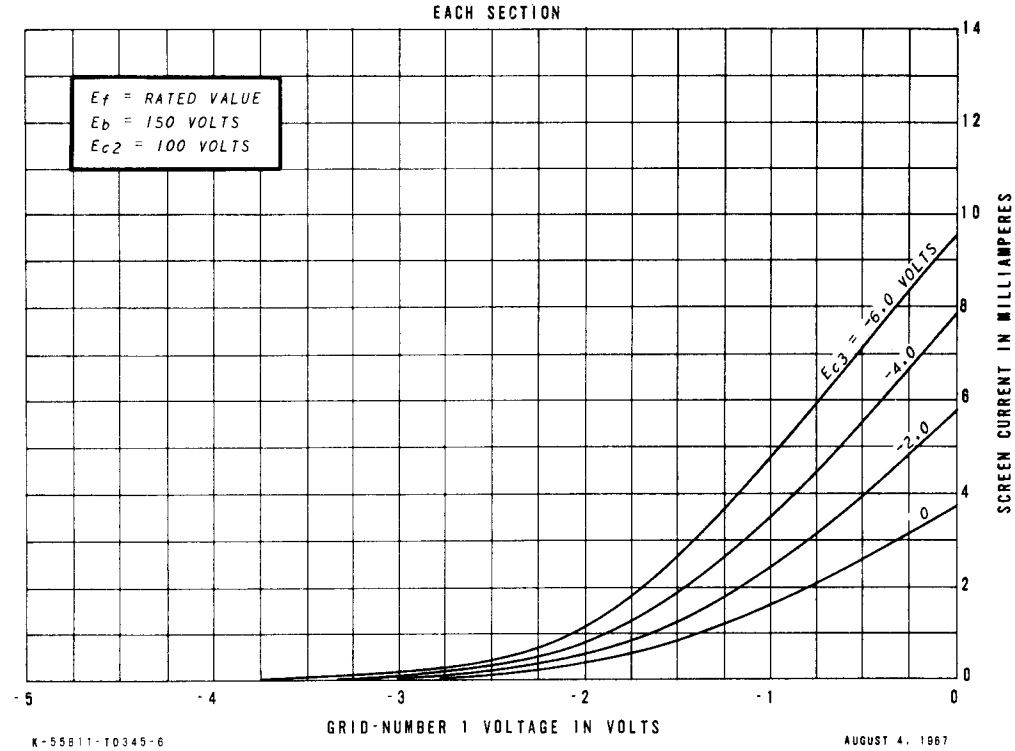


K-55611-T0345-5

AUGUST 4, 1967

AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION



K-55611-T0345-6

AUGUST 4, 1967

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

6BV8

DUPLEX-DIODE TRIODE

DESCRIPTION AND RATING

The 6BV8 is a miniature duplex-diode medium-mu triode in which separate cathode and plate connections are provided for each diode section. The tube is intended primarily for service as a combined synchronous detector and chrominance amplifier in color television receivers. The high perveance characteristic of the triode section adapts the tube particularly to this service. It is also suitable for use as a combined FM detector and audio-frequency voltage amplifier.

The 6BV8 is especially suited for use where series-connected heaters are employed since it has a 600-milliampere heater current and a controlled heater warm-up characteristic.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ± 10% Volts
Heater Current	0.6 Amperes
Heater Warm-up Time*	11 Seconds
Direct Interelectrode Capacitances†	
Triode Grid to Plate	2.0 μμf
Triode Input	3.6 μμf
Triode Output	0.4 μμf
Grid to Diode-Number 1 Plate, maximum	0.03 μμf
Grid to Diode-Number 2 Plate, maximum	0.07 μμf
Diode-Number 1 Plate to Diode-Number 1 Cathode and Heater	2.4 μμf
Diode-Number 2 Plate to Diode-Number 2 Cathode and Heater	2.4 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

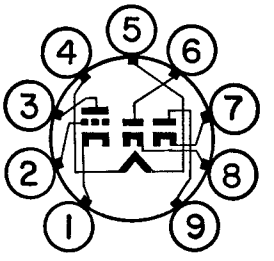
DESIGN-MAXIMUM VALUES

Plate Voltage	330 Volts
Positive DC Grid Voltage	0 Volts
Plate Dissipation	2.7 Watts
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	
DC Component	100 Volts
Total DC and Peak	200 Volts
Heater Negative with Respect to Cathode	
Total DC and Peak	200 Volts
Grid Circuit Resistance	
With Fixed Bias	0.1 Megohms
With Cathode Bias	0.5 Megohms
Diode Current for Continuous Operation, Each Diode	10 Milliamperes

Design-Maximum Ratings are the limiting values, expressed with respect to bogie tubes, at which satisfactory tube life can be expected to occur. To obtain satisfactory circuit performance, therefore, the equipment designer must establish the circuit design so that no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to the combined effect of supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

GENERAL ELECTRIC

BASING DIAGRAM

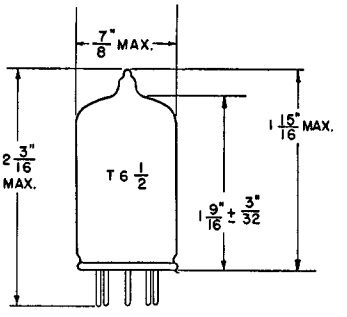


RETMA 9FJ

TERMINAL CONNECTIONS

Pin 1—Triode Cathode
Pin 2—Triode Grid
Pin 3—Triode Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Diode Number 2 Plate
Pin 7—Diode Number 1 Cathode
Pin 8—Diode Number 2 Cathode
Pin 9—Diode Number 1 Plate

PHYSICAL DIMENSIONS



RETMA 6-2

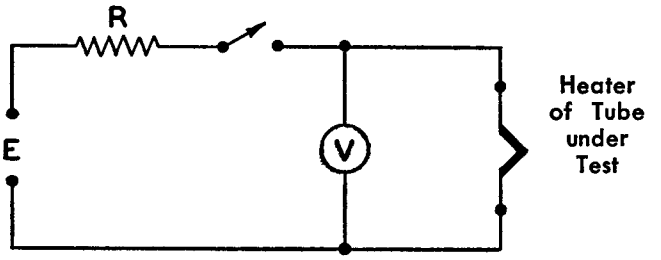
CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	75	200 Volts
Grid Voltage	0	... Volts
Cathode-Bias Resistor	..	330 Ohms
Amplification Factor	..	33
Plate Resistance, approximate	..	5900 Ohms
Transconductance	..	5600 Micromhos
Plate Current	14	11 Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes	..	−11 Volts
Average Diode Current, Each Diode With 5.0 Volts DC Applied		23 Milliamperes

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals (V) to increase from zero to the heater test voltage (V_1). For this type, E = 25.0 volts (RMS or DC), V_1 = 5.00 volts (RMS or DC), and R = 31.5 ohms.

† Without external shield.



CLASS A RESISTANCE-COUPLED AMPLIFIER

TRIODE SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

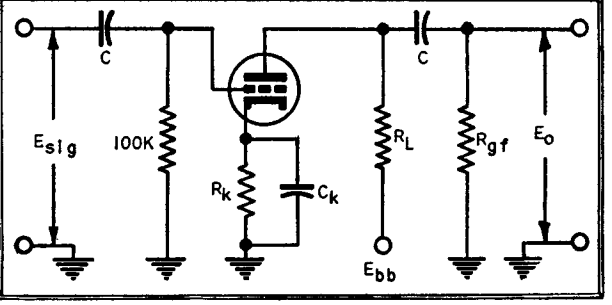
R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	1600	7.5	18	1500	16	20	1500	28	21
0.10	0.24	1900	7.8	19	1900	22	21	1900	38	21
0.24	0.24	4200	9.4	18	3600	19	19	3600	33	20
0.24	0.51	5100	12	19	4300	26	20	4200	42	22
0.51	0.51	9200	10	18	7800	22	19	7500	36	20
0.51	1.0	11000	13	18	10000	28	19	9400	46	20

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2000	11	17	1400	24	20	1100	39	22
0.10	0.24	2500	15	18	1800	31	21	1600	53	22
0.24	0.24	5300	13	18	3700	28	20	3200	45	21
0.24	0.51	6100	16	18	4700	33	20	4100	57	21
0.51	0.51	8100	14	17	8000	28	19	7100	48	20
0.51	1.0	13000	17	18	10000	34	19	9300	59	20

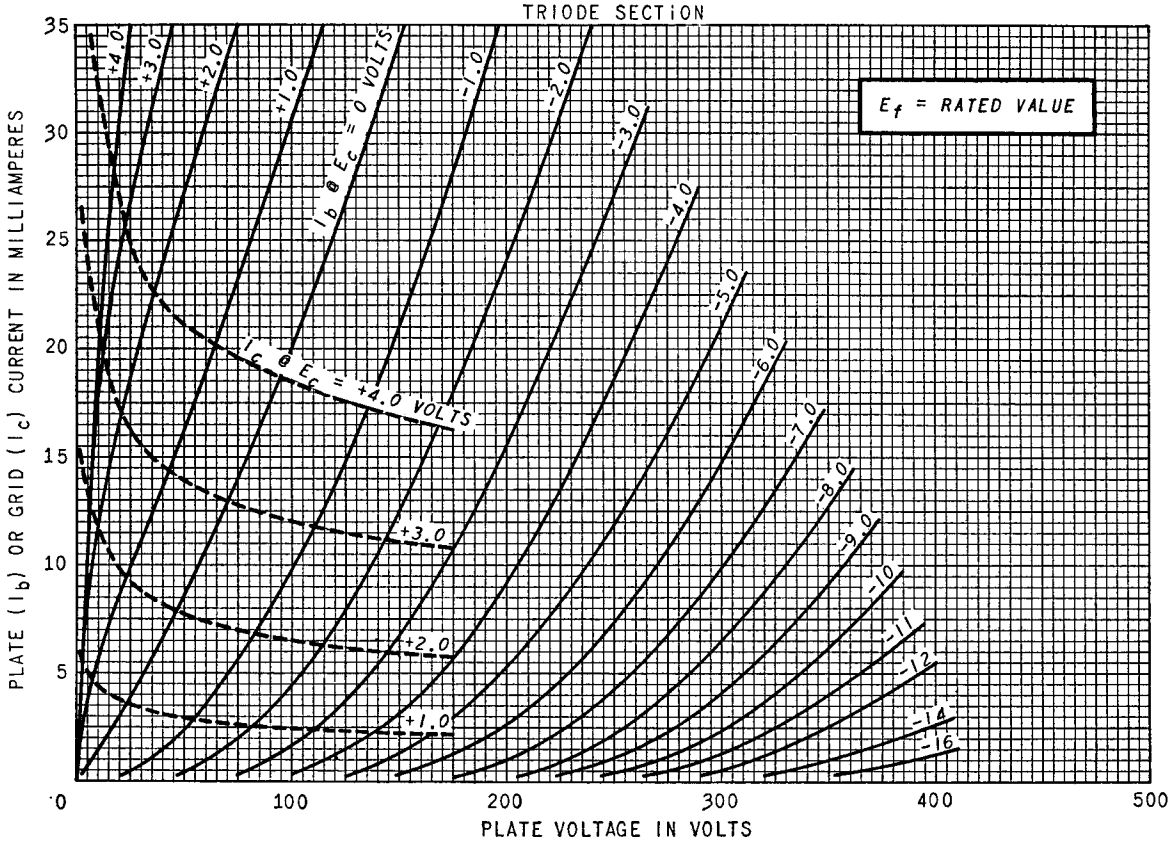
Notes:

1. E_o is maximum RMS voltage output for approximately five percent total harmonic distortion.
2. Gain is measured for an output voltage of two volts RMS.
3. R_k is in ohms; R_L and R_{gf} are in megohms.
4. Coupling capacitors (C) should be selected to give desired frequency response. R_k should be adequately by-passed.



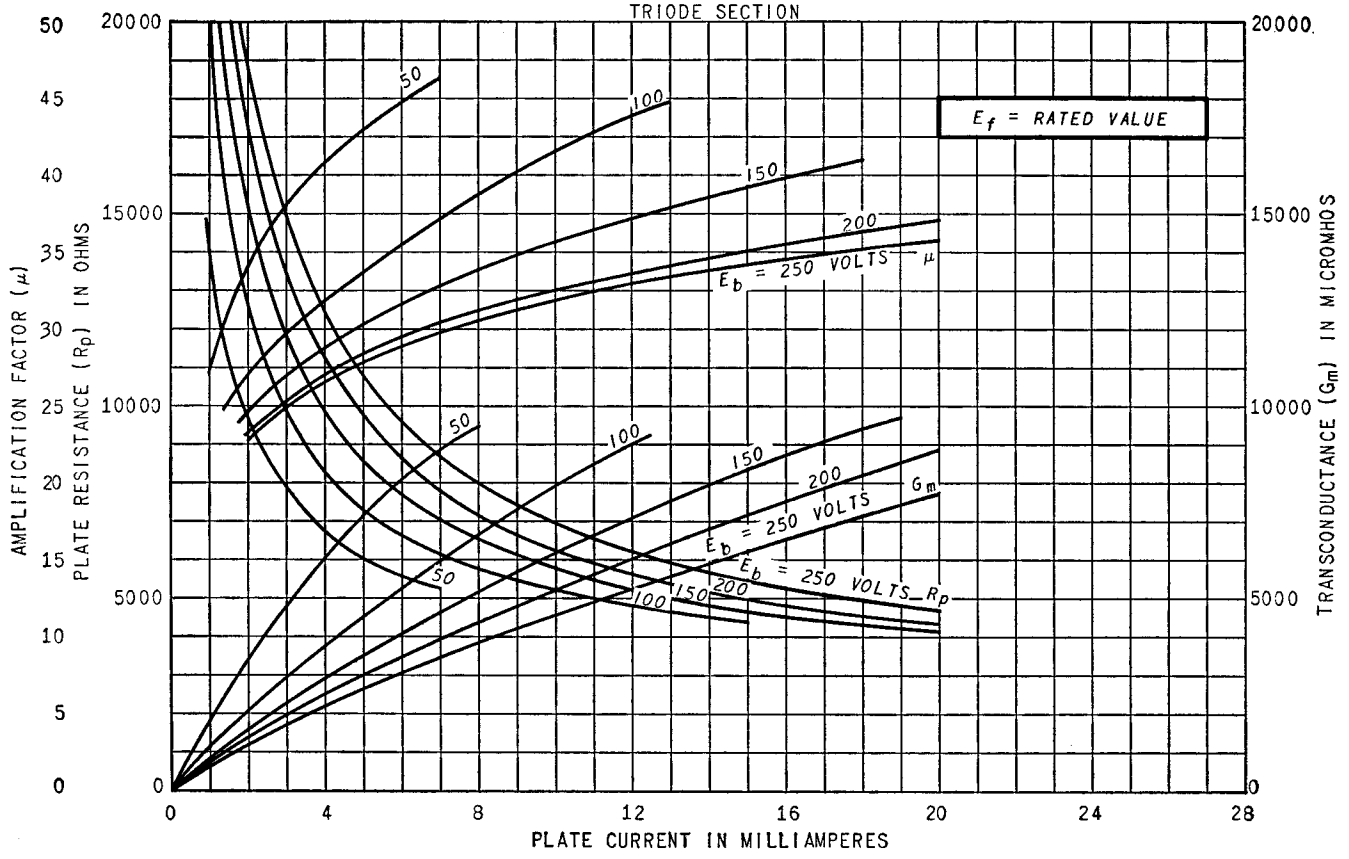
AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION

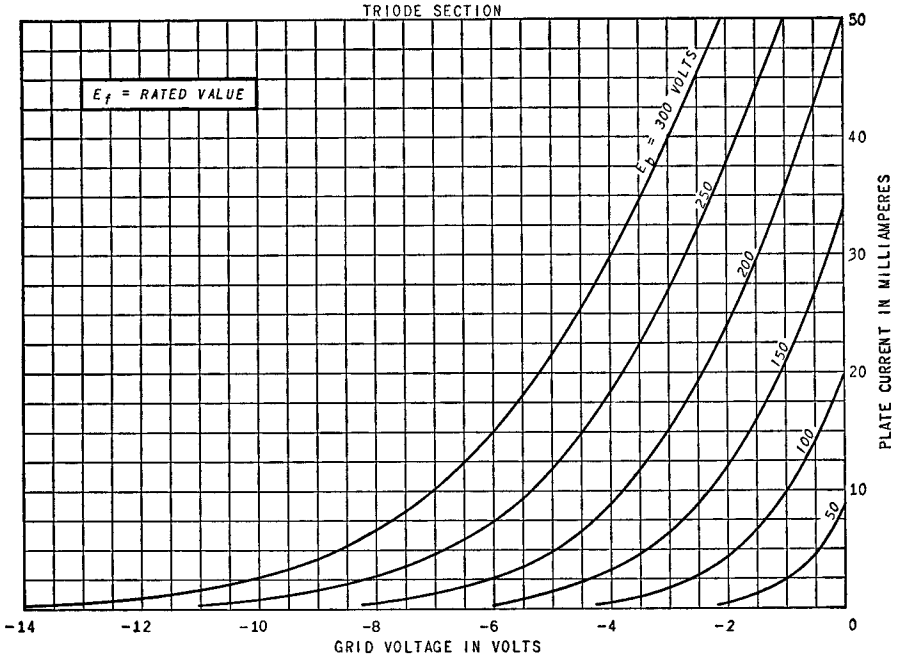


AVERAGE CHARACTERISTICS

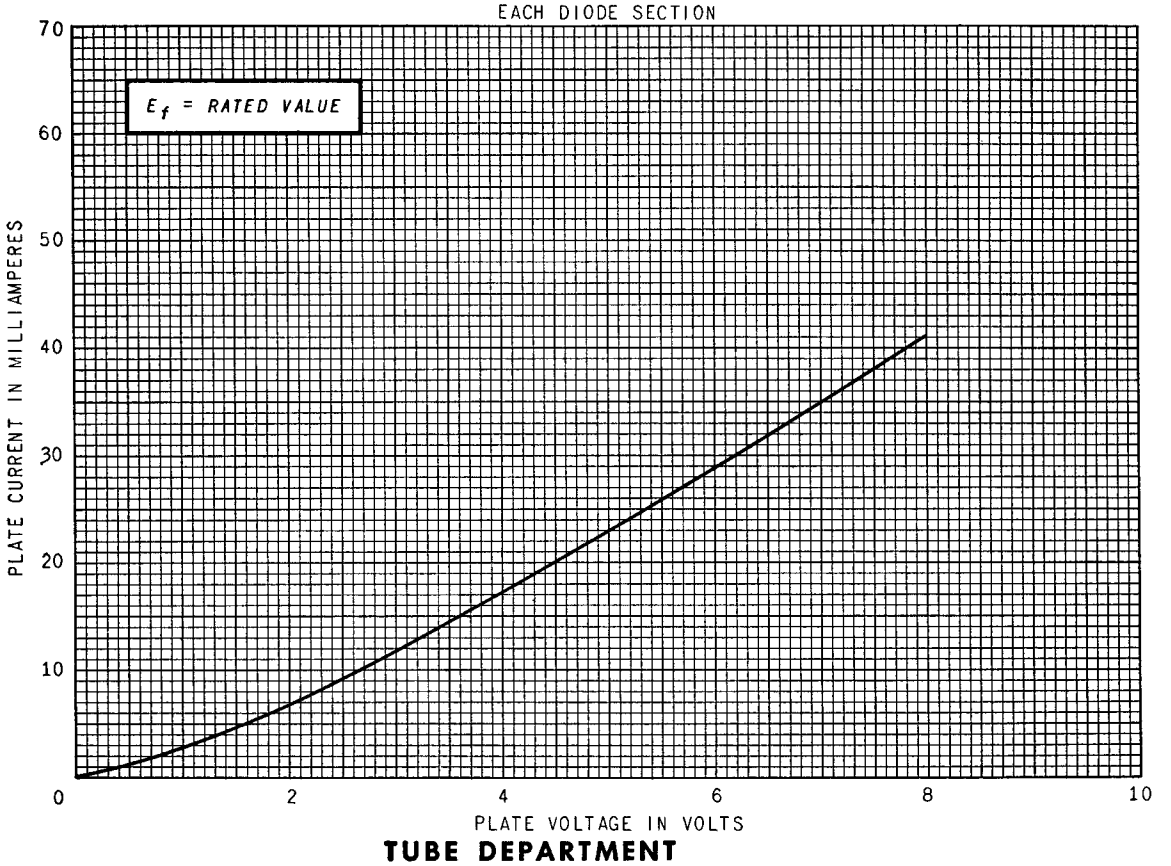
TRIODE SECTION



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Compactron Dissimilar Double Pentode

6BW11

● COLOR TV TYPE ● MULTI-FUNCTION ● FIRST VIDEO AMPLIFIER ● BANDPASS AMPLIFIER

The 6BW11 is a compactron containing two dissimilar sharp-cutoff pentodes. Section 1 is a medium performance video amplifier useful for reference frequency or first video amplifier applications in color television receivers. It has characteristics similar to the 6AU8 pentode. Section 2 features a high transconductance and is useful for bandpass amplifier, burst amplifier, sound IF or video IF applications in color television receivers. It is generally equivalent to the 6EW6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.8	Amperes

Direct Interelectrode Capacitances§

Section 1

Grid-Number 1 to Plate: (1g1 to 1p)	0.03	pf
Input: 1g1 to (h + 1k + 1g2 + 1g3 + 2g3 + i.s.)	7.5	pf
Output: 1p to (h + 1k + 1g2 + 1g3 + 2g3 + i.s.)	2.8	pf

Section 2

Grid-Number 1 to Plate: (2g1 to 2p)	0.03	pf
Input: 2g1 to (h + 2k + 2g2 + 2g3 + 1g3 + i.s.)	12	pf
Output: 2p to (h + 2k + 2g2 + 2g3 + 1g3 + i.s.)	2.8	pf

Coupling

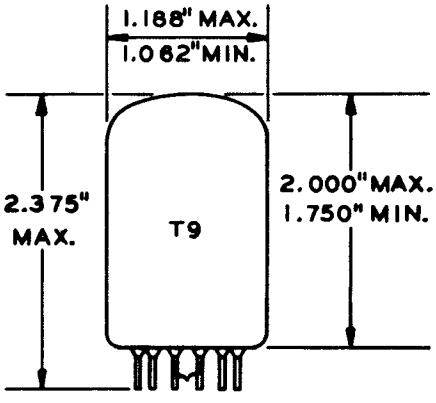
Cathode, Section 1 to Cathode, Section 2: (1k to 2k), maximum¶	0.003	pf
Grid-Number 1, Section 1 to Plate, Section 2: (1g1 to 2p), maximum	0.004	pf
Grid-Number 1, Section 2 to Plate, Section 1: (2g1 to 1p), maximum	0.003	pf
Plate, Section 1 to Plate, Section 2: (1p to 2p), maximum	0.018	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

PHYSICAL DIMENSIONS

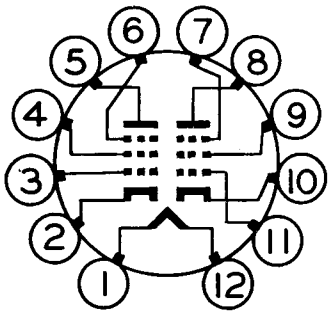


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode (Section 2)
Pin 3 - Grid Number 1 (Section 2)
Pin 4 - Grid Number 2 (Screen) (Section 2)
Pin 5 - Plate (Section 2)
Pin 6 - Grid Number 3 (Suppressor) and Internal Shield (Section 2)
Pin 7 - Grid Number 3 (Suppressor) and Internal Shield (Section 1)
Pin 8 - Plate (Section 1)
Pin 9 - Grid Number 2 (Screen) (Section 1)
Pin 10 - Cathode (Section 1)
Pin 11 - Grid Number 1 (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12HD

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Section 1	Section 2	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	330	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	4.0	3.1	Watts
Screen Dissipation	0.8	0.65	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Cathode Bias	0.25	0.25	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Section 1	Section 2	
Plate Voltage	125	125	Volts
Suppressor, Connected to Cathode at Socket			
Screen Voltage	125	125	Volts
Cathode-Bias Resistor	56	56	Ohms
Plate Resistance, approximate	0.12	0.2	Megohms
Transconductance	8500	13000	Micromhos
Plate Current	22	11	Milliamperes
Screen Current	4.8	3.8	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 20 Microamperes	-9.5	-3	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

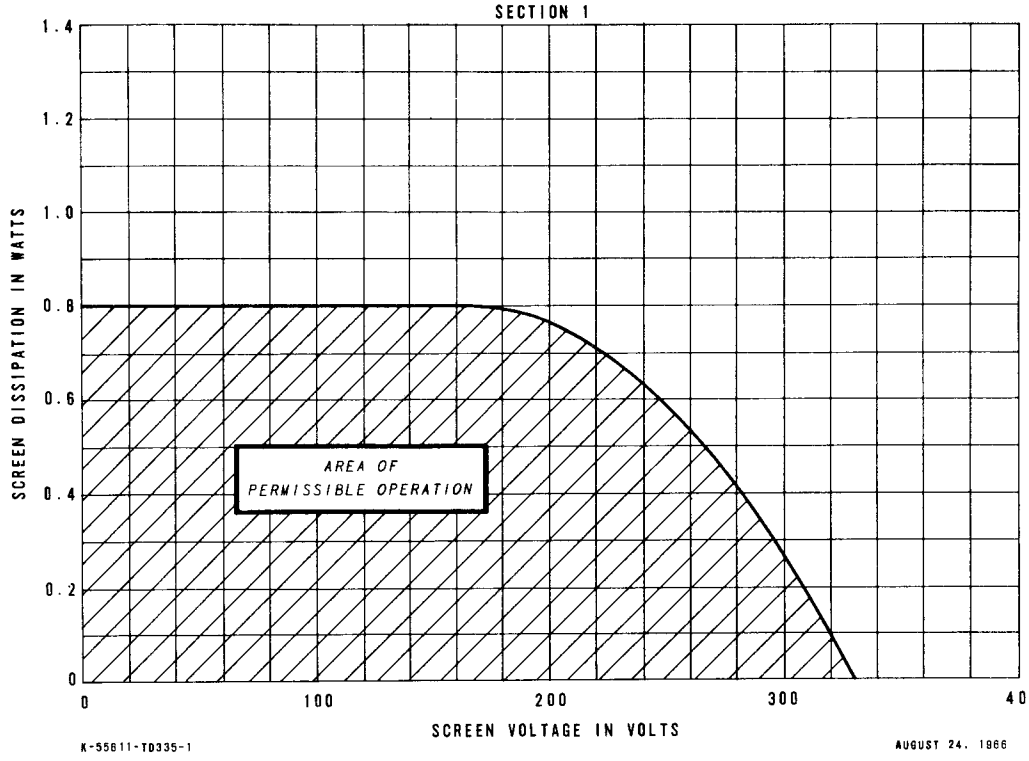
‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ With external shield (EIA 309) connected to cathode of section under test unless otherwise indicated.

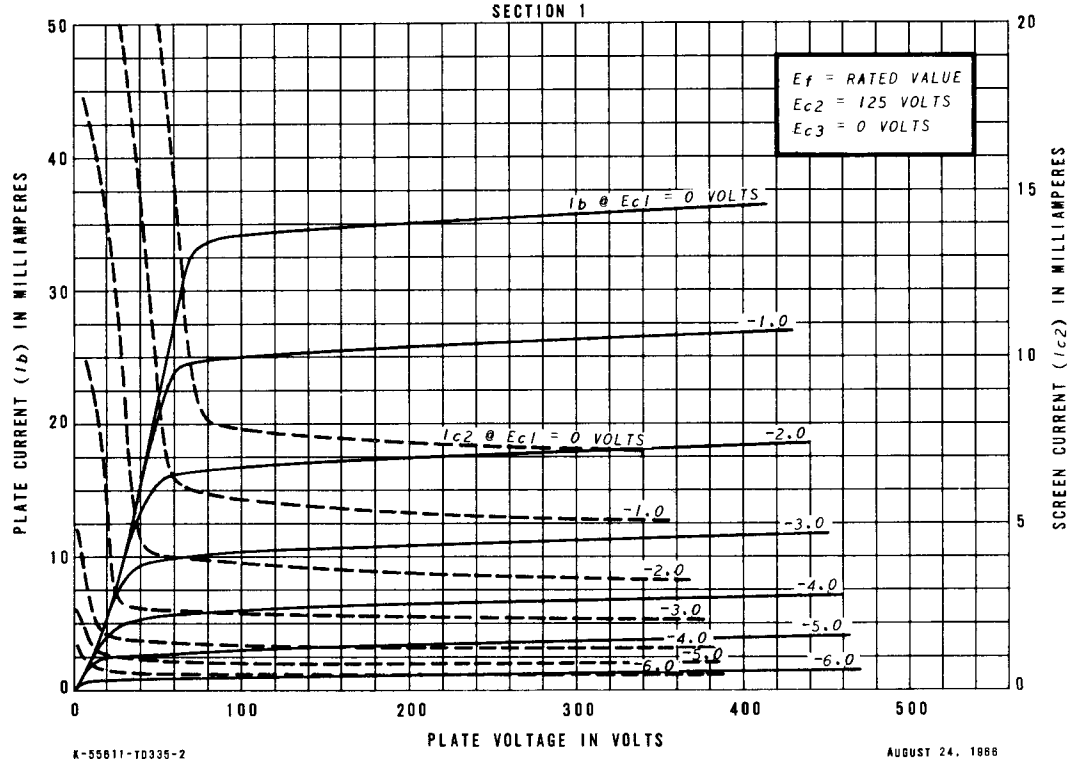
¶ With external shield (EIA 309) connected to ground.

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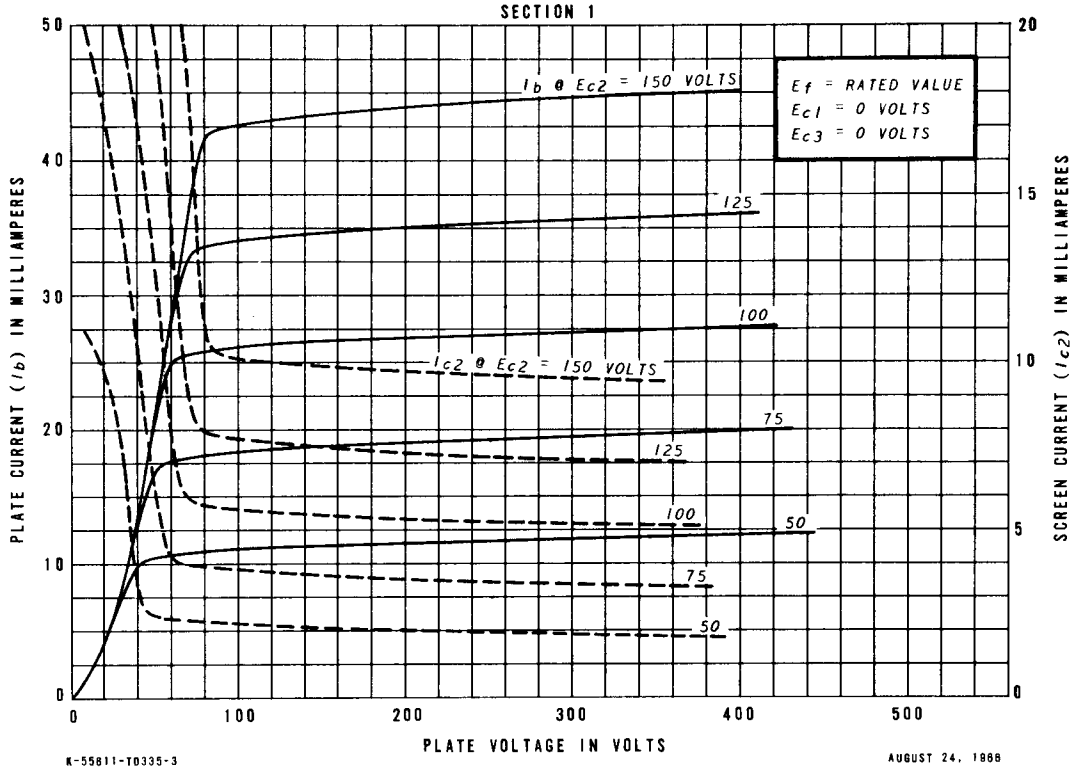
SCREEN RATING CHART



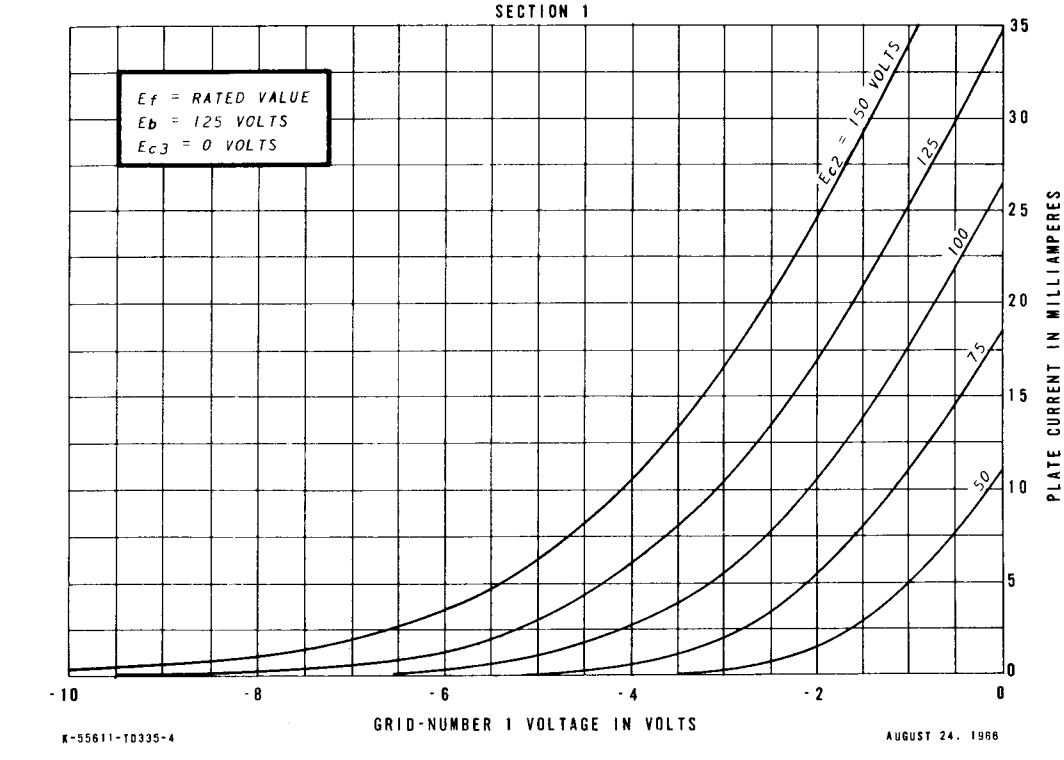
AVERAGE PLATE CHARACTERISTICS



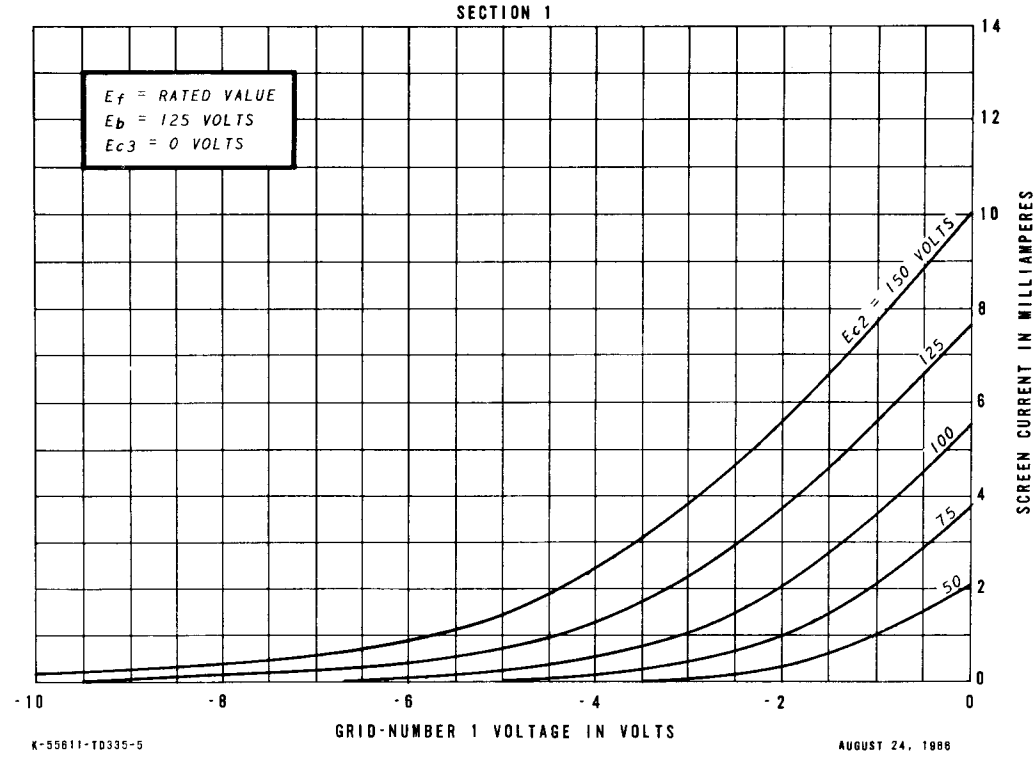
AVERAGE PLATE CHARACTERISTICS



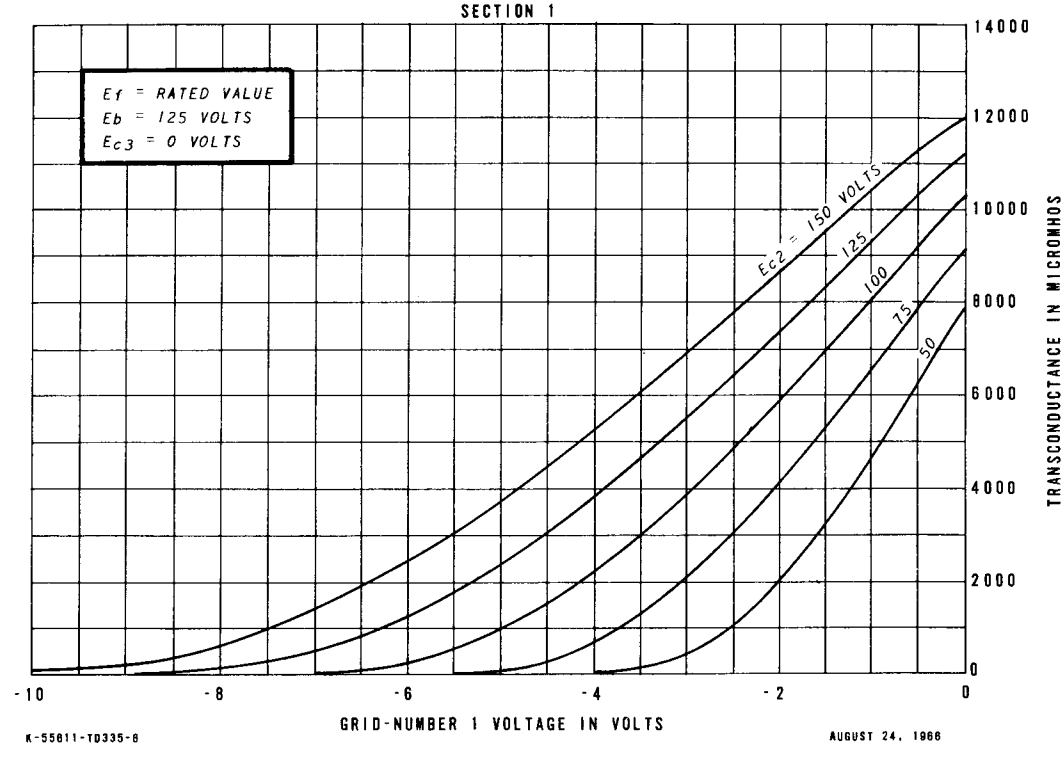
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

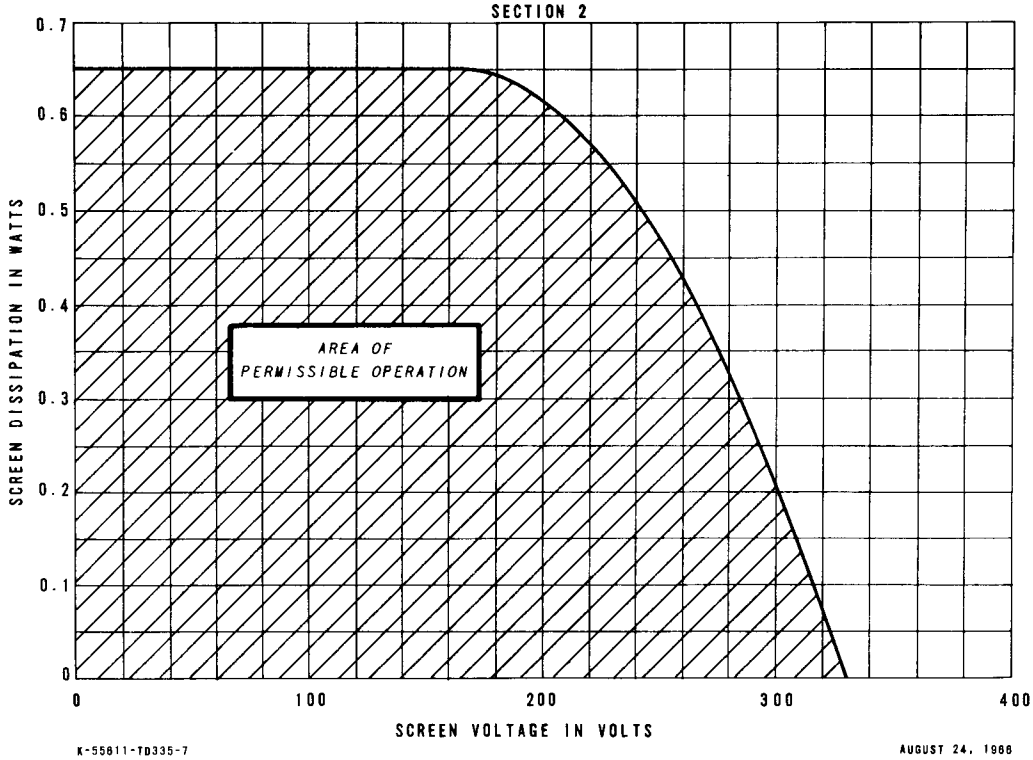


AVERAGE TRANSFER CHARACTERISTICS



SCREEN RATING CHART

SECTION 2

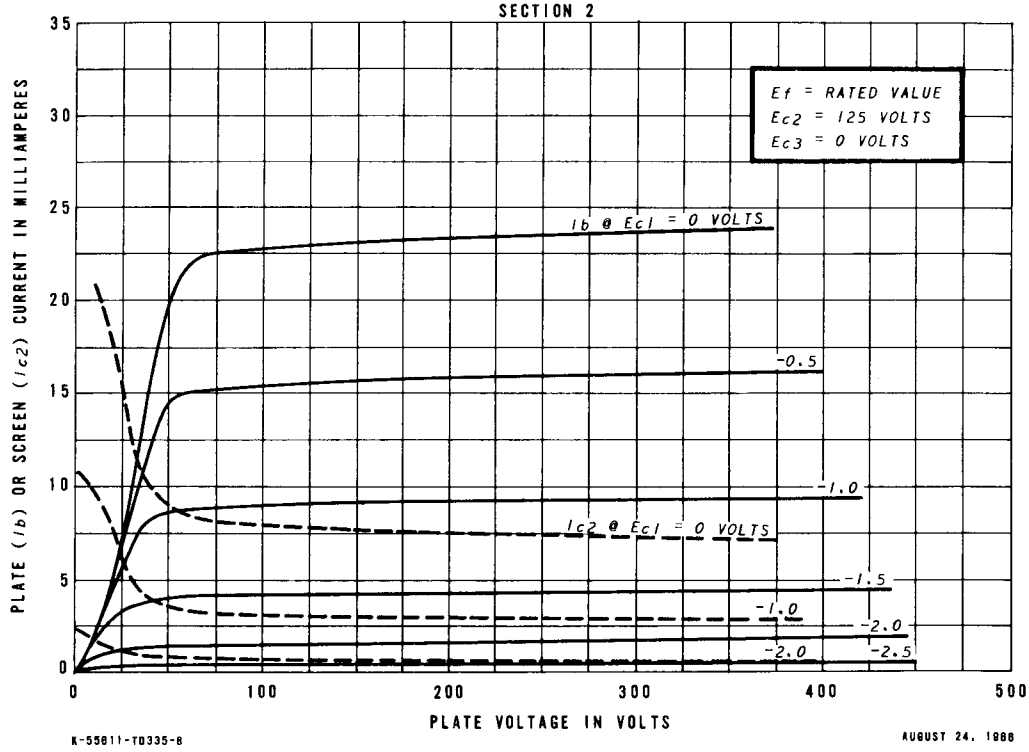


K-55811-TD335-7

AUGUST 24, 1966

AVERAGE PLATE CHARACTERISTICS

SECTION 2

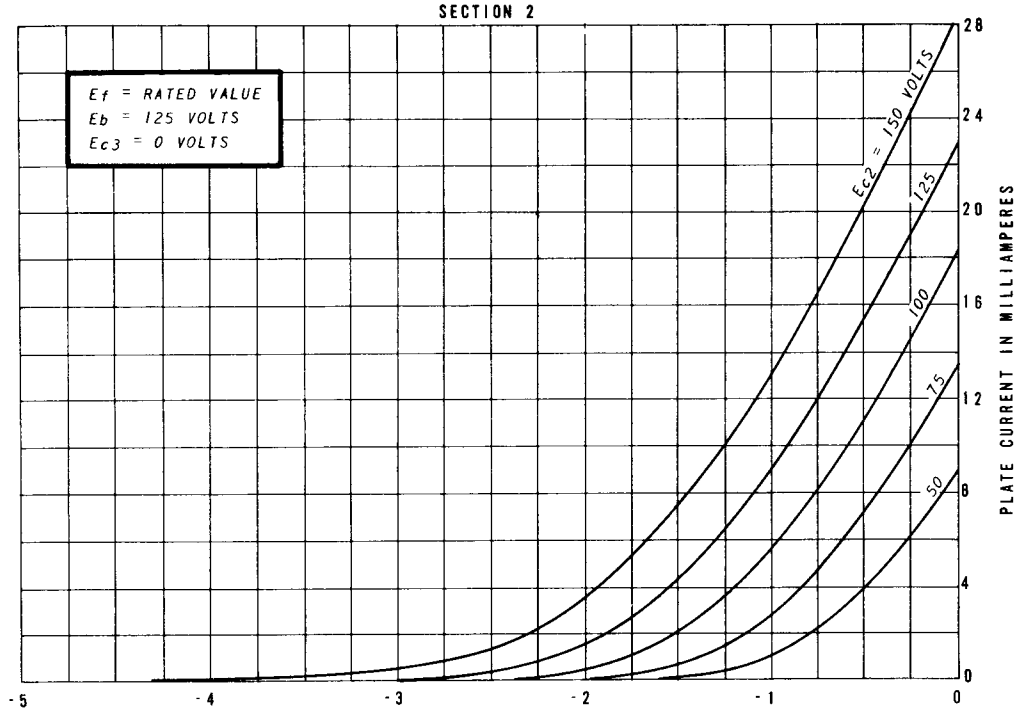


K-55811-TD335-8

AUGUST 24, 1966

AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

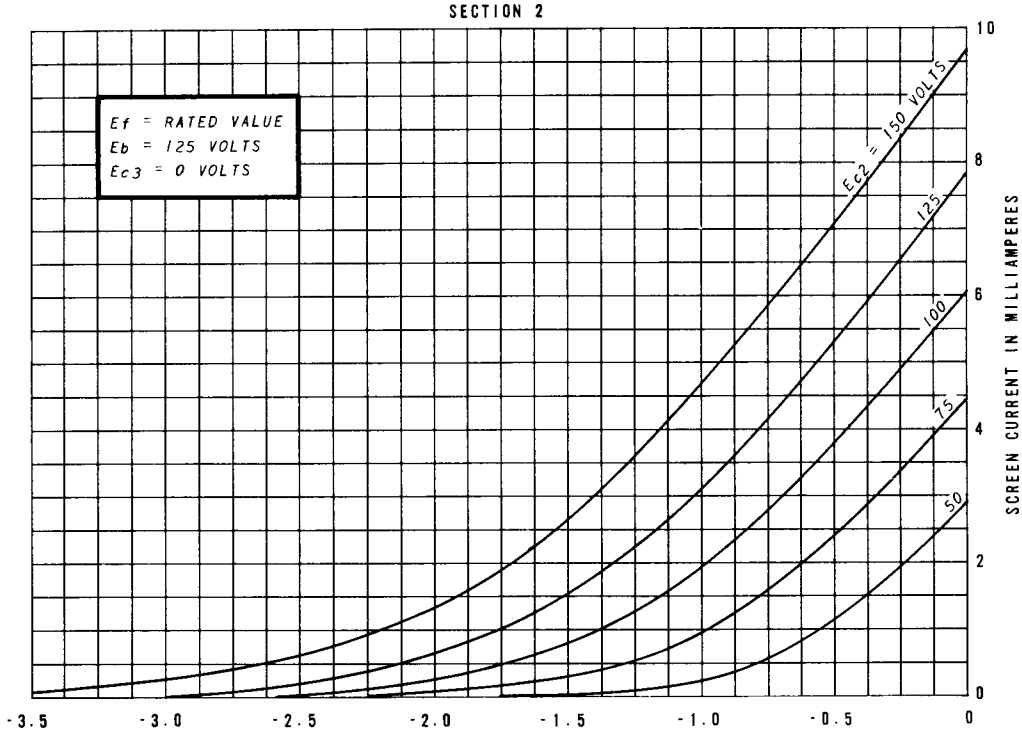


K-55611-T0335-9

AUGUST 24, 1966

AVERAGE TRANSFER CHARACTERISTICS

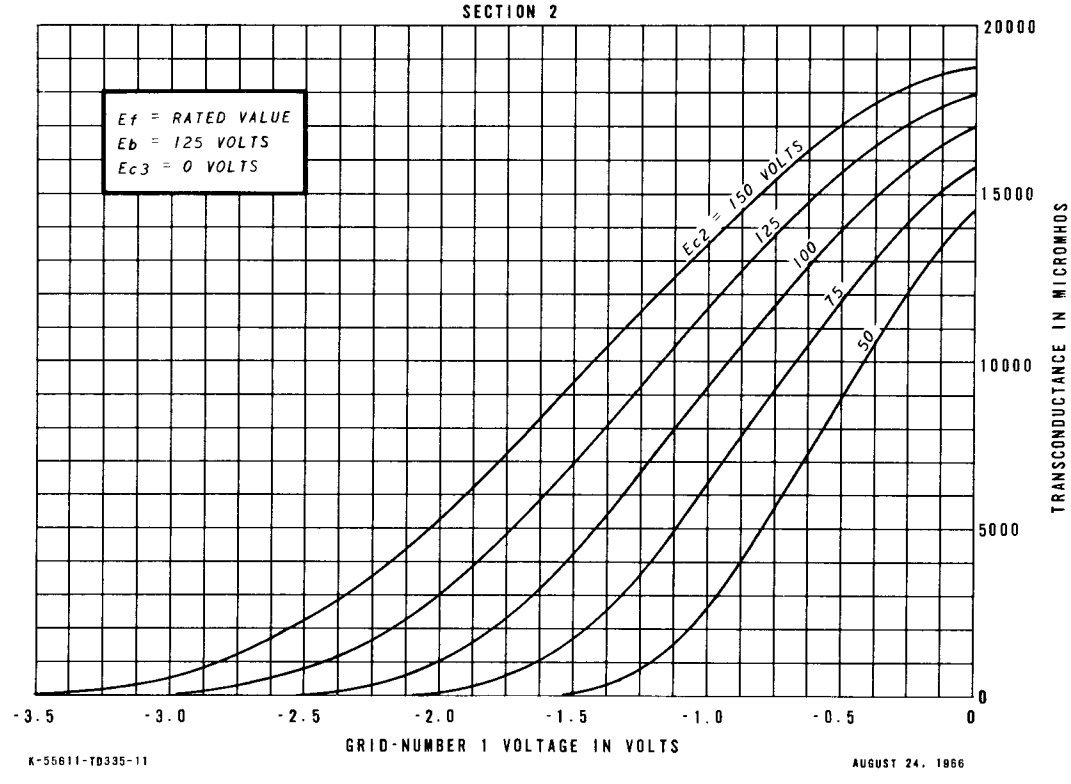
SECTION 2



K-55611-T0335-10

AUGUST 24, 1966

AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

—PRODUCT INFORMATION—

Compactron Diode

6BW3

FOR TV DAMPING DIODE APPLICATIONS

■ COLOR TV TYPE ■ DIFFUSION BONDED CATHODE ■ 5000 VOLTS DC ■ 175 MILLIAMPERES DC

The 6BW3 is a compactron containing a single heater-cathode type diode. It is intended for service as the damping diode in the horizontal deflection circuit of color television receivers.

The diffusion bonded cathode practically eliminates one of the major failure mechanisms in damping diodes, which is plate-to-cathode arcing caused by emissive particles being pulled from the cathode by the high electrostatic field.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current♦	1.6	Amperes

Direct Interelectrode Capacitances, approximate●

Cathode to Plate and Heater: k to (p + h)	8.5	pf
Plate to Cathode and Heater: p to (k + h)	6.0	pf
Heater to Cathode: (h to k)	3.8	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-60

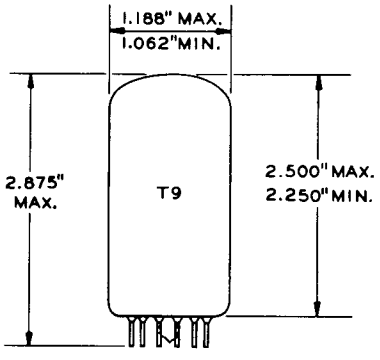
Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches
Minimum Seated Height	2.250	Inches

MAXIMUM RATINGS

TV DAMPER SERVICE▲—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	5000	Volts
Plate Dissipation	6.5	Watts
Steady-State Peak Plate Current	1100	Milliamperes
DC Output Current	175	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with respect to Cathode		
DC Component	900	Volts
Total DC and Peak	5000	Volts

PHYSICAL DIMENSIONS

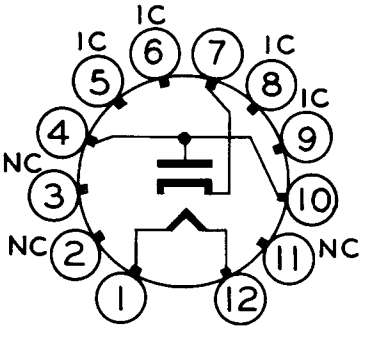


EIA 9-60

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - No Connection
Pin 3 - No Connection
Pin 4 - Plate
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Cathode
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Plate
Pin 11 - No Connection
Pin 12 - Heater

BASING DIAGRAM



EIA 12FX

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop
Ib = 350 Milliamperes DC ..... 32 Volts

NOTES

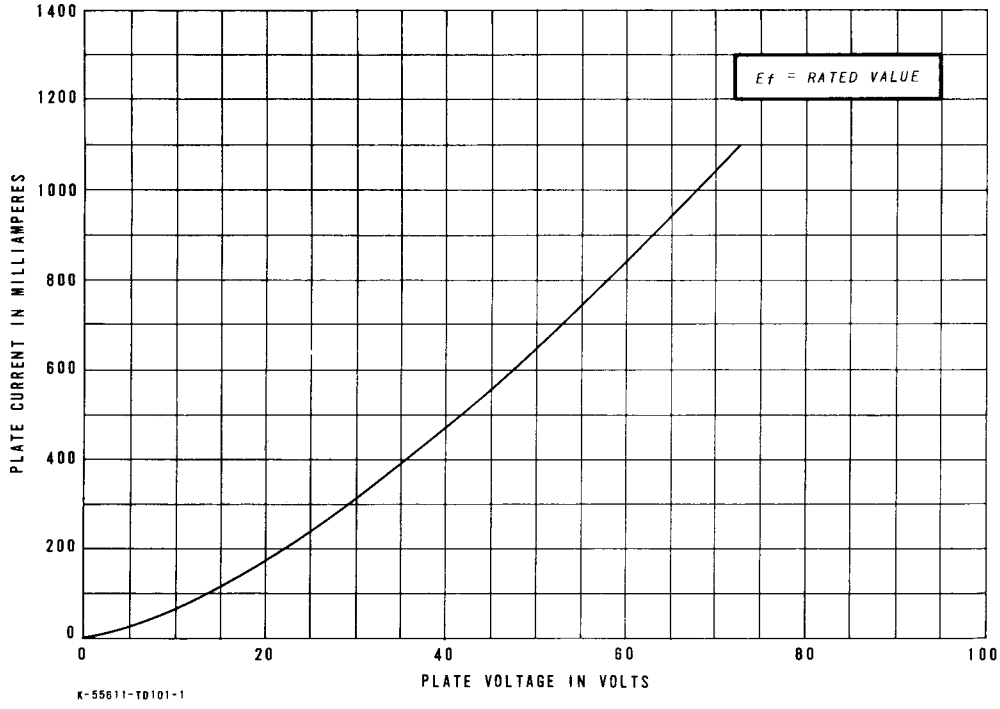
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

♦ Without external shield.

▲ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

AVERAGE PLATE CHARACTERISTICS



The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

6BW8

DUPLEX-DIODE PENTODE

DESCRIPTION AND RATING

The 6BW8 is a duplex-diode sharp-cutoff pentode in which separate cathodes are provided for the diode and pentode sections. The diode sections are primarily intended for use as a horizontal phase detector in television receivers. The pentode section is suitable for use as a sound intermediate-frequency amplifier, sound limiter, and automatic-gain-control keyer.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ± 10% Volts
Heater Current	0.45 Amperes
Direct Interelectrode Capacitances*	
Pentode Grid-Number 1 to Plate, maximum	0.020 μμf
Pentode Input	4.8 μμf
Pentode Output	2.6 μμf
Grid-Number 1 to Each Diode Plate, maximum	0.006 μμf
Diode-Number 1 Plate to Diode Cathode and Heater	1.3 μμf
Diode-Number 2 Plate to Diode Cathode and Heater	1.2 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin
* Without external shield.

MAXIMUM RATINGS

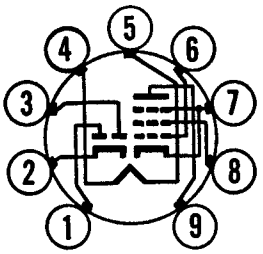
DESIGN-MAXIMUM VALUES

Plate Voltage	330 Volts
Screen-Supply Voltage	330 Volts
Screen Voltage—See Screen Rating Chart	
Positive DC Grid-Number 1 Voltage	0 Volts
Negative DC Grid-Number 1 Voltage	55 Volts
Plate Dissipation	3.0 Watts
Screen Dissipation	0.55 Watts
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	
DC Component	100 Volts
Total DC and Peak	200 Volts
Heater Negative with Respect to Cathode	
Total DC and Peak	200 Volts
Grid-Number 1 Circuit Resistance	
With Fixed Bias	0.1 Megohms
With Cathode Bias	0.5 Megohms
Diode Current for Continuous Operation, Each Diode	5.0 Milliamperes

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

GENERAL ELECTRIC

BASING DIAGRAM

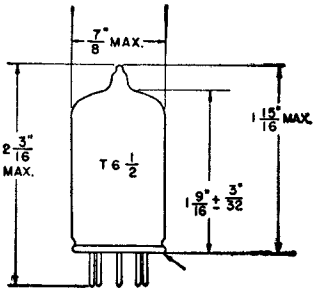


RETMA 9HK

TERMINAL CONNECTIONS

Pin 1—Diode Number 2 Plate
Pin 2—Diode Cathode
Pin 3—Diode Number 1 Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Grid Number 1
Pin 7—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 8—Pentode Grid Number 2 (Screen)
Pin 9—Pentode Plate

PHYSICAL DIMENSIONS



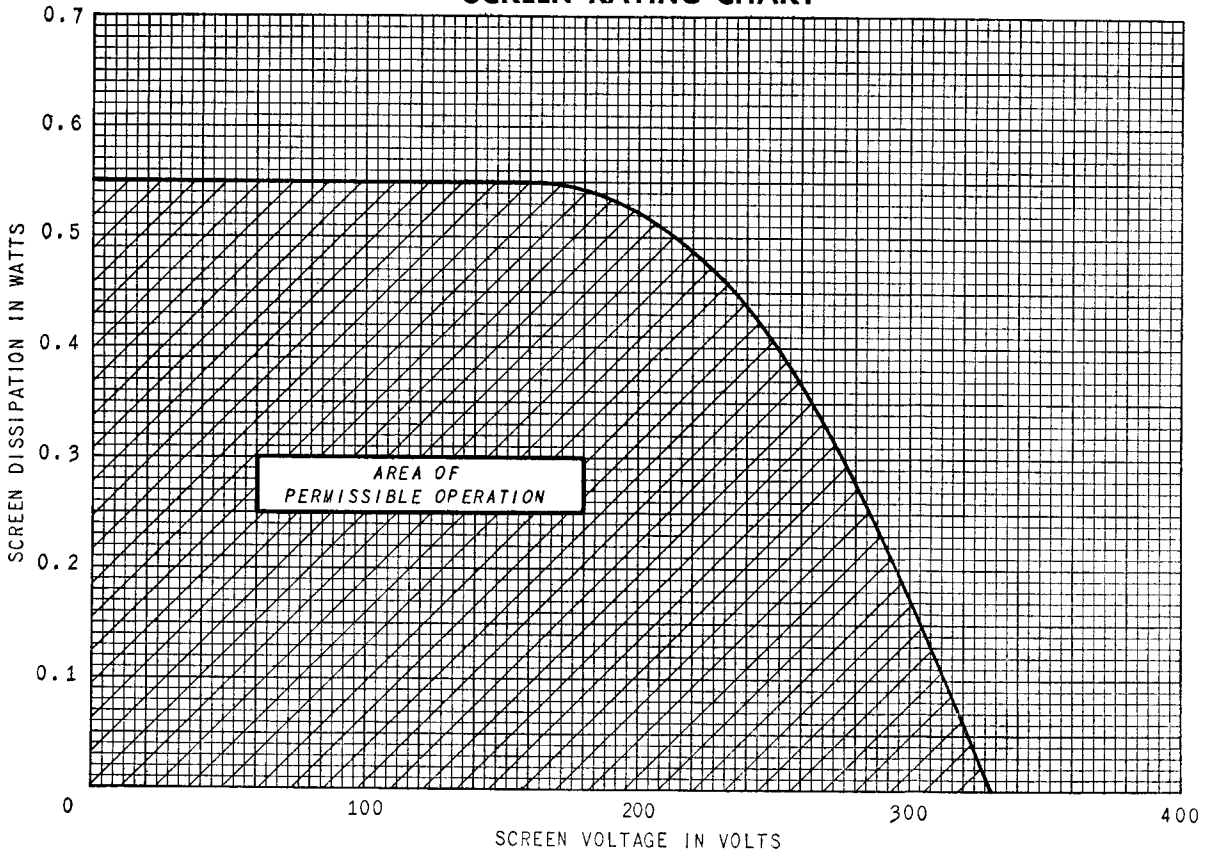
RETMA 6-2

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

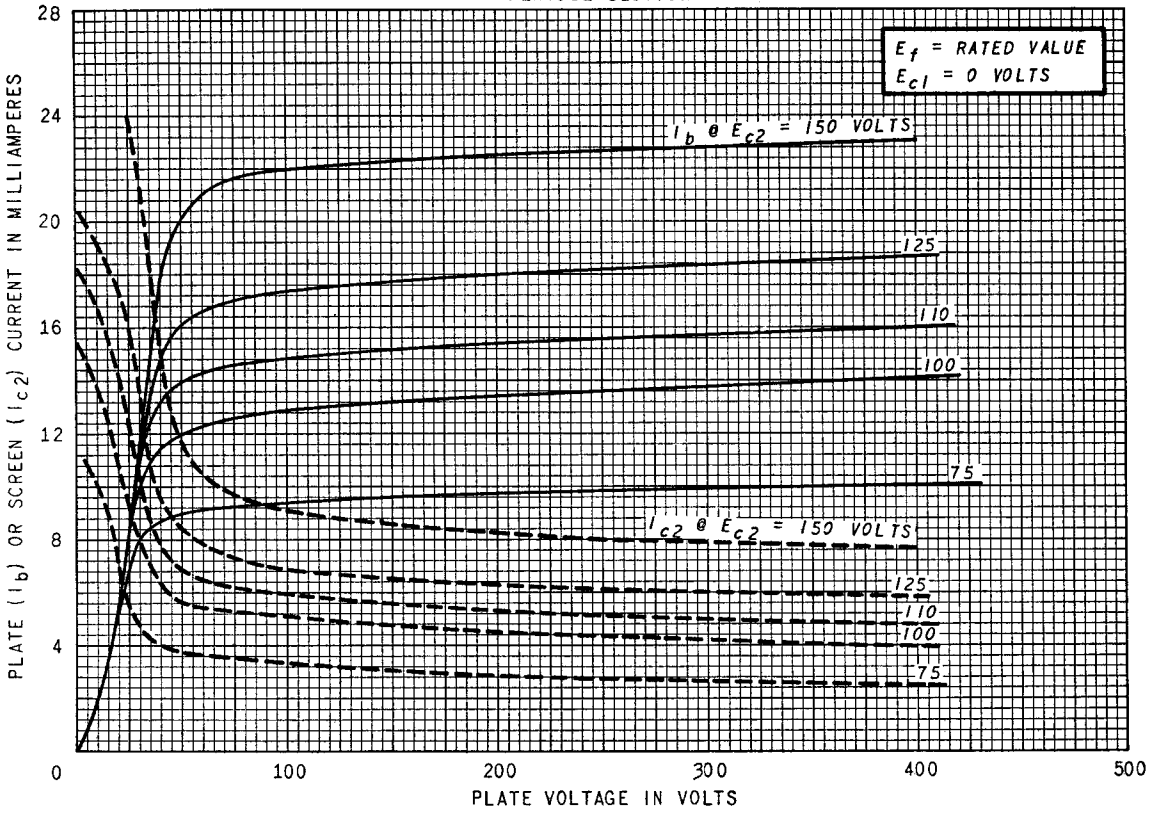
Plate Voltage	250 Volts
Screen Voltage	110 Volts
Cathode-Bias Resistor	68 Ohms
Plate Resistance, approximate	0.25 Megohms
Transconductance	5200 Micromhos
Plate Current	10 Milliamperes
Screen Current	3.5 Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	−10 Volts
Average Diode Current, Each Diode With 5 Volts DC Applied	20 Milliamperes

SCREEN RATING CHART



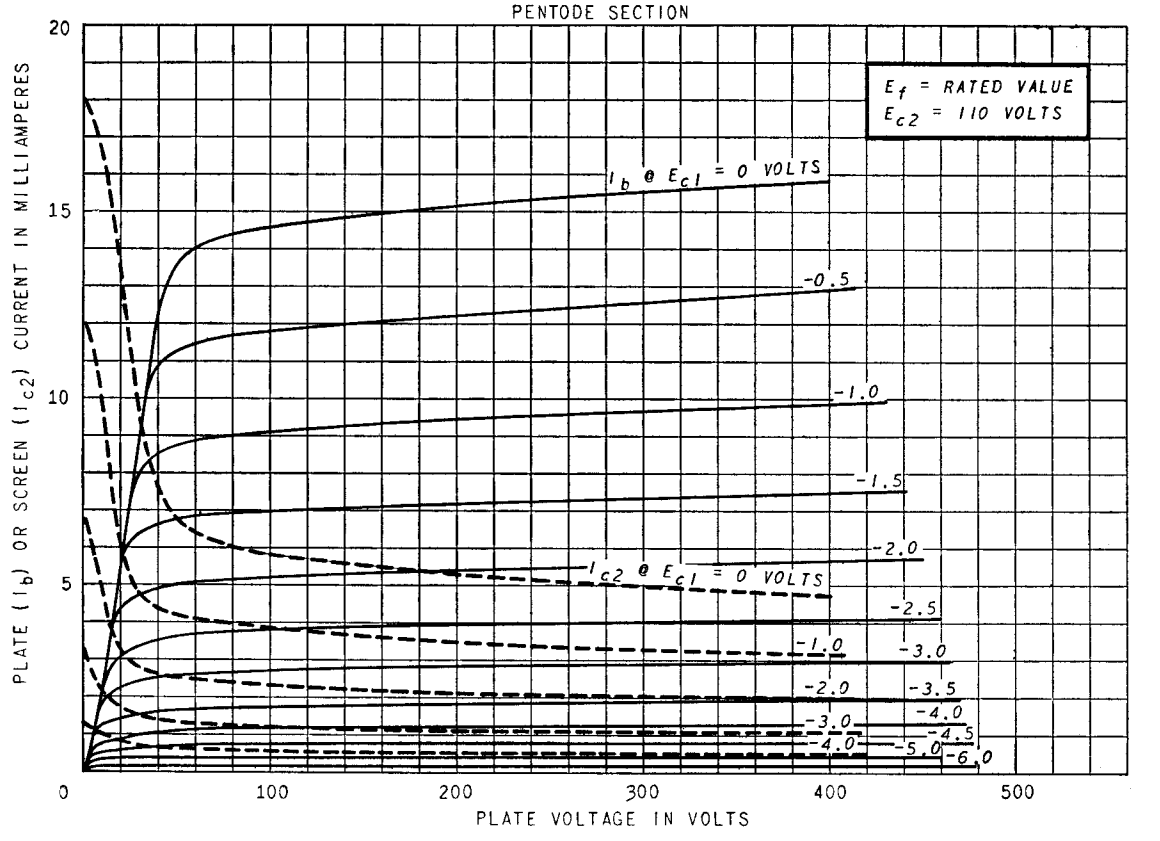
AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

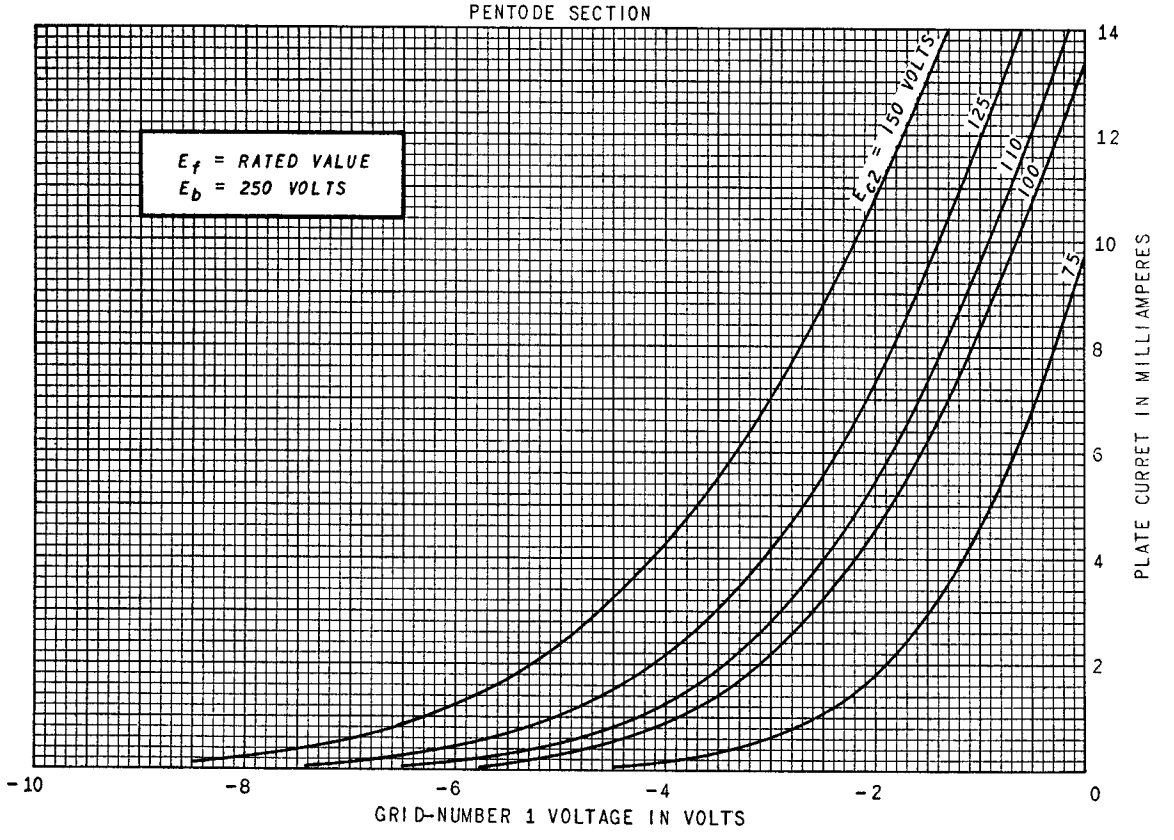


AVERAGE PLATE CHARACTERISTICS

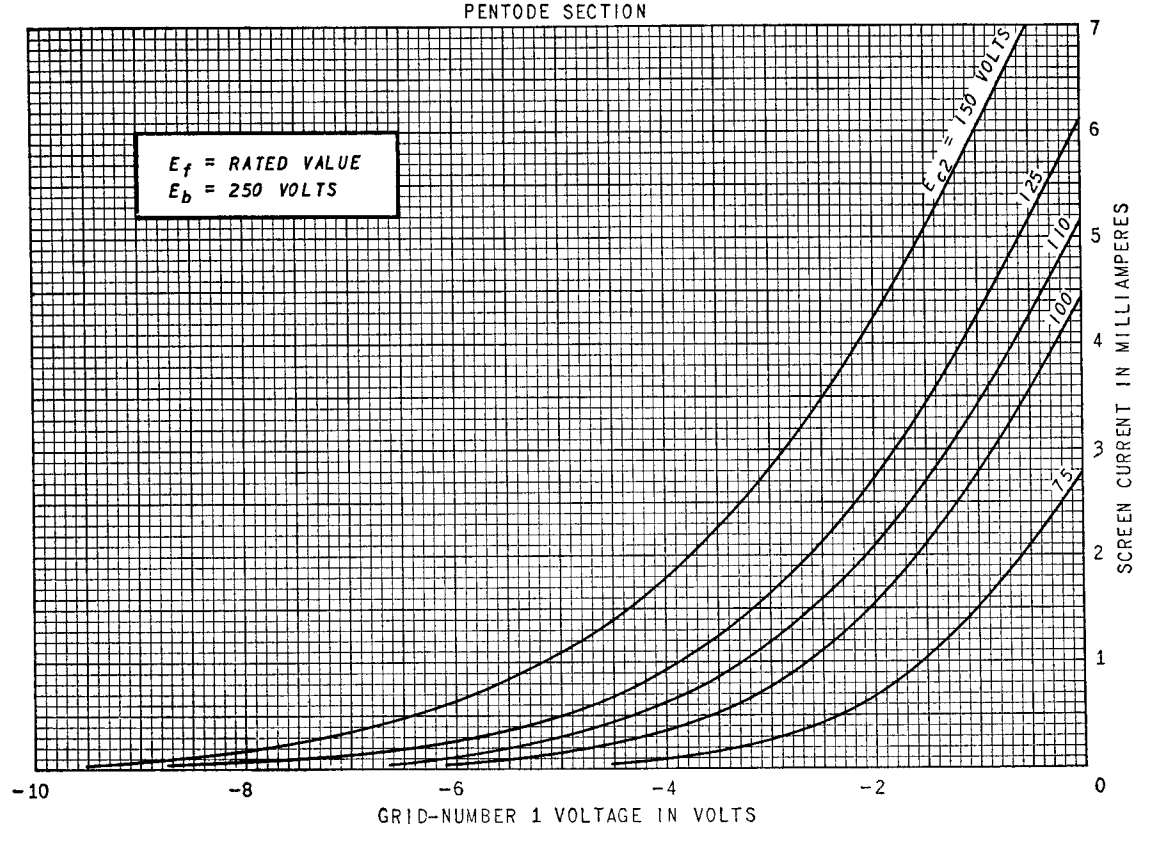
PENTODE SECTION



AVERAGE TRANSFER CHARACTERISTICS

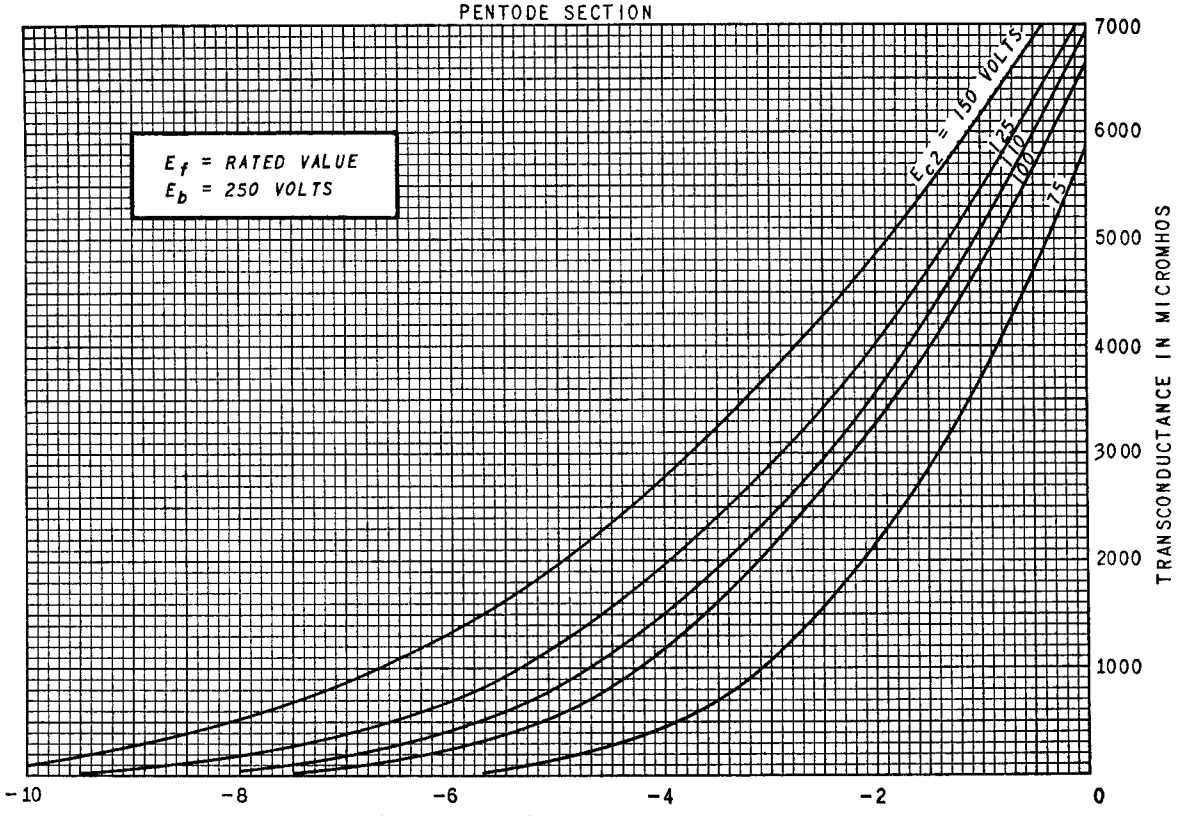


AVERAGE TRANSFER CHARACTERISTICS



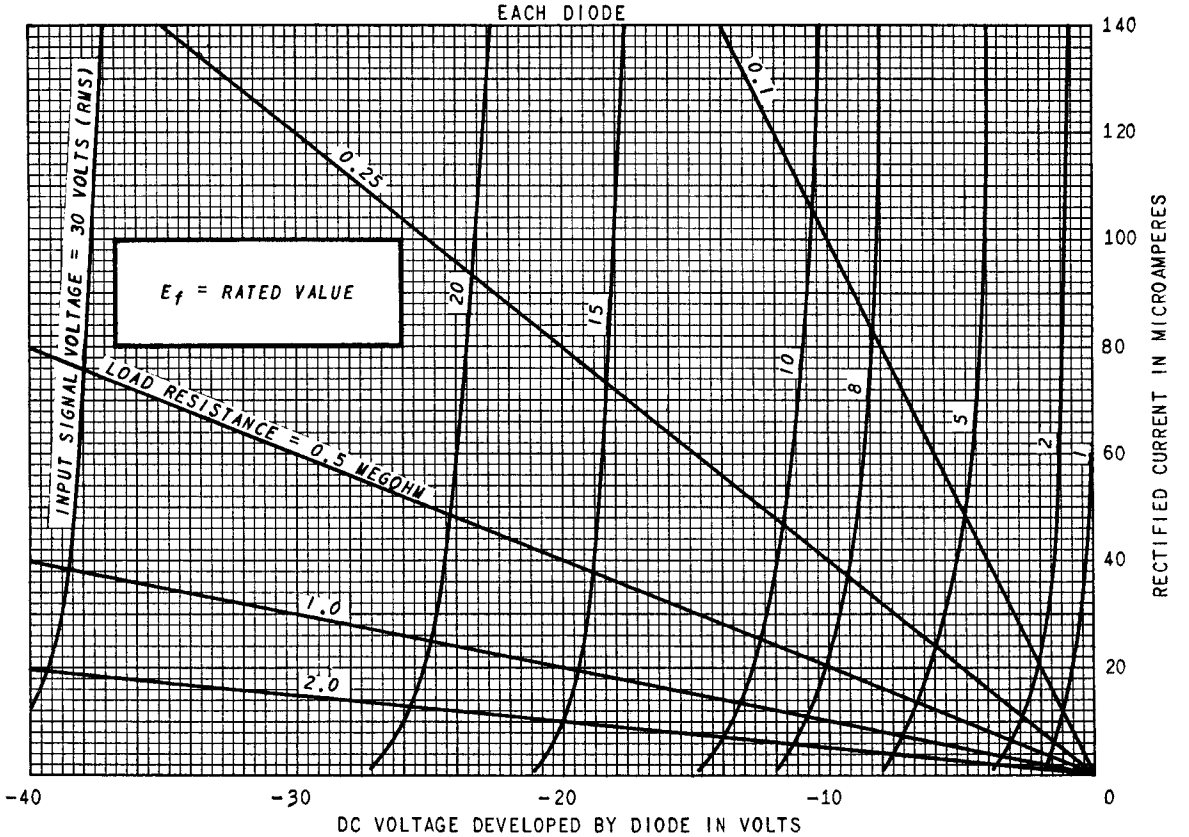
AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



OPERATION CHARACTERISTICS

EACH DIODE



Electronic TUBES

6BX7-GT
Description and Rating

TWIN TRIODE

GENERAL DESCRIPTION

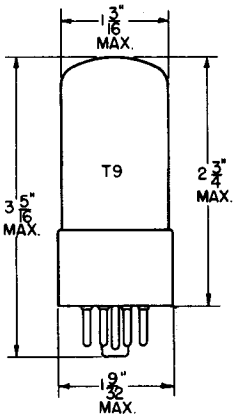
Principal Application: The 6BX7-GT is a high-transconductance twin triode designed primarily for use as a combined vertical deflection amplifier and vertical oscillator in television receivers. Each section of the 6BX7-GT features high plate current at low plate voltages and is capable of withstanding the high pulse voltages normally encountered in this application. The 6BX7-GT, when operated from relatively low plate supply voltages, is capable of deflecting fully large-deflection-angle picture tubes.

Cathodes	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	1.5 Amperes
Envelope	T-9, Glass
Base	B8-58, Short Intermediate Shell Octal 8-Pin
Mounting Position	Any

Direct Interelectrode Capacitances: #

	Section 1	Section 2	
Grid to Plate	4.2	4.0	μμf
Input	4.4	4.8	μμf
Output	1.1	1.2	μμf
Grid to Grid	0.11		μμf
Plate to Plate	1.5		μμf

PHYSICAL DIMENSIONS

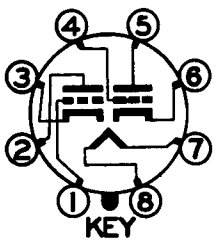


RTMA 9-41

TERMINAL CONNECTIONS

Pin 1 - Grid (Section 2)
Pin 2 - Plate (Section 2)
Pin 3 - Cathode (Section 2)
Pin 4 - Grid (Section 1)
Pin 5 - Plate (Section 1)
Pin 6 - Cathode (Section 1)
Pin 7 - Heater
Pin 8 - Heater

BASING DIAGRAM



RTMA 8BD
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES * (EACH SECTION)	Vertical Deflection Amplifier and Oscillator **	
D-C Plate Voltage	500	Volts
Peak Positive Pulse Plate Voltage (Absolute Maximum)	2000	Volts
Positive D-C Grid Voltage	0	Volts
Peak Negative Grid Voltage	-500	Volts
Plate Dissipation (Each Plate) **	10	Watts
Plate Dissipation (Both Plates) **	12	Watts
Average Cathode Current	60	Milliamperes
Peak Cathode Current	180	Milliamperes
Heater-Cathode Voltage:		
Heater Negative with Respect to Cathode		
Total D-C and Peak	200	Volts
Heater Positive with Respect to Cathode		
D-C Component	100	Volts
Total D-C and Peak	200	Volts
Grid Circuit Resistance	2.2	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS (EACH SECTION)

Plate Voltage	100	250	Volts
Cathode Bias Resistor	0	390	Ohms
Amplification Factor	---	10	
Plate Resistance (Approx)	---	1300	Ohms
Transconductance	---	7600	Micromhos
Plate Current	80	42	Milliamperes
Grid Voltage (Approx) for I_b = 50 Microamperes	---	-40	Volts

VERTICAL DEFLECTION AMPLIFIER [+] (SECTION 2) [++]

Plate Voltage	170	Volts
Cathode Bias Resistor [‡]	170	Ohms
Grid Input Voltage: (Approx)		
Sawtooth Component	41	Volts
Negative Peaking Component	70	Volts
D-C Cathode Current	24	Milliamperes
Peak Cathode Current	65	Milliamperes
Plate Output Voltage: (Approx)		
Sawtooth Component	160	Volts
Peak Positive Pulse Component	840	Volts

\# *Without external shield*

\#\# *For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice for Television Stations", Federal Communications Commission. The duration of the voltage pulse must not exceed 15-percent of one scanning cycle.*

* *All maximum ratings are based on the RTMA system of Design-Center Maximums except where absolute maximum is specified. The absolute maximum ratings represent limiting values beyond which the serviceability of the tube may be impaired from the viewpoint of life and satisfactory performance. Equipment incorporating this tube must be so designed that the absolute maximum values will never be exceeded under any usual condition of supply-voltage variation, manufacturing variation (including components) in the equipment, and/or control adjustment.*

** *An adequate cathode bias resistor or other suitable means is required to protect the tube in the absence of excitation.*

[+] *For use in conjunction with a 70-degree picture tube operating at an anode voltage of 14 kilovolts*

[++] *When the 6BX7-GT is operated as a combined vertical deflection amplifier and oscillator, it is recommended that section 1 (pins 4, 5, and 6) be used as the oscillator.*

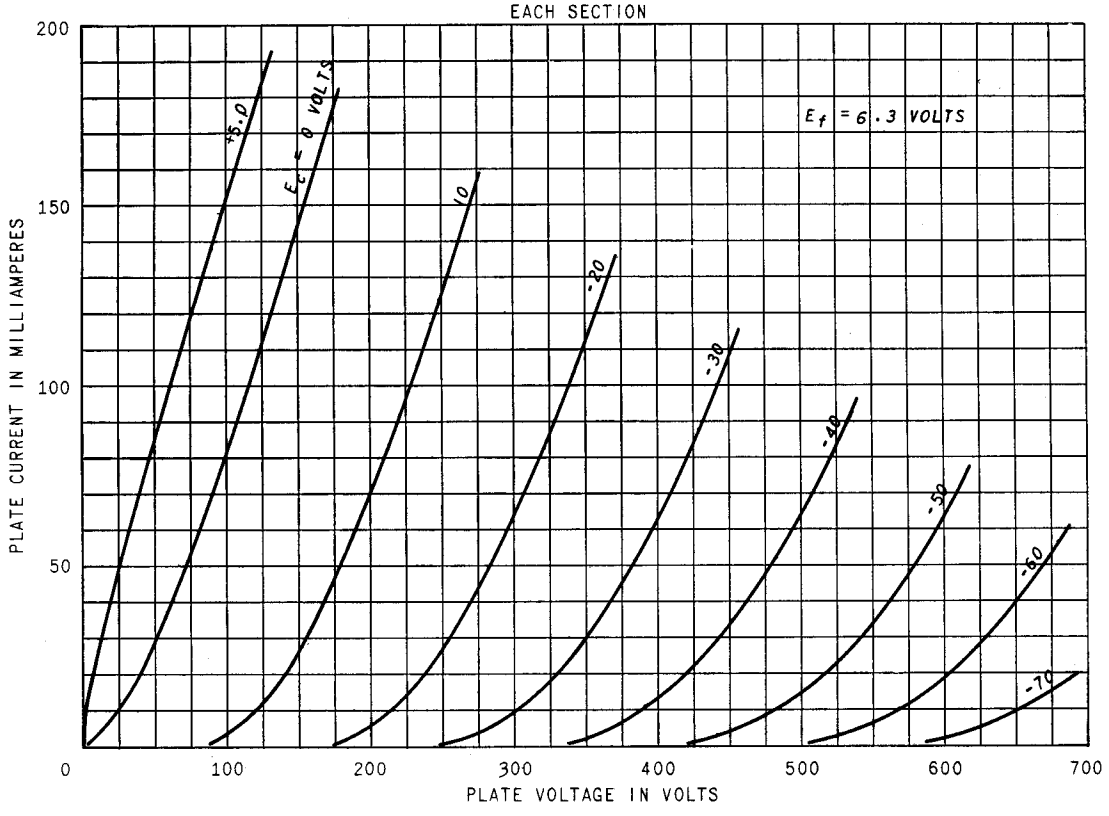
[‡] *Typical value of total cathode resistance for optimum linearity*

TYPICAL WAVEFORMS OF VERTICAL DEFLECTION AMPLIFIER

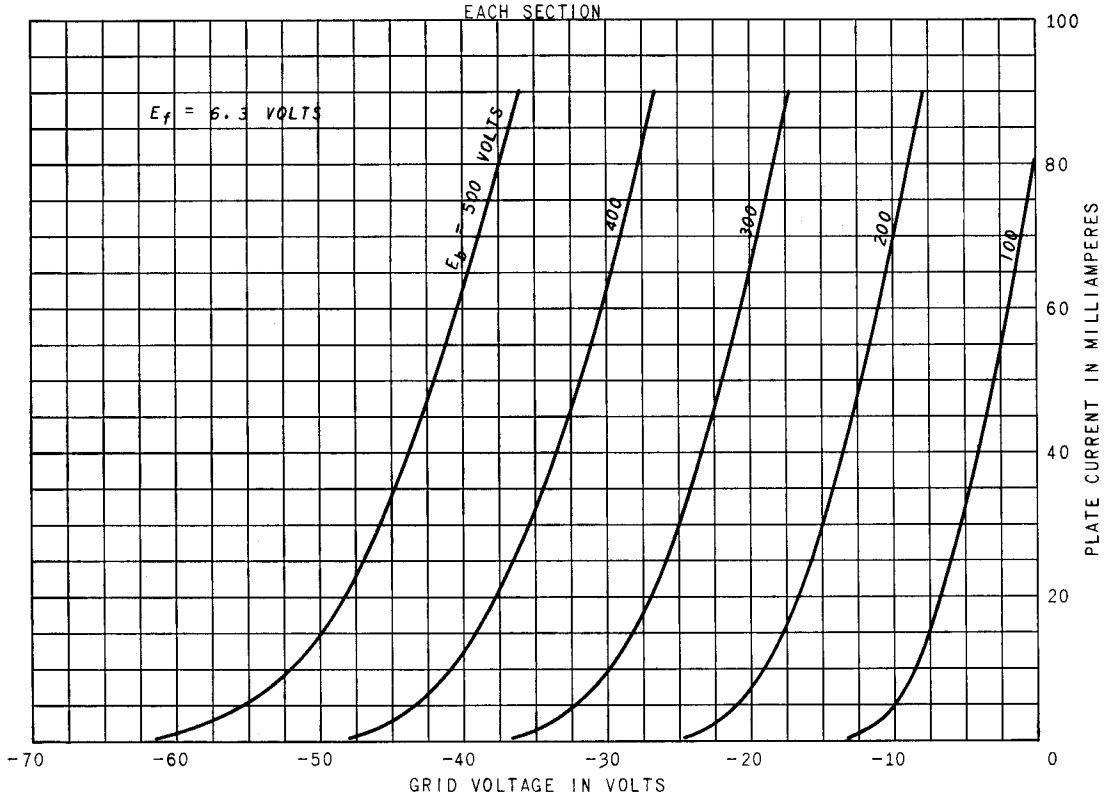


GRID INPUT VOLTAGE — CATHODE CURRENT — PLATE OUTPUT VOLTAGE

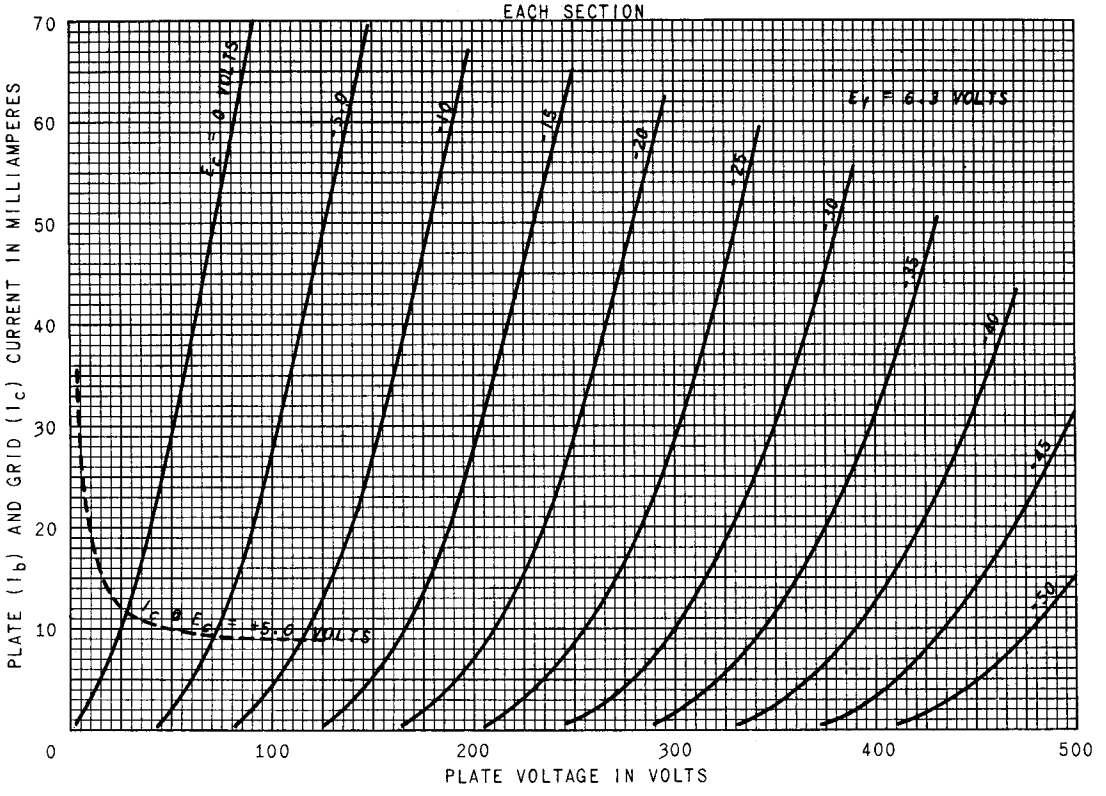
AVERAGE PLATE CHARACTERISTICS



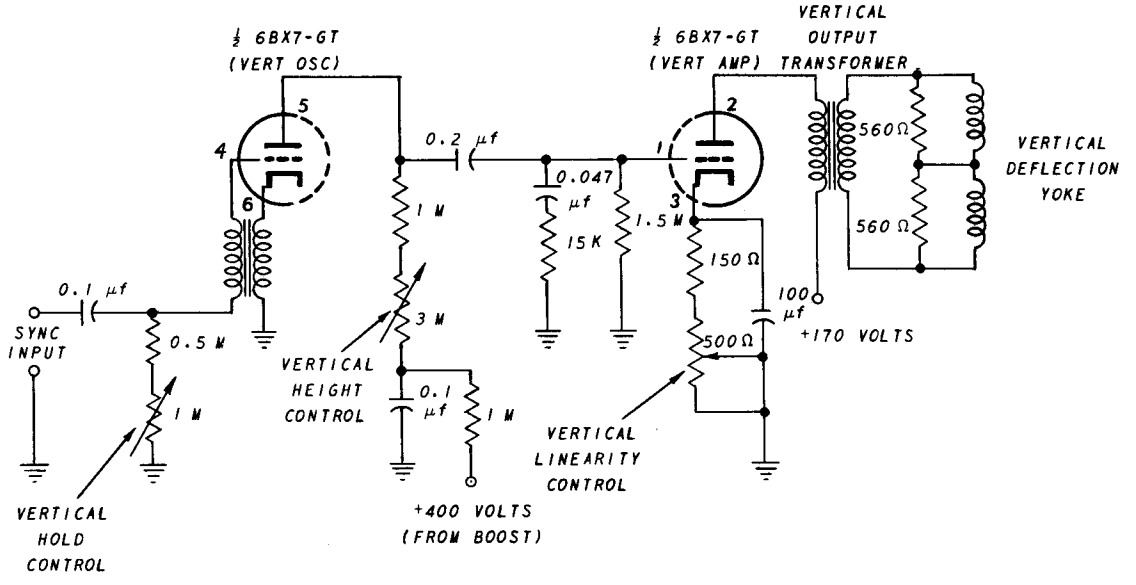
AVERAGE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



TYPICAL VERTICAL DEFLECTION CIRCUIT USING THE 6BX7-GT



Circuits shown herein are examples of possible tube applications. The description and illustration of them does not convey to the purchaser of tubes any license under patent claims of General Electric Company.

Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.

ET-T804
2-52

Electronic TUBES

6BY4

TRIODE

FOR UHF AMPLIFIER APPLICATIONS

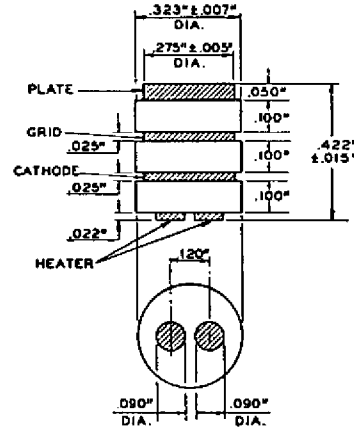
DESCRIPTION AND RATING

The 6BY4 is a ceramic high-mu triode of parallel-plane construction designed primarily for use as a grounded-grid radio-frequency amplifier in combined UHF-VHF television tuners. In this service, at 900 megacycles, the 6BY4 exhibits a power gain of approximately 15 decibels and a noise factor of approximately 8.5 decibels with a 10-megacycle bandwidth. The high performance capabilities of the tube thus make possible simplified tuner designs in which the 6BY4 serves as the r-f amplifier for both the UHF and VHF bands. Special features of the tube include excellent isolation between input and output circuits, low lead inductances, low interelectrode capacitances, short transit time, extremely high ratio of transconductance to plate current, and small size.

The size of the 6BY4 makes it particularly suited to compact tuner designs. In these applications, the tube may be used with special clip-type or friction-type sockets which are either separate units or integral with the tuner; the 6BY4 may also be adapted to coaxial circuitry.

The special metal-ceramic construction of the 6BY4 provides several fundamental advantages over conventional glass receiving tubes. The tube may operate at much higher envelope temperatures, exhibits increased resistance to mechanical shock and vibration, has greatly increased physical strength, and produces significantly lower microphonic output. The 6BY4 construction is also well suited for use with printed circuit boards and other types of automatic circuit assembly.

PHYSICAL DIMENSIONS



GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3 ±10%	Volts
Heater Current	0.25	Amperes
Direct Interelectrode Capacitances*		
Plate to Cathode, maximum	0.007	μμf
Cathode to Grid and Heater	2.0	μμf
Plate to Grid and Heater	0.7	μμf
Heater to Cathode	0.8	μμf

MECHANICAL

Mounting Position—Any

Envelope—See Physical Dimensions

* Without external shield.

GENERAL ELECTRIC

from JETEC release #1529, Oct. 17, 1955

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES (SEE NOTE)

Plate Voltage	300	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.1	Watts
DC Cathode Current	5.5	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	25	Volts
Total DC and Peak	50	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	50	Volts

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur. To obtain satisfactory circuit performance, therefore, the equipment designer must establish the circuit design so that no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

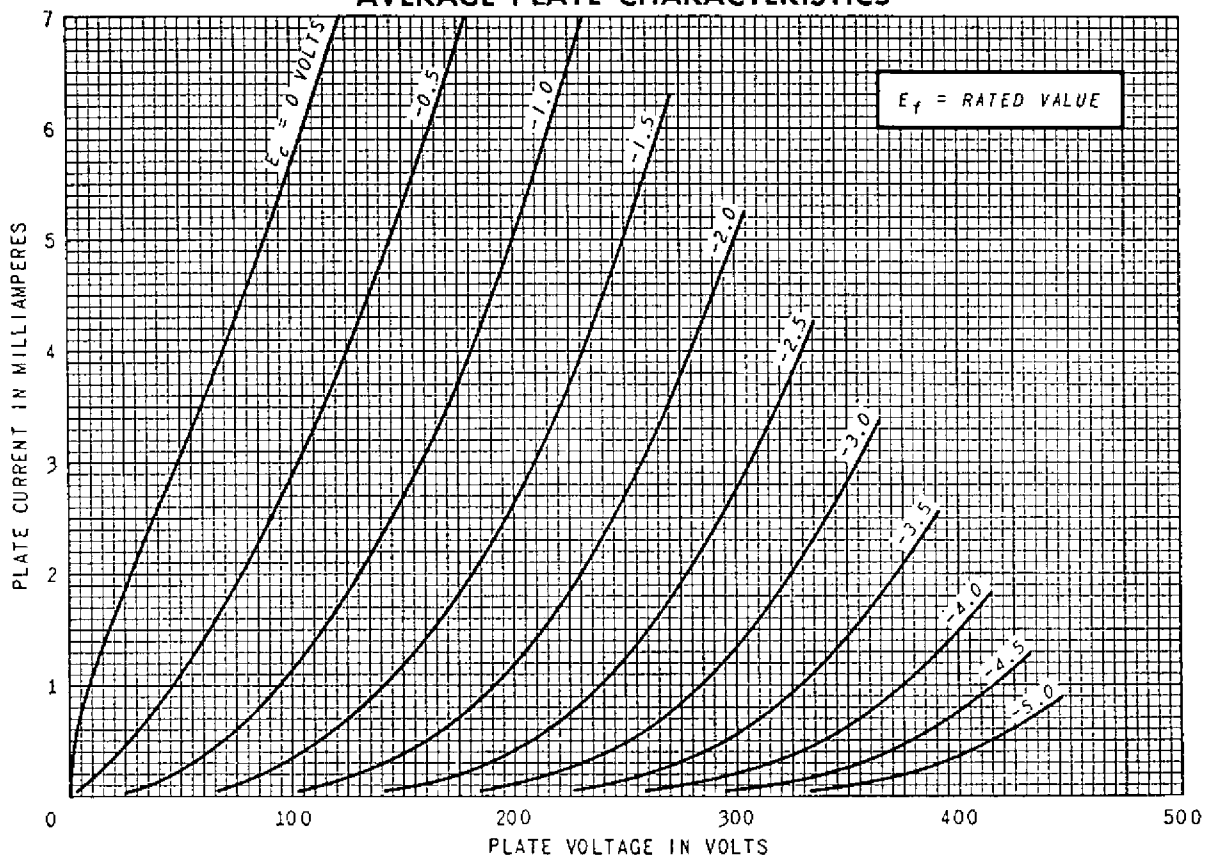
CLASS A_1 AMPLIFIER

Plate Voltage	200	Volts
Cathode-Bias Resistor	200	Ohms
Amplification Factor	100	
Plate Resistance, approximate	16,700	Ohms
Transconductance	6000	Micromhos
Plate Current	5.0	Milliamperes
Grid Voltage, approximate		
Ib = 10 Microamperes	−4.0	Volts

GROUNDED-GRID AMPLIFIER—900 MEGACYCLES

Plate Voltage	200	Volts
Cathode-Bias Resistor	200	Ohms
Plate Current	5.0	Milliamperes
Band width, approximate	10	Megacycles
Power Gain, approximate	15	Decibels
Noise Figure (Matched Input), approximate	8.5	Decibels

AVERAGE PLATE CHARACTERISTICS



Electronic TUBES

6BY6—3BY6

HEPTODE

FOR GATED AMPLIFIER SERVICE

DESCRIPTION AND RATING

The 6BY6 is a miniature dual-control heptode designed primarily for use as a combined sync separator and sync clipper in television receivers. Each of the two independent control grids exhibits a sharp-cutoff characteristic.

Except for heater ratings, the 3BY6 is identical to the 6BY6. In addition as a result of its controlled heater warm-up characteristic, the 3BY6 is especially suited for use in television receivers which employ series-connected heaters. When the 3BY6 is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

GENERAL

ELECTRICAL

	3BY6	6BY6	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	3.15	6.3	Volts
Heater Current	0.6	0.3	Amperes
Heater Warm-up Time*	11	....	Seconds
Direct Interelectrode Capacitances+			
Grid-Number 1 to Plate, maximum	0.08		μμf
Grid-Number 3 to Plate, maximum	0.35		μμf
Grid-Number 1 to All	5.4		μμf
Grid-Number 3 to All	6.9		μμf
Plate to All	7.6		μμf
Grid-Number 1 to Grid-Number 3, maximum	0.15		μμf

MECHANICAL

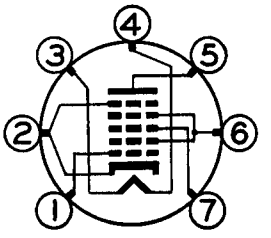
Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	300	Volts
Screen-Supply Voltage	300	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 3 Voltage	0	Volts
Negative DC Grid-Number 3 Voltage	50	Volts
Peak Positive Grid-Number 3 Voltage	25	Volts
Negative DC Grid-Number 1 Voltage	100	Volts
Plate Dissipation	2.0	Watts
Screen Dissipation	1.0	Watts
Grid-Number 3 Input	0.1	Watts
Grid-Number 1 Input	0.1	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 3 Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

BASING DIAGRAM

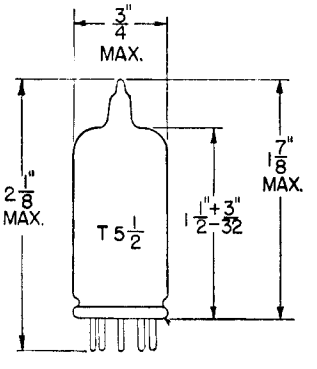


RETMA 7CH

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode and Grid Number 5
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grids Number 2 and 4 (Screen)
Pin 7—Grid Number 3

PHYSICAL DIMENSIONS



RETMA 5-2

GENERAL ELECTRIC

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

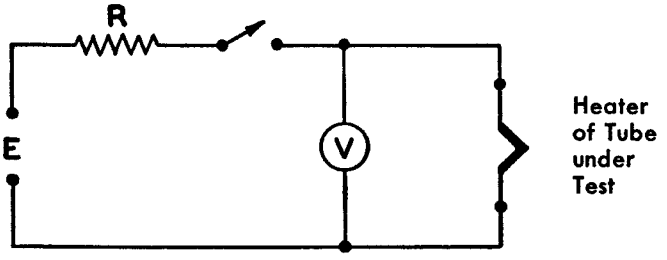
Plate Voltage	250	250	250	Volts
Screen Voltage	100	100	100	Volts
Grid-Number 3 Voltage	0	—	−2.5	Volts
Grid-Number 1 Voltage	—	−4.0	−2.5	Volts
Grid-Number 3 Transconductance	—	—	500	Micromhos
Grid-Number 1 Transconductance	—	—	1900	Micromhos
Plate Current	—	—	6.5	Milliamperes
Screen Current	—	—	9.0	Milliamperes
Grid-Number 3 Voltage, approximate I_b=35 Microamperes	—	−15	—	Volts
Grid-Number 1 Voltage, approximate I_b=35 Microamperes	−12	—	—	Volts

SYNC SEPARATOR AND SYNC CLIPPER SERVICE

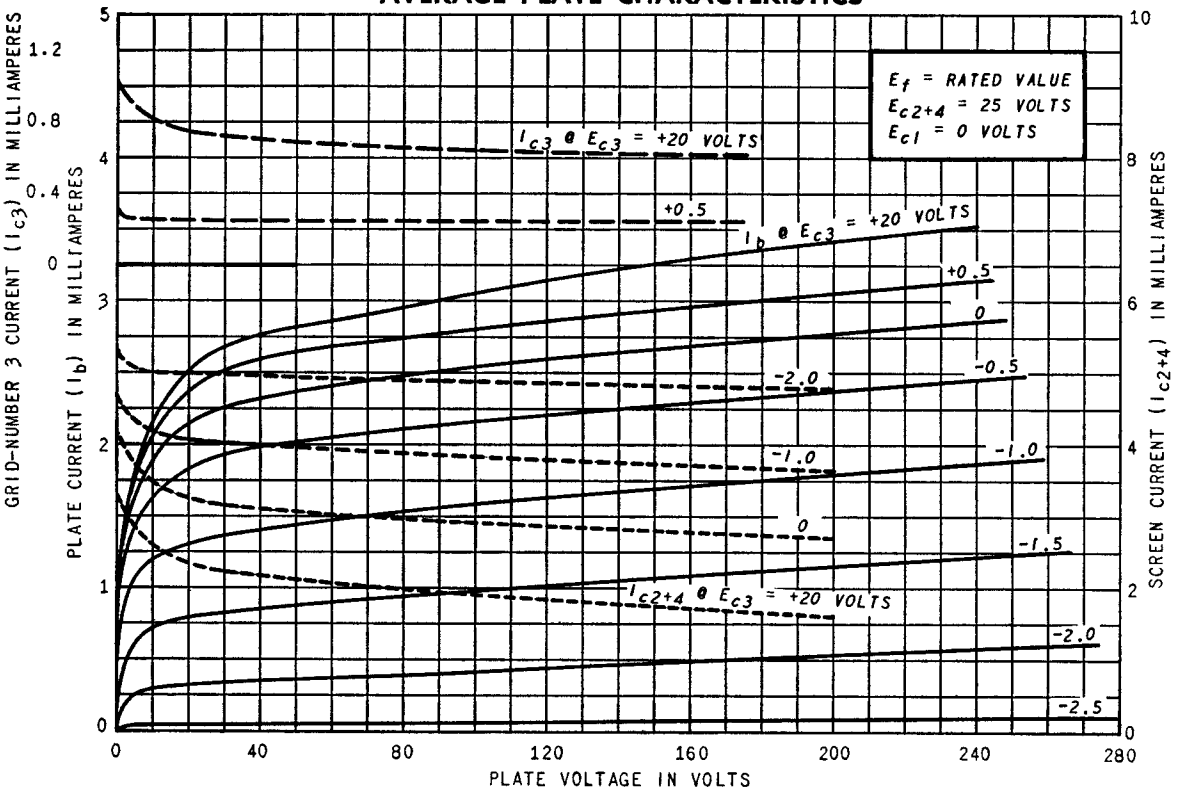
Plate Voltage	25	25	10	Volts
Screen Voltage	25	25	25	Volts
Grid-Number 3 Voltage	0	—	0	Volts
Grid-Number 1 Voltage	—	0	0	Volts
Plate Current	—	—	1.4	Milliamperes
Screen Current	—	—	3.5	Milliamperes
Grid-Number 3 Voltage, approximate I_b=50 Microamperes	—	−2.5	—	Volts
Grid-Number 1 Voltage, approximate I_b=50 Microamperes	−2.3	—	—	Volts

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E=12.5 volts (RMS or DC), V_1=2.5 volts (RMS or DC), and R=15.8 ohms.

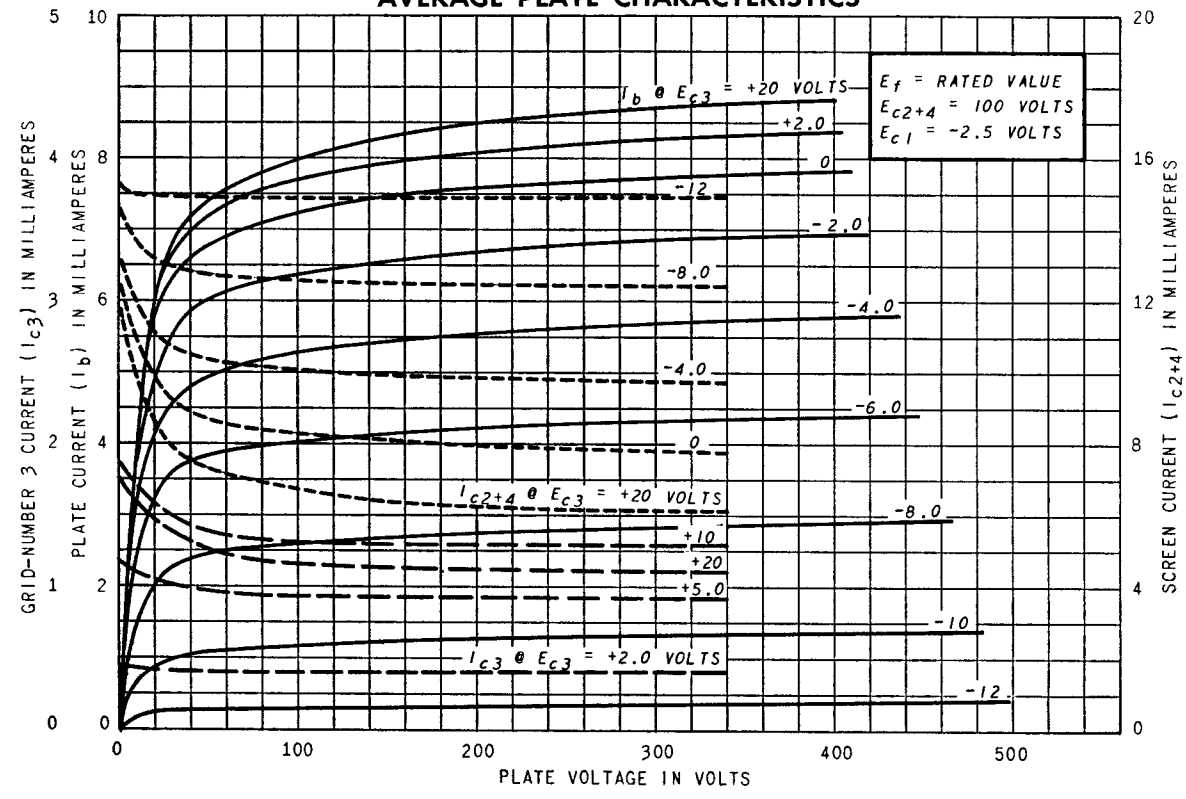
+ Without external shield.



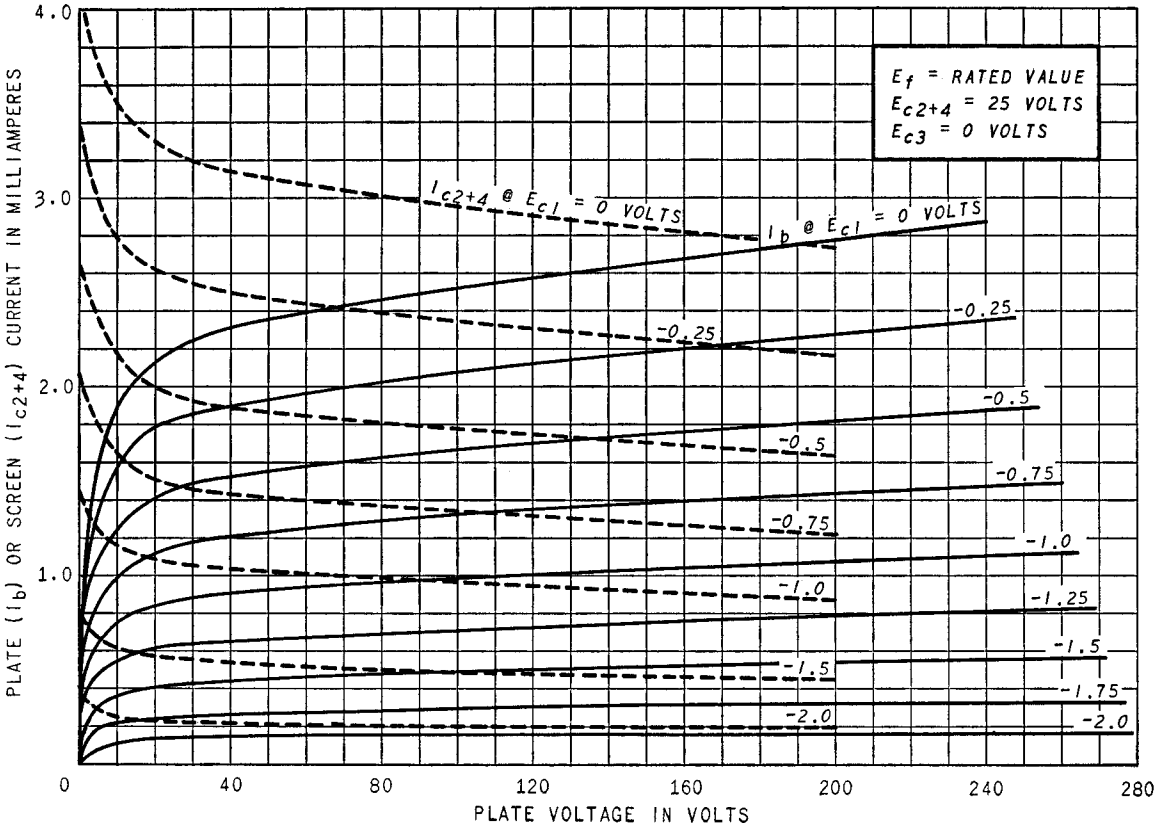
AVERAGE PLATE CHARACTERISTICS



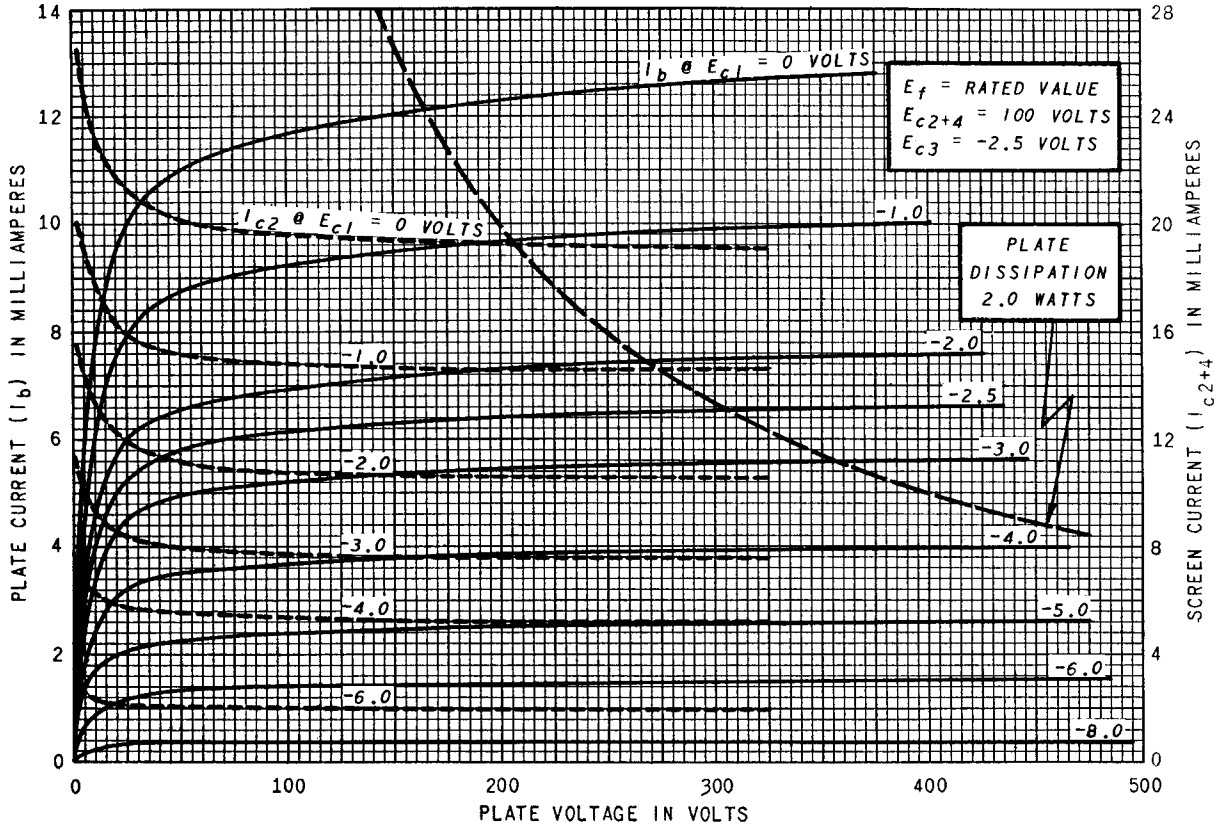
AVERAGE PLATE CHARACTERISTICS



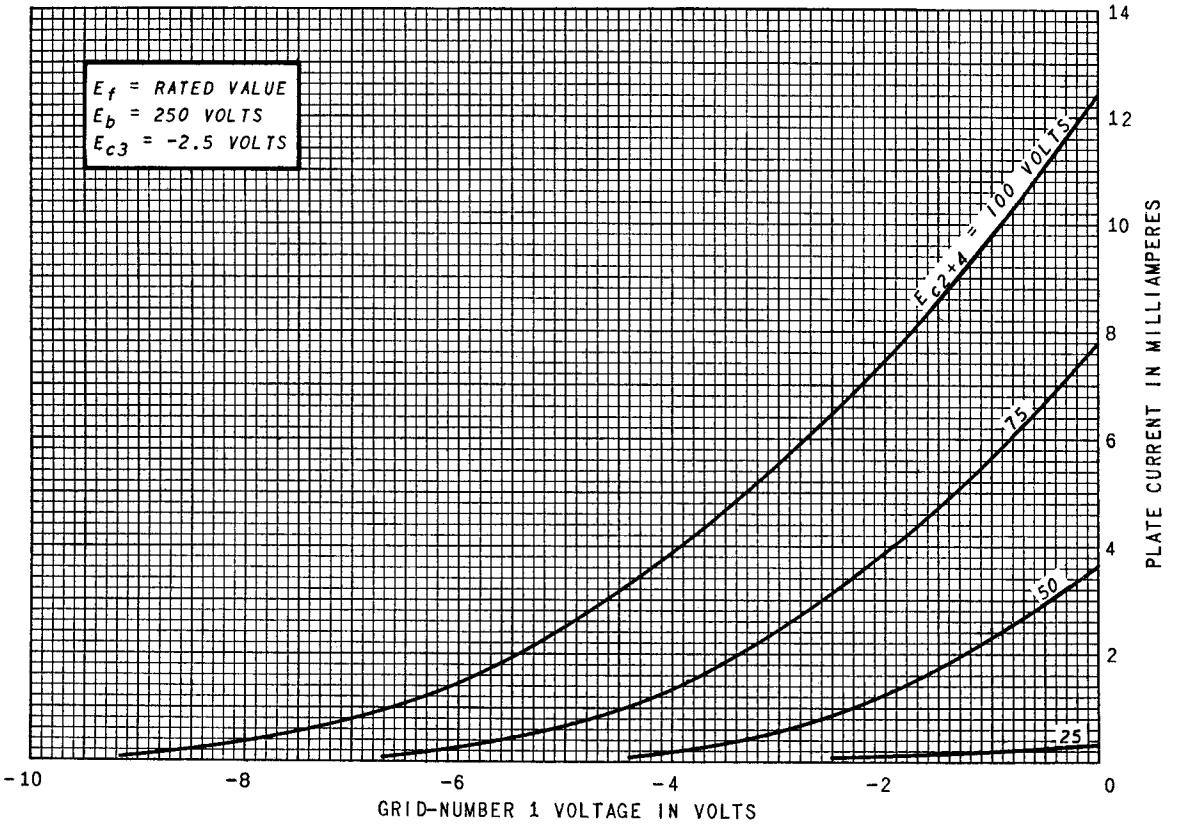
AVERAGE PLATE CHARACTERISTICS



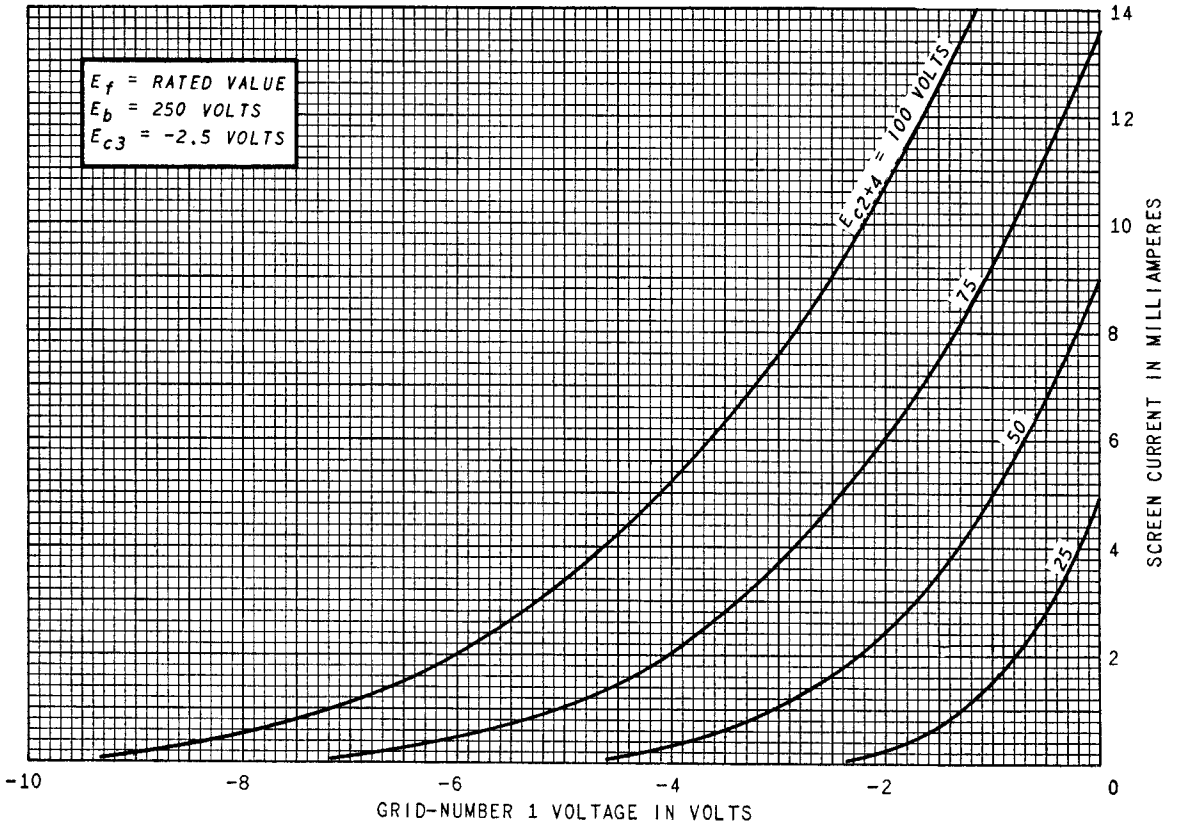
AVERAGE PLATE CHARACTERISTICS



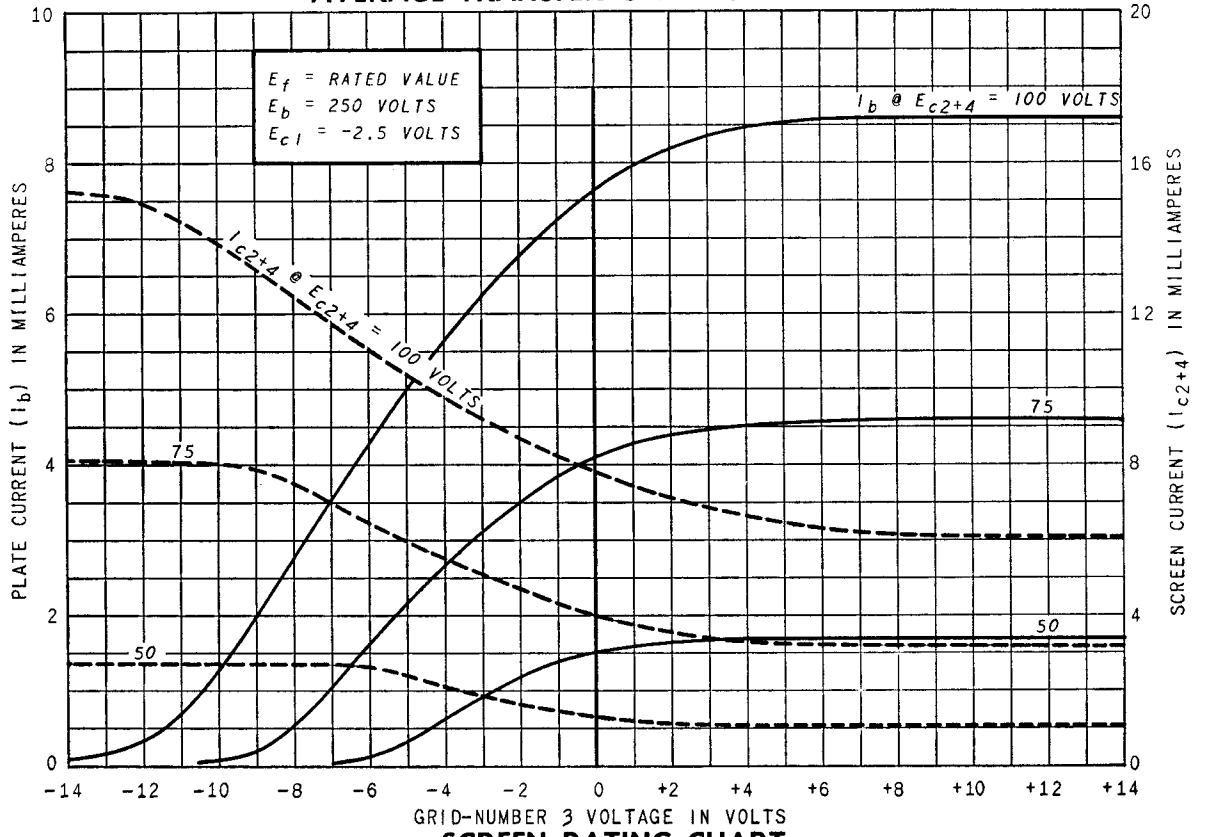
AVERAGE TRANSFER CHARACTERISTICS



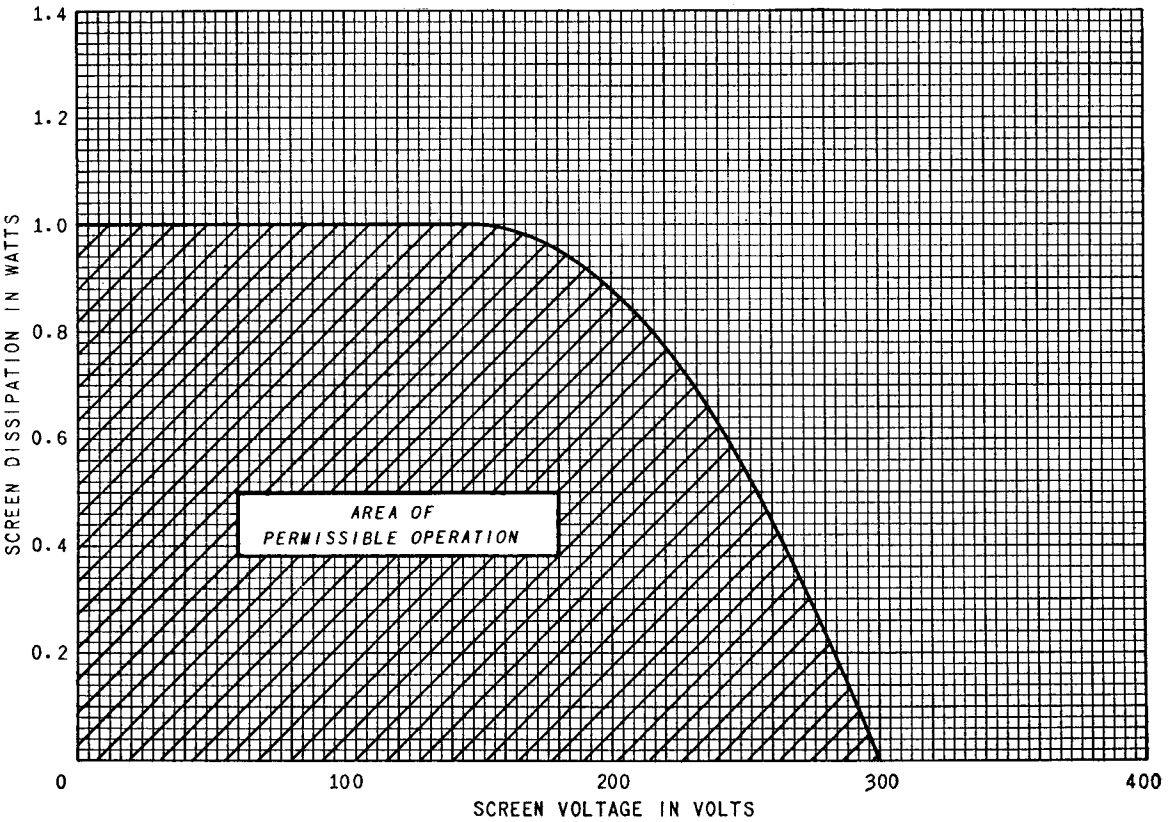
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



SCREEN RATING CHART



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

—PRODUCT INFORMATION—

Compactron Diode

6BZ3

FOR TV DAMPING DIODE APPLICATIONS

The 6BZ3 is a compactron containing a single heater-cathode type diode intended for service as the damping diode in the horizontal-deflection circuit of television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.06	Volts
Heater Current‡	1.2	Amperes

Direct Interelectrode Capacitances, approximate§

Cathode to Plate and Heater:		
k to (p + h)	11	pf
Plate to Cathode and Heater:		
p to (k + h)	8.5	pf
Heater to Cathode: (h to k)	3.4	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-60

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height.	2.500	Inches
Minimum Seated Height.	2.250	Inches

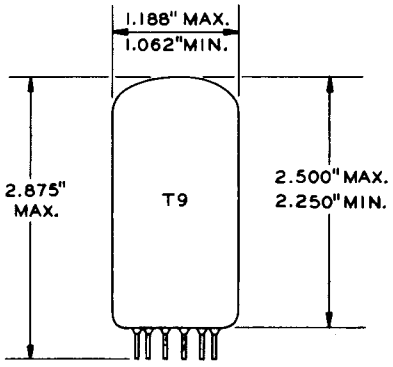
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

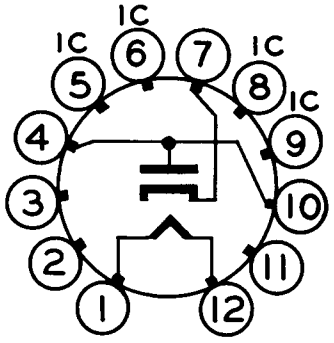


EIA 9-60

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - No Connection
Pin 3 - No Connection
Pin 4 - Plate
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Cathode
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Plate
Pin 11 - No Connection
Pin 12 - Heater

BASING DIAGRAM



EIA 12FX

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS (Cont'd)

TV DAMPER SERVICE¶—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	4500	Volts
Plate Dissipation	6.5	Watts
Steady-State Peak Plate Current	1200	Milliamperes
DC Output Current	200	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	900	Volts
Total DC and Peak	4500	Volts

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 350 Milliamperes DC	21	Volts

NOTES

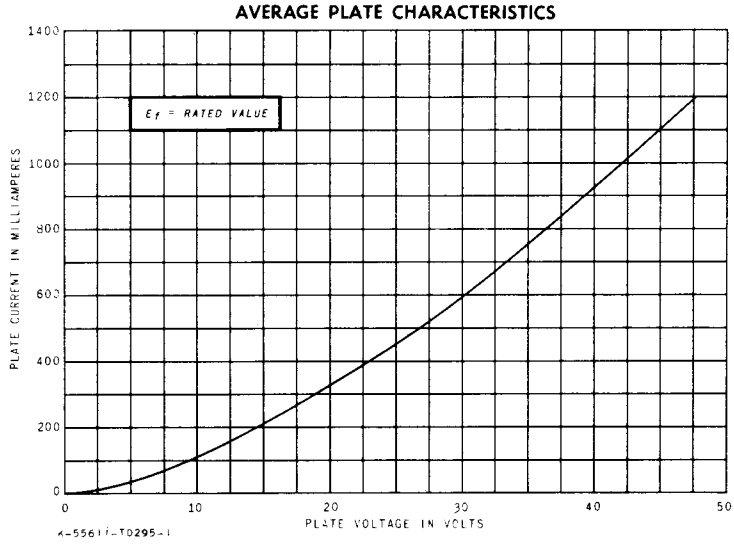
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

6BZ6 — 3BZ6

PENTODE

DESCRIPTION AND RATING

The 6BZ6 is a miniature semi-remote-cutoff pentode designed primarily for use as an intermediate-frequency amplifier in television receivers. Its semi-remote-cutoff characteristic makes the tube particularly useful in stages to which it is desired to apply automatic-gain-control. The tube also features a high transconductance and relatively low interelectrode capacitances.

Except for heater ratings, the 3BZ6 is identical to the 6BZ6. In addition the 3BZ6 has a controlled heater warm-up characteristic which makes it especially suited for use in television receivers that employ 600-milliampere, series-connected heaters.

GENERAL

ELECTRICAL

	3BZ6	6BZ6	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	3.15	6.3 ± 10%	Volts
Heater Current	0.6 ± 6%	0.3	Amperes
Heater Warm-up Time*	11		Seconds
	With Shield†	Without Shield	
Direct Interelectrode Capacitances			
Grid-Number 1 to Plate, maximum	0.015	0.025	μμf
Input	7.0	7.0	μμf
Output	3.0	2.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

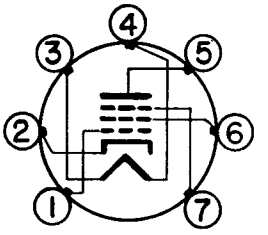
Plate Voltage	330	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	2.3	Watts
Screen Dissipation	0.55	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

GENERAL ELECTRIC

Supersedes ET-T971, dated 10-55

BASING DIAGRAM

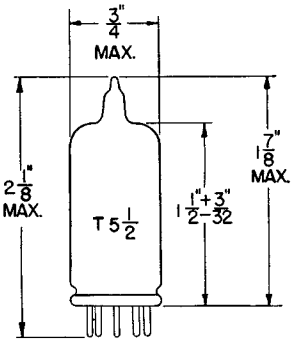


RETMA 7CM

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Internal Shield and Grid Number 3 (Suppressor)

PHYSICAL DIMENSIONS



RETMA 5-2

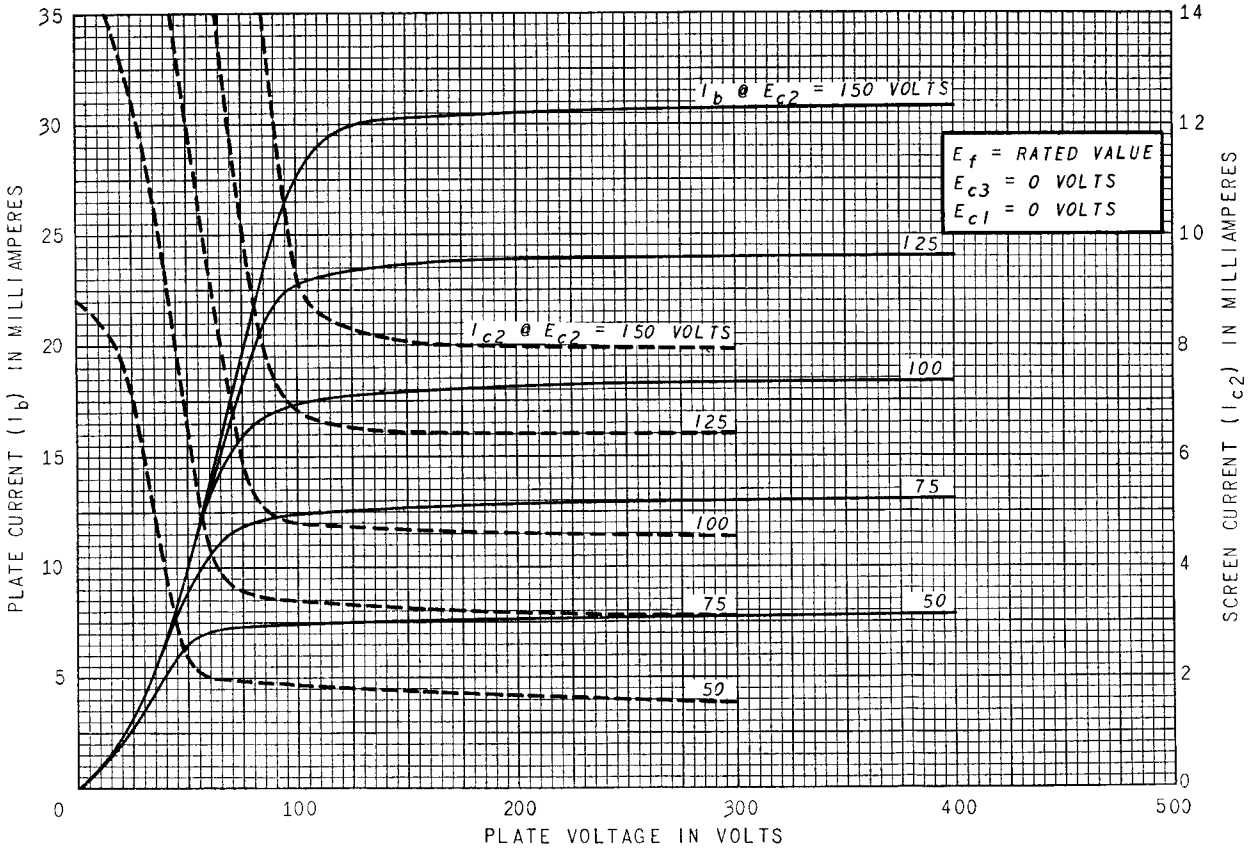
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER			
Plate Voltage	125	125	Volts
Suppressor, Connected to Cathode at Socket			
Screen Voltage	125	125	Volts
Grid-Number 1 Voltage	−4.5	...	Volts
Cathode-Bias Resistor	...	56	Ohms
Plate Resistance, approximate	...	0.26	Megohms
Transconductance	700	8000	Micromhos
Plate Current	...	14	Milliamperes
Screen Current	...	3.6	Milliamperes
Grid-Number 1 Voltage, approximate			
Gm = 50 Micromhos		−19	Volts

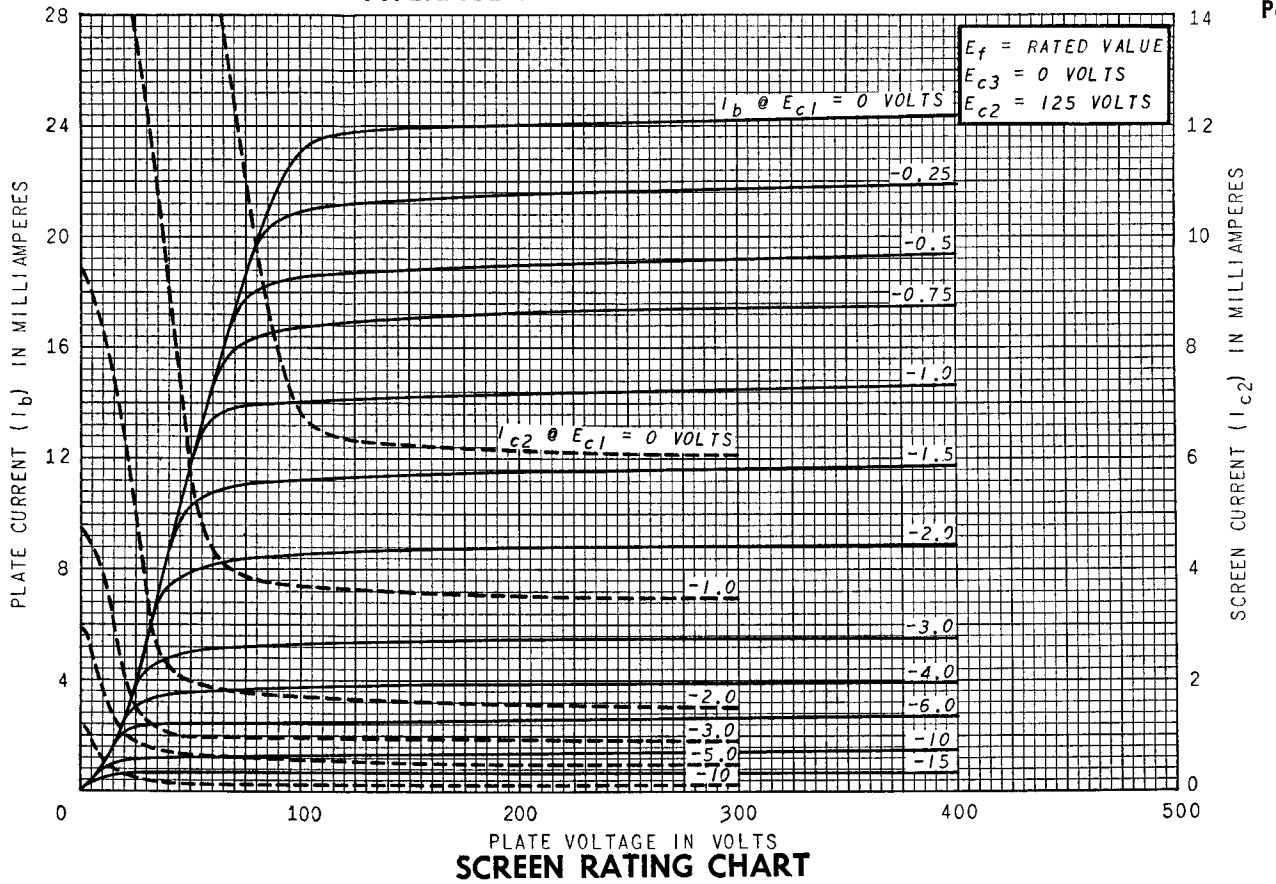
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (RETMA 316) connected to pin 2.

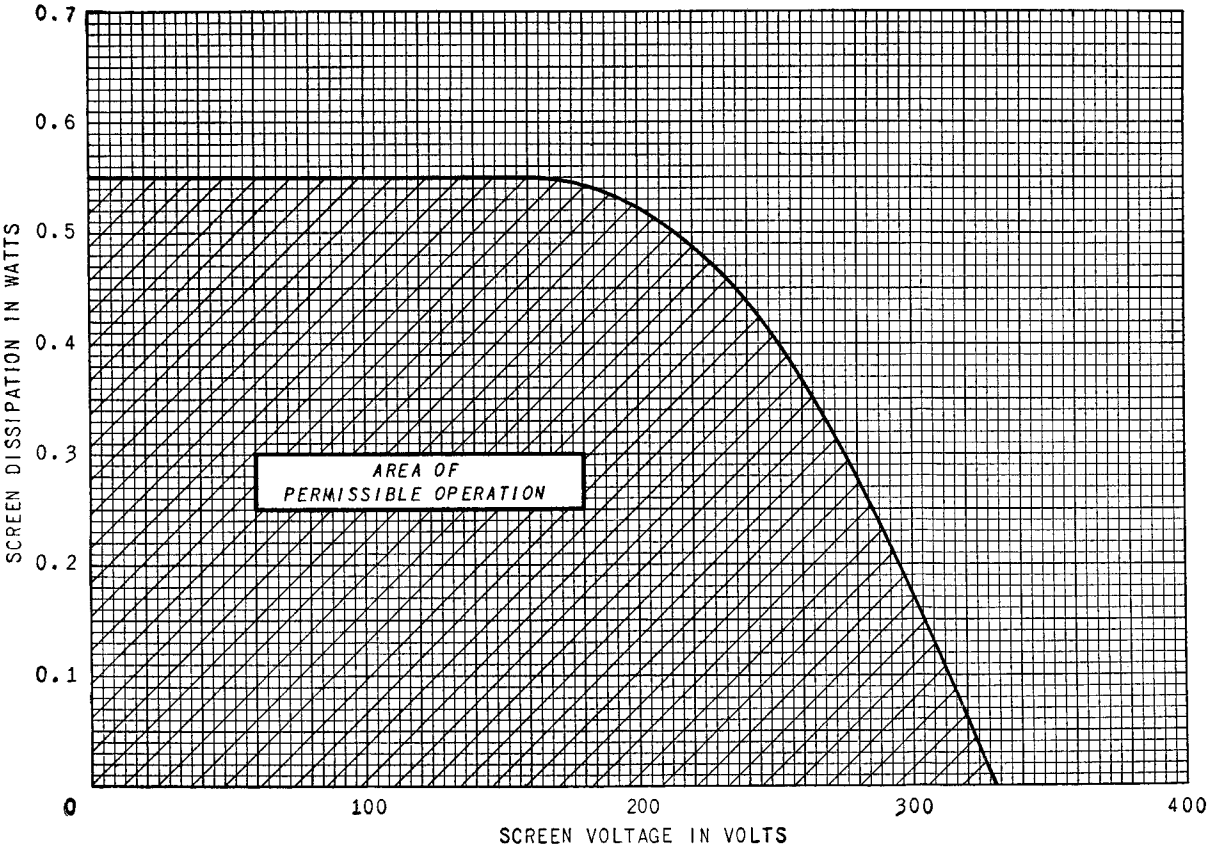
AVERAGE PLATE CHARACTERISTICS



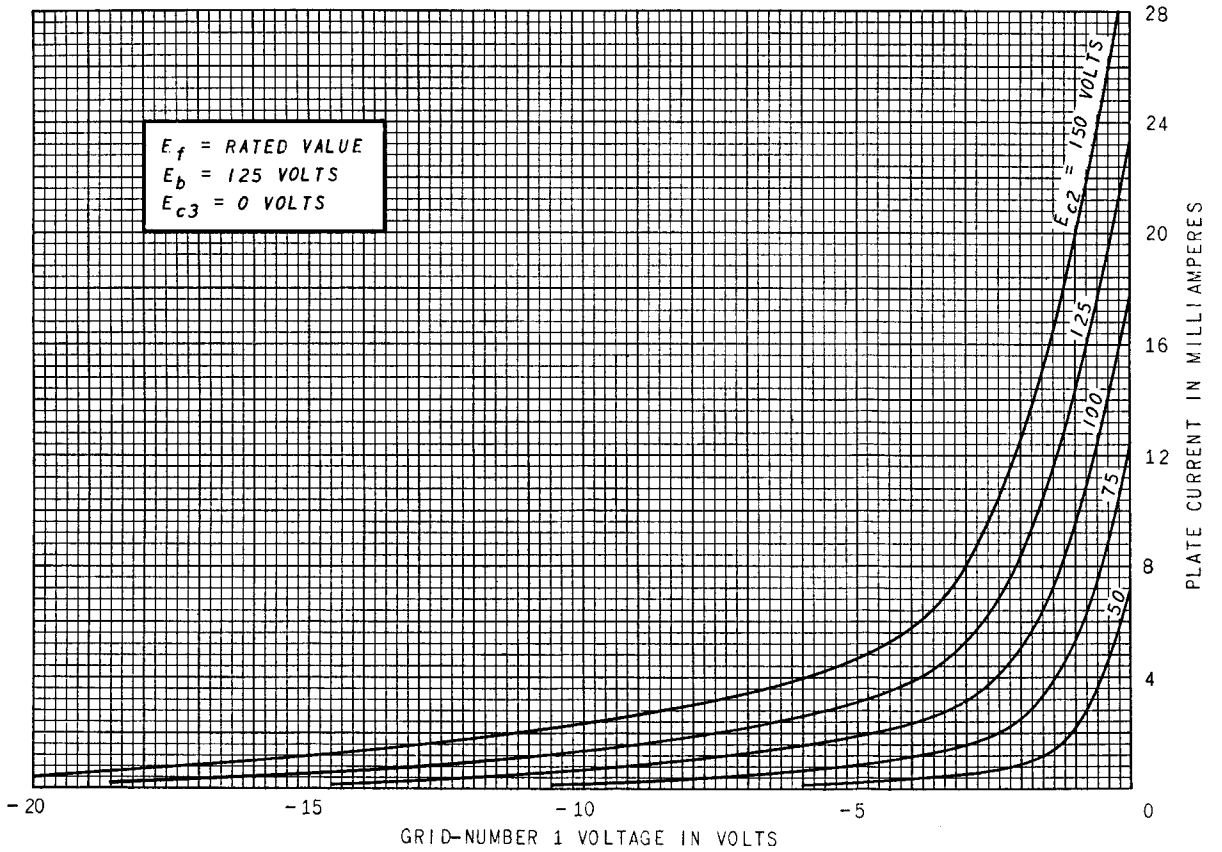
AVERAGE PLATE CHARACTERISTICS



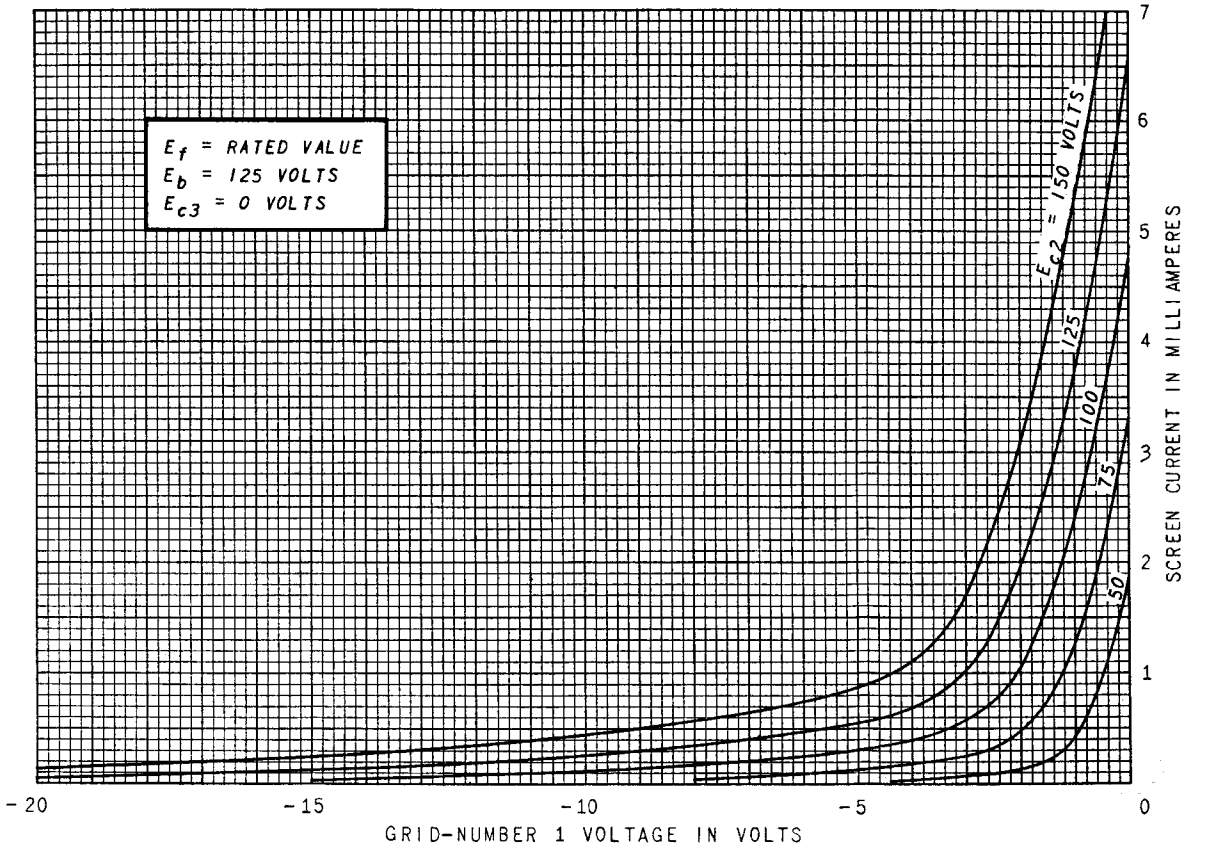
SCREEN RATING CHART



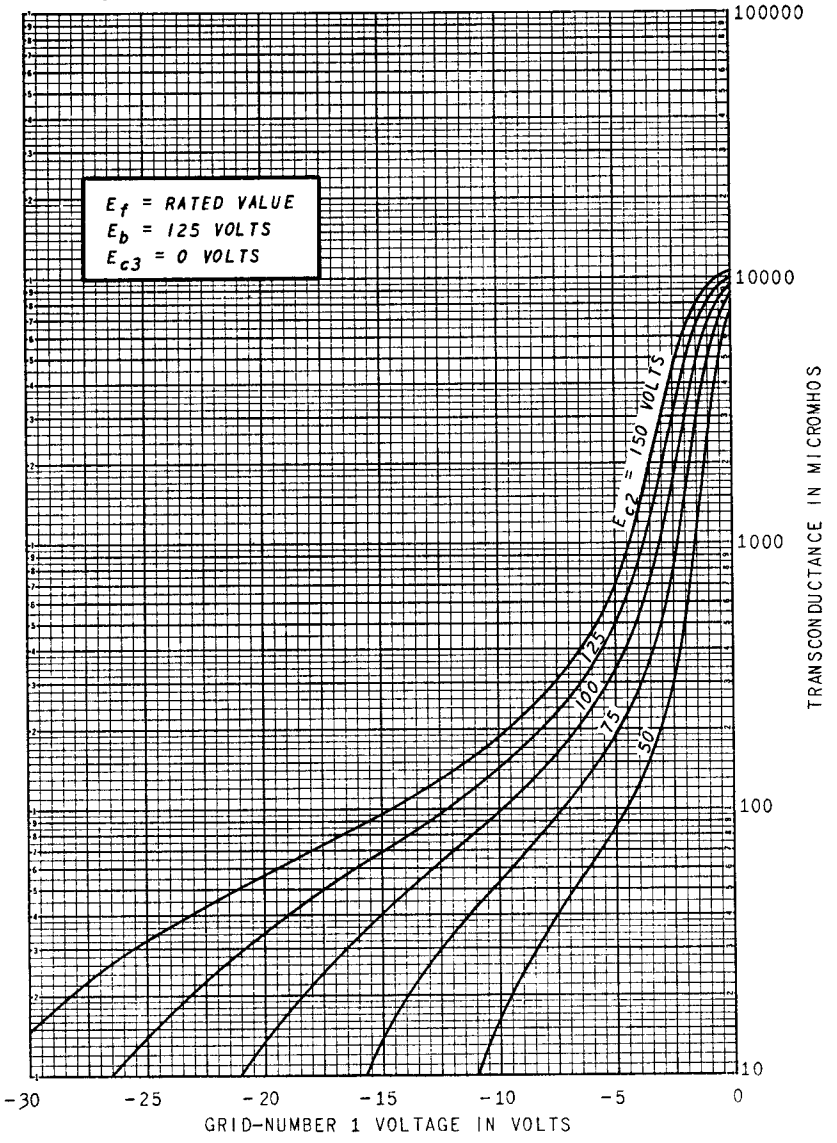
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBES

6BZ7—4BZ7

TWIN TRIODE

FOR VHF CASCODE AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6BZ7 is a miniature, medium-mu twin triode designed primarily for use as a cascode radio-frequency amplifier in very-high-frequency television tuners. In this application, its performance is characterized by high gain and low noise figure. An internal shield provides isolation between the two triode sections.

Except for heater ratings, the 4BZ7 is identical to the 6BZ7. In addition, as a result of its controlled heater warm-up characteristic, the 4BZ7 is especially suited for use in television receivers that employ 600-milliampere, series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	4BZ7		6BZ7	
Heater Voltage, AC or DC	4.2		6.3	Volts
Heater Current	0.6		0.4	Amperes
Heater Warm-up Time*	11		....	Seconds
Direct Interelectrode Capacitances†	Section 1		Section 2	
Grid to Plate	1.2		1.2	μμf
Input	2.6		....	μμf
Output	1.2		....	μμf
Heater to Cathode	2.6		2.6	μμf
Plate to Plate, maximum		0.01		μμf
Plate (Section 2) to Plate and Grid (Section 1), maximum		0.024		μμf
Plate to Cathode	0.12		0.12	μμf
Grounded-Grid Input			5.0	μμf
Grounded-Grid Output			2.2	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

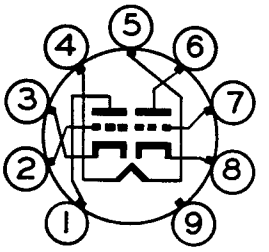
DESIGN-CENTER VALUES, EACH SECTION

Plate Voltage	250‡	Volts
Plate Dissipation	2.0	Watts
DC Cathode Current	20	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200‡	Volts
Grid Circuit Resistance	0.5	Megohms

GENERAL ELECTRIC

Supersedes ET-T853, dated 4-54

BASING DIAGRAM



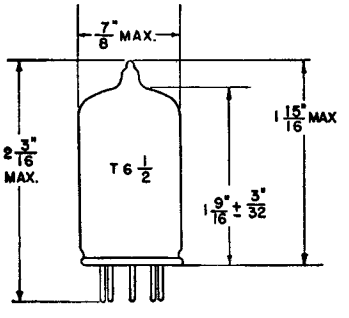
RETMA 9AJ

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Internal Shield

It is recommended that pin 9 be grounded.

PHYSICAL DIMENSIONS



RETMA 6-2

CHARACTERISTICS AND TYPICAL OPERATION

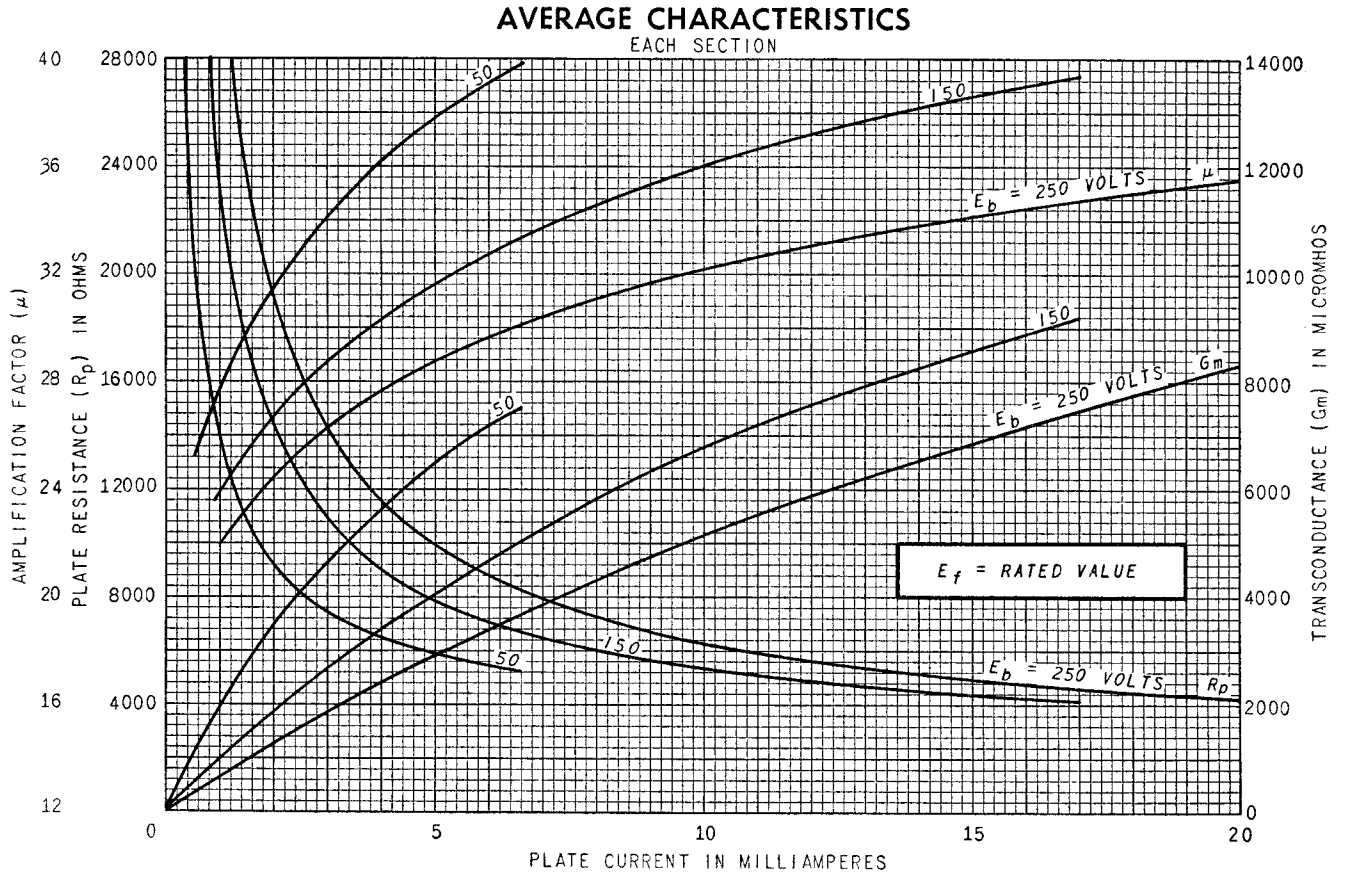
CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	150	Volts
Cathode-Bias Resistor	220	Ohms
Amplification Factor	36	
Plate Resistance, approximate	5300	Ohms
Transconductance	6800	Micromhos
Plate Current	10	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes	−7	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

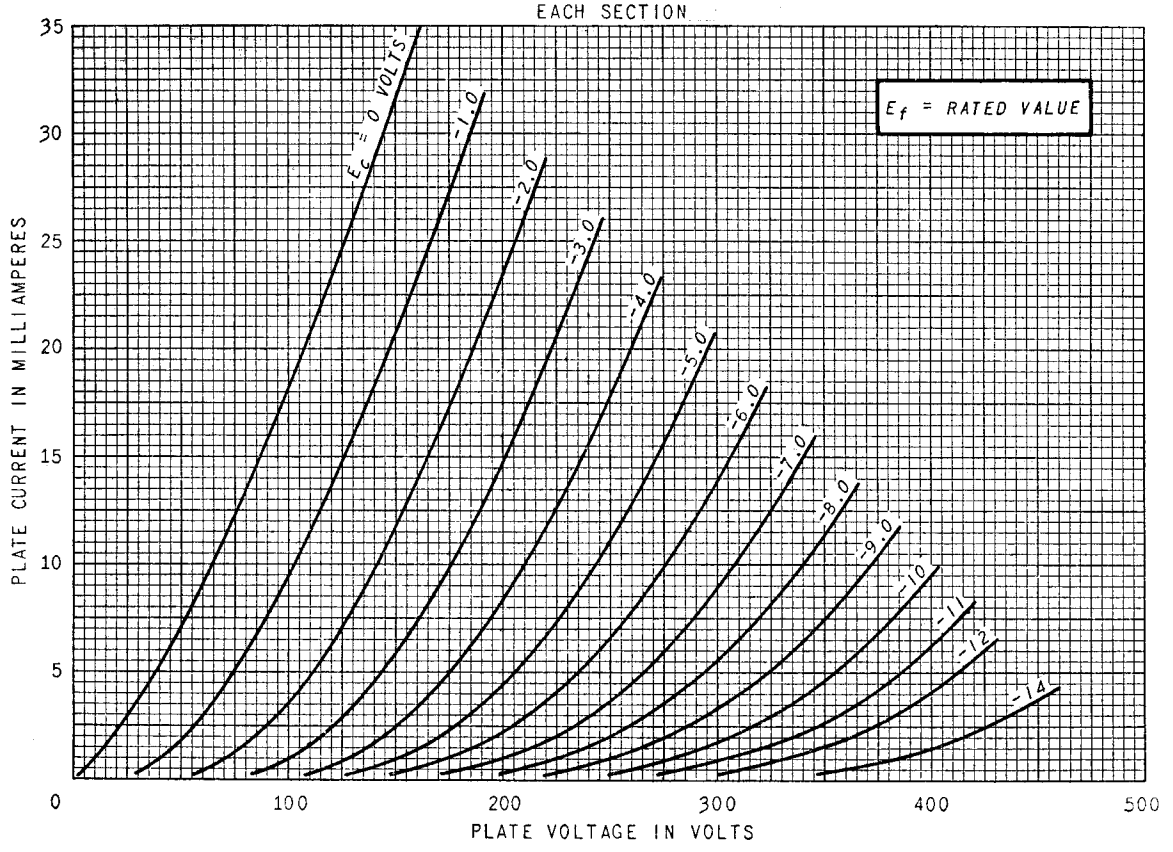
† With external shield (RETMA 315) connected to pin 9.

‡ When the tube is used as a cascode amplifier and the two sections are connected in series, this voltage may be as high as 300 volts maximum under cutoff conditions.



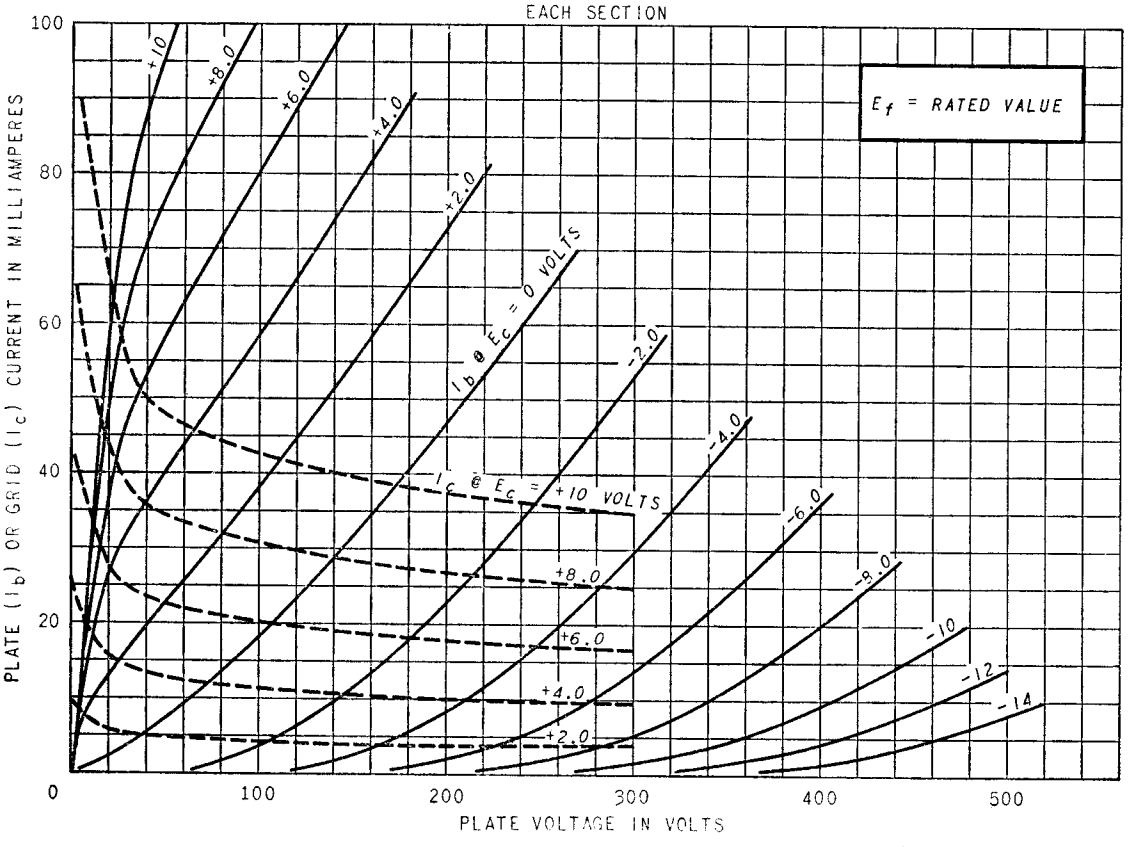
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



AVERAGE PLATE CHARACTERISTICS

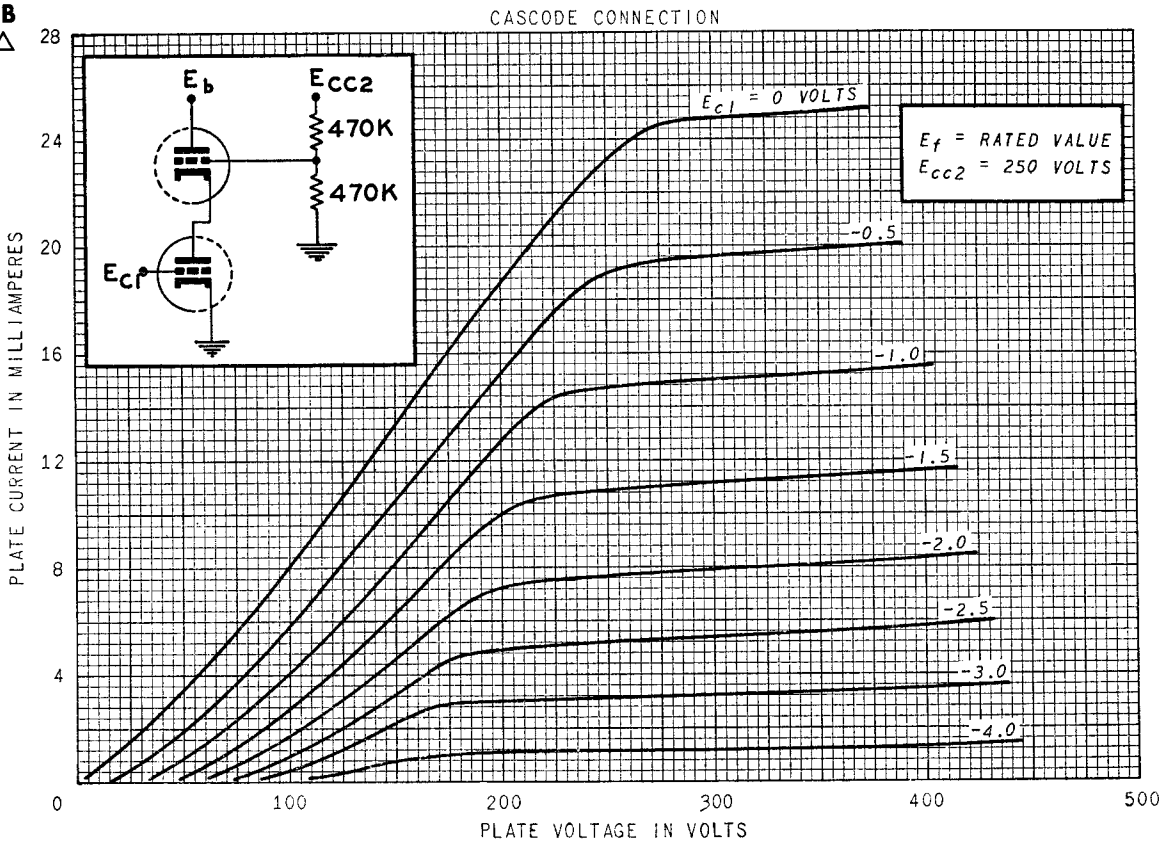
EACH SECTION



△ *Supersedes pages 3 and 4, dated 12-56*

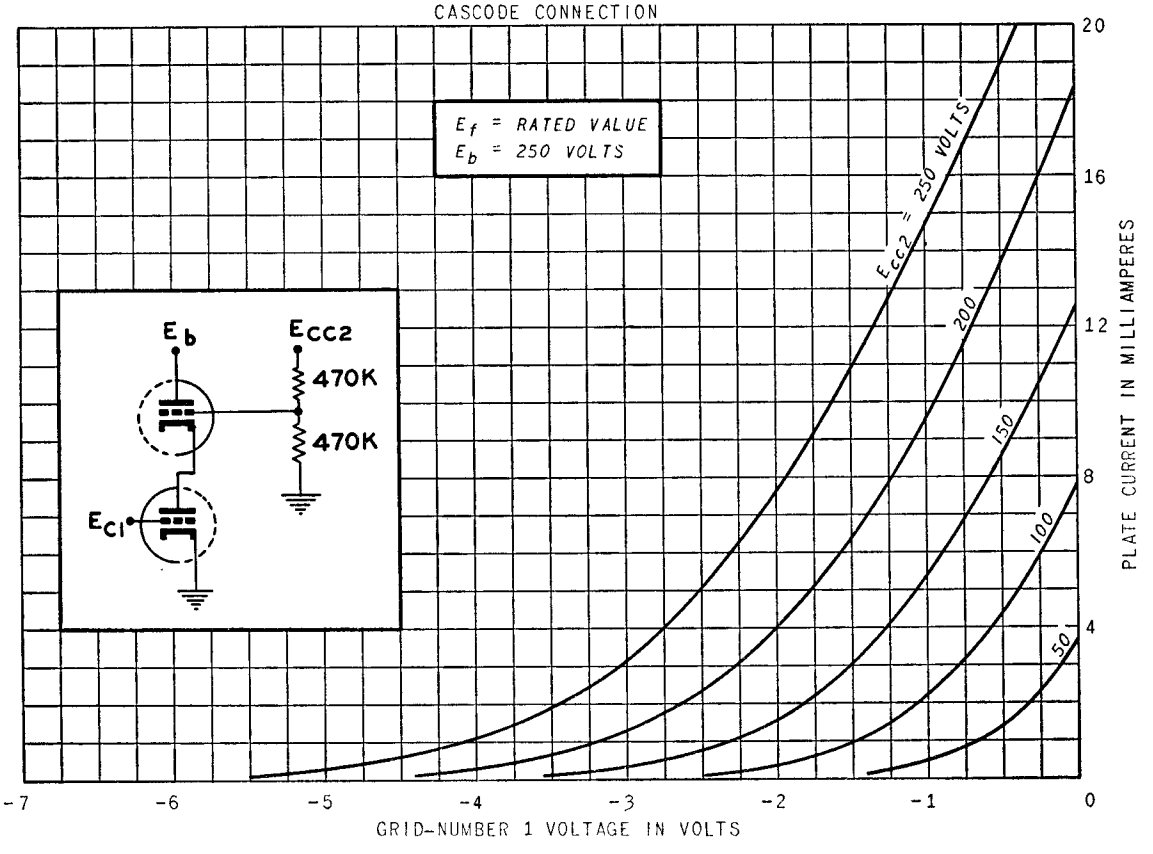
AVERAGE PLATE CHARACTERISTICS

CASCODE CONNECTION



AVERAGE TRANSFER CHARACTERISTICS

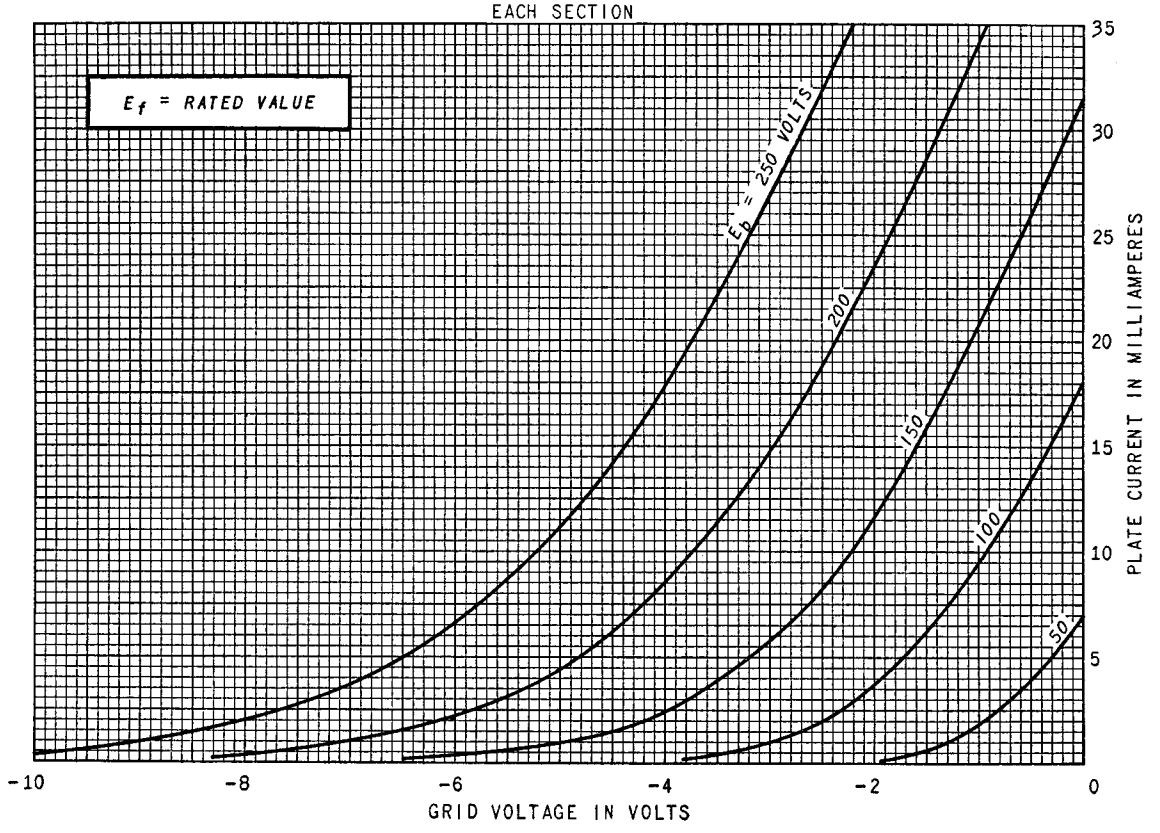
CASCODE CONNECTION



△ *Supersedes pages 3 and 4, dated 12-56*

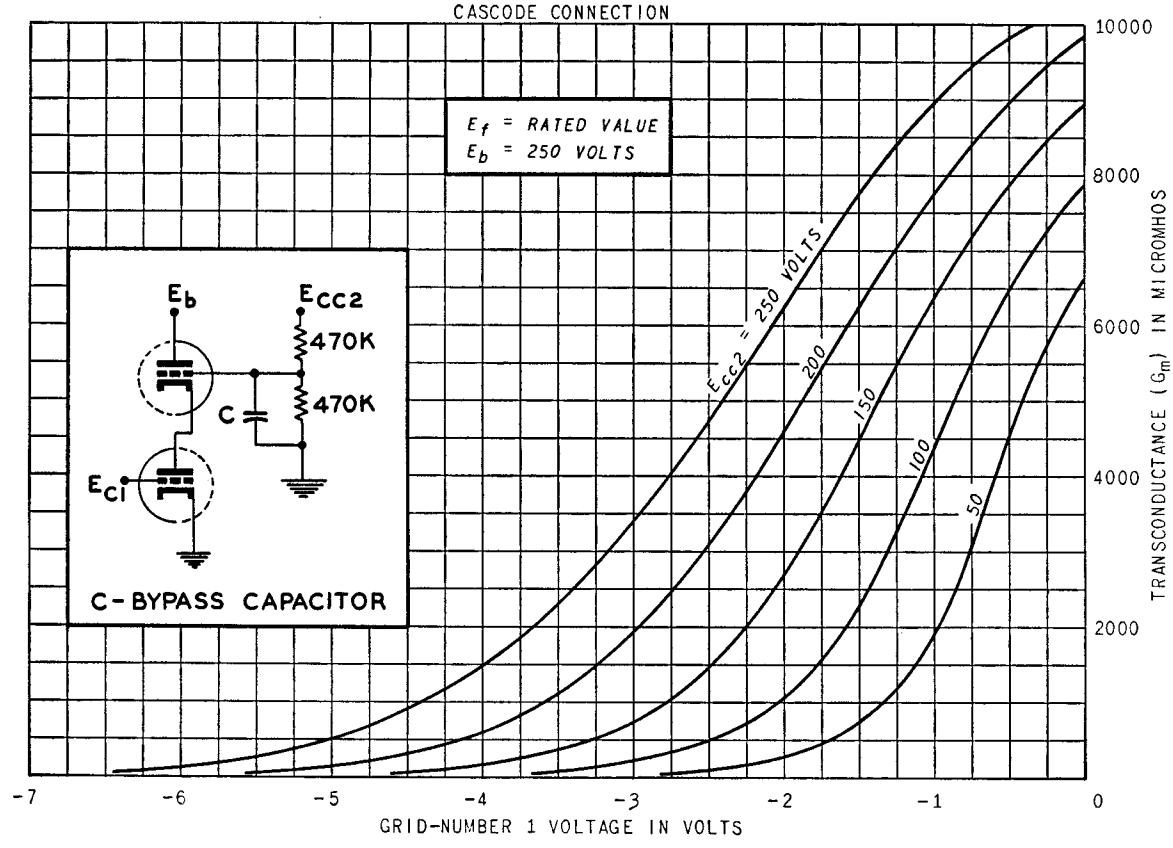
AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION



AVERAGE TRANSFER CHARACTERISTICS

CASCODE CONNECTION



Electronic TUBES

6C4

TRIODE

DESCRIPTION AND RATING

The 6C4 is a miniature, medium-mu triode suitable for use in a wide variety of general-purpose applications. It is especially useful as a local oscillator in high-frequency and very-high-frequency receiver circuits.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.15	Amperes

Direct Interelectrode Capacitances

	With Shield*	Without Shield	
Grid to Plate: (g to p)	1.4	1.6	μμf
Input: g to (h+k)	1.8	1.8	μμf
Output: p to (h+k)	2.5	1.3	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES	Class A_1 Amplifier	Class C Telegraphy	
Plate Voltage	300	300	Volts
Negative DC Grid Voltage	—	50	Volts
Plate Dissipation	3.5	5.0	Watts
DC Plate Current	—	25	Milliamperes
DC Grid Current	—	8.0	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Circuit Resistance			
With Fixed Bias	0.25	0.25	Megohms
With Cathode Bias	1.0	1.0	Megohms

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all tubes.

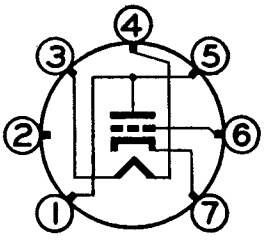
The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply voltage.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

Supersedes ET-T283D dated 6-53

BASING DIAGRAM

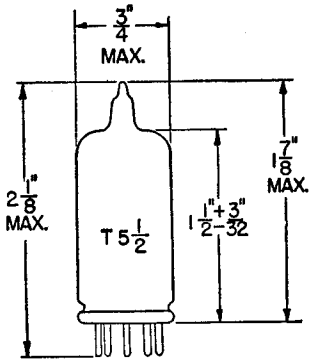


EIA 6BG

TERMINAL CONNECTIONS

Pin 1—Plate
Pin 2—Internal Connection
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid
Pin 7—Cathode

PHYSICAL DIMENSIONS



EIA 5-2

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	100	250	Volts
Grid Voltage	0	−8.5	Volts
Amplification Factor	19.5	17	
Plate Resistance, approximate	6250	7700	Ohms
Transconductance	3100	2200	Micromhos
Plate Current	11.8	10.5	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	−10	−25	Volts

CLASS C TELEGRAPHY, RF POWER AMPLIFIER AND OSCILLATOR

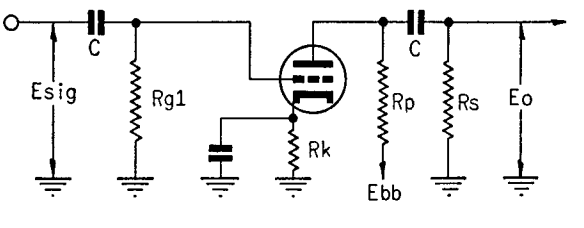
DC Plate Voltage	300	Volts
DC Grid Voltage	−27	Volts
DC Plate Current	25	Milliamperes
DC Grid Current, approximate	7	Milliamperes
Grid Driving Power, approximate	0.35	Watts
Power Output, approximate†	5.5	Watts

* With external shield (EIA 316) connected to pin 7.

† At 150 megacycles a power output of 2.5 watts may be obtained when the 6C4 is used as an oscillator with a grid resistor of 10,000 ohms and maximum rated input.

CLASS A RESISTANCE-COUPLED AMPLIFIER

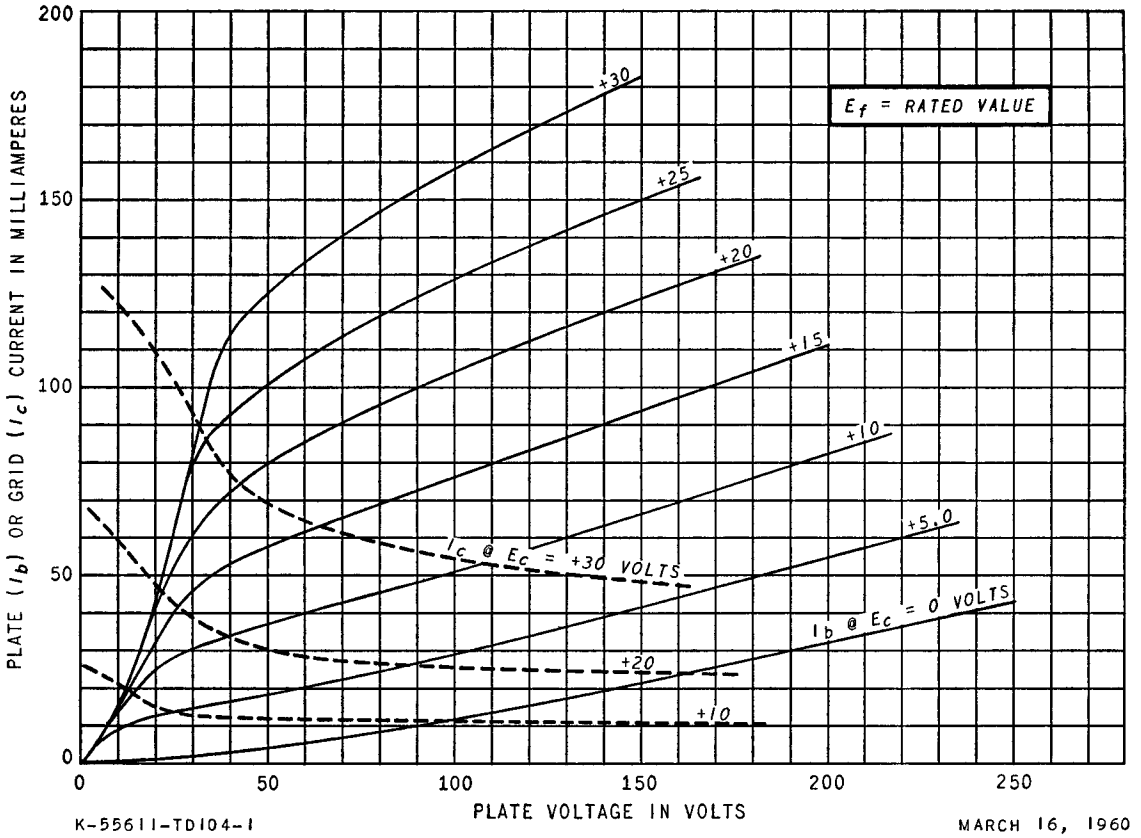
Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
			Rk	Gain	Eo	Rk	Gain	Eo	Rk	Gain	Eo
0.10	0.10	0.10	3900	10	10	3600	11	20	3500	11	30
0.10	0.24	0.10	5000	11	14	4700	12	27	4400	12	41
0.24	0.24	0.10	9400	11	13	8700	11	25	8700	12	38
0.24	0.51	0.10	11000	11	17	11000	12	32	11000	12	48
0.51	0.51	0.10	19000	11	15	18000	12	29	18000	12	43
0.51	1.0	0.10	24000	11	19	23000	12	37	23000	12	54
0.24	0.24	10	0	14	12	0	16	20	0	17	28
0.24	0.51	10	0	14	16	0	16	28	0	17	40
0.51	0.51	10	0	14	15	0	15	26	0	16	38
0.51	1.0	10	0	14	19	0	16	35	0	16	52



Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

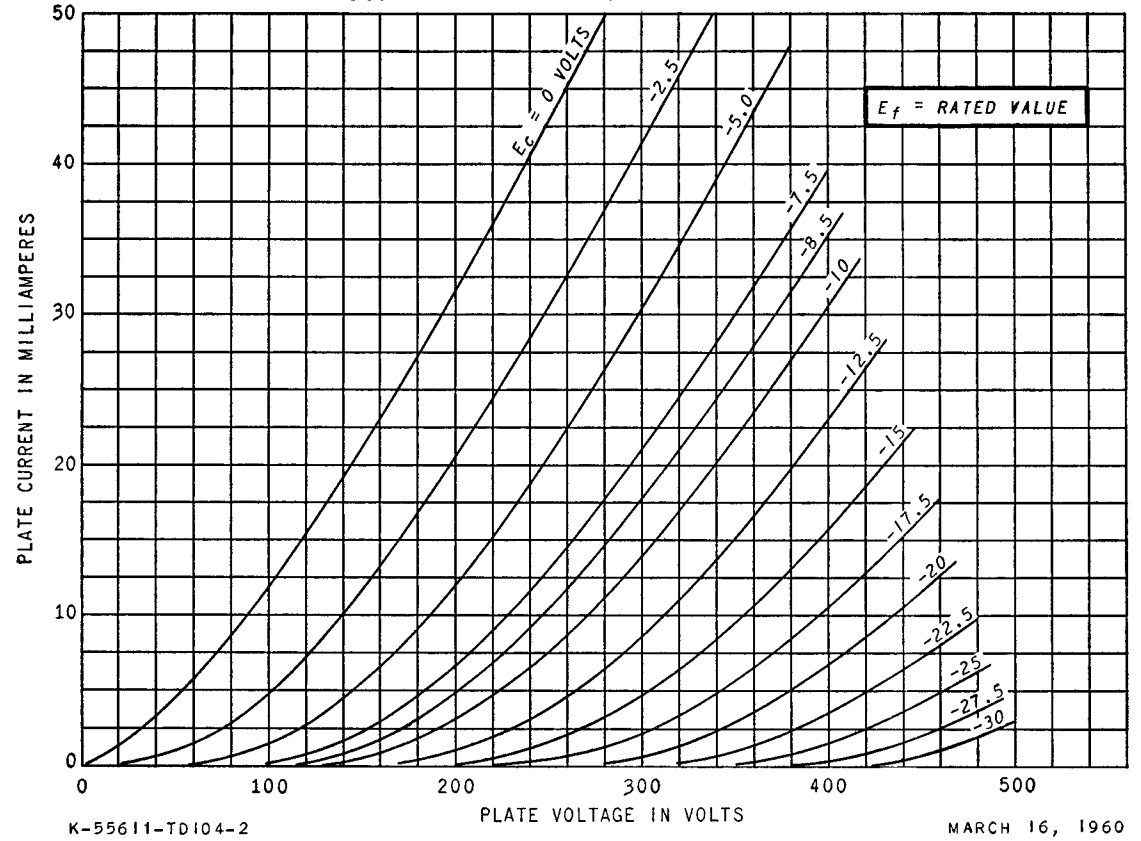
AVERAGE PLATE CHARACTERISTICS



K-55611-TD104-1

MARCH 16, 1960

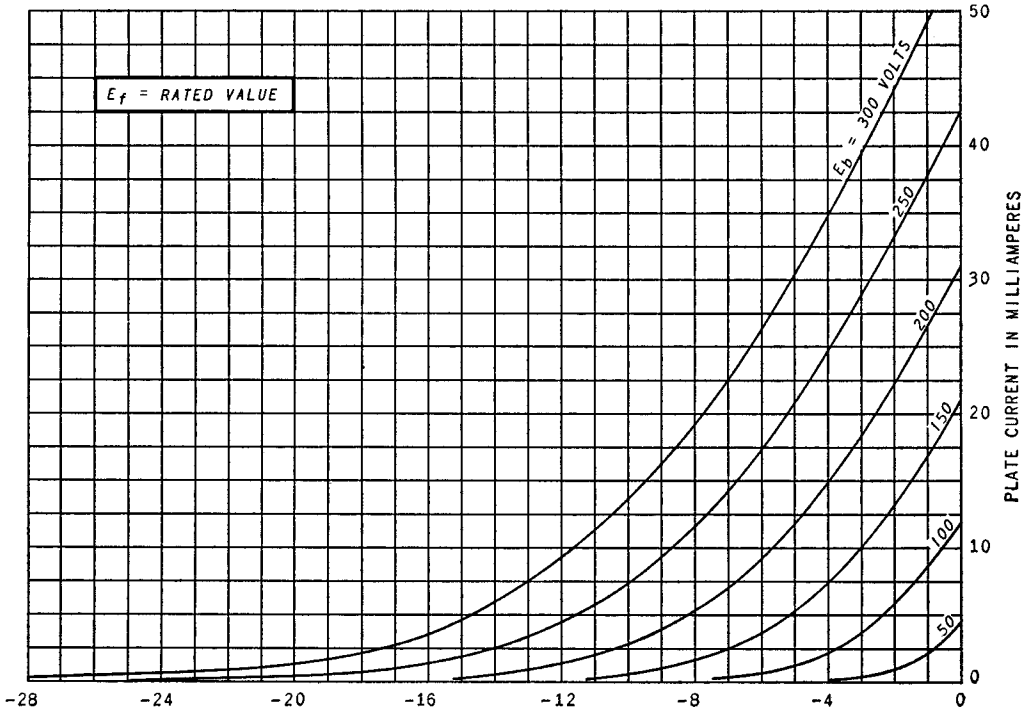
AVERAGE PLATE CHARACTERISTICS



K-55611-TD104-2

MARCH 16, 1960

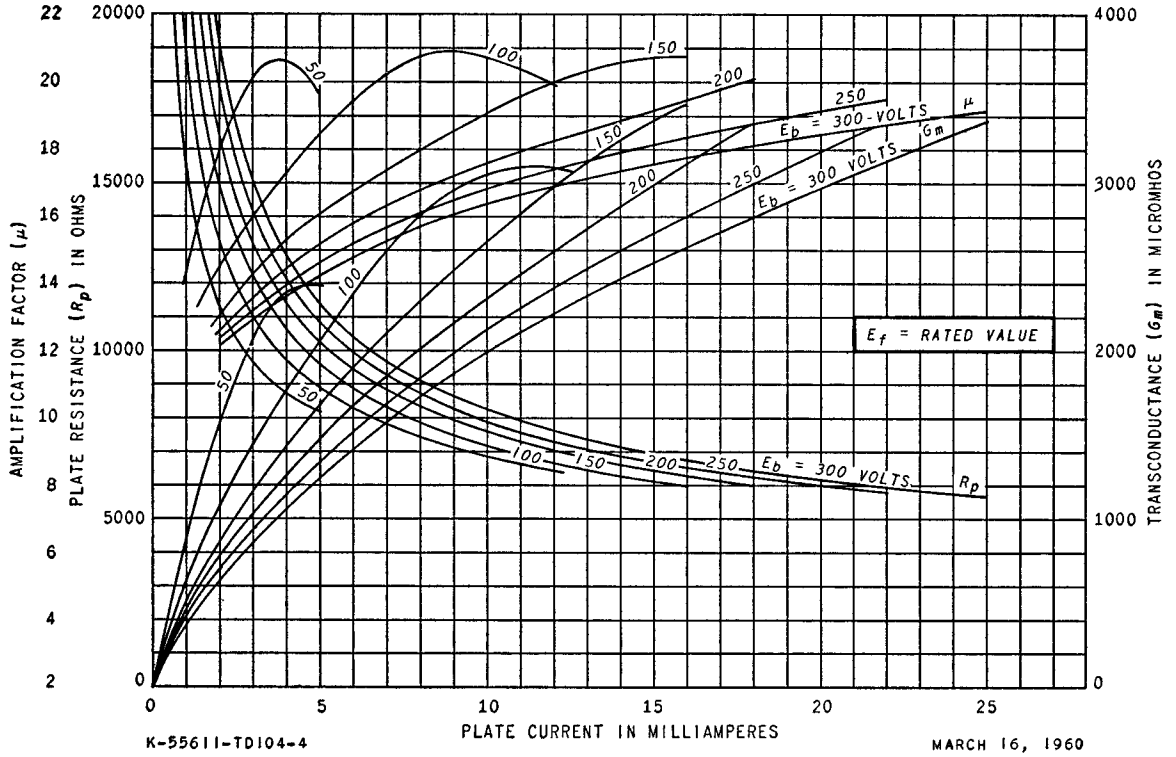
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD104-3

MARCH 16, 1960

AVERAGE CHARACTERISTICS



K-55611-TD104-4

MARCH 16, 1960

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

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COMPACTRON

TECHNICAL DATA

GENERAL ELECTRIC COMPANY, OWENSBORO, KENTUCKY

from JEDEC release #2906,
Aug. 1, 1960

6C10

TRIPLE TRIODE

The 6C10 is a compactron containing three high-mu triodes. Features of the device include separate pin connections for all three cathodes, grids, and plates, a button base, and a compact glass envelope. The 6C10 is especially suited for use in resistance-coupled voltage amplifiers, phase inverters, and numerous industrial-control circuits when high voltage-gain is desired.

GENERAL

Electrical

Cathode - Coated Unipotential		
Heater Voltage, AC or DC	6.3±10%	Volts
Heater Current	0.45	Amperes
Direct Interelectrode Capacitances*		
Grid to Plate, Each Section	1.7	μμf
Input, Each Section	1.6	μμf
Output, Section 1	0.30	μμf
Output, Section 2	0.24	μμf
Output, Section 3	0.34	μμf

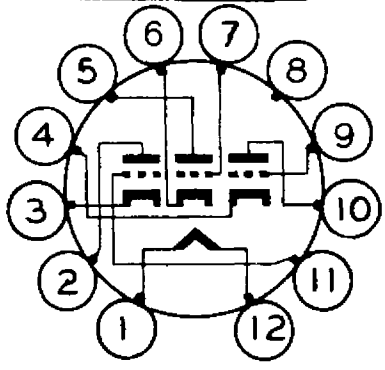
Mechanical

Mounting Position - Any		
Envelope - T-9, Glass		
Base - E12-70, Button 12-Pin		
Outline Drawing - EIA 9-62		
Maximum Diameter	1.188	Inches
Maximum Over-all Length	1.938	Inches
Maximum Seated Height	1.500	Inches

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate (Section 3)
Pin 3 - Cathode (Section 3)
Pin 4 - Cathode (Section 1)
Pin 5 - Plate (Section 2)
Pin 6 - Cathode (Section 2)
Pin 7 - Grid (Section 2)
Pin 8 - Internal Connection
Pin 9 - Grid (Section 1)
Pin 10 - Plate (Section 1)
Pin 11 - Grid (Section 3)
Pin 12 - Heater

BASING DIAGRAM



EIA 12BQ

CLIFTON, N. J. 200 E. Main Avenue (Clifton) GRegory 3-6387 (NYC) Wisconsin 7-4065, 6, 7, 8
NEWTONVILLE, MASS. 701 Washington St. WOodward 9-9420
WASHINGTON, D. C. 777—14th St., N.W. EXecutive 3-3600
CHICAGO, ILL. 3800 N. Milwaukee SPring 7-1600
DALLAS, TEXAS 3200 Maple Avenue Riverside 7-4296
SAN MATEO, CALIF. 442 Peninsular Ave. Diamond 2-7201
LOS ANGELES, CALIF. 11840 W. Olympic GRanite 9-7765 BRadshaw 2-8566

MAXIMUM RATINGS

Design-Maximum Values, Each Section

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation, Each Plate	1.0	Watts
Total Plate Dissipation, All Plates	3.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electron device under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier, Each Section

Plate Voltage	100	250	Volts
Grid Voltage	-1.0	-2.0	Volts
Amplification Factor	100	100	
Plate Resistance, approximate	80000	62500	Ohms
Transconductance	1250	1600	Micromhos
Plate Current	0.5	1.2	Milliamperes

* Without external shield.

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Nov. 28, 1960

Release No. 2906A
Type 6C10

As Registered

Heater Voltage, AC or DC	6.3 ± 10% Volts
Heater Current	0.45 Amperes

As Proposed

Heater Characteristics and Ratings (Design-Maximum Rating System)

	Series Heater Operation*	Parallel Heater Operation*
Heater Voltage, AC or DC	6.3≠	6.3 ± 0.6 Volts
Heater Current	0.6 ± 0.04	0.6 Amperes #
Heater Warm-up Time**	11	--- Seconds

* For parallel heater operation, the equipment designer shall design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. For series heater operation, the equipment designer shall design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

≠ Heater voltage at bogey heater current.

\# Heater current at bogey heater voltage.

** The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

Electronic TUBES

6CA4

TWIN DIODE

FOR FULL-WAVE POWER-RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6CA4 is a miniature, heater-cathode, twin diode for full-wave rectifier operation. High output current and small size make it especially suitable for compact amplifier designs.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Voltage, AC or DC . . . . . 6.3 ± 10% Volts
Heater Current . . . . . 1.0 Amperes

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

RECTIFIER SERVICE—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage . . . . . 1200 Volts
AC Plate-Supply Voltage per Plate—See Rating Chart I
Steady-State Peak Plate Current per Plate . . . . . 500 Milliamperes
Transient Peak Plate Current per Plate,
Maximum Duration 0.2 Seconds . . . . . 1.85 Amperes
DC Output Current—See Rating Chart I
Heater-Cathode Voltage
Heater Negative with Respect to Cathode . . . . . 500 Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

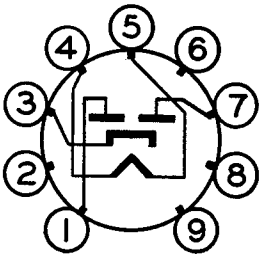
These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

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GENERAL ELECTRIC

BASING DIAGRAM

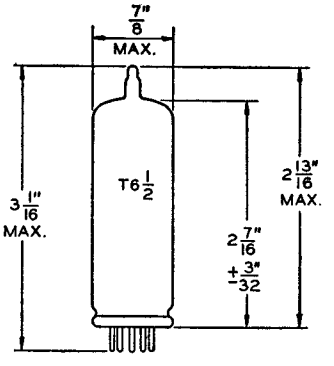


EIA 9M

TERMINAL CONNECTIONS

Pin 1—Plate Number 2
Pin 2—Internal Connection
Pin 3—Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Internal Connection
Pin 7—Plate Number 1
Pin 8—Internal Connection
Pin 9—Internal Connection

PHYSICAL DIMENSIONS



EIA 6-4

CHARACTERISTICS AND TYPICAL OPERATION

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

AC Plate-Supply Voltage per Plate, RMS	250	300	350	Volts
Filter Input Capacitor	50	50	50	Microfarads
Total Plate-Supply Resistance per Plate	150	200	240	Ohms
DC Output Current	150	150	150	Milliamperes
DC Output Voltage at Filter Input	245	293	347	Volts

Tube Voltage Drop

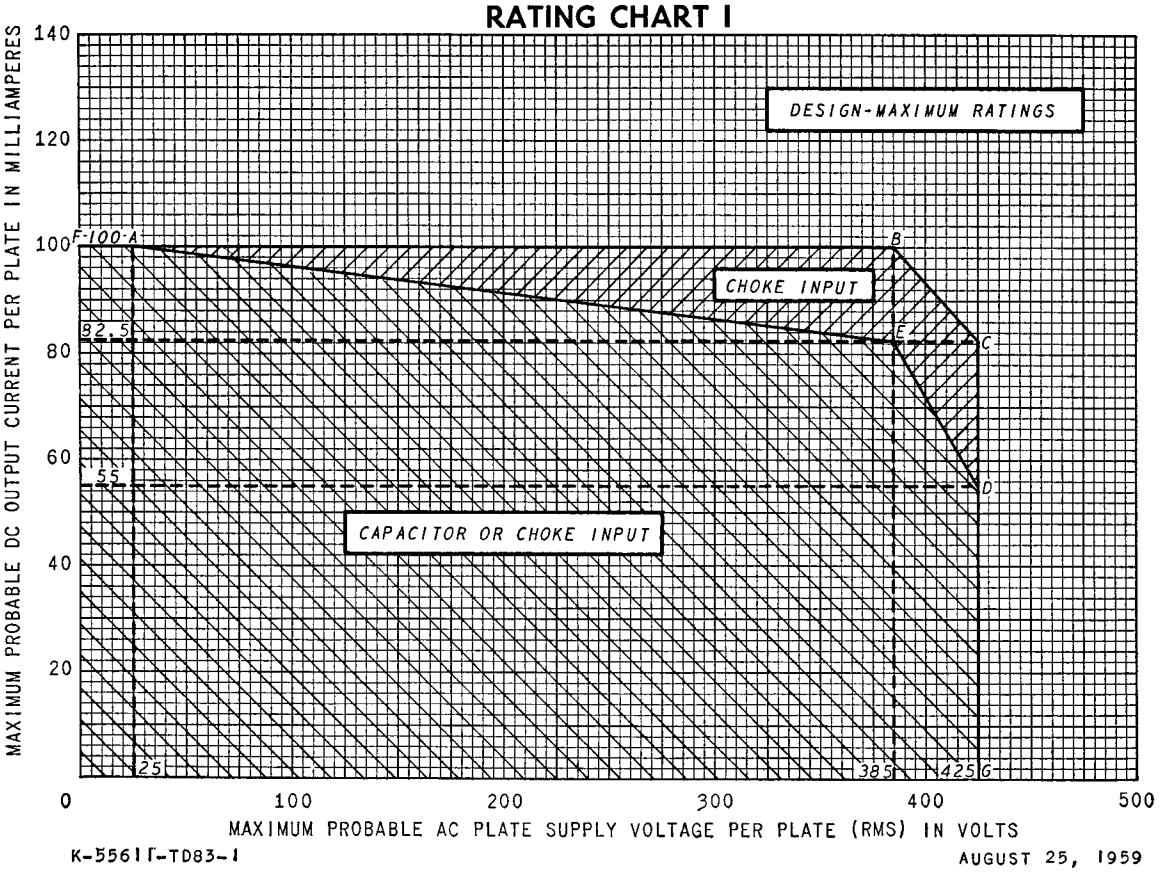
Ib = 150 Milliamperes DC per Plate	20	Volts

To simplify the application of the maximum ratings to circuit design, the Design-Maximum ratings are presented in chart form as Rating Charts I, II, and III. Rating Chart I presents the maximum ratings for a-c plate supply voltage and d-c output current. Rating Chart II provides a convenient method for checking conformance with the maximum steady-state peak-plate-current rating. Rating Chart III offers a convenient method for checking conformance with the maximum transient peak-plate-current rating. Rating Chart I applies to both capacitor-input and choke-input filters, while Rating Charts II and III apply to capacitor-input filters only.

Operating points should be so selected that the boundary limits of a-c plate supply voltage and d-c output current on Rating Chart I, and maximum d-c output current per plate and rectification efficiency on Rating Chart II, are not exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, and environmental conditions. On Rating Chart I the boundary FAEDG defines the limits for capacitor-input filter operation, and the boundary FABCDG defines the limits for choke-input filter operation.

Rating Chart III shows the minimum value of plate supply resistance (R_s) required to remain within the transient peak-plate-current rating. The value of R_s should be such that it lies to the left of the line on Rating Chart III at the highest probable value of line voltage.

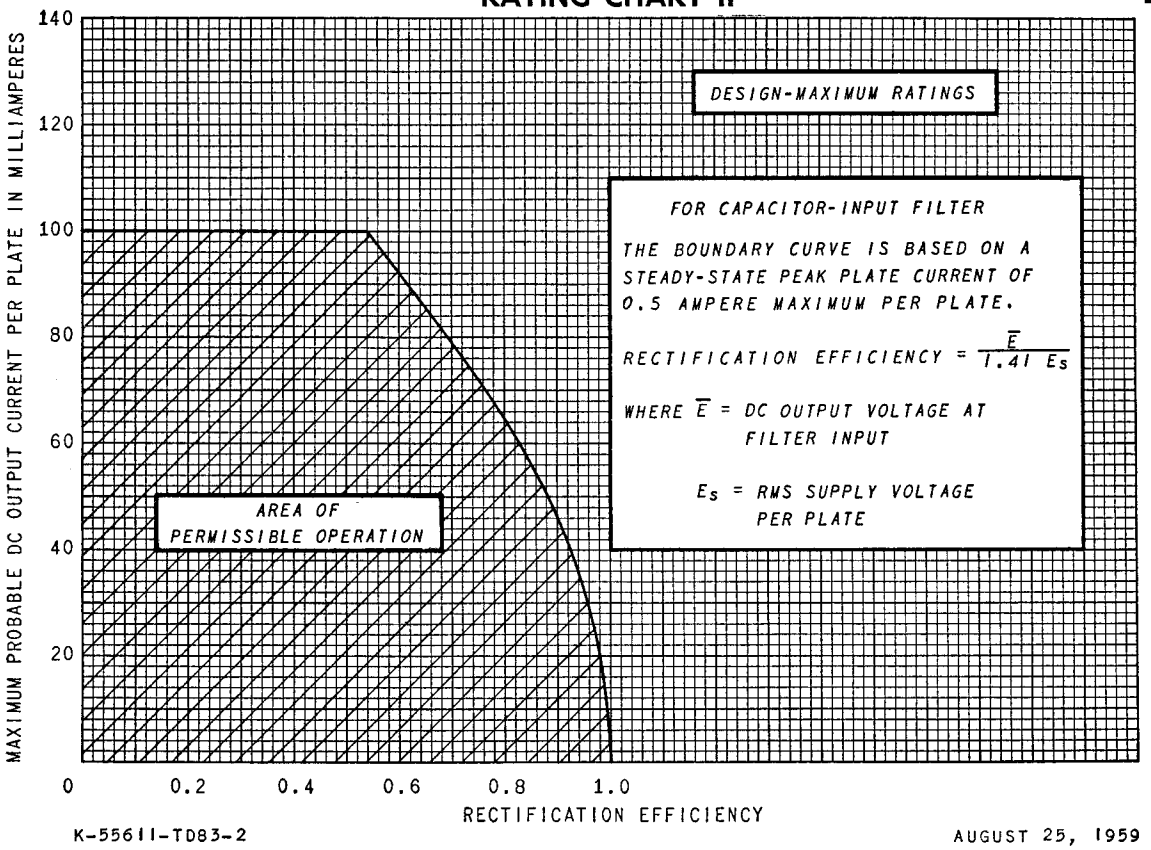
RATING CHART I



K-5561I-TD83-1

AUGUST 25, 1959

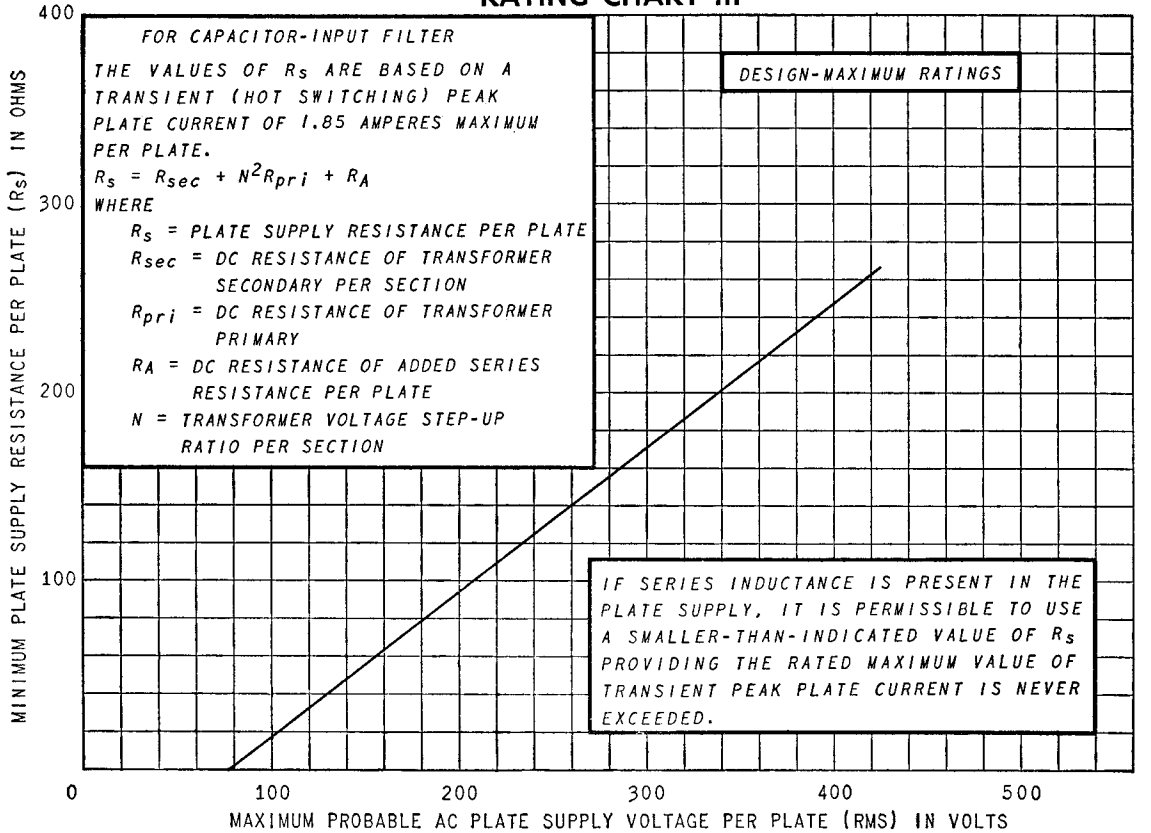
RATING CHART II



K-55611-TD83-2

AUGUST 25, 1959

RATING CHART III

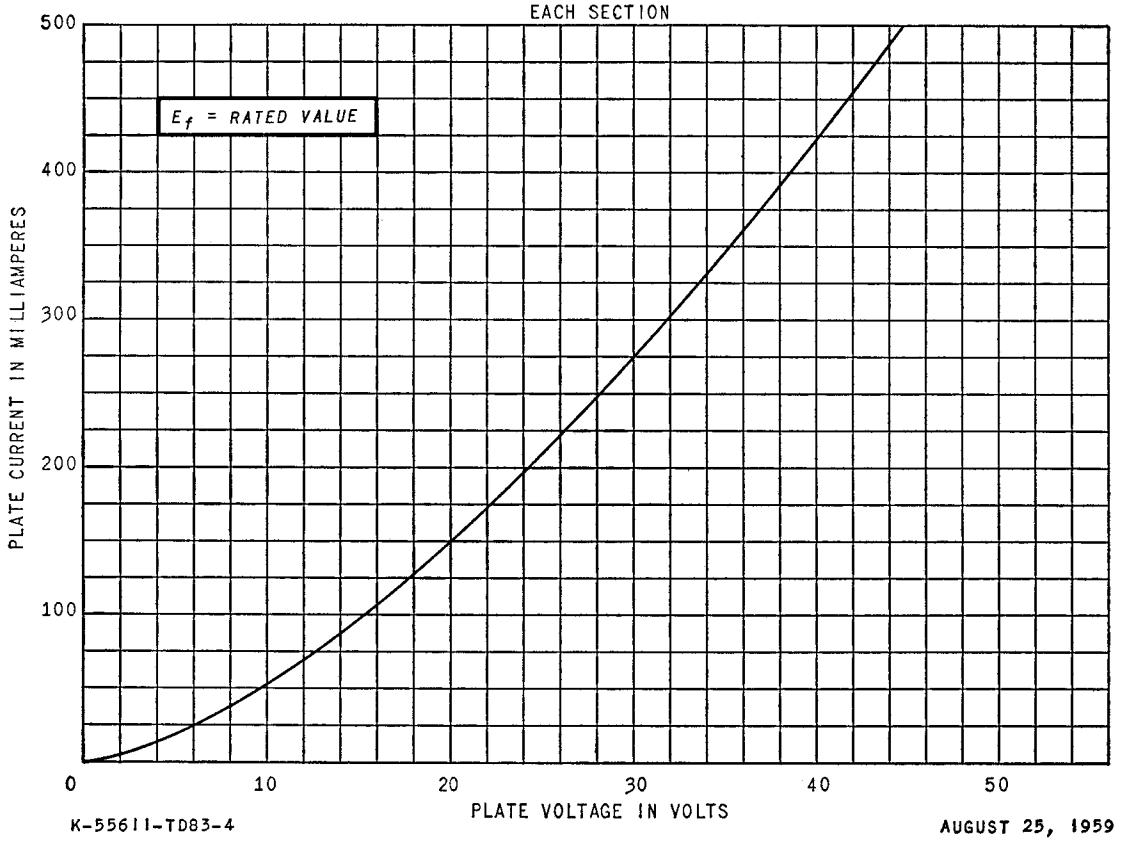


K-55611-TD83-3

AUGUST 25, 1959

AVERAGE PLATE CHARACTERISTICS

EACH SECTION

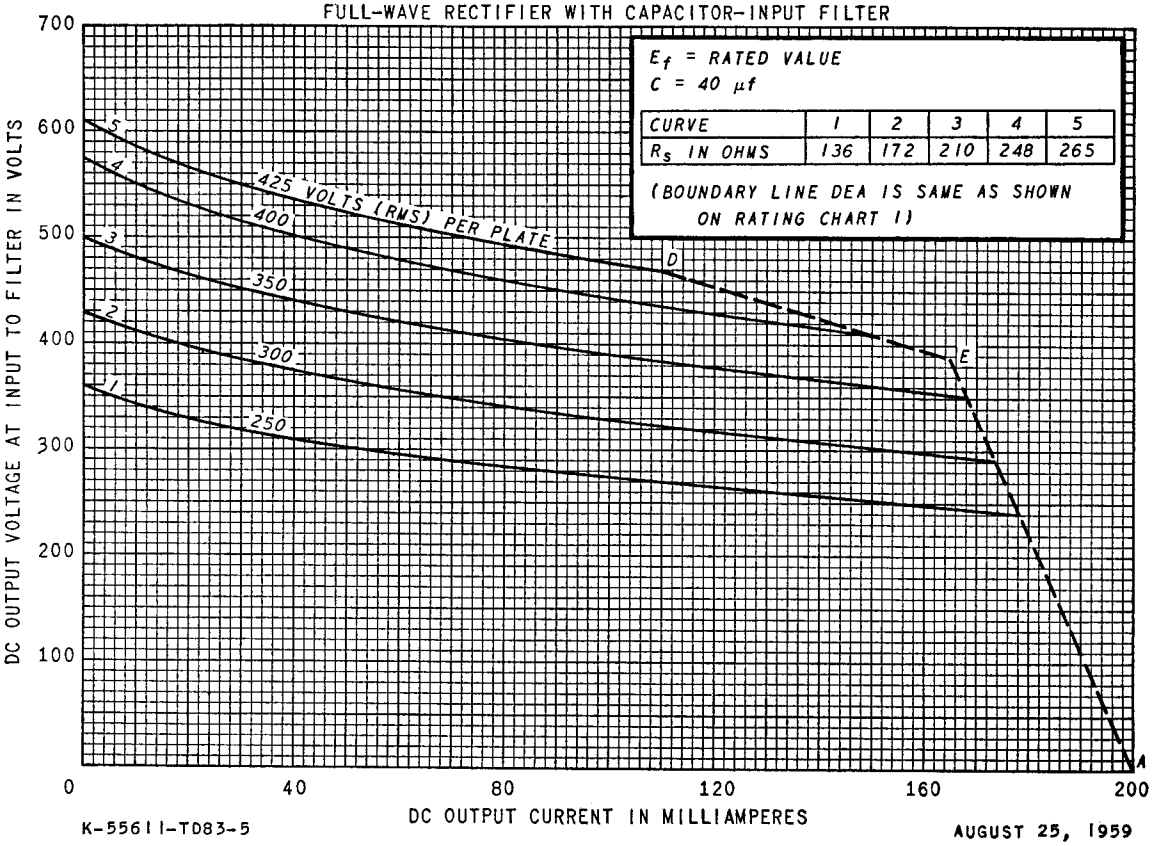


K-55611-TD83-4

AUGUST 25, 1959

OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

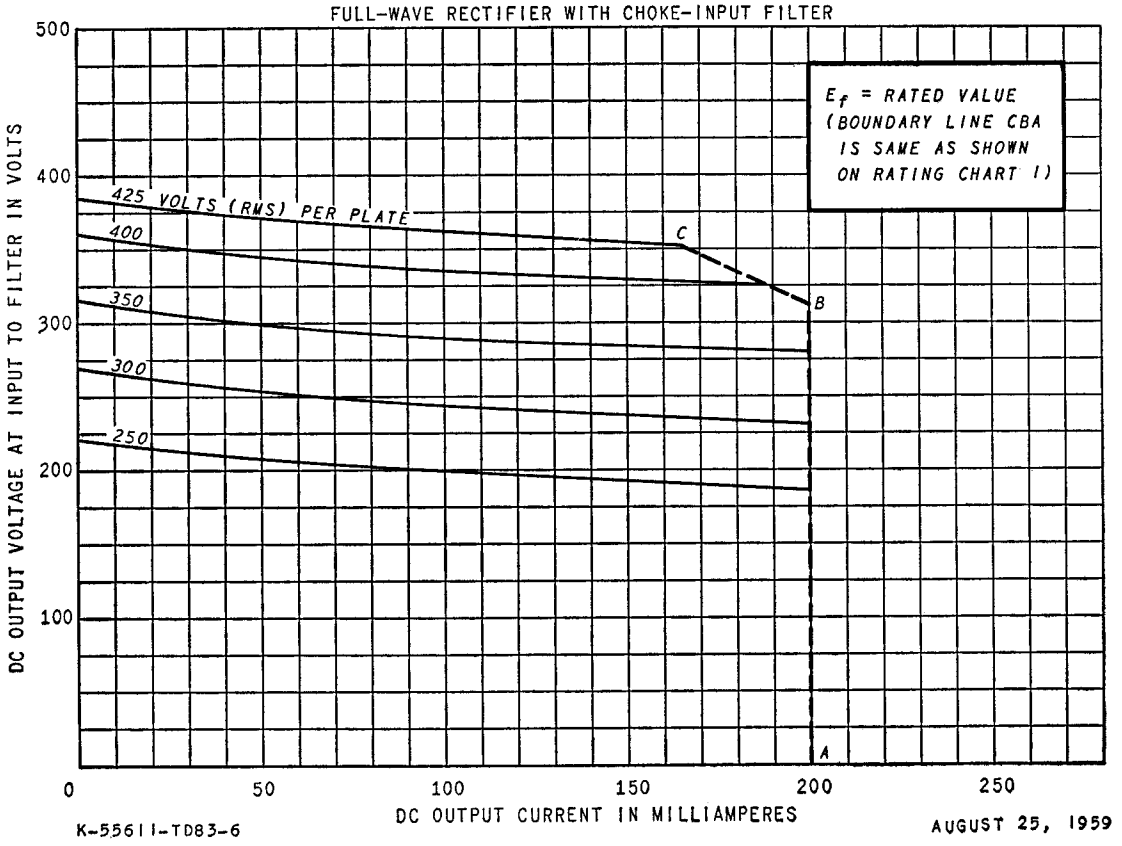


K-55611-TD83-5

AUGUST 25, 1959

OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER



K-5561I-TD83-6

AUGUST 25, 1959

BEAM PENTODE

FOR AF POWER AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6CA5 is a miniature beam pentode designed primarily for use in the audio-frequency power output stage of radio and television receivers. The tube features high power sensitivity at relatively low plate and screen voltages.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC	6.3	Volts
Heater Current	1.2	Amperes
Direct Interelectrode Capacitances, approximate*		
Grid-Number 1 to Plate: (g1 to p)	0.5	pf
Input: g1 to (h+k+g2+b.p.)	15	pf
Output: p to (h+k+g2+b.p.)	9	pf

MECHANICAL

Operating Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

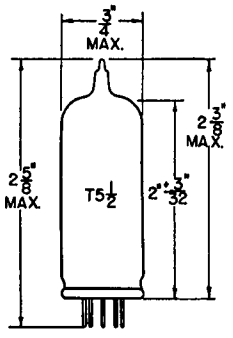
Plate Voltage	130	Volts
Screen Voltage	130	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	5.0	Watts
Screen Dissipation	1.4	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
DC Component	...	Volts
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	0.5	Megohms
Bulb Temperature at Hottest Point	180	C

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under normal conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube in average applications, making allowance for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube under normal operating conditions at the stated normal supply voltage.

PHYSICAL DIMENSIONS

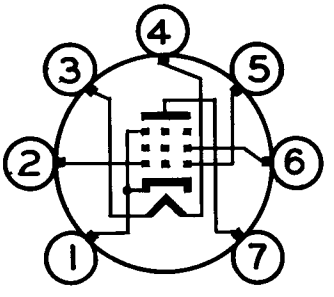


EIA 5-3

TERMINAL CONNECTIONS

Pin 1—Cathode and Beam Plates
Pin 2—Grid Number 1
Pin 3—Heater
Pin 4—Heater
Pin 5—Grid Number 1
Pin 6—Grid Number 2 (Screen)
Pin 7—Plate

BASING DIAGRAM



EIA 7CV

GENERAL ELECTRIC

Supersedes 6CA5, dated 1-56

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

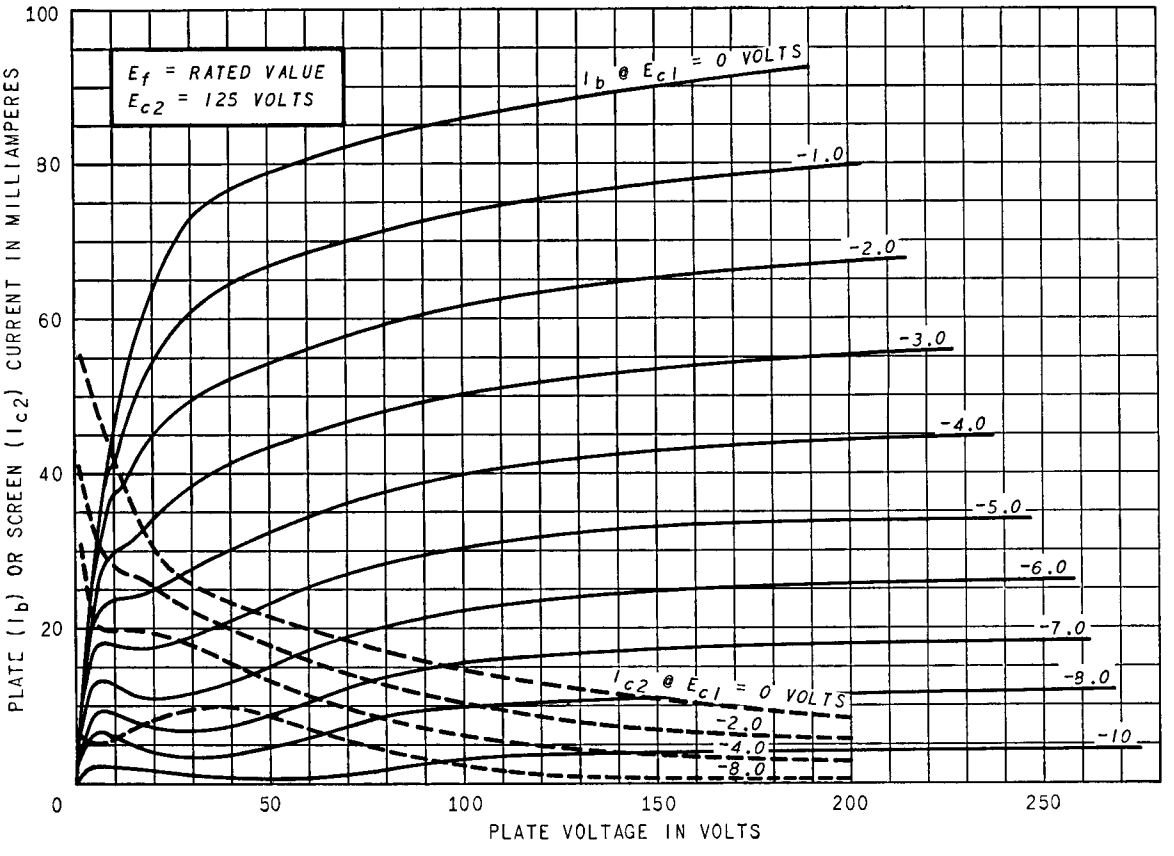
Plate Voltage	110	125	Volts
Screen Voltage	110	125	Volts
Grid-Number 1 Voltage	−4.0	−4.5	Volts
Peak AF Grid-Number 1 Voltage	4.0	4.5	Volts
Plate Resistance, approximate	16000	15000	Ohms
Transconductance	8100	9200	Micromhos
Zero-Signal Plate Current	32	37	Milliamperes
Maximum-Signal Plate Current, approximate	31	36	Milliamperes
Zero-Signal Screen Current	3.5	4.0	Milliamperes
Maximum-Signal Screen Current, approximate	7.5	11	Milliamperes
Load Resistance	3500	4500	Ohms
Total Harmonic Distortion, approximate	5	6	Percent
Maximum-Signal Power Output	1.1	1.5	Watts

NOTES

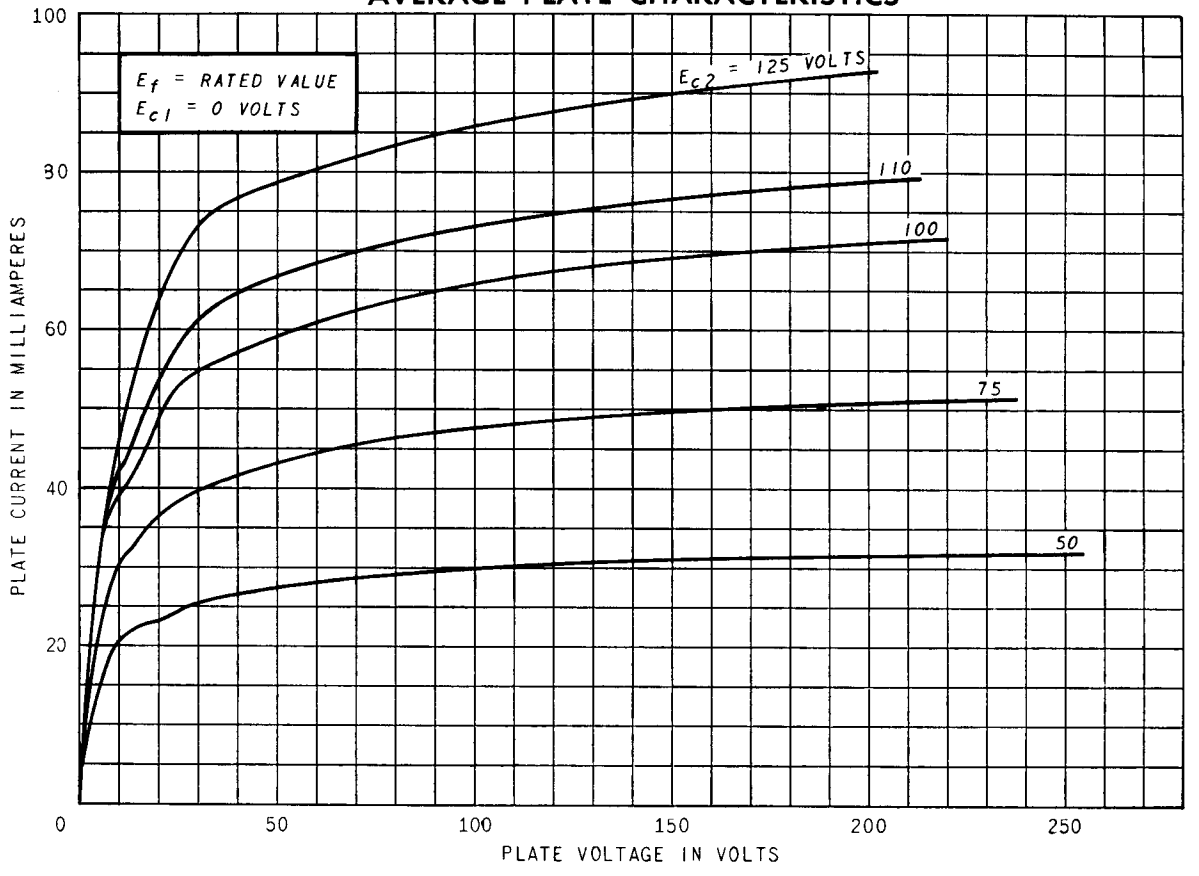
* Without external shield.

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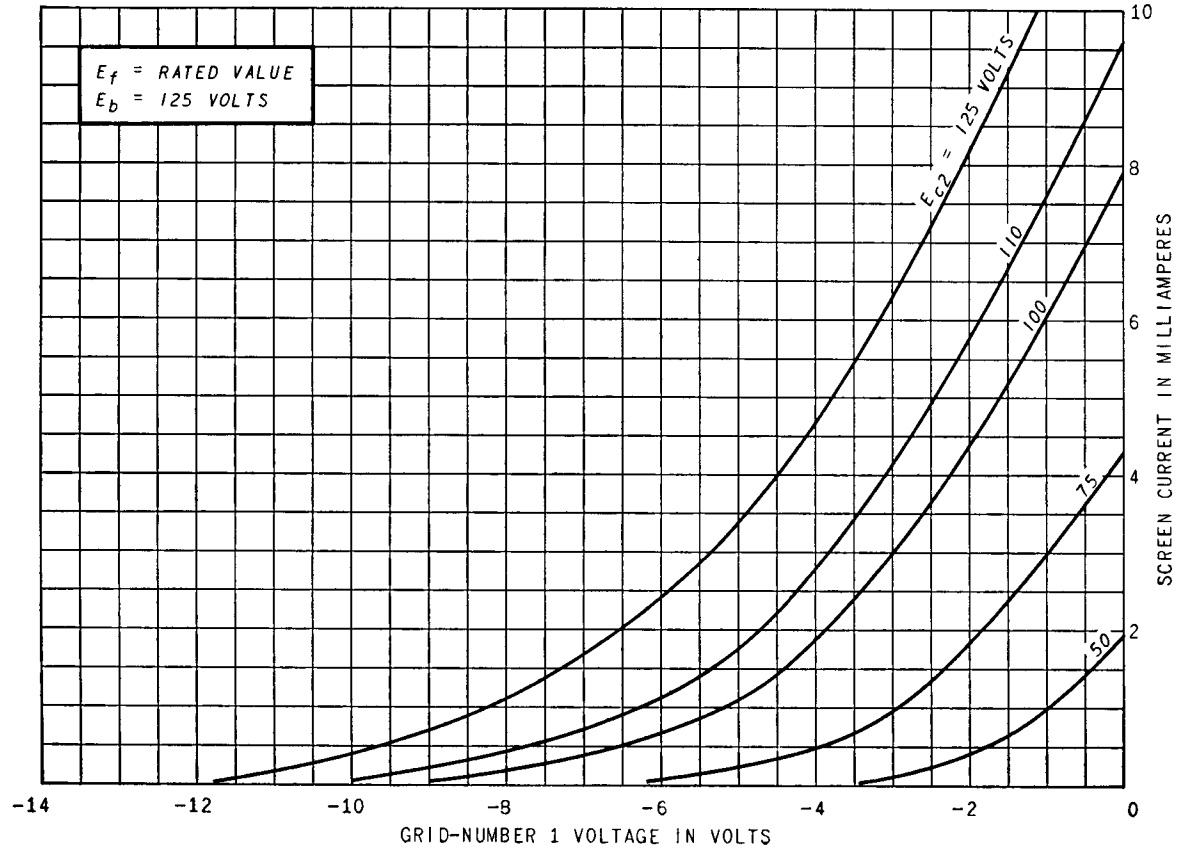
AVERAGE PLATE CHARACTERISTICS



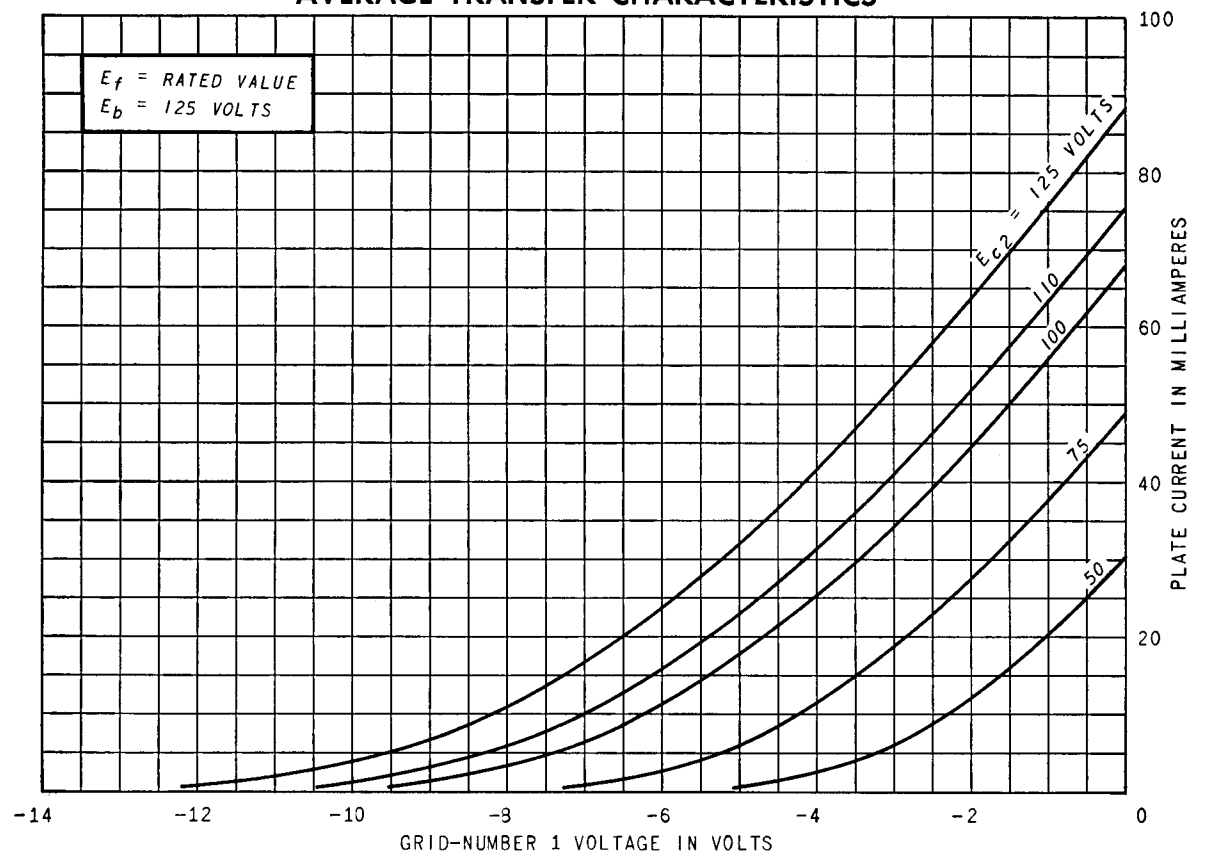
AVERAGE PLATE CHARACTERISTICS



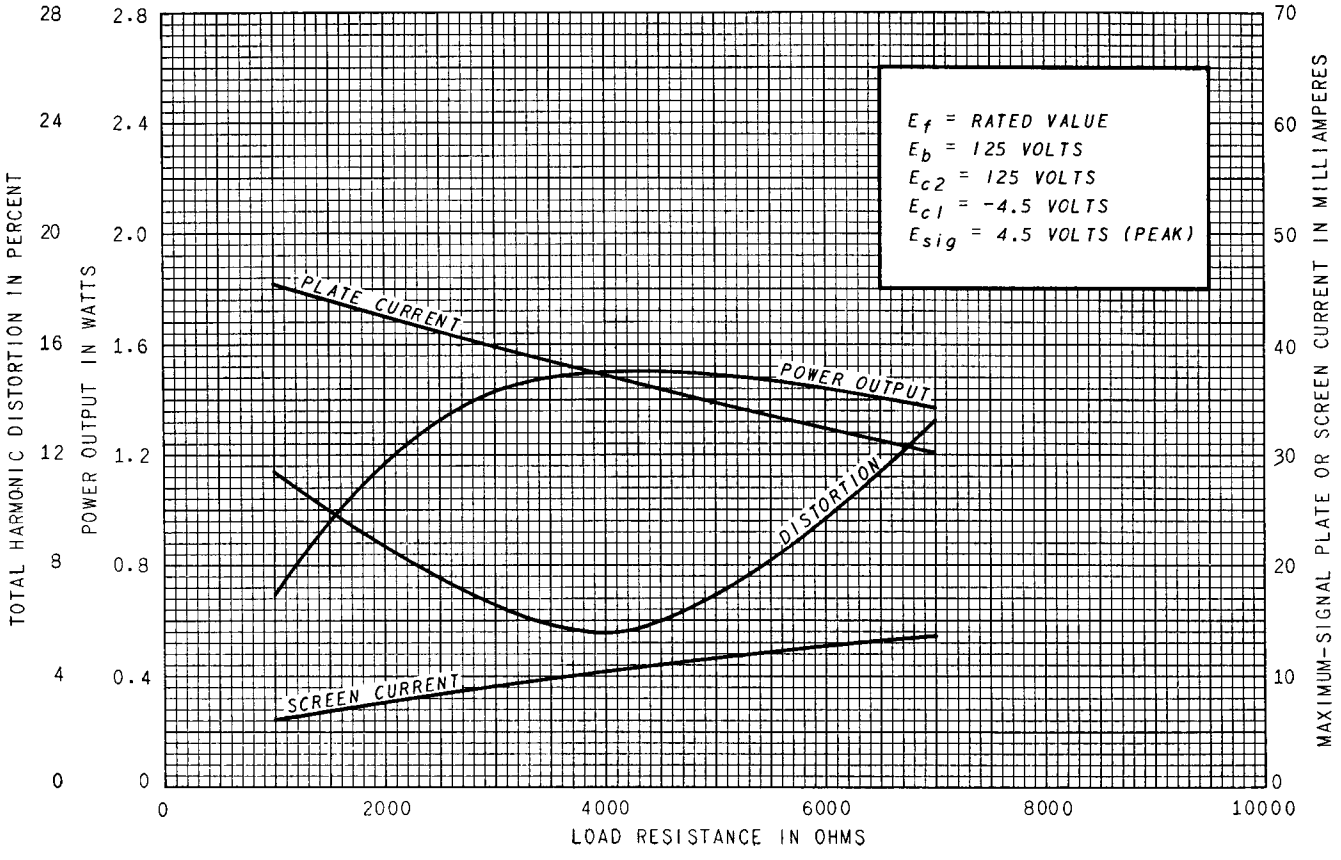
AVERAGE TRANSFER CHARACTERISTICS



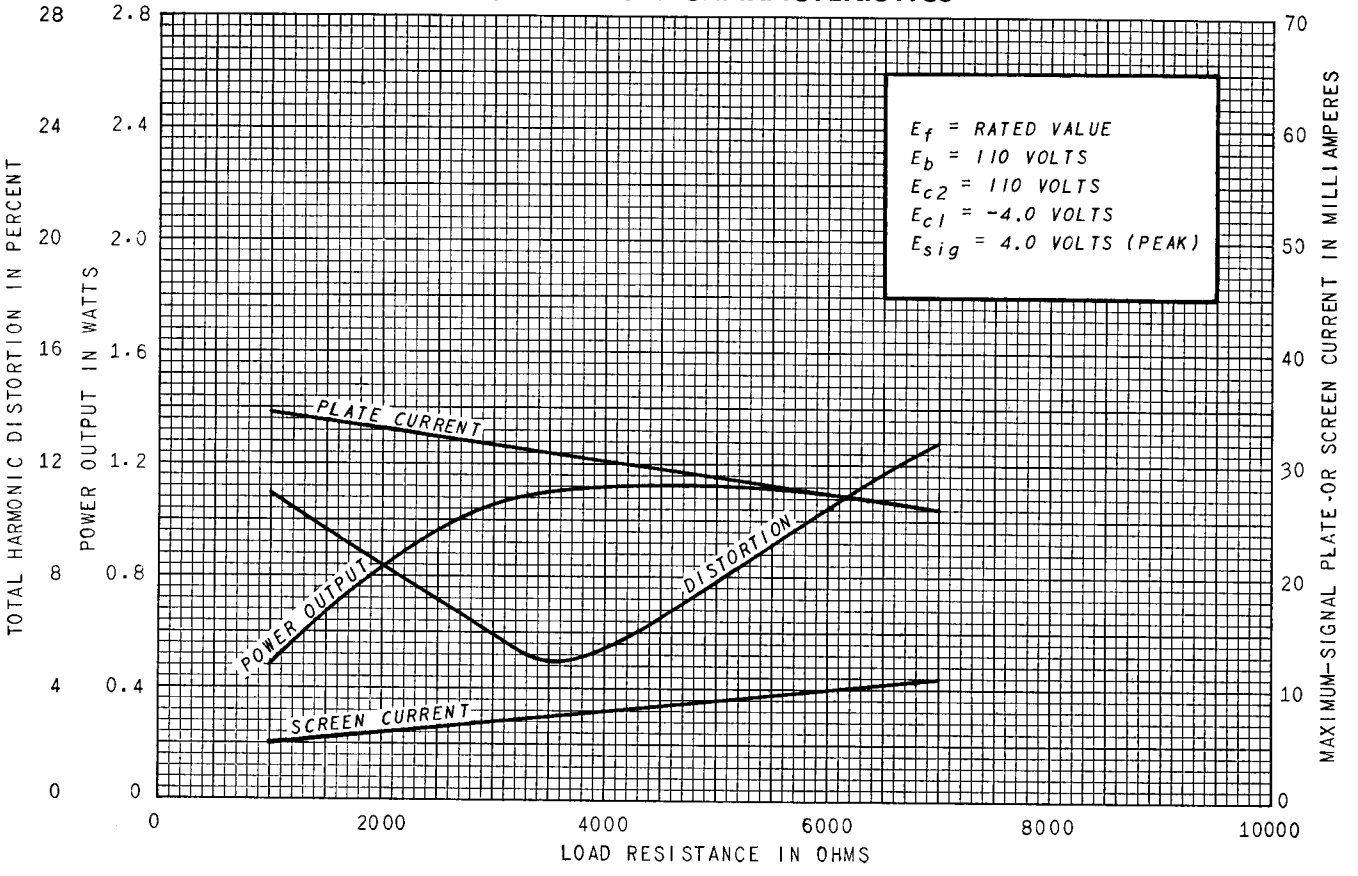
AVERAGE TRANSFER CHARACTERISTICS



OPERATION CHARACTERISTICS



OPERATION CHARACTERISTICS



Compactron Dissimilar-Double-Triode Pentode

6CA11

- COLOR TV TYPE
- FRAME-GRID VIDEO AMPLIFIER
- 21200 MICROMHOS
- MULTI-FUNCTION
- HIGH TRANSCONDUCTANCE TRIODES

The 6CA11 is a multifunction compactron containing a high-gain, frame-grid video amplifier pentode which is particularly well suited for color television use. It also contains two high-mu, high-transconductance triodes designed for cathode follower and video amplifier applications.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	1.02	Amperes
Direct Interelectrode Capacitances§		
Triode (Section 1)		
Grid to Plate: (1Tg to 1Tp)	2.7	pf
Input: 1Tg to (1Tk + 2Tk + Pg3 + h + i.s.:	4.7	pf
Output: 1Tp to (1Tk + 2Tk + Pg3 + h + i.s.)	4.0	pf
Triode (Section 2)		
Grid to Plate: (2Tg to 2Tp)	2.1	pf
Input: 2Tg to (2Tk + 1Tk + Pg3 + h + i.s.)	2.8	pf
Output: 2Tp to (2Tk + 1Tk + Pg3 + h + i.s.)	2.0	pf
Pentode Section		
Grid-Number 1 to Plate: (Pg1 to Pp)	0.13	pf
Input: Pg1 to (Pk + 2Tk + Pg2 + Pg3 + h + i.s.)	12.3	pf
Output: Pp to (Pk + 2Tk + Pg2 + Pg3 + h + i.s.)	4.6	pf

Coupling

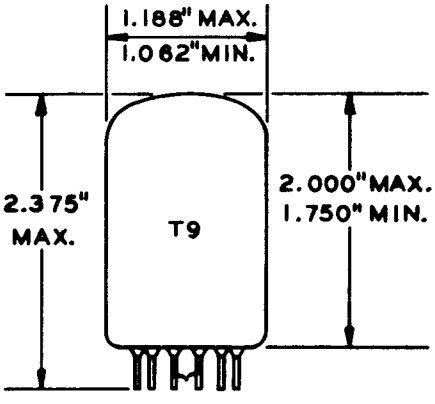
Pentode Plate to Triode Plate (Section 2): (Pp to 2Tp), maximum	0.04	pf
Triode Plate (Section 1) to Triode Plate (Section 2): (1Tp to 2Tp), maximum.	0.10	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height.	2.000	Inches
Minimum Seated Height.	1.750	Inches

PHYSICAL DIMENSIONS

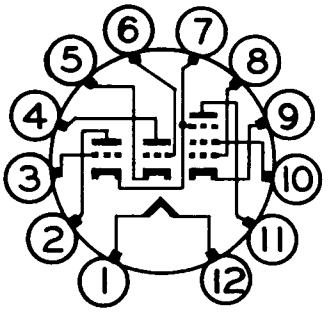


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Triode Plate (Section 2)
Pin 3 - Triode Grid (Section 2)
Pin 4 - Triode Plate (Section 1)
Pin 5 - Triode Cathode (Section 1)
Pin 6 - Triode Grid (Section 1)
Pin 7 - Triode Cathode (Section 2), Pentode Grid Number 3, and Internal Shield
Pin 8 - Pentode Grid Number 1
Pin 9 - Pentode Cathode
Pin 10 - Pentode Grid Number 2 (Screen)
Pin 11 - Pentode Plate
Pin 12 - Heater

BASING DIAGRAM



EIA 12HN

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Pentode Section

Plate Voltage	330	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	5.0	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	50000	Ohms
With Cathode Bias	100000	Ohms

Triode (Section 1)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Triode (Section 2)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section			
Plate Voltage	40	200	Volts
Screen Voltage	120	120	Volts
Grid-Number 1 Voltage	0	---	Volts
Cathode-Bias Resistor	---	65	Ohms
Plate Resistance, approximate	---	490000	Ohms
Transconductance	---	21200	Micromhos
Plate Current	68	27.5	Milliamperes
Screen Current	17.6	4.9	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	---	-5.0	Volts
Triode (Section 1)			
Plate Voltage		200	Volts
Cathode-Bias Resistor		270	Ohms
Amplification Factor		59	
Plate Resistance, approximate		9200	Ohms
Transconductance		6300	Micromhos
Plate Current		7.6	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes		-6.3	Volts
Triode (Section 2)			
Plate Voltage		200	Volts
Cathode-Bias Resistor		270	Ohms
Amplification Factor		69	
Plate Resistance, approximate		12400	Ohms
Transconductance		5500	Micromhos
Plate Current		7.1	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes		-5.5	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

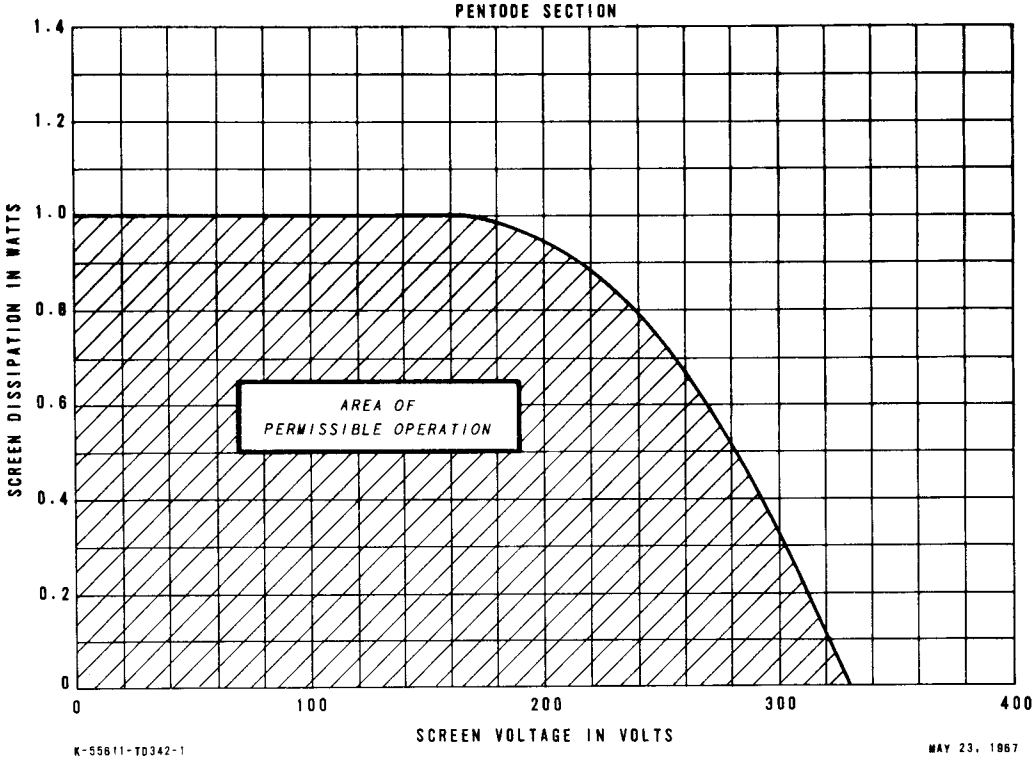
‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

SCREEN RATING CHART

PENTODE SECTION

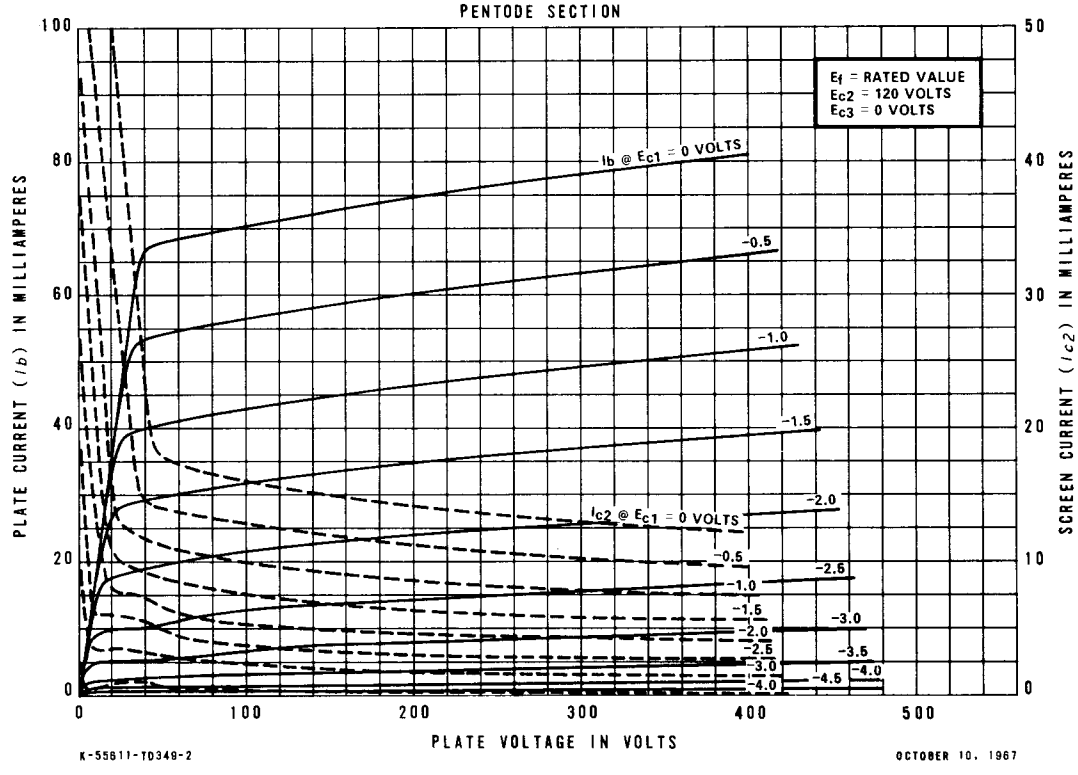


K-55611-T0342-1

MAY 23, 1967

AVERAGE PLATE CHARACTERISTICS

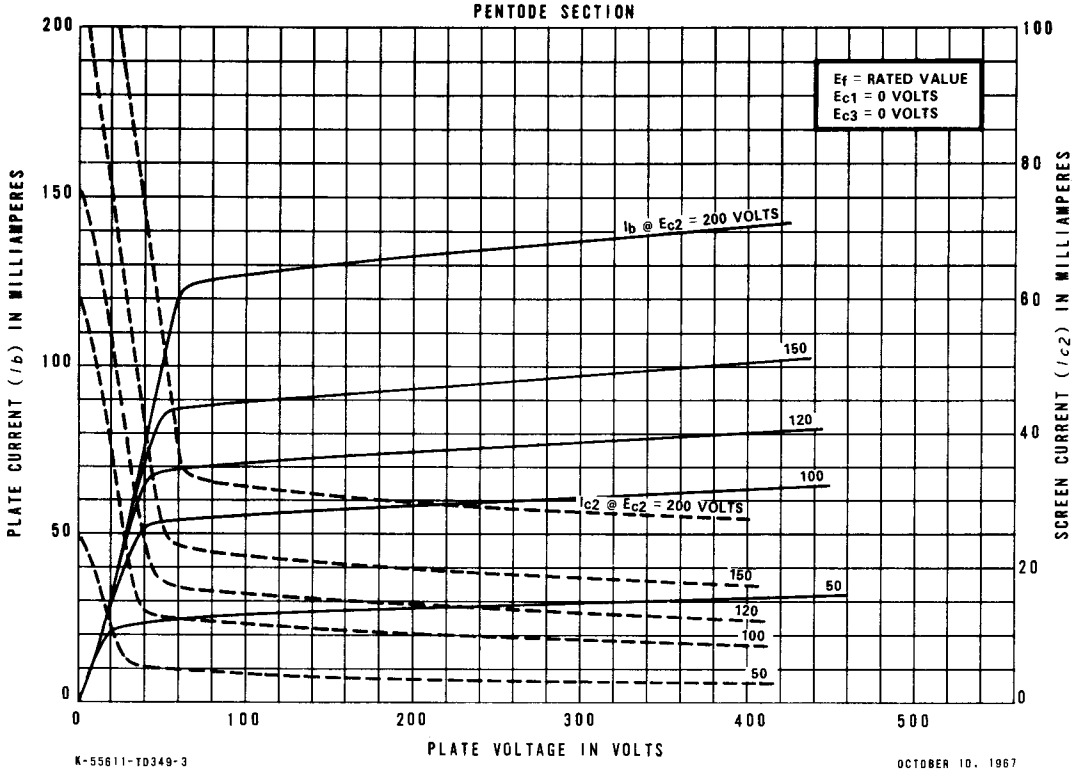
PENTODE SECTION



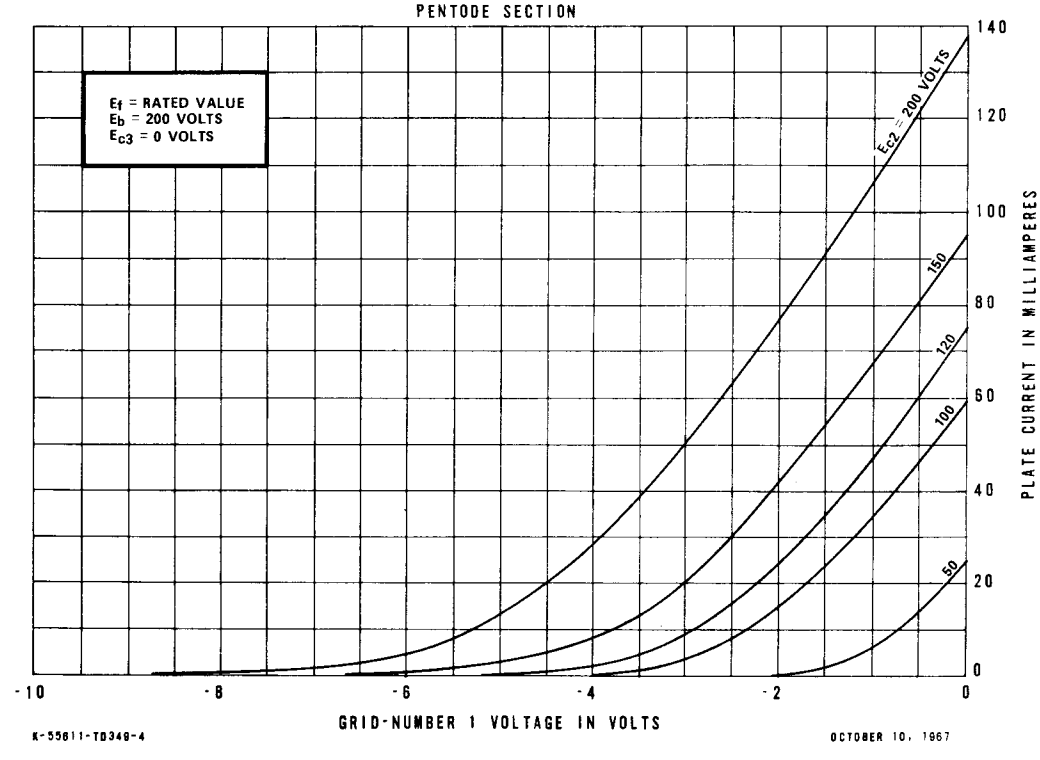
K-55611-T0349-2

OCTOBER 10, 1967

AVERAGE PLATE CHARACTERISTICS

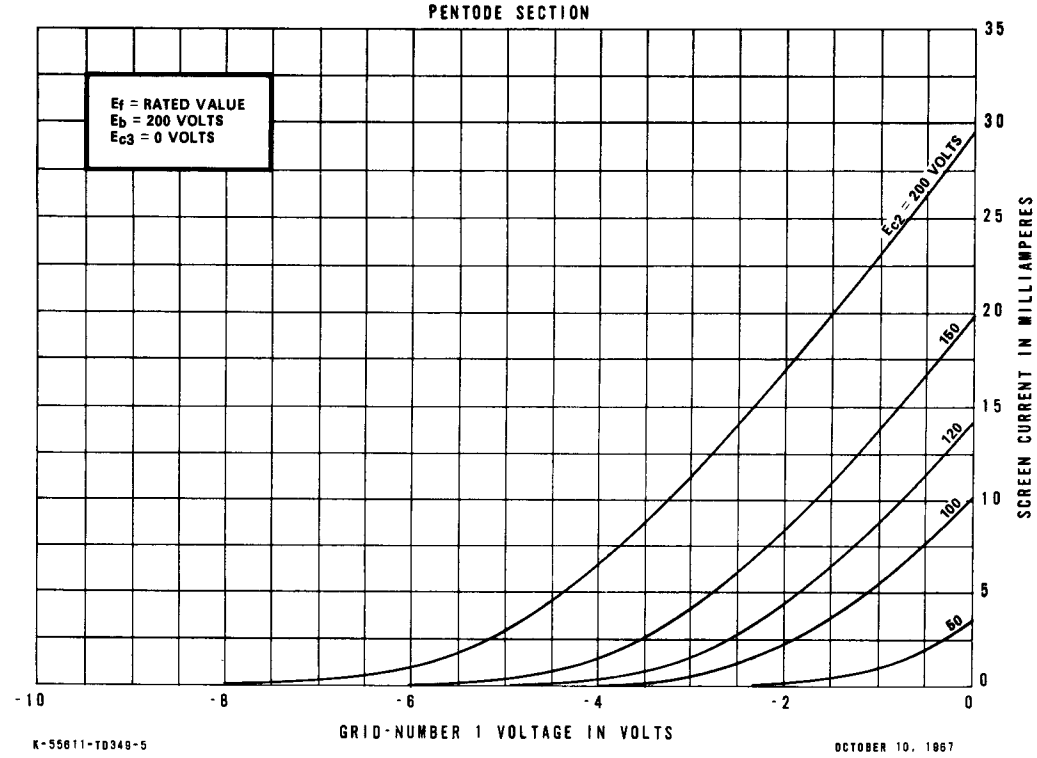


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

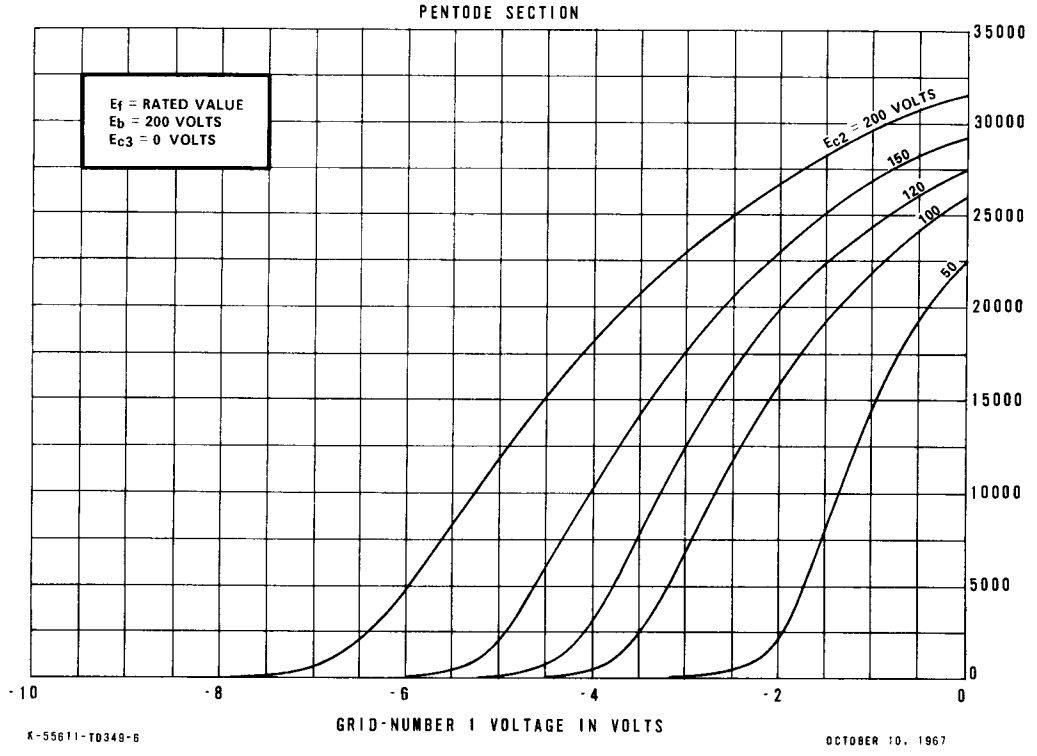


K-55611-TD349-5

OCTOBER 10, 1967

AVERAGE TRANSFER CHARACTERISTICS

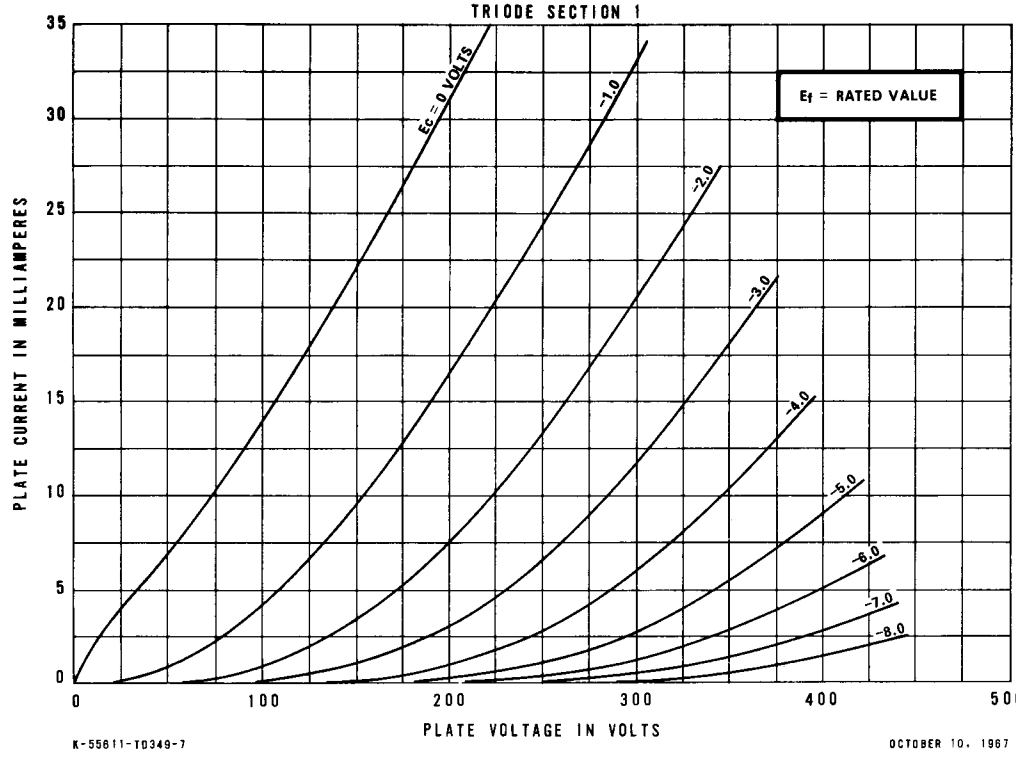
PENTODE SECTION



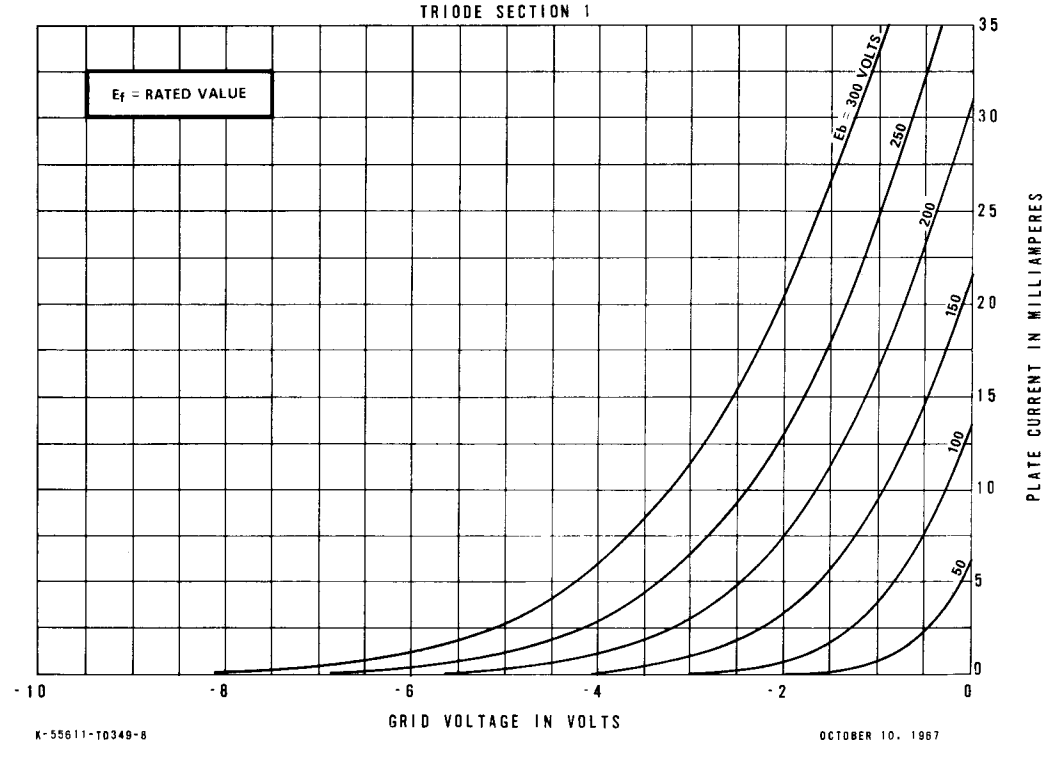
K-55611-TD349-6

OCTOBER 10, 1967

AVERAGE PLATE CHARACTERISTICS

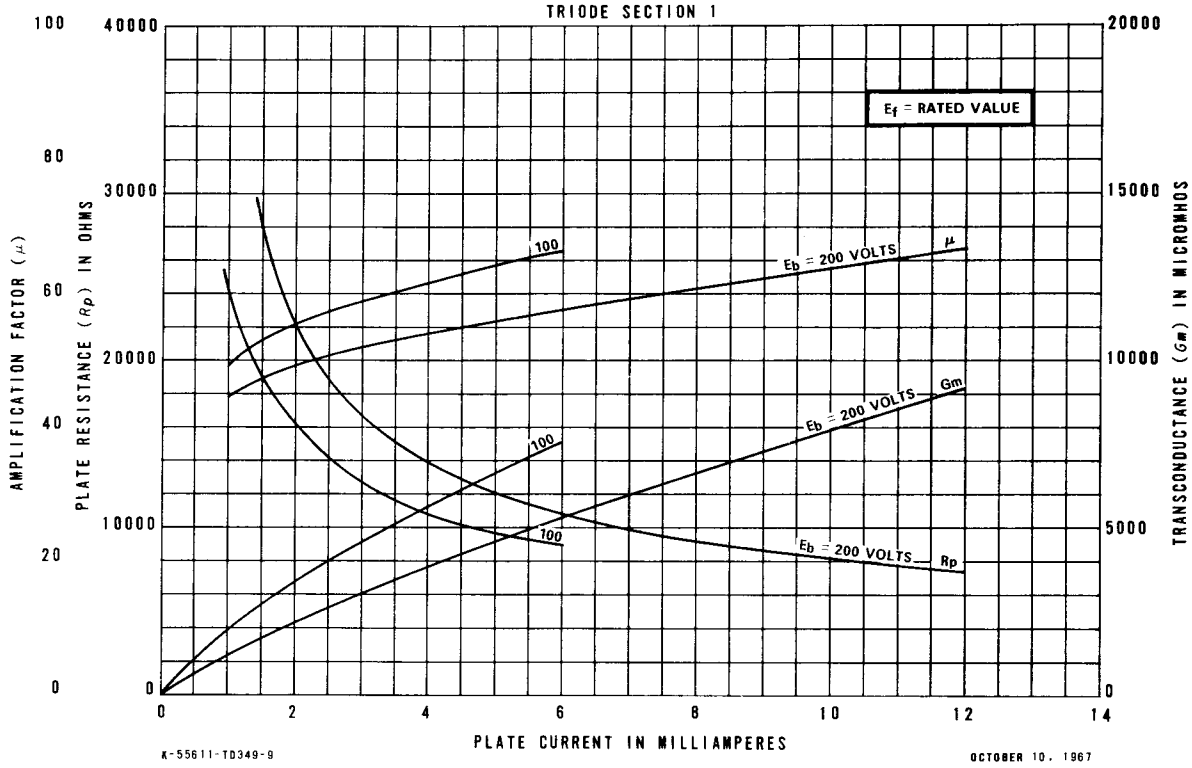


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS

TRIODE SECTION 1

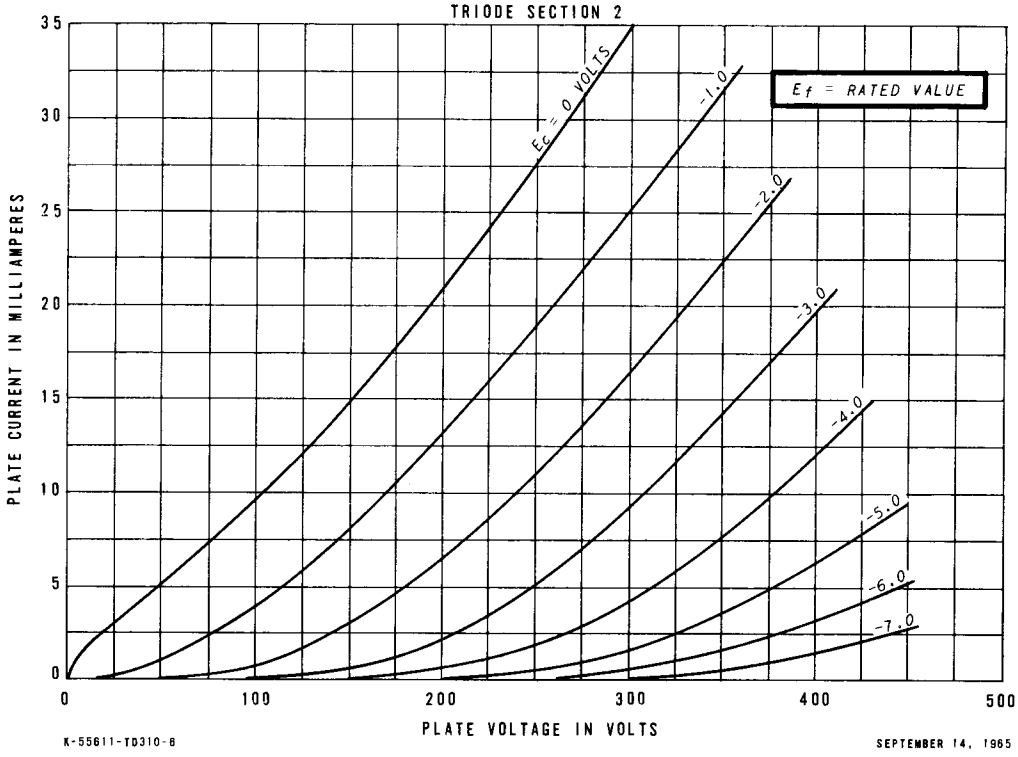


K-55611-TD349-9

OCTOBER 10, 1967

AVERAGE PLATE CHARACTERISTICS

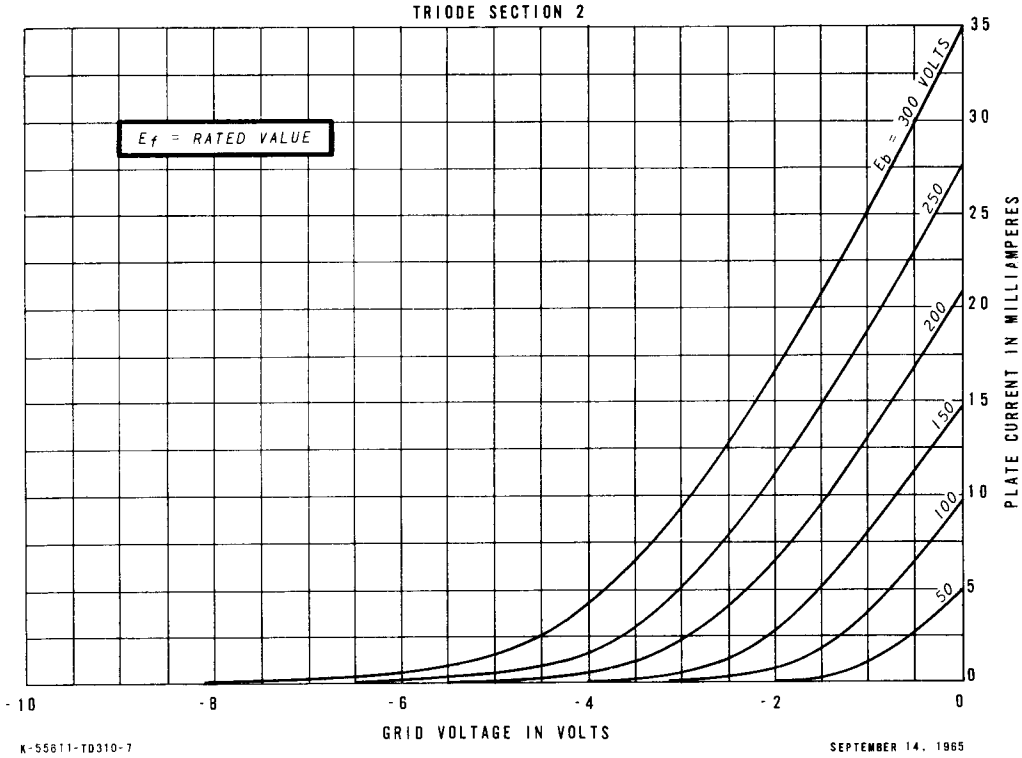
TRIODE SECTION 2



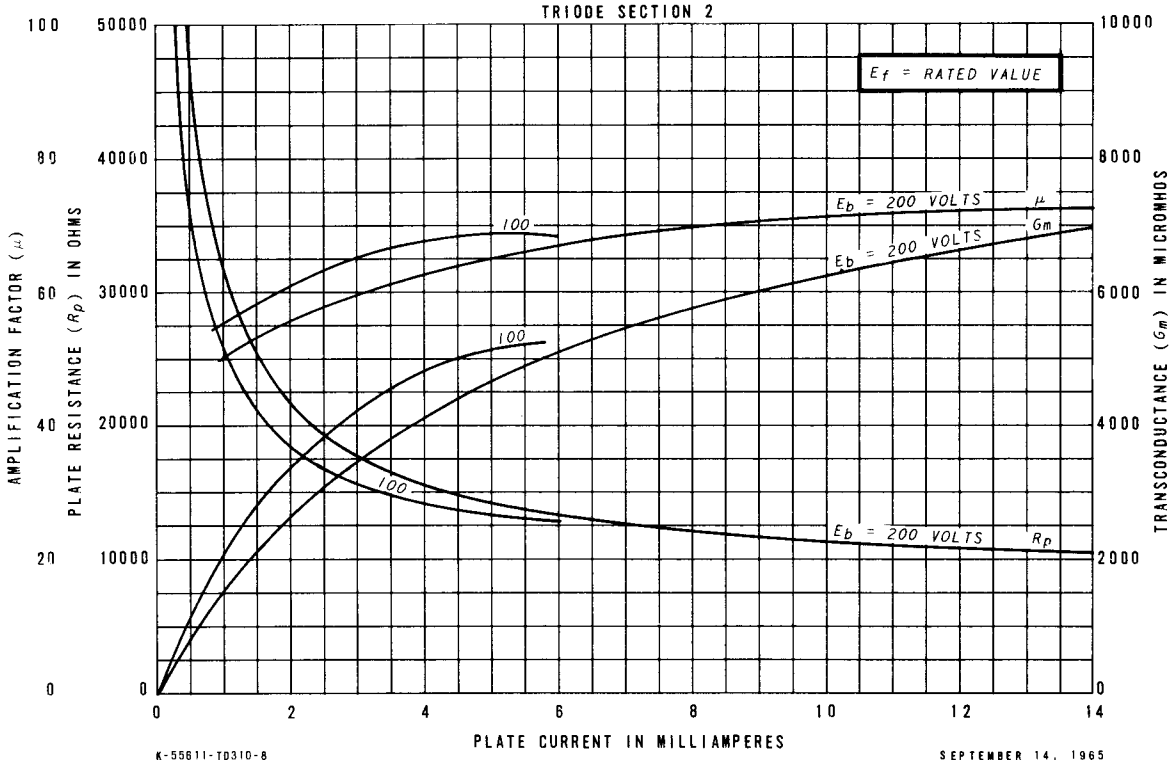
K-55611-TD310-8

SEPTEMBER 14, 1965

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

6CB6-A
PENTODE

DESCRIPTION AND RATING

The 6CB6-A is a miniature pentode designed for use as a radio-frequency or intermediate-frequency amplifier in television receivers. Features of the tube include high transconductance and low interelectrode capacitances. The suppressor and cathode terminals are brought out to separate base pins to permit the use of an unbypassed cathode-bias resistor to minimize the effects of regeneration.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

	Series Heater Operation*	Parallel Heater Operation*	
Heater Voltage, AC or DC	6.3	6.3 ± 0.6	Volts
Heater Current	0.3 ± 0.02	0.3†	Amperes
Heater Warm-up Time‡	11		Seconds

Direct Interelectrode Capacitances

	With§ Shield	Without Shield	
Grid-Number 1 to Plate: (g1 to p), max.	0.015	0.025	pf
Input: g1 to (h+k+g2+g3+i.s.)	6.5	6.5	pf
Output: p to (h+k+g2+g3+i.s.)	3.0	2.0	pf

MECHANICAL

Mounting Position—Any

Envelope—T-5½, Glass

Base—E7-1, Miniature Button 7-Pin

Outline Drawing—EIA 5-2

Maximum Diameter	¾	Inches
Maximum Over-all Length	2⅛	Inches
Maximum Seated Height	1⅞	Inches

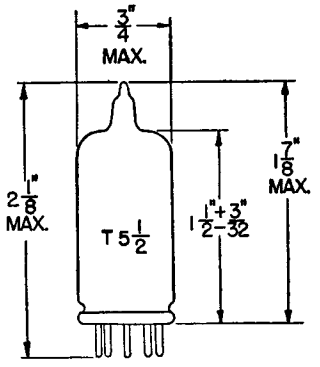
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

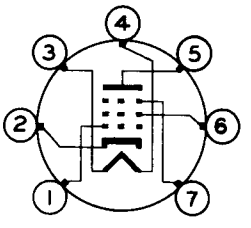


EIA 5-2

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Internal Shield and Grid Number 3 (Suppressor)

BASING DIAGRAM



EIA 7CM

GENERAL ELECTRIC

Supersedes ET-T1297 dated 4-56

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	330	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	2.3	Watts
Screen Dissipation	0.55	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	125	125	Volts
Suppressor, Connected to Cathode at Socket			
Screen Voltage	125	125	Volts
Grid-Number 1 Voltage	−3.0	....	Volts
Cathode-Bias Resistor	...	56	Ohms
Plate Resistance, approximate	...	0.28	Megohms
Transconductance	...	8000	Micromhos
Plate Current	2.8	13	Milliamperes
Screen Current	...	3.7	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 20 Microamperes		−6.5	Volts

* For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified rated value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified rated value, with heater supply variations restricted to maintain heater current within the specified tolerance.

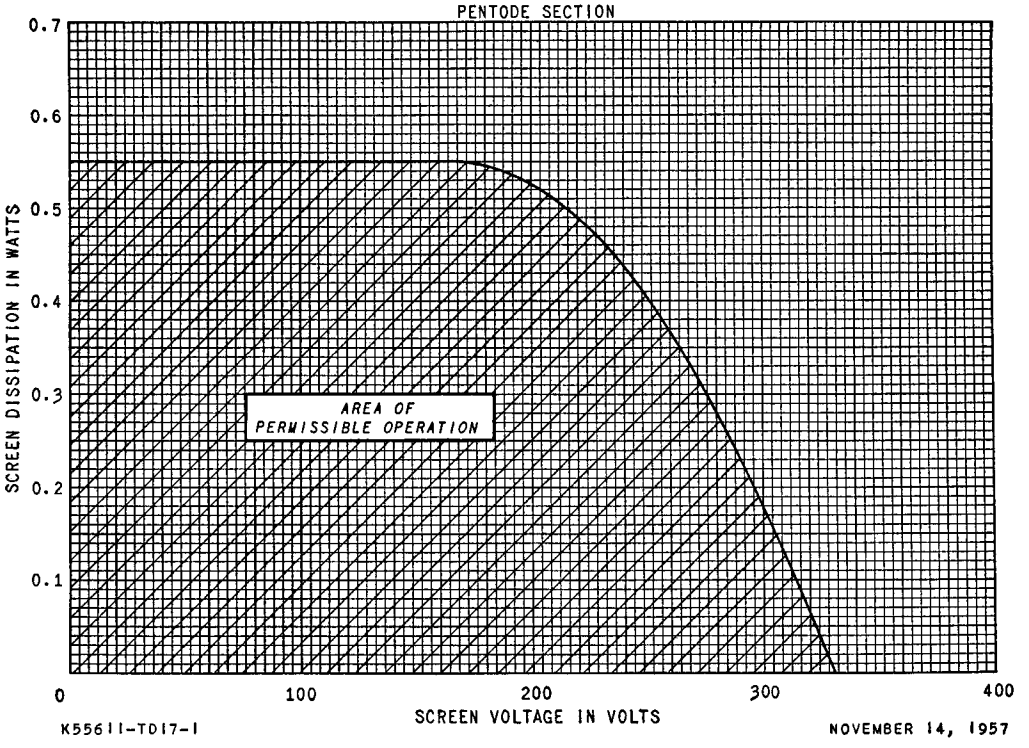
† Heater current of a bogey tube at Ef = 6.3 volts.

‡ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

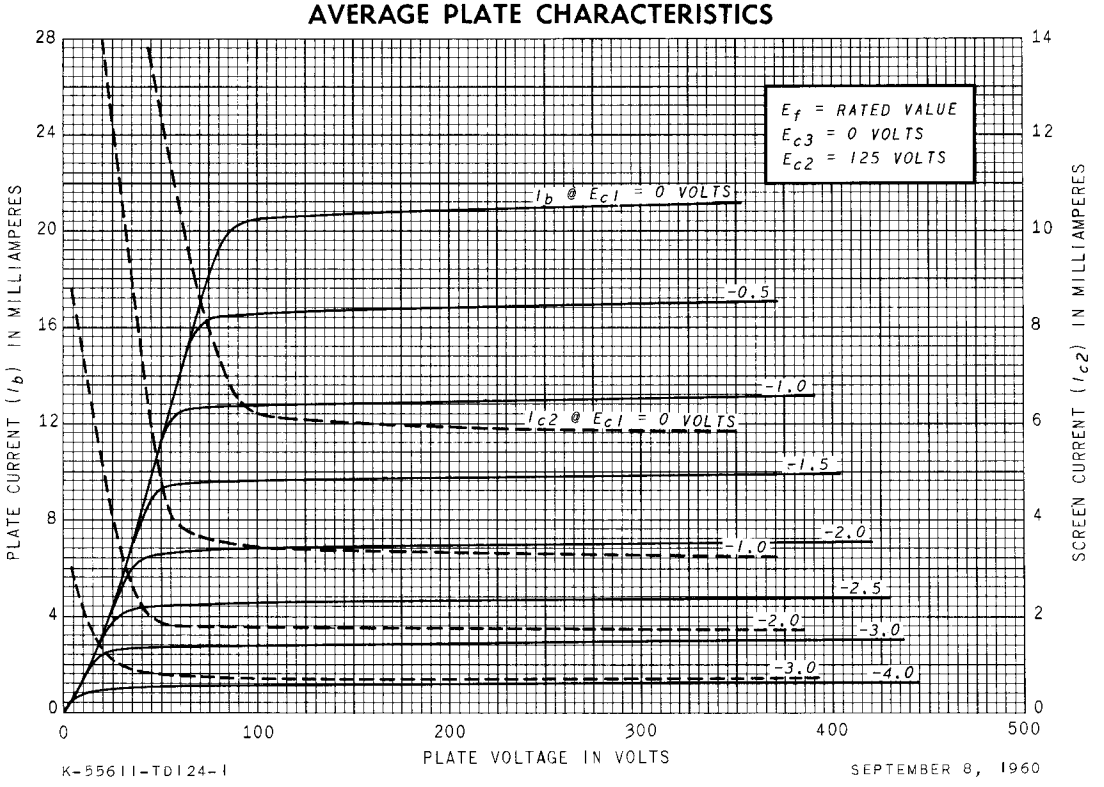
§ With external shield (EIA 316) connected to pin 2.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

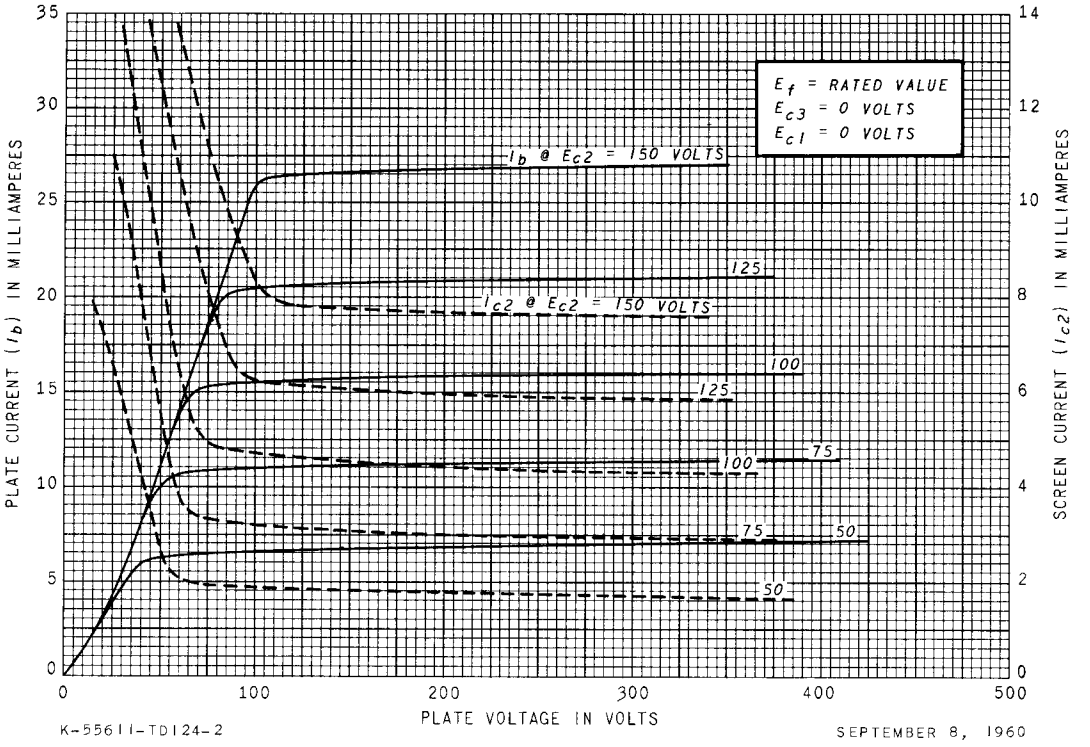
SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS



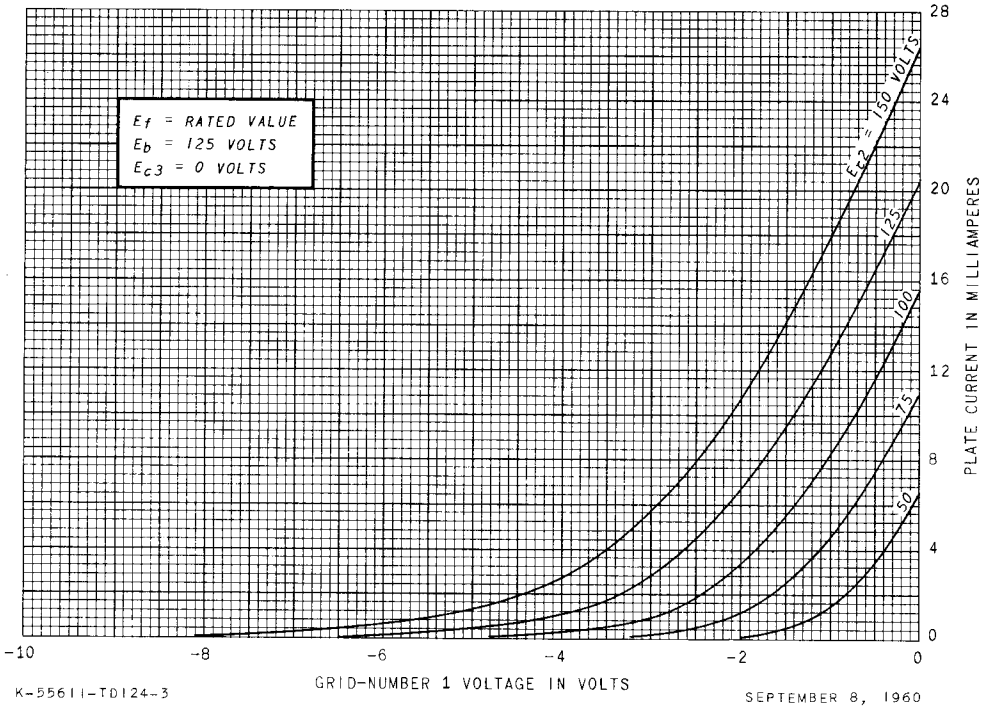
AVERAGE PLATE CHARACTERISTICS



K-55611-TD124-2

SEPTEMBER 8, 1960

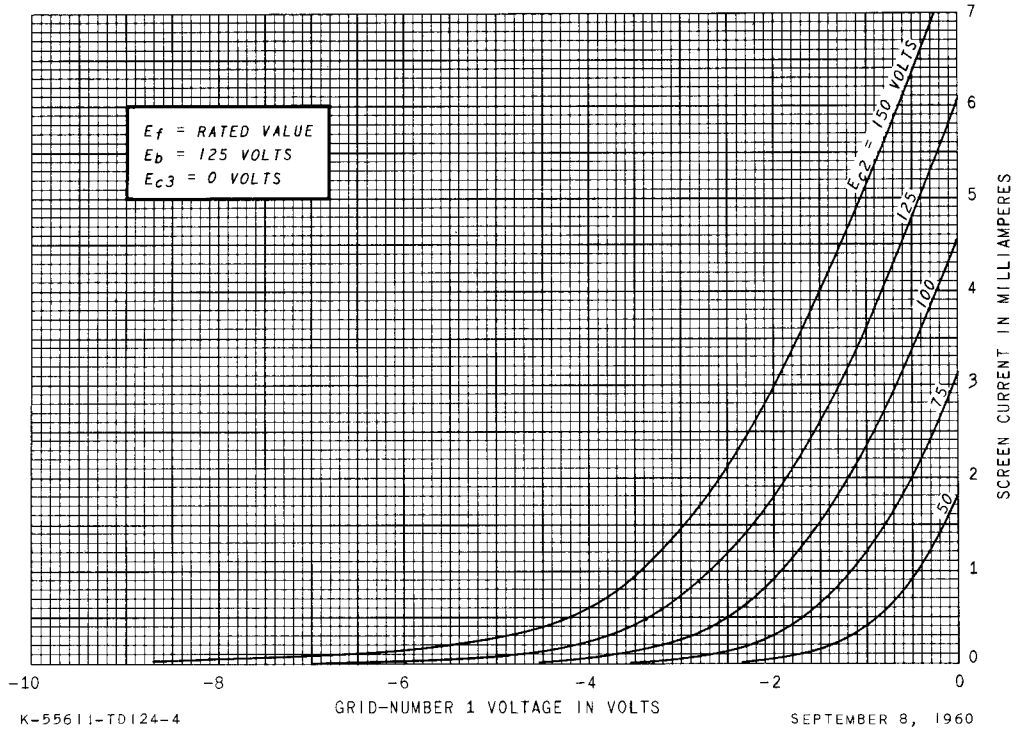
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD124-3

SEPTEMBER 8, 1960

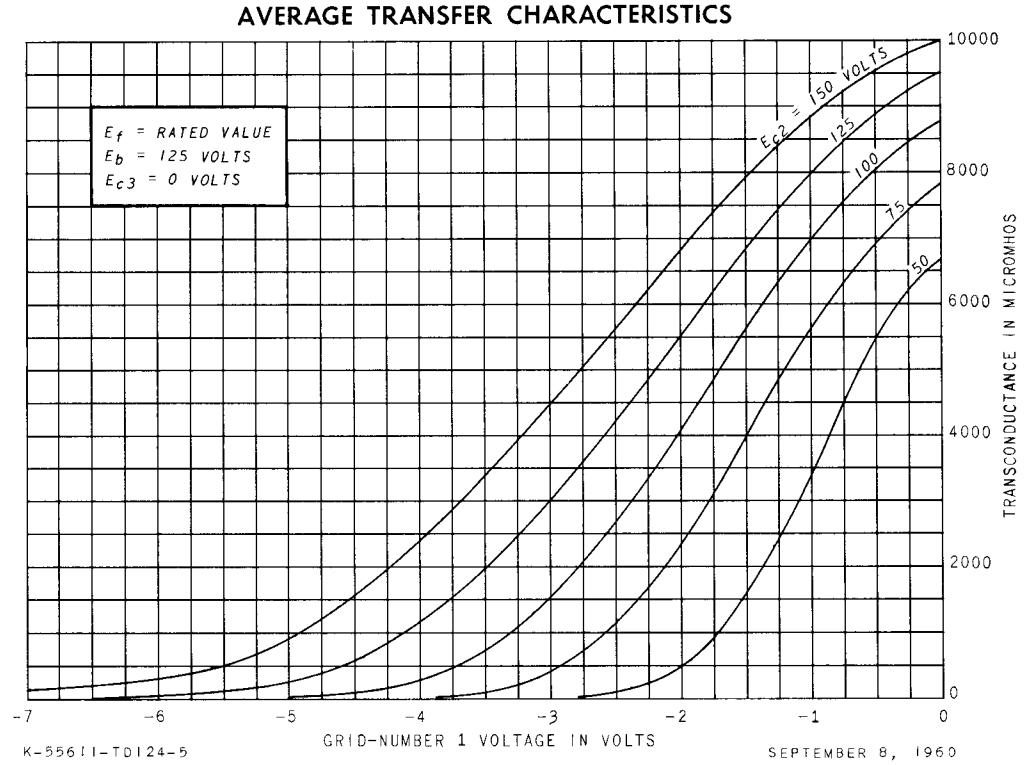
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD124-4

SEPTEMBER 8, 1960

AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD124-5

SEPTEMBER 8, 1960

Electronic TUBES

6CD6-GA—25CD6-GB

BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6CD6-GA is a beam-power pentode designed primarily for use as the horizontal-deflection amplifier in television receivers which incorporate large-deflection-angle picture tubes. Features of the tube include an extremely high perveance, high plate current at low plate and screen voltages, and a high ratio of plate to screen current. The 6CD6-GA may be used as a replacement for the 6CD6-G; it differs from the 6CD6-G by employing a straight-sided T-12 envelope and incorporating increased maximum ratings for plate dissipation, pulse plate voltage, and bulb temperature.

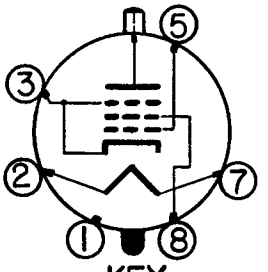
Except for heater ratings, the 25CD6-GB is identical to the 6CD6-GA. In addition, as a result of its controlled heater warm-up characteristic, the 25CD6-GB is especially suited for use in television receivers which employ series-connected heaters. When the 25CD6-GB is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

GENERAL

ELECTRICAL

	6CD6-GA	25CD6-GB	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	6.3	25.0	Volts
Heater Current	2.5	0.6	Amperes
Heater Warm-up Time*	..	11	Seconds
Direct Interelectrode Capacitances, approximate†			
Grid-Number 1 to Plate		1.1	μμf
Input		22	μμf
Output		8.5	μμf

BASING DIAGRAM

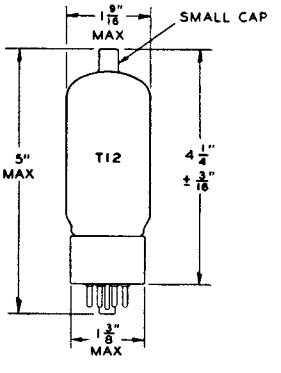


RETMA 5BT

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Heater
Pin 3—Cathode and Beam Plates
Pin 4—No Connection
Pin 5—Grid Number 1
Pin 6—No Connection
Pin 7—Heater
Pin 8—Grid Number 2 (Screen)
Cap —Plate

PHYSICAL DIMENSIONS



GENERAL ELECTRIC

MECHANICAL

Mounting Position—Vertical‡
Envelope—T-12, Glass
Base—B8-110, Short Medium-Shell Octal 8-Pin
Top Cap—C1-1, Small

MAXIMUM RATINGS

HORIZONTAL-DEFELECTION AMPLIFIER SERVICE§
DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

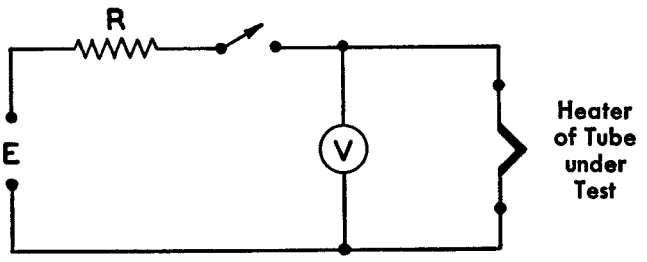
DC Plate-Supply Voltage (Boost + DC Power Supply)	700	Volts
Peak Positive Pulse Plate Voltage	7000▲	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Screen Voltage	175	Volts
Peak Negative Grid-Number 1 Voltage	200	Volts
Plate Dissipationπ	20	Watts
Screen Dissipation	3.0	Watts
DC Cathode Current	200	Milliamperes
Peak Cathode Current	700	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	0.47	Megohms
Bulb Temperature at Hottest Point	225	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	60	175	Volts
Screen	100	175	Volts
Grid-Number 1 Voltage	0♦	−30	Volts
Plate Resistance, approximate	...	7200	Ohms
Transconductance	...	7700	Micromhos
Plate Current	230	75	Milliamperes
Screen Current	21	5.5	Milliamperes
Grid-Number 1 Voltage, approximate			
I_b = 1.0 Milliampere	...	−55	Volts
Triode Amplification Factor#	...	3.9	

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E = 100 volts (RMS or DC), V_1 = 20.0 volts (RMS or DC), and R = 126 ohms.



† Without external shield.

‡ Horizontal operation is permitted if pins 2 and 7 are in a vertical plane.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

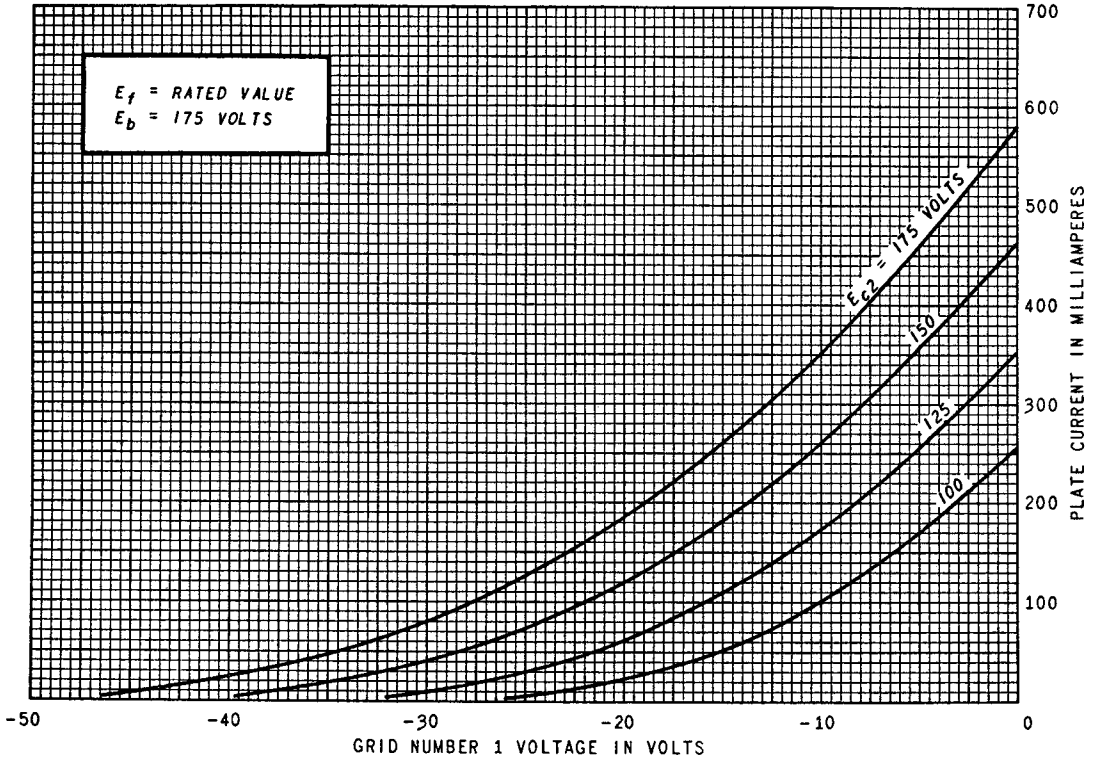
▲Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

π In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in absence of excitation.

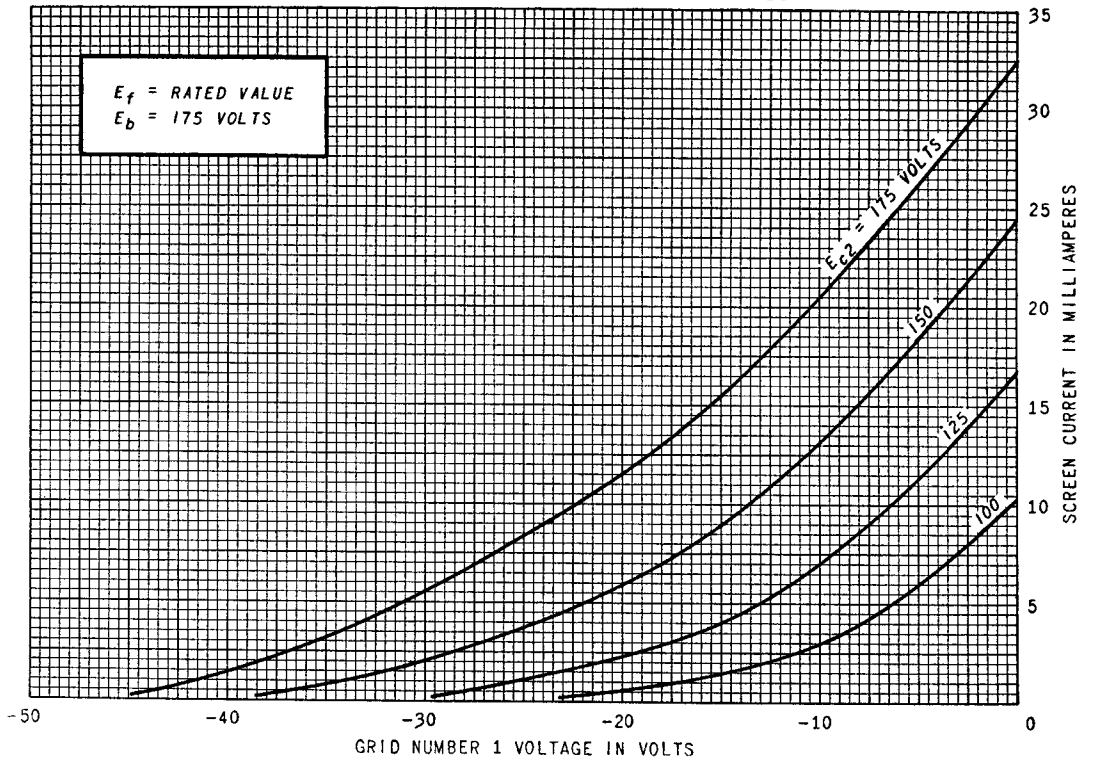
♦ Applied for very short interval so as not to damage tube.

Triode connection (screen tied to plate) with Eb = Ec2 = 175 volts and Ec1 = −30 volts.

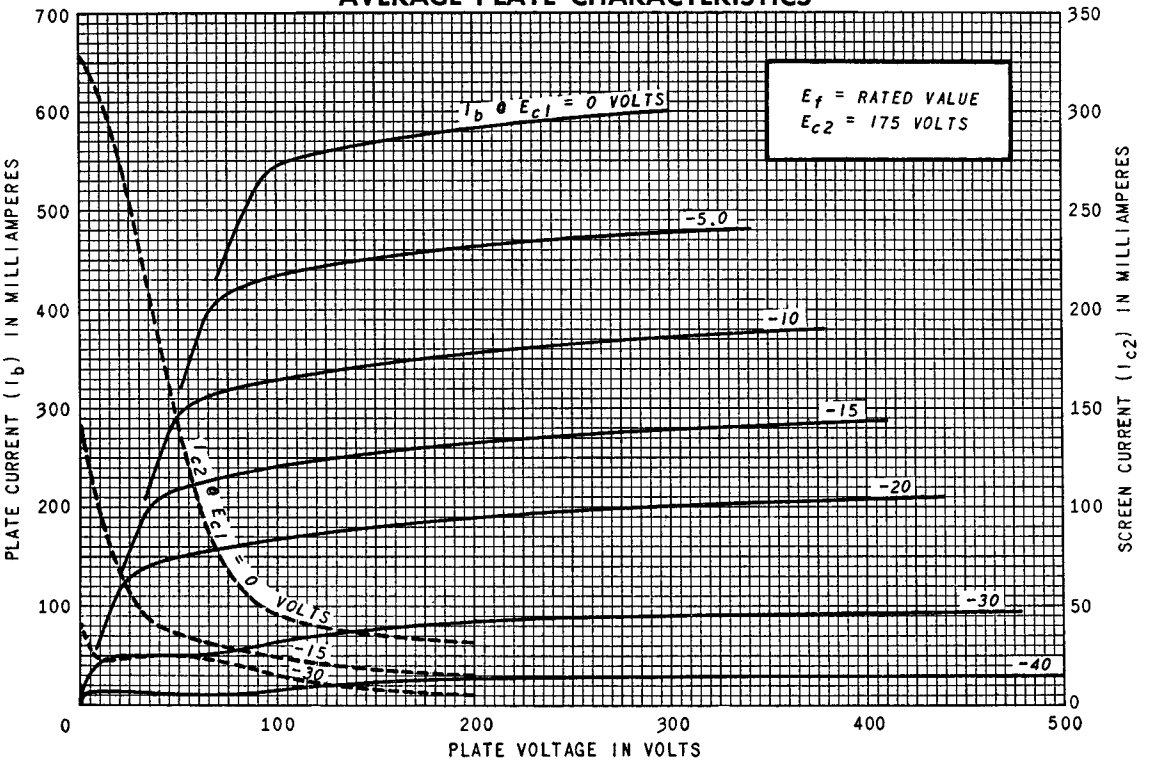
AVERAGE TRANSFER CHARACTERISTICS



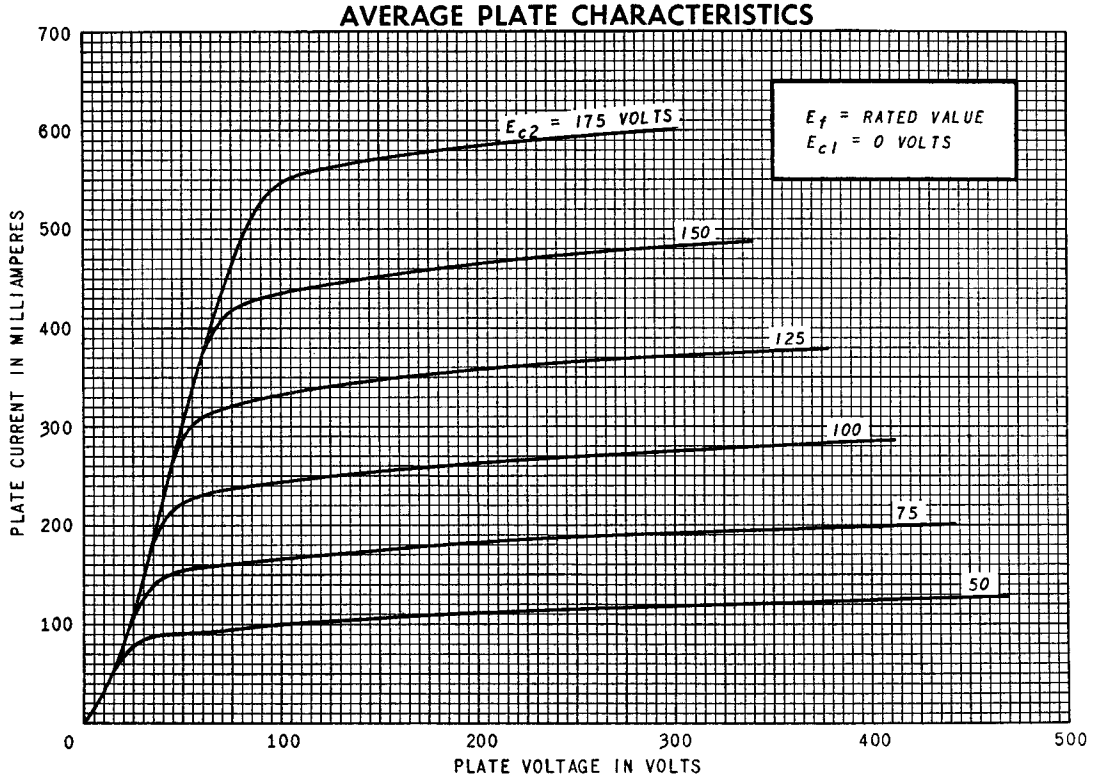
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



Electronic TUBES

6CE5-3CE5-4CE5

PENTODE

DESCRIPTION AND RATING

The 6CE5 is a miniature sharp-cutoff pentode designed for use as a wide-band, radio-frequency amplifier in television receivers. Features of the tube include high transconductance and low interelectrode capacitance. The 6CE5 also exhibits a controlled heater warm-up characteristic which makes it especially suited for use in television receivers that employ series-connected heaters.

Except for heater ratings, the 3CE5 and the 4CE5 are identical to the 6CE5.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	3CE5	4CE5	6CE5	
Heater Voltage, AC or DC	3.15	4.2	6.3	Volts
Heater Current	0.6	0.45	0.3	Amperes
Heater Warm-up Time*	11	11	11	Seconds
Direct Interelectrode Capacitances†				
Grid-Number 1 to Plate, maximum			0.03	μμf
Input			6.5	μμf
Output			1.9	μμf

MECHANICAL

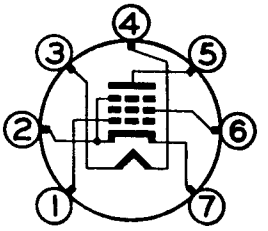
Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	300	Volts
Screen-Supply Voltage	300	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	2.0	Watts
Screen Dissipation	0.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

BASING DIAGRAM

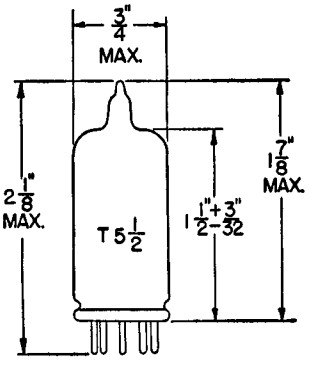


RETMA 7BD

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode, Grid Number 3 (Suppressor), and Internal Shield
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Cathode, Grid Number 3 (Suppressor), and Internal Shield

PHYSICAL DIMENSIONS



RETMA 5-2

GENERAL ELECTRIC

CHARACTERISTICS AND TYPICAL OPERATION

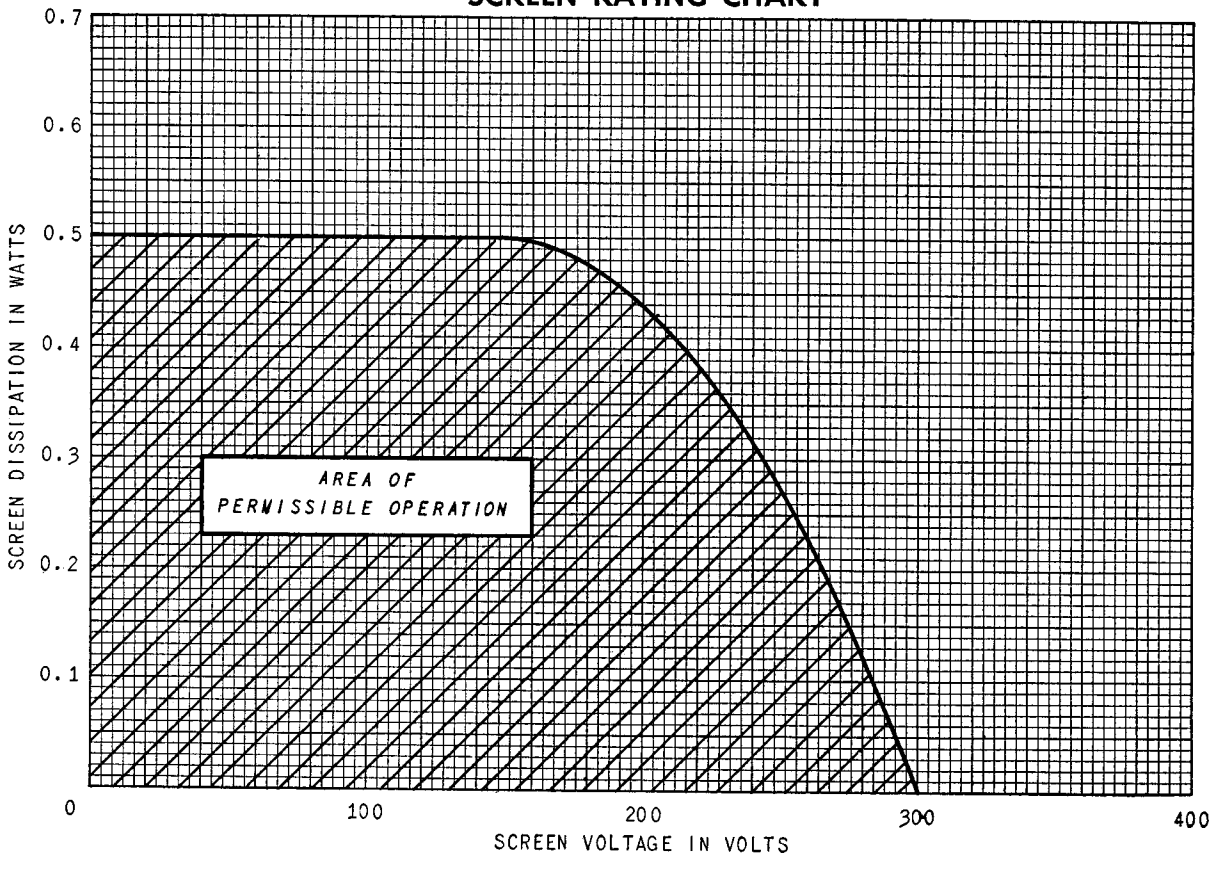
CLASS A_1 AMPLIFIER

Plate Voltage	125	Volts
Screen Voltage	125	Volts
Grid-Number 1 Supply Voltage	−1.0	Volts
Grid-Number 1 Resistor (bypassed)	1.0	Megohms
Plate Resistance, approximate	0.3	Megohms
Transconductance	7600	Micromhos
Plate Current	11	Milliamperes
Screen Current	2.8	Milliamperes
Grid-Number 1 Voltage, approximate		
I_b = 35 Microamperes	−5.0	Volts

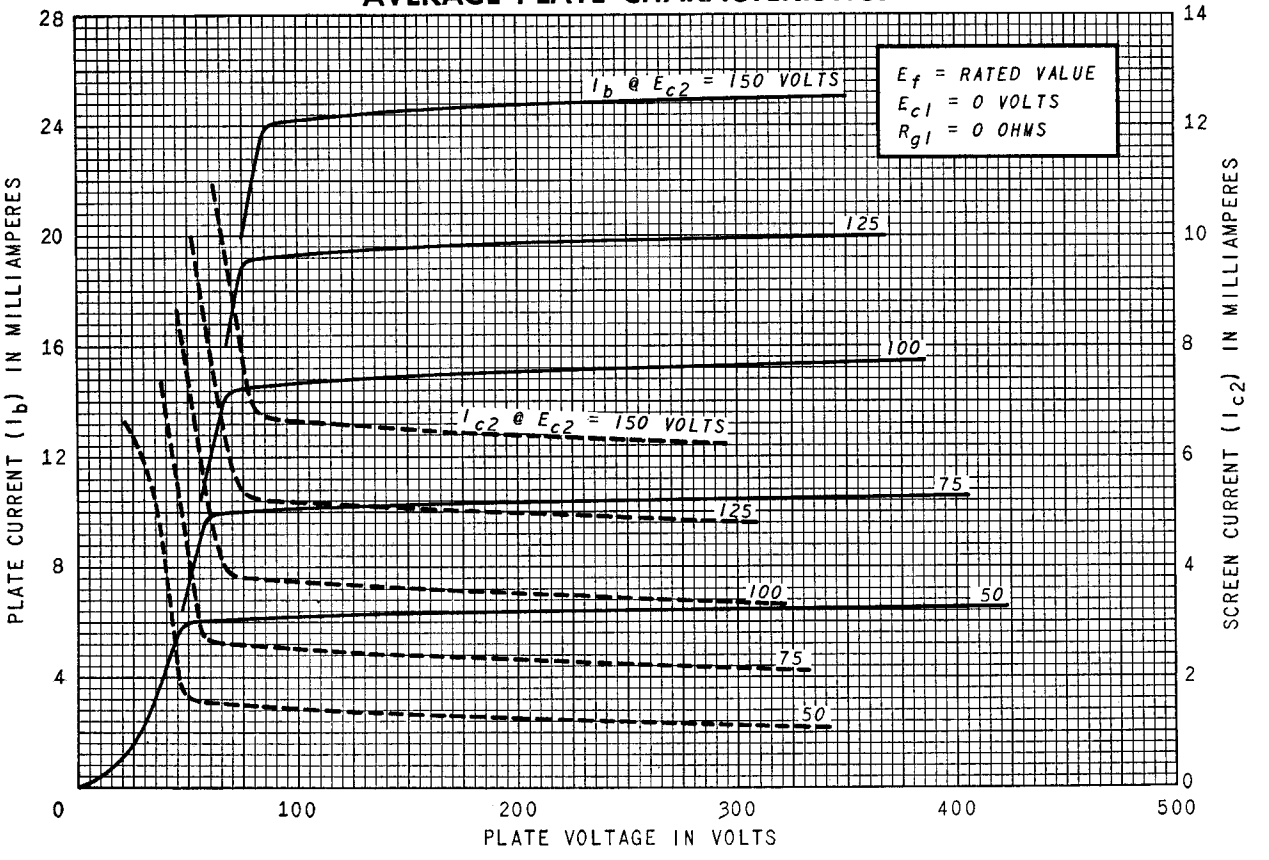
* The time required for the voltage across the heater to reach 80 per cent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

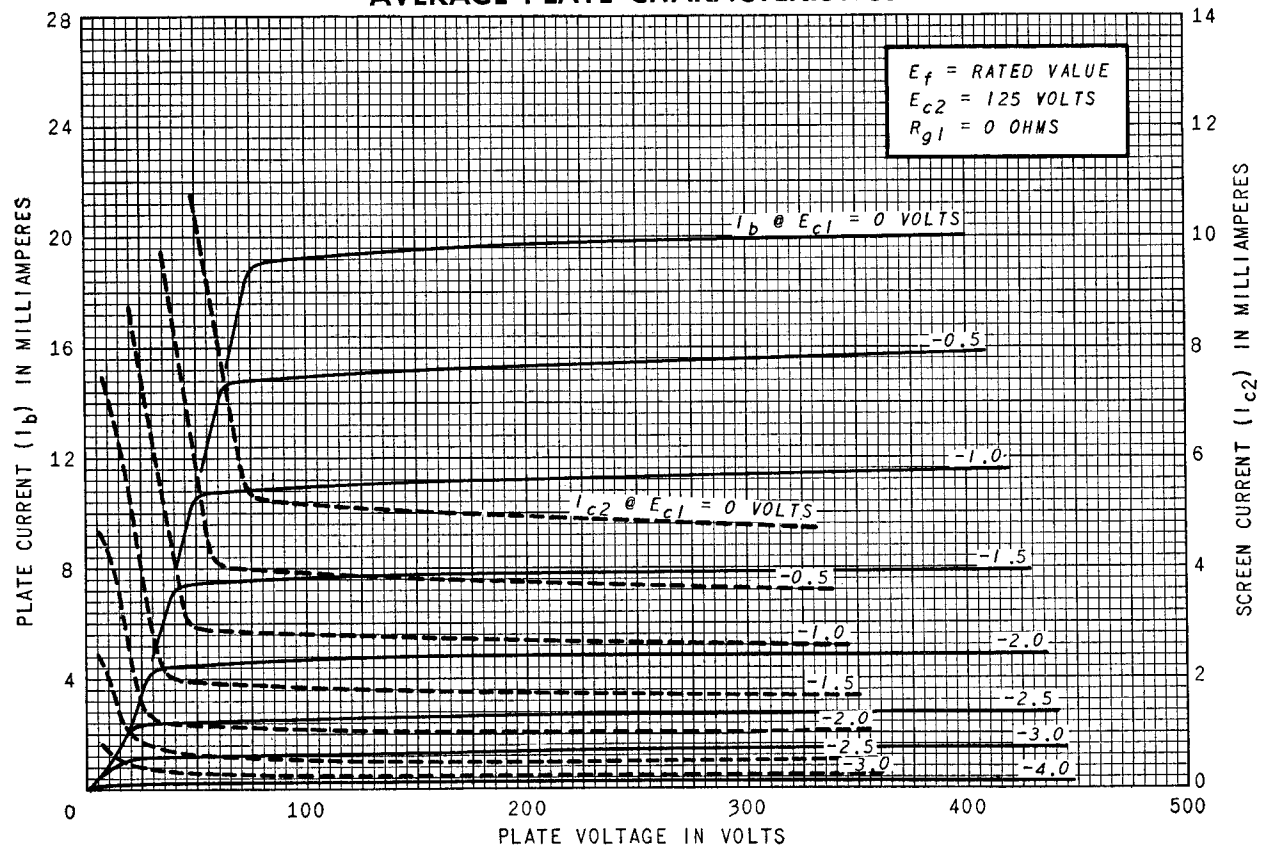
SCREEN RATING CHART



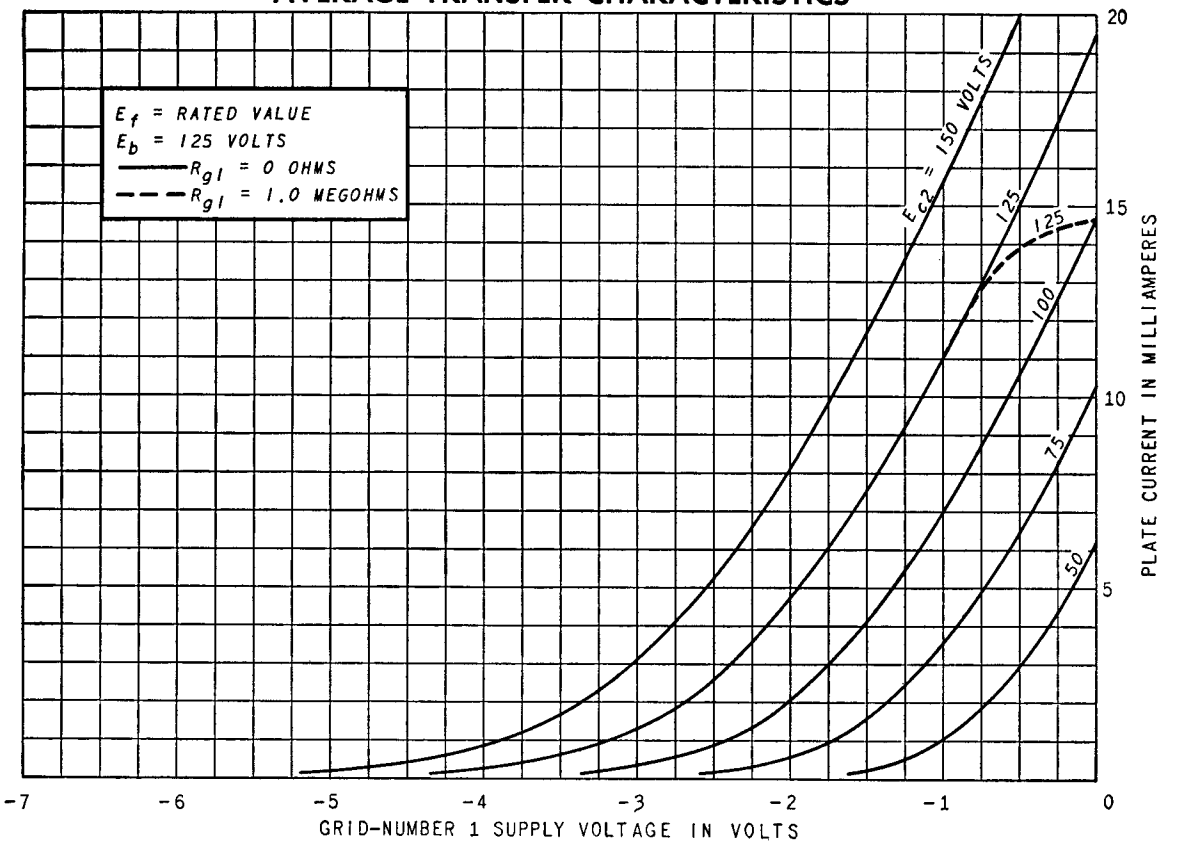
AVERAGE PLATE CHARACTERISTICS



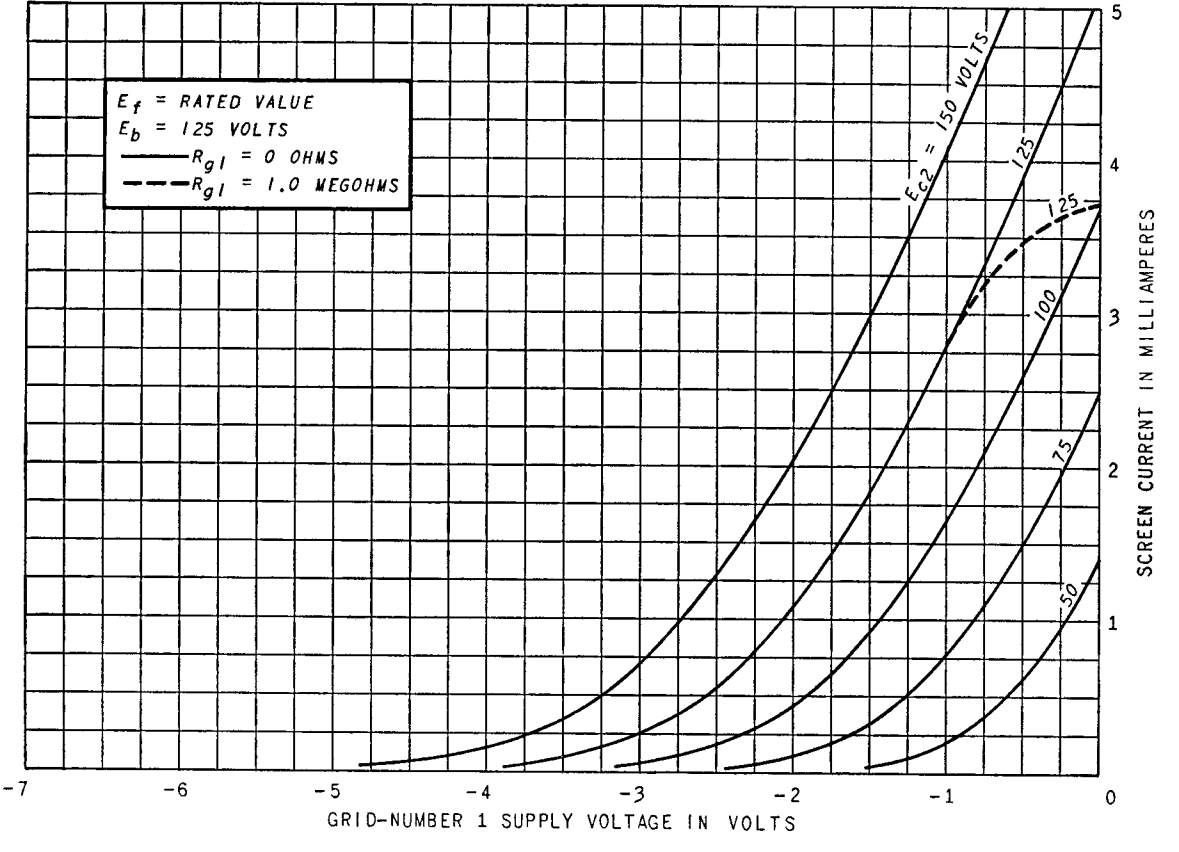
AVERAGE PLATE CHARACTERISTICS



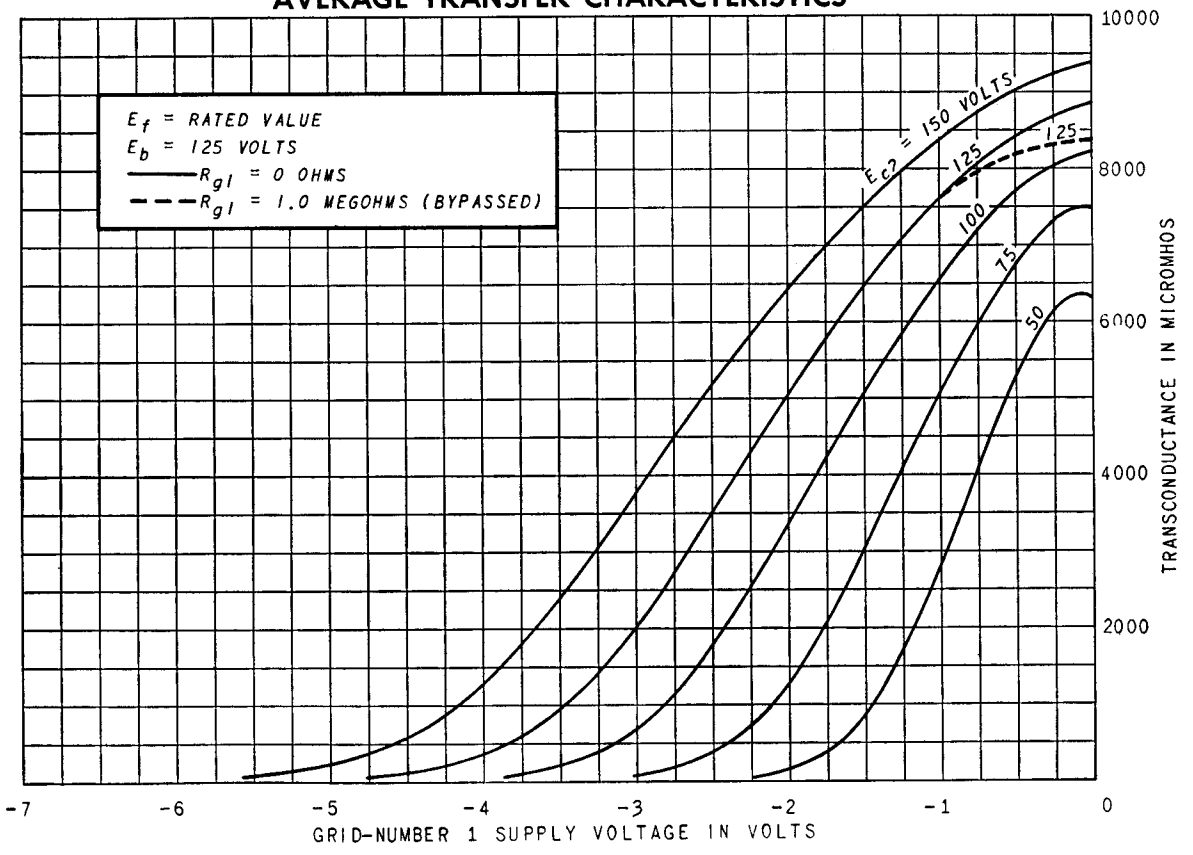
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBES

6CF6 - 3CF6

PENTODE

DESCRIPTION AND RATING

The 6CF6 is a miniature sharp-cutoff pentode designed especially for use as a gain-controlled intermediate-frequency amplifier in television receivers. Except for the plate-current cutoff characteristic, the 6CF6 is identical to the 6CB6; and like that tube features high transconductance and low interelectrode capacitances. The tube is also useful as a radio-frequency amplifier in VHF television tuners.

The 3CF6 is identical to the 6CF6 except for heater ratings. The 3CF6 in addition incorporates a controlled heater warm-up characteristic which makes it especially suited for use in television receivers that employ 600-milliampere, series-connected heaters.

GENERAL

ELECTRICAL

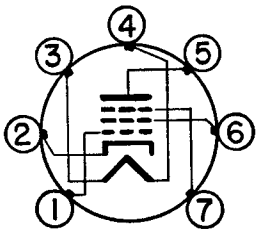
	3CF6	6CF6	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	3.15	6.3 ± 10%	Volts
Heater Current	0.6 ± 6%	0.3	Amperes
Heater Warm-up Time*	11	..	Seconds

Direct Interelectrode Capacitances	With Shield†	Without Shield	
Grid-Number 1 to Plate, maximum	0.015	0.025	μμf
Input	6.5	6.5	μμf
Output	3.0	2.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

BASING DIAGRAM

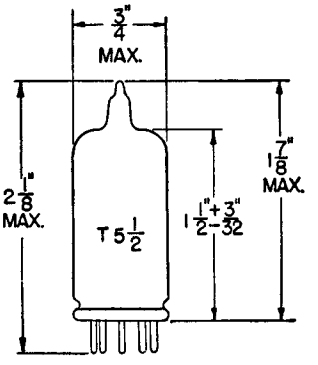


RETMA 7CM

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Internal Shield and Grid Number 3 (Suppressor)

PHYSICAL DIMENSIONS



RETMA 5-2

GENERAL ELECTRIC

Supersedes ET-T1311, dated 1-56

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	330	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	2.3	Watts
Screen Dissipation	0.55	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

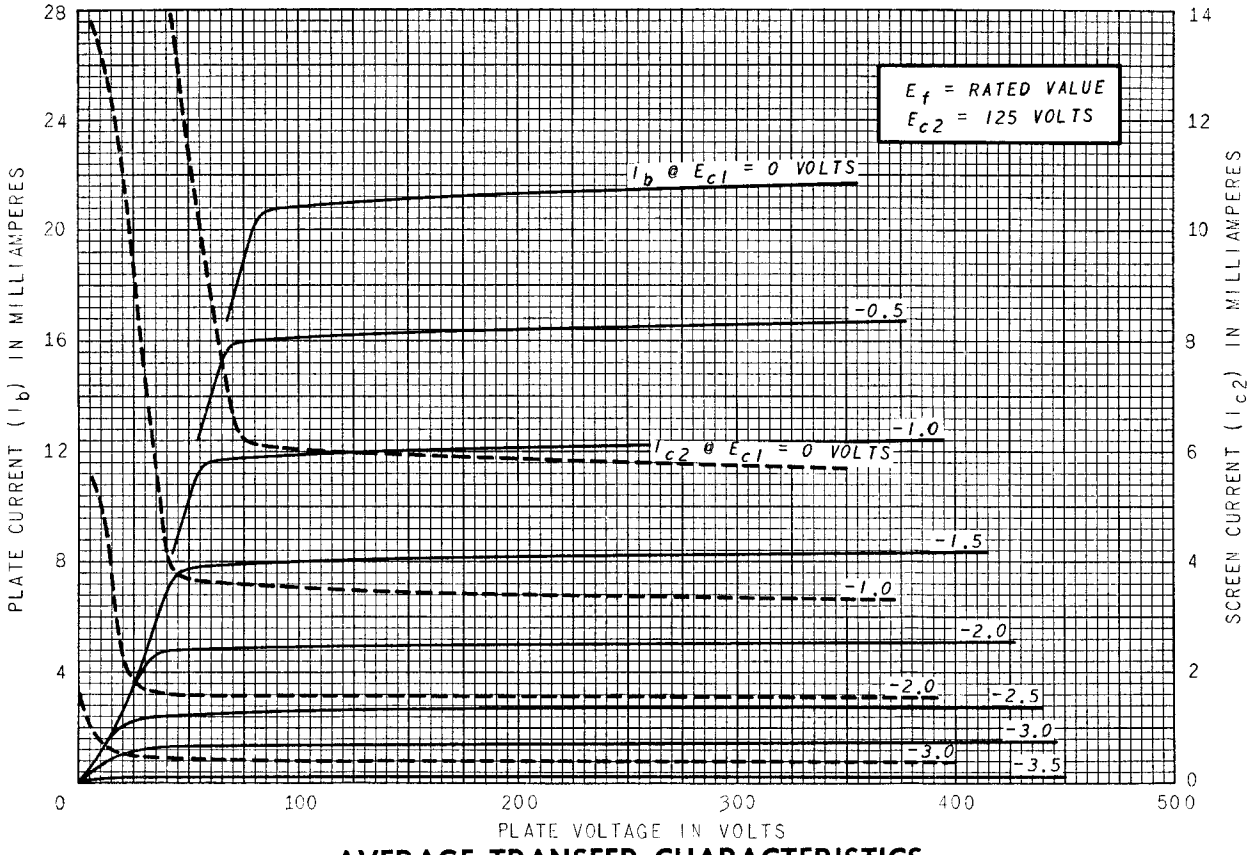
CLASS A_1 AMPLIFIER

Plate Voltage	125	125	Volts
Suppressor, Connected to Cathode at Socket			
Screen Voltage	125	125	Volts
Grid-Number 1 Voltage	−3.0	....	Volts
Cathode-Bias Resistor	....	56	Ohms
Plate Resistance, approximate	....	0.3	Megohms
Transconductance	....	7800	Micromhos
Plate Current	2.2	12.5	Milliamperes
Screen Current	....	3.7	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib—20 Microamperes	....	−6.0	Volts

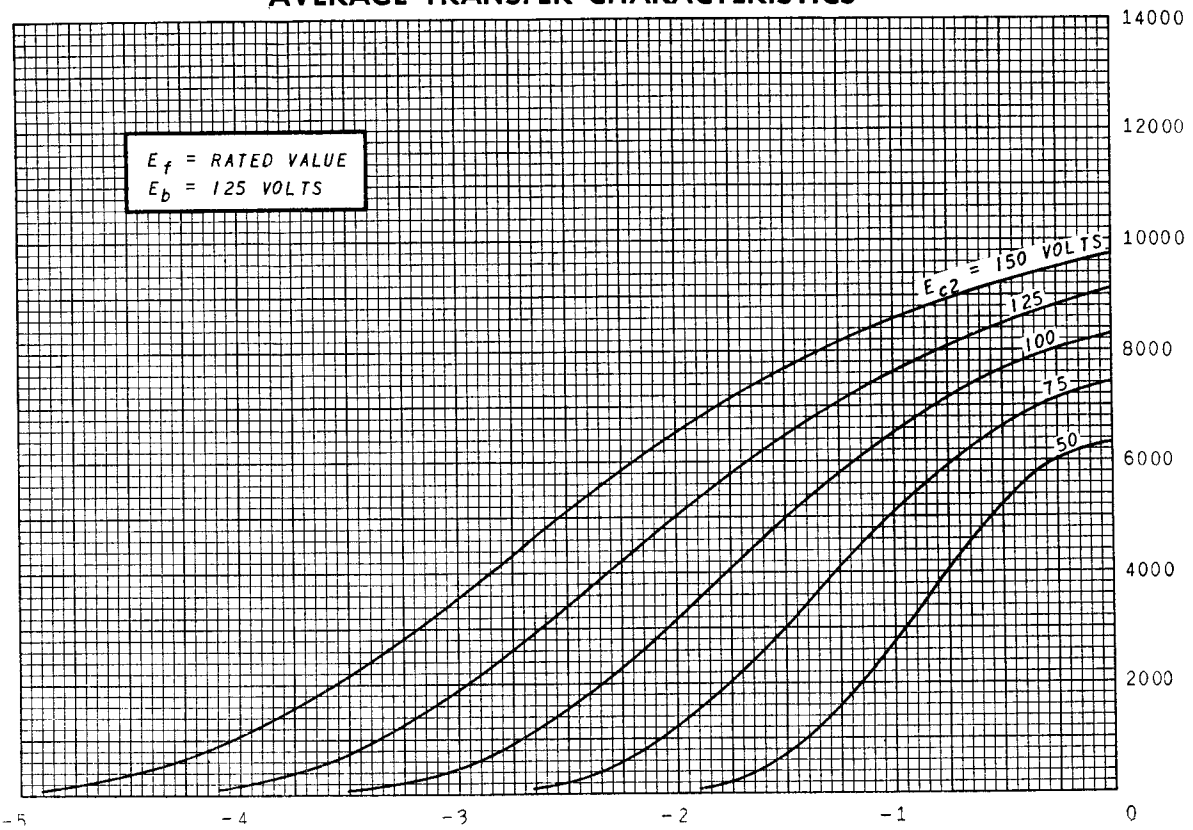
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (RETMA 316) connected to pin 2.

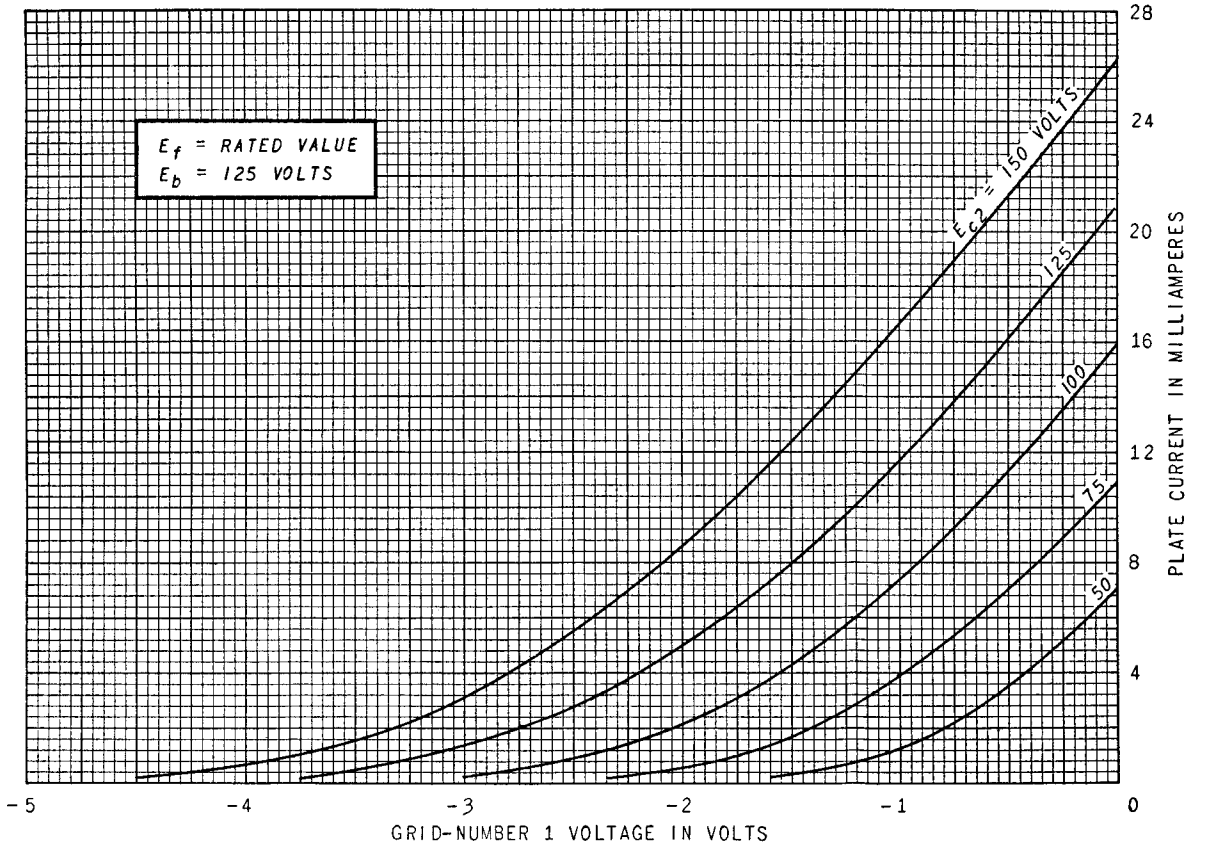
AVERAGE PLATE CHARACTERISTICS



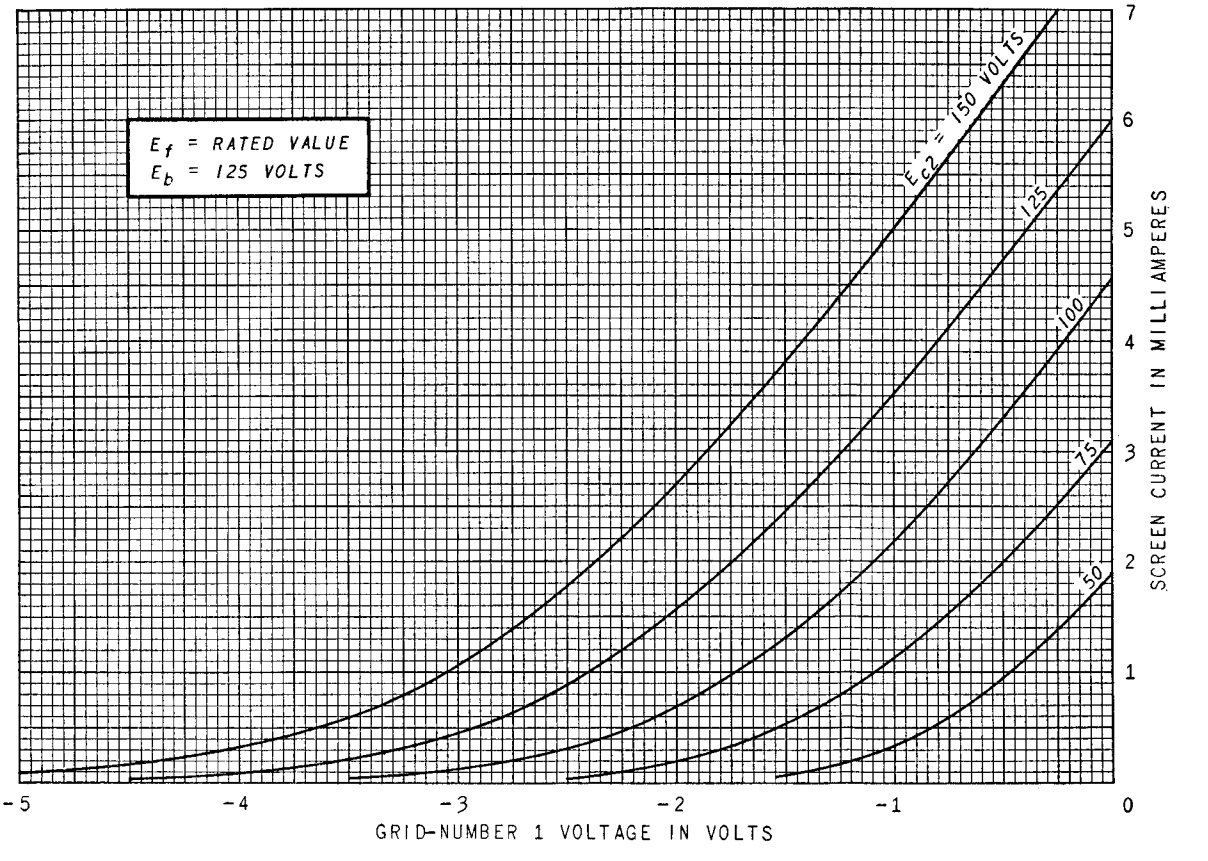
AVERAGE TRANSFER CHARACTERISTICS



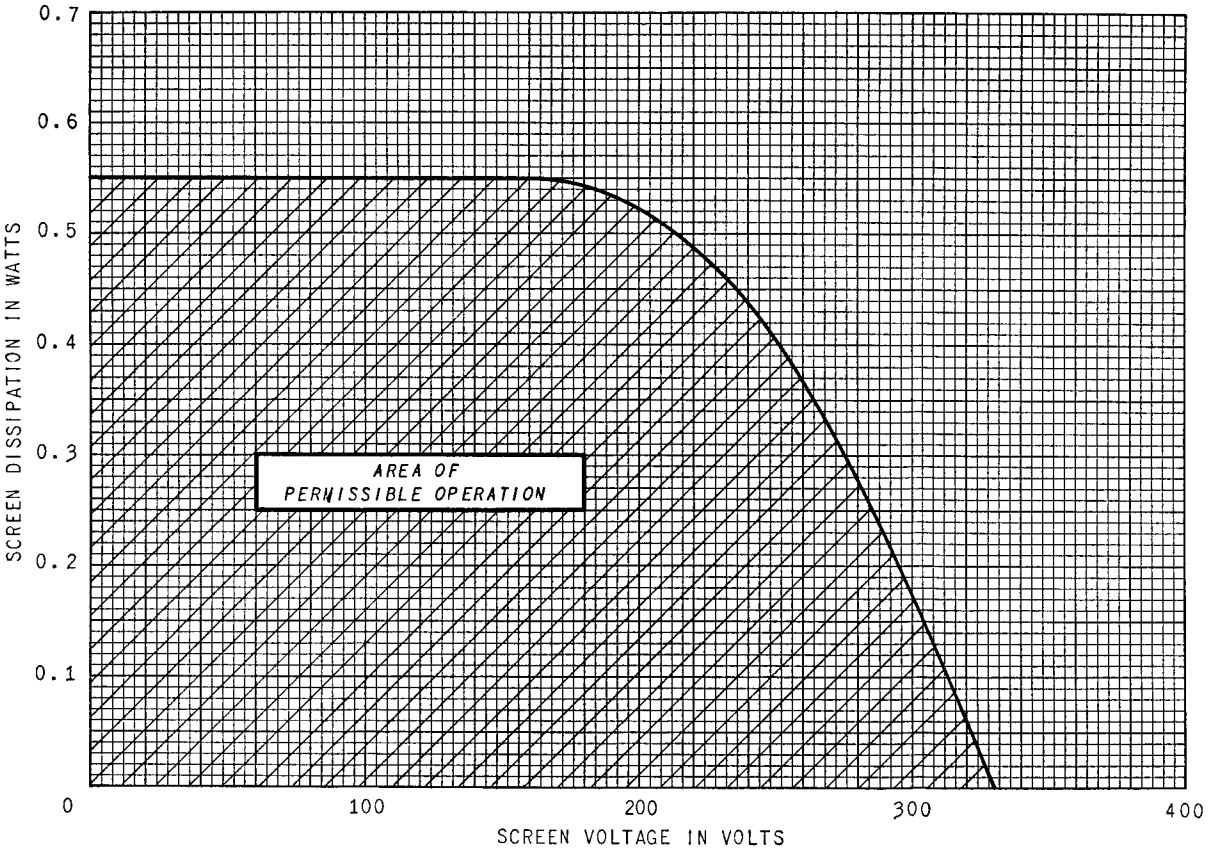
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



SCREEN RATING CHART



—PRODUCT INFORMATION—

Compactron Diode

6CG3

FOR TV DAMPING DIODE APPLICATIONS

- **COLOR TV TYPE**
- **LOW TUBE DROP**
- **DIFFUSION BONDED CATHODE**
- **5000 VOLTS DC**
- **350 MILLIAMPERES DC**

The 6CG3 is a compactron containing a single heater-cathode type diode. It is intended for service as the damping diode in the horizontal deflection circuit of color television receivers.

The diffusion bonded cathode practically eliminates one of the major failure mechanisms in damping diodes, which is plate-to-cathode arcing caused by emissive particles being pulled from the cathode by the high electrostatic field.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	1.8	Amperes

Direct Interelectrode Capacitances, approximate§

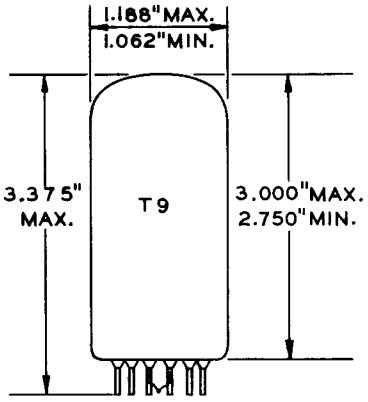
Cathode to Plate and Heater:		
k to (p + h)	16	pf
Plate to Cathode and Heater:		
p to (k + h)	13	pf
Heater to Cathode:		
(h to k)	4.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-62

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.375	Inches
Maximum Seated Height	3.000	Inches
Minimum Seated Height	2.750	Inches

PHYSICAL DIMENSIONS

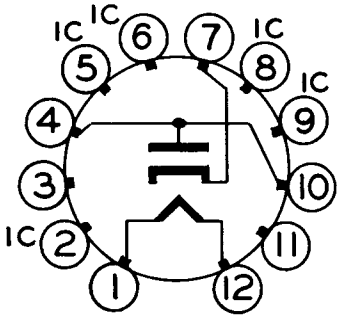


EIA 9-62

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Internal Connection - Do Not Use
Pin 3 - No Connection
Pin 4 - Plate
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Cathode
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Plate
Pin 11 - No Connection
Pin 12 - Heater

BASING DIAGRAM



EIA 12HF

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

TV DAMPER SERVICE¶—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	5000	Volts
Plate Dissipation	9.0	Watts
Steady-State Peak Plate Current	1050	Milliamperes
DC Output Current	350	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	900	Volts
Total DC and Peak	5000	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 700 Milliamperes DC	25	Volts

NOTES

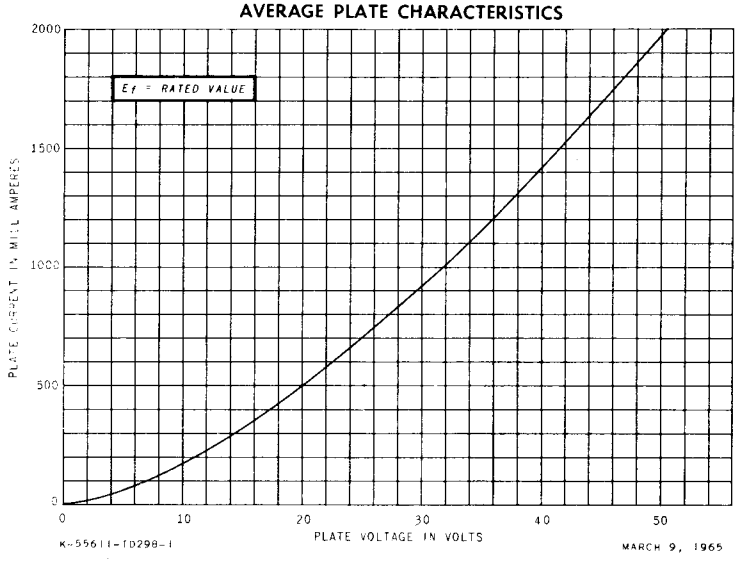
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky

Electronic TUBES

6CG7—8CG7

TWIN TRIODE

FOR GENERAL-PURPOSE AMPLIFIER AND OSCILLATOR APPLICATIONS

DESCRIPTION AND RATING

The 6CG7 is a miniature medium-mu twin triode suitable for use in a wide variety of general-purpose applications. It is particularly useful as a vertical-deflection oscillator and horizontal-deflection oscillator in television receivers. Like the 6SN7-GTB to which it is electrically equivalent, the tube may also be used as a resistance-coupled amplifier, phase inverter, or multivibrator.

Except for heater ratings, the 8CG7 is identical to the 6CG7. Both tubes exhibit a controlled heater-warm-up characteristic which makes them especially suited for use in television receivers that employ series-connected heaters.

GENERAL

ELECTRICAL

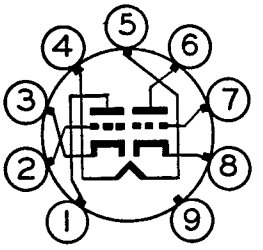
Cathode—Coated Unipotential	6CG7	8CG7
Heater Voltage, AC or DC	6.3	8.4 Volts
Heater Current	0.6	0.45 Amperes
Heater Warm-up Time*	11	11 Seconds

Direct Interelectrode Capacitances, approximate†	
Grid to Plate, Each Section	4.0 μμf
Input, Each Section	2.3 μμf
Output, Each Section	2.2 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

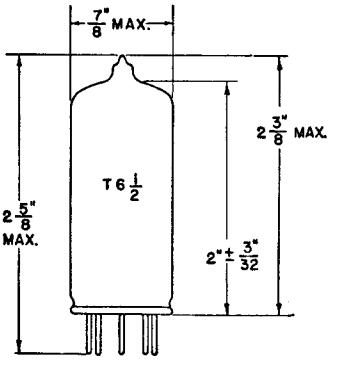


RETMA 9AJ

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Internal Shield

PHYSICAL DIMENSIONS



RETMA 6-3

GENERAL ELECTRIC

Supersedes ET-T941A, dated 12-55

MAXIMUM RATINGS

DESIGN-CENTER VALUES, EACH SECTION

	Class A_1 Amplifier	
DC Plate Voltage	300	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation, Each Plate	3.5	Watts
Total Plate Dissipation, Both Plates	5.0	Watts
DC Cathode Current	20	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	1.0	Megohms

	Vertical-Oscillator Service‡	Horizontal-Oscillator Service‡	
DC Plate Voltage	300	300	Volts
Peak Negative Grid Voltage	400	600	Volts
Plate Dissipation, Each Plate	3.5	3.5	Watts
Total Plate Dissipation, Both Plates	5.0	5.0	Watts
DC Cathode Current	20	20	Milliamperes
Peak Cathode Current	70	300	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance			
With Fixed Bias	2.2	2.2	Megohms
With Cathode Bias	2.2	2.2	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	90	250	250	Volts
Grid Voltage	0	−12.5	−8.0	Volts
Amplification Factor	20	.....	20	
Plate Resistance, approximate	6700	.....	7700	Ohms
Transconductance	3000	.....	2600	Micromhos
Plate Current	10	1.3	9.0	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	−7	.....	−18	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

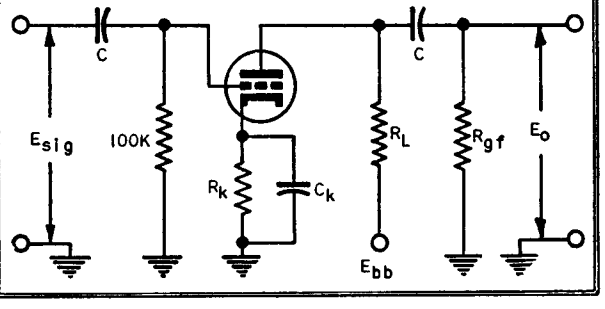
R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2600	11	14	2100	28	15	2000	49	16
0.10	0.24	3200	15	16	2700	36	16	2600	65	17
0.24	0.24	6200	12	15	5000	27	16	4700	53	17
0.24	0.51	7400	16	16	6300	37	16	6000	66	17
0.51	0.51	14000	13	15	12000	30	16	11000	54	16
0.51	1.0	17000	16	15	15000	36	16	13000	56	16

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	3400	13	14	2700	29	15	2500	51	15
0.10	0.24	4300	17	15	3600	37	16	3400	67	16
0.24	0.24	8100	15	14	6500	32	15	6100	57	16
0.24	0.51	9900	18	15	8400	40	16	8000	71	16
0.51	0.51	16000	15	14	13000	32	16	12000	59	16
0.51	1.0	21000	19	15	18000	41	16	16000	73	16

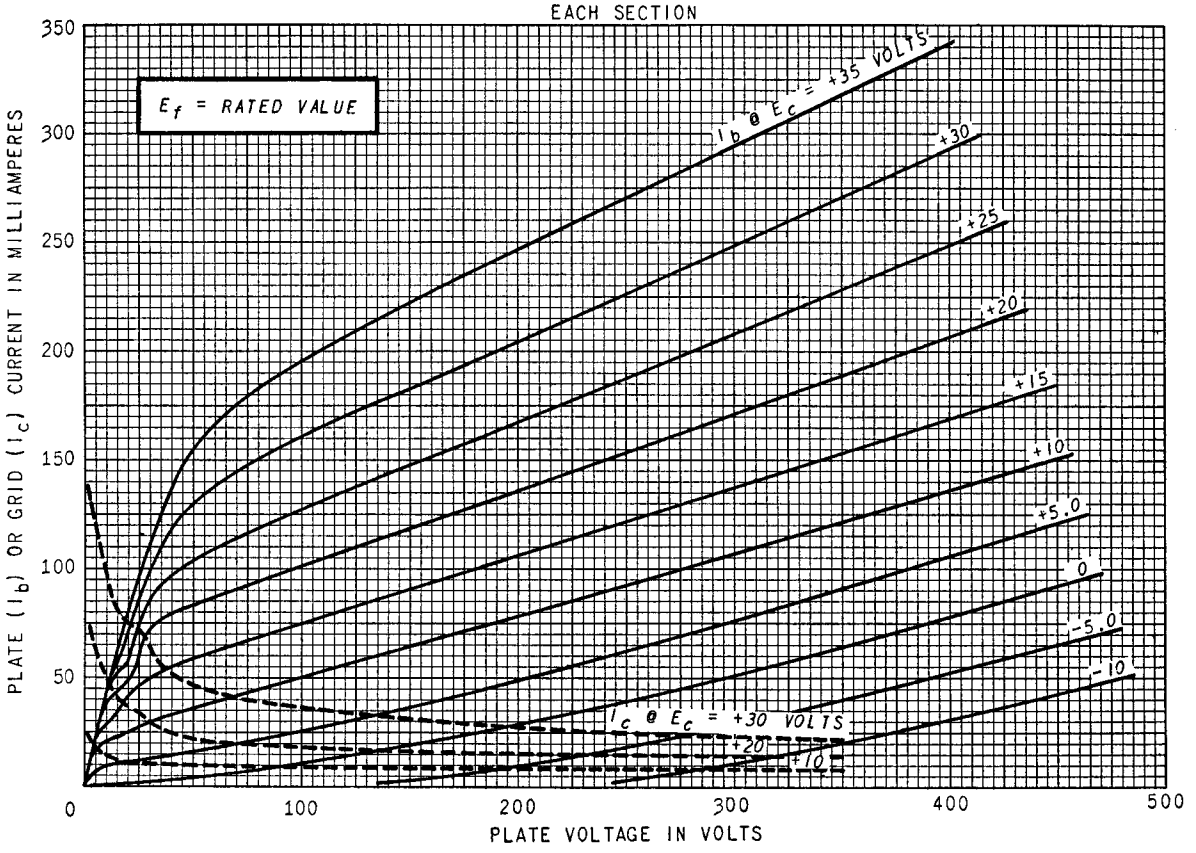
Notes:

1. E_o is maximum RMS voltage output for approximately five percent total harmonic distortion.
2. Gain is measured for an output voltage of two volts RMS.
3. R_k is in ohms; R_L and R_{gf} are in megohms.
4. Coupling capacitors (C) should be selected to give desired frequency response. R_k should be adequately by-passed.



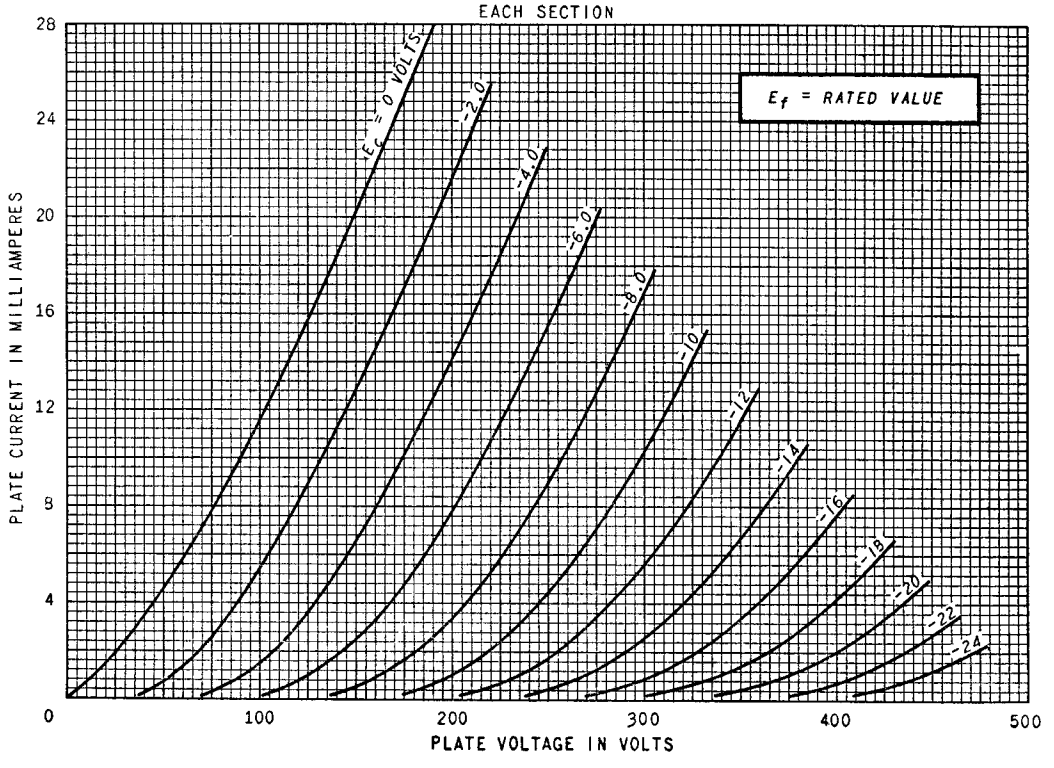
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



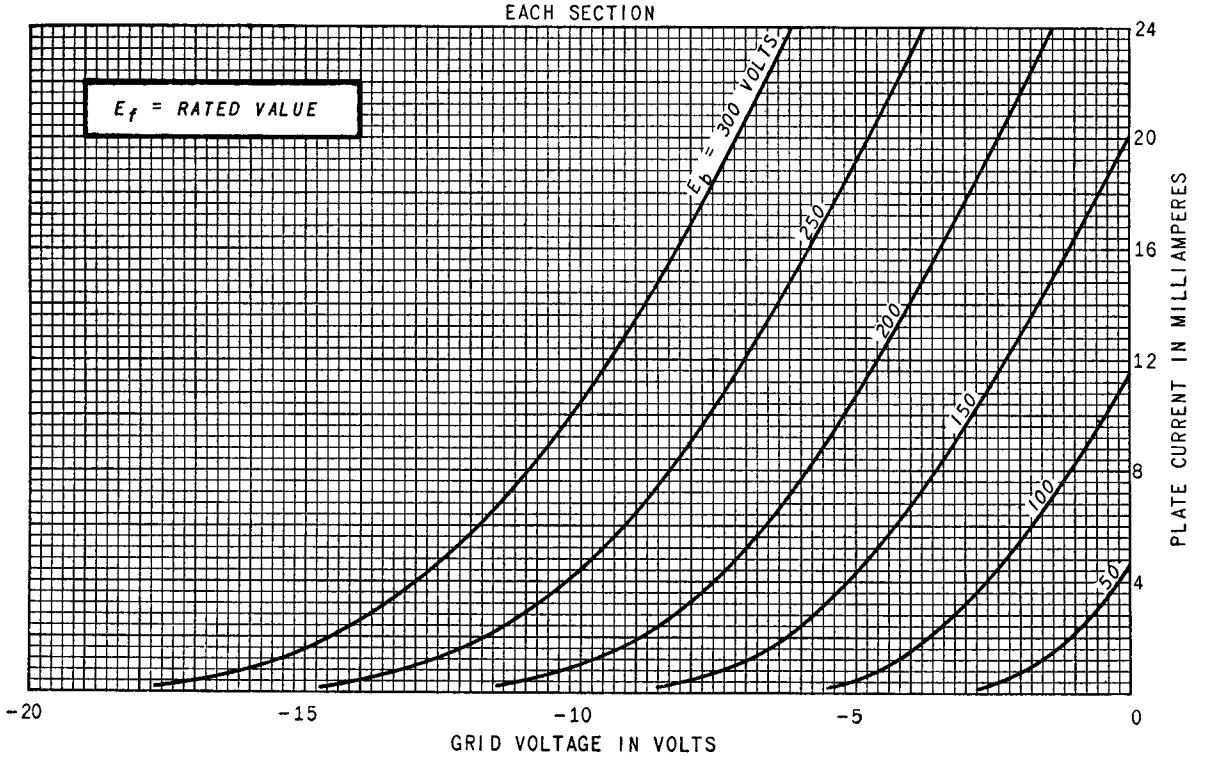
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



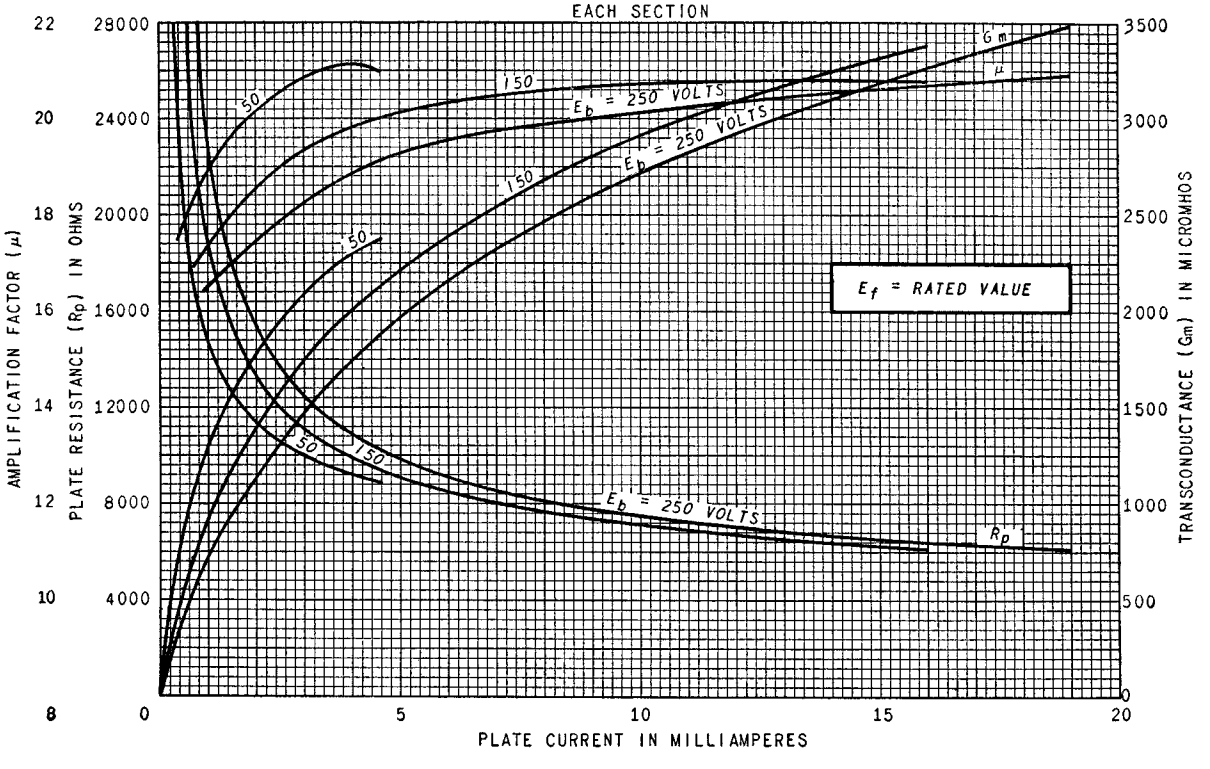
AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION



AVERAGE CHARACTERISTICS

EACH SECTION



6CG8-A

TRIODE-PENTODE

FOR VHF CONVERTER APPLICATIONS

DESCRIPTION AND RATING

The 6CG8-A is a miniature tube containing a medium-mu triode and a sharp-cutoff pentode. It is designed primarily for use as a combined triode oscillator and pentode mixer in VHF television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

	Series Heater Operation	Parallel Heater Operation	
Heater Voltage, AC or DC	6.3	6.3 ± 0.6*	Volts
Heater Current	0.45 ± 0.03*	0.45†	Amperes
Heater Warm-up Time‡	11	.....	Seconds

Direct Interelectrode Capacitances

	With Shield§	Without Shield	
Pentode Section			
Grid-Number 1 to Plate: (Pg1 to Pp), max.	0.02	0.04	pf
Input: Pg1 to (h+k+Pg2+Pg3)	4.8	4.6	pf
Output: Pp to (h+k+Pg2+Pg3)	1.6	0.9	pf
Triode Section			
Grid to Plate: (Tg to Tp)	1.5	1.5	pf
Input: Tg to (h+k+Pg3)	2.4	2.0	pf
Output: Tp to (h+k+Pg3)	1.0	0.5	pf
Pentode-Grid Number 1 to Triode Plate: (Pg1 to Tp), max.	0.04	0.05	pf
Pentode Plate to Triode Plate: (Pp to Tp), max.	0.008	0.05	pf
Heater to Cathode: (h to k)	6.5#	6.5	pf

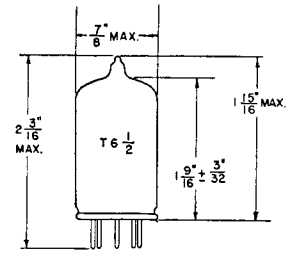
MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin
Outline Drawing—EIA 6-2

Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 3/16	Inches
Maximum Seated Height	1 15/16	Inches

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PHYSICAL DIMENSIONS

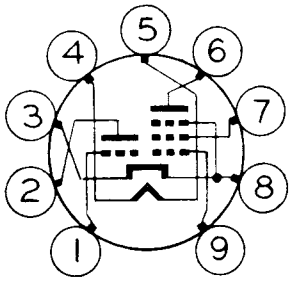


EIA 6-2

TERMINAL CONNECTIONS

Pin 1—Triode Grid
Pin 2—Triode Plate
Pin 3—Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Plate
Pin 7—Pentode Grid Number 2 (Screen)
Pin 8—Cathode and Pentode Grid Number 3 (Suppressor)
Pin 9—Pentode Grid Number 1

BASING DIAGRAM



EIA 9GF

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section	
Plate Voltage	275	275	Volts
Screen Supply Voltage	275	....	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	2.3	1.7	Watts
Screen Dissipation	0.45	....	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section		Triode Section	
Plate Voltage	100	125	125	Volts
Screen Voltage	70	125	....	Volts
Grid-Number 1 Voltage	0	−1.0	−1.0	Volts
Amplification Factor	....	.....	40	
Plate Resistance, approximate	....	300000	6000	Ohms
Transconductance	5700	5500	6500	Micromhos
Plate Current	....	9.0	12	Milliamperes
Screen Current	....	2.2	....	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 20 Microamperes	....	−6.5	−7	Volts

FOOTNOTES

* For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance. For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

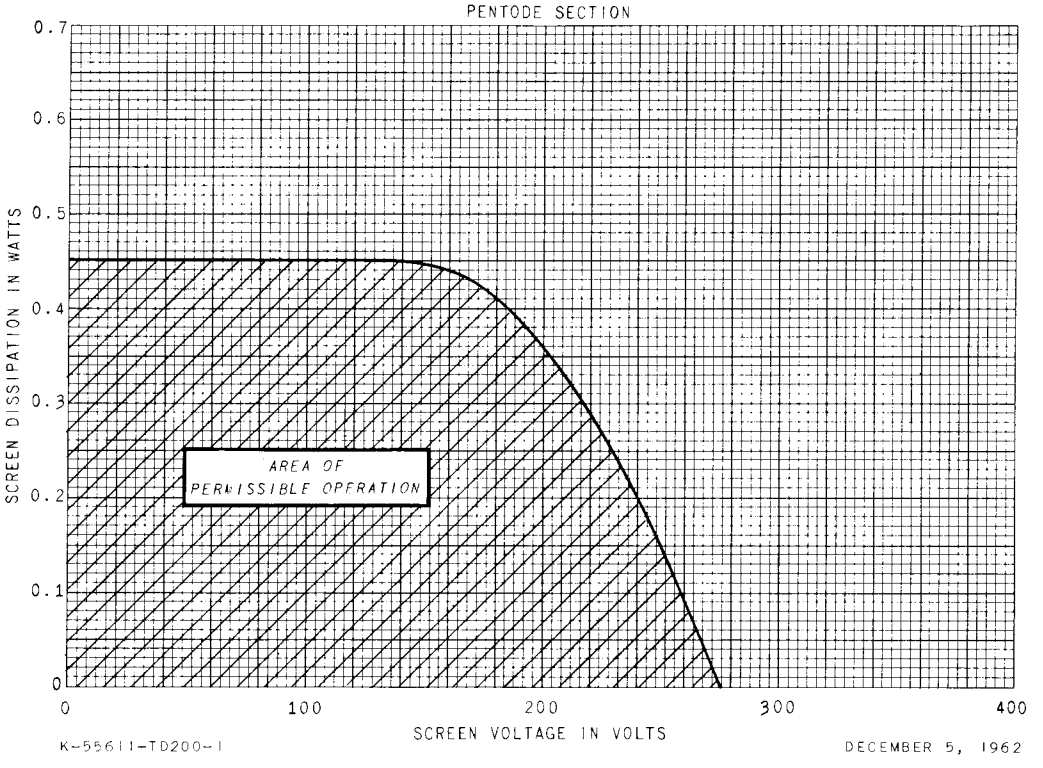
† Heater current of a bogey tube at Ef = 6.3 volts.

‡ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

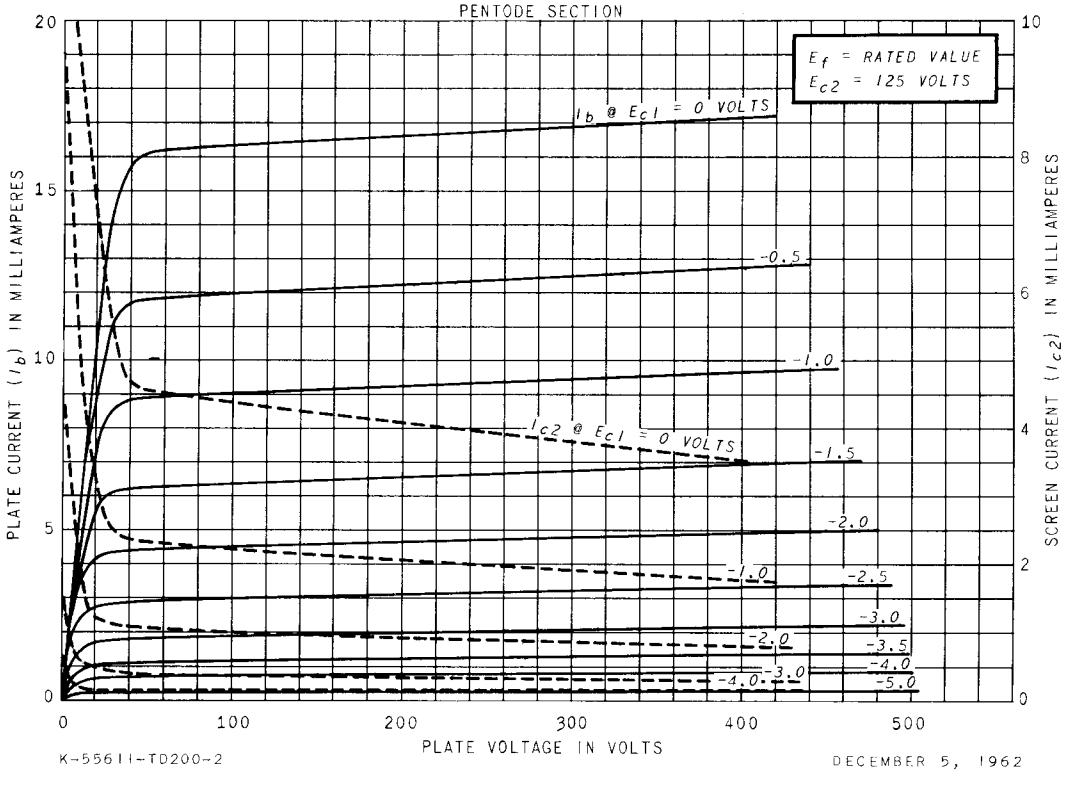
§ With external shield (EIA 315) connected to cathode unless otherwise indicated.

With external shield (EIA 315) connected to ground.

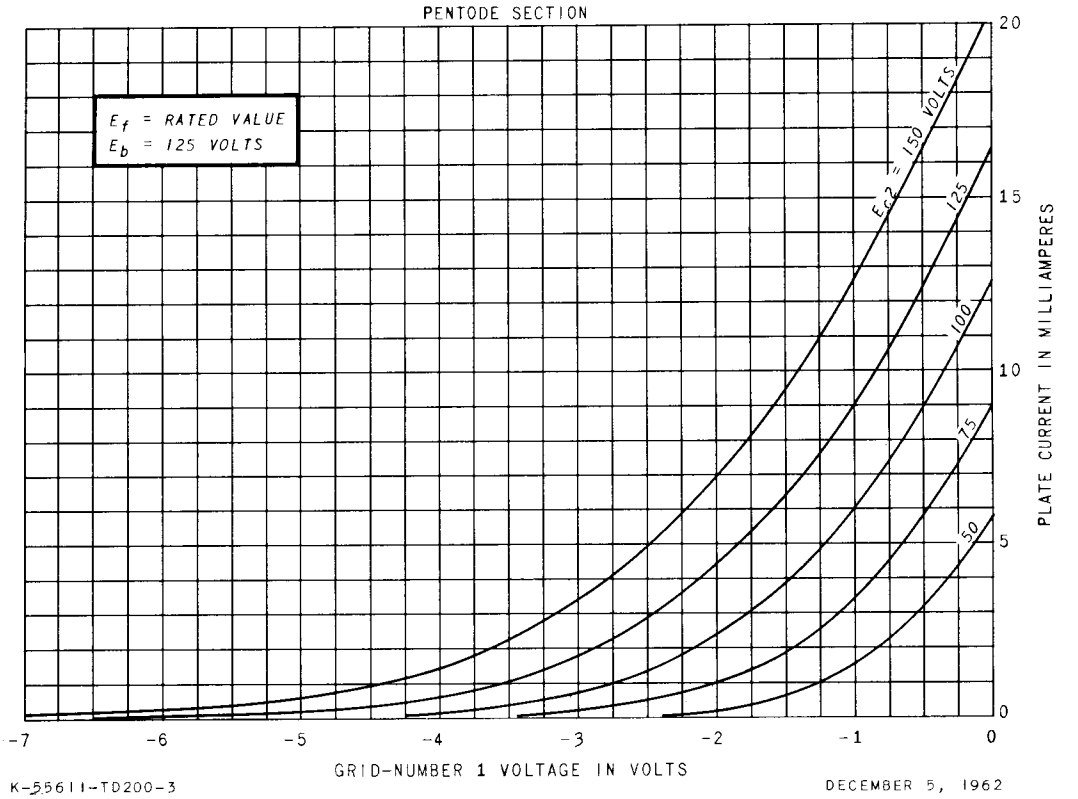
SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS



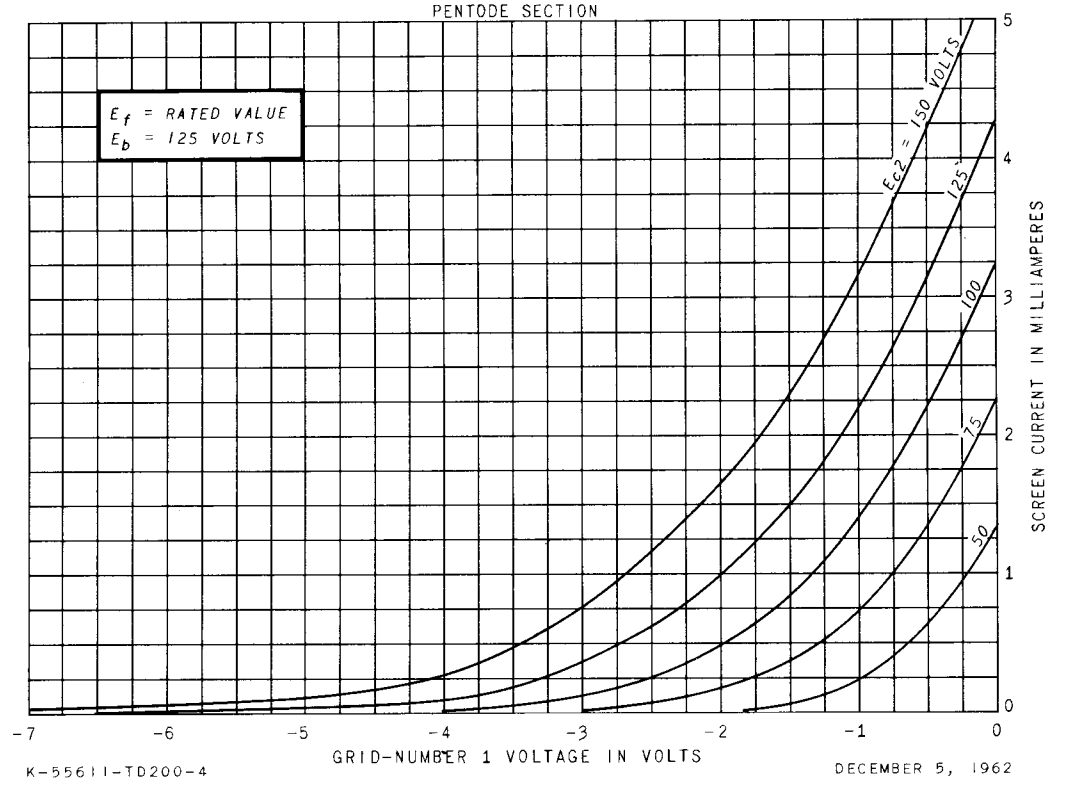
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD200-3

DECEMBER 5, 1962

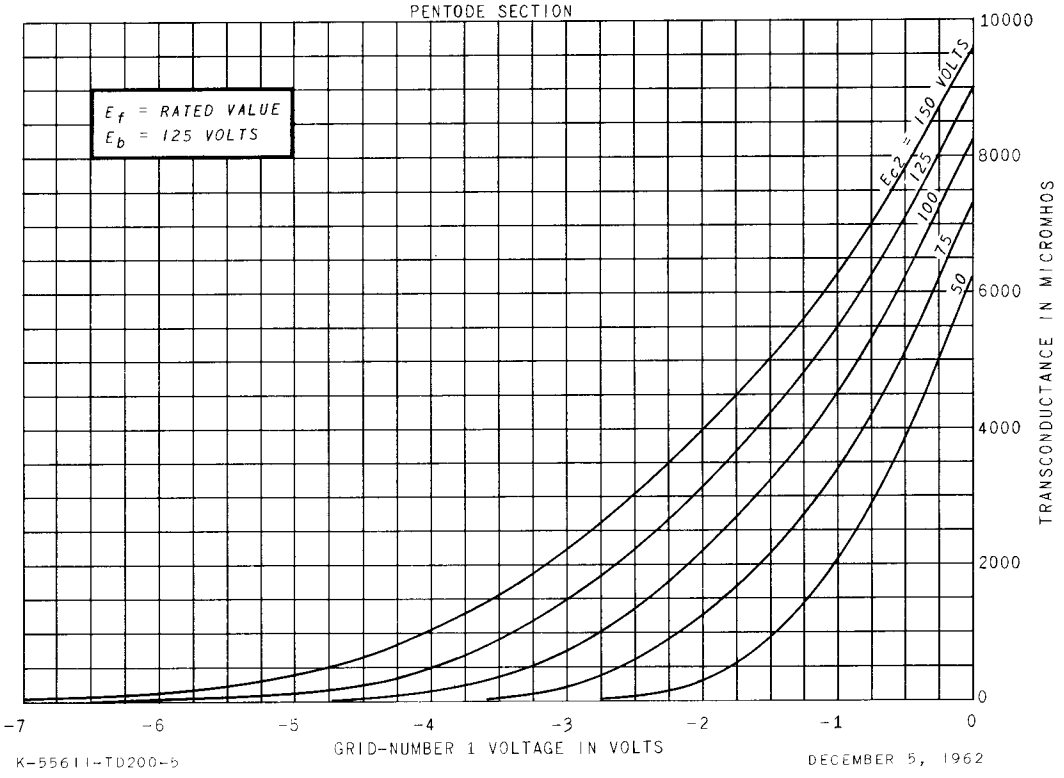
AVERAGE TRANSFER CHARACTERISTICS



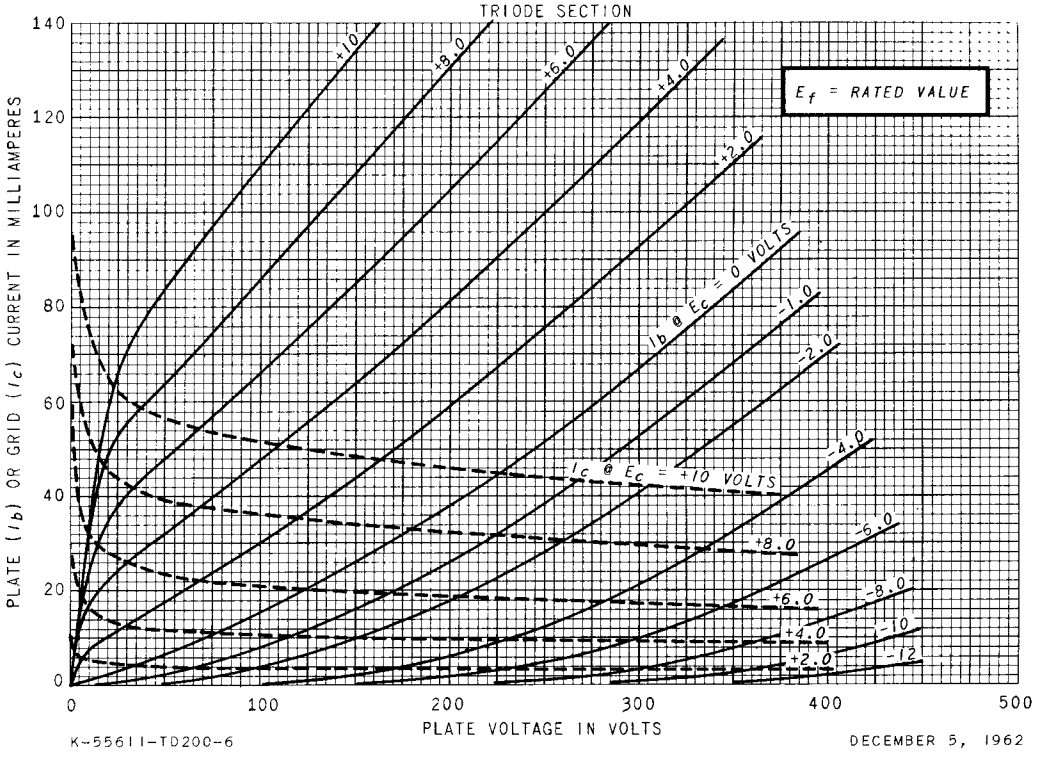
K-55611-TD200-4

DECEMBER 5, 1962

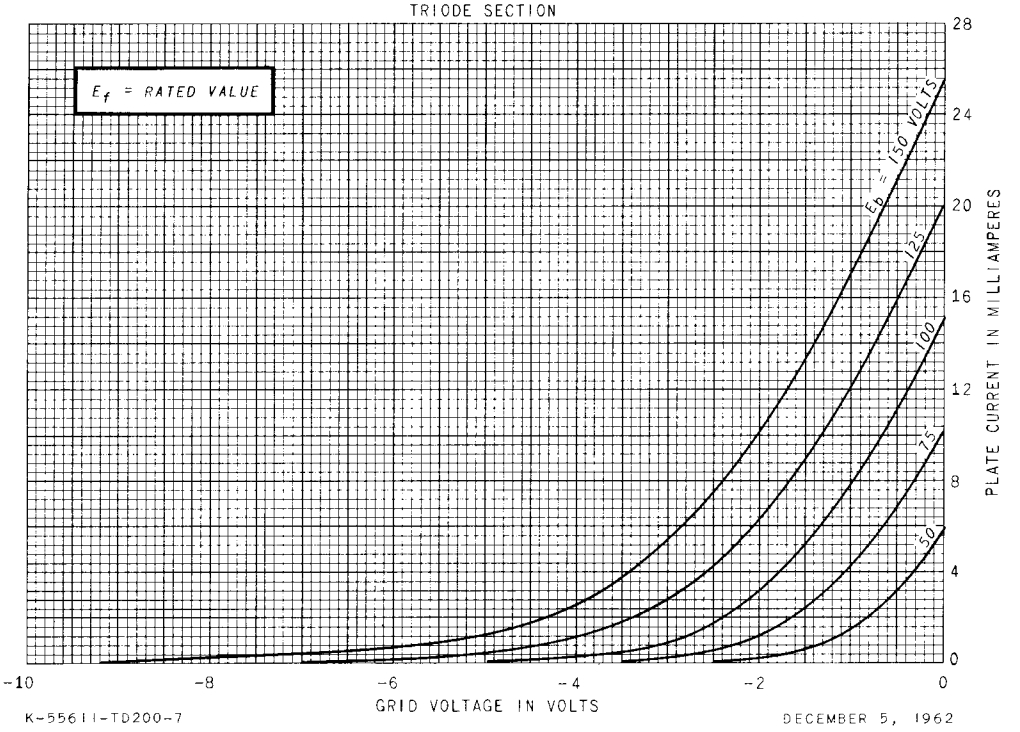
AVERAGE TRANSFER CHARACTERISTICS



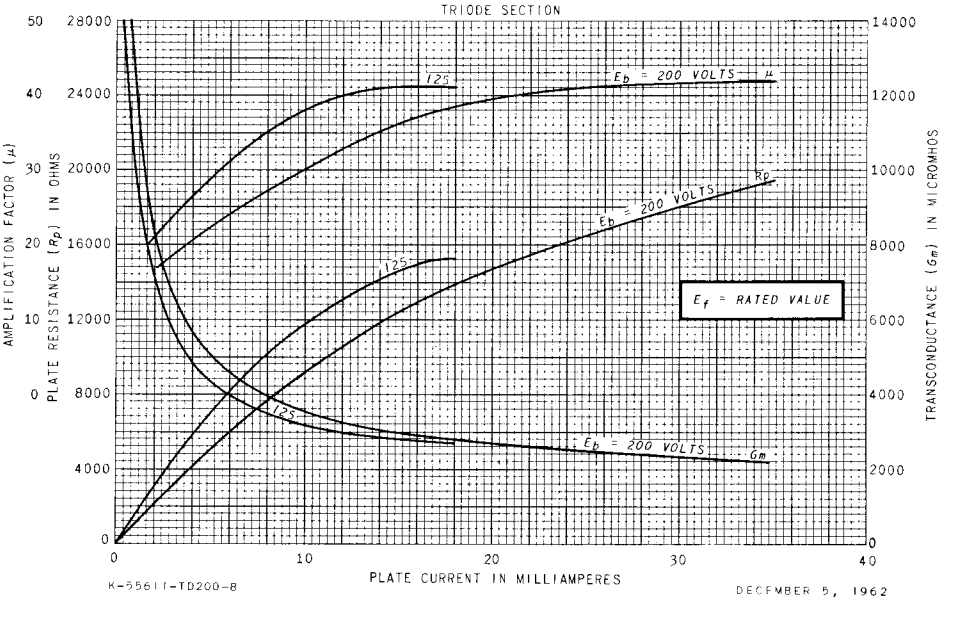
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONIC INNOVATIONS IN ACTION

TUBES

Diode

6CJ3

FOR TV DAMPING DIODE APPLICATIONS

- COLOR TV TYPE
- DIFFUSION BONDED CATHODE
- LOW TUBE DROP
- 5000 VOLTS DC
- 350 MILLIAMPERES DC

The 6CJ3 is a single heater-cathode type diode intended for service as the damping diode in the horizontal-deflection circuit of color television receivers. It utilizes a T-9 bulb and features a 9-pin glass button base with a 0.687-inch pin circle.

The diffusion bonded cathode practically eliminates one of the major failure mechanisms in damping diodes, which is plate-to-cathode arcing caused by emissive particles being pulled from the cathode by the high electrostatic field.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	1.8	Amperes

Direct Interelectrode Capacitances, approximate§

Cathode to Plate and Heater:		
k to (p + h)	16	pf
Plate to Cathode and Heater:		
p to (k + h)	13	pf
Heater to Cathode:		
(h to k)	4.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E9-89, Button 9-Pin
Outline Drawing - EIA 9-111

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.380	Inches
Maximum Seated Height	3.000	Inches
Minimum Seated Height	2.750	Inches

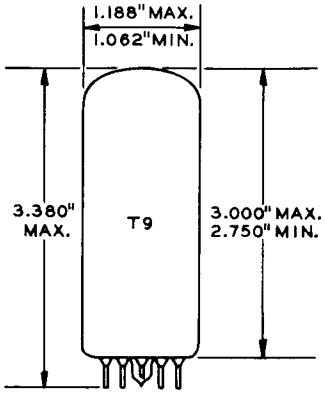
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

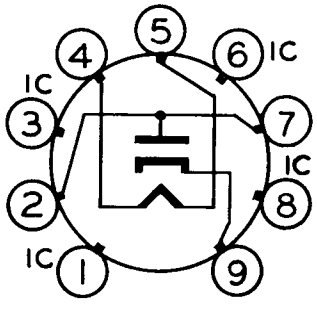


EIA 9-111

TERMINAL CONNECTIONS

Pin 1 - Internal Connection - Do Not Use
Pin 2 - Plate
Pin 3 - Internal Connection - Do Not Use
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Plate
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Cathode

BASING DIAGRAM



EIA 9HP

GENERAL ELECTRIC

Supersedes 6CJ3 PI Sheet dated 5-66

MAXIMUM RATINGS (Cont'd)

TV DAMPER SERVICE¶—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	5500	Volts
Plate Dissipation	6.5	Watts
Steady-State Peak Plate Current	2100	Milliamperes
DC Output Current	350	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	900	Volts
Total DC and Peak	5500	Volts

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 700 Milliamperes	25	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

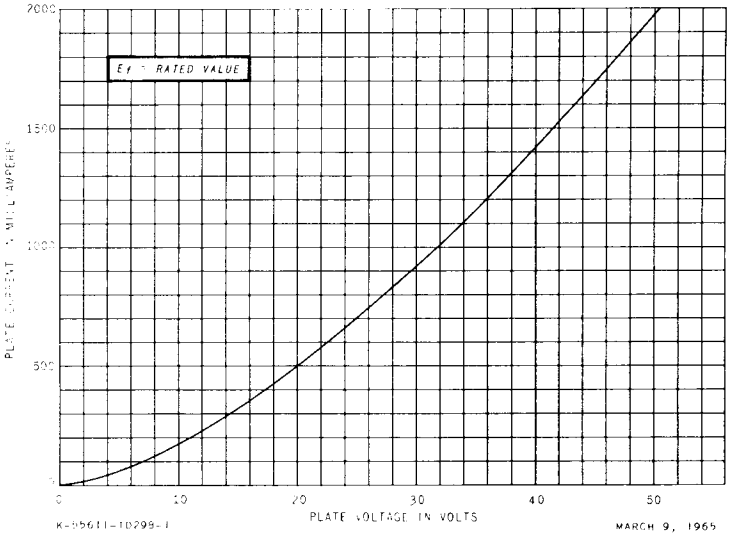
‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

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AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

6CK4

TRIODE

FOR TV VERTICAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6CK4 is a low-mu triode designed for use as the vertical-deflection amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	1.25	Amperes
Direct Interelectrode Capacitances*		
Grid to Plate	6.5	μμf
Input	8.0	μμf
Output	1.8	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B6-60, Short Intermediate-Shell Octal 6-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED	Vertical-Deflection Amplifier†	
DC Plate Voltage	550	Volts
Peak Positive Pulse Plate Voltage	2000‡	Volts
Peak Negative Grid Voltage	250	Volts
Plate Dissipation	12§	Watts
DC Cathode Current	100	Milliamperes
Peak Cathode Current	350	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Cathode Bias	2.2	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

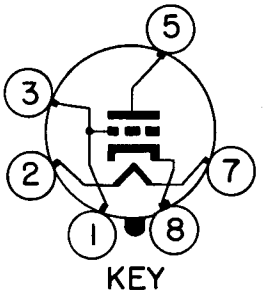
The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

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GENERAL ELECTRIC

BASING DIAGRAM

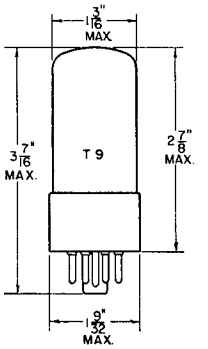


EIA 8JB

TERMINAL CONNECTIONS

Pin 1—Grid
Pin 2—Heater
Pin 3—Grid
Pin 5—Plate
Pin 7—Heater
Pin 8—Cathode

PHYSICAL DIMENSIONS



EIA 9-43

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	100	250	250	Volts
Grid Voltage	0¶	−38	−28	Volts
Amplification Factor	....	....	6.6	
Plate Resistance, approximate	....	....	1200	Ohms
Transconductance	....	....	5500	Micromhos
Plate Current	125	10	40	Milliamperes
Grid Voltage, approximate Ib = 0.5 Milliamperes	....	....	−50	Volts

* Without external shield.

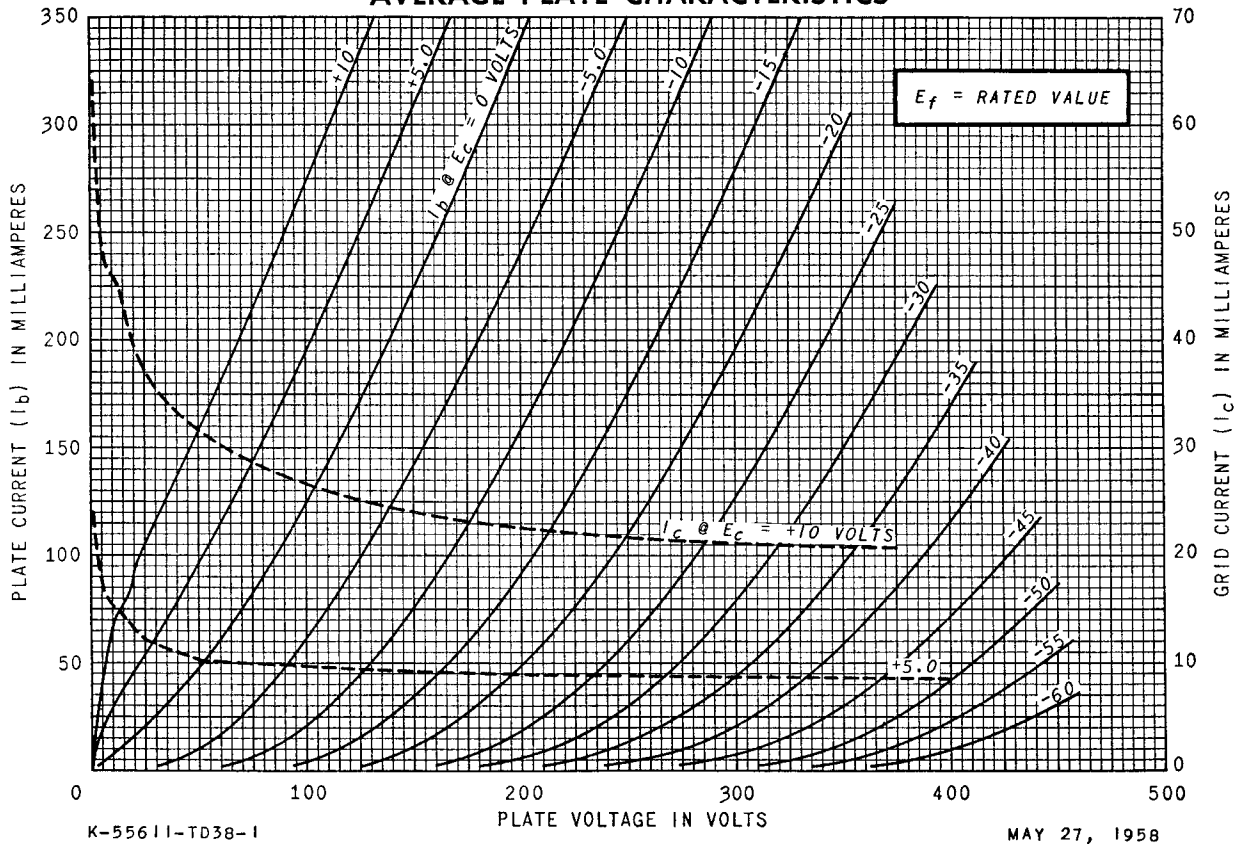
† For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

‡ Value given is to be considered as an Absolute Maximum rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

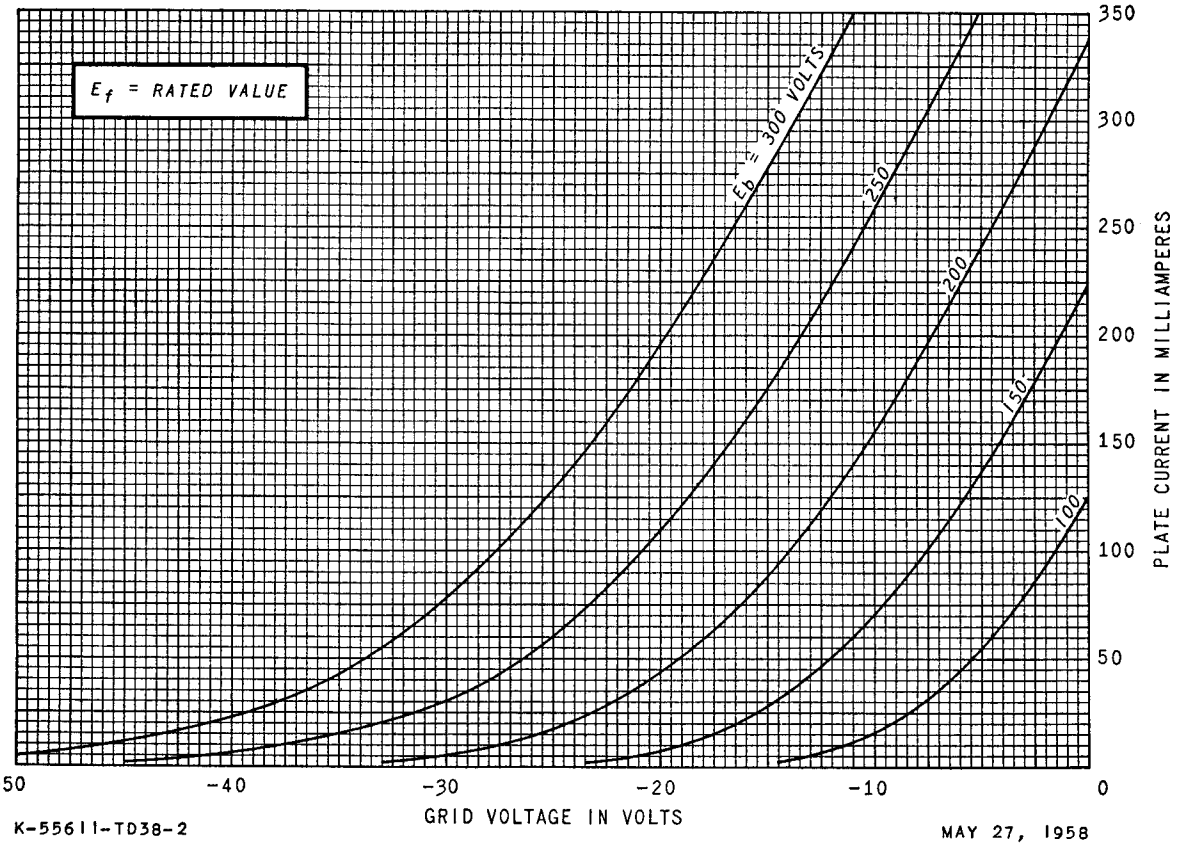
§ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

¶ Applied for short interval (two seconds maximum) so as not to damage tube.

AVERAGE PLATE CHARACTERISTICS



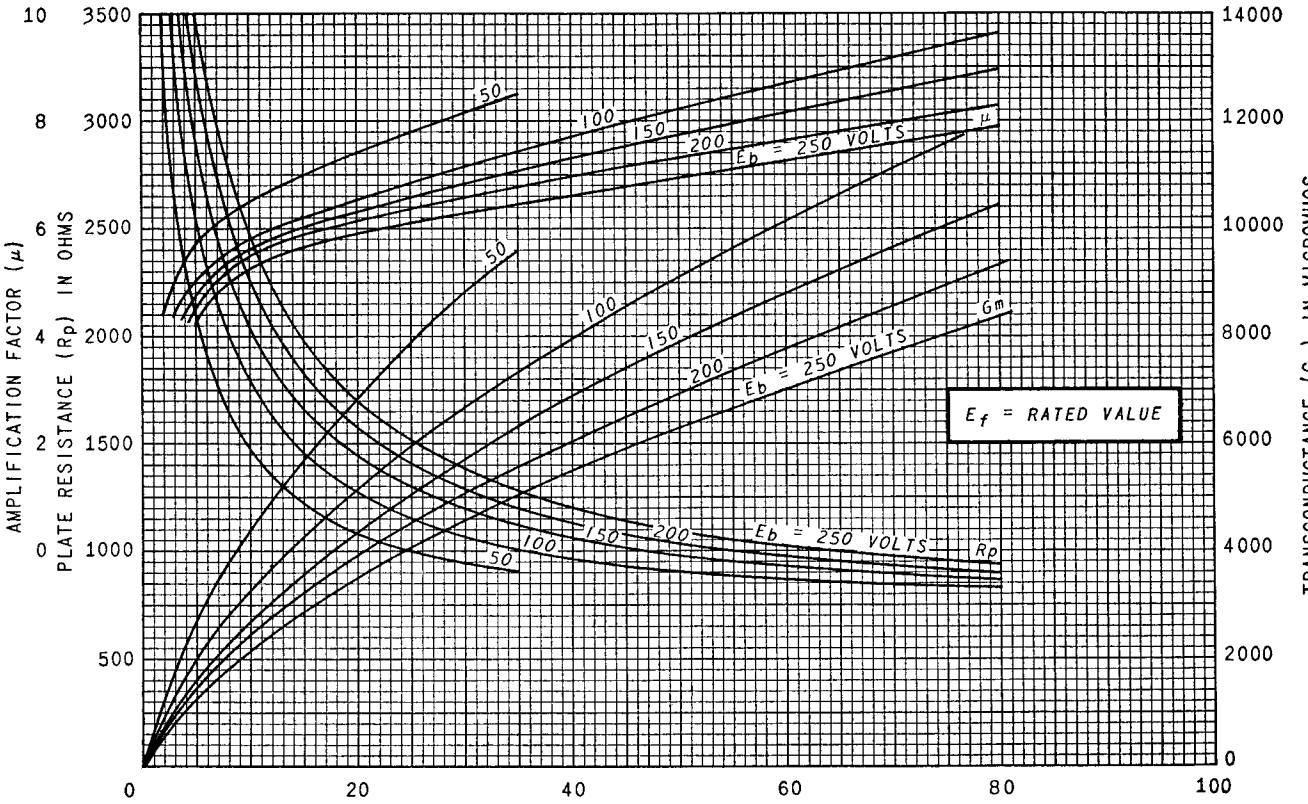
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD38-2

MAY 27, 1958

AVERAGE CHARACTERISTICS



K-5561I-TD38-3

MAY 27, 1958

Electronic TUBE

6CL6
Description and Rating
PENTODE

The 6CL6 is a miniature power pentode designed primarily for use as the video output amplifier in television receivers. The tube exhibits high transconductance, high power sensitivity, and low interelectrode capacitances. These characteristics make the 6CL6 suitable for driving large television picture tubes at low distortion levels. The tube is also useful as a wide-band amplifier in industrial and laboratory equipment.

GENERAL

Cathode - Coated Unipotential		
Heater Voltage, A-C or D-C	6.3	Volts
Heater Current	0.65	Ampere
Envelope - T-6½, Glass		
Base - E9-1, Small Button 9-Pin		
Mounting Position - Any		
Direct Interelectrode Capacitances*		
Grid-Number 1 to Plate, maximum	0.12	μμf
Input	11	μμf
Output	5.5	μμf

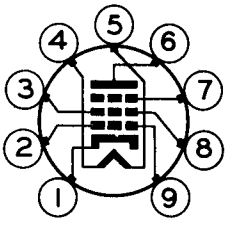
MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate-Supply Voltage	300	Volts
Plate Voltage	300	Volts
Suppressor Voltage	0	Volts
Screen-Supply Voltage	300	Volts
Screen Voltage - See Screen Rating Chart		
Positive D-C Grid-Number 1 Voltage	0	Volts
Negative D-C Grid-Number 1 Voltage	50	Volts
Plate Dissipation	7.5	Watts
Screen Dissipation	1.7	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohm
With Cathode Bias	0.5	Megohm
Bulb Temperature at Hottest Point	+200	Centigrade

** Without external shield.*

BASING DIAGRAM

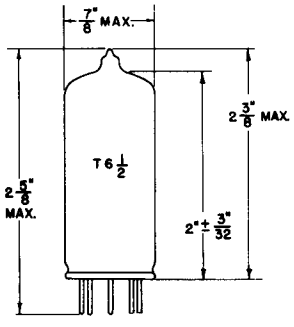


RTMA 9BV
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 - Cathode
Pin 2 - Grid Number 1
Pin 3 - Grid Number 2 (Screen)
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Plate
Pin 7 - Internal Shield and Grid Number 3 (Suppressor)
Pin 8 - Grid Number 2 (Screen)
Pin 9 - Grid Number 1

PHYSICAL DIMENSIONS



RTMA 6-3

GENERAL ELECTRIC

Supersedes ET-T811 dated 2-53

CHARACTERISTICS AND TYPICAL OPERATION

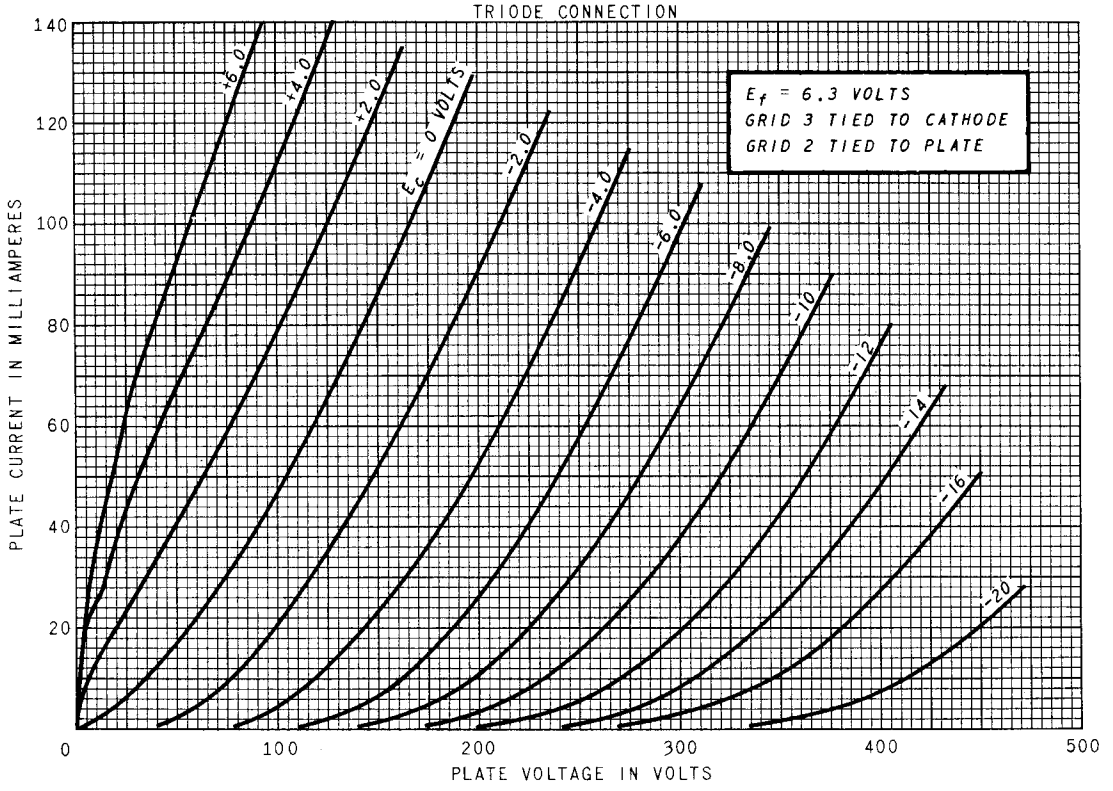
CLASS A_1 AMPLIFIER

Plate Voltage	250	Volts
Suppressor - Connected to Cathode at Socket		
Screen Voltage	150	Volts
Grid-Number 1 Voltage	-3.0	Volts
Peak AF Grid-Number 1 Voltage	3.0	Volts
Plate Resistance, approximate	150000	Ohms
Transconductance	11000	Micromhos
Zero-Signal Plate Current	30	Milliamperes
Maximum-Signal Plate Current	31	Milliamperes
Zero-Signal Screen Current	7.0	Milliamperes
Maximum-Signal Screen Current	7.2	Milliamperes
Load Resistance	7500	Ohms
Total Harmonic Distortion, approximate	8	Percent
Maximum-Signal Power Output	2.8	Watts
Grid-Number 1 Voltage, approximate, I_b = 10 Microamperes	-14	Volts

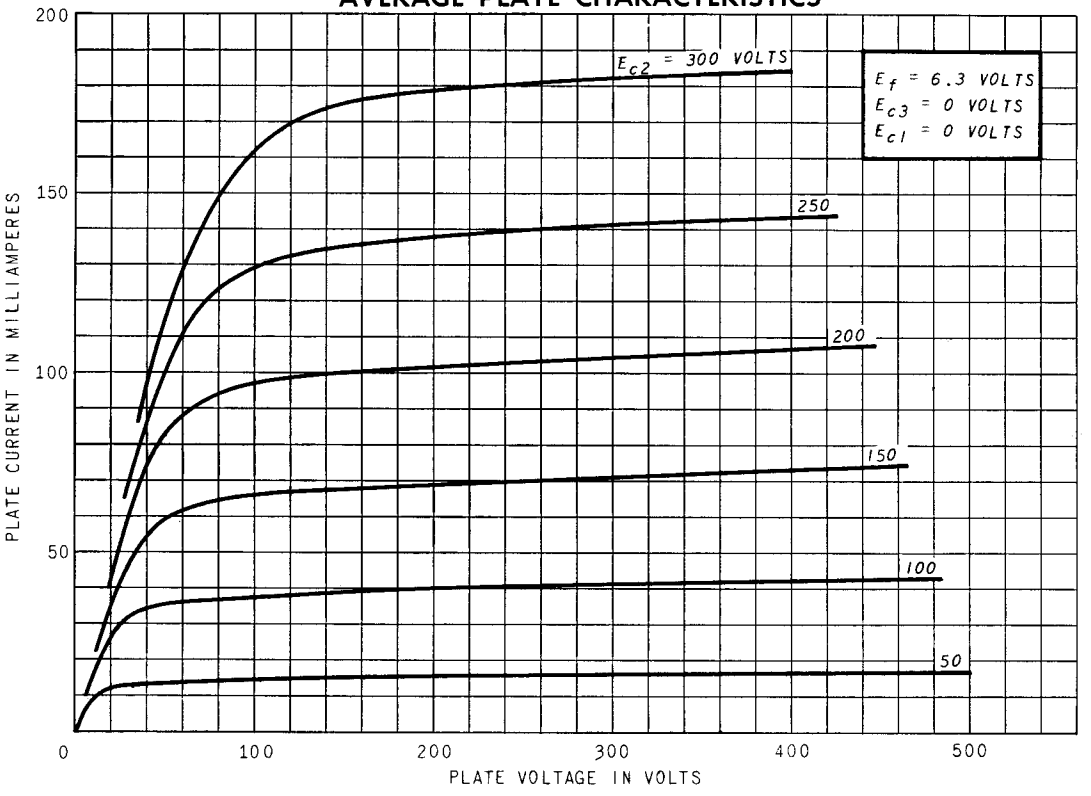
VIDEO AMPLIFIER, 4 MEGACYCLE BANDWIDTH

Plate-Supply Voltage	300	Volts
Suppressor - Connected to Cathode at Socket		
Screen-Supply Voltage	300	Volts
Screen Resistor	24000	Ohms
Grid-Number 1 Voltage	-2	Volts
Grid-Number 1 Resistance	0.1	Megohm
Grid-Number 1 Signal Voltage, Peak-to-Peak	3.0	Volts
Zero-Signal Plate Current	30	Milliamperes
Zero-Signal Screen Current	7.0	Milliamperes
Load Resistance	3900	Ohms
Voltage Output, Peak-to-Peak	132	Volts

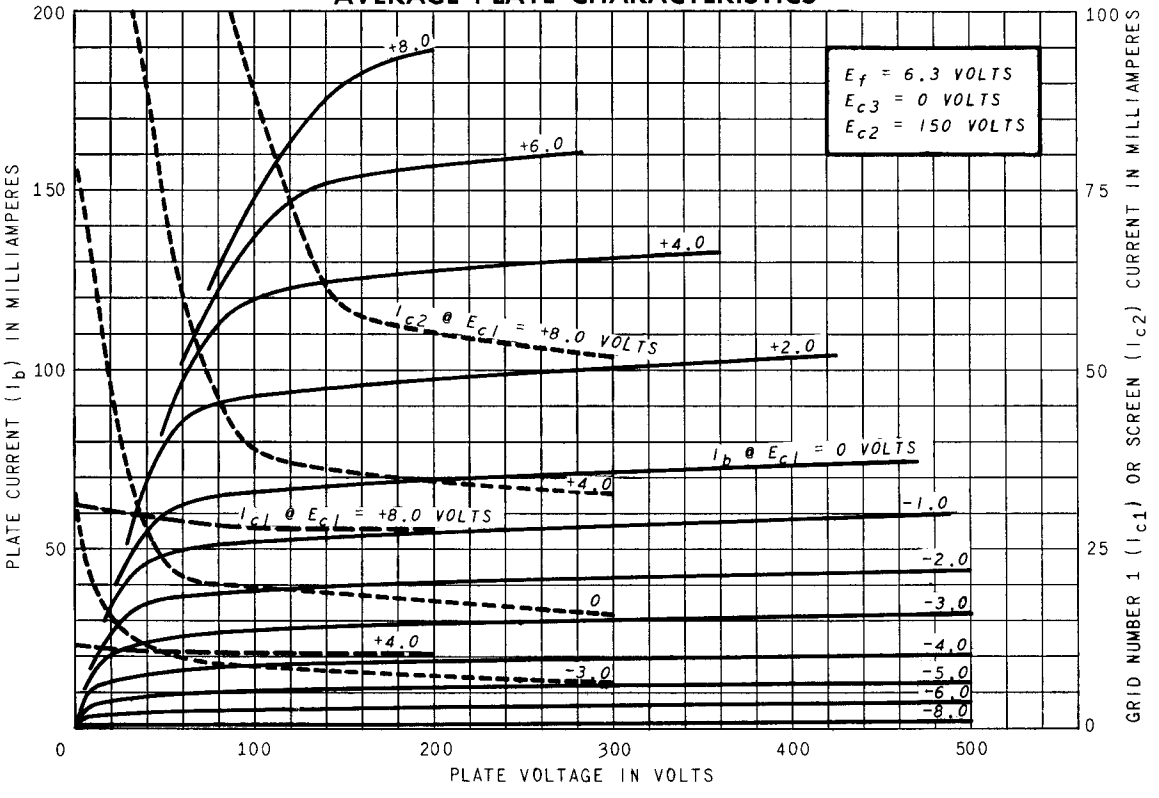
AVERAGE PLATE CHARACTERISTICS



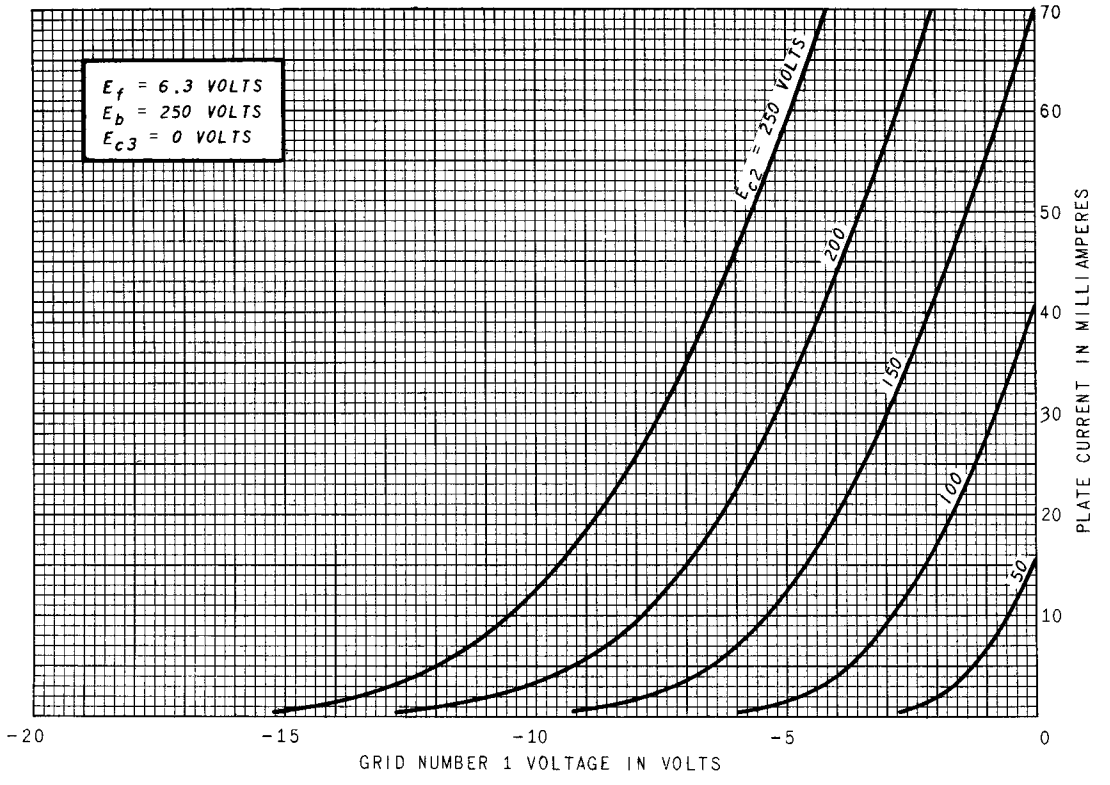
AVERAGE PLATE CHARACTERISTICS



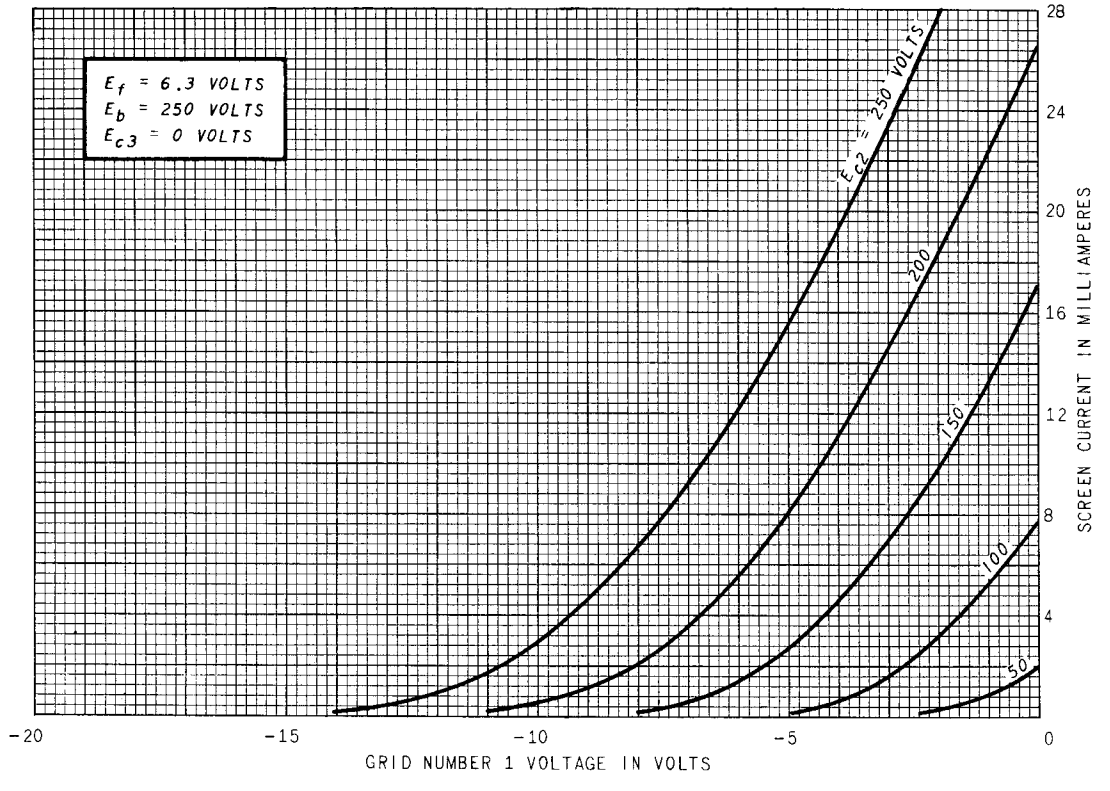
AVERAGE PLATE CHARACTERISTICS



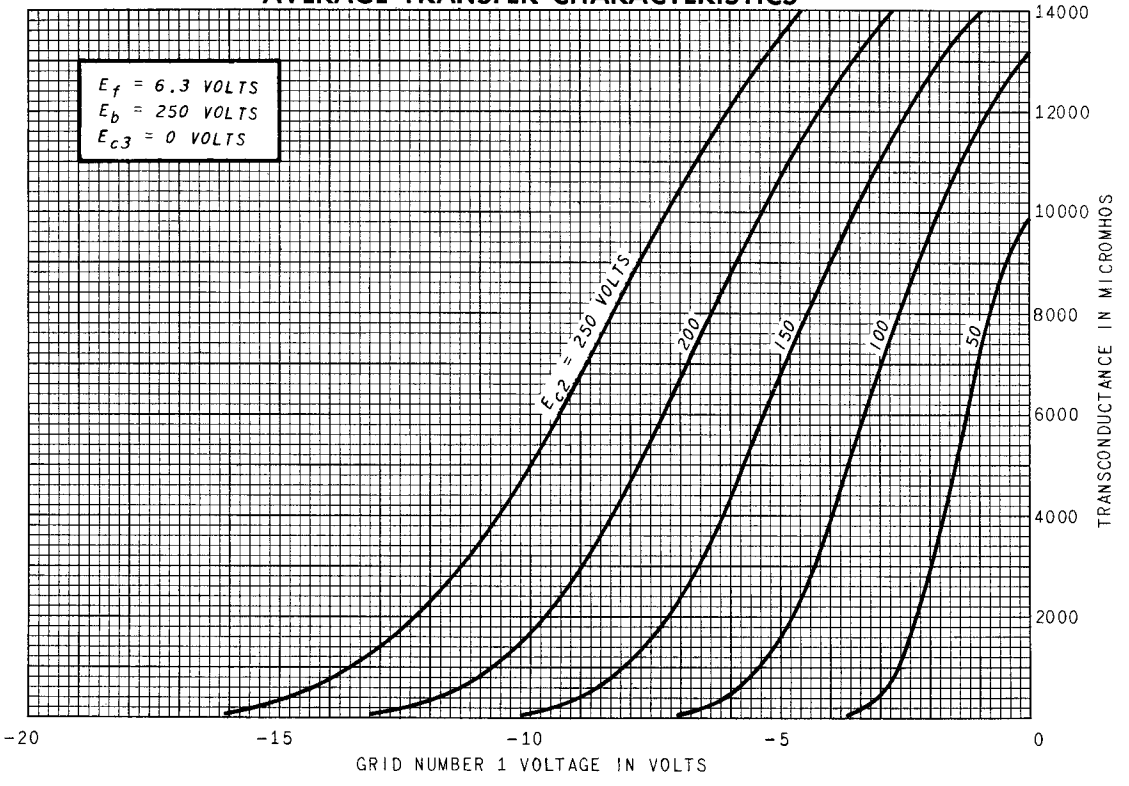
AVERAGE TRANSFER CHARACTERISTICS



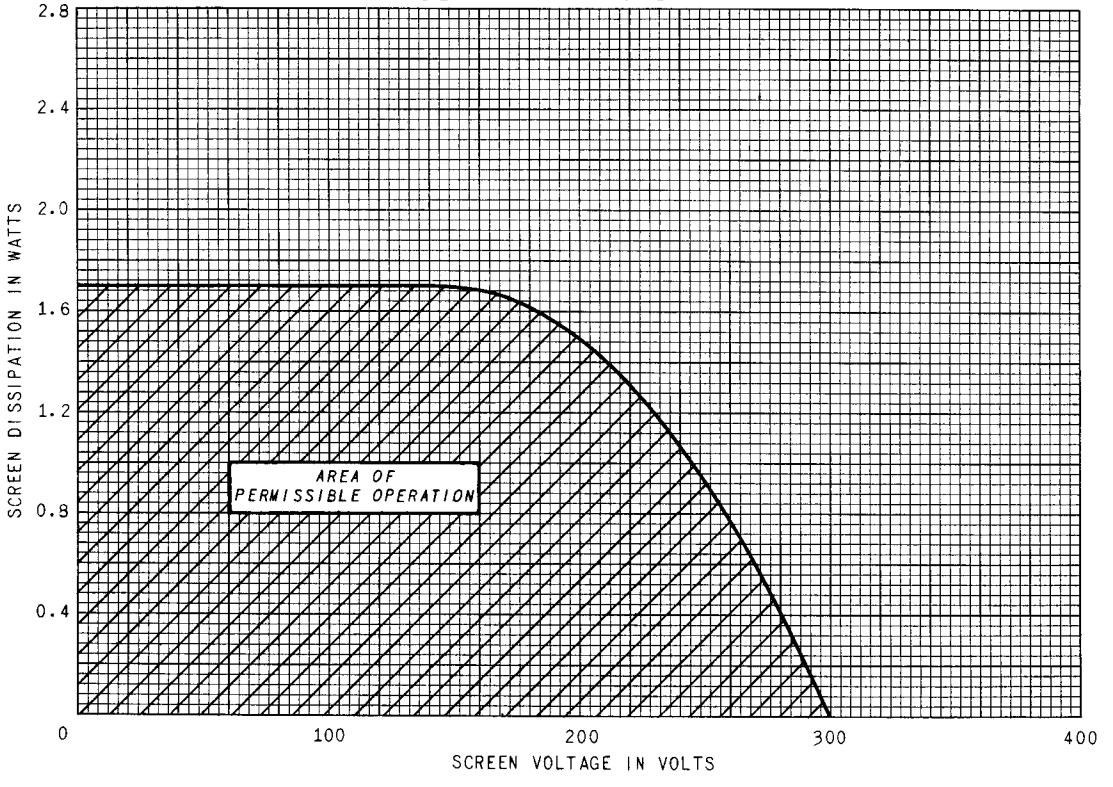
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



SCREEN RATING CHART



6CL8—5CL8—9CL8

TRIODE-TETRODE

DESCRIPTION AND RATING

The 6CL8 is a miniature tube which contains a sharp-cutoff tetrode and a medium-mu triode in one envelope. Intended primarily for service as a combined triode oscillator and tetrode mixer in VHF television tuners, the 6CL8 features a controlled heater-warm-up characteristic which makes it especially suited for use in television receivers that employ series-connected heaters.

Except for heater ratings, the 5CL8 and 9CL8 are identical to the 6CL8.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	5CL8	6CL8	9CL8	
Heater Voltage, AC or DC	4.7	6.3	9.5	Volts
Heater Current	0.6	0.45	0.3	Amperes
Heater Warm-up Time*	11	11	11	Seconds

Direct Interelectrode Capacitances	With Shield†	Without Shield	
Tetrode Section			
Grid-Number 1 to Plate, maximum	0.016	0.028	μμf
Input	5.0	5.0	μμf
Output	3.0	2.0	μμf
Triode Section			
Grid to Plate	1.8	1.8	μμf
Input	2.7	2.7	μμf
Output	1.2	0.4	μμf
Heater to Cathode, Each Section, approximate	2.5‡	2.5	μμf

MECHANICAL

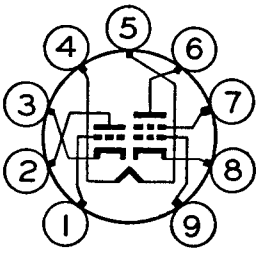
Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES	Tetrode Section	Triode Section	
Plate Voltage	300	300	Volts
Screen-Supply Voltage	300	....	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	2.8	2.7	Watts
Screen Dissipation	0.5	....	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

GENERAL ELECTRIC

BASING DIAGRAM

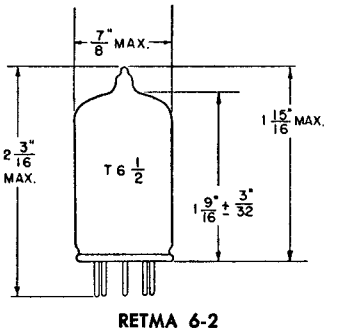


RETMA 9FX

TERMINAL CONNECTIONS

Pin 1—Triode Grid
Pin 2—Triode Plate
Pin 3—Triode Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Tetrode Plate
Pin 7—Tetrode Grid Number 2 (Screen)
Pin 8—Tetrode Cathode
Pin 9—Tetrode Grid Number 1

PHYSICAL DIMENSIONS



RETMA 6-2

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

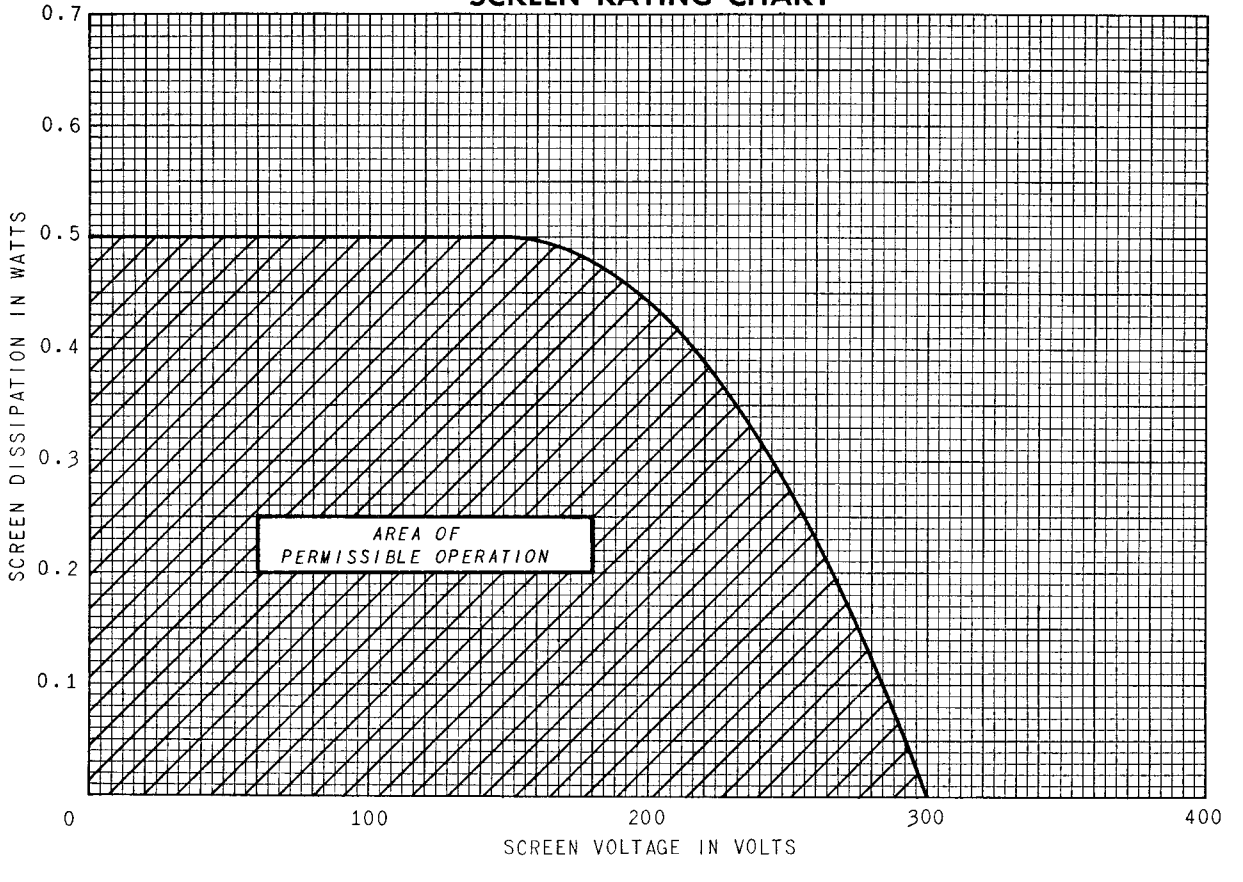
	Tetrode Section	Triode Section	
Plate Voltage	125	125	Volts
Screen Voltage	125	.....	Volts
Grid-Number 1 Voltage	−1.0	.....	Volts
Cathode-Bias Resistor	.....	56	Ohms
Amplification Factor	.....	40	
Plate Resistance, approximate	100000	5000	Ohms
Transconductance	5800	8000	Micromhos
Plate Current	12	15	Milliamperes
Screen Current	4.0	.....	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	−10	−9	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

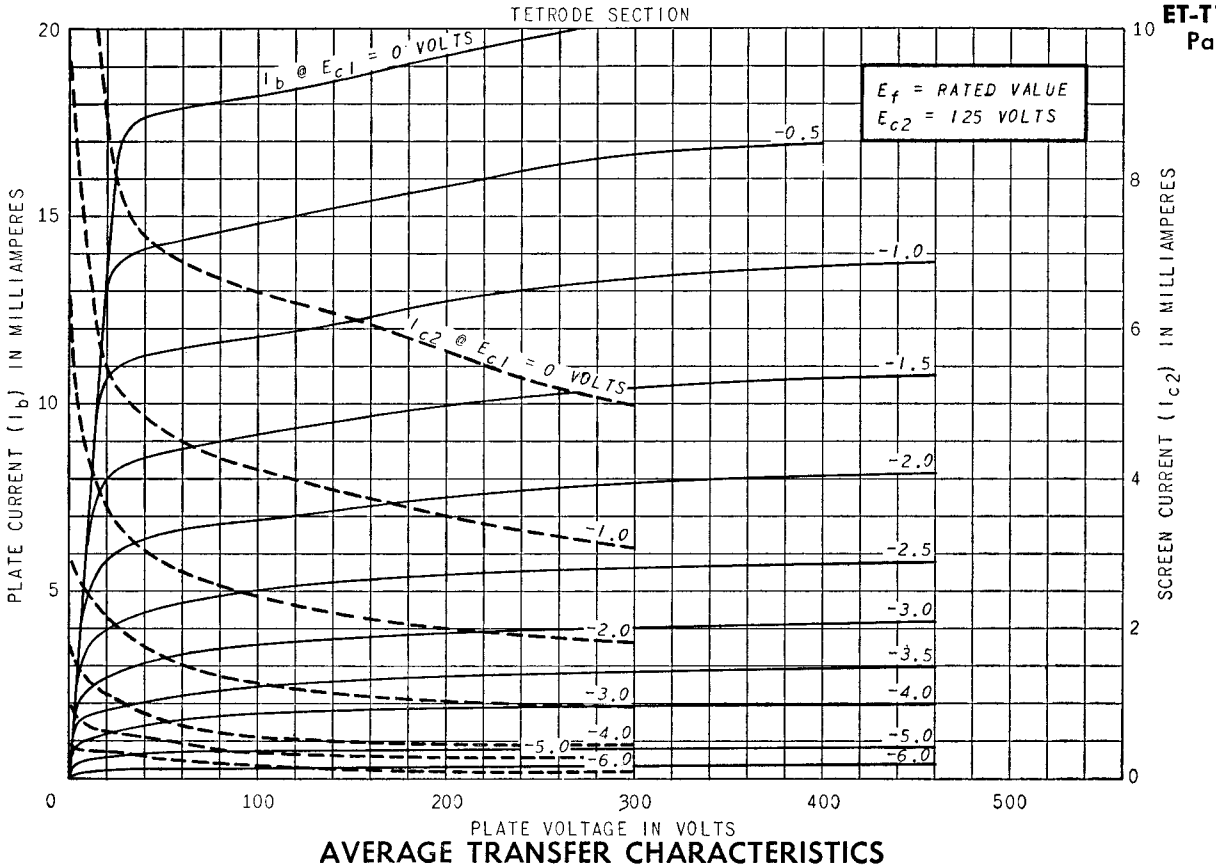
† With external shield (RETMA 315) connected to cathode of section under test unless otherwise indicated.

‡ With external shield (RETMA 315) connected to ground.

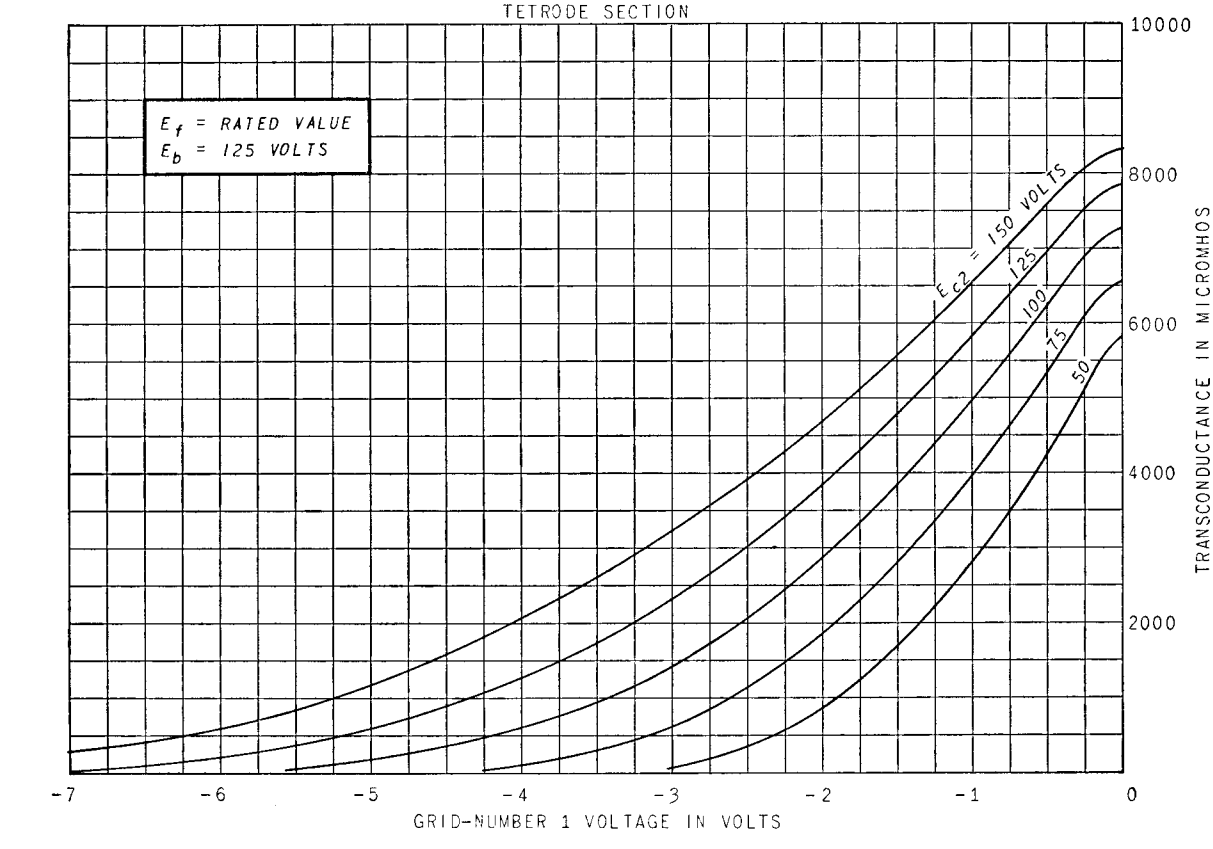
SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

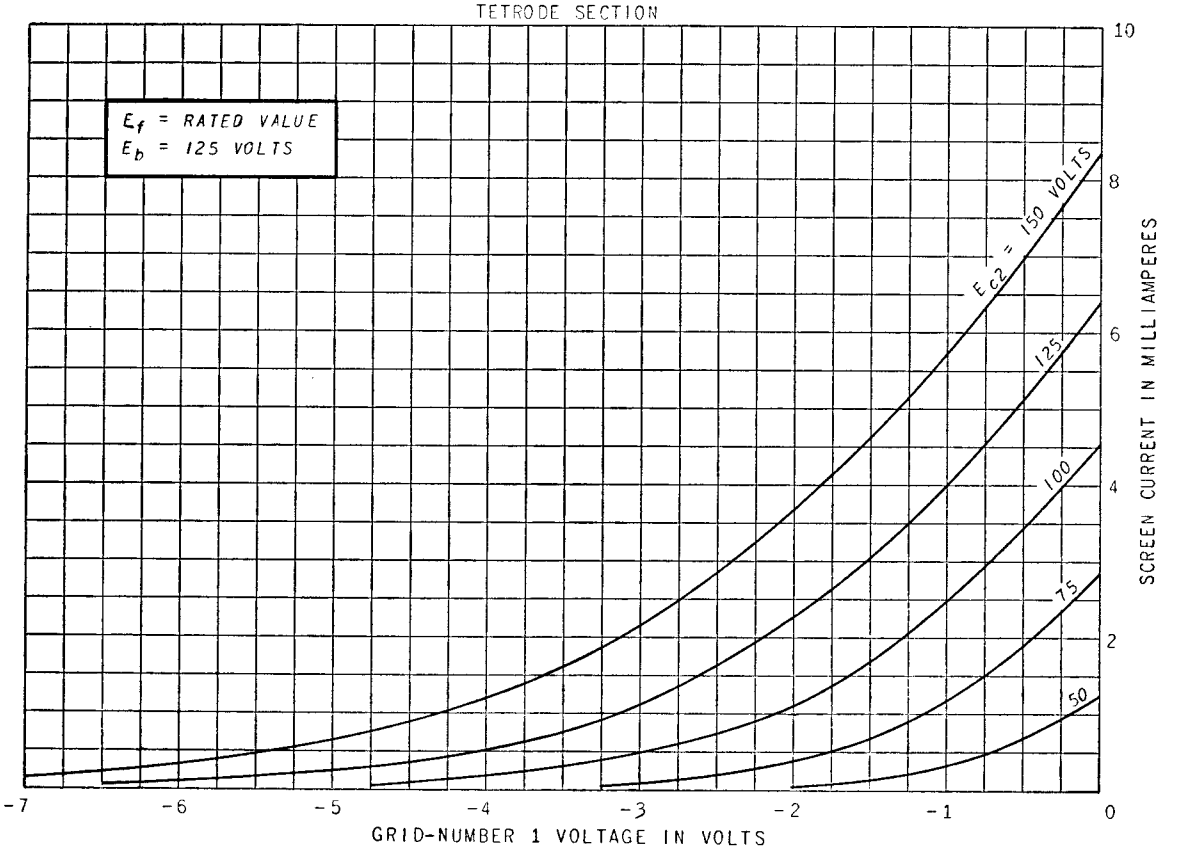


AVERAGE TRANSFER CHARACTERISTICS



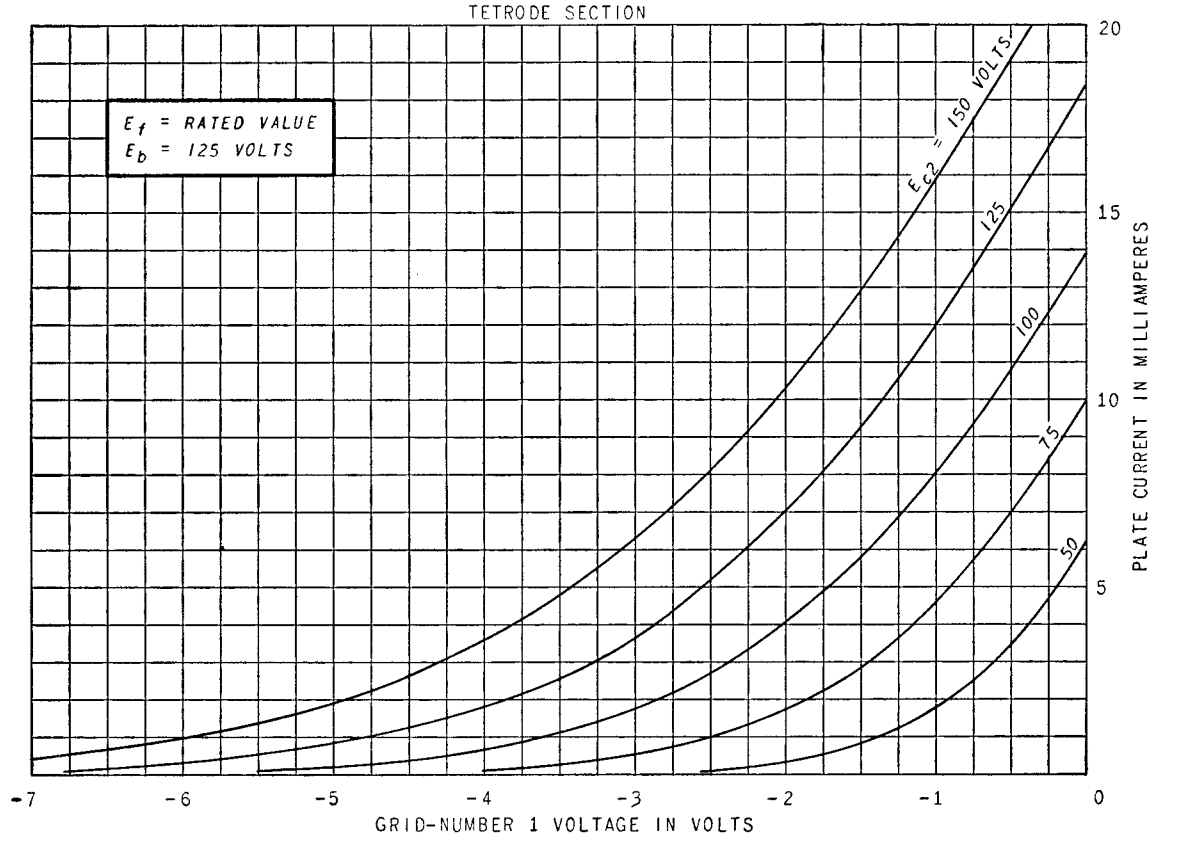
AVERAGE TRANSFER CHARACTERISTICS

TETRODE SECTION



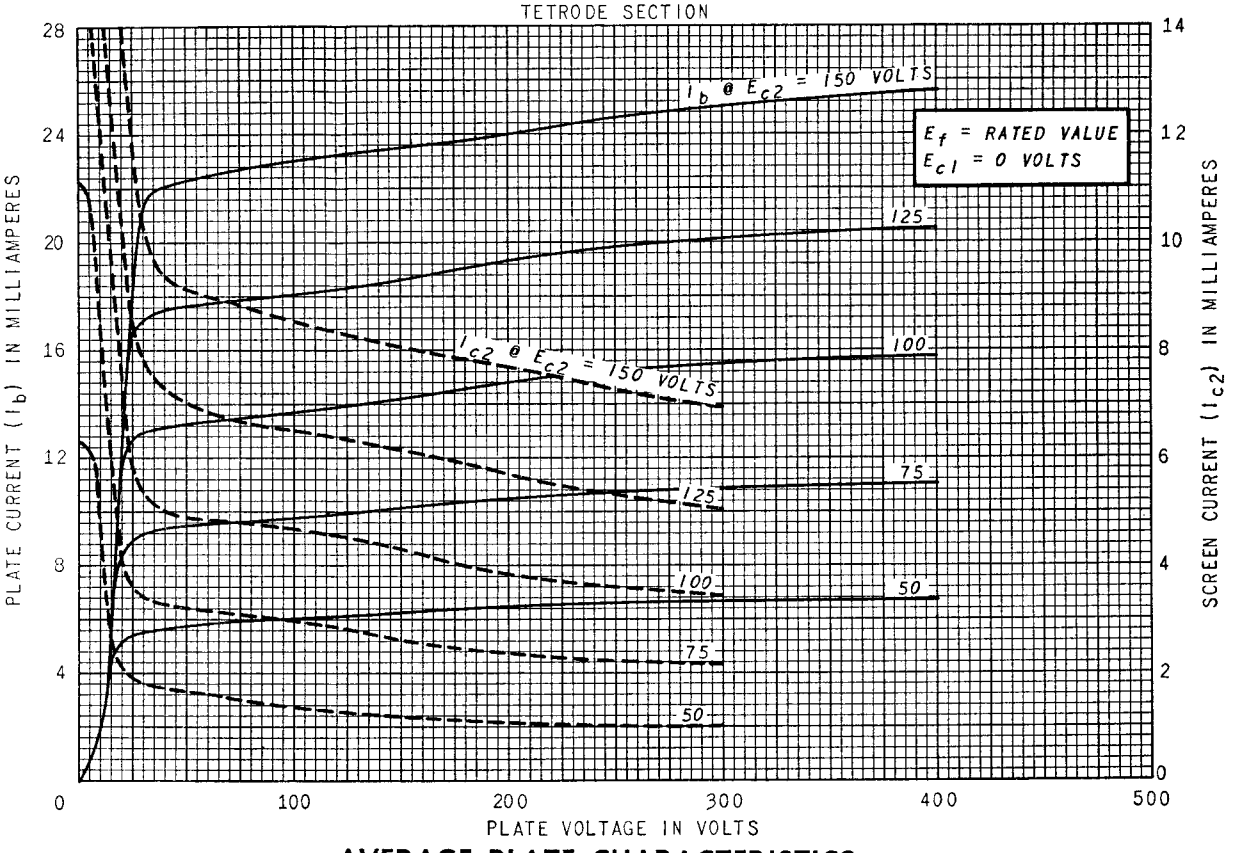
AVERAGE TRANSFER CHARACTERISTICS

TETRODE SECTION



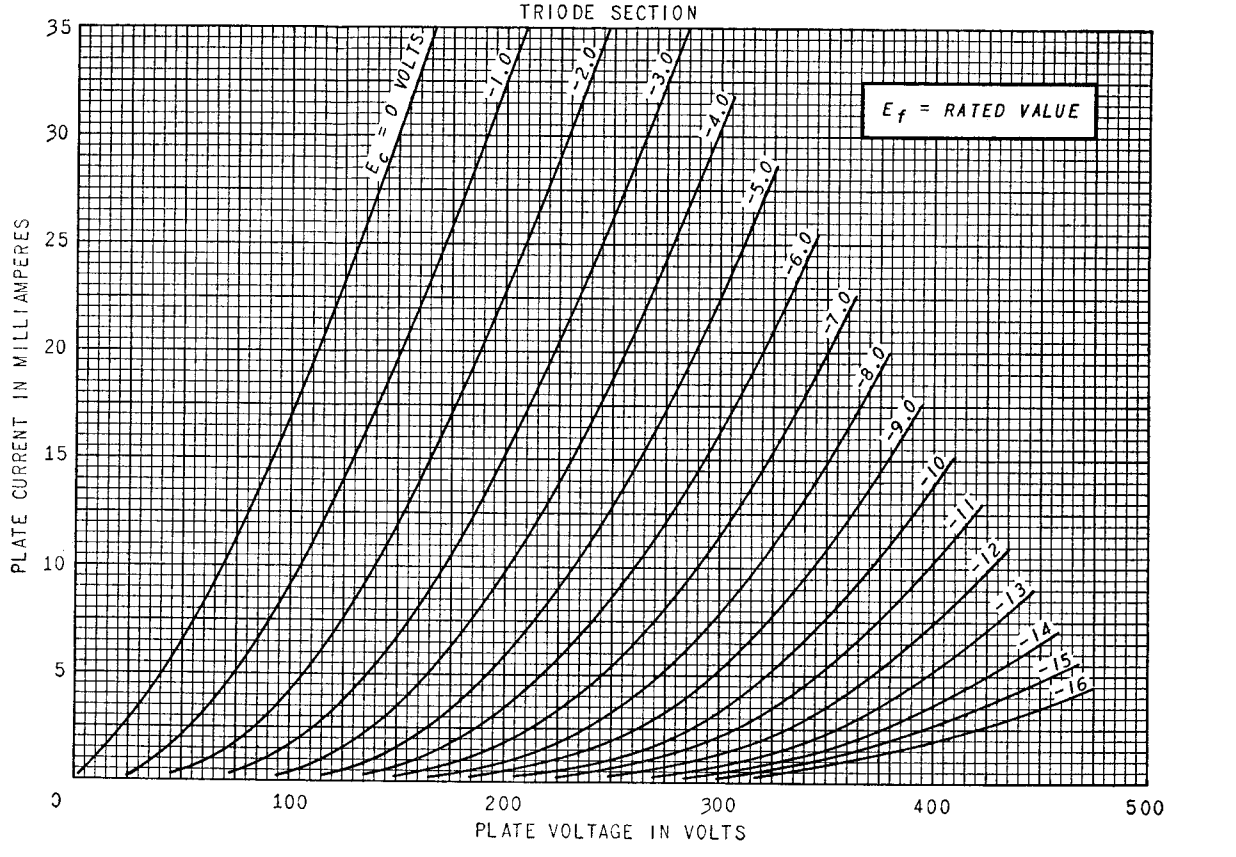
AVERAGE PLATE CHARACTERISTICS

TETRODE SECTION

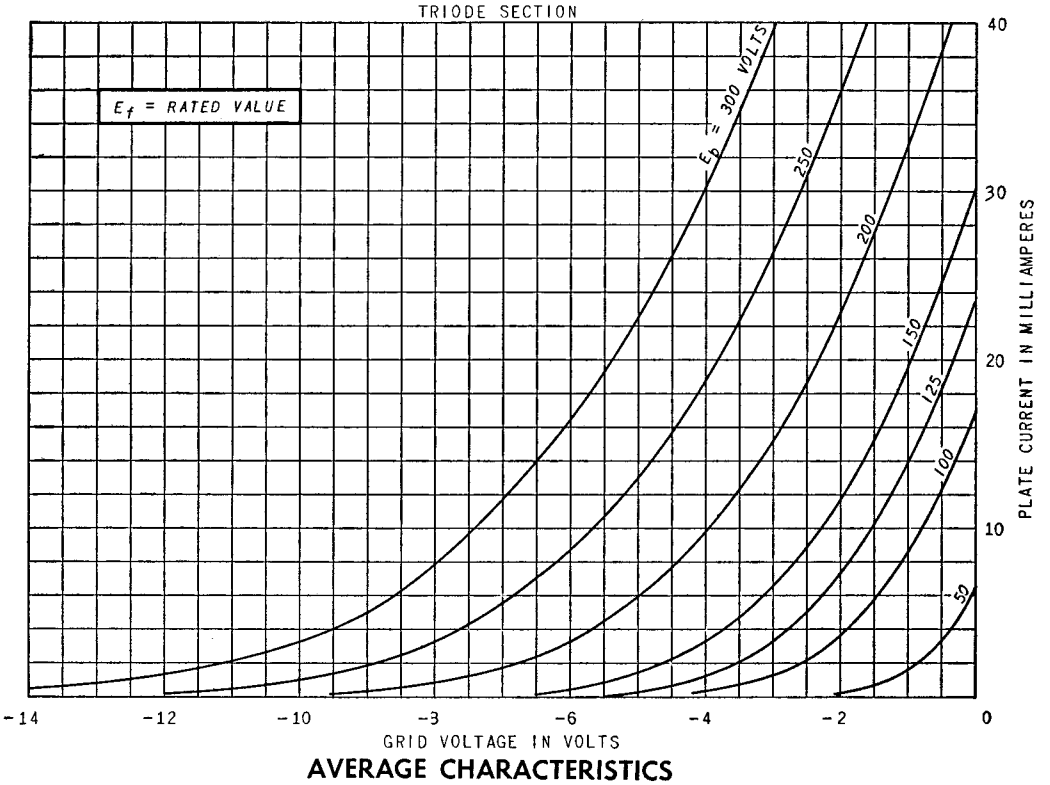


AVERAGE PLATE CHARACTERISTICS

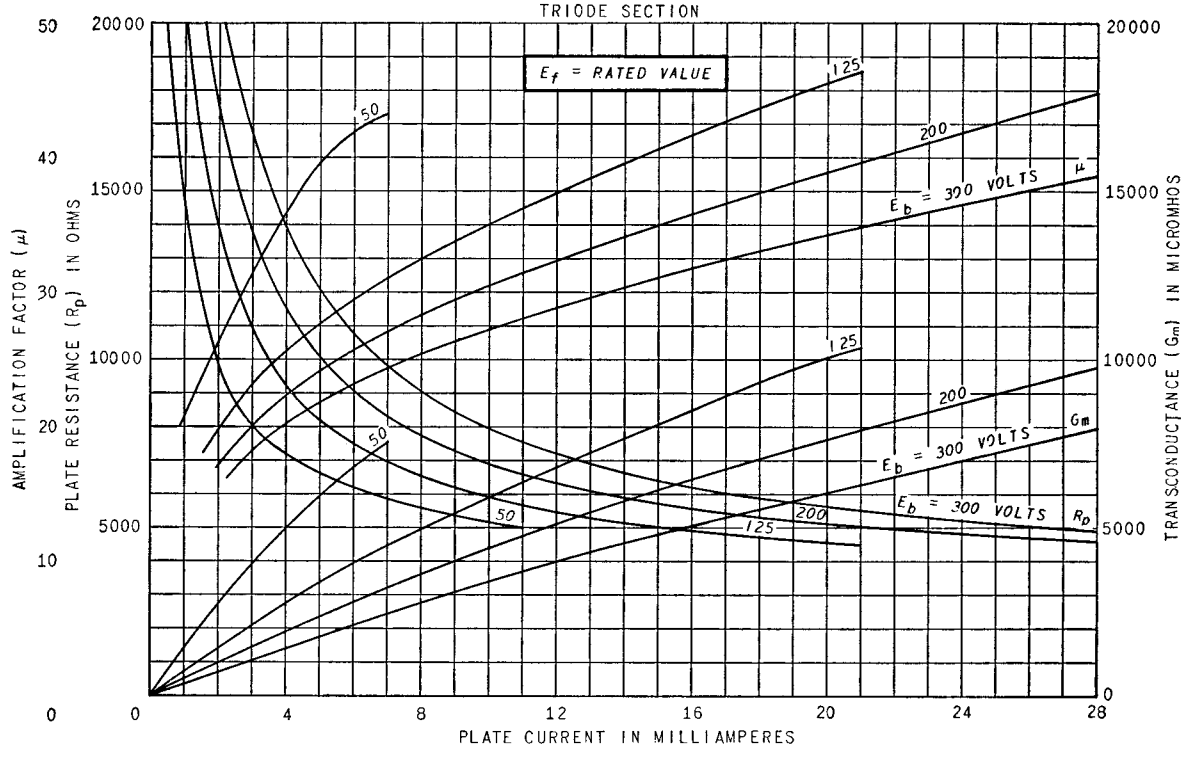
TRIODE SECTION



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6CL8-A—5CL8-A

TRIODE-TETRODE

DESCRIPTION AND RATING

The 6CL8-A is a miniature tube which contains a sharp-cutoff tetrode and a medium-mu triode in one envelope. Primarily intended for service as a combined triode-oscillator and tetrode-mixer in VHF television tuners, the tube features a controlled heater-warm-up characteristic which makes it especially suited for use in television receivers with series-connected heaters.

The 6CL8-A is unilaterally interchangeable, both electrically and mechanically, with the 6CL8. It differs primarily from the 6CL8 in having a tetrode section with lower grid-plate capacitance and higher transconductance.

Except for heater ratings, 5CL8-A is identical with the 6CL8-A.

GENERAL

ELECTRICAL	5CL8-A	6CL8-A	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	4.7	6.3	Volts
Heater Current	0.6	0.45	Amperes
Heater Warm-up Time*	11	11	Seconds
Direct Interelectrode Capacitances	With Shield†	Without Shield	
Tetrode Section			
Grid-Number 1 to Plate, maximum	0.01	0.02	μμf
Input	5.0	5.0	μμf
Output	3.0	2.0	μμf
Triode Section			
Grid to Plate	1.8	1.8	μμf
Input	2.8	2.8	μμf
Output	2.0	1.5	μμf
Tetrode Grid-Number 1 to Triode Plate, maximum	0.01	0.015	μμf
Tetrode Plate to Triode Plate, maximum	0.03	0.15	μμf
Heater to Cathode, Each Section	3.0‡	3.0	μμf

MECHANICAL

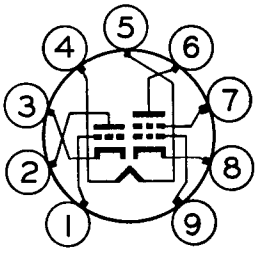
Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

Supersedes ET-T1473, dated 10-57

BASING DIAGRAM

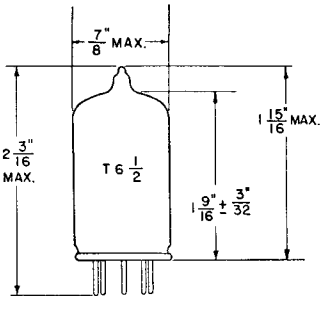


EIA 9FX

TERMINAL CONNECTIONS

Pin 1—Triode Grid
Pin 2—Triode Plate
Pin 3—Triode Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Tetrode Plate
Pin 7—Tetrode Grid Number 2 (Screen)
Pin 8—Tetrode Cathode
Pin 9—Tetrode Grid Number 1

PHYSICAL DIMENSIONS



EIA 6-2

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	5CL8-A	6CL8-A	
Allowable Heater Current	0.56 to 0.64	0.42 to 0.48	Amperes
	Tetrode Section	**Triode Section**	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	....	Volts
Screen Voltage—See Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.0	2.5	Watts
Screen Dissipation	0.55	....	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

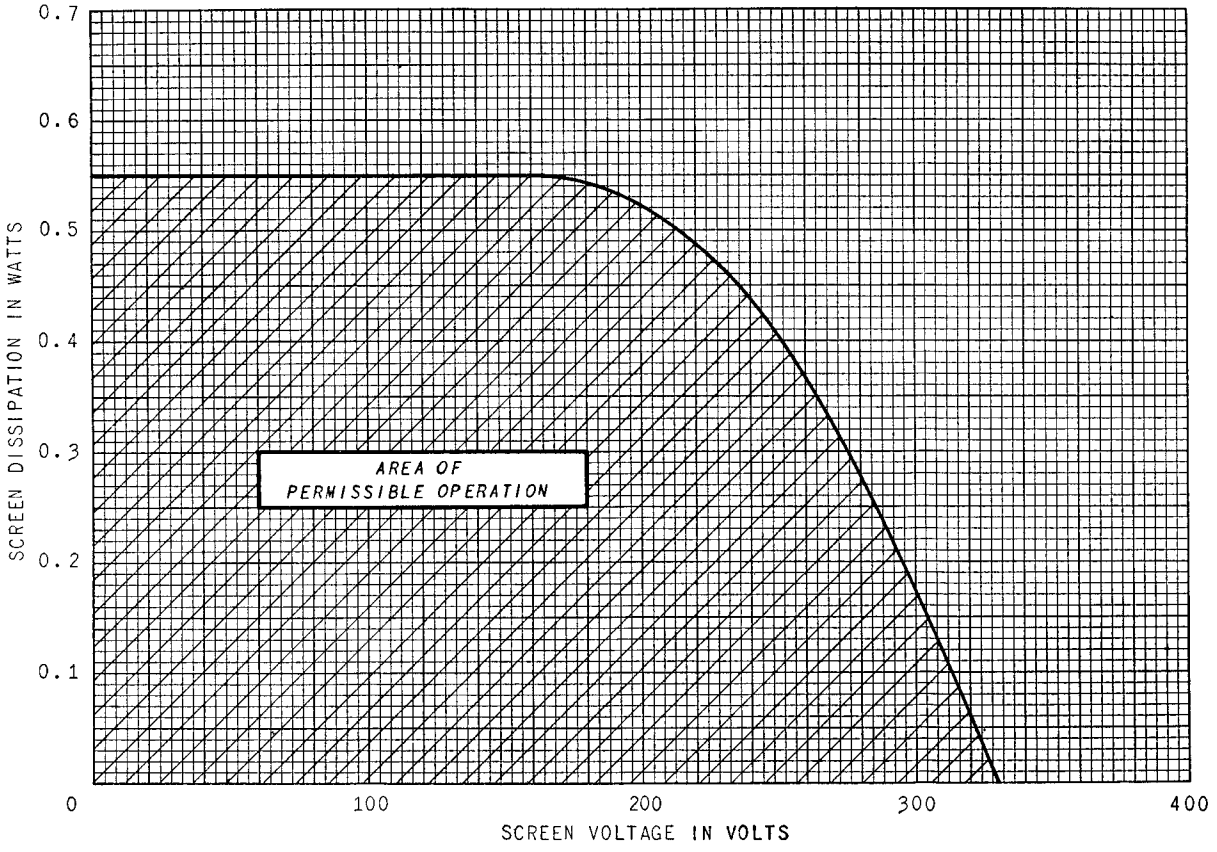
AVERAGE CHARACTERISTICS		Tetrode Section	Triode Section	
Plate Voltage	100	125	125	Volts
Screen Voltage	70	125	....	Volts
Grid-Number 1 Voltage	0	−1.0	−1.0	Volts
Amplification Factor	....	....	40	
Plate Resistance, approximate	....	200000	5000	Ohms
Transconductance	7000	6500	8000	Micromhos
Plate Current	....	12	14	Milliamperes
Screen Current	....	4.0	....	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 20 Microamperes	....	−9	−9	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (EIA 315) connected to cathode of section under test unless otherwise indicated.

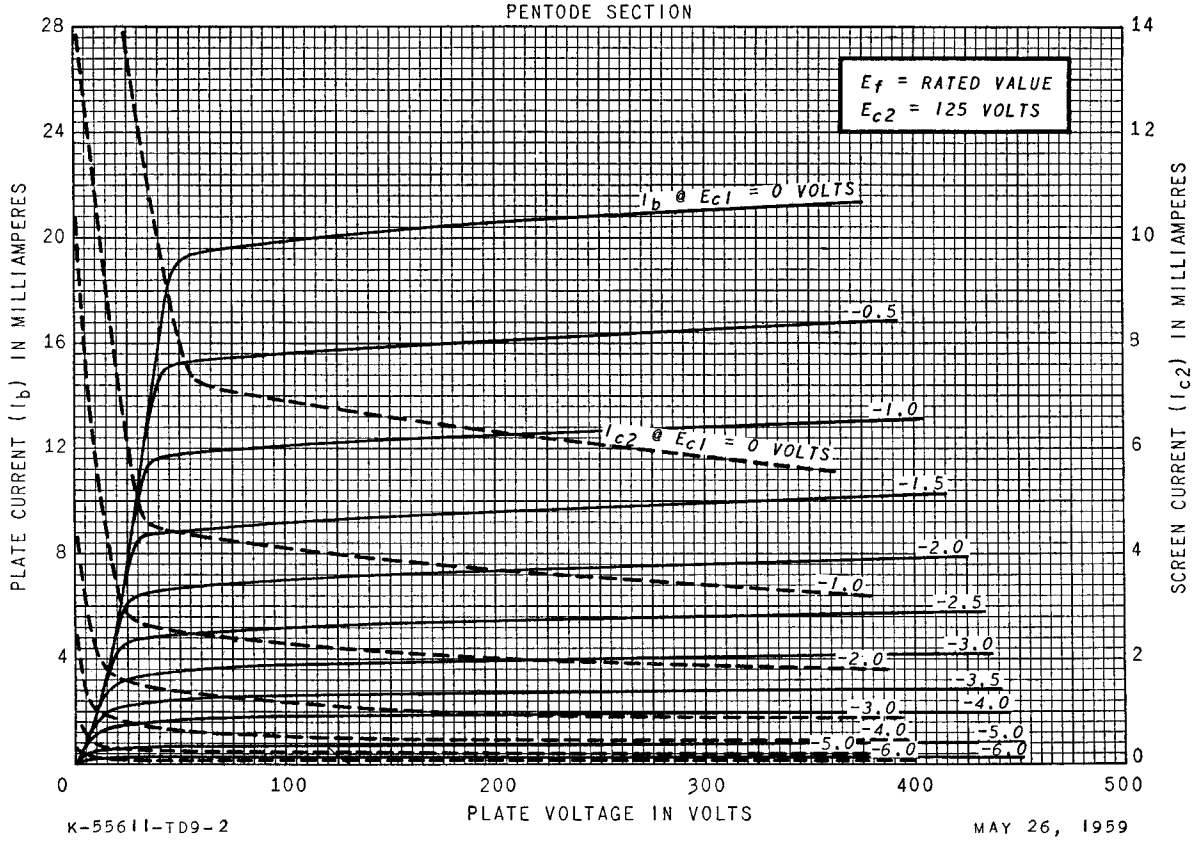
‡ With external shield (EIA 315) connected to ground.

SCREEN RATING CHART

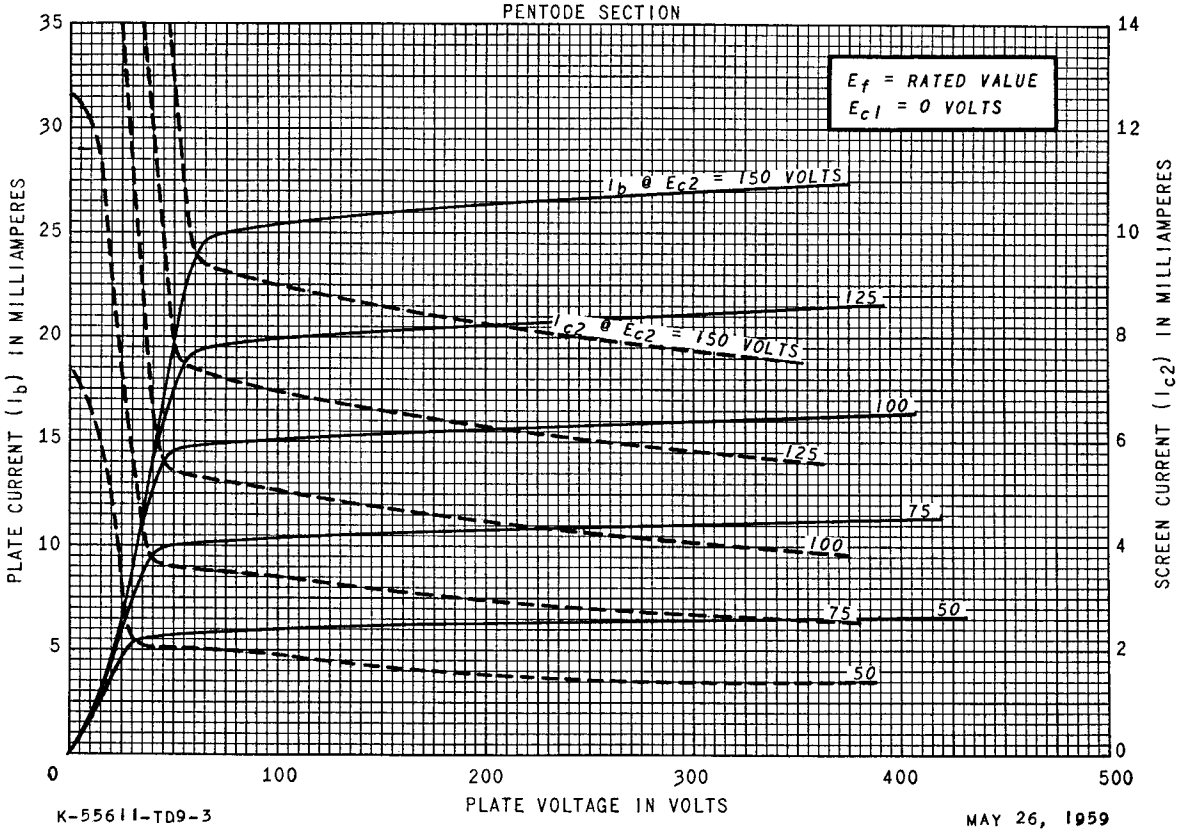


AVERAGE PLATE CHARACTERISTICS

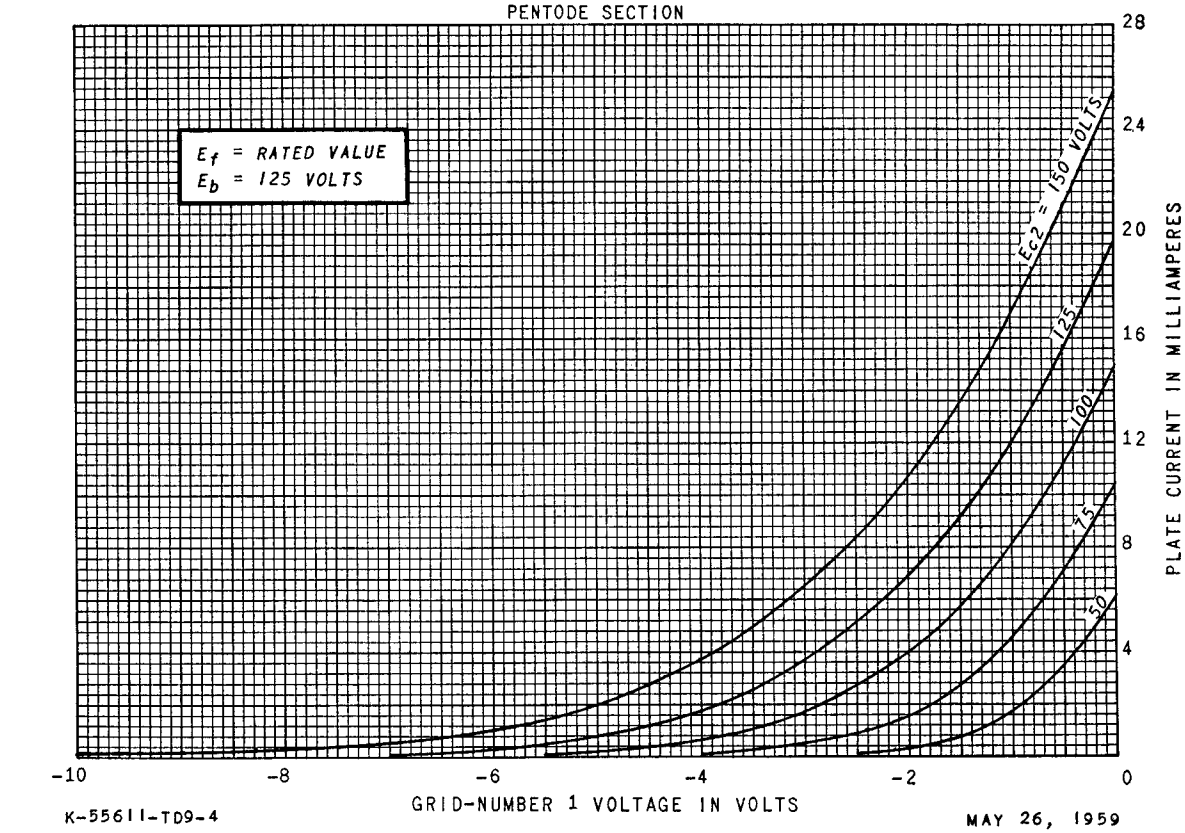
PENTODE SECTION



AVERAGE PLATE CHARACTERISTICS

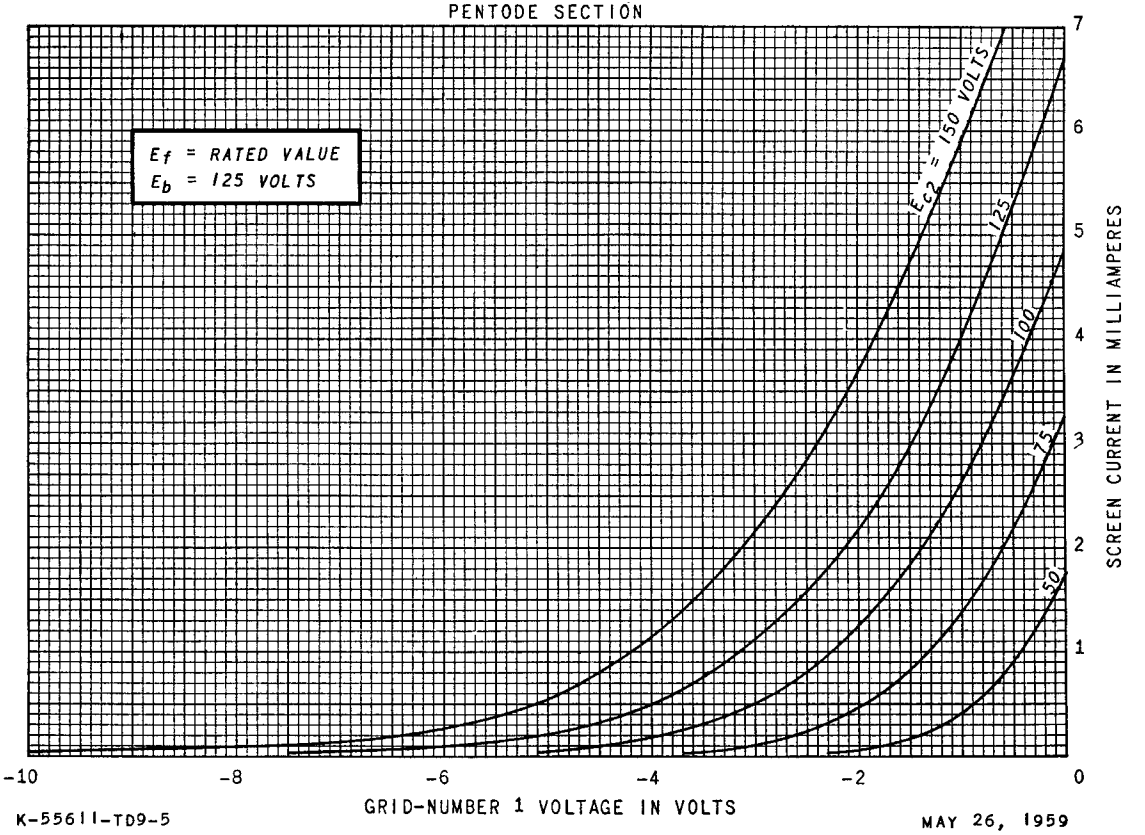


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

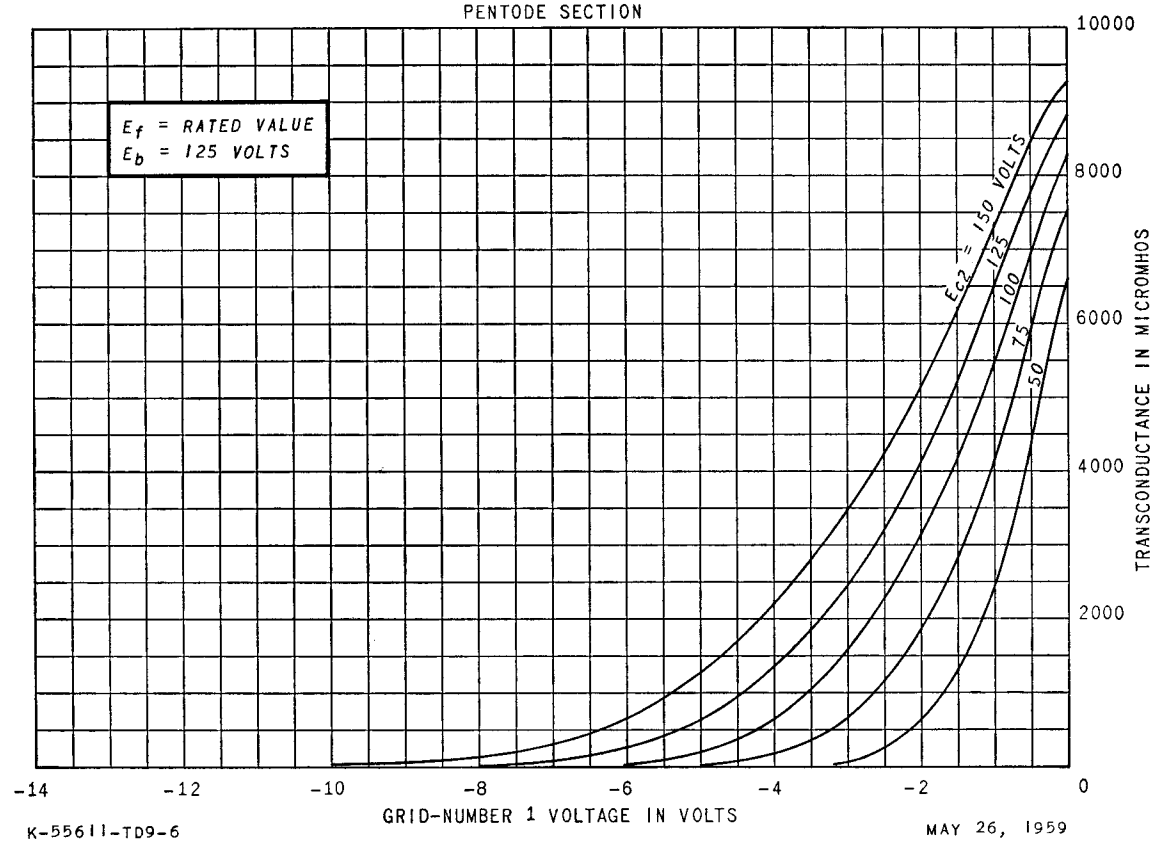


K-55611-TD9-5

MAY 26, 1959

AVERAGE TRANSFER CHARACTERISTICS

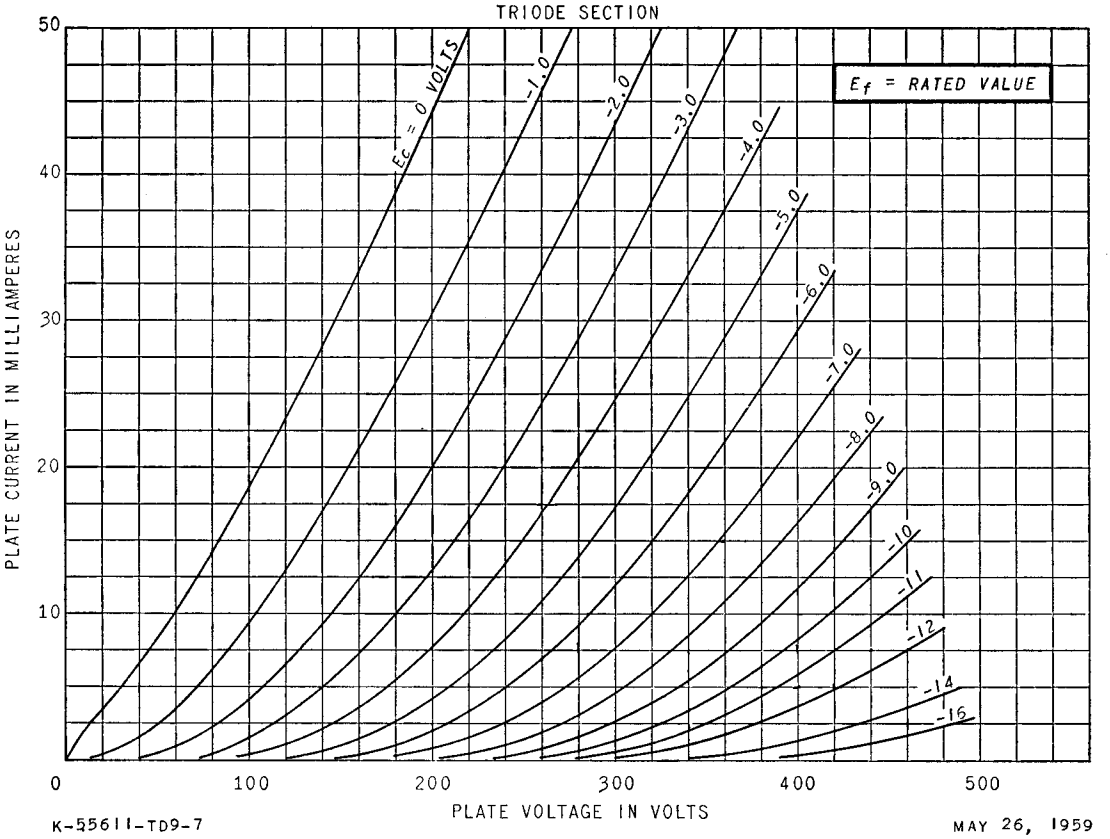
PENTODE SECTION



K-55611-TD9-6

MAY 26, 1959

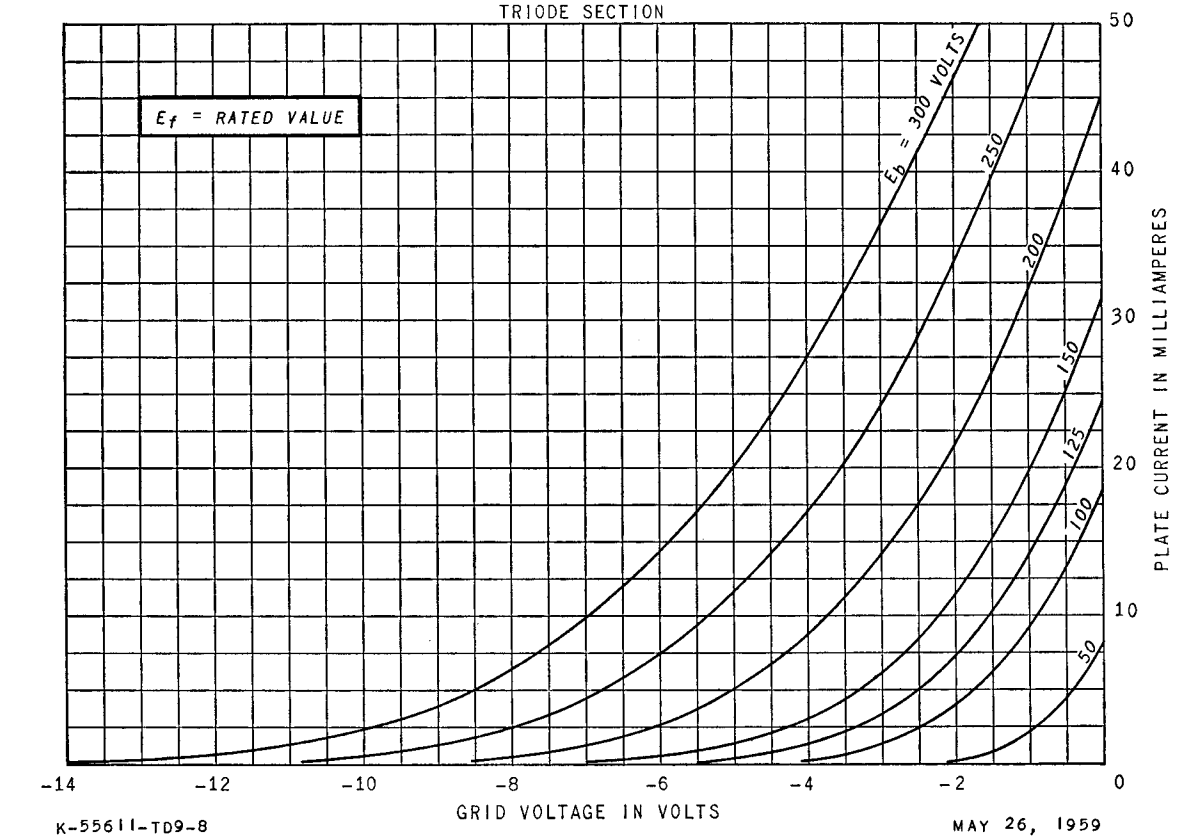
AVERAGE PLATE CHARACTERISTICS



K-55611-TD9-7

MAY 26, 1959

AVERAGE TRANSFER CHARACTERISTICS

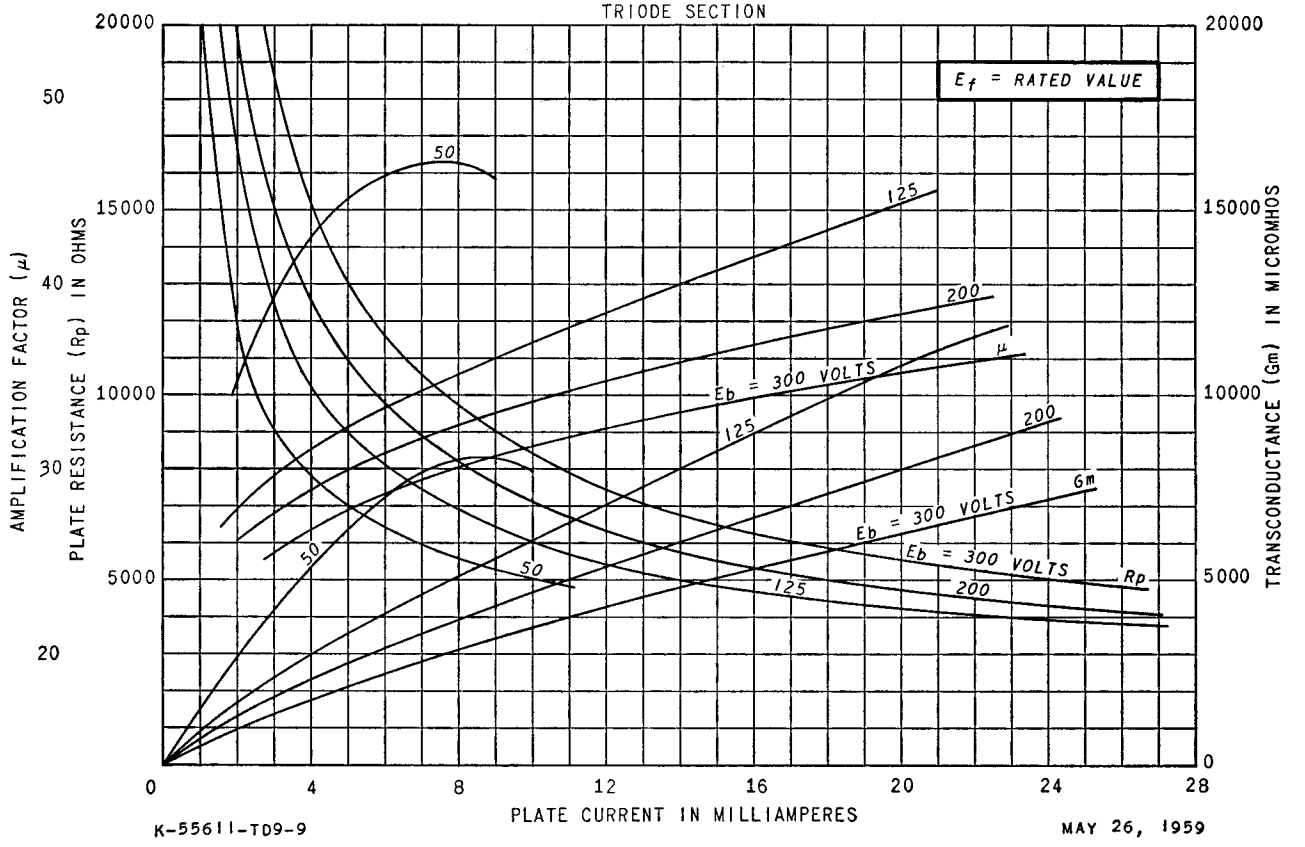


K-55611-TD9-8

MAY 26, 1959

AVERAGE CHARACTERISTICS

TRIODE SECTION



K-55611-TD9-9

MAY 26, 1959

Electronic TUBES

6CM7

DISSIMILAR DOUBLE TRIODE

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6CM7 is a miniature tube which contains two dissimilar medium-mu triodes in one envelope. It is intended for use as a combined vertical-deflection oscillator and amplifier in television receivers. In this application, section one may be used as a conventional blocking oscillator, while section two is particularly adapted for vertical amplifier service as a result of its high-perveance characteristics and its 5-watt plate dissipation rating.

In addition the 6CM7 features a controlled heater warm-up characteristic which makes it especially suited for use in television receivers which employ 600-milliampere series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC		6.3	Volts
Heater Current		0.6	Amperes
Heater Warm-up Time*		11	Seconds
Direct Interelectrode Capacitances, approximate†	Section 1	Section 2	
Grid to Plate	3.8	3.0	μμf
Input	2.0	3.5	μμf
Output	0.5	0.4	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

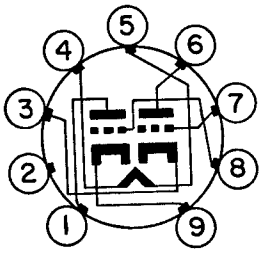
MAXIMUM RATINGS

DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

	Vertical-Oscillator Service‡ (Section 1)	Vertical-Deflection Amplifier‡ (Section 2)	
DC Plate Voltage	500	500	Volts
Peak Positive Pulse Plate Voltage	—	2200§	Volts
Peak Negative Grid Voltage	200	200	Volts
Plate Dissipation	1.25	5.5π	Watts
DC Cathode Current	15	20	Milliamperes
Peak Cathode Current	70	70	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance			
With Fixed Bias	2.2	1.0	Megohms
With Cathode Bias	2.2	2.5	Megohms
With Grid-Resistor Bias	2.2	—	Megohms

GENERAL ELECTRIC

BASING DIAGRAM

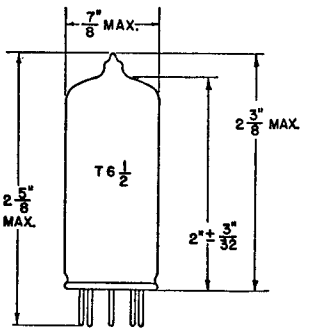


RETMA 9ES

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—No Connection
Pin 3—Cathode (Section 1)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Grid (Section 2)
Pin 9—Cathode (Section 2)

PHYSICAL DIMENSIONS



RETMA 6-3

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER	Section 1 (Oscillator)	Section 2 (Amplifier)	
Plate Voltage	200	250	Volts
Grid Voltage	−7	−8	Volts
Amplification Factor	21	18	
Plate Resistance, approximate	10500	4100	Ohms
Transconductance	2000	4400	Micromhos
Plate Current	5.0	20	Milliamperes
Plate Current, approximate Ec = −10 Volts	1	—	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	−14	—	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

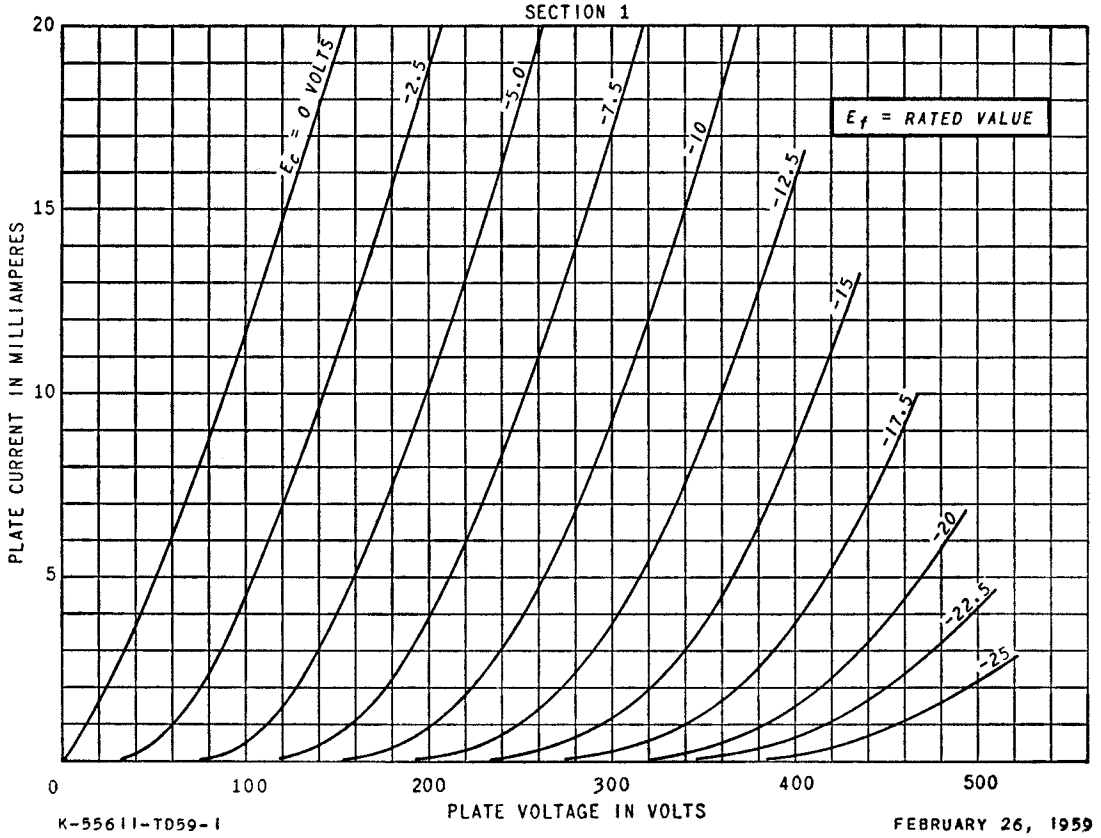
π In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

PRINTED IN U.S.A.

AVERAGE PLATE CHARACTERISTICS

SECTION 1

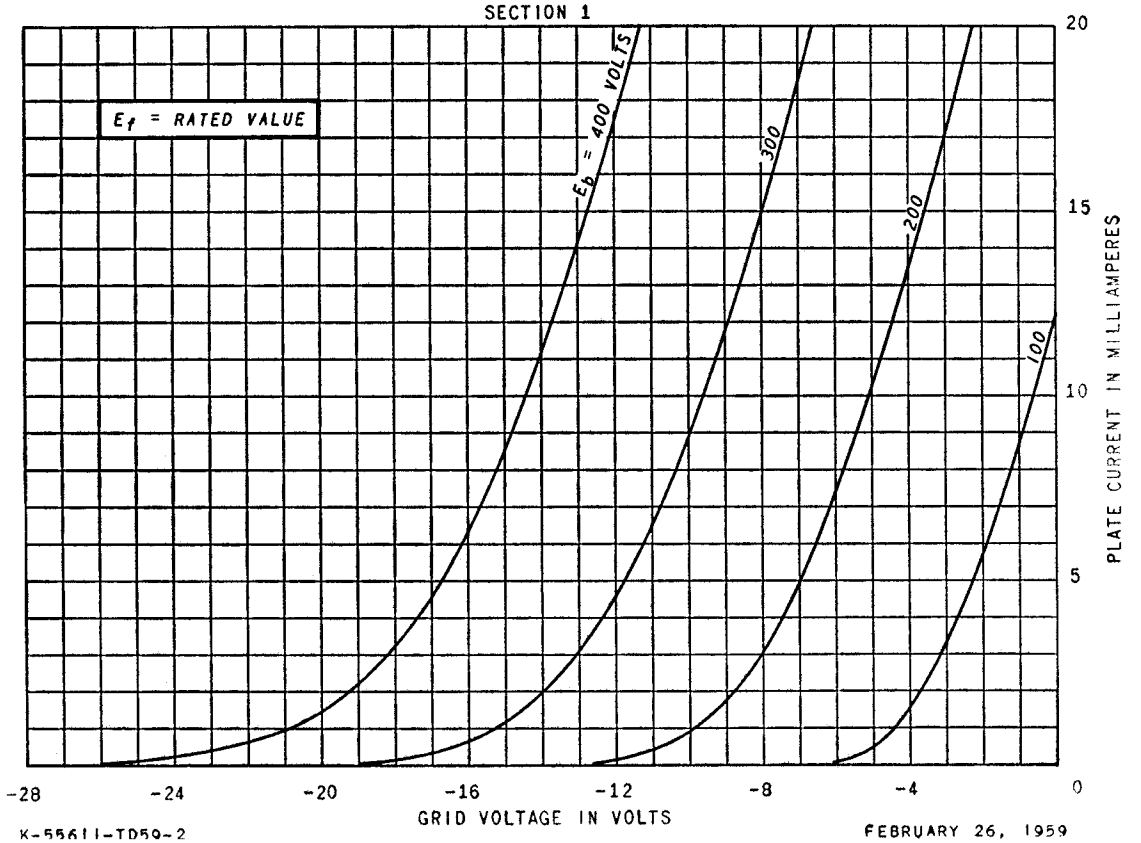


K-5561I-TD59-1

FEBRUARY 26, 1959

AVERAGE TRANSFER CHARACTERISTICS

SECTION 1

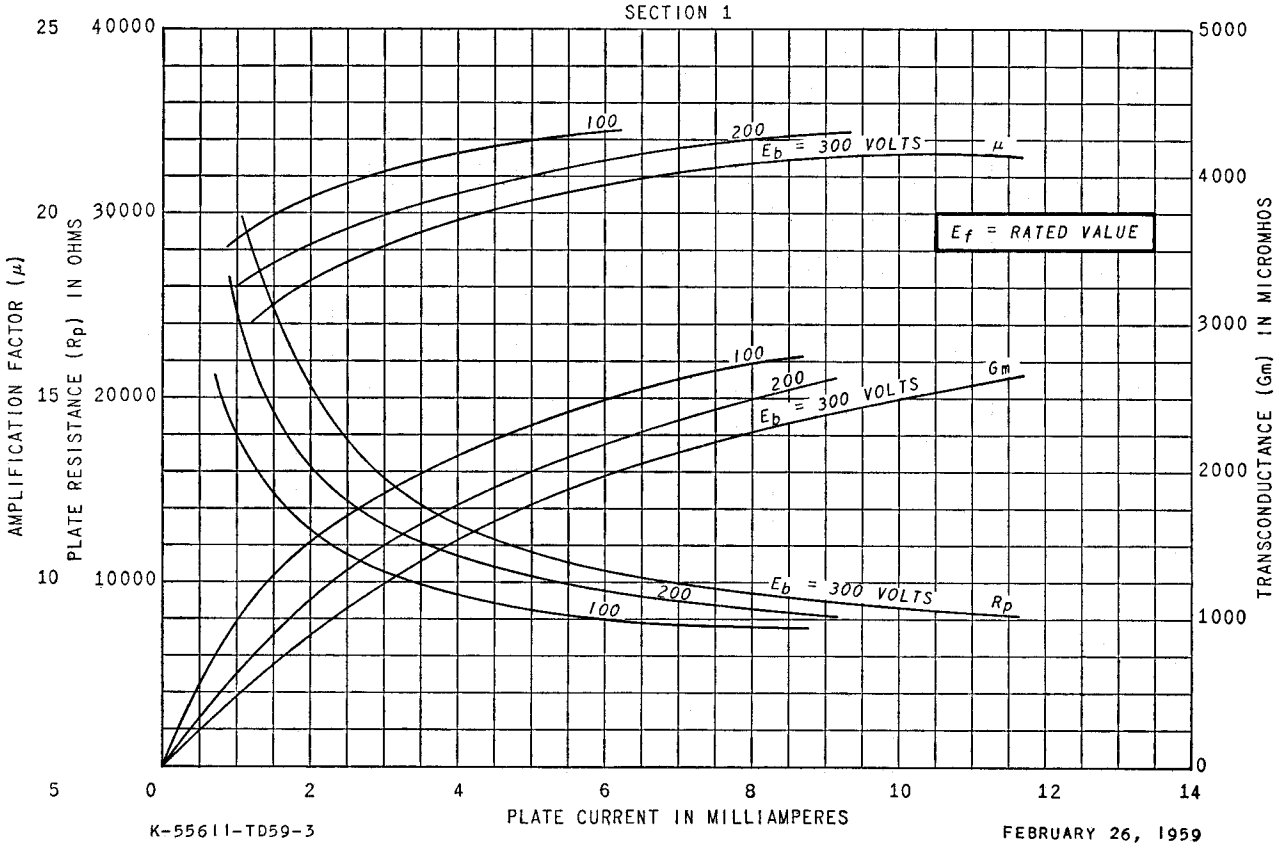


K-5561I-TD59-2

FEBRUARY 26, 1959

AVERAGE CHARACTERISTICS

SECTION 1

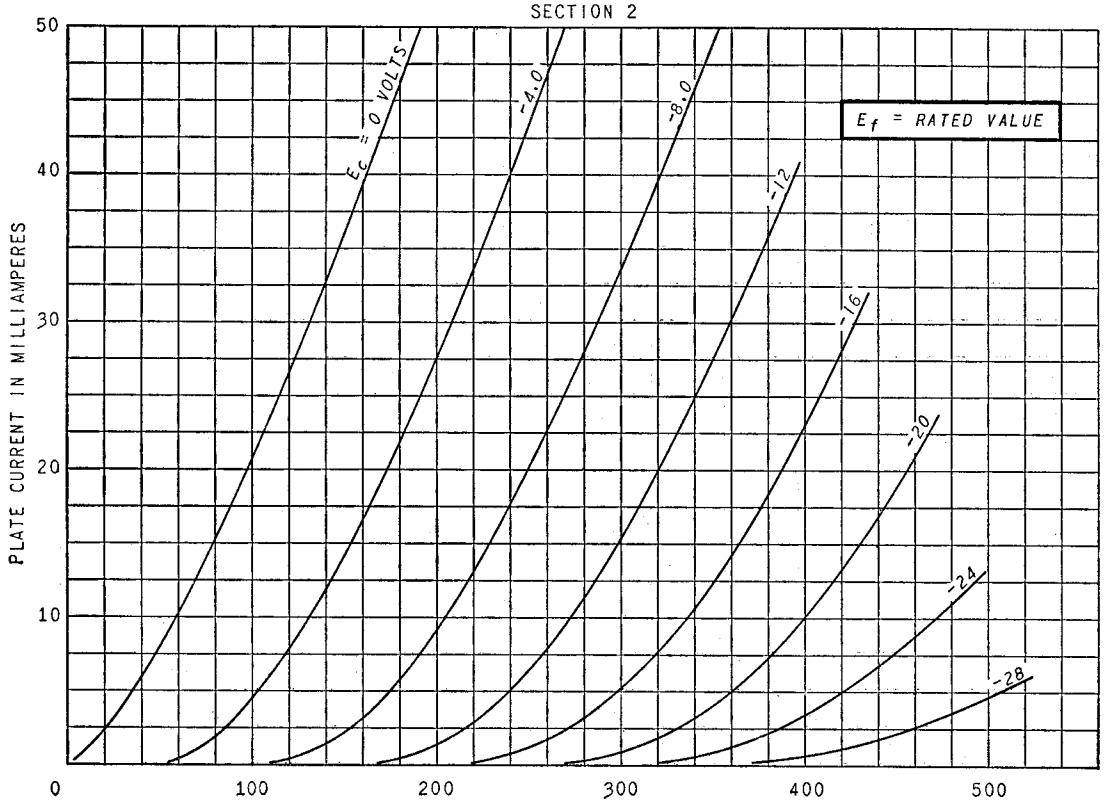


K-55611-TD59-3

FEBRUARY 26, 1959

AVERAGE PLATE CHARACTERISTICS

SECTION 2

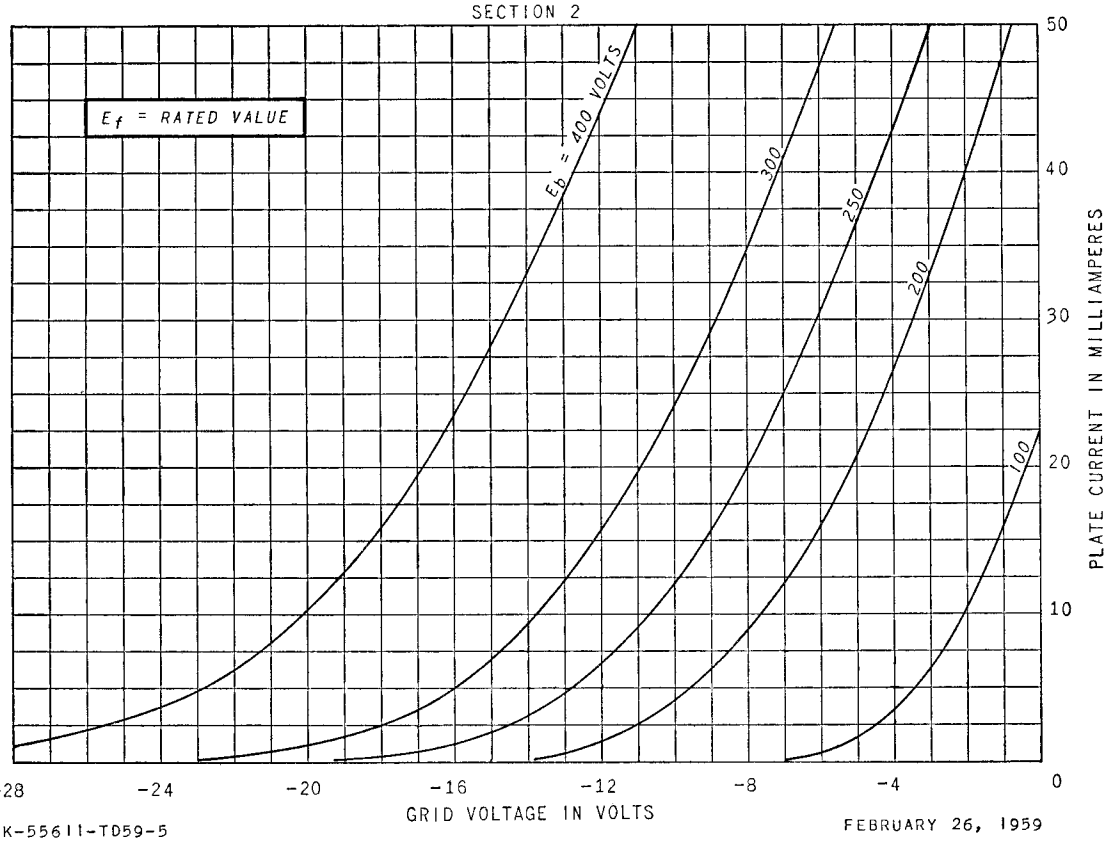


K-55611-TD59-4

FEBRUARY 26, 1959

AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

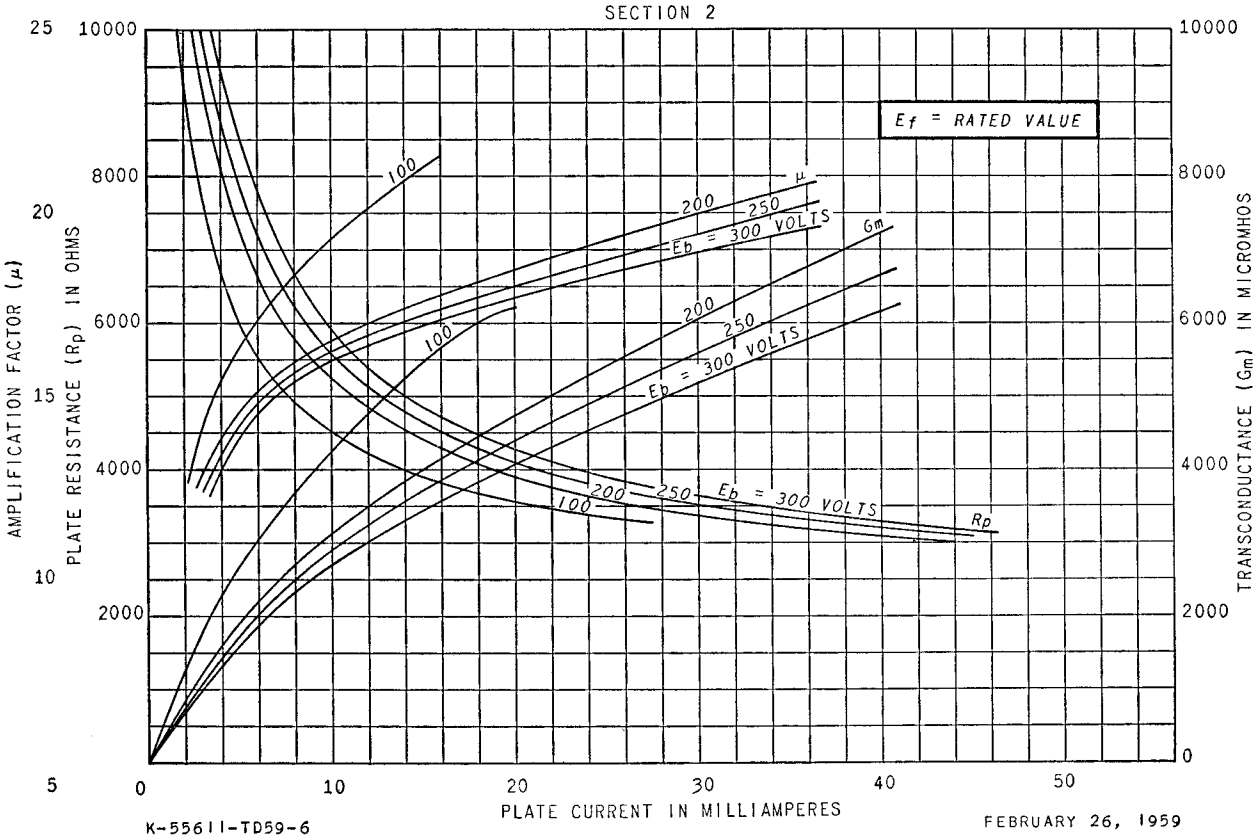


K-55611-TD59-5

FEBRUARY 26, 1959

AVERAGE CHARACTERISTICS

SECTION 2



K-55611-TD59-6

FEBRUARY 26, 1959

Electronic TUBES

6CN7—8CN7

DUPLEX-DIODE TRIODE

DESCRIPTION AND RATING

The 6CN7 is a duplex-diode high-mu triode in which separate cathodes are provided for the diode and triode sections. The triode section of the 6CN7 is electrically identical to the triode section of the 6T8. The tube is primarily intended for service as a combined horizontal phase detector and reactance tube in television receivers. The triode section may also be used in a variety of other applications, such as in sync-separator, sync-amplifier, or audio-amplifier circuits.

Except for heater ratings, the 8CN7 is identical to the 6CN7. Both of the tubes incorporate a controlled heater-warm-up characteristic which makes them especially suited for use in television receivers that employ series-connected heaters.

GENERAL

ELECTRICAL	6CN7 Series	6CN7 Parallel	8CN7 Series	8CN7 Parallel	
Cathode—Coated Unipotential					
Heater Voltage, AC or DC	6.3	3.15	8.4	4.2	Volts
Heater Current	0.3	0.6	0.225	0.45	Amperes
Heater Warm-up Time*	..	11	...	11	Seconds

Direct Interelectrode Capacitances†		
Triode Grid to Plate	1.8	μμf
Triode Input	1.5	μμf
Triode Output	0.5	μμf
Grid to Each Diode Plate	0.006	μμf
Diode-Number 1 Plate to Diode Cathode and Heater	3.6	μμf
Diode-Number 2 Plate to Diode Cathode and Heater	3.6	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button, 9-Pin

MAXIMUM RATINGS

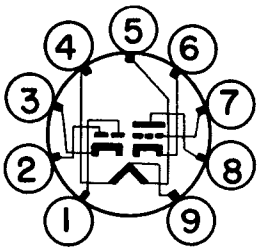
DESIGN-CENTER VALUES

Plate Voltage	300 Volts
Positive DC Grid Voltage	0 Volts
Plate Dissipation	1.0 Watts
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	
DC Component	100 Volts
Total DC and Peak	200 Volts
Heater Negative with Respect to Cathode	
Total DC and Peak	200 Volts
Diode Current for Continuous Operation, Each Diode	5.0 Milliamperes

GENERAL ELECTRIC

Supersedes ET-T908, dated 3-55

BASING DIAGRAM

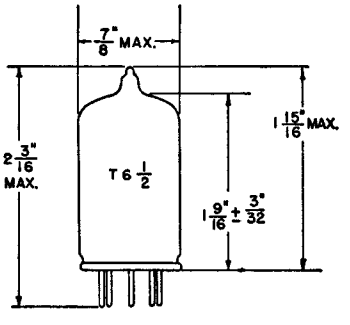


RETMA 9EN

TERMINAL CONNECTIONS

Pin 1—Diode Number 2 Plate
Pin 2—Diode Number 1 Plate
Pin 3—Diode Cathode and Internal Shield
Pin 4—Heater
Pin 5—Heater
Pin 6—Triode Cathode
Pin 7—Triode Grid
Pin 8—Triode Plate
Pin 9—Heater Center-Tap

PHYSICAL DIMENSIONS



RETMA 6-2

CHARACTERISTICS AND TYPICAL OPERATIONS

CLASS A_1 AMPLIFIER

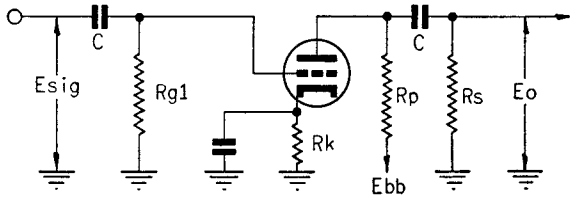
Plate Voltage	100	250 Volts
Grid Voltage	−1.0	−3.0 Volts
Amplification Factor	70	70
Plate Resistance, approximate	54000	58000 Ohms
Transconductance	1300	1200 Micromhos
Plate Current	0.8	1.0 Milliamperes
Average Diode Current, Each Diode with 5.0 Volts DC Applied		20 Milliamperes

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

CLASS A RESISTANCE-COUPLED AMPLIFIER

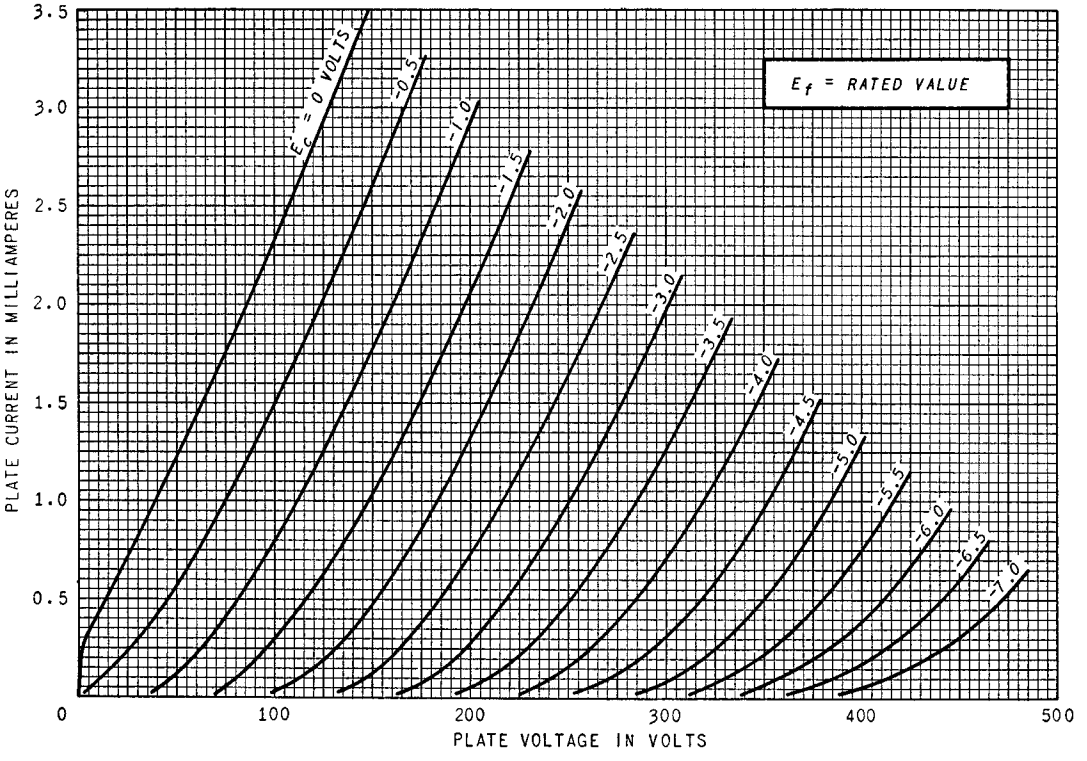
R_p Meg.	R_s Meg.	R_{g1} Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	0.10	0.10	5700	21	7.0	2400	29	18	1800	33	35
0.10	0.24	0.10	6100	26	9.0	2700	34	23	2000	38	42
0.24	0.24	0.10	9100	30	10	4300	40	24	3000	44	43
0.24	0.51	0.10	10000	34	13	4700	45	31	3300	49	52
0.51	0.51	0.10	15000	37	14	7500	47	28	5600	51	50
0.51	1.0	0.10	16000	40	16	8200	50	35	6200	55	60
0.24	0.24	10	0	31	5.0	0	44	19	0	48	40
0.24	0.51	10	0	37	7.0	0	49	25	0	52	52
0.51	0.51	10	0	39	7.5	0	51	22	0	54	44
0.51	1.0	10	0	42	10	0	54	28	0	58	56



Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

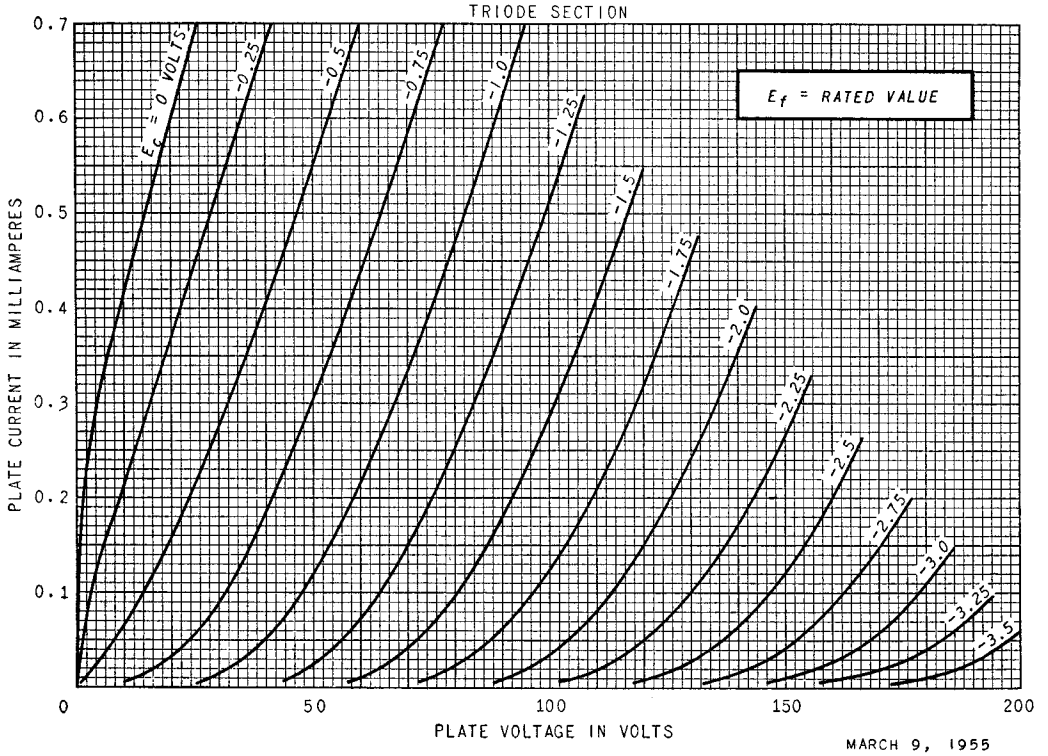
Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

AVERAGE PLATE CHARACTERISTICS



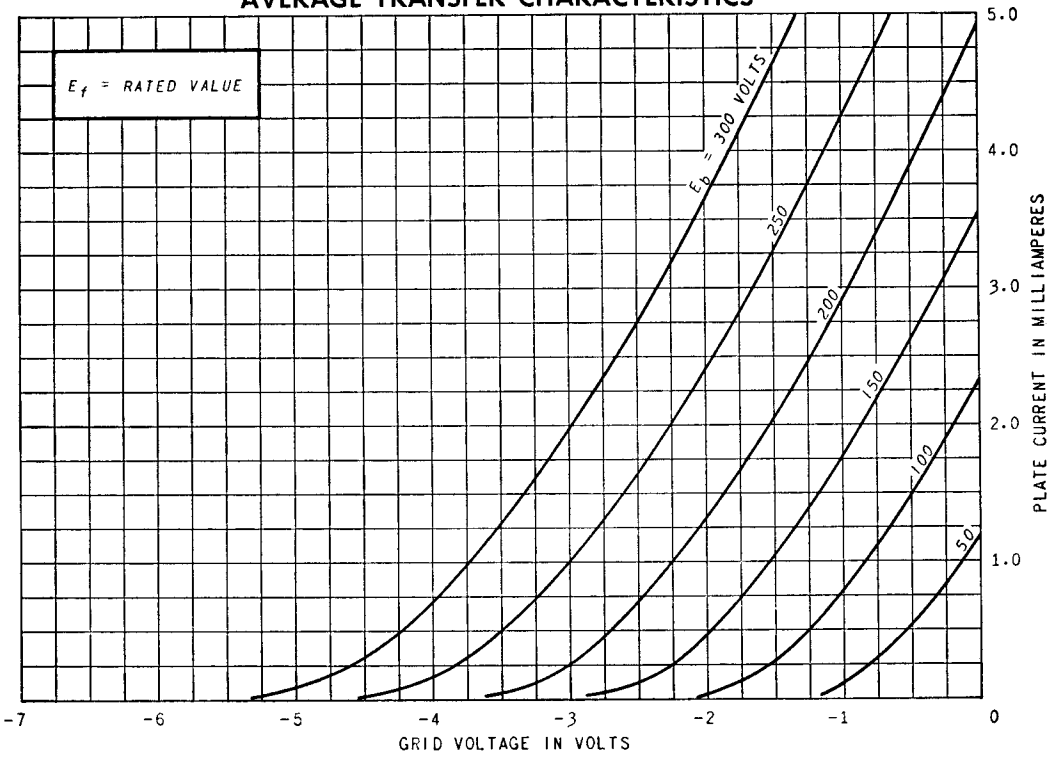
AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION

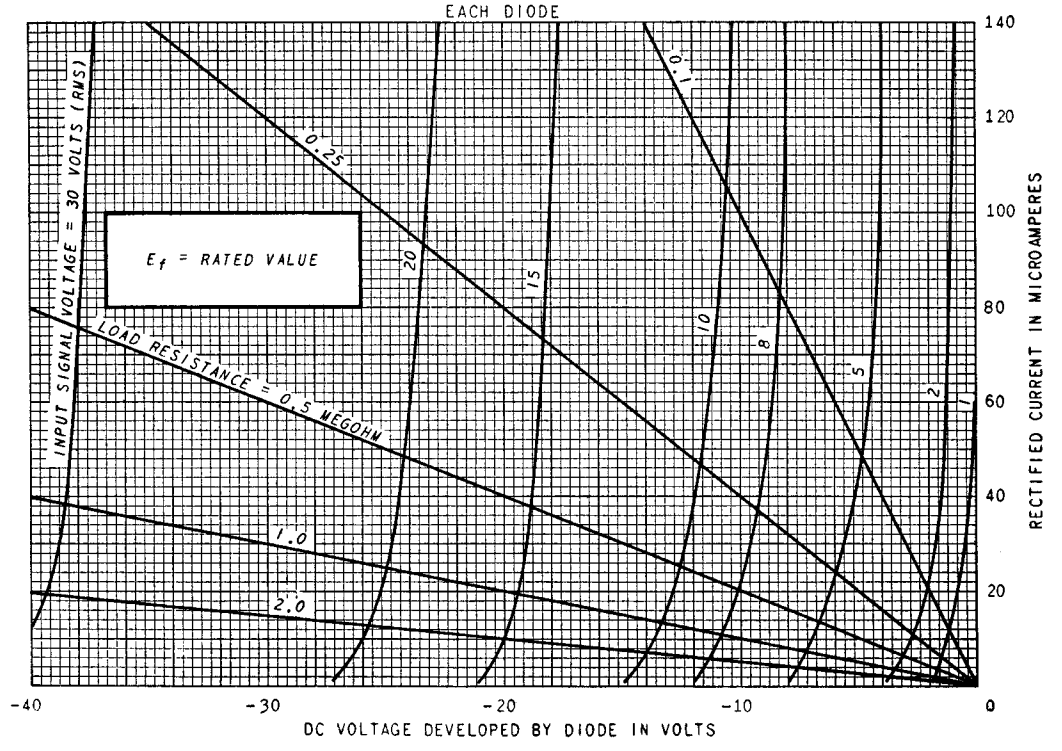


MARCH 9, 1955

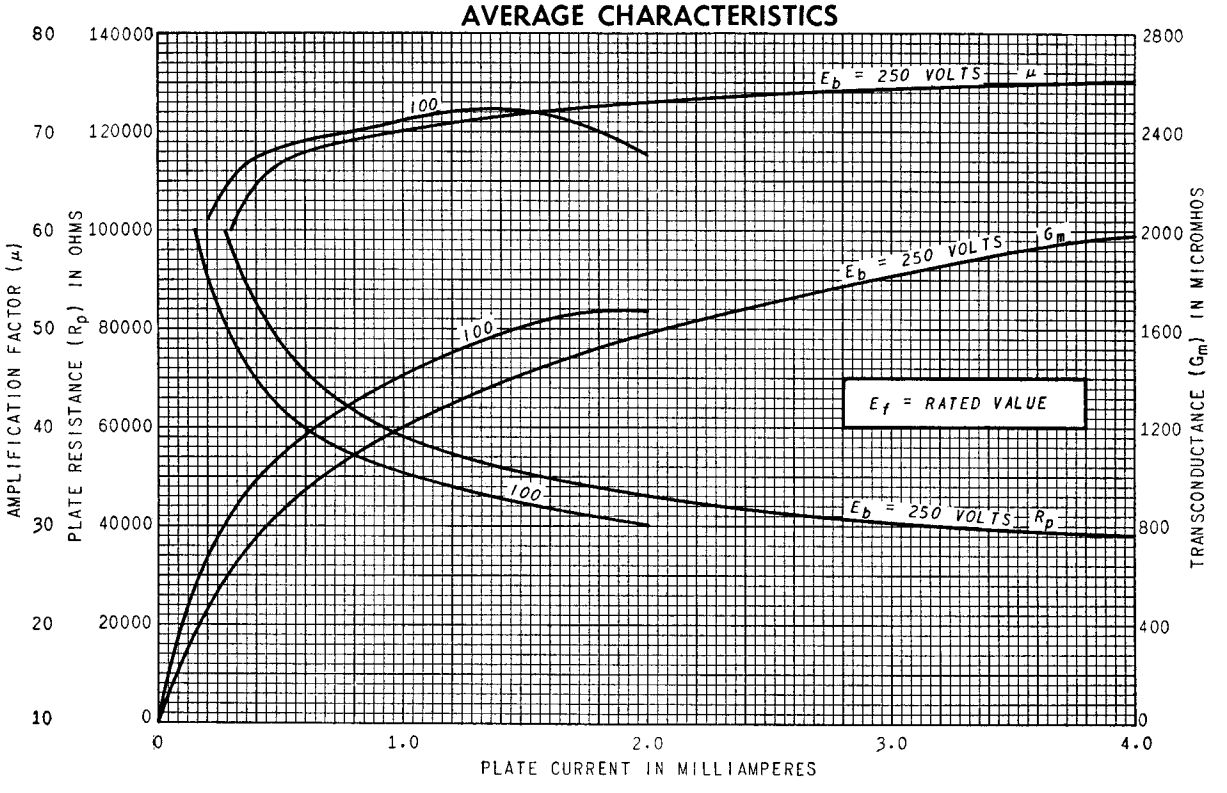
AVERAGE TRANSFER CHARACTERISTICS



OPERATION CHARACTERISTICS



AVERAGE CHARACTERISTICS



Electronic TUBES

6CQ8

TRIODE—TETRODE

DESCRIPTION AND RATING

The 6CQ8 is a miniature tube which contains a sharp-cutoff tetrode and a medium-mu triode in one envelope. Each section has a separate cathode and is electrically independent. The tube is intended primarily for service as a combined triode oscillator and tetrode mixer in television and FM receivers, although it is also suitable for a wide variety of general-purpose applications.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.45 ± 6%	Amperes
Heater Warm-up Time*	11	Seconds

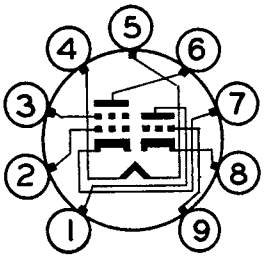
Direct Interelectrode Capacitances

	With Shield†	Without Shield	
Tetrode Section			
Grid-Number 1 to Plate: (Tegl to Tep), max.	0.015	0.019	μμf
Input: Tegl to (H+Tek+Teg2+I.S.)	5.0	5.0	μμf
Output: Tep to (H+Tek+Teg2+I.S.)	3.3	2.5	μμf
Triode Section			
Grid to Plate: (Tg to Tp)	1.8	1.8	μμf
Input: Tg to (H+Tk)	2.7	2.7	μμf
Output: Tp to (H+Tk)	1.2	0.4	μμf
Tetrode Plate to Triode Plate: (Tep to Tp), max.	0.01	0.07	μμf
Heater to Cathode, each section	3.0‡	3.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

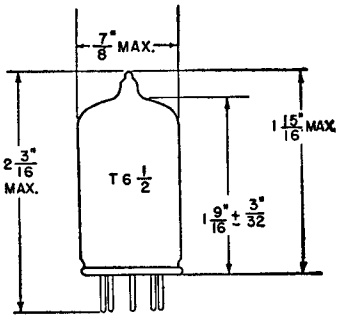


EIA 9GE

TERMINAL CONNECTIONS

Pin 1—Triode Plate
Pin 2—Tetrode Grid Number 1
Pin 3—Tetrode Grid Number 2 (Screen)
Pin 4—Heater
Pin 5—Heater
Pin 6—Tetrode Plate
Pin 7—Tetrode Cathode and Internal Shield
Pin 8—Triode Cathode
Pin 9—Triode Grid

PHYSICAL DIMENSIONS



EIA 6-2

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES	Tetrode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	——	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.2	3.1	Watts
Screen Dissipation	——	——	Watts
Grid-Number 1 Input	——	0.55	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER	Tetrode Section	Triode Section	
Plate Voltage	125	125	Volts
Screen Voltage	125	——	Volts
Grid-Number 1 Voltage	−1.0	——	Volts
Cathode-Bias Resistor	——	56	Ohms
Amplification Factor	——	40	
Plate Resistance, approximate	140000	5000	Ohms
Transconductance	5800	8000	Micromhos
Plate Current	12	15	Milliamperes
Screen Current	4.2	——	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 100 Microamperes	−7	−7	Volts

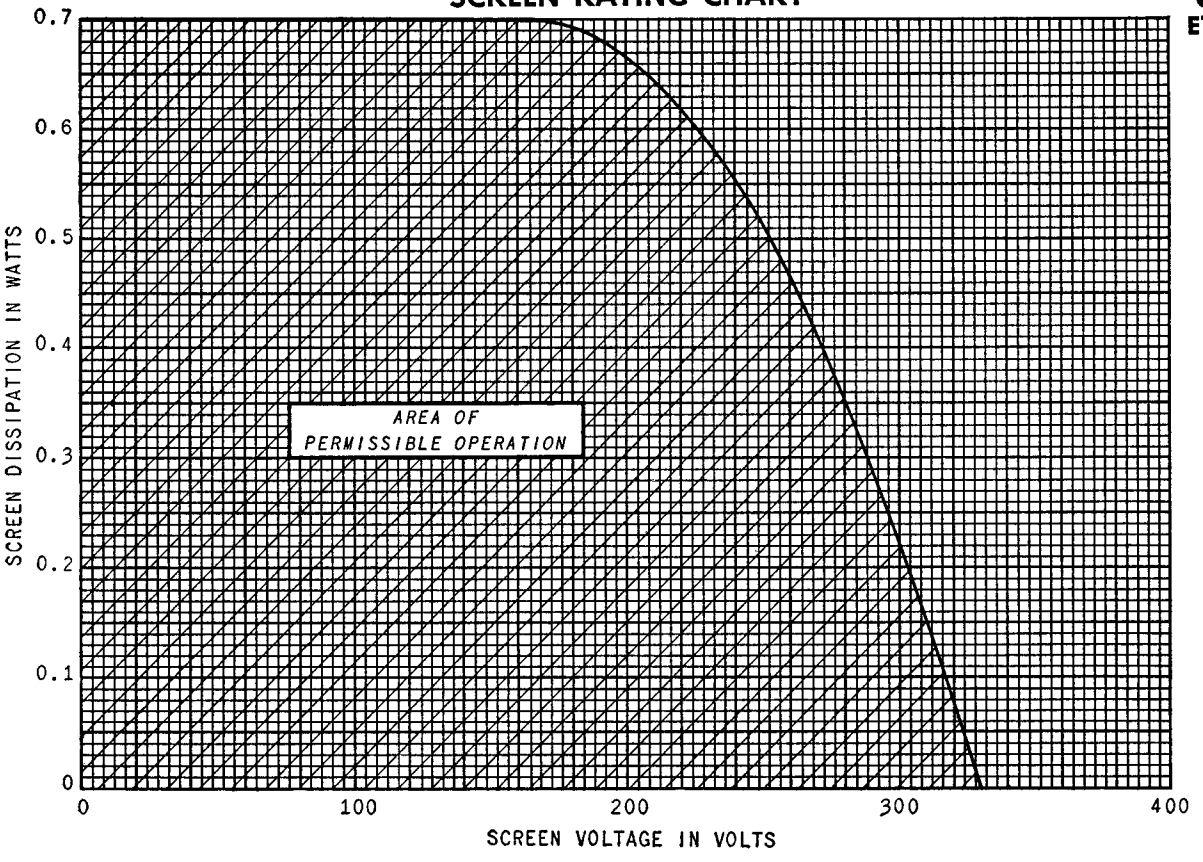
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (EIA 315) connected to cathode of unit under test unless otherwise indicated.

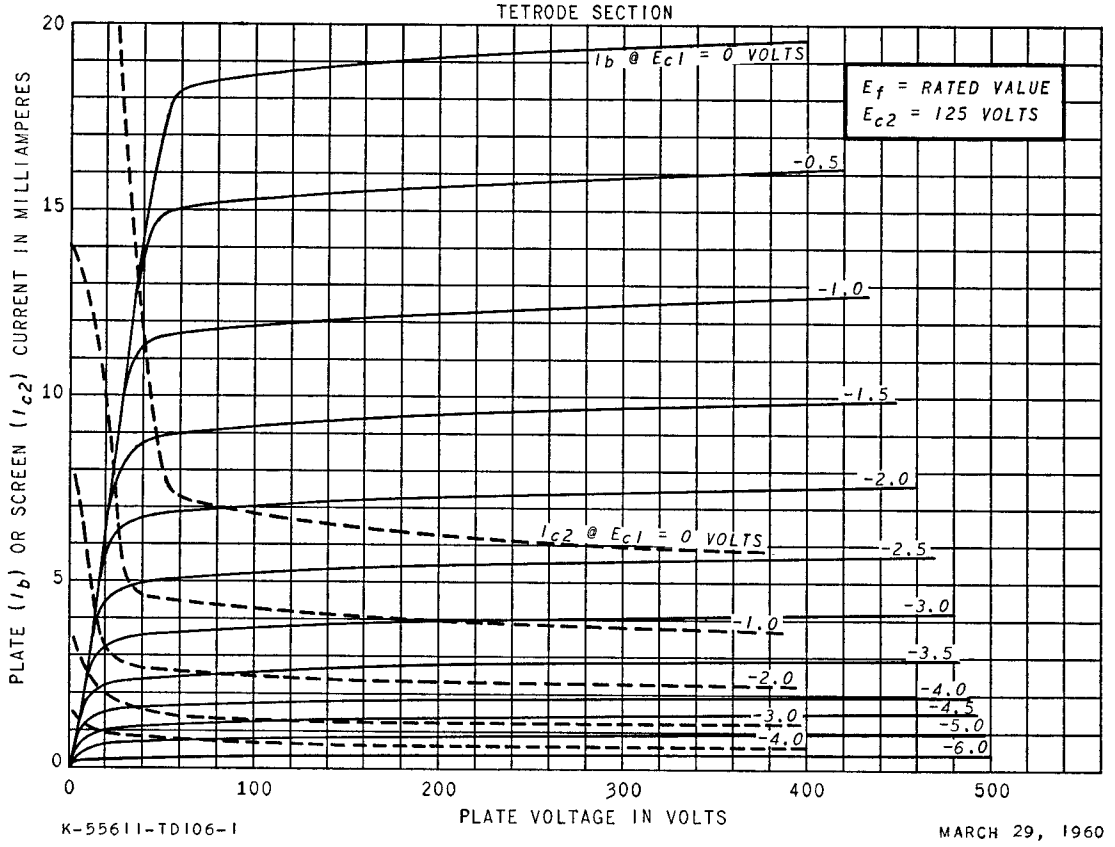
‡ With external shield (EIA 315) connected to ground.

The DC Component must not exceed 100 volts.

SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

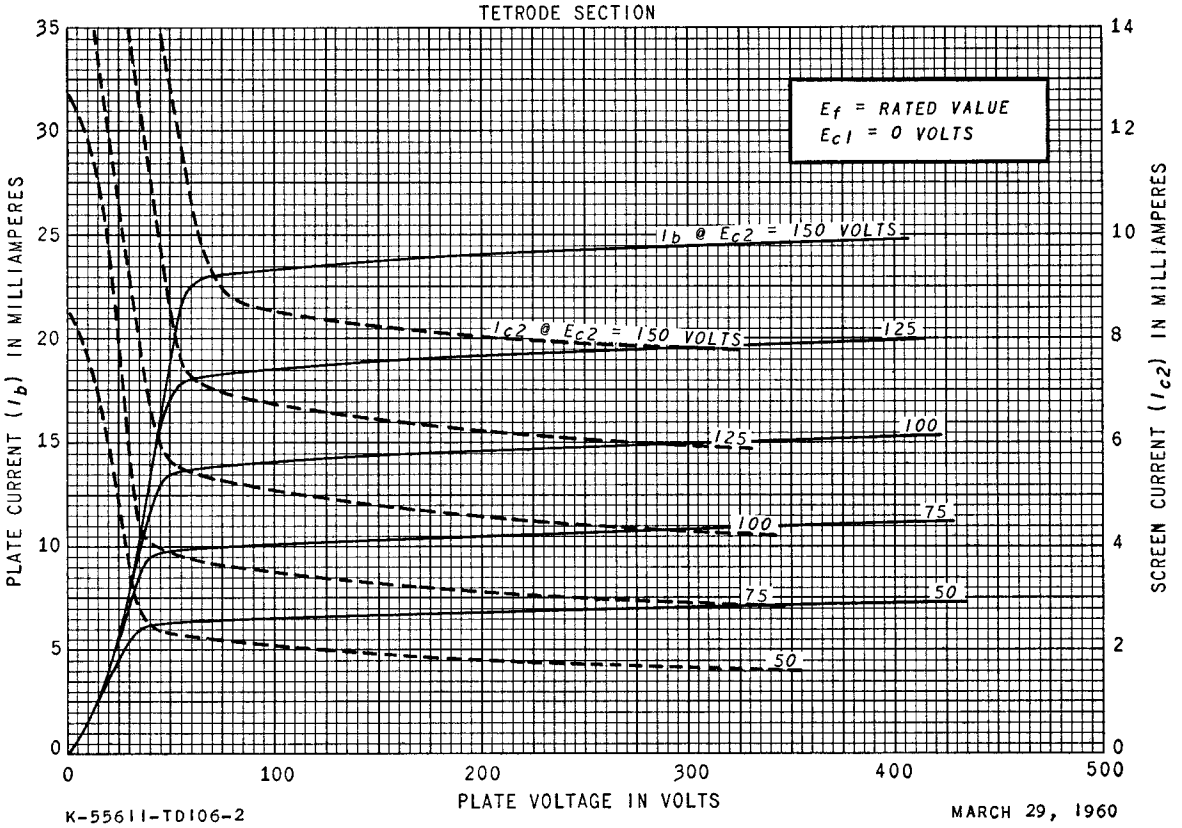


K-55611-TD106-1

MARCH 29, 1960

AVERAGE PLATE CHARACTERISTICS

TETRODE SECTION

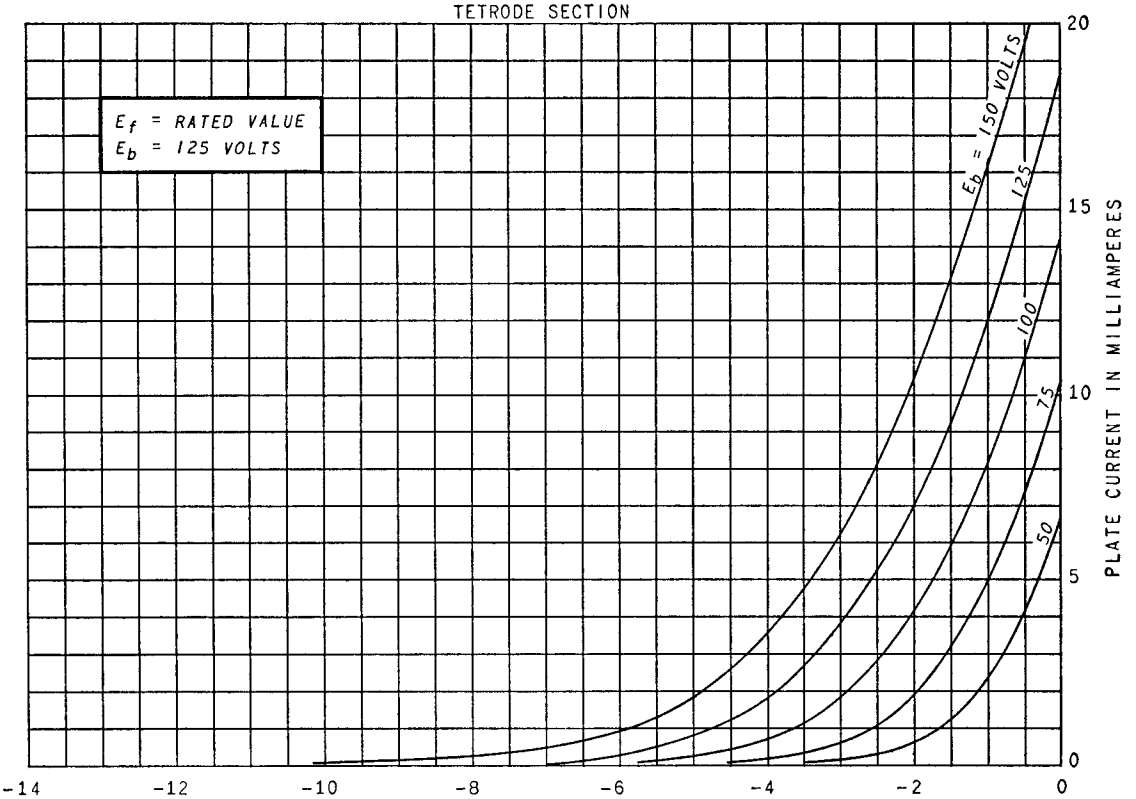


K-55611-TD106-2

MARCH 29, 1960

AVERAGE TRANSFER CHARACTERISTICS

TETRODE SECTION

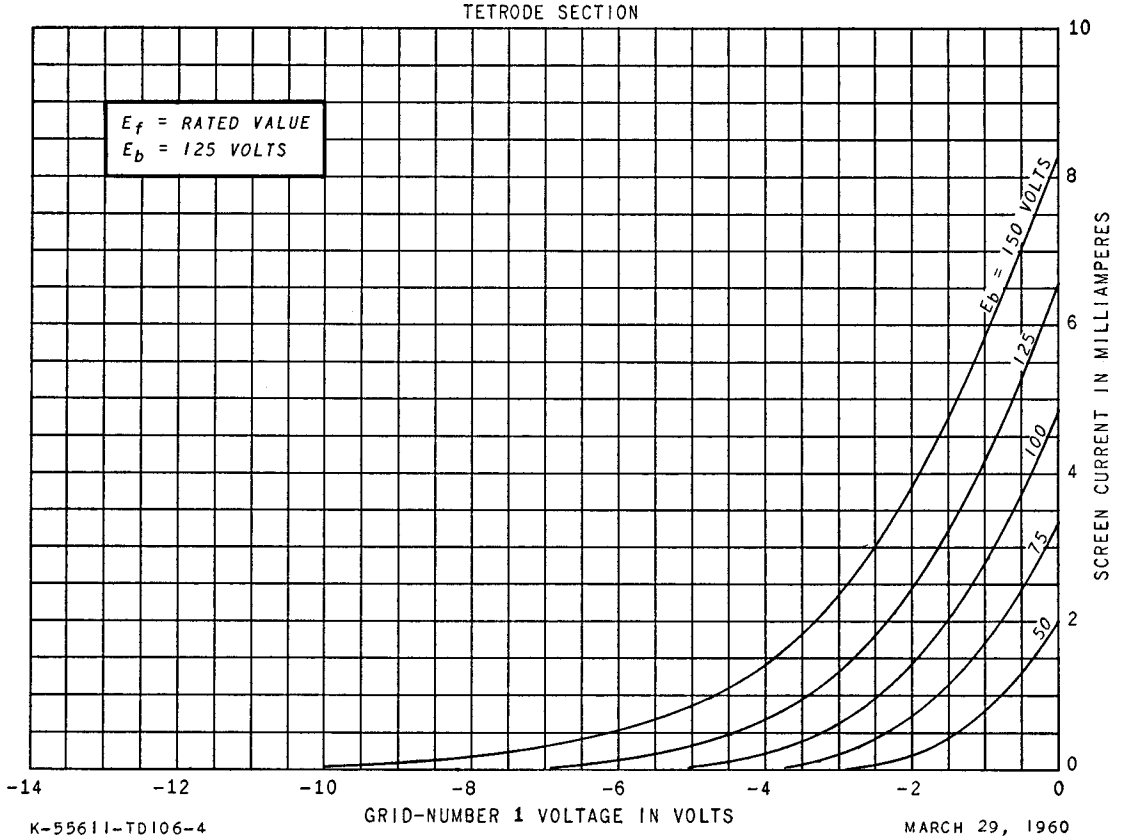


K-55611-TD106-3

MARCH 29, 1960

AVERAGE TRANSFER CHARACTERISTICS

TETRODE SECTION

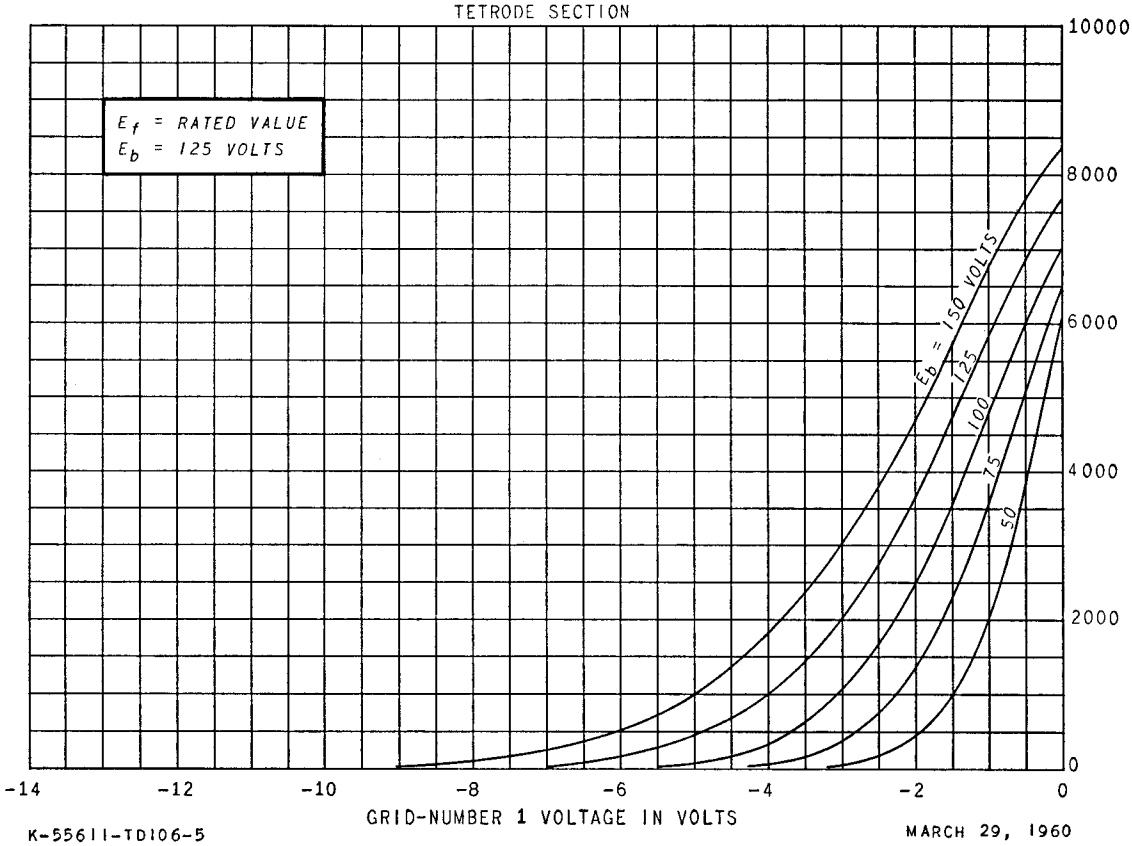


K-55611-TD106-4

MARCH 29, 1960

AVERAGE TRANSFER CHARACTERISTICS

TETRODE SECTION

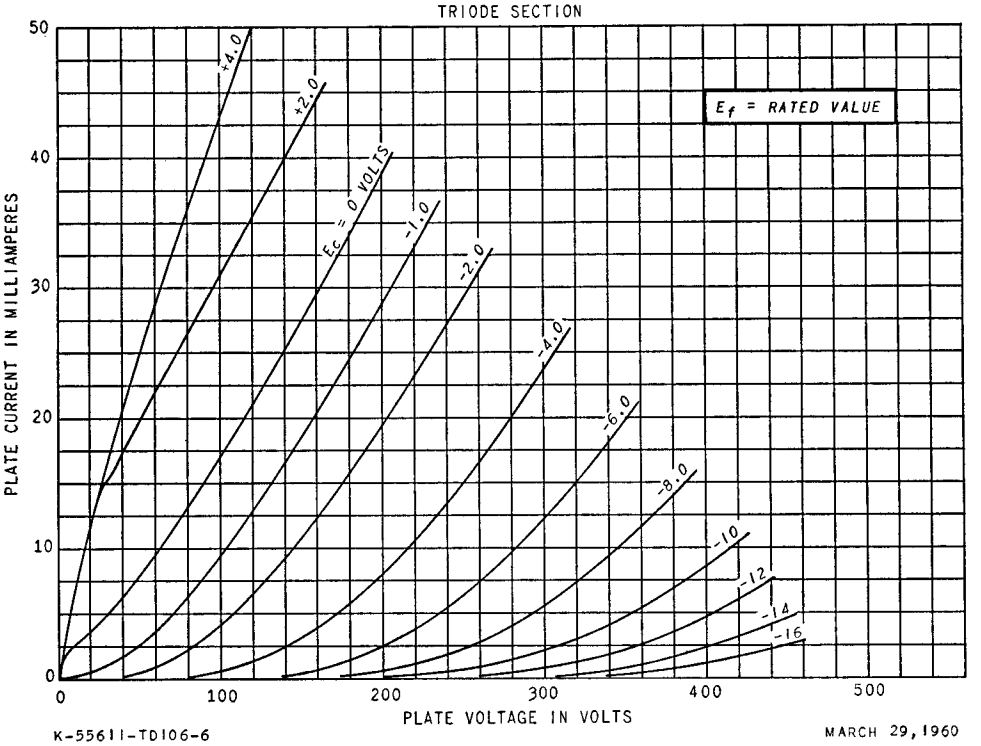


K-55611-TD106-5

MARCH 29, 1960

AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION

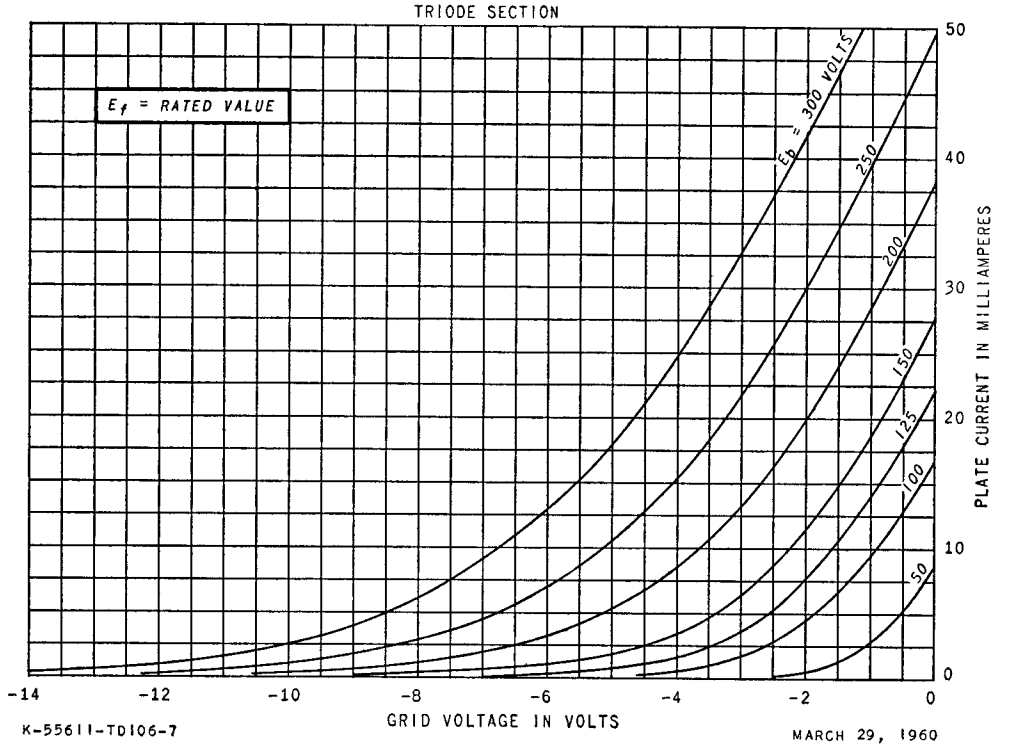


K-55611-TD106-6

MARCH 29, 1960

AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION



K-55611-TD106-7

MARCH 29, 1960

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6CS6

HEPTODE

FOR GATED AMPLIFIER SERVICE

DESCRIPTION AND RATING

The 6CS6 is a miniature dual-control heptode designed primarily for use as a combined sync separator and sync clipper in television receivers. Each of the two independent control grids exhibits a sharp-cutoff characteristic.

GENERAL

Electrical

Cathode—Coated Unipotential

	3CS6	4CS6	6CS6	
Heater Voltage, AC or DC	3.15	4.2	6.3	Volts
Heater Current	0.6	0.45	0.3	Amperes
Heater Warm-up Time*	11	11	...	Seconds

Direct Interelectrode Capacitances, approximate†

Grid-Number 1 to Plate, maximum	0.07	μμf
Grid-Number 3 to Plate, maximum	0.36	μμf
Grid-Number 1 to All Except Plate	5.5	μμf
Grid-Number 3 to All Except Plate	7.0	μμf
Plate to All	7.5	μμf
Grid-Number 1 to Grid-Number 3, maximum	0.22	μμf

Mechanical

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

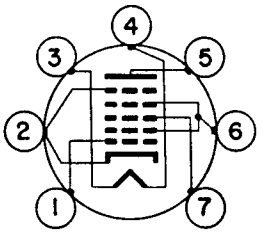
DESIGN-CENTER VALUES

Plate Voltage	300	Volts
Screen-Supply Voltage	300	Volts
Screen Voltage	100	Volts
Plate Dissipation	1.0	Watts
Screen Dissipation	1.0	Watts
DC Cathode Current	14	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 3 Circuit Resistance	2.2	Megohms
Grid-Number 1 Circuit Resistance	0.47	Megohms

GENERAL ELECTRIC

Supersedes ET-T877, dated 9-54

BASING DIAGRAM

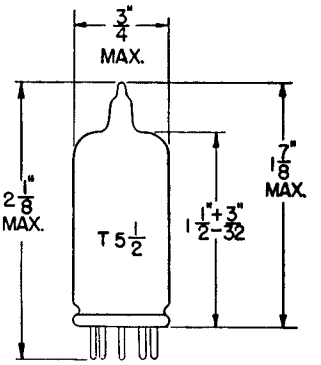


EIA 7CH

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode and Grid Number 5
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grids Number 2 and 4 (Screen)
Pin 7—Grid Number 3

PHYSICAL DIMENSIONS



EIA 5-2

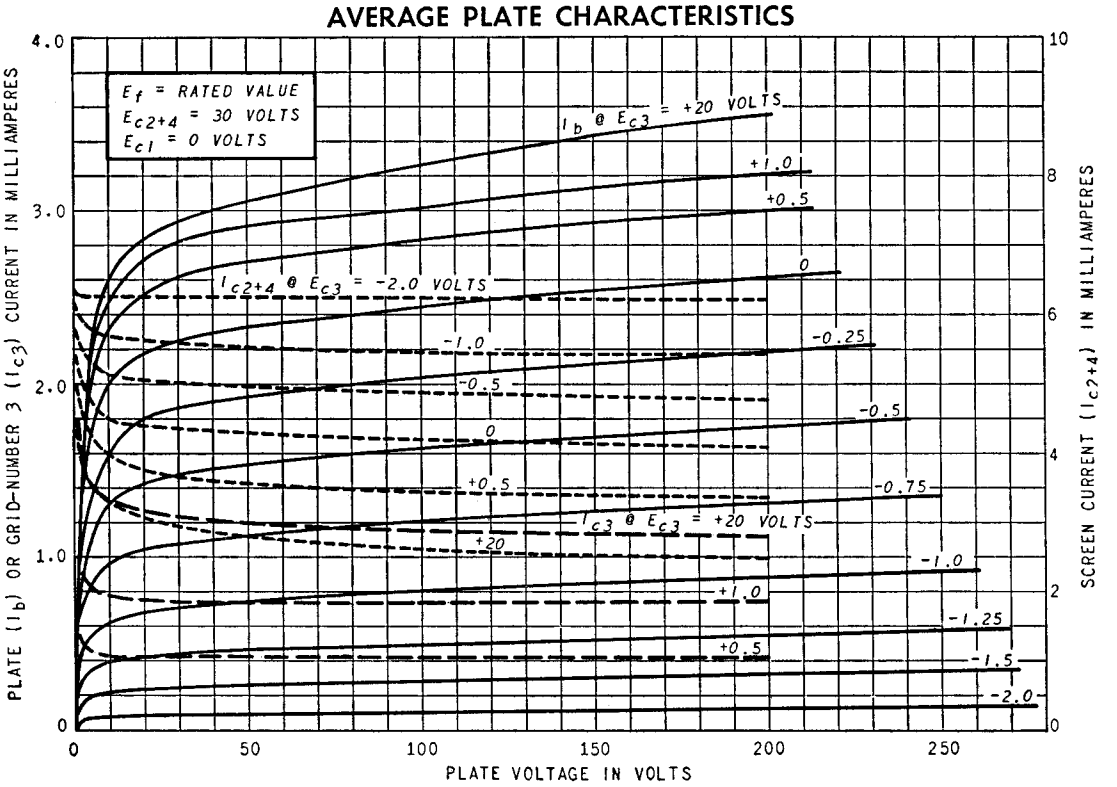
CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

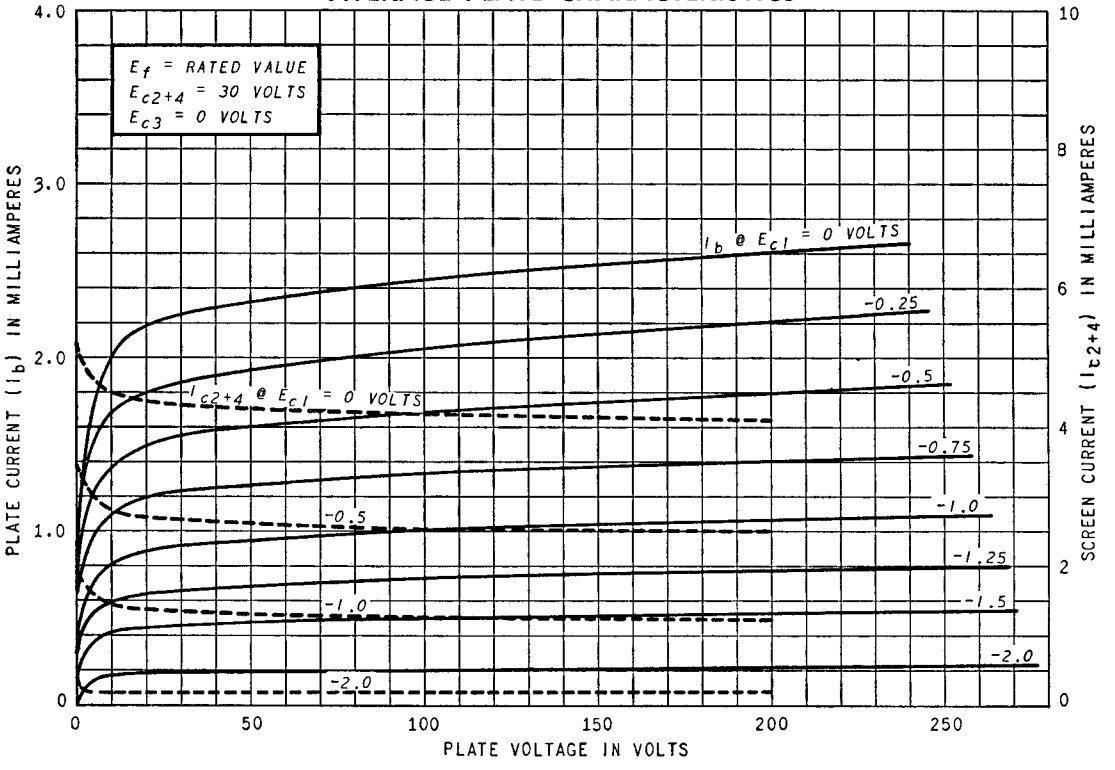
Plate Voltage	10	100	100	Volts
Screen Voltage	30	30	30	Volts
Grid-Number 3 Voltage	0	−1.0	0	Volts
Grid-Number 1 Voltage	0	0	−1.0	Volts
Plate Resistance, approximate		0.7	1.0	Megohms
Grid-Number 3 Transconductance		1500	...	Micromhos
Grid-Number 1 Transconductance		....	1100	Micromhos
Plate Current	2.0	0.8	1.0	Milliamperes
Screen Current	4.5	5.5	1.3	Milliamperes
Grid-Number 3 Voltage, approximate Ib = 50 Microamperes		−2.2	....	Volts
Grid-Number 1 Voltage, approximate Ib = 50 Microamperes		....	−2.5	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

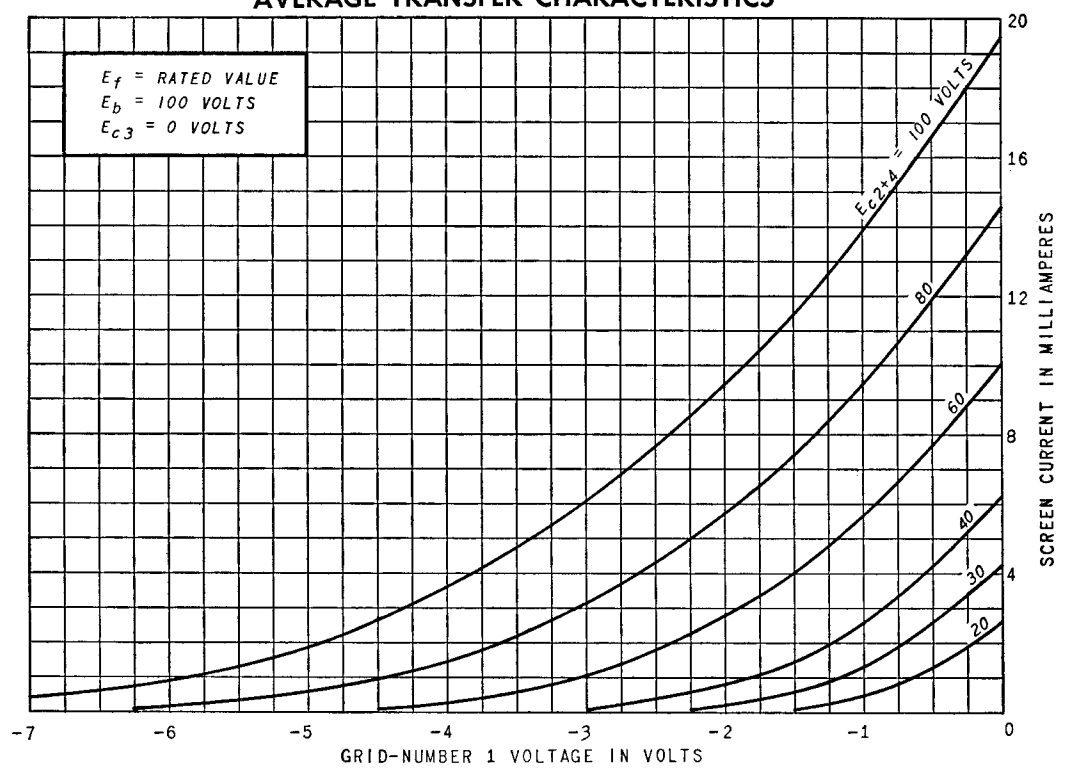
† Without external shield.



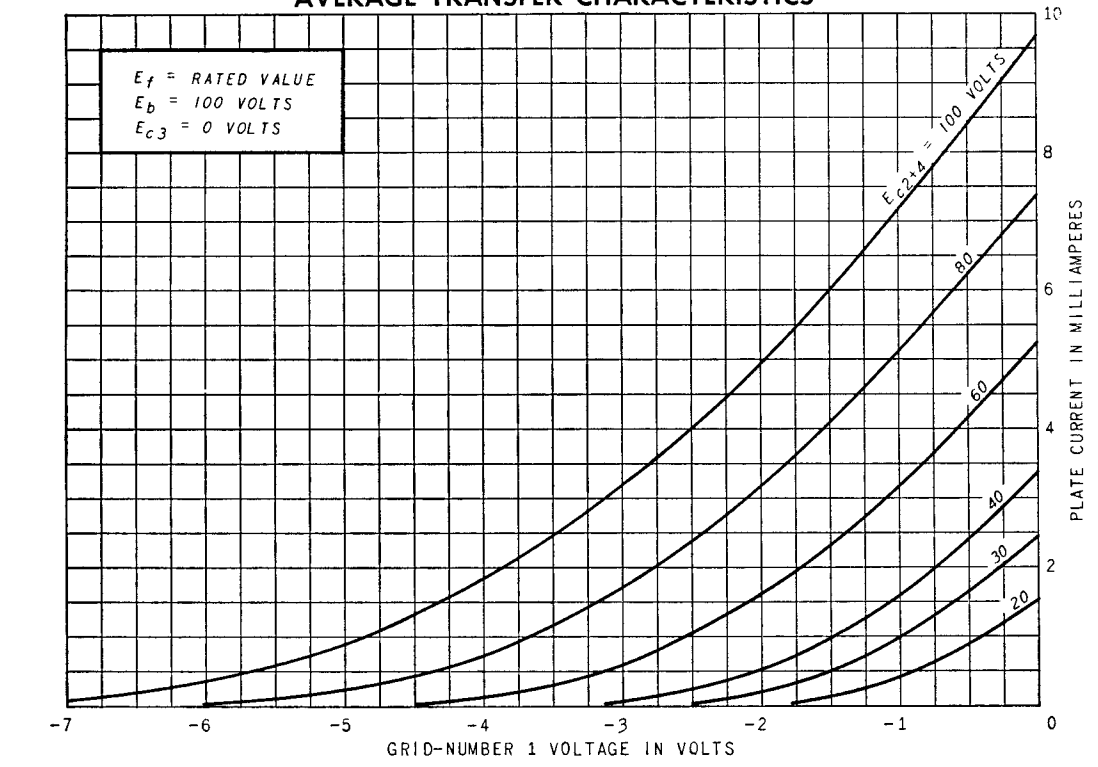
AVERAGE PLATE CHARACTERISTICS



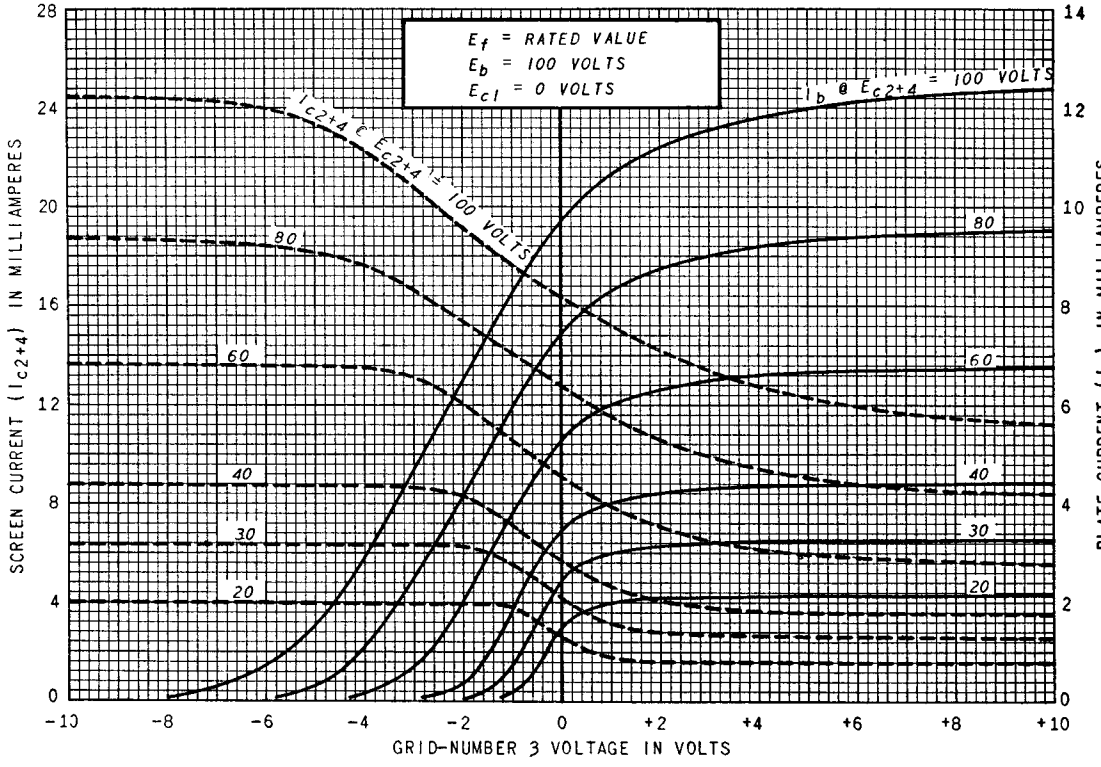
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

Electronic TUBES

6CU5

BEAM PENTODE

FOR AF POWER AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6CU5 is a miniature beam-power pentode primarily designed for use in the audio-frequency power-output stage of radio receivers. The tube features high power sensitivity and high efficiency at relatively low plate and screen voltages.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3	Volts
Heater Current	1.2	Amperes
Direct Interelectrode Capacitances*		
Grid-Number 1 to Plate	0.6	μμf
Input	13	μμf
Output	8.5	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

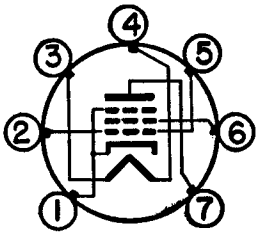
MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	135	Volts
Screen Voltage	117	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	6.0	Watts
Screen Dissipation	1.25	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.5	Megohms
Bulb Temperature at Hottest Point	220	C

GENERAL ELECTRIC

BASING DIAGRAM

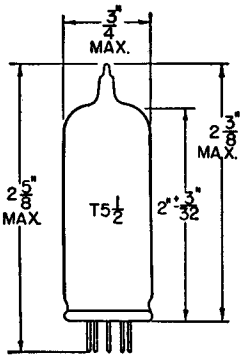


EIA 7CV

TERMINAL CONNECTIONS

Pin 1—Cathode and Beam Plates
Pin 2—Grid Number 1
Pin 3—Heater
Pin 4—Heater
Pin 5—Grid Number 1
Pin 6—Grid Number 2 (Screen)
Pin 7—Plate

PHYSICAL DIMENSIONS



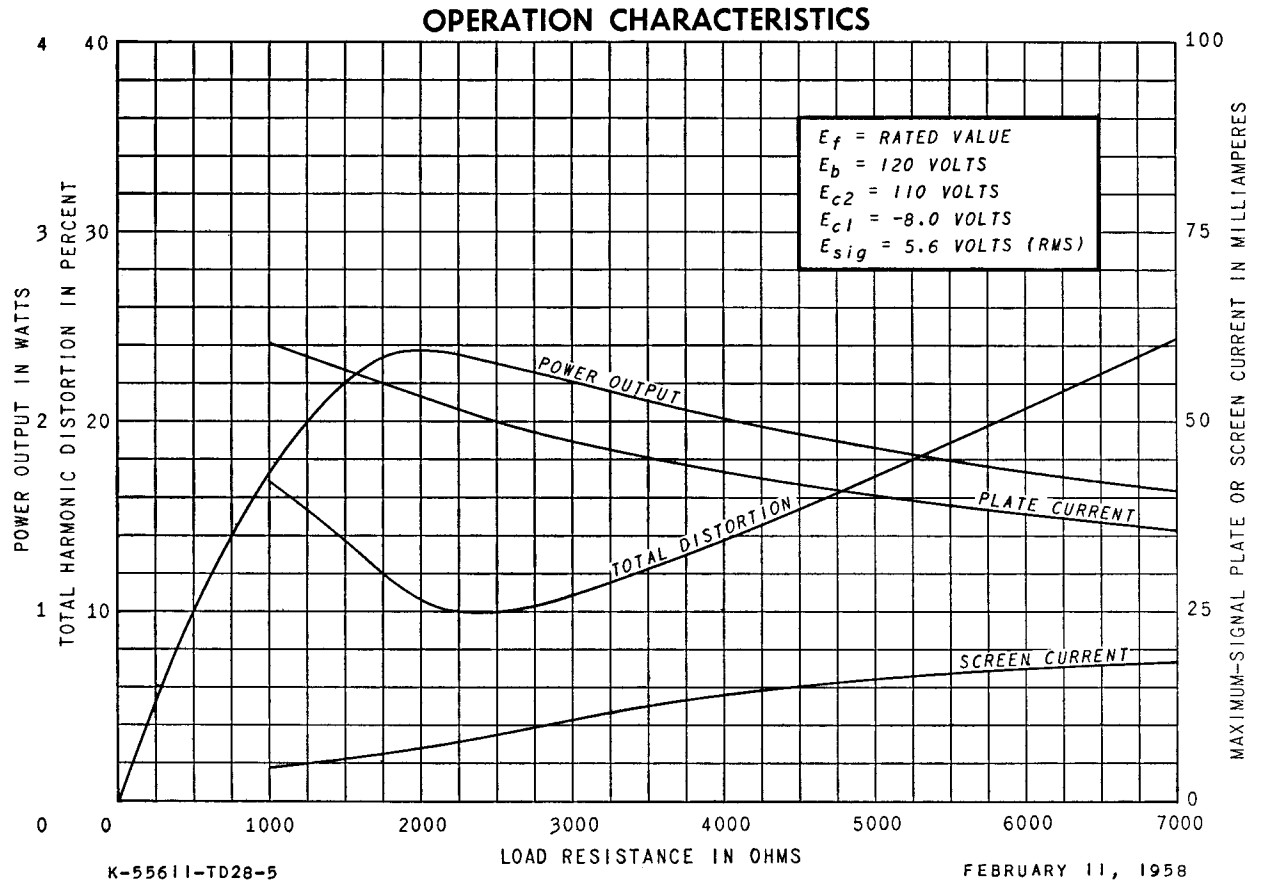
EIA 5-3

CHARACTERISTICS AND TYPICAL OPERATION

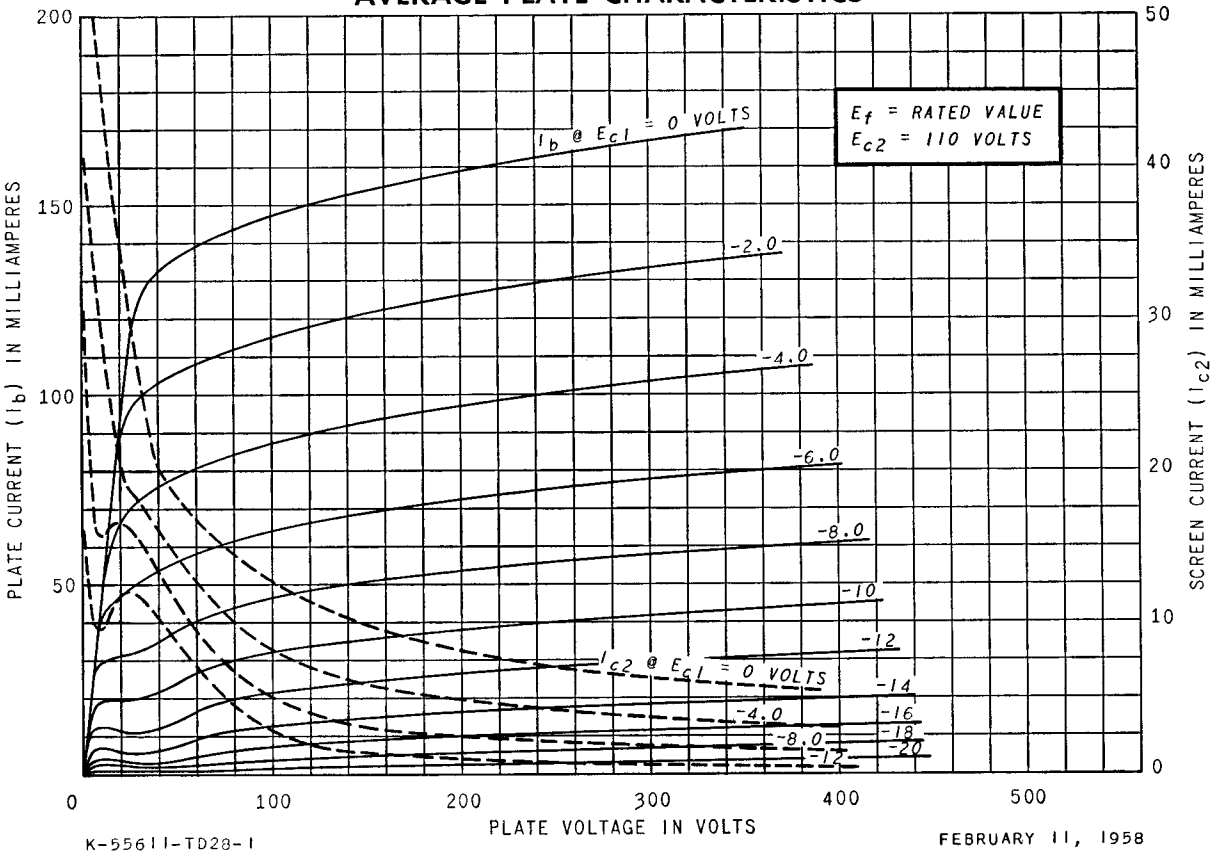
CLASS A_1 AMPLIFIER

Plate Voltage	120	Volts
Screen Voltage	110	Volts
Grid-Number 1 Voltage	−8.0	Volts
Peak AF Grid-Number 1 Voltage	8.0	Volts
Plate Resistance, approximate	10000	Ohms
Transconductance	7500	Micromhos
Zero-Signal Plate Current	49	Milliamperes
Maximum-Signal Plate Current	50	Milliamperes
Zero-Signal Screen Current	4.0	Milliamperes
Maximum-Signal Screen Current	8.5	Milliamperes
Load Resistance	2500	Ohms
Total Harmonic Distortion, approximate	10	Percent
Maximum-Signal Power Output	2.3	Watts

*Without external shield.



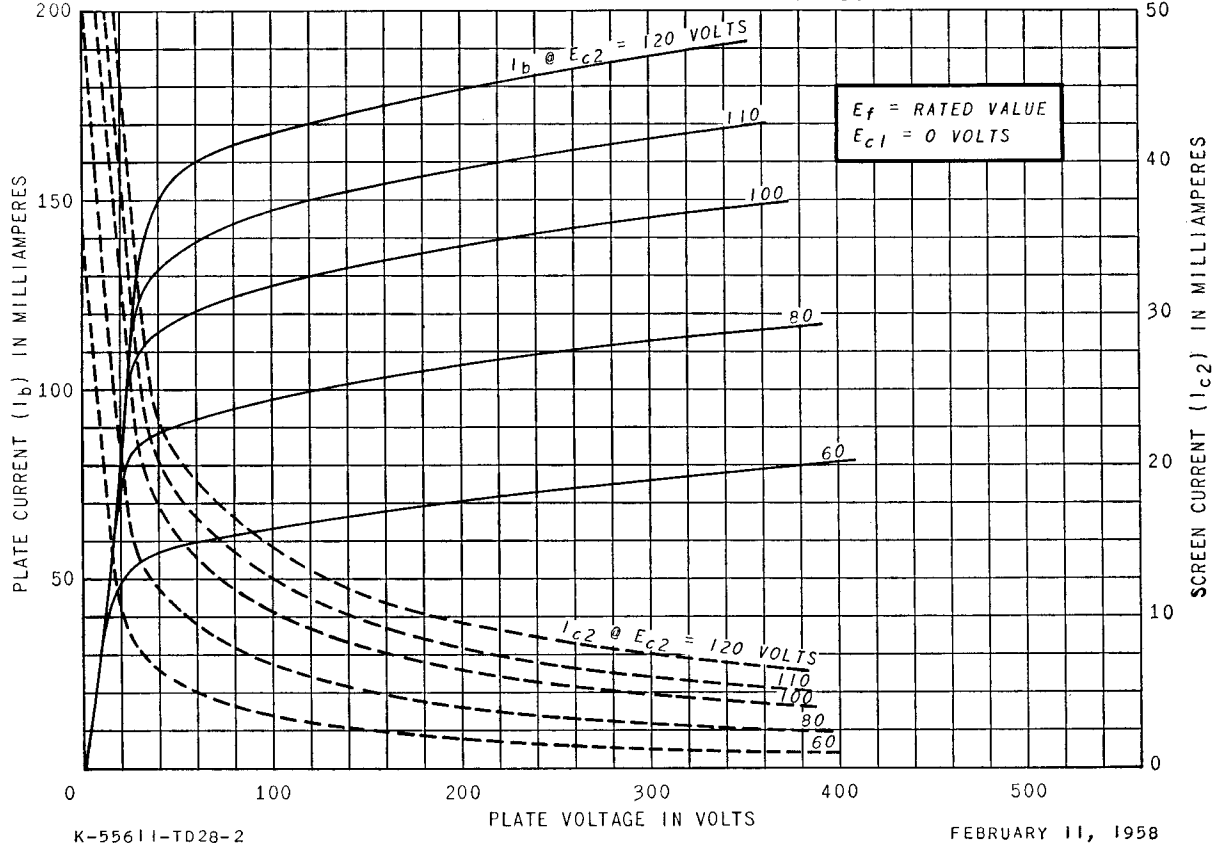
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD28-1

FEBRUARY 11, 1958

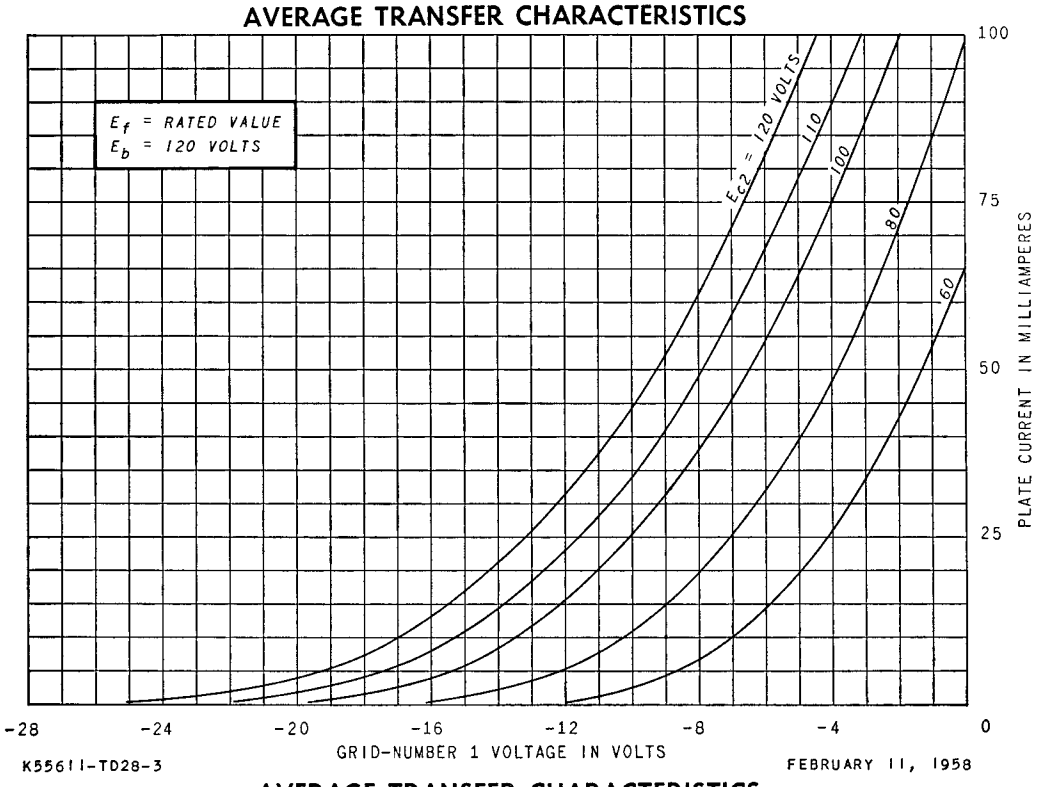
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD28-2

FEBRUARY 11, 1958

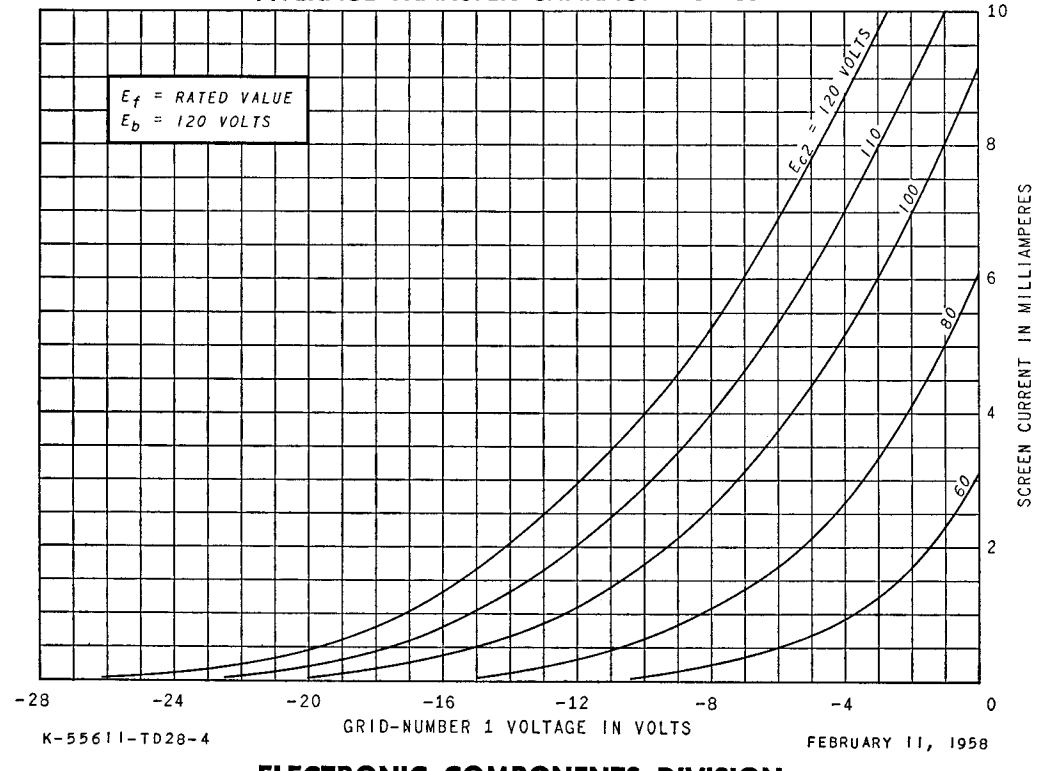
AVERAGE TRANSFER CHARACTERISTICS



K5561I-TD28-3

FEBRUARY 11, 1958

AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD28-4

FEBRUARY 11, 1958

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6CU6—12CU6—25CU6

BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6CU6 is a beam-power pentode designed primarily for use as horizontal-deflection amplifier in television receivers. The tube exhibits high perveance, high plate current at low plate and screen voltages, and a high ratio of plate to screen current.

Except for heater ratings, the 12CU6 and 25CU6 are identical to the 6CU6. In addition, the 12CU6 features a controlled heater warm-up characteristic which makes it especially suited for use in television receivers that employ 600-milliampere, series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	6CU6	12CU6	25CU6	
Heater Voltage, AC or DC	6.3	12.6	25.0	Volts
Heater Current	1.2	0.6	0.3	Amperes
Heater Warm-up Time*	—	11	—	Seconds

Direct Interelectrode Capacitances†

Grid-Number 1 to Plate	0.6	μμf
Input	15	μμf
Output	7.0	μμf

MECHANICAL

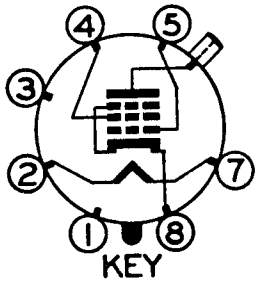
Mounting Position—Any
Envelope—T-11 or T-12, Glass
Base—B7-12, Medium-Shell Octal 7-Pin
or B7-111 or B7-119, Short Medium-Shell Octal 7-Pin
or B6-122, Short Medium-Shell Octal 6-Pin.
Top Cap—C1-3 or C1-33, Skirted Miniature

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE‡
DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

DC Plate-Supply Voltage (Boost + DC Power Supply)	600	Volts
Peak Positive Pulse Plate Voltage	6000§	Volts
Peak Negative Pulse Plate Voltage	1250	Volts
Screen Voltage	200	Volts
Peak Negative Grid-Number 1 Voltage	300	Volts
Plate Dissipation△	11	Watts
Screen Dissipation	2.5	Watts
DC Cathode Current	110	Milliamperes
Peak Cathode Current	400	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	0.47	Megohms
Bulb Temperature at Hottest Point	220	C

BASING DIAGRAM

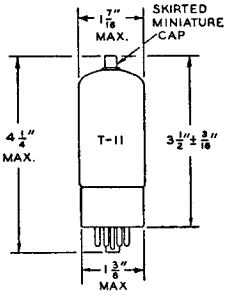


RETMA 6AM

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Heater
Pin 3—No Connection
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates
Cap —Plate
Pin 1 omitted on Base Number B6-122.

PHYSICAL DIMENSIONS



T-11 Version

T-12 version is identical except that the maximum bulb diameter is 1 9/16 inches.

GENERAL ELECTRIC

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	60	250	Volts
Screen Voltage	150	150	Volts
Grid-Number 1 Voltage	0¶	−22.5	Volts
Plate Resistance, approximate	—	14500	Ohms
Transconductance	—	5900	Micromhos
Plate Current	260	57	Milliamperes
Screen Current	26	2.1	Milliamperes
Grid-Number 1 Voltage, approximate $I_b = 1.0$ Milliampere	—	−43	Volts
Triode Amplification Factor**	—	4.3	

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

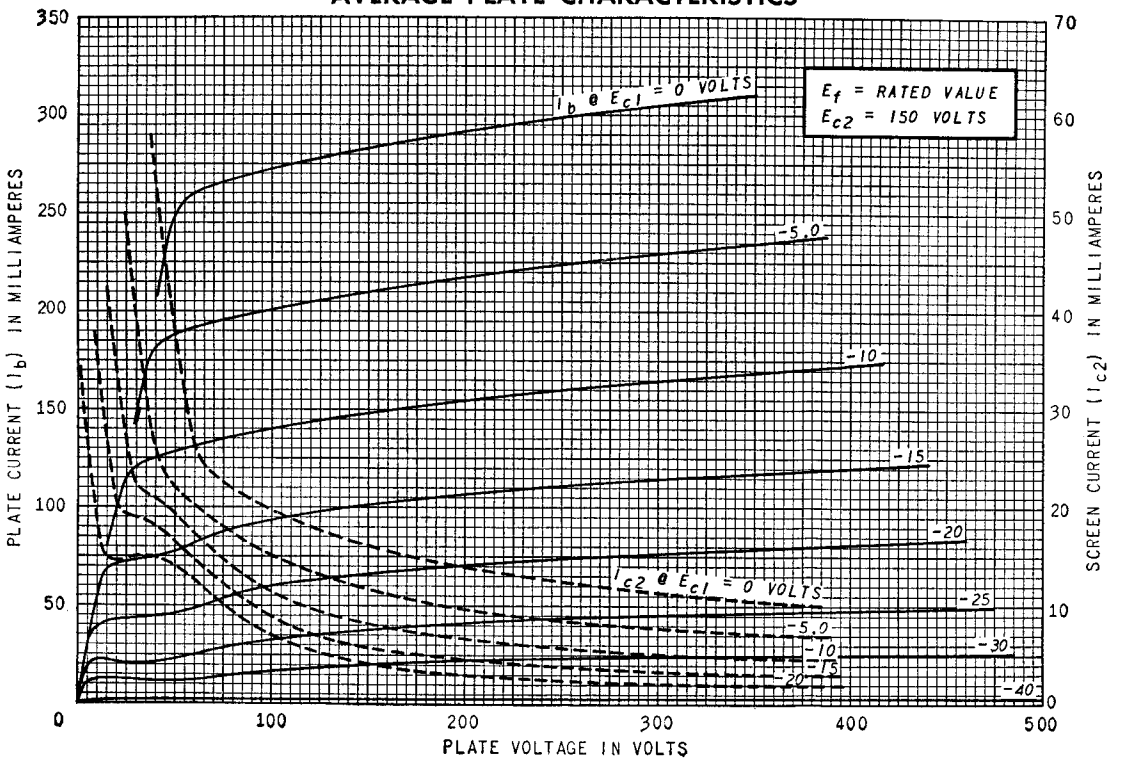
§ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

△In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

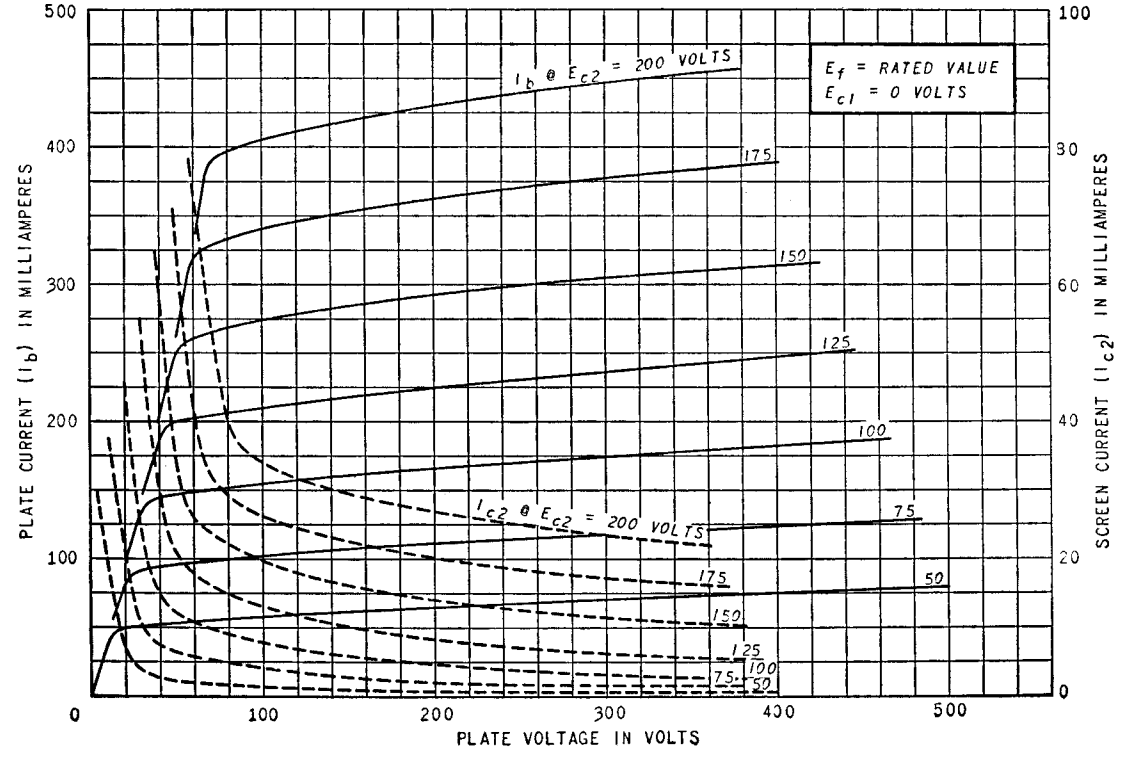
¶ Applied for short interval (two seconds maximum) so as not to damage tube.

**Triode connection (screen tied to plate) with $E_b = E_{c2} = 150$ volts and $E_{c1} = -22.5$ volts.

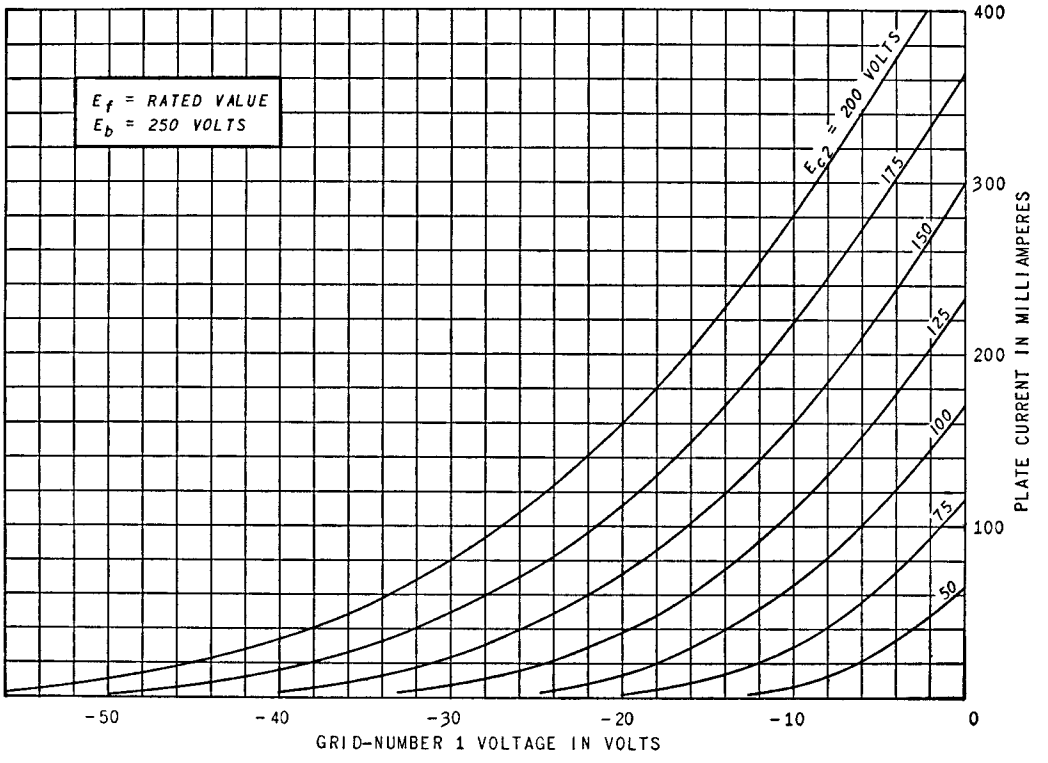
AVERAGE PLATE CHARACTERISTICS



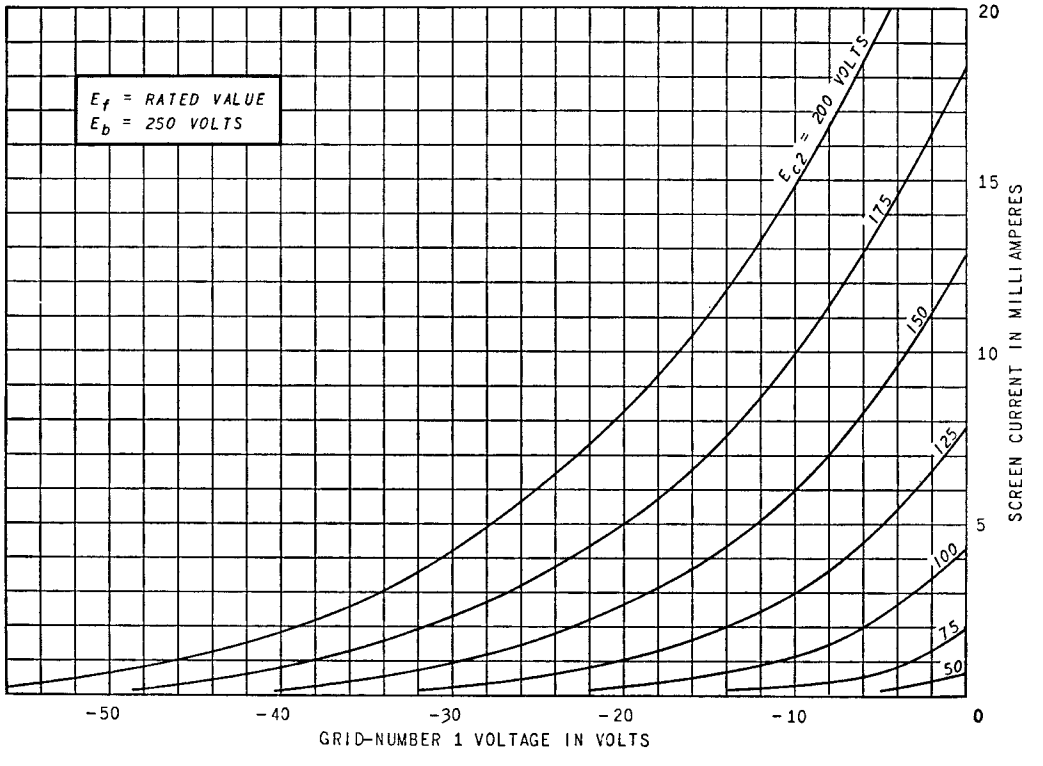
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

POWER-AMPLIFIER PENTODE

DESCRIPTION AND RATING

FOR AF POWER AMPLIFIER APPLICATIONS

The 6CW5 is a power-amplifier pentode designed for use in the audio-frequency power-output stage of television and radio receivers and in high-fidelity amplifiers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.76	Amperes
Direct Interelectrode Capacitances*		
Grid Number 1 to Plate	0.6	pf
Grid Number 1 to All	12	pf
Plate to All	6.0	pf

MECHANICAL

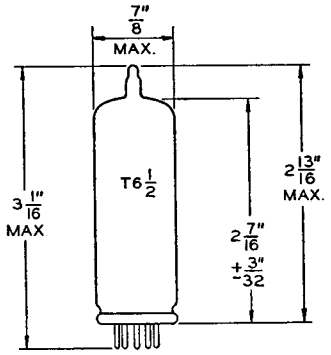
Mounting Position—Any		
Envelope—T-6½, Glass		
Base—E9-1, Small Button 9-Pin		
Outline Drawing—EIA 6-4		
Maximum Diameter	$\frac{7}{8}$	Inches
Maximum Over-all Length	$3\frac{1}{16}$	Inches
Maximum Seated Height	$2\frac{13}{16}$	Inches

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	250	Volts
Screen Voltage	200	Volts
Plate Dissipation	12	Watts
Screen Dissipation	1.75	Watts
Peak Screen Dissipation	6.0	Watts
DC Cathode Current	100	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode		
DC Component	150	Volts
Total DC and Peak	300	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	1.0	Megohms

PHYSICAL DIMENSIONS

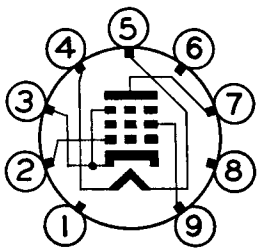


EIA 6-4

TERMINAL CONNECTIONS

Pin 1—Internal Connection
Pin 2—Grid Number 1
Pin 3—Cathode and Grid Number 3 (Suppressor)
Pin 4—Heater
Pin 5—Heater
Pin 6—Internal Connection
Pin 7—Plate
Pin 8—Internal Connection
Pin 9—Grid Number 2 (Screen)

BASING DIAGRAMS



EIA 9CV

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	170	Volts	Plate Resistance, approximate	23000	Ohms
Screen Voltage	170	Volts	Transconductance	10000	Micromhos
Grid-Number 1 Voltage	−12.5	Volts	Plate Current	70	Milliamperes
			Screen Current	5.0	Milliamperes

CLASS A_1 AMPLIFIER

Plate Voltage	170	Volts	Zero-Signal Screen Current	5.0	Milliamperes
Screen Voltage	170	Volts	Maximum-Signal Screen Current	22	Milliamperes
Grid-Number 1 Voltage	−12.5	Volts	Load Resistance	2400	Ohms
Peak AF Grid-Number 1 Voltage	9.9	Volts	Total Harmonic Distortion, approximate	10	Percent
Zero-Signal Plate Current	70	Milliamperes	Maximum-Signal Power Output	5.6	Watts
Maximum-Signal Plate Current	70	Milliamperes			

PUSH-PULL CLASS AB_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	250	Volts	Zero-Signal Screen Current	4.0	Milliamperes
Screen Voltage	200	Volts	Maximum-Signal Screen Current	23	Milliamperes
Grid-Number 1 Voltage	−18.5	Volts	Effective Load Resistance, Plate-to-Plate	3000	Ohms
Peak AF Grid-to-Grid Voltage	34	Volts	Total Harmonic Distortion	1.0	Percent
Zero-Signal Plate Current	91	Milliamperes	Maximum-Signal Power Output	25	Watts
Maximum-Signal Plate Current	180	Milliamperes			

*Without external shield.

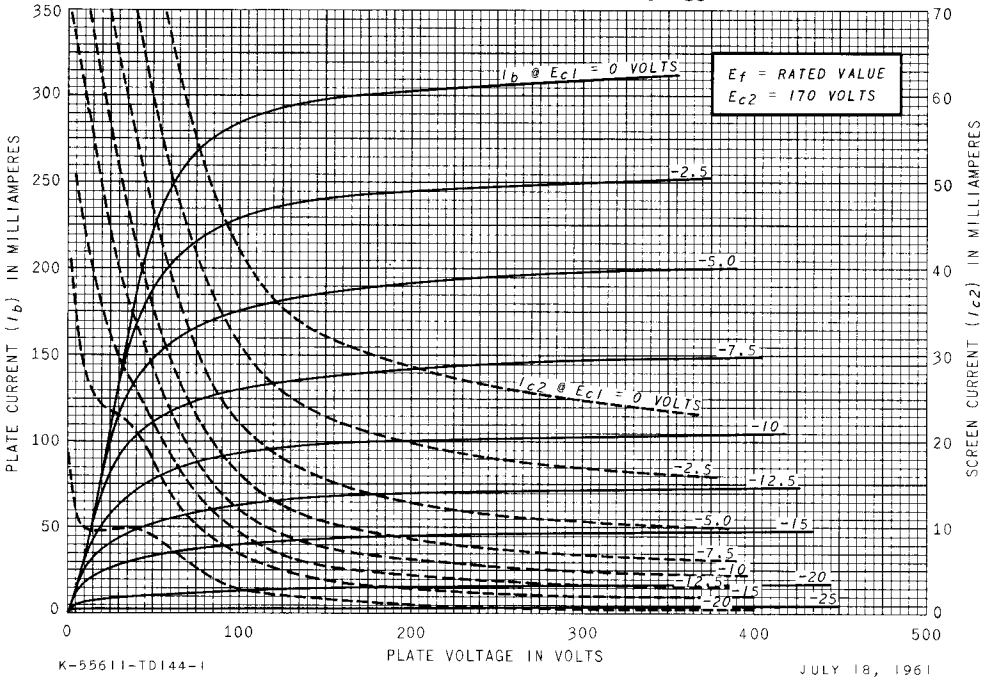
Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under normal conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube in average applications, making allowance for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube under normal operating conditions at the stated normal supply voltage.

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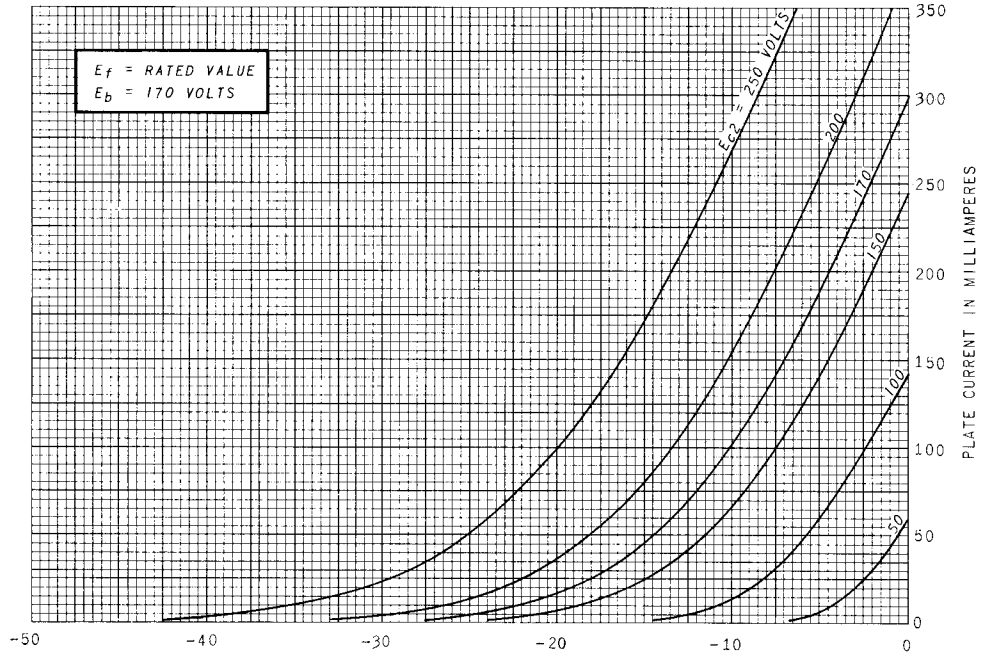
AVERAGE PLATE CHARACTERISTICS



K-5561I-TDI44-1

JULY 18, 1961

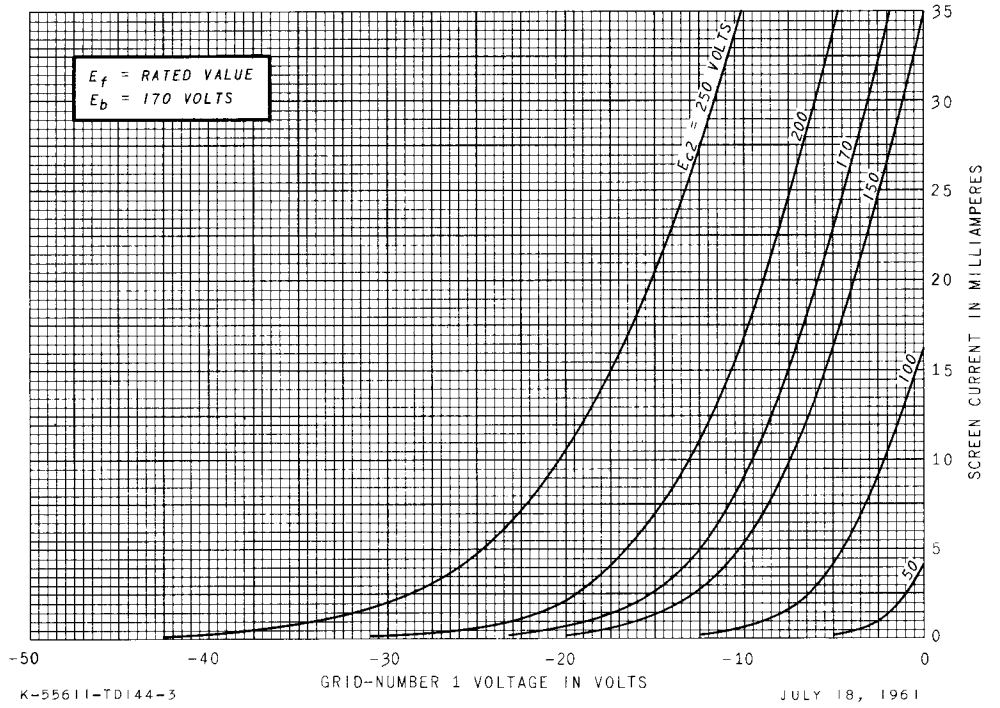
AVERAGE TRANSFER CHARACTERISTICS



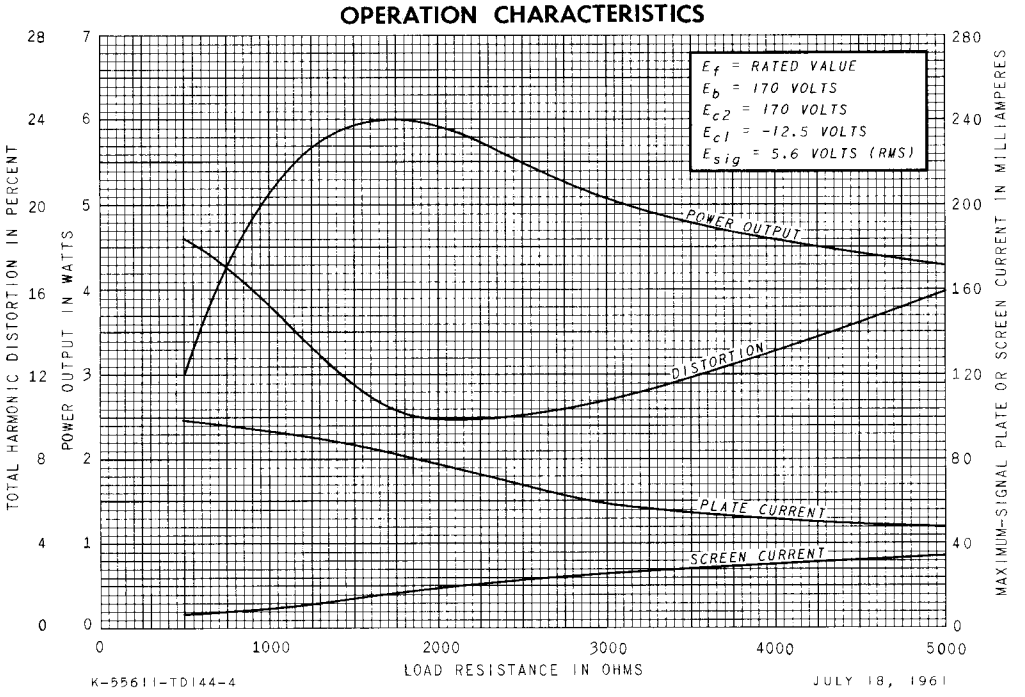
K-5561I-TDI44-2

JULY 18, 1961

AVERAGE TRANSFER CHARACTERISTICS



OPERATION CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Electronic TUBES

6CX8—8CX8

TRIODE-PENTODE

DESCRIPTION AND RATING

The 6CX8 is a miniature tube containing a sharp-cutoff pentode and a medium-mu triode in one envelope. The pentode section is intended primarily for use as a video amplifier. The triode section is suitable for a sweep oscillator, sync separator, sync amplifier, or sync clipper.

Except for heater ratings, the 8CX8 is identical to the 6CX8. In addition, it incorporates a controlled heater warm-up characteristic which makes it especially suited for use in television receivers with series-connected heaters.

GENERAL

ELECTRICAL	6CX8	8CX8	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	6.3 ± 10%	8.0	Volts
Heater Current	0.75	0.6 ± 6%	Amperes
Heater Warm-up Time*	....	11	Seconds
Direct Interelectrode Capacitances†			
Pentode Section			
Grid-Number 1 to Plate	0.06		μμf
Input	9.0		μμf
Output	4.4		μμf
Triode Section			
Grid to Plate	4.4		μμf
Input	2.2		μμf
Output	0.38		μμf
Pentode Grid-Number 1 to Triode Plate, maximum	.005		μμf
Triode Grid to Pentode Plate, maximum	.018		μμf
Pentode Plate to Triode Plate, maximum	0.17		μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1 Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, See Note on page 2

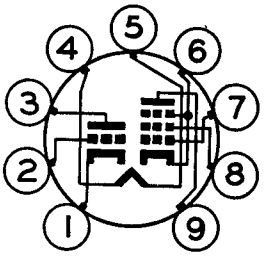
	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen-Supply Voltage	330	...	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	5.0	2.0	Watts
Screen Dissipation	1.1	...	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

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GENERAL ELECTRIC

Supersedes ET-T1387, dated 11-56

BASING DIAGRAM

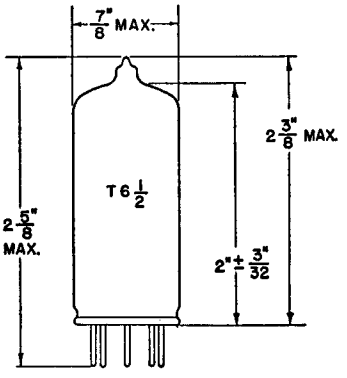


EIA 9DX

TERMINAL CONNECTIONS

Pin 1—Triode Cathode
Pin 2—Triode Grid
Pin 3—Triode Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 7—Pentode Grid Number 1
Pin 8—Pentode Grid Number 2 (Screen)
Pin 9—Pentode Plate

PHYSICAL DIMENSIONS



EIA 6-3

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

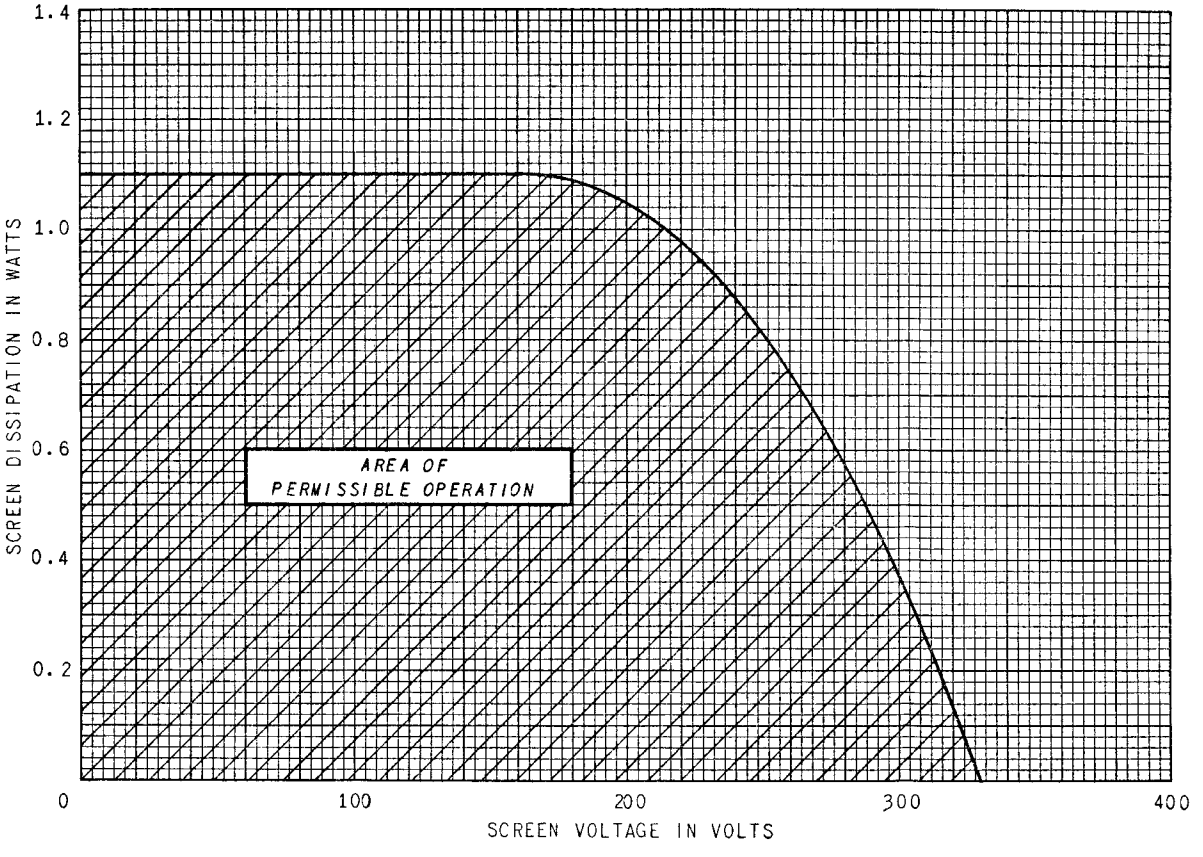
		Pentode Section	Triode Section	
Plate Voltage	40	200	150	Volts
Screen Voltage	125	125	....	Volts
Grid-Number 1 Voltage	0‡	.....	....	Volts
Cathode-Bias Resistor		68	150	Ohms
Amplification Factor		.....	40	
Plate Resistance, approximate		70000	8700	Ohms
Transconductance		10000	4600	Micromhos
Plate Current	40	24	9.2	Milliamperes
Screen Current	15.5	5.2	....	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes		−8.5	−5.0	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

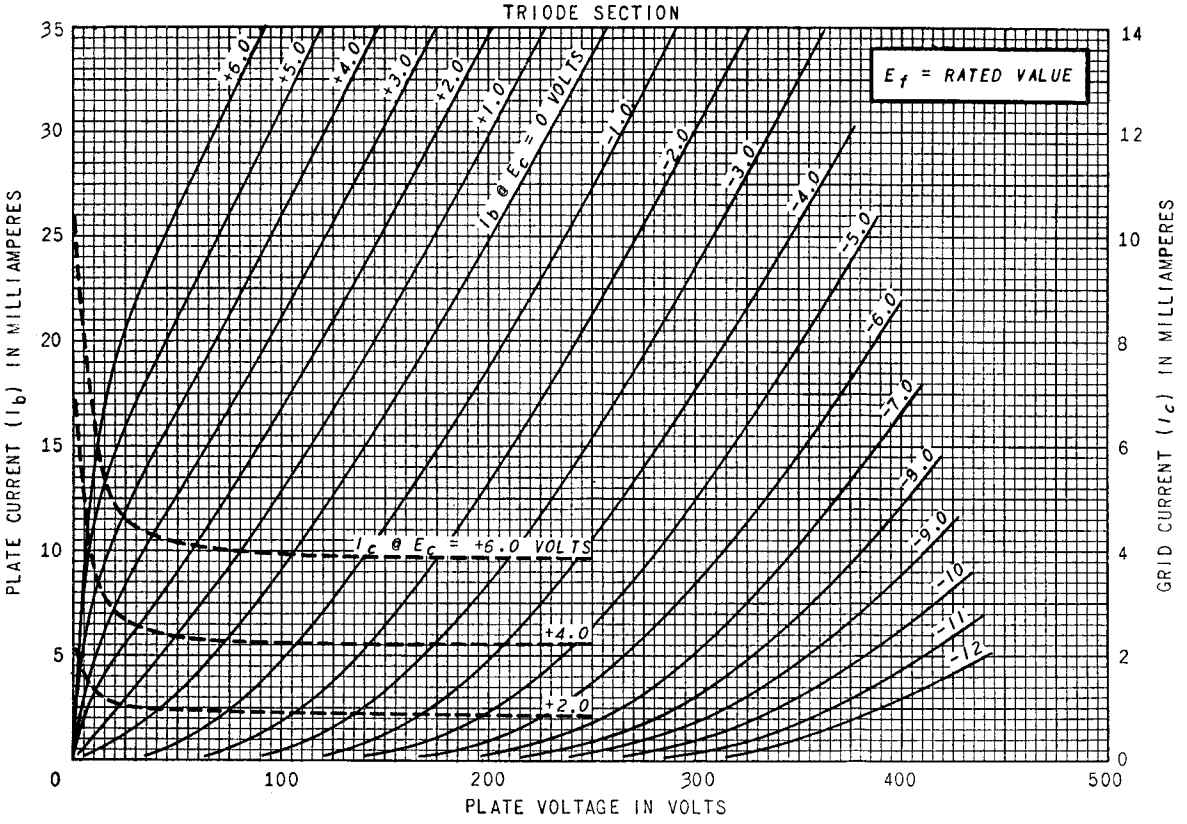
‡ Applied for short interval (two seconds maximum) so as not to damage tube.

SCREEN RATING CHART



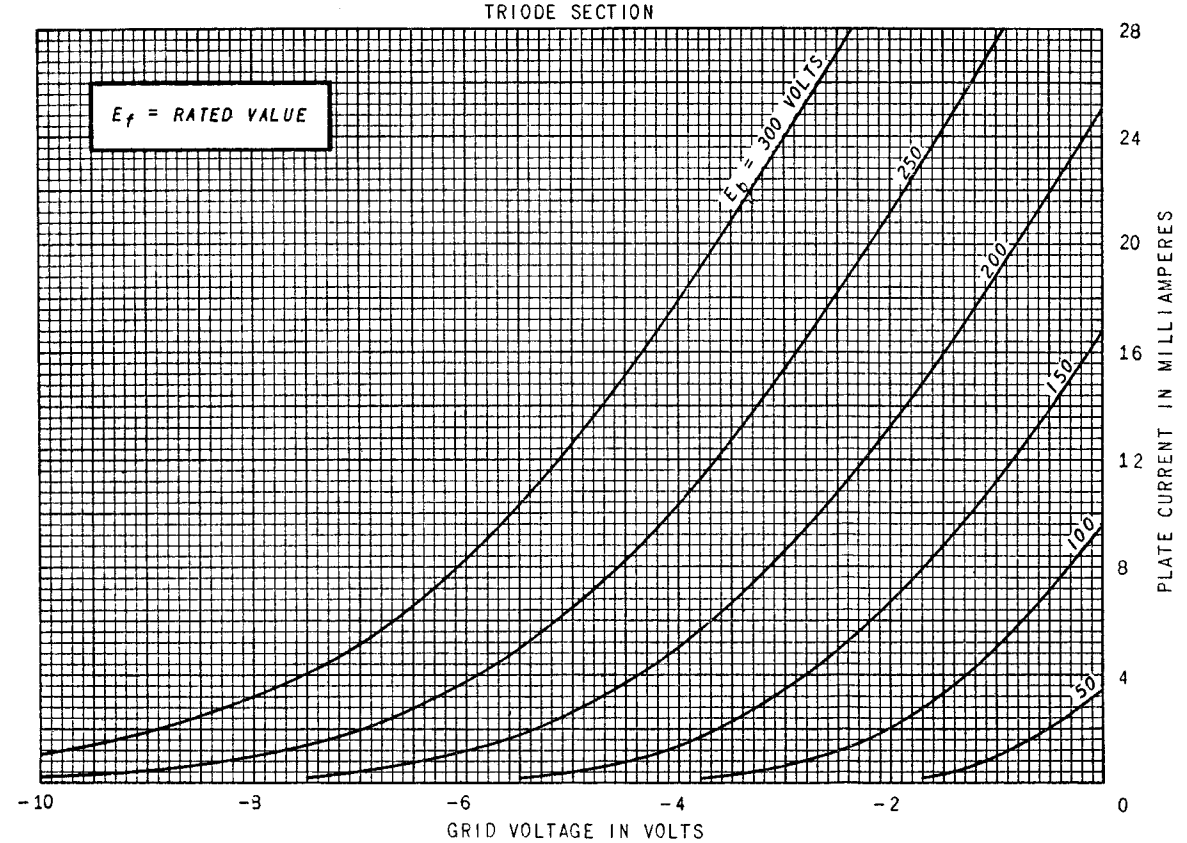
AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION

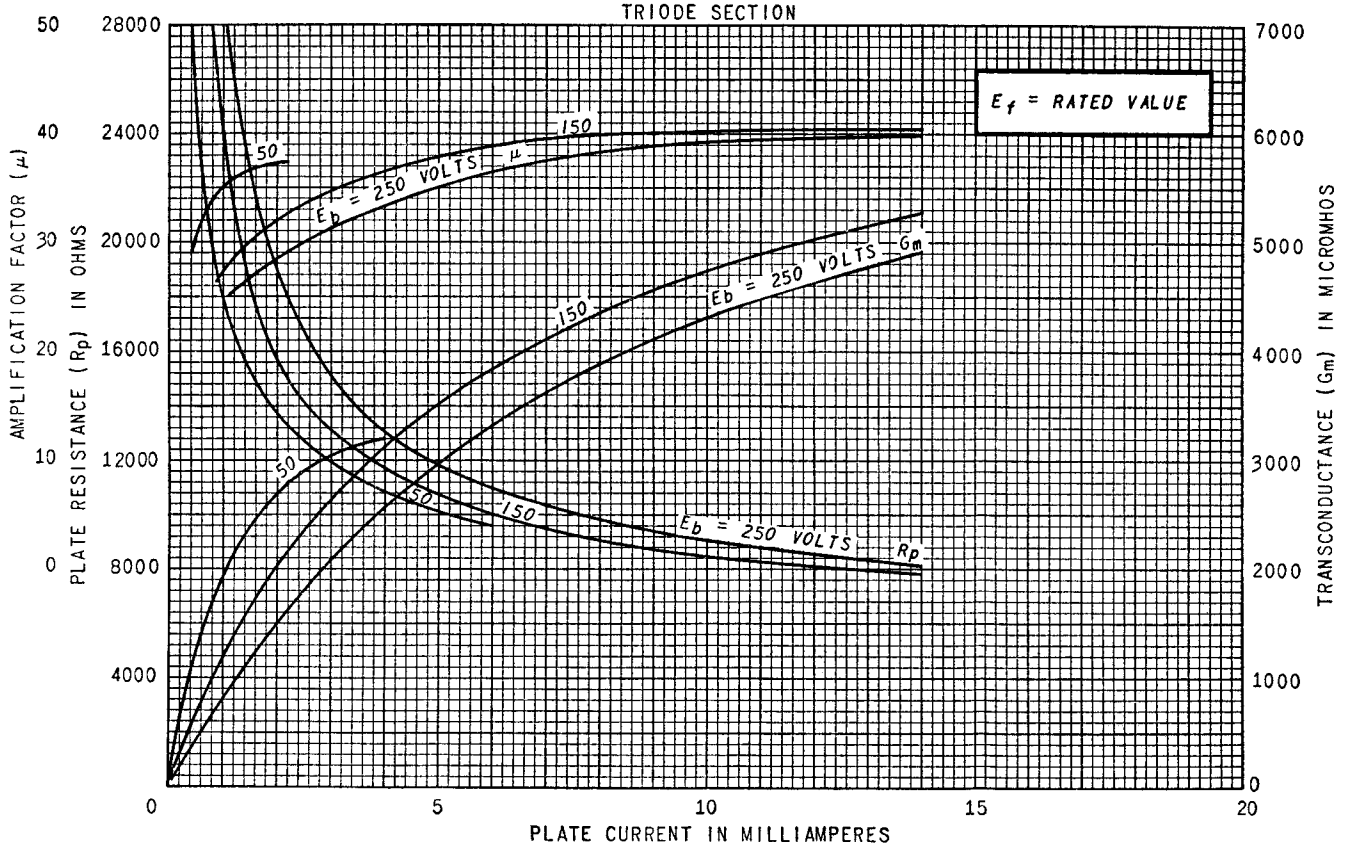


AVERAGE TRANSFER CHARACTERISTICS

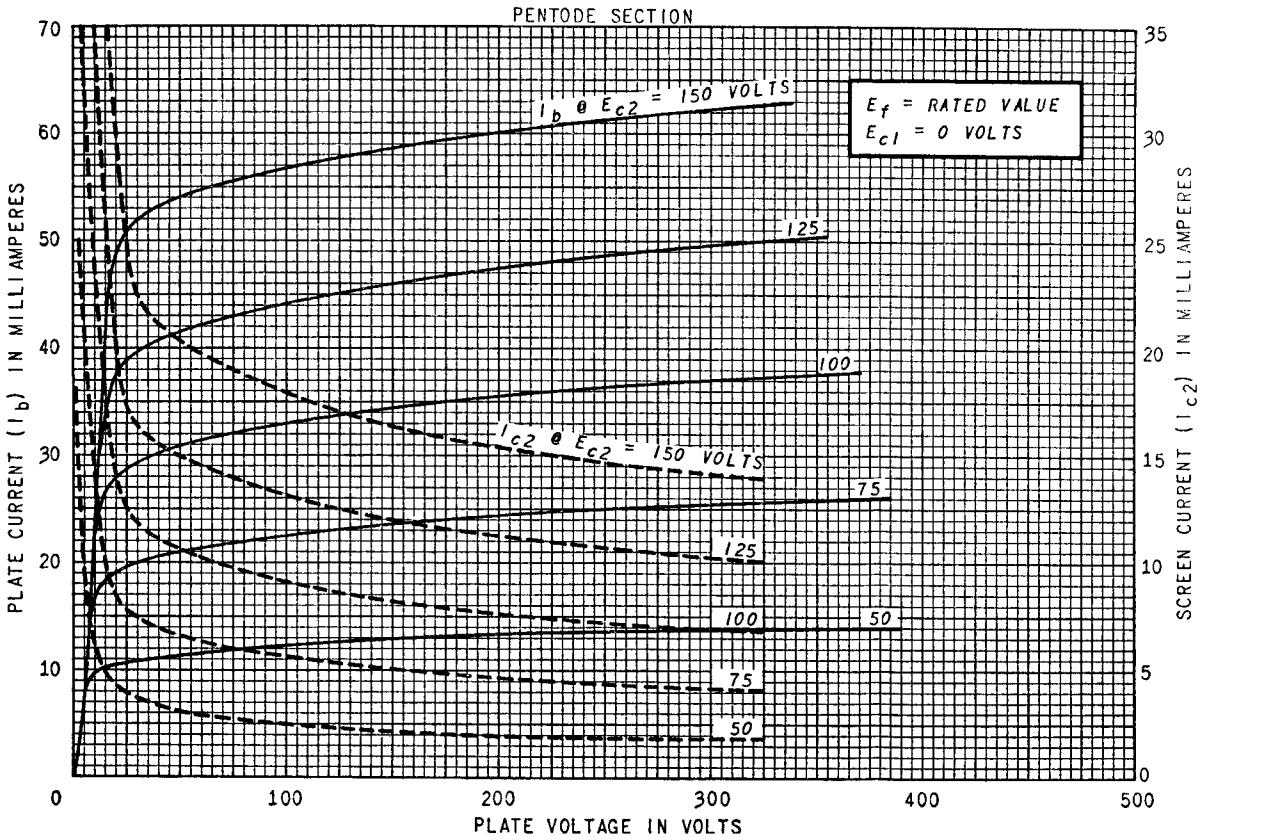
TRIODE SECTION



AVERAGE CHARACTERISTICS

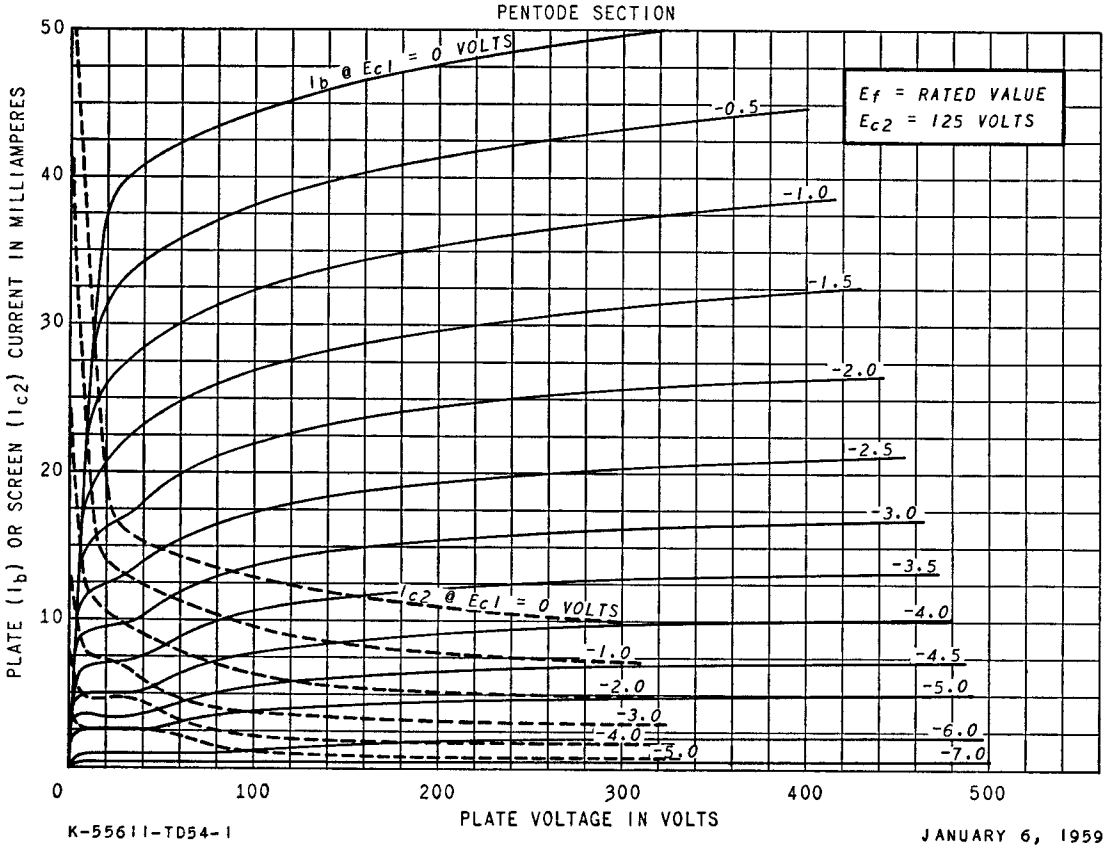


AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

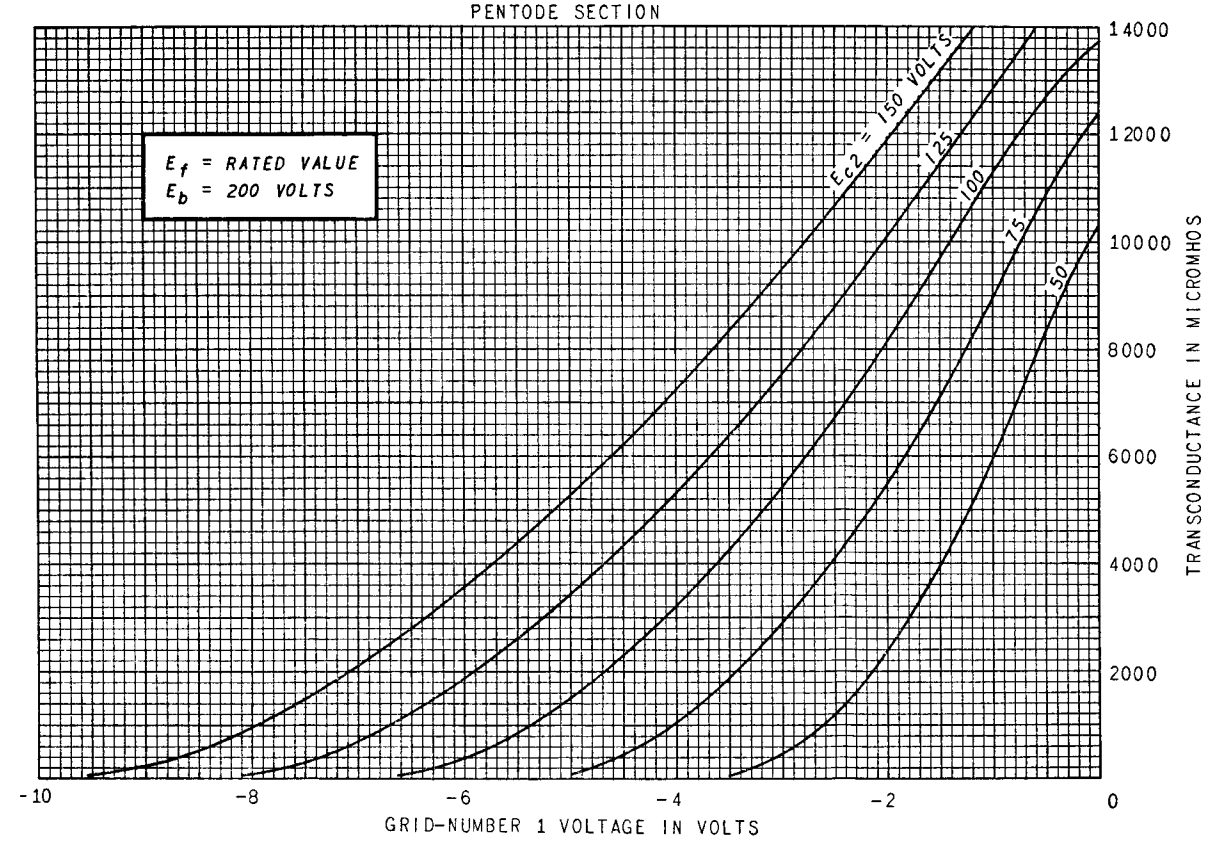


K-55611-TD54-1

JANUARY 6, 1959

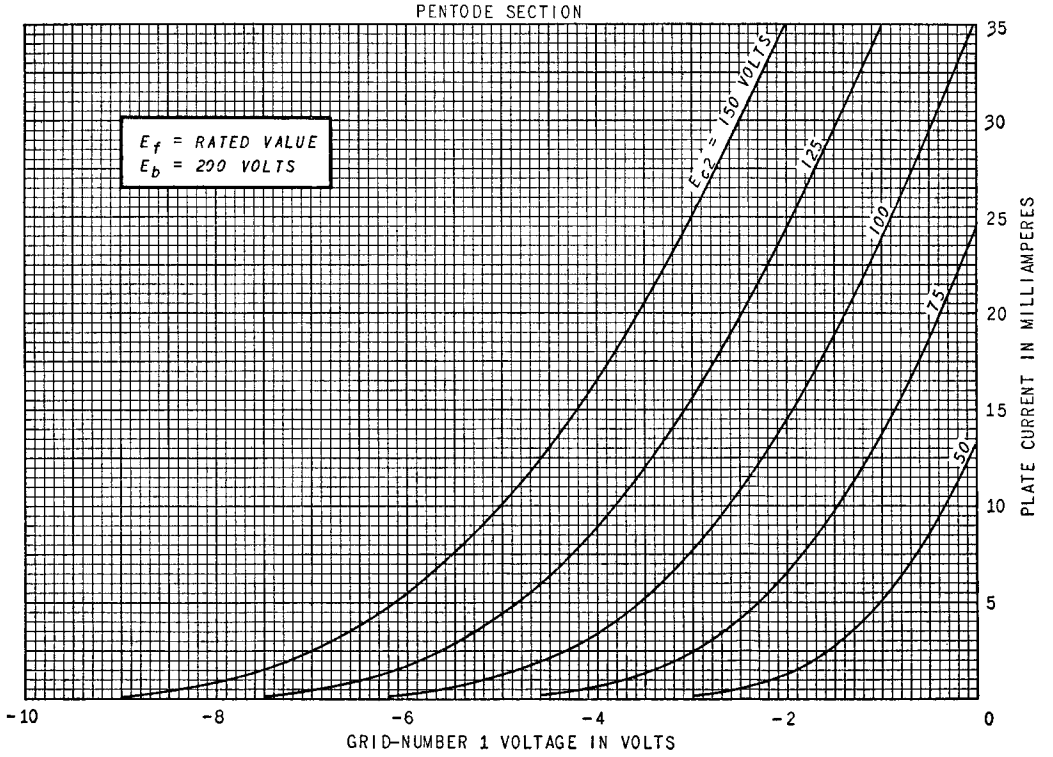
AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



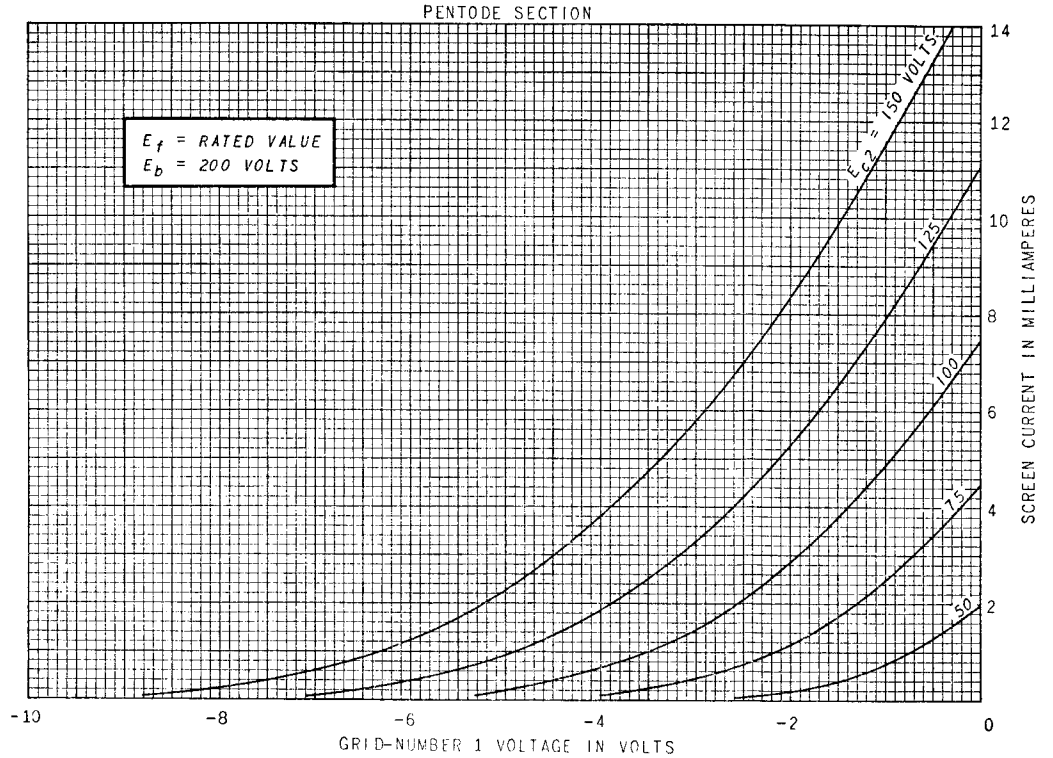
AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6CY5

TETRODE

FOR VHF RF AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6CY5 is a miniature sharp-cutoff tetrode designed for radio-frequency amplifier use in VHF television tuners. Features of the tube include high transconductance, high input impedance, and low interelectrode capacitances.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3 ±10%	Volts
Heater Current	0.2	Amperes
Direct Interelectrode Capacitances*		
Grid-Number 1 to Plate	0.03	μμf
Input	4.5	μμf
Output	3.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

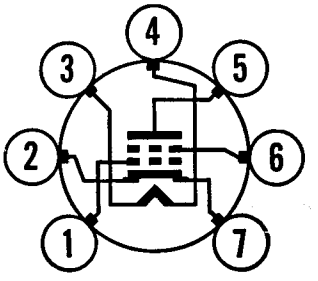
Plate Voltage	180	Volts
Screen-Supply Voltage	180	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	2.0	Watts
Screen Dissipation	0.5	Watts
DC Cathode Current	20	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	100	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

BASING DIAGRAM

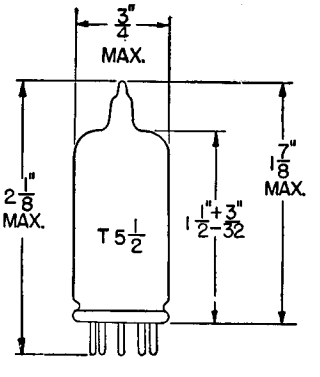


EIA 7EW

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode and Internal Shield
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Cathode and Internal Shield

PHYSICAL DIMENSIONS



EIA 5-2

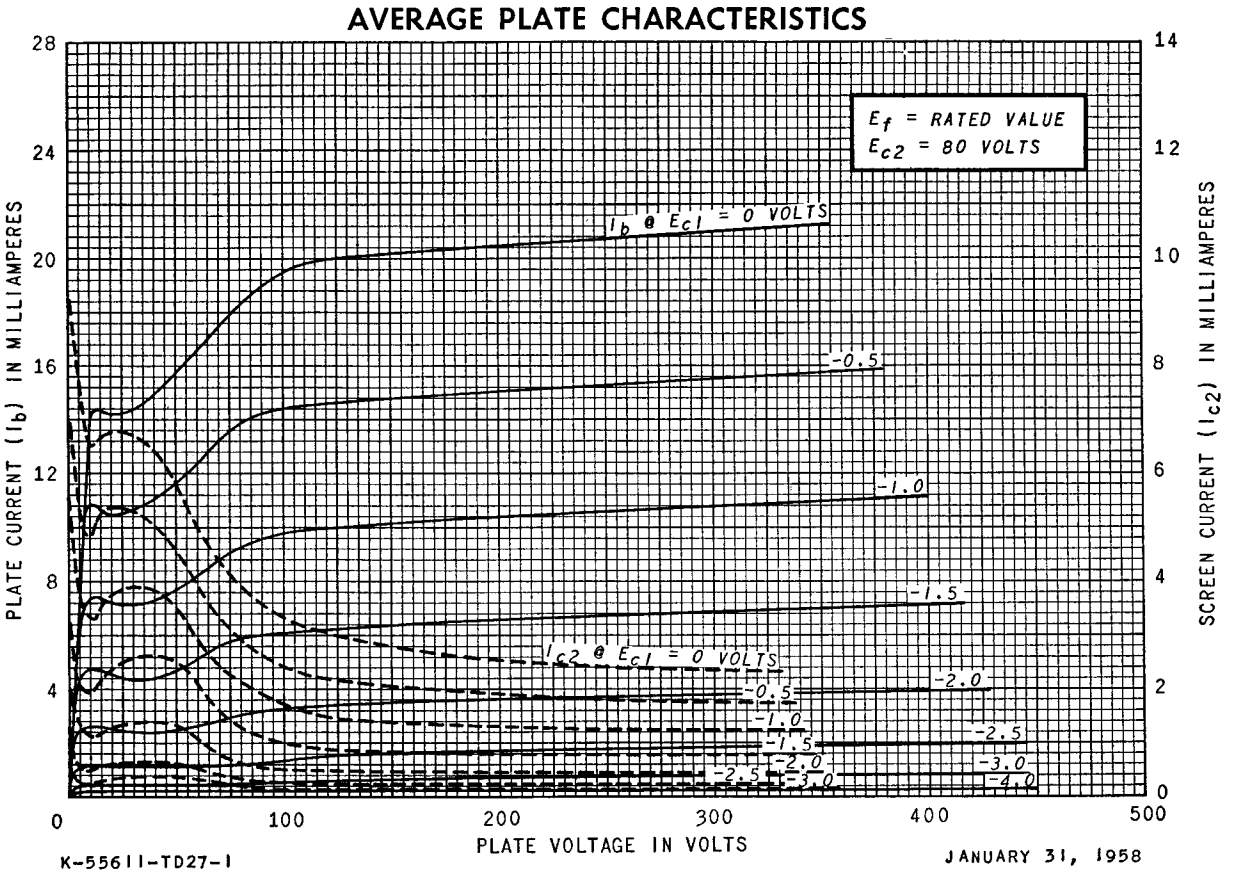
GENERAL ELECTRIC

CHARACTERISTICS AND TYPICAL OPERATION

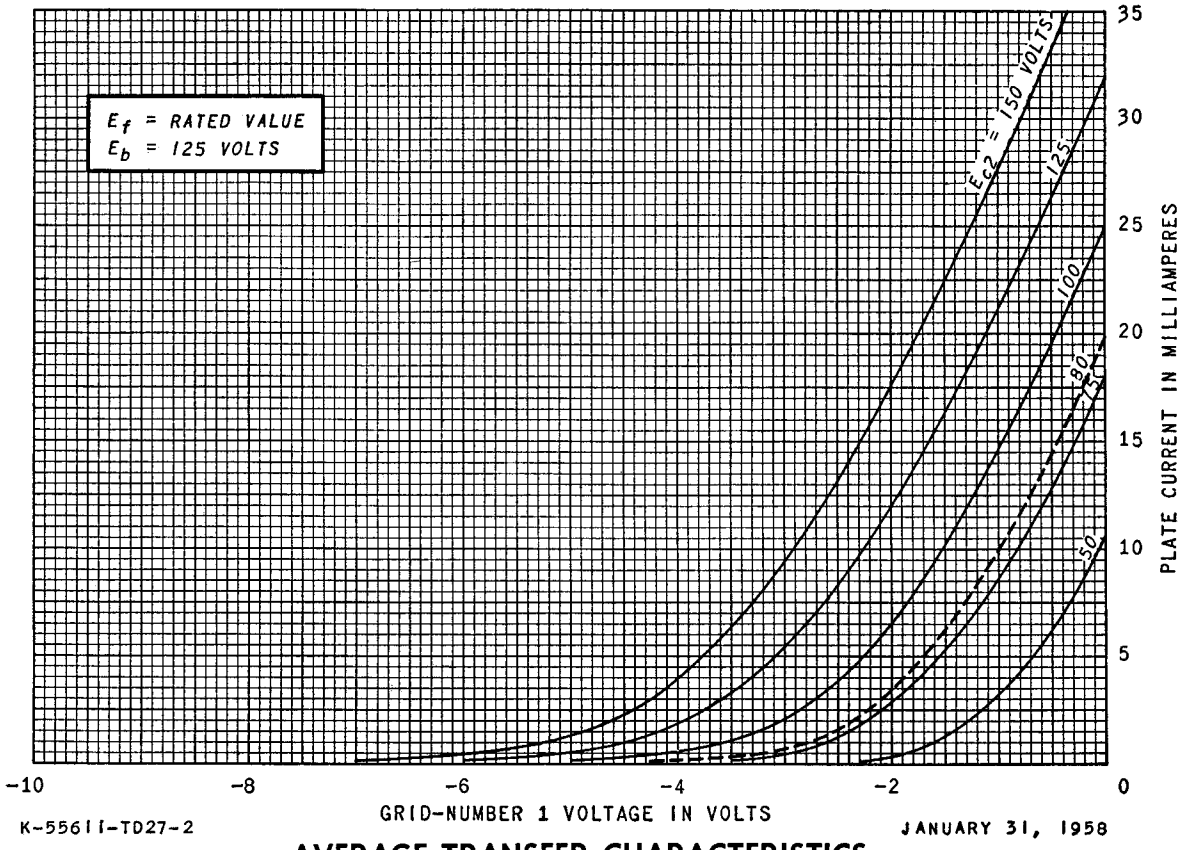
AVERAGE CHARACTERISTICS

Plate Voltage	125	Volts
Screen Voltage	80	Volts
Grid-Number 1 Voltage	−1.0	Volts
Plate Resistance, approximate	100000	Ohms
Transconductance	8000	Micromhos
Plate Current	10	Milliamperes
Screen Current	1.5	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 20 Microamperes	−6	Volts

* With External Shield (EIA 316) connected to Cathode.



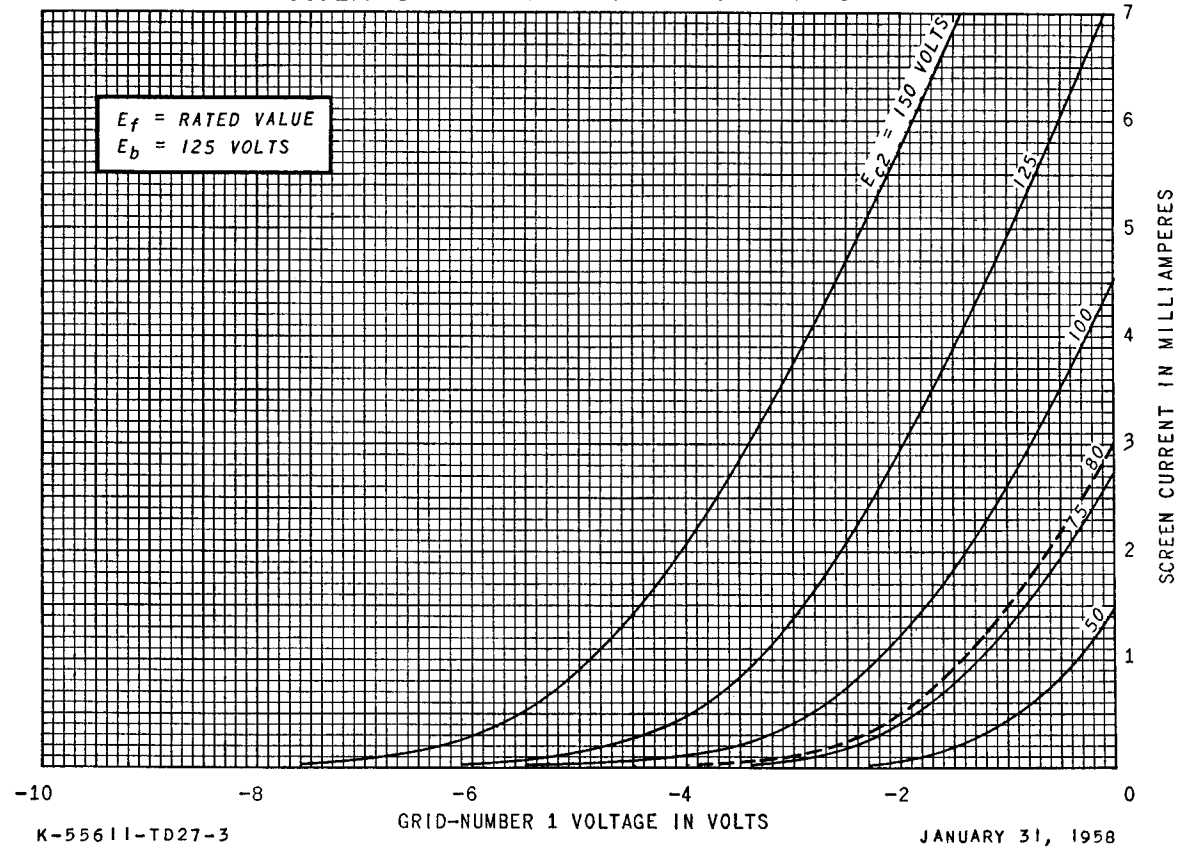
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD27-2

JANUARY 31, 1958

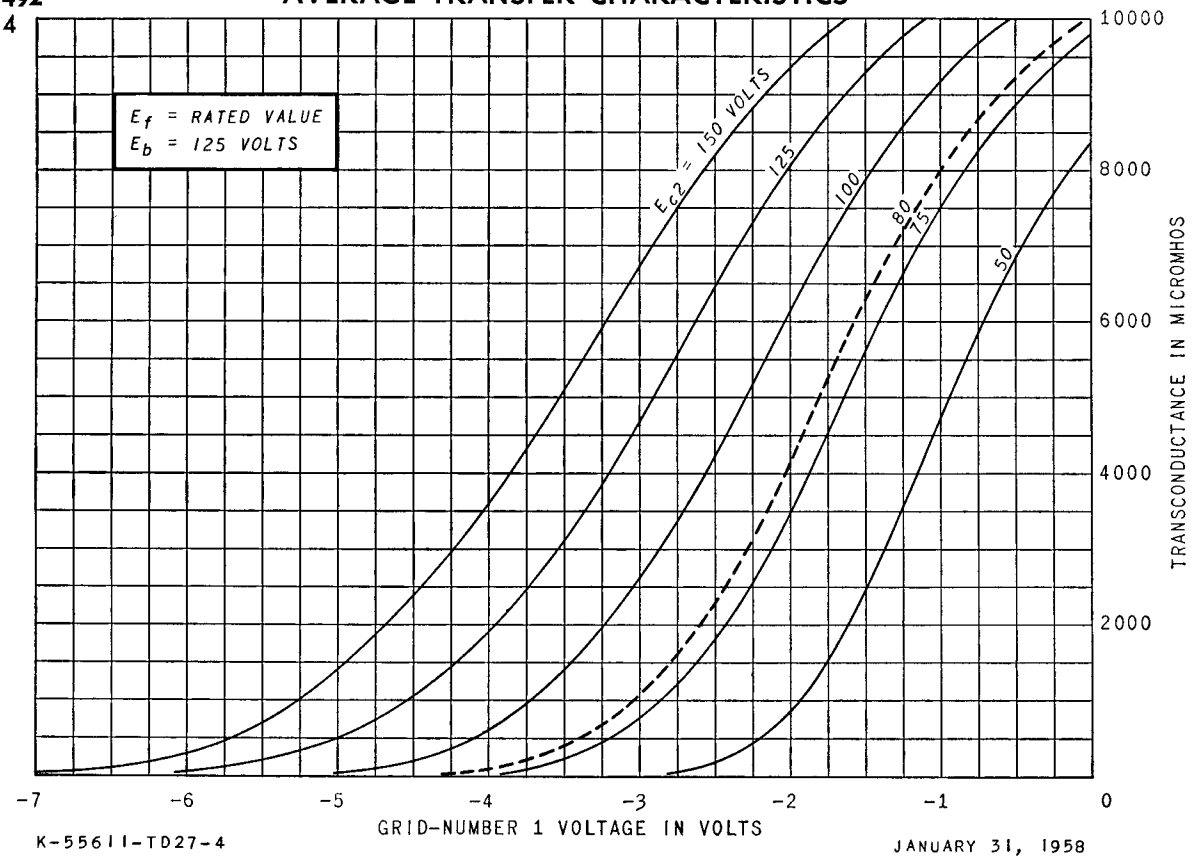
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD27-3

JANUARY 31, 1958

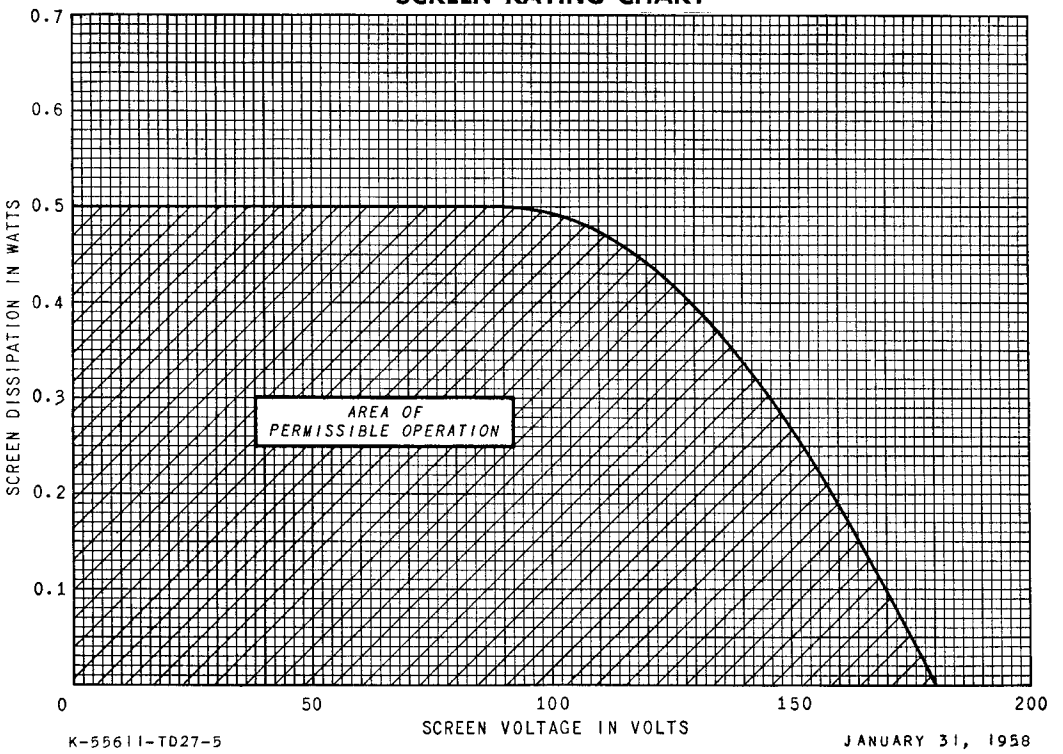
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD27-4

JANUARY 31, 1958

SCREEN RATING CHART



K-55611-TD27-5

JANUARY 31, 1958

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Electronic TUBES

6CY7—8CY7

DISSIMILAR DOUBLE TRIODE

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6CY7 is a miniature tube which contains two dissimilar triodes in one envelope. The tube is intended for use as a combined vertical-deflection oscillator and amplifier in television receivers.

Except for heater ratings, the 8CY7 is identical to the 6CY7. In addition, the 8CY7 incorporates a controlled heater warm-up characteristic which makes it especially suited for use in television receivers that employ series-connected heaters.

GENERAL

ELECTRICAL

	6CY7	8CY7	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	6.3±10%	7.9	Volts
Heater Current	0.75	0.6±6%	Amperes
Heater Warm-up Time*	.....	11	Seconds

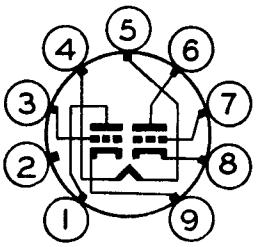
Direct Interelectrode Capacitances, approximate†

	Section 1	Section 2	
Grid to Plate	1.8	4.4	μμf
Input	1.5	5.0	μμf
Output	0.30	1.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

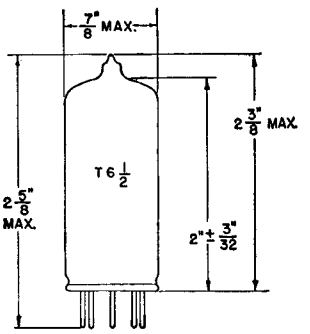


RETMA 9EF

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Internal Connection—Do not use
Pin 3—Grid (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Cathode (Section 2)

PHYSICAL DIMENSIONS



RETMA 6-3

GENERAL ELECTRIC

MAXIMUM RATINGS

	Vertical-Oscillator Service‡ (Section 1)	Vertical-Deflection Amplifier‡ (Section 2)	
DESIGN-MAXIMUM VALUES			
DC Plate Voltage	350	350	Volts
Peak Positive Pulse Plate Voltage	——	1800	Volts
Peak Negative Grid Voltage	400	250	Volts
Plate Dissipation	1.0	5.5§	Watts
DC Cathode Current	——	35	Milliamperes
Peak Cathode Current	——	120	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance			
With Fixed Bias	2.2	——	Megohms
With Cathode Bias	2.2	2.2	Megohms

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

	Section 1 (Oscillator)	Section 2 (Amplifier)		
AVERAGE CHARACTERISTICS				
Plate Voltage	250	60	150	Volts
Grid Voltage	−3.0	0	——	Volts
Cathode-Bias Resistor	——	——	620	Ohms
Amplification Factor	68	——	5.0	
Plate Resistance, approximate	52000	——	920	Ohms
Transconductance	1300	——	5400	Micromhos
Plate Current	1.2	80	30	Milliamperes
Plate Current, approximate				
Ec = −30 Volts	——	——	3.5	Milliamperes
Grid Voltage, approximate				
Ib = 200 Microamperes	——	——	−40	Volts
Grid Voltage, approximate				
Ib = 10 Microamperes	−5.5	——	——	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

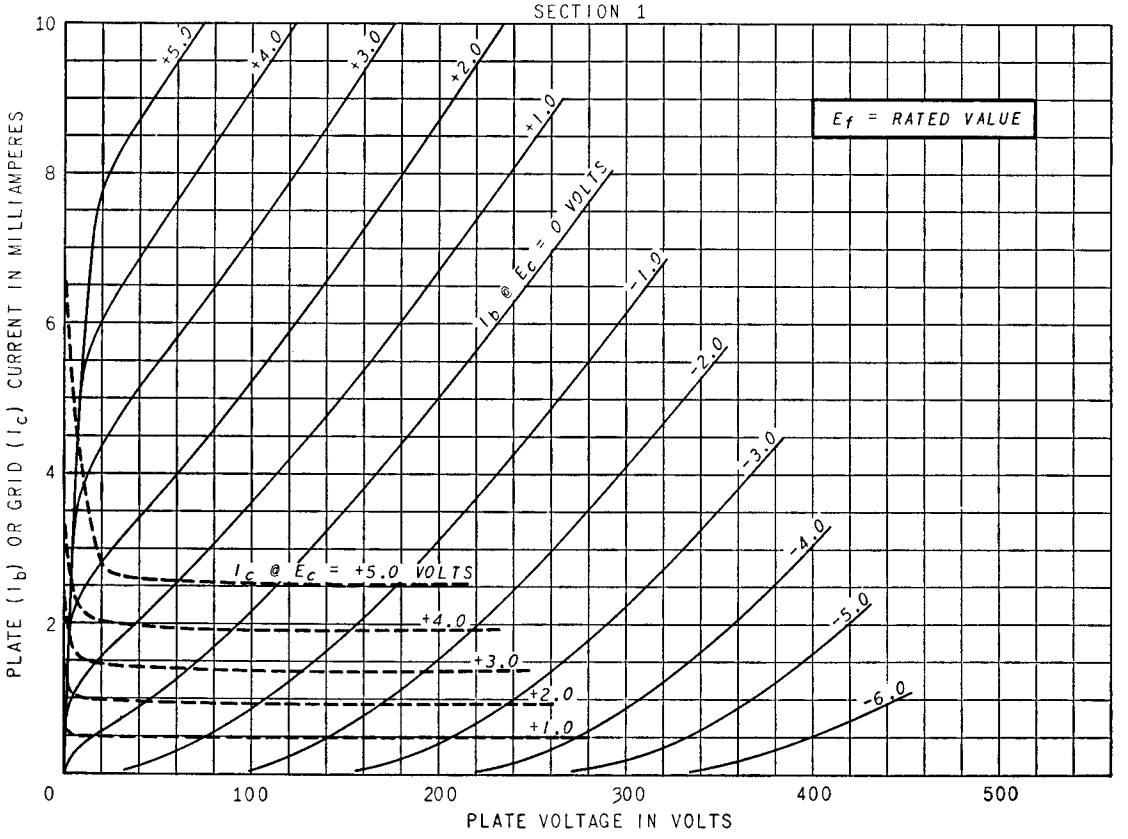
† Without external shield.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

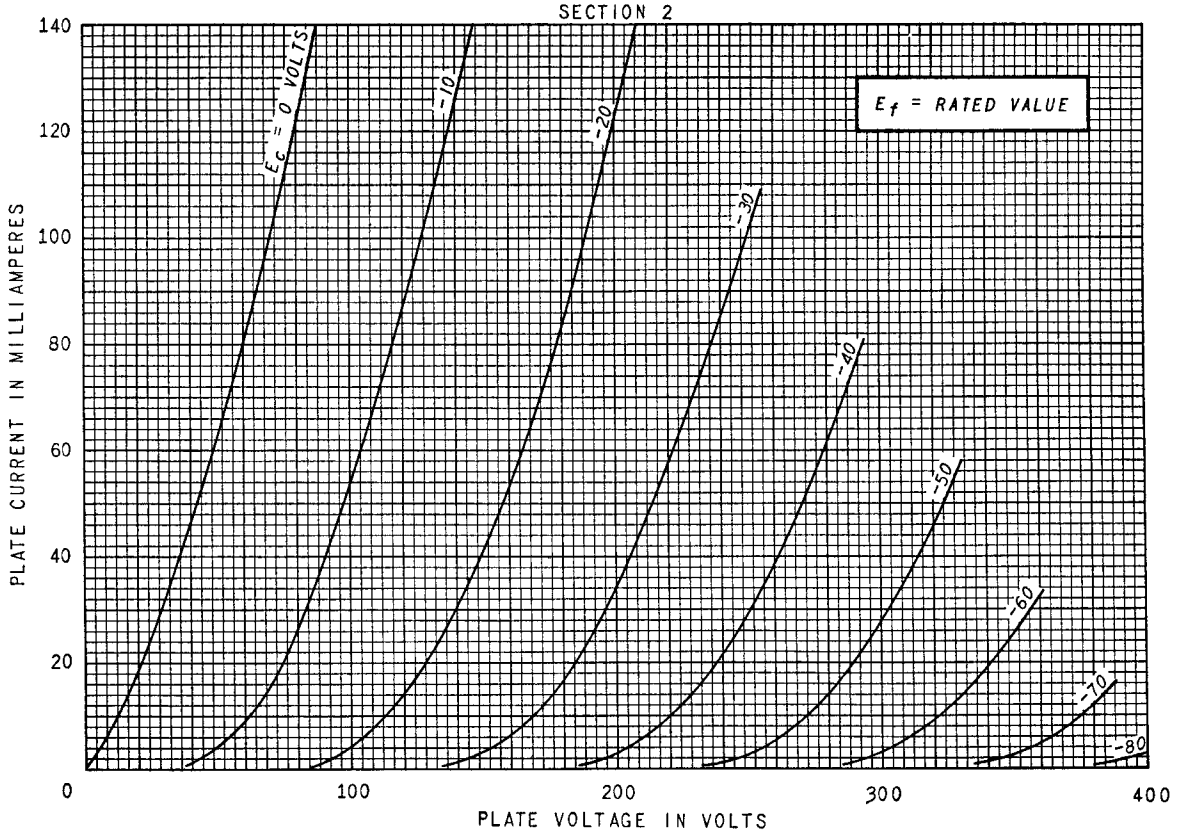
AVERAGE PLATE CHARACTERISTICS

SECTION 1



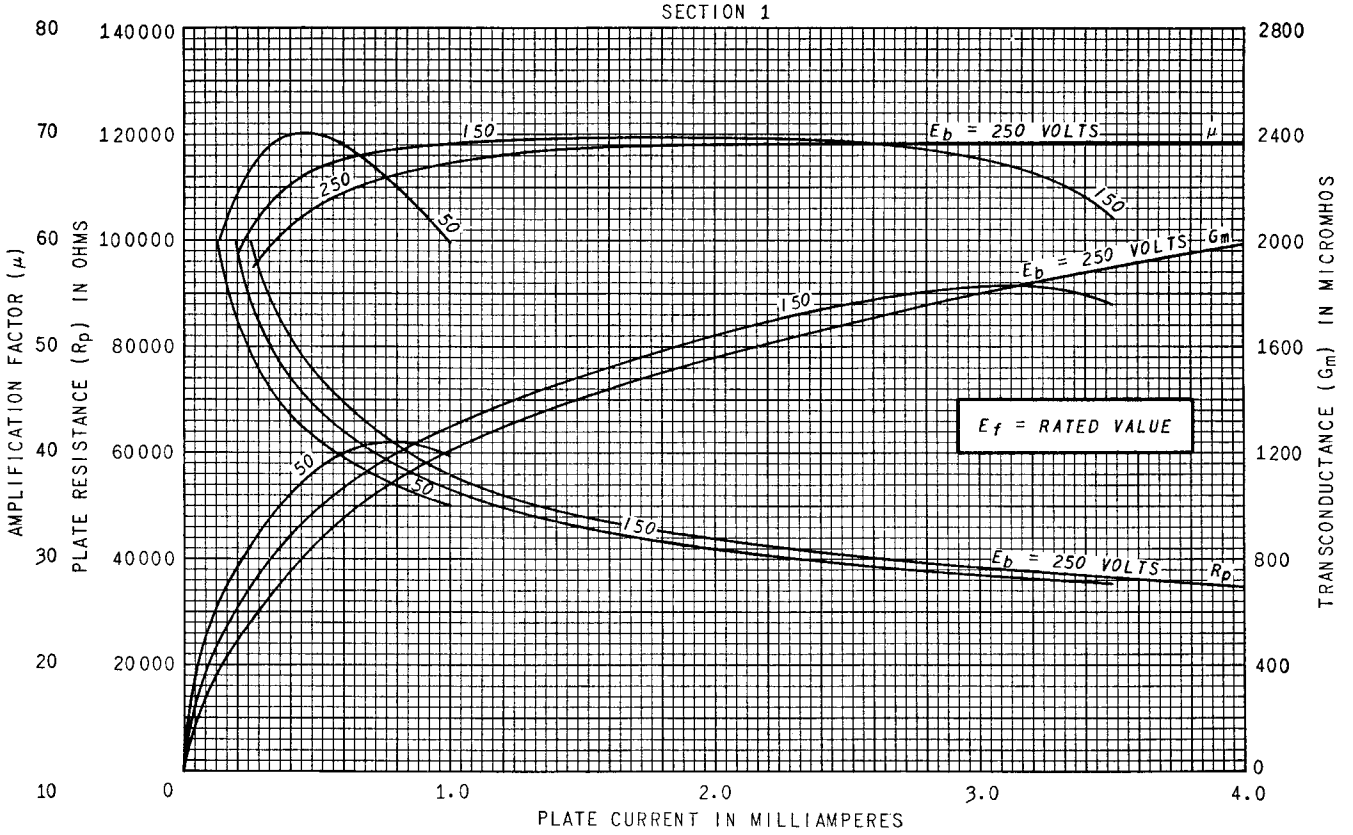
AVERAGE PLATE CHARACTERISTICS

SECTION 2



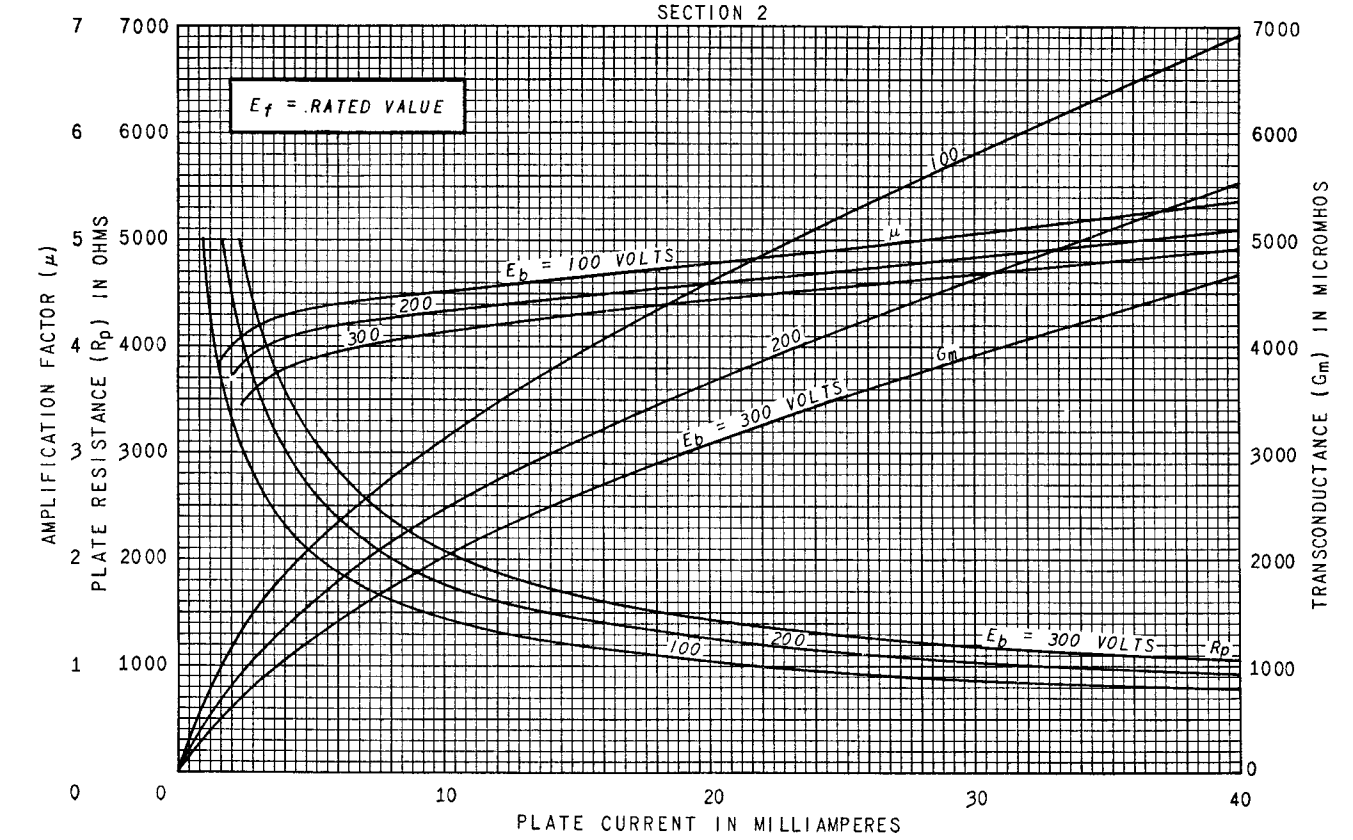
AVERAGE CHARACTERISTICS

SECTION 1



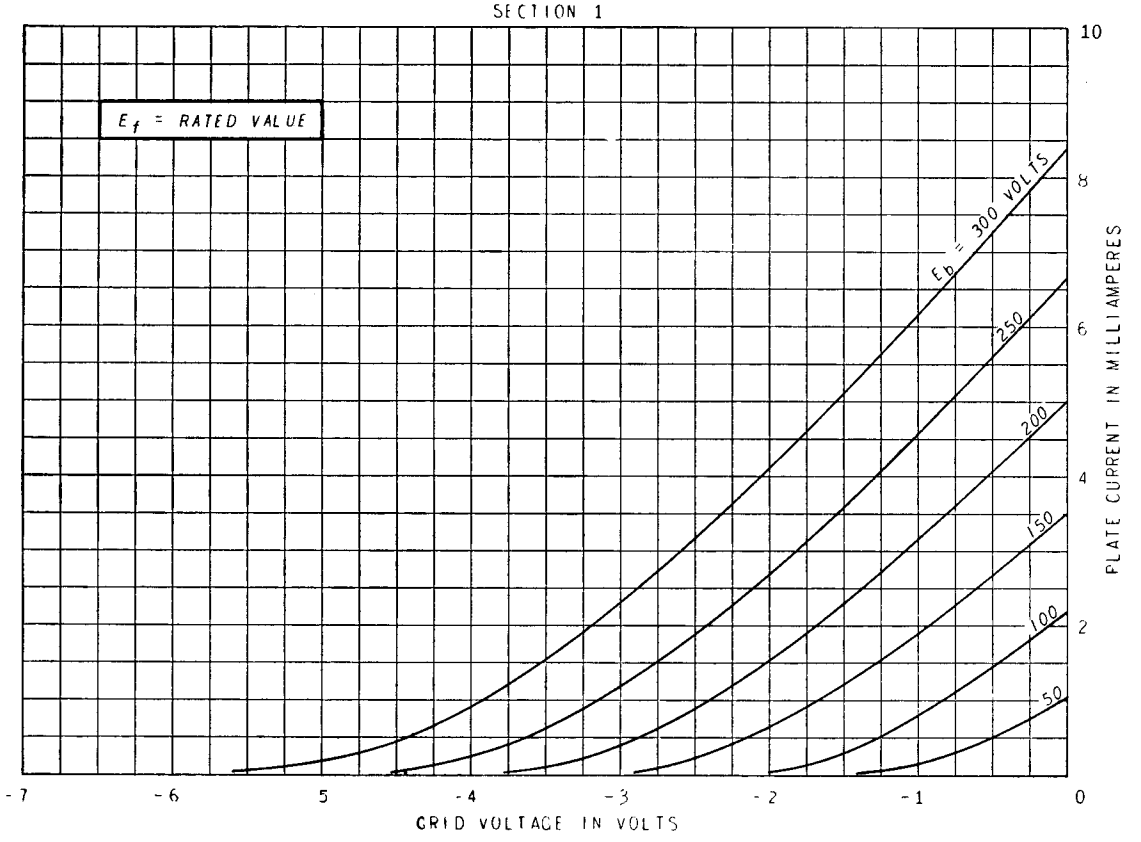
AVERAGE CHARACTERISTICS

SECTION 2



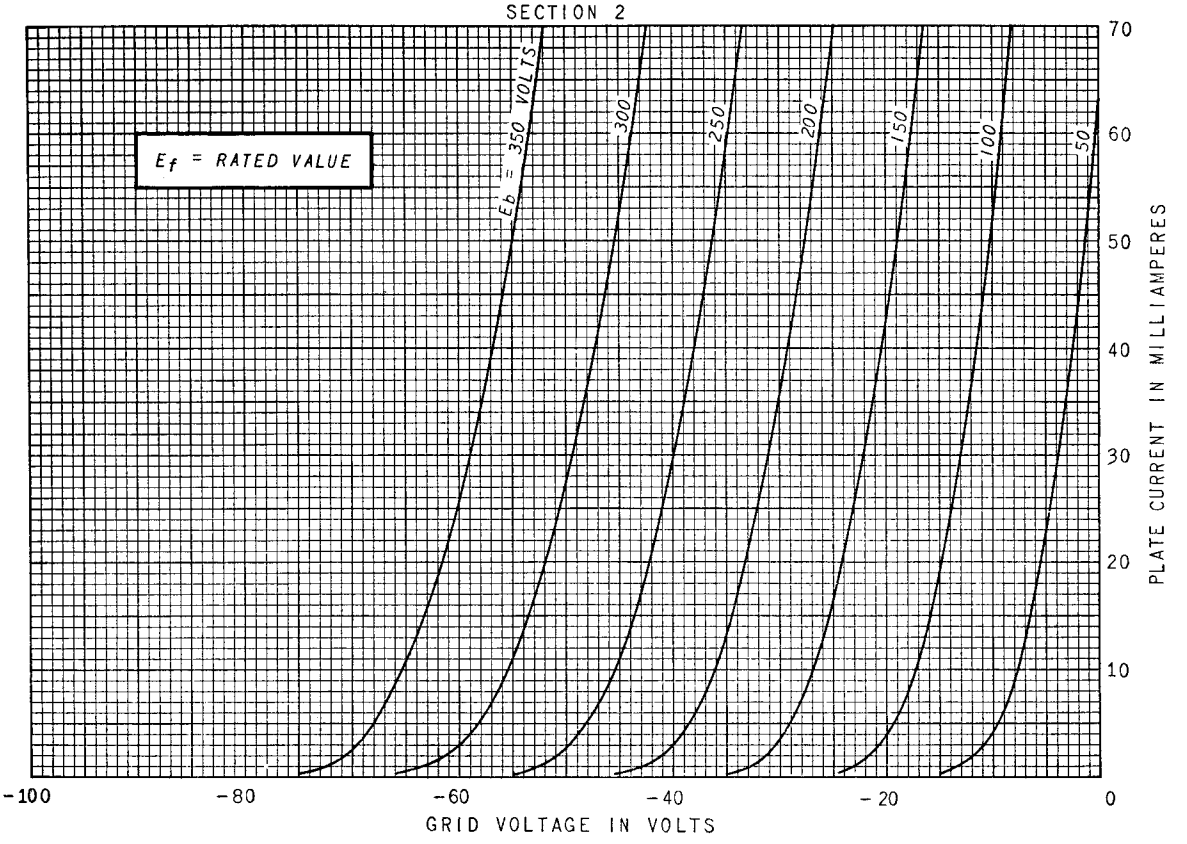
AVERAGE TRANSFER CHARACTERISTICS

SECTION 1



AVERAGE TRANSFER CHARACTERISTICS

SECTION 2



6DA4—12D4—17D4

DIODE

FOR TV DAMPING DIODE APPLICATIONS

DESCRIPTION AND RATING

The 6DA4 is a single heater-cathode type diode for service as the damping diode in the horizontal-deflection circuit of television receivers. It will withstand high pulse voltages between the heater and cathode and high inverse pulse voltages between the plate and cathode. These characteristics make the tube particularly useful in autotransformer deflection systems where high pulse voltages are applied to the cathode of the damper tube.

Except for heater ratings, the 12D4 and 17D4 are identical to the 6DA4. In addition, the 12D4 and 17D4 incorporate a controlled heater-warm-up characteristic which makes them especially suited for use in television receivers with series-connected heaters.

GENERAL

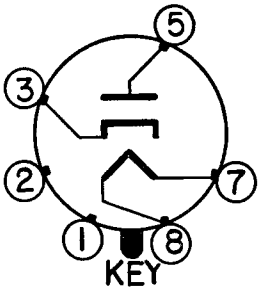
ELECTRICAL

Cathode—Coated Unipotential	6DA4	12D4	17D4	
Heater Voltage, AC or DC	6.3	12.6	16.8	Volts
Heater Current	1.2	0.6	0.45	Amperes
Heater Warm-up Time*	..	11	11	Seconds
Direct Interelectrode Capacitances, approximate†				
Cathode to Plate and Heater			8.0	μμf
Plate to Cathode and Heater			6.0	μμf
Heater to Cathode			3.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B5-82 or B6-8, Intermediate-Shell Octal
or B5-85 or B6-60, Short Intermediate-Shell Octal

BASING DIAGRAM



EIA 4CG

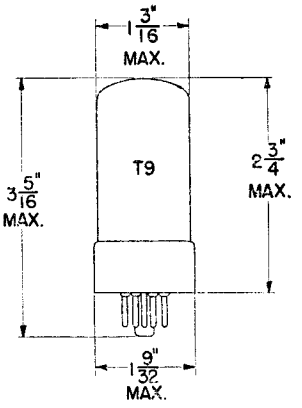
TERMINAL CONNECTIONS

Pin 1—Internal Connection‡
Pin 2—Internal Connection
Pin 3—Cathode
Pin 5—Plate
Pin 7—Heater
Pin 8—Heater

‡ Pin 1 omitted on B5-82 and B5-85 bases.

Socket terminals 1, 2, 4, and 6 should not be used.

PHYSICAL DIMENSIONS



EIA 9-11
OR 9-41

MAXIMUM RATINGS

TV DAMPER SERVICE§
DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	4400	Volts
Plate Dissipation	5.5	Watts
Steady-State Peak Plate Current	900	Milliamperes
DC Output Current	155	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	900	Volts
Total DC and Peak	4400	Volts

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

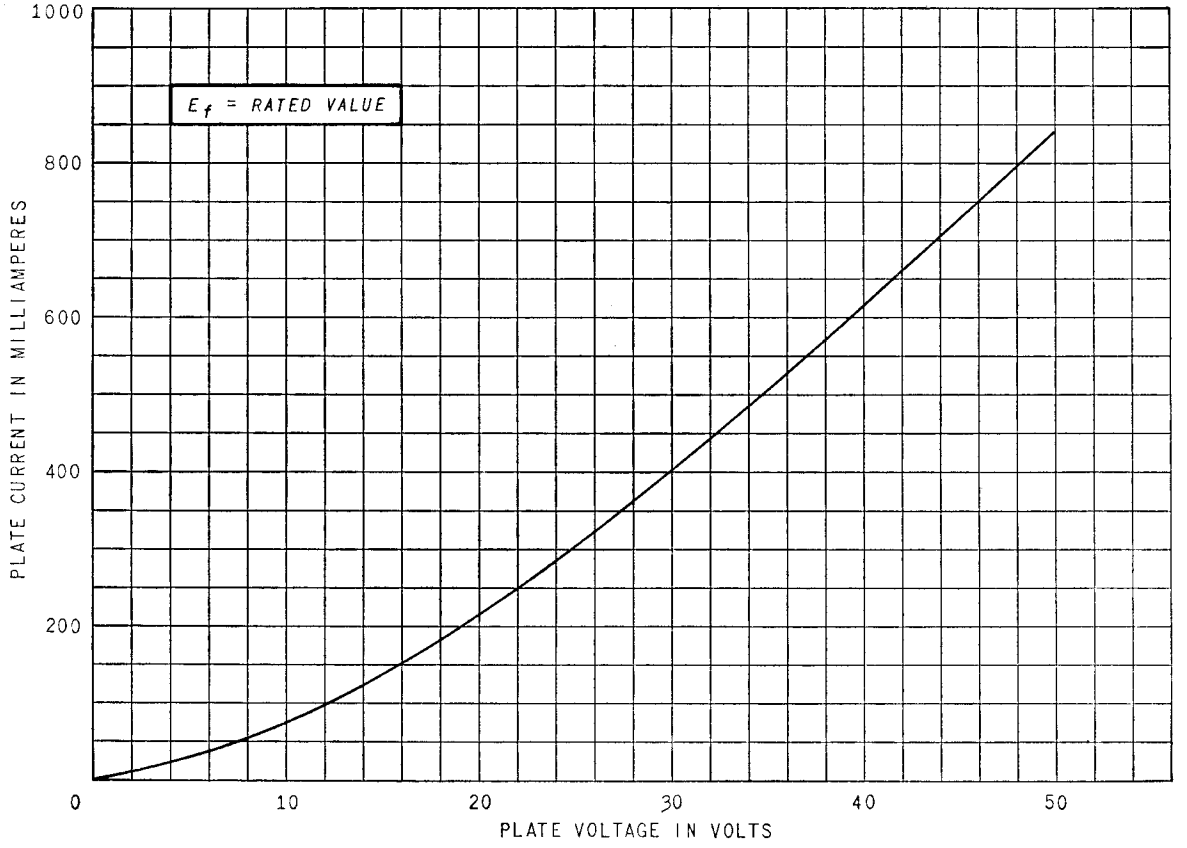
AVERAGE CHARACTERISTICS

Tube Voltage Drop		
I_b = 250 Milliamperes DC	22	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.
† Without external shield.
§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

Operation of this tube as a power rectifier is not recommended.

AVERAGE PLATE CHARACTERISTICS



Electronic TUBES

6DE4

DIODE

FOR TV DAMPING DIODE APPLICATIONS

DESCRIPTION AND RATING

The 6DE4 is a single heater-cathode-type diode designed for use as the damping diode in the horizontal-deflection circuit of television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	1.6	Amperes
Direct Interelectrode Capacitances, approximate*		
Cathode to Plate and Heater: k to (p+h)	11.5	μμf
Plate to Cathode and Heater: p to (k+h)	8.5	μμf
Heater to Cathode: (h to k)	4.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B5-85, Short Intermediate-Shell Octal 5-Pin

MAXIMUM RATINGS

TV DAMPER SERVICE—DESIGN-MAXIMUM VALUES†

Peak Inverse Plate Voltage	5000	Volts
Plate Dissipation	6.5	Watts
Steady-State Peak Plate Current	1100	Milliamperes
DC Output Current	175	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	900	Volts
Total DC and Peak	5000	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

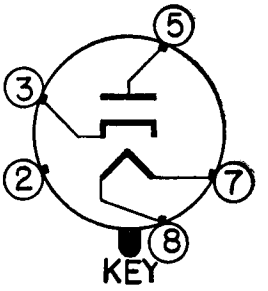
These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM



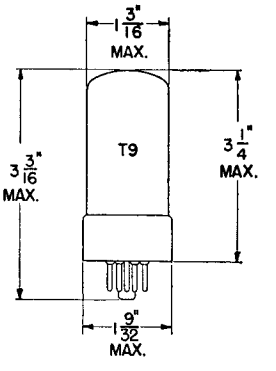
EIA 4CG

TERMINAL CONNECTIONS

Pin 2—Internal Connection—Do Not Use
Pin 3—Cathode
Pin 5—Plate
Pin 7—Heater
Pin 8—Heater

Socket terminals 1, 2, 4, and 6 should not be used.

PHYSICAL DIMENSIONS



EIA 9-44

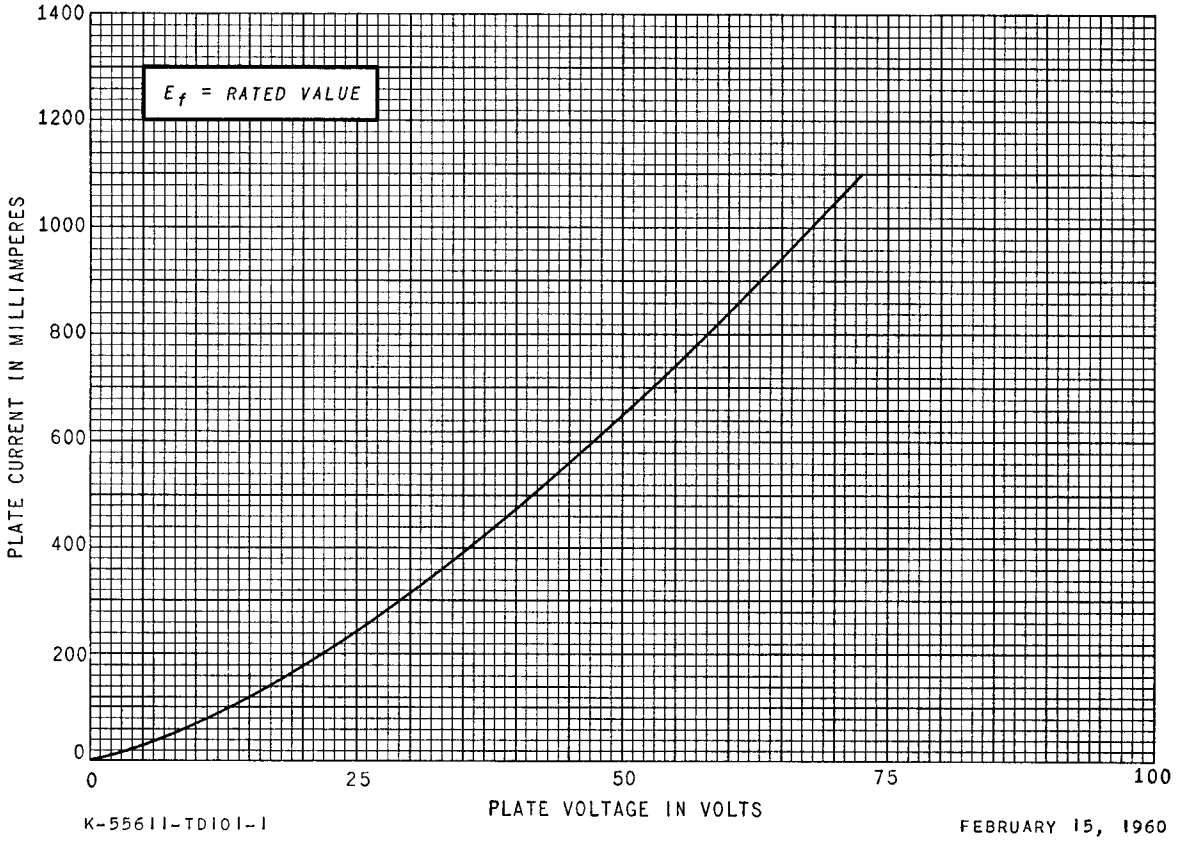
AVERAGE CHARACTERISTICS

Tube Voltage Drop
Ib = 350 Milliamperes DC . . . . . 32 Volts

* Without external shield.

† For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

AVERAGE PLATE CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6DE6

PENTODE

DESCRIPTION AND RATING

The 6DE6 is a miniature sharp-cutoff pentode designed especially for use as an intermediate-frequency amplifier in television receivers. The tube features high transconductance and relatively low interelectrode capacitances.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.3	Amperes

Direct Interelectrode Capacitances	With Shield*	Without Shield	
Grid-Number 1 to Plate, maximum	0.015	0.025	μμf
Input	6.5	6.5	μμf
Output	3.0	2.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin
* With External Shield (RETMA 316) connected to pin 2.

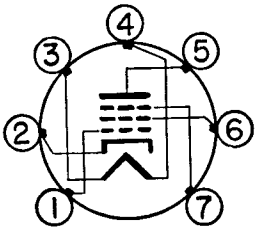
MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	330	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	2.3	Watts
Screen Dissipation	0.55	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

BASING DIAGRAM

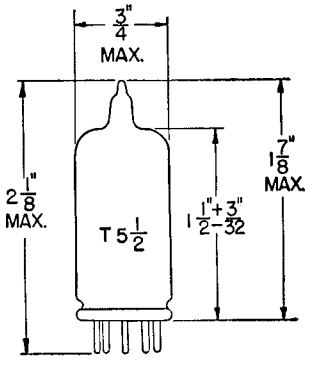


RETMA 7CM

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Internal Shield and Grid Number 3 (Suppressor)

PHYSICAL DIMENSIONS



RETMA 5-2

GENERAL ELECTRIC

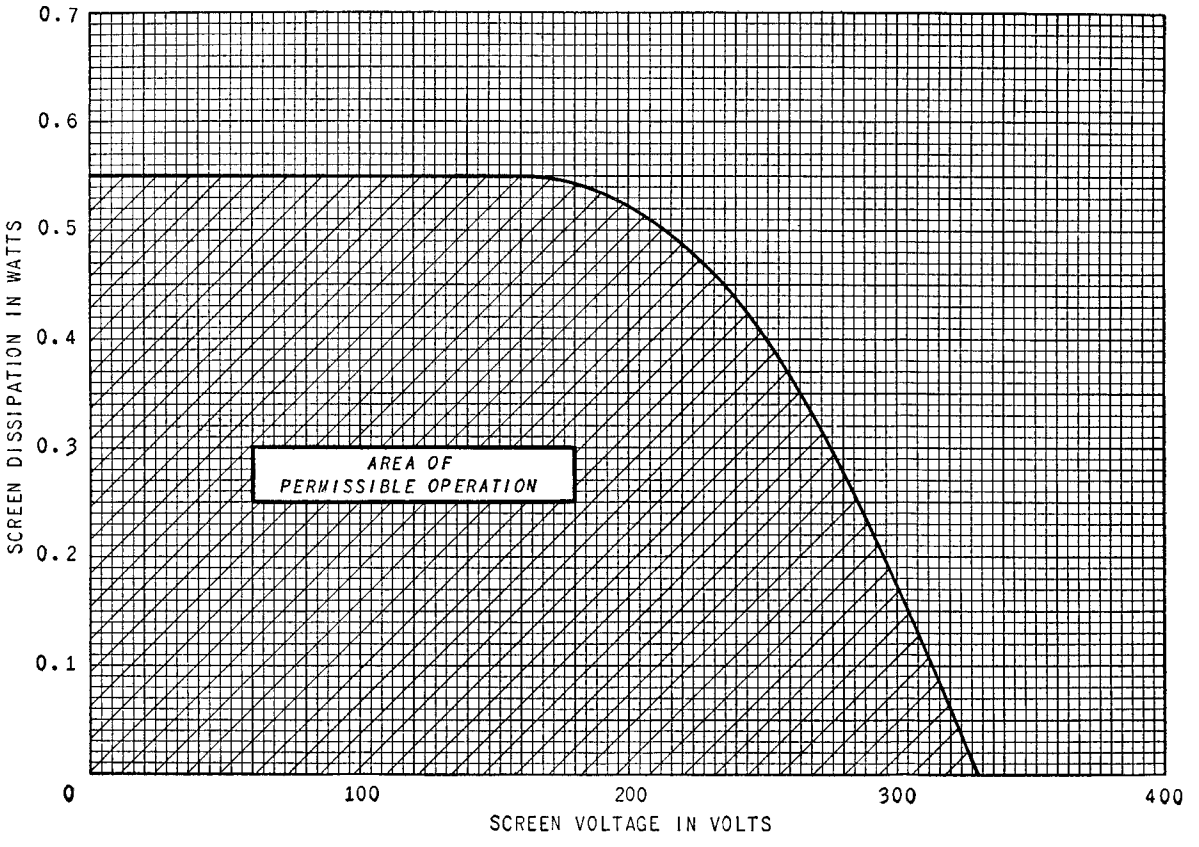
Supersedes ET-T942, dated 5-55

CHARACTERISTICS AND TYPICAL OPERATION

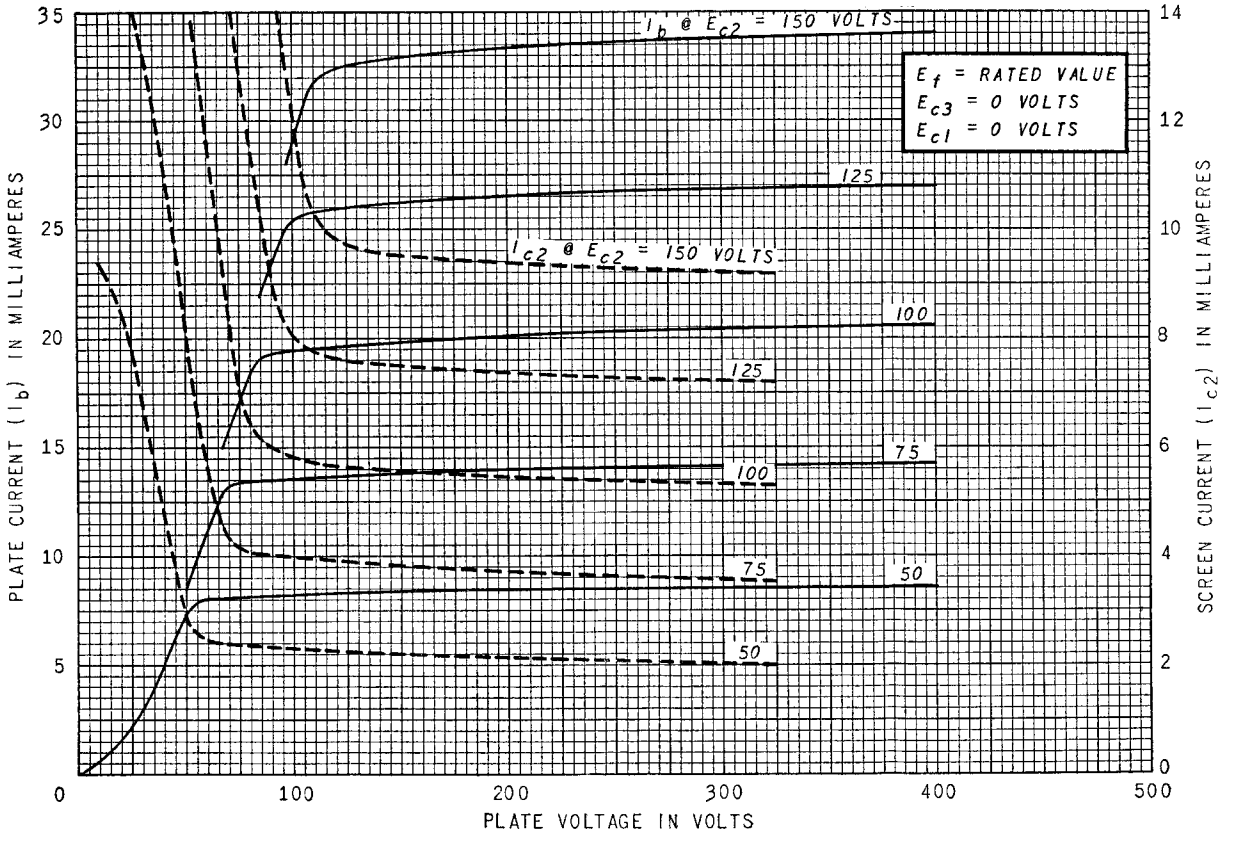
CLASS A_1 AMPLIFIER

Plate Voltage	125	125	Volts
Suppressor, Connected to Cathode at Socket			
Screen Voltage	125	125	Volts
Grid-Number 1 Voltage	−5.5	—	Volts
Cathode-Bias Resistor	—	56	Ohms
Plate Resistance, approximate	—	0.25	Megohms
Transconductance	700	8000	Micromhos
Plate Current	—	15.5	Milliamperes
Screen Current	—	4.2	Milliamperes
Grid-Number 1 Voltage, approximate			
I_b = 20 Microamperes	—	−9	Volts

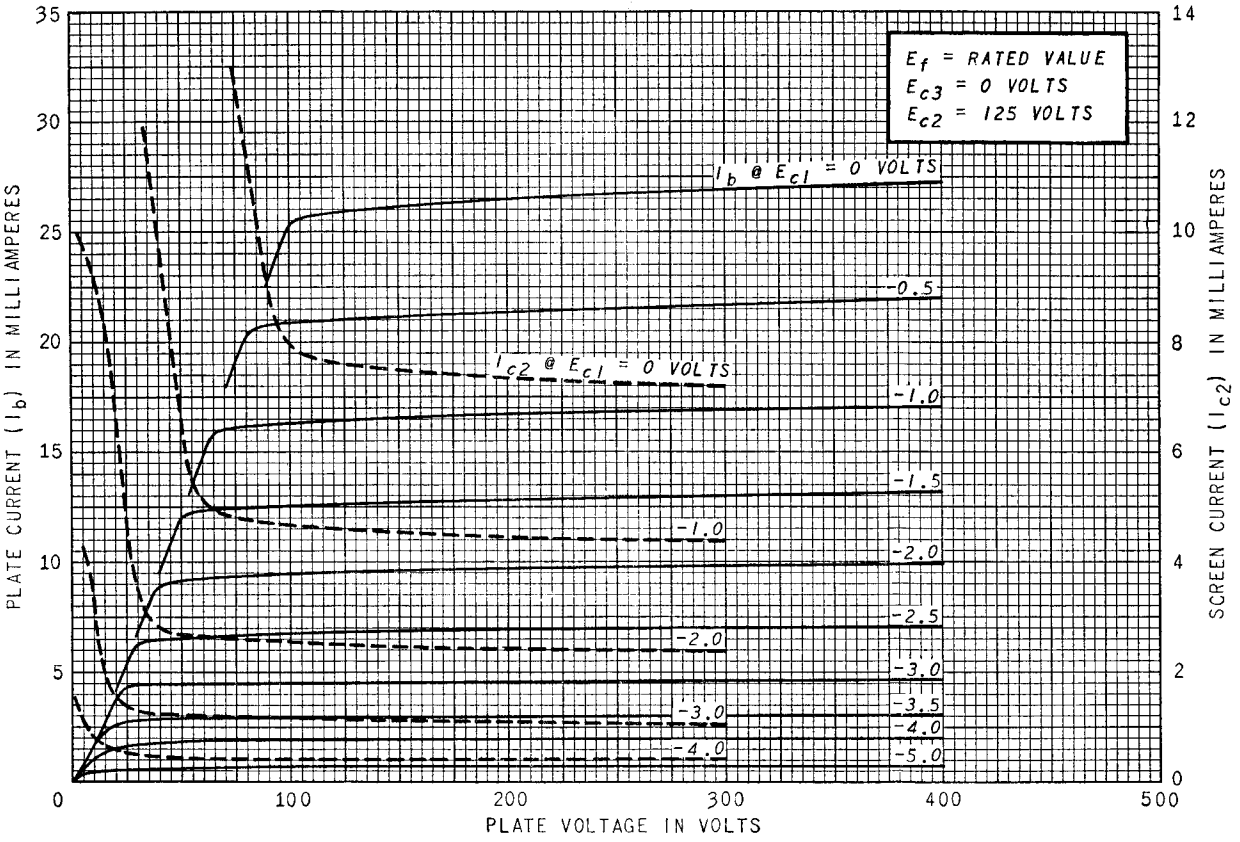
SCREEN RATING CHART



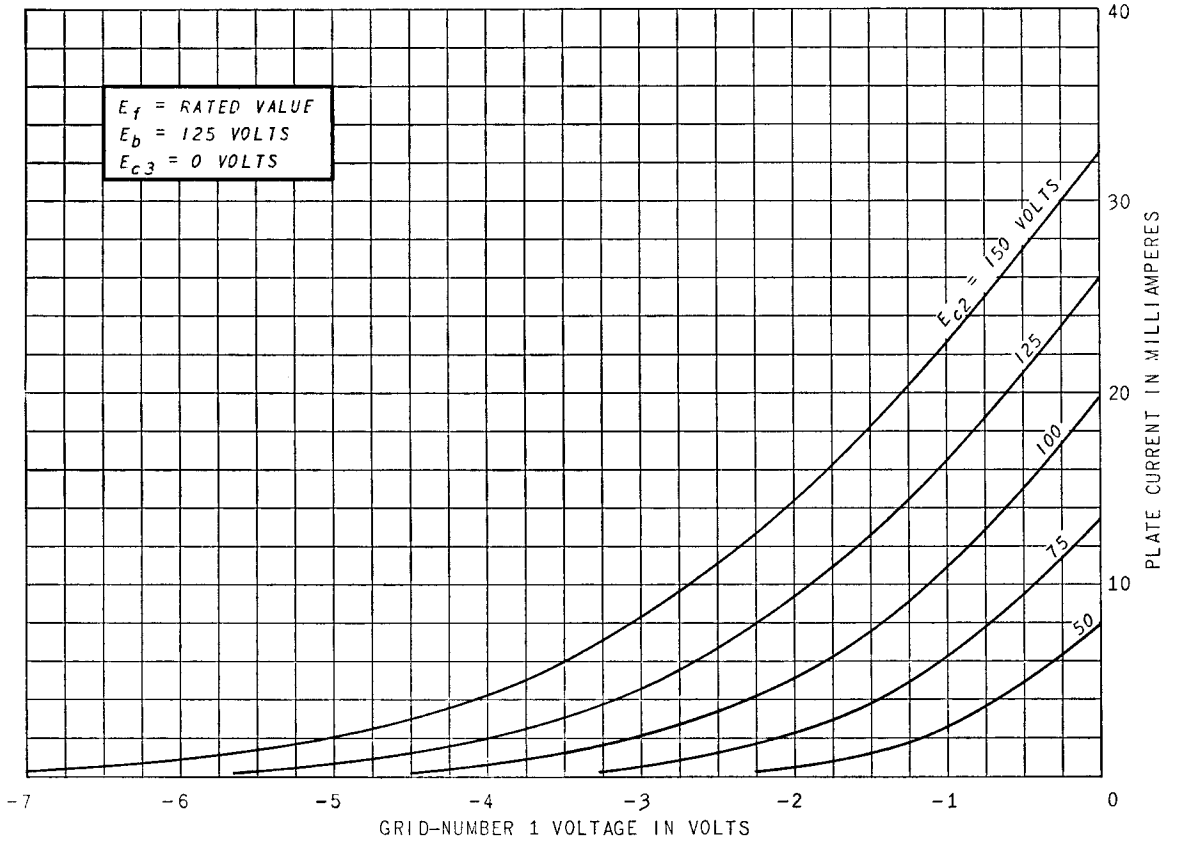
AVERAGE PLATE CHARACTERISTICS



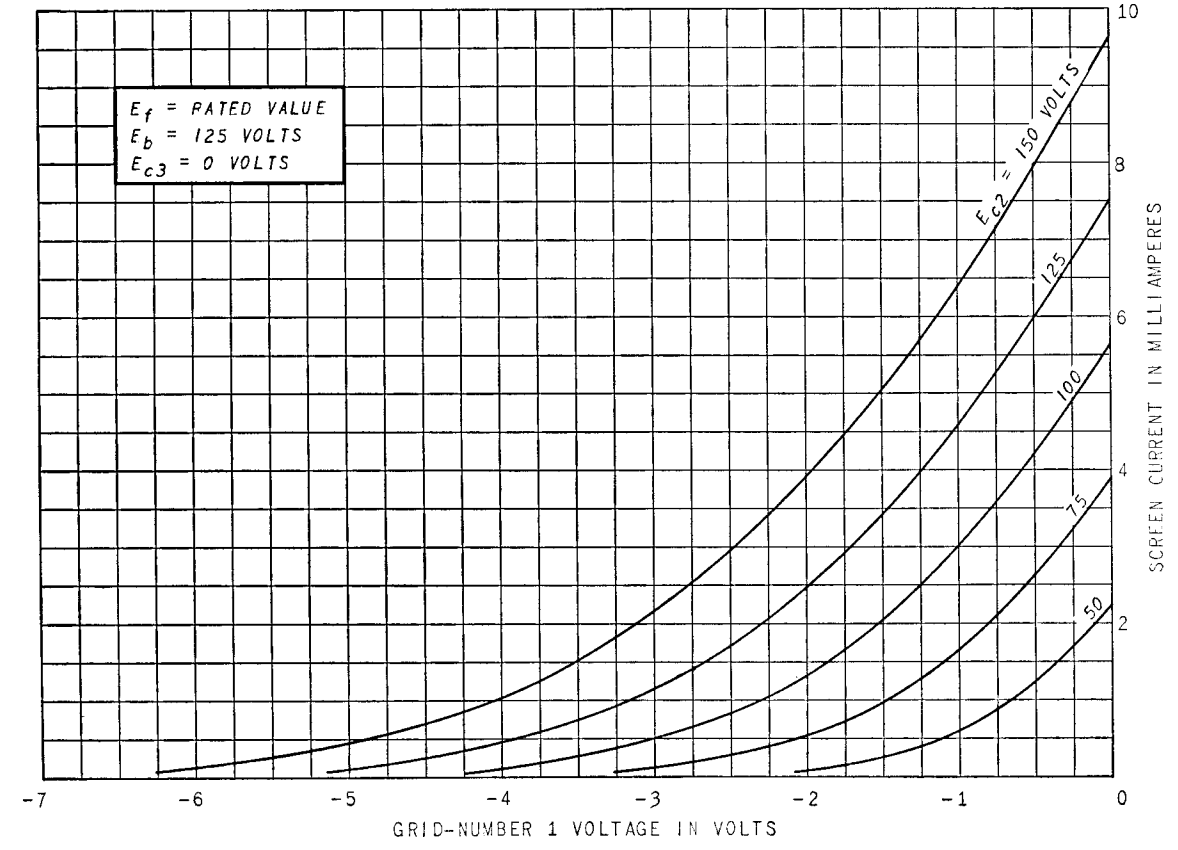
AVERAGE PLATE CHARACTERISTICS



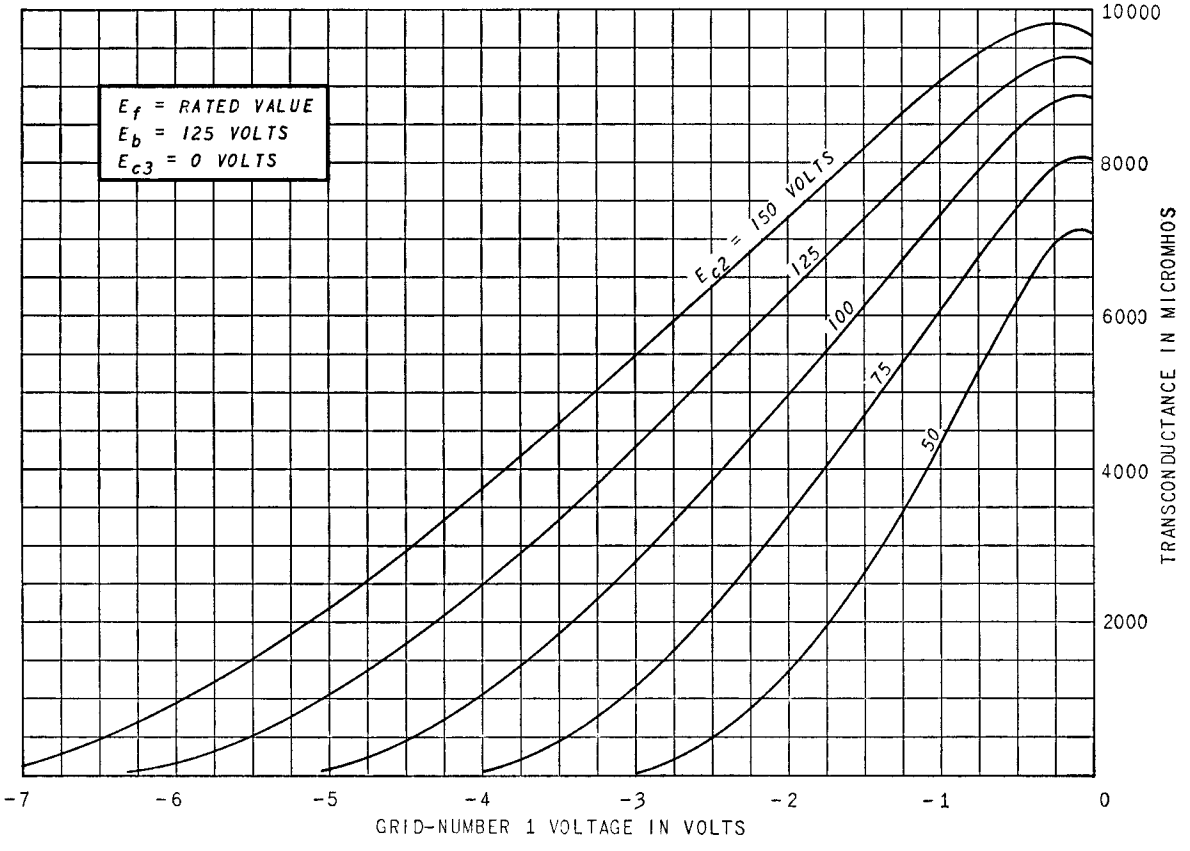
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Diode

6DK3

FOR TV DAMPING DIODE APPLICATIONS

■ COLOR TV TYPE ■ LOW TUBE DROP ■ 6,500 VOLTS DC AND PEAK ■ 400 MILLIAMPERES DC

The 6DK3 is a heater–cathode type diode intended for service as the damping diode in the horizontal–deflection circuit of color television receivers. It utilizes a unique heater–cathode insulating system making possible a rating of 6,500 volts peak. The 6DK3 also features a top cap connection to the cathode, a T–9 bulb and a 9–pin glass button base with a 0.687–inch pin circle.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	6.3±0.6	Volts
Heater Current ●	1.8	Amperes

Direct Interelectrode Capacitances, approximate▲

Cathode to Plate and Heater: k to (p + h)	22	pf
Plate to Cathode and Heater: p to (k + h)	13.6	pf
Heater to Cathode: (h to k)	1.10	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E9-89, Button 9-Pin
Top Cap - C1-2, Skirted Miniature
Outline Drawing - EIA 9-117

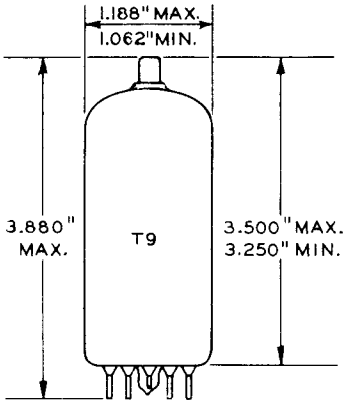
Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.880	Inches
Maximum Seated Height	3.500	Inches
Minimum Seated Height	3.250	Inches

MAXIMUM RATINGS

TV DAMPER SERVICE♦—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	6,500	Volts
Plate Dissipation	9.0	Watts
Steady-State Peak Plate Current	1,200	Milliamperes
DC Output Current	400	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with respect to Cathode		
DC Component	900	Volts
Total DC and Peak	6,500	Volts
Bulb Temperature⊕	220	°C

PHYSICAL DIMENSIONS

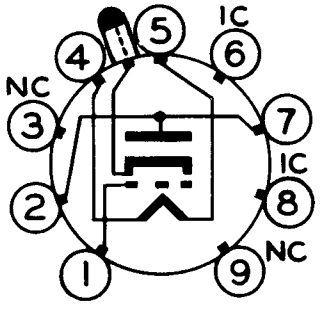


EIA 9-117

TERMINAL CONNECTIONS §

Pin 1 - Heater Insulation Coil
Pin 2 - Plate
Pin 3 - No Connection
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Plate
Pin 8 - Internal Connection - Do Not Use
§ Pin 9 - No Connection
Cap - Cathode

BASING DIAGRAM



EIA 9SG

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 400 Milliamperes	16	Volts
Ib = 800 Milliamperes	25	Volts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey at Ef = 6.3 volts.

▲ Without external shield.

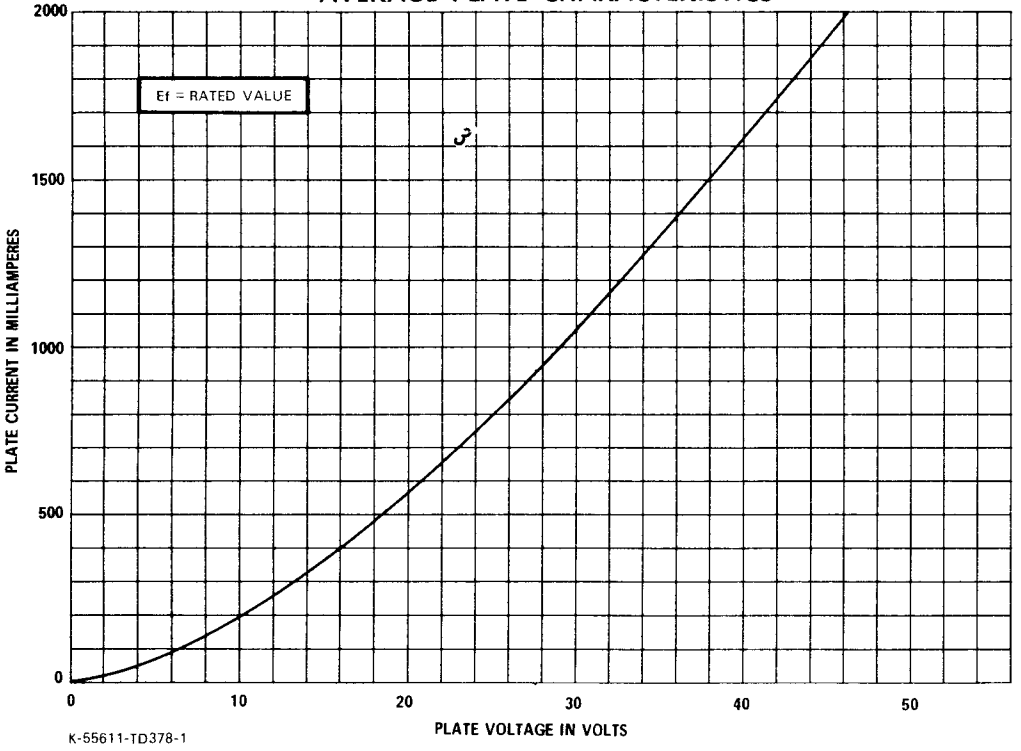
♦ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

⊕ Measured with an infrared thermometer, Ircon Model 700 BC or equivalent

§ May be used as a tie point for components at or near heater potential.

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AVERAGE PLATE CHARACTERISTICS



K-55611-TD378-1

GENERAL ELECTRIC
TUBE PRODUCTS DEPARTMENT
OWENSBORO, KENTUCKY 42301

Electronic TUBES

6DK6

PENTODE

DESCRIPTION AND RATING

The 6DK6 is a miniature sharp-cutoff pentode designed for use as a wide-band radio-frequency or intermediate-frequency amplifier in television receivers. Features of the tube include high transconductance and low interelectrode capacitances.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.3	Amperes
Direct Interelectrode Capacitances*		
Grid-No. 1 to Plate	0.020	μμf
Input	6.3	μμf
Output	1.9	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	300	Volts
Screen Voltage	150	Volts
Plate Dissipation	2.0	Watts
Screen Dissipation	0.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	300	Volts

CHARACTERISTICS AND TYPICAL OPERATION

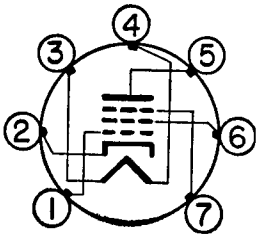
CLASS A_1 AMPLIFIER

Plate Voltage	125	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Transconductance	9800	Micromhos
Plate Current	12	Milliamperes
Screen Current	3.8	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 20 Microamperes	−6.5	Volts

* Without external shield.

GENERAL ELECTRIC

BASING DIAGRAM

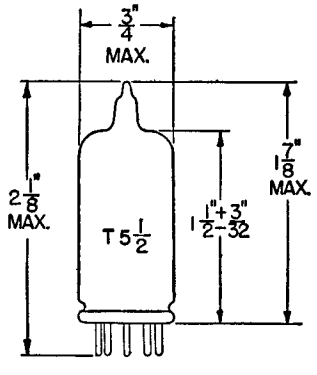


EIA 7CM

TERMINAL CONNECTIONS

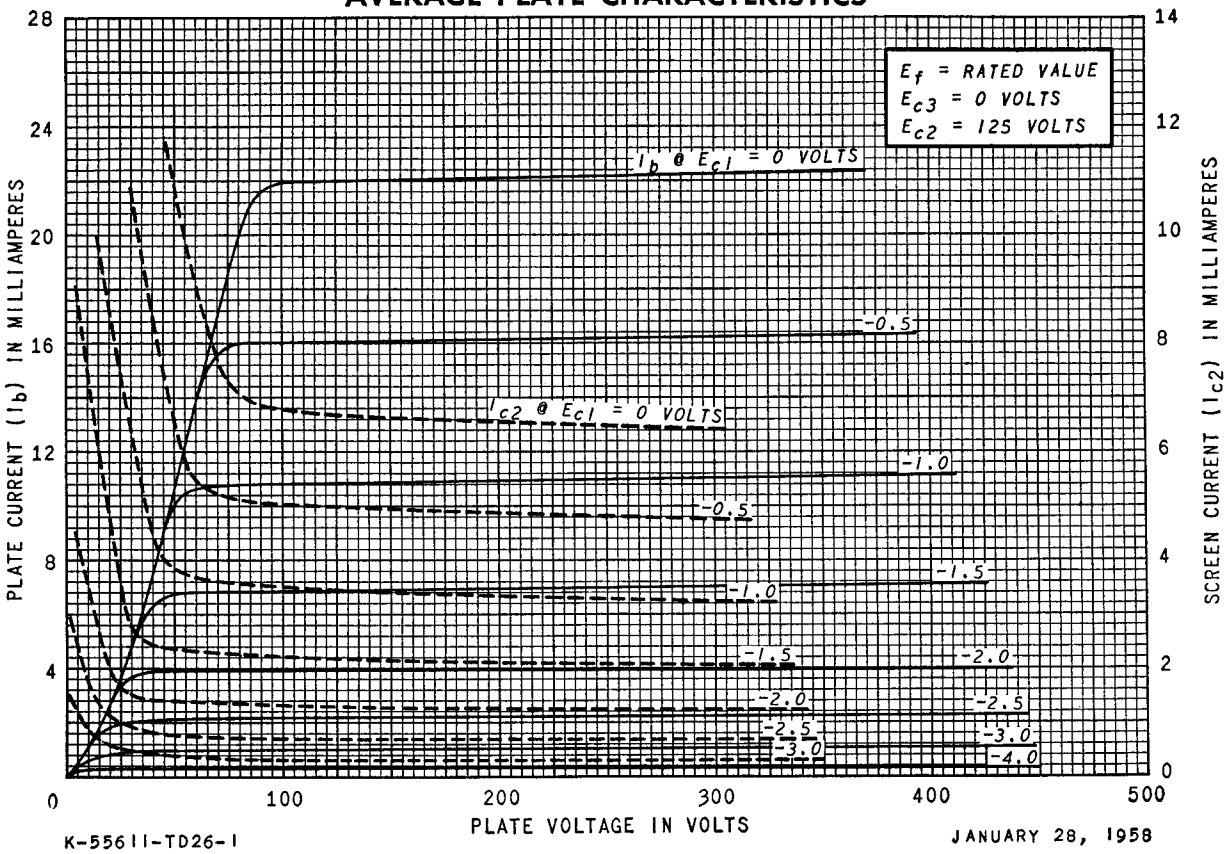
Pin 1—Grid Number 1
Pin 2—Cathode
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Internal Shield and Grid-Number 3 (Suppressor)

PHYSICAL DIMENSIONS



EIA 5-2

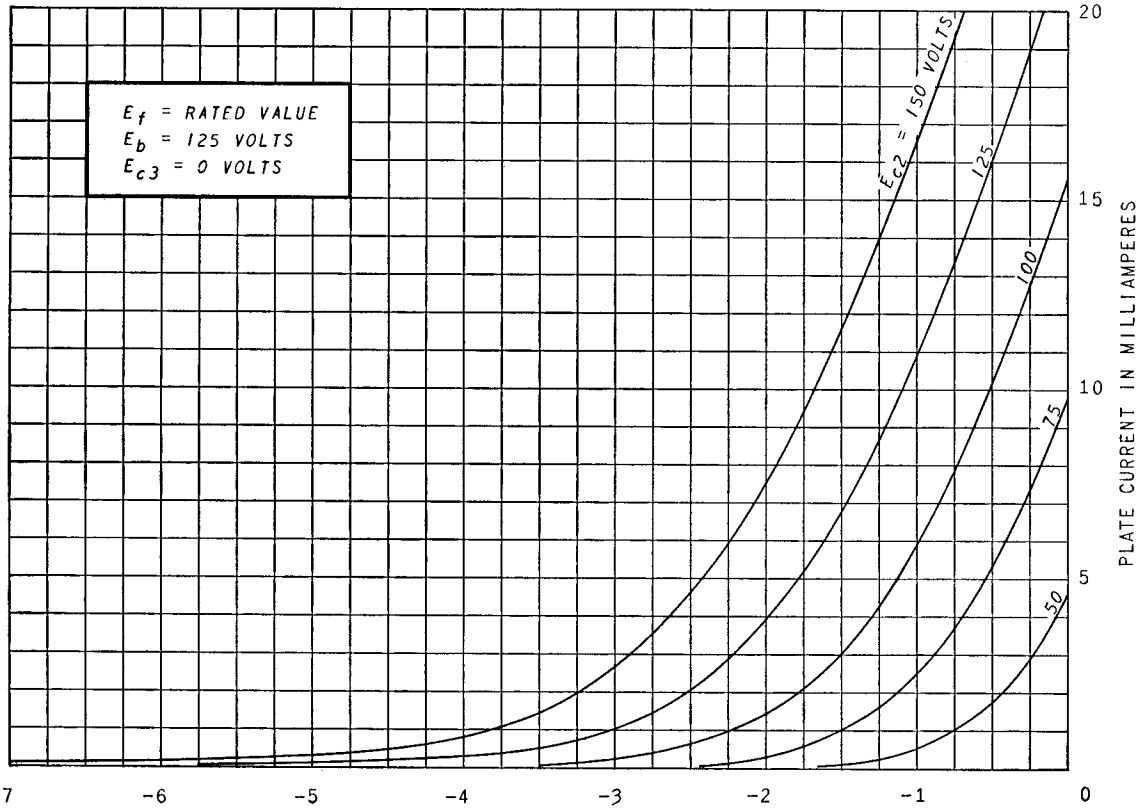
AVERAGE PLATE CHARACTERISTICS



K-55611-TD26-1

JANUARY 28, 1958

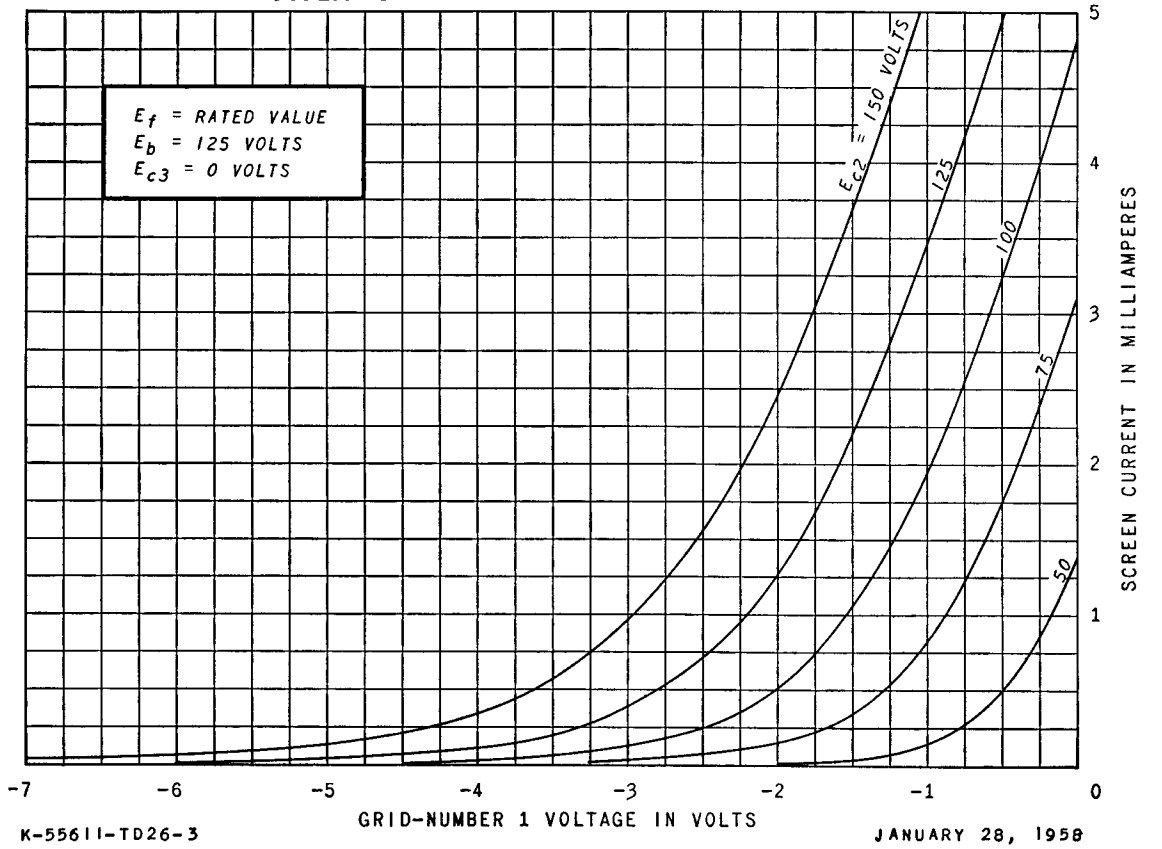
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD26-2

JANUARY 28, 1958

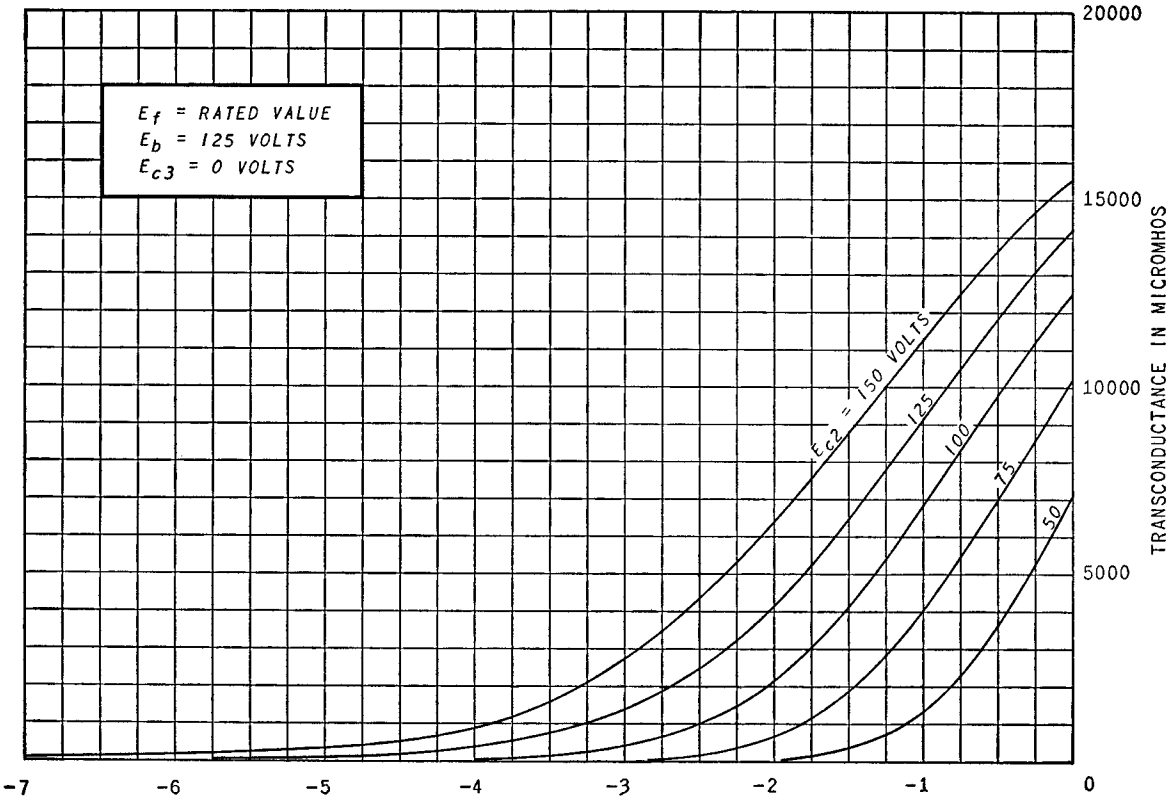
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD26-3

JANUARY 28, 1958

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD26-4

JANUARY 28, 1958

Electronic TUBES

6DN7

DISSIMILAR DOUBLE TRIODE

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6DN7 is a dissimilar double-triode designed for use as a combined vertical-deflection oscillator and amplifier in television receivers. Section 1 is intended for service as an oscillator and Section 2 as an amplifier.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Voltage, AC or DC . . . . . 6.3 ± 10% Volts
Heater Current . . . . . 0.9 Amperes
Direct Interelectrode Capacitances, approximate*

	Section 1	Section 2	
Grid to Plate	4.0	5.5	μμf
Input	2.2	4.6	μμf
Output	0.7	1.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B8-142, Intermediate-Shell Octal 8-Pin

MAXIMUM RATINGS

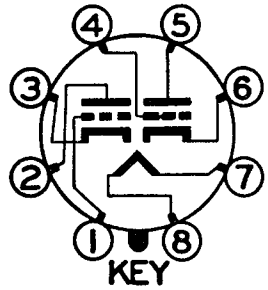
DESIGN-MAXIMUM VALUES	Vertical-Oscillator Service (Section 1)†	Vertical-Deflection Amplifier (Section 2)†	
DC Plate Voltage	350	550	Volts
Peak Positive Pulse Plate Voltage	. . .	2500	Volts
Peak Negative Grid Voltage	400	250	Volts
Plate Dissipation	1.0	10‡	Watts
DC Cathode Current	. . .	50	Milliamperes
Peak Cathode Current	. . .	150	Milliamperes
Heater Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Circuit Resistance			
With Fixed Bias	2.2	2.2	Megohms
With Cathode Bias	2.2	. . .	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

BASING DIAGRAM

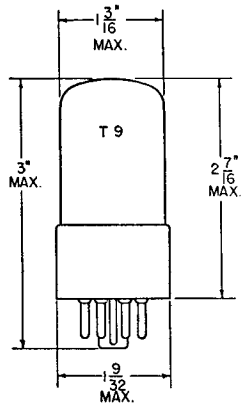


EIA 8BD

TERMINAL CONNECTIONS

Pin 1—Grid (Section 2)
Pin 2—Plate (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Grid (Section 1)
Pin 5—Plate (Section 1)
Pin 6—Cathode (Section 1)
Pin 7—Heater
Pin 8—Heater

PHYSICAL DIMENSIONS



EIA 9-5

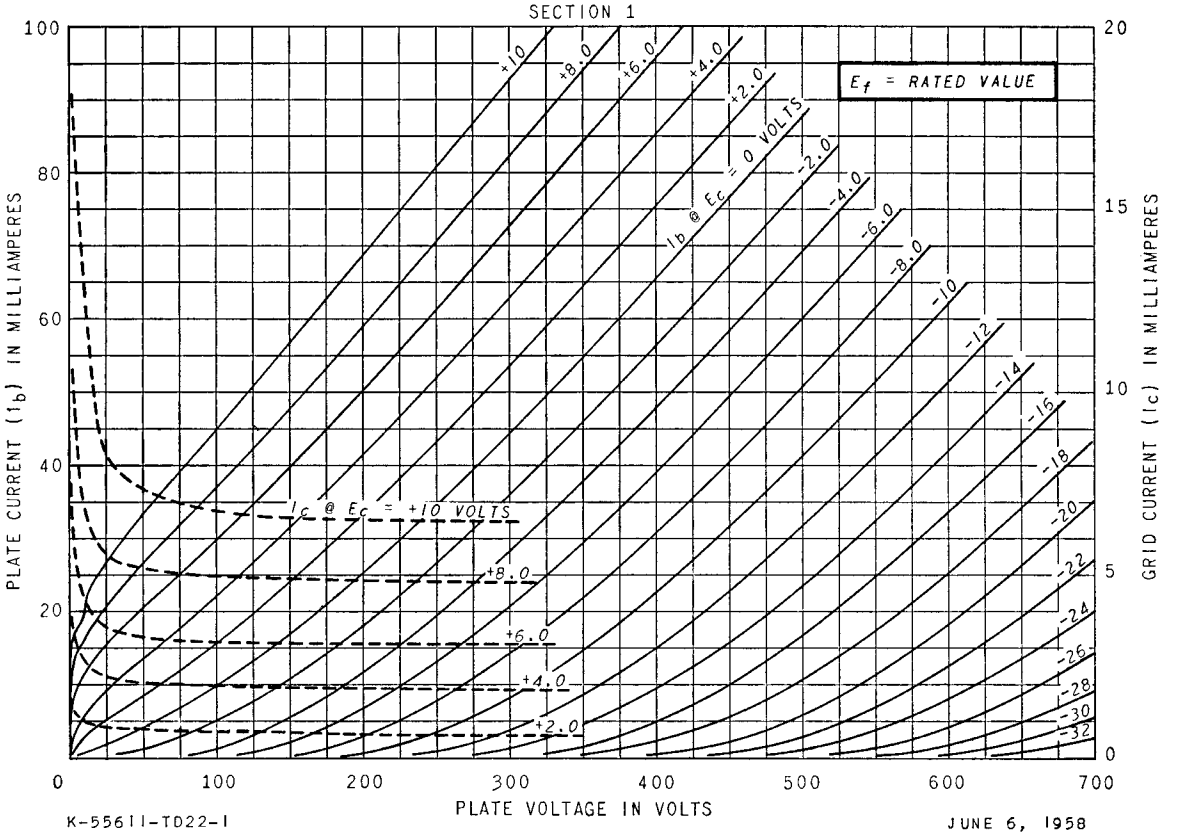
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CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Section 1 (Oscillator)	Section 2 (Amplifier)	
Plate Voltage	250	150	250 Volts
Grid Voltage	−8.0	0§	−9.5 Volts
Amplification Factor	22.5	...	15.4
Plate Resistance, approximate	9000	...	2000 Ohms
Transconductance	2500	...	7700 Micromhos
Plate Current	8.0	68	41 Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	−18	...	... Volts
Grid Voltage, approximate Ib = 50 Microamperes	...	...	−23 Volts

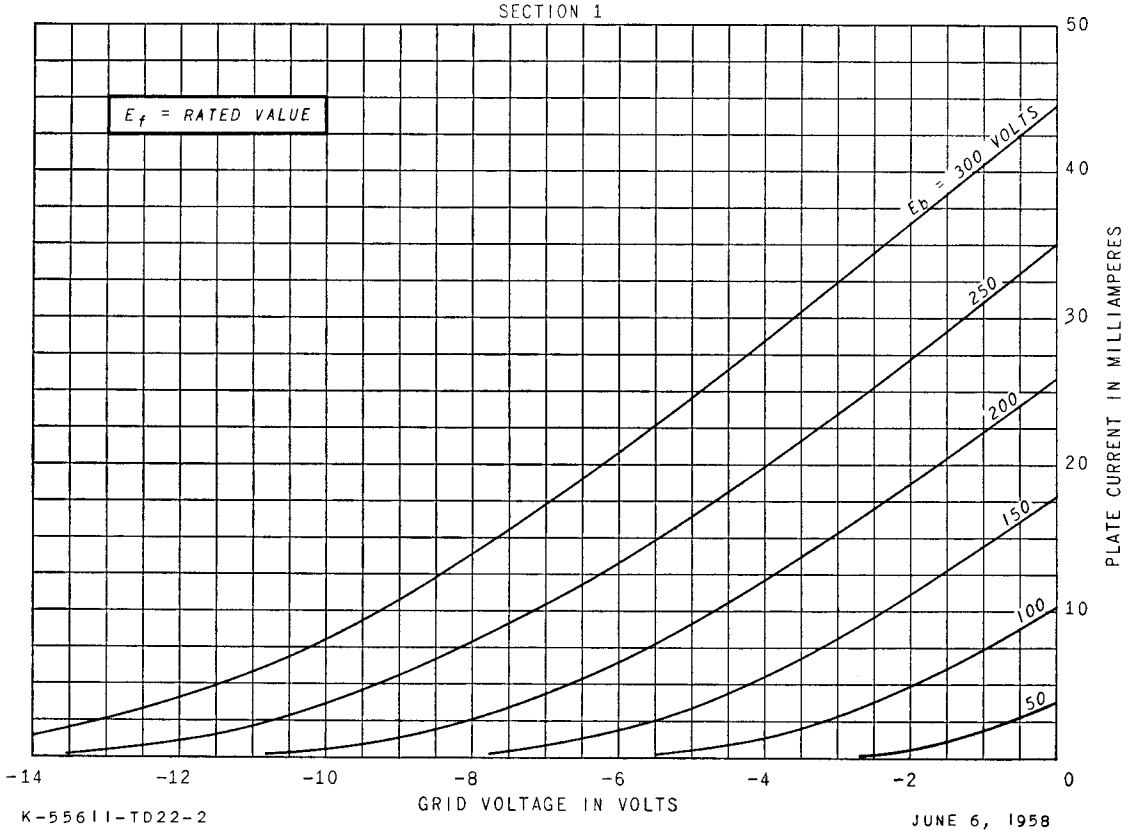
* Without external shield.
† For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communication Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.
‡ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.
§ Applied for short interval (two seconds maximum) so as not to damage tube.

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

SECTION 1

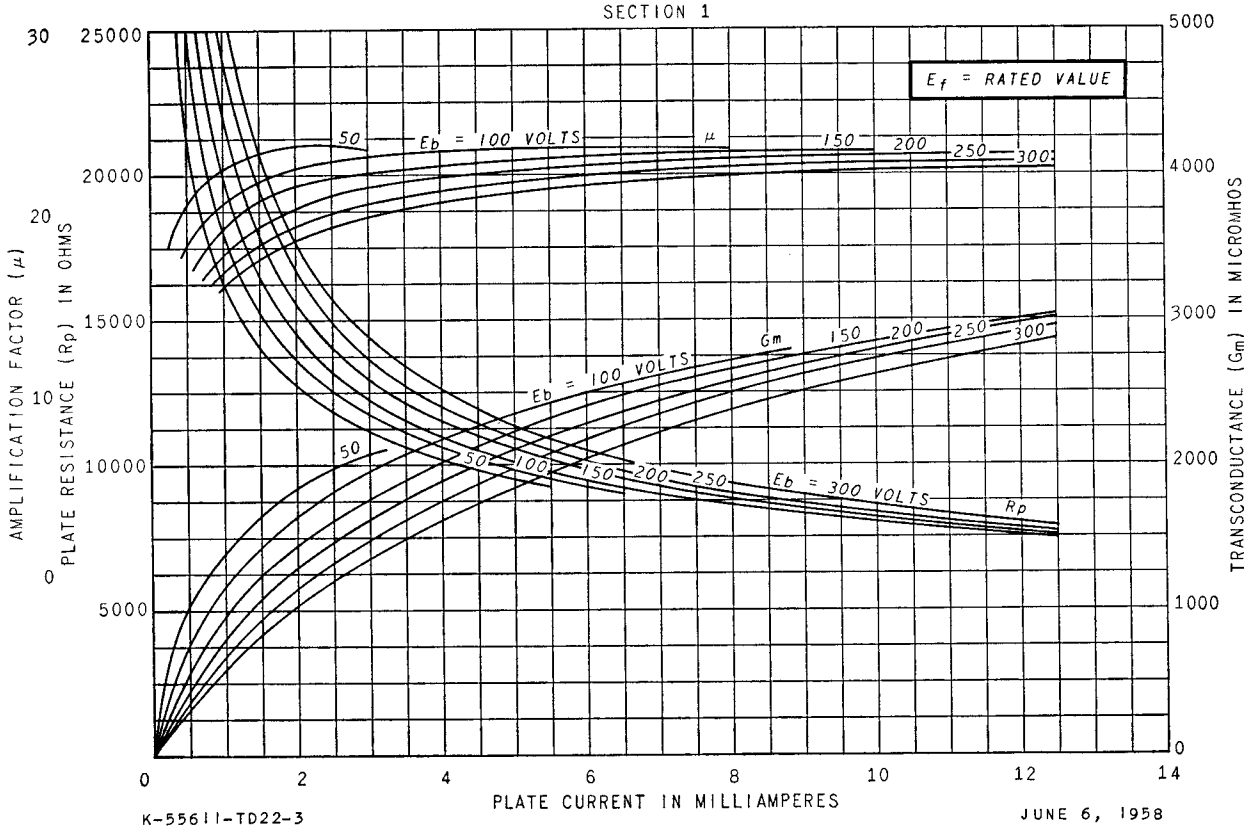


K-5561I-TD22-2

JUNE 6, 1958

AVERAGE CHARACTERISTICS

SECTION 1

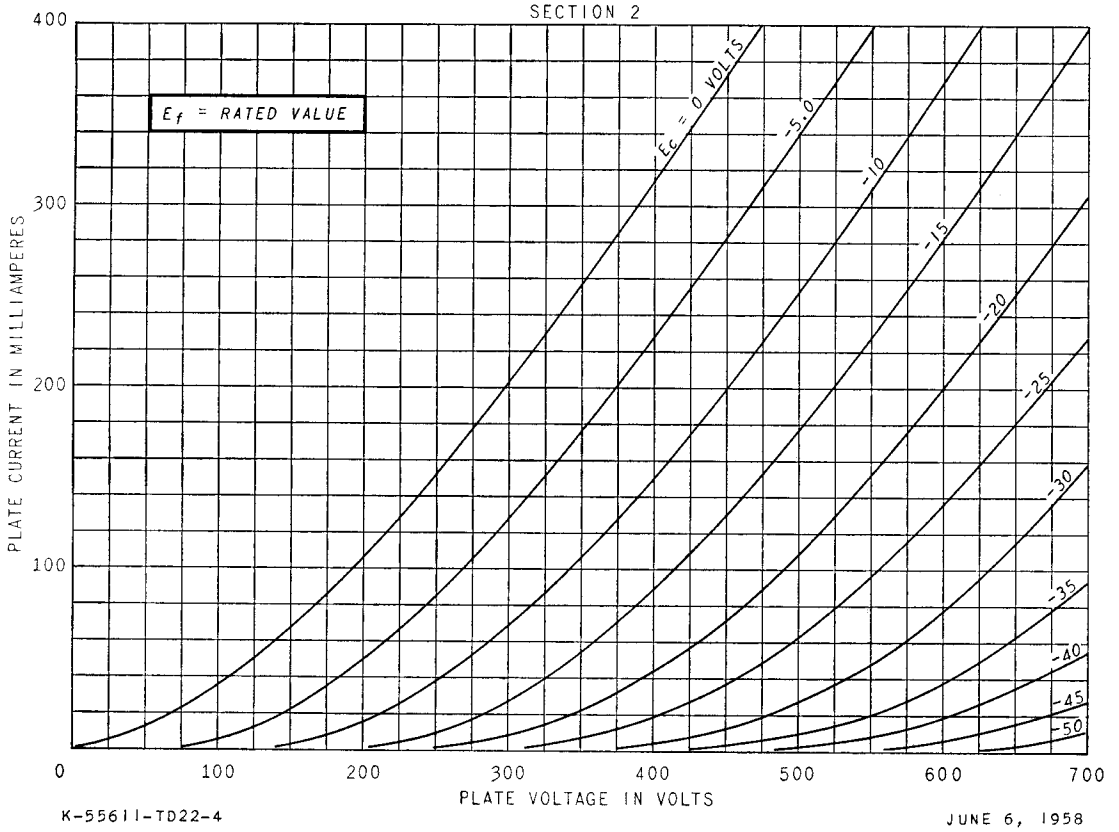


K-5561I-TD22-3

JUNE 6, 1958

AVERAGE PLATE CHARACTERISTICS

SECTION 2

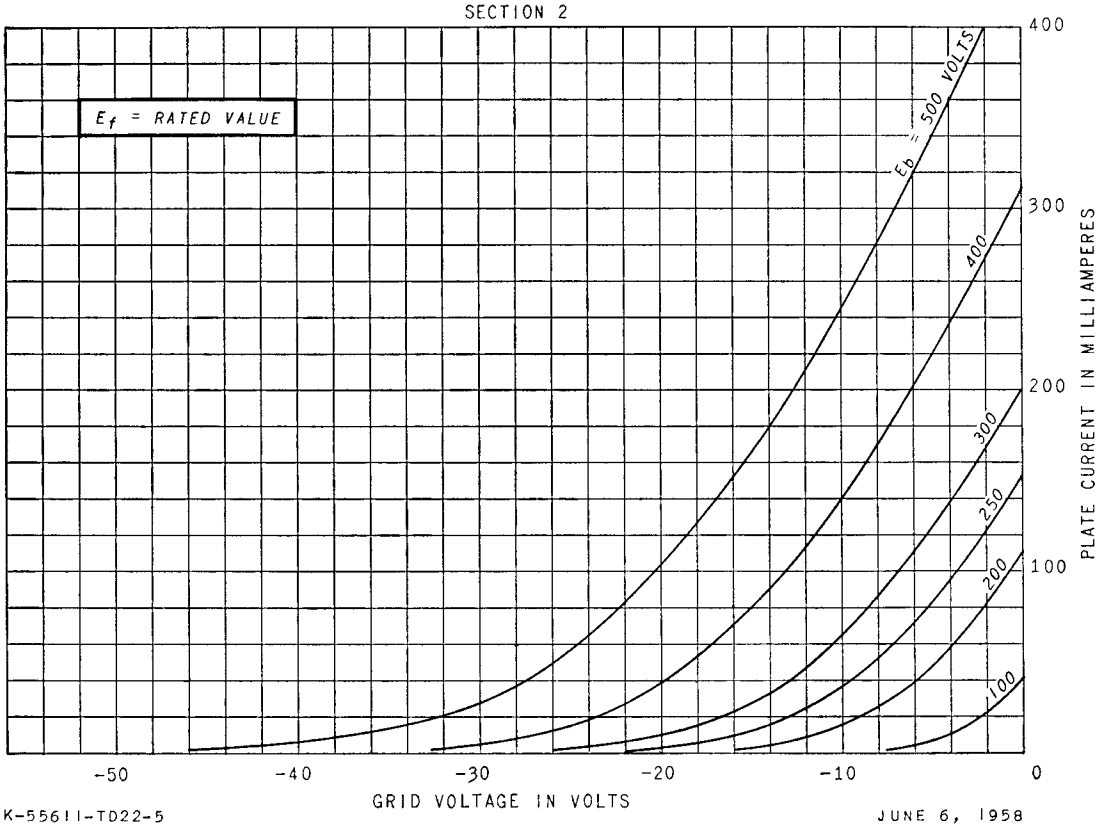


K-55611-TD22-4

JUNE 6, 1958

AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

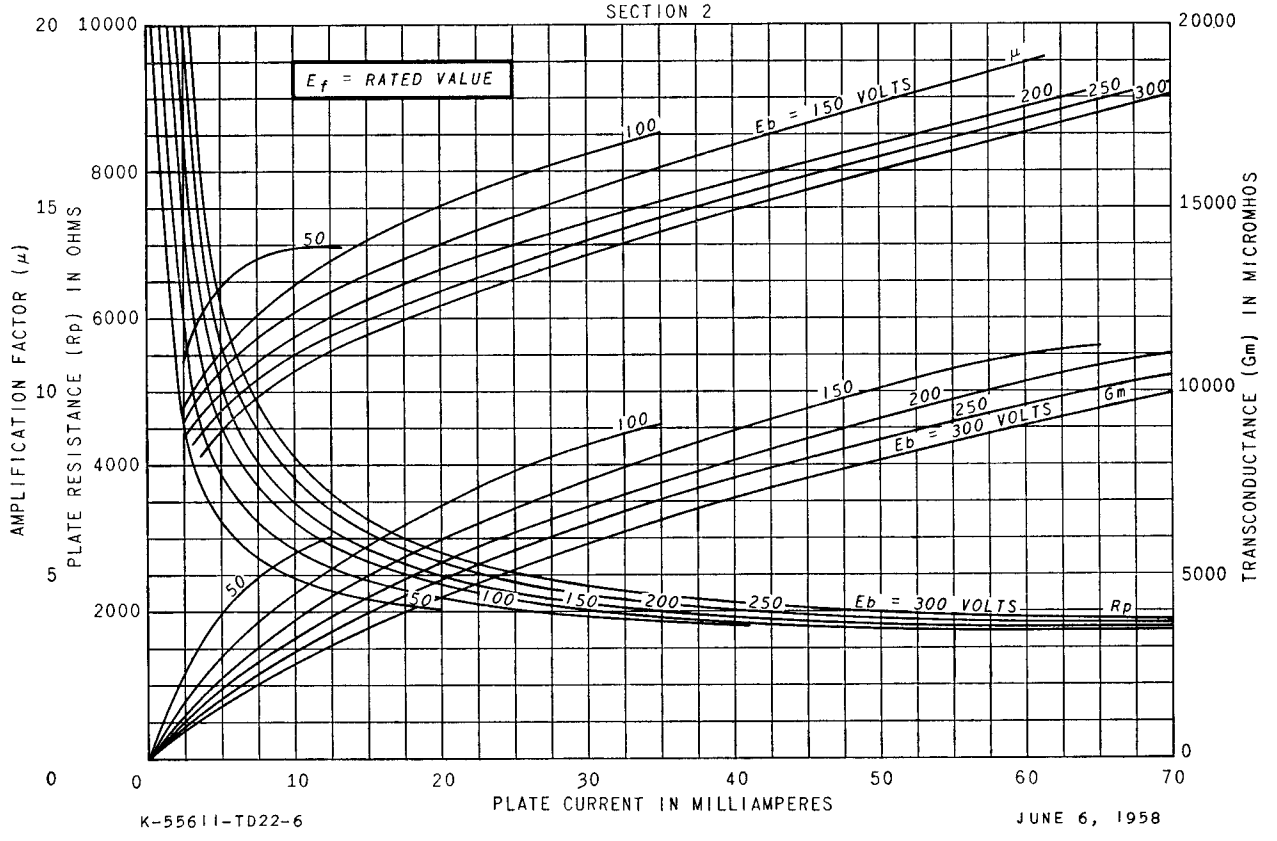


K-55611-TD22-5

JUNE 6, 1958

AVERAGE CHARACTERISTICS

SECTION 2



Electronic TUBES

6DQ6-A—12DQ6-A—17DQ6-A

BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6DQ6-A is a beam-power pentode primarily designed for use as the horizontal-deflection amplifier in television receivers. Its high zero-bias plate current at low plate and screen voltages makes the tube well suited for use in receivers which operate at low plate-supply voltages.

Except for heater ratings, the 12DQ6-A and 17DQ6-A are identical to the 6DQ6-A. In addition, they incorporate a controlled heater warm-up characteristic which makes them especially suited for use in television receivers that employ series-connected heaters.

GENERAL

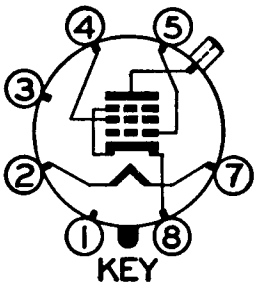
ELECTRICAL

Cathode—Coated Unipotential	6DQ6-A	12DQ6-A	17DQ6-A	
Heater Voltage, AC or DC	6.3	12.6	16.8	Volts
Heater Current	1.2	0.6	0.45	Amperes
Heater Warm-up Time*	..	11	11	Seconds
Direct Interelectrode Capacitances, approximate†				
Grid-Number 1 to Plate			0.55	μμf
Input			15	μμf
Output			7.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-12, Glass
Base—B7-119, Short Medium-Shell Octal 7-Pin
Top Cap—C1-3, Skirted Miniature

BASING DIAGRAM

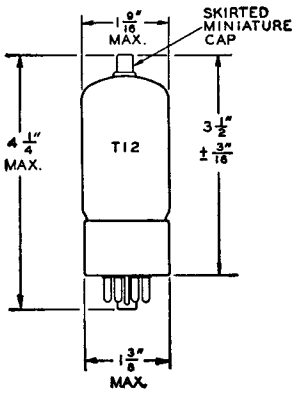


RETMA 6AM

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Heater
Pin 3—No Connection
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates
Cap—Plate

PHYSICAL DIMENSIONS



GENERAL ELECTRIC

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE‡
DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

DC Plate-Supply Voltage (Boost+DC Power Supply)	700	Volts
Peak Positive Pulse Plate Voltage	6000§	Volts
Peak Negative Pulse Plate Voltage	1375	Volts
Screen Voltage	200	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
Peak Negative Grid-Number 1 Voltage	300	Volts
Plate Dissipation△	15	Watts
Screen Dissipation	3.0	Watts
DC Cathode Current	140	Milliamperes
Peak Cathode Current	440	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Grid-Leak Bias	1.0	Megohms
Bulb Temperature at Hottest Point	220	C

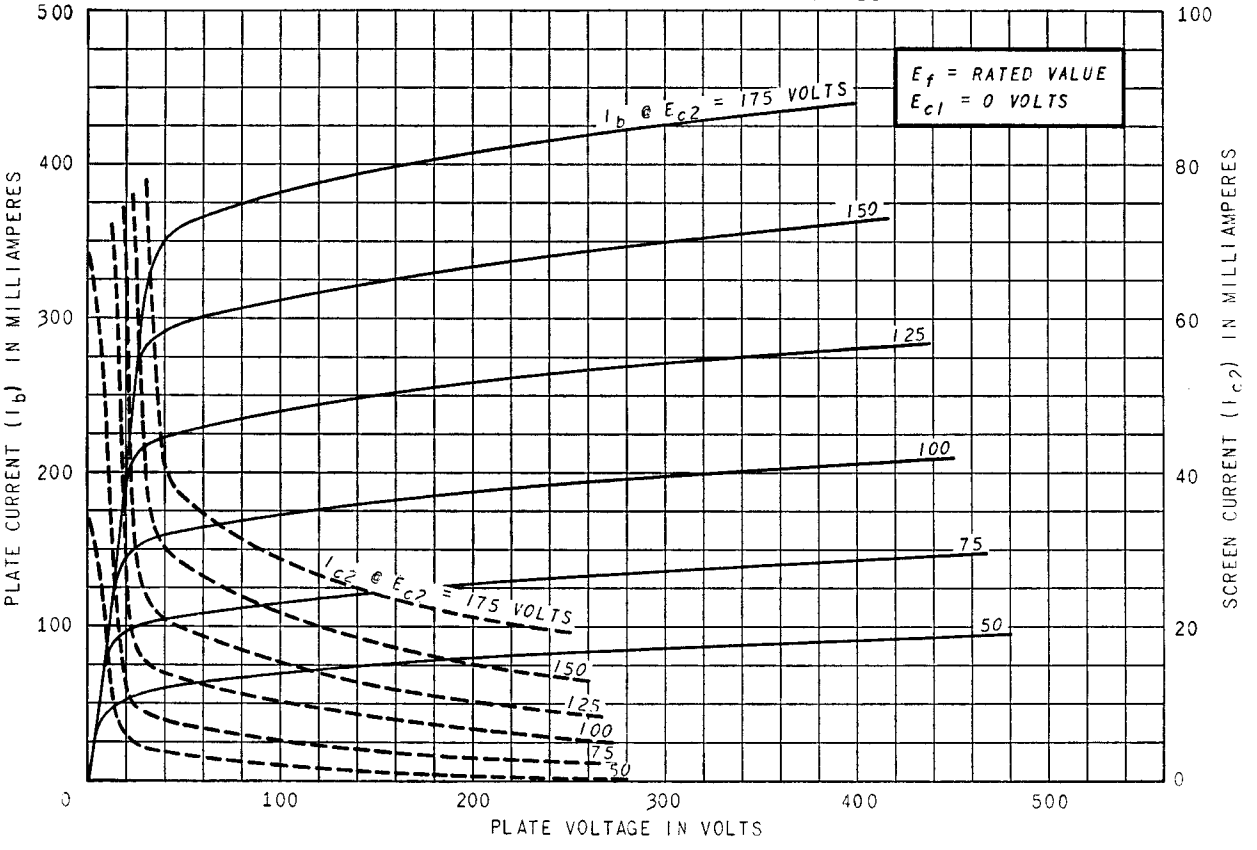
CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

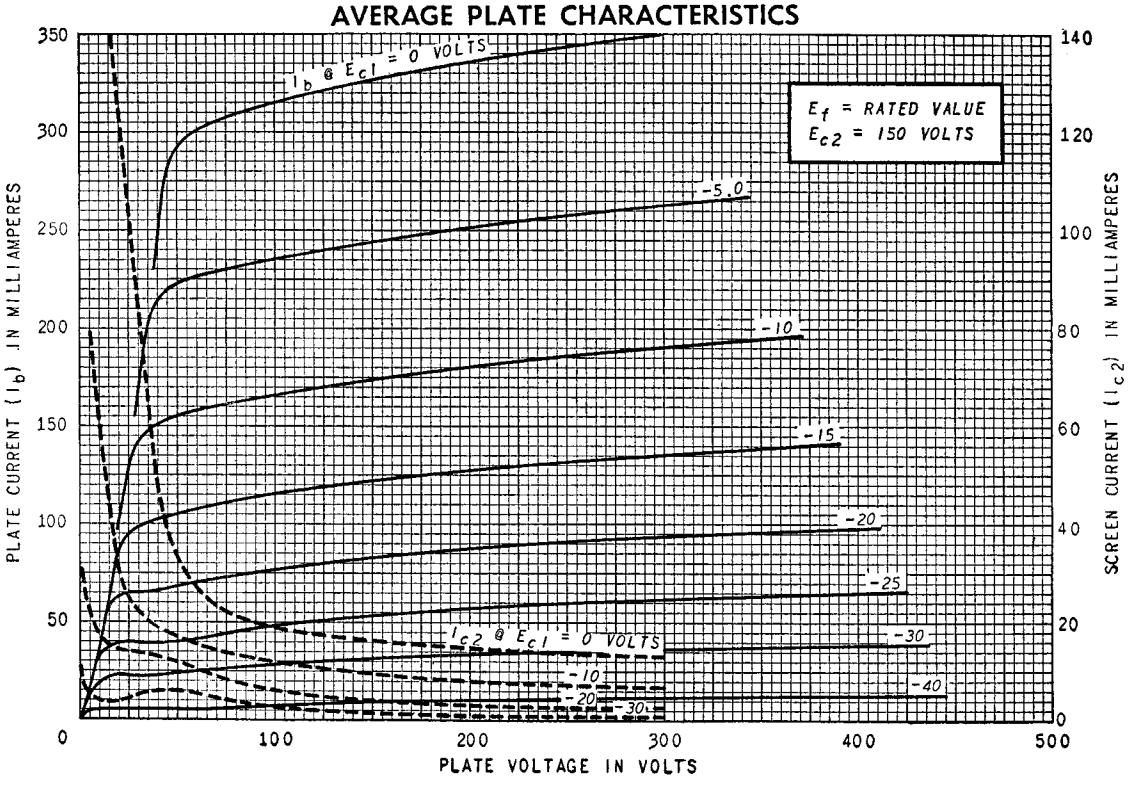
Plate Voltage	60	250	Volts
Screen Voltage	150	150	Volts
Grid-Number 1 voltage	0¶	−22.5	Volts
Plate Resistance, approximate	..	20000	Ohms
Transconductance	..	6600	Micromhos
Plate Current	300	75	Milliamperes
Screen Current	27	2.4	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 1.0 Milliampere	..	−46	Volts
Triode Amplification Factor♦	..	4.1	

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.
† Without external shield.
‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.
§ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.
△In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.
¶ Applied for short interval (2 seconds maximum) so as not to damage tube.
♦ Triode connection (screen tied to plate) with Eb = Ec2 = 150 volts, and Ec1 = −22.5 volts.

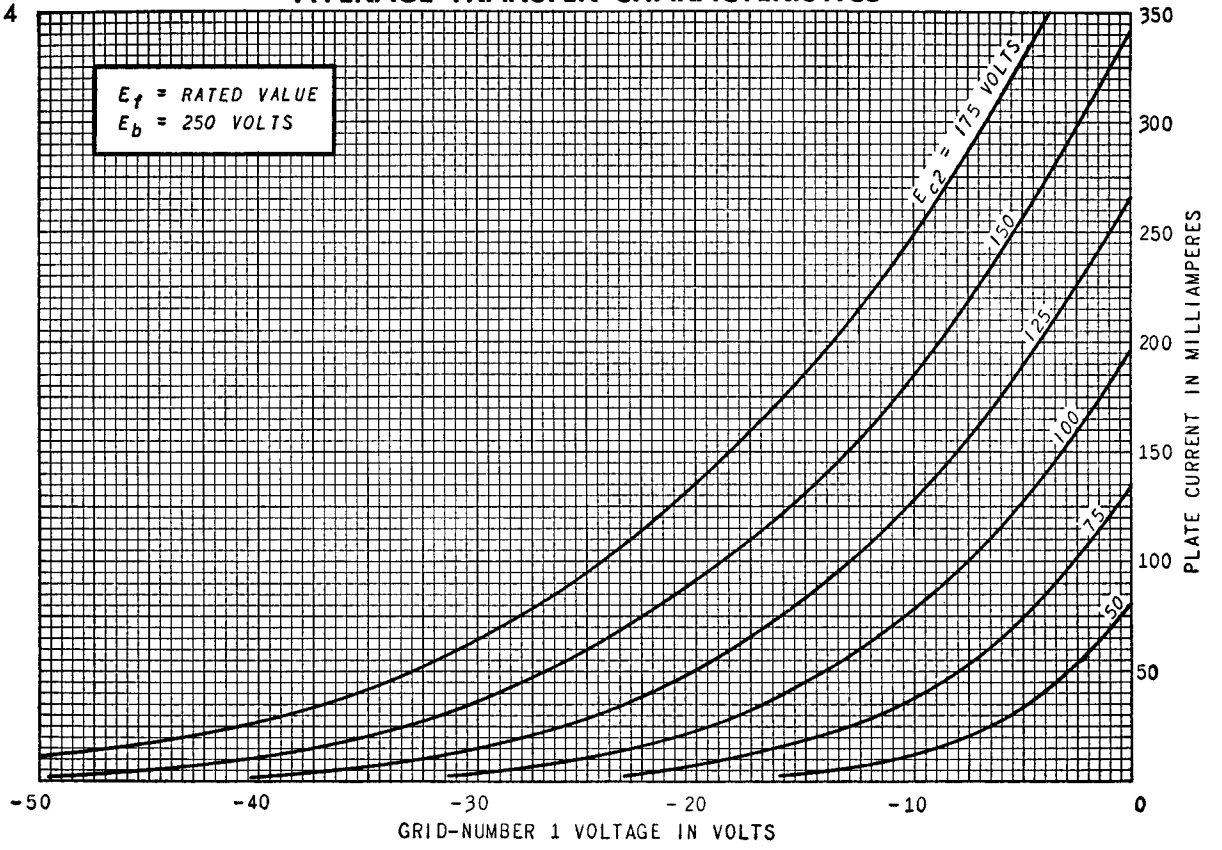
AVERAGE PLATE CHARACTERISTICS



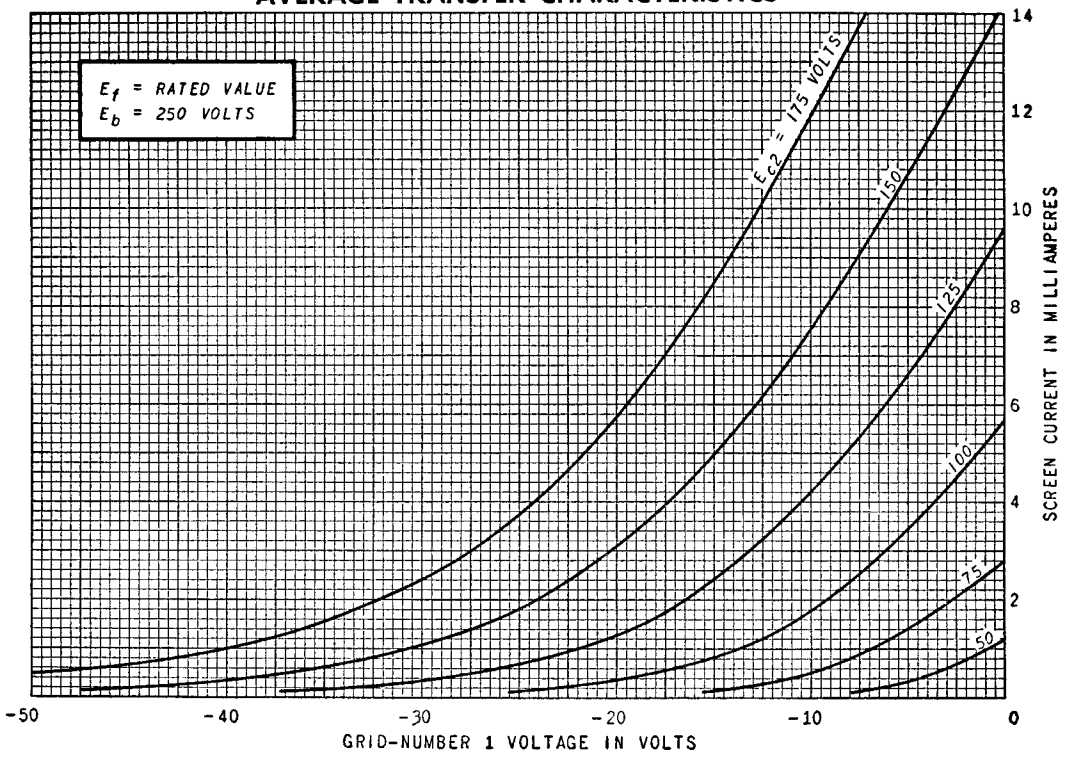
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

6DQ6-B
BEAM PENTODE

DESCRIPTION AND RATING

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

The 6DQ6-B is a beam-power pentode primarily designed for use as the horizontal-deflection amplifier in television receivers. Its high zero-bias plate current at low plate and screen voltages makes the tube well suited for use in receivers that operate at low plate-supply voltages. It differs from the 6DQ6-A in having higher ratings and higher zero-bias plate current.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	1.2	Amperes
Direct Interelectrode Capacitances, approximate‡		
Grid-Number 1 to Plate: (g1 to p)	0.5	pf
Input: g1 to (h+k+g2+b.p.)	15	pf
Output: p to (h+k+g2+b.p.)	7.0	pf

MECHANICAL

Mounting Position—Any
Envelope—T-12, Glass
Base—B6-122, Short Medium-Shell Octal 6-Pin
or B6-148, Short Medium-Shell Octal 6-Pin
or B7-111, Short Medium-Shell Octal 7-Pin
or B7-119, Short Medium-Shell Octal 7-Pin
Top Cap—C1-3, Skirted Miniature
Outline Drawing—EIA 12-51

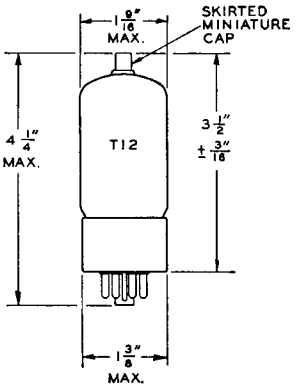
Maximum Diameter	$1\frac{9}{16}$	Inches
Maximum Over-all Length	$4\frac{1}{4}$	Inches
Maximum Seated Height	$3\frac{11}{16}$	Inches

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE¶—DESIGN-MAXIMUM VALUES

DC Plate-Supply Voltage (Boost+DC Power Supply)	770	Volts
Peak Positive Pulse Plate Voltage	6500	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Screen Voltage	220	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation #	18	Watts
Screen Dissipation	3.6	Watts
DC Cathode Current	175	Milliamperes
Peak Cathode Current	610	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohm
Bulb Temperature at Hottest Point	220	C

PHYSICAL DIMENSIONS

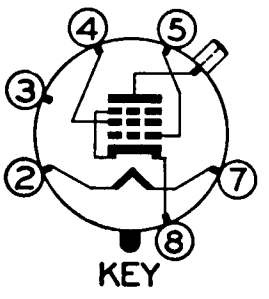


EIA 12-51

TERMINAL CONNECTIONS

Pin 1—No Connection§
Pin 2—Heater
Pin 3—No Connection
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates
Cap—Plate

BASING DIAGRAM



EIA 6AM

GENERAL ELECTRIC

Supersedes ET-T1534 dated 3-59

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	60	250	Volts
Screen Voltage	150	150	150	Volts
Grid-Number 1 Voltage	....	0△	−22.5	Volts
Plate Resistance, approximate	....	....	18000	Ohms
Transconductance	....	....	7300	Micromhos
Plate Current	....	345	65	Milliamperes
Screen Current	....	27	1.8	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 1.0 Milliamperes	−100	....	−42	Volts
Triode Amplification Factor ϕ	....	....	4.4	

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at $E_F = 6.3$ volts.

‡ Without external shield.

§ Pin 1 is omitted when either a B6-122 or B6-148 base is used.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

⁂ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

△ Applied for short interval (two seconds maximum) so as not to damage tube.

ϕ Triode connection (screen tied to plate) with Eb = Ec2 = 150 volts, and Ec1 = −22.5 volts.

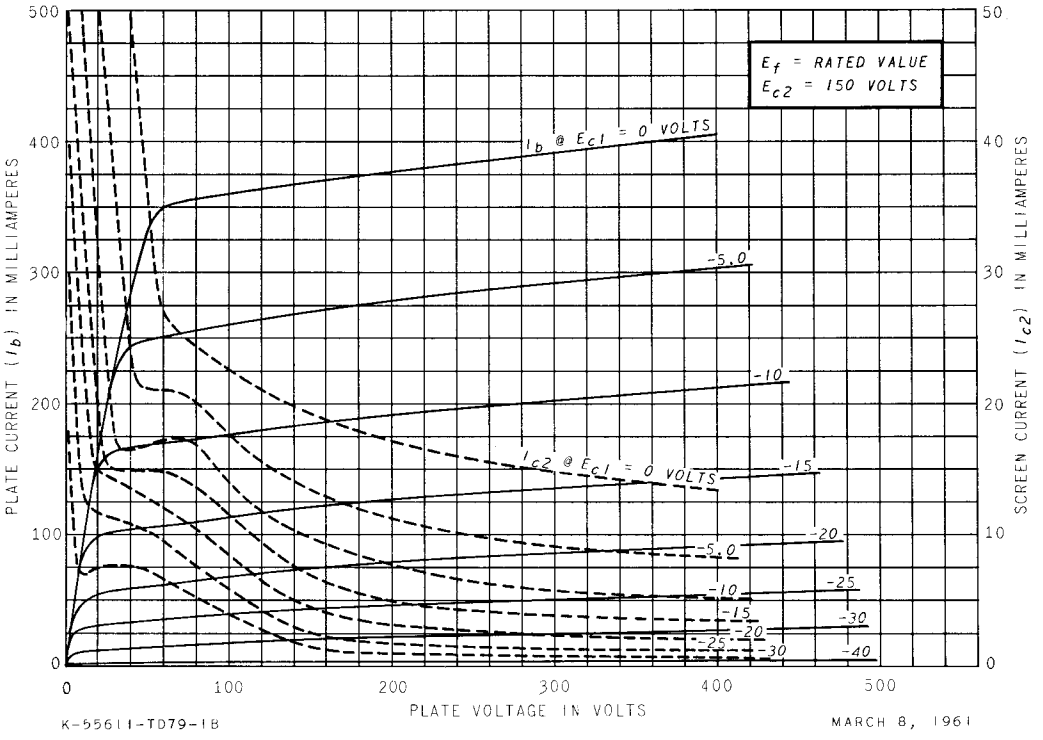
Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

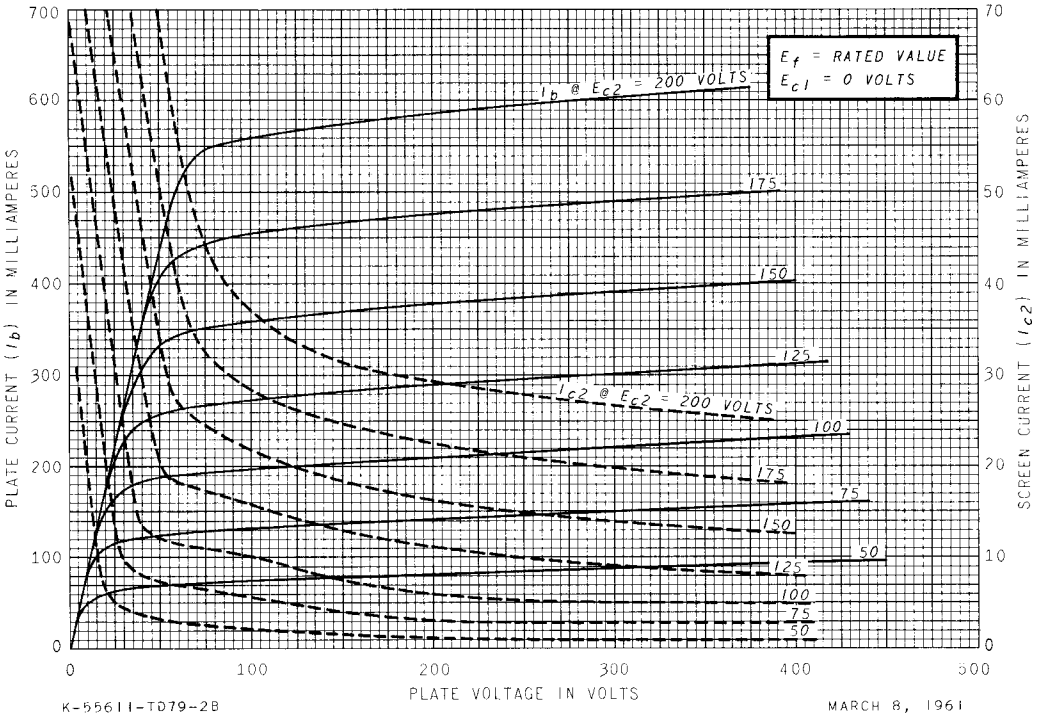
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD79-1B

MARCH 8, 1961

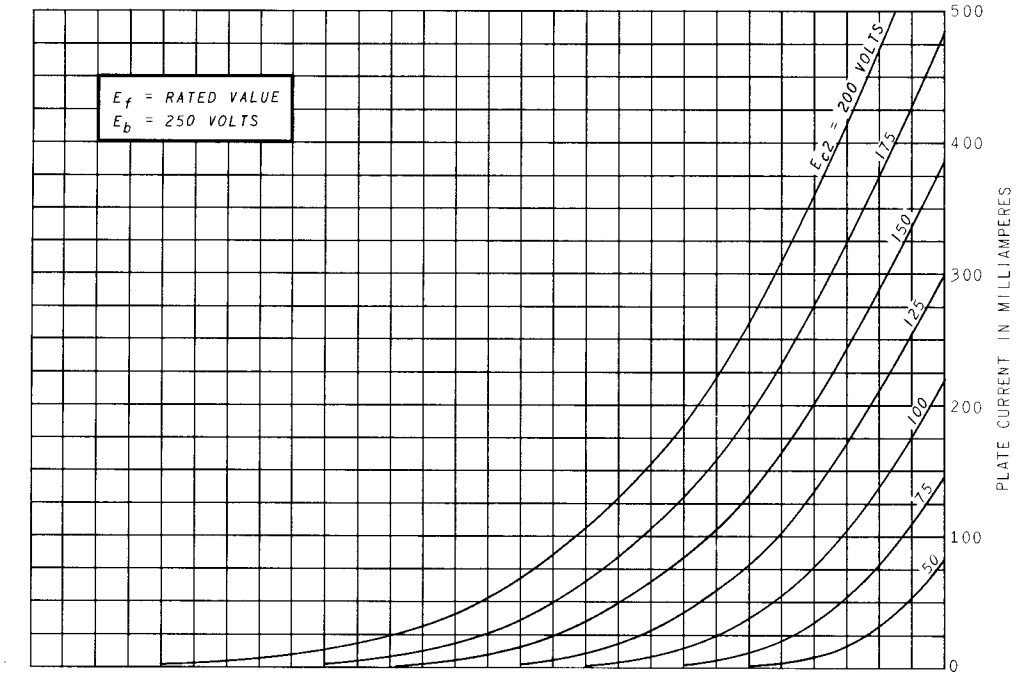
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD79-2B

MARCH 8, 1961

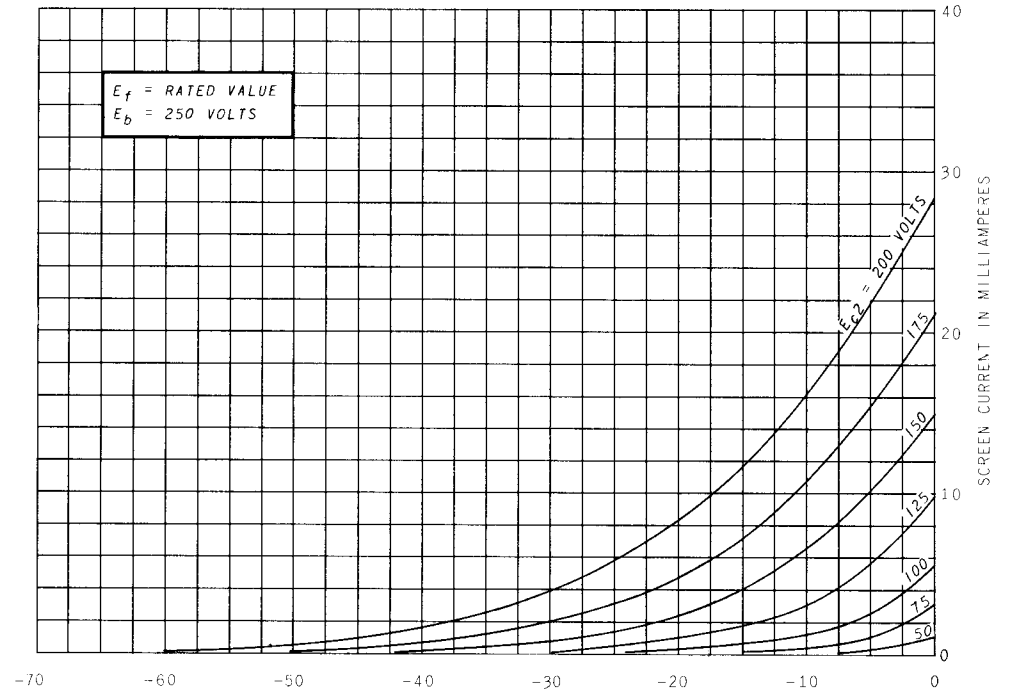
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD79-3B

MARCH 8, 1961

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD79-4B

MARCH 8, 1961

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

6DT6 - 3DT6 - 4DT6

PENTODE

FOR FM DETECTOR APPLICATIONS

DESCRIPTION AND RATING

The 6DT6 is a miniature sharp-cutoff dual-control pentode primarily intended for use as an FM detector in television receivers. It is also suitable for use in delay circuits, gain-controlled amplifier circuits, and mixer circuits.

As an FM detector, the 6DT6 performs the combined functions of limiter and detector when used in conjunction with suitable circuitry. It also exhibits high sensitivity, and is capable of providing high audio output voltage.

Except for heater ratings, the 3DT6 and 4DT6 are identical to the 6DT6. In addition, they incorporate a controlled heater warm-up characteristic, which makes them especially suited for use in television receivers that employ series-connected heaters.

GENERAL

ELECTRICAL

	3DT6	4DT6	6DT6	
Cathode—Coated Unipotential				
Heater Voltage, AC or DC	3.15	4.2	6.3	Volts
Heater Current	0.6	0.45	0.3	Amperes
Heater Warm-up Time*	11	11	...	Seconds
Direct Interelectrode Capacitances, approximate†				
Grid-Number 1 to Plate			0.02	μμf
Grid-Number 3 to Plate			1.4	μμf
Grid-Number 1 to All Except Plate			5.8	μμf
Grid-Number 3 to All			6.1	μμf
Grid-Number 1 to Grid-Number 3			0.1	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

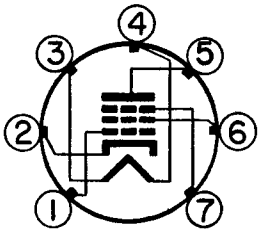
FM DETECTOR SERVICE—DESIGN-CENTER VALUES

Plate Voltage	300	Volts
Suppressor Voltage	25	Volts
Screen-Supply Voltage	300	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	1.5	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	0.5	Megohms

GENERAL ELECTRIC

Supersedes ET-T1313, dated 2-56

BASING DIAGRAM

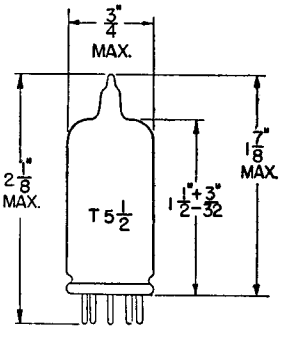


RETMA 7EN

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode and Internal Shield
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Grid Number 3 (Suppressor)

PHYSICAL DIMENSIONS



RETMA 5-2

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	150 Volts
Suppressor Voltage	0 Volts
Screen Voltage	100 Volts
Cathode-Bias Resistor	560 Ohms
Plate Resistance, approximate	0.15 Megohms
Grid-Number 1 Transconductance	800 Micromhos
Grid-Number 3 Transconductance	515 Micromhos
Plate Current	1.1 Milliamperes
Screen Current	2.1 Milliamperes
Grid-Number 1 Voltage, approximate	
Ib = 10 Microamperes	−4.5 Volts
Grid-Number 3 Voltage, approximate	
Ib = 10 Microamperes	−3.5 Volts

4.5-Megacycle FM Detector—See Circuit Diagram

RMS Input Signal to Grid to Driver Tube	15	200	500 Millivolts
Plate Supply Voltage	250	250	250 Volts
Suppressor Voltage (Obtained from a 560,000-ohm resistor)	−5.0	−6.0	−6.4 Volts
Screen Voltage	100	100	100 Volts
Cathode-Bias Resistor	560	560	560 Ohms
Plate Load Resistor	0.27	0.27	0.27 Megohms
Plate Current	0.23	0.22	0.21 Milliamperes
Screen Current	3.4	5.5	6.0 Milliamperes
Grid-Number 1 Current	0.013	0.6	0.8 Milliamperes
Bandwidth			
For a Total Harmonic Distortion of 10 Percent	65	120	118 Kilocycles
AM Rejection‡, approximate	33	29	28 Decibels
RMS Audio Output Voltage, approximate			
With ±7.5-kc Deviation from Mean Value of 4.5 Megacycles	5.5	6.5	7.5 Volts
With ±25-kc Deviation from Mean Value of 4.5 Megacycles	17	21	23 Volts
Total Harmonic Distortion, approximate			
With ±25-kc Deviation from Mean Value of 4.5 Megacycles	2	3	4 Percent

Sensitivity		
With ±7.5-kc Deviation from Mean Value of 4.5 Megacycles	5§	Millivolts
With ±25-kc Deviation from Mean Value of 4.5 Megacycles	15§	Millivolts

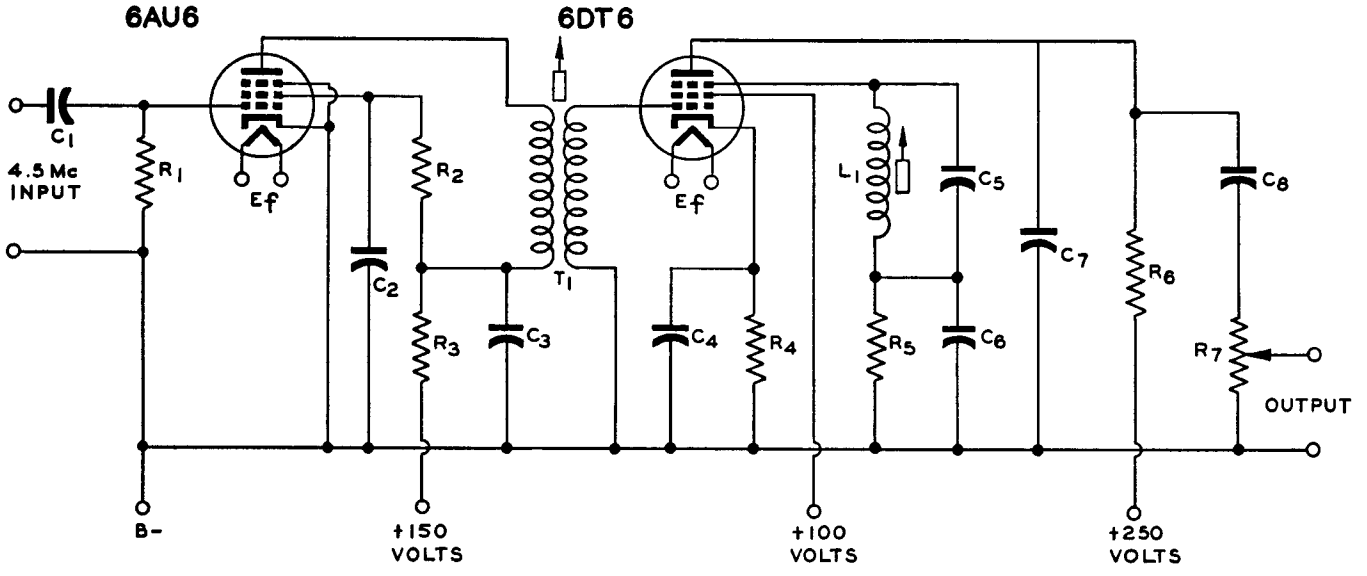
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (RETMA 316) connected to cathode.

‡ Ratio of the audio output voltage produced by 30-percent amplitude modulation of the 4.5-megacycle carrier frequency to the audio output voltage produced by ±25-kilocycle deviation from the 4.5-megacycle carrier frequency, with a modulating frequency of 400 cps in both cases.

§ Signal level at which detector circuit will handle the indicated deviation in frequency from the mean value of 4.5 megacycles before distortion occurs.

LOCKED-OSCILLATOR, QUADRATURE-GRID DETECTOR CIRCUIT UTILIZING TYPE 6DT6 OR 3DT6



C1 - 47μμf, 400 VOLTS
C2 C3 - 0.01μf, 400VOLTS
C4 - 0.01μf, 200 VOLTS
C5 - 18μμf, 200 VOLTS
C6 - 0.05μf, 200 VOLTS
C7 - 100 TO 1000 μμf, 400 VOLTS
C8 - 0.01μf, 400 VOLTS

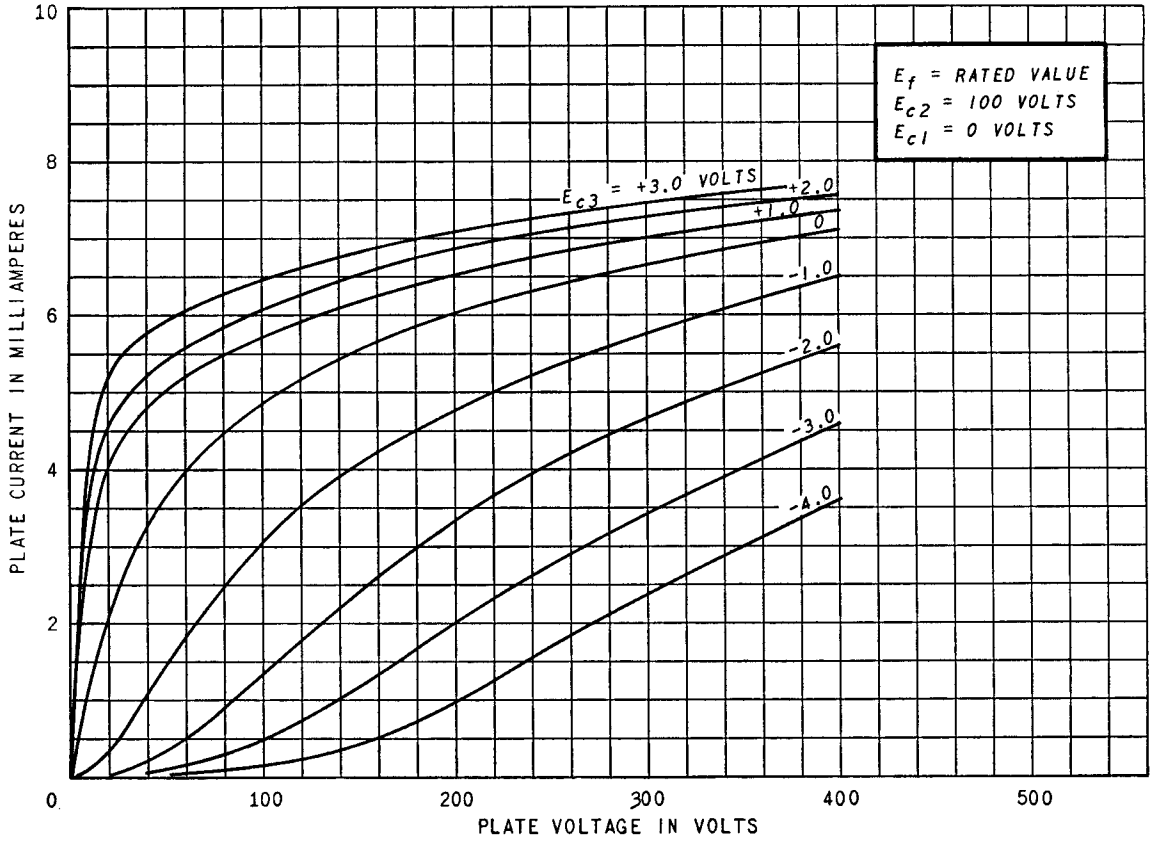
L1 - SLUG-TUNED INDUCTOR WITH Q OF 50 AND TUNEABLE TO 4.5-MC
R1 - 100000 OHMS, 0.5 WATT
R2 - 12000 OHMS, 0.5 WATT
R3 - 1000 OHMS, 0.5 WATT
R4 - 560 OHMS, 0.5 WATT
R5 - 560000 OHMS, 0.5 WATT

R6 - 270000 OHMS, 0.5 WATT
R7 - 0.5 MEGOHM POTENTIOMETER
T1 - SLUG-TUNED, BIFILAR WOUND IF TRANSFORMER WITH RATIO OF 1:1.5, Q > 60, AND TUNEABLE TO 4.5-MC WITH TUBE AND WIRING CAPACITANCE

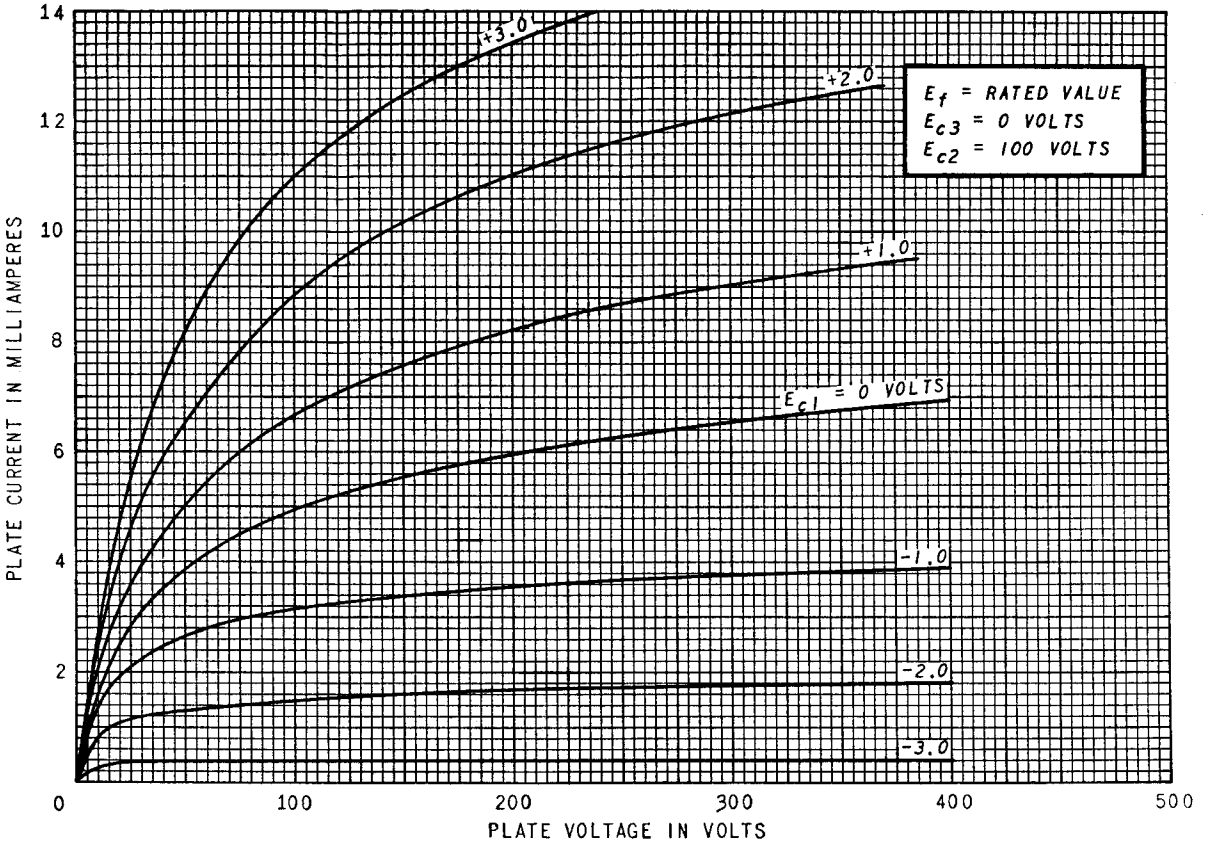
RECOMMENDED ALIGNMENT PROCEDURE

1. Feed a 500-millivolt, 4.5-mc, 400-cps FM-modulated (±25-kc deviation) signal to the input of the driver tube.
2. Adjust L1 for maximum undistorted sound output. Since several maxima may occur during this adjustment, it is important to select the proper one. This is the higher frequency peak and coincides with maximum voltage drop across R5.
3. Reduce the level of the 4.5-mc signal to 5 millivolts RMS.
4. Using an oscilloscope, adjust T1 for a centered discriminator characteristic with oscillation beats at the edges. Alternatively, T1 may be adjusted for maximum d-c voltage across R5.
5. Repeat steps 1 through 4 as necessary to assure accurate alignment.

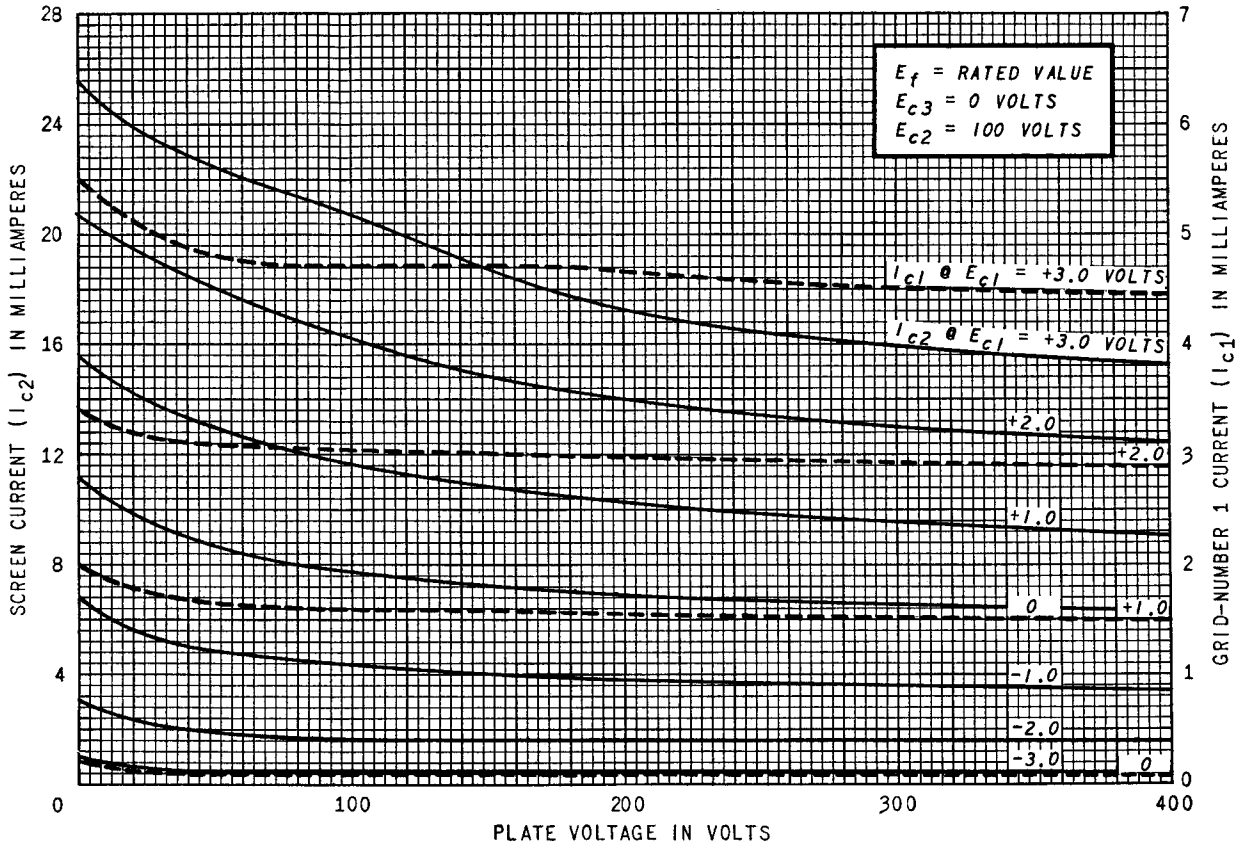
AVERAGE PLATE CHARACTERISTICS



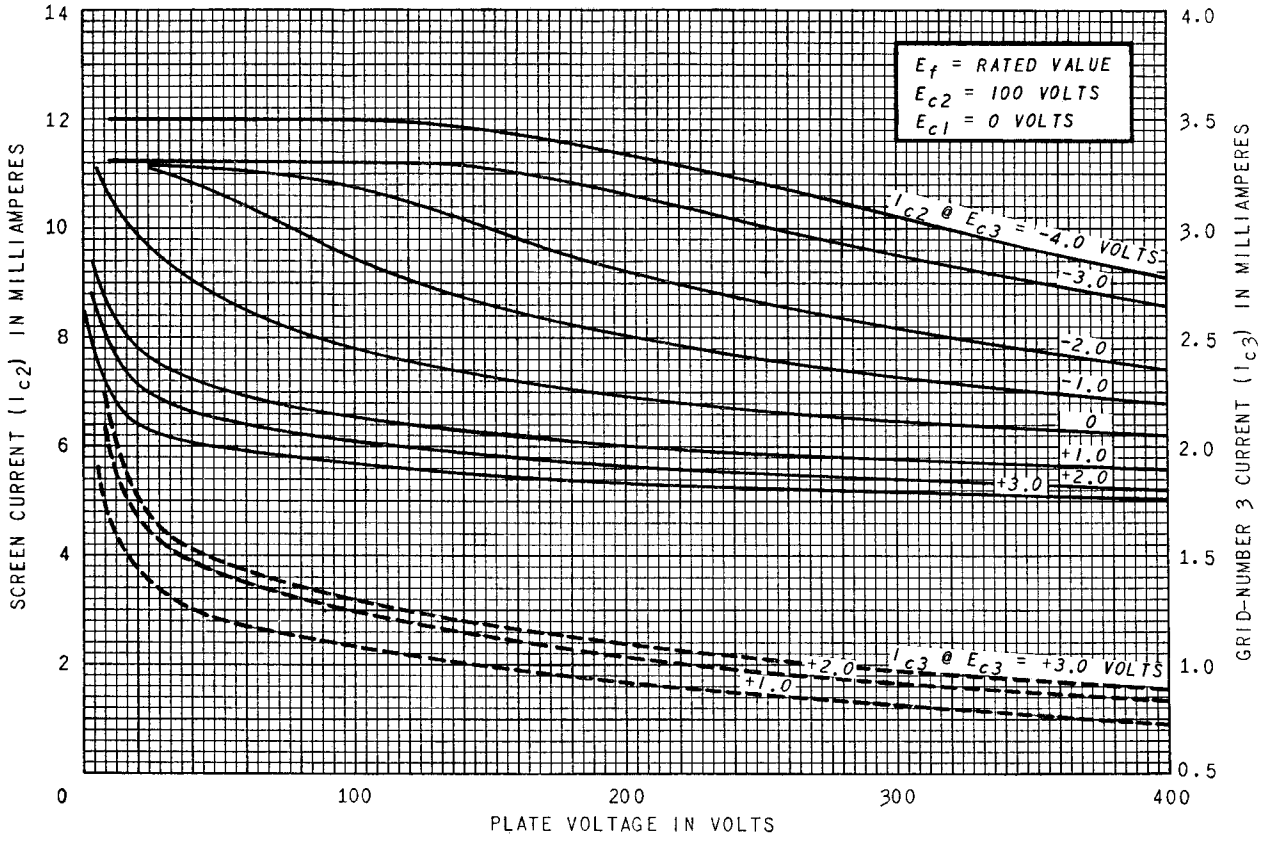
AVERAGE PLATE CHARACTERISTICS



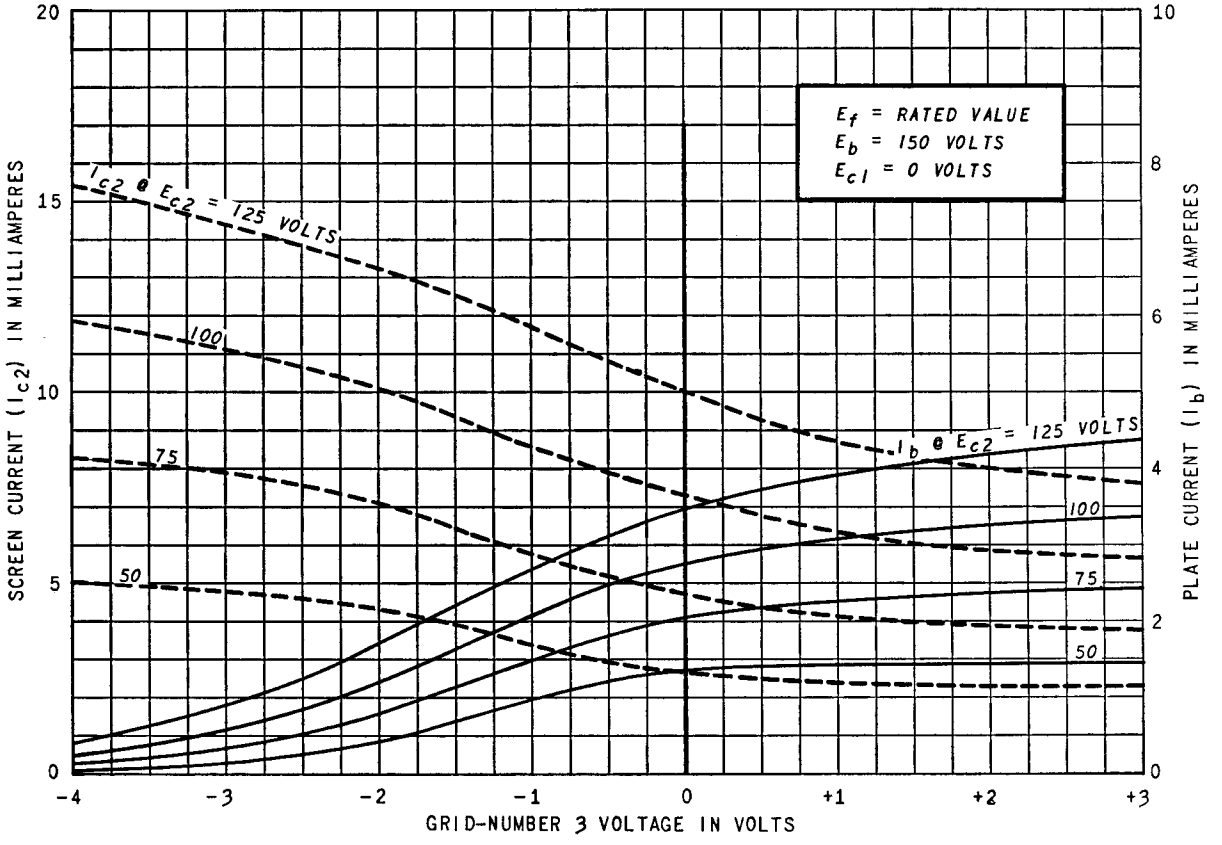
AVERAGE CHARACTERISTICS



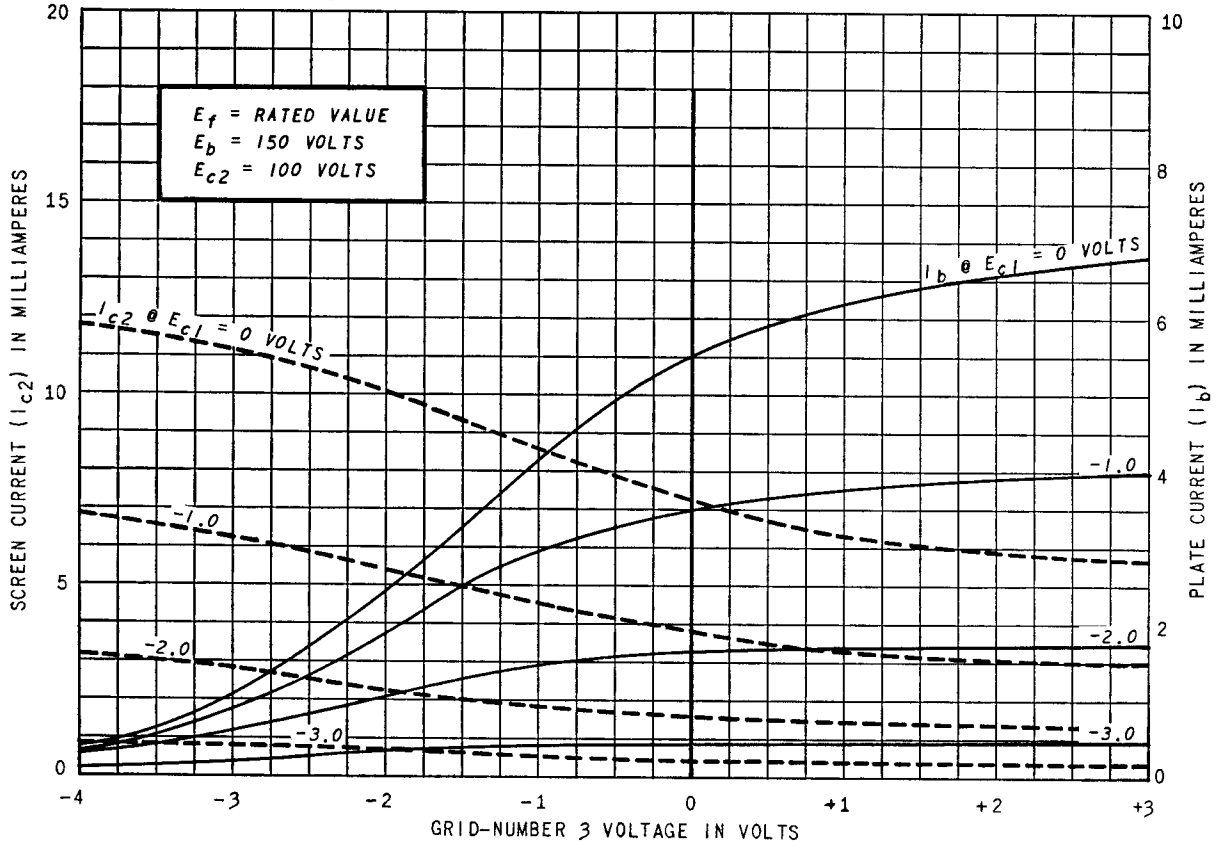
AVERAGE CHARACTERISTICS



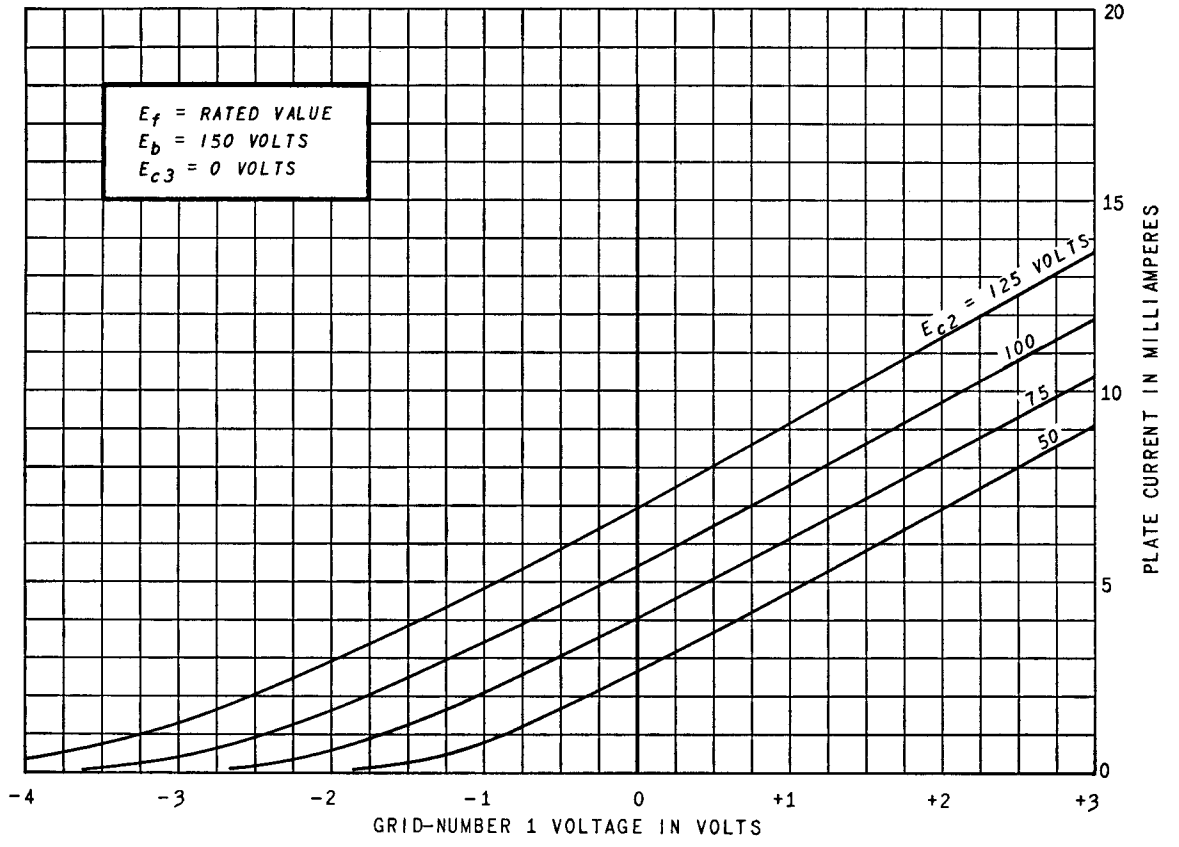
AVERAGE TRANSFER CHARACTERISTICS



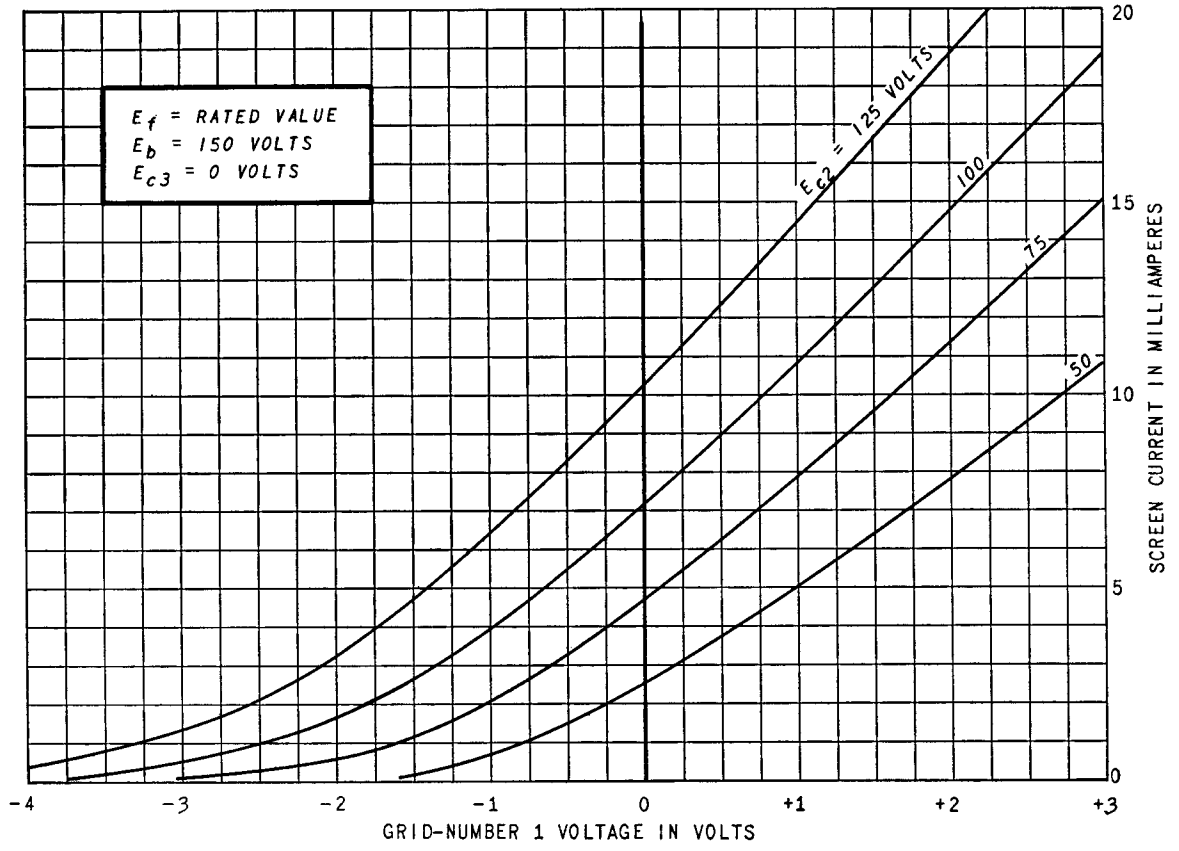
AVERAGE TRANSFER CHARACTERISTICS



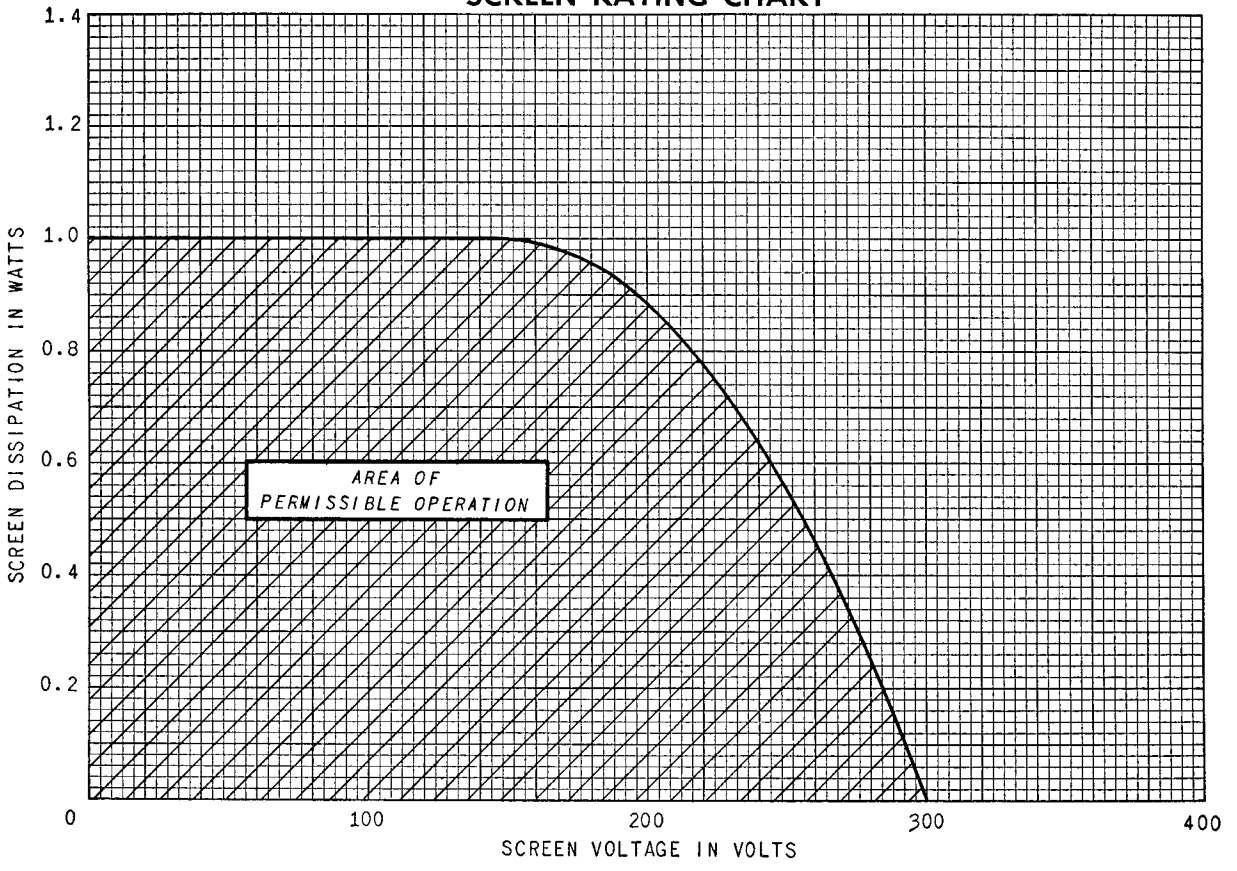
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



SCREEN RATING CHART



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6DT8 - 12DT8

TWIN TRIODE

DESCRIPTION AND RATING

The 6DT8 is a miniature, high-mu, twin triode designed for use as a radio-frequency amplifier or as a combined oscillator and mixer in FM receivers. The incorporation of an internal shield contributes to the stable performance of this tube as a high-frequency amplifier.

Except for heater ratings, the 12DT8 is identical to the 6DT8.

GENERAL

ELECTRICAL	6DT8	12DT8	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	6.3	12.6	Volts
Heater Current	0.3	0.15	Amperes
Direct Interelectrode Capacitances, approximate*	Section 1	Section 2	
Grid to Plate	1.6	1.6	μμf
Input	2.7	2.7	μμf
Output	1.6	1.6	μμf
Heater to Cathode	3.0	3.0	μμf
Grounded-Grid Input†		5.3	μμf
Grounded-Grid Output†		2.8	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES, EACH SECTION

Plate Voltage	300	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	2.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	1.0	Megohms

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

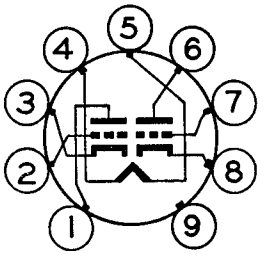
The tube manufacturer chooses these values to provide acceptable serviceability of the tube in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation (for an alternating-current power source, 117 volts plus or minus 10 percent is accepted USA practice), equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in tube characteristics.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply voltage.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM

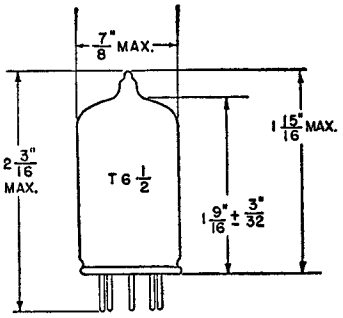


EIA 9DE

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Internal Shield

PHYSICAL DIMENSIONS



EIA 6-2

CHARACTERISTICS AND TYPICAL OPERATION

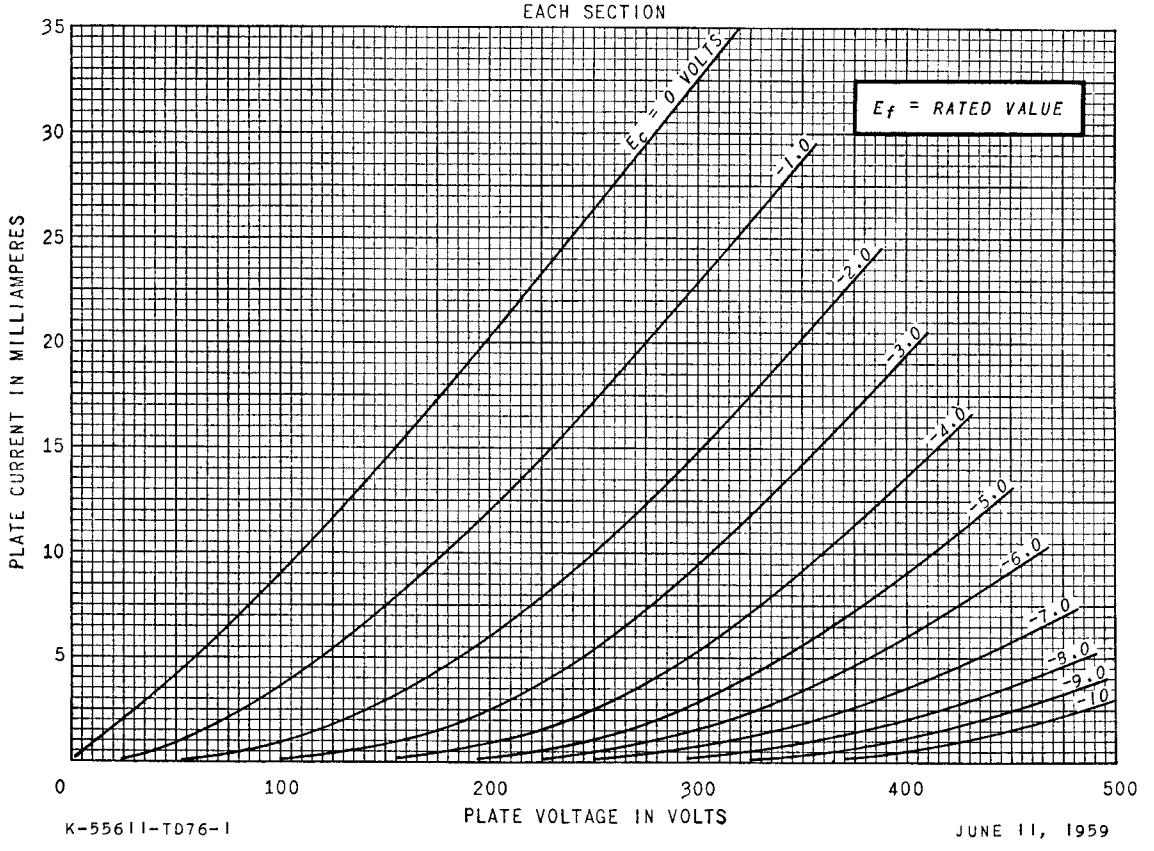
CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	100	250	Volts
Cathode-Bias Resistor	270	200	Ohms
Amplification Factor	60	60	
Plate Resistance, approximate	15000	10900	Ohms
Transconductance	4000	5500	Micromhos
Plate Current	3.7	10	Milliamperes
Grid Voltage, approximate			
Ib = 10 Microamperes	−5	−12	Volts

* With external shield (EIA 315) connected to cathode of section under test unless otherwise indicated.
† With external shield (EIA 315) connected to grid.

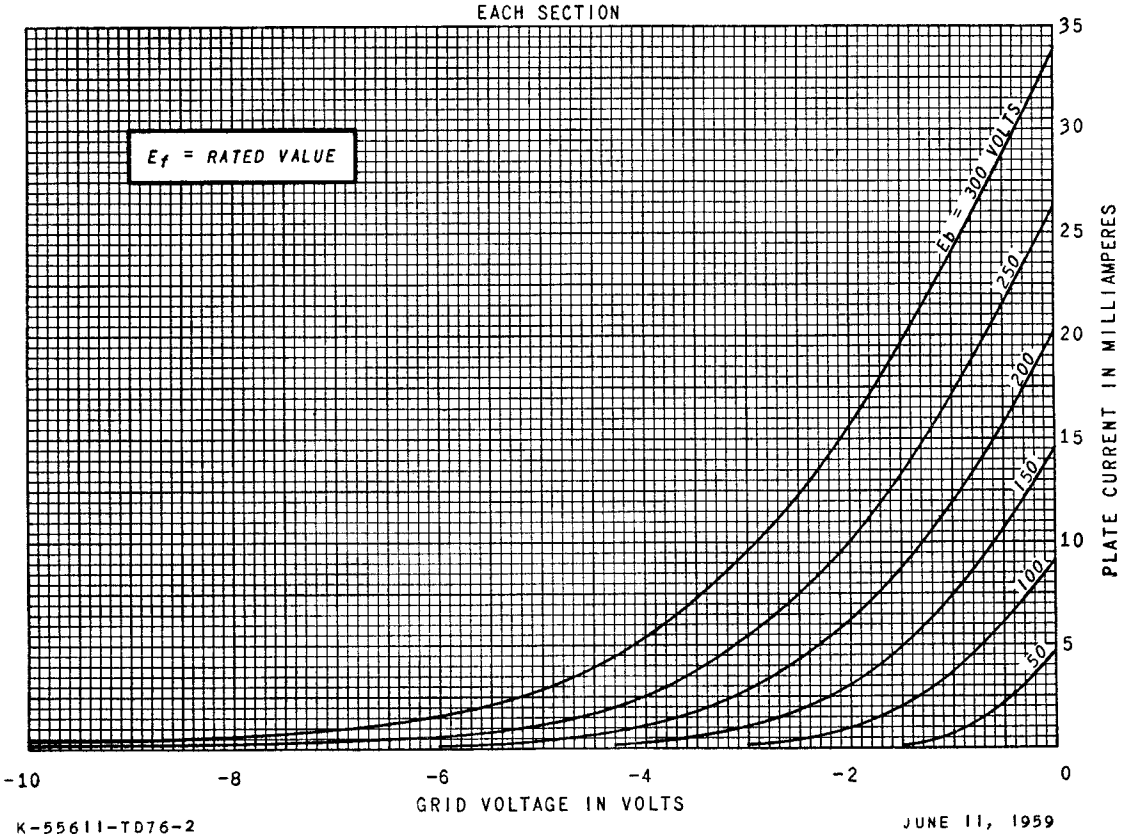
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION

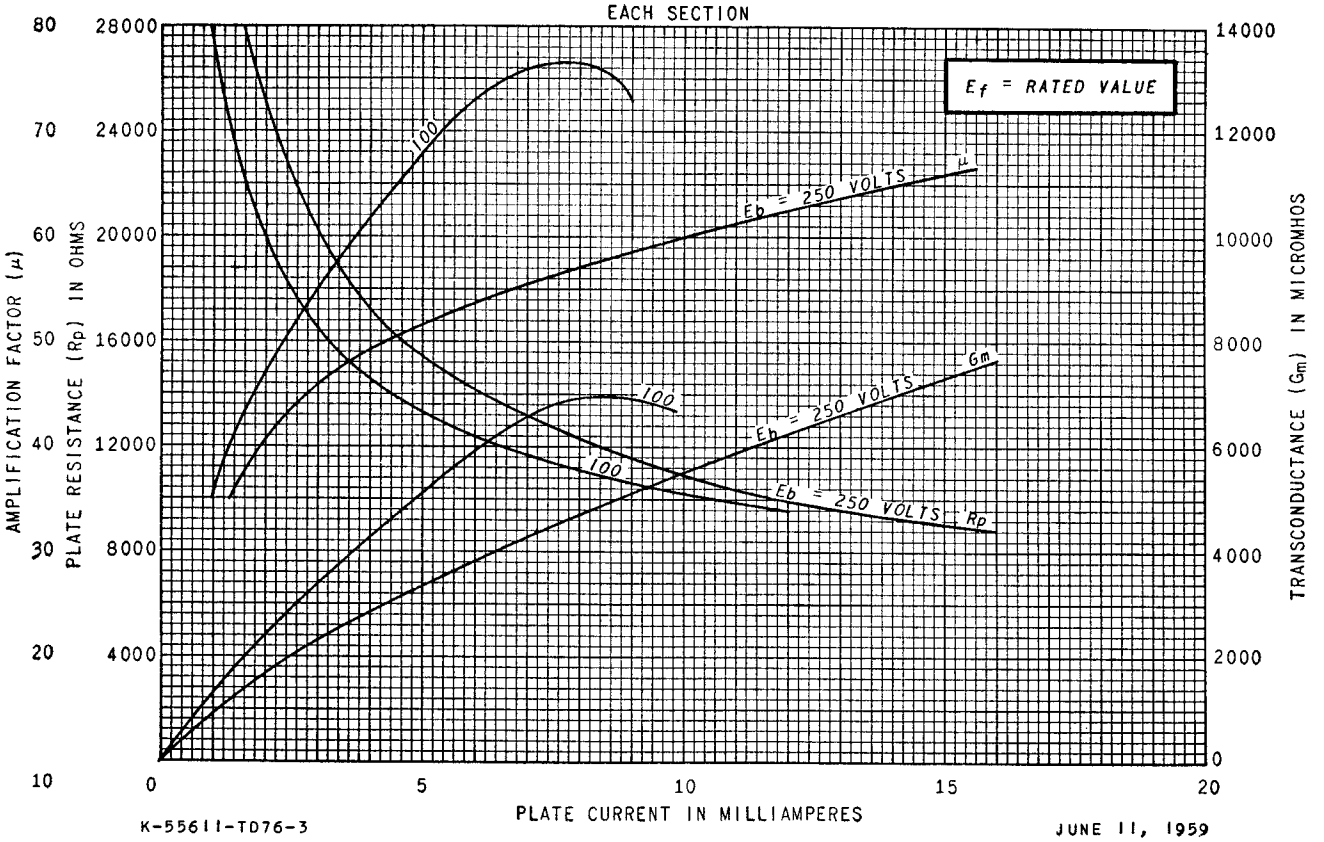


K-55611-TD76-2

JUNE 11, 1959

AVERAGE CHARACTERISTICS

EACH SECTION



K-55611-TD76-3

JUNE 11, 1959

Electronic TUBES

6DZ7

TWIN PENTODE

FOR AF POWER AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6DZ7 is a twin power pentode designed for use in the output stage of high-fidelity audio amplifiers. The incorporation of two pentode sections in one envelope makes it especially suitable for compact stereo systems.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3		Volts
Heater Current	1.52		Amperes
	Section 1	**Section 2**	
Direct Interelectrode Capacitances, approximate*			
Grid-Number 1 to Plate	0.7	0.5	μμf
Input	11	11	μμf
Output	5.0	5.0	μμf
Grid-Number 1, Section 1 to Grid-Number 1, Section 2	0.03		μμf
Plate, Section 1 to Plate, Section 2	1.5		μμf

MECHANICAL

Mounting Position—Any
Envelope—T-12, Glass
Base—B8-110, Short Medium-Shell Octal 8-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION UNLESS OTHERWISE INDICATED

Allowable Heater Voltage	5.7 to 6.9	Volts
Plate Voltage	440	Volts
Screen Voltage	300	Volts
Plate Dissipation	13.2	Watts
Screen Dissipation, Total	4.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	0.27	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

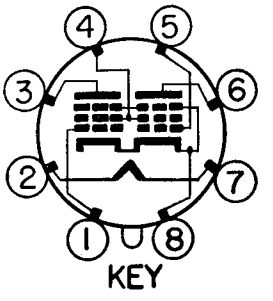
The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

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GENERAL ELECTRIC

BASING DIAGRAM

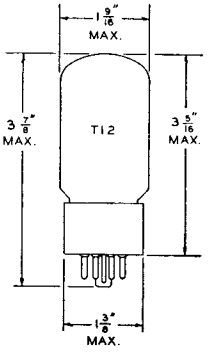


EIA 8JP

TERMINAL CONNECTIONS

Pin 1—Grid Number 1 (Section 2)
Pin 2—Heater
Pin 3—Plate (Section 2)
Pin 4—Grid Number 2 (Both Sections)
Pin 5—Grid Number 1 (Section 1)
Pin 6—Plate (Section 1)
Pin 7—Heater
Pin 8—Cathode and Grid Number 3 (Both Sections)

PHYSICAL DIMENSIONS



EIA 12-14

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

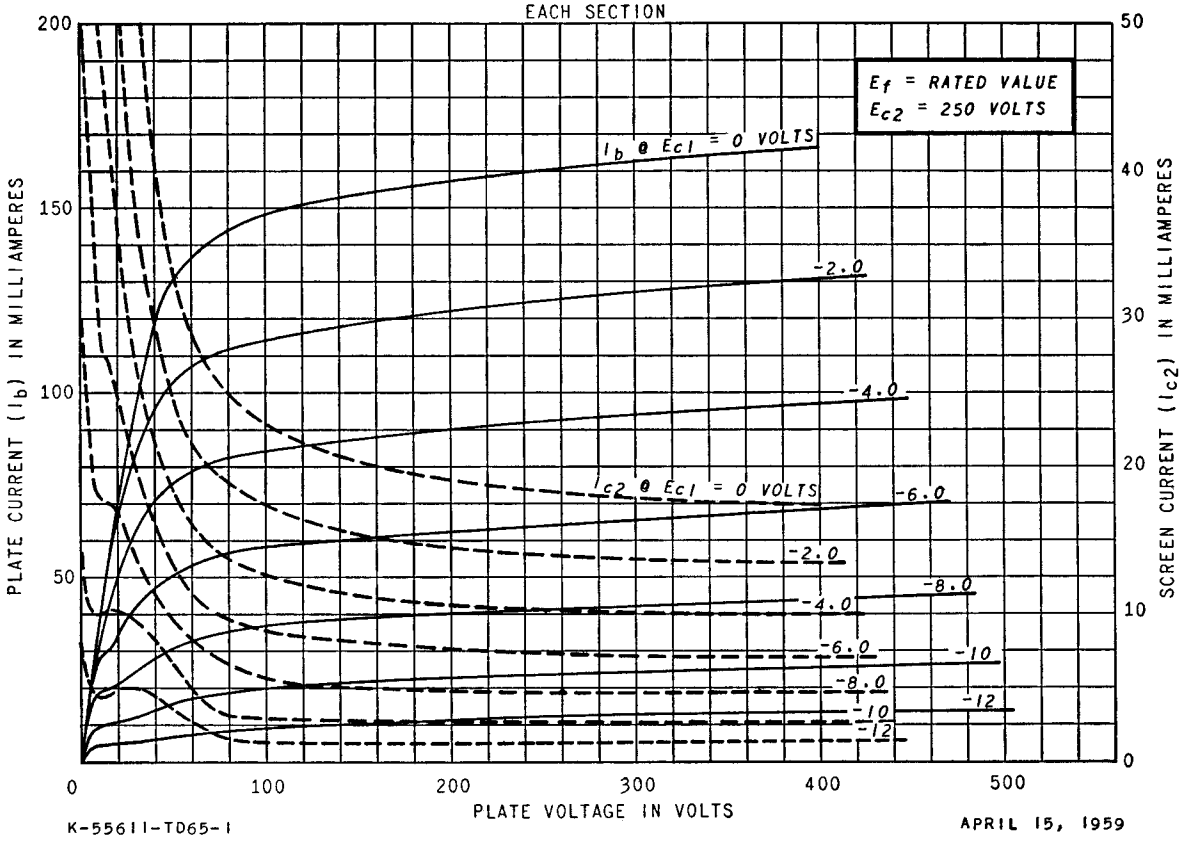
Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	−7.3	Volts
Plate Resistance, approximate	38000	Ohms
Transconductance	11300	Micromhos
Plate Current	48	Milliamperes
Screen Current	5.5	Milliamperes

PUSH-PULL CLASS AB_1 AMPLIFIER, SINGLE TUBE

	Fixed Bias	Cathode Bias	
Plate Voltage	400	300	Volts
Screen Voltage	250	250	Volts
Grid-Number 1 Voltage	−11	....	Volts
Cathode-Bias Resistor	...	120	Ohms
Peak AF Grid-to-Grid Voltage	22	22	Volts
Zero-Signal Plate Current	40	66	Milliamperes
Maximum-Signal Plate Current	100	80	Milliamperes
Zero-Signal Screen Current	4.0	7.0	Milliamperes
Maximum-Signal Screen Current	13	15	Milliamperes
Effective Load Resistance, Plate-to-Plate	9000	9000	Ohms
Total Harmonic Distortion	2.5	3.5	Percent
Maximum-Signal Power Output	18	12	Watts

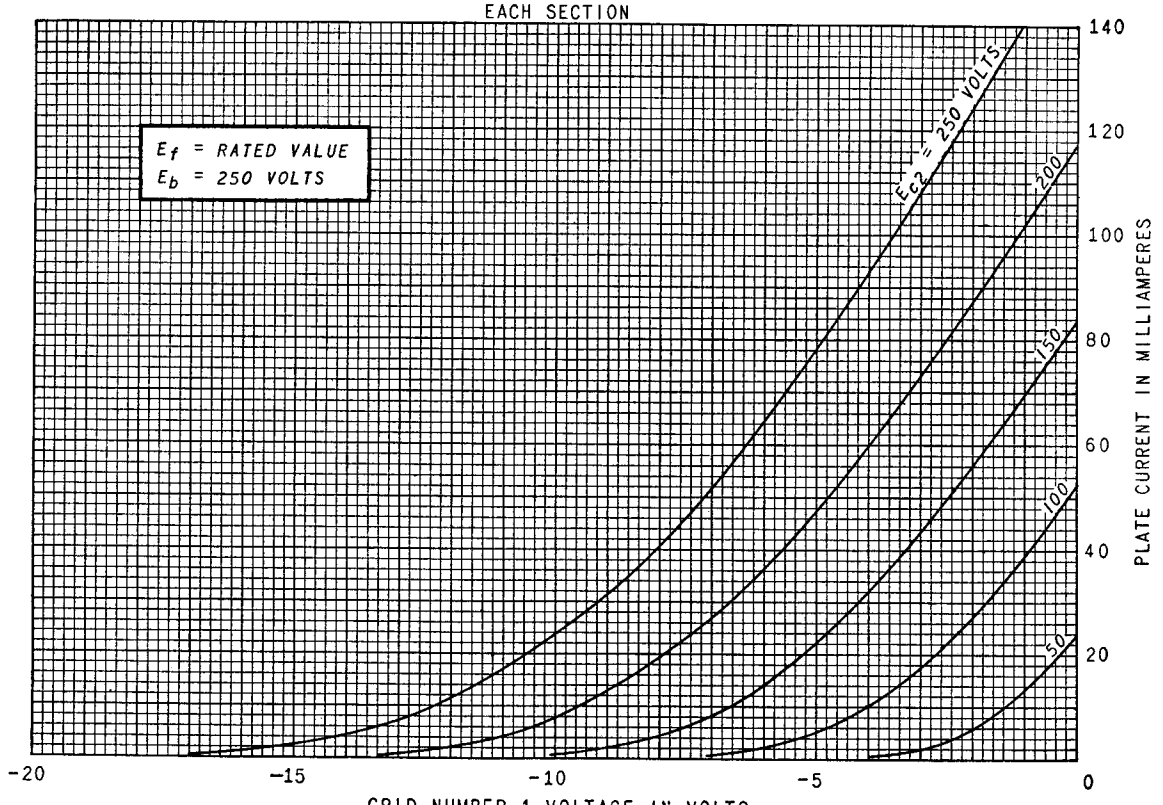
* Without external shield.

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION

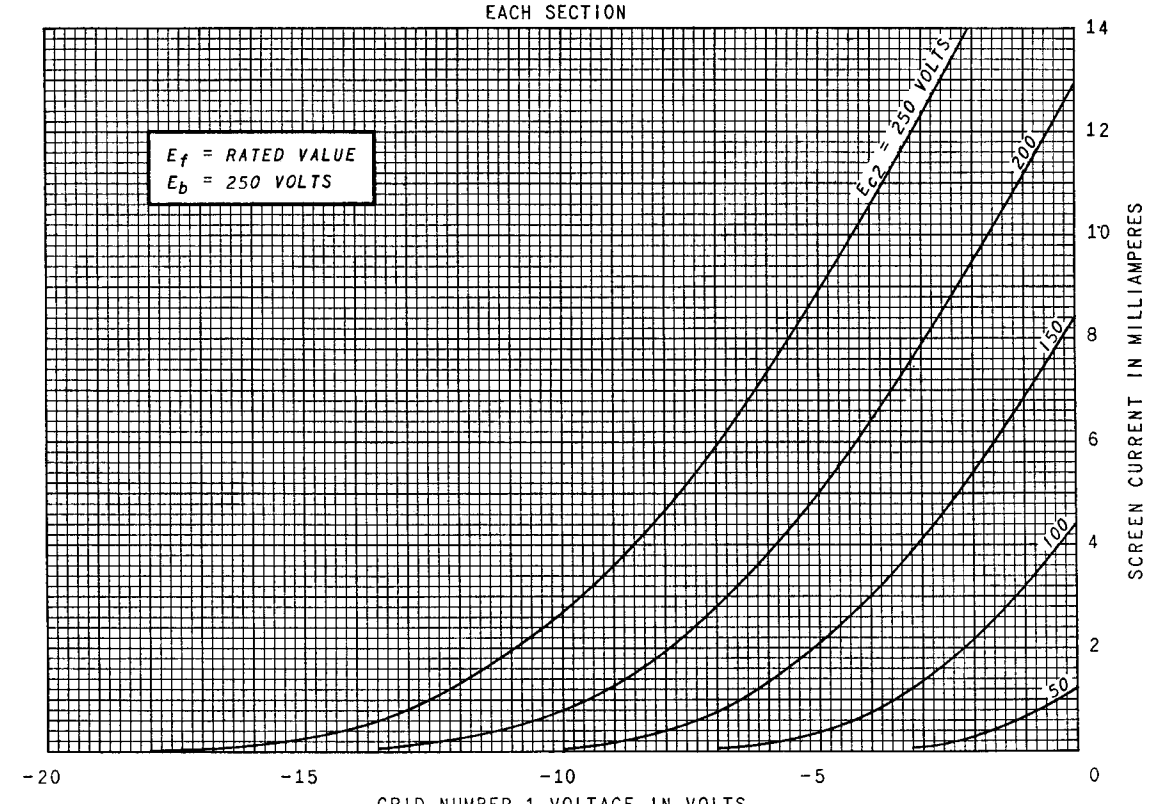


K-55611-TD65-2

APRIL 15, 1959

AVERAGE TRANSFER CHARACTERISTICS

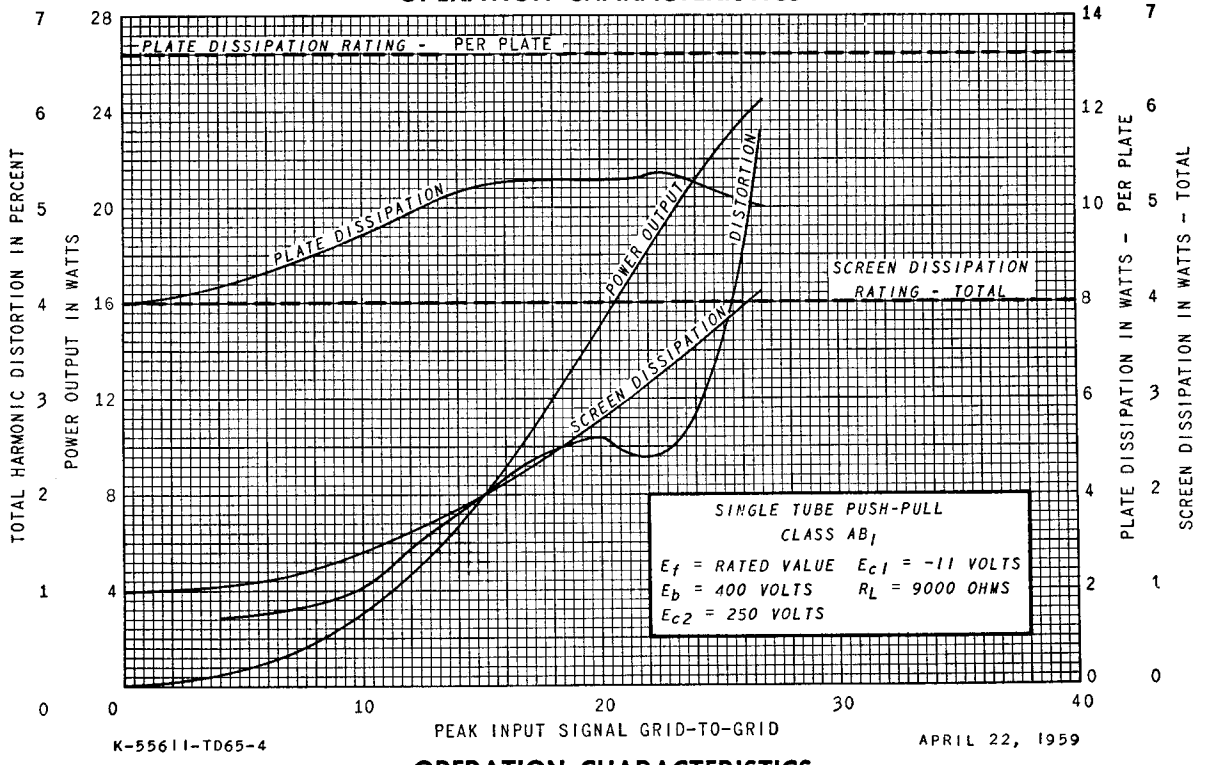
EACH SECTION



K-55611-TD65-3

APRIL 15, 1959

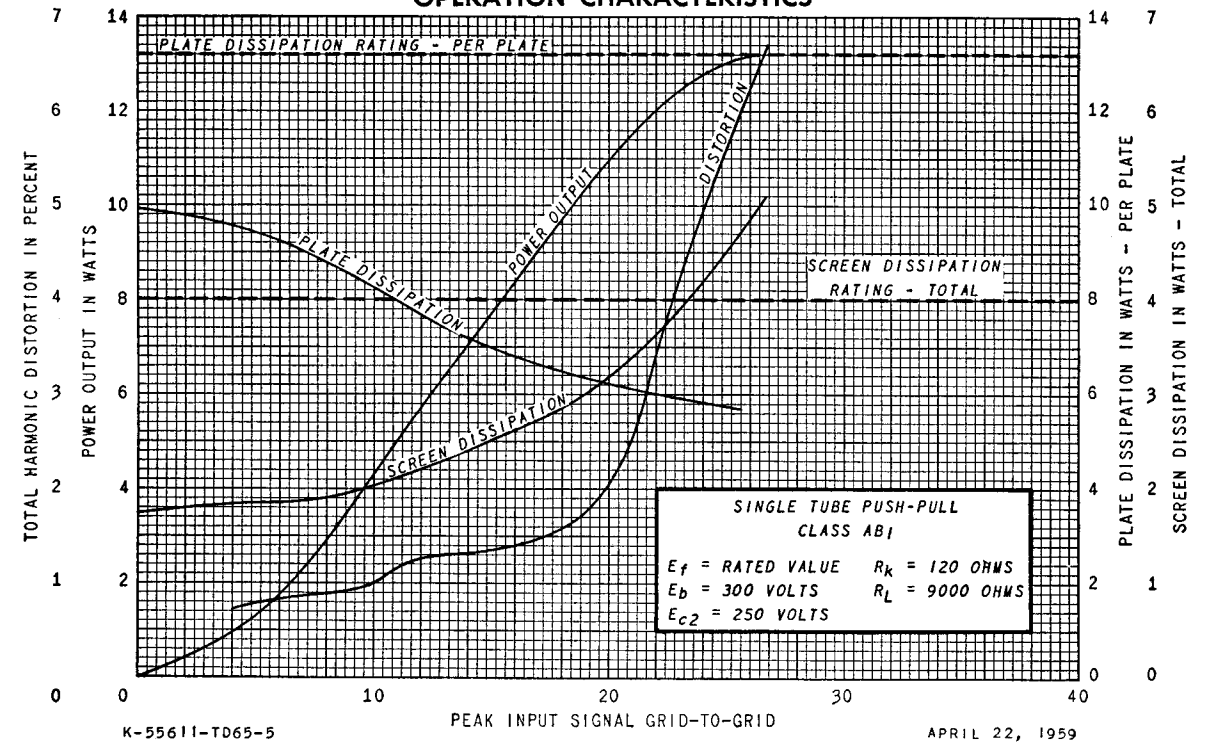
OPERATION CHARACTERISTICS



K-55611-TD65-4

APRIL 22, 1959

OPERATION CHARACTERISTICS



K-55611-TD65-5

APRIL 22, 1959

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6EA7

DISSIMILAR DOUBLE TRIODE

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6EA7 is a dissimilar double-triode designed for use as a combined vertical-deflection oscillator and amplifier in television receivers. Section one, a high-mu triode, is intended for service as an oscillator; Section two, a low-mu, high-perveance triode, for service as an amplifier.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3	Volts
Heater Current	1.05	Amperes

Direct Interelectrode Capacitances, approximate*

	Section 1	Section 2	
Grid to Plate	4.0	8.0	μμf
Input	2.2	6.0	μμf
Output	0.6	1.3	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B8-6 Intermediate-Shell Octal 8-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES	Vertical Oscillator Service (Section 1)†	Vertical Deflection Amplifier (Section 2)†	
Allowable Heater Voltage		5.7 to 6.9	Volts
DC Plate Voltage	350	550	Volts
Peak Positive Pulse Plate Voltage	—	1500	Volts
Peak Negative Grid Voltage	400	250	Volts
Plate Dissipation	1.0	10‡	Watts
DC Cathode Current	—	50	Milliamperes
Peak Cathode Current	—	175	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance			
With Fixed Bias	1.0	1.0	Megohms
With Cathode Bias	2.2	2.2	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

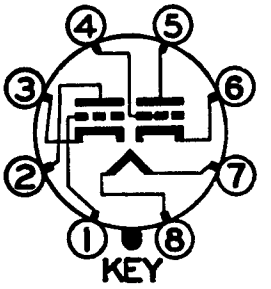
The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

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GENERAL ELECTRIC

BASING DIAGRAM

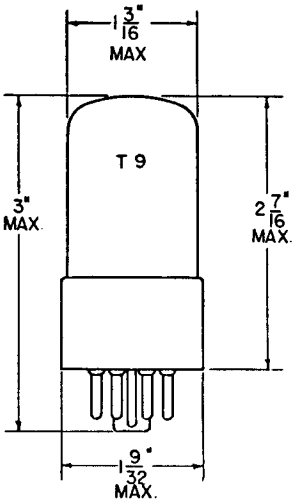


EIA 8BD

TERMINAL CONNECTIONS

Pin 1—Grid (Section 2)
Pin 2—Plate (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Grid (Section 1)
Pin 5—Plate (Section 1)
Pin 6—Cathode (Section 1)
Pin 7—Heater
Pin 8—Heater

PHYSICAL DIMENSIONS



EIA 9-5

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Section 1 (Oscillator)	Section 2 (Amplifier)		
Plate Voltage	250	60	175	Volts
Grid Voltage	−3.0	0§	−25	Volts
Amplification Factor	65	—	5.0	
Plate Resistance, approximate	34000	—	770	Ohms
Transconductance	1900	—	6500	Micromhos
Plate Current	1.5	95	48	Milliamperes
Grid Voltage, approximate Ib = 20 Microamperes	−5	—	—	Volts
Grid Voltage, approximate Ib = 200 Microamperes	—	—	−55	Volts

* Without external shield.

† For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

‡ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

§ Applied for short interval (two seconds maximum) so as not to damage tube.

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6EA8

TRIODE-PENTODE
FOR VHF CONVERTER APPLICATIONS

DESCRIPTION AND RATING

The 6EA8 is a miniature tube which contains a sharp-cutoff pentode and a triode in one envelope. Each section has a separate cathode and is electrically independent. The tube is primarily intended for service as a combined triode oscillator and pentode mixer in television receivers. Incorporation of a controlled heater warm-up characteristic makes the tube especially suited for use in television receivers that employ series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

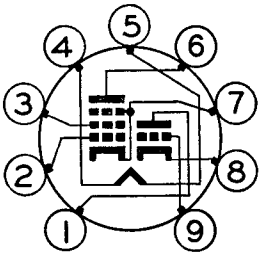
Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.45 ±6%	Amperes
Heater Warm-up Time*	11	Seconds

Direct Interelectrode Capacitances	With Shield†	Without Shield	
Pentode Section			
Grid-Number 1 to Plate: (Pg1 to Pp) maximum	0.01	0.02	μμf
Input: Pg1 to (h+Pk+Pg2+Pg3+i.s.)	5.0	5.0	μμf
Output: Pp to (h+Pk+Pg2+Pg3+i.s.)	3.4	2.6	μμf
Heater to Cathode: (Pk to h)	3.0‡	3.0	μμf
Triode Section			
Grid to Plate (Tg to Tp)	1.7	1.7	μμf
Input: Tg to (Tk+h+Pk+Pg3+i.s.)	3.2	3.0	μμf
Output: Tp to (Tk+h+Pk+Pg3+i.s.)	1.9	1.4	μμf
Heater to Cathode: (Tk to h)	3.0‡	3.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

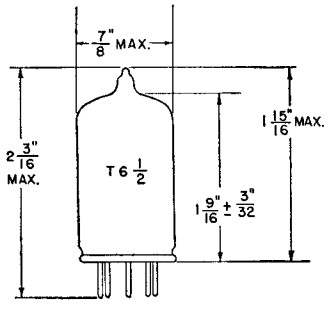


EIA 9AE

TERMINAL CONNECTIONS

Pin 1—Triode Plate
Pin 2—Pentode Grid Number 1
Pin 3—Pentode Grid Number 2 (Screen)
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Plate
Pin 7—Pentode Cathode, Grid Number 3 and Internal Shield
Pin 8—Triode Cathode
Pin 9—Triode Grid

PHYSICAL DIMENSIONS



EIA 6-2

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GENERAL ELECTRIC

Supersedes ET-T1480, dated 11-57

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	...	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.1	3.0	Watts
Screen Dissipation	0.55	...	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section	Triode Section	
Plate Voltage	125	150	Volts
Screen Voltage	125	...	Volts
Grid-Number 1 Voltage	−1.0	...	
Cathode-Bias Resistor	...	56	Ohms
Amplification Factor	...	40	
Plate Resistance, approximate	80000	5000	Ohms
Transconductance	6400	8500	Micromhos
Plate Current	12	18	Milliamperes
Screen Current	4.0	...	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 10 Microamperes	−9	−12	Volts

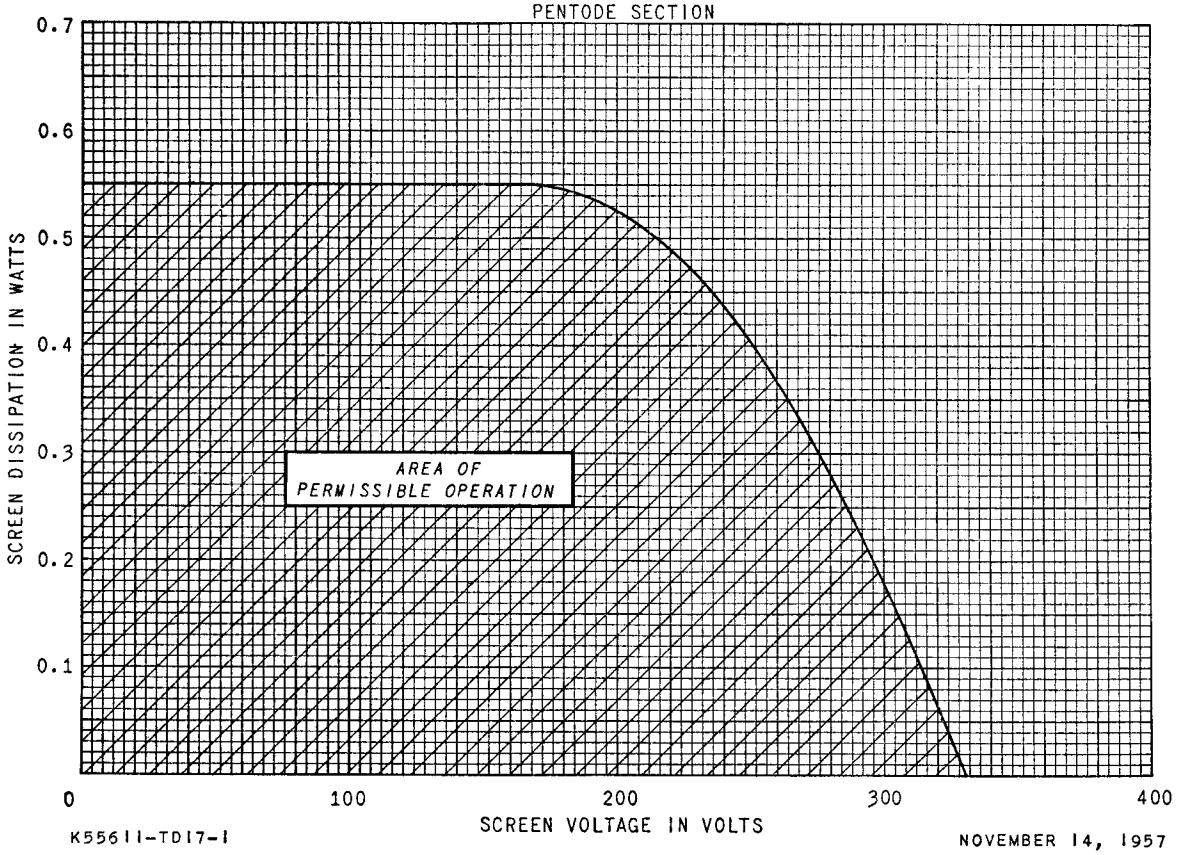
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (EIA 315) connected to cathode of section under test unless otherwise indicated.

‡ With external shield (EIA 315) connected to ground.

SCREEN RATING CHART

PENTODE SECTION

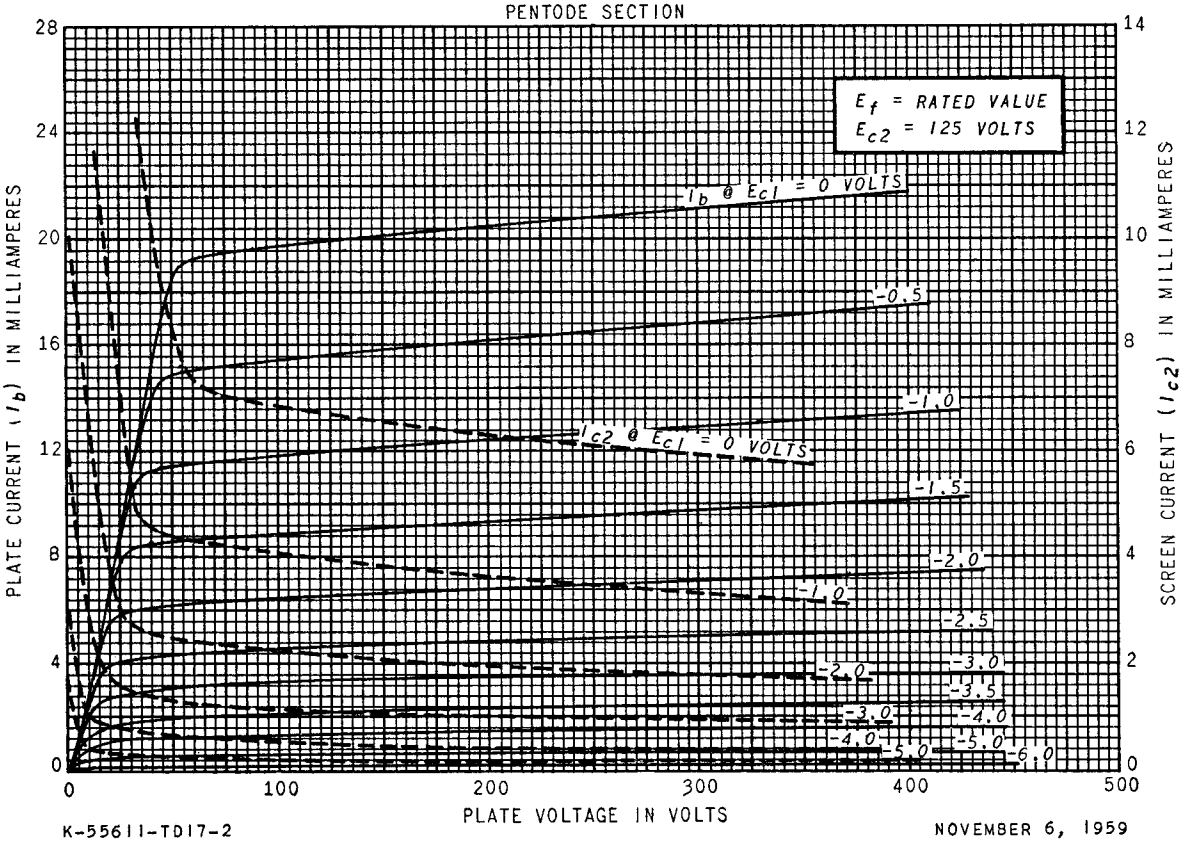


K55611-TD17-1

NOVEMBER 14, 1957

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

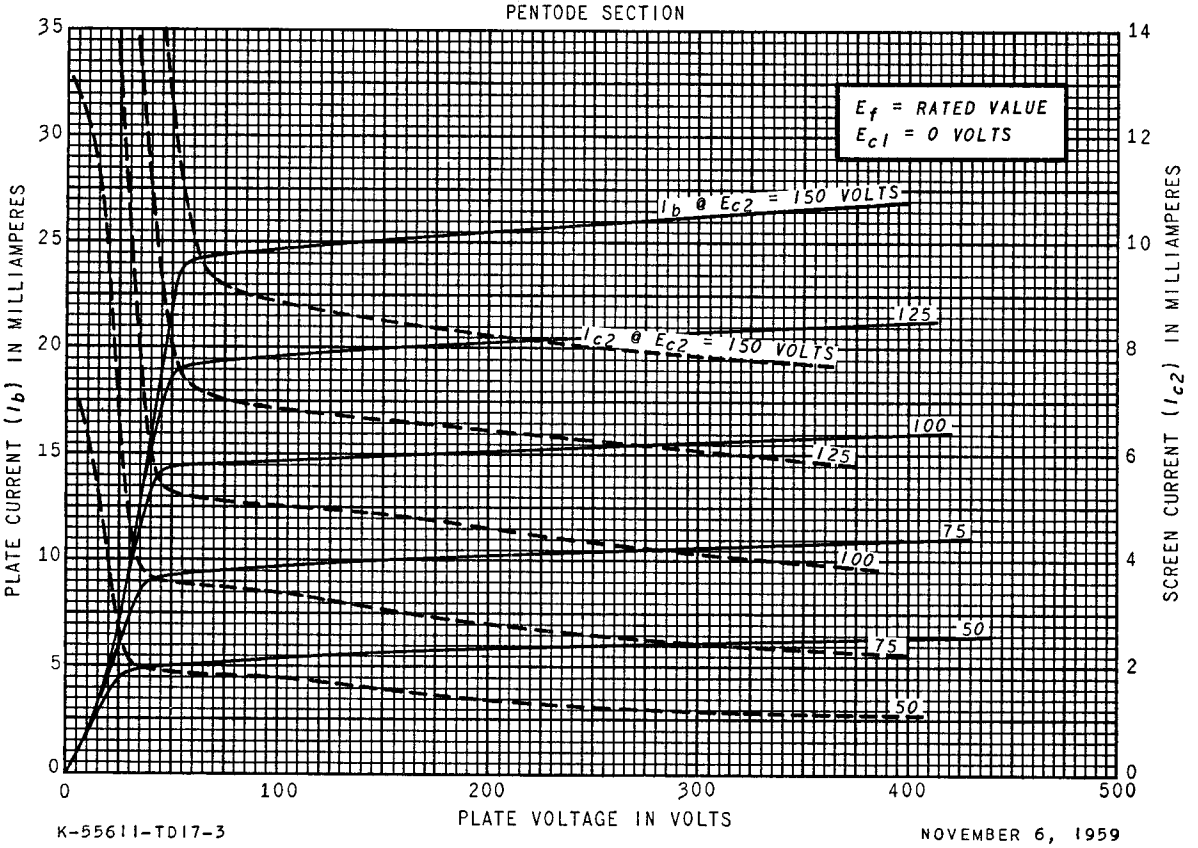


K-55611-TD17-2

NOVEMBER 6, 1959

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

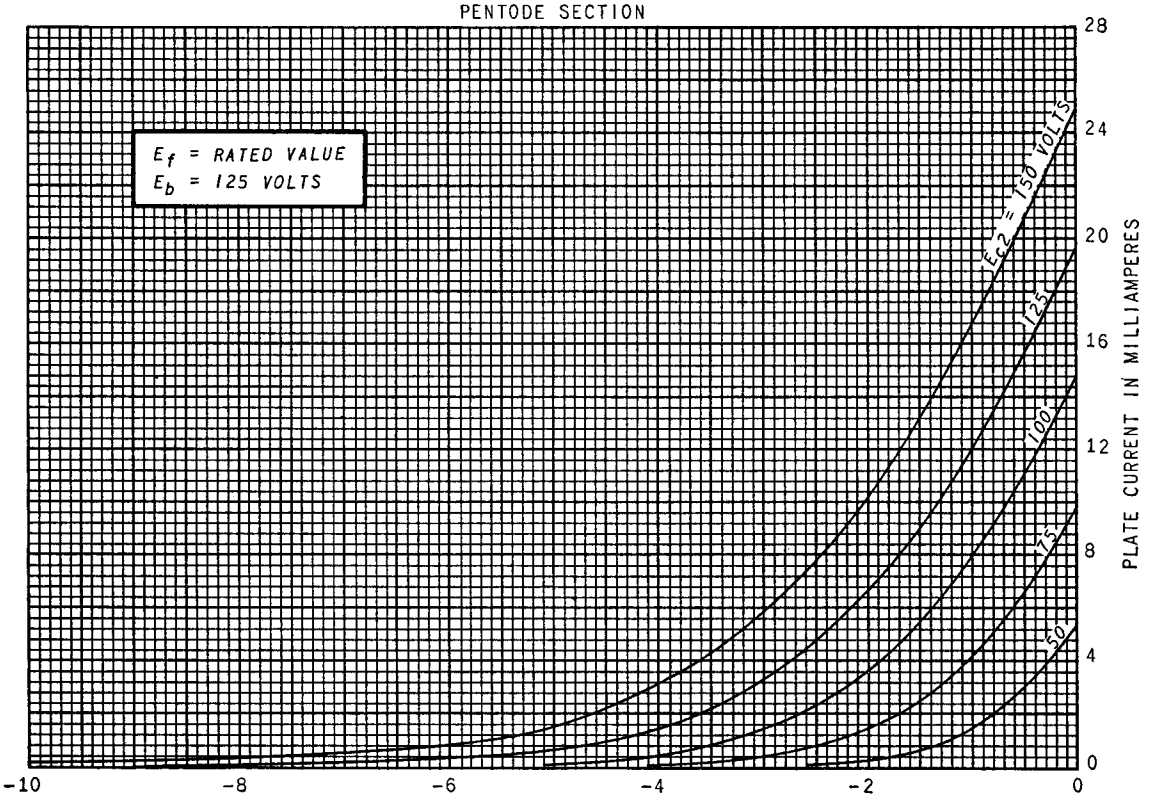


K-55611-TD17-3

NOVEMBER 6, 1959

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

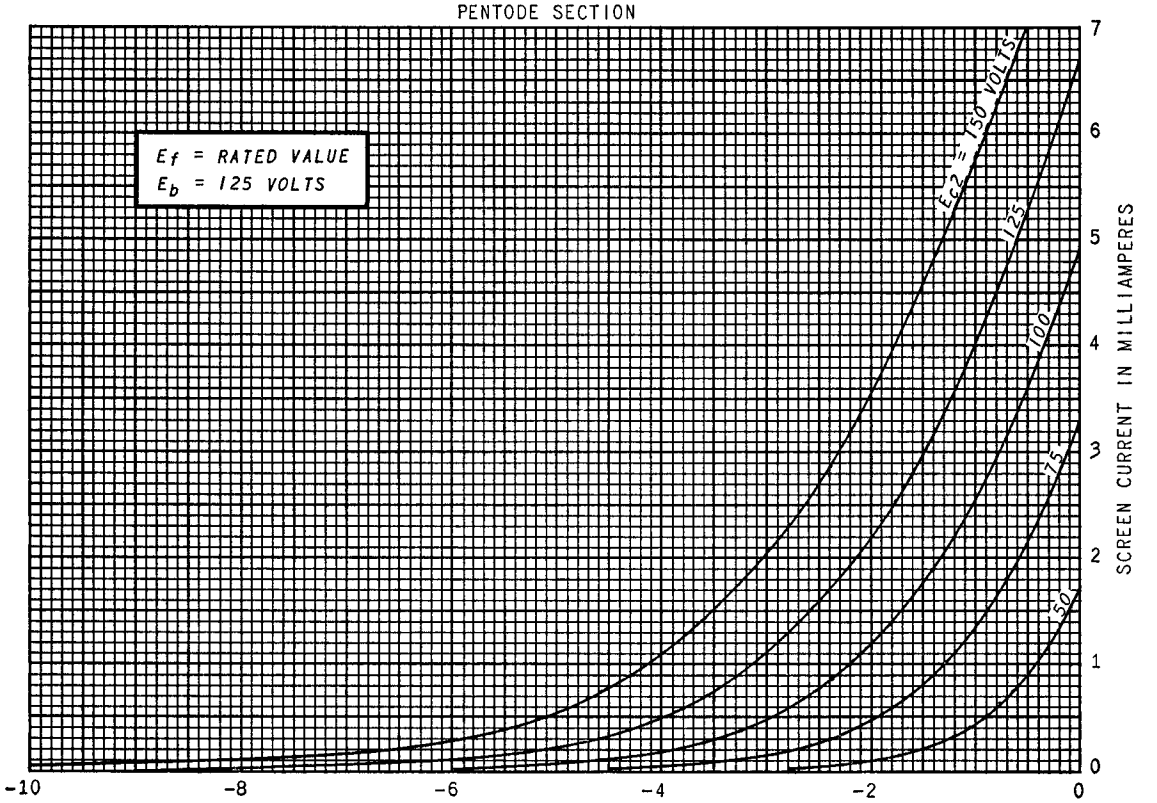


K-55611-TD17-4

NOVEMBER 6, 1959

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

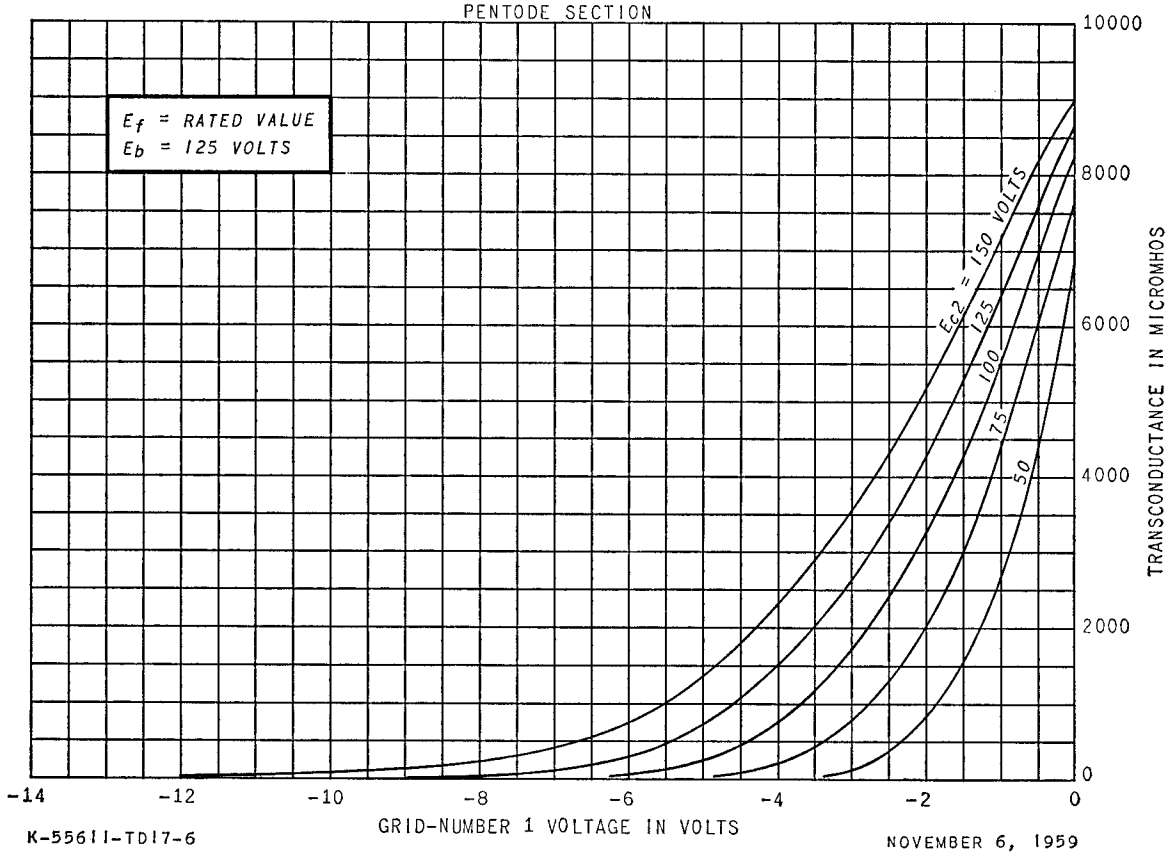


K-5561I-TDI7-5

NOVEMBER 6, 1959

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

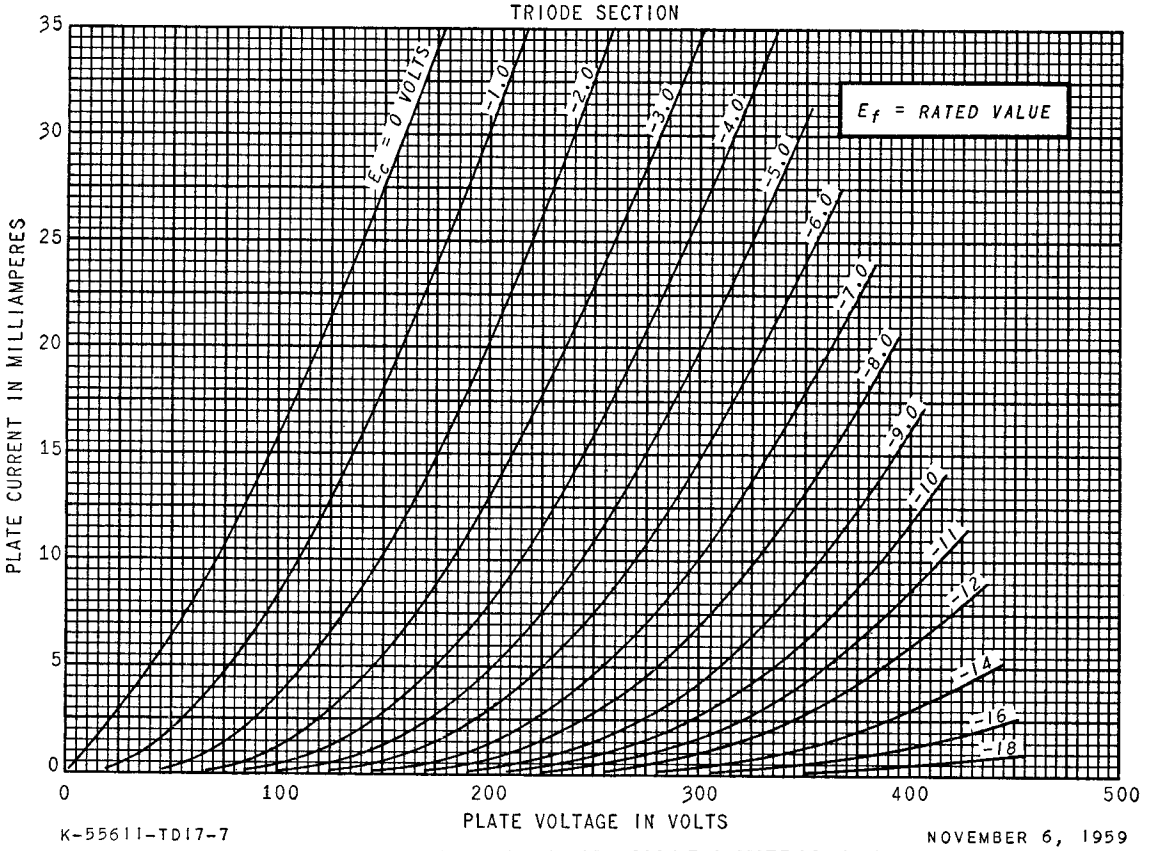


K-5561I-TDI7-6

NOVEMBER 6, 1959

AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION

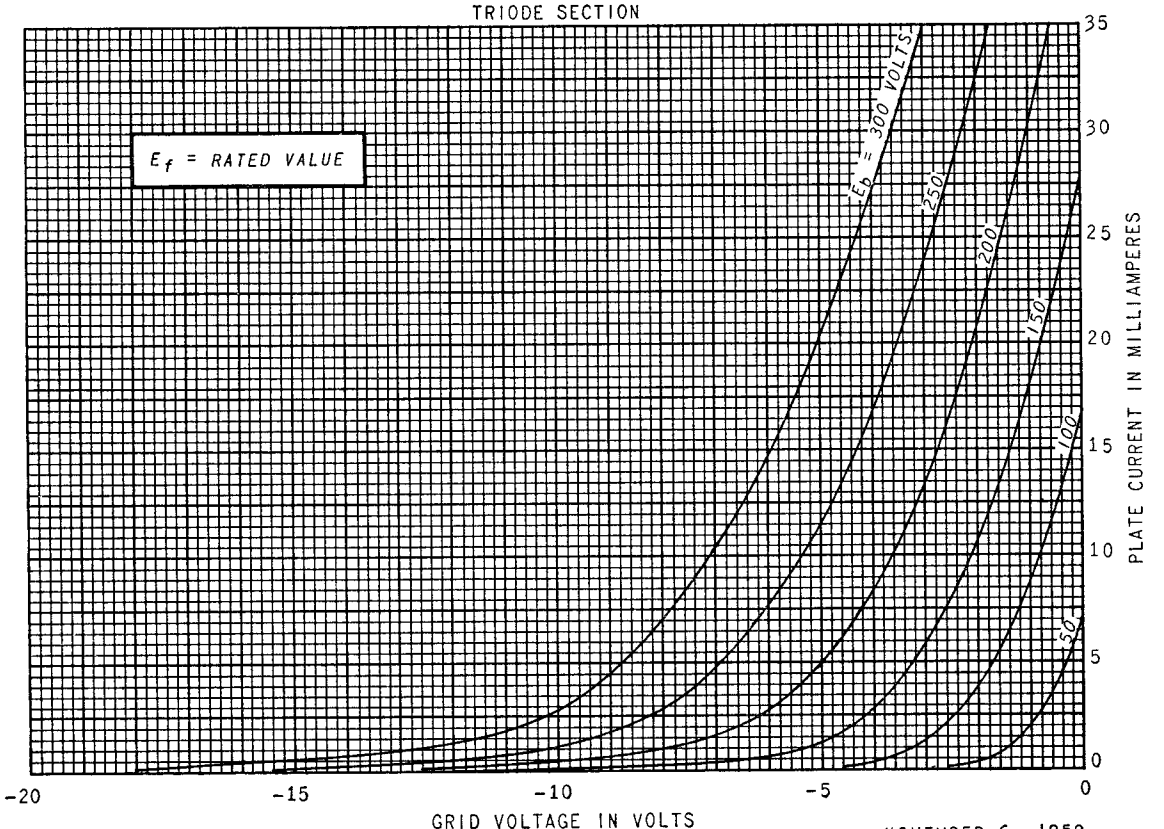


K-5561I-TDI7-7

NOVEMBER 6, 1959

AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION

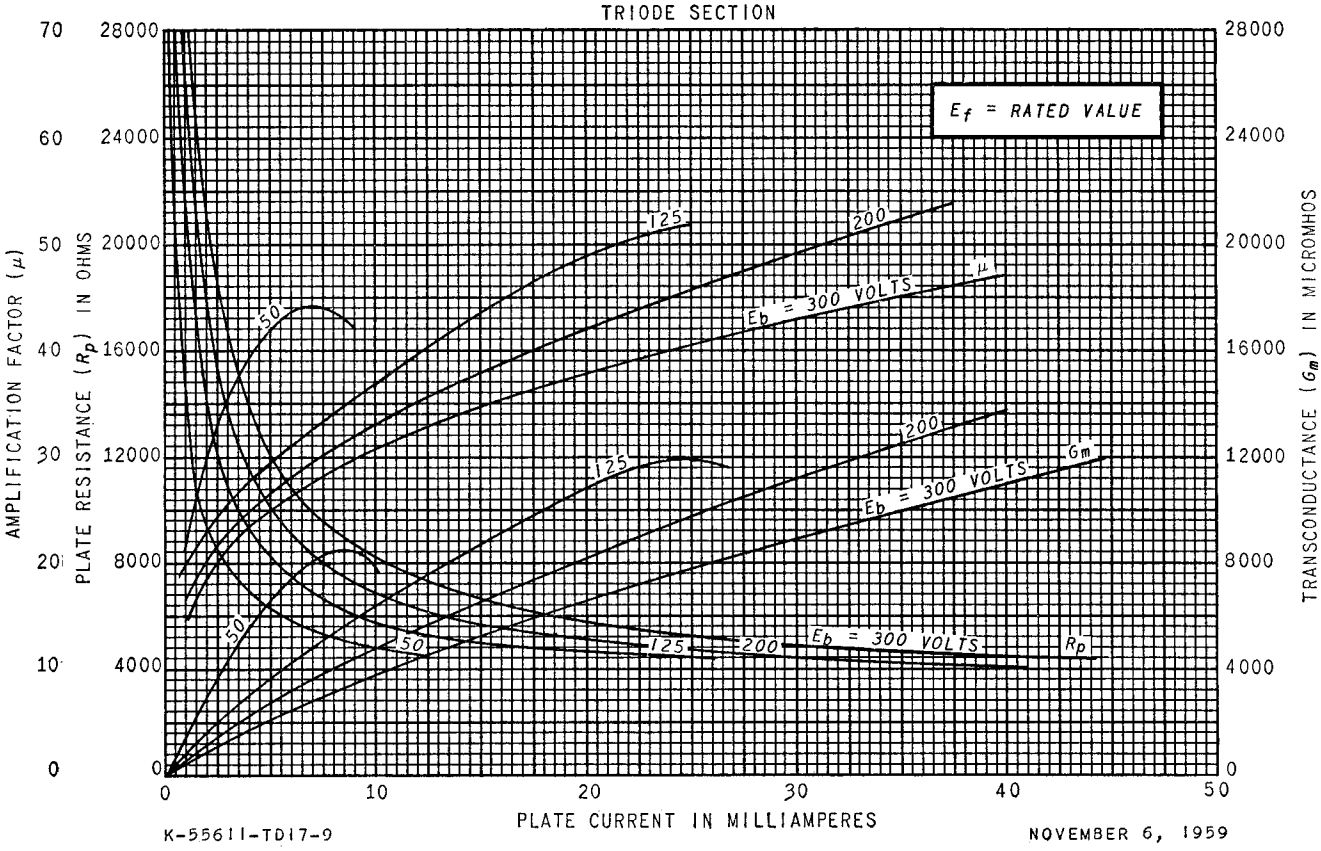


K-5561I-TDI7-8

NOVEMBER 6, 1959

AVERAGE CHARACTERISTICS

TRIODE SECTION



K-5561I-TDI7-9

NOVEMBER 6, 1959

6EB8
TRIODE-PENTODE

DESCRIPTION AND RATING

The 6EB8 is a miniature tube containing a sharp-cutoff pentode and a high-mu triode in one envelope. The pentode section is intended primarily for use as a video amplifier. The triode section is suitable for a wide variety of general-purpose uses.

GENERAL

ELECTRICAL

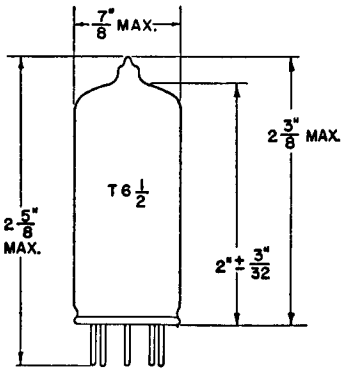
Cathode—Coated Unipotential		
Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.75	Amperes
Direct Interelectrode Capacitances‡		
Pentode Section		
Grid-Number 1 to Plate: (Pg1 to Pp), maximum	0.01	pf
Input: Pg1 to (h+Pk+Pg2+Pg3+i.s.)	11	pf
Output: Pp to (h+Pk+Pg2+Pg3+i.s.)	4.2	pf
Triode Section		
Grid to Plate: (Tg to Tp)	4.4	pf
Input: Tg to (h+Tk)	2.4	pf
Output: Tp to (h+Tk)	0.36	pf
Pentode Grid-Number 1 to Triode Plate: (Pg1 to Tp), maximum	0.005	pf
Triode Grid to Pentode Plate: (Tg to Pp), maximum	0.018	pf
Pentode Plate to Triode Plate: (Pp to Tp), maximum	0.17	pf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin
Outline Drawing EIA 6-3

Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 5/8	Inches
Maximum Seated Height	2 3/8	Inches

PHYSICAL DIMENSIONS

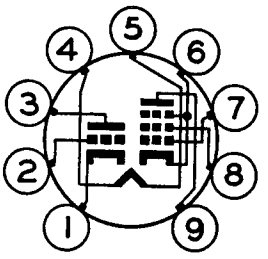


EIA 6-3

TERMINAL CONNECTIONS

Pin 1—Triode Cathode
Pin 2—Triode Grid
Pin 3—Triode Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 7—Pentode Grid Number 1
Pin 8—Pentode Grid Number 2 (Screen)
Pin 9—Pentode Plate

BASING DIAGRAM



EIA 9DX

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	...	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	5.0	1.0	Watts
Screen Dissipation	1.1	...	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohm
With Cathode Bias	1.0	1.0	Megohm

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

	Pentode Section		Triode Section	
Plate Voltage	45	200	200	Volts
Screen Voltage	125	125	.....	Volts
Grid-Number 1 Voltage	0§	.....	−2.0	Volts
Cathode-Bias Resistor	...	68	.....	Ohms
Amplification Factor	...	.....	100	
Plate Resistance, approximate	...	75000	37000	Ohms
Transconductance	...	12500	2700	Micromhos
Plate Current	40	25	2.0	Milliamperes
Screen Current	15	7.0	.....	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 100 Microamperes	...	−9	.....	Volts
Grid-Number 1 Voltage, approximate				
Ib = 20 Microamperes	...	.....	−5	Volts

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

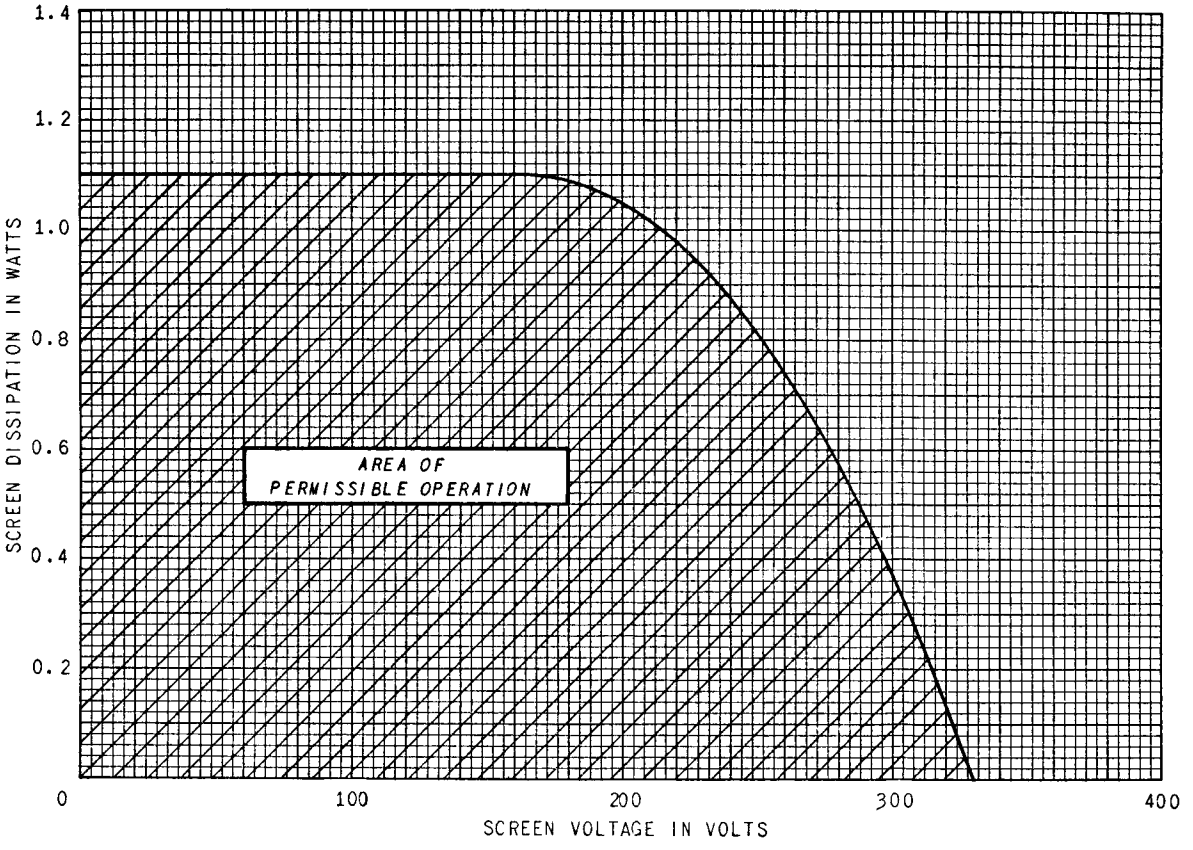
† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ Applied for short interval (two seconds maximum) so as not to damage tube.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

SCREEN RATING CHART



Compactron Beam Triode

6EH4-A

FOR HV SHUNT REGULATOR APPLICATIONS

■ COLOR TV TYPE ■ 27000 VOLTS DC ■ 40 WATTS PLATE DISSIPATION ■ X-RADIATION RATING

The 6EH4-A is a low-current, high-voltage, beam triode intended for use as a shunt regulator in the high-voltage power supply of color television receivers.

The 6EH4-A has a maximum d-c plate-voltage rating of 27000 volts, a maximum d-c plate current rating of 1.5 milliamperes, and a maximum plate-dissipation rating of 40 watts.

Features of the 6EH4-A include built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output. The 6EH4-A also features the utilization of a high voltage shield to minimize the effects of a momentary arc within the tube.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	6.3 ± 0.6	Volts
Heater Current ●	0.2	Amperes

Direct Interelectrode Capacitances ▲

Grid to Plate: (g to p)	0.036	pf
Input: g to (h+k)	1.9	pf
Output: p to (h+k)	0.63	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Top Cap - C1-50, Small
Outline Drawing - EIA 12-118

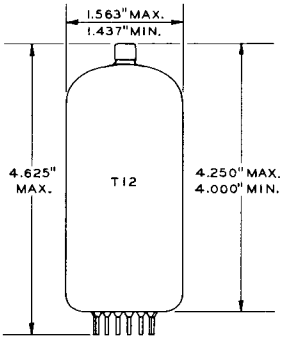
Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	4.625	Inches
Maximum Seated Height	4.250	Inches
Minimum Seated Height	4.000	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

Plate Voltage (Absolute-Maximum Value)	27000	Volts
Negative DC Grid Voltage	135	Volts
Peak Negative Grid Voltage ♦	440	Volts
Plate Dissipation (Absolute-Maximum Value)	40	Watts
DC Plate Current (Absolute-Maximum Value)	1.5	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	Not Recommended	
Heater Negative with Respect to Cathode §	450	Volts
Grid-Circuit Resistance ⊕	3.0	Megohms

PHYSICAL DIMENSIONS

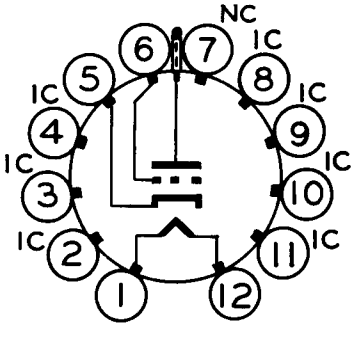


EIA 12-118

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Internal Connection - Do Not Use
Pin 3 - Internal Connection - Do Not Use
Pin 4 - Internal Connection - Do Not Use
Pin 5 - Cathode and Internal Shield
Pin 6 - Grid
Pin 7 - No Connection
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Internal Connection - Do Not Use
Pin 11 - Internal Connection - Do Not Use
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12FA

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Unregulated DC Supply Voltage	36000	Volts
Equivalent Resistance of Unregulated Supply	11	Megohms
DC Reference Voltage	200	Volts
Equivalent Resistance of Reference Supply	1000	Ohms
Effective Grid-Plate Transconductance	200	Micromhos
DC Plate Current for Zero Load Current	1000	Microamperes
DC Plate Current for Load Current of 1 Milliampere	45	Microamperes
Regulated DC Output Voltage at Zero Load Current	25000	Volts
Regulated DC Output Voltage at Load Current of 1 Milliampere	24500	Volts

X-RADIATION RATING

X-radiation, maximum	0.5	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation of the 6EH4-A outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-radiation form Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

WARNING

X-RADIATION

Operation of the 6EH4-A outside of the Absolute-Maximum Ratings indicated may produce soft X-rays above 0.5 milliroentgens per hour which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide required shielding.

Precautions must be exercised during the servicing of the equipment employing the 6EH4-A to assure that the high voltage is adjusted to the recommended value ano that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 6EH4-A is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 6EH4-A in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

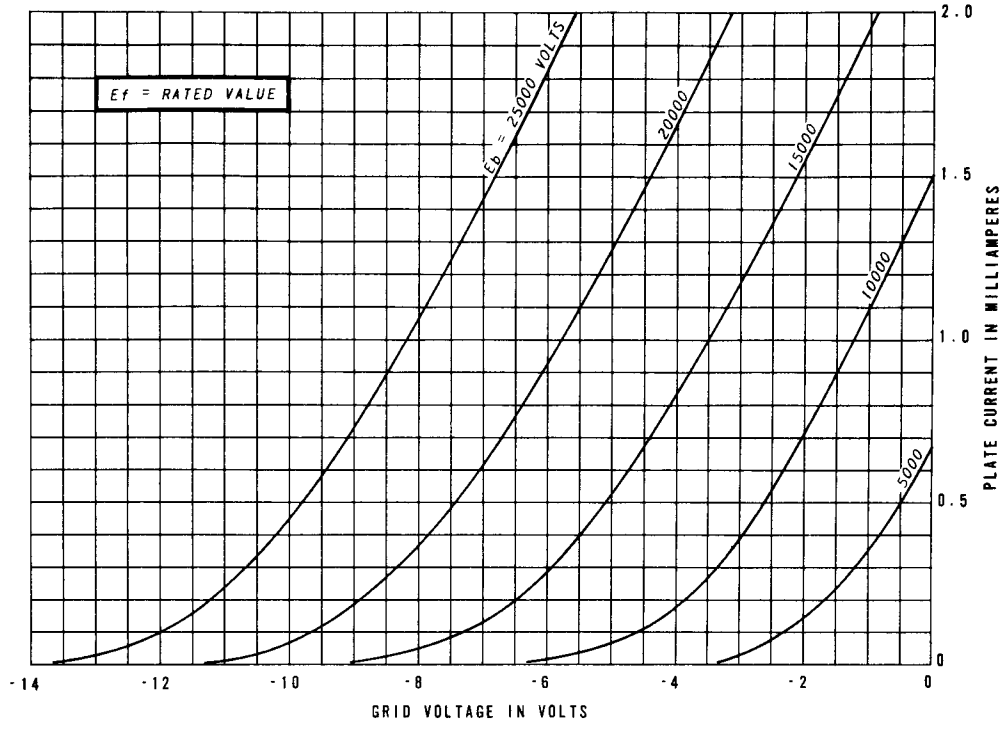
▲ Without external shield.

♦ Peak value for duration of 20 seconds maximum during equipment warmup.

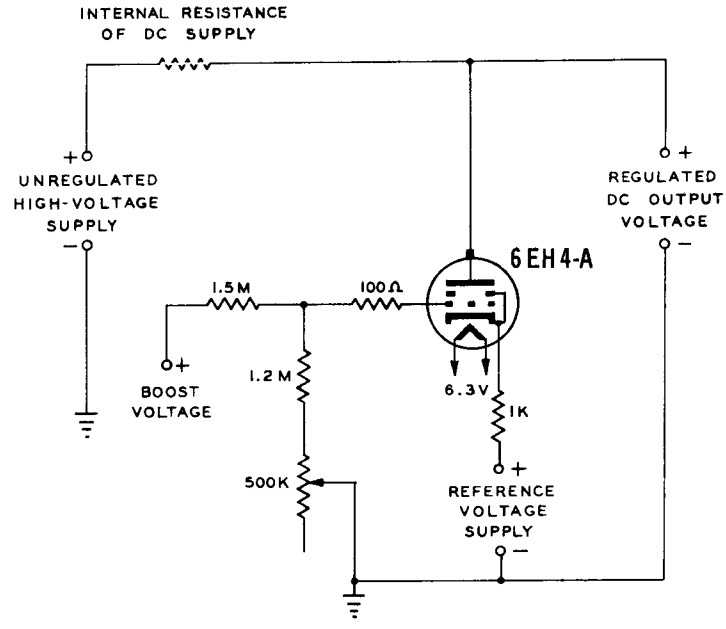
§ Sufficient impedance (1000 ohms is recommended) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions to 450 ma. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

⊕ With flyback transformer high-voltage supply.

AVERAGE TRANSFER CHARACTERISTICS



TYPICAL SHUNT REGULATOR CIRCUIT



APPLICATION CONSIDERATIONS

The base pins of the 6EH4-A fit the standard compactron socket. Socket terminals for pins 2, 3, 4, 8, 9, 10 and 11 should not be used for tie points. Tube performance may be adversely affected should this precaution not be followed.

Sufficient impedance (1000 ohms is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short circuit conditions to 450 ma. This protection impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

A unique design feature of the 6EH4-A is the utilization of a high voltage shield to minimize the effects of a momentary arc within the tube. This shield is brought out to a separate pin so that it can be tied directly to ground, whereas it has been customary in the more conventional tubes of this type to tie the shield directly to the cathode. When the shield is tied to the cathode, any arcing can cause failure of the cathode-resistor and/or breakdown of the heater cathode insulation, failures which the 6EH4-A has been designed to prevent.

The high voltages at which the 6EH4-A is operated may be very hazardous. Extreme caution should be used while making any circuit adjustments. The 6EH4-A and all of its associated hardware should be housed in a protective enclosure. It is particularly important that all parts which may be at a high potential with respect to ground be housed in this protective enclosure. The protective enclosure should be constructed with a system of interlocks to prevent anyone from coming in contact with any high potential point in the electrical system. The interlocks should break the primary circuit of the high-voltage supply when any part of the protective enclosure is open, and should prevent the closing of the primary circuit until the protective enclosure is closed and locked.

High voltages may appear at points in the circuit which are normally at low potentials as a result of improper circuit connection or of capacitor breakdown. Therefore, before touching any part of the circuit, the power supply switch should be turned off and both terminals of any capacitor should be grounded.

The bulb of the 6EH4-A becomes hot during operation. Therefore, it is essential that provision be made for free circulation of air around the tube in order to insure sufficient cooling.

The plate of the 6EH4-A exhibits a dull red color when the tube is operated at maximum plate dissipation. In addition it may exhibit a bluish glow on the upper half of the bulb inner wall surface during normal operation. This bluish glow is a result of fluorescence and it should not be mistaken for gas.

To prevent any strain from being exerted on the seal of the plate cap, it is important that connection to the plate cap be made by an appropriate connector which has a flexible lead.

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

6EH8

TRIODE-PENTODE

FOR VHF CONVERTER APPLICATIONS

DESCRIPTION AND RATING

The 6EH8 is a miniature tube which contains a sharp-cutoff pentode and a triode in one envelope. It is intended primarily for use as a combined triode oscillator and pentode mixer in television receivers. The 6EH8 incorporates a controlled heater-warm-up characteristic.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential			
Heater Voltage, AC or DC	6.3		Volts
Heater Current	0.45 ± 6%		Amperes
Heater Warm-up Time*	11		Seconds
Direct Interelectrode Capacitances	**With Shield†**	**Without Shield**	
Pentode Section			
Grid-Number 1 to Plate, maximum	0.012	0.02	μμf
Input	4.8	4.8	μμf
Output	3.2	2.4	μμf
Triode Section			
Grid to Plate	1.8	1.8	μμf
Input	2.8	2.8	μμf
Output	2.2	1.7	μμf
Heater to Cathode	8.5‡	8.5	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

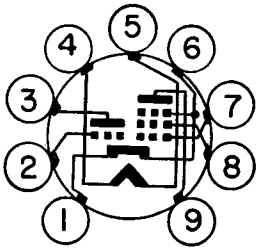
DESIGN-MAXIMUM VALUES	**Pentode Section**	**Triode Section**	
Plate Voltage	300	300	Volts
Screen Supply Voltage	300	....	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	2.8	2.5	Watts
Screen Dissipation	0.5	....	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

BASING DIAGRAM

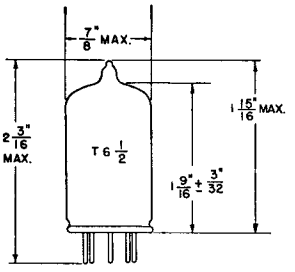


EIA 9JG

TERMINAL CONNECTIONS

Pin 1—Cathode, Pentode Grid Number 3 (Suppressor), and Internal Shield
Pin 2—Triode Grid
Pin 3—Triode Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Cathode, Pentode Grid Number 3 (Suppressor), and Internal Shield
Pin 7—Pentode Grid Number 1
Pin 8—Pentode Grid Number 2 (Screen)
Pin 9—Pentode Plate

PHYSICAL DIMENSIONS



EIA 6-2

The tubes ands arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

CHARACTERISTICS AND TYPICAL OPERATION

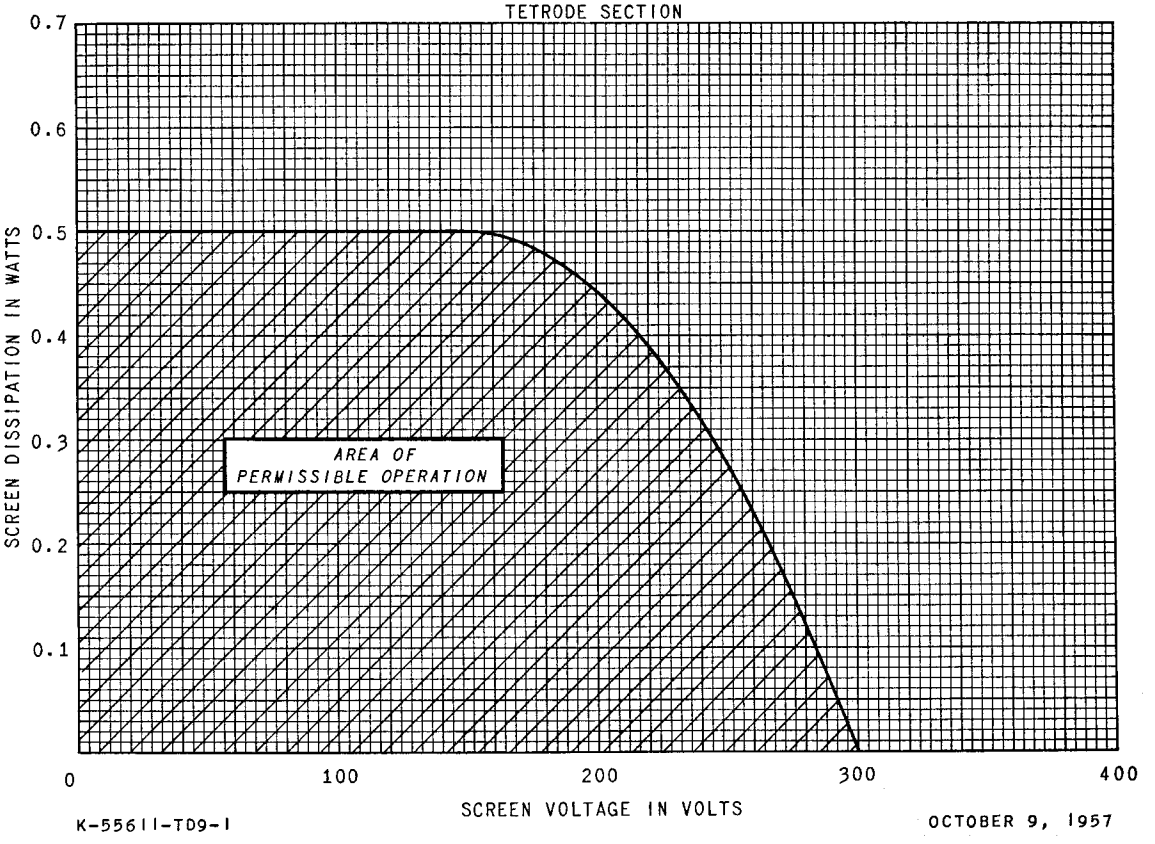
CLASS A_1 AMPLIFIER	Pentode Section		Triode Section	
Plate Voltage	100	125	125	Volts
Screen Voltage	70	125	....	Volts
Grid-Number 1 Voltage	0	−1.0	−1.0	Volts
Amplification Factor	....	....	40	
Plate Resistance, approximate	....	0.17	....	Megohms
Transconductance	6500	6000	7500	Micromhos
Plate Current	....	12	13.5	Milliamperes
Screen Current	....	4.0	....	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 20 Microamperes	....	−10	−9	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (EIA 315) connected to cathode unless otherwise noted.

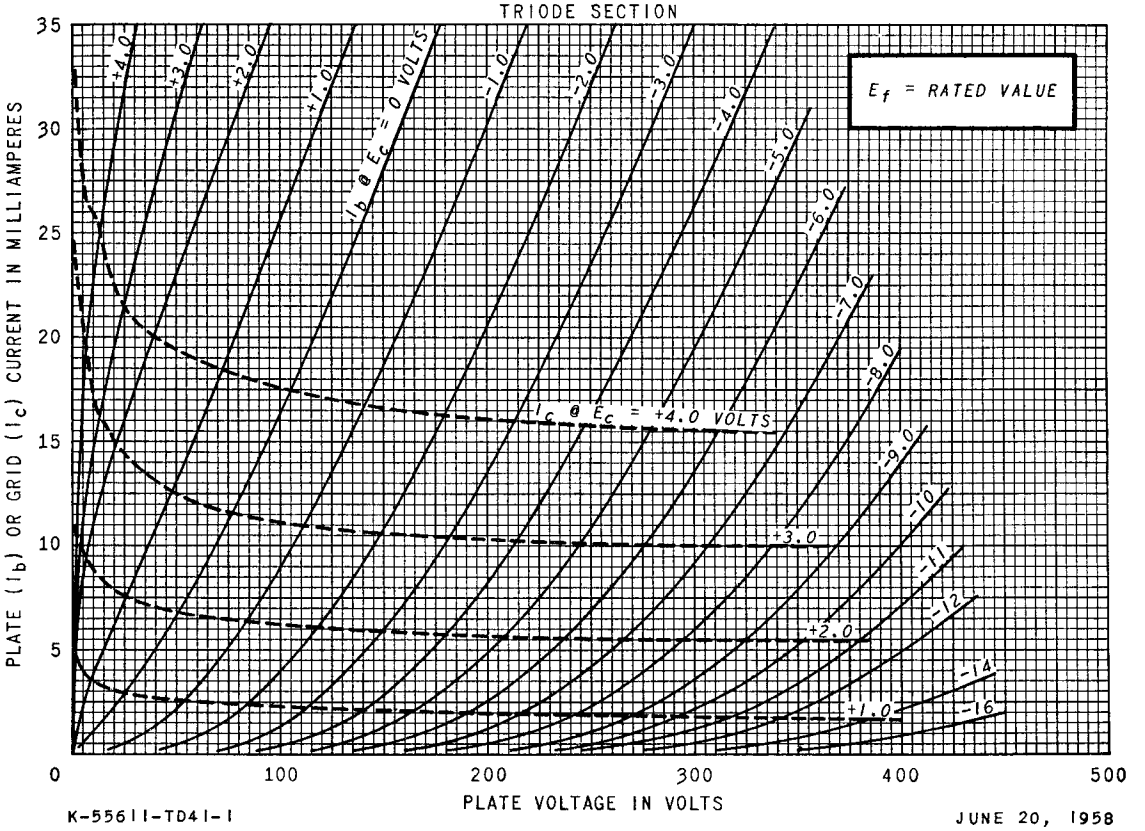
‡ With external shield (EIA 315) connected to ground.

SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION

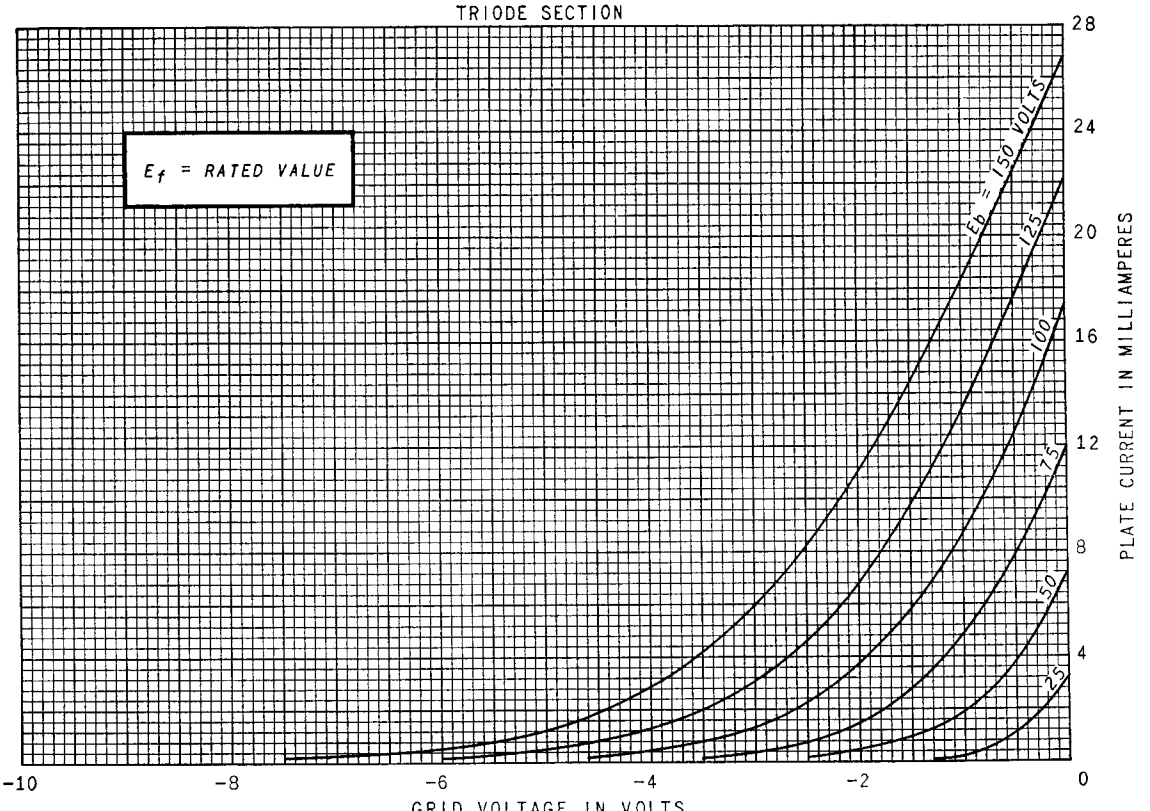


K-55611-TD41-1

JUNE 20, 1958

AVERAGE TRANSFER CHARACTERISTICS

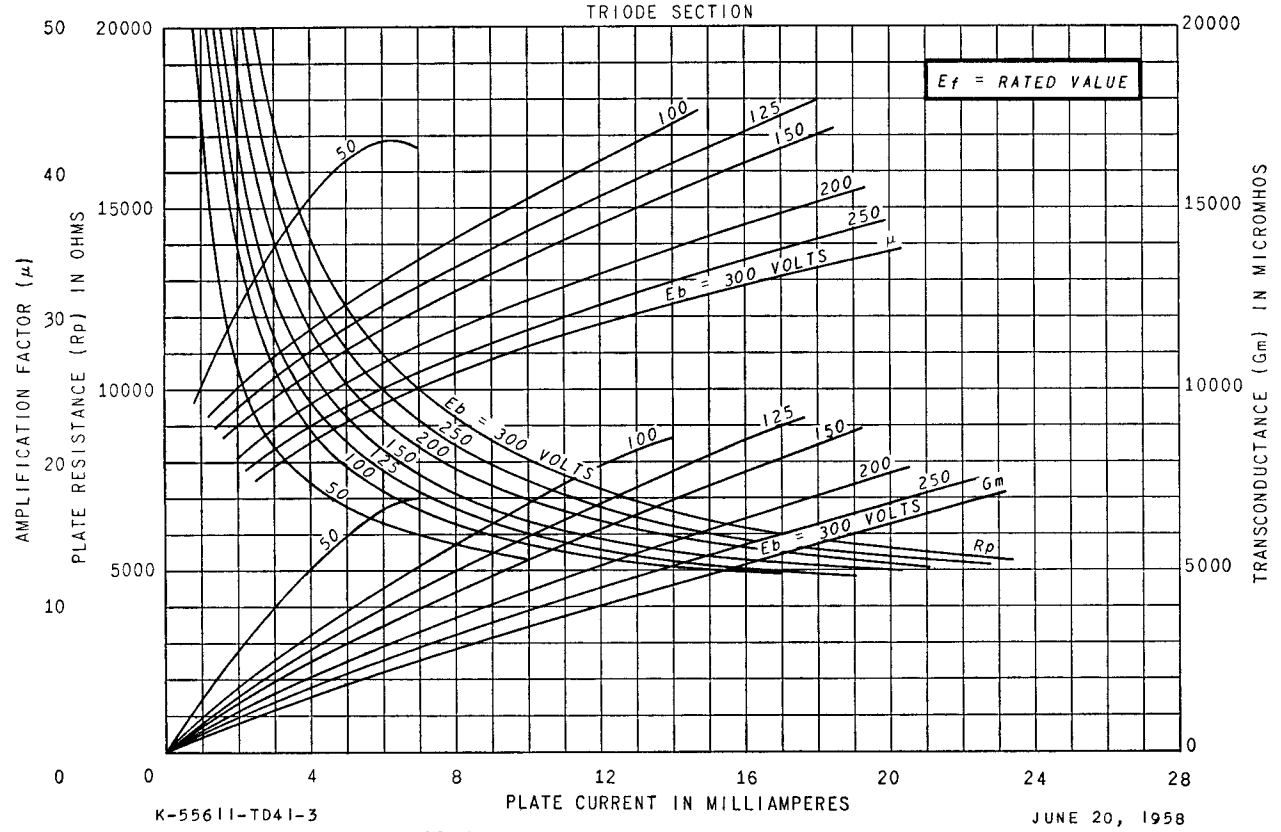
TRIODE SECTION



K-55611-TD41-2

JUNE 20, 1958

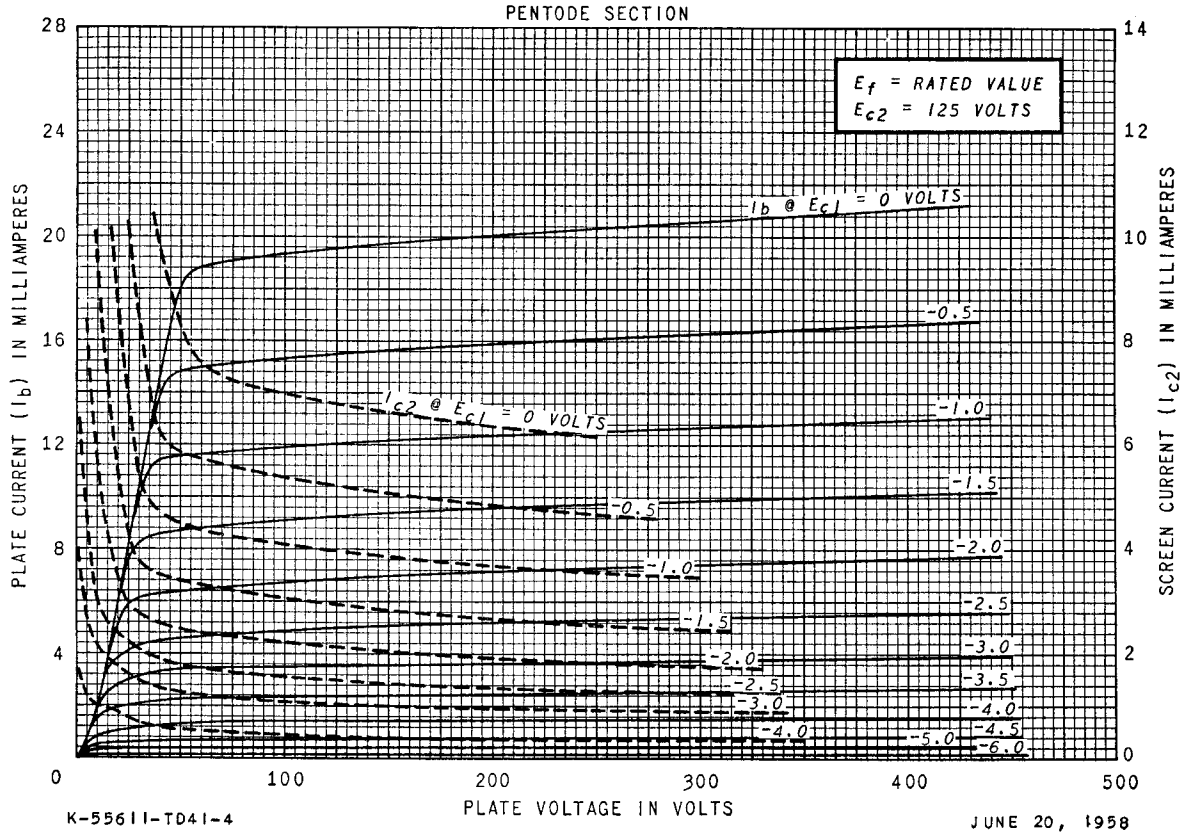
AVERAGE CHARACTERISTICS



K-55611-TD41-3

JUNE 20, 1958

AVERAGE PLATE CHARACTERISTICS

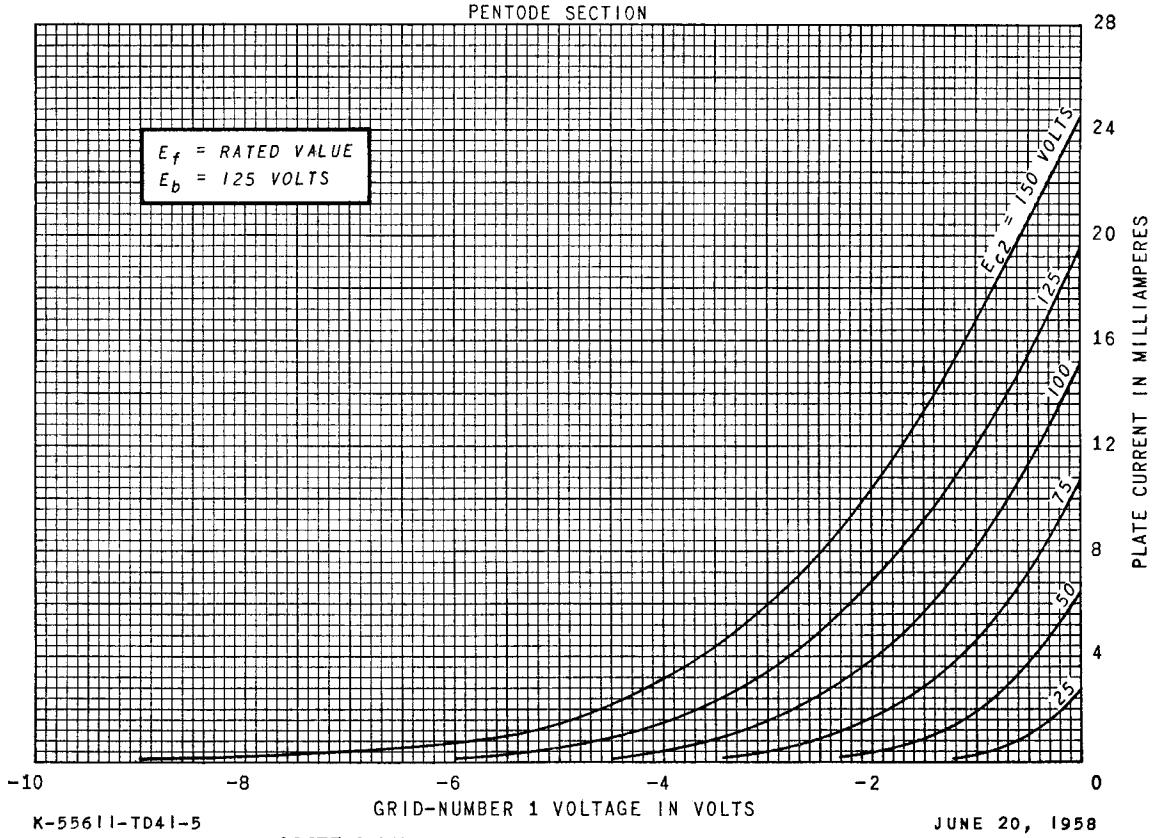


K-55611-TD41-4

JUNE 20, 1958

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

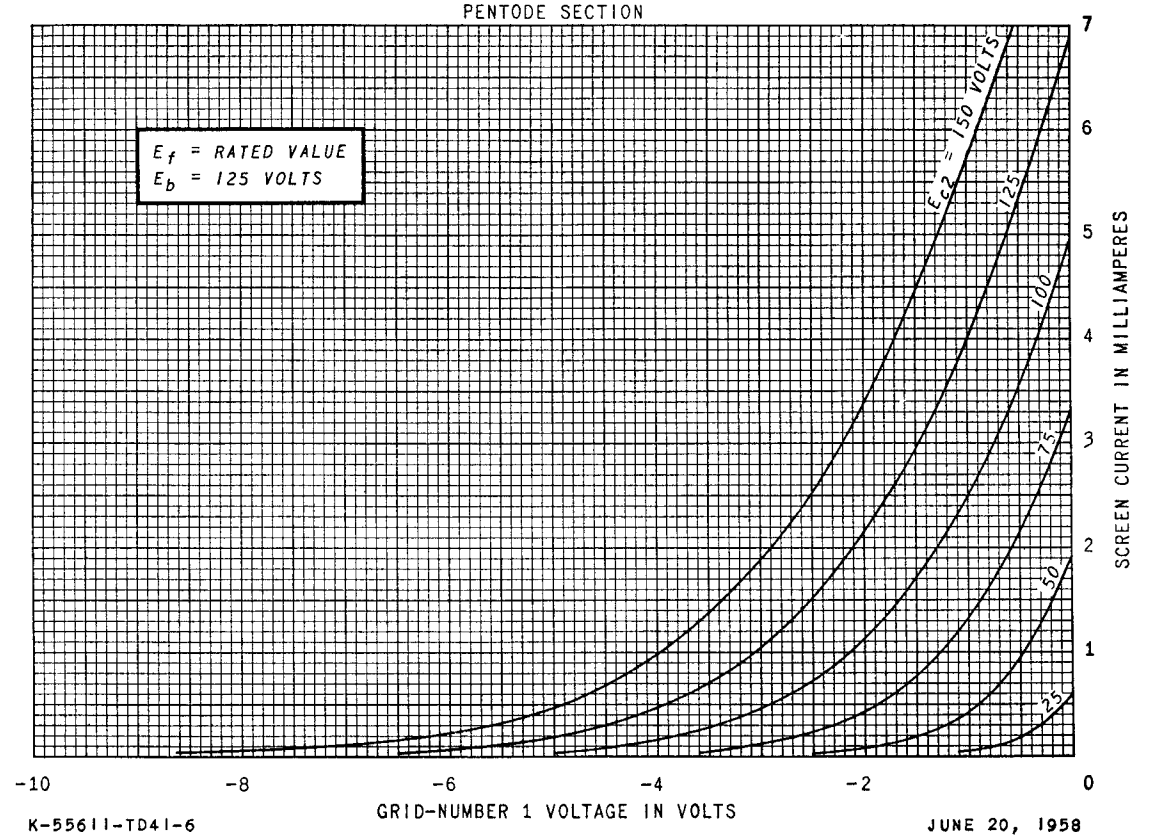


K-5561I-TD4I-5

JUNE 20, 1958

AVERAGE TRANSFER CHARACTERISTICS

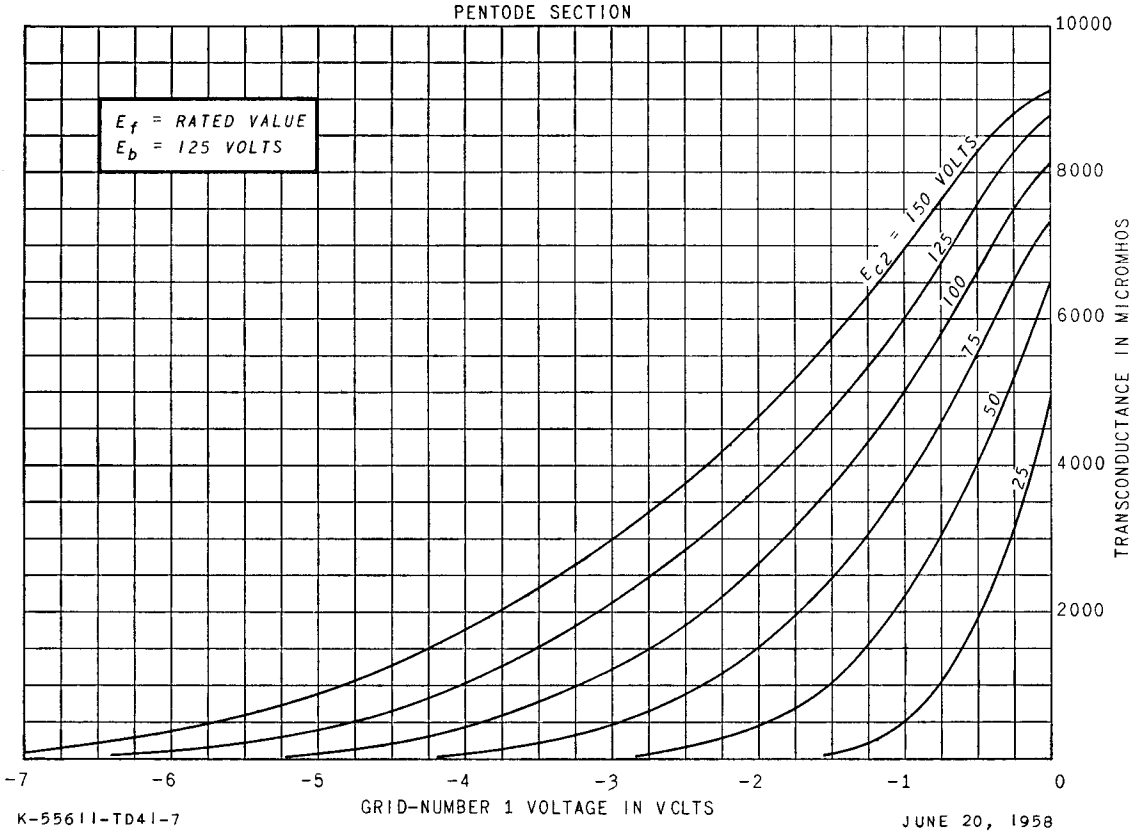
PENTODE SECTION



K-5561I-TD4I-6

JUNE 20, 1958

AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

—PRODUCT INFORMATION—

Compactron Beam Triode

6EJ4-A

FOR HV SHUNT REGULATOR APPLICATIONS

■ COLOR TV TYPE ■ 27000 VOLTS DC ■ 40 WATTS PLATE DISSIPATION ■ X-RADIATION RATING

The 6EJ4-A is a low-current, high-voltage, beam triode intended for use as a shunt regulator in the high-voltage power supply of color television receivers.

The 6EJ4-A has a maximum d-c plate-voltage rating of 27000 volts, a maximum d-c plate current rating of 1.5 milliamperes, and a maximum plate-dissipation rating of 40 watts.

Features of the 6EJ4-A include built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output. The 6EJ4-A also features the utilization of a high voltage shield to minimize the effects of a momentary arc within the tube.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	6.3 ± 0.6	Volts
Heater Current ●	0.2	Amperes

Direct Interelectrode Capacitances ▲

Grid to Plate: (g to p)	0.03	pf
Input: g to (h+k)	2.0	pf
Output: p to (h+k)	0.8	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Top Cap - C1-50, Small
Outline Drawing - EIA 12-118

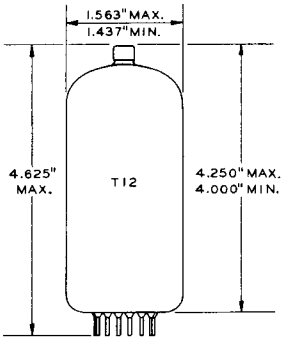
Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	4.625	Inches
Maximum Seated Height	4.250	Inches
Minimum Seated Height	4.000	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

Plate Voltage (Absolute-Maximum Value)	27000	Volts
Negative DC Grid Voltage	135	Volts
Peak Negative Grid Voltage ♦	440	Volts
Plate Dissipation (Absolute-Maximum Value)	40	Watts
DC Plate Current (Absolute-Maximum Value)	1.5	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	Not Recommended	
Heater Negative with Respect to Cathode §	450	Volts
Grid-Circuit Resistance ⊕	3.0	Megohms

PHYSICAL DIMENSIONS

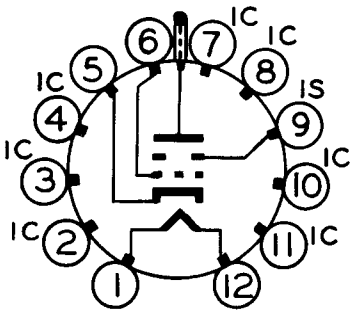


EIA 12-118

TERMINAL CONNECTIONS □

Pin 1 - Heater
Pin 2 - Internal Connection - Do Not Use
Pin 3 - Internal Connection - Do Not Use
Pin 4 - Internal Connection - Do Not Use
Pin 5 - Cathode
Pin 6 - Grid
Pin 7 - Internal Connection - Do Not Use
Pin 8 - Internal Connection - Do Not Use
Pin 9 - High Voltage Shield □
Pin 10 - Internal Connection - Do Not Use
Pin 11 - Internal Connection - Do Not Use
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12HC

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Unregulated DC Supply Voltage	36000	Volts
Equivalent Resistance of Unregulated Supply	11	Megohms
DC Reference Voltage	200	Volts
Equivalent Resistance of Reference Supply	1000	Ohms
Effective Grid-Plate Transconductance	200	Micromhos
DC Plate Current for Zero Load Current	1000	Microamperes
DC Plate Current for Load Current of 1 Milliampere	45	Microamperes
Regulated DC Output Voltage at Zero Load Current	25000	Volts
Regulated DC Output Voltage at Load Current of 1 Milliampere	24500	Volts

X-RADIATION RATING

X-radiation, maximum	0.5	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation of the 6EJ4-A outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-radiation form Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

WARNING

X-RADIATION

Operation of the 6EJ4-A outside of the Absolute-Maximum Ratings indicated may produce soft X-rays above 0.5 milliroentgens per hour which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide required shielding.

Precautions must be exercised during the servicing of the equipment employing the 6EJ4-A to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 6EJ4-A is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 6EJ4-A in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

▲ Without external shield.

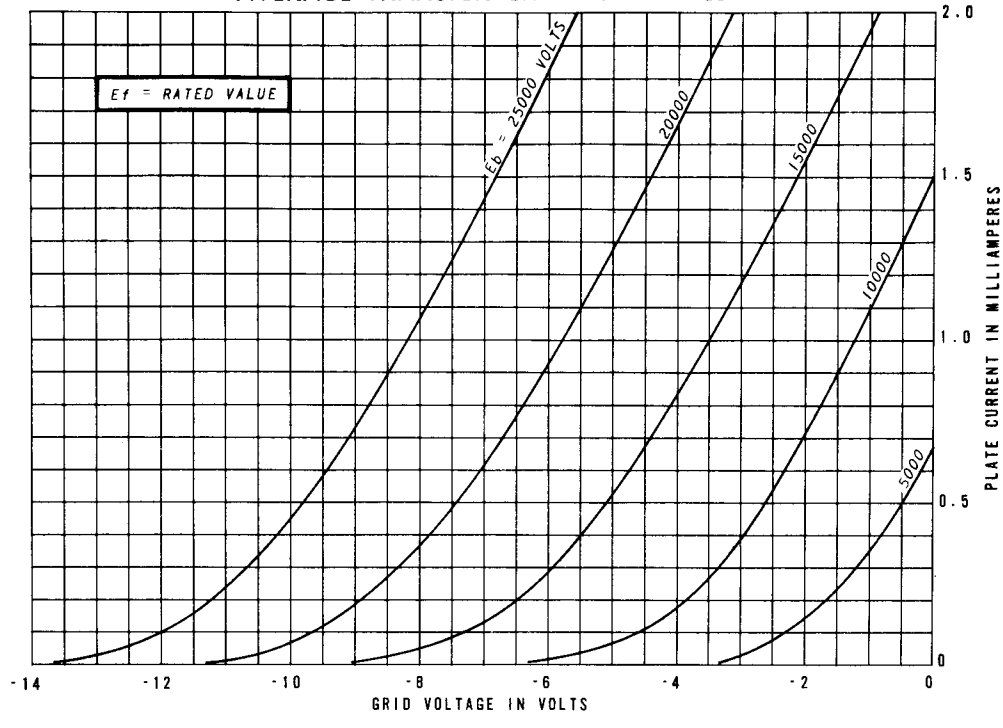
♦ Peak value for duration of 20 seconds maximum during equipment warmup.

§ Sufficient impedance (1000 ohms is recommended) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions to 450 ma. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

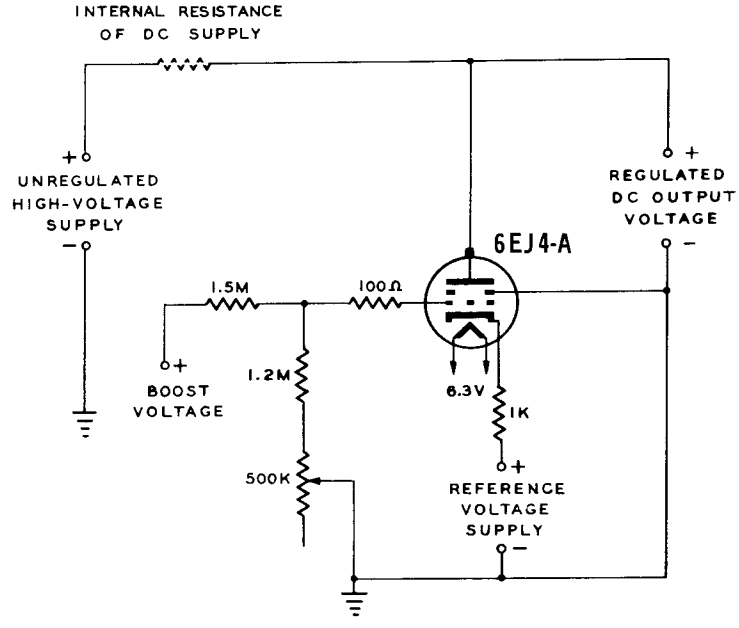
⊕ With flyback transformer high-voltage supply.

□ Shield connected directly to ground to minimize the effects of a momentary arc within the tube.

AVERAGE TRANSFER CHARACTERISTICS



TYPICAL SHUNT REGULATOR CIRCUIT



APPLICATION CONSIDERATIONS

The base pins of the 6EJ4-A fit the standard compactron socket. Socket terminals for pins 2, 3, 4, 7, 8, 10, and 11 should not be used for tie points. Tube performance may be adversely affected should this precaution not be followed.

Sufficient impedance (1000 ohms is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short circuit conditions to 450 ma. This protection impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

A unique design feature of the 6EJ4-A is the utilization of a high voltage shield to minimize the effects of a momentary arc within the tube. This shield is brought out to a separate pin so that it can be tied directly to ground, whereas it has been customary in the more conventional tubes of this type to tie the shield directly to the cathode. When the shield is tied to the cathode, any arcing can cause failure of the cathode resistor and/or breakdown of the heater cathode insulation, failures which the 6EJ4-A has been designed to prevent.

The high voltages at which the 6EJ4-A is operated may be very hazardous. Extreme caution should be used while making any circuit adjustments. The 6EJ4-A and all of its associated hardware should be housed in a protective enclosure. It is particularly important that all parts which may be at a high potential with respect to ground be housed in this protective enclosure. The protective enclosure should be constructed with a system of interlocks to prevent anyone from coming in contact with any high potential point in the electrical system. The interlocks should break the primary circuit of the high-voltage supply when any part of the protective enclosure is open, and should prevent the closing of the primary circuit until the protective enclosure is closed and locked.

High voltages may appear at points in the circuit which are normally at low potentials as a result of improper circuit connection or of capacitor breakdown. Therefore, before touching any part of the circuit, the power supply switch should be turned off and both terminals of any capacitor should be grounded.

The bulb of the 6EJ4-A becomes hot during operation. Therefore, it is essential that provision be made for free circulation of air around the tube in order to insure sufficient cooling.

The plate of the 6EJ4-A exhibits a dull red color when the tube is operated at maximum plate dissipation. In addition, it may exhibit a bluish glow on the upper half of the bulb inner wall surface during normal operation. This bluish glow is a result of fluorescence and it should not be mistaken for gas.

To prevent any strain from being exerted on the seal of the plate cap, it is important that connection to the plate cap be made by an appropriate connector which has a flexible lead.

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

—PRODUCT INFORMATION—

Beam Triode

6EL4-A

FOR HV SHUNT REGULATOR APPLICATIONS

■ COLOR TV TYPE ■ 27000 VOLTS DC ■ 40 WATTS PLATE DISSIPATION ■ X-RADIATION RATING

The 6EL4-A is a low-current, high-voltage, beam triode intended for use as a shunt regulator in the high-voltage power supply of color television receivers.

The 6EL4-A has a maximum d-c plate-voltage rating of 27000 volts, a maximum d-c plate current rating of 1.5 milliamperes, and a maximum plate-dissipation rating of 40 watts.

Features of the 6EL4-A include built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output. The 6EL4-A also features the utilization of a high voltage shield to minimize the effects of a momentary arc within the tube.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	6.3 ± 0.6	Volts
Heater Current ●	0.2	Amperes

Direct Interelectrode Capacitances ▲

Grid to Plate: (g to p)	1.0	pf
Input: g to (h + k)	2.6	pf
Output: p to (h + k)	1.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - B8-118, Short Medium Shell Octal 8-Pin
Top Cap - C1-50, Small
Outline Drawing - EIA 12-21

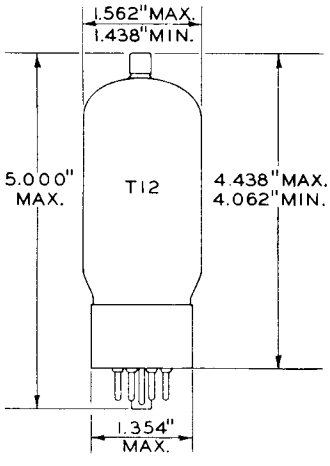
Maximum Diameter	1.562	Inches
Minimum Bulb Diameter	1.438	Inches
Maximum Over-all Length	5.000	Inches
Maximum Seated Height	4.438	Inches
Minimum Seated Height	4.062	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

Plate Voltage (Absolute-Maximum Value)	27000	Volts
Negative DC Grid Voltage	135	Volts
Peak Negative Grid Voltage ♦	440	Volts
Plate Dissipation (Absolute-Maximum Value)	40	Watts
DC Plate Current (Absolute-Maximum Value)	1.5	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	Not Recommended	
Heater Negative with Respect to Cathode §	450	Volts
Grid-Circuit Resistance ⊕	3.0	Megohms

PHYSICAL DIMENSIONS

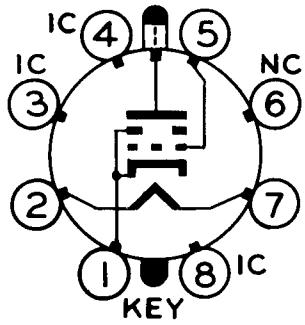


EIA 12-21

TERMINAL CONNECTIONS

Pin 1 - Cathode and Internal Shield
Pin 2 - Heater
Pin 3 - Internal Connection - Do Not Use
Pin 4 - Internal Connection - Do Not Use
Pin 5 - Grid
Pin 6 - No Connection
Pin 7 - Heater
Pin 8 - Internal Connection - Do Not Use
Cap - Plate

BASING DIAGRAM



EIA 8MW

GENERAL ELECTRIC

Supersedes PI Sheet dated 12-70

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Unregulated DC Supply Voltage	36000	Volts
Equivalent Resistance of Unregulated Supply	11	Megohms
DC Reference Voltage	200	Volts
Equivalent Resistance of Reference Supply	1000	Ohms
Effective Grid-Plate Transconductance	200	Micromhos
DC Plate Current for Zero Load Current	1000	Microamperes
DC Plate Current for Load Current of 1 Milliampere	45	Microamperes
Regulated DC Output Voltage at Zero Load Current	25000	Volts
Regulated DC Output Voltage at Load Current of 1 Milliampere	24500	Volts

X-RADIATION RATING

X-radiation, maximum	0.5	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation of the 6EL4-A outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

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WARNING

X-RADIATION

Operation of the 6EL4-A outside of the Absolute-Maximum Ratings indicated may produce soft X-rays above 0.5 milliroentgens per hour which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide required shielding.

Precautions must be exercised during the servicing of the equipment employing the 6EL4-A to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 6EL4-A is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 6EL4-A in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

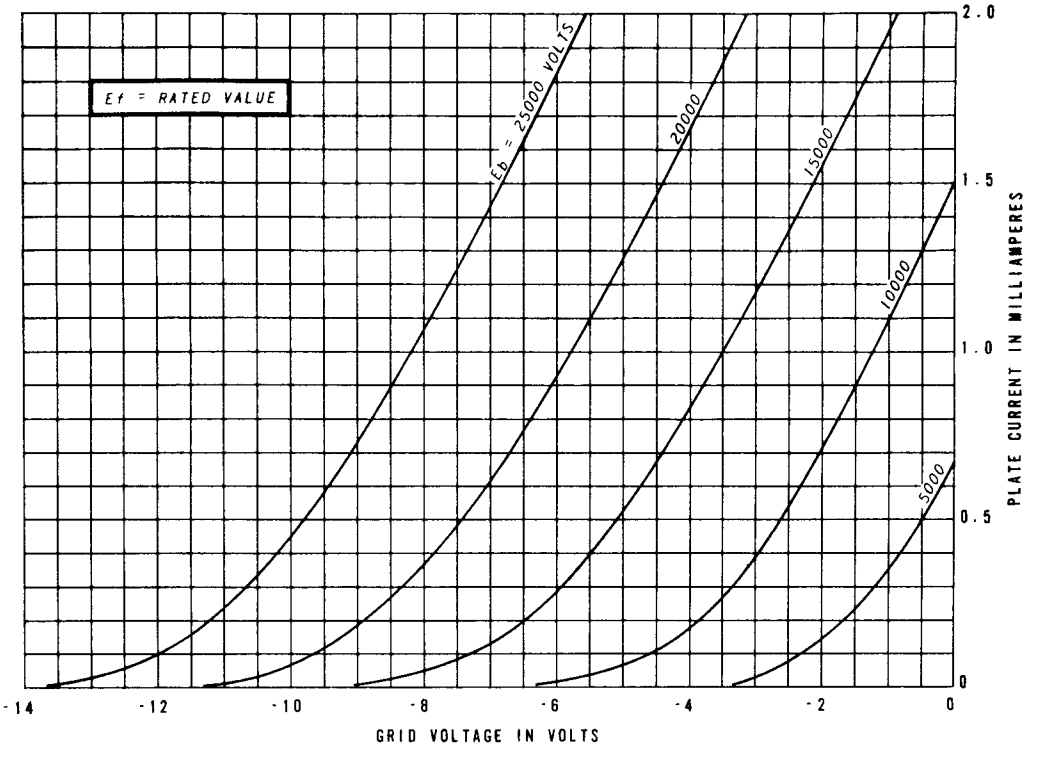
▲ Without external shield.

♦ Peak value for duration of 20 seconds maximum during equipment warmup.

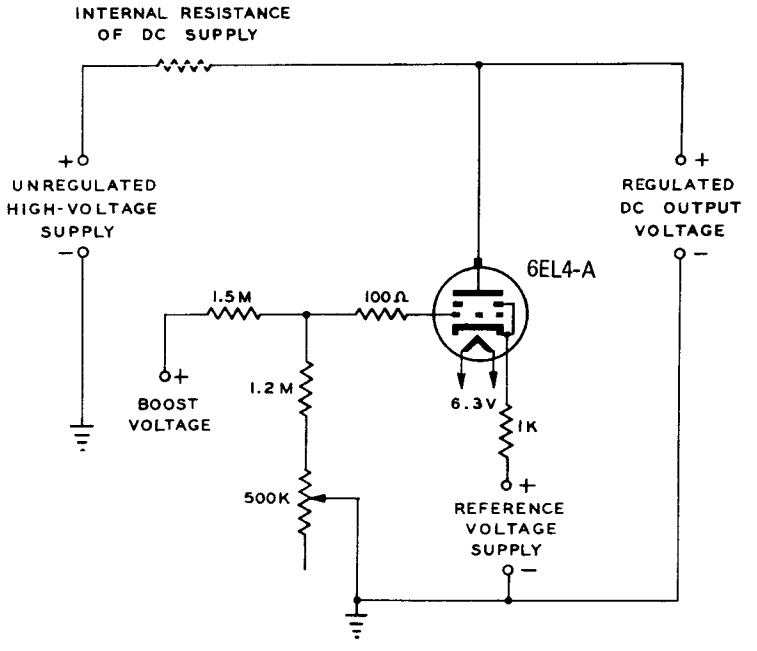
§ Sufficient impedance (1000 ohms is recommended) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions to 450 ma. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

⊕ With flyback transformer high-voltage supply.

AVERAGE TRANSFER CHARACTERISTICS



TYPICAL SHUNT REGULATOR CIRCUIT



APPLICATION CONSIDERATIONS

The base pins of the 6EL4-A fit the standard octal socket. Socket terminals for pins 3, 4, and 8 should not be used for tie points. Tube performance may be adversely affected should this precaution not be followed.

Sufficient impedance (1000 ohms is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short circuit conditions to 450 ma. This protection impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

The high voltages at which the 6EL4-A is operated may be very hazardous. Extreme caution should be used while making any circuit adjustments. The 6EL4-A and all of its associated hardware should be housed in a protective enclosure. It is particularly important that all parts which may be at a high potential with respect to ground be housed in this protective enclosure. The protective enclosure should be constructed with a system of interlocks to prevent anyone from coming in contact with any high potential point in the electrical system. The interlocks should break the primary circuit of the high-voltage supply when any part of the protective enclosure is open, and should prevent the closing of the primary circuit until the protective enclosure is closed and locked.

High voltages may appear at points in the circuit which are normally at low potentials as a result of improper circuit connection or of capacitor breakdown. Therefore, before touching any part of the circuit, the power supply switch should be turned off and both terminals of any capacitor should be grounded.

The bulb of the 6EL4-A becomes hot during operation. Therefore, it is essential that provision be made for free circulation of air around the tube in order to insure sufficient cooling.

The plate of the 6EL4-A exhibits a dull red color when the tube is operated at maximum plate dissipation. In addition, it may exhibit a bluish glow on the upper half of the bulb inner wall surface during normal operation. This bluish glow is a result of fluorescence and it should not be mistaken for gas.

To prevent any strain from being exerted on the seal of the plate cap, it is important that connection to the plate cap be made by an appropriate connector which has a flexible lead.

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

—PRODUCT INFORMATION—

Beam Triode

6EN4

FOR HV SHUNT REGULATOR APPLICATIONS

■ COLOR TV TYPE ■ 30000 VOLTS DC ■ 40 WATTS PLATE DISSIPATION ■ X-RADIATION RATING

The 6EN4 is a low current, high-voltage, sharp cutoff beam triode intended for use as a shunt regulator in the high-voltage power supply of color television receivers.

The 6EN4 has a maximum d-c plate voltage rating of 30000 volts, a maximum d-c plate current rating of 1.6 milli-amperes, and a maximum plate-dissipation rating of 40 watts.

The basing of the 6EN4 has been designed to permit the original equipment manufacturer to wire the tube socket so as to prevent the earlier high voltage regulator tubes from being used in place of the 6EN4. Moreover, the 6EN4, with its improved X-radiation features, can be used as a replacement for the 6BK4, 6BK4-A, 6BK4-C and 6EL4-A in earlier color television receivers.

Features of the 6EN4 include built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	6.3 ± 0.6	Volts
Heater Current ●	0.2	Amperes

Direct Interelectrode Capacitances ▲

Grid to Plate: (g to p)	1.0	pf
Input: g to (h+k)	2.6	pf
Output: p to (h+k)	1.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - B8-118, Short Medium Shell Octal 8-Pin
Top Cap - C1-50, Small
Outline Drawing - EIA 12-21

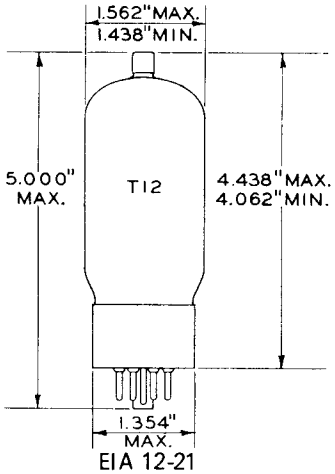
Maximum Diameter	1.562	Inches
Minimum Bulb Diameter	1.438	Inches
Maximum Over-all Length	5.000	Inches
Maximum Seated Height	4.438	Inches
Minimum Seated Height	4.062	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

Plate Voltage (Absolute-Maximum Value)	30000	Volts
Negative DC Grid Voltage	135	Volts
Peak Negative Grid Voltage ♦	440	Volts
Plate Dissipation (Absolute-Maximum Value)	40	Watts
DC Plate Current (Absolute-Maximum Value)	1.6	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	Not Recommended	
Heater Negative with Respect to Cathode §	450	Volts
Grid-Circuit Resistance	3.0	Megohms

PHYSICAL DIMENSIONS

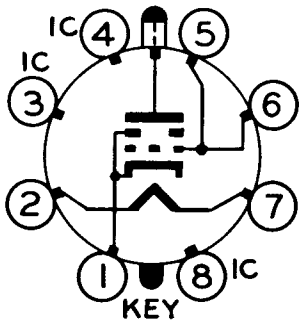


EIA 12-21

TERMINAL CONNECTIONS

Pin 1 - Cathode and Internal Shield
Pin 2 - Heater
Pin 3 - Internal Connection - Do Not Use
Pin 4 - Internal Connection - Do Not Use
Pin 5 - Grid
Pin 6 - Grid
Pin 7 - Heater
Pin 8 - Internal Connection - Do Not Use
Cap - Plate

BASING DIAGRAM



EIA 8NJ

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Unregulated DC Supply Voltage	36000	Volts
Equivalent Resistance of Unregulated Supply	11	Megohms
Voltage Divider Values:		
R1 (5 Watts)	220	Megohms
R2 (2 Watts)	1	Megohms
R3 (½ Watt)	0.82	Megohms
DC Reference Voltage	200	Volts
Equivalent Resistance of Reference Supply	1000	Ohms
Effective Grid-Plate Transconductance	200	Micromhos
DC Plate Current for Zero Load Current	1000	Microamperes
DC Plate Current for Load Current of 1 Milliampere	45	Microamperes
Regulated DC Output Voltage at Zero Load Current	25000	Volts
Regulated DC Output Voltage at Load Current of 1 Milliampere	24500	Volts

X-RADIATION RATING

X-radiation, maximum	0.5	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including filament voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation of the 6EN4 outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

WARNING

X-RADIATION

Operation of the 6EN4 outside of the Absolute-Maximum Ratings indicated may produce soft X-rays above 0.5 milliroentgens per hour which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide required shielding.

Precautions must be exercised during the servicing of the equipment employing the 6EN4 to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 6EN4 is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 6EN4 in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

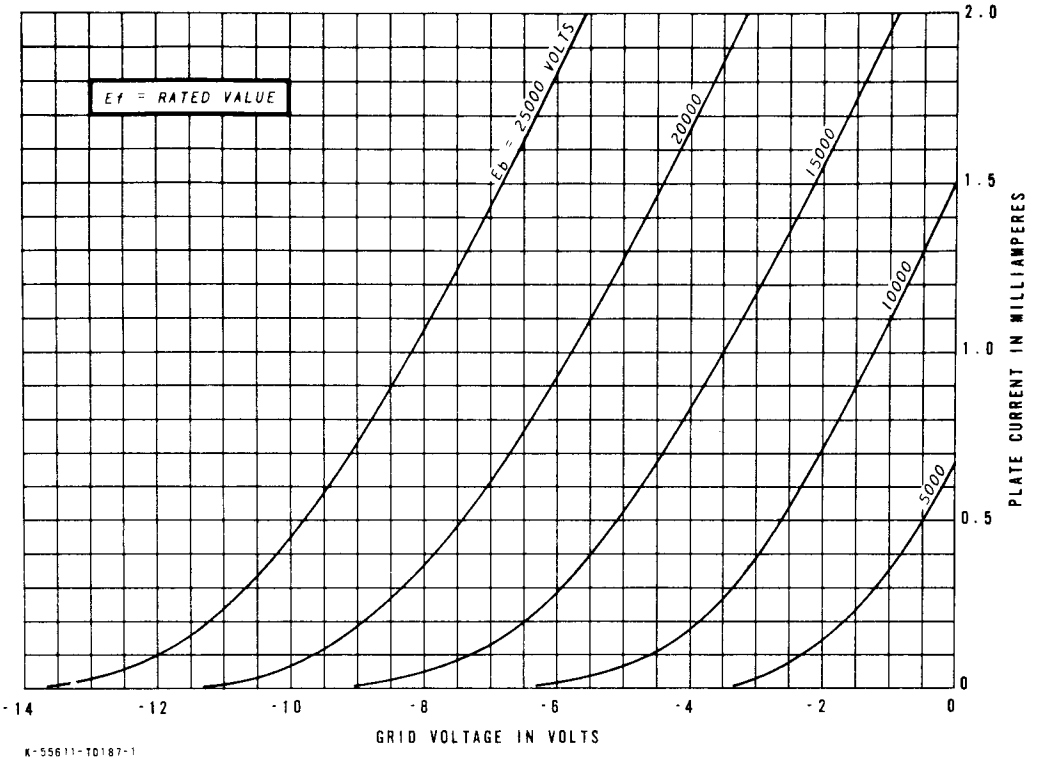
● Heater current of a bogey at Ef = 6.3 volts.

▲ Without external shield.

♦ Peak value for duration of 20 seconds maximum during equipment warmup.

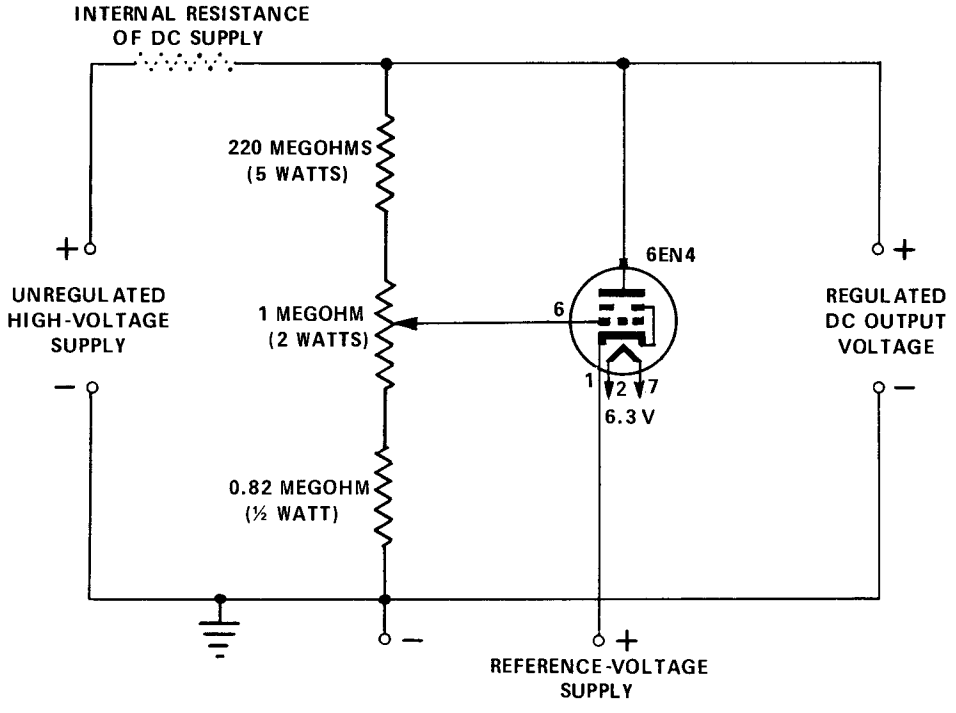
§ Sufficient impedance (1000 ohms is recommended) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions to 450 ma. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

AVERAGE TRANSFER CHARACTERISTICS



K-55611-T0187-1

TYPICAL SHUNT REGULATOR CIRCUIT



APPLICATION CONSIDERATIONS

The base pins of the 6EN4 fit the standard octal socket. Socket terminals for pins 3, 4, and 8 should not be used for tie points. Tube performance may be adversely affected should this precaution not be followed.

Sufficient impedance (1000 ohms is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short circuit conditions to 450 ma. This protection impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

The bulb of the 6EN4 becomes hot during operation. Therefore, it is essential that provision be made for free circulation of air around the tube in order to insure sufficient cooling. Darkening of the bulb during service is a normal occurrence and has no effect on performance of the 6EN4.

The plate of the 6EN4 exhibits a dull red color when the tube is operated at maximum plate dissipation. In addition, it may exhibit a bluish glow on the upper half of the bulb inner wall surface during normal operation. This bluish glow is a result of fluorescence and it should not be mistaken for gas.

To prevent any strain from being exerted on the seal of the plate cap, it is important that connection to the plate cap be made by an appropriate connector which has a flexible lead.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

6EU7
TWIN TRIODE

DESCRIPTION AND RATING

The 6EU7 is a miniature, high-mu, twin triode primarily designed for use in low-level stages of high-gain audio-frequency amplifiers. Isolation of the heater pins in the new basing employed and inherent low hum properties make use of the 6EU7 in this application advantageous.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.3	Amperes
Direct Interelectrode Capacitances‡		
Grid to Plate, Each Section: (g to p)	1.5	pf
Input, Each Section: g to (h+k)	1.6	pf
Output, Each Section: p to (h+k)	0.2	pf

MECHANICAL

Mounting Position—Any
Envelope—T-6 ½, Glass
Base—E9-1, Small Button 9-Pin
Outline Drawing—EIA 6-2

Maximum Diameter	7/8	Inch
Maximum Over-all Length	2 3/16	Inches
Maximum Seated Height	1 15/16	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION

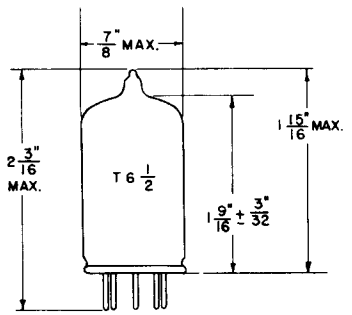
Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	55	Volts
Plate Dissipation	1.2	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

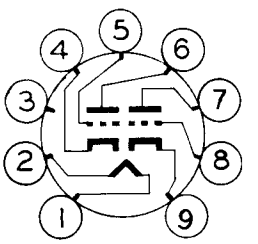


EIA 6-2

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—Heater
Pin 3—No Connection
Pin 4—Cathode (Section 2)
Pin 5—Grid (Section 2)
Pin 6—Plate (Section 2)
Pin 7—Plate (Section 1)
Pin 8—Grid (Section 1)
Pin 9—Cathode (Section 1)

BASING DIAGRAM



EIA 9LS

CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier, Each Section

Plate Voltage	100	250	Volts
Grid Voltage	−1.0	−2.0	Volts
Amplification Factor	100	100	
Plate Resistance, approximate	80000	62500	Ohms
Transconductance	1250	1600	Micromhos
Plate Current	0.5	1.2	Milliamperes
Equivalent Noise and Hum Voltage, Each Section, Average, True RMS§	1.8		Microvolts

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

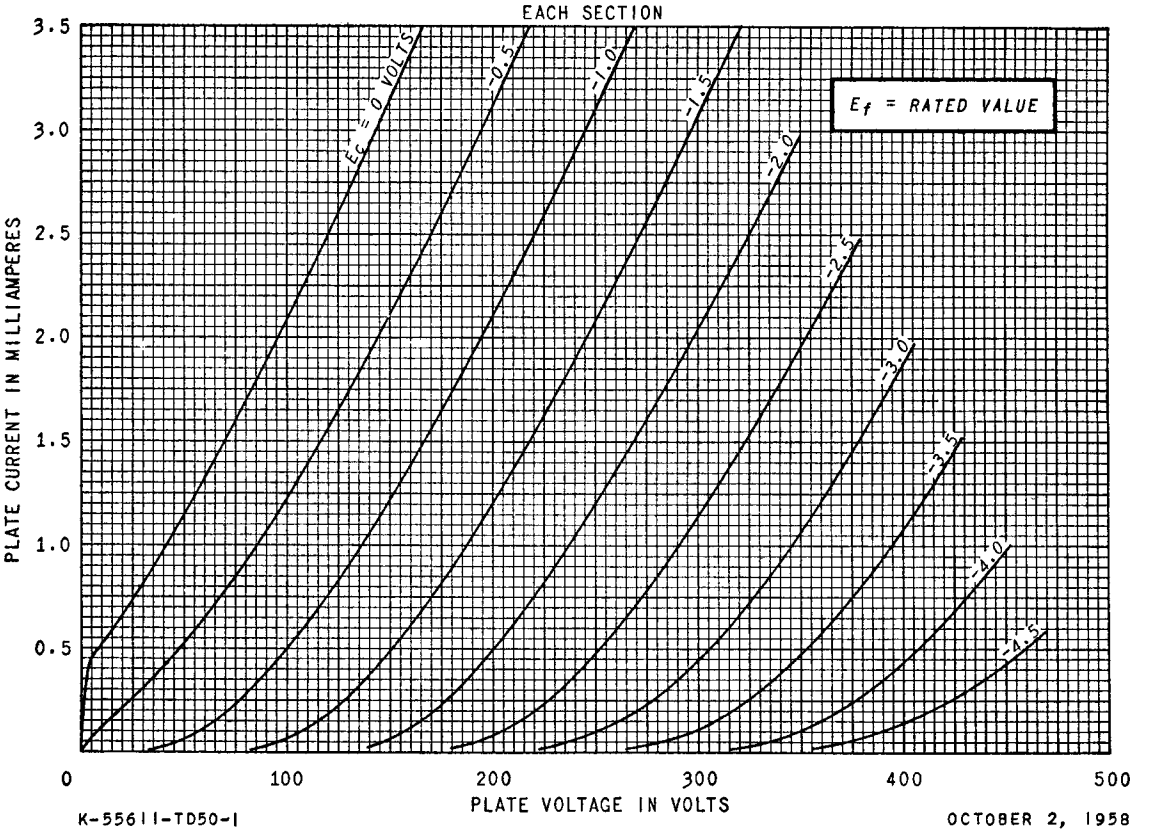
† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

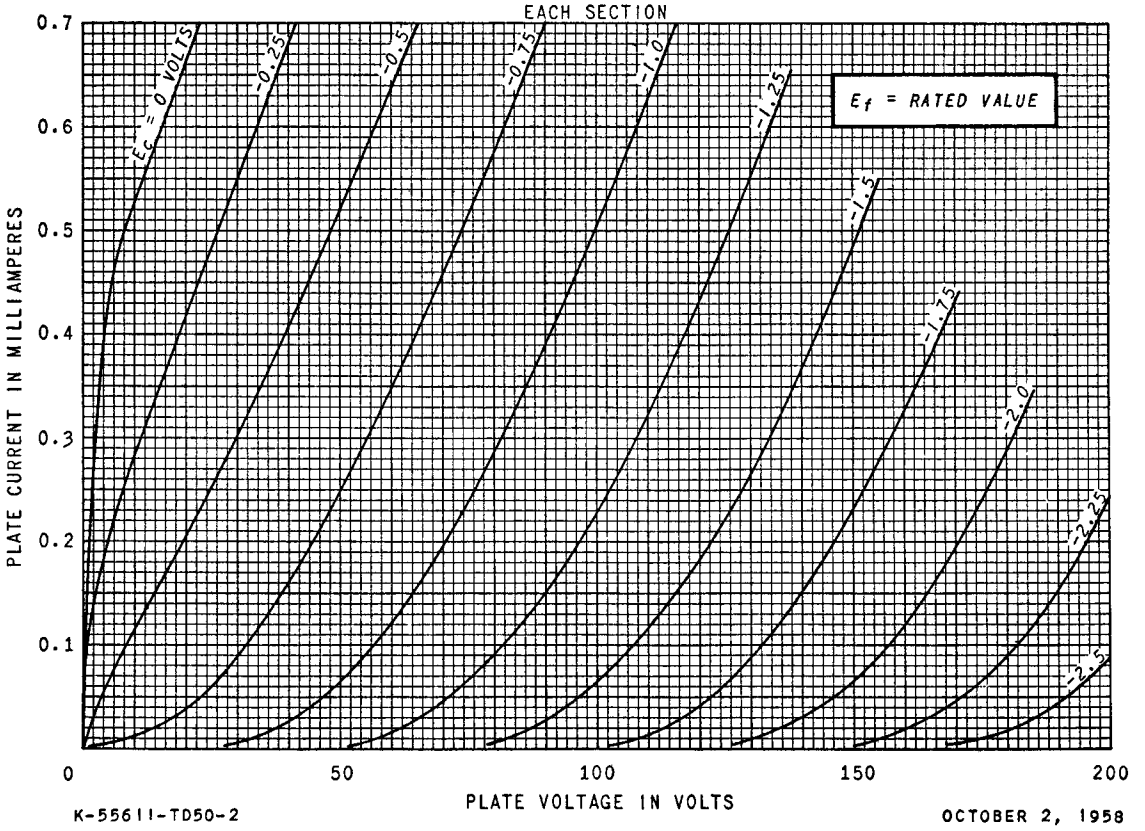
§ Referred to grid and measured under the following conditions: Ef = 6.3 volts AC, CT of heater transformer grounded; Ebb = 250 volts; Rb = 100000 ohms; Rk = 2700 ohms, bypassed by 100 μf; Rg = 0 ohms; Amplifier frequency range = 25 to 1000 cps.

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AVERAGE PLATE CHARACTERISTICS



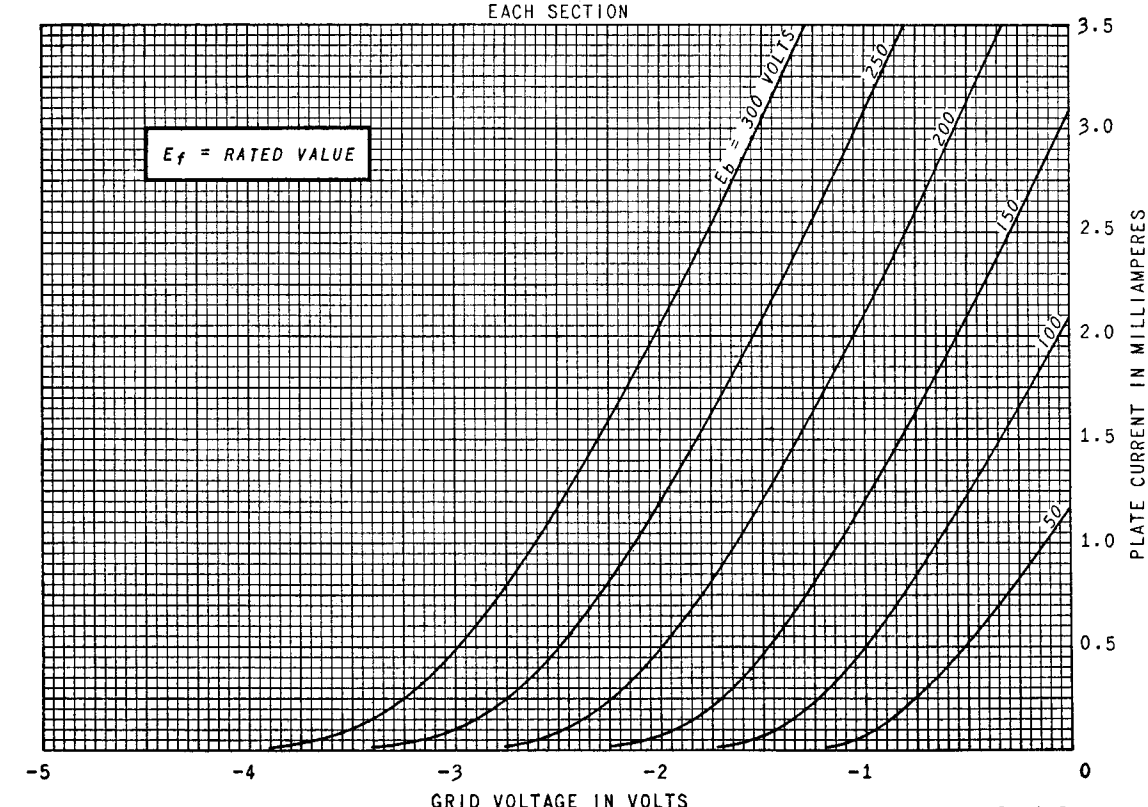
AVERAGE PLATE CHARACTERISTICS



K-55611-TD50-2

OCTOBER 2, 1958

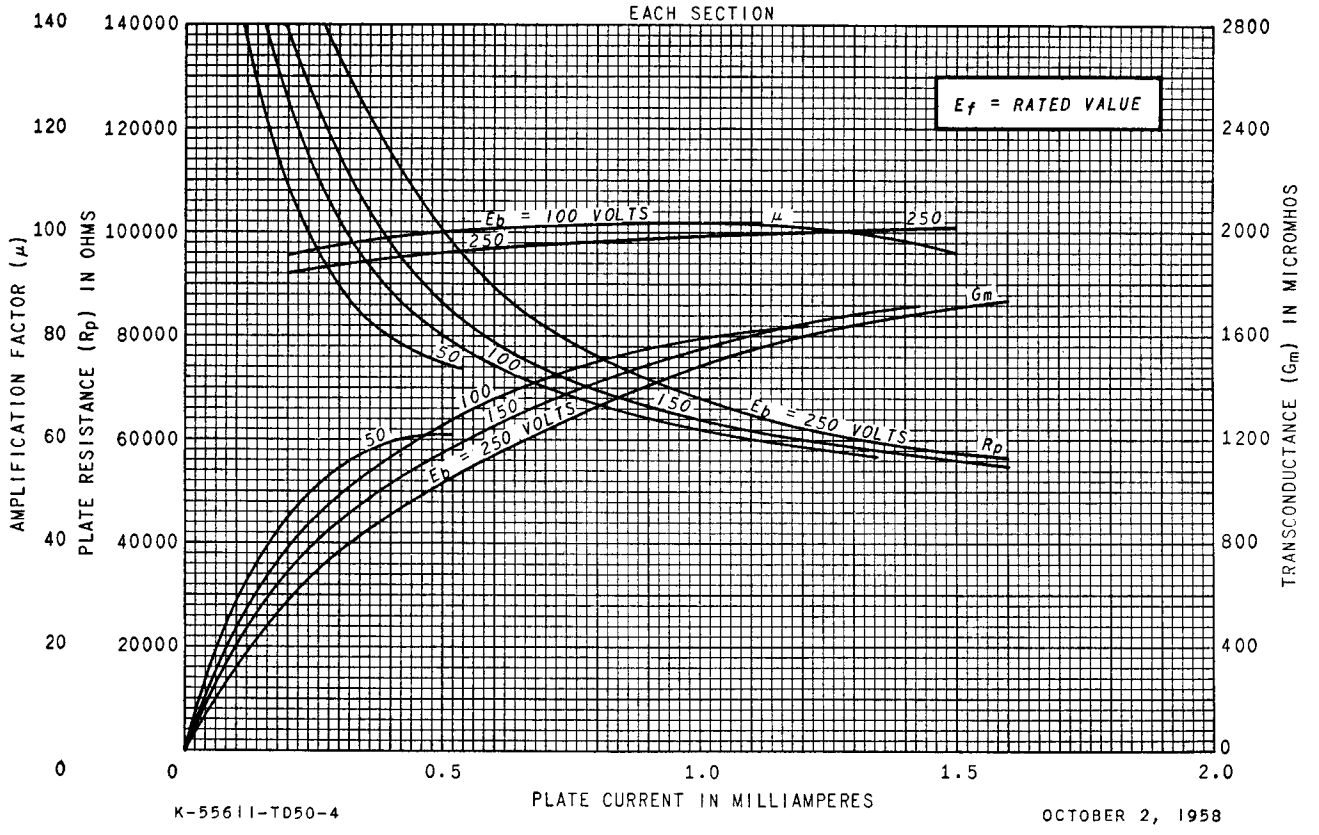
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD50-3

OCTOBER 2, 1958

AVERAGE CHARACTERISTICS



Electronic TUBES

6EU8-5EU8

TRIODE-PENTODE

FOR VHF CONVERTER APPLICATIONS

DESCRIPTION AND RATING

The 6EU8 is a miniature, triode-pentode primarily intended for service as a combined triode oscillator and pentode mixer in television receivers. Except for heater ratings, the 5EU8 is identical to the 6EU8. Both tubes incorporate a controlled heater-warm-up characteristic.

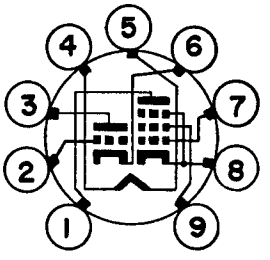
GENERAL

ELECTRICAL	5EU8	6EU8	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	4.7	6.3	Volts
Heater Current	0.6±5%	0.45±6%	Amperes
Heater Warm-up Time*	11	11	Seconds
Direct Interelectrode Capacitances			
Pentode Section	With Shield†	Without Shield	
Grid-Number 1 to Plate: (Pg1 to Pp), maximum	0.01	0.02	μμf
Input: Pgl to (h+Pk+Pg2+Pg3+i.s.)	5.0	5.0	μμf
Output: Pp to (h+Pk+Pg2+Pg3+i.s.)	3.4	2.6	μμf
Heater to Cathode: (Pk to h)	3.0‡	3.0	μμf
Triode Section			
Grid to Plate: (Tg to Tp)	1.7	1.7	μμf
Input: Tg to (Tk+h+Pk+Pg3+i.s.)	3.2	3.0	μμf
Output: Tp to (Tk+h+Pk+Pg3+i.s.)	2.1	1.6	μμf
Heater to Cathode: (Pk to h)	3.0‡	3.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

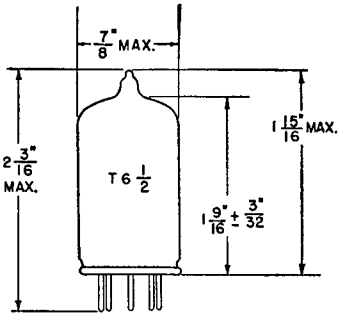


EIA 9JF

TERMINAL CONNECTIONS

Pin 1—Pentode Plate
Pin 2—Triode Grid
Pin 3—Triode Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Triode Cathode
Pin 7—Pentode Grid Number 1
Pin 8—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 9—Pentode Grid Number 2 (Screen)

PHYSICAL DIMENSIONS



EIA 6-2

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combination of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	...	Volts
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.1	3.0	Watts
Screen Dissipation	0.55	...	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance	0.1	0.1	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section	Triode Section	
Plate Voltage	125	150	Volts
Screen Voltage	125	...	Volts
Grid-Number 1 Voltage	−1.0	...	Volts
Cathode-Bias Resistor		56	Ohms
Amplification Factor		40	
Plate Resistance, approximate	80000	5000	Ohms
Transconductance	6400	8500	Micromhos
Plate Current	12	18	Milliamperes
Screen Current	4.0	...	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 10 Microamperes	−9	−12	Volts

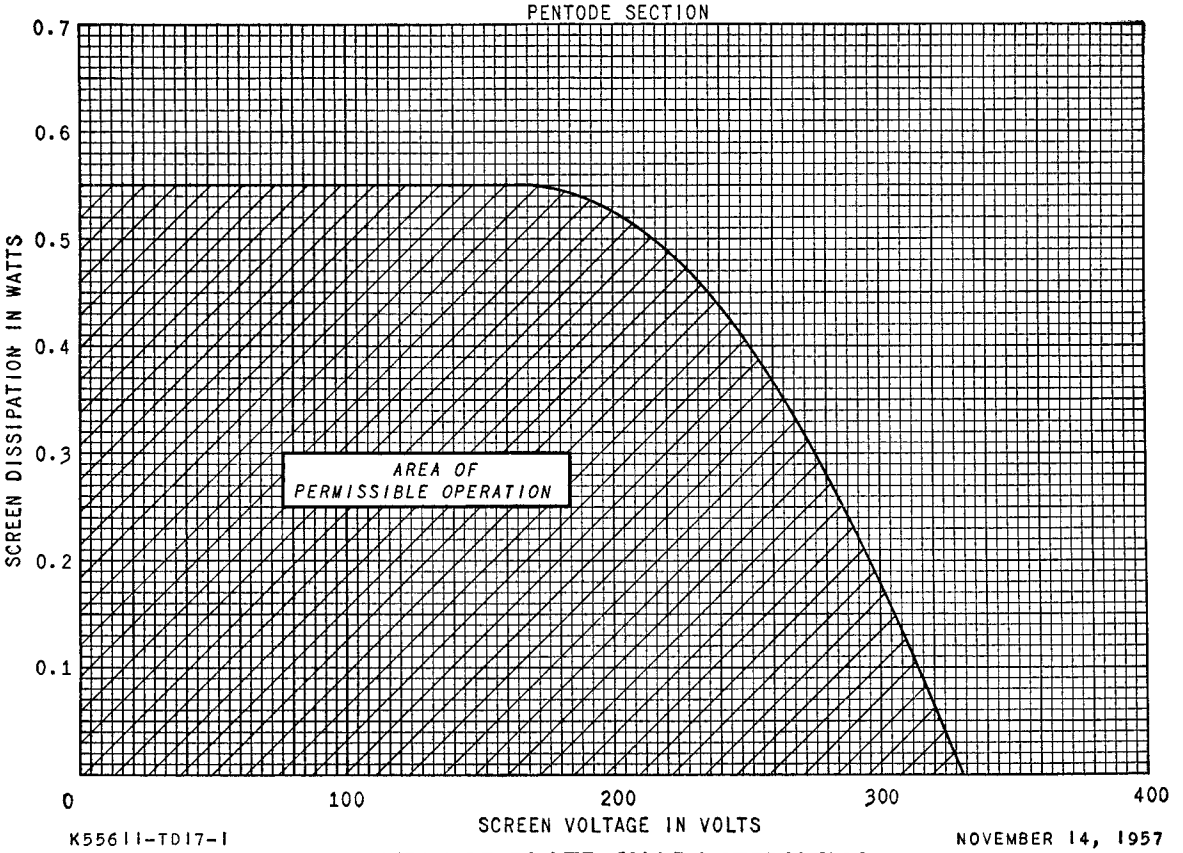
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (EIA 315) connected to cathode of section under test unless otherwise indicated.

‡ With external shield (EIA 315) connected to ground.

SCREEN RATING CHART

PENTODE SECTION

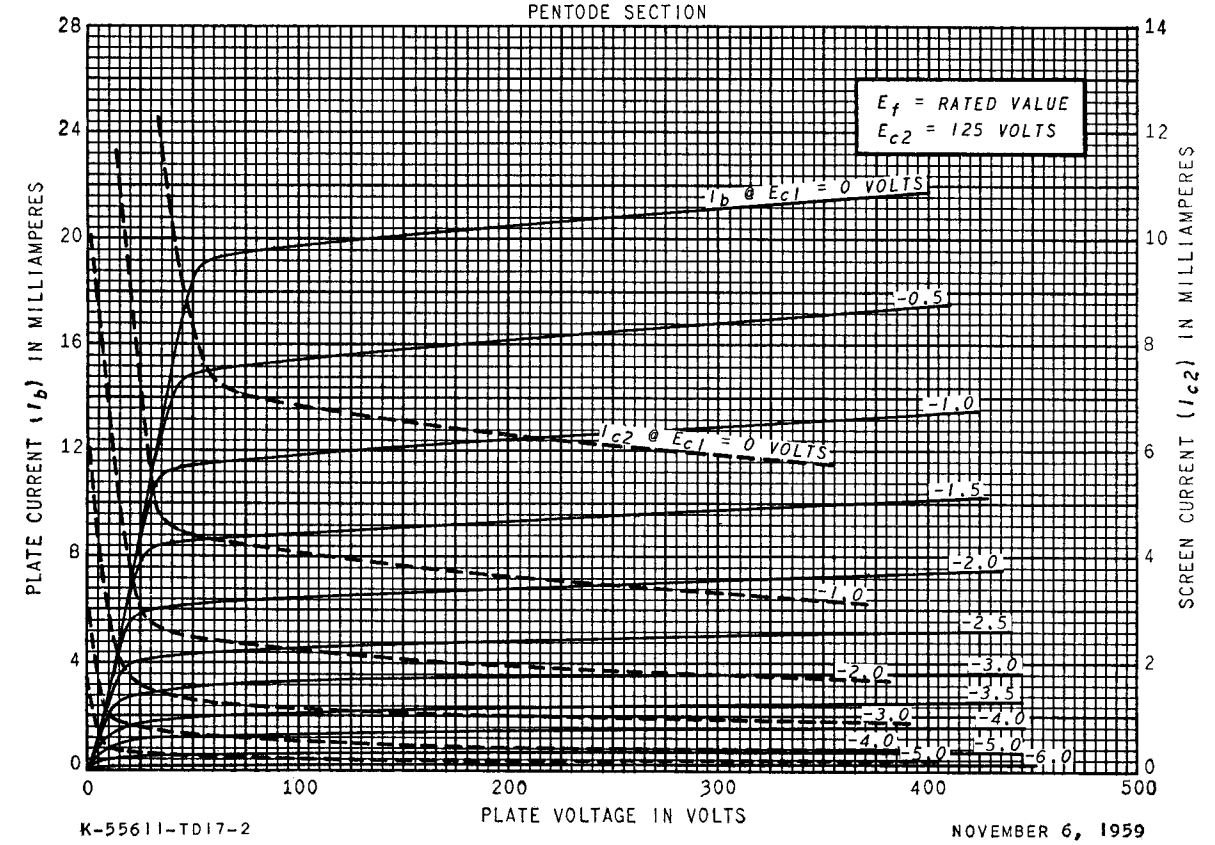


K55611-TD17-1

NOVEMBER 14, 1957

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

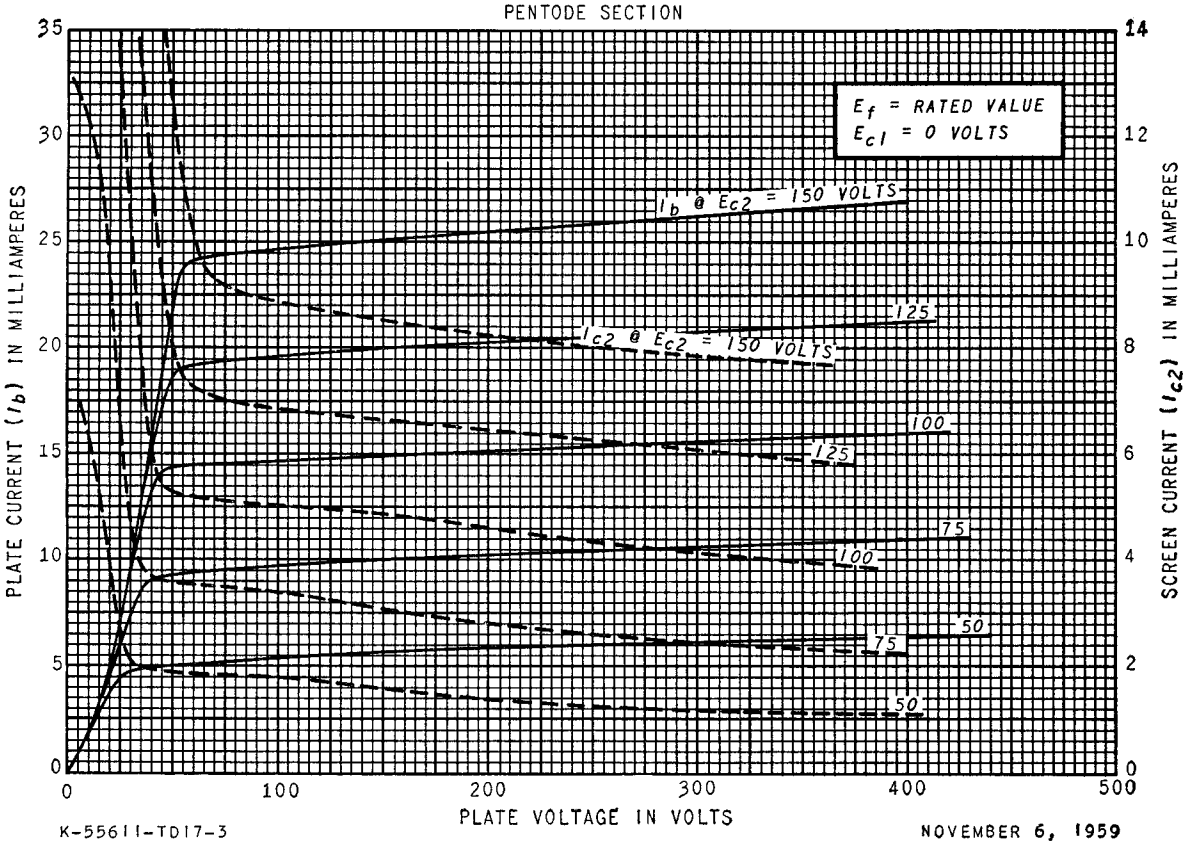


K-55611-TD17-2

NOVEMBER 6, 1959

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

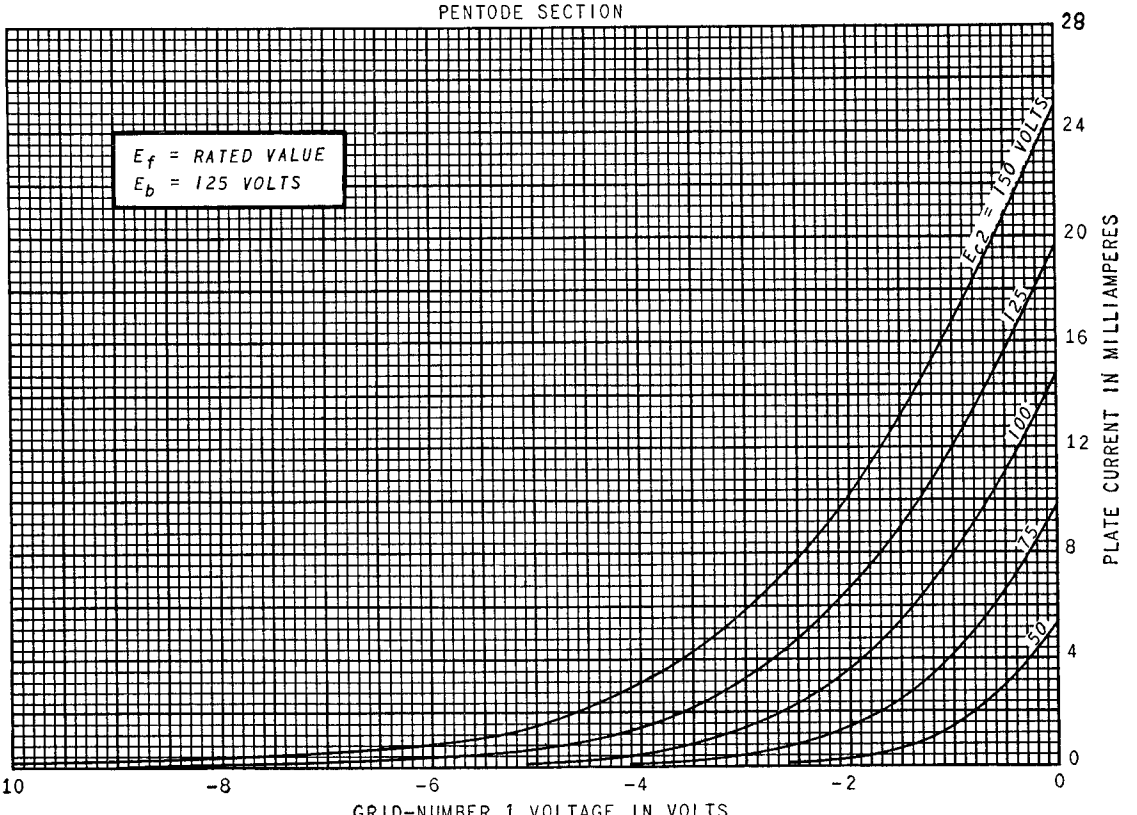


K-55611-TD17-3

NOVEMBER 6, 1959

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

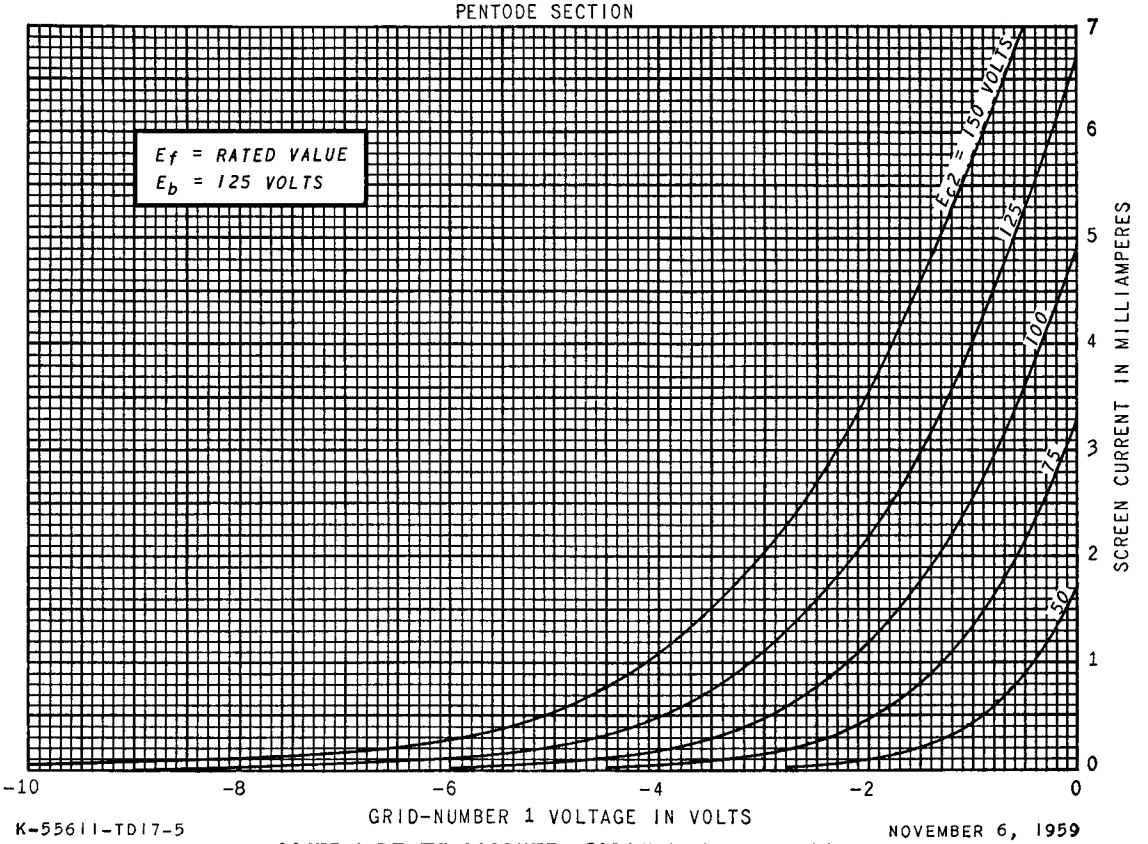


K-55611-TD17-4

NOVEMBER 6, 1959

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

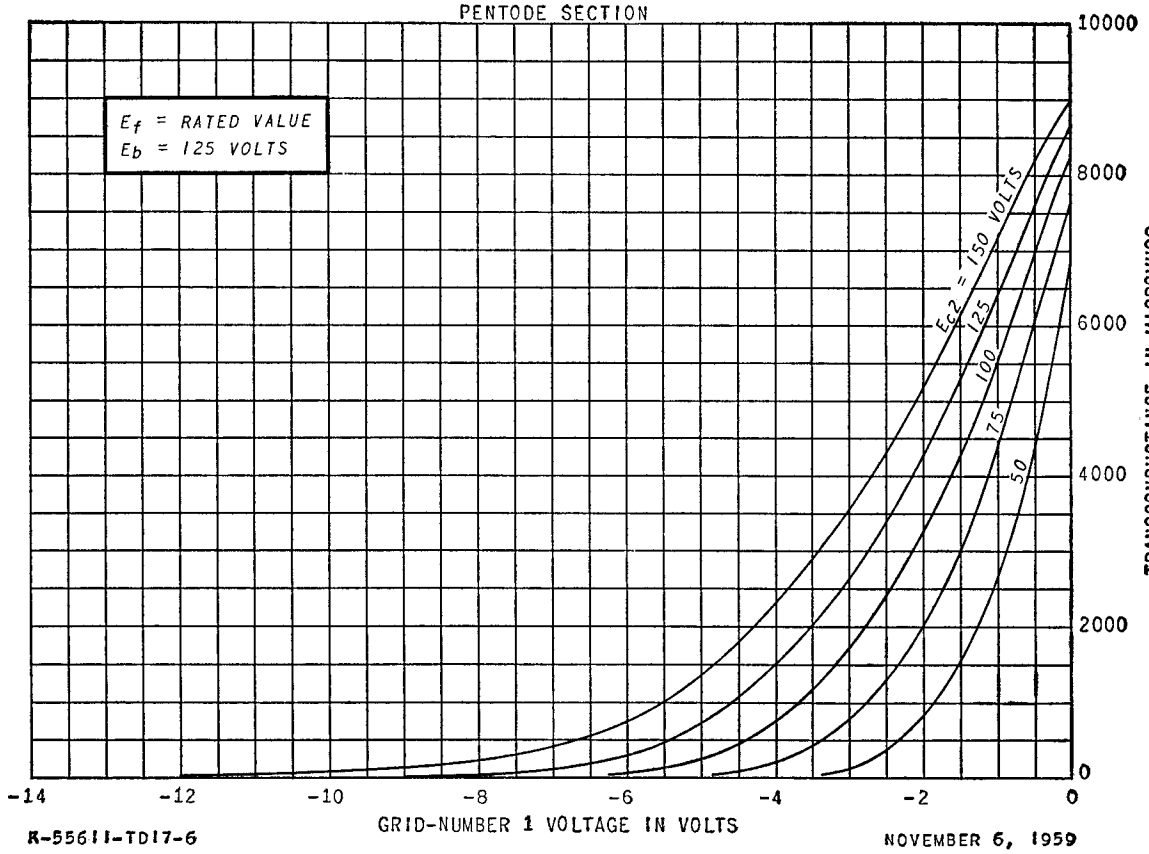


K-55611-TDI7-5

NOVEMBER 6, 1959

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

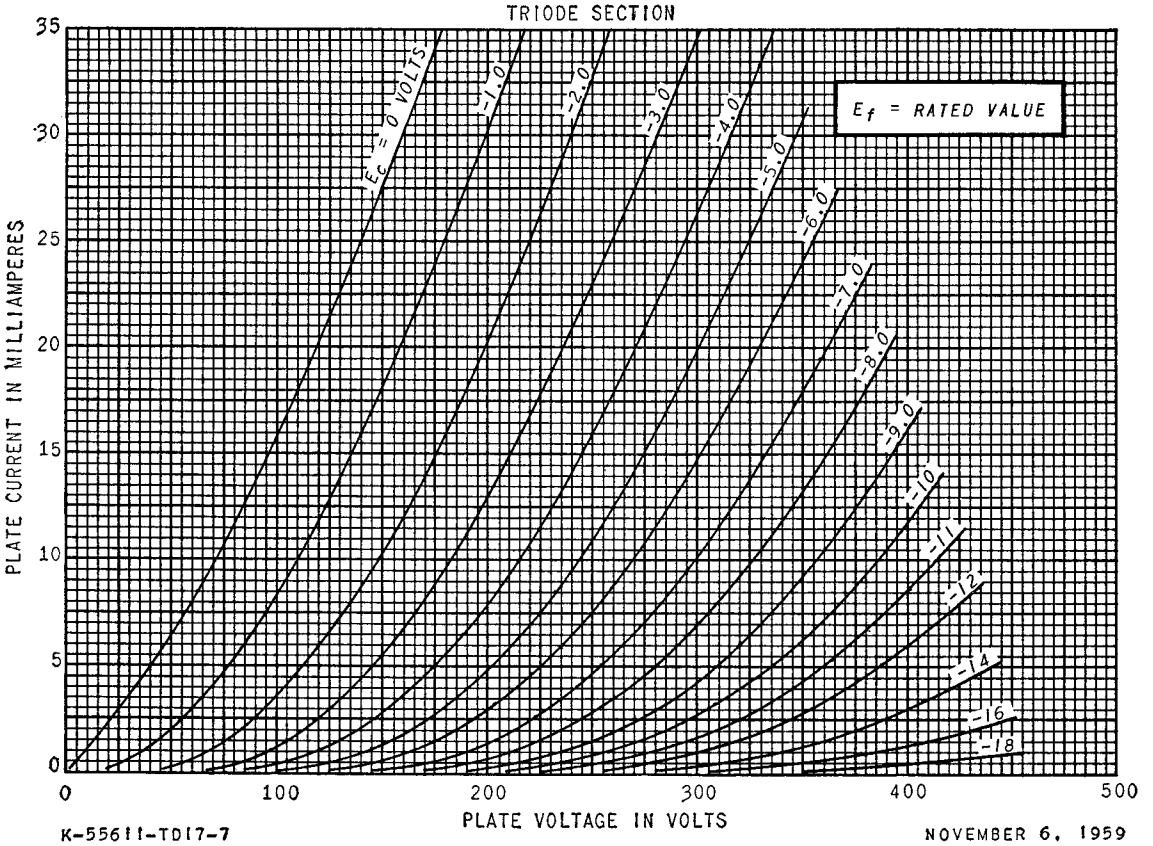


K-55611-TDI7-6

NOVEMBER 6, 1959

AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION

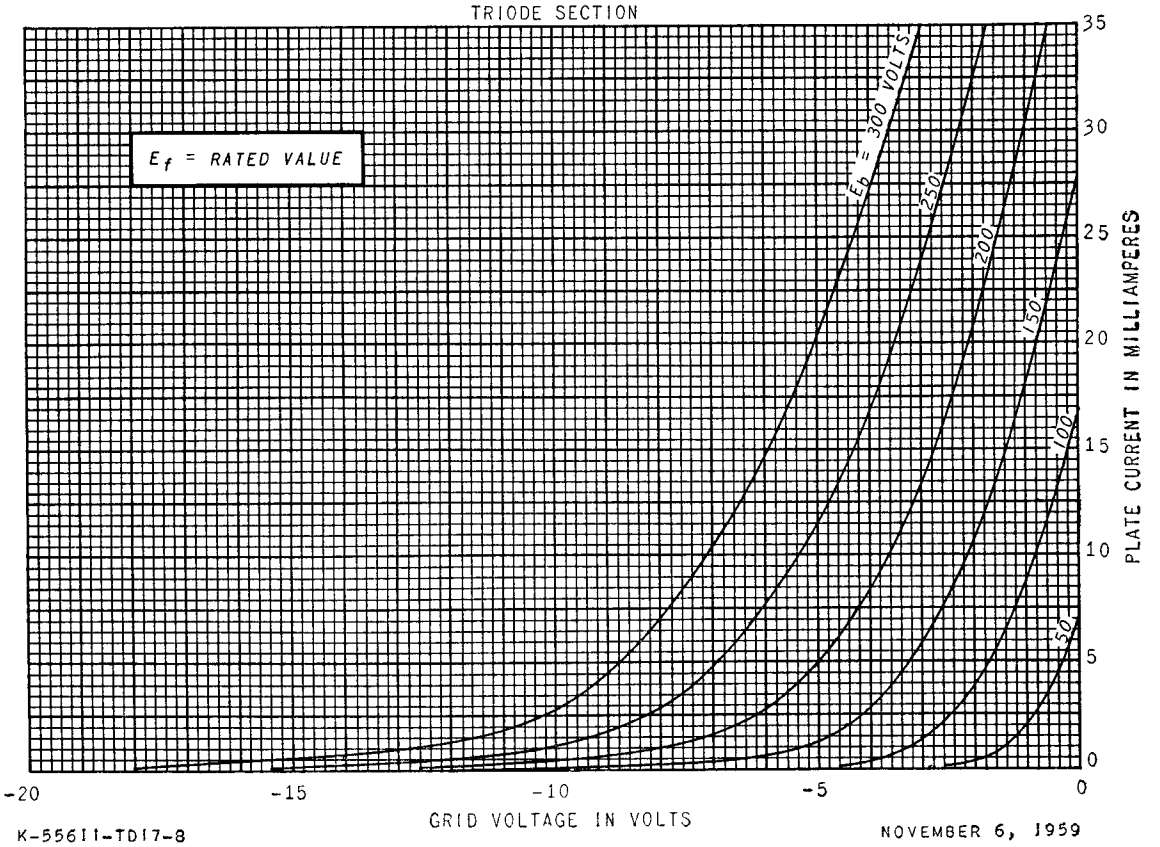


K-5561I-TDI7-7

NOVEMBER 6, 1959

AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION

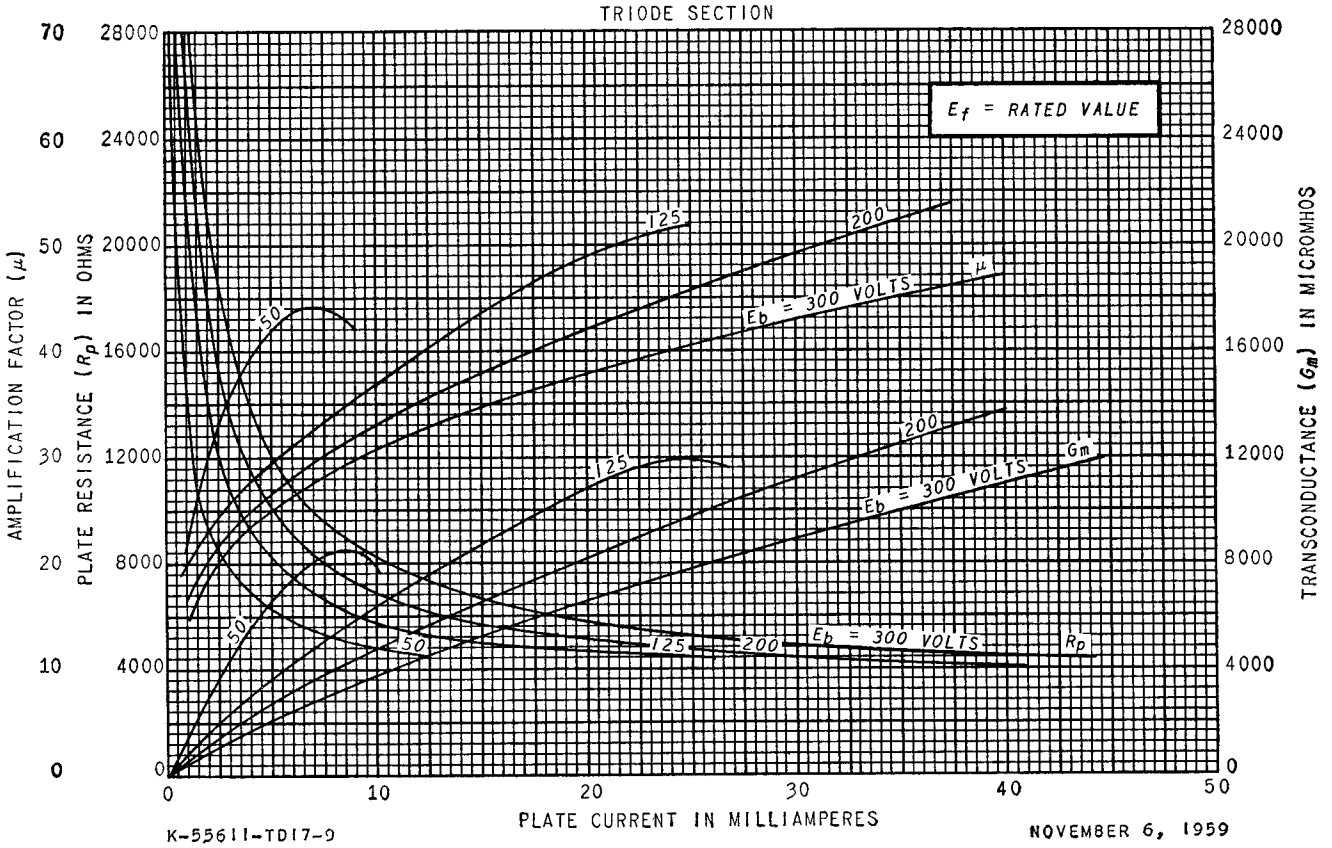


K-5561I-TDI7-8

NOVEMBER 6, 1959

AVERAGE CHARACTERISTICS

TRIODE SECTION



K-55611-TDI7-9

NOVEMBER 6, 1959

Electronic TUBES

6EW6
PENTODE

DESCRIPTION AND RATING

The 6EW6 is a miniature, sharp-cutoff pentode designed for intermediate-frequency amplifier service in television receivers. Features of the tube include high transconductance and separate base-pin terminals for the cathode and suppressor.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ± 10%		Volts
Heater Current	0.4		Amperes
Direct Interelectrode Capacitances	With Shield*	Without Shield	
Grid-Number 1 to Plate, maximum	0.03	0.04	μμf
Input	10.0	10.0	μμf
Output	3.4	2.4	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature-Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

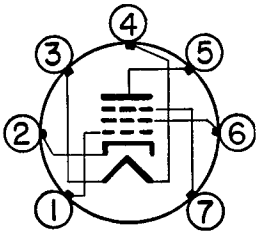
Plate Voltage	330	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	3.1	Watts
Screen Dissipation	0.65	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

BASING DIAGRAM

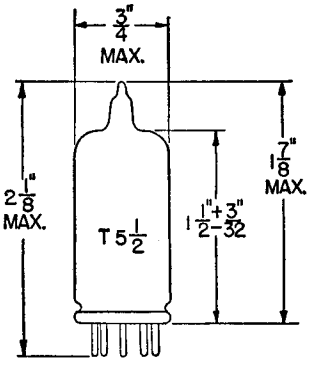


EIA 7CM

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Internal Shield and Grid Number 3 (Suppressor)

PHYSICAL DIMENSIONS



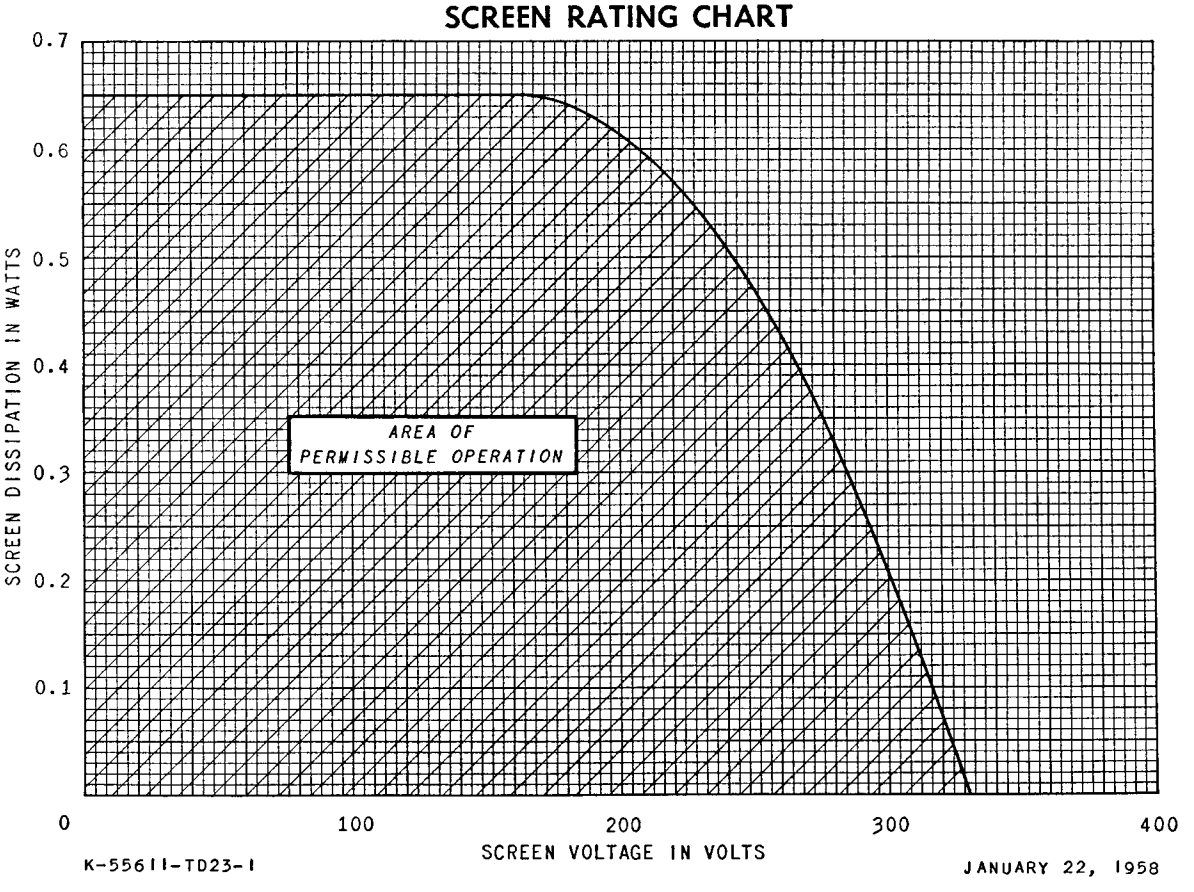
EIA 5-2

CHARACTERISTICS AND TYPICAL OPERATION

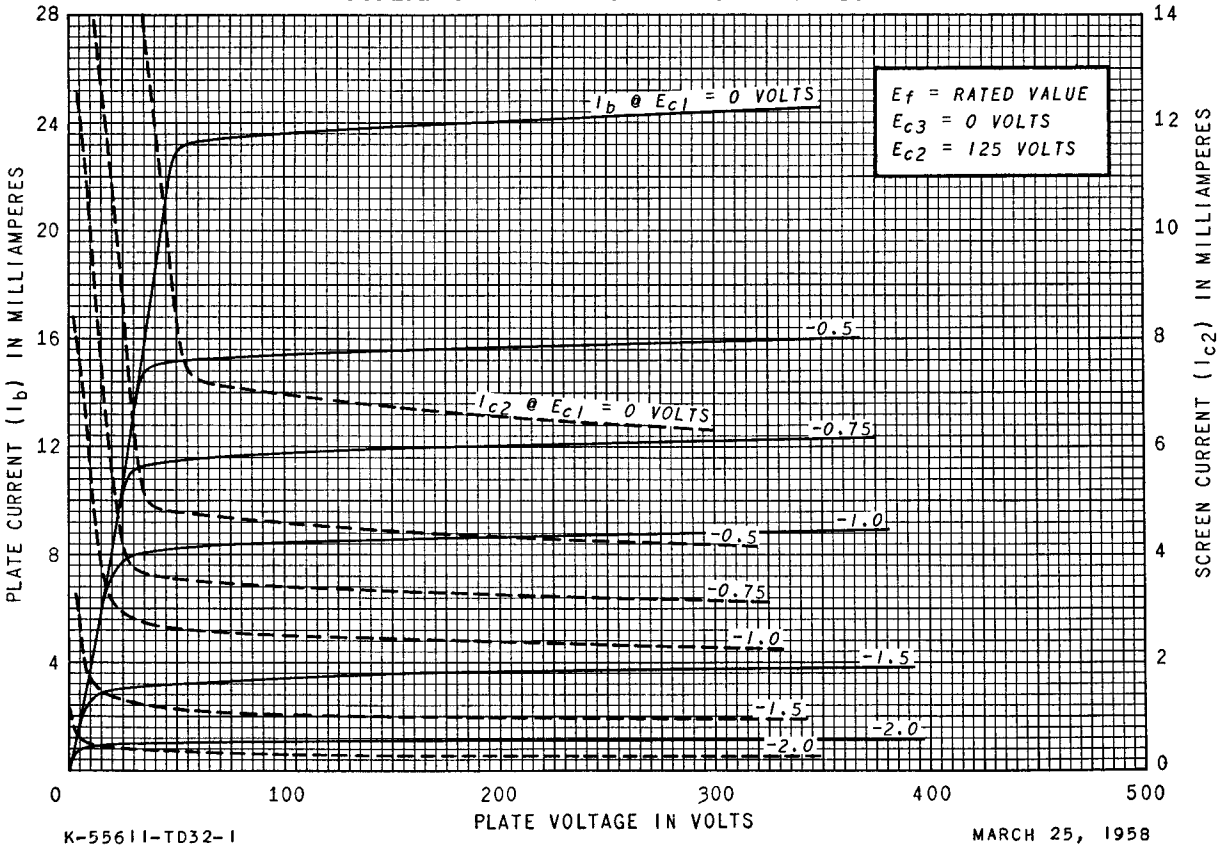
CLASS A_1 AMPLIFIER

Plate Voltage	125	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Plate Resistance, approximate	0.2	Megohms
Transconductance	14000	Micromhos
Plate Current	11	Milliamperes
Screen Current	3.2	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 20 Microamperes	−3.5	Volts

* With external shield (EIA 316) connected to cathode.



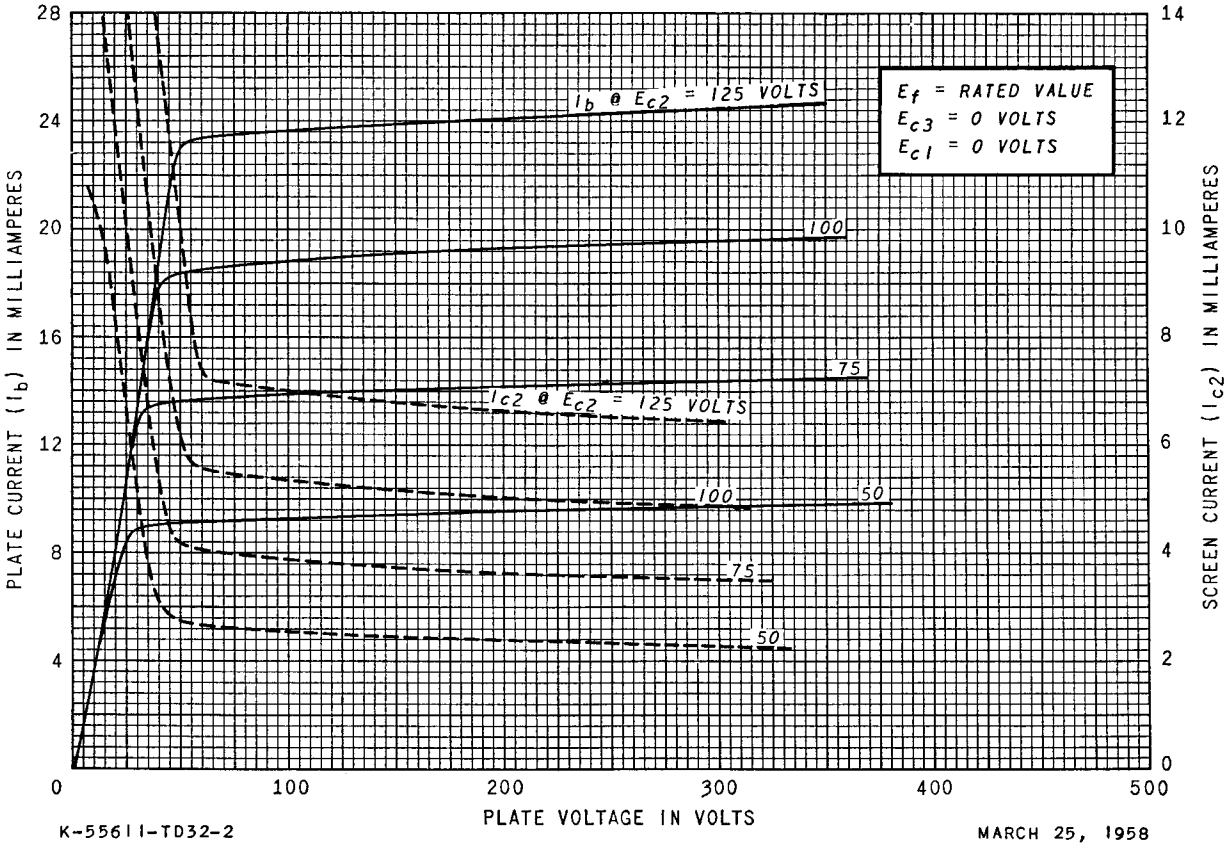
AVERAGE PLATE CHARACTERISTICS



K-55611-TD32-1

MARCH 25, 1958

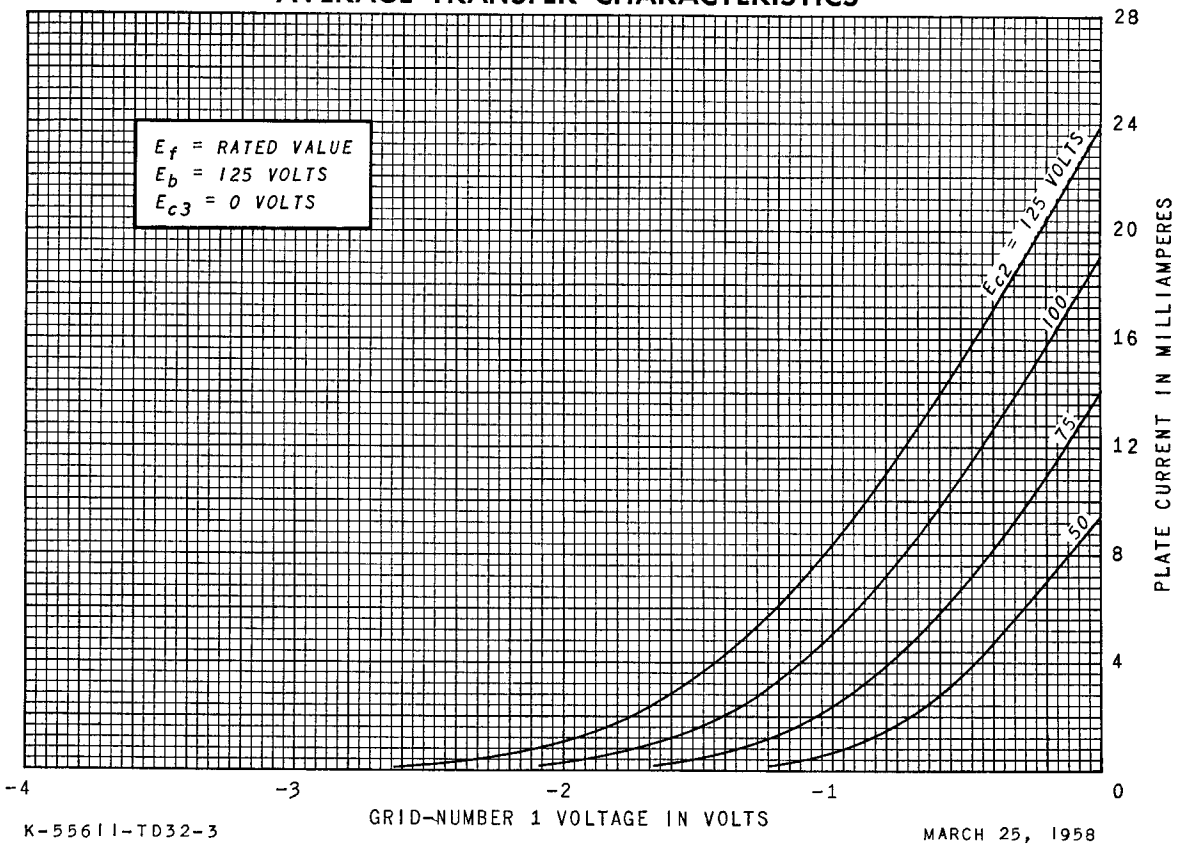
AVERAGE PLATE CHARACTERISTICS



K-55611-TD32-2

MARCH 25, 1958

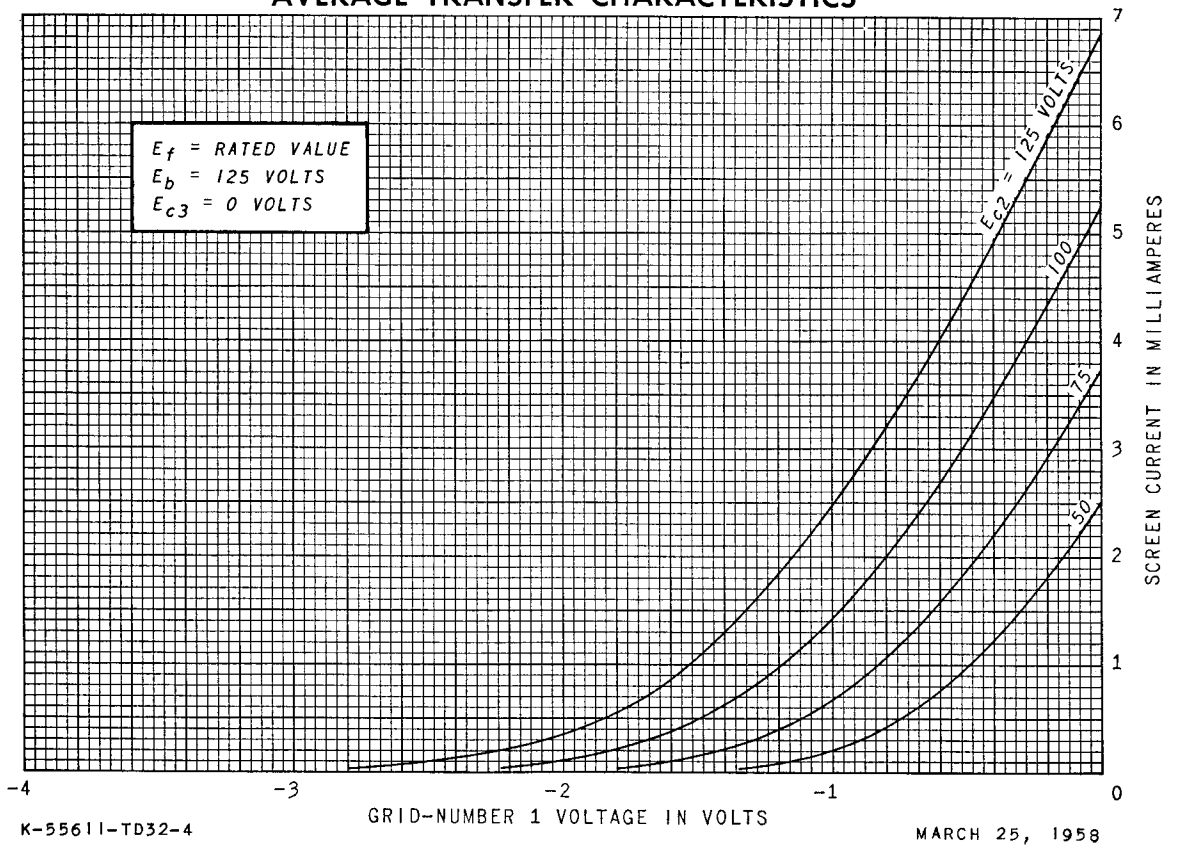
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD32-3

MARCH 25, 1958

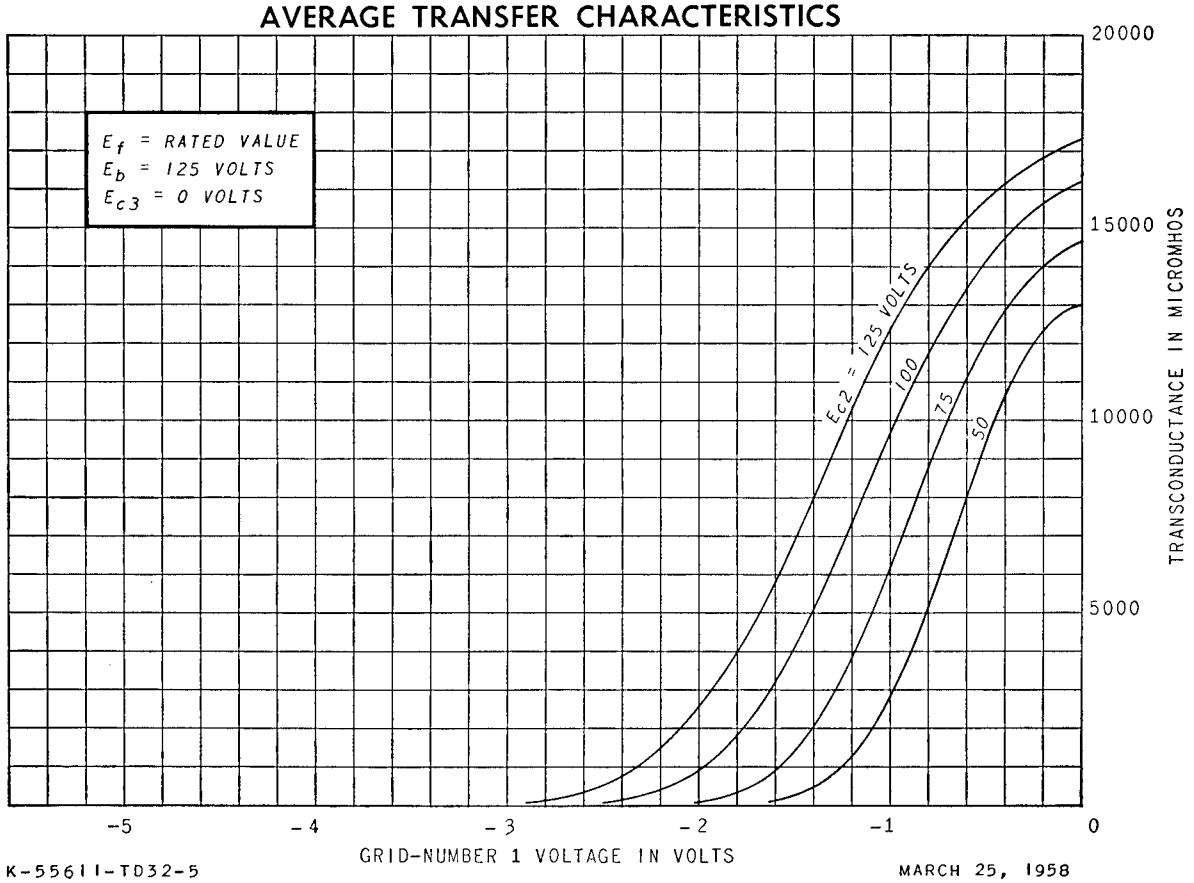
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD32-4

MARCH 25, 1958

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD32-5

MARCH 25, 1958

Electronic TUBES

6EY6

BEAM PENTODE

FOR TV VERTICAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6EY6 is identical to the 7EY6 except for the following ratings:

GENERAL

Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.68	Amperes

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

Electronic TUBES

6EZ5

BEAM PENTODE

FOR TV VERTICAL-DEFLECTION-AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6EZ5 is a beam-power pentode designed for use as the vertical-deflection amplifier in television receivers that employ 110-degree deflection picture tubes. Features of the tube include high perveance and high plate dissipation.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.8	Amperes
Direct Interelectrode Capacitances, approximate*		
Grid-Number 1 to Plate	0.6	μμf
Input	9.0	μμf
Output	7.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B6-81, Intermediate-Shell Octal 6-Pin

MAXIMUM RATINGS

VERTICAL-DEFLECTION-AMPLIFIER SERVICE†
DESIGN-MAXIMUM VALUES

DC Plate Voltage	350	Volts
Peak Pulse Plate Voltage	2500	Volts
Screen Voltage	300	Volts
Plate Dissipation‡	12	Watts
Screen Dissipation‡	2.75	Watts
DC Cathode Current	75	Milliamperes
Peak Cathode Current	260	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	2.2	Megohms
With Fixed Bias	1.0	Megohms
Bulb Temperature at Hottest Point	200	C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

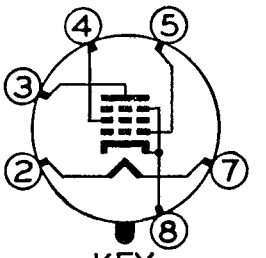
The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

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GENERAL ELECTRIC

Supersedes ET-T1536, dated 6-59.

BASING DIAGRAM

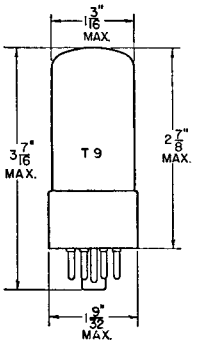


EIA 7AC

TERMINAL CONNECTIONS

Pin 2—Heater
Pin 3—Plate
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates

PHYSICAL DIMENSIONS



EIA 9-15

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

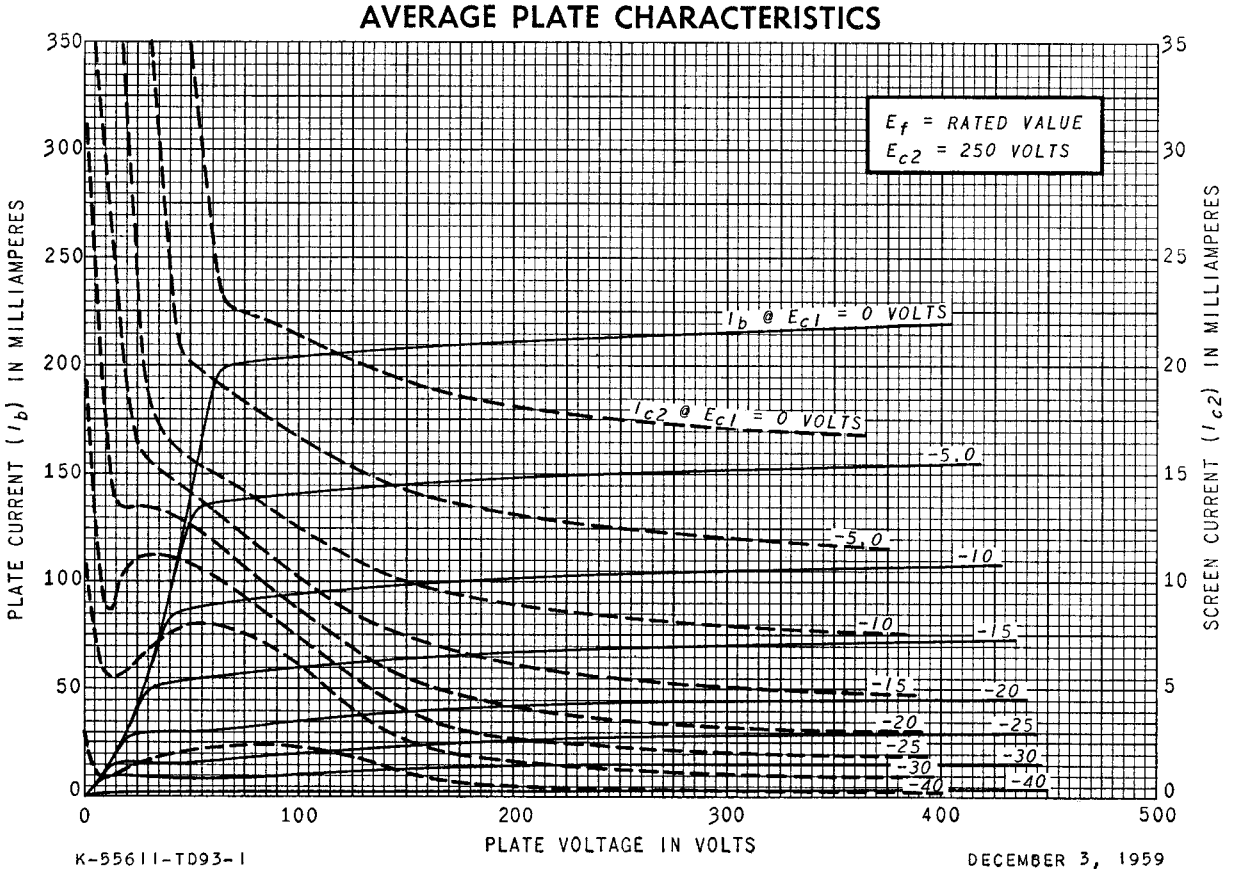
Plate Voltage	60	250 Volts
Screen Voltage	250	250 Volts
Grid-Number 1 Voltage	0§	−20 Volts
Plate Resistance, approximate	...	50000 Ohms
Transconductance	...	4100 Micromhos
Plate Current	180	43 Milliamperes
Screen Current	26	3.5 Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	...	−50 Volts

* Without external shield.

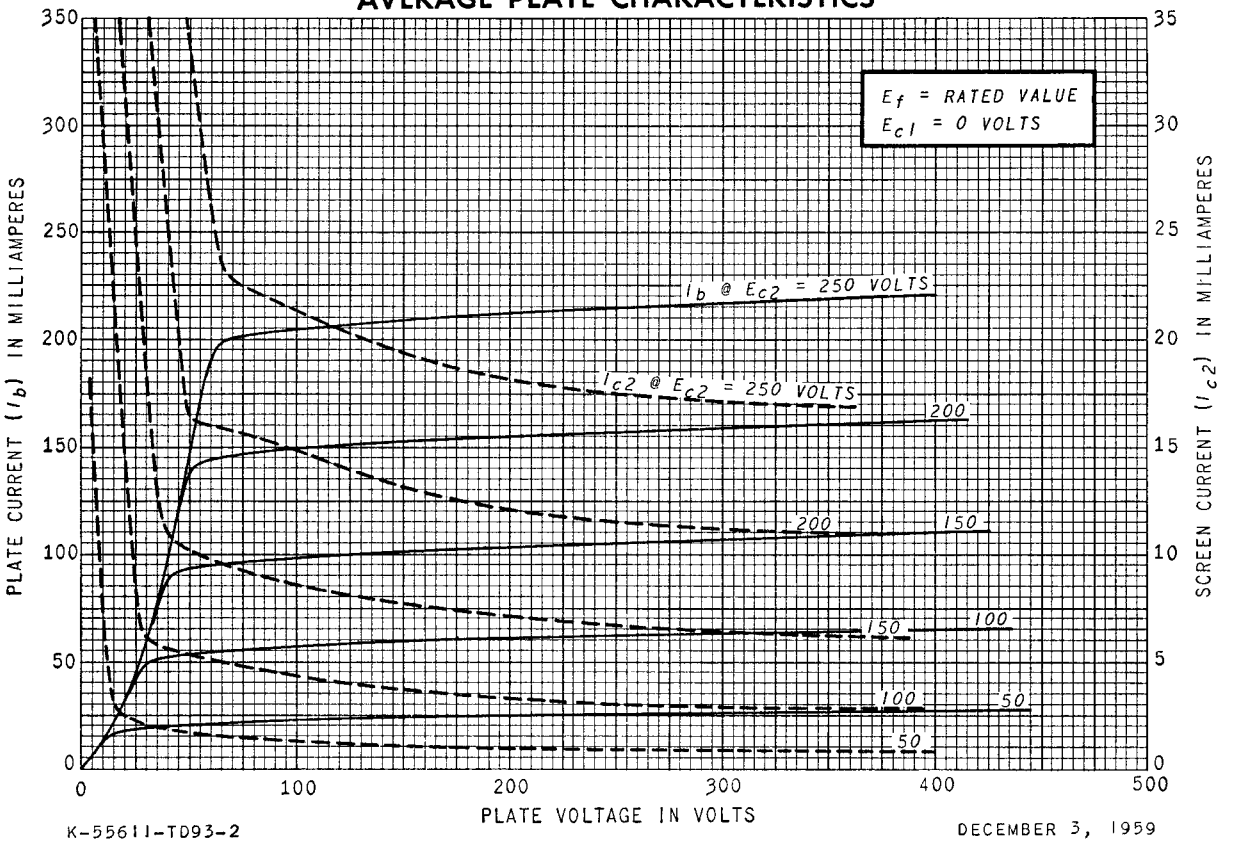
† For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

‡ In stages operating with grid leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

§ Applied for short interval (two seconds maximum) so as not to damage tube.



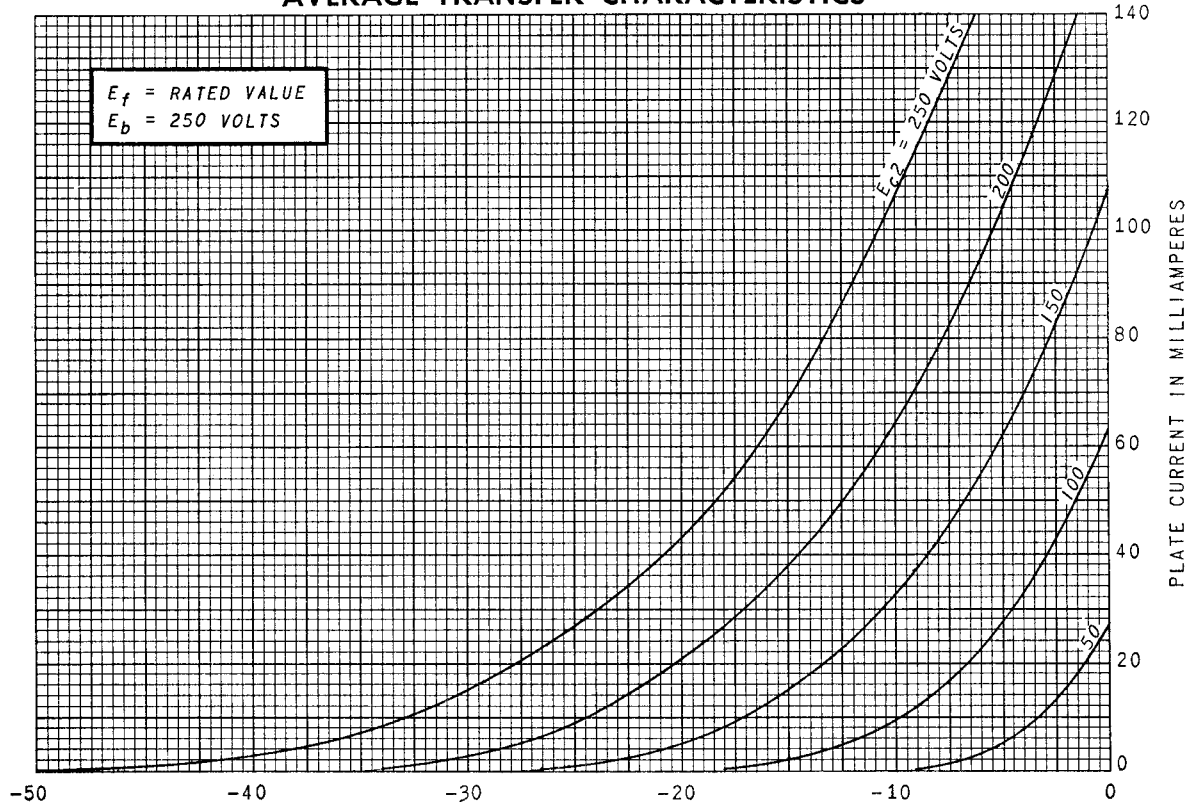
AVERAGE PLATE CHARACTERISTICS



K-55611-TD93-2

DECEMBER 3, 1959

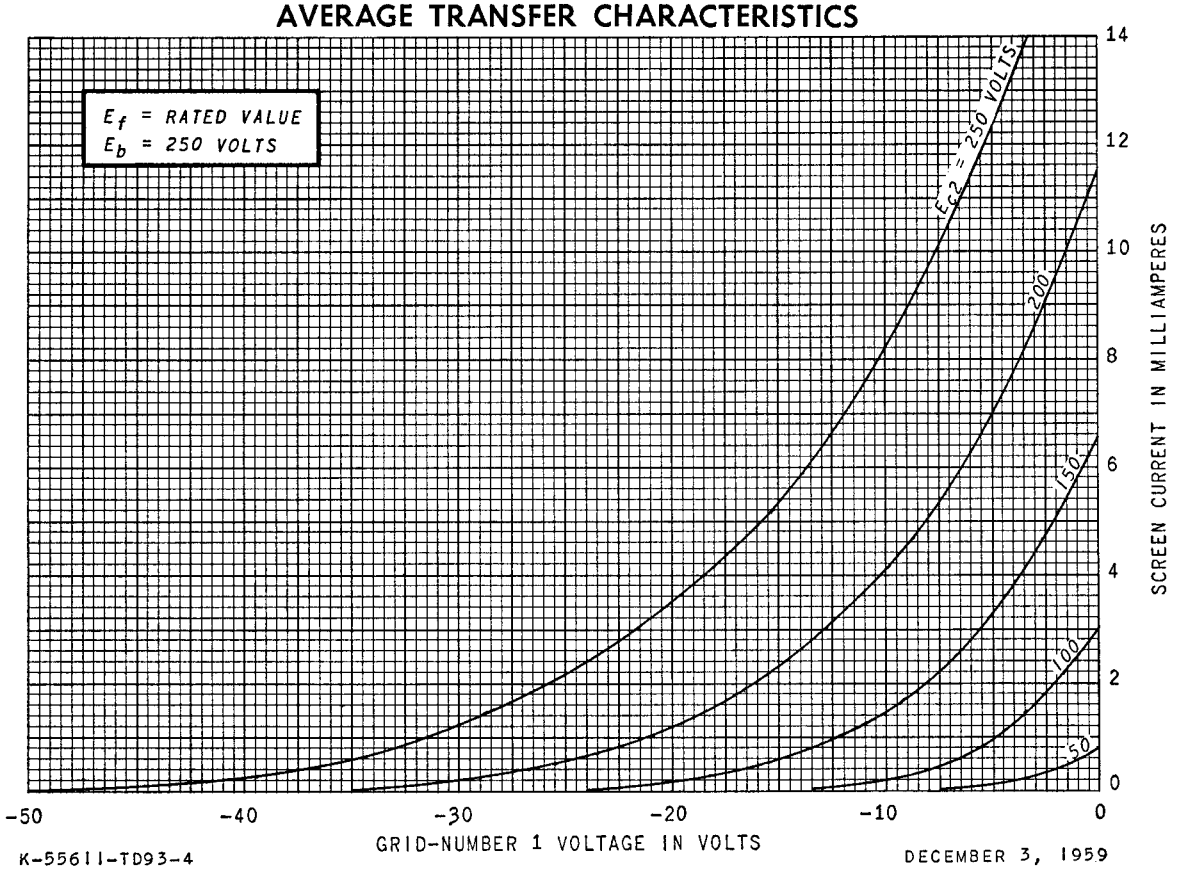
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD93-3

DECEMBER 3, 1959

AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6EZ8

TRIPLE TRIODE

DESCRIPTION AND RATING

The 6EZ8 is a miniature, high-mu, triple triode. The cathodes of Sections 1 and 2 have a common connection with one side of the heater. The cathode of Section 3 is brought out to a separate base pin.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.45	Amperes

Direct Interelectrode Capacitances	With Shield*	Without Shield
Grid to Plate, Each Section	1.5	1.5 μμf
Input, Each Section	2.6	2.4 μμf
Output, Section 1	1.4	0.21 μμf
Output, Section 2	1.2	0.4 μμf
Output, Section 3	1.2	0.36 μμf
Heater to Cathode, Section 3	0.15	0.17 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation, Each Plate	2.0	Watts
Total Plate Dissipation, All Plates	5.0	Watts
Heater-Cathode Voltage (Section 3)		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	100	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

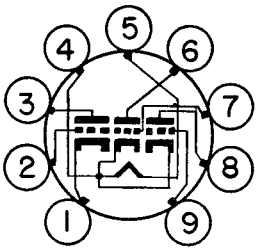
The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

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GENERAL ELECTRIC

BASING DIAGRAM

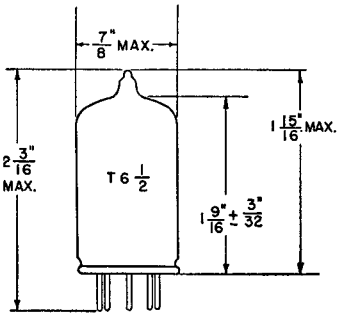


EIA 9KA

TERMINAL CONNECTIONS

Pin 1—Cathode (Section 3)
Pin 2—Grid (Section 3)
Pin 3—Plate (Section 3)
Pin 4—Cathode (Section 2), Cathode (Section1), and Heater
Pin 5—Heater
Pin 6—Plate (Section 2)
Pin 7—Grid (Section 2)
Pin 8—Plate (Section 1)
Pin 9—Grid (Section 1)

PHYSICAL DIMENSIONS



EIA 6-2

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

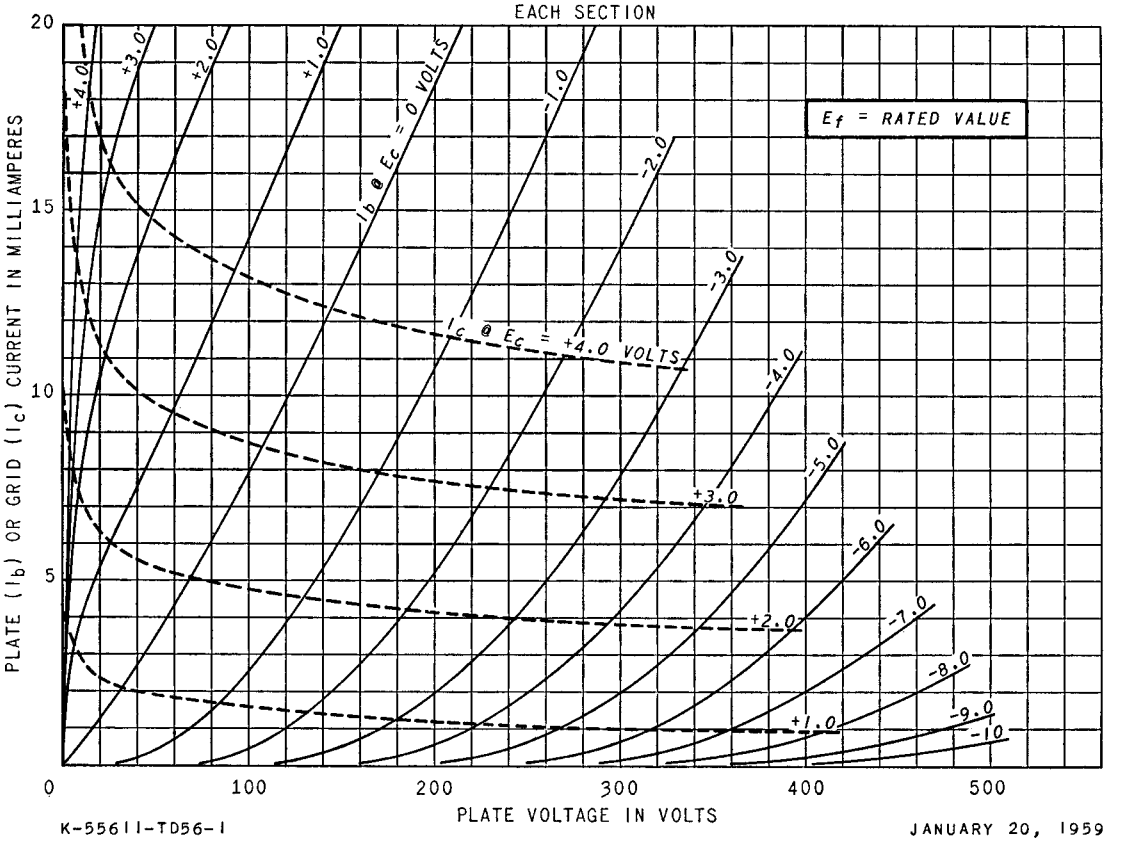
Plate Voltage	125	Volts
Grid Voltage	−1.0	Volts
Amplification Factor	57	
Plate Resistance, approximate	13600	Ohms
Transconductance	4200	Micromhos
Plate Current	4.2	Milliamperes
Grid Voltage, approximate I_b=20 Microamperes	−4	Volts

* With external shield (EIA 315) connected to cathode of section under test.

ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.

AVERAGE PLATE CHARACTERISTICS

EACH SECTION

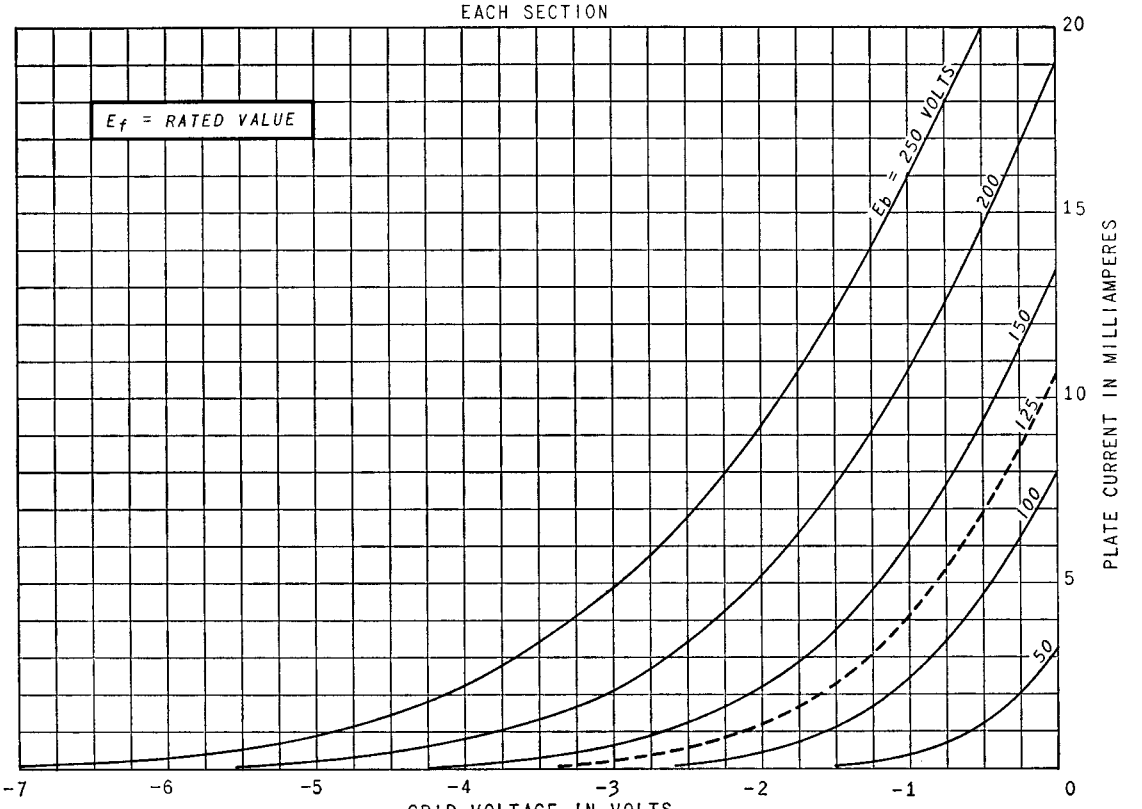


K-55611-TD56-1

JANUARY 20, 1959

AVERAGE TRANSFER CHARACTERISTICS

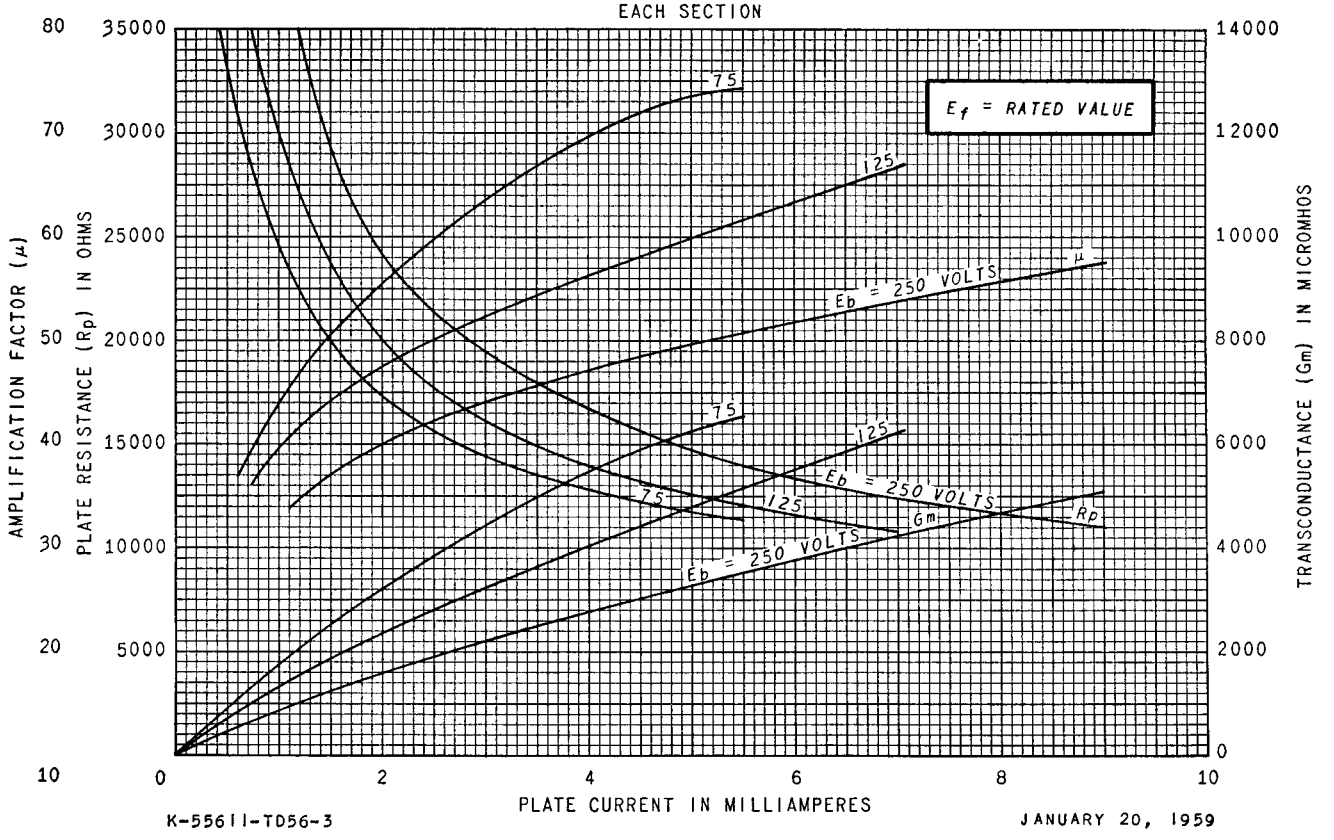
EACH SECTION



K-55611-TD56-2

JANUARY 20, 1959

AVERAGE CHARACTERISTICS



Electronic TUBES

6FG5

"SHADOW-GRID" BEAM PENTODE

FOR VHF RF AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6FG5 is a miniature tube, similar in construction to a beam pentode, with an internally connected grid between the control grid and the screen grid which serves to reduce the ratio of screen current to plate current. The tube is designed for use as a radio-frequency amplifier in VHF television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.2	Amperes
Direct Interelectrode Capacitances*		
Grid-Number 1 to Plate, maximum: (g1 to p)	0.02	μμf
Input: gl to (h+k+g2+g3+b.p.)	4.2	μμf
Output: p to (h+k+g2+g3+b.p.)	2.8	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	275	Volts
Screen Voltage	275	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
Plate Dissipation	2.75	Watts
Screen Dissipation	0.15	Watts
DC Cathode Current	20	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	3.3	Megohms

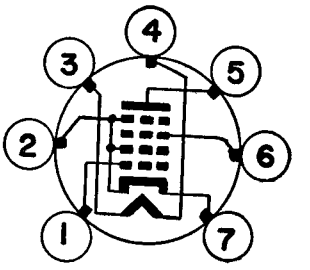
Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

BASING DIAGRAM

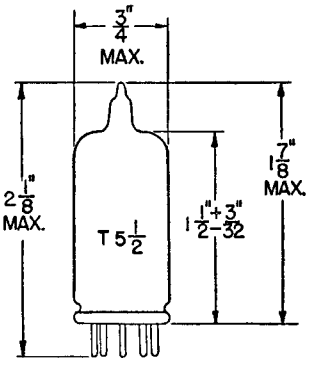


EIA 7GA

TERMINAL CONNECTIONS

Pin 1—Grid Number 1 (Control Grid)
Pin 2—Cathode, Grid Number 2 ("Shadow Grid"), and Beam Plate
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 3 (Screen Grid)
Pin 7—Cathode, Grid Number 2 ("Shadow Grid"), and Beam Plate

PHYSICAL DIMENSIONS



EIA 5-2

GENERAL ELECTRIC

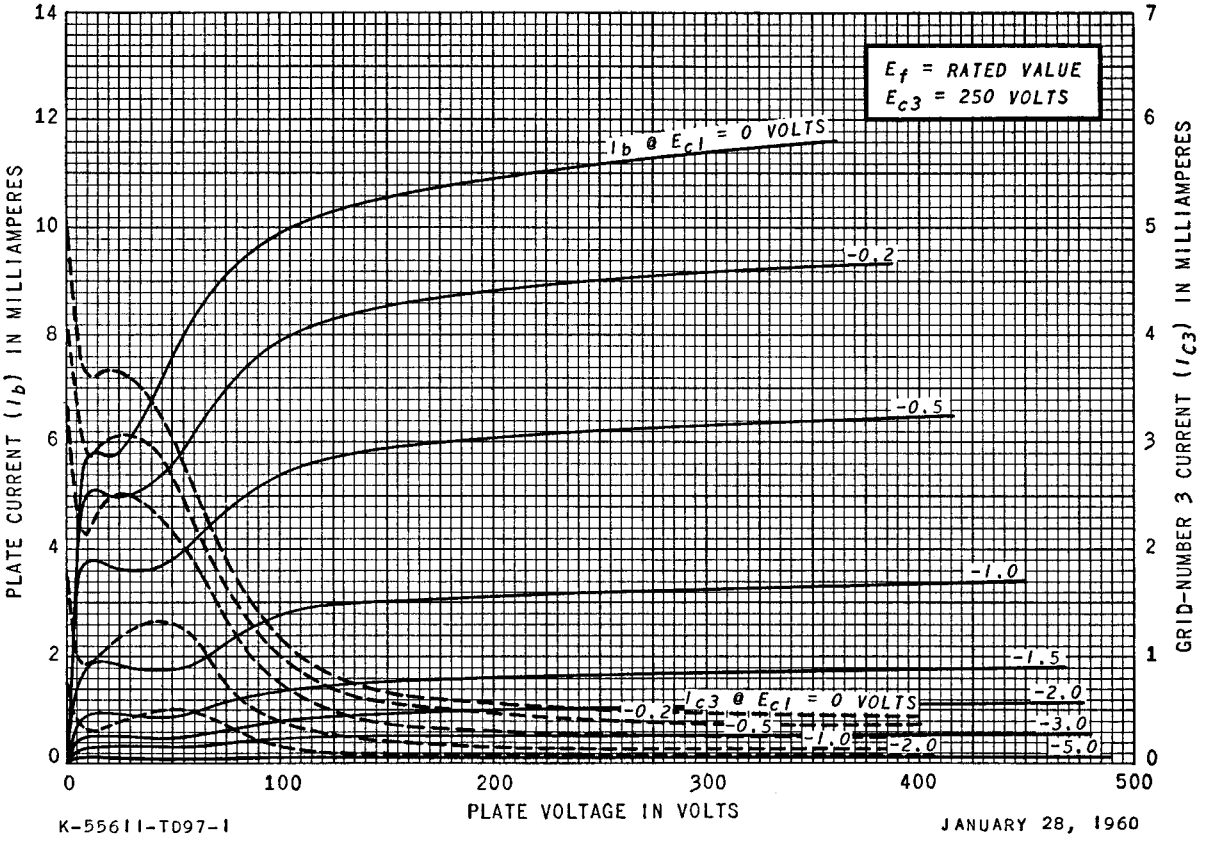
CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

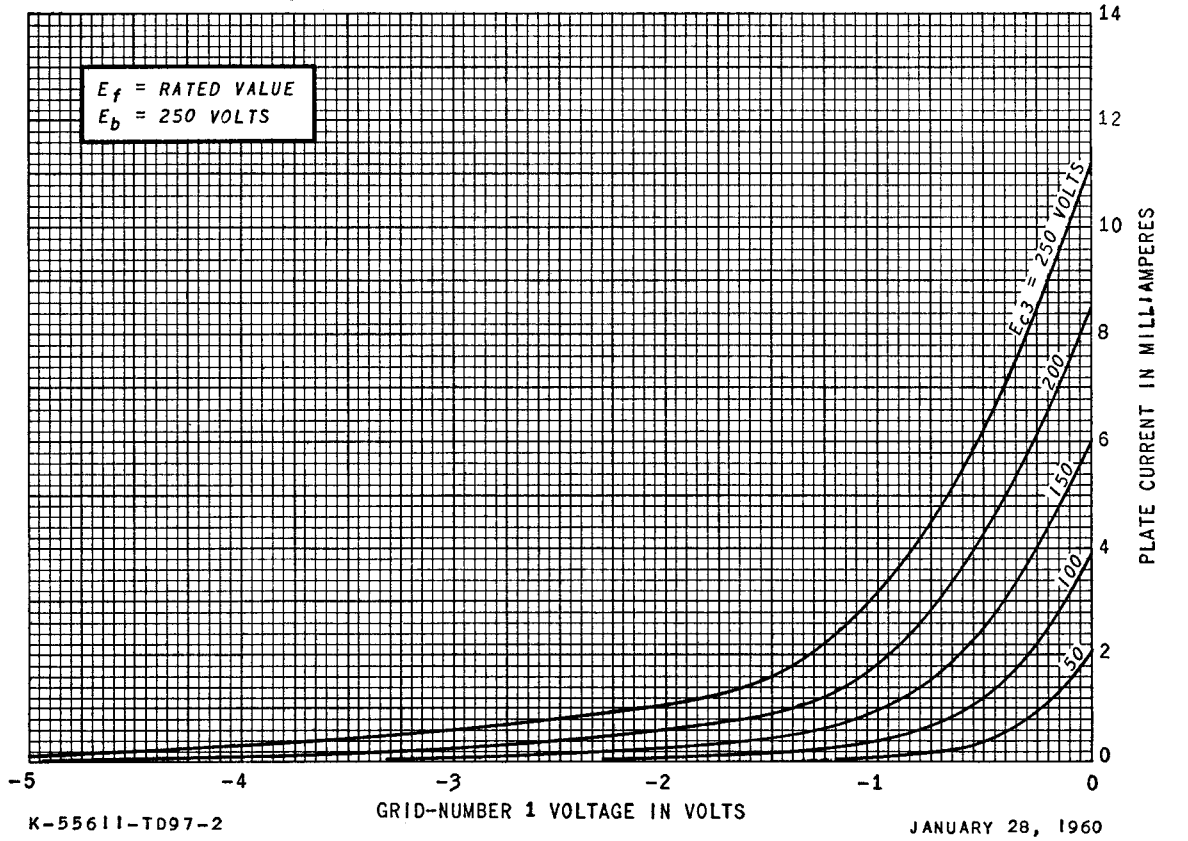
Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	−0.2	Volts
Plate Resistance, approximate	0.25	Megohms
Transconductance	9500	Micromhos
Plate Current	9.0	Milliamperes
Screen Current	0.42	Milliamperes
Grid-Number 1 Voltage, approximate Gm = 100 Micromhos	−5	Volts

* Without external shield.

AVERAGE PLATE CHARACTERISTICS



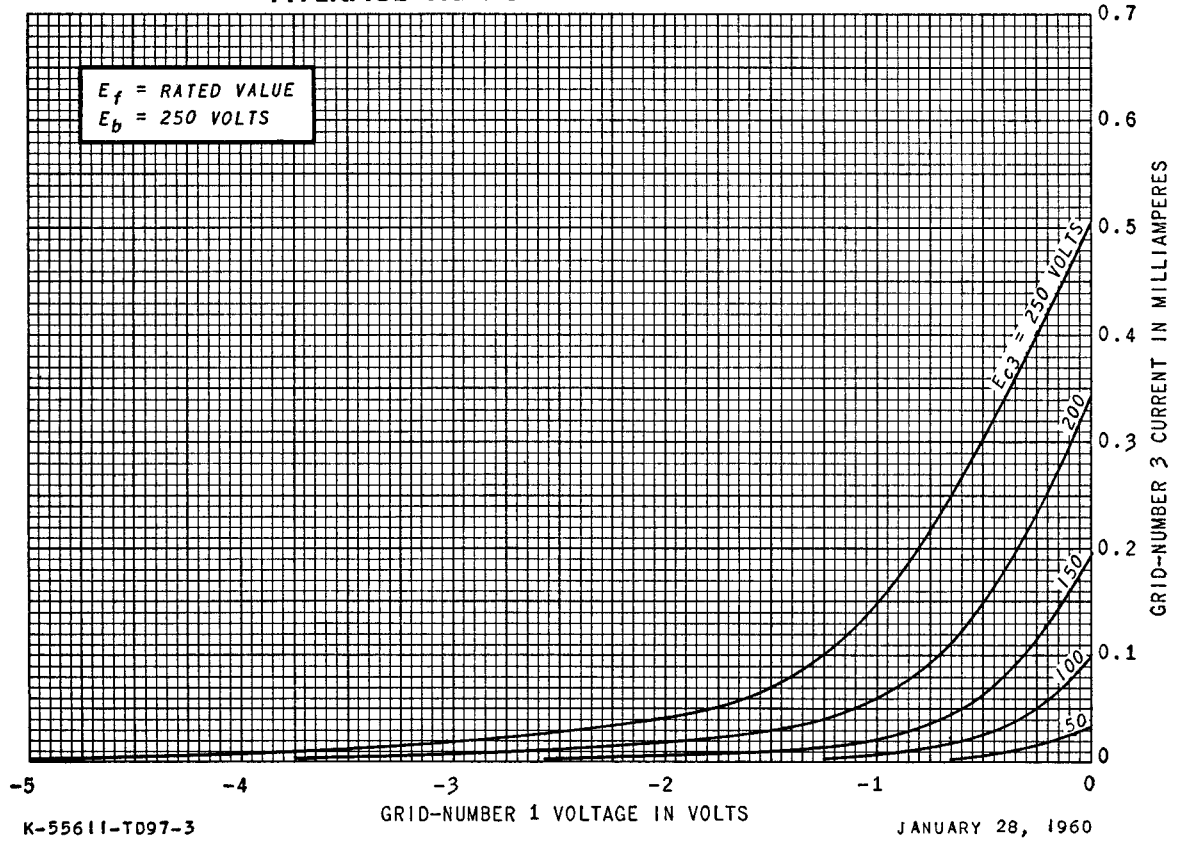
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD97-2

JANUARY 28, 1960

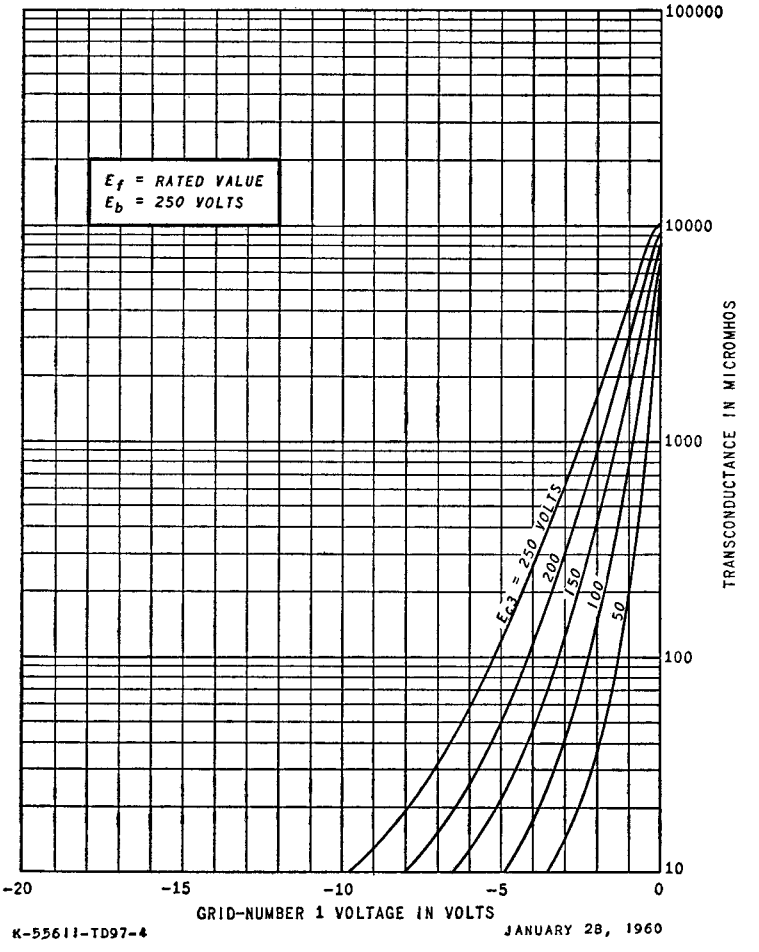
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD97-3

JANUARY 28, 1960

AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6FG7-5FG7

TRIODE—PENTODE

For VHF Converter Applications

DESCRIPTION AND RATING

The 6FG7 is a miniature tube that contains a medium-mu triode and a sharp-cutoff pentode in one envelope. Primarily designed for use as a combined triode oscillator and pentode mixer in VHF television receivers, the tube features two cathode leads connected to separate base pins to reduce the effective cathode lead inductance.

Except for heater ratings, the 5FG7 is identical to the 6FG7.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

	5FG7	6FG7	
Heater Voltage, AC or DC	4.7	6.3	Volts
Heater Current	0.6±6%	0.45±6%	Amperes
Heater Warm-up Time†	11	11	Seconds

Direct Interelectrode Capacitances

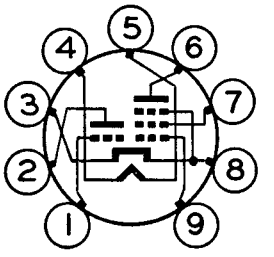
	With Shield‡	Without Shield	
Pentode Section			
Grid-Number 1 to Plate: (Pg1 to Pp), max.	0.01	0.02	μμf
Input: Pg1 to (h+Pk+Tk+Pg2+Pg3)	5.0	5.0	μμf
Output: Pp to (h+Pk+Tk+Pg2+Pg3)	3.4	2.4	μμf
Triode Section			
Grid to Plate: (Tg to Tp)	1.8	1.8	μμf
Input: Tg to (h+Pk+Tk+Pg3)	3.0	3.0	μμf
Output: Tp to (h+Pk+Tk+Pg3)	1.9	1.3	μμf
Heater to Cathode: h to (Pk+Tk+Pg3)	6.0§	6.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

BASING DIAGRAM

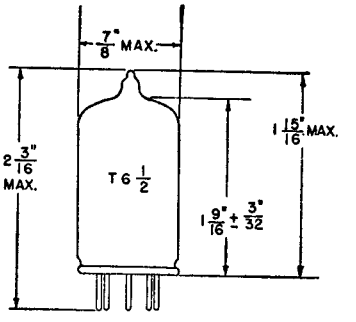


EIA 9GF

TERMINAL CONNECTIONS

Pin 1—Triode Grid
Pin 2—Triode Plate
Pin 3—Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Plate
Pin 7—Pentode Grid Number 2 (Screen)
Pin 8—Cathode and Pentode Grid Number 3 (Suppressor)
Pin 9—Pentode Grid Number 1

PHYSICAL DIMENSIONS



EIA 6-2

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen-Supply Voltage	330	——	Volts
Screen Voltage—See Screen Rating Chart, Page 7			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.0	2.5	Watts
Screen Dissipation	0.55	——	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section		Triode Section	
Plate Voltage	100	125	125	Volts
Screen Voltage	100	125	——	Volts
Grid-Number 1 Voltage	0	−1.0	−1.0	Volts
Amplification Factor	——	——	43	
Plate Resistance, approximate	——	180000	5700	Ohms
Transconductance	7400	6000	7500	Micromhos
Plate Current	——	11	13	Milliamperes
Screen Current	——	4.0	——	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 30 Microamperes	——	−7.5	−6.5	Volts

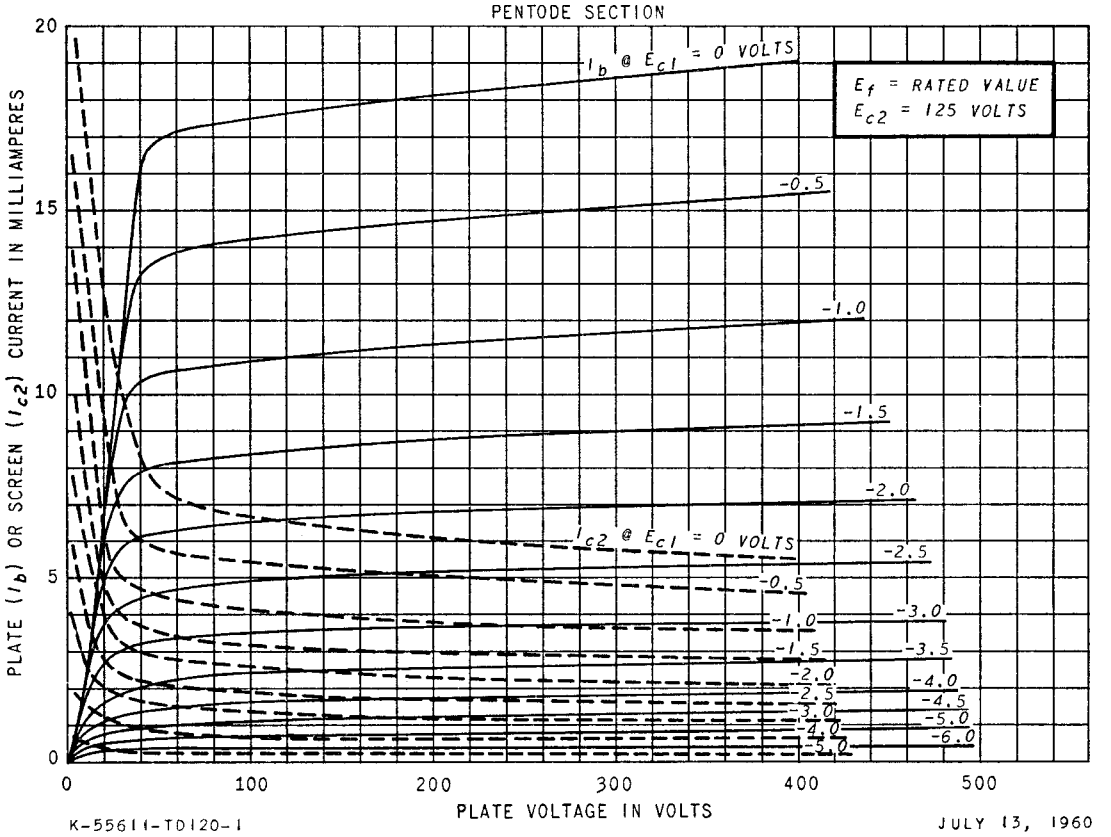
† The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

‡ With external shield (EIA 315) connected to cathode of section under test unless otherwise indicated.

§ With external shield (EIA 315) connected to ground.

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

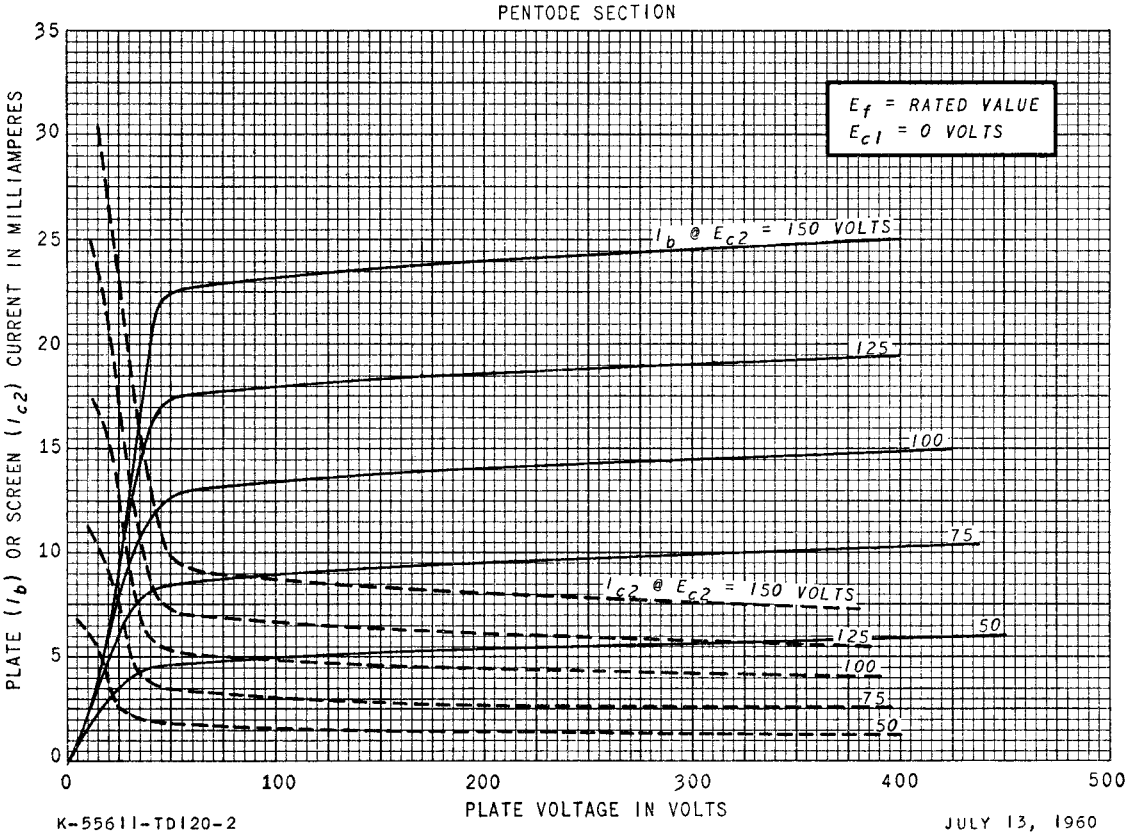


K-5561I-TD120-1

JULY 13, 1960

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

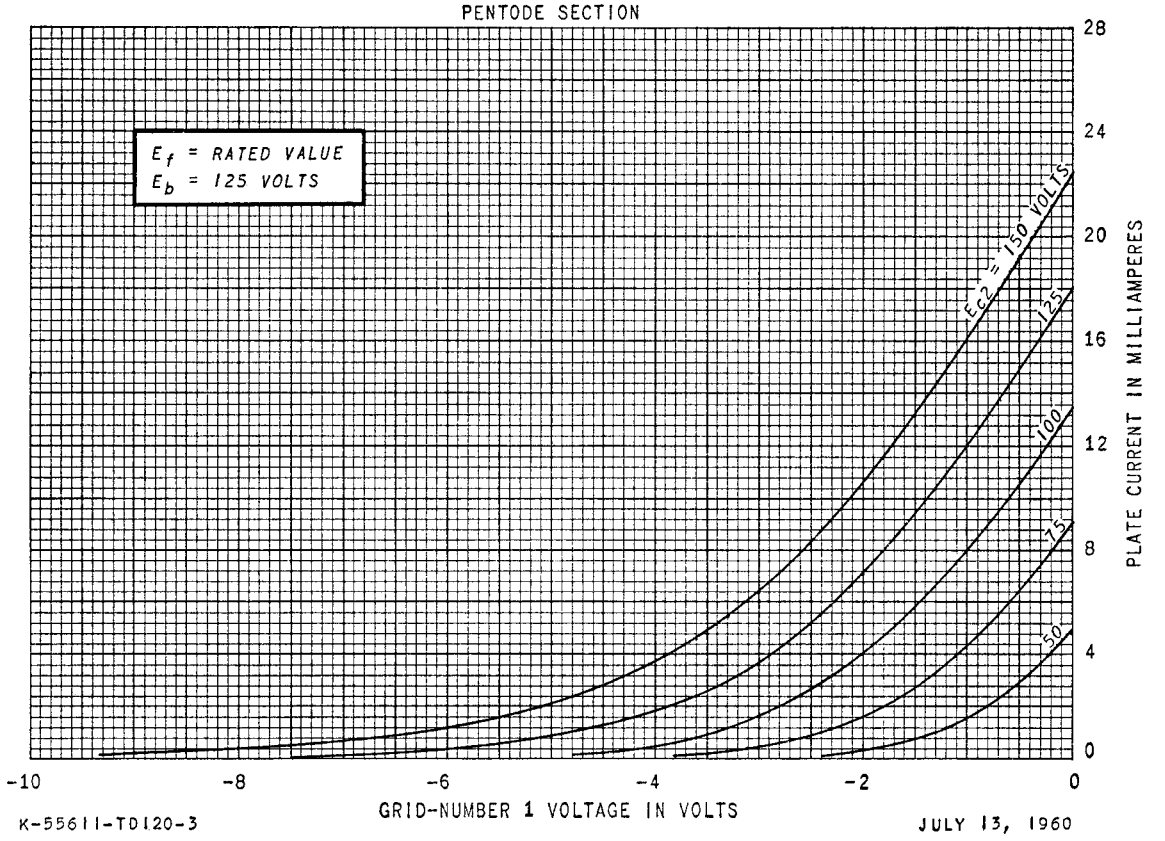


K-5561I-TD120-2

JULY 13, 1960

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

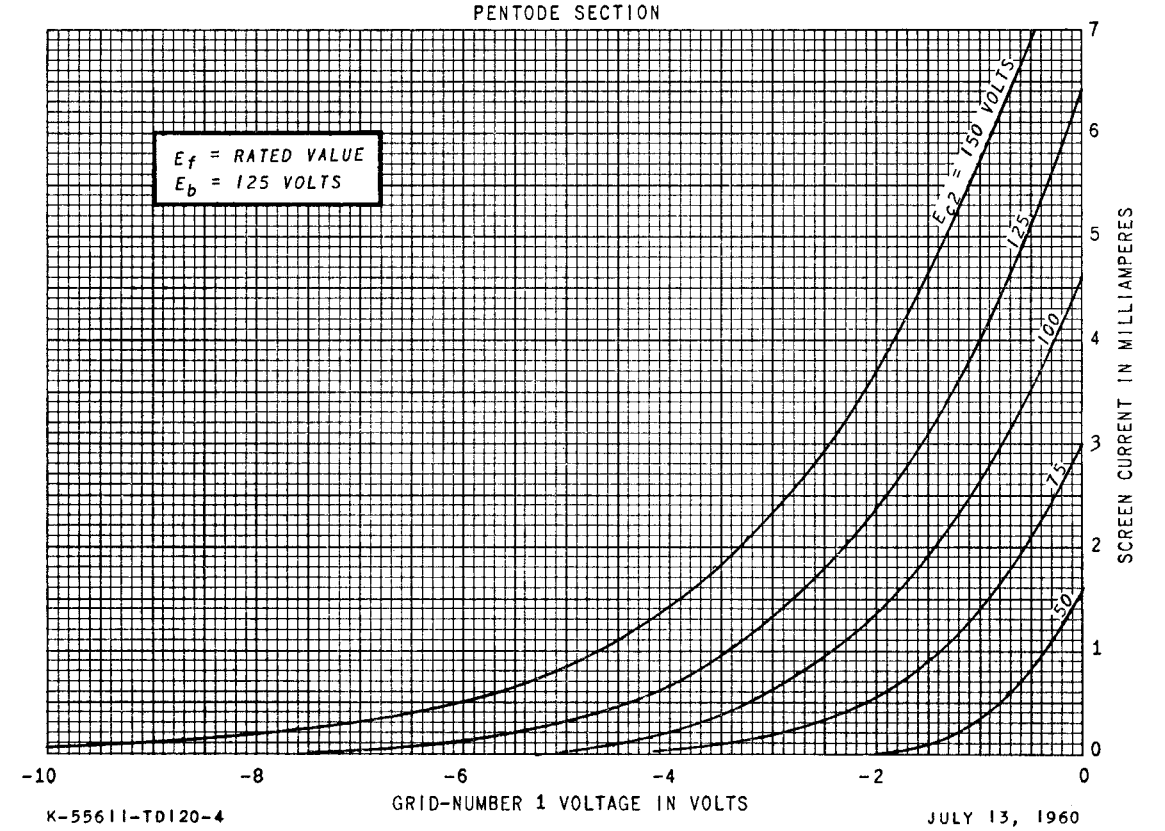


K-55611-TD120-3

JULY 13, 1960

AVERAGE TRANSFER CHARACTERISTICS

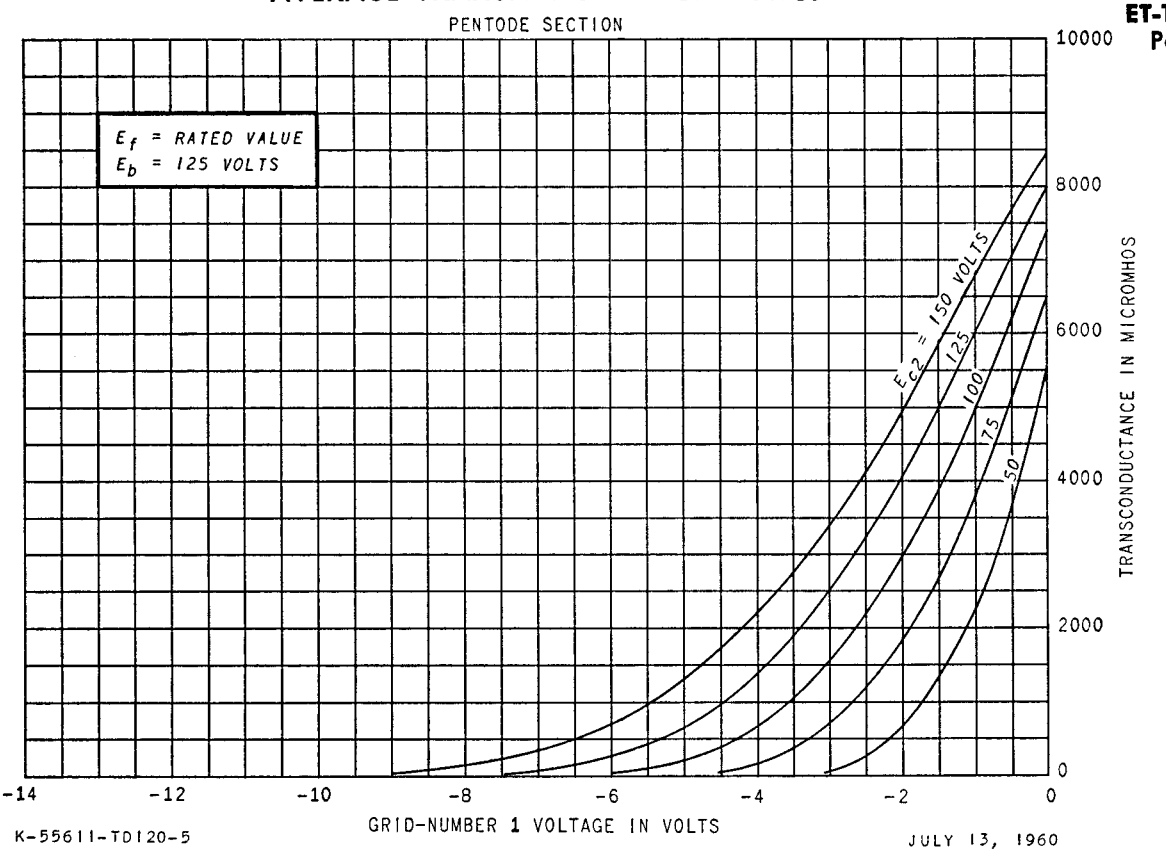
PENTODE SECTION



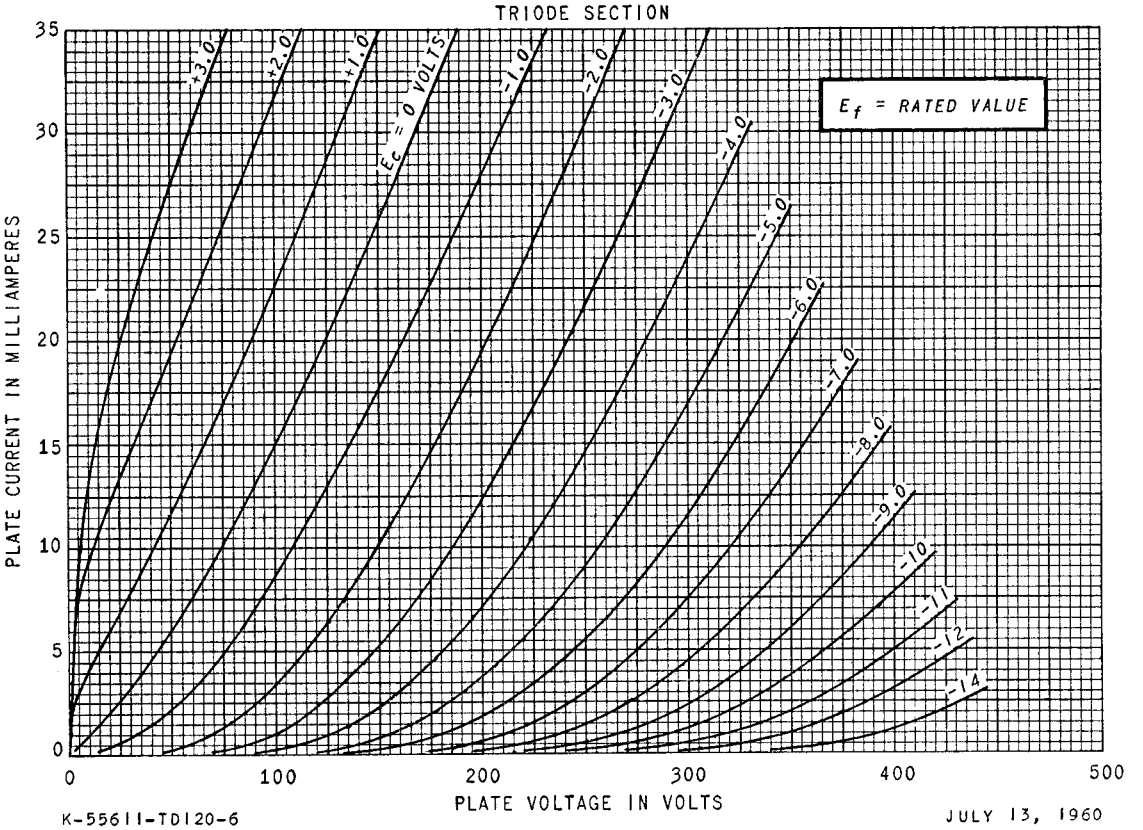
K-55611-TD120-4

JULY 13, 1960

AVERAGE TRANSFER CHARACTERISTICS

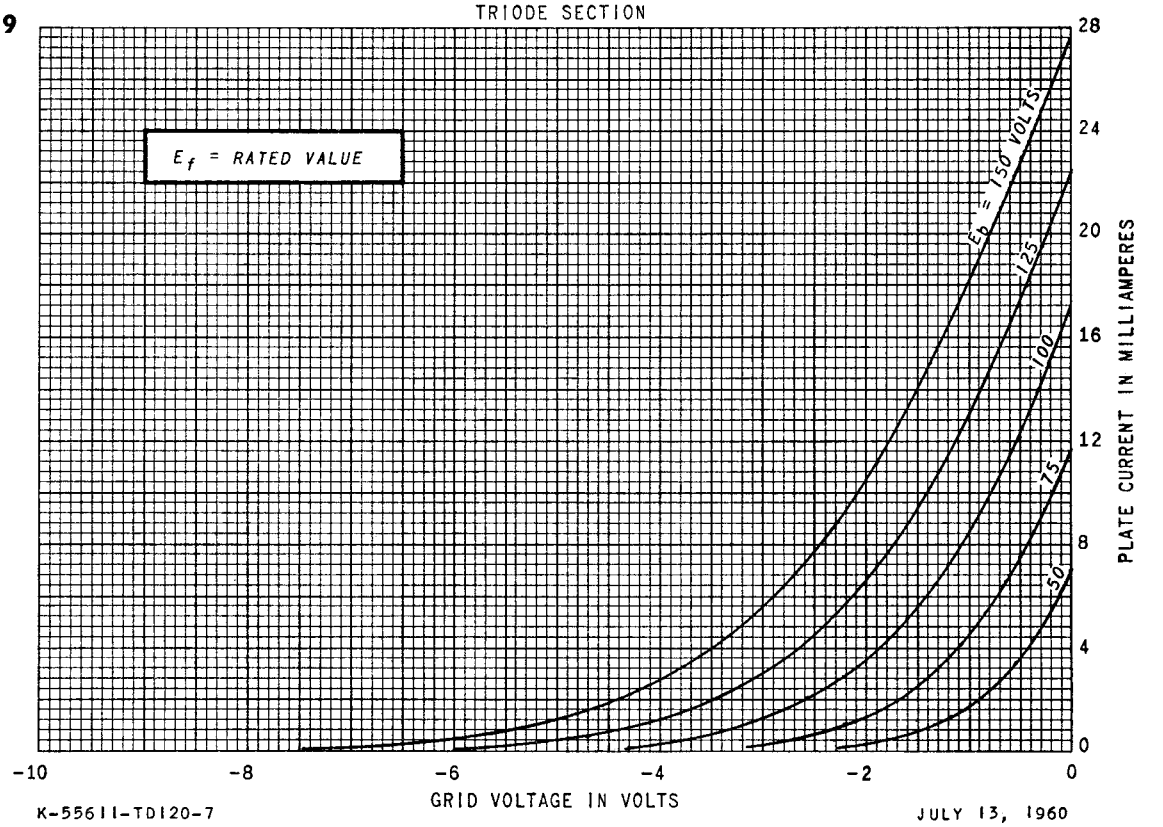


AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION

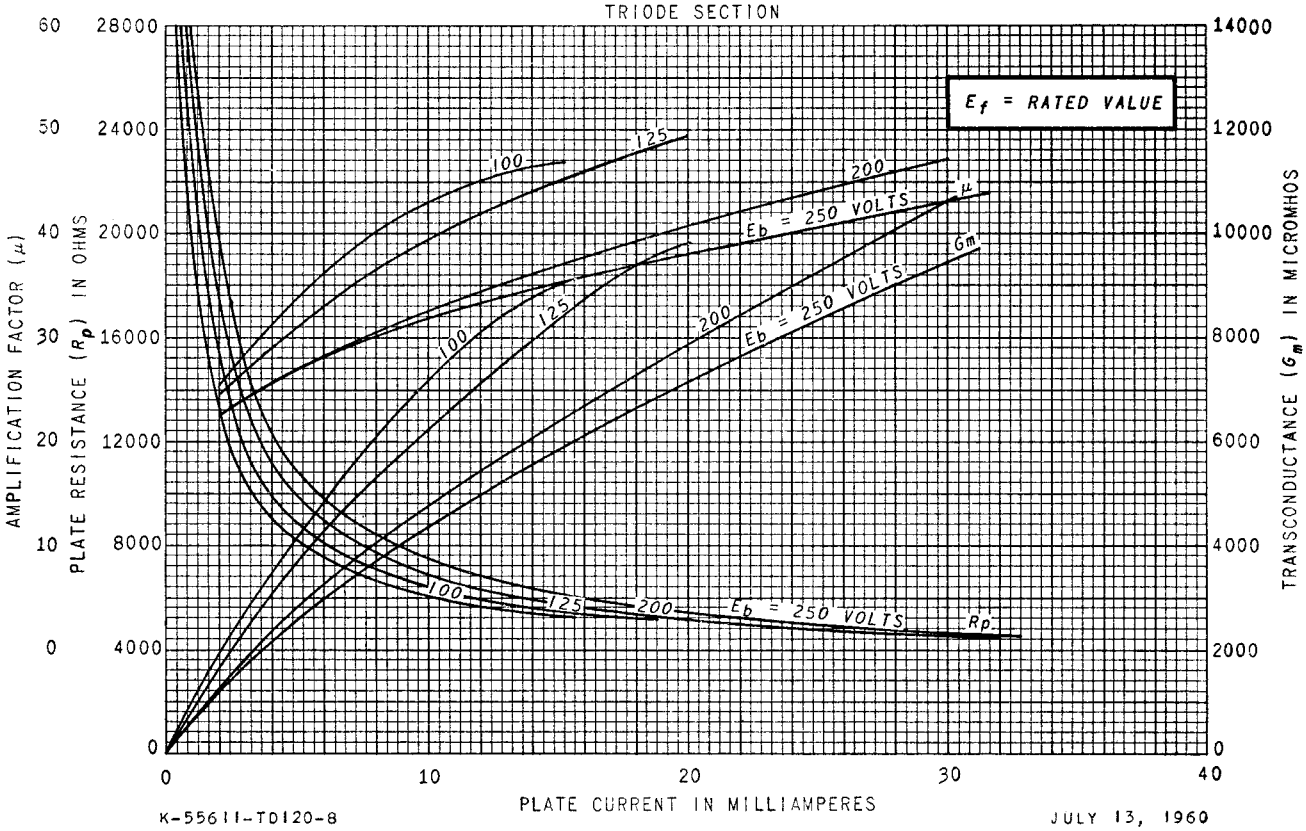


K-55611-TD120-7

JULY 13, 1960

AVERAGE CHARACTERISTICS

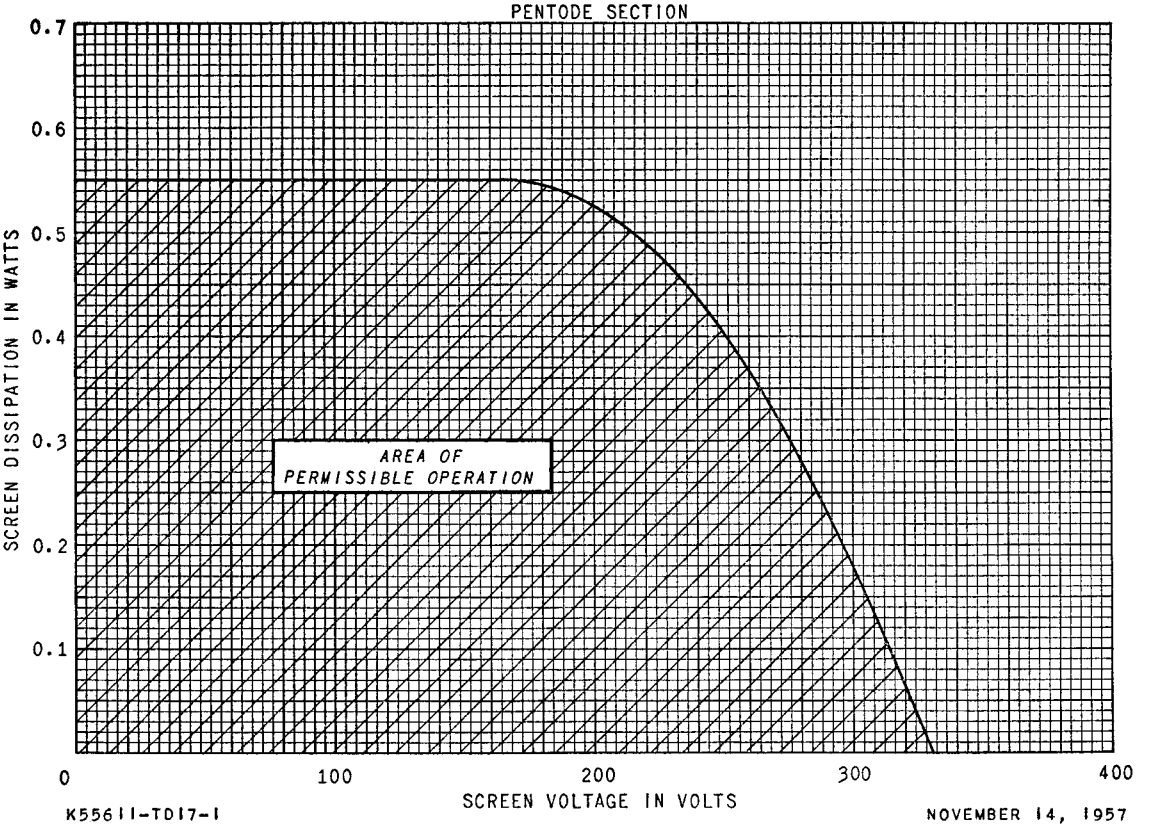
TRIODE SECTION



K-55611-TD120-8

JULY 13, 1960

SCREEN RATING CHART



Electronic TUBES

6FJ7

DISSIMILAR DOUBLE TRIODE

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6FJ7 is a COMPACTRON device containing two dissimilar triode sections, designed for use as a combined vertical-deflection oscillator and amplifier in television receivers. Section 1 is intended for service as an oscillator and Section 2 as an amplifier.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings (Design-Maximum Rating System)

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.9	Ampere

Direct Interelectrode Capacitances, approximate‡

	Section 1	Section 2	
Grid to Plate: (g to p)	3.8	5.0	pf
Input: g to (h+k)	2.2	4.0	pf
Output: p to (h+k)	0.48	0.54	pf

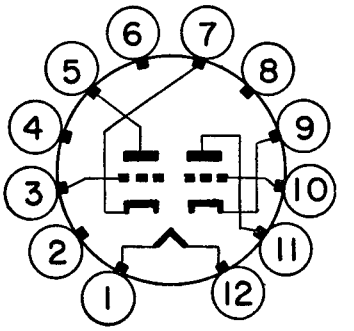
MECHANICAL

Mounting Position—Any

Envelope—T-9, Glass

Base—E12-70, Button 12-Pin

BASING DIAGRAM

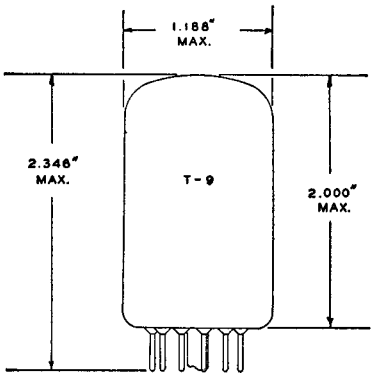


EIA 12BM

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—No Connection
Pin 3—Grid (Section 2)
Pin 4—No Connection
Pin 5—Plate (Section 2)
Pin 6—Internal Connection—Do Not Use
Pin 7—Cathode (Section 2)
Pin 8—No Connection
Pin 9—Cathode (Section 1)
Pin 10—Grid (Section 1)
Pin 11—Plate (Section 1)
Pin 12—Heater

PHYSICAL DIMENSIONS



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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Vertical Oscillator Service§ (Section 1)	Vertical Deflection Amplifier§ (Section 2)	
DC Plate Voltage	350	550	Volts
Peak Positive Pulse Plate Voltage	—	2500	Volts
Peak Negative Grid Voltage	400	250	Volts
Plate Dissipation	1.0	10¶	Watts
DC Cathode Current	—	50	Milliamperes
Peak Cathode Current	—	150	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance			
With Fixed Bias	2.2	2.2	Megohms
With Cathode Bias	2.2	—	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions. The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Section 1 (Oscillator)	Section 2 (Amplifier)		
Plate Voltage	250	150	250	Volts
Grid Voltage	−8.0	0#	−9.5	Volts
Amplification Factor	22.5	—	15.4	
Plate Resistance, approximate	9000	—	2000	Ohms
Transconductance	2500	—	7700	Micromhos
Plate Current	8.0	68	41	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	−18	—	—	Volts
Grid Voltage, approximate Ib = 50 Microamperes	—	—	−23	Volts

* The equipment designer shall design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current at bogey heater voltage.

‡ Without external shield.

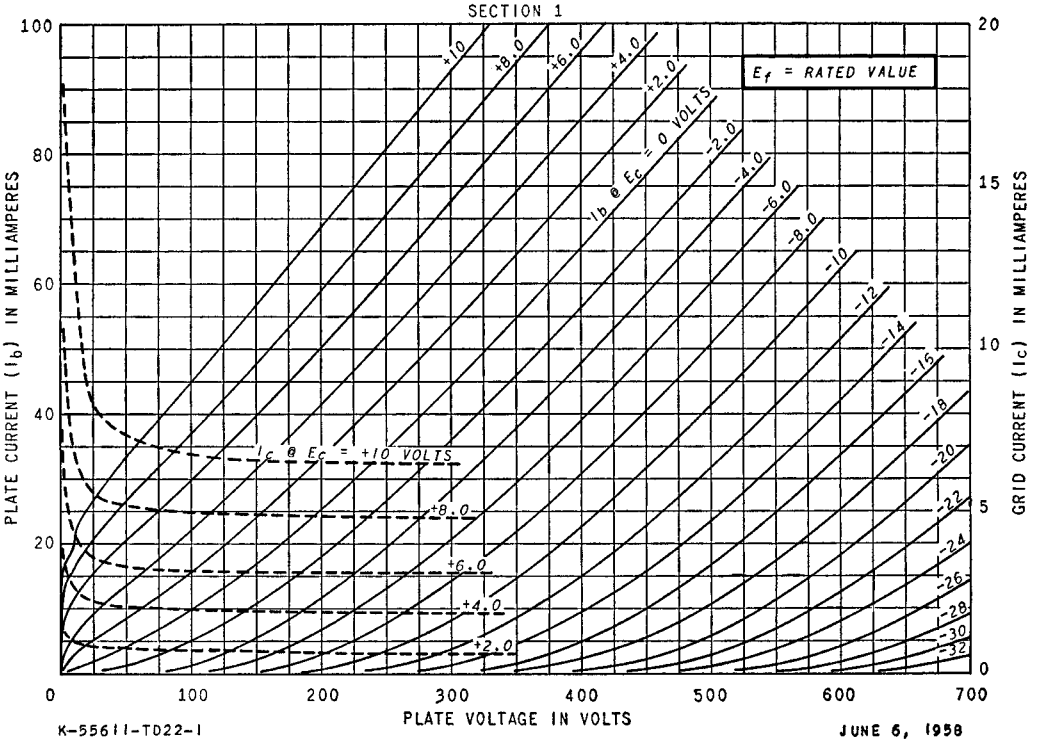
§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¶ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the device in the absence of excitation.

Applied for short interval (two seconds maximum) so as not to damage device.

AVERAGE PLATE CHARACTERISTICS

SECTION 1

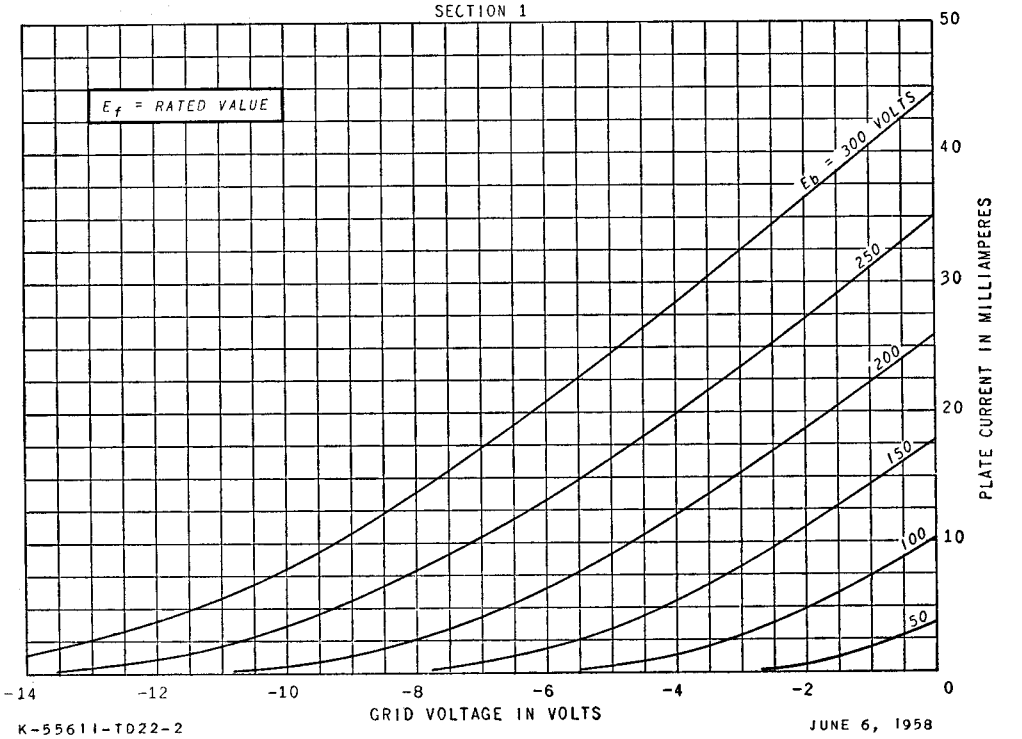


K-55611-TD22-1

JUNE 6, 1958

AVERAGE TRANSFER CHARACTERISTICS

SECTION 1

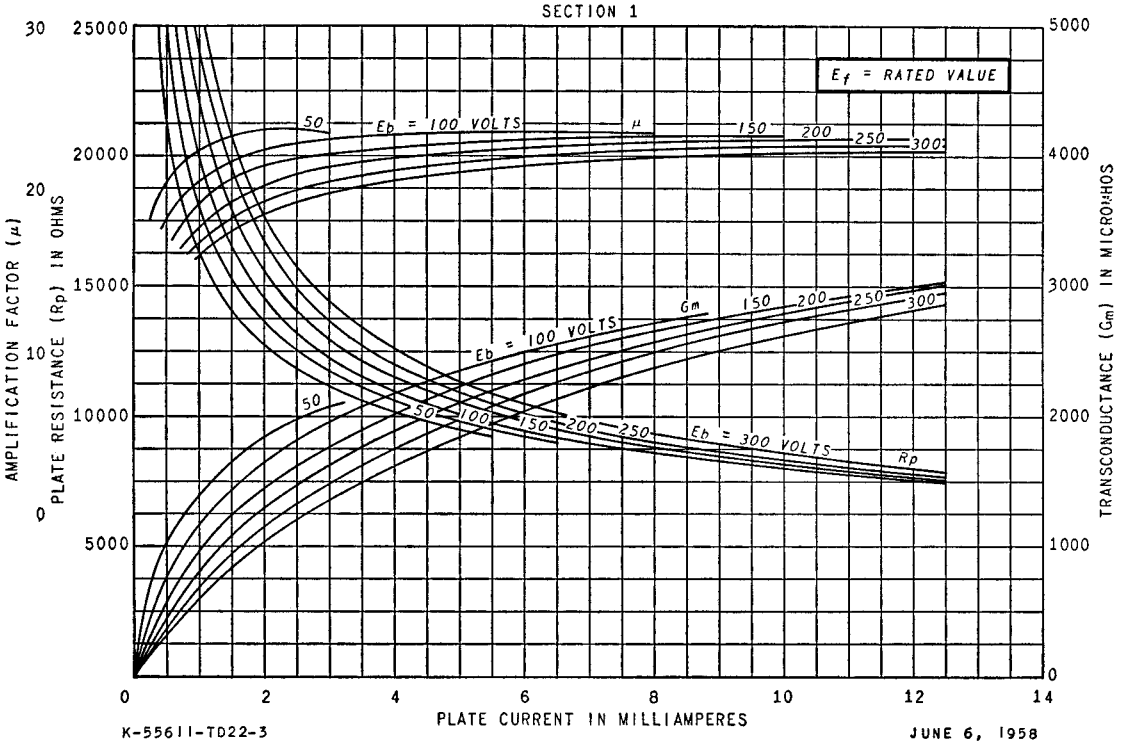


K-55611-TD22-2

JUNE 6, 1958

AVERAGE CHARACTERISTICS

SECTION 1

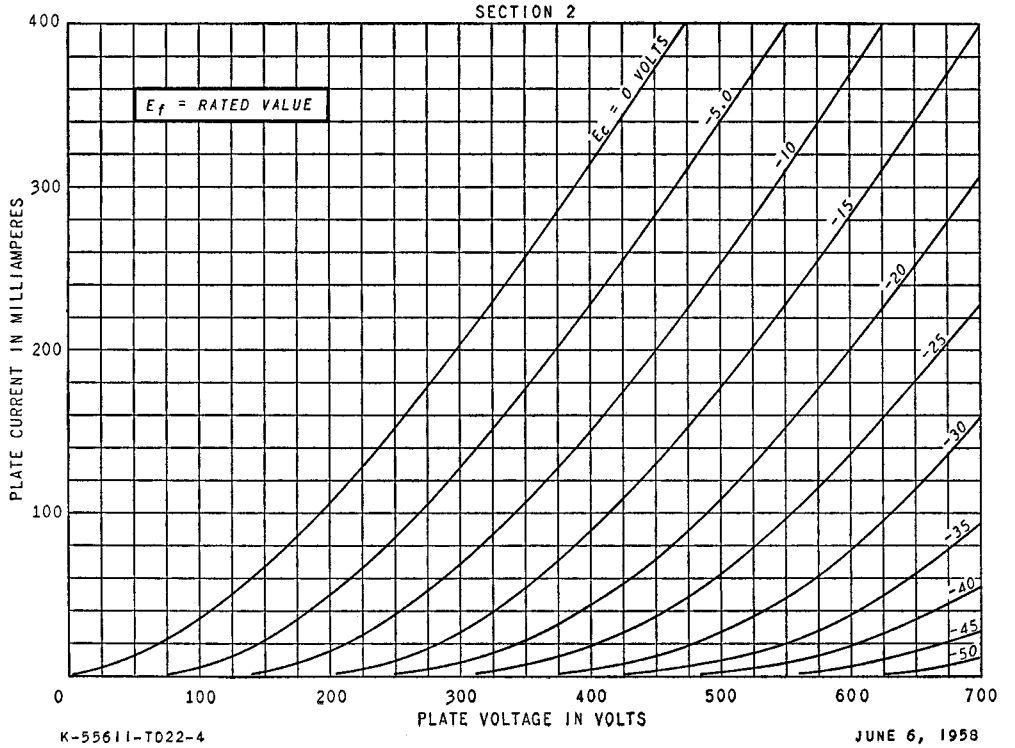


K-55611-TD22-3

JUNE 6, 1958

AVERAGE PLATE CHARACTERISTICS

SECTION 2

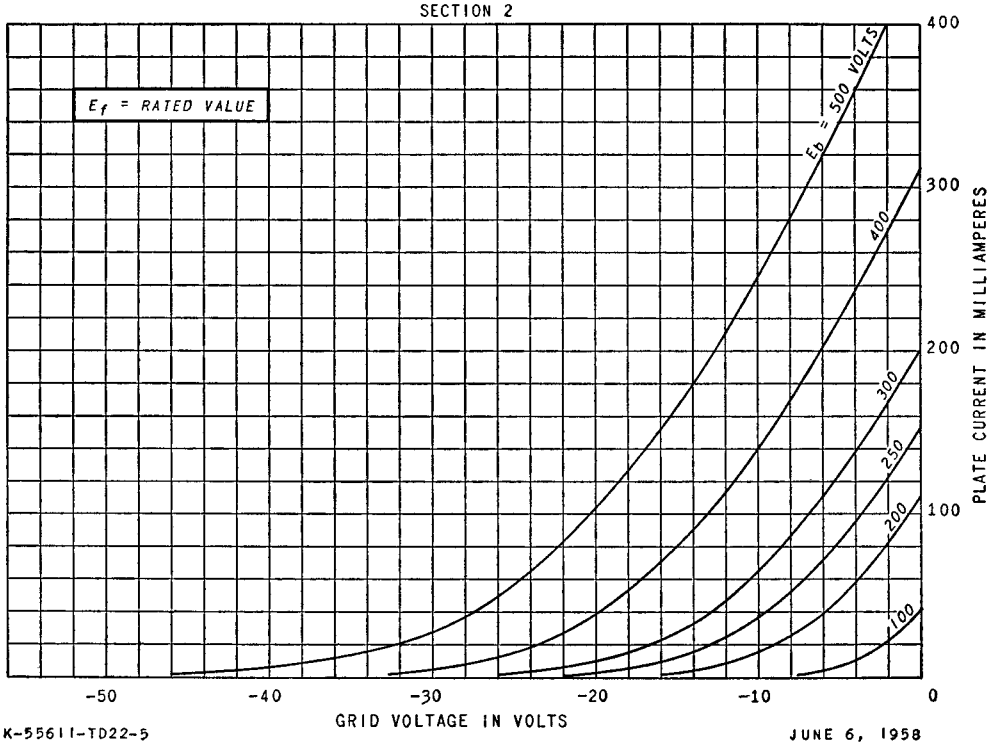


K-55611-TD22-4

JUNE 6, 1958

AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

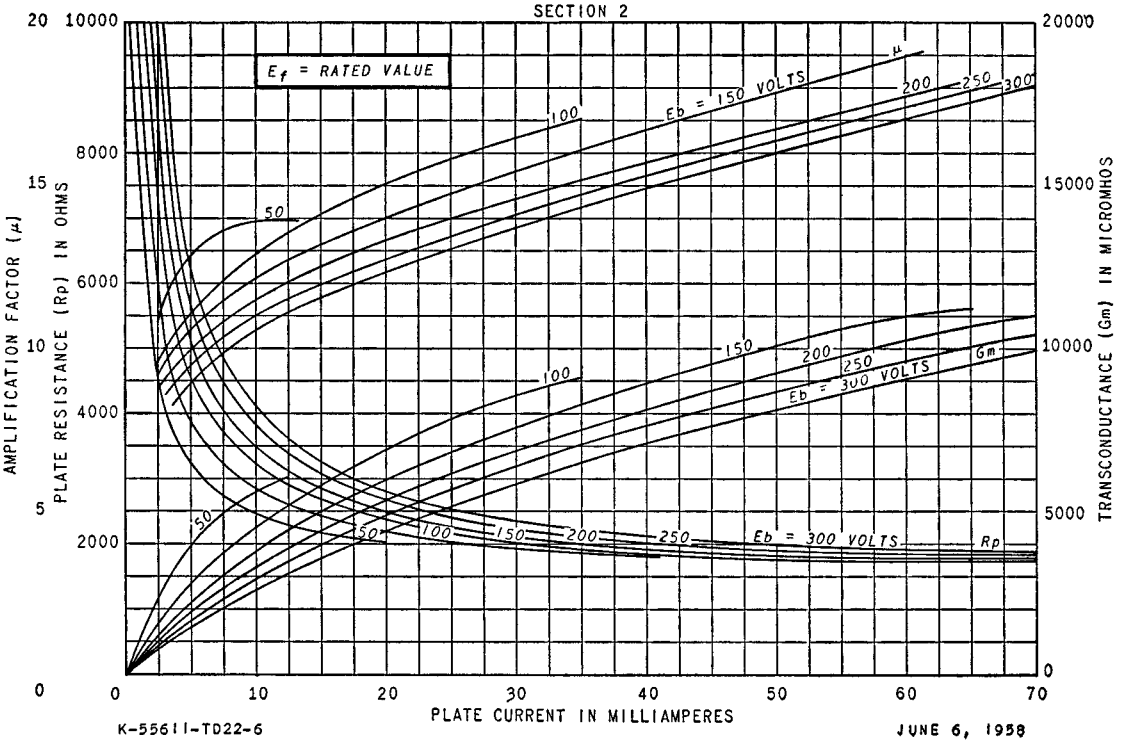


K-55611-TD22-5

JUNE 6, 1958

AVERAGE CHARACTERISTICS

SECTION 2



K-55611-TD22-6

JUNE 6, 1958

ELECTRONICS

6FM7

COMPACTRON DISSIMILAR DOUBLE TRIODE

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6FM7 is a compactron dissimilar double triode designed for use as a combined vertical-deflection oscillator and amplifier in television receivers. Section one, a high-mu triode, is intended for service as an oscillator; Section two, a low-mu, high-perveance triode, for service as an amplifier.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC* . . .	6.3±0.6	Volts
Heater Current†	1.05	Amperes

Direct Interelectrode Capacitances, approximate‡

	Section 1	Section 2	
Grid to Plate: (g to p)	4.0	7.0	pf
Input: g to (h + k) . .	2.4	7.0	pf
Output: p to (h + k). .	0.4	1.1	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Maximum Over-all Length. . . .	2.375	Inches
Maximum Seated Height	2.000	Inches

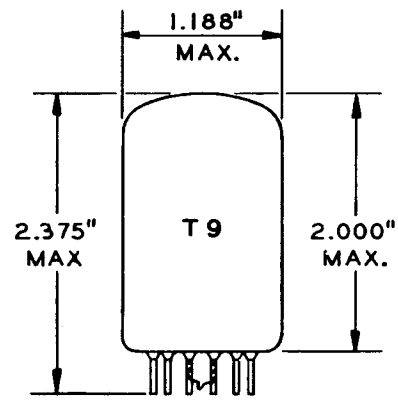
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

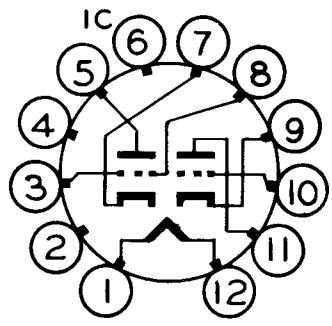


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - No Connection
Pin 3 - Grid (Section 2)
Pin 4 - No Connection
Pin 5 - Plate (Section 2)
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Cathode (Section 2)
Pin 8 - Grid (Section 2)
Pin 9 - Cathode (Section 1)
Pin 10 - Grid (Section 1)
Pin 11 - Plate (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12EJ

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

	Vertical Oscillator Service (Section 1)§	Vertical Deflection Amplifier (Section 2)§	
DC Plate Voltage	350	550	Volts
Peak Positive Pulse Plate Voltage	---	1500	Volts
Peak Negative Grid Voltage	400	250	Volts
Plate Dissipation	1.0	10¶	Watts
DC Cathode Current	---	50	Milliamperes
Peak Cathode Current	---	175	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance			
With Fixed Bias	1.0	1.0	Megohms
With Cathode Bias	2.2	2.2	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Section 1 (Oscillator)	Section 2 (Amplifier)		
Plate Voltage	250	60	175	Volts
Grid Voltage	-3.0	0#	-25	Volts
Amplification Factor	66	---	5.5	
Plate Resistance, approximate	30000	---	920	Ohms
Transconductance	2200	---	6000	Micromhos
Plate Current	2.0	95	40	Milliamperes
Grid Voltage, approximate Ib = 20 Microamperes	-5.3	---	---	Volts
Grid Voltage, approximate Ib = 200 Microamperes	---	---	-45	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

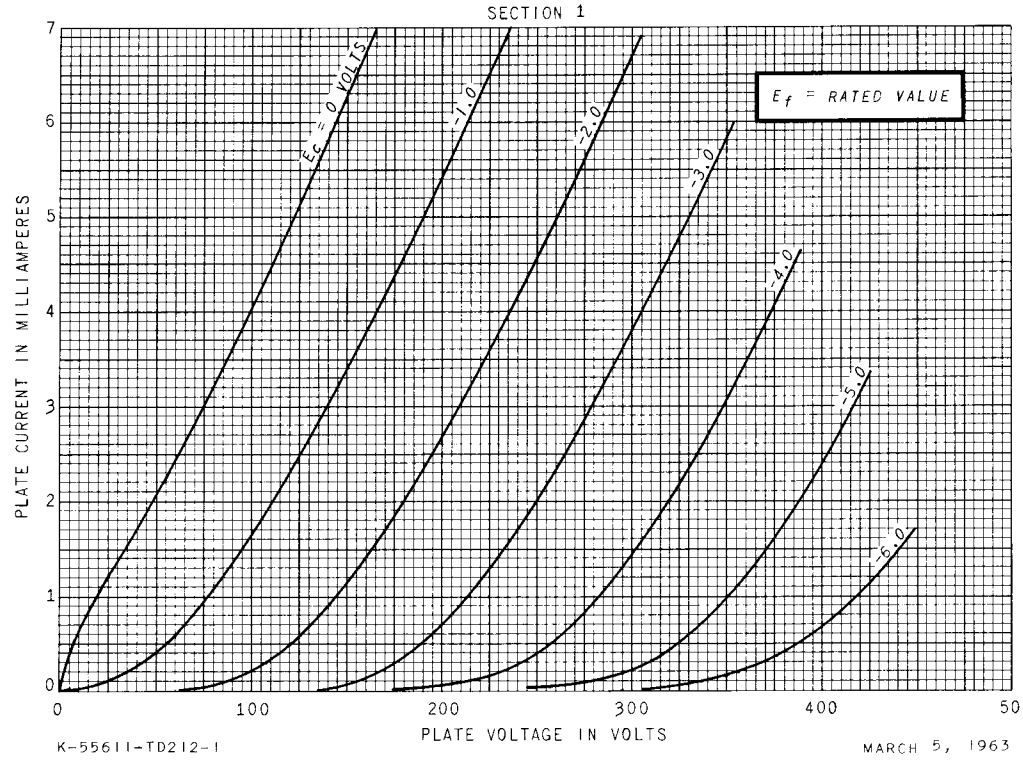
§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¶ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

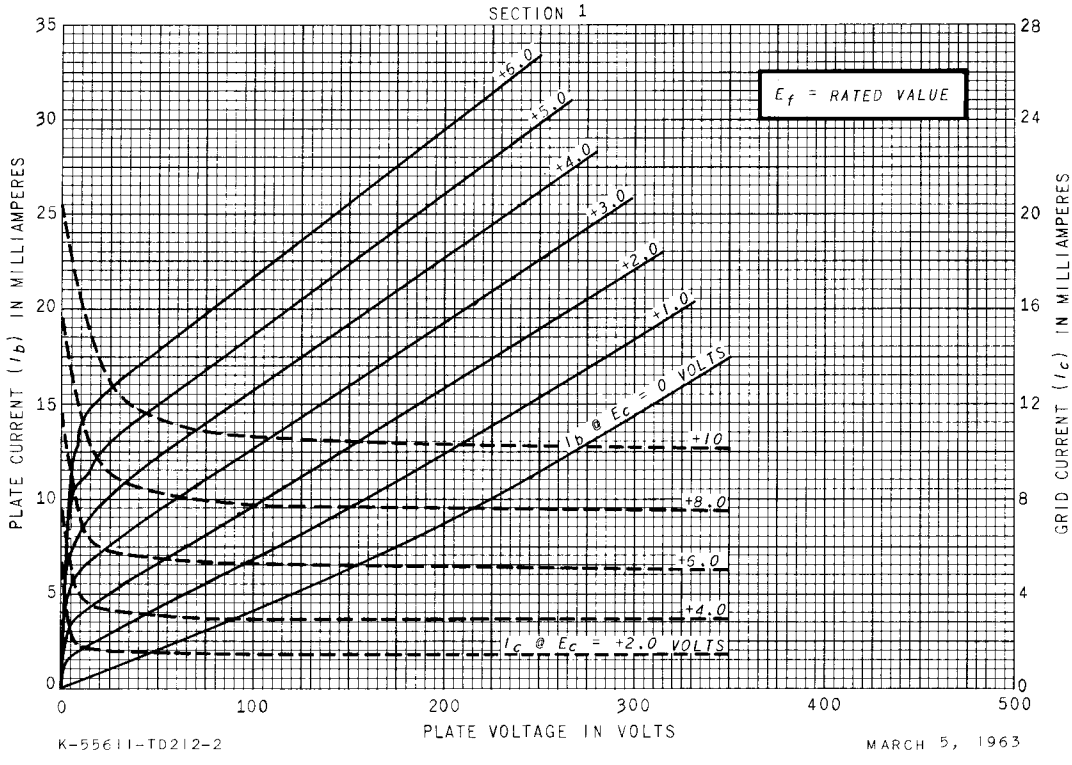
Applied for short interval (two seconds maximum) so as not to damage tube.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

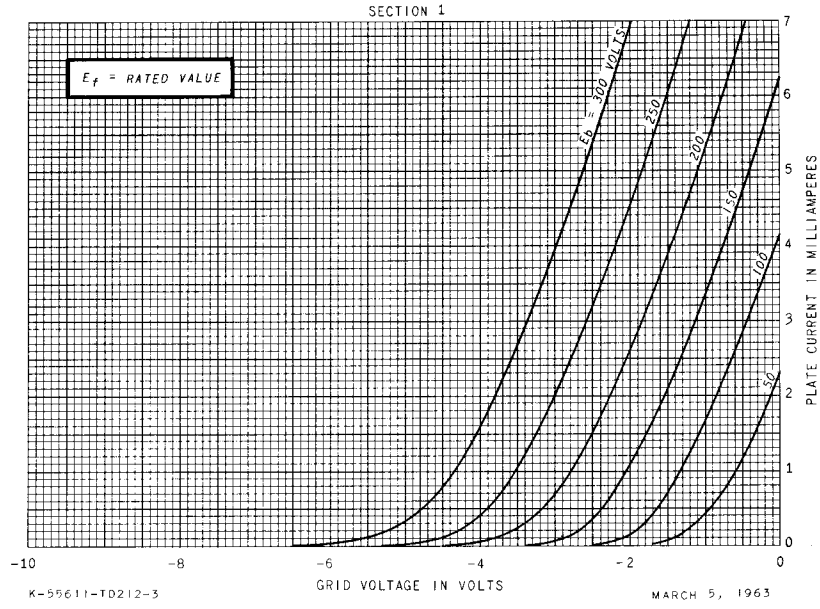
AVERAGE PLATE CHARACTERISTICS



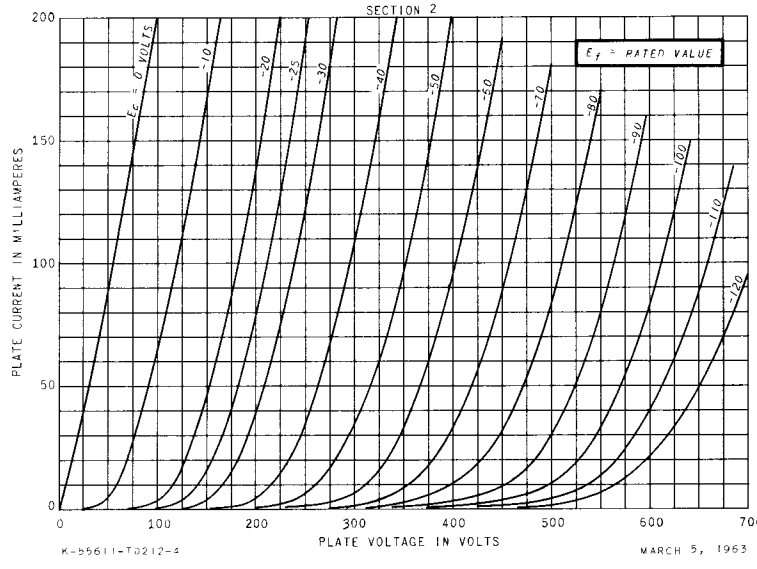
AVERAGE PLATE CHARACTERISTICS



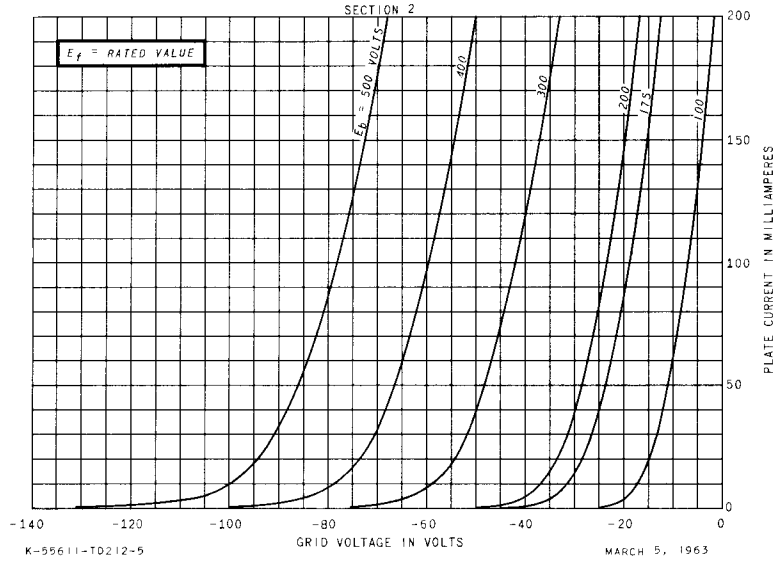
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

6FM8

DUPLEX-DIODE TRIODE

FOR DETECTOR AND AF VOLTAGE-AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6FM8 is a duplex-diode, high-mu triode with separate cathodes for each of the diode sections and the triode section. The tube is designed primarily for use as an FM detector and AF voltage amplifier.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.45	Amperes
Direct Interelectrode Capacitances*		
Triode Grid to Plate	1.8	μμf
Triode Input	1.5	μμf
Triode Output	0.16	μμf
Grid to Diode-Number 1 Plate	0.05	μμf
Grid to Diode-Number 2 Plate	0.04	μμf
Diode-Number 1 Input	2.4	μμf
Diode-Number 2 Input	2.2	μμf
Diode-Number 1 Cathode to All	4.6	μμf
Diode-Number 2 Cathode to All	4.8	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Allowable Heater Voltage	5.7 to 6.9	Volts
Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.1	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Diode Current for Continuous Operation, Each Diode	5.0	Milliamperes

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

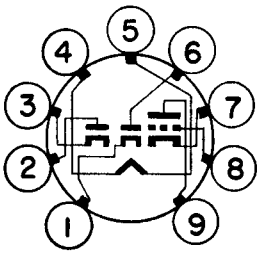
The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply voltage variation, equipment, component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM

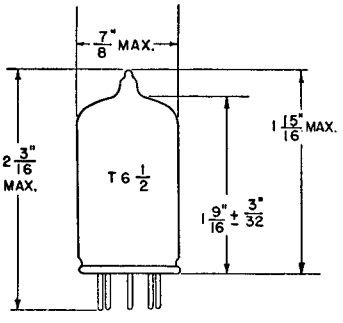


EIA 9KR

TERMINAL CONNECTIONS

Pin 1—Diode Number 2 Cathode
Pin 2—Diode Number 1 Plate
Pin 3—Diode Number 1 Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Diode Number 2 Plate
Pin 7—Triode Cathode
Pin 8—Triode Grid
Pin 9—Triode Plate

PHYSICAL DIMENSIONS



EIA 6-2

CHARACTERISTICS AND TYPICAL OPERATION

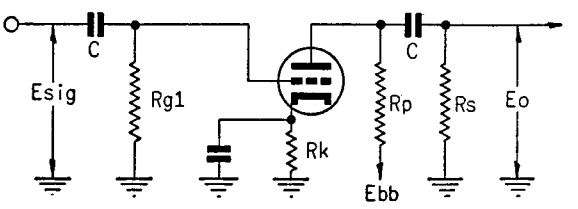
CLASS A_1 AMPLIFIER

Plate Voltage	250	Volts
Grid Voltage	−3.0	Volts
Amplification Factor	70	
Plate Resistance, approximate	58000	Ohms
Transconductance	1200	Micromhos
Plate Current	1.0	Milliamperes
Average Diode Current, Each Diode With 5.0 Volts DC Applied	20	Milliamperes

*Without external shield.

CLASS A RESISTANCE-COUPLED AMPLIFIER

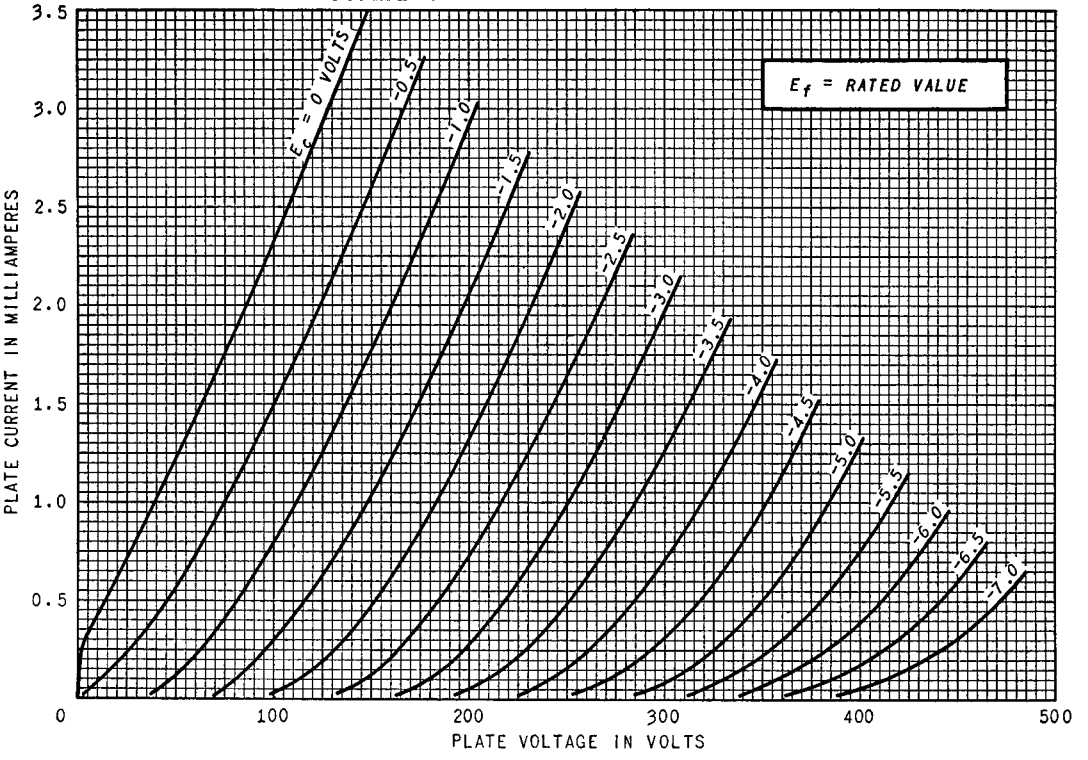
Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	0.10	0.10	5700	21	7.0	2400	29	18	1800	33	35
0.10	0.24	0.10	6100	26	9.0	2700	34	23	2000	38	42
0.24	0.24	0.10	9100	30	10	4300	40	24	3000	44	43
0.24	0.51	0.10	10000	34	13	4700	45	31	3300	49	52
0.51	0.51	0.10	15000	37	14	7500	47	28	5600	51	50
0.51	1.0	0.10	16000	40	16	8200	50	35	6200	55	60
0.24	0.24	10	0	31	5.0	0	44	19	0	48	40
0.24	0.51	10	0	37	7.0	0	49	25	0	52	52
0.51	0.51	10	0	39	7.5	0	51	22	0	54	44
0.51	1.0	10	0	42	10	0	54	28	0	58	56



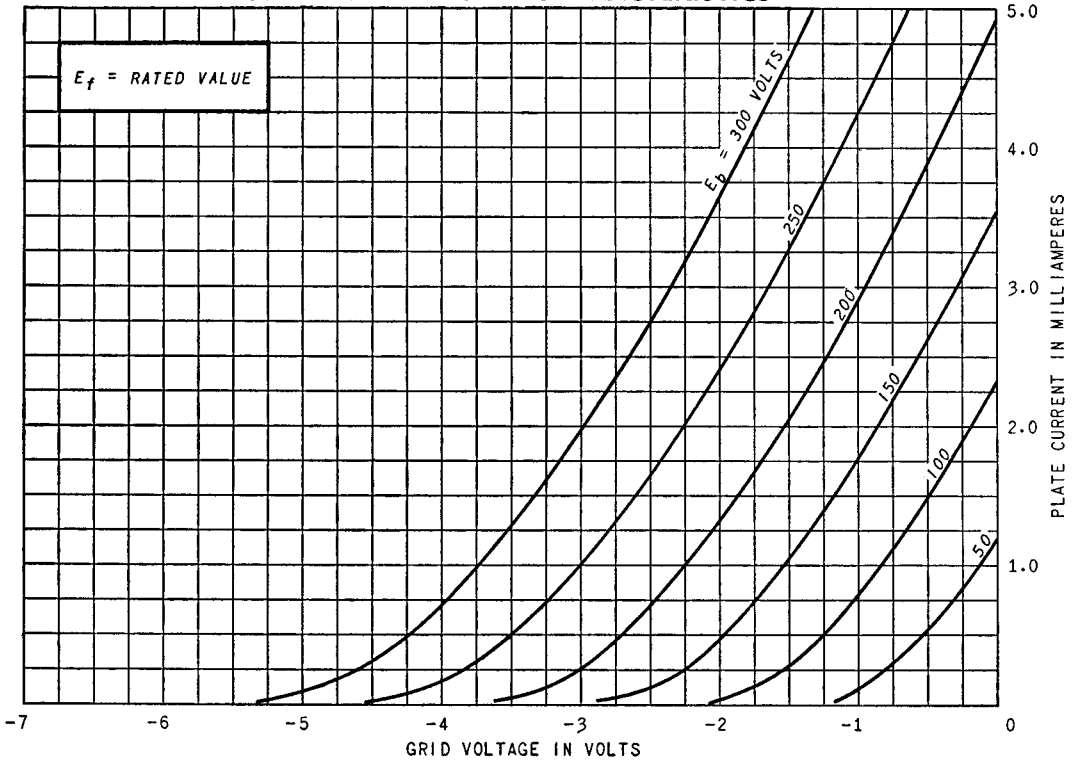
Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

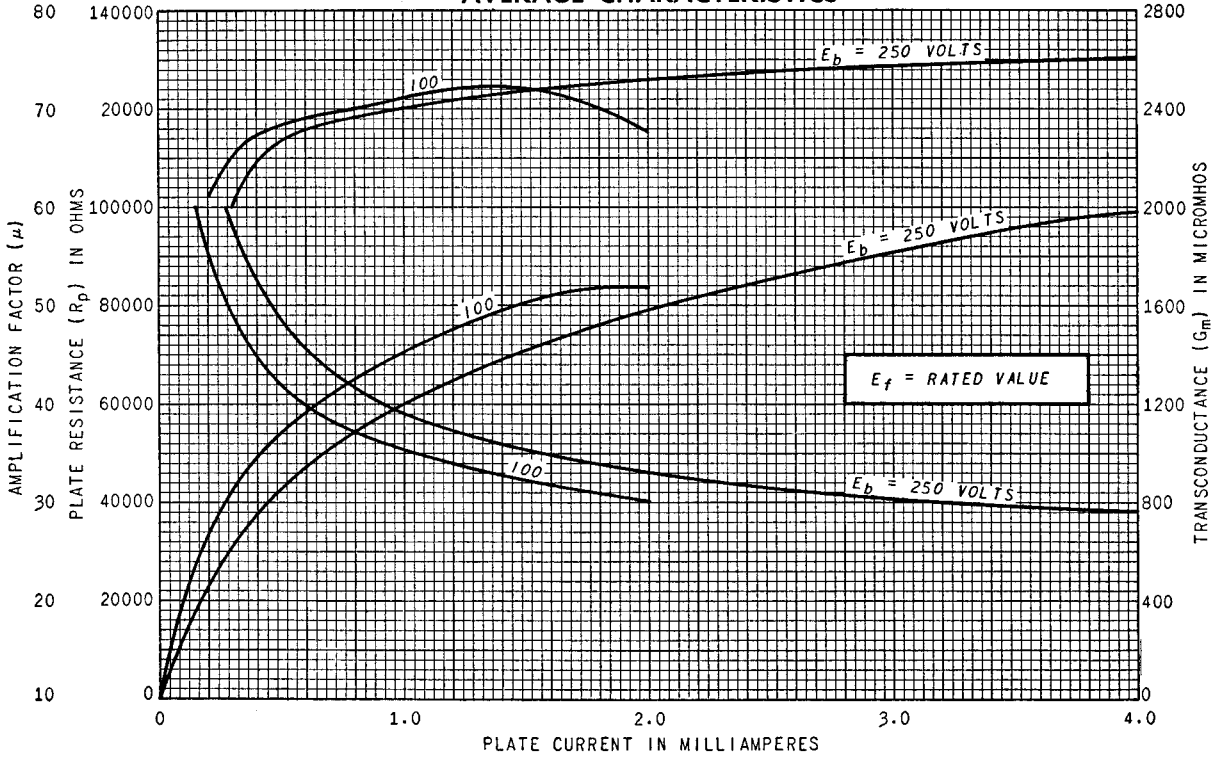
AVERAGE PLATE CHARACTERISTICS



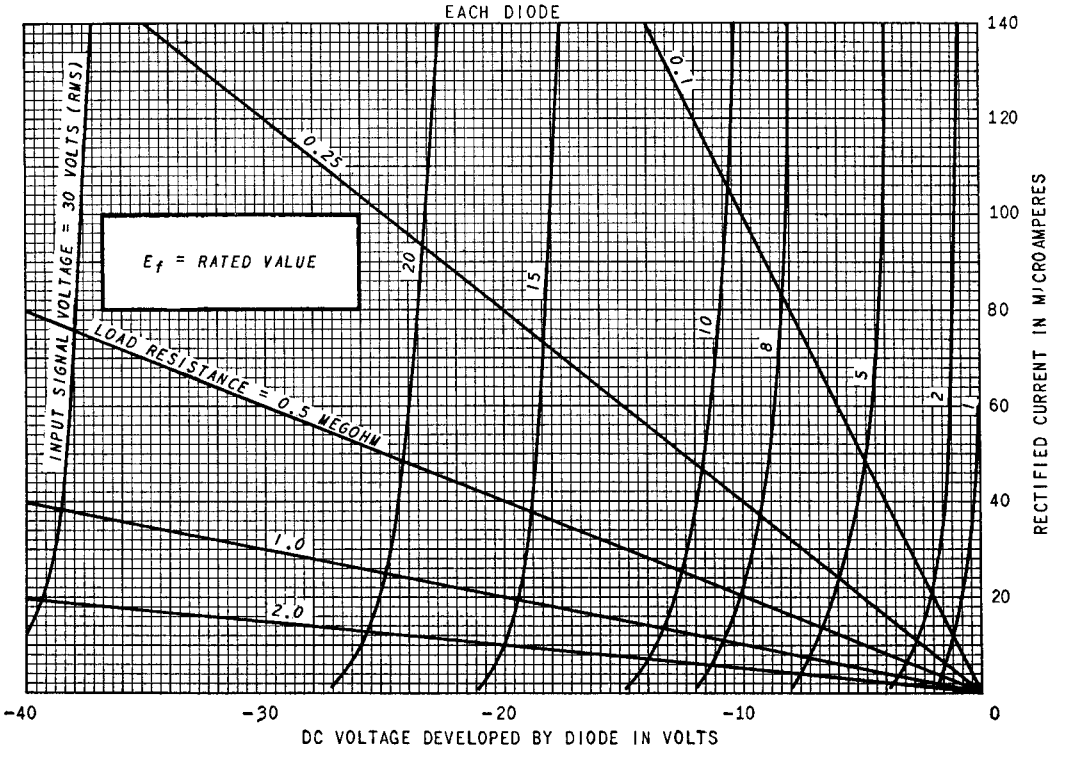
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



OPERATION CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

6FQ7

TWIN TRIODE

DESCRIPTION AND RATING

The 6FQ7 is a general-purpose, medium-mu twin triode of the 9-pin miniature type intended particularly for use as a vertical-deflection oscillator or horizontal-deflection oscillator in television receivers.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings

	Series Heater Operation*	Parallel Heater Operation*	
Heater Voltage, AC or DC	6.3†	6.3 ± 0.6	Volts
Heater Current	0.6 ± 0.04	0.6‡	Amperes
Heater Warm-up Time§	11	....	Seconds

Direct Interelectrode Capacitances, approximate¶

	Section 1	Section 2	
Grid to Plate: (g to p)	3.6	3.8	pf
Input: g to (h+k)	2.4	2.4	pf
Output: p to (h+k)	0.34	0.26	pf
Plate to Plate: (1p to 2p)	1.0		pf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin
Outline Drawing—EIA 6-3

Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 5/8	Inches
Maximum Seated Height	2 3/8	Inches

MAXIMUM RATINGS

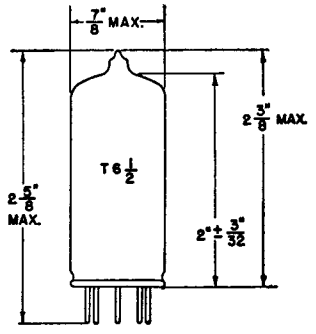
Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

PHYSICAL DIMENSIONS

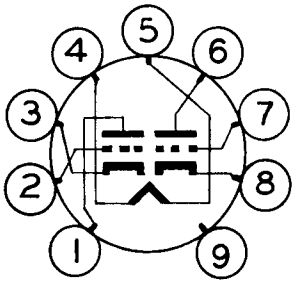


EIA 6-3

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—No Connection

BASING DIAGRAM



EIA 9LP

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES, EACH SECTION CLASS A_1 AMPLIFIER

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation, Either Plate	4.0	Watts
Plate Dissipation, Both Sections Operating	5.7	Watts
Cathode Current	22	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	1.0	Megohms

HORIZONTAL-DEFLECTION OSCILLATOR ⁂

DC Plate Voltage	330	Volts
Peak Negative-Pulse Grid Voltage	660	Volts
Plate Dissipation, Either Plate	4.0	Watts
Plate Dissipation, Both Sections Operating	5.7	Watts
DC Cathode Current	22	Milliamperes
Peak Cathode Current	330	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance	2.2	Megohms

VERTICAL-DEFLECTION OSCILLATOR ⁂

DC Plate Voltage	330	Volts
Peak Negative-Pulse Grid Voltage	440	Volts
Plate Dissipation, Either Plate	4.0	Watts
Plate Dissipation, Both Sections Operation	5.7	Watts
DC Cathode Current	22	Milliamperes
Peak Cathode Current	77	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance	2.2	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	90	250	Volts
Grid Voltage	0	−8.0	Volts
Amplification Factor	20	20	
Plate Resistance, approximate	6700	7700	Ohms
Transconductance	3000	2600	Micromhos
Plate Current	10	9.0	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	−7.0	−18	Volts
Plate Current, approximate Ec = −12.5 Volts		1.3	Milliamperes

* For parallel heater operation, the equipment designer should design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

† Heater voltage for a bogey tube at If = 0.6 amperes.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

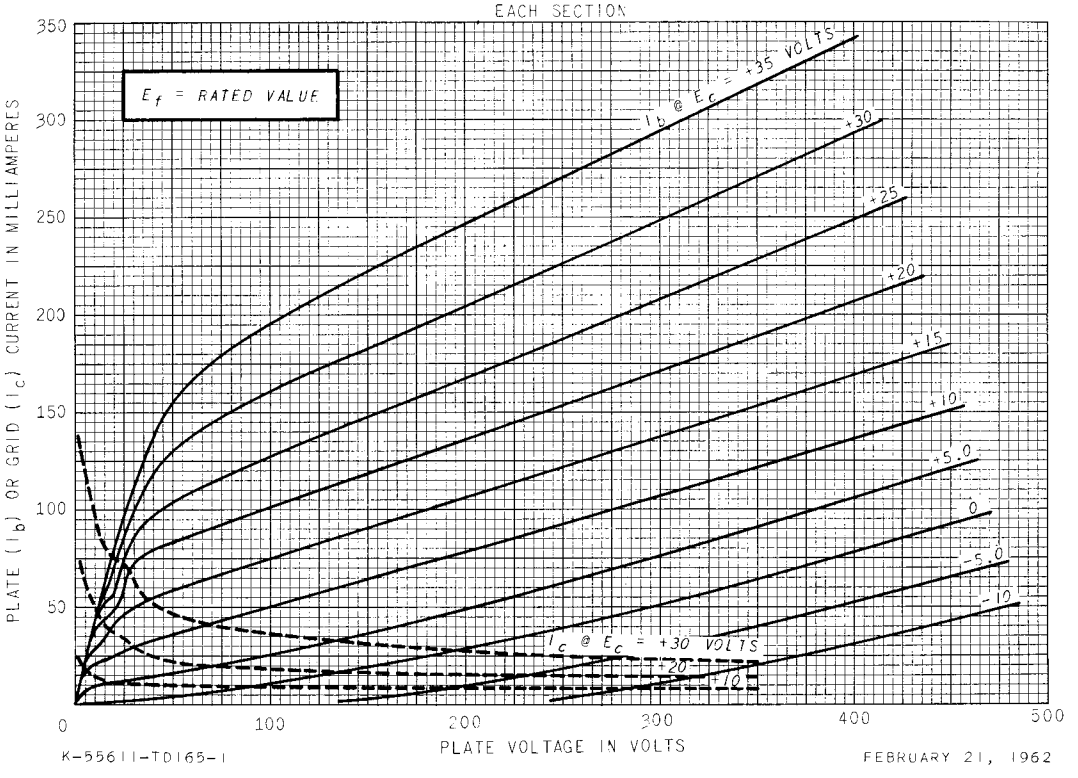
§ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

¶ Without external shield.

⁂ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

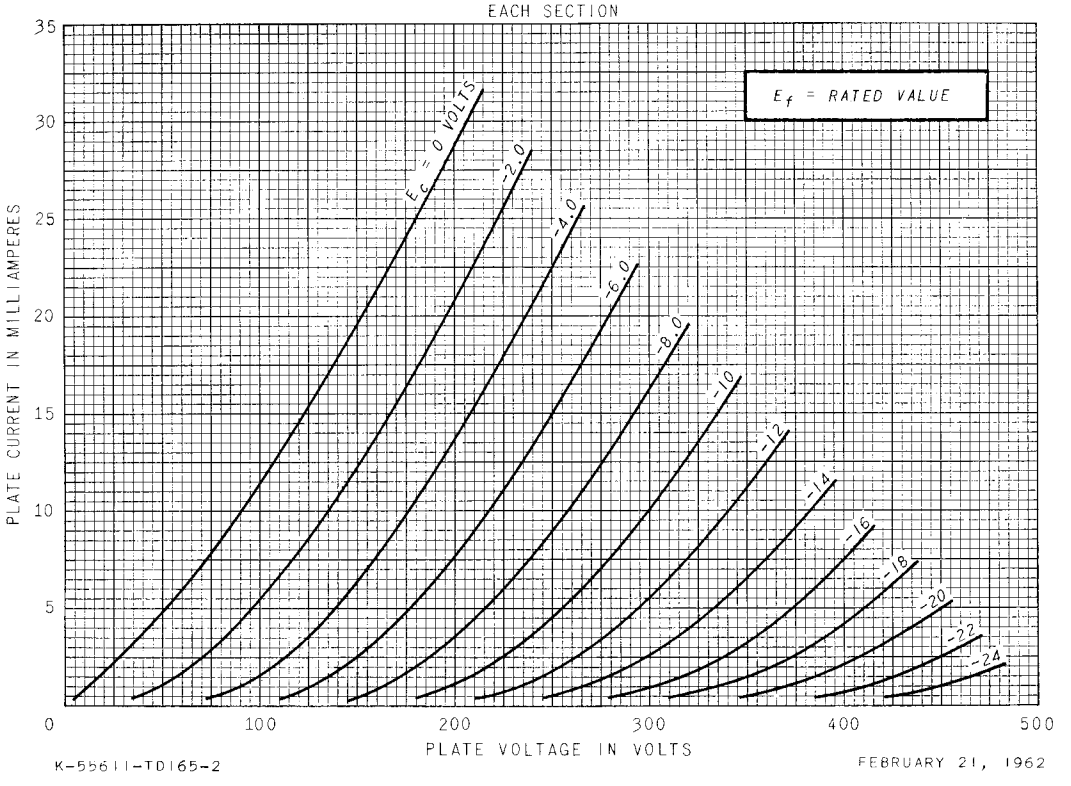
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



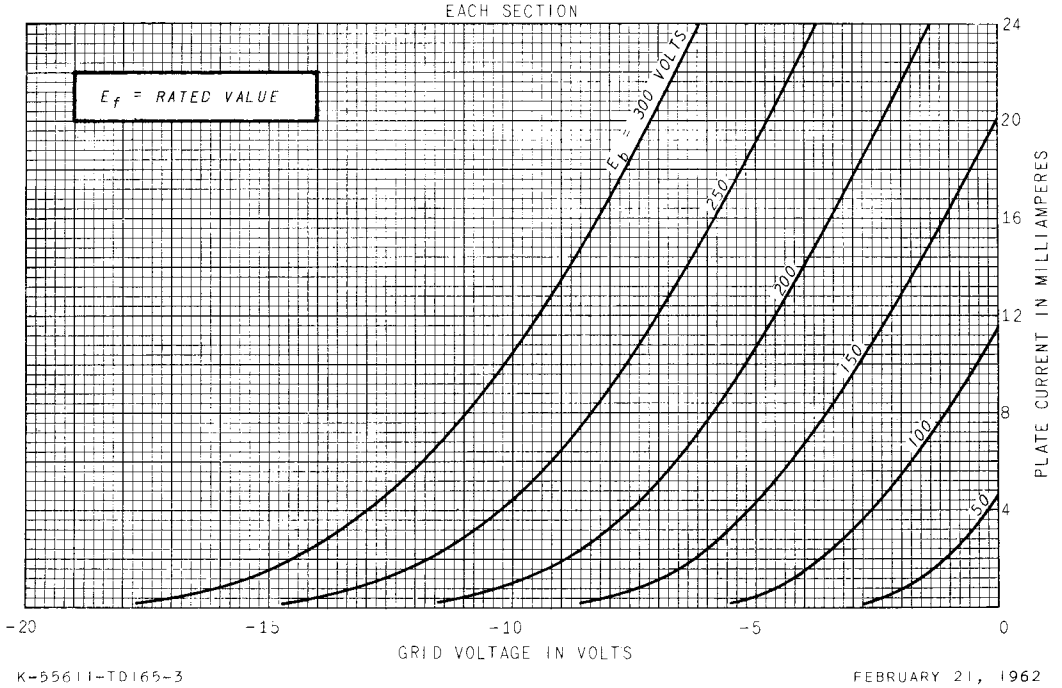
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION

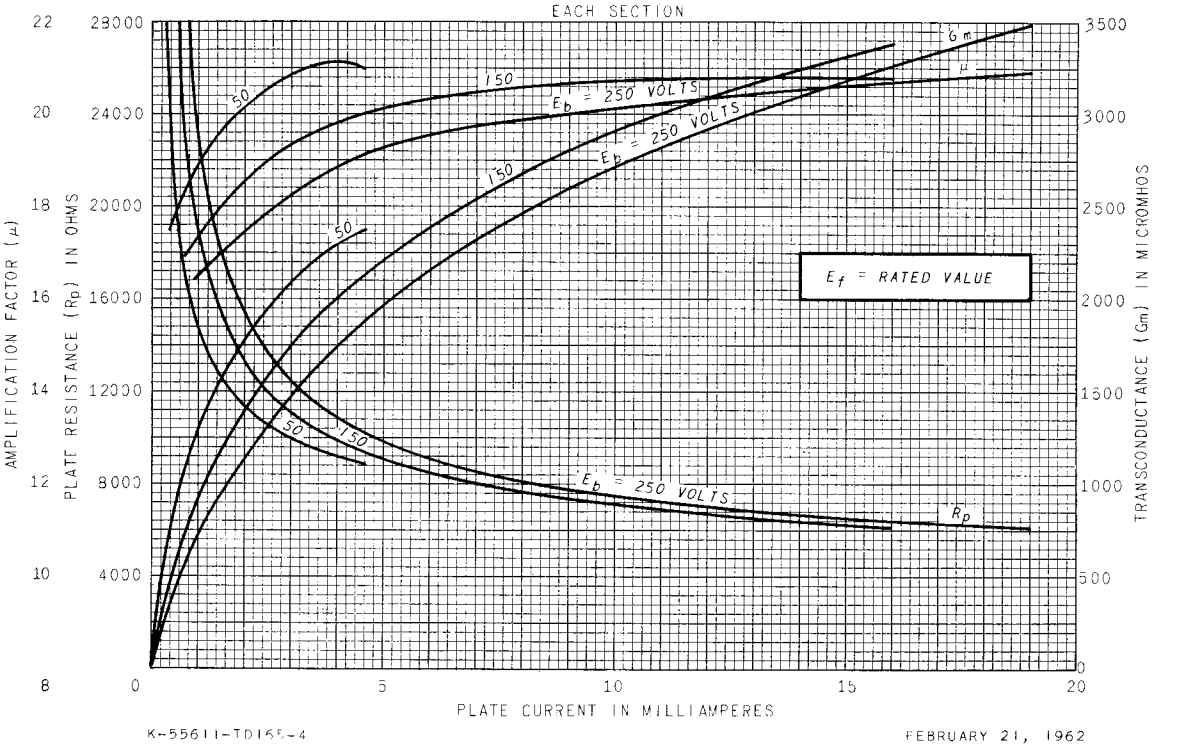


K-55611-TD165-3

FEBRUARY 21, 1962

AVERAGE CHARACTERISTICS

EACH SECTION



K-55611-TD165-4

FEBRUARY 21, 1962

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

6FS5

"SHADOW-GRID" BEAM PENTODE

DESCRIPTION AND RATING

FOR VHF RF AMPLIFIER APPLICATIONS

The 6FS5 is a miniature tube, similar in construction to a beam pentode, with an internally connected grid between the control grid and the screen grid, which serves to reduce the ratio of screen current to plate current. The tube is designed for use as a radio-frequency amplifier in VHF television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.2	Amperes

	With Shield	Without Shield‡	
Direct Interelectrode Capacitances			
Grid Number 1 to Plate: (g1 to p)	0.016	0.03	pf
Input: g1 to (h+k+g2+g3+b.p.	4.8	4.8	pf
Output: p to (h+k+g2+g3+b.p.)	2.8	2.0	pf

MECHANICAL

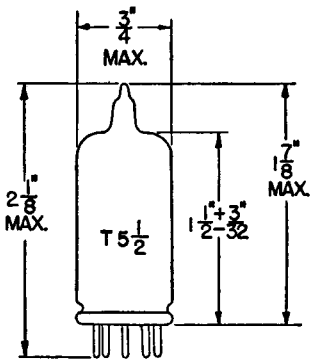
Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	300	Volts
Screen Voltage	150	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
Plate Dissipation	3.25	Watts
Screen Dissipation	0.15	Watts
DC Cathode Current	20	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.5	Megohms

PHYSICAL DIMENSIONS

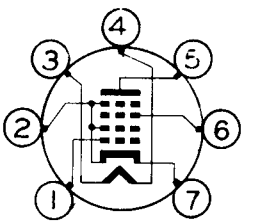


EIA 5-2

TERMINAL CONNECTIONS

Pin 1—Grid Number 1 (Control Grid)
Pin 2—Cathode, Grid Number 2 ("Shadow Grid"), and Beam Plate
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 3 (Screen Grid)
Pin 7—Cathode, Grid Number 2 ("Shadow Grid"), and Beam Plate

BASING DIAGRAM



EIA 7GA

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	275	Volts
Screen Voltage	135	Volts
Grid-Number 1 Voltage	−0.2	Volts
Plate Resistance, approximate	0.24	Megohms
Transconductance	10000	Micromhos
Plate Current	9.0	Milliamperes
Screen Current	0.17	Milliamperes
Grid-Number 1 Voltage, approximate Gm = 100 Micromhos	−5	Volts

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ With external shield (EIA 316) connected to pin 7.

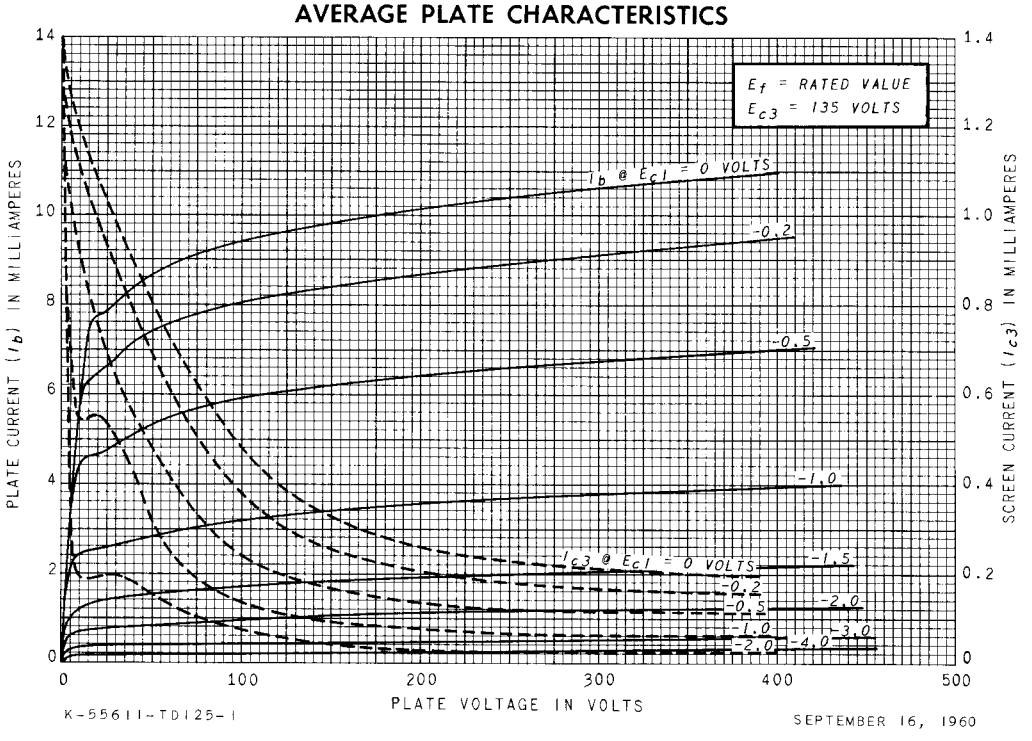
Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

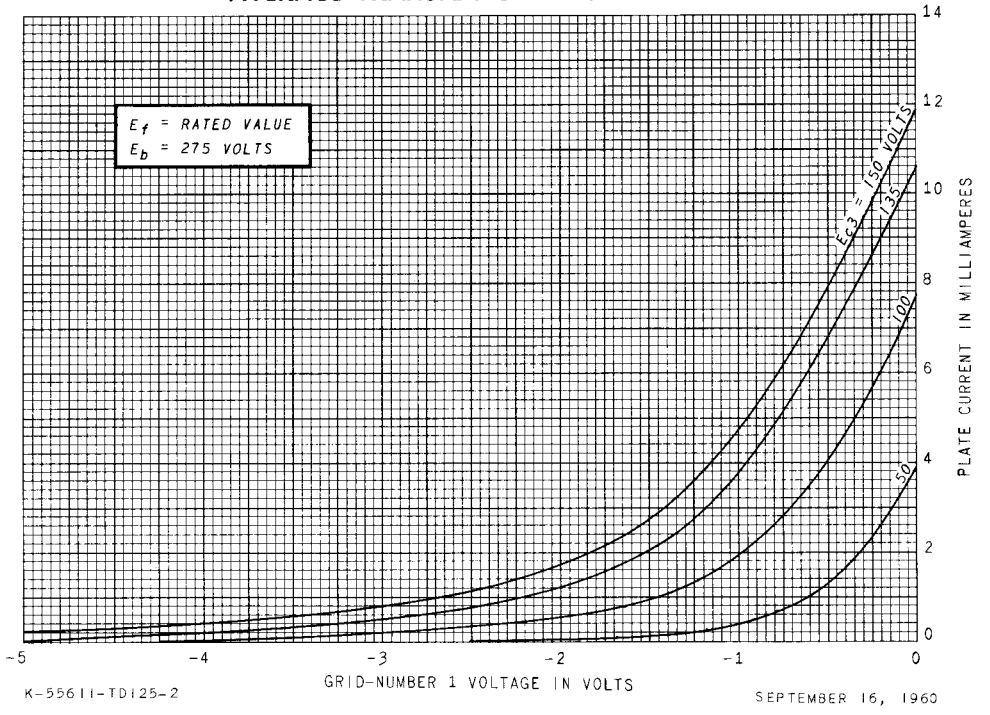
The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

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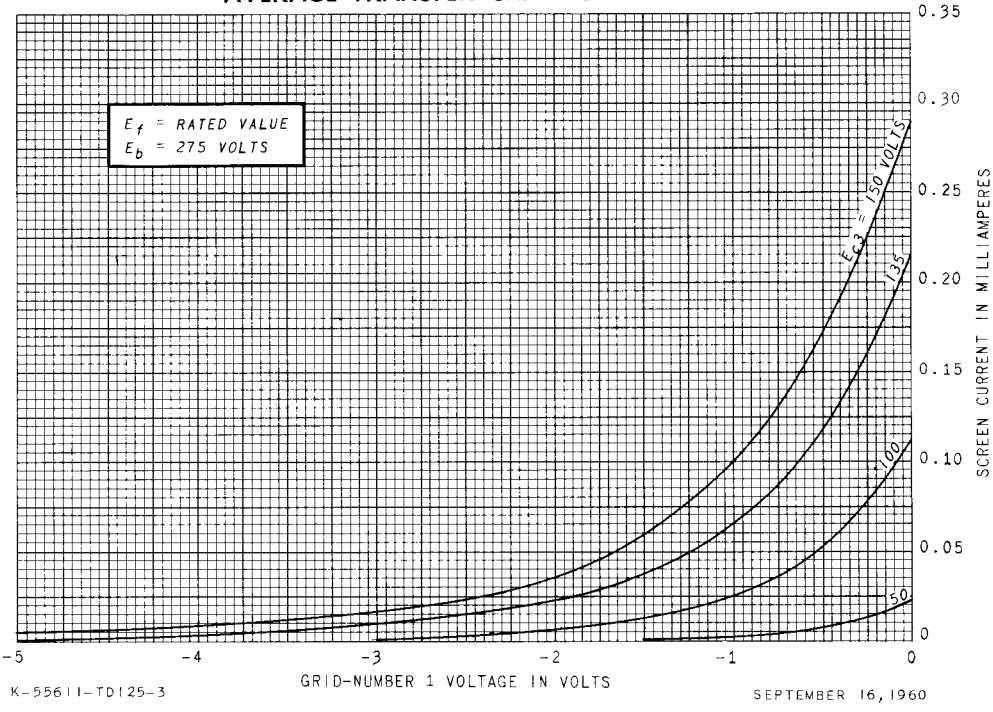
AVERAGE PLATE CHARACTERISTICS



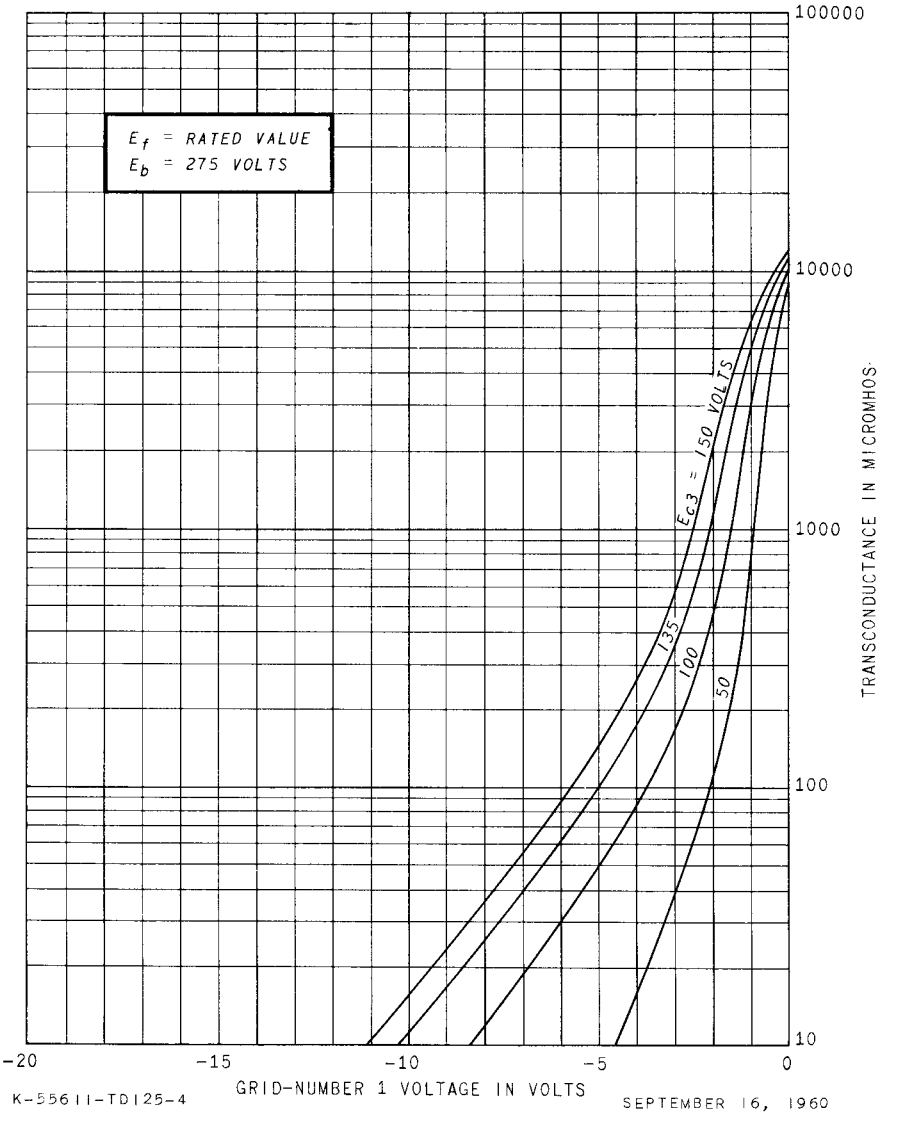
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBES

6FV8

TRIODE-PENTODE

DESCRIPTION AND RATING

The 6FV8 is a miniature tube that contains a sharp-cutoff pentode and a medium-mu triode in one envelope. The triode section is designed for use as a vertical-deflection oscillator; the pentode section is for IF amplifier or general-purpose use.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.45±6%	Amperes
Heater Warm-up Time*	11	Seconds

Direct Interelectrode Capacitances	With Shield†	Without Shield	
Pentode Section			
Grid-Number 1 to Plate: (Pg1 to Pp), max.	0.01	0.02	μμf
Input: Pg1 to (h+Pk+Pg2+Pg3+i.s.)	5.0	5.0	μμf
Output: Pp to (h+Pk+Pg2+Pg3+i.s.)	3.0	2.0	μμf
Triode Section			
Grid to Plate: (Tg to Tp)	1.8	1.8	μμf
Input: Tg to (h+Tk+Pk+Pg3+i.s.)	2.8	2.8	μμf
Output: Tp to (h+Tk+Pk+Pg3+i.s.)	2.0	1.5	μμf
Pentode Plate to Triode Plate: (Pp to Tp), max.	0.03	0.15	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

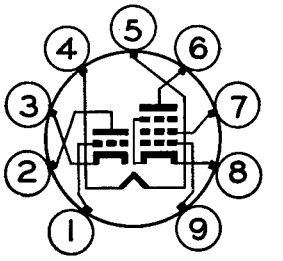
DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section‡	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	—	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	—	Volts
Peak Negative Pulse Grid Voltage	—	250	Volts
Plate Dissipation	2.3	2.0§	Watts
Screen Dissipation	0.55	—	Watts
DC Cathode Current	—	20	Milliamperes
Peak Cathode Current	—	70	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	—	Megohms
With Cathode Bias	1.0	3.0	Megohms

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GENERAL ELECTRIC

BASING DIAGRAM

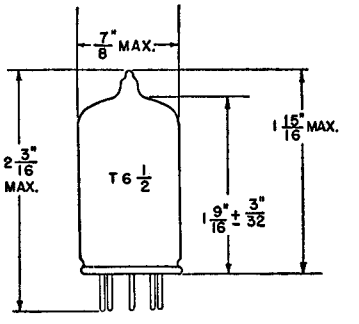


EIA 9FA

TERMINAL CONNECTIONS

Pin 1—Triode Grid
Pin 2—Triode Plate
Pin 3—Triode Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Plate
Pin 7—Pentode Grid Number 2 (Screen)
Pin 8—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 9—Pentode Grid Number 1

PHYSICAL DIMENSIONS



EIA 6-2

Design-maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Pentode Section	Triode Section	
Plate Voltage	125	125	Volts
Screen Voltage	125	....	Volts
Grid-Number 1 Voltage	−1.0	−1.0	Volts
Amplification Factor	——	40	
Plate Resistance, approximate	200,000	5000	Ohms
Transconductance	6500	8000	Micromhos
Plate Current	12	14	Milliamperes
Screen Current	4.0	——	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 20 Microamperes	−9	−9	Volts

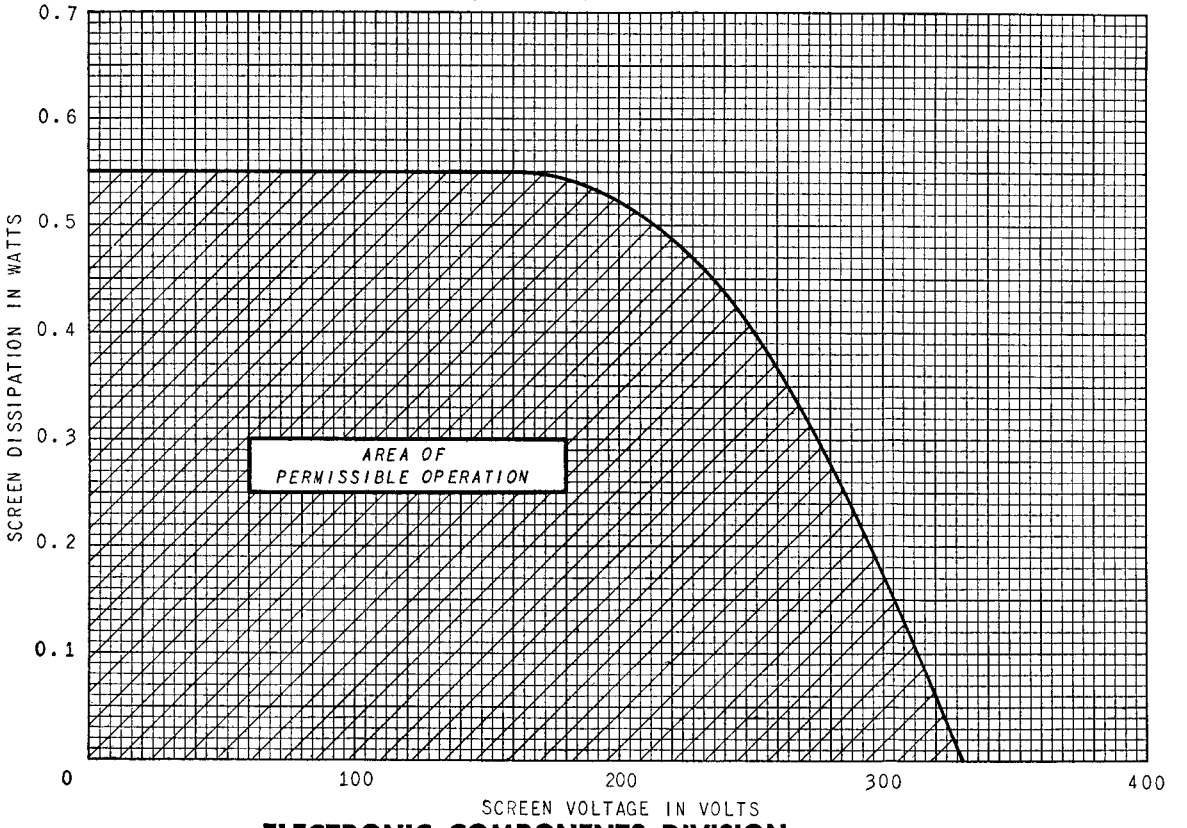
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (EIA 315) connected to Pin 4.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

SCREEN RATING CHART



Electronic TUBES

6FW5

BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6FW5 is a beam-power pentode primarily designed for use as the horizontal-deflection amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	1.2	Amperes

Direct Interelectrode Capacitances, approximate†

Grid-Number 1 to Plate: (g1 to p)	0.5	μμf
Input: g1 to (h+k+g2+b.p.)	17	μμf
Output: p to (h+k+g2+b.p.)	7.0	μμf

MECHANICAL

Mounting Position—Any

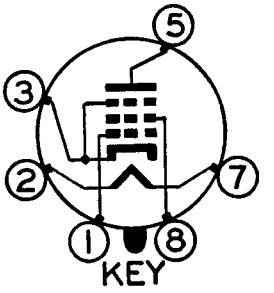
Envelope—T-12, Glass

Base—B6-112, Short Medium-Shell Octal 6-Pin

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GENERAL ELECTRIC

BASING DIAGRAM

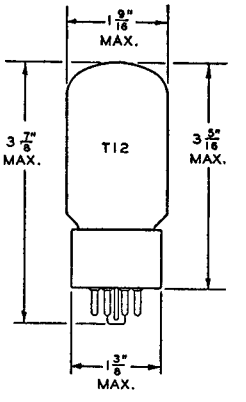


EIA 6CK

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Heater
Pin 3—Cathode and Beam Plates
Pin 5—Plate
Pin 7—Heater
Pin 8—Grid Number 2 (Screen)

PHYSICAL DIMENSIONS



EIA 12-14

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE—DESIGN-MAXIMUM VALUES‡

DC Plate-Supply Voltage (Boost+DC Power Supply)	770	Volts
Peak Positive-Pulse Plate Voltage	6500	Volts
Peak Negative-Pulse Plate Voltage	1500	Volts
Screen Voltage	220	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation§	17.5	Watts
Screen Dissipation	3.5	Watts
DC Cathode Current	175	Milliamperes
Peak Cathode Current	550	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point	220	C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	60	250	Volts
Screen Voltage	150	150	Volts
Grid-Number 1 Voltage	0¶	−22.5	Volts
Plate Resistance, approximate	—	20000	Ohms
Transconductance	—	6600	Micromhos
Plate Current	345	75	Milliamperes
Screen Current	30	2.4	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 1.0 Milliampere	—	−46	Volts
Triode Amplification Factor#	—	4.1	

† Without external shield.

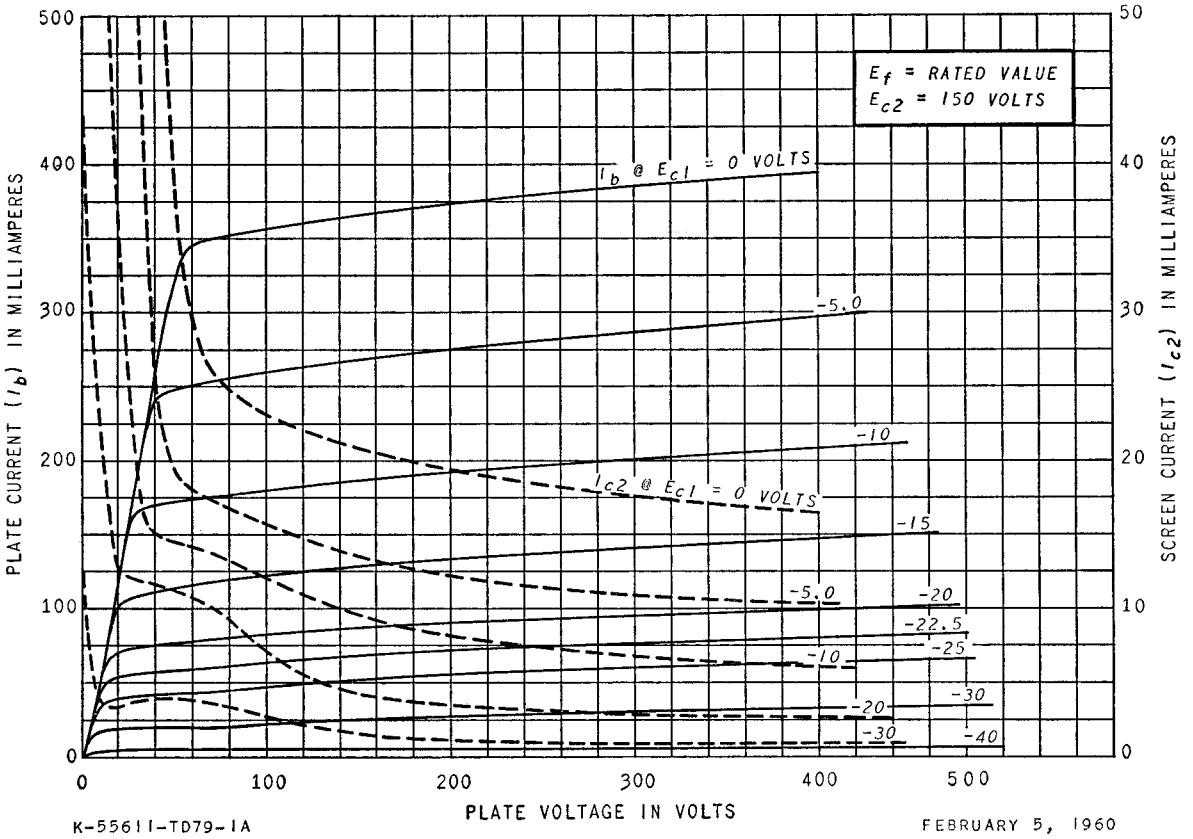
‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

¶ Applied for short interval (two seconds maximum) so as not to damage tube.

Triode connection (screen tied to plate) with Eb = Ec2 = 150 volts and Ec1 = −22.5 volts.

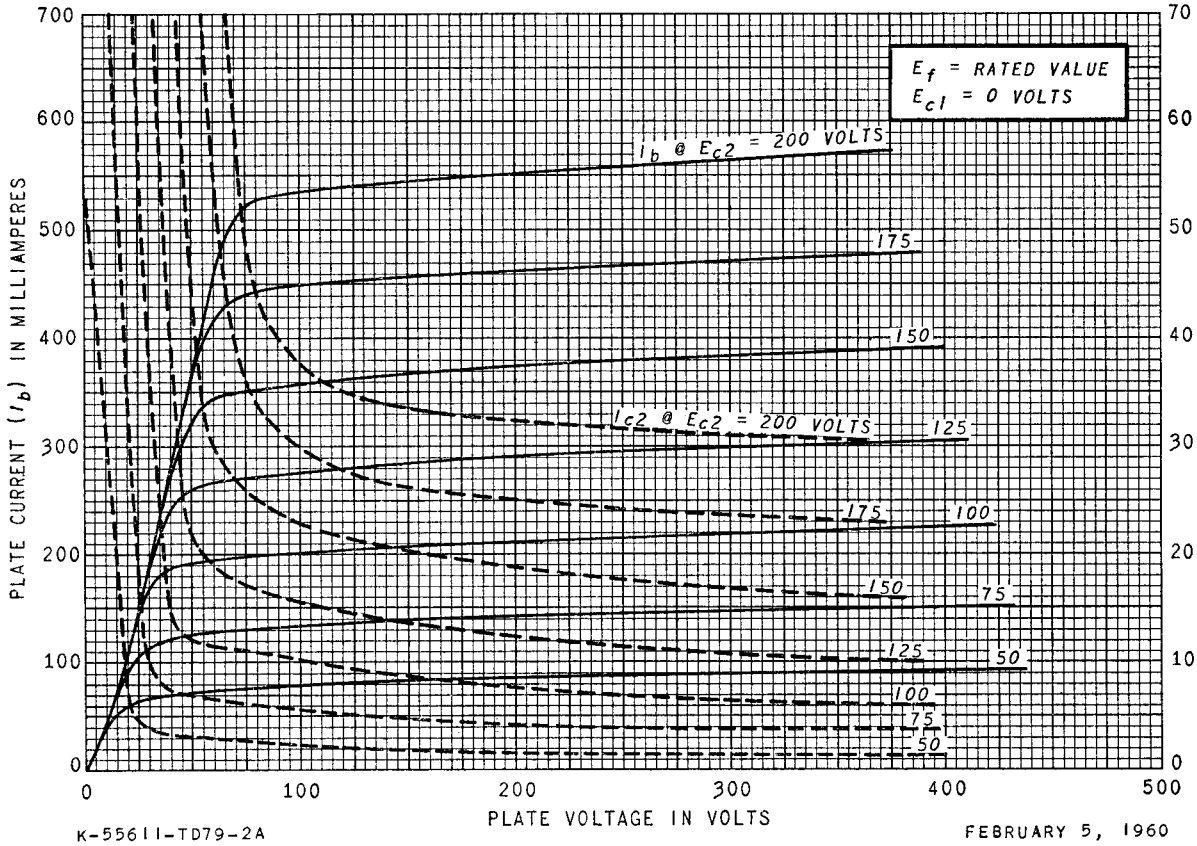
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD79-IA

FEBRUARY 5, 1960

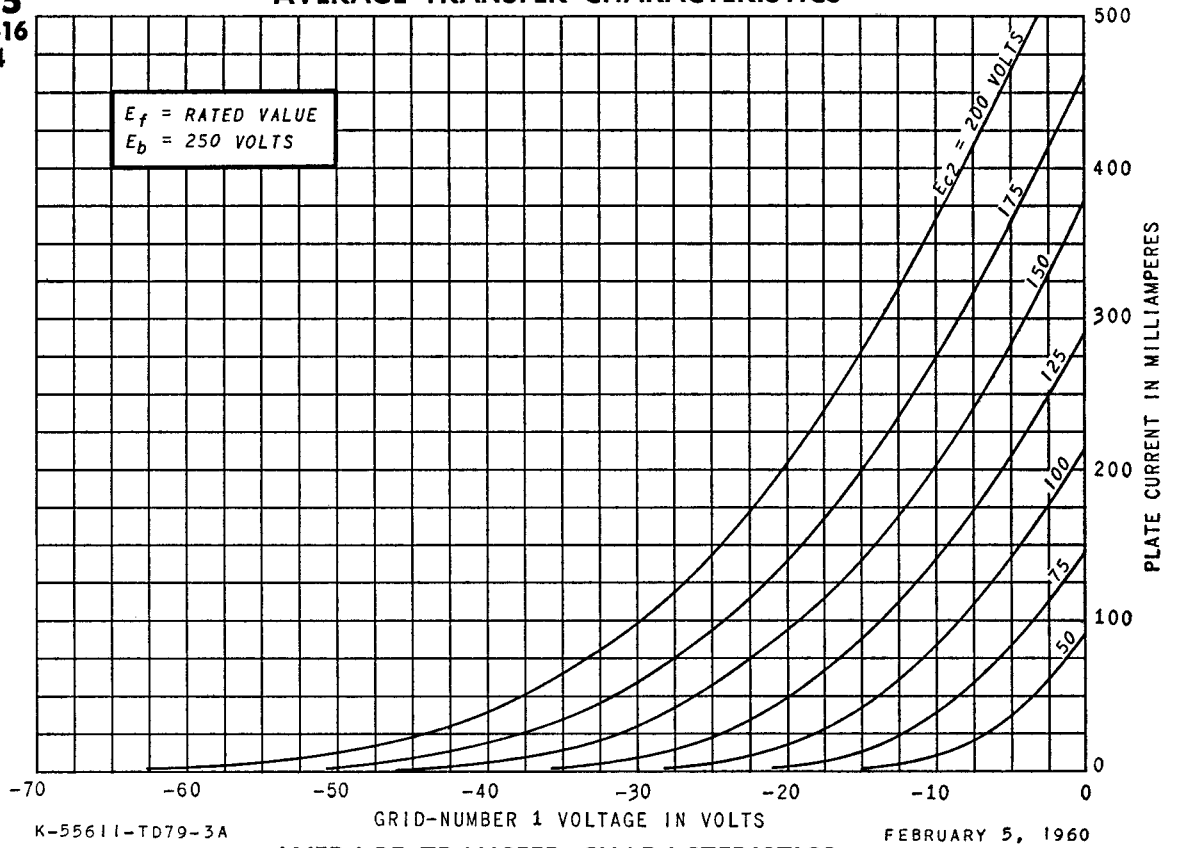
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD79-2A

FEBRUARY 5, 1960

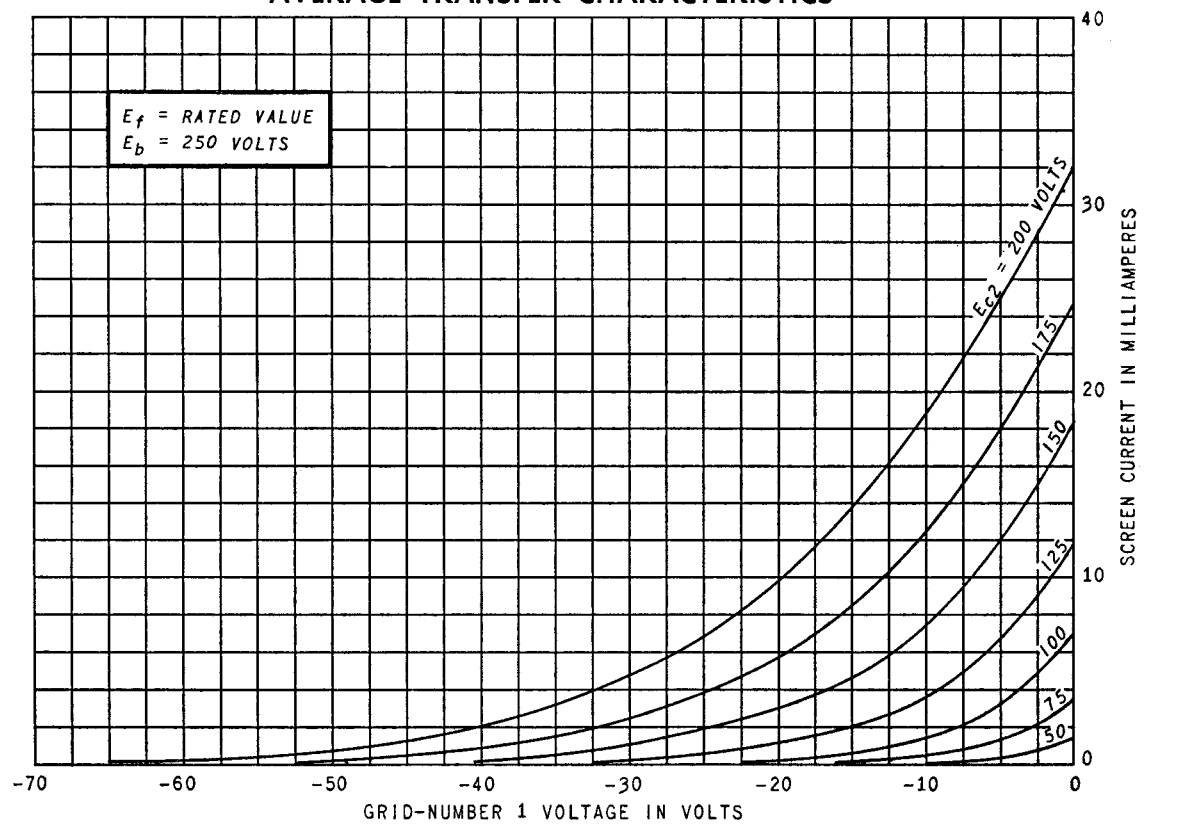
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD79-3A

FEBRUARY 5, 1960

AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD79-4A

FEBRUARY 5, 1960

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

ELECTRONICS

6FY7

COMPACTRON DISSIMILAR DOUBLE TRIODE

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6FY7 is a compactron containing two dissimilar triode sections, designed for use as a combined vertical-deflection oscillator and amplifier in television receivers. Section 1 is intended for service as an oscillator and Section 2 as an amplifier.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	1.05	Amperes

Direct Interelectrode Capacitances, approximate§

	Section 1	Section 2	
Grid to Plate: (g to p)	4.4	9.5	pf
Input: g to (h + k)	2.2	6.5	pf
Output: p to (h + k)	0.4	1.2	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-60

Maximum Diameter	1.188	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches

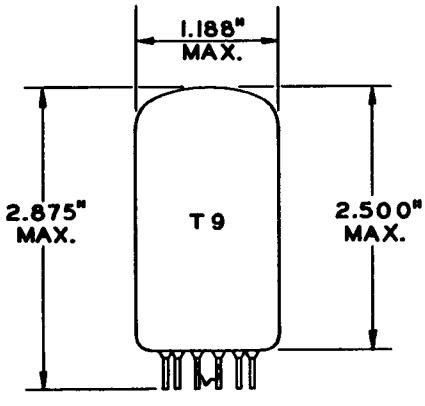
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

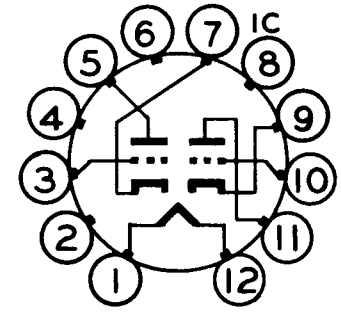


EIA 9-60

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - No Connection
Pin 3 - Grid (Section 2)
Pin 4 - No Connection
Pin 5 - Plate (Section 2)
Pin 6 - No Connection
Pin 7 - Cathode (Section 2)
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Cathode (Section 1)
Pin 10 - Grid (Section 1)
Pin 11 - Plate (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12E0

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MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES	Vertical Oscillator Service¶ (Section 1)	Vertical Deflection Amplifier¶ (Section 2)	
DC Plate Voltage	330	275	Volts
Peak Positive Pulse Plate Voltage	---	2000	Volts
Peak Negative Grid Voltage	400	250	Volts
Plate Dissipation	1.0	7.0#	Watts
DC Cathode Current	20	50	Milliamperes
Peak Cathode Current	70	175	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance	2.2	2.2	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Section 1 (Oscillator)	Section 2 (Amplifier)		
Plate Voltage	250	60	150	Volts
Grid Voltage	-3.0	0¢	-17.5	Volts
Amplification Factor	65	---	6.0	
Plate Resistance, approximate	40500	---	920	Ohms
Transconductance	1600	---	6500	Micromhos
Plate Current	1.4	95	35	Milliamperes
Plate Current, approximate				
Ec = -25 Volts	---	---	6	Milliamperes
Grid Voltage, approximate				
Ib = 30 Microamperes	-5.5	---	---	Volts
Grid Voltage, approximate				
Ib = 50 Microamperes	---	---	-36	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

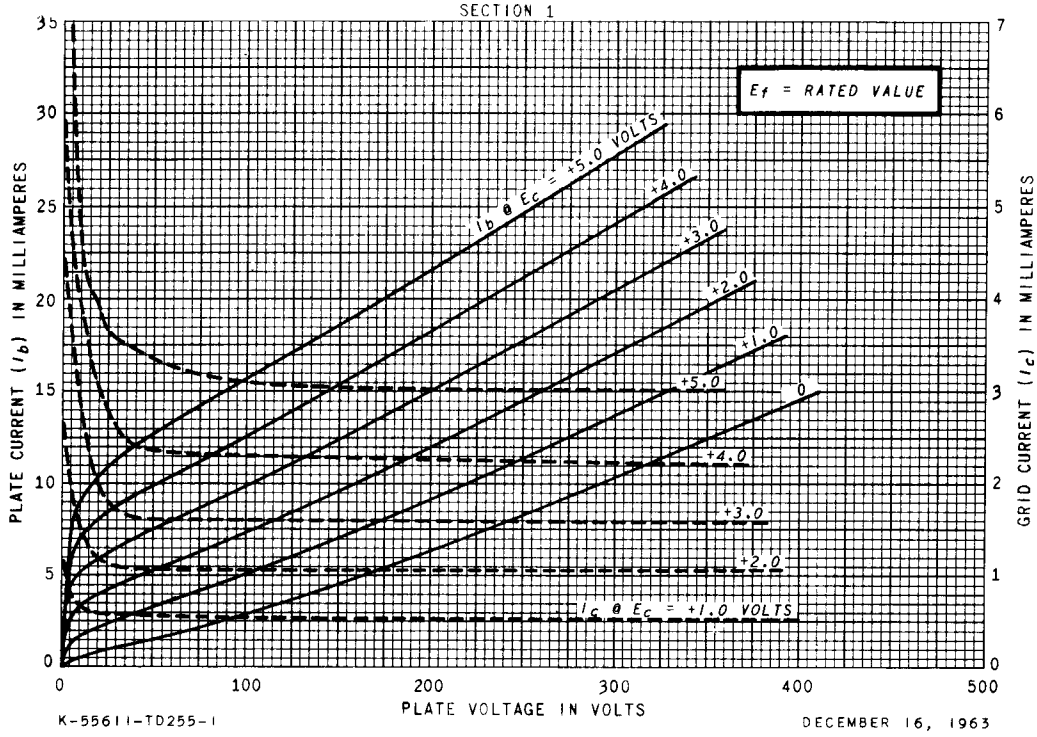
§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

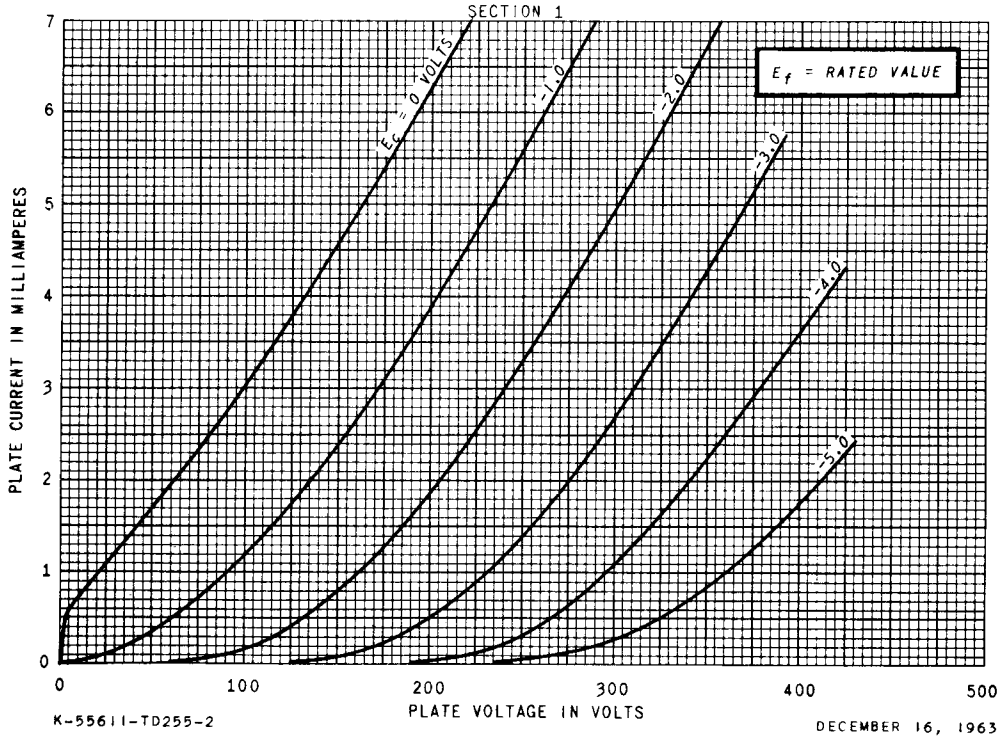
In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

¢ Applied for short interval (two seconds maximum) so as not to damage tube.

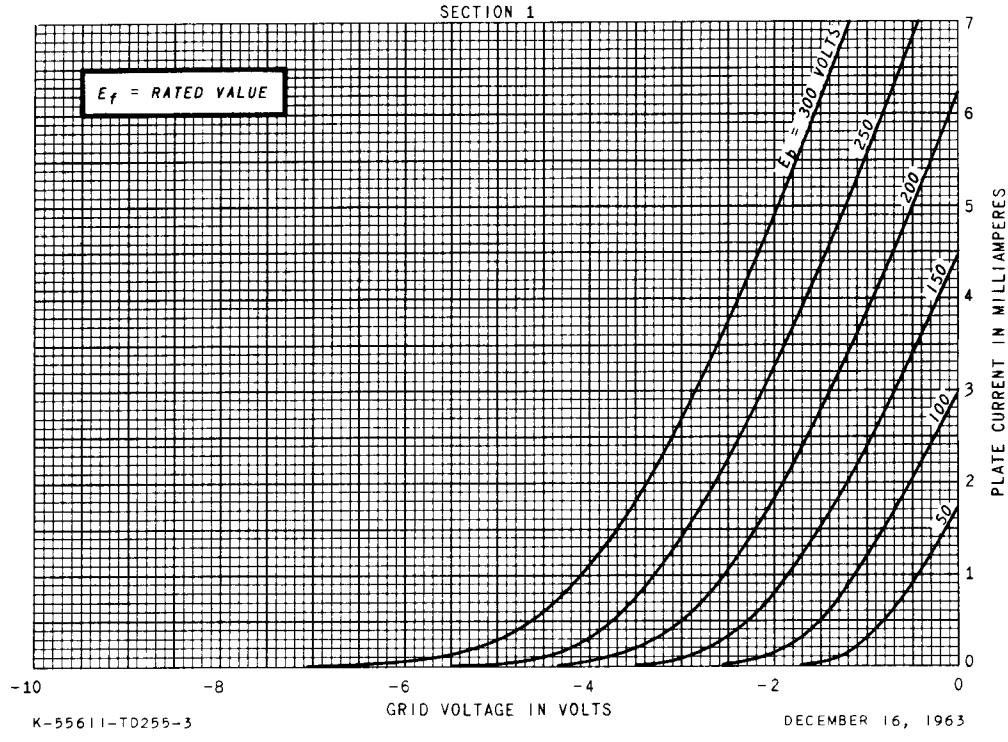
AVERAGE PLATE CHARACTERISTICS



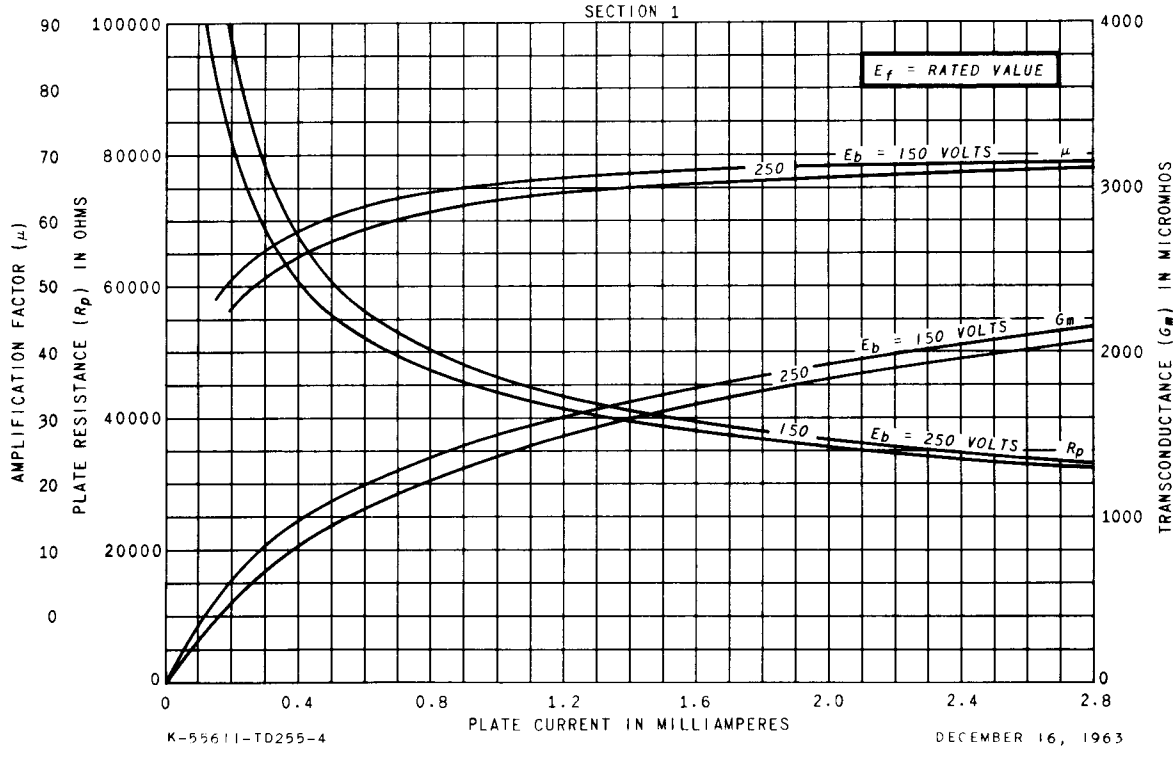
AVERAGE PLATE CHARACTERISTICS



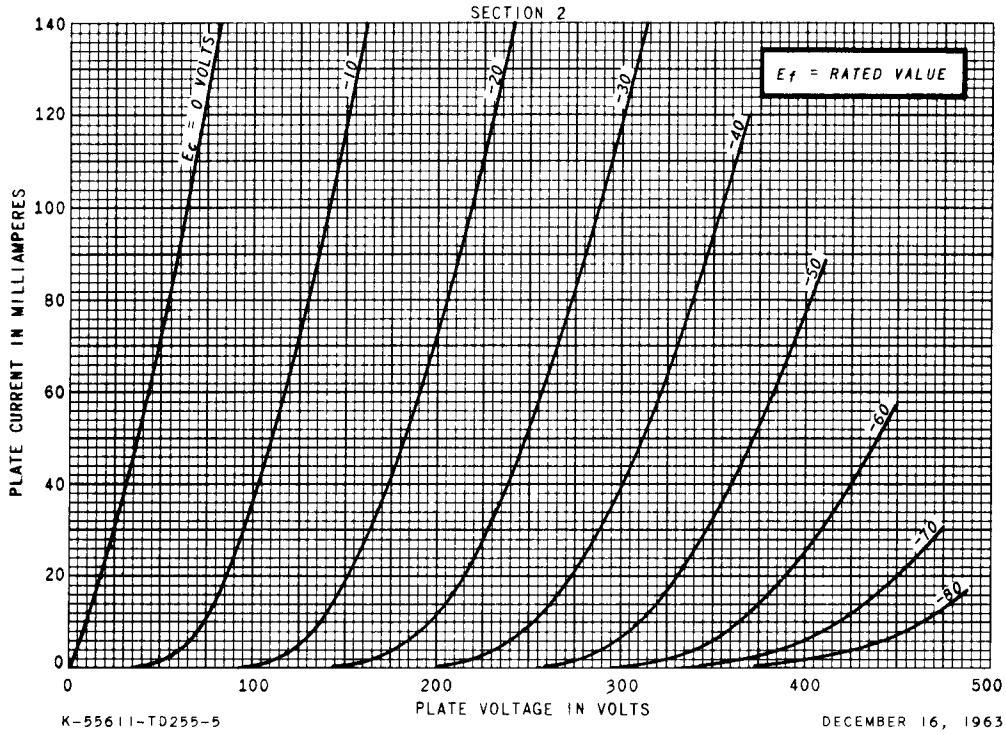
AVERAGE TRANSFER CHARACTERISTICS



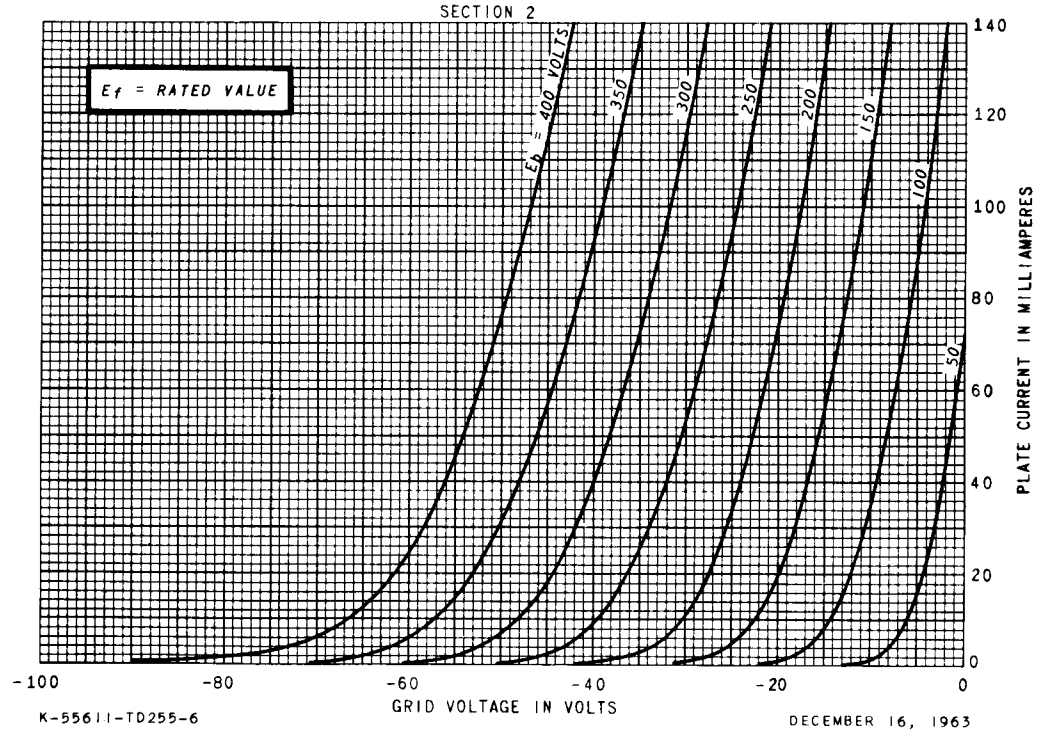
AVERAGE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

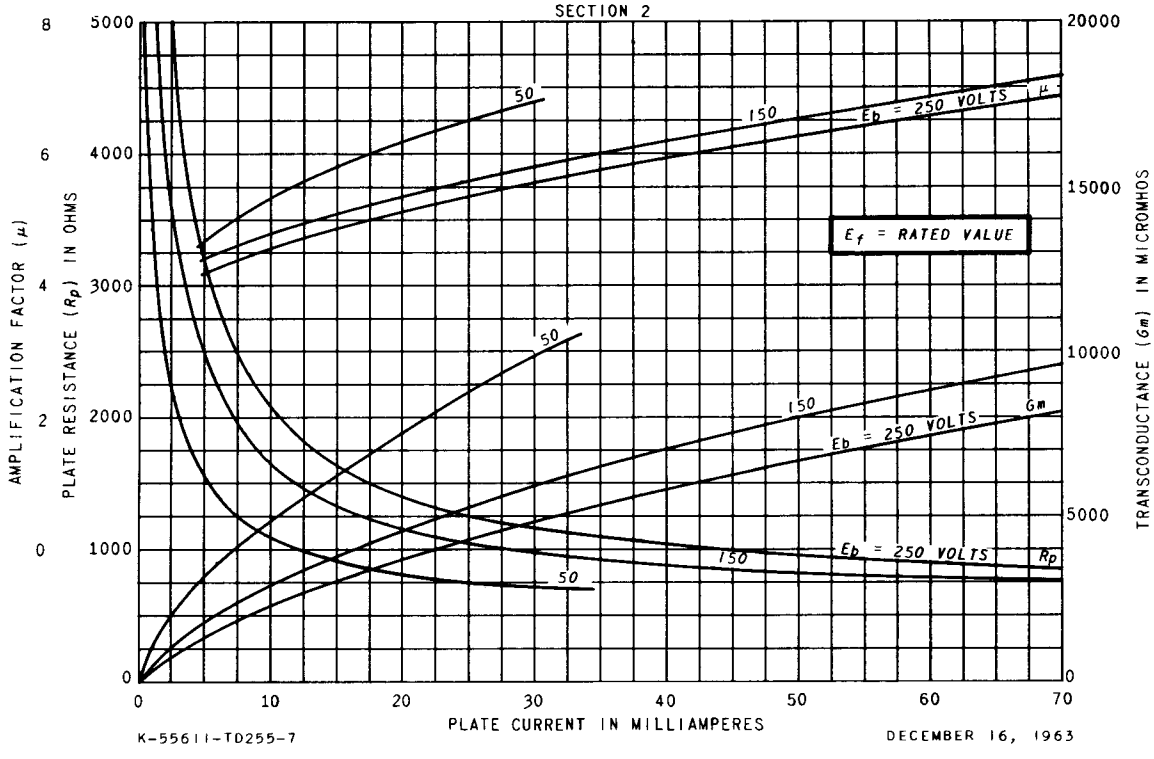


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS

SECTION 2



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

COMPACTRON BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6GE5 is a compactron beam-power pentode primarily designed for use as the horizontal-deflection amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC†	6.3 ± 0.6	Volts
Heater Current‡	1.2	Amperes
Direct Interelectrode Capacitances, approximate§		
Grid-Number 1 to Plate: (g1 to p)	0.34	pf
Input: g1 to (h + k + g2 + b.p.)	16	pf
Output: p to (h + k + g2 + b.p.)	7.0	pf

MECHANICAL

Mounting Position—Any
Envelope—T-12, Glass
Base—E12-74, Button 12-Pin
Outline Drawing—EIA 12-56

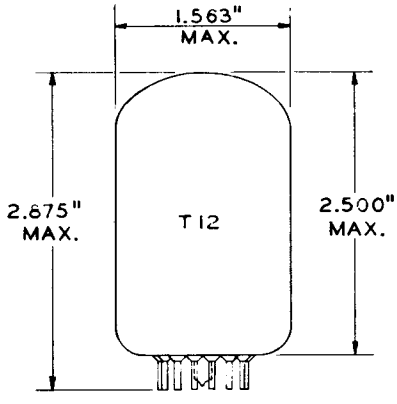
Maximum Diameter	1.563	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE—DESIGN-MAXIMUM VALUES¶

DC Plate-Supply Voltage (Boost + DC Power Supply)	770	Volts
Peak Positive Pulse Plate Voltage	6500	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Screen Voltage	220	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation=	17.5	Watts
Screen Dissipation	3.5	Watts
DC Cathode Current	175	Milliamperes
Peak Cathode Current	550	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point	220	C

PHYSICAL DIMENSIONS

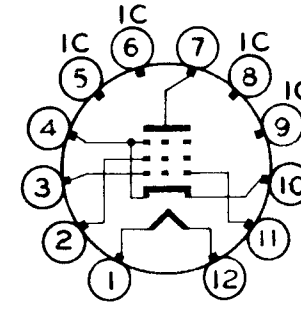


EIA 12-56

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—Grid Number 2 (Screen)
Pin 3—Grid Number 1
Pin 4—Cathode and Beam Plates
Pin 5—Internal Connection—Do Not Use
Pin 6—Internal Connection—Do Not Use
Pin 7—Plate
Pin 8—Internal Connection—Do Not Use
Pin 9—Internal Connection—Do Not Use
Pin 10—Cathode and Beam Plates
Pin 11—Grid Number 1
Pin 12—Heater

BASING DIAGRAM



EIA 12BJ

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	60	250	Volts
Screen Voltage	150	150	150	Volts
Grid-Number 1 Voltage		0△	−22.5	Volts
Plate Resistance, approximate		...	18000	Ohms
Transconductance		...	7300	Micromhos
Plate Current		345	65	Milliamperes
Screen Current		27	1.8	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 1.0 Milliamperes	−100	...	−42	Volts
Triode Amplification Factor**		...	4.4	

† The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

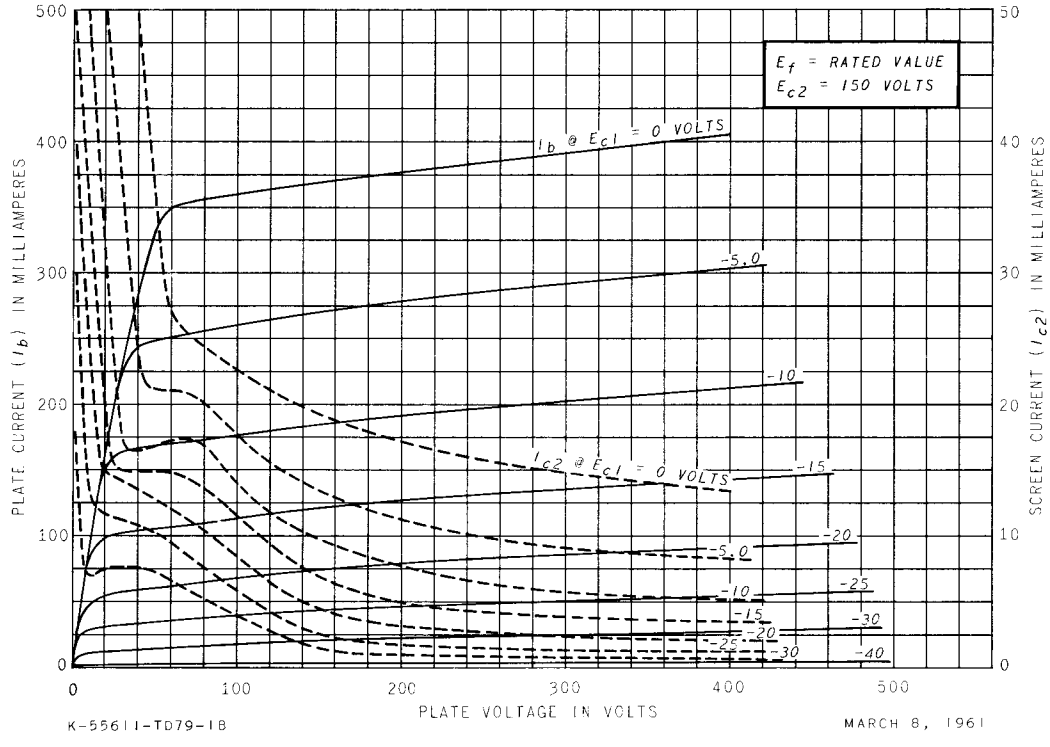
In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

△Applied for short interval (two seconds maximum) so as not to damage tube.

**Triode connection (screen tied to plate) with Eb = Ec2 = 150 volts and Ec1 = −22.5 volts.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

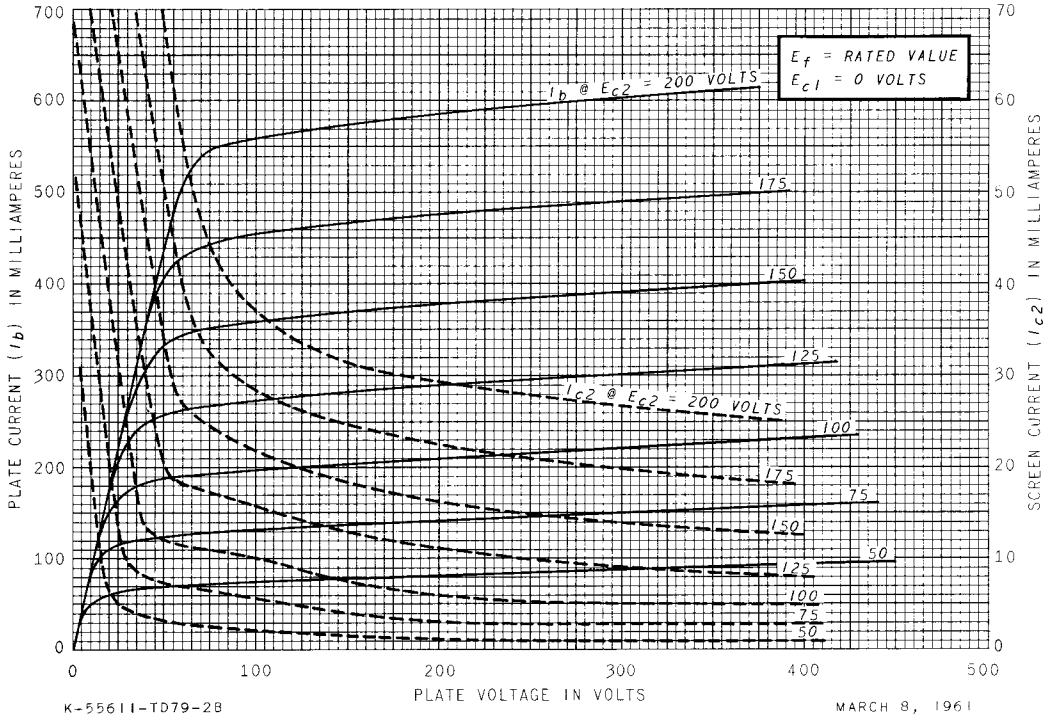
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD79-1B

MARCH 8, 1961

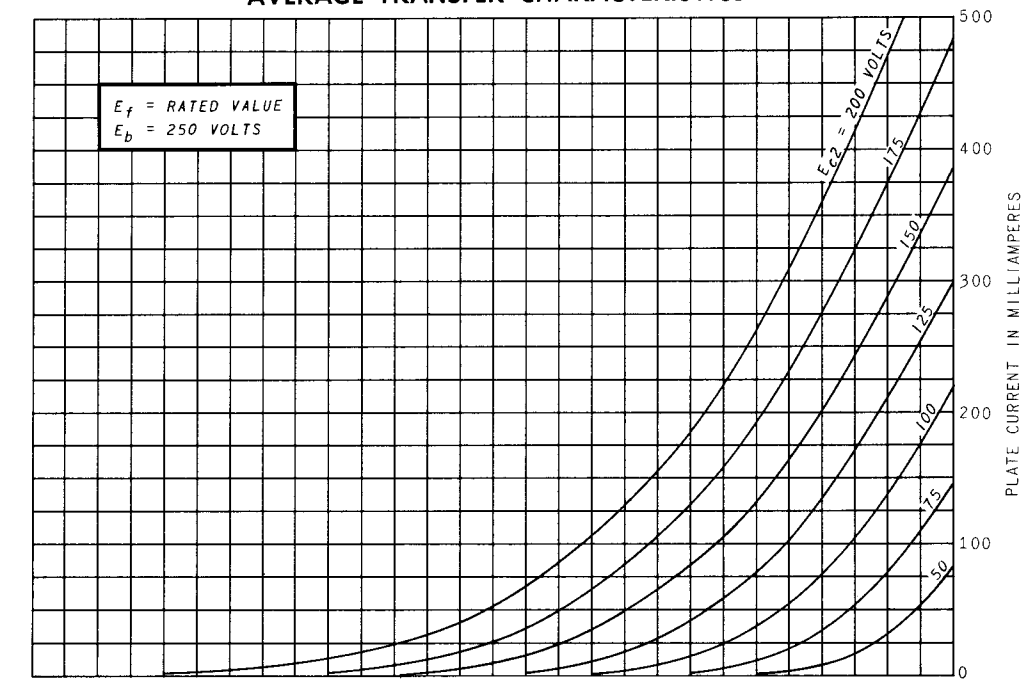
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD79-2B

MARCH 8, 1961

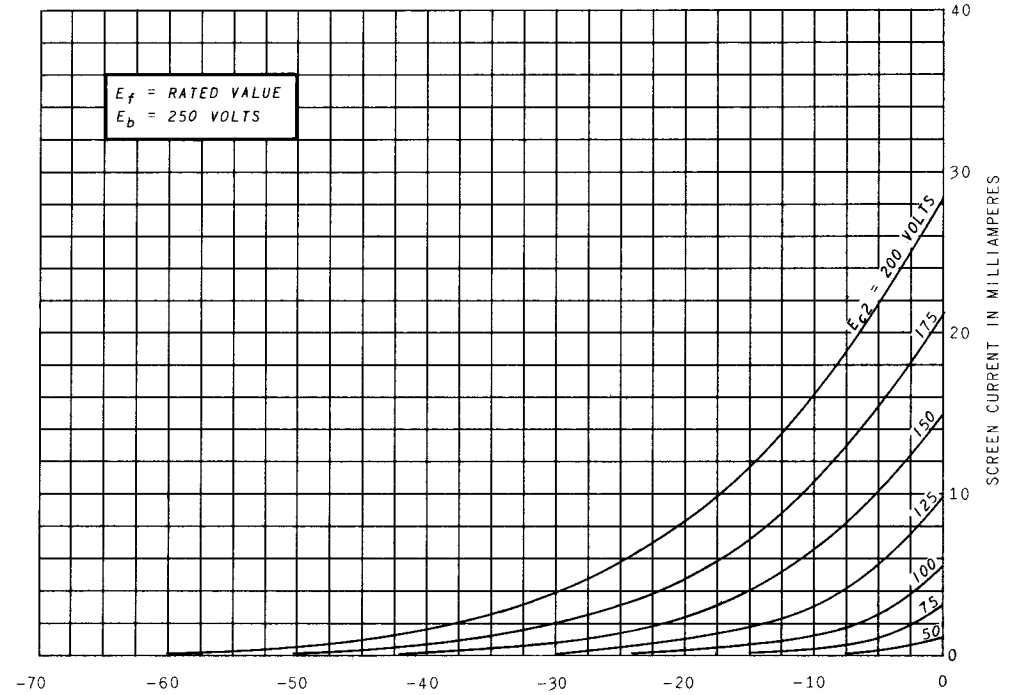
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD79-3B

MARCH 8, 1961

AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD79-4B

MARCH 8, 1961

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

from JEDEC release #3531,
Dec. 18, 1961

6GF5

BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

The 6GF5 is a COMPACTRON* beam-power pentode primarily designed for use as the horizontal-deflection amplifier in television receivers.

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC+	6.3±0.6	Volts
Heater Current‡	1.2	Amperes
Direct Interelectrode Capacitances§		
Grid-Number 1 to Plate: (g1 to p)	0.2	pf
Input: g1 to (h + k + g2 + b.p.)	16	pf
Output: p to (h + k + g2 + b.p.)	7.5	pf

Mechanical

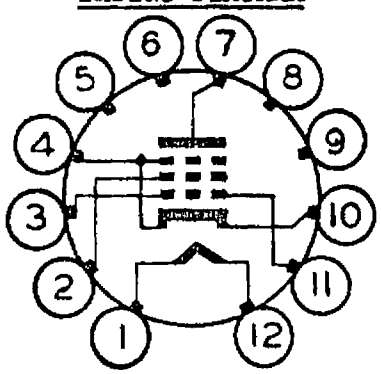
Mounting Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-60

Maximum Diameter	1.188	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Grid Number 2 (Screen)
Pin 3 - Grid Number 1
Pin 4 - Cathode and Beam Plates
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Plate
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Cathode and Beam Plates
Pin 11 - Grid Number 1
Pin 12 - Heater

BASING DIAGRAM



EIA 12BJ

6GF5

MAXIMUM RATINGS

Horizontal-Deflection Amplifier Service - Design-Maximum Values¶

DC Plate-Supply Voltage (Boost + DC Power Supply)	770	Volts
Peak Positive Pulse Plate Voltage	5000	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Screen Voltage	220	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation#	9.0	Watts
Screen Dissipation	2.5	Watts
DC Cathode Current	160	Milliamperes
Peak Cathode Current	500	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point	200	C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics

Plate Voltage	60	250	Volts
Screen Voltage	150	150	Volts
Grid-Number 1 Voltage	0Δ	-26.5	Volts
Plate Resistance, approximate	---	260000	Ohms
Transconductance	---	4700	Micromhos
Plate Current	345	34	Milliamperes
Screen Current	33	1.6	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 1.0 Milliamperes	---	-46	Volts
Triode Amplification Factor**	---	4.2	

* T. M. of General Electric Company.

\+ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Δ Applied for short interval (two seconds maximum) so as not to damage tube.

** Triode connection (screen tied to plate) with Eb = Ec2 = 150 volts and Ec1 = -26.5 volts.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

ELECTRONIC INNOVATIONS IN ACTION

TUBES

Dissimilar Double Triode

6GF7-A

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

■ COLOR TV TYPE ■ T-9 ENVELOPE ■ DISSIMILAR DOUBLE TRIODE

The 6GF7-A is a dissimilar double triode designed for use as a combined vertical-deflection oscillator and amplifier in television receivers. Section one, a high-mu triode, is intended for service as an oscillator; section two, a low-mu, high-perveance triode, for service as an amplifier.

The 6GF7-A utilizes a T-9 bulb and features a 9-pin glass button base with a 0.687-inch circle.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current•	0.985	Amperes

Direct Interelectrode Capacitances, approximate♦

	Section 1	Section 2	
Grid to Plate: (g to p)	4.6	9.0	pf
Input: g to (h+k)	2.4	6.5	pf
Output: p to (h+k)	0.26	1.4	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E9-89, Button 9-Pin
Outline Drawing - EIA 9-108

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.630	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

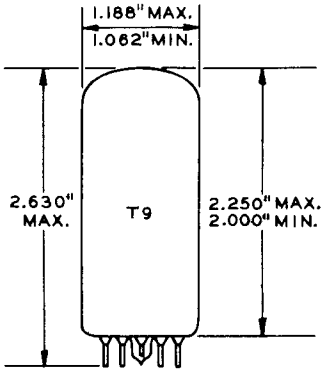
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

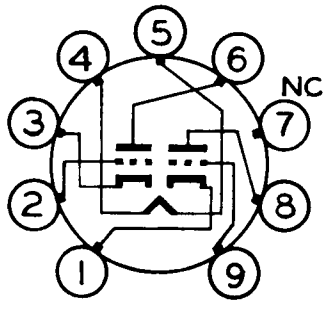


EIA 9-108

TERMINAL CONNECTIONS

Pin 1 - Cathode (Section 1)
Pin 2 - Grid (Section 2)
Pin 3 - Cathode (Section 2)
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Plate (Section 2)
Pin 7 - No Connection
Pin 8 - Plate (Section 1)
Pin 9 - Grid (Section 1)

BASING DIAGRAM



EIA 9QD

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES	Vertical Oscillator Service▲ (Section 1)	Vertical Deflection Amplifier▲ (Section 2)	
DC Plate Voltage	330	330	Volts
Peak Positive Pulse Plate Voltage	---	1500⊕	Volts
Peak Negative Grid Voltage	400	250	Volts
Plate Dissipation	1.5	11□	Watts
DC Cathode Current	22	50	Milliamperes
Peak Cathode Current	77	175	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance			
With Cathode Bias	2.2	2.2	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Section 1 (Oscillator)	Section 2 (Amplifier)		
Plate Voltage	250	60	150	Volts
Grid Voltage	-3.0	0§	-20	Volts
Amplification Factor	64	---	5.4	
Plate Resistance, approximate	40000	---	750	Ohms
Transconductance	1600	---	7200	Micromhos
Plate Current	1.4	95	50	Milliamperes
Plate Current, approximate				
E_c = -28 Volts	---	---	10	Milliamperes
Grid Voltage, approximate				
I_b = 10 Microamperes	-5.5	---	---	Volts
Grid Voltage, approximate				
I_b = 100 Microamperes	---	---	-45	Volts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

♦ Without external shield.

▲ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

⊕ Value given is to be considered as an Absolute-Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation, including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

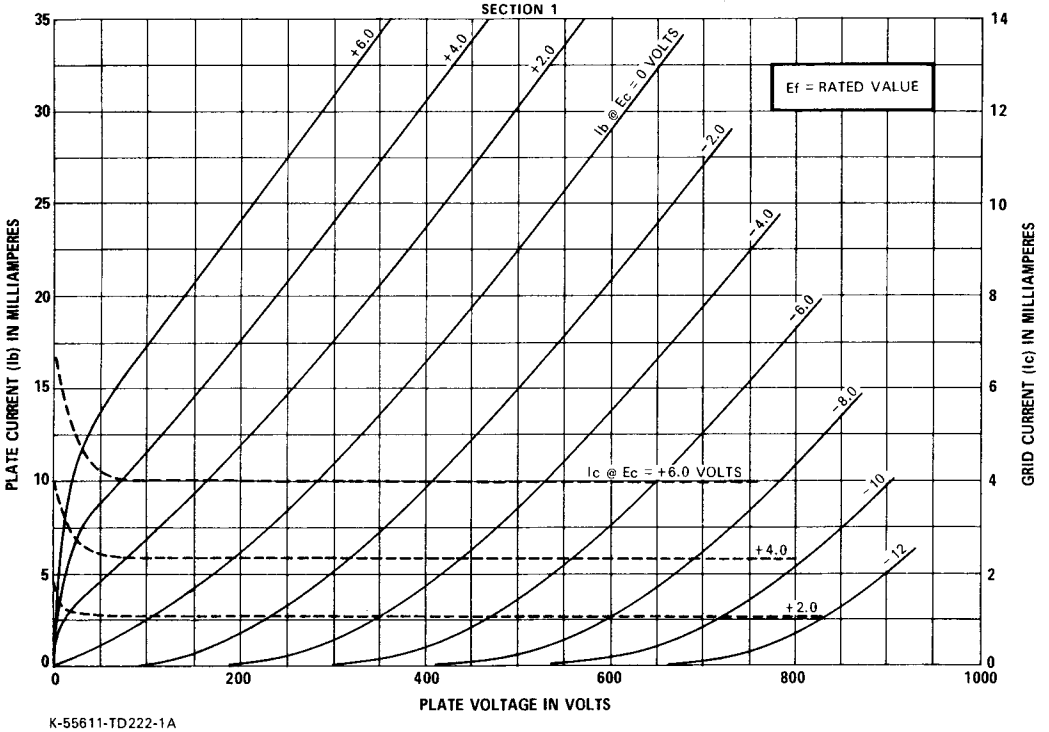
□ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

§ Applied for short interval (two seconds maximum) so as not to damage tube.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS

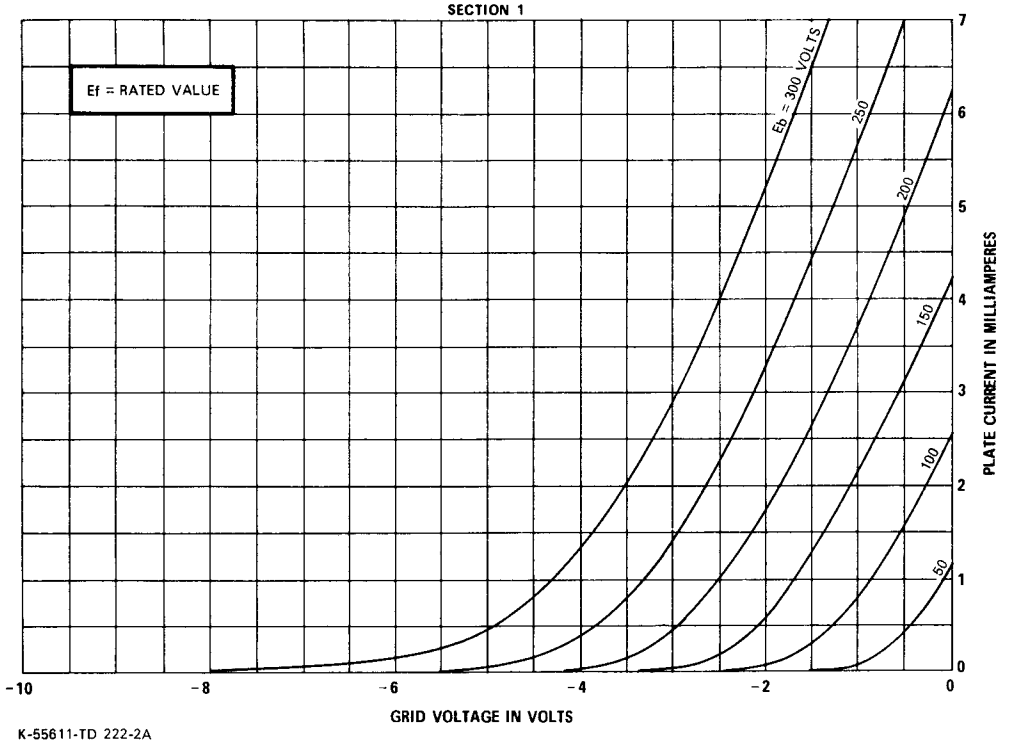
SECTION 1



K-55611-TD222-1A

AVERAGE TRANSFER CHARACTERISTICS

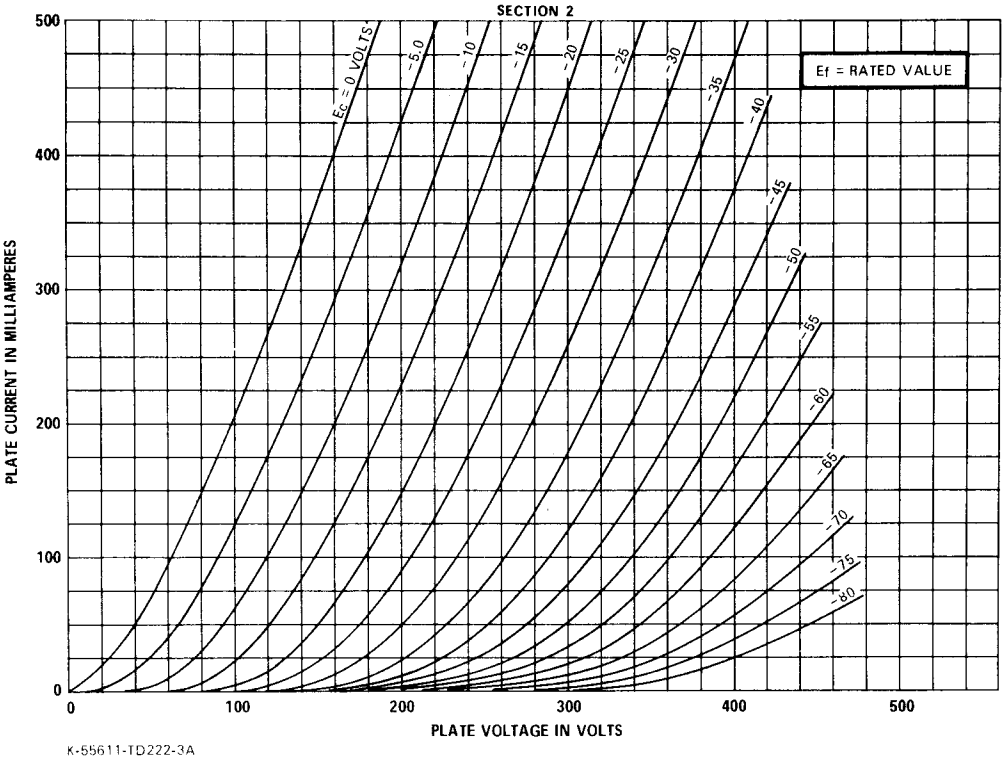
SECTION 1



K-55611-TD 222-2A

AVERAGE PLATE CHARACTERISTICS

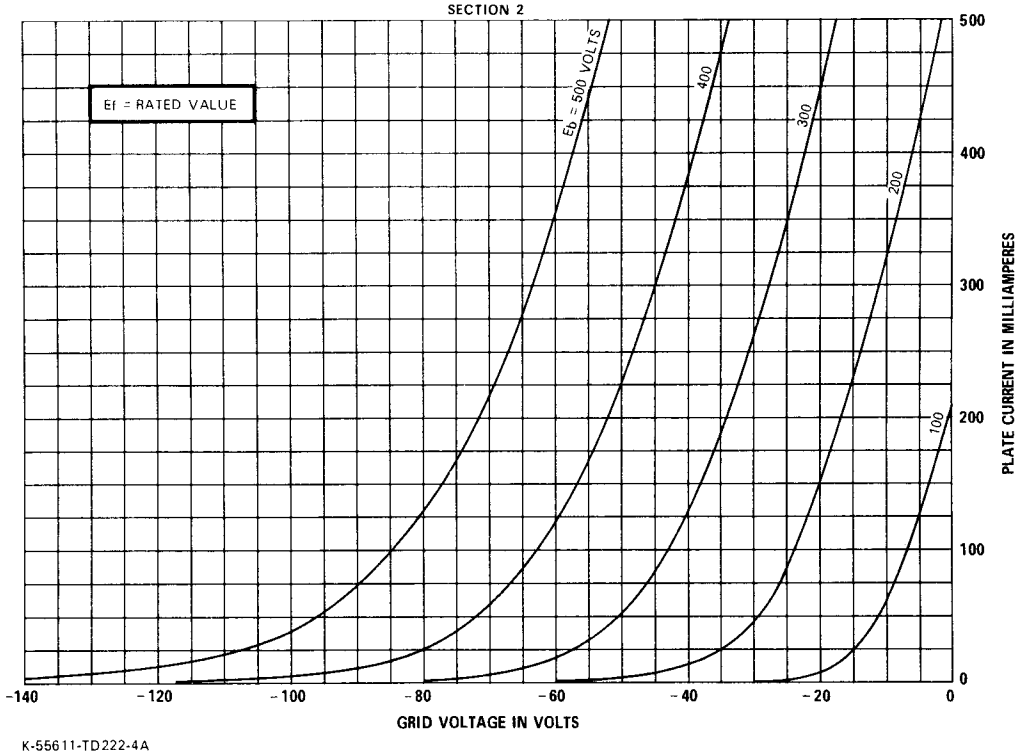
SECTION 2



K-55611-TD222-3A

AVERAGE TRANSFER CHARACTERISTICS

SECTION 2



K-55611-TD222-4A

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

Electronic TUBES

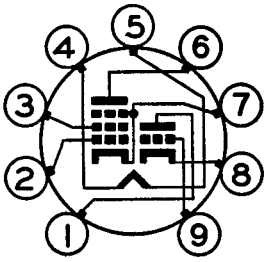
6GH8—5GH8
TRIODE-PENTODE

DESCRIPTION AND RATING

The 6GH8 is a miniature tube which contains a sharp-cutoff pentode and a medium-mu triode in one envelope. Each section has a separate cathode and is electrically independent. The pentode section is intended primarily for service as an oscillator in the horizontal deflection system of television receivers.

Except for heater characteristics, the 5GH8 is identical to the 6GH8.

BASING DIAGRAM



EIA 9AE

TERMINAL CONNECTIONS

Pin 1—Triode Plate
Pin 2—Pentode Grid Number 1
Pin 3—Pentode Grid Number 2 (Screen)
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Plate
Pin 7—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 8—Triode Cathode
Pin 9—Triode Grid

GENERAL

ELECTRICAL

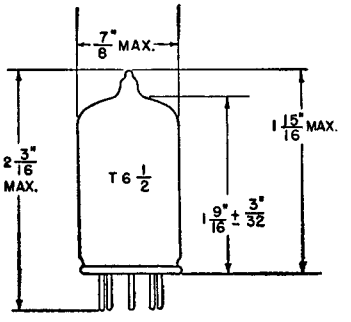
	5GH8	6GH8	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	4.7	6.3	Volts
Heater Current	0.6	0.45	Amperes
Heater Warm-up Time*	11	11	Seconds

Direct Interelectrode Capacitances	With Shield†	Without Shield	
Pentode Section			
Grid-Number 1 to Plate, maximum	0.01	0.02	μμf
Input	5.5	5.5	μμf
Output	3.4	2.6	μμf
Triode Section			
Grid to Plate	1.7	1.7	μμf
Input	3.6	3.4	μμf
Output	1.1	0.3	μμf
Heater to Cathode, Each Section§	3.0	3.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

PHYSICAL DIMENSIONS



EIA 6-2

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GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES	5GH8	6GH8	
Allowable Heater Current	0.56 to 0.64	0.42 to 0.48	Amperes

	Pentode Section (Horizontal Oscillator Service¶)	Triode Section	
DC Plate Voltage	350	330	Volts
Screen Supply Voltage	330	....	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Peak Negative DC Grid-Number 1 Voltage	175	....	Volts
Plate Dissipation	2.5	2.5	Watts
Screen Dissipation	0.55	....	Watts
DC Cathode Current	20	....	Milliamperes
Peak Cathode Current	300	....	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	2.2	2.2	Megohms
With Cathode Bias	2.2	2.2	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditons applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Pentode Section	Triode Section	
Plate Voltage	125	125	Volts
Screen Voltage	125	....	Volts
Grid-Number 1 Voltage	−1.0	−1.0	Volts
Amplification Factor	....	46	
Plate Resistance, approximate	200000	5400	Ohms
Transconductance	7500	8500	Micromhos
Plate Current	12	13.5	Milliamperes
Screen Current	4.0	....	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 10 Microamperes	−8	−8	Volts

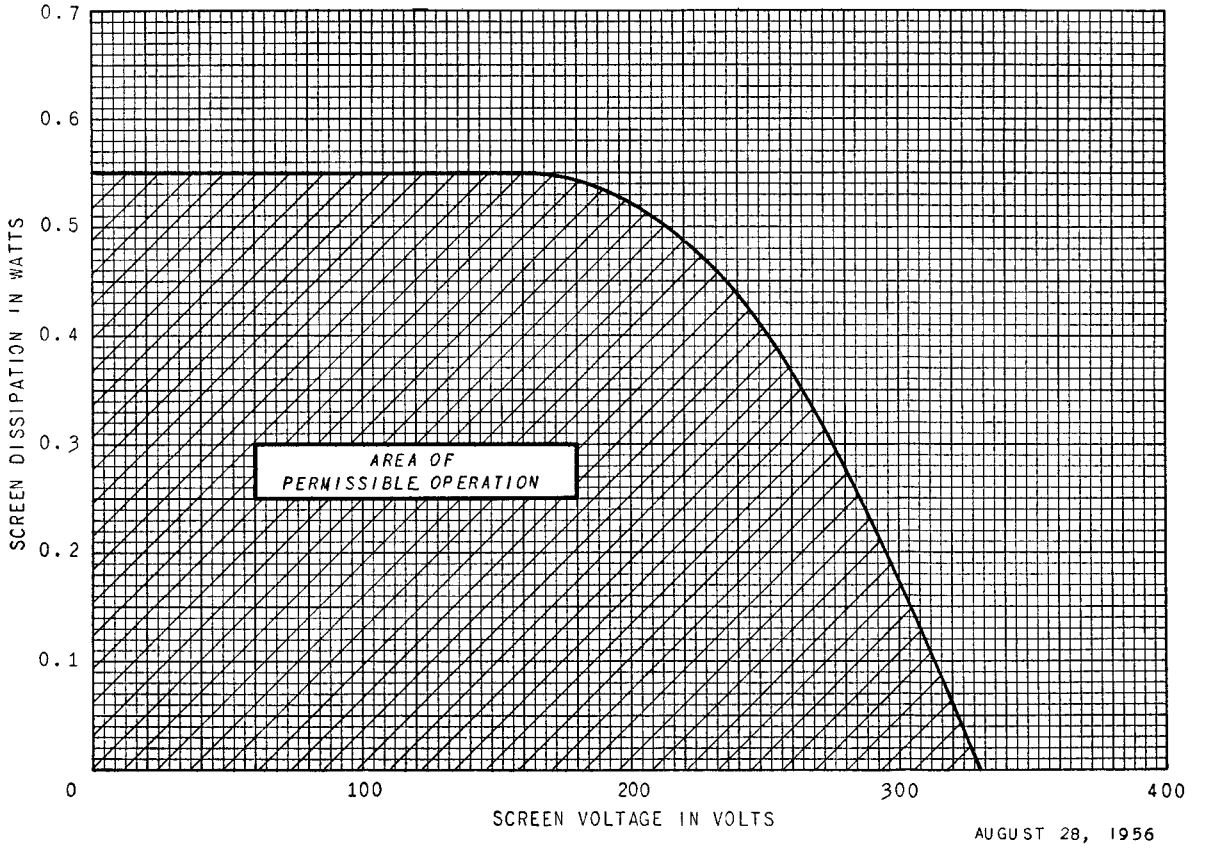
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (EIA 315) connected to cathode of section under test unless otherwise indicated.

§ With external shield (EIA 315) connected to ground.

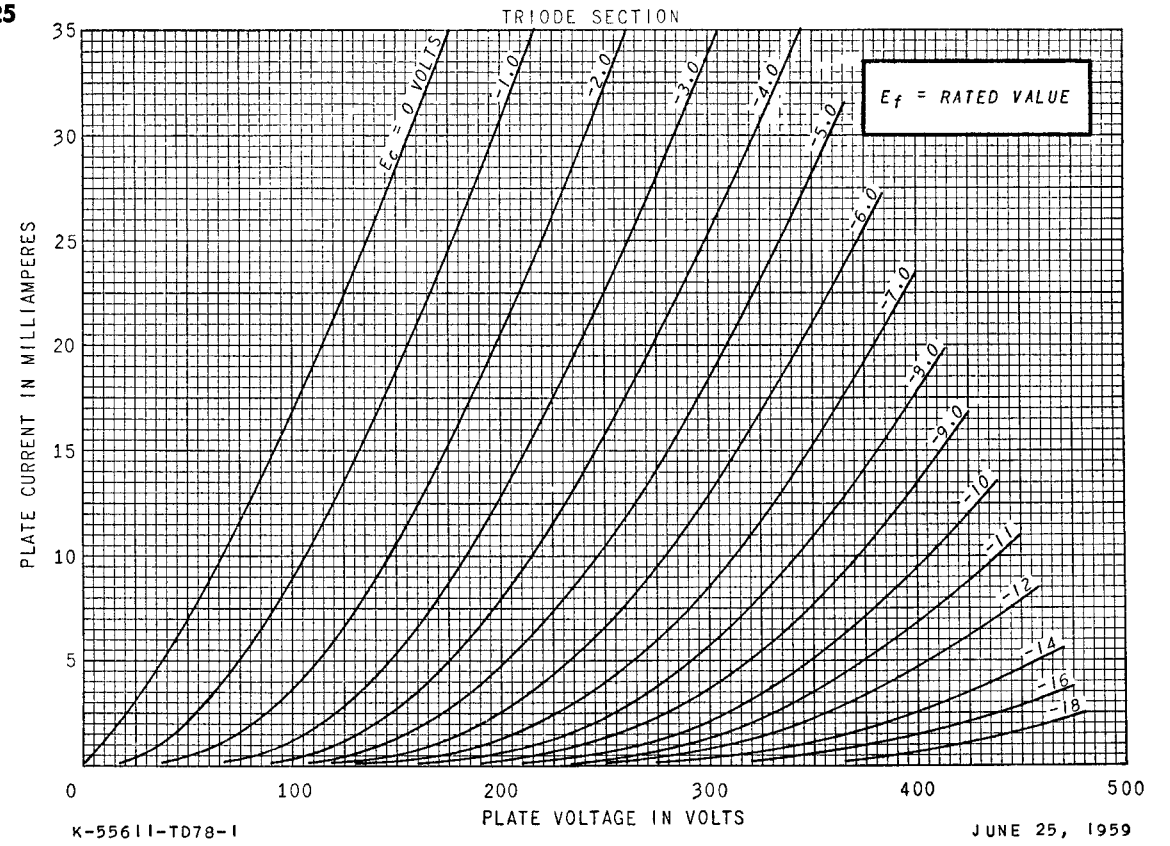
¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission.

SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION

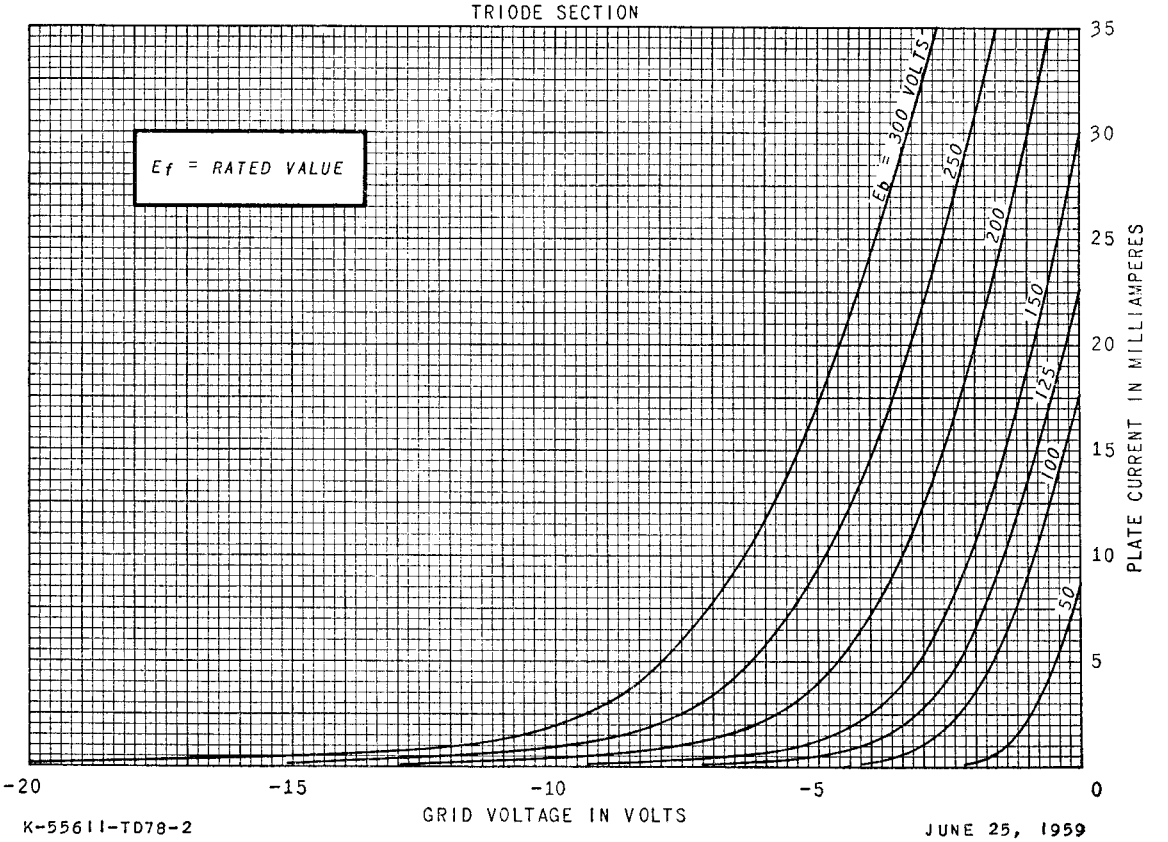


K-5561I-TD78-1

JUNE 25, 1959

AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION

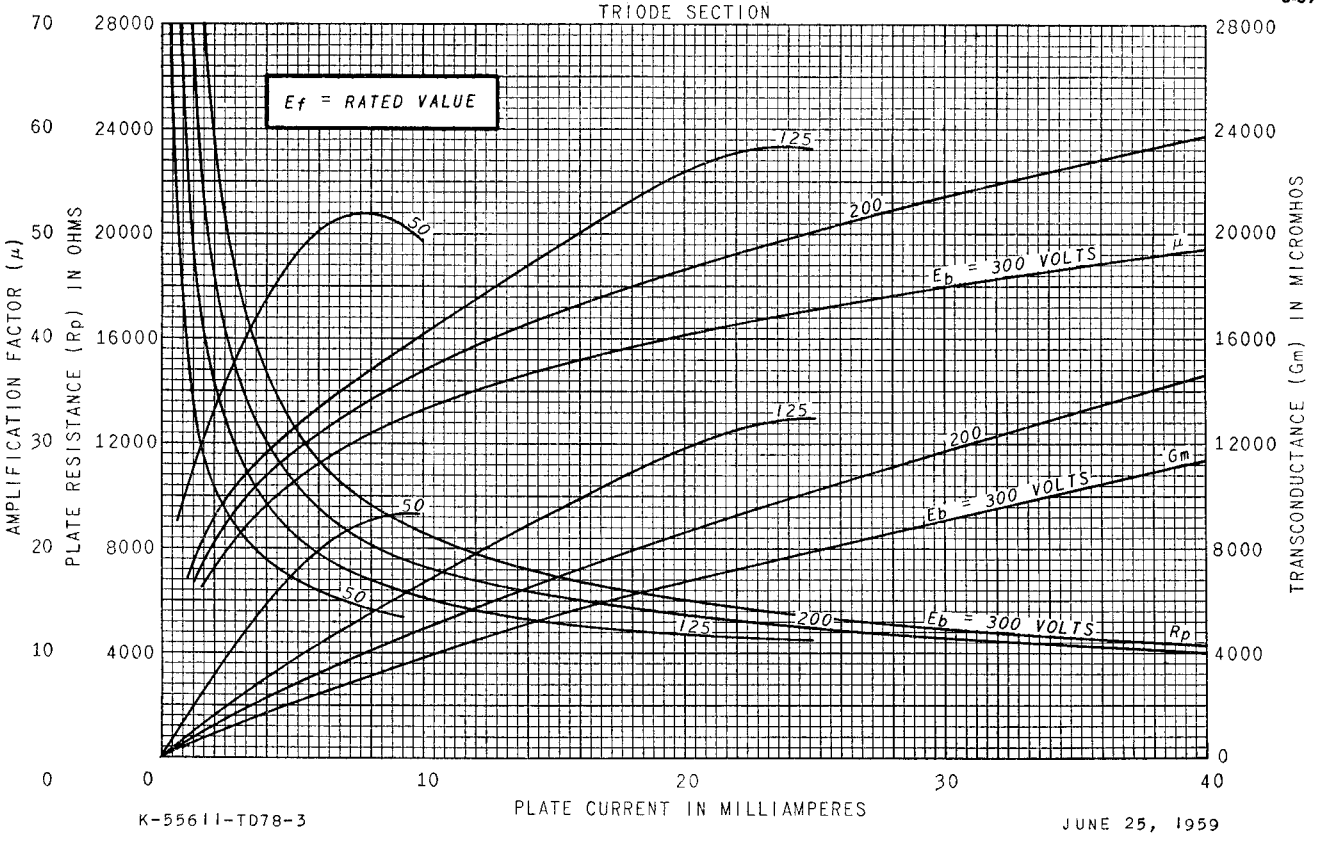


K-5561I-TD78-2

JUNE 25, 1959

AVERAGE CHARACTERISTICS

TRIODE SECTION

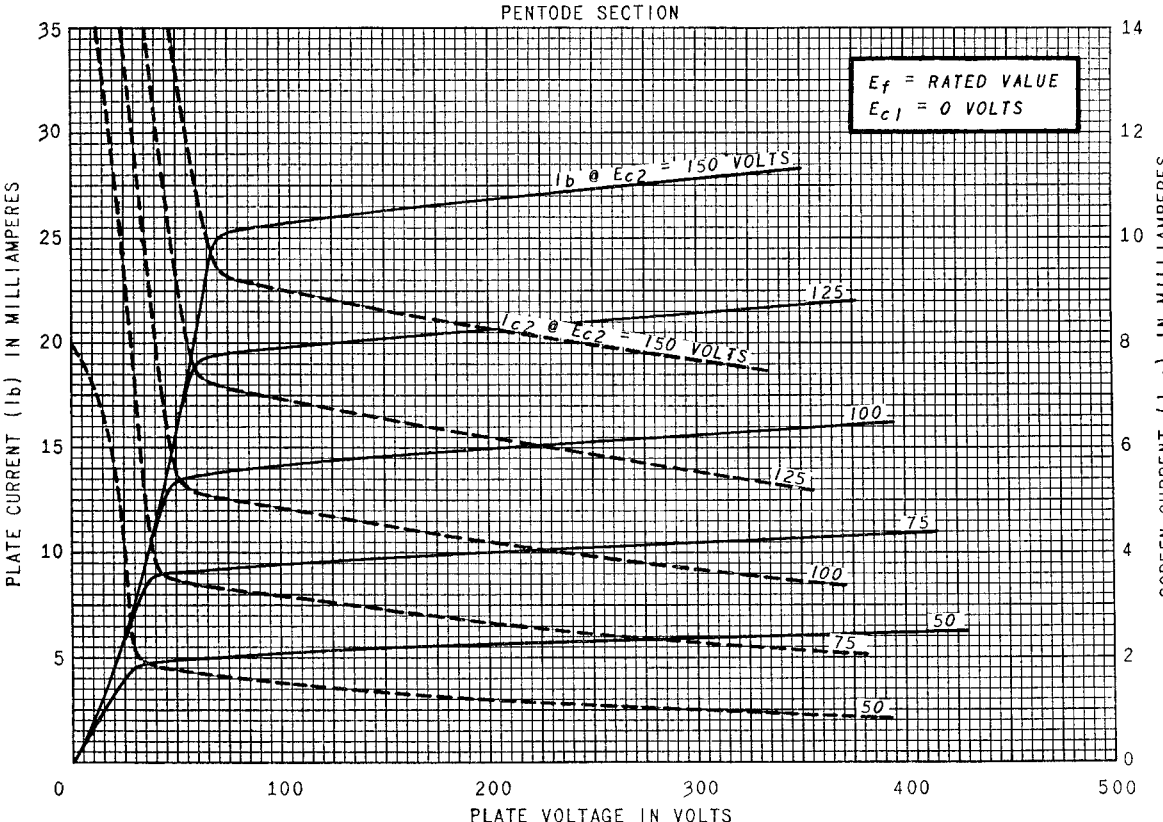


K-55611-TD78-3

JUNE 25, 1959

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

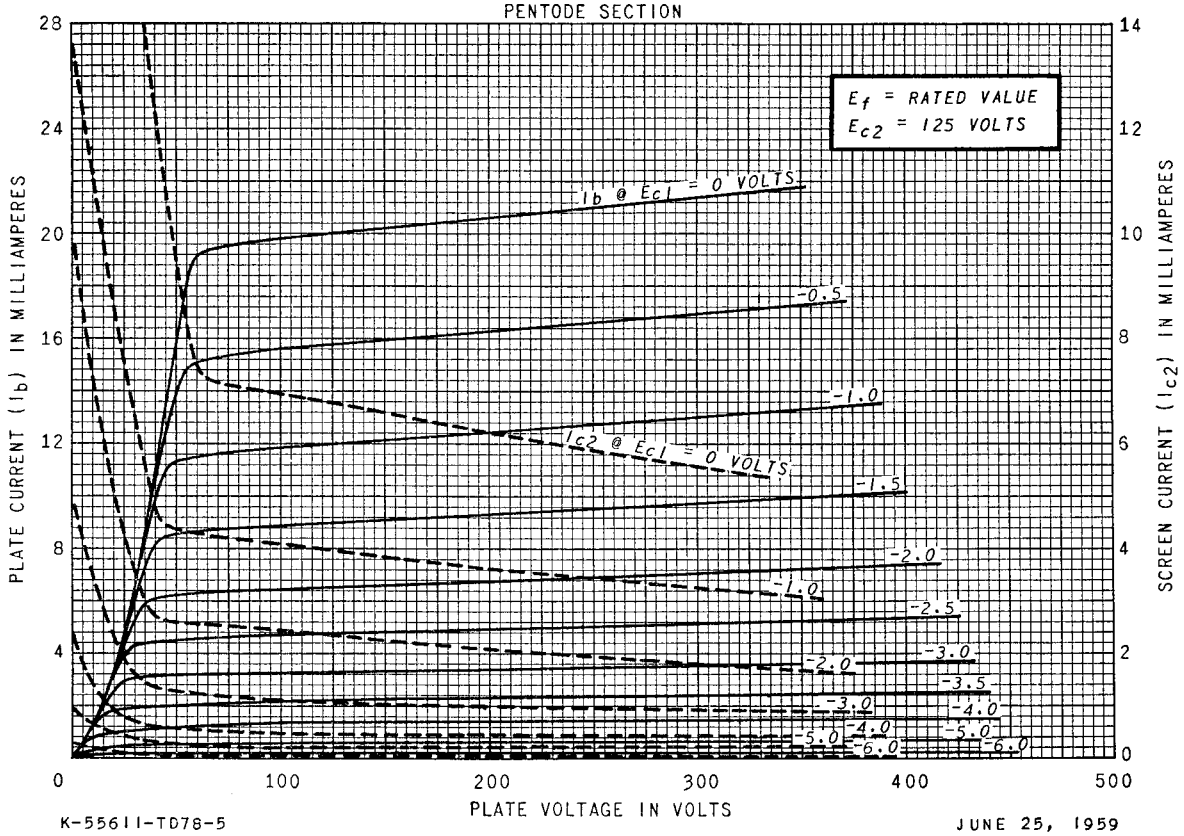


K-55611-TD78-4

JUNE 25, 1959

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

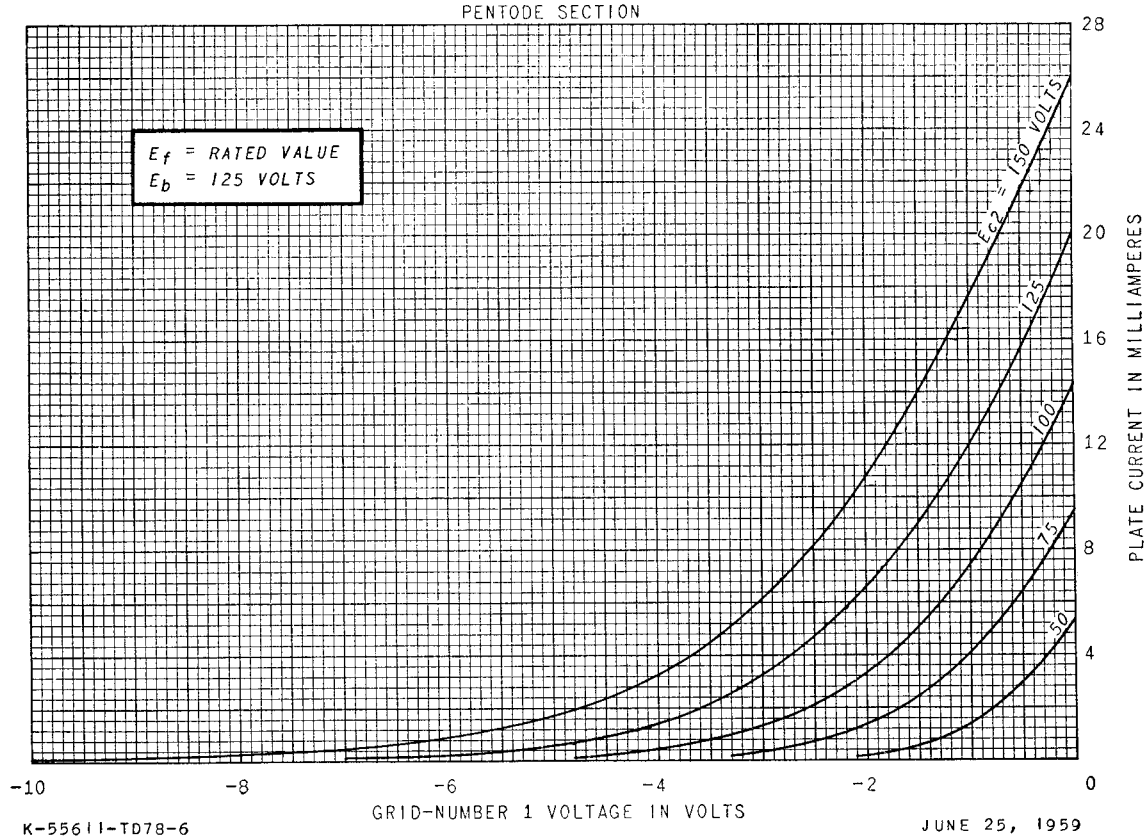


K-55611-TD78-5

JUNE 25, 1959

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

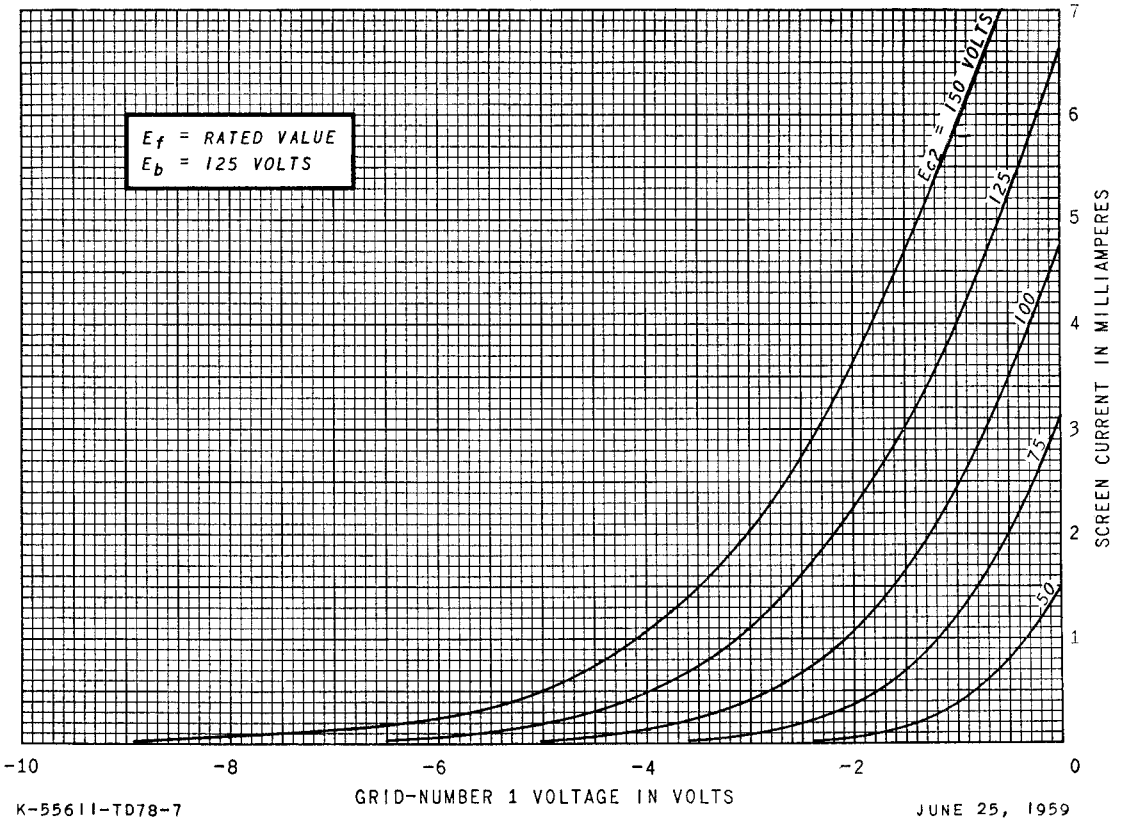


K-55611-TD78-6

JUNE 25, 1959

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

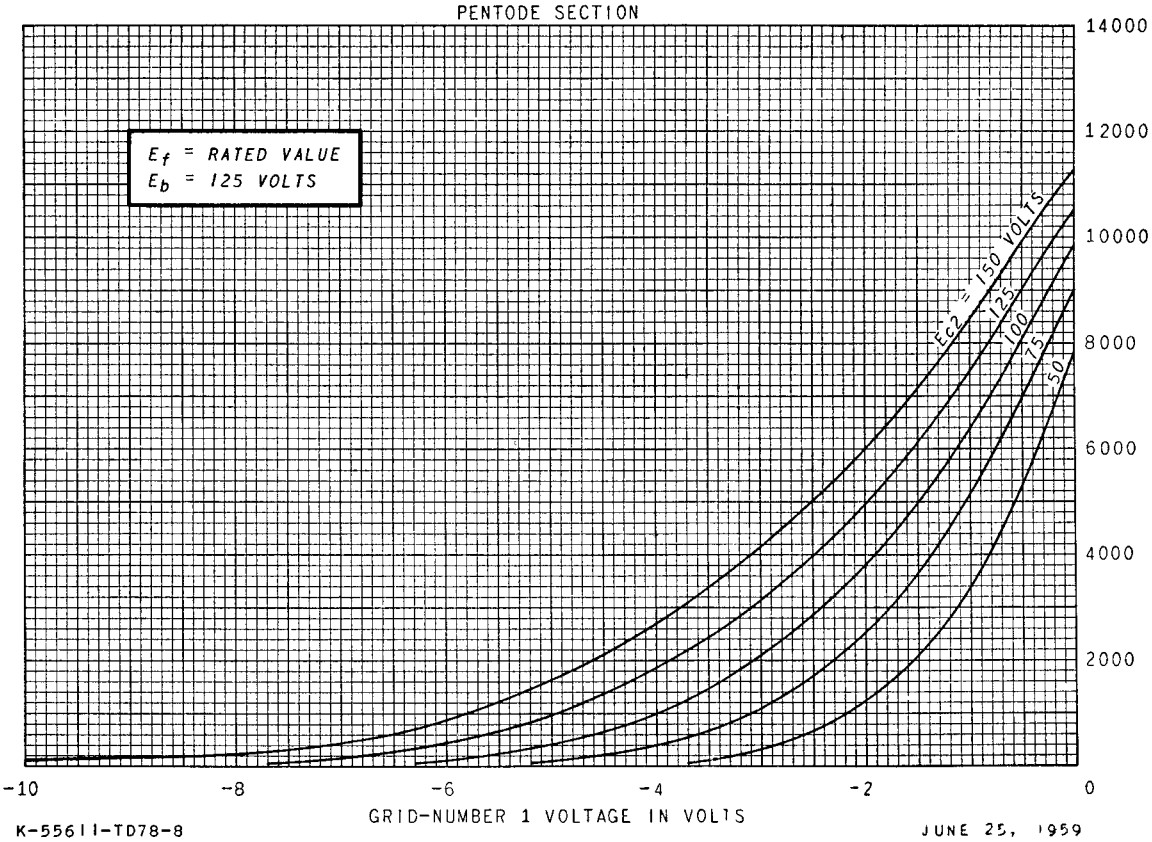


K-55611-TD78-7

JUNE 25, 1959

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



K-55611-TD78-8

JUNE 25, 1959

ELECTRONICS

6GH8-A

TRIODE-PENTODE

DESCRIPTION AND RATING

The 6GH8-A is a miniature tube which contains a sharp-cutoff pentode and a medium-mu triode. Each section has a separate cathode and is electrically independent. The pentode section is intended primarily for service as an oscillator in the horizontal-deflection system of television receivers.

Except for being controlled to assure low interelectrode leakage, the 6GH8-A is identical to the 6GH8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, average§	11	Seconds

Direct Interelectrode Capacitances

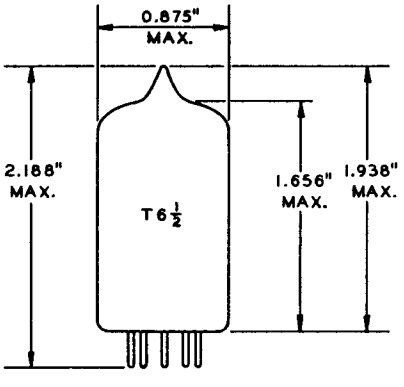
	With Shield	Without Shield	
Pentode Section			
Grid-Number 1 to Plate: (Pg1 to Pp), maximum	0.01¶	0.02	pf
Input: Pg1 to (h + k + Pg2 + Pg3 + i.s.)	5.0¶	5.0	pf
Output: Pp to (h + k + Pg2 + Pg3 + i.s.)	3.4¶	2.6	pf
Triode Section			
Grid to Plate: (Tg to Tp)	1.7#	1.7	pf
Input: Tg to (h + Tk + Pk + Pg3 + i.s.)	3.2#	3.0	pf
Output: Tp to (h + Tk + Pk + Pg3 + i.s.)	1.9#	1.4	pf
Heater to Cathode, Each Section△	3.0	3.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

Maximum Diameter	0.875	Inches
Maximum Over-all Length	2.188	Inches
Maximum Seated Height	1.938	Inches

PHYSICAL DIMENSIONS

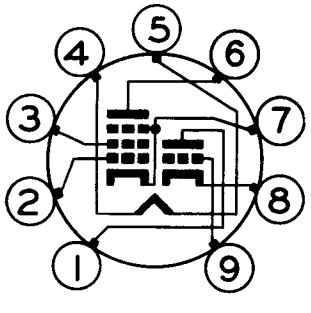


EIA 6-2

TERMINAL CONNECTIONS

Pin 1 - Triode Plate
Pin 2 - Pentode Grid Number 1
Pin 3 - Pentode Grid Number 2 (Screen)
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Plate
Pin 7 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 8 - Triode Cathode
Pin 9 - Griode Grid

BASING DIAGRAM



EIA 9AE

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section Horizontal Oscillator Service**	Triode Section	
DC Plate Voltage	350	330	Volts
Screen Supply Voltage	330	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Peak Negative DC Grid-Number 1 Voltage	175	---	Volts
Plate Dissipation	2.5	2.5	Watts
Screen Dissipation	0.55	---	Watts
DC Cathode Current	20	---	Milliamperes
Peak Cathode Current	300	---	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	2.2	2.2	Megohms
With Cathode Bias	2.2	2.2	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section	Triode Section	
Plate Voltage	125	125	Volts
Screen Voltage	125	---	Volts
Grid-Number 1 Voltage	-1.0	-1.0	Volts
Amplification Factor	---	46	
Plate Resistance, approximate	200000	5400	Ohms
Transconductance	7500	8500	Micromhos
Plate Current	12	13.5	Milliamperes
Screen Current	4.0	---	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	-8.0	-8.0	Volts

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

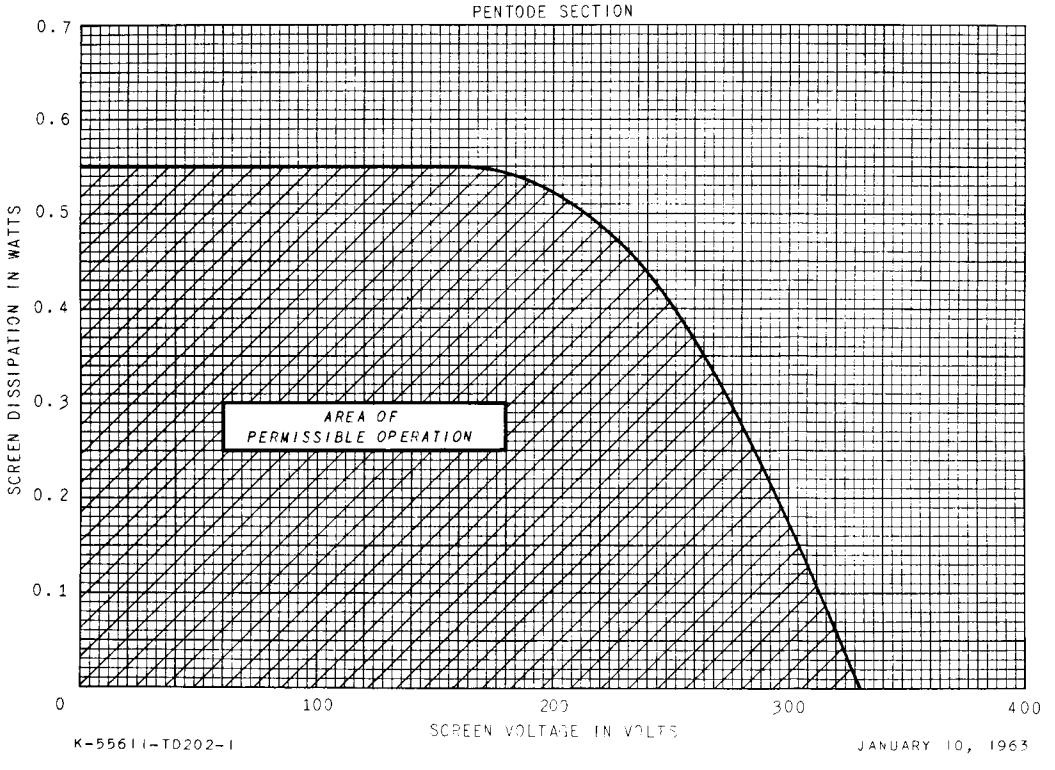
¶ With external shield (EIA 315) connected to pentode cathode.

With external shield (EIA 315) connected to triode cathode.

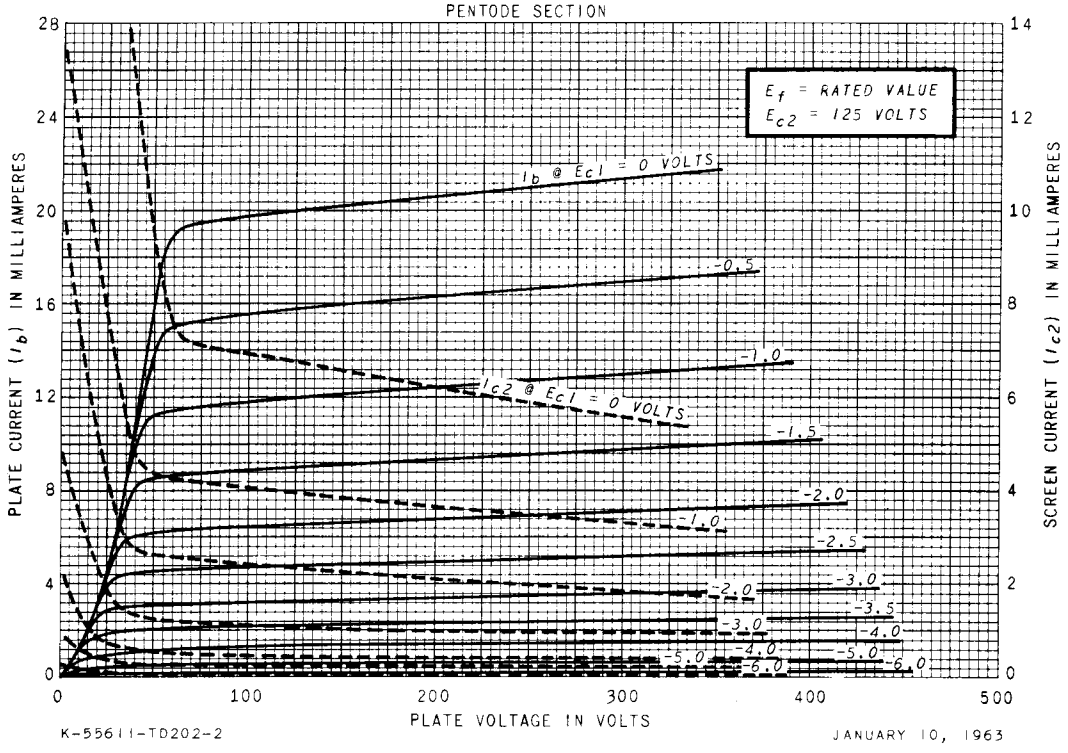
Δ With external shield (EIA 315) connected to ground.

** For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

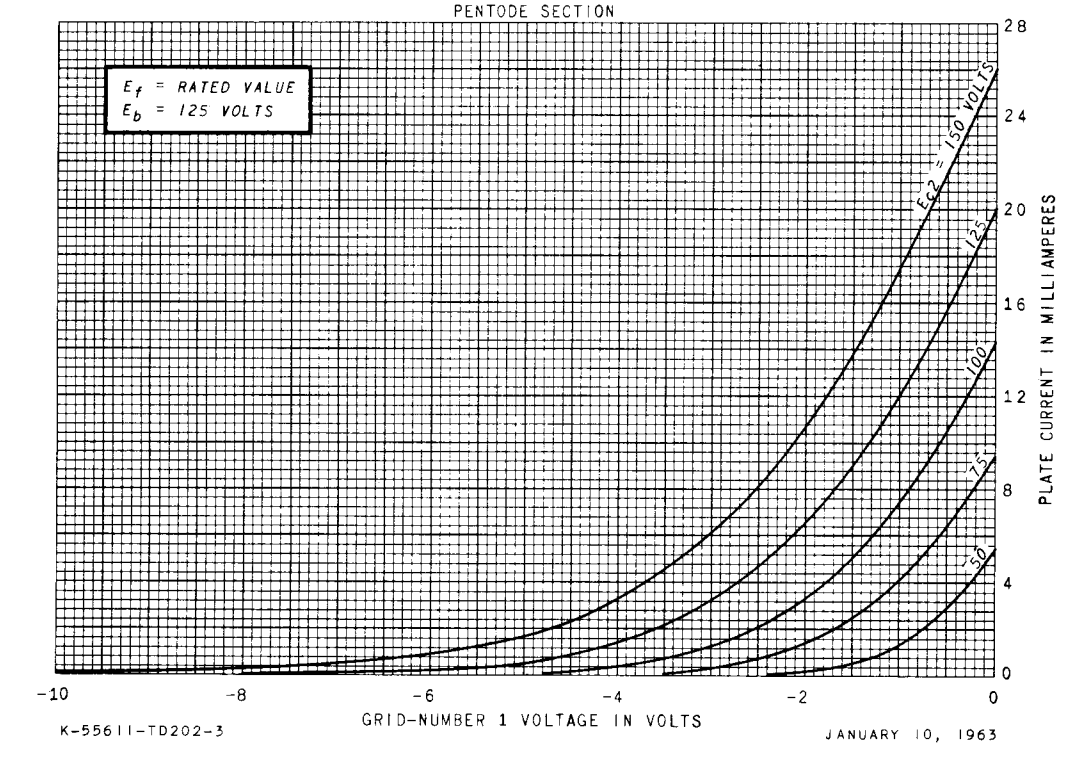
SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

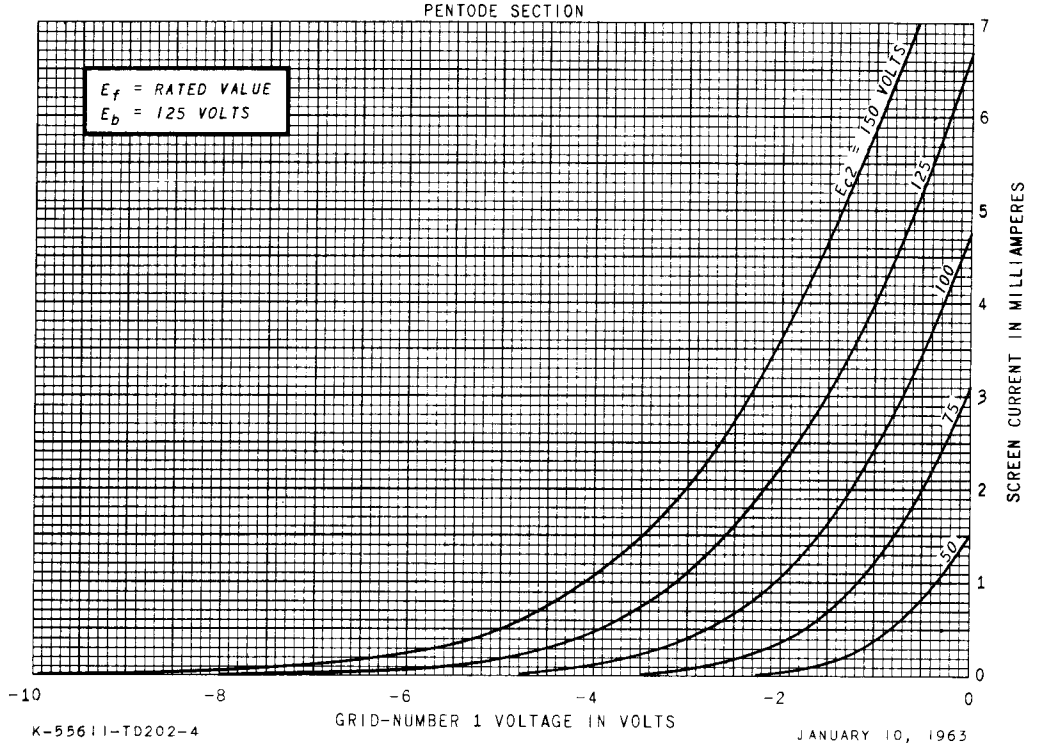


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

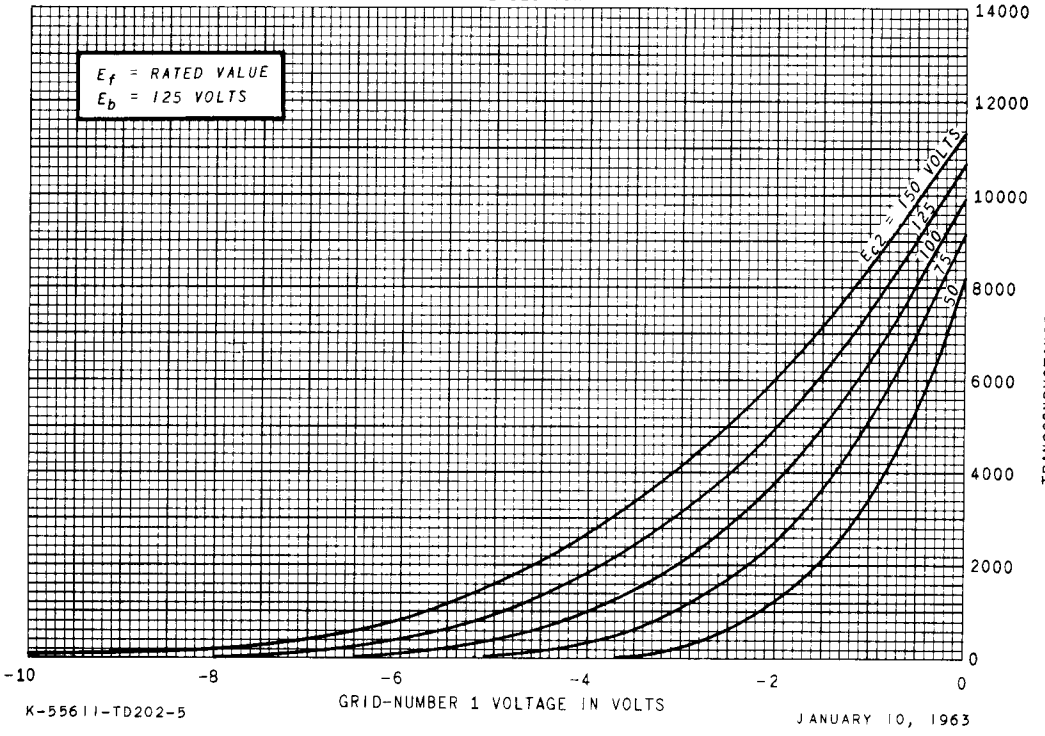


K-5561I-TD202-4

JANUARY 10, 1963

AVERAGE TRANSFER CHARACTERISTICS

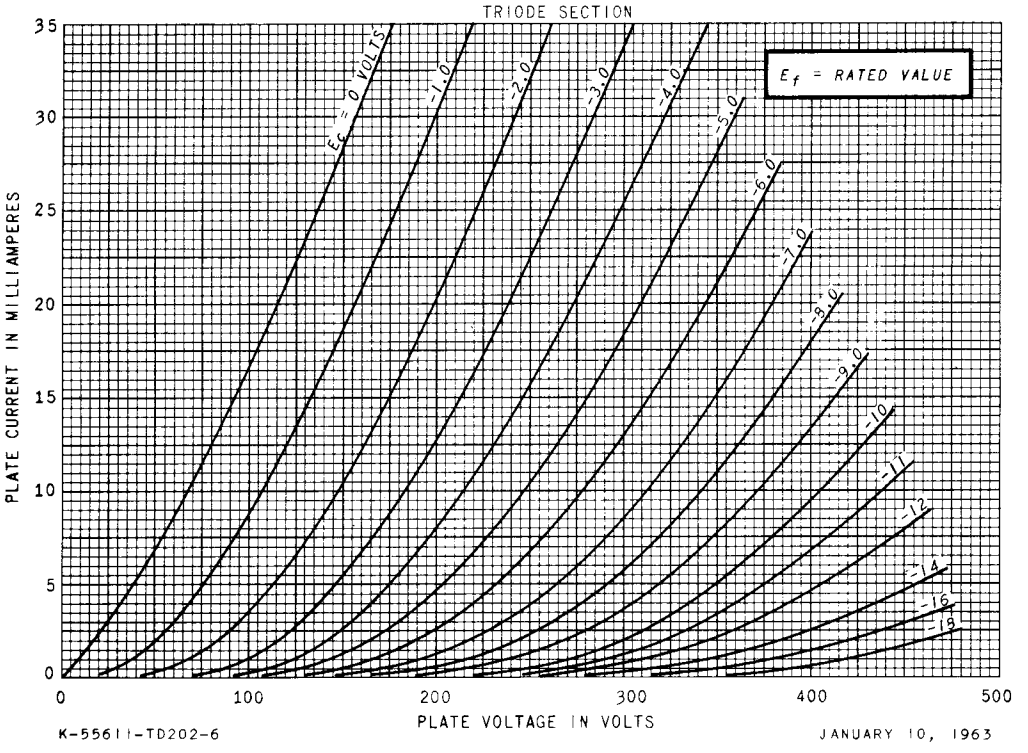
PENTODE SECTION



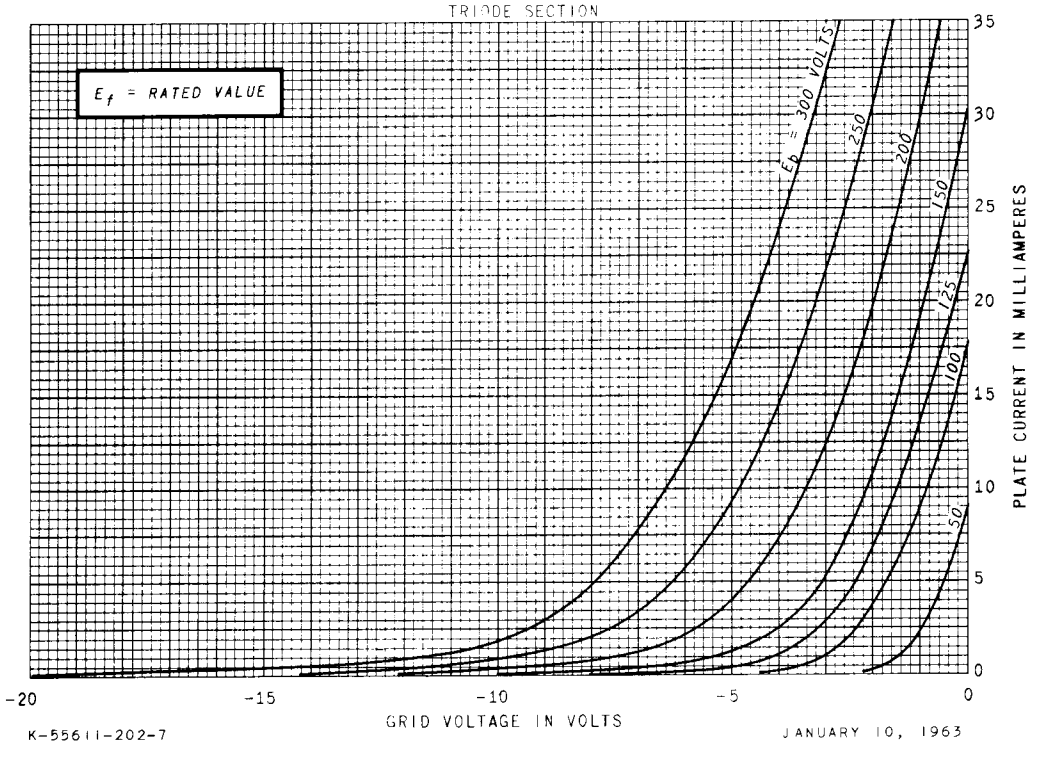
K-5561I-TD202-5

JANUARY 10, 1963

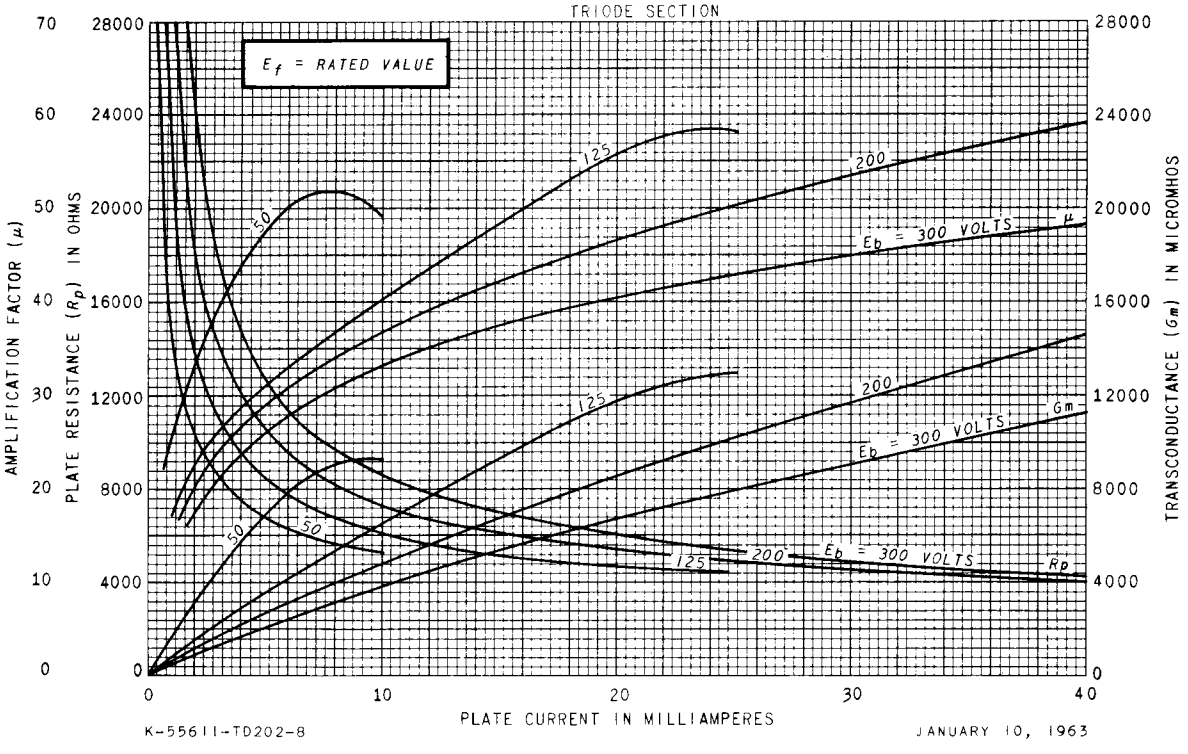
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



FRAME-GRID TRIODE

DESCRIPTION AND RATING

The 6GK5 is a frame-grid, gain-controlled triode designed for use as a VHF RF amplifier.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.18	Amperes
Direct Interelectrode Capacitances‡		
Grid to Plate: (g to p)	0.52	pf
Input: g to (h+k+i.s.)	5.0	pf
Output: p to (h+k+i.s.)	3.5	pf
Heater to Cathode: (h to k)	2.5	pf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin
Outline Drawing—EIA 5-2

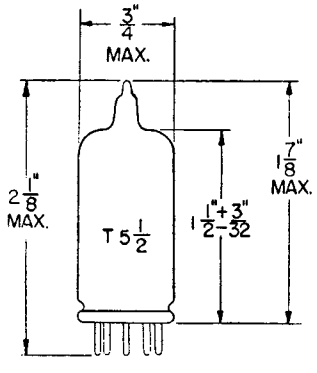
Maximum Diameter	¾	Inches
Maximum Over-all Length	2⅛	Inches
Maximum Seated Height	1⅞	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	200	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	2.5	Watts
DC Cathode Current	22	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	100	Volts
Grid Circuit Resistance		
With Cathode Bias	1.0	Megohms

PHYSICAL DIMENSIONS

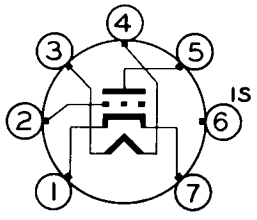


EIA 5-2

TERMINAL CONNECTIONS

Pin 1—Cathode
Pin 2—Grid
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Internal Shield
Pin 7—Cathode

BASING DIAGRAM



EIA 7FP

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	135	Volts
Grid Voltage	−1.0	Volts
Amplification Factor	78	
Plate Resistance, approximate	5400	Ohms
Transconductance	15000	Micromhos
Plate Current	11.5	Milliamperes
Grid Voltage, approximate Gm = 150 Micromhos	−4.2	Volts
Grid Voltage, approximate Gm = 1500 Micromhos	−2.5	Volts
Hot Input Resistance (200 MC)§	275	Ohms
Hot Input Capacitance (200 MC)§	11.2	pf
Noise Figure (200 MC)¶	4.7	db

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

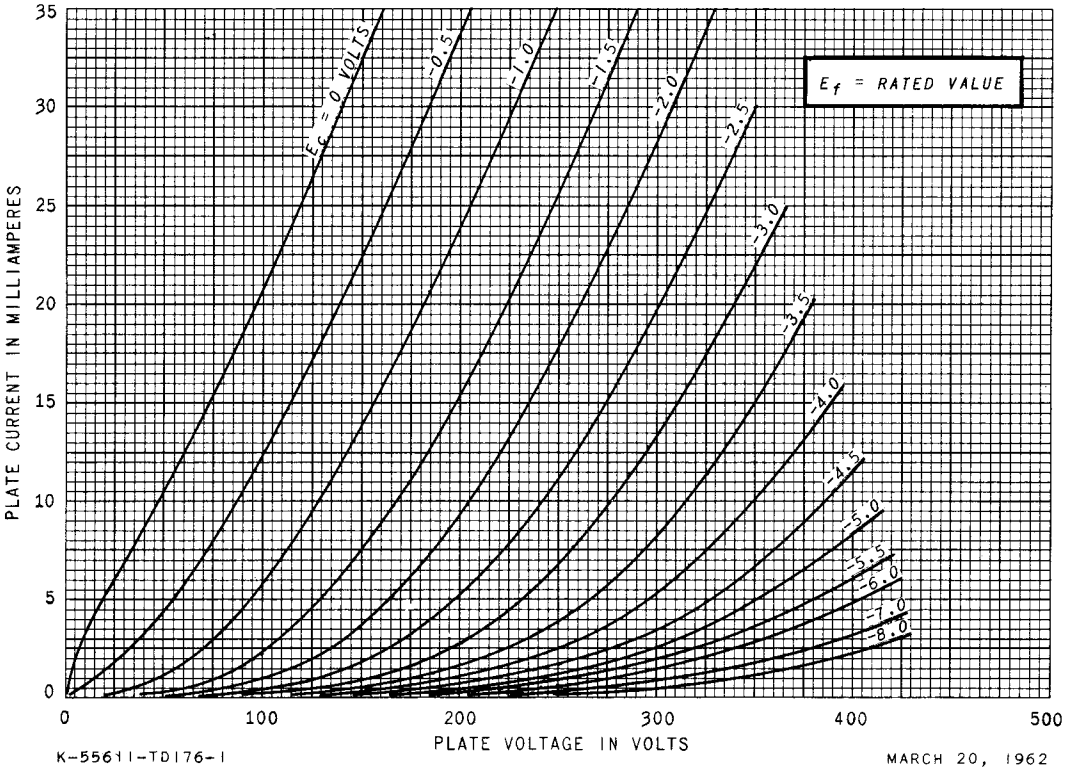
‡ With external shield (EIA 316) connected to cathode.

§ Measured under grounded-plate conditions.

¶ Optimized neutralized triode RF amplifier stage, noise matched.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

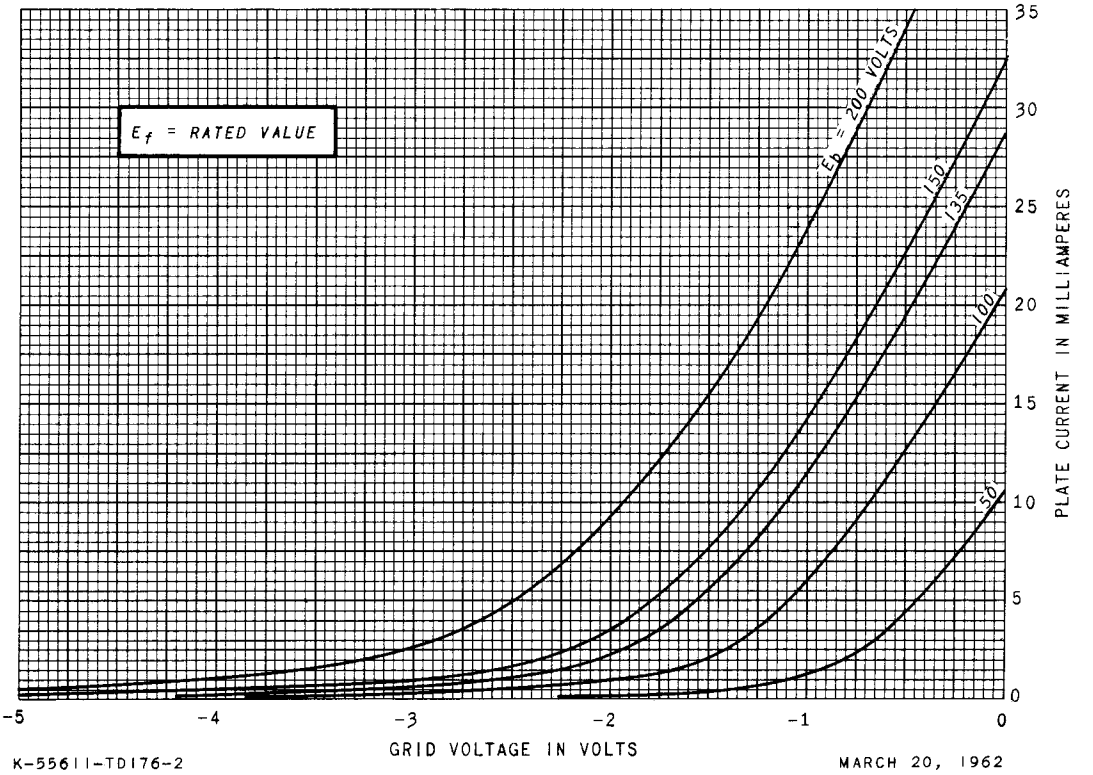
AVERAGE PLATE CHARACTERISTICS



K-5561I-TDI76-I

MARCH 20, 1962

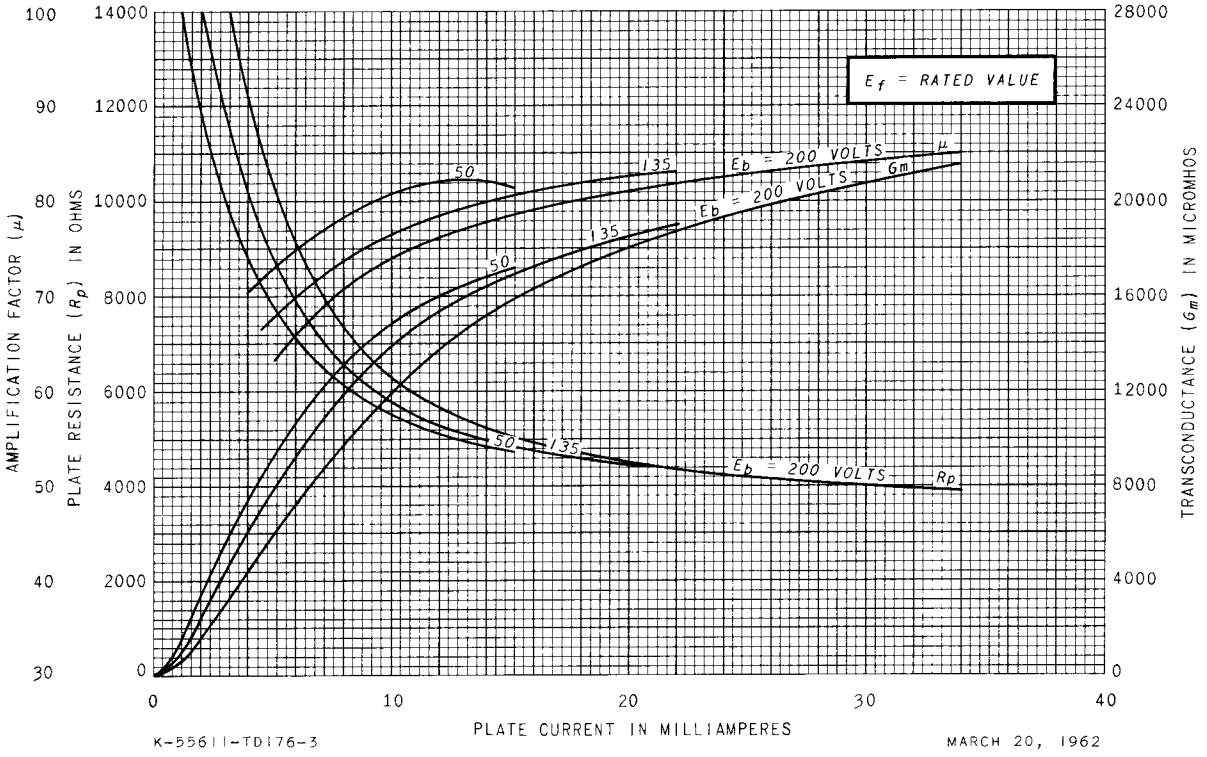
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TDI76-2

MARCH 20, 1962

AVERAGE CHARACTERISTICS



Beam Pentode

6GK6

TUBES

FOR AF POWER AMPLIFIER APPLICATIONS

The 6GK6 is a general-purpose power pentode that may be used either in audio output amplifier or video power output amplifier stages of television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	6.3 ± 0.6	Volts
Heater Current♦	0.76	Amperes

Direct Interelectrode Capacitances, approximate●

Grid Number 1 to Plate: (g1 to p), maximum	0.14	pf
Input: g1 to (h + k + g2 + g3 + i.s.)	10	pf
Output: p to (h + k + g2 + g3 + i.s.)	7.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-6½, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-4

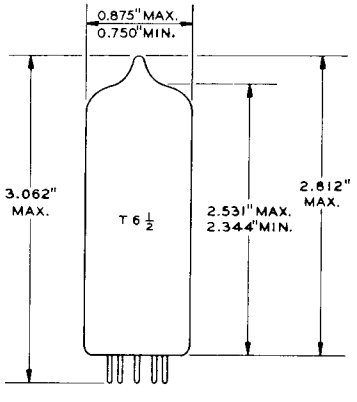
Maximum Diameter	0.875	Inches
Minimum Diameter	0.750	Inches
Maximum Over-all Length	3.062	Inches
Maximum Seated Height	2.812	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	330▲	Volts
Screen Voltage	330	Volts
Negative DC Grid-Number 1 Voltage	100	Volts
Plate Dissipation	13.2▲	Watts
Screen Dissipation, Average	2.0	Watts
Screen Dissipation, Peak	4.0	Watts
DC Cathode Current	65	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode	100	Volts
Heater Negative with respect to Cathode	100	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.3	Megohms
With Cathode Bias	1.0	Megohms

PHYSICAL DIMENSIONS

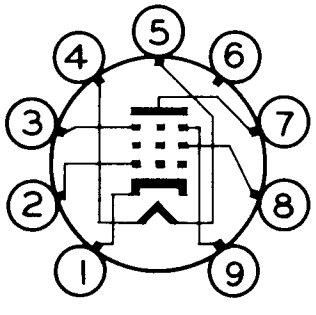


EIA 6-4

TERMINAL CONNECTIONS

Pin 1 - Cathode
Pin 2 - Grid Number 1
Pin 3 - Internal Shield and Grid Number 3 (Suppressor)
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - No Connection
Pin 7 - Plate
Pin 8 - Grid Number 2 (Screen)
Pin 9 - Internal Shield and Grid Number 3 (Suppressor)

BASING DIAGRAM



EIA 9GK

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MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	-7.3	Volts
Plate Resistance, approximate	38000	Ohms
Transconductance	11300	Micromhos
Zero-Signal Plate Current	48	Milliamperes
Zero-Signal Screen Current	5.5	Milliamperes
Load Resistance	5200	Ohms
Total Harmonic Distortion, approximate	10	Percent
Maximum-Signal Power Output	5.7	Watts
Amplification Factor of Grid Number 2 with respect to Grid Number 1, zero signal	19	

PUSH-PULL AMPLIFIER, VALUES FOR TWO TUBES

	Class AB		Class B		
Plate Voltage	250	300	250	300	Volts
Screen Voltage	250	300	250	300	Volts
Cathode-Bias Resistor	130	130	---	---	Ohms
Grid-Number 1 Voltage	---	---	-11.6	-14.7	Volts
Peak AF Grid-to-Grid Voltage	22.4	28	22.4	28	Volts
Zero-Signal Plate Current	62	72	20	15	Milliamperes
Maximum-Signal Plate Current	75	92	75	92	Milliamperes
Zero-Signal Screen Current	7.0	8.0	2.2	1.6	Milliamperes
Maximum-Signal Screen Current	15	22	15	22	Milliamperes
Effective Load Resistance, Plate-to-Plate	8000	8000	8000	8000	Ohms
Total Harmonic Distortion	3.0	4.0	3.0	4.0	Percent
Maximum-Signal Power Output	11	17	11	17	Watts

NOTES

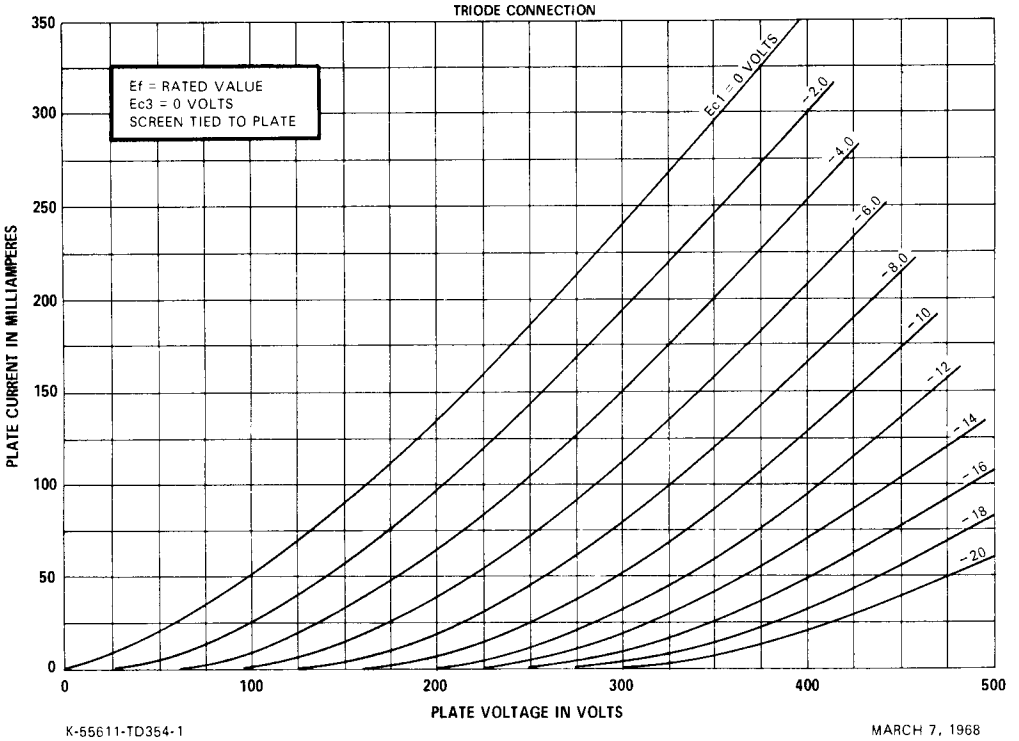
★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

♦ Heater current of a bogey tube at Ef = 6.3 volts.

● Without external shield.

▲ When the heater and positive voltage are obtained from a storage battery by means of a vibrator, the maximum values of plate and screen voltages are 275 volts and the plate dissipation is 9.9 watts.

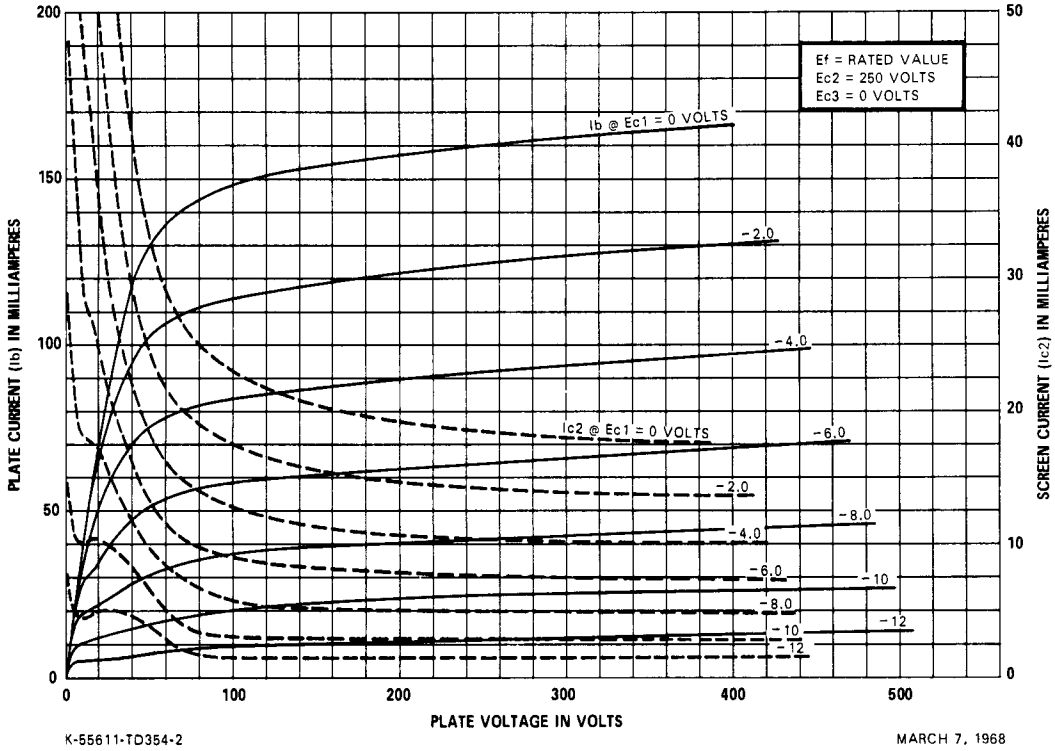
AVERAGE PLATE CHARACTERISTICS



K-55611-TD354-1

MARCH 7, 1968

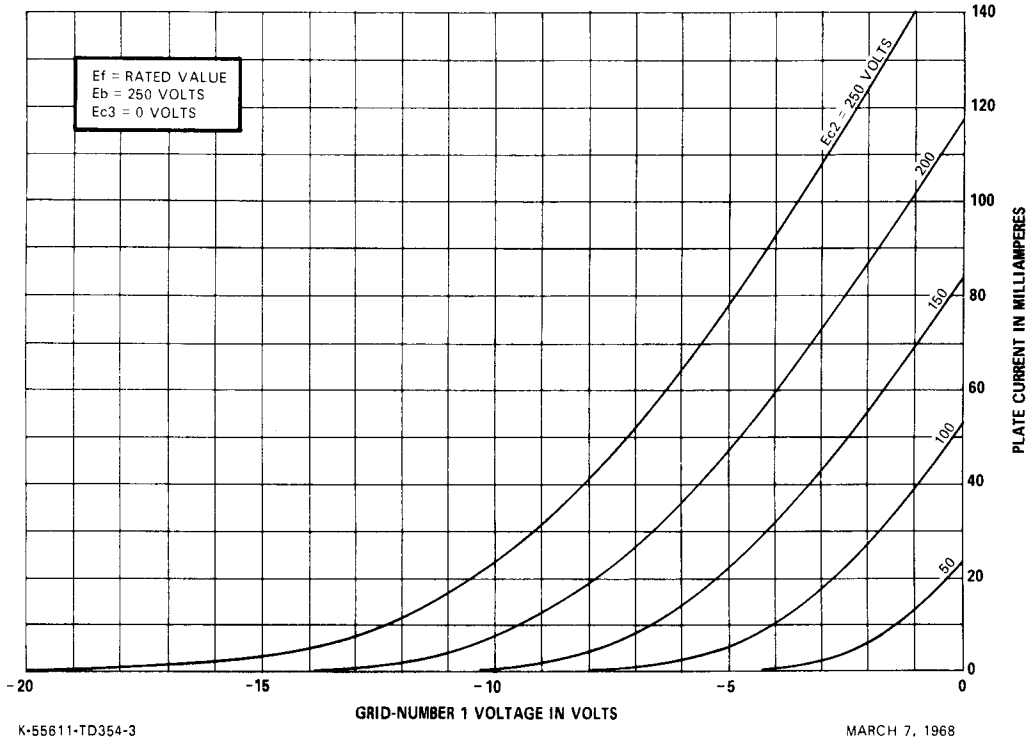
AVERAGE PLATE CHARACTERISTICS



K-55611-TD354-2

MARCH 7, 1968

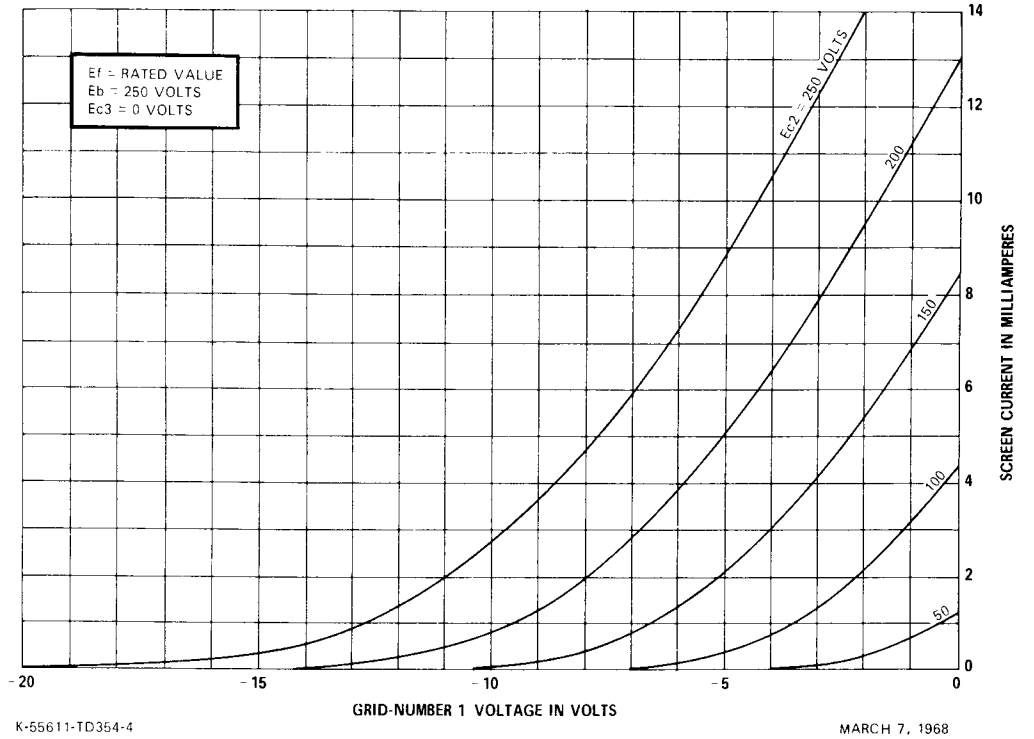
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD354-3

MARCH 7, 1968

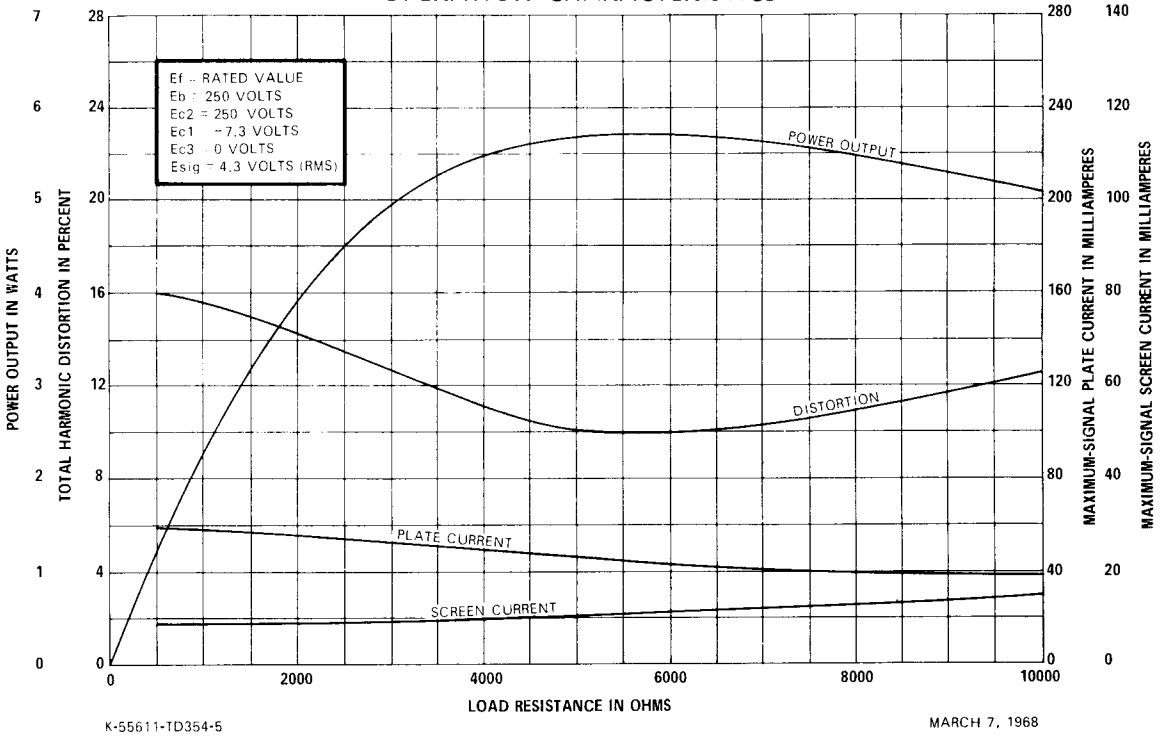
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD354-4

MARCH 7, 1968

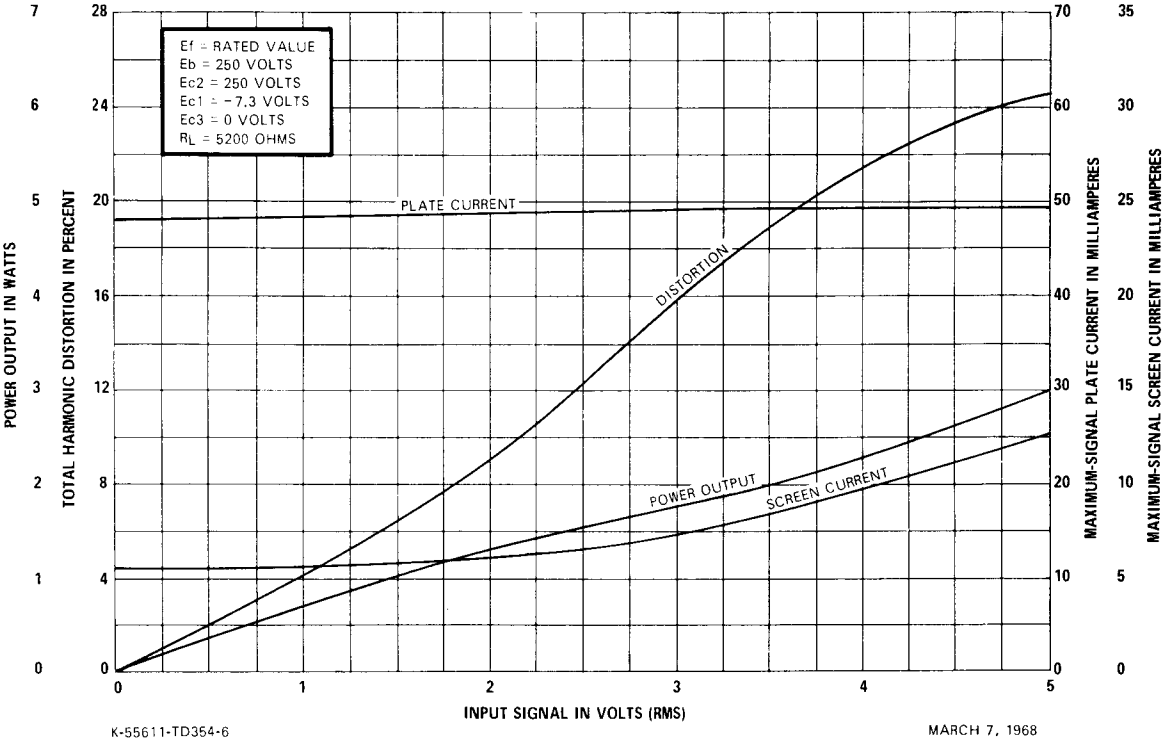
OPERATION CHARACTERISTICS



K-55611-TD354-5

MARCH 7, 1968

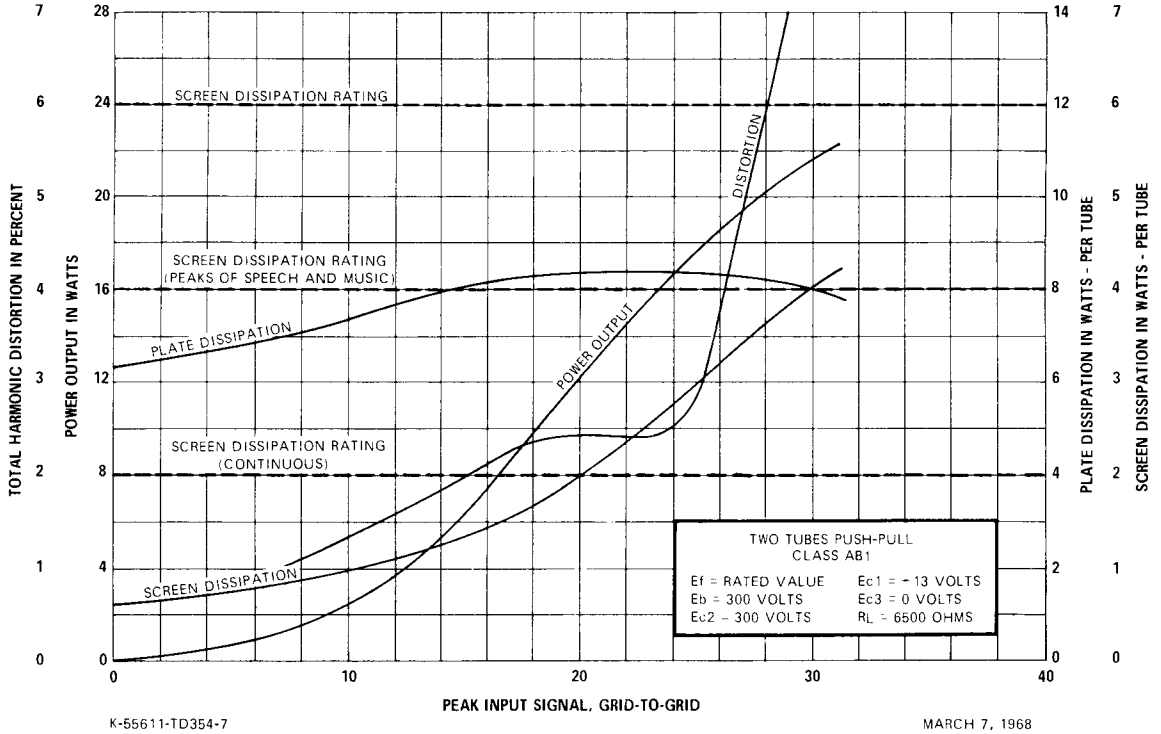
OPERATION CHARACTERISTICS



K-55611-TD354-6

MARCH 7, 1968

OPERATION CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONICS

6GL7

DISSIMILAR DOUBLE TRIODE

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6GL7 is a dissimilar double triode designed for use as a combined vertical-deflection oscillator and amplifier in television receivers. Section 1, a high-mu triode, is intended for service as an oscillator; Section 2, a low-mu, high-perveance triode, for service as an amplifier.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current†	1.05	Amperes

Direct Interelectrode Capacitances, approximate‡

	Section 1	Section 2	
Grid to Plate: (g to p)	4.0	8.0	pf
Input: g to (h + k)	2.2	6.0	pf
Output: p to (h + k)	0.6	1.3	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - B8-6, Intermediate-Shell Octal 8-Pin
Outline Drawing - EIA 9-5

Maximum Diameter	1.281	Inches
Maximum Over-all Length	3.000	Inches
Maximum Seated Height	2.438	Inches

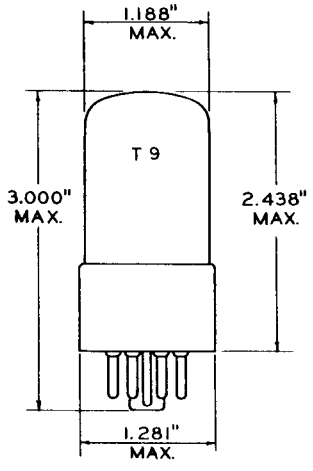
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

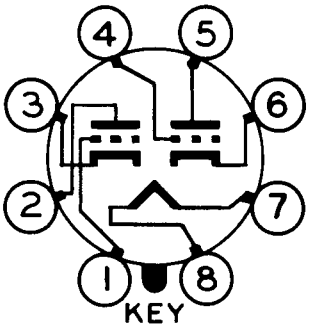


EIA 9-5

TERMINAL CONNECTIONS

Pin 1 - Grid (Section 2)
Pin 2 - Plate (Section 2)
Pin 3 - Cathode (Section 2)
Pin 4 - Grid (Section 1)
Pin 5 - Plate (Section 1)
Pin 6 - Cathode (Section 1)
Pin 7 - Heater
Pin 8 - Heater

BASING DIAGRAM



EIA 8BD

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

	Vertical Oscillator Service (Section 1) §	Vertical Deflection Amplifier (Section 2) §	
DC Plate Voltage	350	550	Volts
Peak Positive Pulse Plate Voltage	---	1500	Volts
Peak Negative Grid Voltage	400	250	Volts
Plate Dissipation	1.0	10¶	Watts
DC Cathode Current	---	50	Milliamperes
Peak Cathode Current	---	175	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance			
With Fixed Bias	1.0	1.0	Megohms
With Cathode Bias	2.2	2.2	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Section 1 (Oscillator)		Section 2 (Amplifier)		
Plate Voltage	250	275	60	175	Volts
Grid Voltage	-3.0	#	0Δ	-25	Volts
Amplification Factor	66	---	---	5	
Plate Resistance, approximate	30000	---	---	780	Ohms
Transconductance	2200	1600	---	6400	Micromhos
Plate Current	2.0	13	100	46	Milliamperes
Grid Voltage, approximate Ib = 20 Microamperes	-5.3	---	---	---	Volts
Grid Voltage, approximate Ib = 200 Microamperes	---	---	---	-60	Volts

FOOTNOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¶ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Adjusted for Ib = 13 milliamperes.

Δ Applied for short interval (two seconds maximum) so as not to damage tube.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

6GM6

PENTODE

DESCRIPTION AND RATING

The 6GM6 is a miniature, semiremote-cutoff pentode designed for use in gain-controlled, intermediate-frequency amplifier stages of television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current†	0.4	Amperes
Direct Interelectrode Capacitances‡		
Grid-Number 1 to Plate; (g1 to p), maximum	0.036	pf
Input: g1 to (h + k + g2 + g3 + i.s.)	10	pf
Output: p to (h + k + g2 + g3 + i.s.)	2.4	pf

MECHANICAL

Operating Position - Any
Envelope - T-5 1/2, Glass
Base - E7-1, Miniature Button 7-Pin
Outline Drawing - EIA 5-2

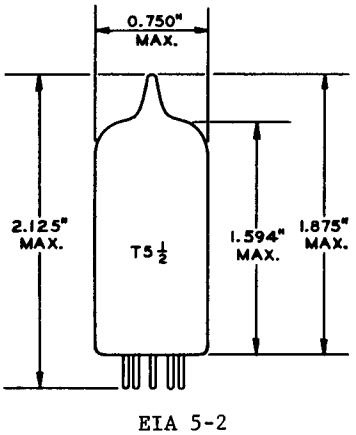
Maximum Diameter	0.750	Inches
Maximum Over-all Length	2.125	Inches
Maximum Seated Height	1.875	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	330	Volts
Suppressor Voltage	0	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	3.1	Watts
Screen Dissipation	0.65	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

PHYSICAL DIMENSIONS

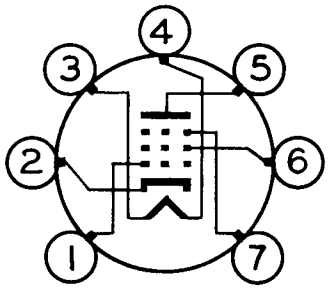


EIA 5-2

TERMINAL CONNECTIONS

Pin 1 - Grid Number 1
Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Grid Number 3 (Suppressor) and Internal Shield

BASING DIAGRAM



EIA 7CM

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	125	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Plate Resistance, approximate	0.2	Megohms
Transconductance	13000	Micromhos
Plate Current	14	Milliamperes
Screen Current	3.4	Milliamperes
Grid-Number 1 Voltage, approximate		
Gm = 60 Micromhos	-15	Volts

NOTES

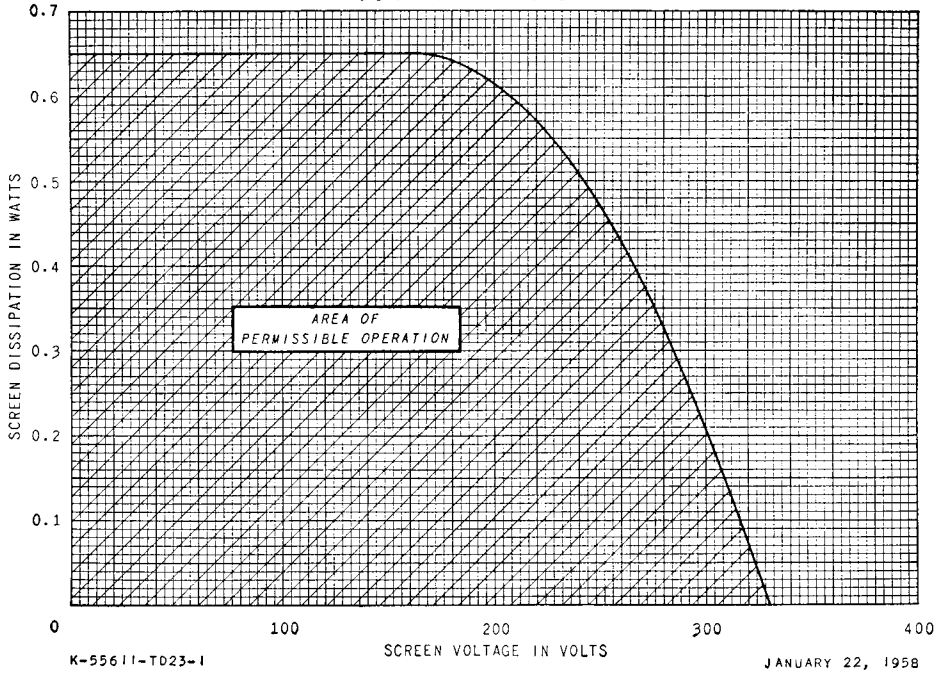
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

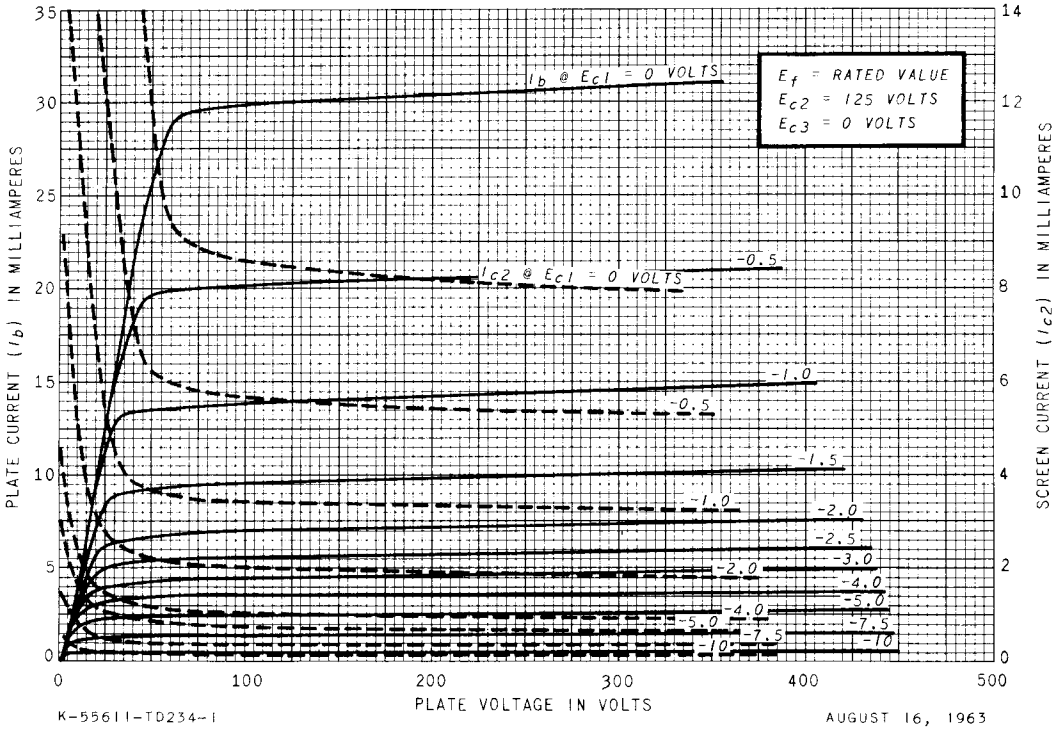
‡ Without external shield.

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SCREEN RATING CHART



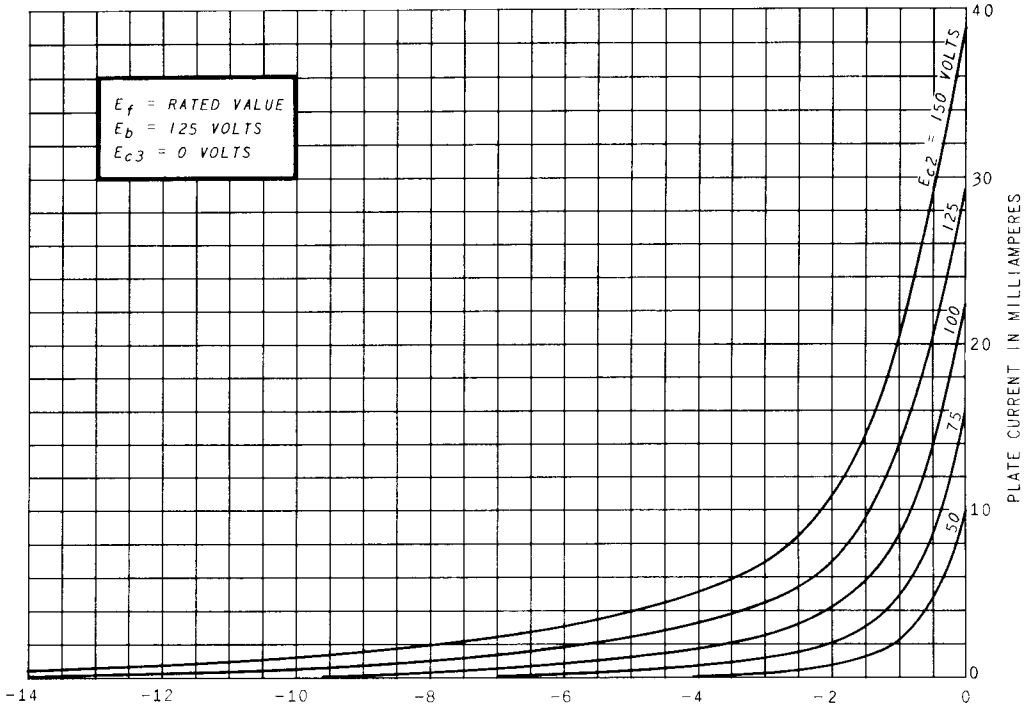
AVERAGE PLATE CHARACTERISTICS



K-55611-TD234-1

AUGUST 16, 1963

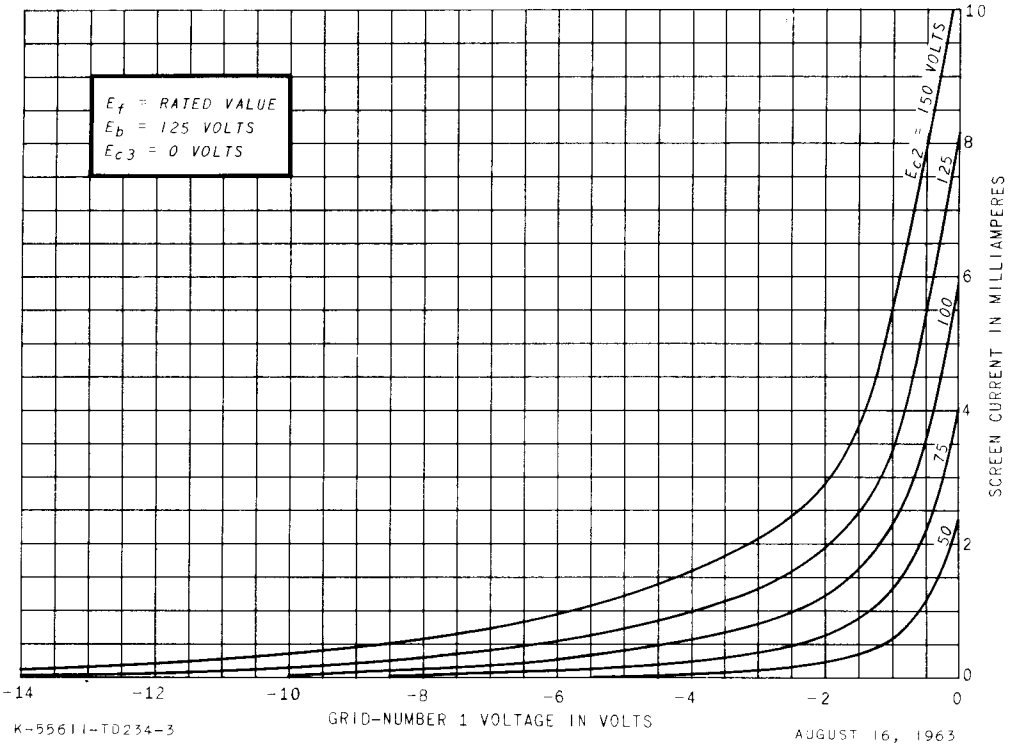
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD234-2

AUGUST 16, 1963

AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

6GN8

TRIODE-PENTODE

DESCRIPTION AND RATING

The 6GN8 is a miniature tube containing a sharp-cutoff pentode and a high-mu triode in one envelope. The pentode section is intended primarily for use as a video amplifier. The triode section is suitable for use as a voltage amplifier or sync separator.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.75	Amperes
Direct Interelectrode Capacitances‡		
Pentode Section		
Grid-Number 1 to Plate: (Pg1 to Pp)	0.1	pf
Input: Pg1 to (h+k+Pg2+Pg3+i.s.)	11	pf
Output: Pp to (h+k+Pg2+Pg3+i.s.)	4.2	pf
Triode Section		
Grid to Plate (Tg to Tp)	4.4	pf
Input: Tg to (h+Tk)	2.2	pf
Output: Tp to (h+Tk)	0.36	pf
Pentode Grid-Number 1 to Triode Plate: (Pg1 to Tp), maximum	0.005	pf
Triode Grid to Pentode Plate: (Tg to Pp), maximum	0.018	pf
Pentode Plate to Triode Plate: (Pp to Tp), maximum	0.17	pf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin
Outline Drawing—EIA 6-3

Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 5/8	Inches
Maximum Seated Height	2 3/8	Inches

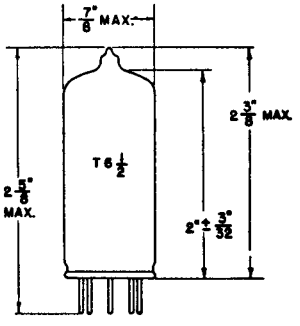
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

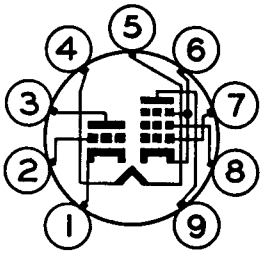


EIA 6-3

TERMINAL CONNECTIONS

Pin 1—Triode Cathode
Pin 2—Triode Grid
Pin 3—Triode Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 7—Pentode Grid Number 1
Pin 8—Pentode Grid Number 2 (Screen)
Pin 9—Pentode Plate

BASING DIAGRAM



EIA 9DX

MAXIMUM RATINGS (Continued)

DESIGN-MAXIMUM VALUES	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	....	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	5.0	1.0	Watts
Screen Dissipation	1.1	....	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section		Triode Section	
Plate Voltage	60	200	250	Volts
Screen Voltage	150	150	....	Volts
Grid-Number 1 Voltage	0§	....	−2	Volts
Cathode-Bias Resistor	....	100	.....	Ohms
Amplification Factor	....	.....	100	
Plate Resistance, Approximate	....	60000	37000	Ohms
Transconductance	....	11500	2700	Micromhos
Plate Current	55	25	2.0	Milliamperes
Screen Current	18	5.5	.....	Milliamperes
Grid-Number 1 Voltage, Approximate Ib = 10 Microamperes	....	.....	−5	Volts
Grid-Number 1 Voltage, Approximate Ib = 100 Microamperes	....	−10	.....	Volts

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

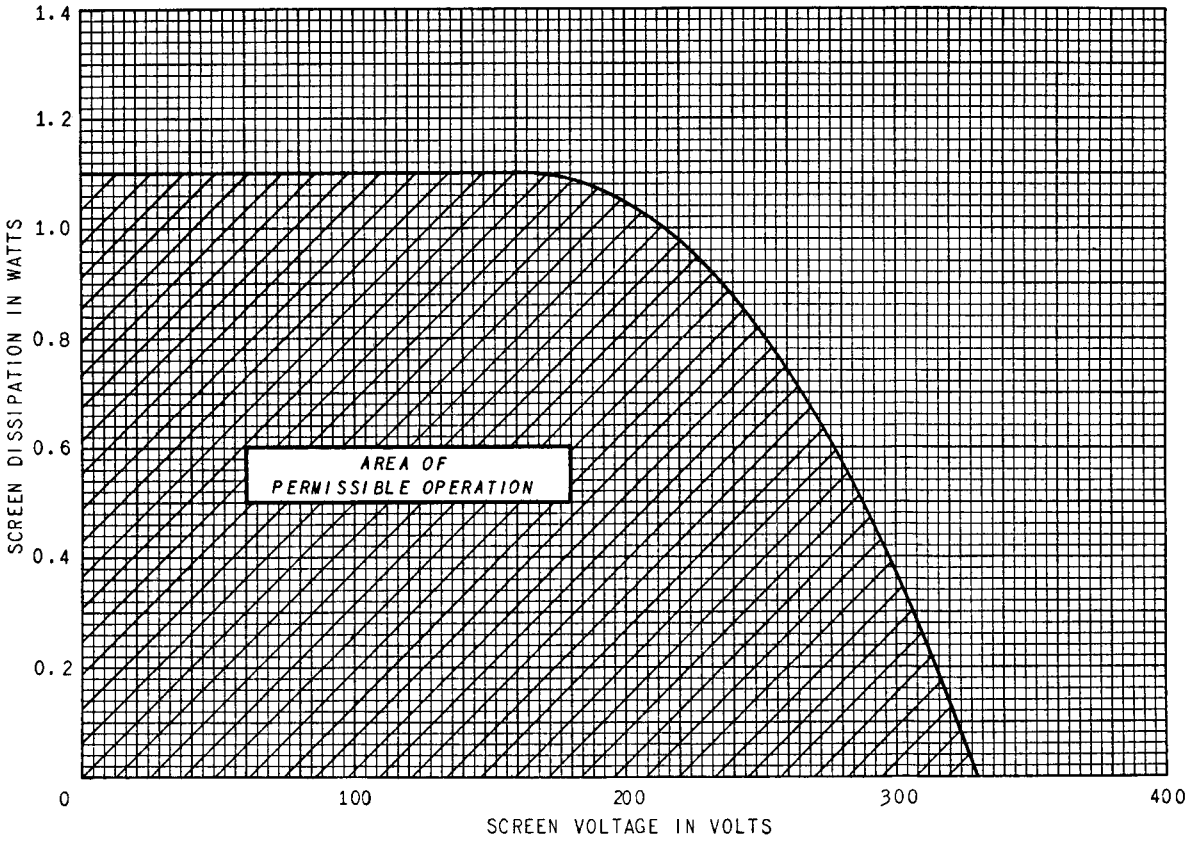
† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ Applied for short interval (two seconds maximum) so as not to damage tube.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

SCREEN RATING CHART



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

6GU7
TWIN TRIODE

DESCRIPTION AND RATING

The 6GU7 is a medium-mu twin triode of the 9-pin miniature type intended for use in the matrixing circuits of color television receivers. It can also be used in phase-inverter, multivibrator, and general-purpose amplifier applications.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

	Series Circuit*	Parallel Circuit‡	
Heater Voltage, AC or DC	6.3	6.3±0.6§	Volts
Heater Current	0.6±0.04§	0.6¶	Amperes
Heater Warm-up Time, average#	11	---	Seconds

Direct Interelectrode Capacitances, approximate△

	Section 1	Section 2	
Grid to Plate: (g to p)	3.0	3.0	pf
Input: g to (h + k)	3.4	3.6	pf
Output: p to (h + k)	0.44	0.34	pf
Plate (Section 1 to Plate (Section 2): (1p to 2p)	1.0		pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-3

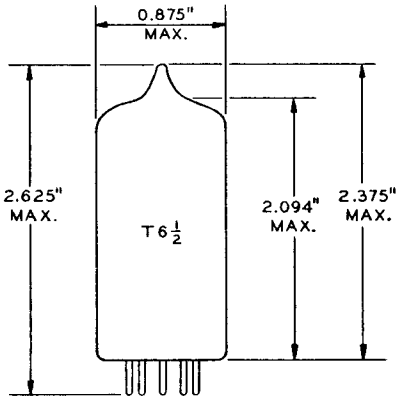
Maximum Diameter	0.875	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.375	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation, Each Plate	3.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	1.0	Megohms

PHYSICAL DIMENSIONS

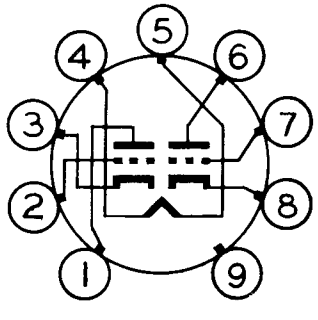


EIA 6-3

TERMINAL CONNECTIONS

Pin 1 - Plate (Section 2)
Pin 2 - Grid (Section 2)
Pin 3 - Cathode (Section 2)
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Plate (Section 1)
Pin 7 - Grid (Section 1)
Pin 8 - Cathode (Section 1)
Pin 9 - No Connection

BASING DIAGRAM



EIA 9LP

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration:

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	250	Volts
Grid Voltage	-10.5	Volts
Amplification Factor	17	
Plate Resistance, approximate	5500	Ohms
Transconductance	3100	Micromhos
Plate Current	11.5	Milliamperes
Plate Current, approximate Ec = -14 volts	4	Milliamperes
Grid Voltage, approximate Ib = 50 Microamperes	-23	Volts

NOTES

* Operated with the heater in series with the heaters of other tubes having the same bogey heater current.

‡ Operated with the heater in parallel with the heaters of other tubes having the same bogey heater voltage.

§ For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance; for series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

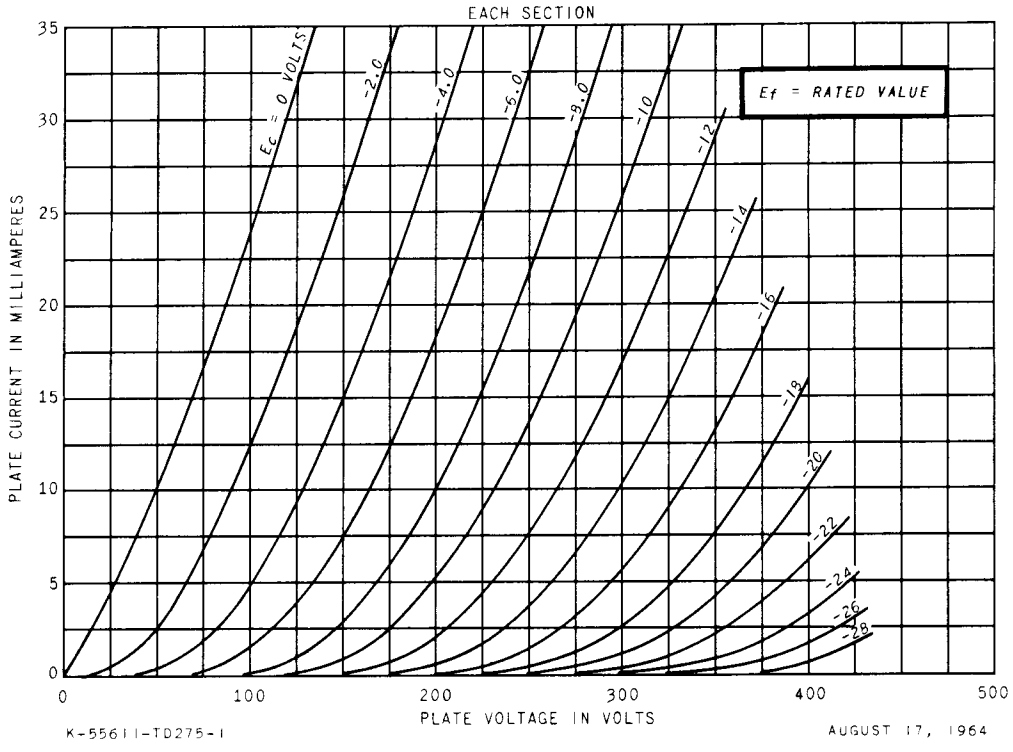
¶ Heater current of a bogey tube at Ef = 6.3 volts.

\# The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

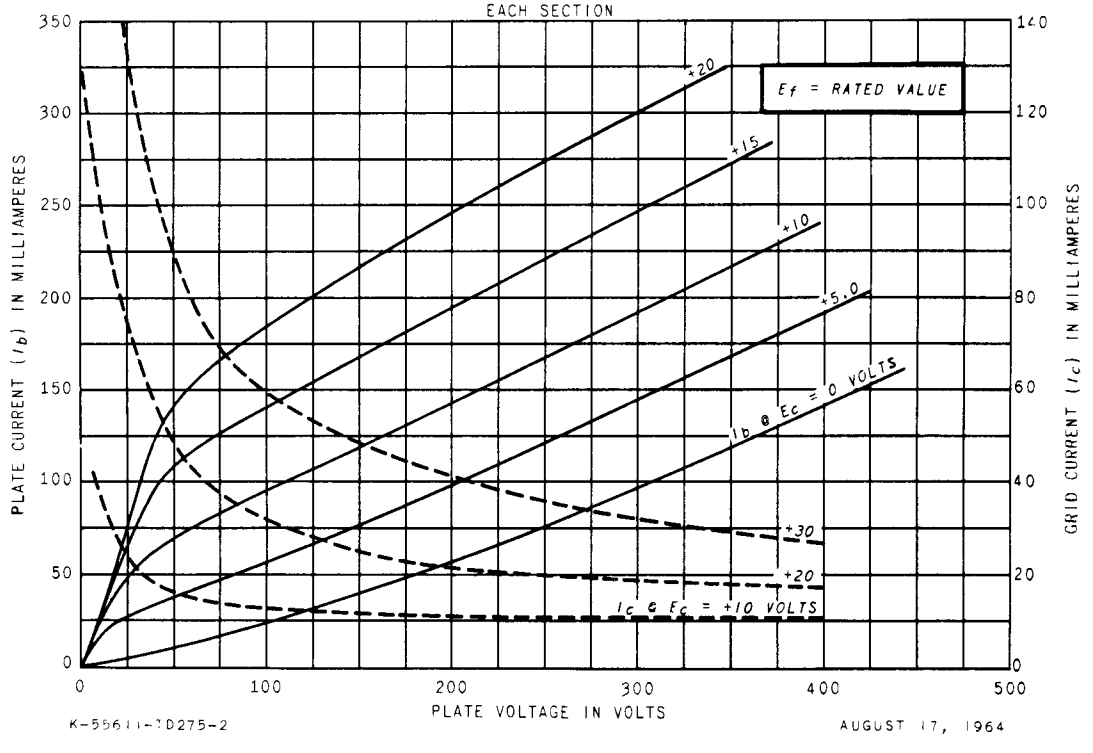
Δ Without external shield.

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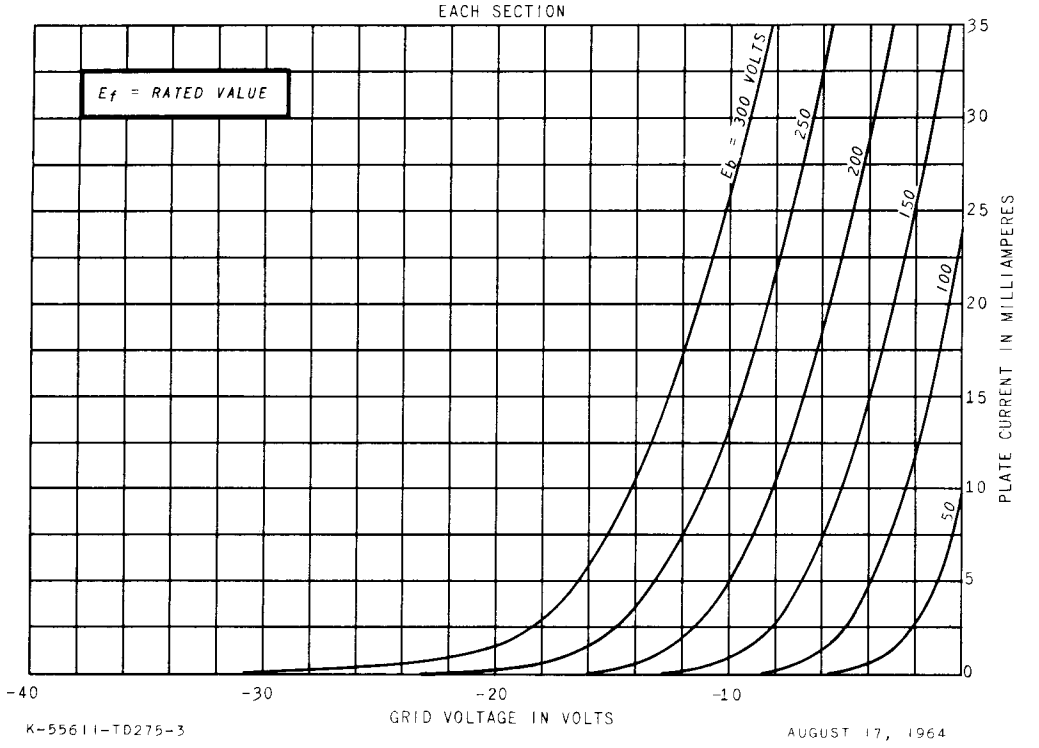
AVERAGE PLATE CHARACTERISTICS



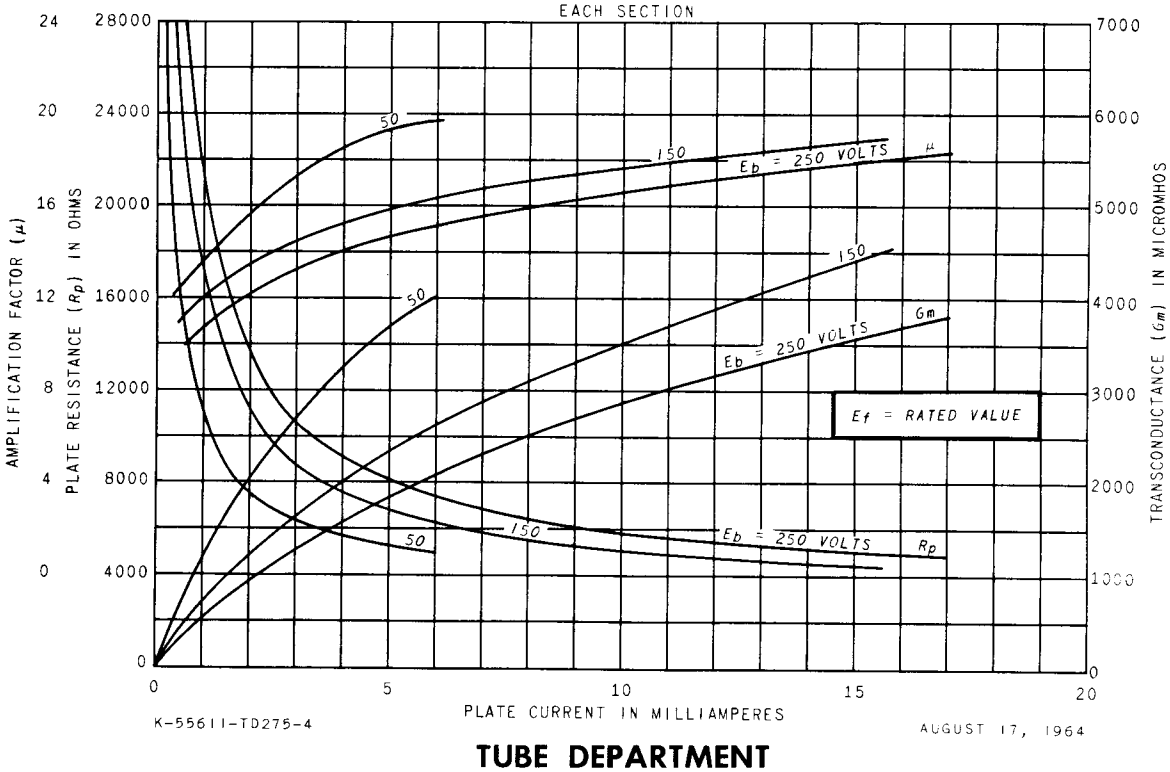
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

COMPACTRON BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6GV5 is a compactron beam-power pentode primarily designed for use as the horizontal-deflection amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	1.2	Amperes

Direct Interelectrode Capacitances, approximate‡

Grid-Number 1 to Plate: (g1 to p)	0.6	pf
Input: g1 to (h+k+g2+b.p.)	16	pf
Output: p to (h+k+g2+b.p.)	7.0	pf

MECHANICAL

Operating Position—Any

Envelope—T-12, Glass

Base—E12-74, Button 12-Pin

Top Cap—C1-3, Skirted Miniature

Outline Drawing—EIA 12-79

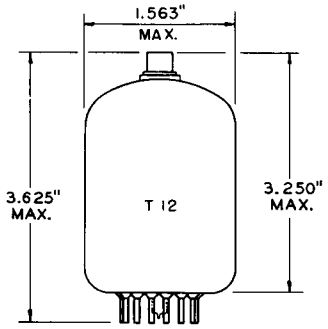
Maximum Diameter	1.563	Inches
Maximum Over-all Length	3.625	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE—DESIGN-MAXIMUM VALUES§

DC Plate-Supply Voltage (Boost+DC Power Supply)	770	Volts
Peak Positive Pulse Plate Voltage	6500	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Screen Voltage	220	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation¶	17.5	Watts
Screen Dissipation	3.5	Watts
DC Cathode Current	175	Milliamperes
Peak Cathode Current	550	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point	220	C

PHYSICAL DIMENSIONS

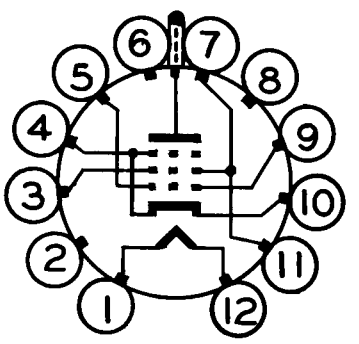


EIA 12-79

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—No Connection
Pin 3—Grid Number 2 (Screen)
Pin 4—Cathode and Beam Plates
Pin 5—Grid Number 1
Pin 6—No Connection
Pin 7—Grid Number 2 (Screen)
Pin 8—No Connection
Pin 9—Grid Number 1
Pin 10—Cathode and Beam Plates
Pin 11—Grid Number 2 (Screen)
Pin 12—Heater
Cap—Plate

BASING DIAGRAM



EIA 12DR

MAXIMUM RATINGS (CONT'D)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	60	250	Volts
Screen Voltage	150	150	150	Volts
Grid-Number 1 Voltage	....	0#	−22.5	Volts
Plate Resistance, approximate	....	....	18000	Ohms
Transconductance	....	....	7300	Micromhos
Plate Current	....	345	65	Milliamperes
Screen Current	....	27	1.8	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 1.0 Milliamperes	−100	....	−42	Volts
Triode Amplification Factor△	....	....	4.4	

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

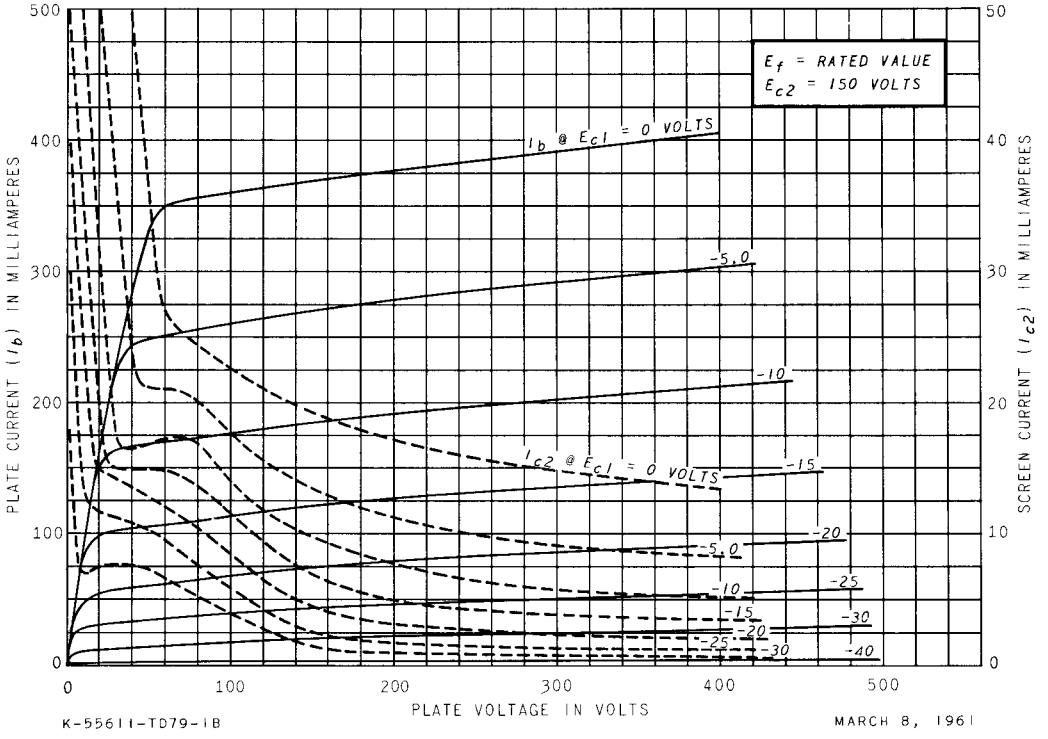
¶ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Applied for short interval (two seconds maximum) so as not to damage tube.

△Triode connection (screen tied to plate) with Eb = Ec2 = 150 volts and Ec1 = −22.5 volts.

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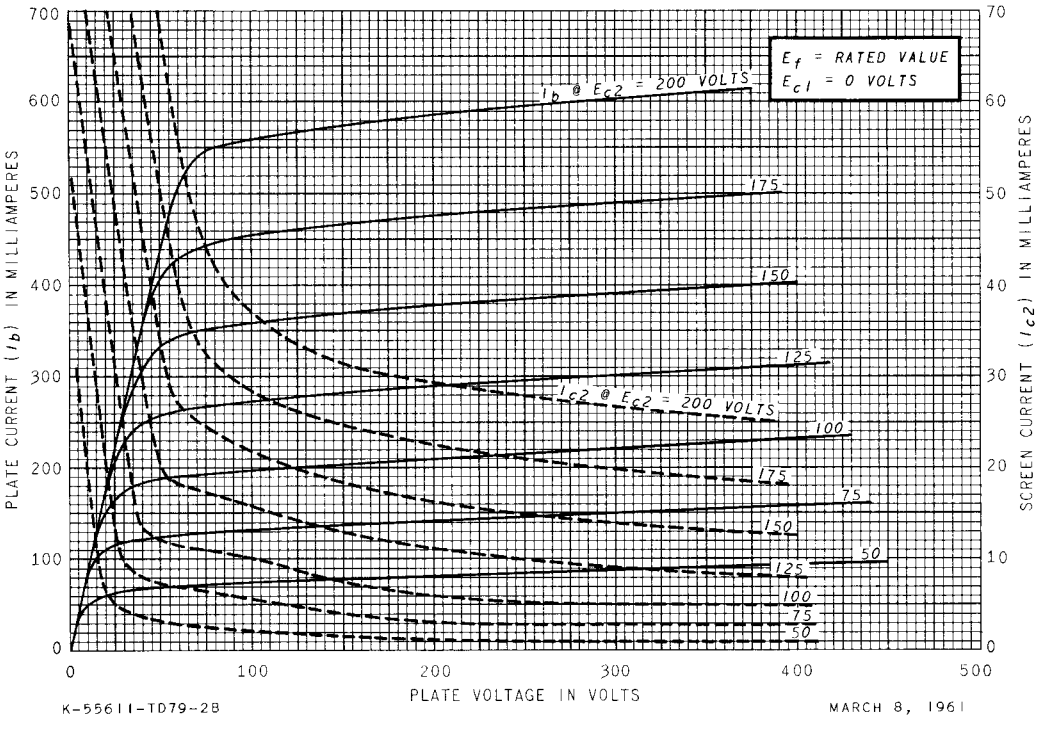
AVERAGE PLATE CHARACTERISTICS



K-55611-TD79-1B

MARCH 8, 1961

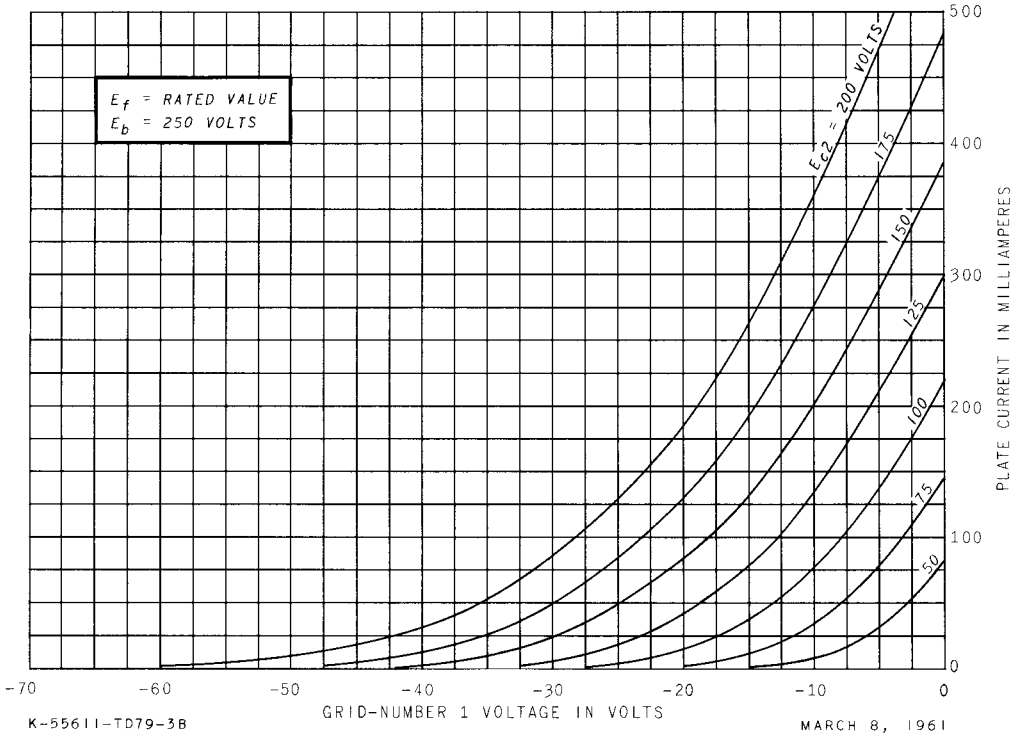
AVERAGE PLATE CHARACTERISTICS



K-55611-TD79-2B

MARCH 8, 1961

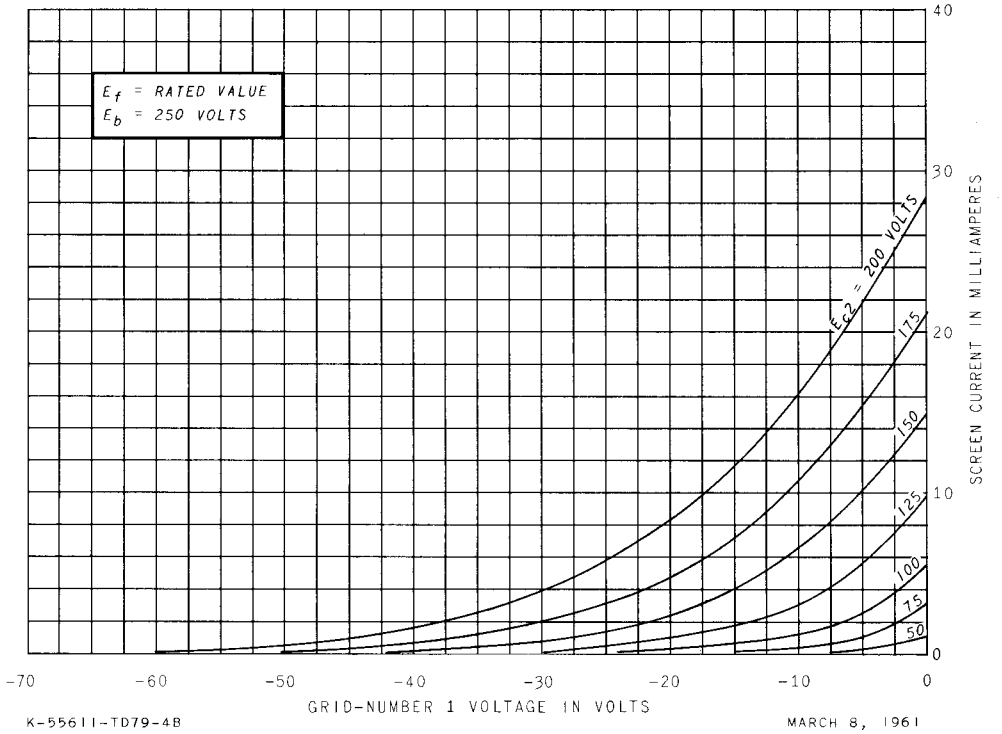
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD79-3B

MARCH 8, 1961

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD79-4B

MARCH 8, 1961

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

6GX6
PENTODE
FOR FM DETECTOR APPLICATIONS

DESCRIPTION AND RATING

The 6GX6 is a miniature, dual-control pentode primarily intended for use as an FM detector in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

	Series Circuit*	Parallel Circuit‡	
Heater Voltage, AC or DC	6.3	6.3±0.6§	Volts
Heater Current	0.45±0.03§	0.45¶	Amperes
Heater Warm-up Time, average#	11	---	Seconds

Direct Interelectrode Capacitances△

Grid Number 1 to Plate: (g1 to p)	0.026	pf
Grid Number 1 to All except Plate: (g1 to h + k + g2 + g3 + i.s.)	8.0	pf
Grid Number 1 to Grid Number 3: (g1 to g3)	0.12	pf
Grid Number 3 to Plate: (g3 to p)	1.6	pf
Grid Number 3 to All: (g3 to h + k + g1 + g2 + p + i.s.)	6.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-5 1/2, Glass
Base - E7-1, Miniature Button 7-Pin
Outline Drawing - EIA 5-2

Maximum Diameter	0.750	Inches
Maximum Over-all Length	2.125	Inches
Maximum Seated Height	1.875	Inches

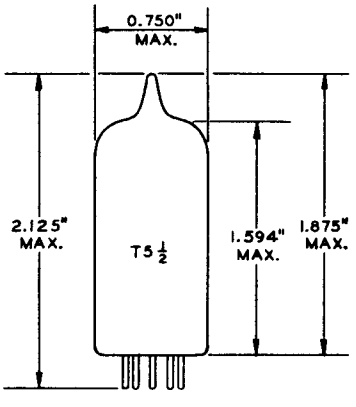
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

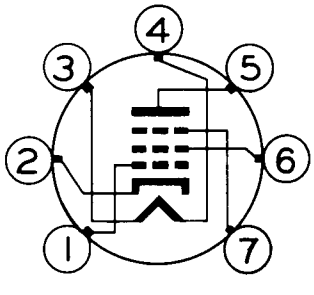


EIA 5-2

TERMINAL CONNECTIONS

Pin 1 - Grid Number 1
Pin 2 - Cathode and Internal Shield
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Grid Number 3 (Suppressor)

BASING DIAGRAM



EIA 7EN

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

Plate Voltage	300	Volts
Grid-Number 3 Voltage		
Positive Value (DC and Peak)	25	Volts
Negative Value (DC and Peak)	100	Volts
Screen Supply Voltage	300	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
Plate Dissipation	1.7	Watts
Grid-Number 3 Dissipation	0.1	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.22	Megohms
With Cathode Bias	0.47	Megohms
Grid-Number 3 Circuit Resistance	0.68	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Supply Voltage	150	Volts
Grid-Number 3 Supply Voltage	0	Volts
Screen Supply Voltage	100	Volts
Grid-Number 1 Supply Voltage	0	Volts
Cathode-Bias Resistor	180	Ohms
Plate Resistance, approximate	0.14	Megohms
Transconductance, Grid-Number 1 to Plate	3700	Micromhos
Transconductance, Grid-Number 3 to Plate	750	Micromhos
Plate Current	3.7	Milliamperes
Screen Current	3.0	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 20 Microamperes	-4.5	Volts
Grid-Number 3 Voltage, approximate		
Ib = 20 Microamperes	-7.0	Volts

NOTES

* Operated with the heater in series with the heaters of other tubes having the same bogey heater current.

‡ Operated with the heater in parallel with the heaters of other tubes having the same bogey heater voltage.

§ For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance; for series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

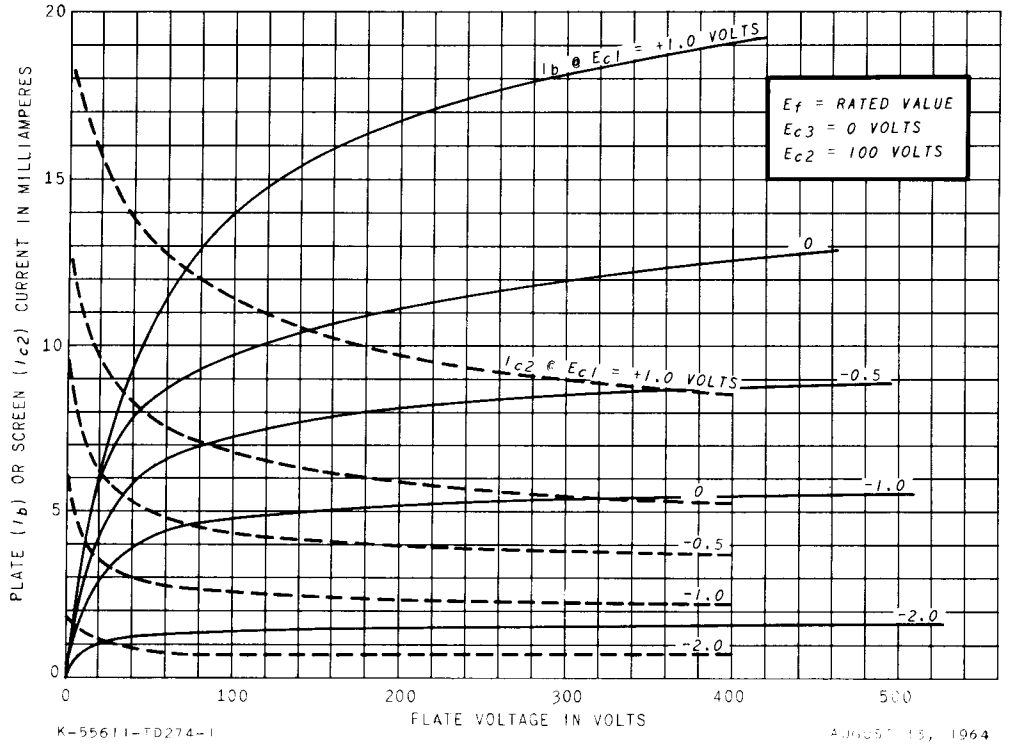
¶ Heater current of a bogey tube at Ef = 6.3 volts.

The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

Δ Without external shield.

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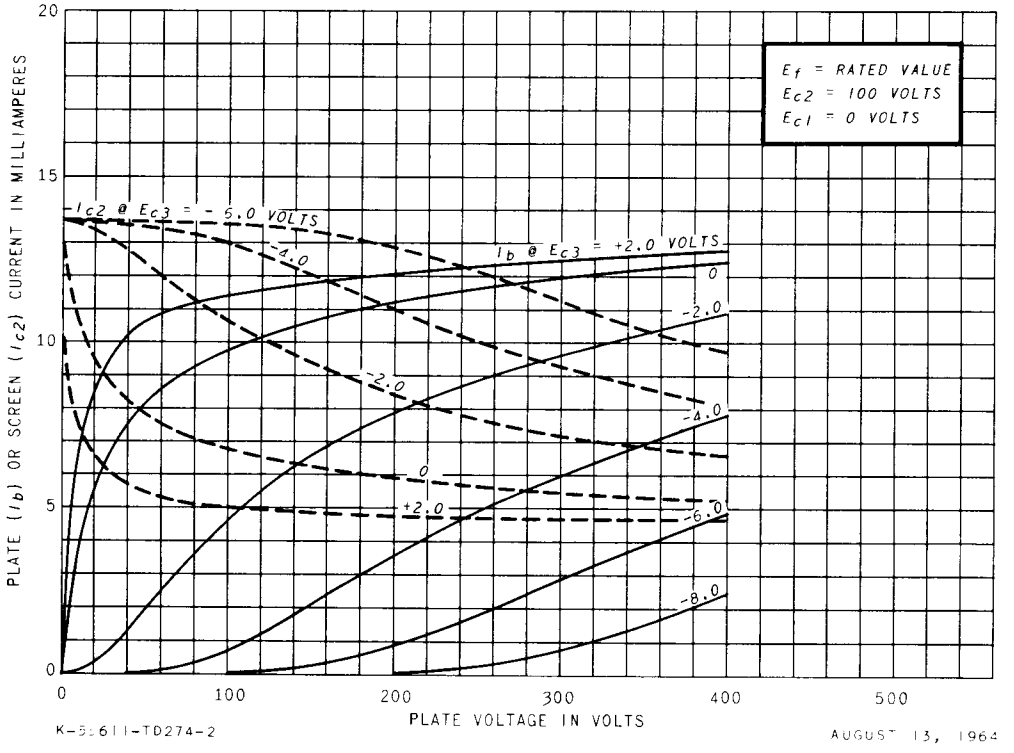
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD274-1

AUGUST 13, 1964

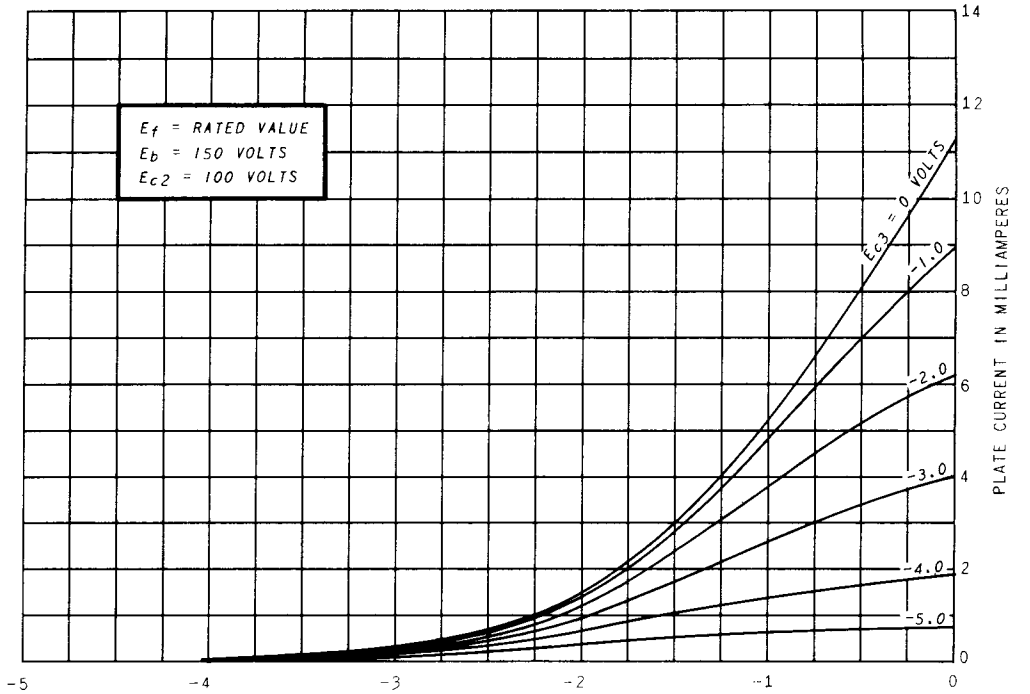
AVERAGE PLATE CHARACTERISTICS



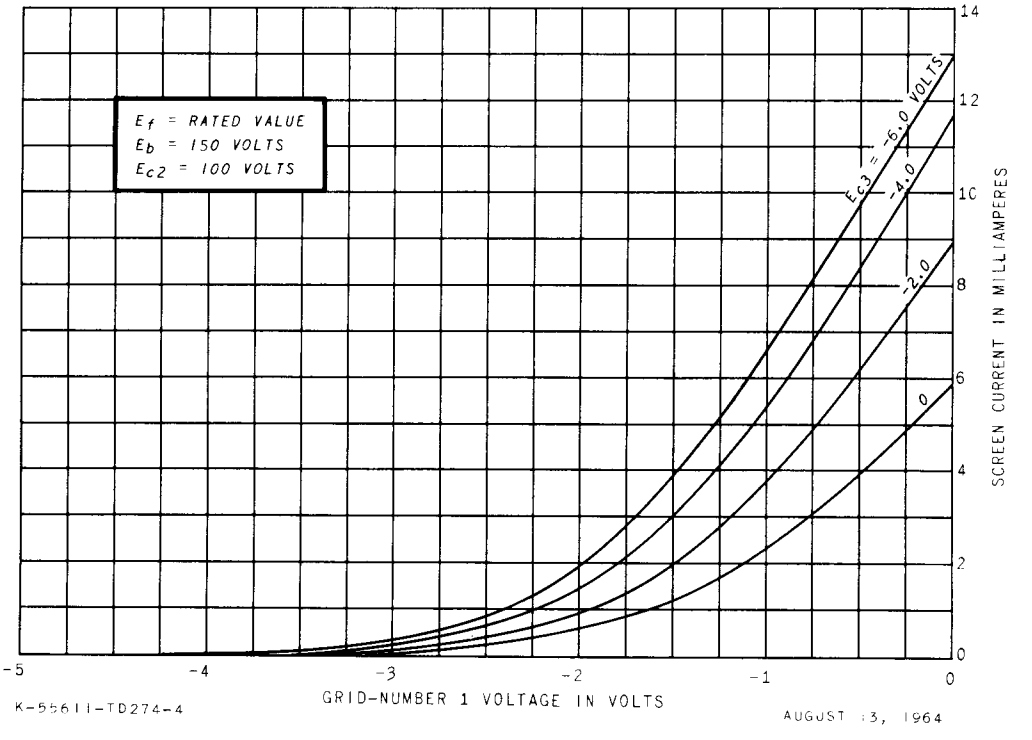
K-5561I-TD274-2

AUGUST 13, 1964

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

6GY5

COMPACTRON BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6GY5 is a compactron beam-power pentode designed for use as the horizontal-deflection amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current+	1.5	Amperes
Direct Interelectrode Capacitances, approximate‡		
Grid-Number 1 to Plate: (g1 to p)	0.48	pf
Input: g1 to (h + k + g2 + b.p.)	22	pf
Output: p to (h + k + g2 + b.p.)	9.0	pf

MECHANICAL

Mounting Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Top Cap - C1-3, Skirted Miniature
Outline Drawing - EIA 12-79

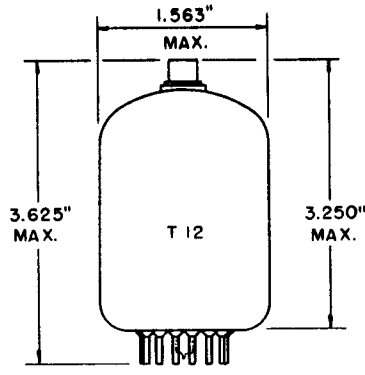
Maximum Diameter	1.563	Inches
Maximum Over-all Length	3.625	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE— DESIGN-MAXIMUM VALUES§

DC Plate-Supply Voltage (Boost + DC Power Supply)	770	Volts
Peak Positive Pulse Plate Voltage	6500	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Screen Voltage	220	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation¶	18	Watts
Screen Dissipation	3.5	Watts
DC Cathode Current	230	Milliamperes
Peak Cathode Current	800	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point	220	C

PHYSICAL DIMENSIONS

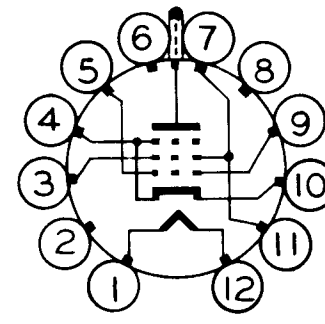


EIA 12-79

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - No Connection
Pin 3 - Grid Number 2 (Screen)
Pin 4 - Cathode and Beam Plates
Pin 5 - Grid Number 1
Pin 6 - No Connection
Pin 7 - Grid Number 2 (Screen)
Pin 8 - No Connection
Pin 9 - Grid Number 1
Pin 10 - Cathode and Beam Plates
Pin 11 - Grid Number 2 (Screen)
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12DR

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	60	130	Volts
Screen Voltage	130	130	130	Volts
Grid-Number 1 Voltage	---	0#	-20	Volts
Plate Resistance, approximate	---	---	11000	Ohms
Transconductance	---	---	9100	Micromhos
Plate Current	---	410	50	Milliamperes
Screen Current	---	24	1.75	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 1.0 Milliamperes	-66	---	-33	Volts
Triode Amplification Factor△	---	---	4.7	

FOOTNOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

\+ Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

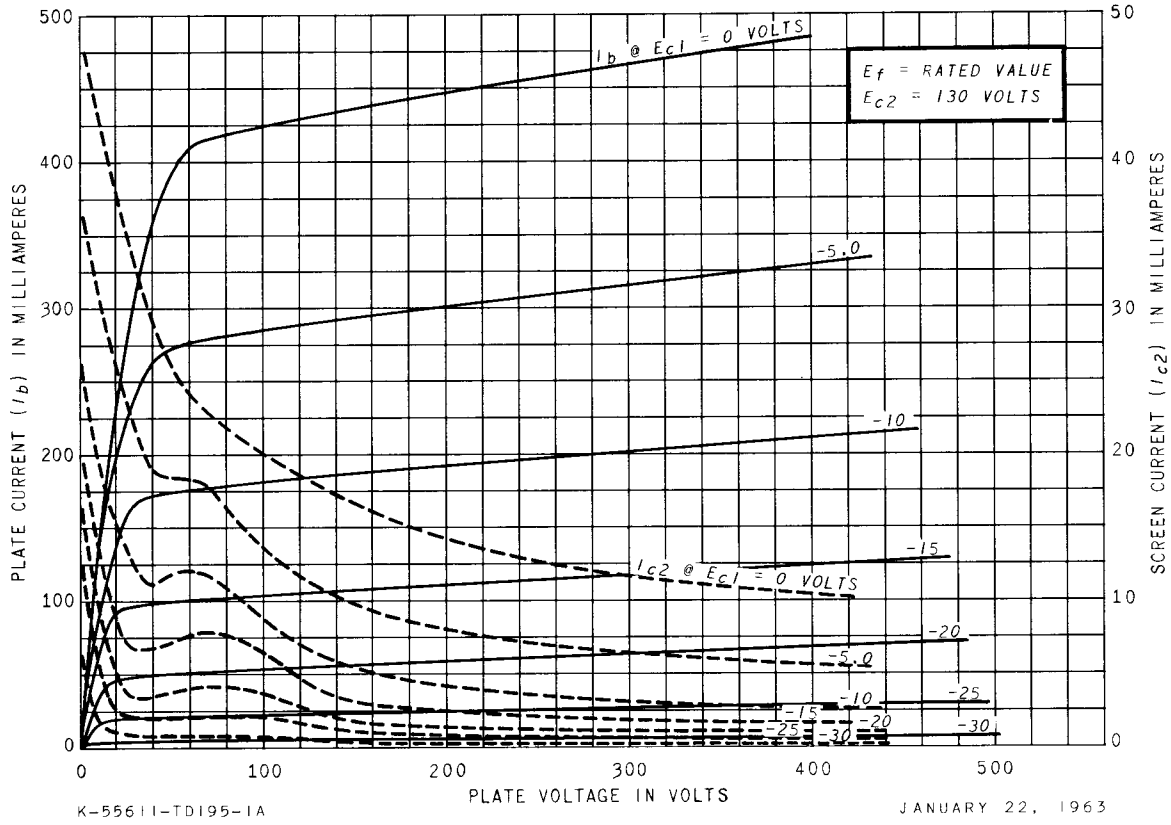
¶ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

\# Applied for short interval (two seconds maximum) so as not to damage tube.

△ Triode connection (screen tied to plate) with Eb = Ec2 = 130 volts and Ec1 = -20 volts.

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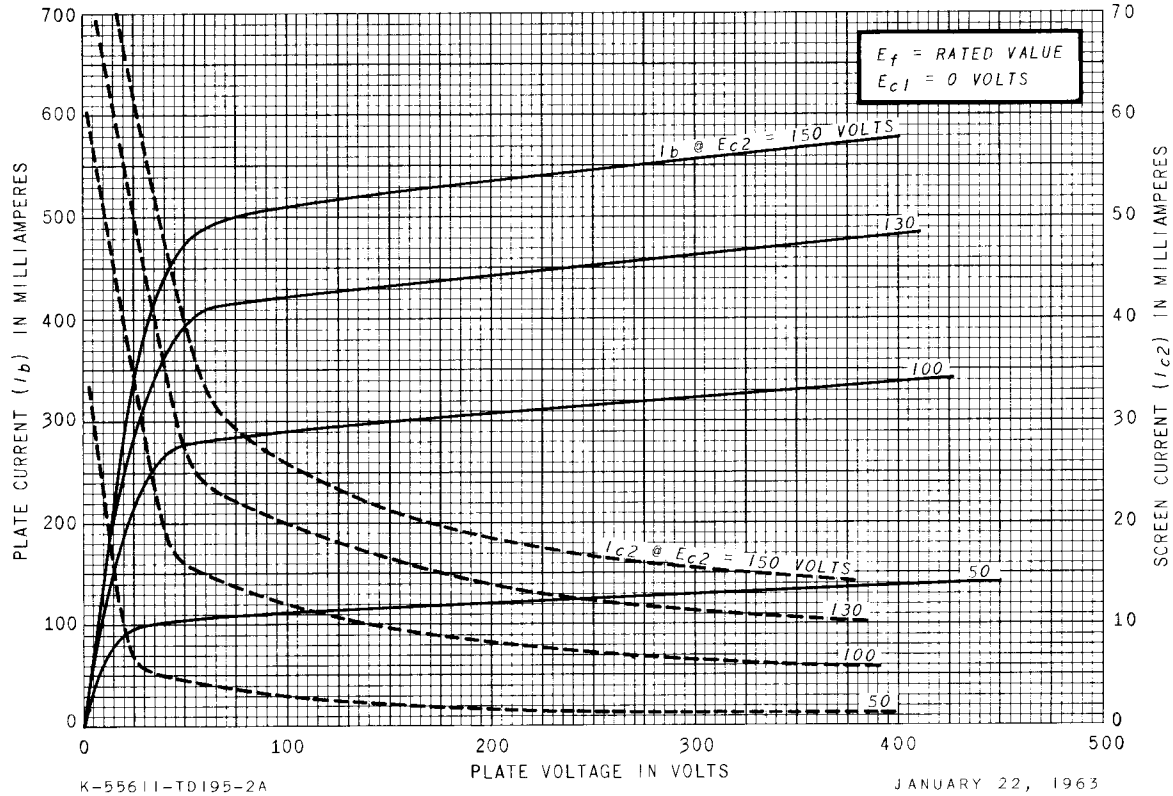
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD195-1A

JANUARY 22, 1963

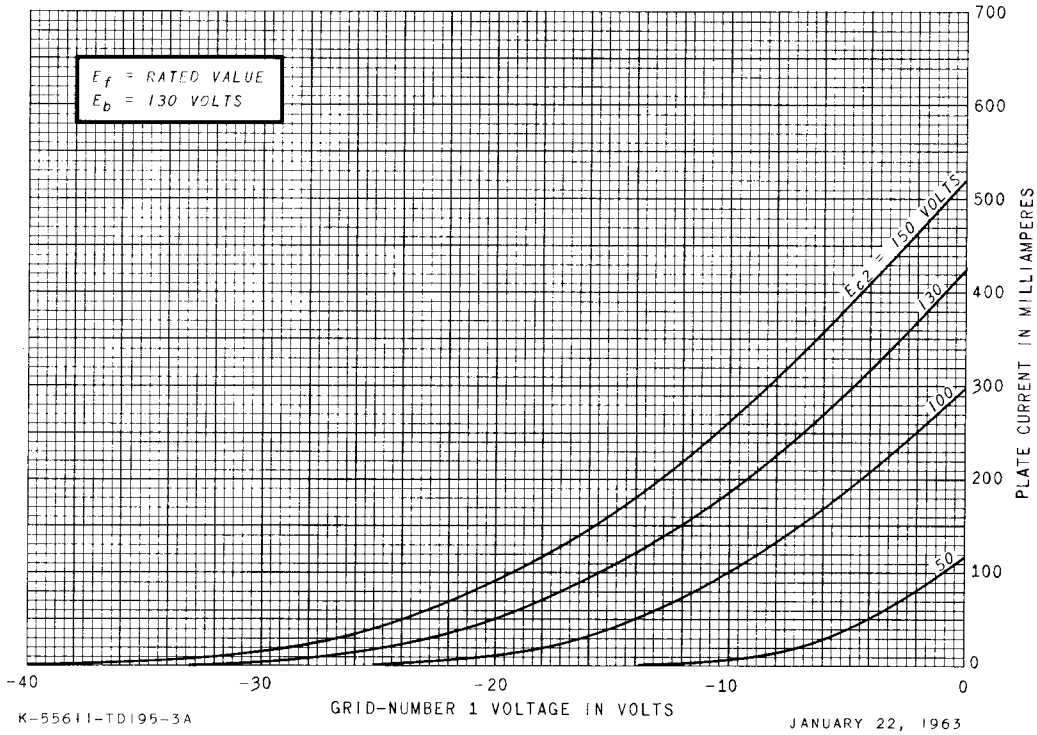
AVERAGE PLATE CHARACTERISTICS



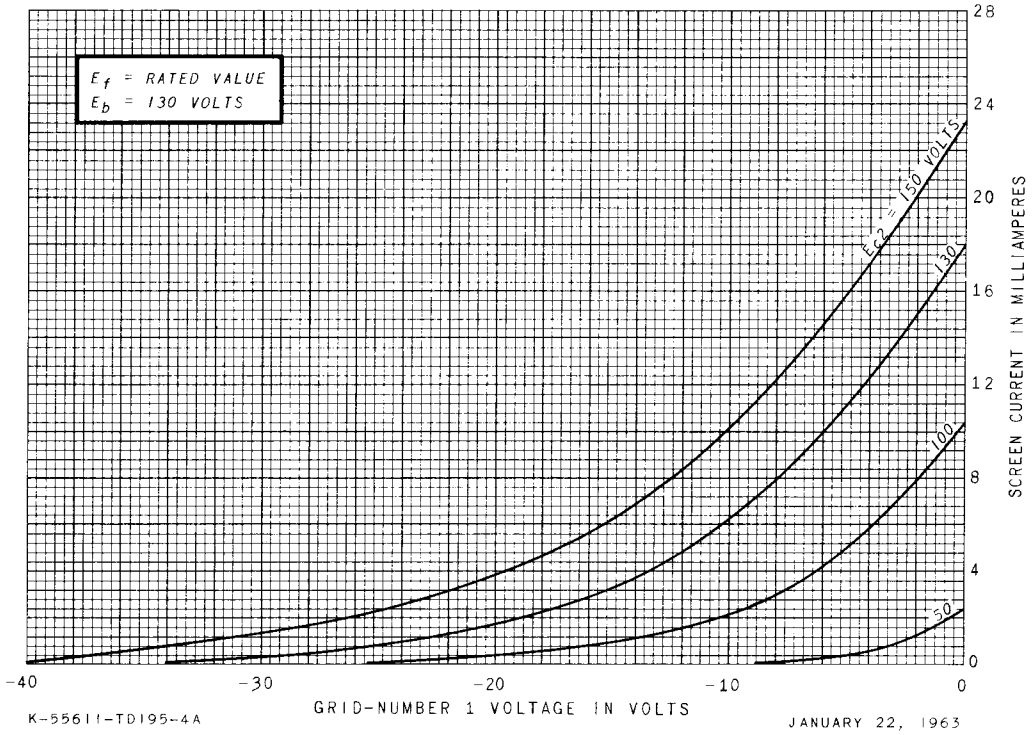
K-5561I-TD195-2A

JANUARY 22, 1963

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

6GY6

PENTODE

FOR GATED AGC AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6GY6 is a miniature, dual-control pentode primarily intended for gated AGC amplifier service in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

	Series Circuit*	Parallel Circuit‡	
Heater Voltage, AC or DC	6.3	6.3±0.6§	Volts
Heater Current	0.45±0.03§	0.45¶	Amperes
Heater Warm-up Time, average#	11	---	Seconds

Direct Interelectrode Capacitances△

Grid Number 1 to Plate: (g1 to p)	0.026	pf
Grid Number 1 to All except Plate: (g1 to h + k + g2 + g3 + i.s.)	8.0	pf
Grid Number 1 to Grid Number 3: (g1 to g3)	0.12	pf
Grid Number 3 to Plate: (g3 to p)	1.6	pf
Grid Number 3 to All: (g3 to h + k + g1 + g2 + p + i.s.)	6.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-5 1/2, Glass
Base - E7-1, Miniature Button 7-Pin
Outline Drawing - EIA 5-2

Maximum Diameter	0.750	Inches
Maximum Over-all Length	2.125	Inches
Maximum Seated Height	1.875	Inches

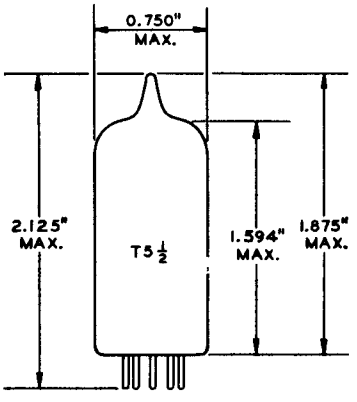
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

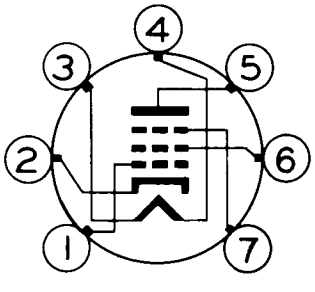


EIA 5-2

TERMINAL CONNECTIONS

Pin 1 - Grid Number 1
Pin 2 - Cathode and Internal Shield
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Grid Number 3 (Suppressor)

BASING DIAGRAM



EIA 7EN

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

Plate Voltage	300	Volts
Peak Positive-Pulse Plate Voltage**	600	Volts
Grid-Number 3 Voltage		
Positive Value (DC and Peak)	0	Volts
Negative Value (DC and Peak)	100	Volts
Screen-Supply Voltage	300	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
Plate Dissipation	1.7	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.22	Megohms
With Cathode Bias	0.47	Megohms
Grid-Number 3 Circuit Resistance	0.68	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Supply Voltage	150	Volts
Grid-Number 3 Supply Voltage	0	Volts
Screen Supply Voltage	100	Volts
Grid-Number 1 Supply Voltage	0	Volts
Cathode-Bias Resistor	180	Ohms
Plate Resistance, approximate	0.14	Megohms
Transconductance, Grid-Number 1 to Plate	3700	Micromhos
Transconductance, Grid-Number 3 to Plate	750	Micromhos
Plate Current	3.7	Milliamperes
Screen Current	3.0	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 20 Microamperes	-4.5	Volts
Grid-Number 3 Voltage, approximate		
Ib = 20 Microamperes	-7.0	Volts

NOTES

* Operated with the heater in series with the heaters of other tubes having the same bogey heater current.

‡ Operated with the heater in parallel with the heaters of other tubes having the same bogey heater voltage.

§ For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance; for series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

¶ Heater current of a bogey tube at Ef = 6.3 volts.

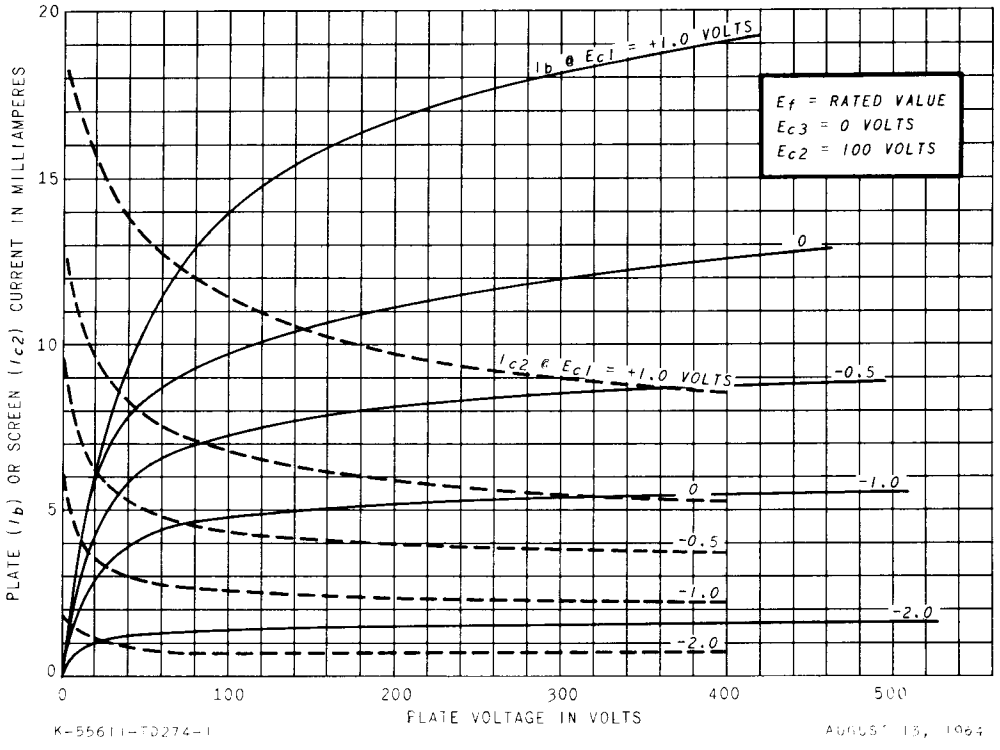
\# The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

Δ Without external shield.

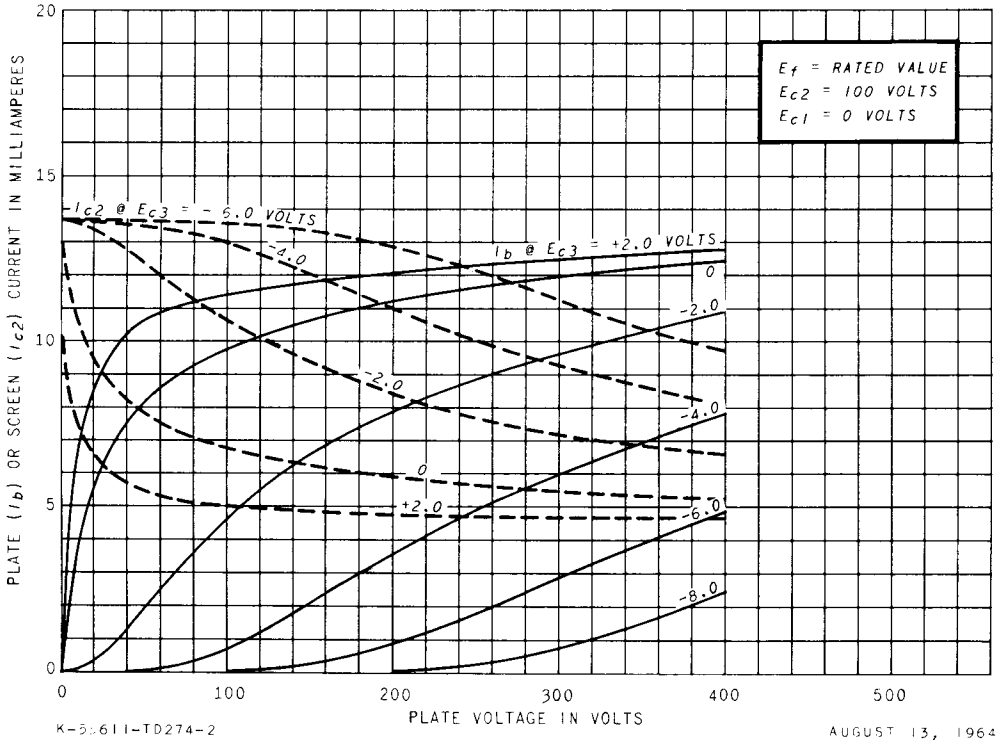
** For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

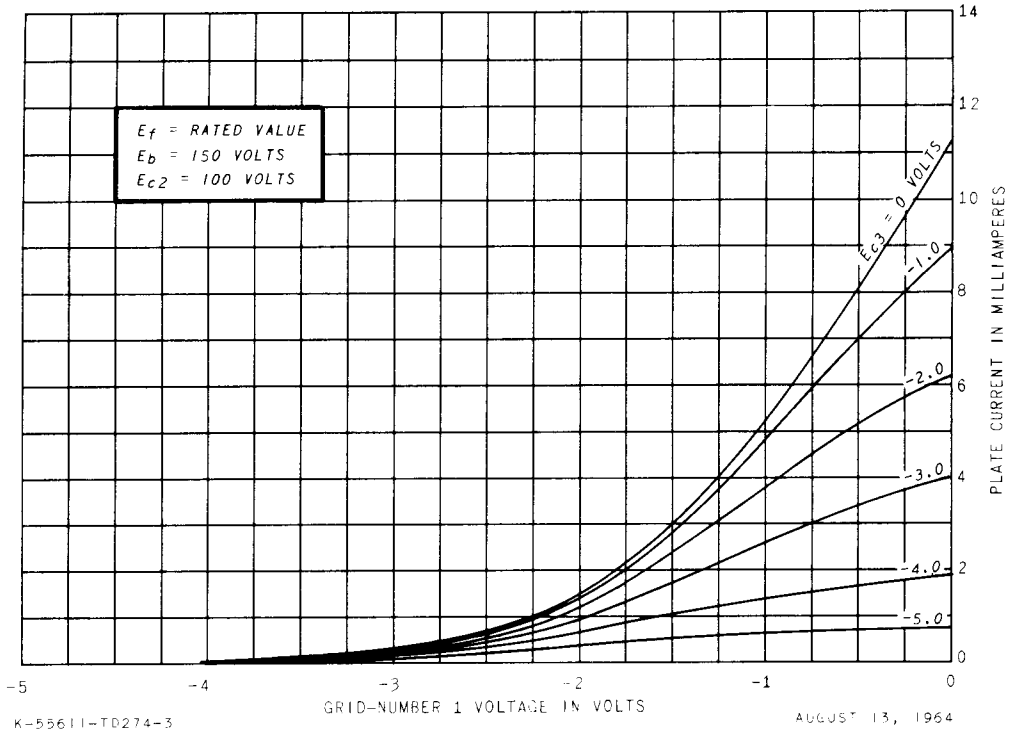
AVERAGE PLATE CHARACTERISTICS



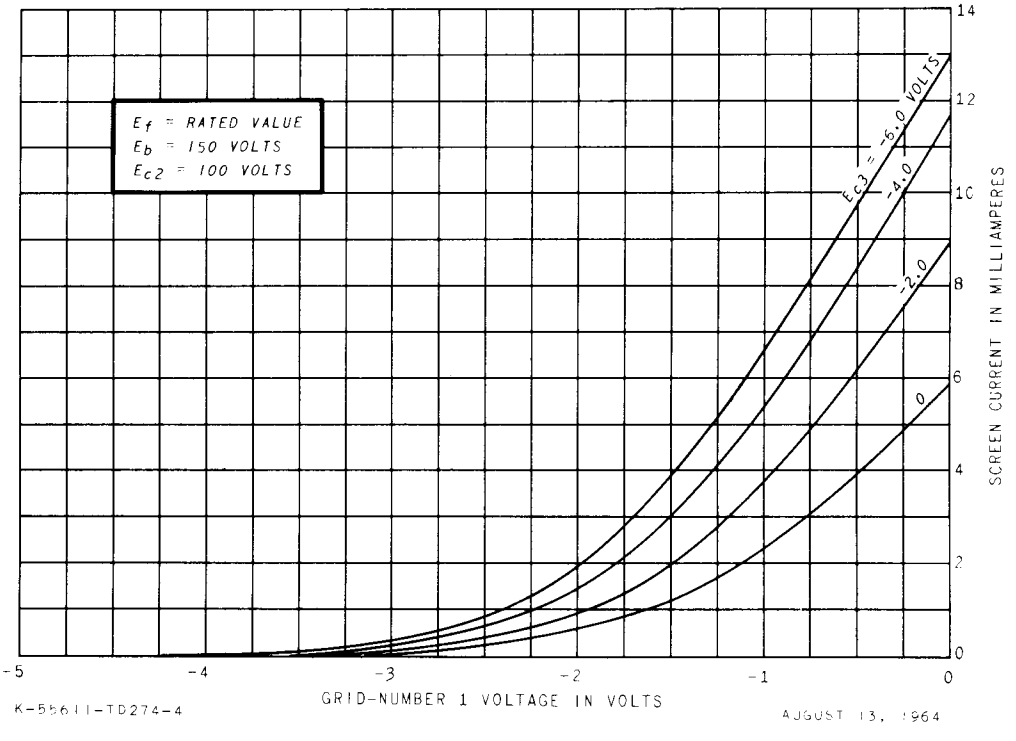
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

6GY8

TRIPLE TRIODE

DESCRIPTION AND RATING

The 6GY8 is a miniature, high-mu, triple triode. It is intended for radio-frequency amplifier, autodyne mixer, and automatic-frequency-control service in FM receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.45	Amperes

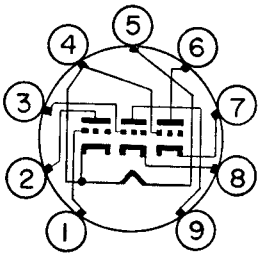
Direct Interelectrode Capacitances

	With Shield*	Without Shield	
Grid to Plate, Section 1: (1g+h+3k to 1p)	1.5	1.6	μμf
Grid to Plate, Section 2: (2g to 2p)	1.4	1.4	μμf
Grid to Plate, Section 3: (3g to 3p)	1.5	1.5	μμf
Input, Section 1: 1k to (H+1g+3k)	5.0†	5.0	μμf
Input, Section 2: 2g to (H+1g+2k+3k)	2.6†	2.4	μμf
Input, Section 3: 3g to (H+1g+3k)	2.4†	2.2	μμf
Output, Section 1: 1p to (H+1g+3k)	2.4†	1.6	μμf
Output, Section 2: 2p to (H+1g+2k+3k)	1.4†	0.4	μμf
Output, Section 3: 3p to (H+1g+3k)	1.0†	0.2	μμf
Heater to Cathode, Section 1: (H+1g+3k to 1k)	5.0	5.0	μμf
Heater to Cathode, Section 2: (H+1g+3k to 2k)	2.8	2.8	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

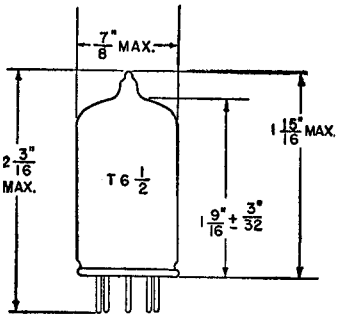


EIA 9MB

TERMINAL CONNECTIONS

Pin 1—Grid (Section 3)
Pin 2—Plate (Section 3)
Pin 3—Grid (Section 2)
Pin 4—Cathode (Section 3), Grid (Section 1), and Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Cathode (Section 1)
Pin 8—Cathode (Section 2)
Pin 9—Plate (Section 2)

PHYSICAL DIMENSIONS



EIA 6-2

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation, Each Plate	2.0	Watts
Total Plate Dissipation, All Plates	5.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	100	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

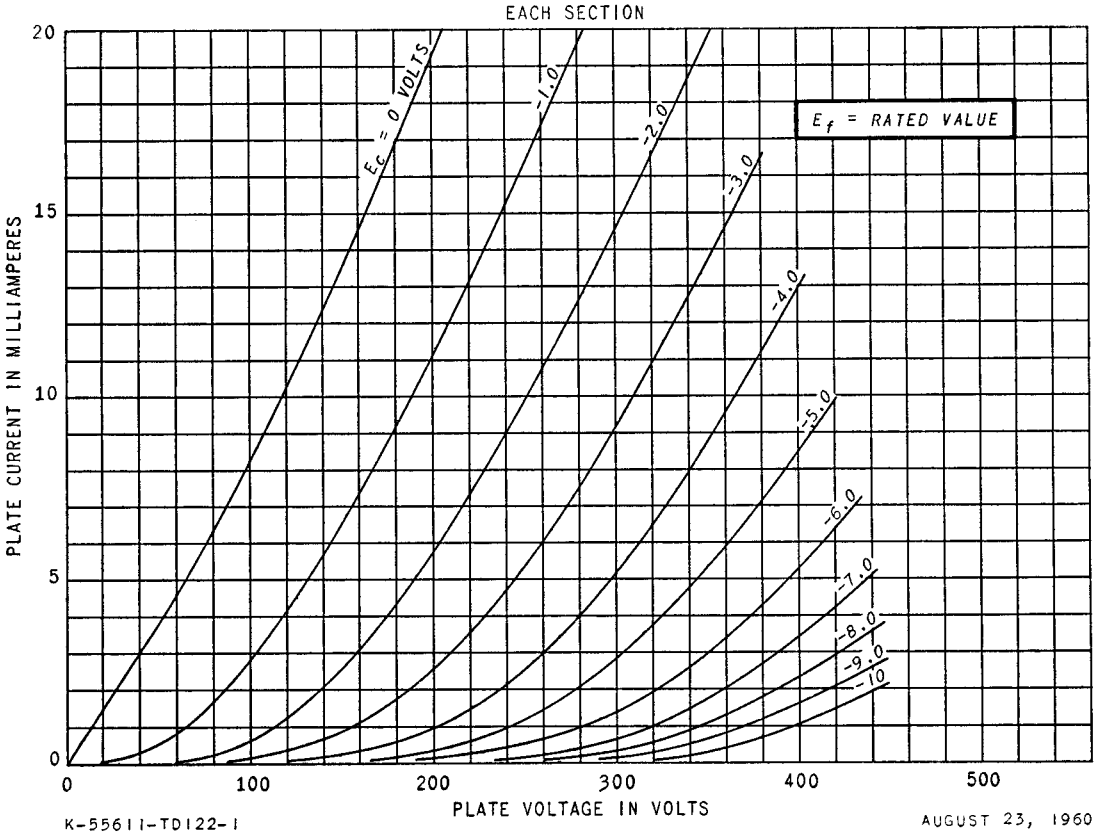
	Section 1	Sections 2 and 3	
Plate Voltage	125	125	Volts
Grid Voltage	———	−1.0	Volts
Cathode-Bias Resistor	220	———	
Amplification Factor	63	63	
Plate Resistance, approximate	14000	14000	Ohms
Transconductance	4500	4500	Micromhos
Plate Current	4.5	4.5	Milliamperes
Grid Voltage, approximate			
Ib = 20 Microamperes	———	−4	Volts

* With external shield (EIA 315) connected to ground unless otherwise indicated.

† With external shield (EIA 315) connected to pin 4.

AVERAGE PLATE CHARACTERISTICS

EACH SECTION

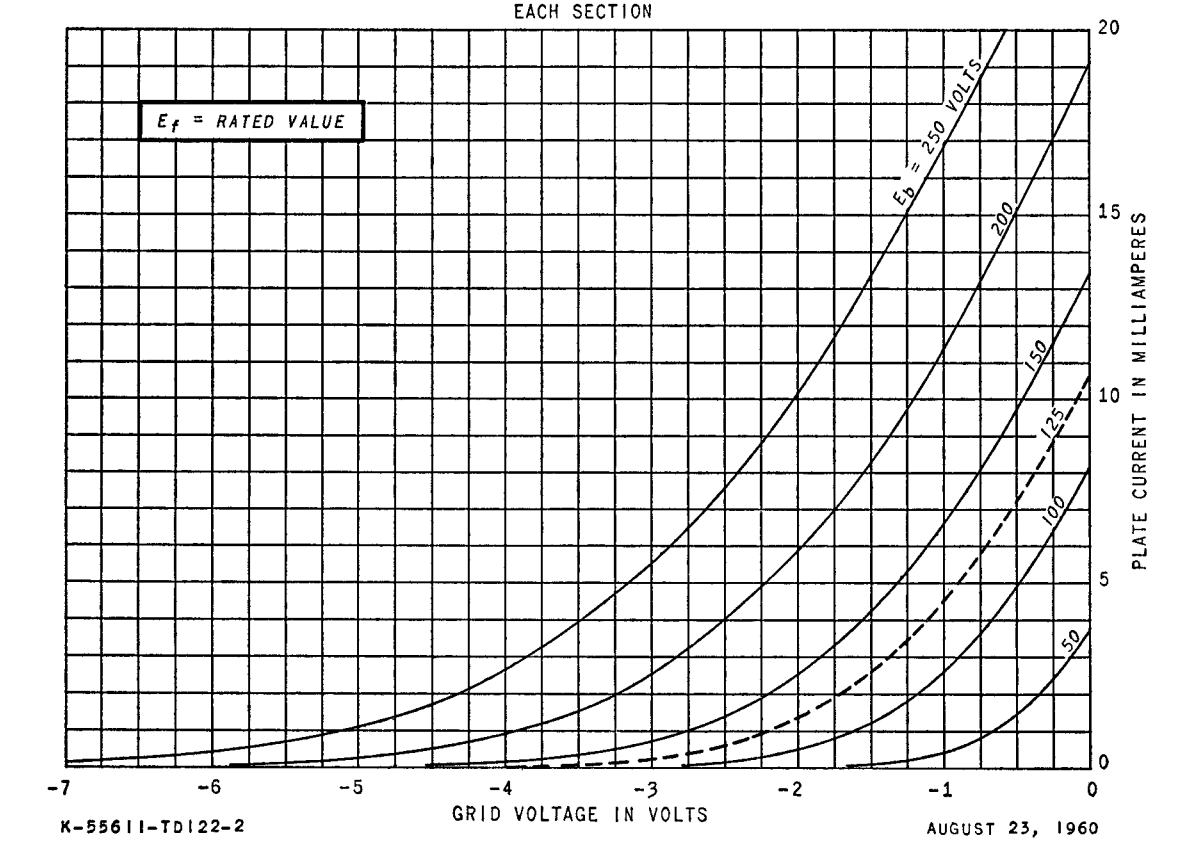


K-55611-TD122-1

AUGUST 23, 1960

AVERAGE TRANSFER CHARACTERISTICS

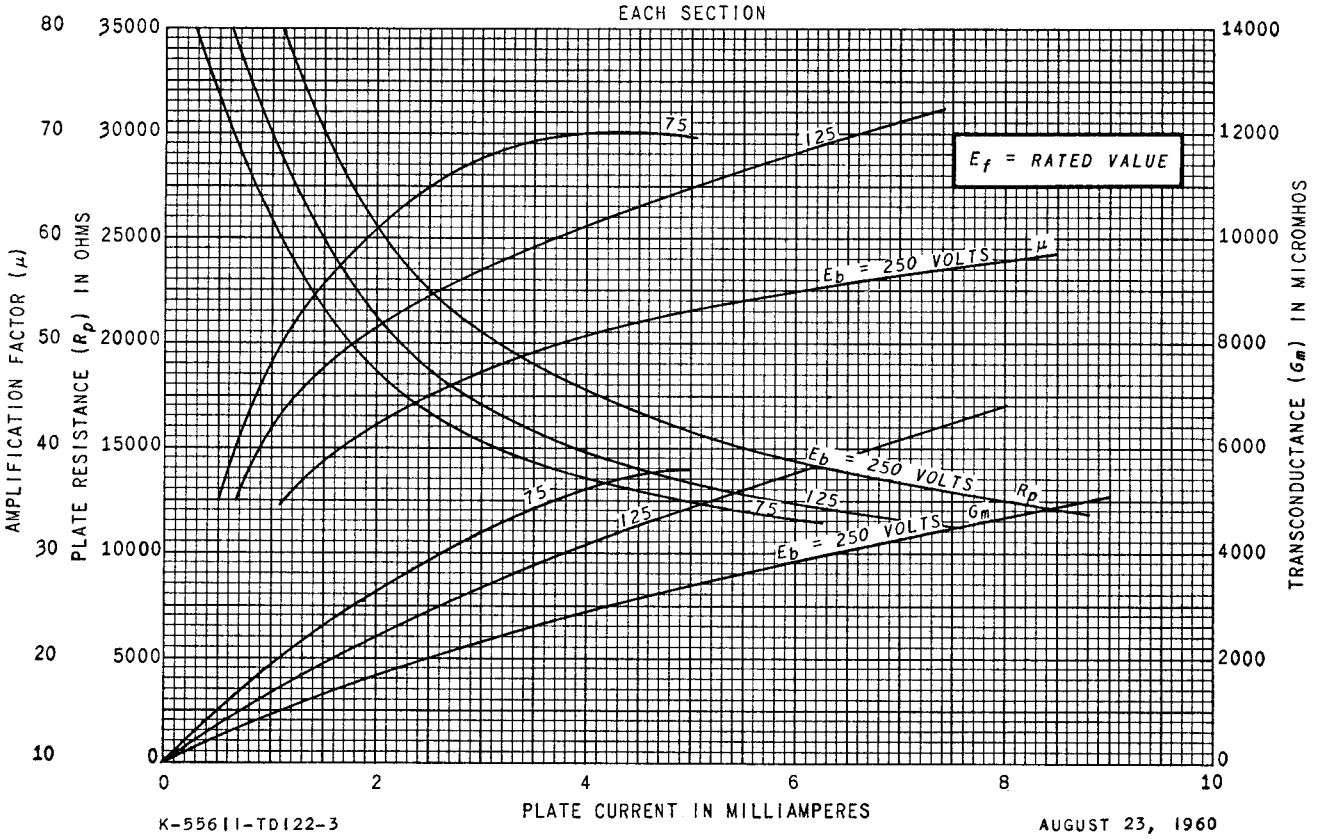
EACH SECTION



K-55611-TD122-2

AUGUST 23, 1960

AVERAGE CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

Electronic TUBE
KEN-RAD

6H6
Description and Rating

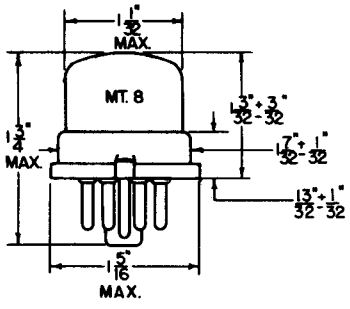
TWIN DIODE

GENERAL DESCRIPTION

Principal Application: The type 6H6 is a twin-diode with individual cathodes brought out to separate base pins. The 6H6 is designed for service as a diode detector, automatic volume control rectifier, or as a low current power rectifier.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.3 Ampere
Envelope	MT-8 Metal Shell
Base	B7-22 Small Wafer Octal 7-Pin Phenolic
Mounting Position	Any
Direct Interelectrode Capacitances: *	
Plate No. 1 to Cathode No. 1*	3.0 μμf
Plate No. 2 to Cathode No. 2*	3.4 μμf
Plate No. 1 to Plate No. 2 (Max)**	0.10 μμf

PHYSICAL DIMENSIONS

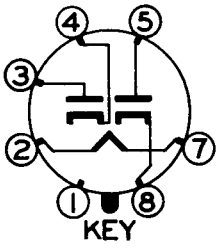


RMA 8-5

TERMINAL CONNECTIONS

Pin 1 - Shell and Internal Shield
Pin 2 - Heater
Pin 3 - Plate Number 2
Pin 4 - Cathode Number 2
Pin 5 - Plate Number 1
Pin 7 - Heater
Pin 8 - Cathode Number 1

BASING DIAGRAM



RMA 7Q
BOTTOM VIEW

MAXIMUM RATINGS

	Design Center	Absolute	
Peak Inverse Voltage	420	465	Volts
Peak Plate Current per Plate	48	53	Milliamperes
A-C Plate Voltage per Plate (RMS)	150	165	Volts
D-C Output Current per Plate	8.0	8.8	Milliamperes
D-C Heater-Cathode Voltage	330	365	Volts

CHARACTERISTICS AND TYPICAL OPERATION

HALF-WAVE RECTIFIER °

Heater Voltage (A-C or D-C)	6.3	6.3	Volts
A-C Plate Voltage per Plate (RMS)	117	150	Volts
Minimum Total Effective Plate-Supply Impedance per Plate #	15	40	Ohms
Maximum D-C Output Current per Plate	8	8	Milliamperes

VOLTAGE DOUBLER

	Half-Wave	Full-Wave	
Heater Voltage (A-C or D-C)	6.3	6.3	Volts
A-C Plate Voltage per Plate (RMS)	117	117	Volts
Minimum Total Effective Plate-Supply Impedance per Plate #	30	15	Ohms
Maximum D-C Output Current per Plate	8	8	Milliamperes

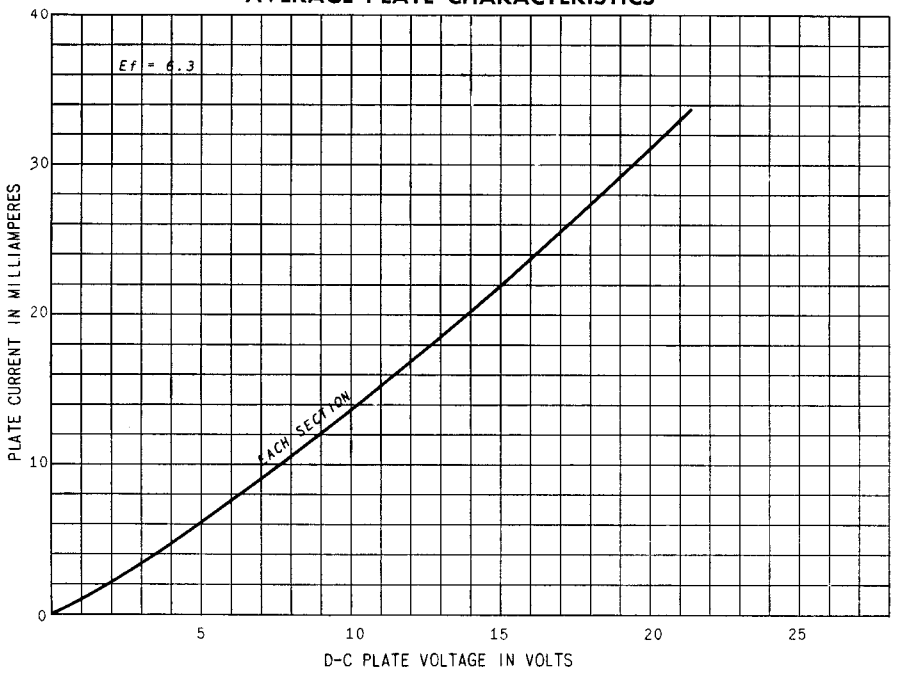
** With Shell and internal shield and heater connected to cathode of unit under test.*

*** With shell and internal shield, heater and cathodes connected to ground.*

o When operated as a half-wave rectifier the two units may be used separately or in parallel.

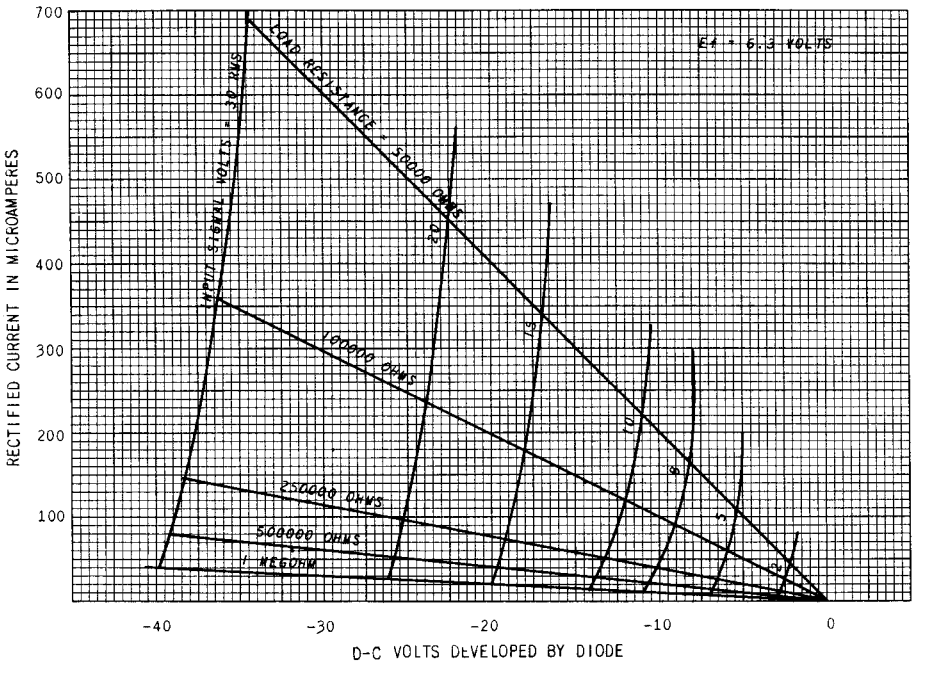
 # When filter condensers larger than 40 microfarads are used it may be necessary to add additional plate-supply impedance to limit the peak plate current to the rated maximum.

AVERAGE PLATE CHARACTERISTICS



OPERATION CHARACTERISTICS

HALF-WAVE EACH SECTION



Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

ELECTRONICS

6HA5
TRIODE

FOR VHF RF AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6HA5 is a miniature triode designed particularly for service in VHF television tuners as a grounded-cathode rf amplifier.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.18	Amperes

Direct Interelectrode Capacitances§

Grid to Plate: (g to p)	0.36	pf
Input: g to (h + k + i.s.)	4.3	pf
Output: p to (h + k + i.s.)	2.9	pf
Plate to Cathode: (p to k)	0.08	pf
Grid to Cathode: (g to k)	3.1	pf
Grid to Heater: (g to h), maximum	0.07	pf
Cathode to Heater: (k to h)	2.3	pf

MECHANICAL

Operating Position - Any
Envelope - T-5 1/2, Glass
Base - E7-1, Miniature Button 7-Pin
Outline Drawing - EIA 5-1

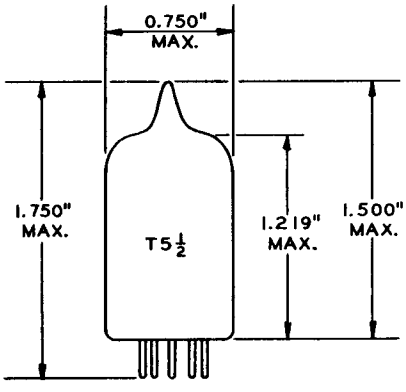
Maximum Diameter	0.750	Inches
Maximum Over-all Length	1.750	Inches
Maximum Seated Height	1.500	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	220	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	2.6	Watts
DC Cathode Current	22	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	110	Volts
Heater Negative with Respect to Cathode	110	Volts
Grid Circuit Resistance	1.0	Megohms

PHYSICAL DIMENSIONS

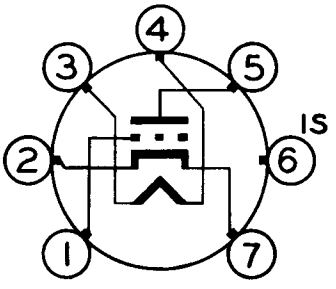


EIA 5-1

TERMINAL CONNECTIONS

Pin 1 - Grid
Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Internal Shield
Pin 7 - Cathode

BASING DIAGRAM



EIA 7GM

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MAXIMUM RATINGS (Cont'd)

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The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	135	135	135	Volts
Grid Voltage	-1.0	-2.7	-5.7	Volts
Plate Current	11.5	---	---	Milliamperes
Transconductance	14500	1500	150	Micromhos
Amplification Factor	72	---	---	
Input Conductance at 200 Mc	1500	---	---	Micromhos
Output Conductance at 200 Mc	200	---	---	Micromhos
Grid Voltage, approximate Ic = 0.3 Microamperes	---	-1.3	---	Volts

AVERAGE CHARACTERISTICS

Plate Supply Voltage	135	200	200	Volts
Plate Load Resistance	1000	4300	5600	Ohms
Cathode-Bias Resistor	0	0	87	Ohms
DC Grid Current	10	10	---	Microamperes
Plate Current	19	19	11.5	Milliamperes
Transconductance	20000	20000	14500	Micromhos
Amplification Factor	80	80	72	
Grid Voltage, approximate				
Gm = 1450 Micromhos	---	---	-3.8	Volts
Gm = 2000 Micromhos	-2.4	-3.3	---	Volts
Gm = 145 Micromhos	---	---	-8.1	Volts
Gm = 200 Micromhos	-5.3	-7.7	---	Volts

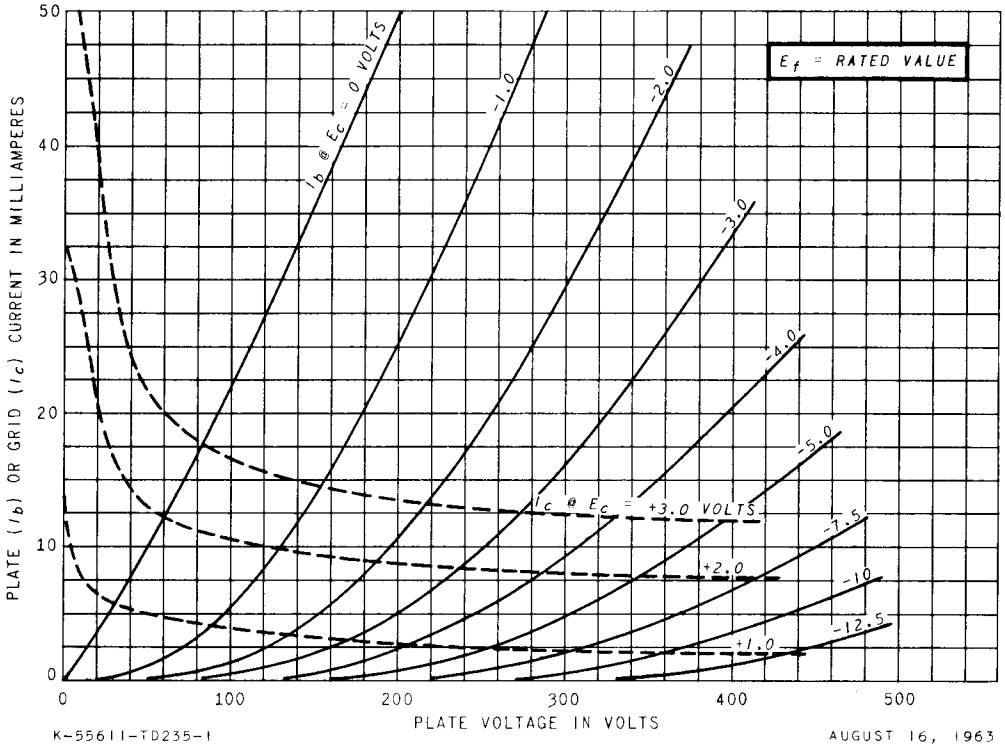
NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ With external shield.

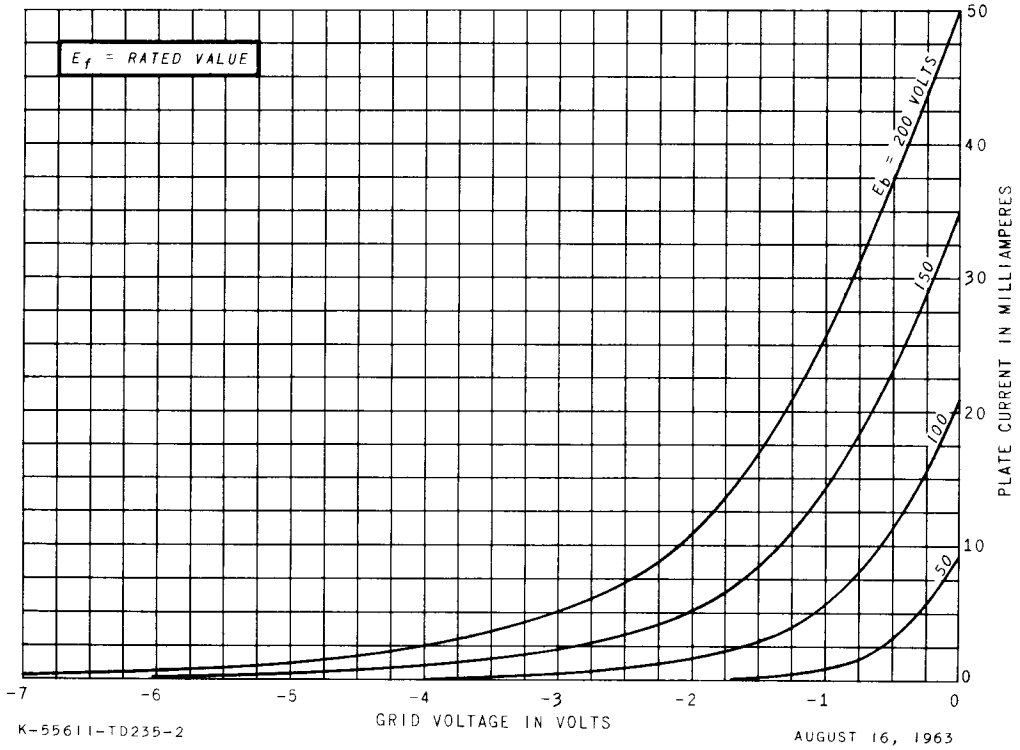
AVERAGE PLATE CHARACTERISTICS



K-55611-TD235-1

AUGUST 16, 1963

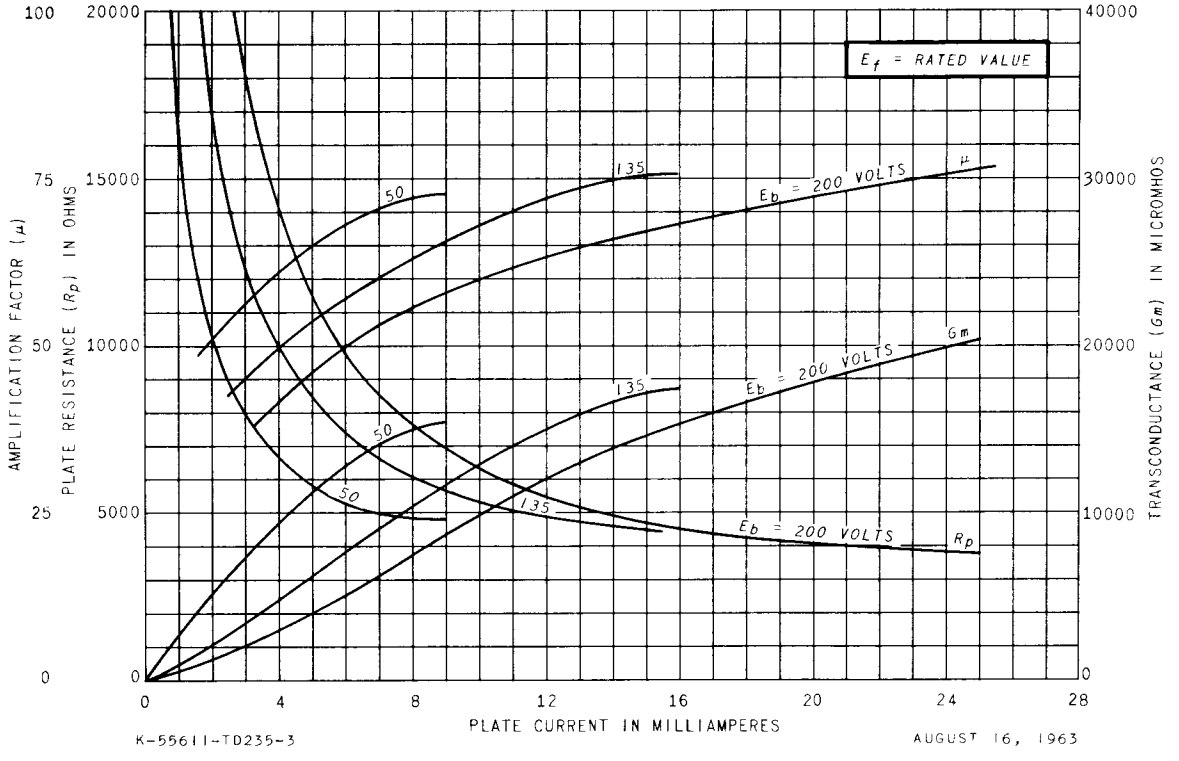
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD235-2

AUGUST 16, 1963

AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

6HB5

COMPACTRON BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6HB5 is a compactron beam-power pentode designed for use as the horizontal-deflection amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current†	1.5	Amperes

Direct Interelectrode Capacitances, approximate‡

Grid-Number 1 to Plate: (g1 to p)	0.4	pf
Input: g1 to (h + k + g2 + b.p.)	22	pf
Output: p to (h + k + g2 + b.p.)	9.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing - EIA 12-58

Maximum Diameter	1.563	Inches
Maximum Over-all Length	3.375	Inches
Maximum Seated Height	3.000	Inches

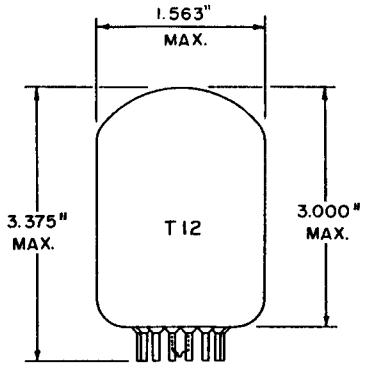
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

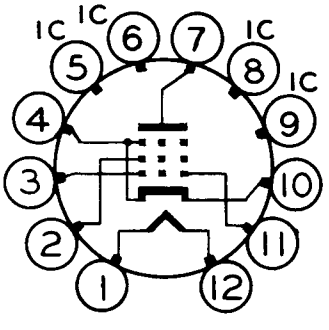


EIA 12-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Grid Number 2 (Screen)
Pin 3 - Grid Number 1
Pin 4 - Cathode and Beam Plates
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Plate
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Cathode and Beam Plates
Pin 11 - Grid Number 1
Pin 12 - Heater

BASING DIAGRAM



EIA 12BJ

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MAXIMUM RATINGS (Cont'd)

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE — DESIGN-MAXIMUM VALUES§

DC Plate-Supply Voltage (Boost + DC Power Supply)	770	Volts
Peak Positive Pulse Plate Voltage	6000	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Screen Voltage	220	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation¶	18	Watts
Screen Dissipation	3.5	Watts
DC Cathode Current	230	Milliamperes
Peak Cathode Current	800	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point	220	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	60	130	Volts
Screen Voltage	130	130	130	Volts
Grid-Number 1 Voltage	---	0#	-20	Volts
Plate Resistance, approximate	---	---	11000	Ohms
Transconductance	---	---	9100	Micromhos
Plate Current	---	410	50	Milliamperes
Screen Current	---	24	1.75	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 1.0 Milliamperes	-66	---	-33	Volts
Triode Amplification Factor△	---	---	4.7	

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

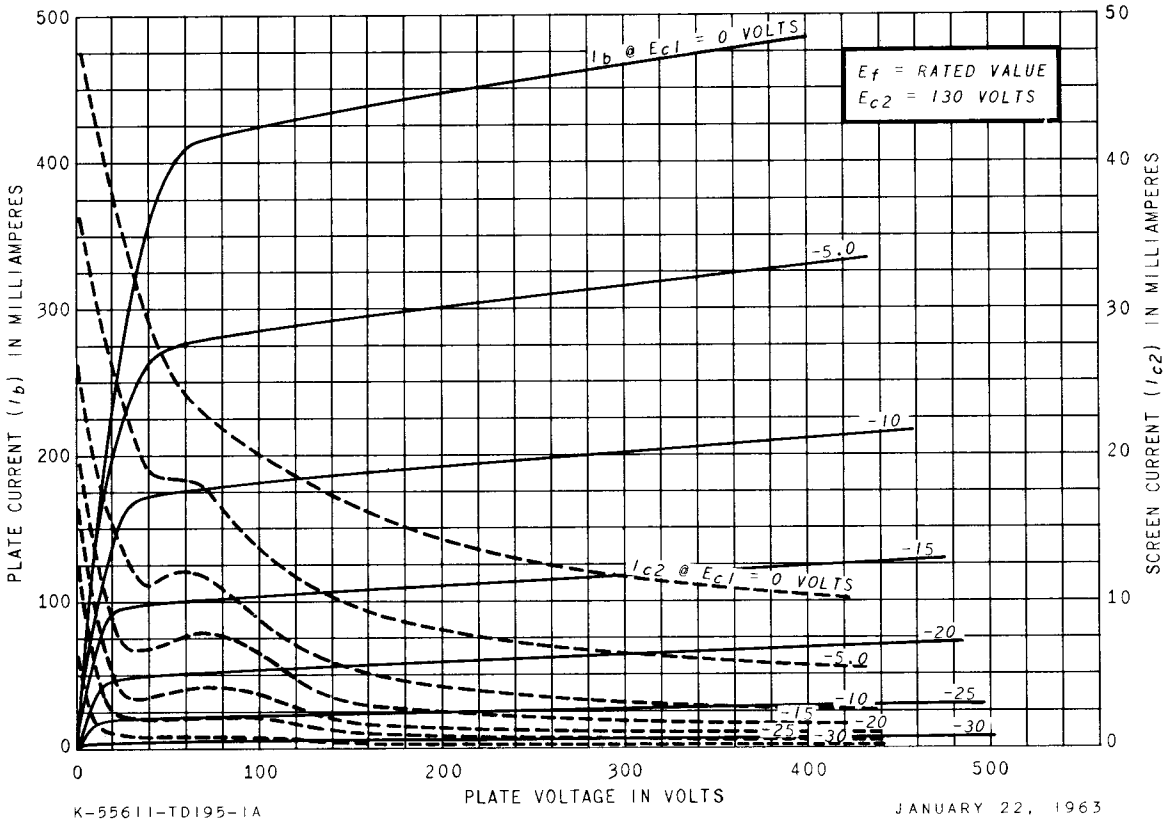
§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¶ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

\# Applied for short interval (two seconds maximum) so as not to damage tube.

△ Triode connection (screen tied to plate) with Eb = Ec2 = 130 volts and Ec1 = -20 volts.

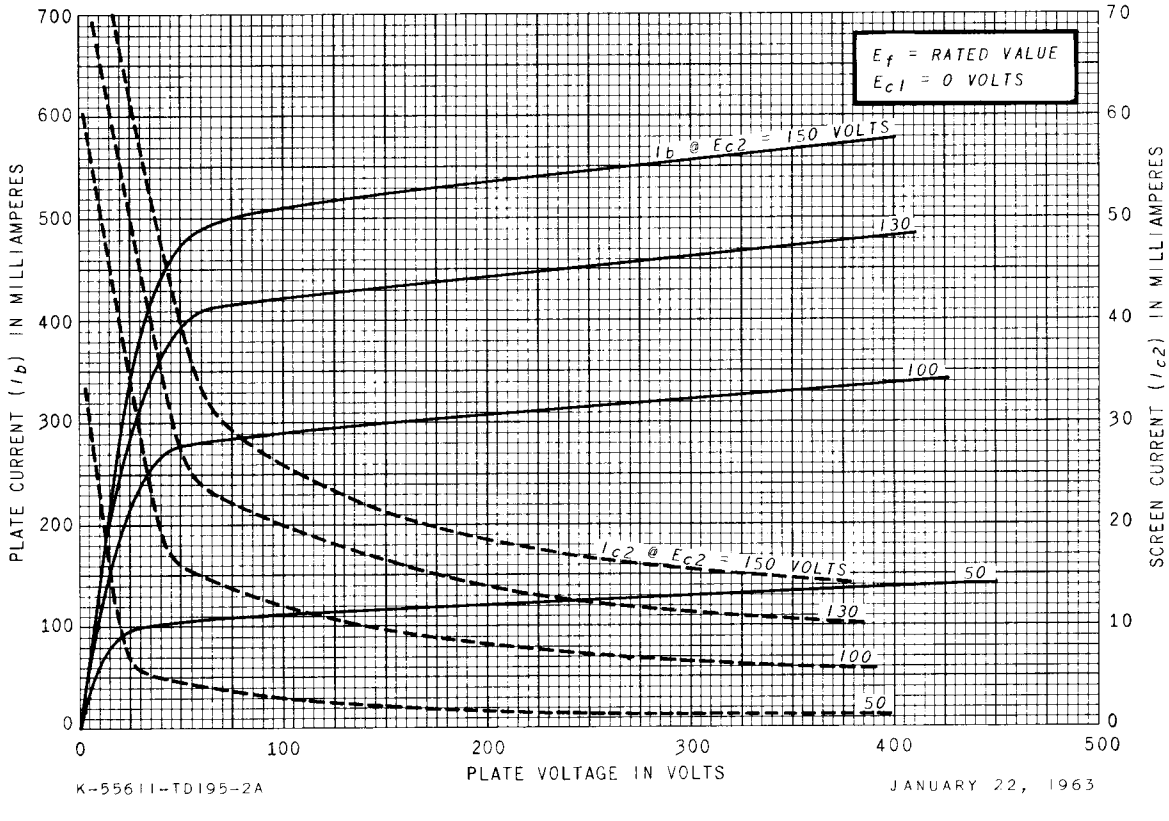
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD195-1A

JANUARY 22, 1963

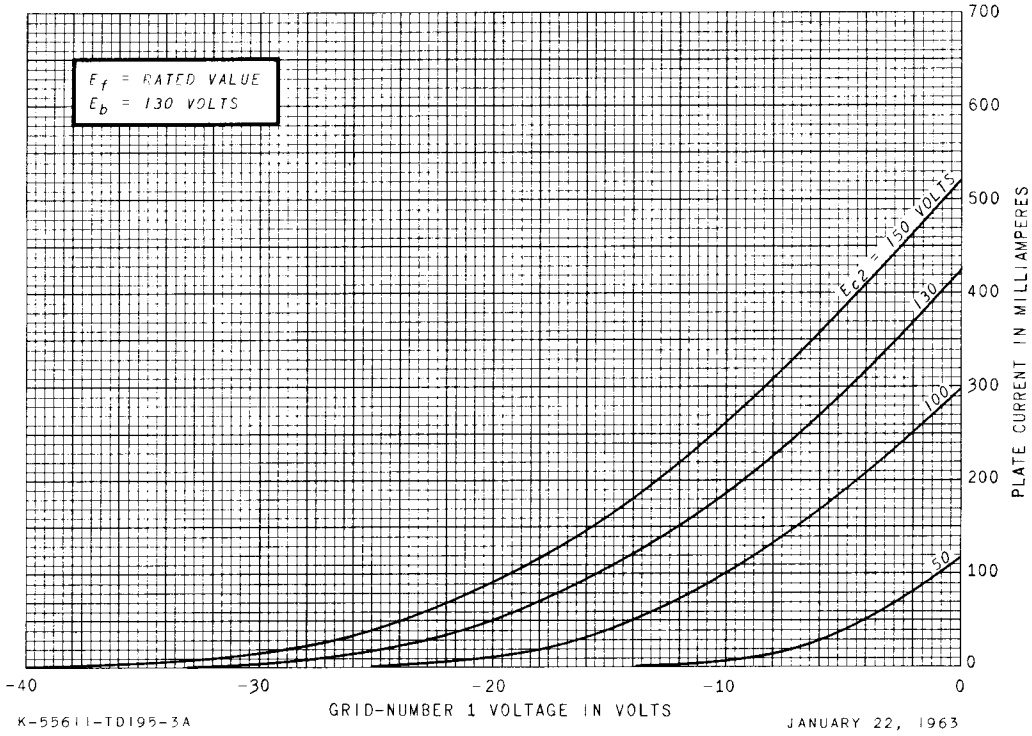
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD195-2A

JANUARY 22, 1963

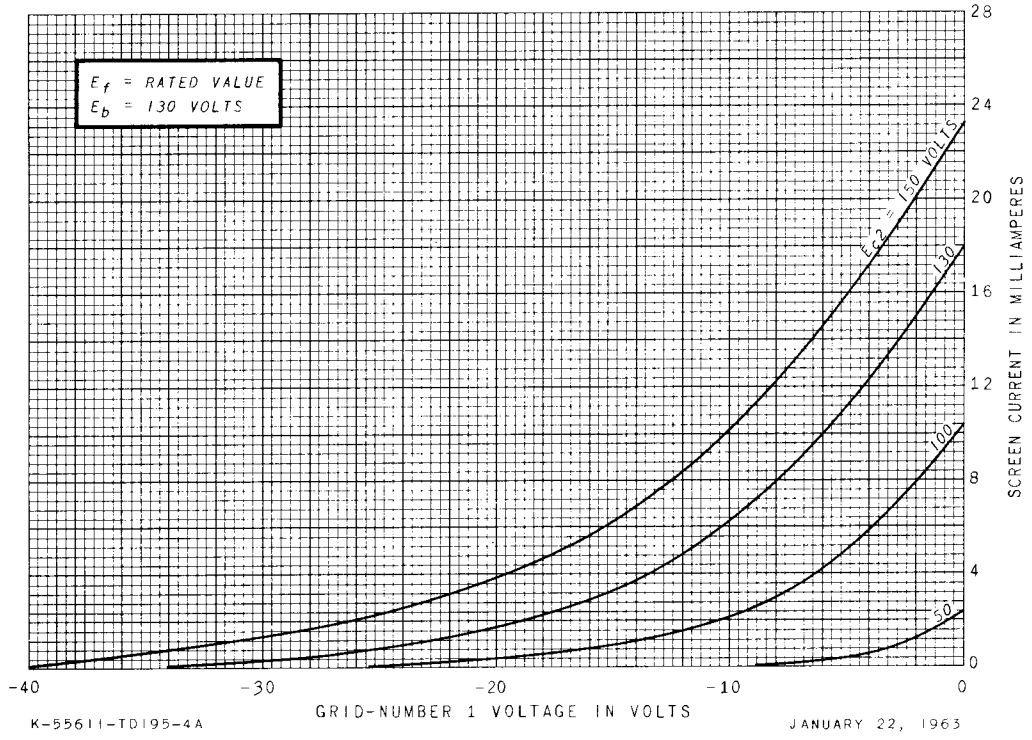
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD195-3A

JANUARY 22, 1963

AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD195-4A

JANUARY 22, 1963

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

6HB6

BEAM PENTODE

FOR TV VERTICAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6HB6 is a beam pentode designed for use as a vertical-deflection amplifier in television receivers. It is also useful in video amplifier applications.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.76	Amperes

Direct Interelectrode Capacitances§

Grid-Number 1 to Plate: (g1 to p)	0.18	pf
Input: g1 to (h + k + g2 + b.p.)	13	pf
Output: p to (h + k + g2 + b.p.)	8.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-4

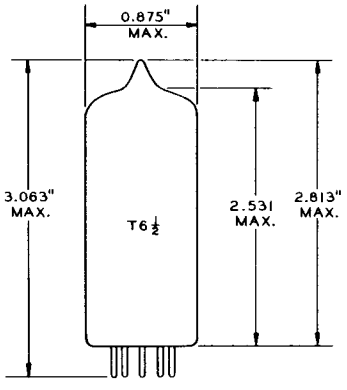
Maximum Diameter	0.875	Inches
Maximum Over-all Length	3.063	Inches
Maximum Seated Height	2.813	Inches

MAXIMUM RATINGS

VERTICAL-DEFLECTION AMPLIFIER SERVICE¶—DESIGN-MAXIMUM VALUES

DC Plate Voltage	350	Volts
Peak Positive Pulse Plate Voltage	2500	Volts
Screen Voltage	300	Volts
Negative DC Grid-Number 1 Voltage	100	Volts
Plate Dissipation	10	Watts
Screen Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	1.0	Megohms
With Cathode Bias	2.2	Megohms

PHYSICAL DIMENSIONS

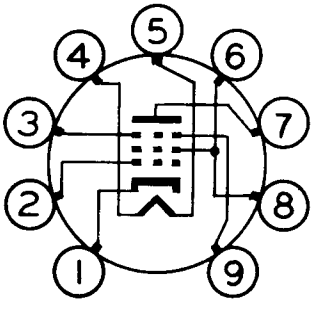


EIA 6-4

TERMINAL CONNECTIONS

Pin 1 - Cathode
Pin 2 - Grid Number 1
Pin 3 - Beam Plates
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Plate
Pin 8 - Grid Number 2 (Screen)
Pin 9 - Beam Plates

BASING DIAGRAM



EIA 9NW

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	60	250	250	Volts
Screen Voltage	250	125	250	Volts
Grid-Number 1 Voltage	0#	---	---	Volts
Cathode-Bias Resistor	---	33	100	Ohms
Plate Resistance, approximate	---	28000	24000	Ohms
Transconductance	---	24000	20000	Micromhos
Amplification Factor: (g1 to g2)	---	---	33	
Plate Current	150	40	40	Milliamperes
Screen Current	37	4.2	6.2	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	---	-6.4	-13	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

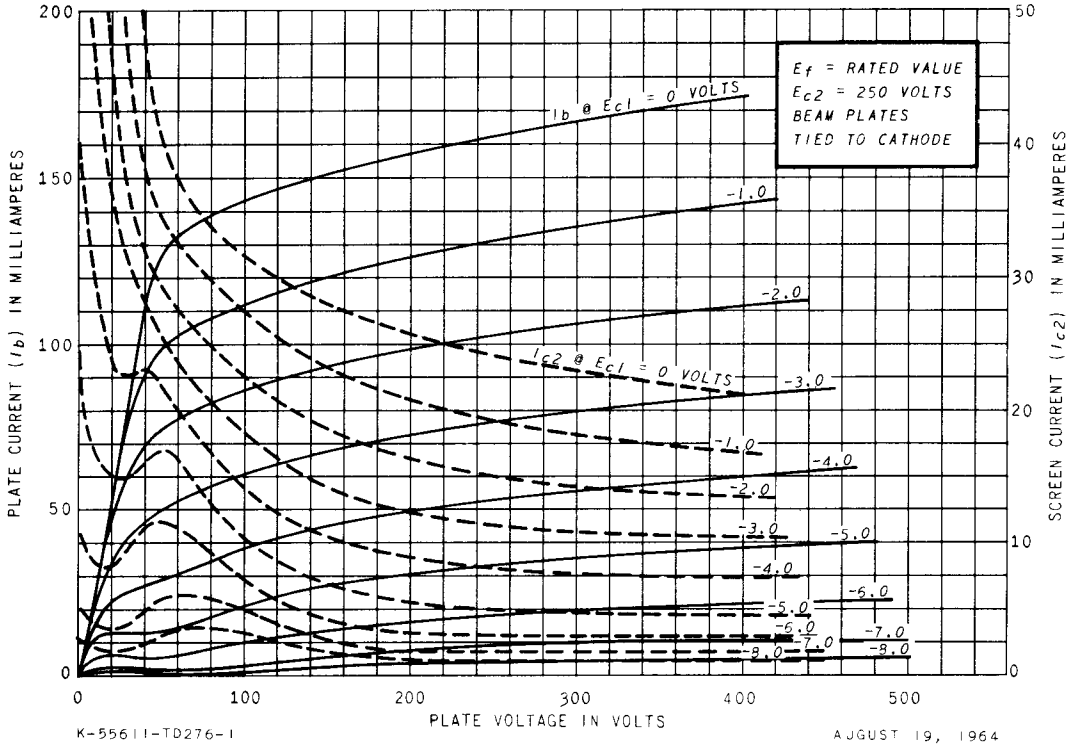
§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

\# Applied for short interval (two seconds maximum) so as not to damage tube.

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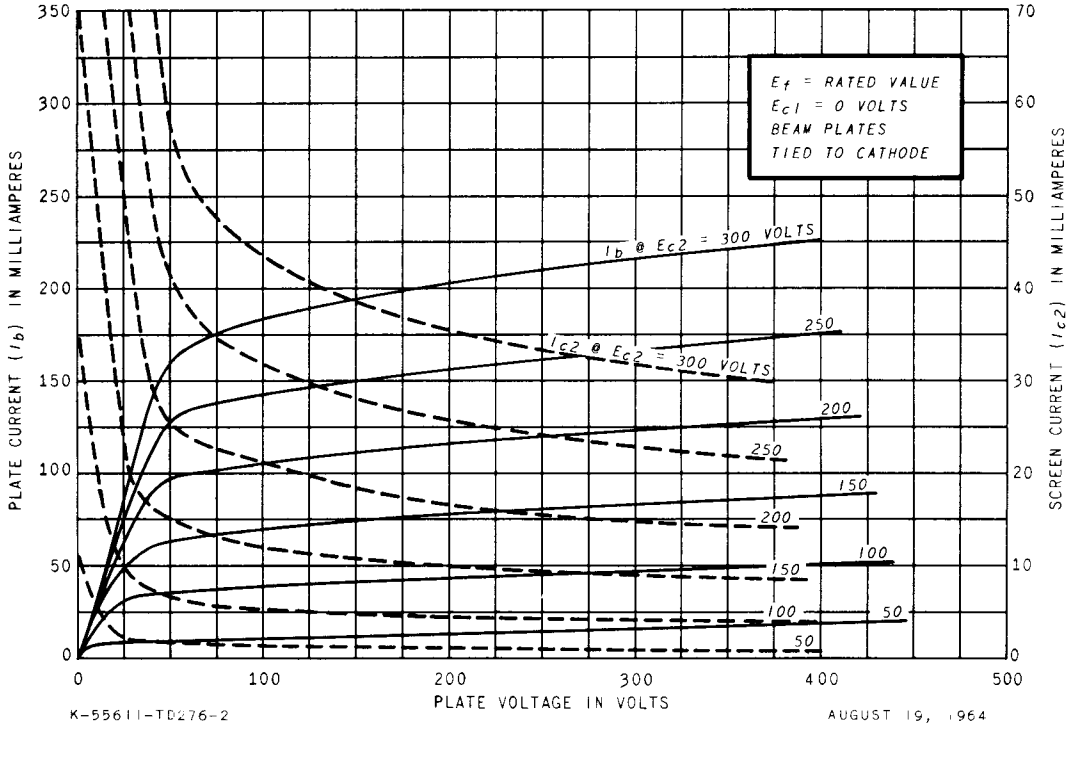
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD276-1

AUGUST 19, 1964

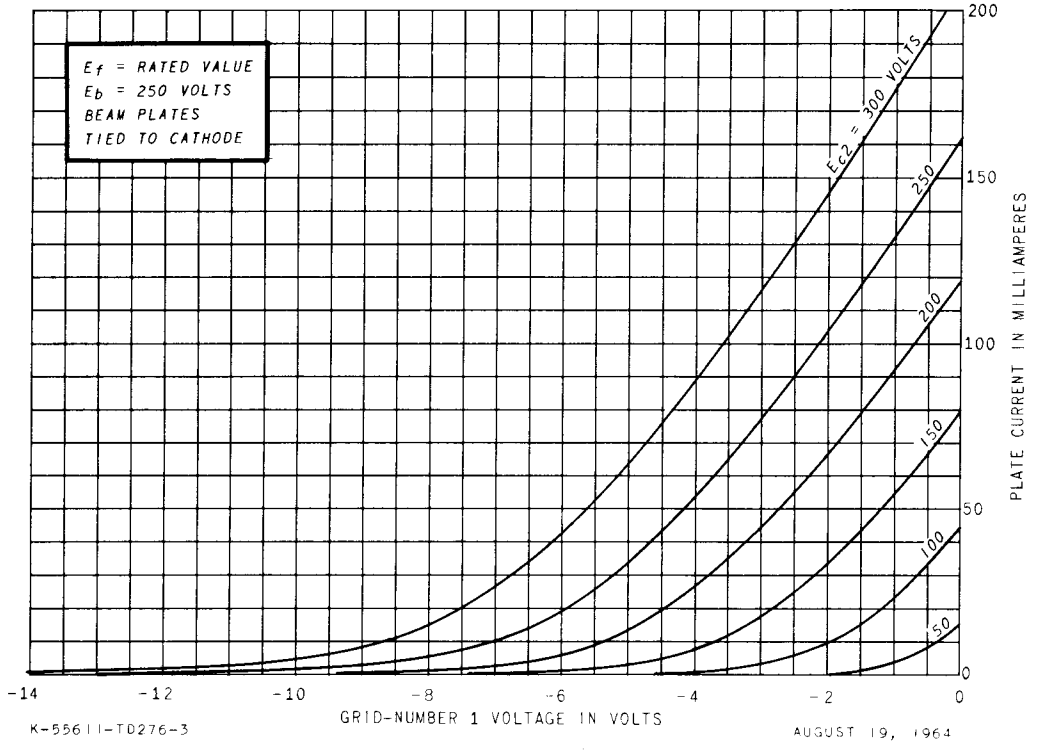
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD276-2

AUGUST 19, 1964

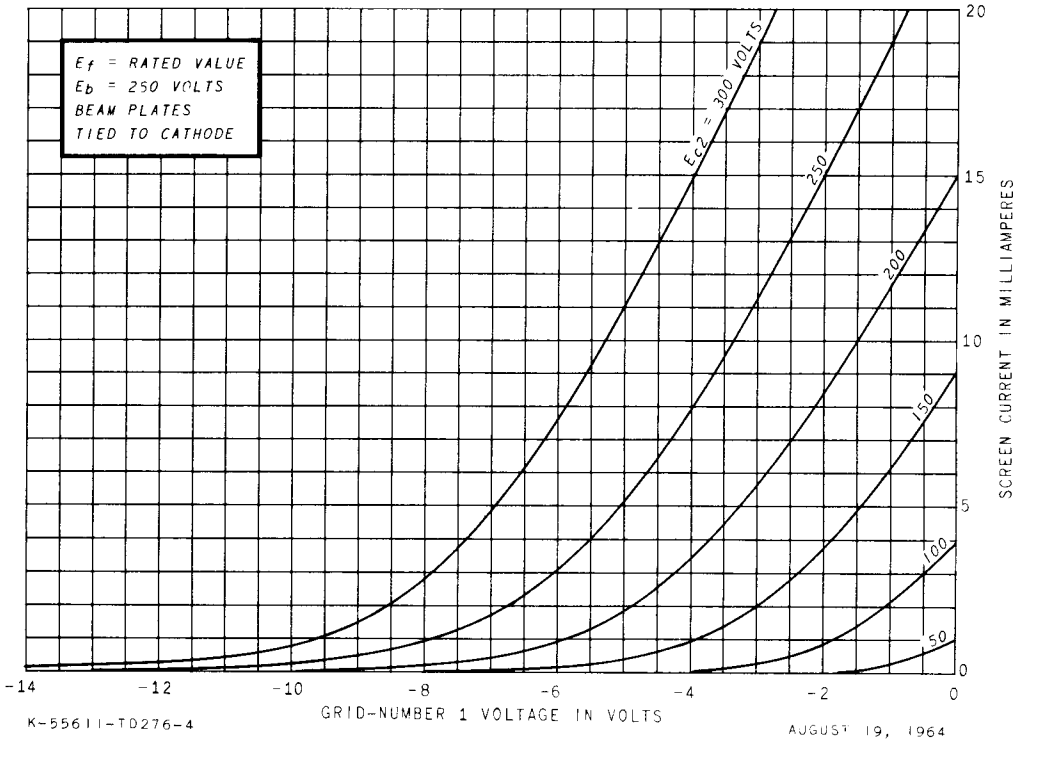
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD276-3

AUGUST 19, 1964

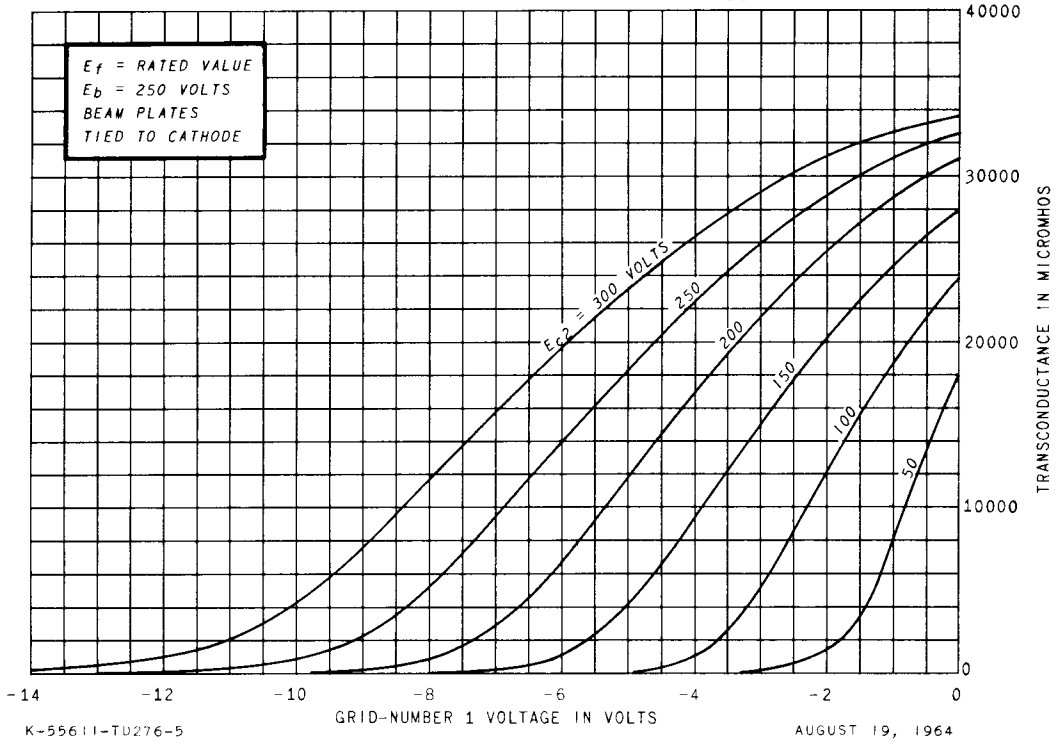
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD276-4

AUGUST 19, 1964

AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD276-5

AUGUST 19, 1964

COMPACTRON BEAM PENTODE

FOR TV VERTICAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6HE5 is a compactron beam pentode designed for use as the vertical-deflection amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.8	Amperes
Direct Interelectrode Capacitances, approximate‡		
Grid-Number 1 to Plate: (g1 to p)	0.54	pf
Input: g1 to (h+k+g2+b.p.)	9.5	pf
Output: p to (h+k+g2+b.p.)	7.0	pf

MECHANICAL

Operating Position—Any
Envelope—T-9, Glass
Base—E12-70, Button 12-Pin
Outline Drawing—EIA 9-60

Maximum Diameter	1.188	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches

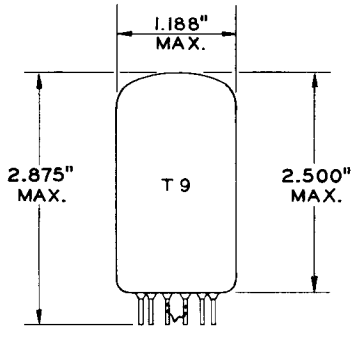
MAXIMUM RATINGS

VERTICAL-DEFLECTION AMPLIFIER SERVICE§
DESIGN-MAXIMUM VALUES

DC Plate Voltage	350	Volts
Peak Pulse Plate Voltage	2500	Volts
Screen Voltage	300	Volts
Plate Dissipation¶	12	Watts
Screen Dissipation¶	2.75	Watts
DC Cathode Current	75	Milliamperes
Peak Cathode Current	260	Milliamperes

Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	1.0	Megohms
With Cathode Bias	2.2	Megohms
Bulb Temperature at Hottest Point	200	C

PHYSICAL DIMENSIONS

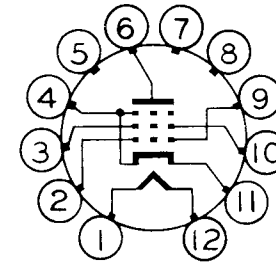


EIA 9-60

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—Grid Number 1
Pin 3—Grid Number 2 (Screen)
Pin 4—Cathode and Beam Plates
Pin 5—No connection
Pin 6—Plate
Pin 7—No Connection
Pin 8—No Connection
Pin 9—Grid Number 1
Pin 10—Grid Number 2 (Screen)
Pin 11—Cathode and Beam Plates
Pin 12—Heater

BASING DIAGRAM



EIA 12EY

MAXIMUM RATINGS (CONT'D)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	60	250	Volts
Screen Voltage	250	250	Volts
Grid-Number 1 Voltage	0#	−20	Volts
Plate Resistance, approximate	—	50000	Ohms
Transconductance	—	4100	Micromhos
Plate Current	180	43	Milliamperes
Screen Current	20	3.5	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	—	−50	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

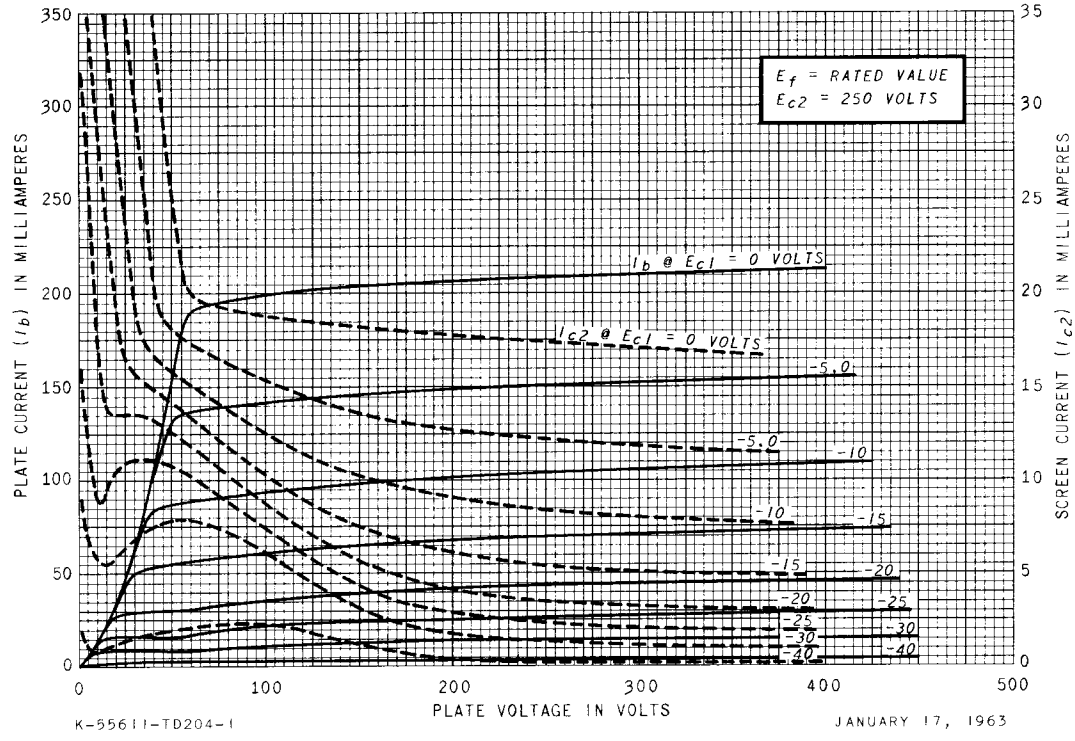
§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

¶ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Applied for short interval (two seconds maximum) so as not to damage tube.

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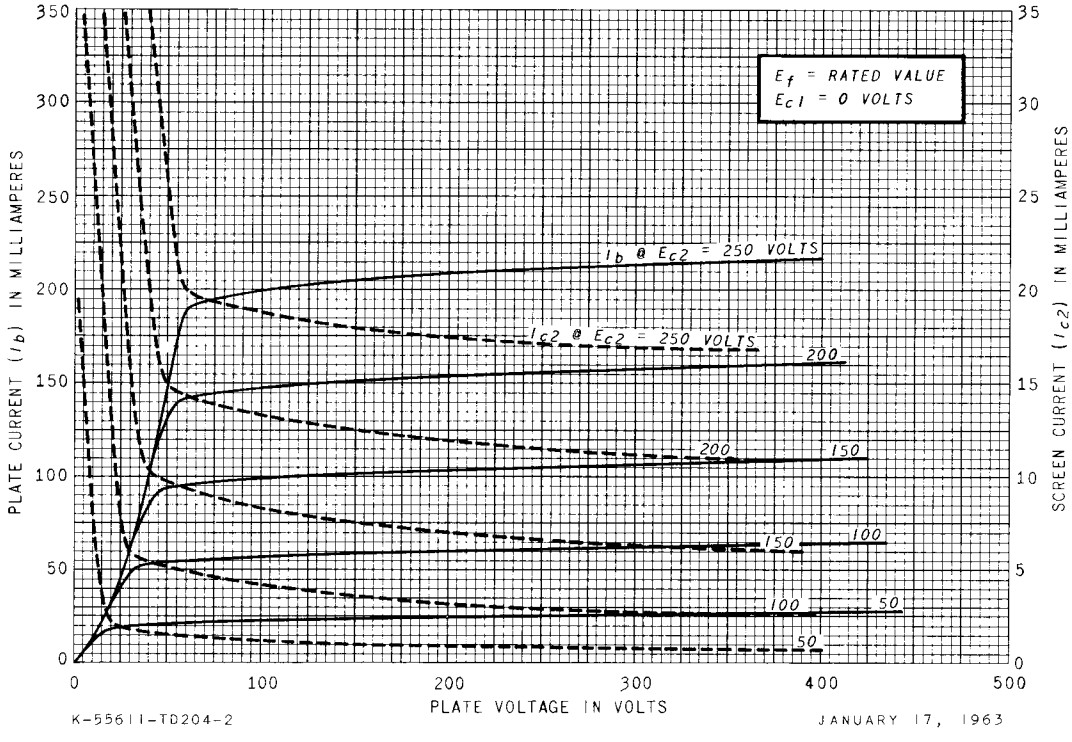
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD204-1

JANUARY 17, 1963

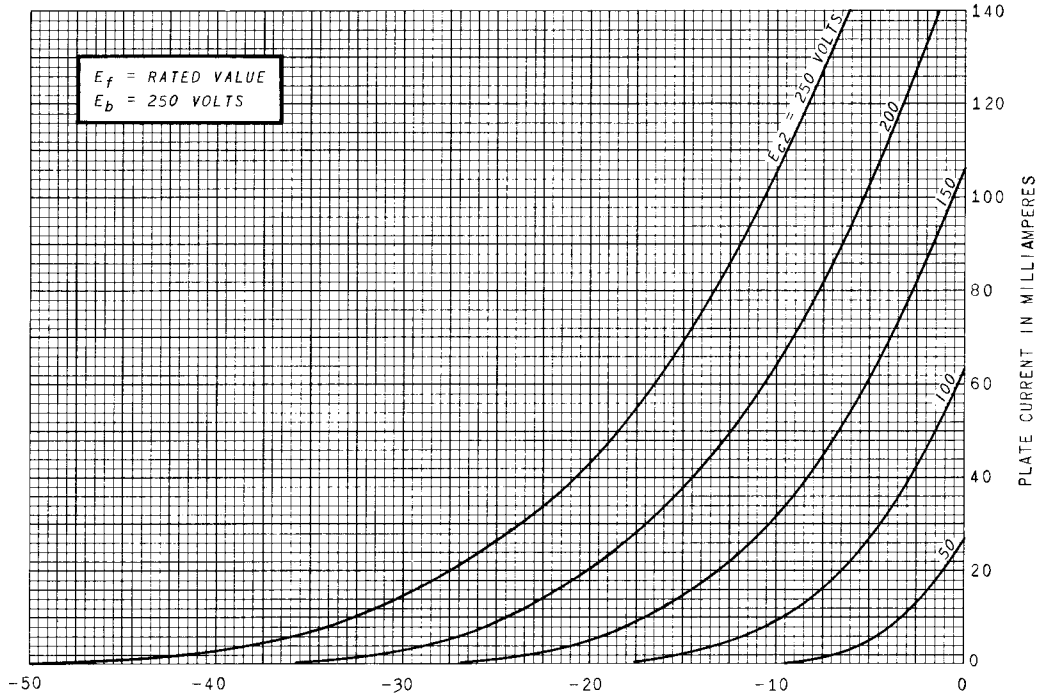
AVERAGE PLATE CHARACTERISTICS



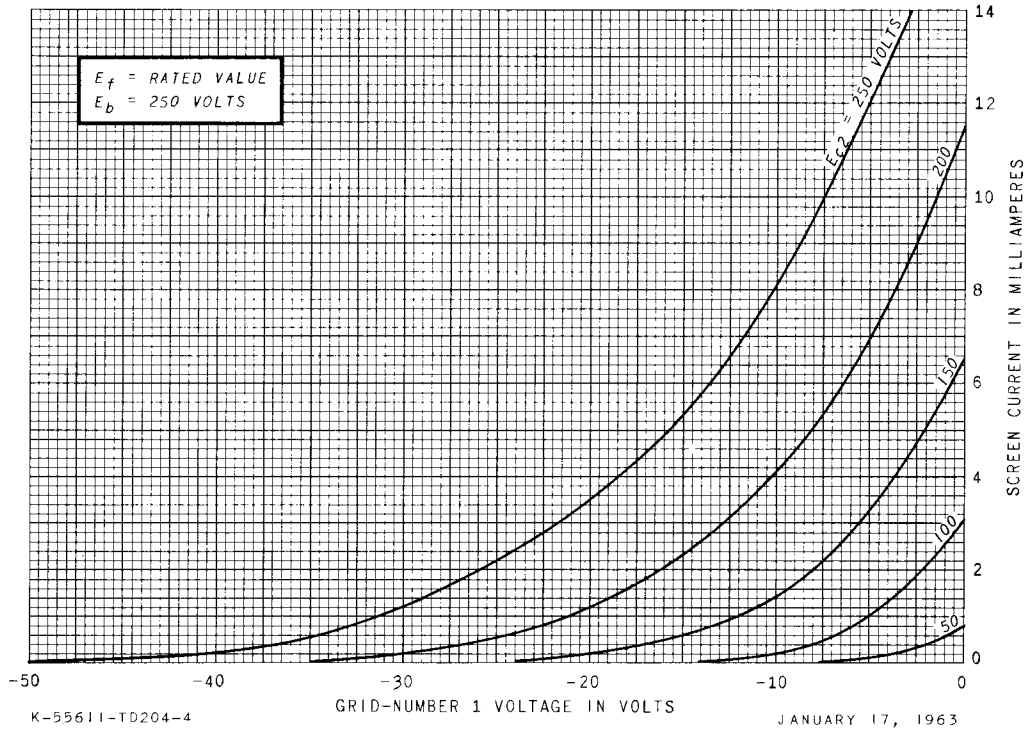
K-5561I-TD204-2

JANUARY 17, 1963

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

PRINTED IN U.S.A.

ELECTRONICS

6HM5
TRIODE

FOR VHF RF AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6HM5 is a miniature triode designed particularly for service in VHF television tuners as a grounded-cathode rf amplifier.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.185	Amperes

Direct Interelectrode Capacitances§

Grid to Plate: (g to p), maximum	0.34	pf
Input: g to (h + k + i.s.)	4.5	pf
Output: p to (h + k + i.s.)	3.0	pf
Heater to Cathode: (h to k)	2.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-5 1/2, Glass
Base - E7-1, Miniature Button 7-Pin
Outline Drawing - EIA 5-2

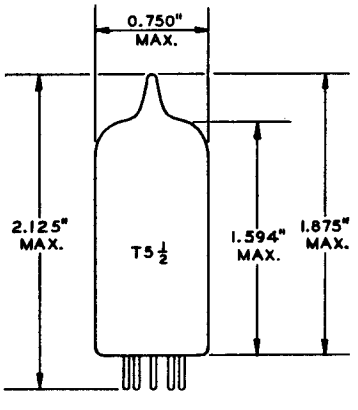
Maximum Diameter	0.750	Inches
Maximum Over-all Length	2.125	Inches
Maximum Seated Height	1.875	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	200	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	2.2	Watts
DC Cathode Current	20	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	100	Volts
Grid Circuit Resistance		
With Cathode Bias	1.0	Megohms

PHYSICAL DIMENSIONS

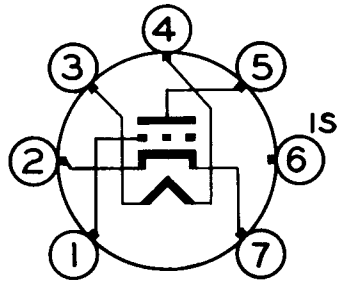


EIA 5-2

TERMINAL CONNECTIONS

Pin 1 - Grid
Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Internal Shield
Pin 7 - Cathode

BASING DIAGRAM



EIA 7GM

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	120	135	Volts
Grid Voltage	0	-1.0	Volts
Grid-Circuit Resistance	0.1	0	Megohms
Amplification Factor	82	78	
Transconductance	18000	14500	Micromhos
Plate Current	15	12.5	Milliamperes
Grid Voltage, approximate Gm = 150 Micromhos	-5.1	-5.7	Volts
Grid Voltage, approximate Gm = 1500 Micromhos	---	-2.7	Volts
Hot Input Resistance¶	---	1000	Ohms
Hot Input Capacitance¶	---	8.5	Picofarads
Noise Figure#	4.0	4.2	Decibels

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

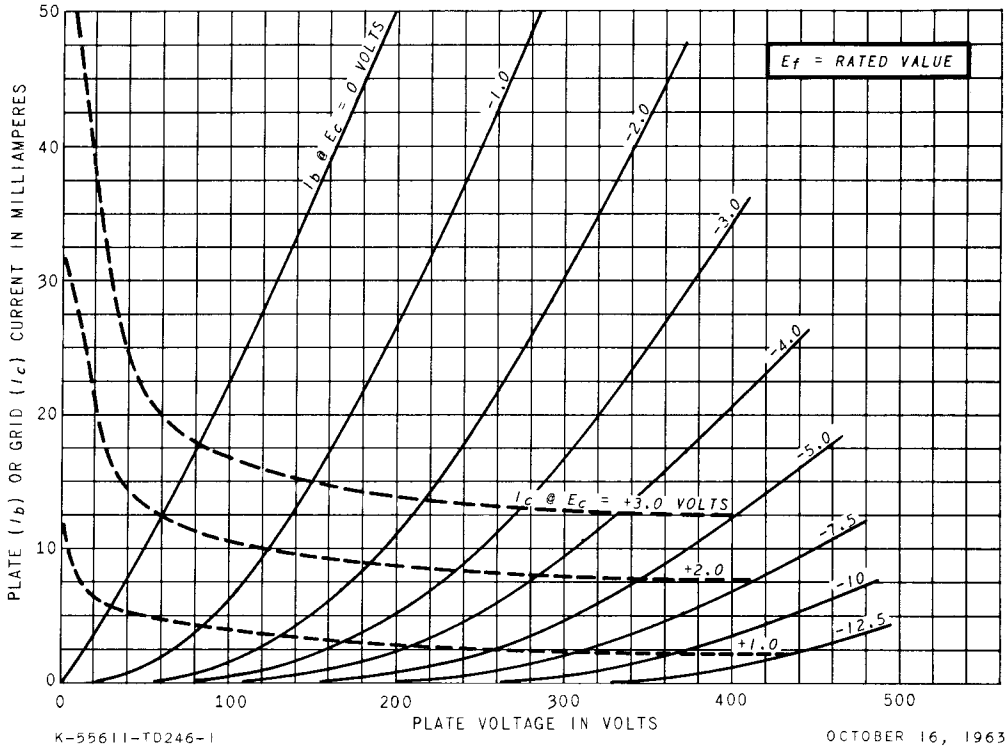
‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ With external shield (EIA 316) connected to cathode.

¶ Measured at 200 megacycles with plate at signal ground; Ec1 = -1.5 volts.

\# In a 200 megacycle noise-matched, optimized, neutralized, grounded-cathode triode amplifier stage.

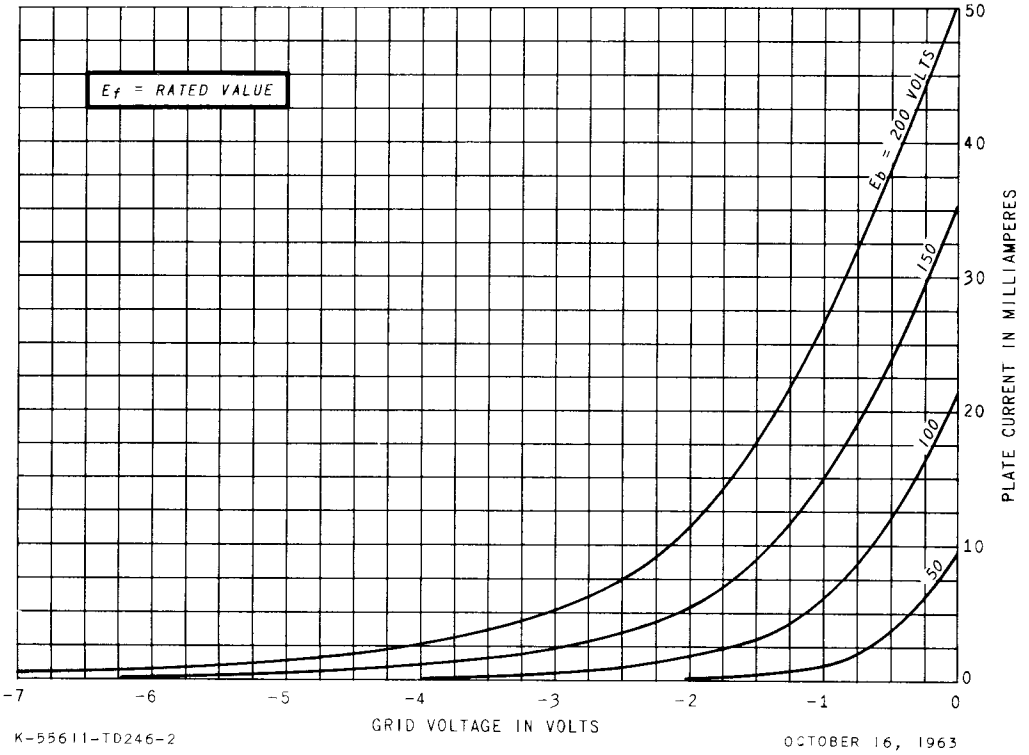
AVERAGE PLATE CHARACTERISTICS



K-55611-TD246-1

OCTOBER 16, 1963

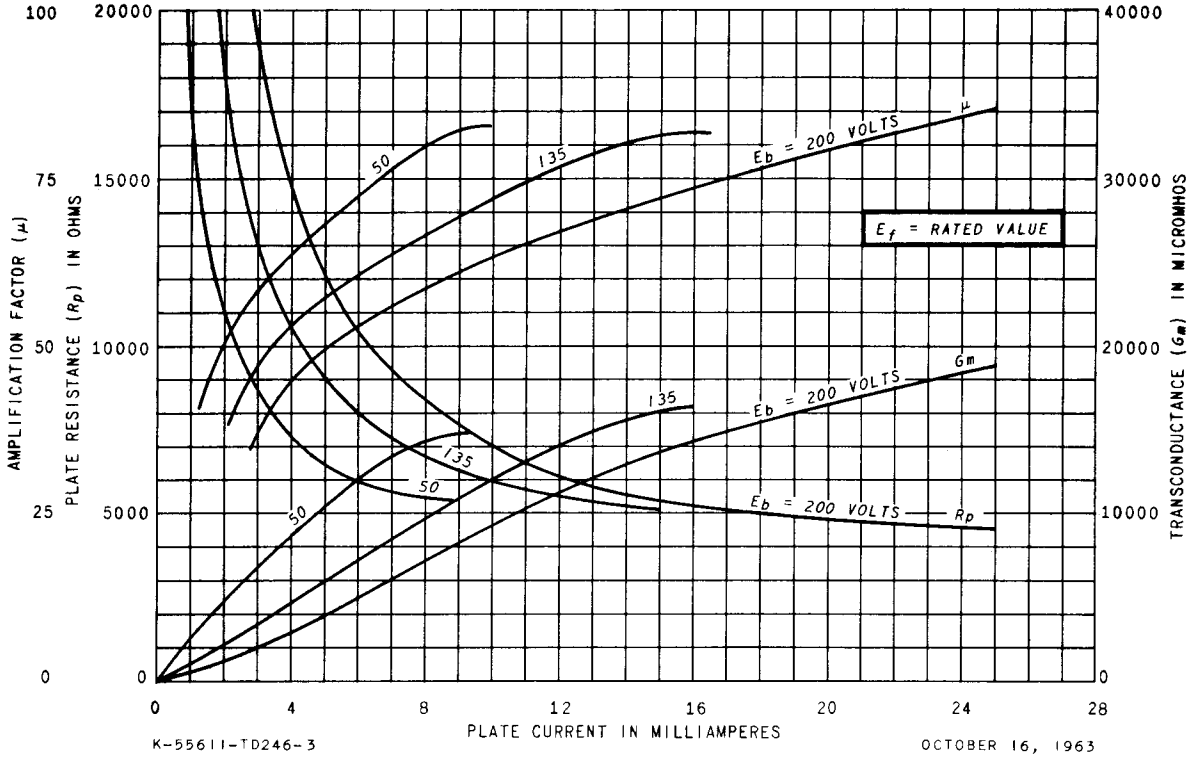
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD246-2

OCTOBER 16, 1963

AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

6HS8

TWIN PENTODE

DESCRIPTION AND RATING

The 6HS8 is a miniature multisection tube that incorporates separate plates and number-3 grids for the two sections together with a common screen, number-1 grid, and cathode. The tube is intended for use as a combined sync-AGC tube in television receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.3	Ampere
Direct Interelectrode Capacitances, approximate‡		
Grid-Number 3 to Plate, Each Section	2.0	pf
Grid-Number 1 to All	6.0	pf
Grid-Number 3 (Each Section) to All	3.6	pf
Plate (Each Section) to All	3.0	pf
Grid-Number 3 (Section 1) to Grid-Number 3 (Section 2), maximum	0.015	pf

MECHANICAL

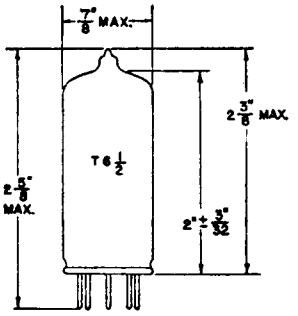
Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage, Each Section	300	Volts
Screen Voltage	150	Volts
Positive DC Grid-Number 3 Voltage, Each Section	3.0	Volts
Negative DC Grid-Number 3 Voltage, Each Section	50	Volts
Peak Positive Grid-Number 3 Voltage, Each Section	50	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
Plate Dissipation, Each Section	1.1	Watts
Screen Dissipation	0.75	Watt
DC Cathode Current	12	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	0.5	Megohm
Grid-Number 3 Circuit Resistance, Each Section	0.5	Megohm

PHYSICAL DIMENSIONS

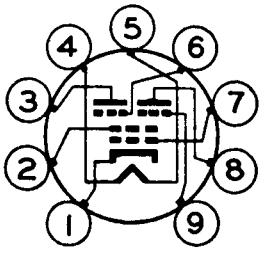


EIA 6-3

TERMINAL CONNECTIONS

Pin 1—Cathode and Internal Shield
Pin 2—Grid Number 2 (Screen)
Pin 3—Plate (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Grid Number 3 (Section 2)
Pin 7—Grid Number 1
Pin 8—Plate (Section 1)
Pin 9—Grid Number 3 (Section 1)

BASING DIAGRAM



EIA 9LW

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, BOTH SECTIONS OPERATING

Plate Voltage, Each Section	100	100	Volts
Screen Voltage	67.5	67.5	Volts
Grid-Number 3 Voltage, Each Section	−10	0	Volts
Grid-Number 1 Voltage	§	§	
Plate Current, Each Section		2.0	Milliamperes
Screen Current	7.0	4.4	Milliamperes
Cathode Current	7.1	8.5	Milliamperes
Grid-Number 3 Transconductance		450	Micromhos
Grid-Number 1 Transconductance	1100	....	Micromhos
Plate Current		2.0	Milliamperes
Grid-Number 3 Voltage, approximate Ib = 25 Microamperes		−3	Volts
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes		−2.3	Volts

AVERAGE CHARACTERISTICS, EACH SECTION SEPARATELY WITH PLATE AND GRID-NUMBER 3 OF OPPOSITE SECTION GROUNDED

Plate Voltage	100	100	Volts
Screen Voltage	67.5	67.5	Volts
Grid-Number 3 Voltage	0	0	Volts
Grid-Number 1 Voltage	0	§	Volts

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ With grid current adjusted for 100 microamperes d-c.

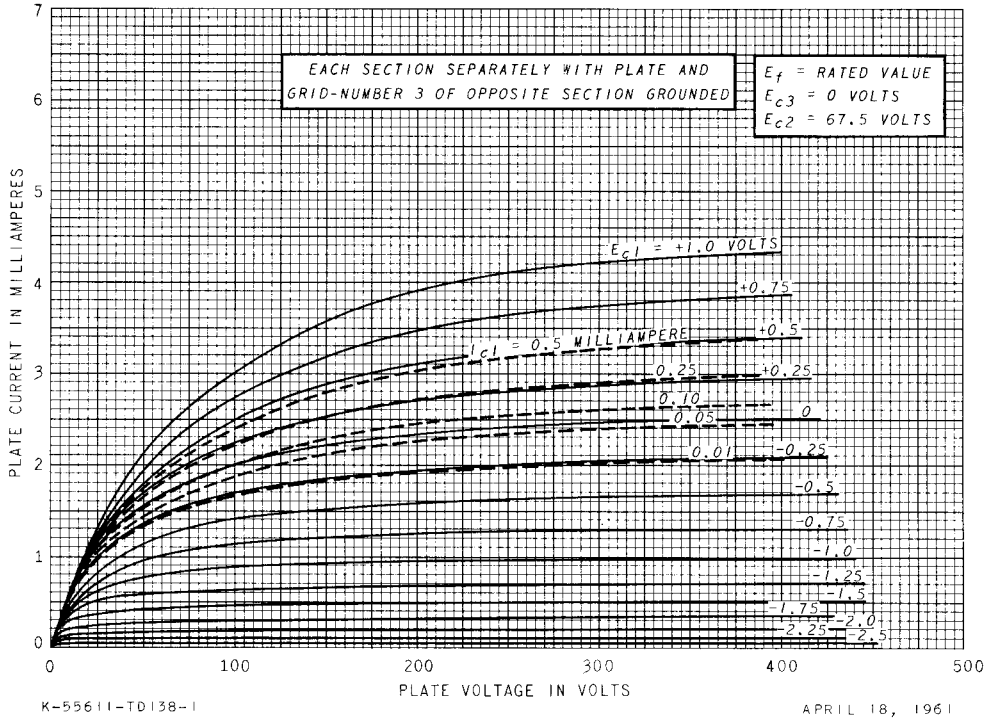
Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

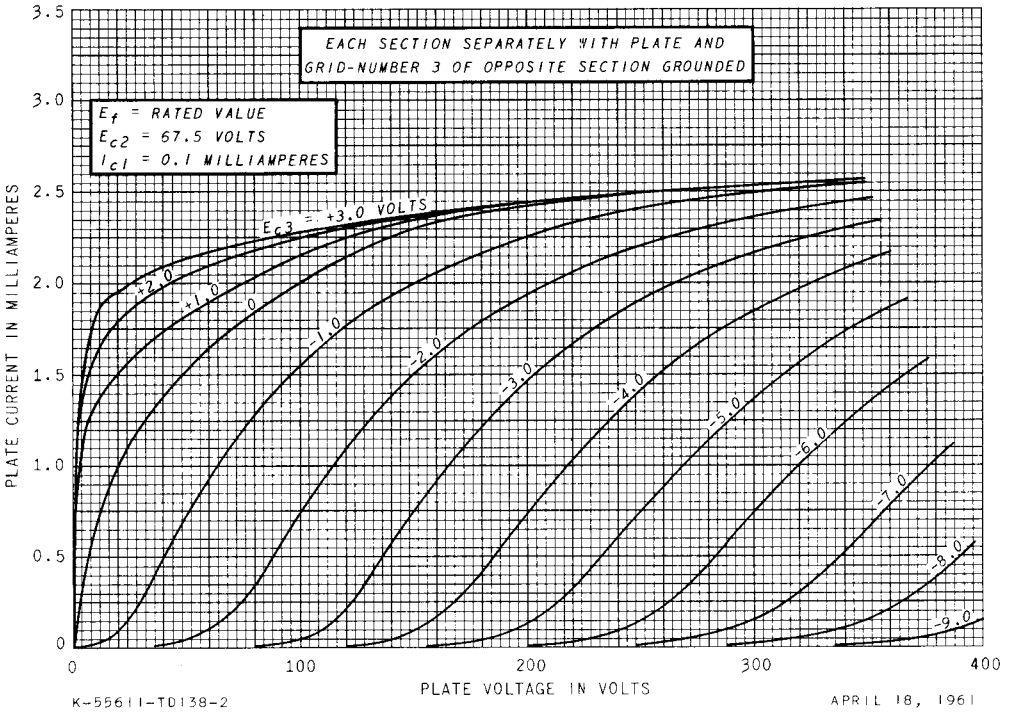
AVERAGE PLATE CHARACTERISTICS



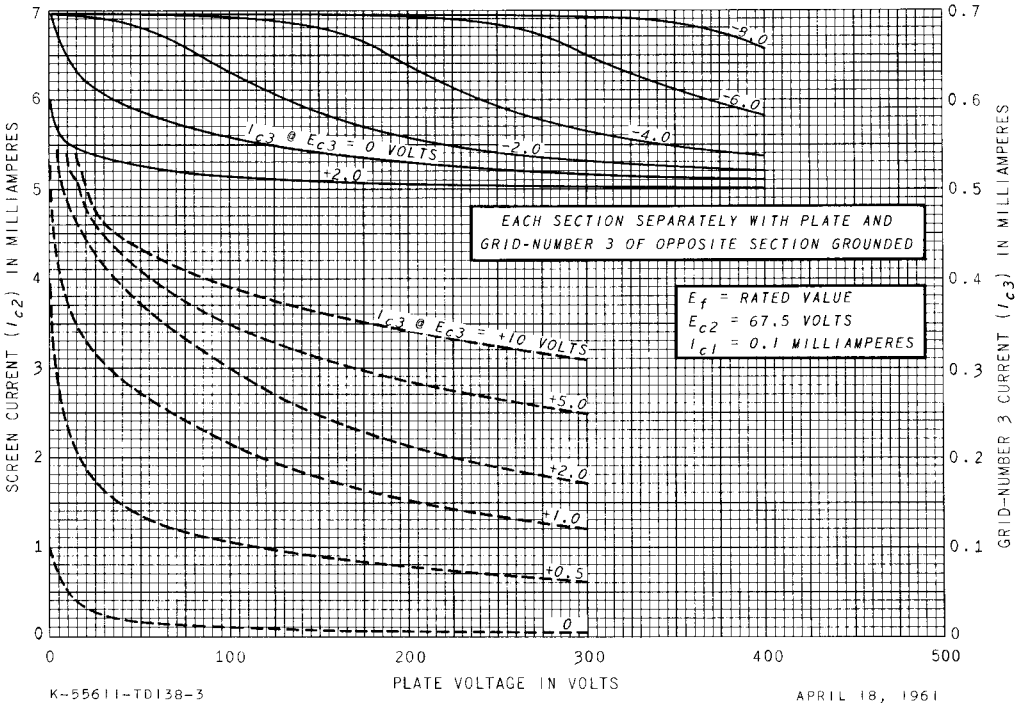
K-5561I-TD138-I

APRIL 18, 1961

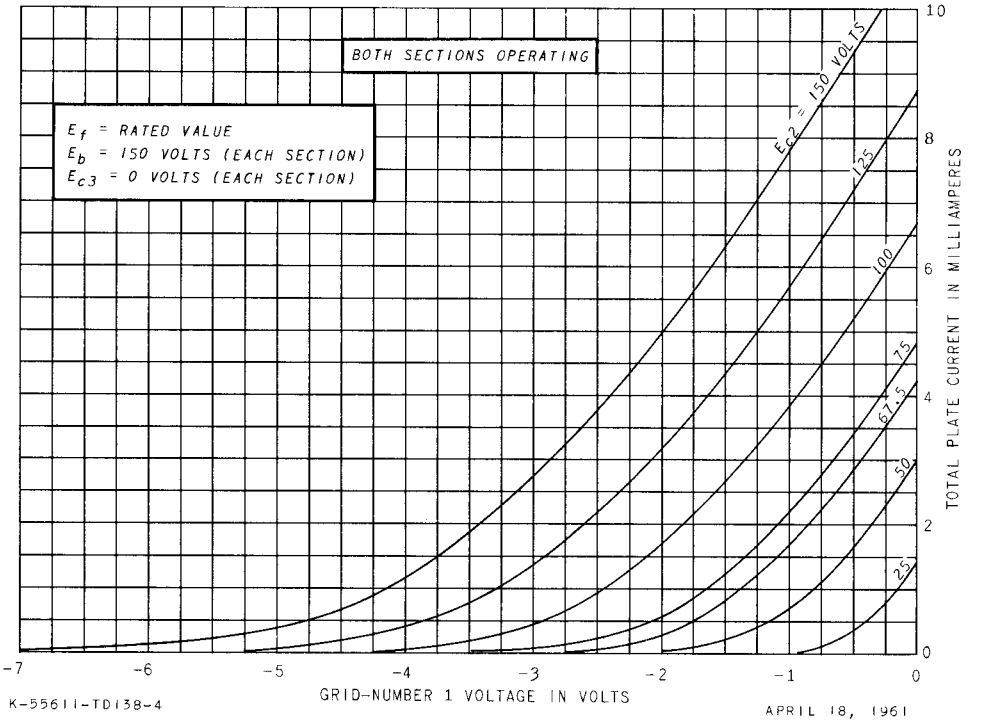
AVERAGE PLATE CHARACTERISTICS



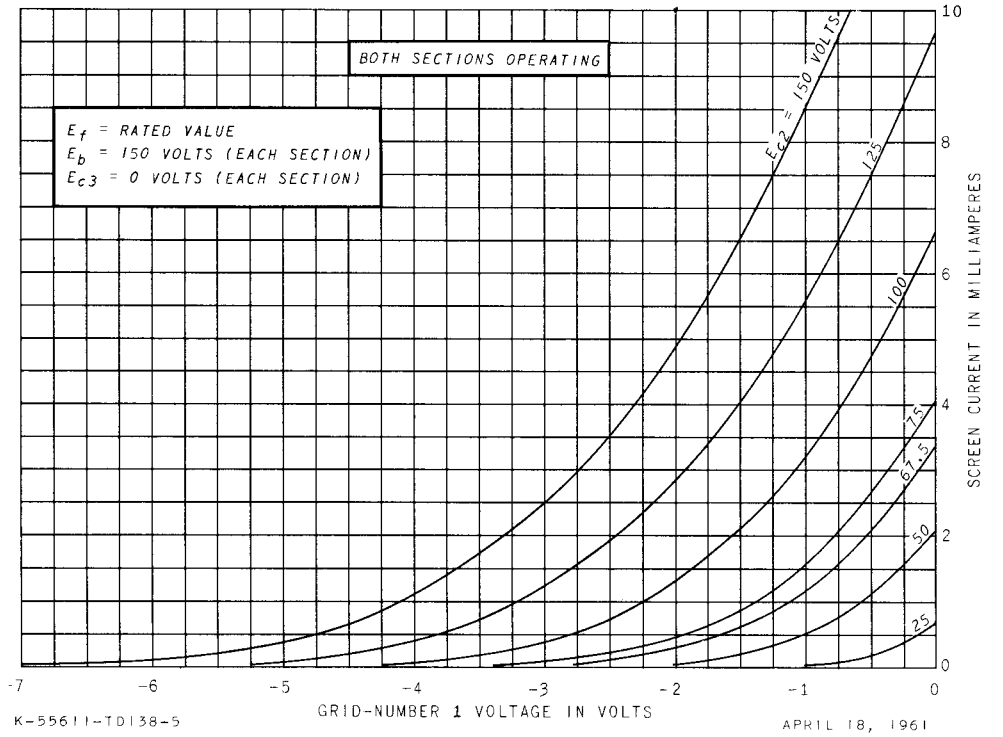
AVERAGE CHARACTERISTICS



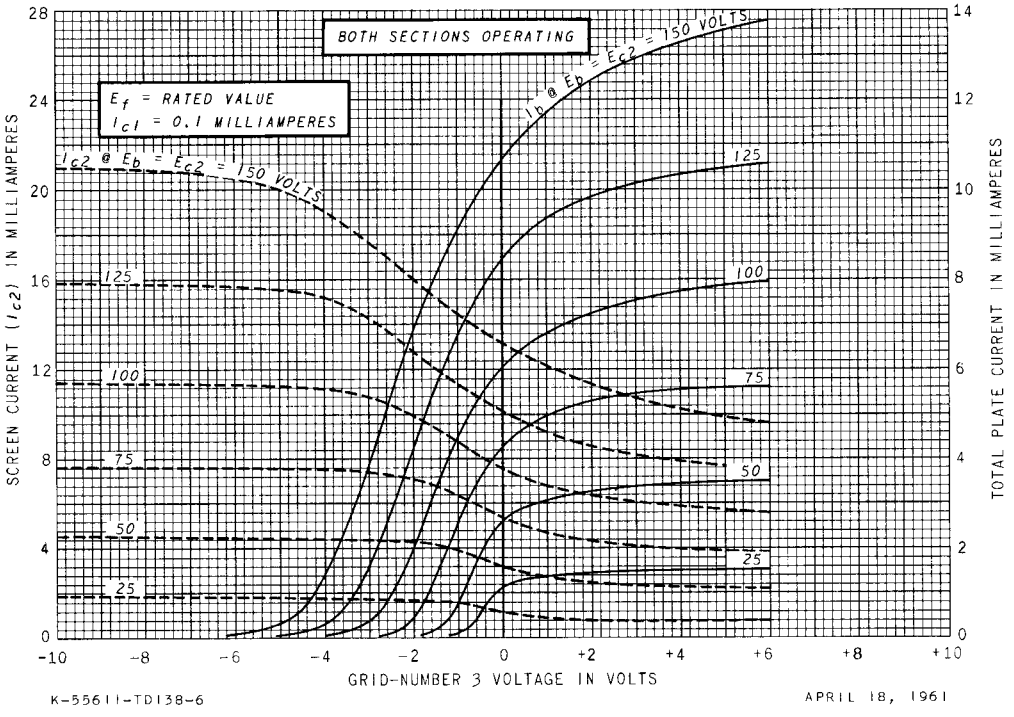
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



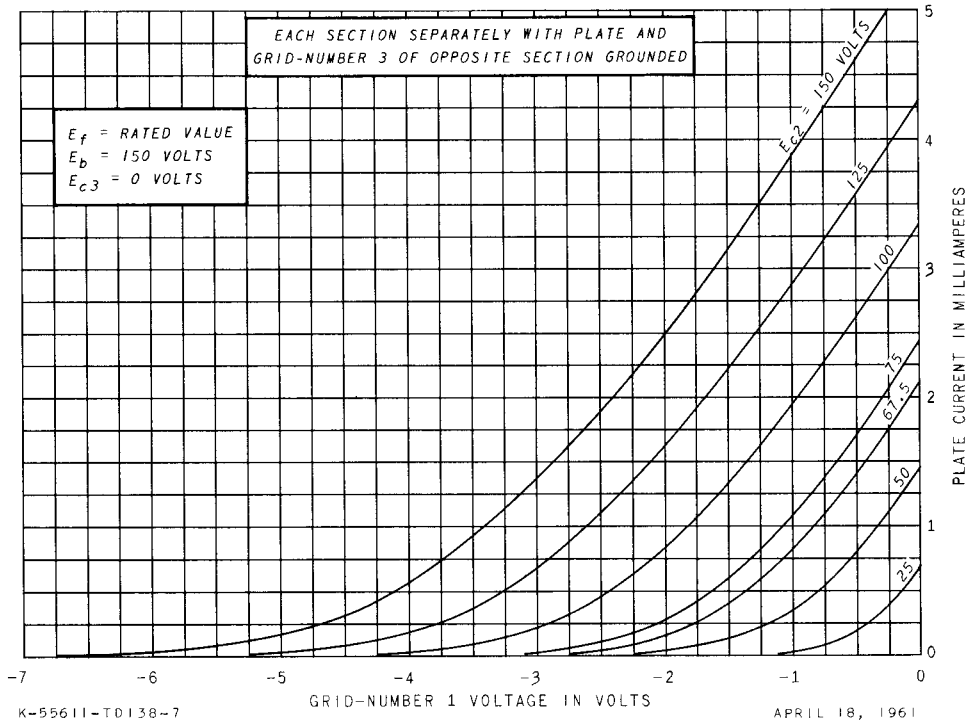
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD138-6

APRIL 18, 1961

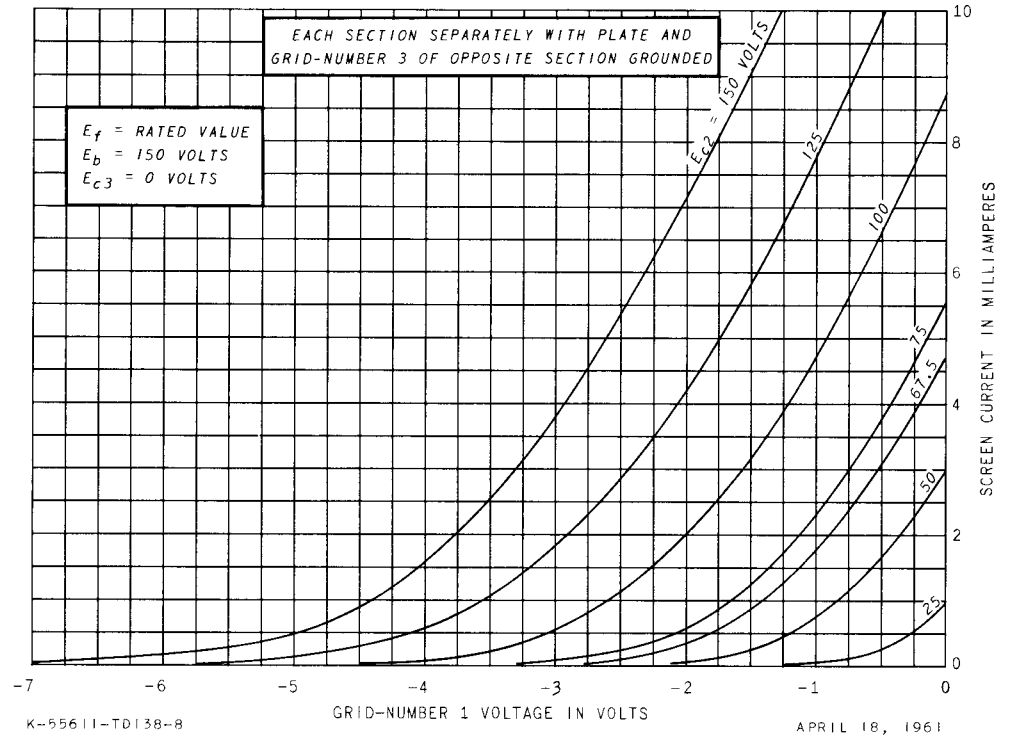
AVERAGE TRANSFER CHARACTERISTICS



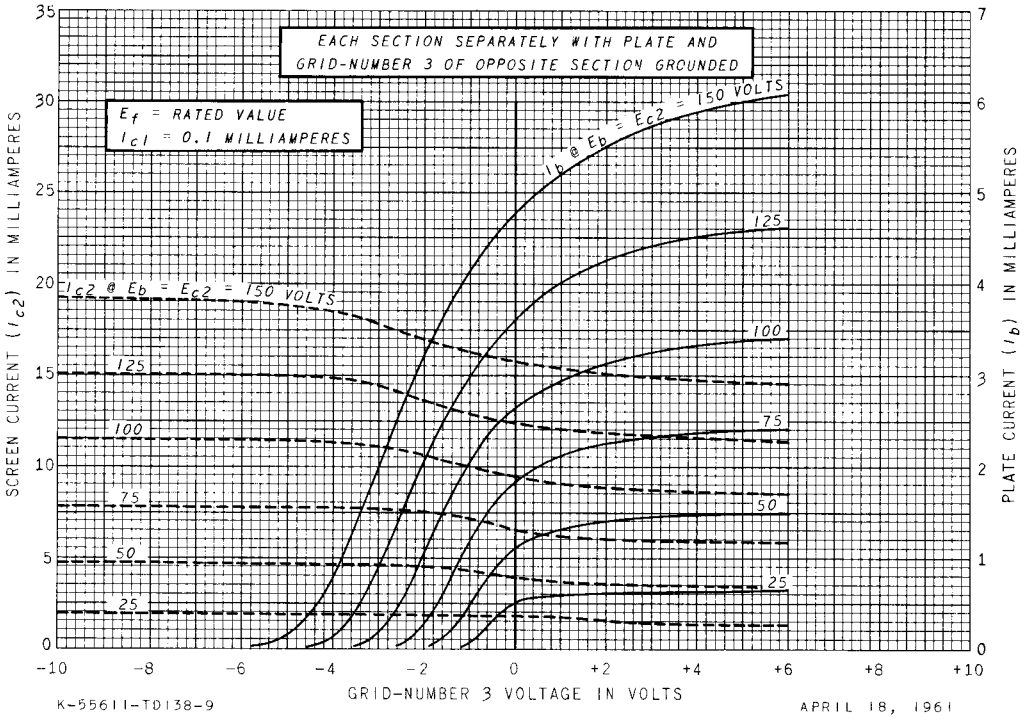
K-55611-TD138-7

APRIL 18, 1961

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Compactron Beam Triode

6HV5-A

- COLOR TV TYPE
- FRAME-GRID CONSTRUCTION
- DIFFUSION BONDED CATHODE
- 35 WATTS PLATE DISSIPATION
- 325 MILLIAMPERES PEAK PLATE CURRENT
- TRANSCONDUCTANCE = 65000 MICROMHOS

The 6HV5-A is a compactron frame-grid beam triode suited for use as a pulse-type high-voltage regulator in the high-voltage power supply of color television receivers.

Features of the 6HV5-A include a diffusion bonded cathode coating which provides a positive bond between the cathode coating and base material, thereby practically eliminating grid-to-cathode shorts caused by cathode flaking. By operating at a relatively low potential (3500 volts), this pulse-type regulator provides much less stress on internal components than shunt regulators operating in the 25000-volt range.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	6.3 ± 0.6	Volts
Heater Current●	1.8	Amperes

Direct Interelectrode Capacitances, approximate♦

Grid to Plate: (g to p)	1.8	pf
Input: g to (h + k + b.p.)	22	pf
Output: p to (h + k + b.p.)	11	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing

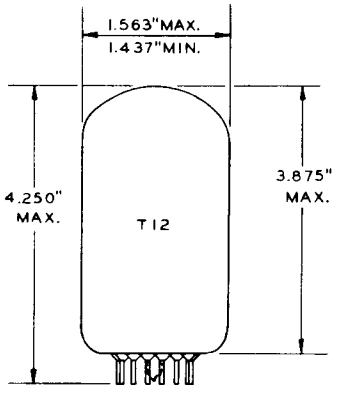
Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	4.250	Inches
Maximum Seated Height	3.875	Inches

MAXIMUM RATINGS

HIGH-VOLTAGE REGULATOR SERVICE§—DESIGN-MAXIMUM VALUES

Peak Plate Voltage	5500	Volts
Plate Dissipation	35	Watts
Peak Plate Current	325	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode⊕		
Total DC and Peak	450	Volts
Grid-Circuit Resistance▲	0.1	Megohms
Bulb Temperature at Hottest Point †	240	C

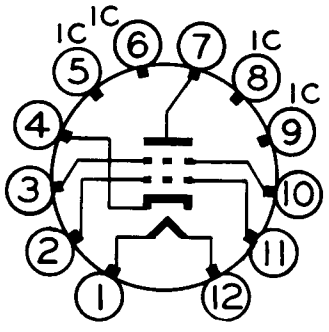
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Grid
Pin 3 - Beam Plate
Pin 4 - Cathode
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Plate
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Beam Plate
Pin 11 - Grid
Pin 12 - Heater

BASING DIAGRAM



EIA 12GY

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pulse Plate Voltage□	3500	Volts
Beam Plate Connected to Cathode at Socket		
Negative DC Grid Voltage	4.4	Volts
Peak Plate Current	300	Milliamperes
Amplification Factor	300	
Transconductance	65000	Micromhos
Plate Resistance, approximate	4600	Ohms
Grid Voltage, approximate		
Eb = 3500 Volts, Ib = 1.0 Milliamperes	-13	Volts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

♦ Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

⊕ Sufficient impedance (220 ohms by-passed with a 0.01 microfarad capacitor is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

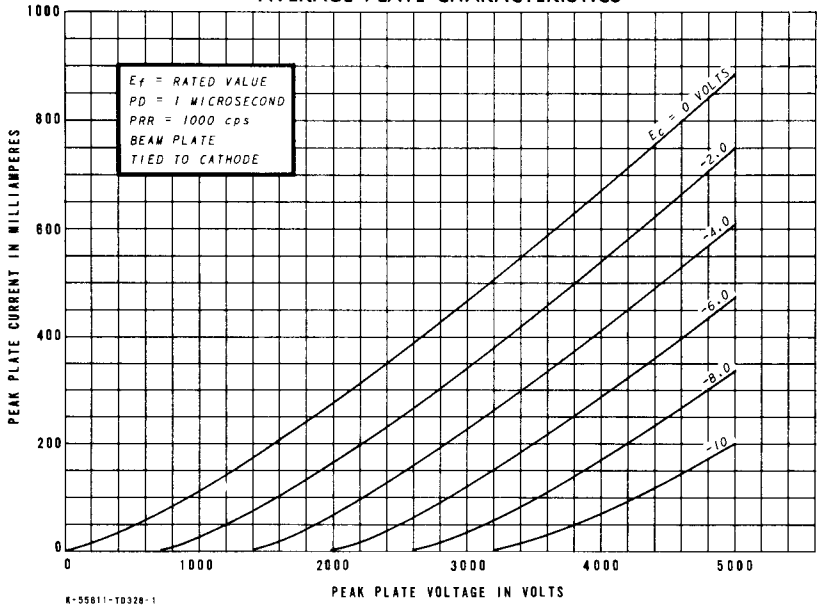
▲ Larger values of grid-circuit resistance may be used if provisions are made to protect the tube.

□ Duty cycle of the pulse must be less than 2.5 percent.

† Measured with an infrared thermometer, Ircon Model 700 BC or equivalent, at an ambient temperature of 40° C.

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AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

from JEDEC release #3531,
Dec. 18, 1961

6HW8

SHEET-BEAM TUBE

The 6HW8 is a miniature, double-plate, sheet-beam tube which incorporates a pair of balanced deflectors to direct the electron beam to either of the two plates, and a control grid to vary the intensity of the beam.

GENERAL

Electrical

Cathode - Coated Unipotential		
Heater Voltage, AC or DC*	6.3±0.6%	Volts
Heater Current+	0.3	Amperes
Direct Interelectrode Capacitances, approximate‡		
Deflector-Number 1 to All	4.2	pf
Deflector-Number 2 to All	4.2	pf
Grid-Number 1 to All Except Plates	7.5	pf
Plate-Number 1 to All	4.4	pf
Plate-Number 2 to All	4.4	pf
Grid-Number 1 to Deflector-Number 1, maximum	0.05	pf
Grid-Number 1 to Deflector-Number 2, maximum	0.03	pf
Plate-Number 1 to Plate-Number 2	0.12	pf
Deflector-Number 1 to Deflector-Number 2	0.35	pf

Mechanical

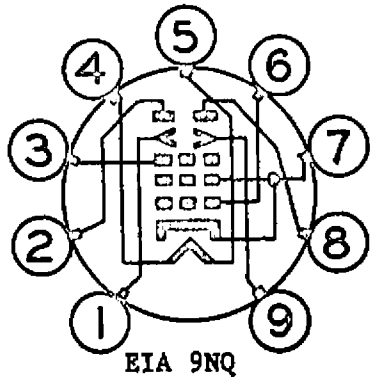
Mounting Position - Any		
Envelope - T-6 1/2, Glass		
Base - E9-1, Small Button 9-Pin		
Outline Drawing - EIA 6-3		
Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 5/8	Inches
Maximum Seated Height	2 3/8	Inches

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TERMINAL CONNECTIONS

Pin 1 - Deflector Number 2
Pin 2 - Plate Number 2
Pin 3 - Accelerator
Pin 4 - Heater
Pin 5 - Heater and Internal Shield
Pin 6 - Grid Number 1 (Control Grid)
Pin 7 - Cathode and Focus Electrode
Pin 8 - Plate Number 1
Pin 9 - Deflector Number 1

BASING DIAGRAM



EIA 9NQ

MAXIMUM RATINGS

Design-Maximum Values

Plate Voltage, Each Plate	330	Volts
Accelerator Voltage	330	Volts
Peak Positive Deflector Voltage, Each Deflector	165	Volts
Peak Negative Deflector Voltage, Each Deflector	165	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation, Each Plate	2.0	Watts
DC Cathode Current	30	Milliamperes
Grid-Number 1 Circuit Resistance		
With Cathode Bias	0.25	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operation conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics with Deflectors Grounded

Plate-Number 1 Voltage	250	Volts
Plate-Number 2, Connected to Plate-Number 1 Accelerator Voltage	250	Volts
Deflector-Number 1 Voltage	0	Volts
Deflector-Number 2 Voltage	0	Volts
Cathode-Bias Resistor	270	Ohms
Total Plate Current	13	Milliamperes

CHARACTERISTICS AND TYPICAL OPERATION (Continued)

Accelerator Current	1.4	Milliamperes
Grid-Number 1 Transconductance	4000	Micromhos
Grid-Number 1 Voltage, approximate Ib (total) = 10 Microamperes	-14	Volts
Average Deflector Characteristics		
Plate-Number 1 Voltage	250	Volts
Plate-Number 2 Voltage	250	Volts
Accelerator Voltage	250	Volts
Cathode-Bias Resistor	270	Ohms
Deflector Switching Voltage, maximum#	40	Volts
Deflector-Bias Voltage for Minimum Deflector Switching Voltage#	12	Volts
Voltage Difference between Deflectors For Ib1 = Ib2, approximate	0	Volts
Plate-Number 1 Current, maximum Ed1 = +2 Volts, Ed2 = +32 Volts Ib2 = 18 ma	50	Microamperes
Plate-Number 2 Current, maximum Ed1 = +32 Volts, Ed2 = +2 Volts Ib1 = 18 ma	50	Microamperes
Deflector-Number 1 Current, maximum Ed1 = +2 Volts, Ed2 = +38 Volts Eb = 225 Volts, Eg1 = +3 Volts	55	Microamperes
Deflector-Number 2 Current, maximum Ed1 = +38 Volts, Ed2 = +2 Volts Eb = 225 Volts, Eg1 = +3 Volts	55	Microamperes

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

\+ Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

\# Deflector switching voltage is defined as the total voltage change on either deflector with an equal and opposite change on the other deflector required to switch the plate current from one plate to the other.

TRIODE-PENTODE

DESCRIPTION AND RATING

The 6HZ8 is a 9-pin, T-9 tube containing a high-mu triode and a sharp-cutoff pentode. The triode is intended for use as a voltage amplifier or sync separator, and the pentode is intended for video amplifier service.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	1.125	Amperes

Direct Interelectrode Capacitances‡

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp), Max.	0.1	pf
Input: Pg1 to (h+k+Pg2+Pg3+i.s.)	12	pf
Output: Pp to (h+k+Pg2+Pg3+i.s.)	5.0	pf

Triode Section

Grid to Plate: (Tg to Tp)	5.0	pf
Input: Tg to (h+Tk)	3.8	pf
Output: Tp to (h+Tk)	0.4	pf
Pentode Grid-Number 1 to Triode Plate: (Pg1 to Tp), Max.	0.005	pf
Triode Grid to Pentode Plate: (Tg to Pp), Max.	0.04	pf
Pentode Plate to Triode Plate: (Pp to Tp), Max.	0.2	pf

MECHANICAL

Operating Position—Any

Envelope—T-9, Glass

Base—E9-82, Small Button 9-Pin

Outline Drawing—EIA 9-77

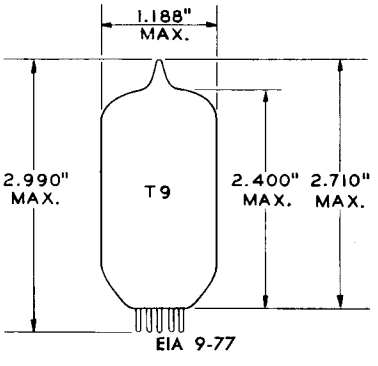
Maximum Diameter	1.188	Inches
Maximum Over-all Length	2.990	Inches
Maximum Seated Height	2.710	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section	
Plate Voltage	330	300	Volts
Screen Supply Voltage	330	...	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	8.0	1.0	Watts
Screen Dissipation	2.0	...	Watts
Heater—Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

PHYSICAL DIMENSIONS

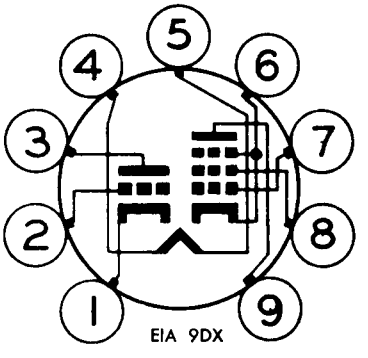


EIA 9-77

TERMINAL CONNECTIONS

Pin 1—Triode Cathode
Pin 2—Triode Grid
Pin 3—Triode Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 7—Pentode Grid Number 1
Pin 8—Pentode Grid Number 2 (Screen)
Pin 9—Pentode Plate

BASING DIAGRAM



EIA 9DX

MAXIMUM RATINGS (CONT'D)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

	Pentode Section		Triode Section	
Plate Voltage	60	250	200	Volts
Screen Voltage	170	170	....	Volts
Grid-Number 1 Voltage	0	....	−2.0	Volts
Cathode-Bias Resistor		100	....	Ohms
Amplification Factor		....	70	
Plate Resistance, approximate		140000	....	Ohms
Transconductance		12600	4000	Micromhos
Plate Current	90	29	3.5	Milliamperes
Screen Current	22.5	6.0	....	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes		−11.5	−5	Volts

NOTES

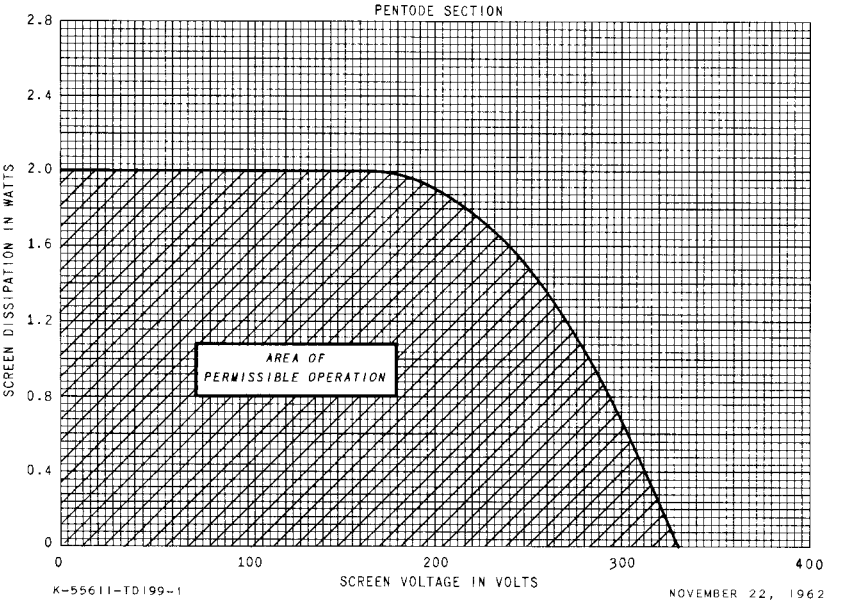
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

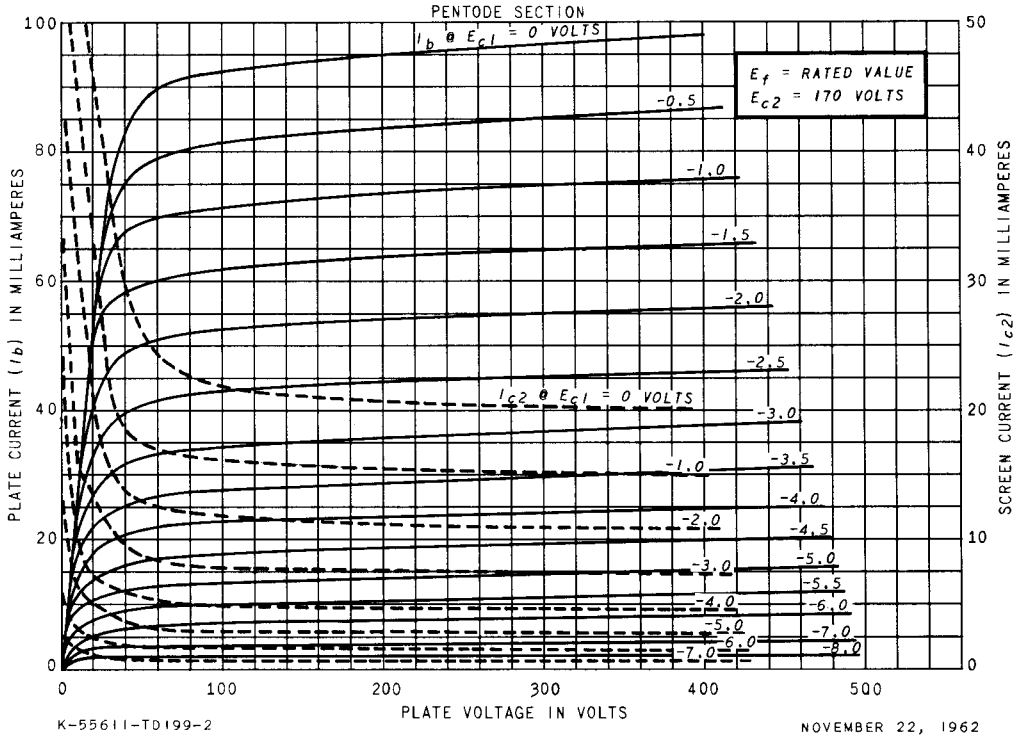
‡ Without external shield.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

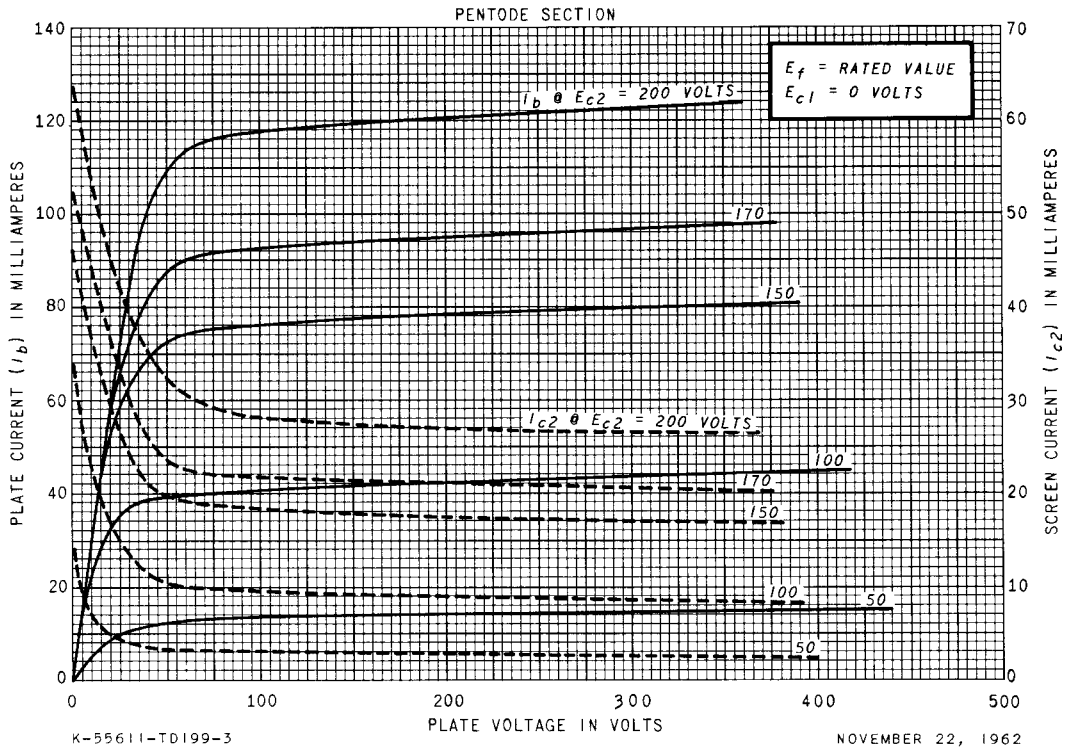
SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

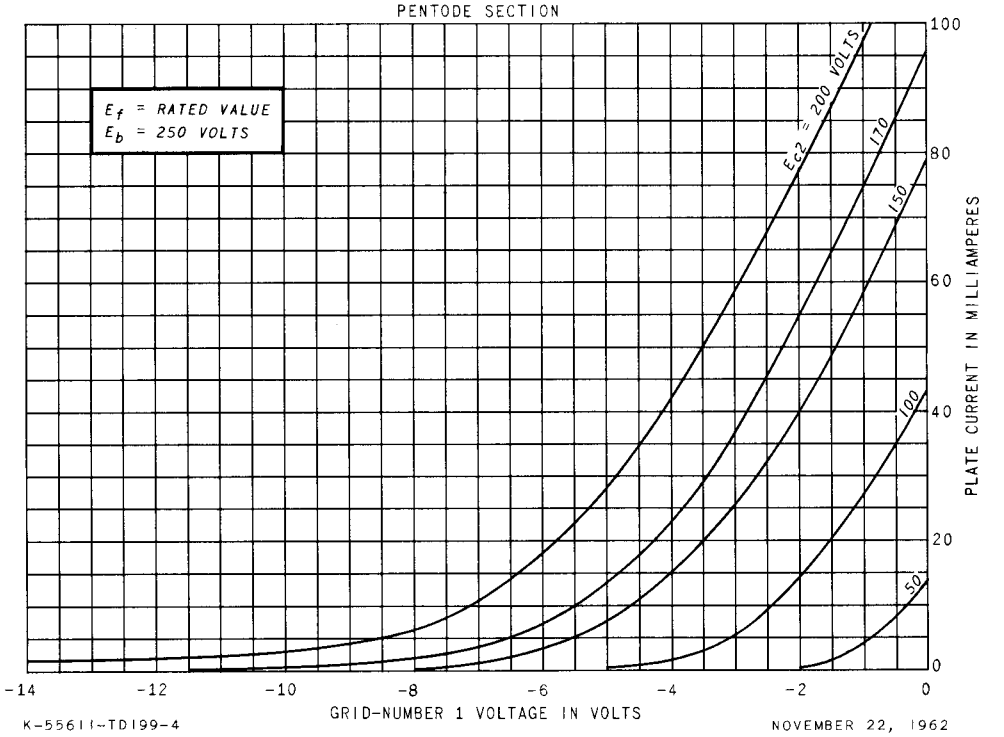


AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

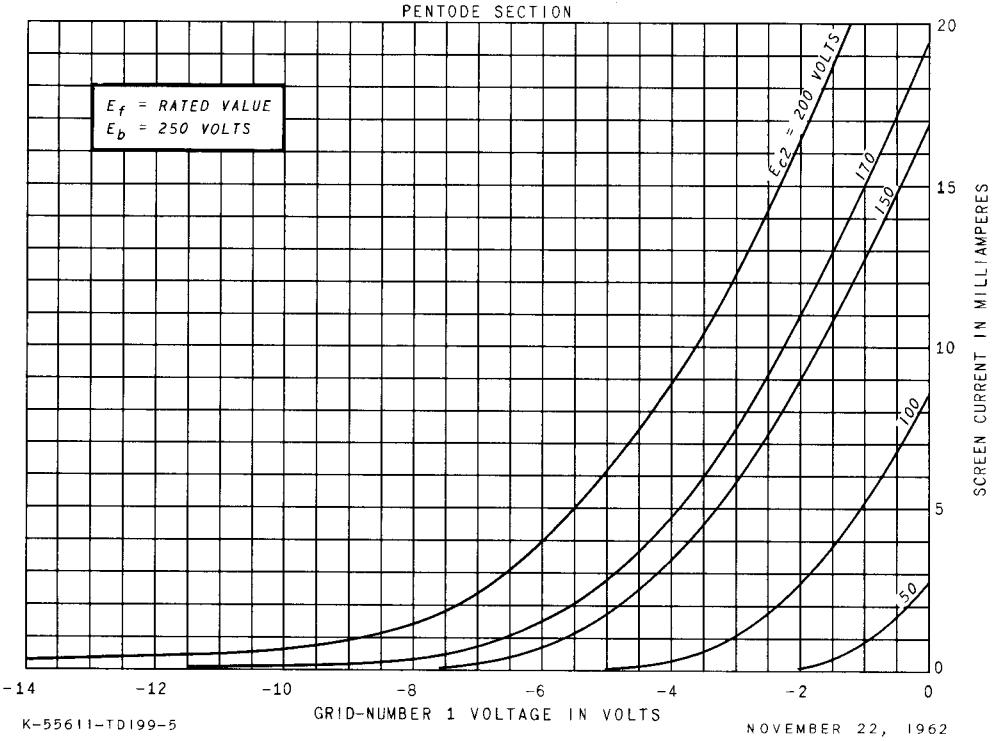


K-55611-TD199-4

NOVEMBER 22, 1962

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

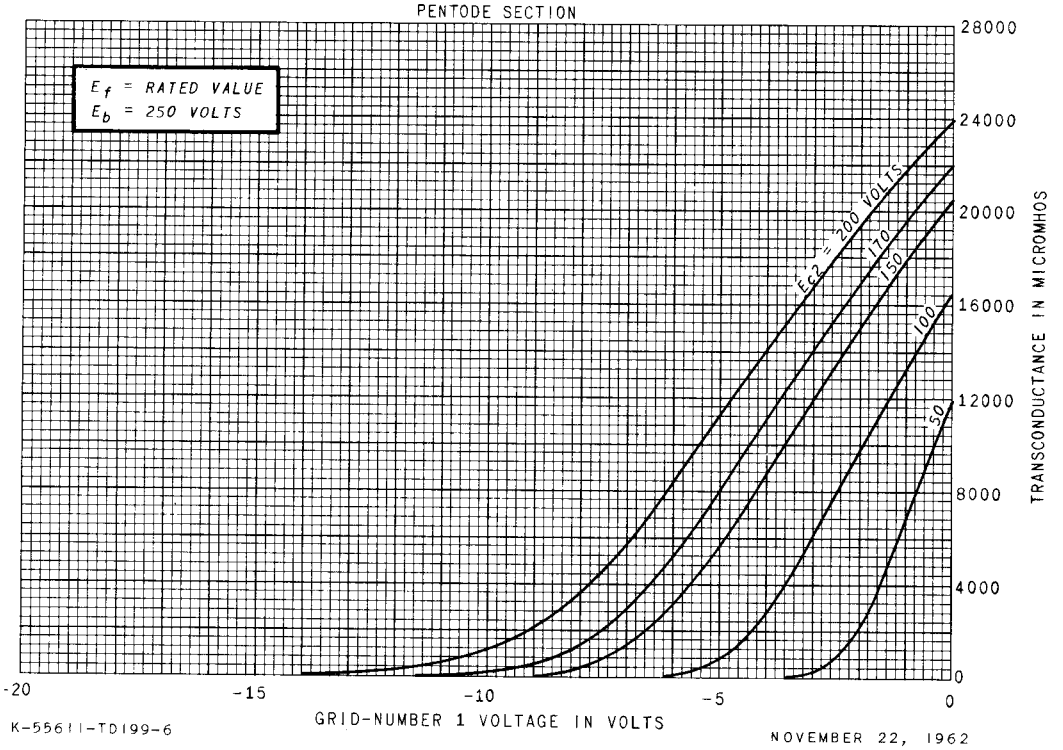


K-55611-TD199-5

NOVEMBER 22, 1962

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

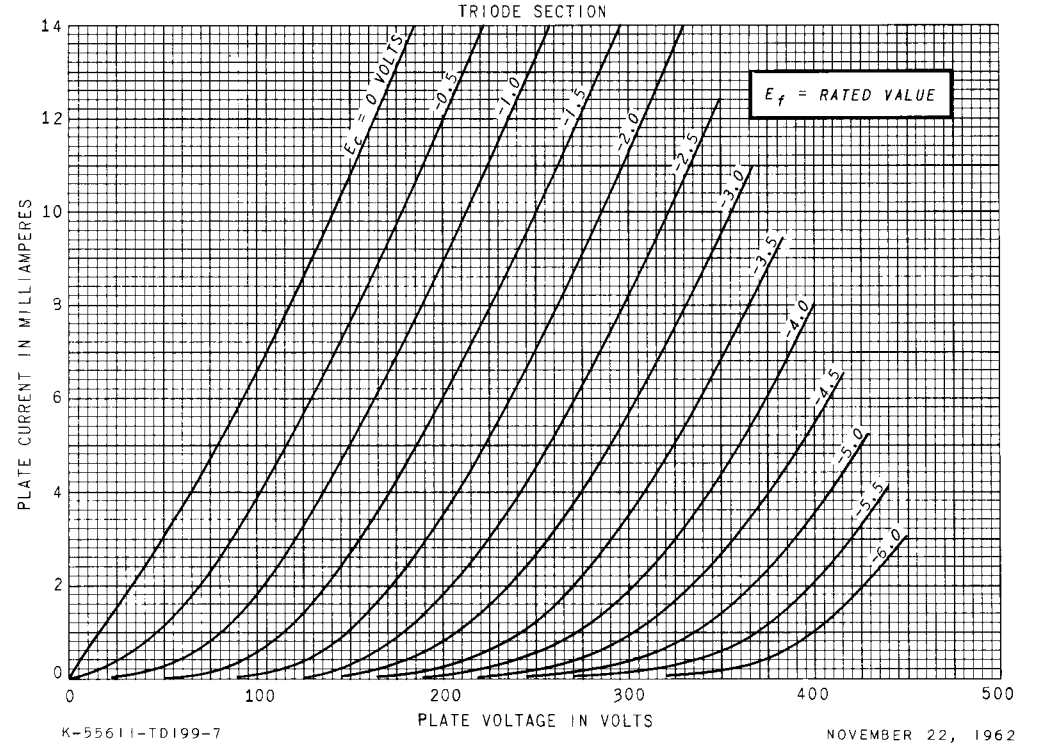


K-5561I-TD199-6

NOVEMBER 22, 1962

AVERAGE PLATE CHARACTERISTICS

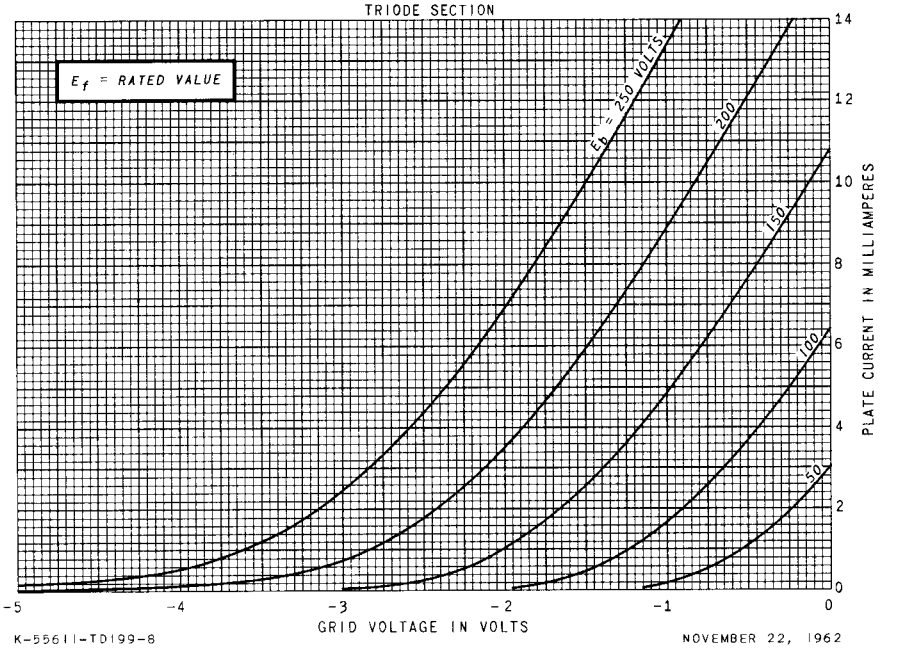
TRIODE SECTION



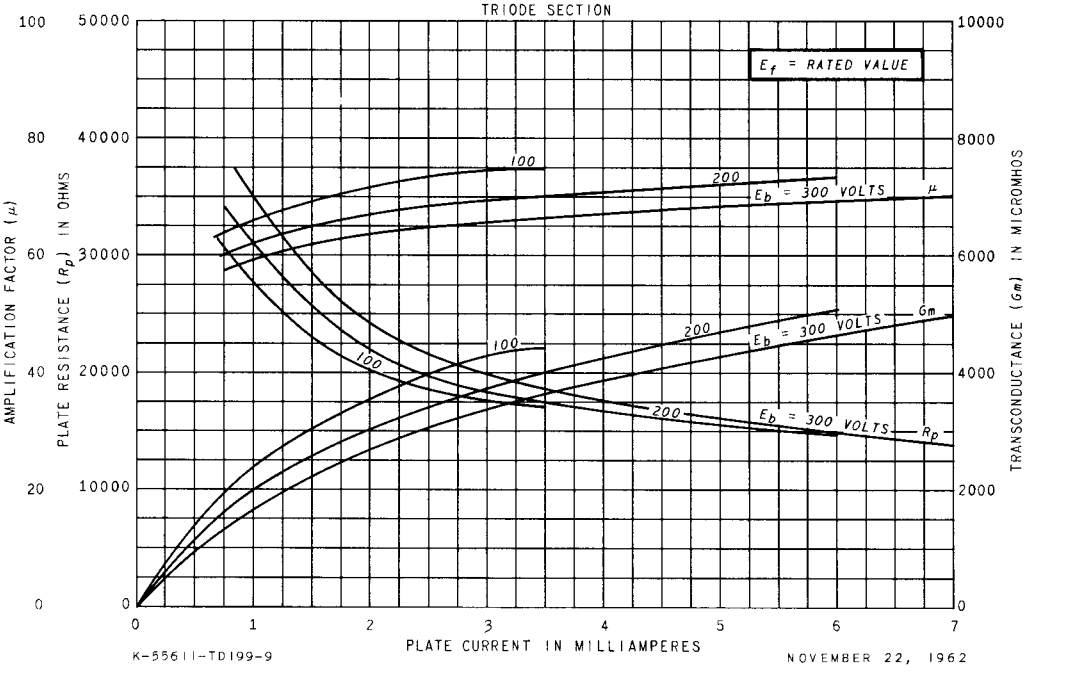
K-5561I-TD199-7

NOVEMBER 22, 1962

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

from JEDEC release #3531,
Dec. 18, 1961

6J11

TWIN PENTODE

The 6J11 is a COMPACTRON* device containing two sharp-cutoff pentodes, designed primarily for intermediate-frequency amplifier service in television receivers.

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC+	6.3±0.6	Volts
Heater Current‡	0.8	Amperes
Direct Interelectrode Capacitances§		
Section 1		
Grid-Number 1 to Plate: (1g1 to 1p), maximum	0.04	pf
Input: 1g1 to (h + 1k + 1g2 + 1g3 + 2g3 + i.s.)	11	pf
Output: 1p to (h + 1k + 1g2 + 1g3 + 2g3 + i.s.)	2.8	pf
Section 2		
Grid-Number 1 to Plate: (2g1 to 2p), maximum	0.04	pf
Input: 2g1 to (h + 2k + 2g2 + 2g3 + 1g3 + i.s.)	11	pf
Output: 2p to (h + 2k + 2g2 + 2g3 + 1g3 + i.s.)	3.2	pf
Cathode Section 1 to Cathode, Section 2: (1k to 2k), maximum	0.02	pf
Grid-Number 1, Section 1 to Plate, Section 2: (1g1 to 2p), maximum	0.003	pf
Grid-Number 1, Section 2 to Plate, Section 1: (2g1 to 1p), maximum	0.003	pf
Plate, Section 1 to Plate, Section 2: (1p to 2p), maximum	0.03	pf

Mechanical

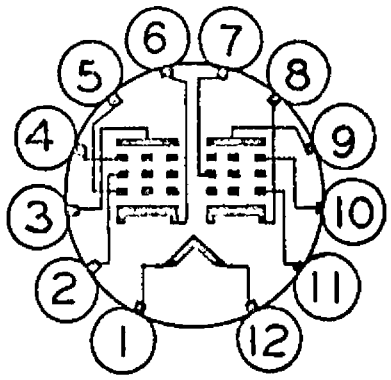
Mounting Position - Any		
Envelope - T-9, Glass		
Base - E12-70, Button 12-Pin		
Outline Drawing - EIA 9-56		
Maximum Diameter	1.188	Inches
Maximum Over-all Length	1.875	Inches
Maximum Seated Height	1.500	Inches

ELECTRONIC COMPONENTS DIVISION GENERAL ELECTRIC OWENSBORO KENTUCKY

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Grid Number 2 (Screen) (Section 2)
Pin 3 - Plate (Section 2)
Pin 4 - Grid Number 3 (Suppressor) and Internal Shield (Section 2)
Pin 5 - Grid Number 1 (Section 2)
Pin 6 - Cathode (Section 2)
Pin 7 - Grid Number 2 (Screen) (Section 1)
Pin 8 - Cathode (Section 1)
Pin 9 - Plate (Section 1)
Pin 10 - Grid Number 3 (Suppressor) and Internal Shield (Section 1)
Pin 11 - Grid Number 1 (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12BW

MAXIMUM RATINGS

Design-Maximum Values, Each Section

Plate Voltage	330	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	3.1	Watts
Screen Dissipation	0.65	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	0.25	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

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CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics, Each Section

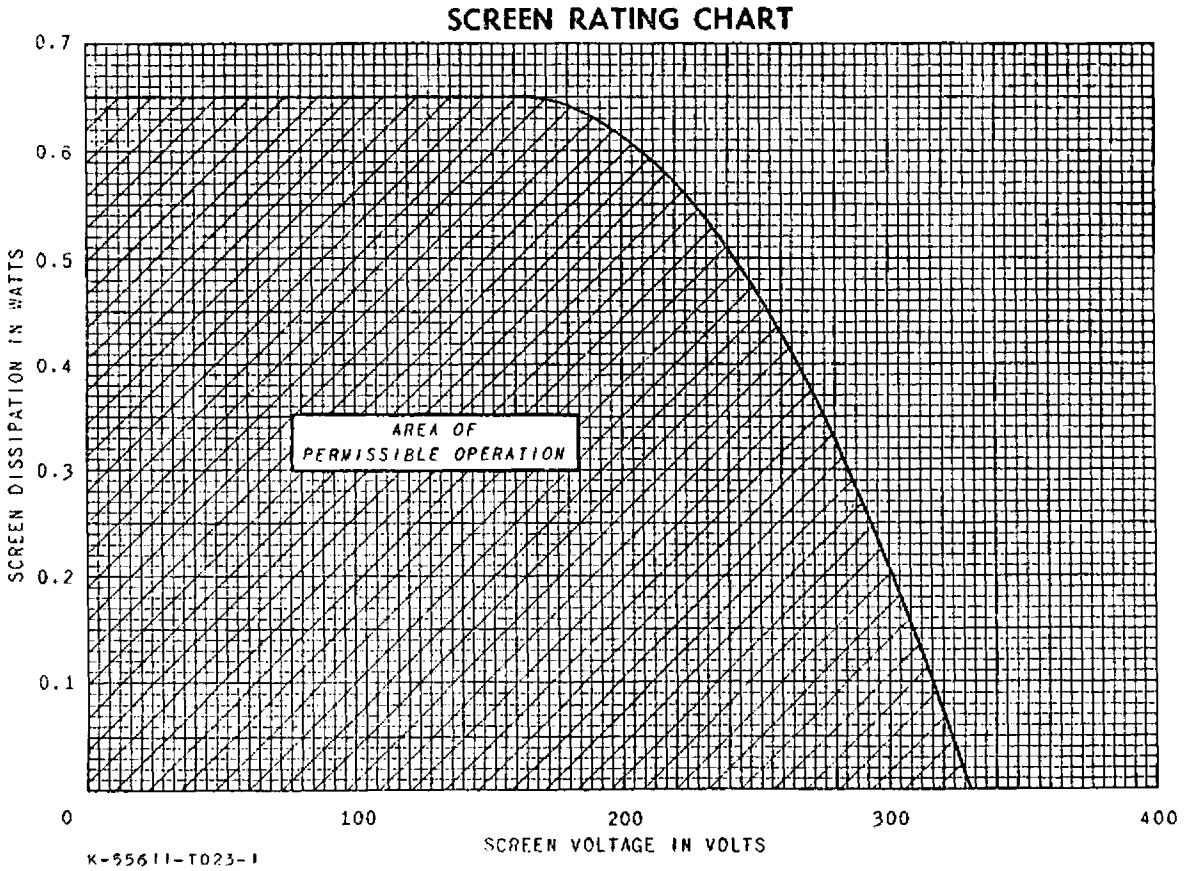
Plate Voltage	125	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Plate Resistance, approximate	0.2	Megohms
Transconductance	13000	Micromhos
Plate Current	11	Milliamperes
Screen Current	3.8	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 20 Microamperes	-3	Volts

* T. M. of General Electric Company.

\+ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ With external shield (EIA 309) connected to cathode of section under test.



Electronic TUBE
KEN-RAD

6J4

Description and Rating

HIGH-FREQUENCY TRIODE

GENERAL DESCRIPTION

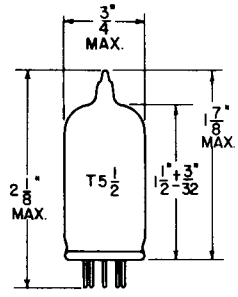
Principal Application: The 6J4 is a miniature high-mu triode designed for use as a grounded-grid amplifier at frequencies up to approximately 500 megacycles. The tube features an extremely high transconductance of 12000 micromhos and permits operation with a high signal-to-noise ratio. Three terminals on the grid provide effective grounding with a minimum of reactance. The 6J4 may also be used in conventional triode circuits with an ungrounded grid.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.4 Ampere
Envelope	T-5½ Glass
Base	E7-1, Miniature Button 7-Pin
Mounting Position	Any

Direct Interelectrode Capacitances: (Approx)#

Plate to Cathode and Heater (Max)	0.24	μμf
Grid to Cathode and Heater	5.5	μμf
Grid to Plate	4.0	μμf
Heater to Cathode	3.2	μμf

PHYSICAL DIMENSIONS

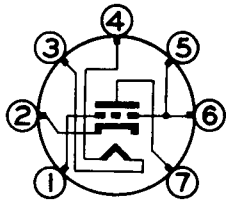


RMA 5-2

TERMINAL CONNECTIONS

Pin 1 - Grid
Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Grid
Pin 6 - Grid
Pin 7 - Plate

BASING DIAGRAM



RMA 7BQ
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES:

Plate Voltage	150	Volts
Plate Dissipation	2.25	Watts
Plate Current	20	Milliamperes
D-C Heater-Cathode Voltage	90	Volts
Grid Circuit Resistance	0.25	Megohm

CHARACTERISTICS AND TYPICAL OPERATION

GROUNDED-GRID CLASS A_1 AMPLIFIER

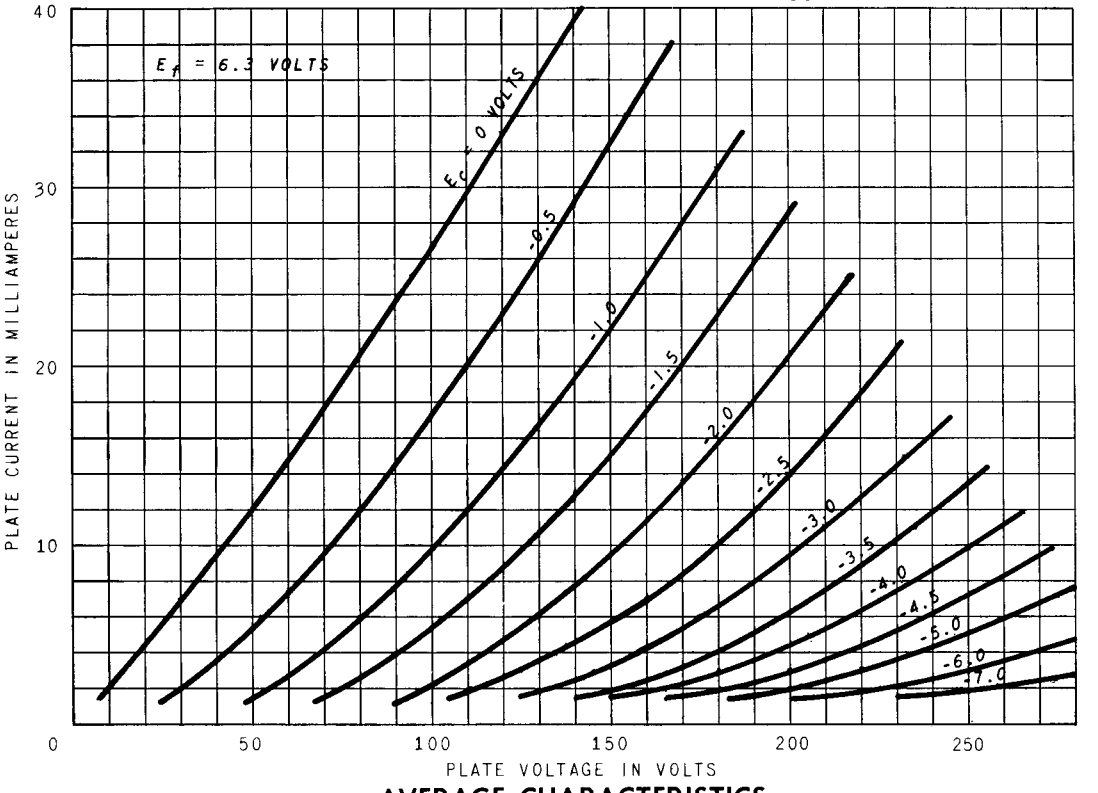
Plate Voltage	100	150	150	Volts
Cathode Bias Resistor*	100	100	100	Ohms
Amplification Factor	55	55	55	
Plate Resistance	5000	4500	4500	Ohms
Transconductance	11000	12000	12000	Micromhos
Plate Current	10	15	15	Milliamperes

 # With external shield #316 connected to grid.

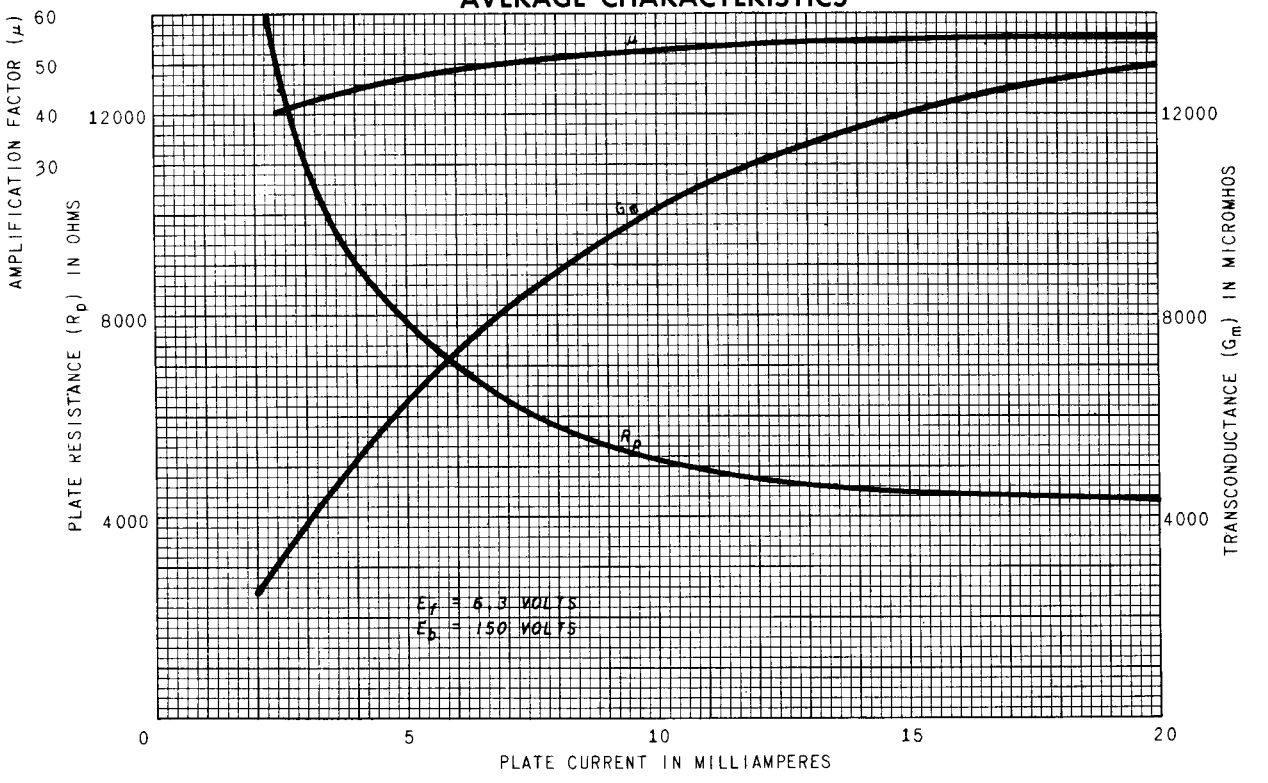
** Operation with fixed bias is not recommended; in addition, the cathode bias resistor should always be suitably by-passed.*

Note: When the 6J4 is used in grounded-grid operation at high frequencies, all three grid terminals should be grounded to minimize the effects of grid-lead inductance.

AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

Electronic TUBE

6J5

Description and Rating

GENERAL-PURPOSE TRIODE

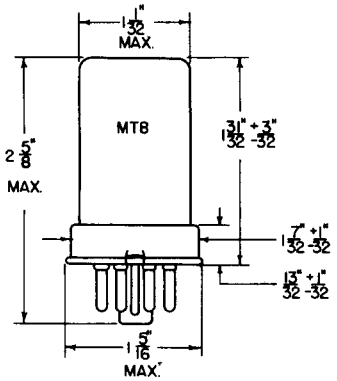
GENERAL DESCRIPTION

Principal Application: The 6J5 is a general-purpose triode designed for use as a detector, amplifier or oscillator. Features of the 6J5 include a relatively high transconductance and a medium amplification factor. It is well suited to resistance-coupled service, having high output voltage capabilities.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.3 Ampere
Envelope	MT-8, Metal Shell
Base	B6-23, Small Wafer Octal 6-Pin

Mounting Position	Any	
Direct Interelectrode Capacitances: #		
Grid to Plate	3.4	μμf
Input	3.4	μμf
Output	3.6	μμf

PHYSICAL DIMENSIONS

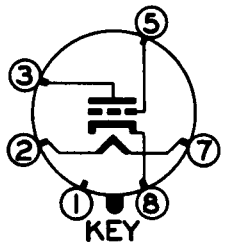


RTMA 8-1

TERMINAL CONNECTIONS

Pin 1 - Shell
Pin 2 - Heater
Pin 3 - Plate
Pin 5 - Grid
Pin 7 - Heater
Pin 8 - Cathode

BASING DIAGRAM



RTMA 6Q
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES

Plate Voltage	300	Volts
Positive D-C Grid Voltage	0	Volts
Plate Dissipation	2.5	Watts
Cathode Current	20	Milliamperes
Heater-Cathode Voltage	90	Volts
Grid Circuit Resistance	1.0	Megohm

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

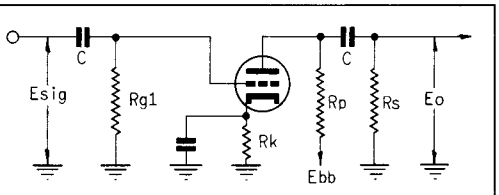
Plate Voltage	90	250	Volts
Grid Voltage	0	-8	Volts
Amplification Factor	20	20	
Plate Resistance (Approx)	6700	7700	Ohms
Transconductance	3000	2600	Micromhos
Plate Current	10	9	Milliamperes
Grid Voltage (Approx) for I_b = 10 Microamperes	-7	-18	Volts

 # With pin 1 connected to pin 8 at the socket

Supersedes ET-T299 dated 5-46

CLASS A RESISTANCE-COUPLED AMPLIFIER

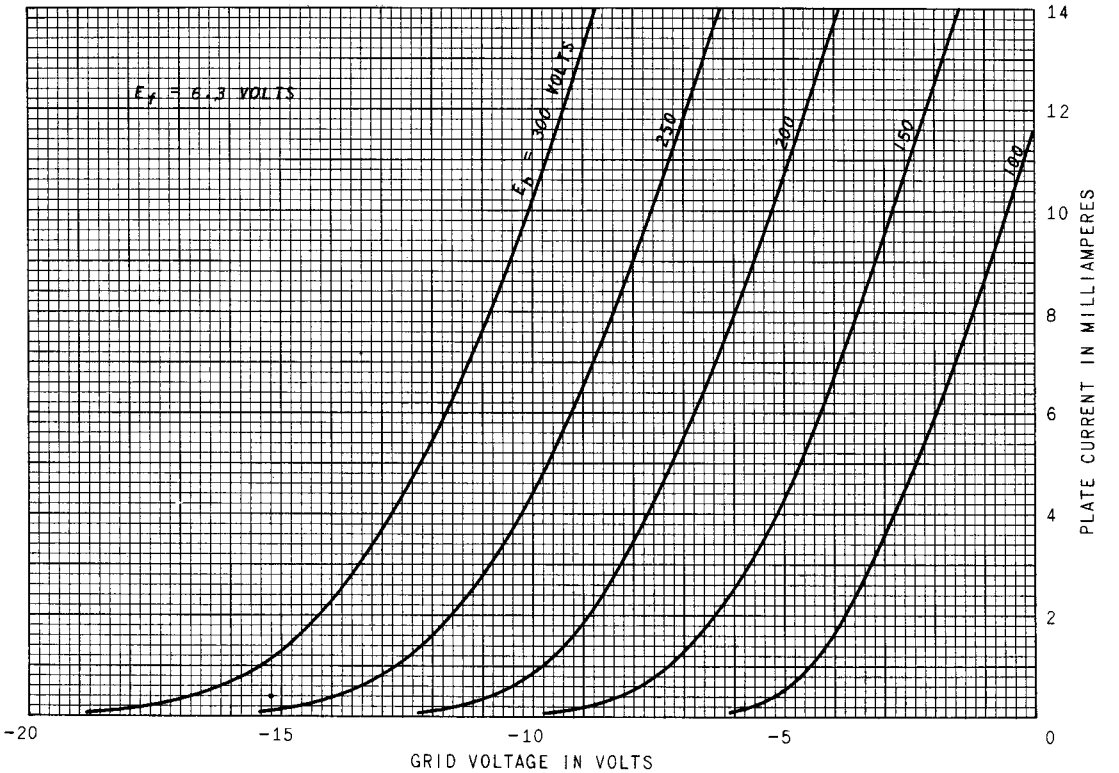
Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
			Rk	Gain	Eo	Rk	Gain	Eo	Rk	Gain	Eo
0.10	0.10	0.1	3300	14	13	2200	14	26	1800	14	40
0.10	0.24	0.1	3600	14	16	2700	15	33	2200	15	51
0.24	0.24	0.1	7500	14	16	5100	15	30	4300	15	44
0.24	0.51	0.1	9100	14	19	6800	15	39	5100	15	54
0.51	0.51	0.1	13000	14	16	9100	15	30	6800	16	40
0.51	1.0	0.1	15000	14	19	10000	16	32	7500	16	45
0.24	0.24	10	0	15	13	0	16	33	0	17	46
0.24	0.51	10	0	16	17	0	17	38	0	18	62
0.51	0.51	10	0	16	14	0	18	32	0	18	53
0.51	1.0	10	0	17	18	0	18	41	0	19	68



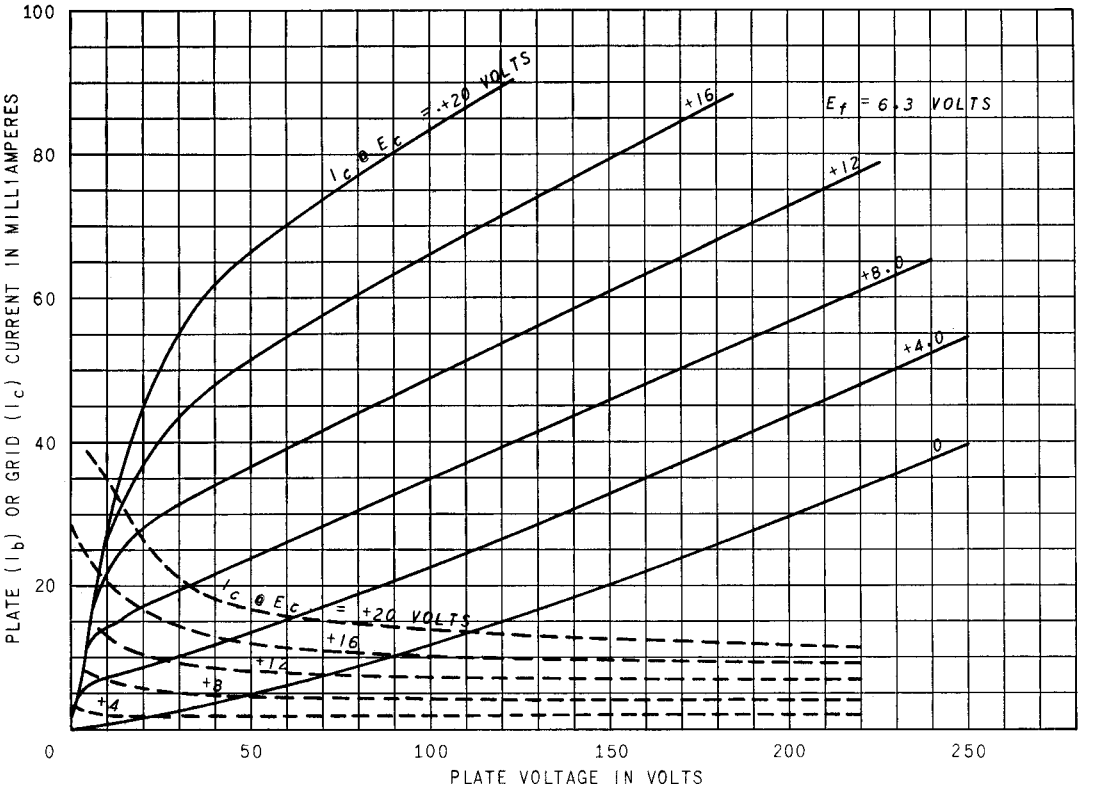
Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

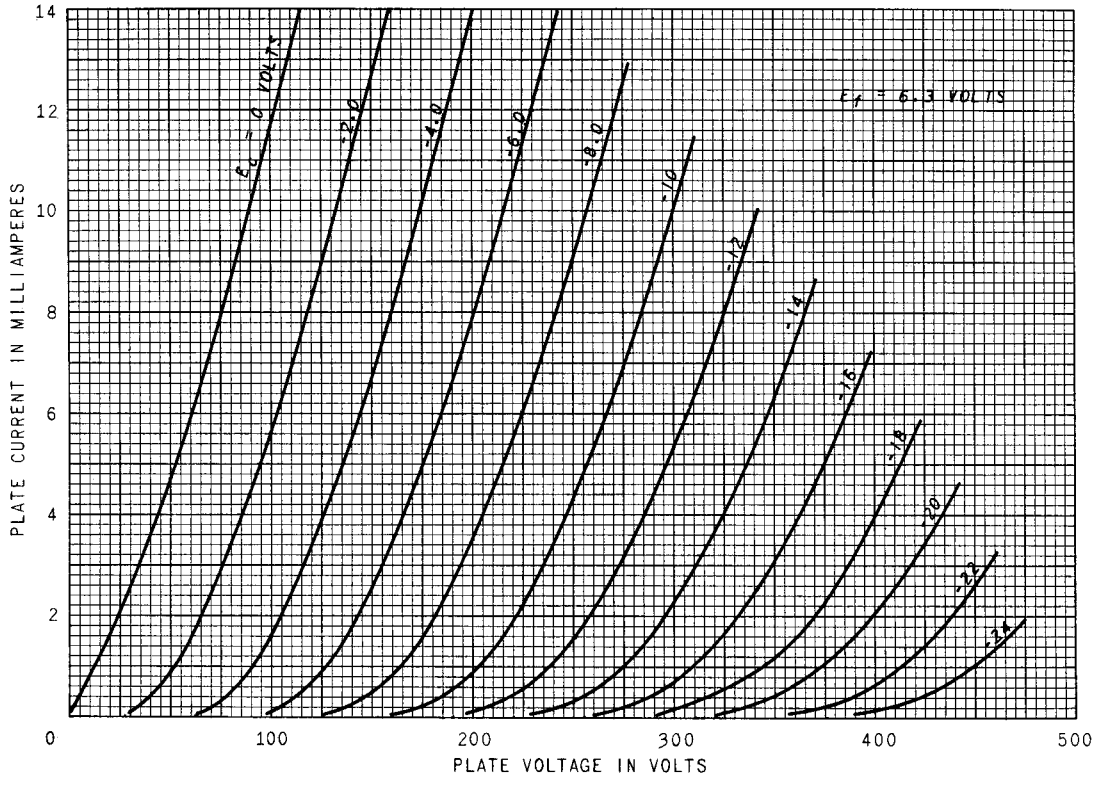
AVERAGE CHARACTERISTICS



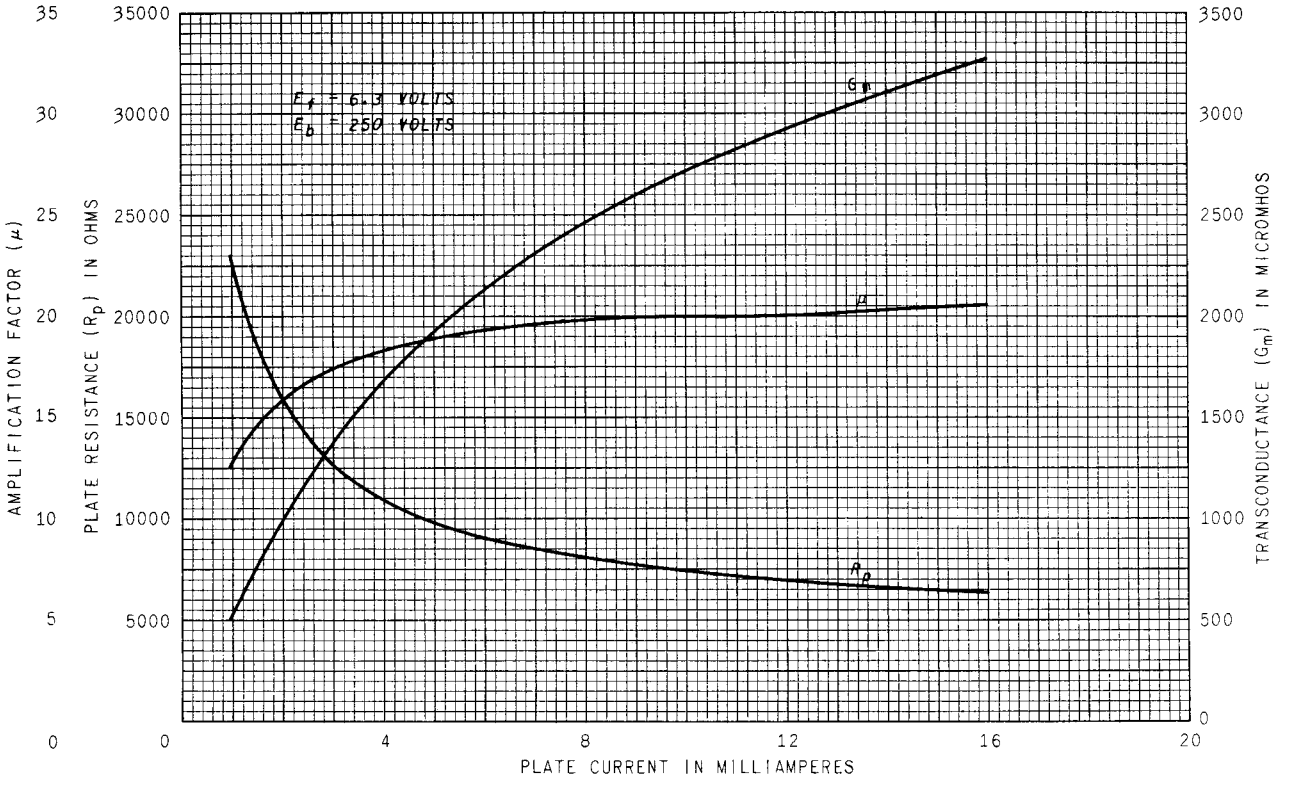
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

6J6—5J6—19J6

TWIN TRIODE

DESCRIPTION AND RATING

The 6J6 is a miniature medium-mu twin triode designed for use as a radio-frequency amplifier, oscillator, or mixer. With the grids connected in push-pull and the plates connected in parallel, each type may be used as a mixer at frequencies as high as 600 megacycles.

The 5J6, 6J6, and 19J6 are alike except for heater ratings and heater-cathode ratings. The 5J6, in addition, exhibits a controlled heater warm-up characteristic which makes the tube especially suited for use in television receivers which employ series-connected heaters. When the 5J6 is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

	5J6	6J6	19J6	
Heater Voltage, AC or DC	4.7	6.3	18.9	Volts
Heater Current	0.6	0.45	0.15	Amperes
Heater Warm-up Time*	11	....	....	Seconds

Direct Interelectrode Capacitances	With Shield†	Without Shield	
Grid to Plate, Each Section	1.5	1.6	μμf
Input, Each Section	2.6	2.2	μμf
Output, Section 1	1.6	0.4	μμf
Output, Section 2	1.0	0.4	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

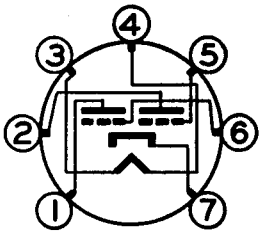
DESIGN-CENTER VALUES, EACH SECTION	Class A_1 Amplifier	Class C Telegraphy	
Plate Voltage	300	300	Volts
Positive DC Grid Voltage	0	0	Volts
Negative DC Grid Voltage	...	40	Volts
Plate Input	...	4.5	Watts
Plate Dissipation	1.5	1.5	Watts
DC Plate Current	...	15	Milliamperes
DC Grid Current	...	8.0	Milliamperes

	5J6	6J6	19J6	5J6	6J6	19J6	
Heater-Cathode Voltage							
Heater Positive with Respect to Cathode							
DC Component	100		...	100		...	Volts
Total DC and Peak	200		100	200		100	Volts
Heater Negative with Respect to Cathode							
Total DC and Peak	200		100	200		100	Volts
Grid Circuit Resistance							
With Cathode Bias‡	0.5		0.5	...		...	Megohms

GENERAL ELECTRIC

Supersedes ET-T835 dated 2-54

BASING DIAGRAM

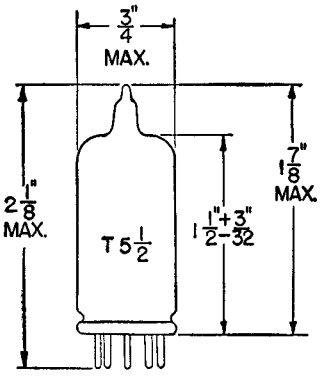


RETMA 7BF

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Plate (Section 1)
Pin 3—Heater
Pin 4—Heater
Pin 5—Grid (Section 1)
Pin 6—Grid (Section 2)
Pin 7—Cathode

PHYSICAL DIMENSIONS



RETMA 5-2

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION§

Plate Voltage	100	Volts
Cathode-Bias Resistor	50	Ohms
Amplification Factor	38	
Plate Resistance, approximate	7100	Ohms
Transconductance	5300	Micromhos
Plate Current	8.5	Milliamperes

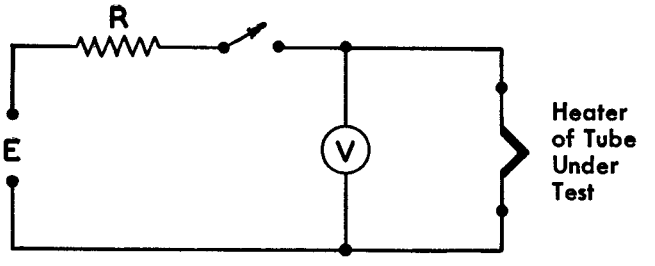
CLASS C TELEGRAPHY, RF POWER AMPLIFIER AND OSCILLATOR—BOTH SECTIONS IN PUSH-PULL

DC Plate Voltage	150	Volts
DC Grid Voltageπ	−10	Volts
DC Plate Current	30	Milliamperes
DC Grid Current, approximate	16	Milliamperes
Grid Driving Power, approximate	0.35	Watts
Power Output, approximate	3.5	Watts

MIXER SERVICE, EACH SECTION△

Plate Voltage	150	Volts
Cathode-Bias Resistor	810	Ohms
Oscillator Peak Voltage	3.0	Volts
Plate Resistance, approximate	10200	Ohms
Conversion Transconductance	1900	Micromhos
Plate Current	4.8	Milliamperes

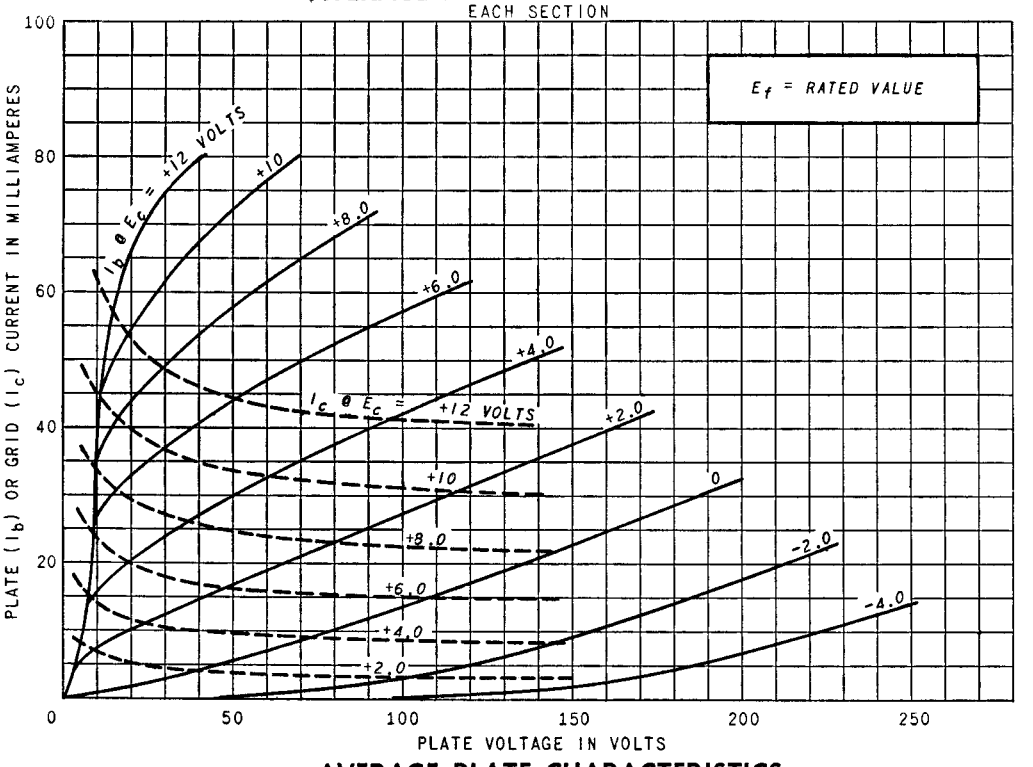
* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E = 18.7 volts (RMS or DC), V_1 = 3.73 volts (RMS or DC), and R = 23.5 ohms.



† With external shield (RETMA 316) connected to pin 7.
‡ Operation with fixed bias is not recommended.
§ Each section separately with specified voltages applied to both sections.
π Obtained by a 625-ohm grid resistor, a 220-ohm cathode resistor, or a fixed-voltage supply.
△Each section separately with grid and plate of opposite section grounded. In actual service, the value of the cathode-bias resistor is determined by the total cathode current of both sections.
Note: Approximately 1.0 watt can be obtained when the tube is operated as a push-pull oscillator at 250 megacycles with a plate voltage of 150 volts, with maximum rated plate dissipation, and with a grid resistor of 2000 ohms common to both sections.

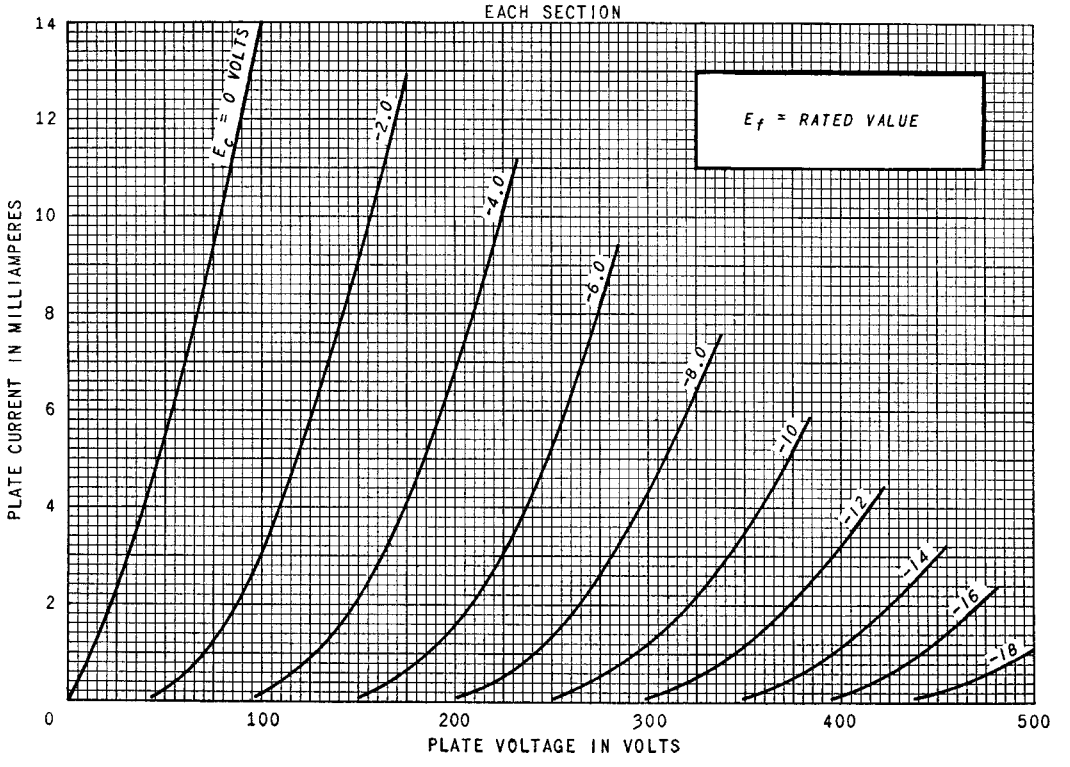
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



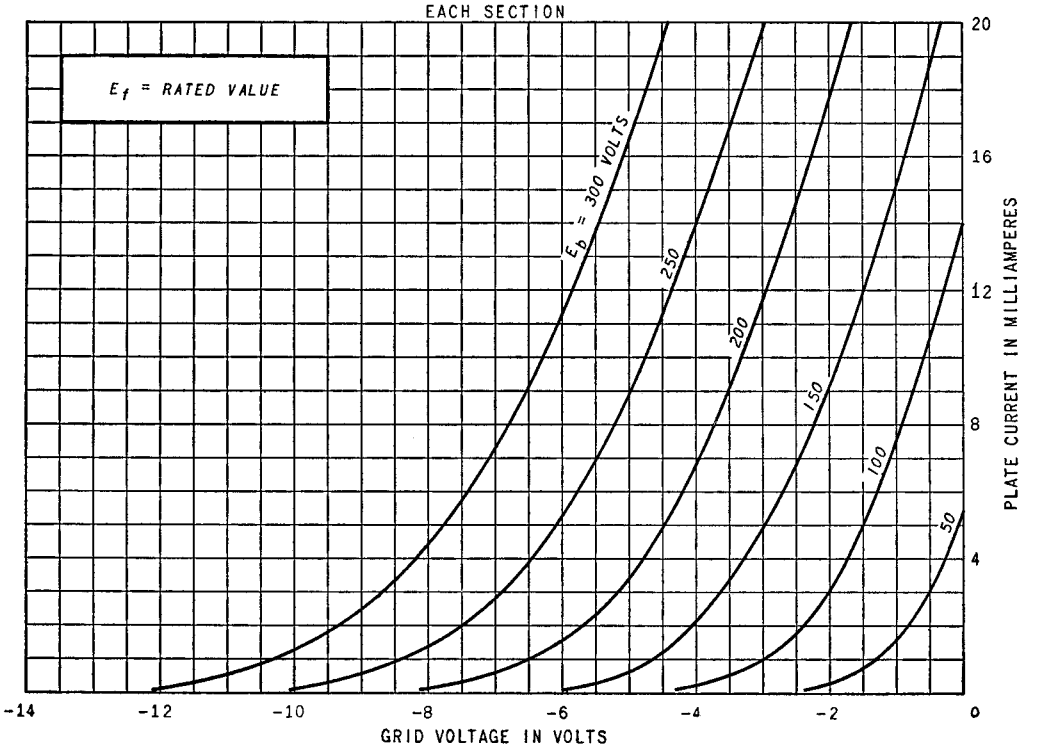
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



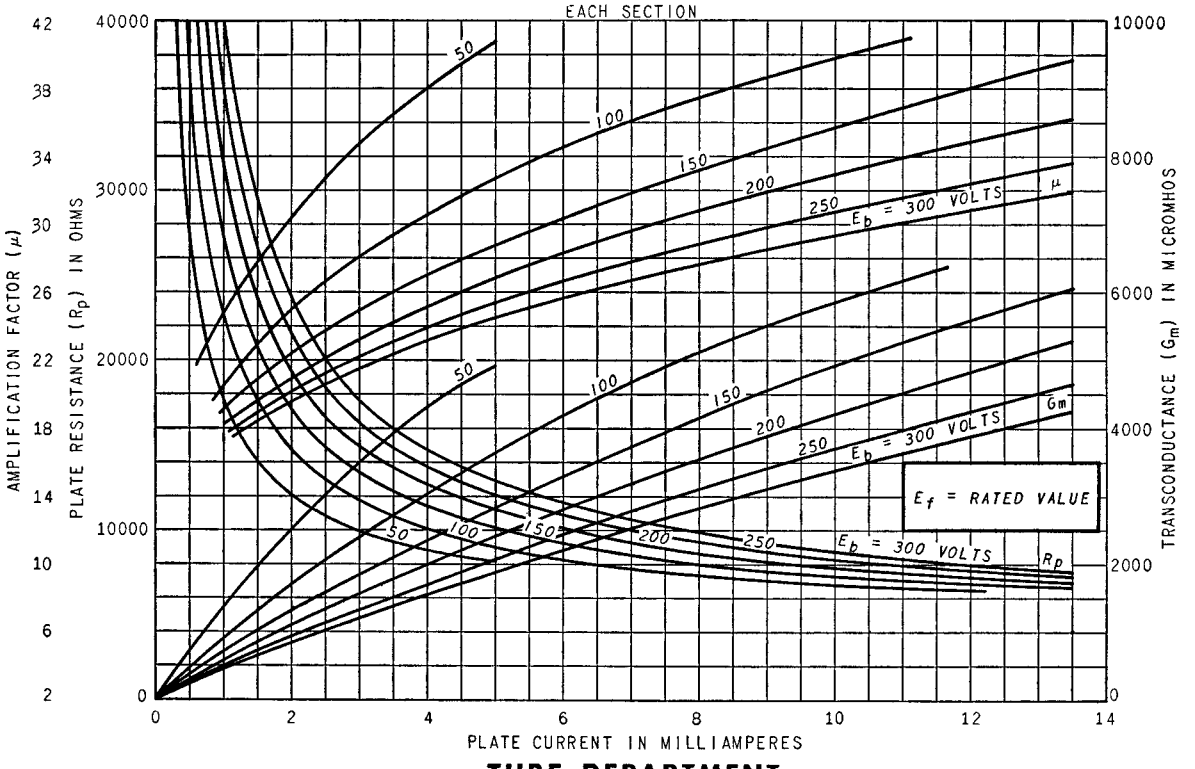
AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION



AVERAGE CHARACTERISTICS

EACH SECTION



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBE
KEN-RAD

6J7

Description and Rating

RADIO-FREQUENCY-AMPLIFIER PENTODE

GENERAL DESCRIPTION

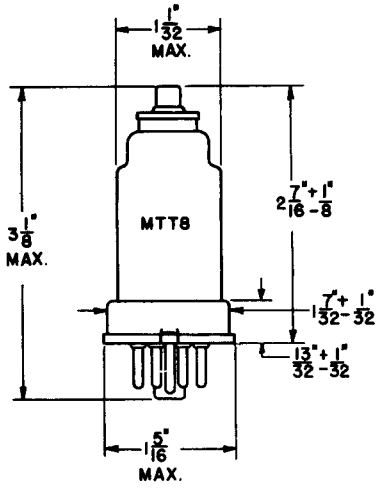
Principal Application: The 6J7 is a heater-cathode type pentode amplifier tube with a sharp cut-off characteristic and is designed for service as a biased detector or high-gain amplifier. Except for capacitances the electrical ratings and characteristics of the 6J7 are the same as those of the 6J7-G, 6J7-GT and 6C6.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.3 Ampere
Envelope	MTT-8 Metal Shell
Base	B7-22 Small Wafer Octal 7-Pin Phenolic
Top Cap	C1-4 Miniature with Wafer
Mounting Position	Any

Direct Interelectrode Capacitances: *

	Triode §	Pentode	
Grid to Plate	2.0	0.005 Max	μμf
Input	5	7	μμf
Output	14	12	μμf

PHYSICAL DIMENSIONS

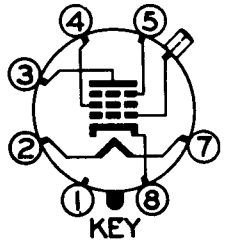


RMA 8-4

TERMINAL CONNECTIONS

Pin 1 - Shell and Internal Shield
Pin 2 - Heater
Pin 3 - Plate
Pin 4 - Grid Number 2 (Screen)
Pin 5 - Grid Number 3 (Suppressor)
Pin 7 - Heater
Pin 8 - Cathode
Top Cap - Grid Number 1

BASING DIAGRAM



RMA 7R
BOTTOM VIEW

MAXIMUM RATINGS

	Triode Connection §		Pentode Connection		
	Design Center	Absolute	Design Center	Absolute	
Plate Voltage	250	275	300	330	Volts
Screen (Grid Number 2) Voltage	---	---	125	140	Volts
Screen Supply Voltage	---	---	300	330	Volts
External Grid Bias Voltage	Never Positive		Never Positive		
Plate Dissipation	1.75	1.93	0.75	0.83	Watts
Screen Dissipation	---	---	0.10	0.11	Watt
D-C Heater-Cathode Voltage	90	100	90	100	Volts

§ *With grid number 2 and grid number 3 connected to plate.*

* *With shell and internal shield connected to cathode.*

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A AMPLIFIER

	Triode Connection §		Pentode Connection		
Heater Voltage	6.3	6.3	6.3	6.3	Volts
Plate Voltage	180	250	100	250	Volts
Screen Voltage	180	250	100	100	Volts
Suppressor Voltage	180	250	0 °	0 °	Volts
Grid Bias Voltage **	-5.3	-8	-3	-3	Volts
Amplification Factor	20	20	---	---	
Plate Resistance	0.0110	0.0105	1.0	>1.0	Megohm
Transconductance	1800	1900	1185	1225	Micromhos
Grid Bias for Cathode-Current Cutoff			-7	-7	Volts
Plate Current	5.3	6.5	2.0	2.0	Milliamperes
Screen Current	---	---	0.5	0.5	Milliampere

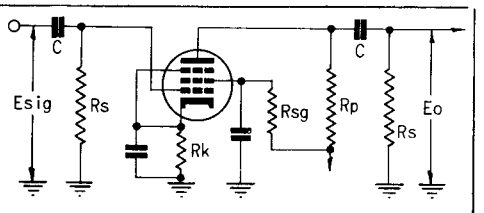
§ *With grid number 2 and grid number 3 connected to plate.*

** *The d-c resistance in the grid circuit should not exceed 1.0 megohm under rated maximum conditions.*

° *Suppressor-grid connected to cathode at socket terminal.*

CLASS A RESISTANCE-COUPLED AMPLIFIER

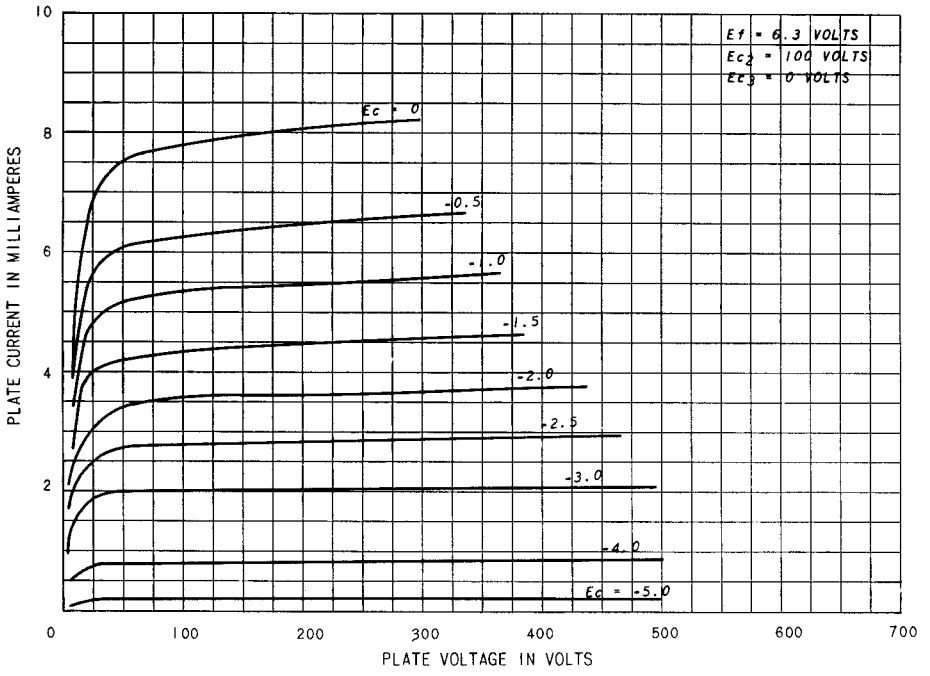
Rp Meg.	Rg1 Meg.	Rs Meg.	Ebb = 90 Volts				Ebb = 180 Volts				Ebb = 300 Volts			
			Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo
0.10	*	0.10	1100	.39	40	16	910	.43	50	42	620	.47	60	54
0.10	*	0.24	1100	.43	53	21	820	.47	68	50	560	.51	80	80
0.24	*	0.24	2400	1.0	67	23	1200	1.1	91	40	1000	1.2	102	78
0.24	*	0.51	2700	1.1	82	31	1500	1.2	115	60	1100	1.3	140	100
0.51	*	0.51	4700	2.2	92	28	2400	2.4	130	44	1600	2.4	157	72
0.51	*	1.0	5100	2.4	116	29	3000	2.7	160	55	2000	3.0	239	95
0.24	10	0.24	---	1.2	71	4.5	---	1.3	112	20	---	1.3	130	39
0.24	10	0.51	---	1.3	86	10	---	1.5	138	35	---	1.5	172	52
0.51	10	0.51	---	2.4	96	6.5	---	2.7	145	29	---	2.7	185	40
0.51	10	1.0	---	2.7	122	11	---	3.0	178	40	---	3.0	280	54



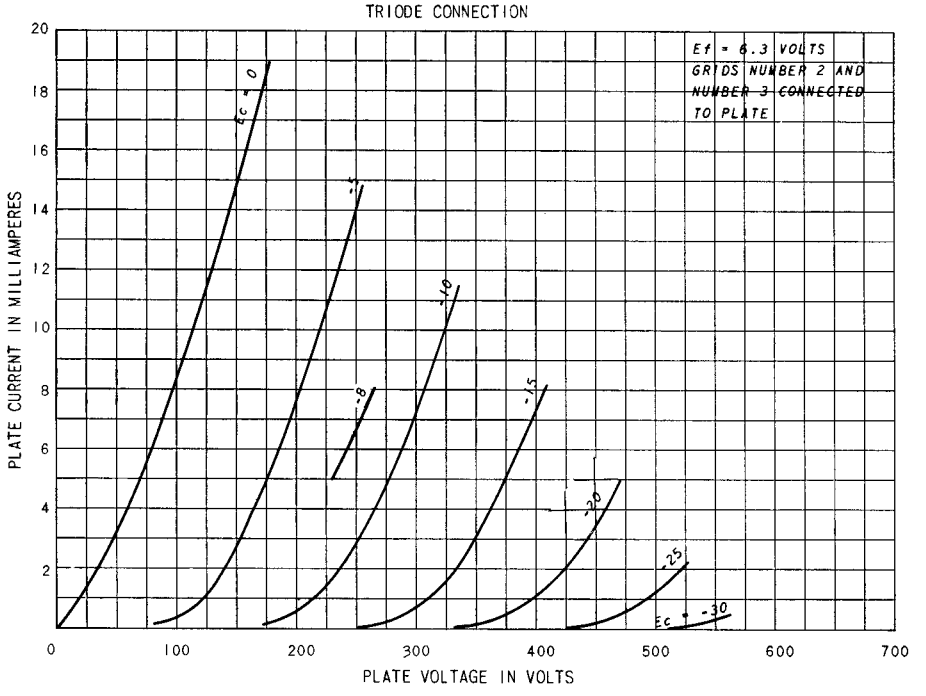
Note: Coupling capacitors (C) should be adjusted to give desired frequency response. Rk and Rsg should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data generator impedance is negligible. * Value of Rg1 is non-critical.

AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



—PRODUCT INFORMATION—

Compactron Beam Pentode

6JB5

FOR TV VERTICAL-DEFLECTION AMPLIFIER APPLICATIONS

- COLOR TV TYPE
- 15 WATTS PLATE DISSIPATION
- VERTICAL OUTPUT TYPE
- HIGH VOLTAGE SCREEN GRID
- HIGH PERVEANCE

The 6JB5 is a compactron beam pentode designed for use as the vertical-deflection amplifier in color television receivers.

Features of the 6JB5 include high perveance, high plate dissipation, a high voltage screen grid, and the utilization of a T-12 bulb to improve life and reliability by lowering operating temperature.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.8	Amperes

Direct Interelectrode Capacitances, approximate§

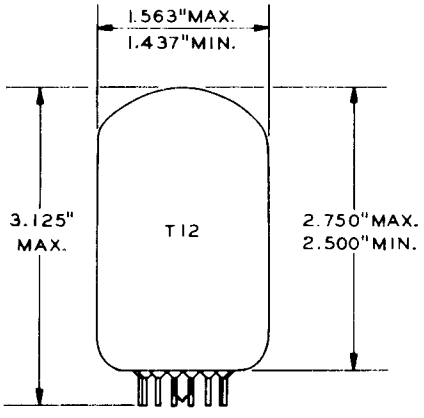
Grid-Number 1 to Plate: (g1 to p)	0.49	pf
Input: g1 to (h + k + g2 + b.p.)	9.5	pf
Output: p to (h + k + g2 + b.p.)	6.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-12 Glass
Base - E12-74, Button 12-Pin
Outline Drawing - EIA 12-57

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	3.125	Inches
Maximum Seated Height	2.750	Inches
Minimum Seated Height	2.500	Inches

PHYSICAL DIMENSIONS

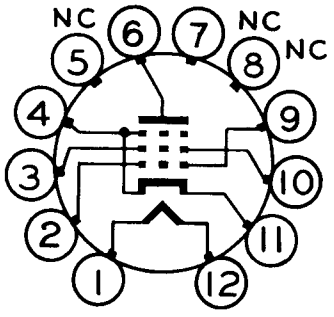


EIA 12-57

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Grid Number 1
Pin 3 - Grid Number 2 (Screen)
Pin 4 - Cathode and Beam Plates
Pin 5 - No Connection
Pin 6 - Plate
Pin 7 - No Connection
Pin 8 - No Connection
Pin 9 - Grid Number 1
Pin 10 - Grid Number 2 (Screen)
Pin 11 - Cathode and Beam Plates
Pin 12 - Heater

BASING DIAGRAM



EIA 12EY

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MAXIMUM RATINGS

VERTICAL-DEFLECTION AMPLIFIER SERVICE¶— DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

DC Plate Voltage	350	Volts
Peak Pulse Plate Voltage	2500	Volts
Screen Voltage	300	Volts
Plate Dissipation#	15	Watts
Screen Dissipation#	2.75	Watts
DC Cathode Current	. 75	Milliamperes
Peak Cathode Current	260	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	1.0	Megohms
With Cathode Bias	2.2	Megohms
Bulb Temperature at Hottest Point	200	C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	60	250	Volts
Screen Voltage	250	250	Volts
Grid-Number 1 Voltage	. 0Δ	-20	Volts
Plate Resistance, approximate	-	50000	Ohms
Transconductance	-	4100	Micromhos
Plate Current	180	43	Milliamperes
Screen Current	20	3.5	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 100 Microamperes	-	-50	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts

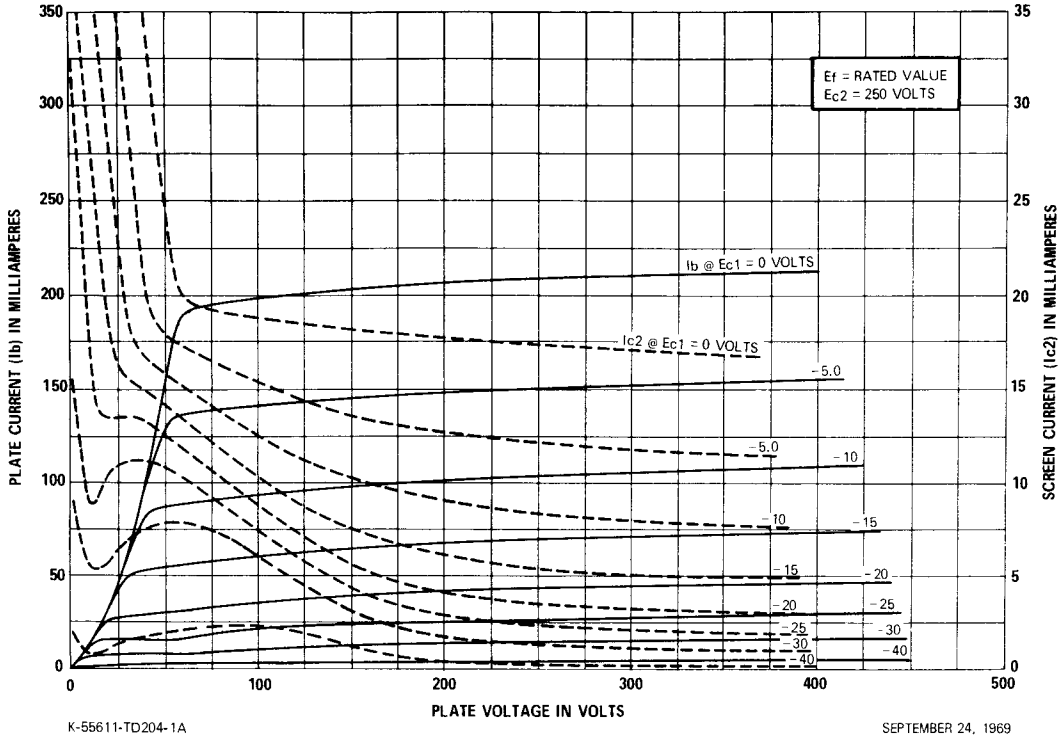
§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

\# In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Δ Applied for short interval (two seconds maximum) so as not to damage tube.

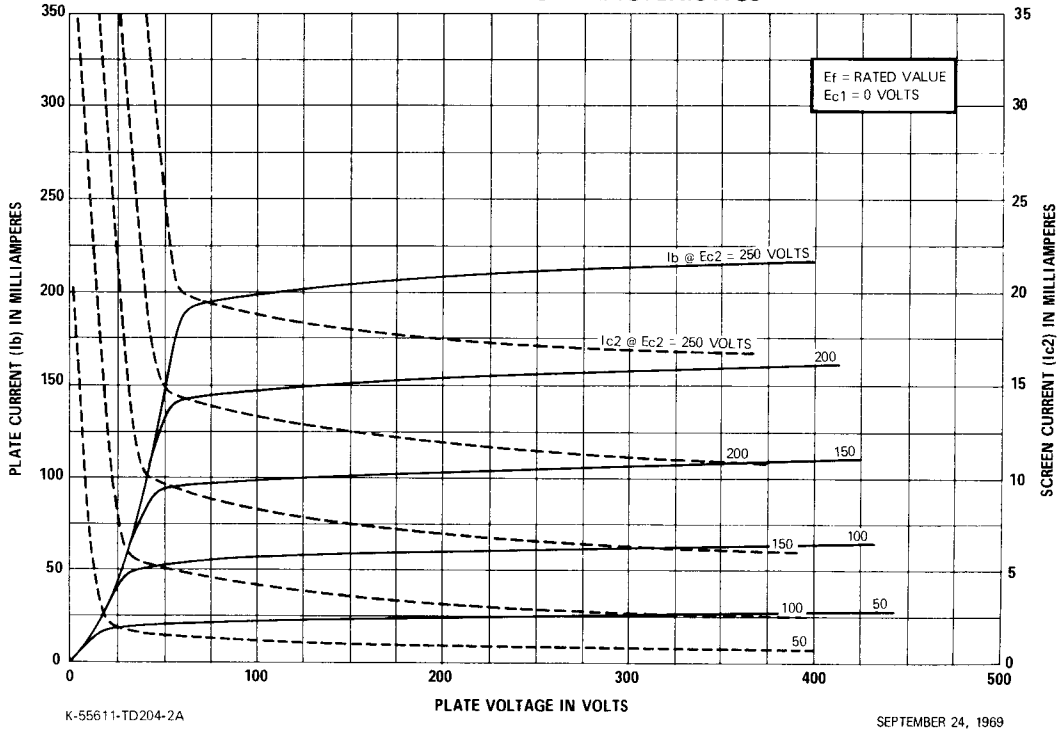
AVERAGE PLATE CHARACTERISTICS



K-55611-TD204-1A

SEPTEMBER 24, 1969

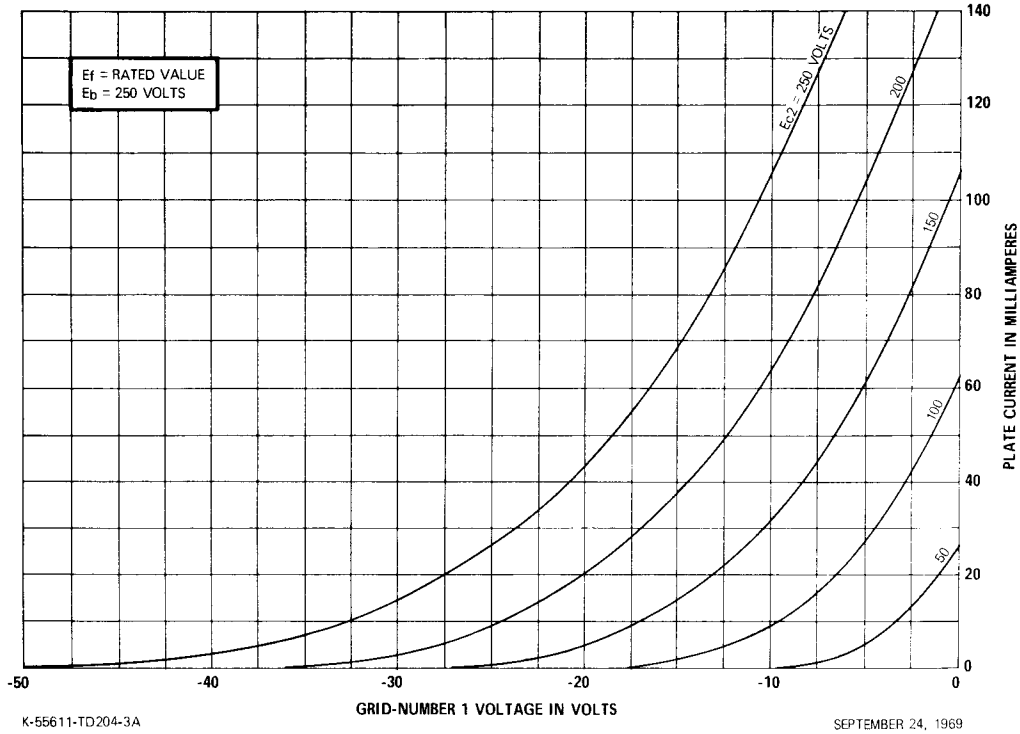
AVERAGE PLATE CHARACTERISTICS



K-55611-TD204-2A

SEPTEMBER 24, 1969

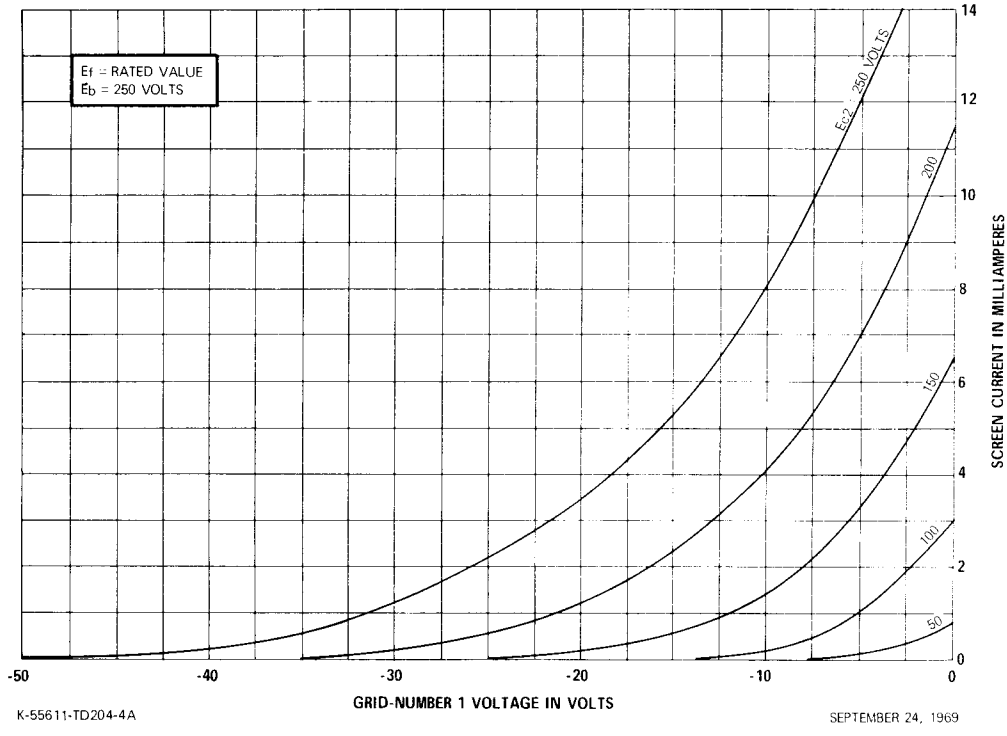
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD204-3A

SEPTEMBER 24, 1969

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD204-4A

SEPTEMBER 24, 1969

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Sharp-Cutoff Pentode

6JC6-A

- FRAME-GRID TYPE
- 16000 MICROMHOS
- NO EXTERNAL SHIELD REQUIRED
- COMMON PLATE AND SCREEN SUPPLY

The 6JC6-A is a miniature, frame-grid, sharp-cutoff pentode designed primarily for use in the intermediate-frequency amplifier stages of both monochrome and color television receivers.

The 6JC6-A is unilaterally interchangeable with the 6JC6, but has higher plate and screen dissipation ratings, and higher transconductance, plate and screen current characteristics.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.3	Amperes

Direct Interelectrode Capacitances, approximate‡

Grid-Number 1 to Plate: (g1 to p), maximum	0.019	pf
Input: g1 to (h + k + g2 + g3 + i.s.)	8.5	pf
Output: p to (h + k + g2 + g3 + i.s.)	3.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-6½, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

Maximum Diameter	0.875	Inches
Minimum Diameter	0.750	Inches
Maximum Over-all Length	2.187	Inches
Maximum Seated Height	1.937	Inches

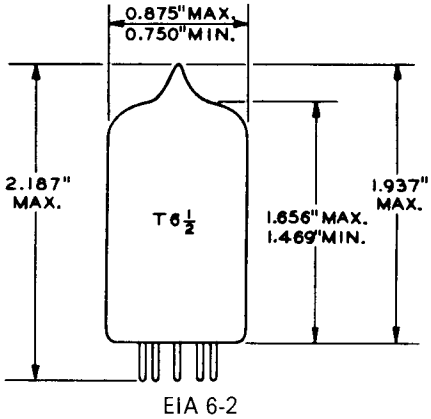
MAXIMUM RATINGS

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The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

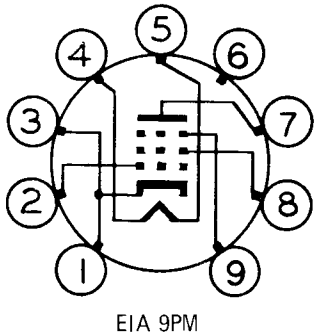


EIA 6-2

TERMINAL CONNECTIONS

Pin 1 - Cathode
Pin 2 - Grid Number 1
Pin 3 - Cathode
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - No Connection
Pin 7 - Plate
Pin 8 - Grid Number 2 (Screen)
Pin 9 - Grid Number 3 (Suppressor) and Internal Shield

BASING DIAGRAM



EIA 9PM

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MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

Plate Voltage	330	Volts
Suppressor Voltage	0	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	3.1	Watts
Screen Dissipation	0.7	Watts
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	125	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Plate Resistance, approximate	0.18	Megohms
Transconductance	16000	Micromhos
Plate Current	14	Milliamperes
Screen Current	3.4	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 100 Microamperes	-3	Volts

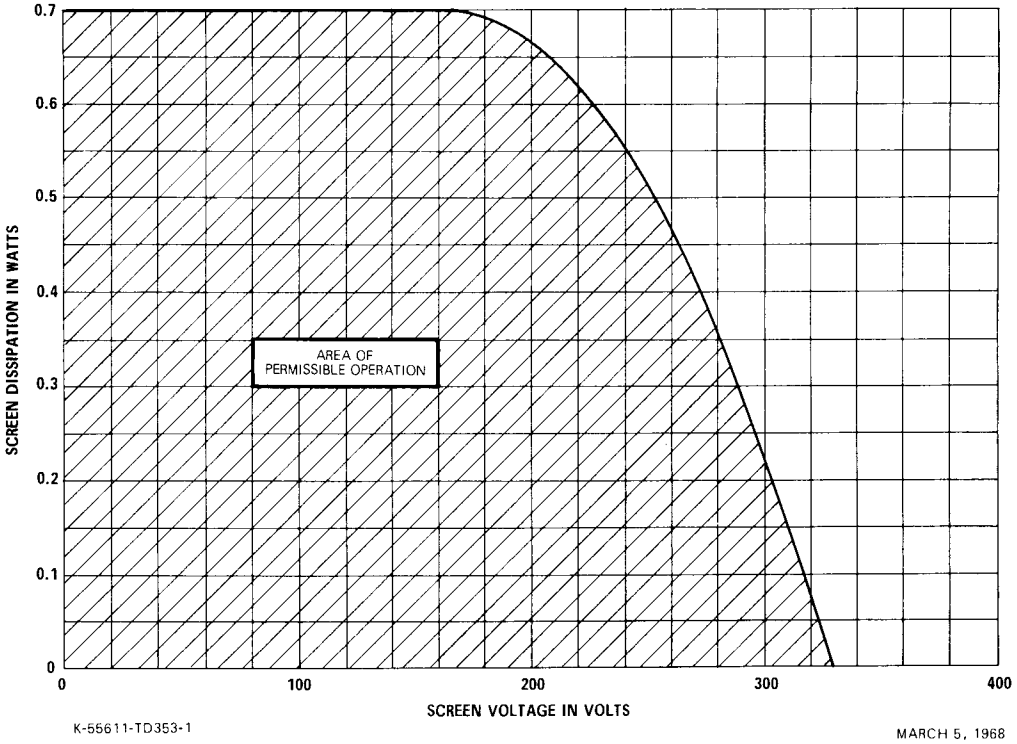
NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

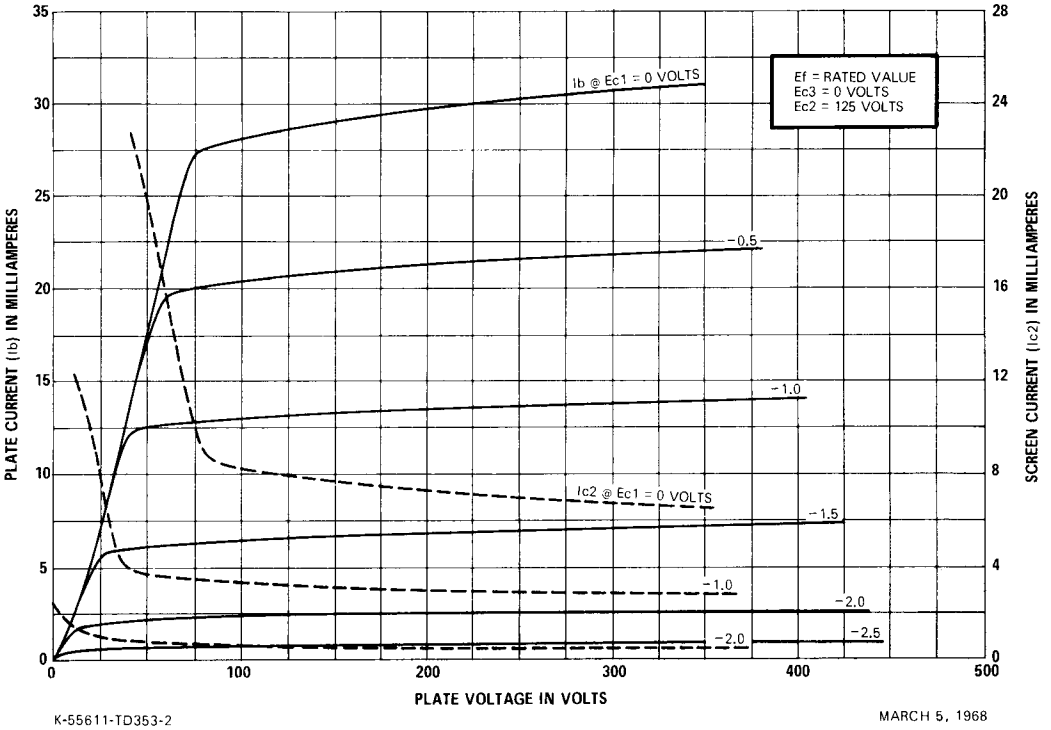
SCREEN RATING CHART



K-55611-TD353-1

MARCH 5, 1968

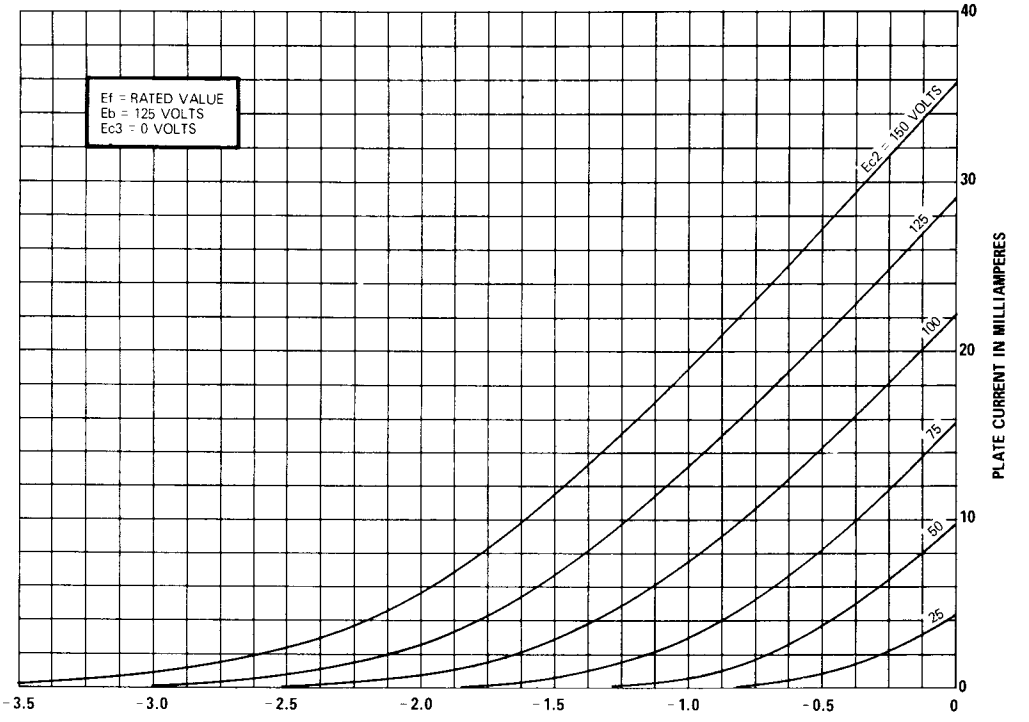
AVERAGE PLATE CHARACTERISTICS



K-55611-TD353-2

MARCH 5, 1968

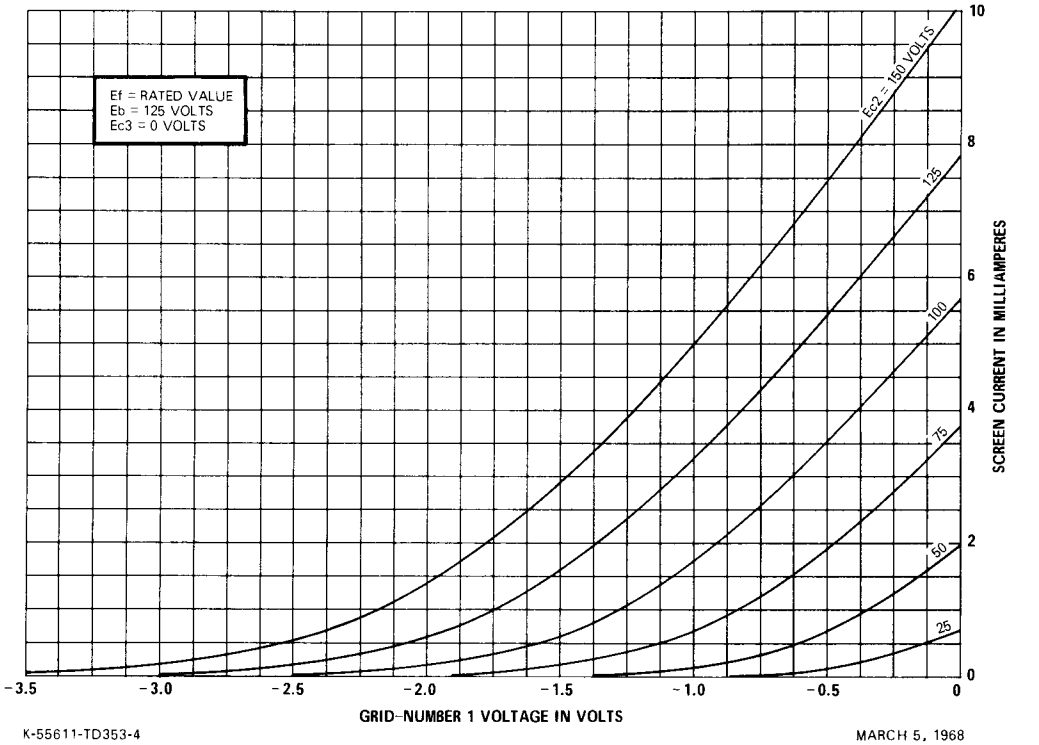
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD353-3

MARCH 5, 1968

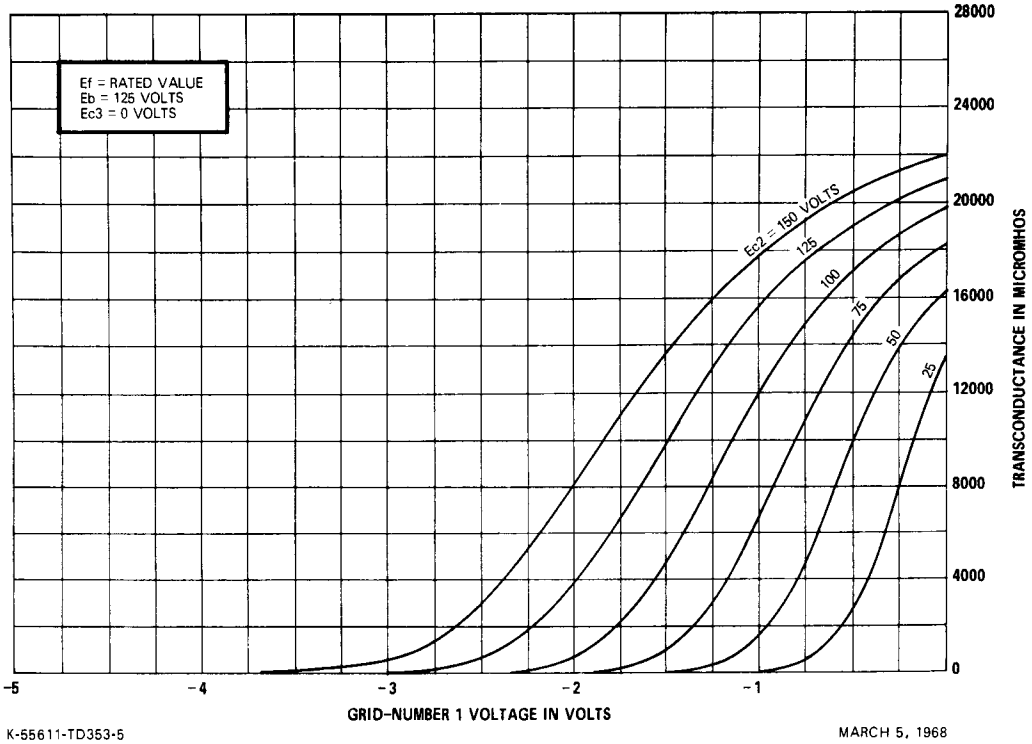
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD353-4

MARCH 5, 1968

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD353-5

MARCH 5, 1968

DESCRIPTION AND RATING

The 6JC8 is a miniature tube which contains a sharp-cutoff pentode and a medium-mu triode in one envelope. The tube is primarily intended for service as a combined triode oscillator and pentode mixer in VHF applications.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

	Series Heater Operation*	Parallel Heater Operation*	
Heater Voltage, AC or DC	6.3	6.3 ± 0.6	Volts
Heater Current	0.45 ± 0.03	0.45†	Amperes
Heater Warm-up Time‡	11	.....	Seconds

Direct Interelectrode Capacitances

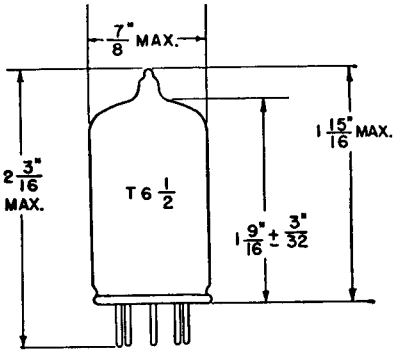
	With Shield§	Without Shield	
Pentode Section			
Grid-Number 1 to Plate: (Pg1 to Pp)	0.018	0.038	pf
Input: Pg1 to (h+k+Pg2+Pg3+i.s.)	5.0	4.8	pf
Output: Pp to (h+k+Pg2+Pg3+i.s.)	1.6	0.9	pf
Triode Section			
Grid to Plate: (Tg to Tp)	1.2	1.3	pf
Input: Tg to (h+k+Pg3+i.s.)	3.2	2.8	pf
Output: Tp to (h+k+Pg3+i.s.)	0.90	0.44	pf
Pentode Grid-Number 1 to Triode Plate, max. (Pg1 to Tp)	0.036	0.05	pf
Pentode Plate to Triode Plate, maximum (Pp to Tp)	0.012	0.075	pf
Heater to Cathode	6.5¶	6.5	pf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin
Outline Drawing—EIA 6-2

Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 3/16	Inches
Maximum Seated Height	1 15/16	Inches

PHYSICAL DIMENSIONS

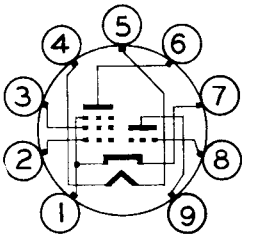


EIA 6-2

TERMINAL CONNECTIONS

Pin 1—Cathode, Pentode Grid Number 3, and Internal Shield
Pin 2—Pentode Grid Number 1
Pin 3—Pentode Grid Number 2 (Screen)
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Plate
Pin 7—Cathode, Pentode Grid Number 3, and Internal Shield
Pin 8—Triode Grid
Pin 9—Triode Plate

BASING DIAGRAM



EIA 9PA

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section	
Plate Voltage	275	275	Volts
Screen Supply Voltage	275	....	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	2.3	1.7	Watts
Screen Dissipation	0.45	....	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	....	Megohms
With Cathode Bias	0.5	....	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section		Triode Section	
Plate Voltage	100	125	125	Volts
Screen Voltage	70	125	....	Volts
Grid-Number 1 Voltage	0	−1.0	−1.0	Volts
Amplification Factor	....	.....	40	
Plate Resistance, approximate	....	300000	6000	Ohms
Transconductance	5700	5500	6500	Micromhos
Plate Current	....	9.0	12	Milliamperes
Screen Current	....	2.2	....	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 20 Microamperes	....	−6.5	−7	Volts

* For parallel heater operation the equipment designer should design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

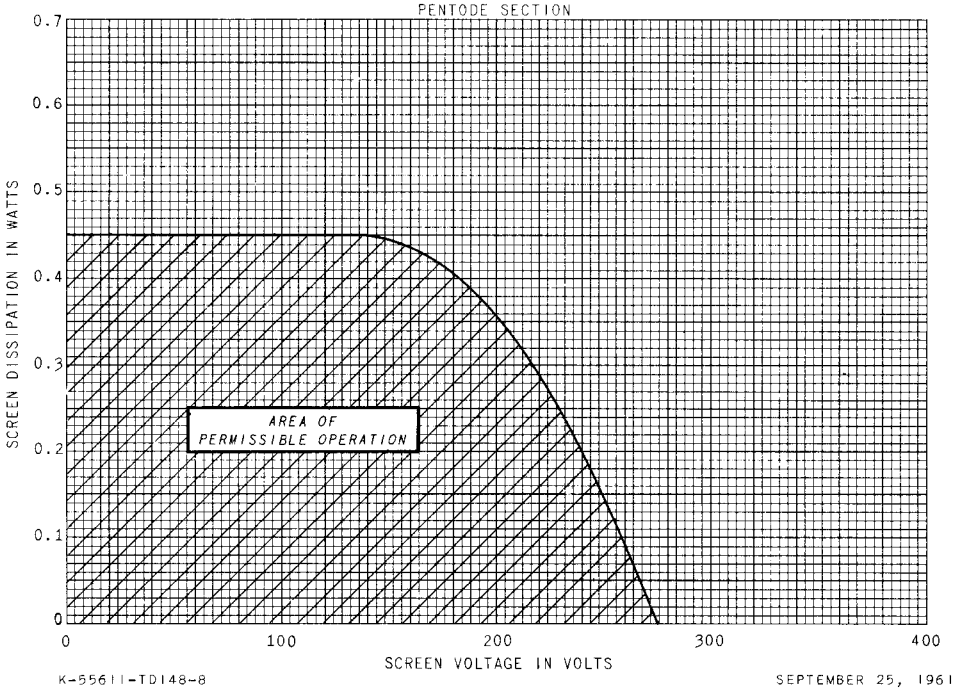
† Heater current of a bogey tube at Ef = 6.3 volts.

‡ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

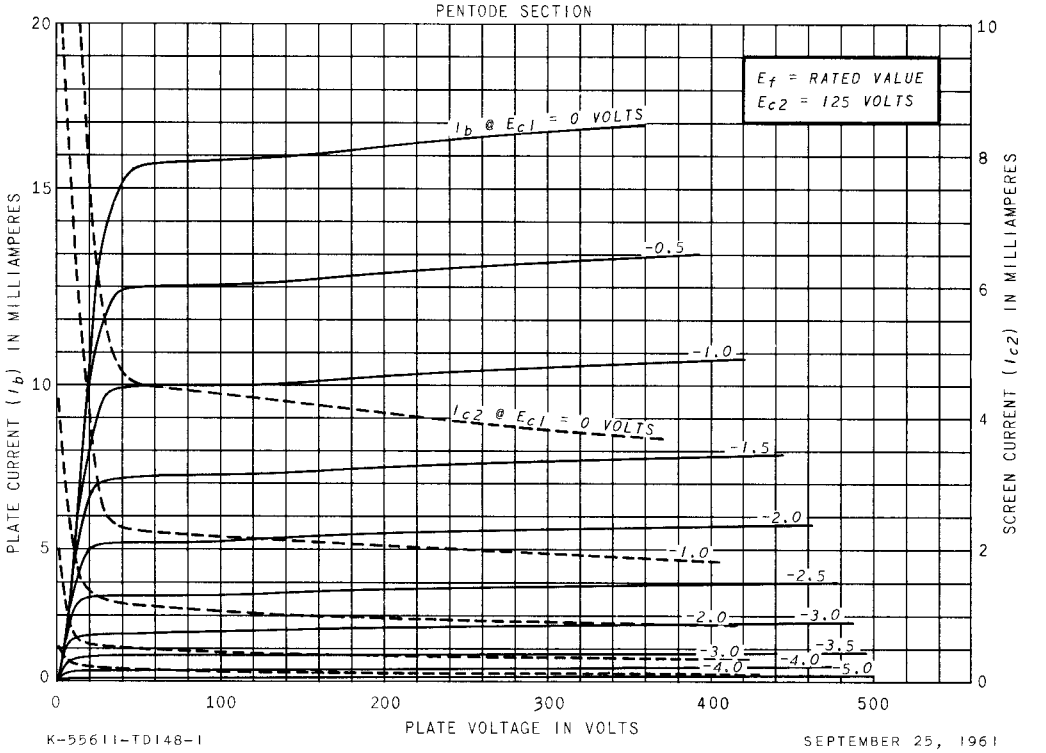
§ With external shield (EIA 315) connected to Pin 3 unless otherwise indicated.

¶ With external shield (EIA 315) connected to Pin 6.

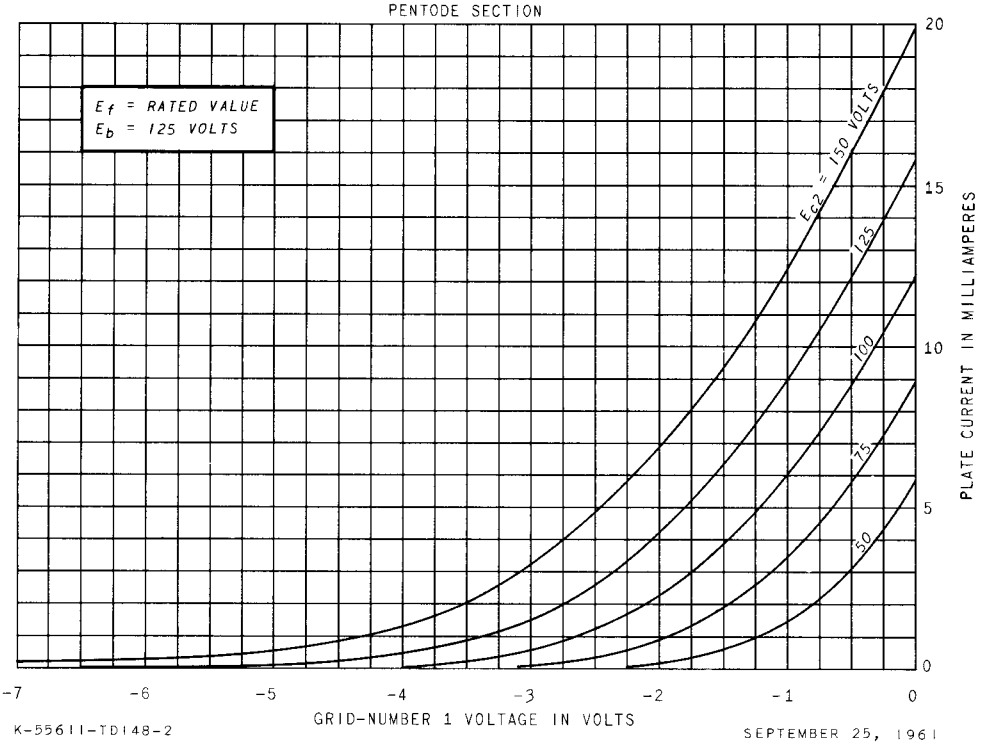
SCREEN RATING CHART



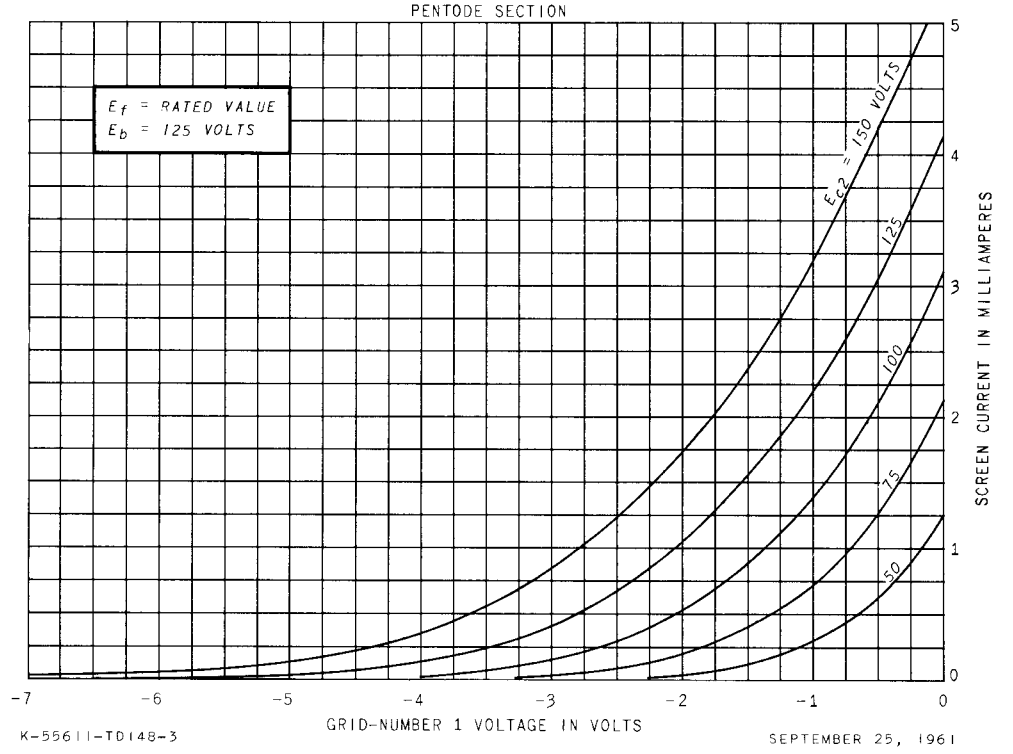
AVERAGE PLATE CHARACTERISTICS



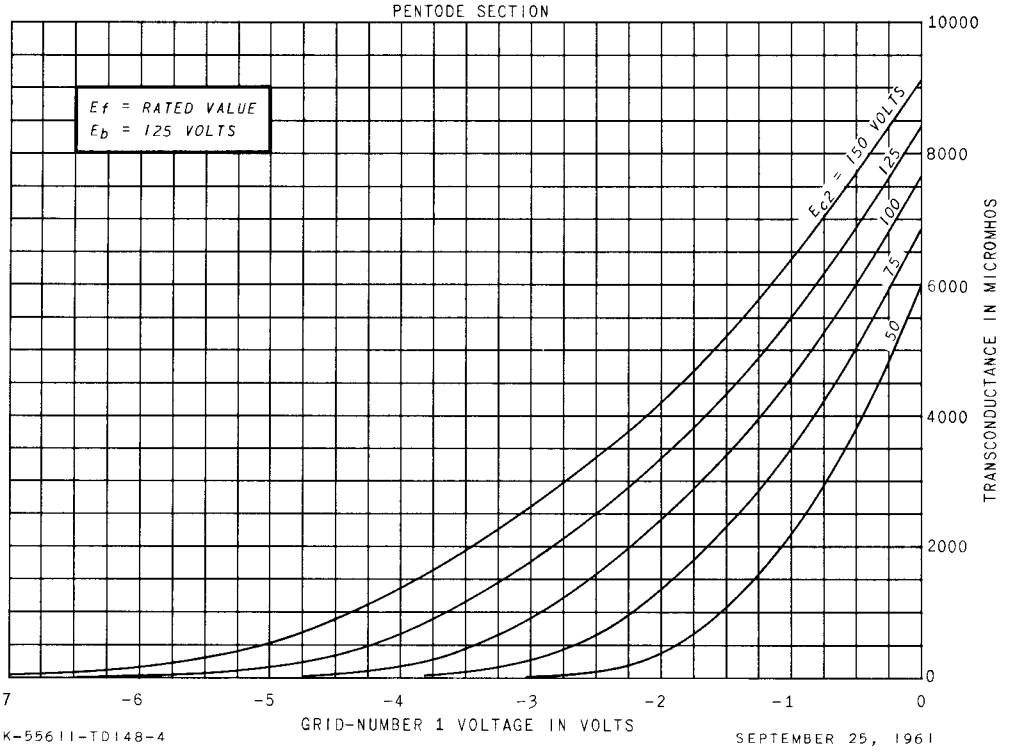
AVERAGE TRANSFER CHARACTERISTICS



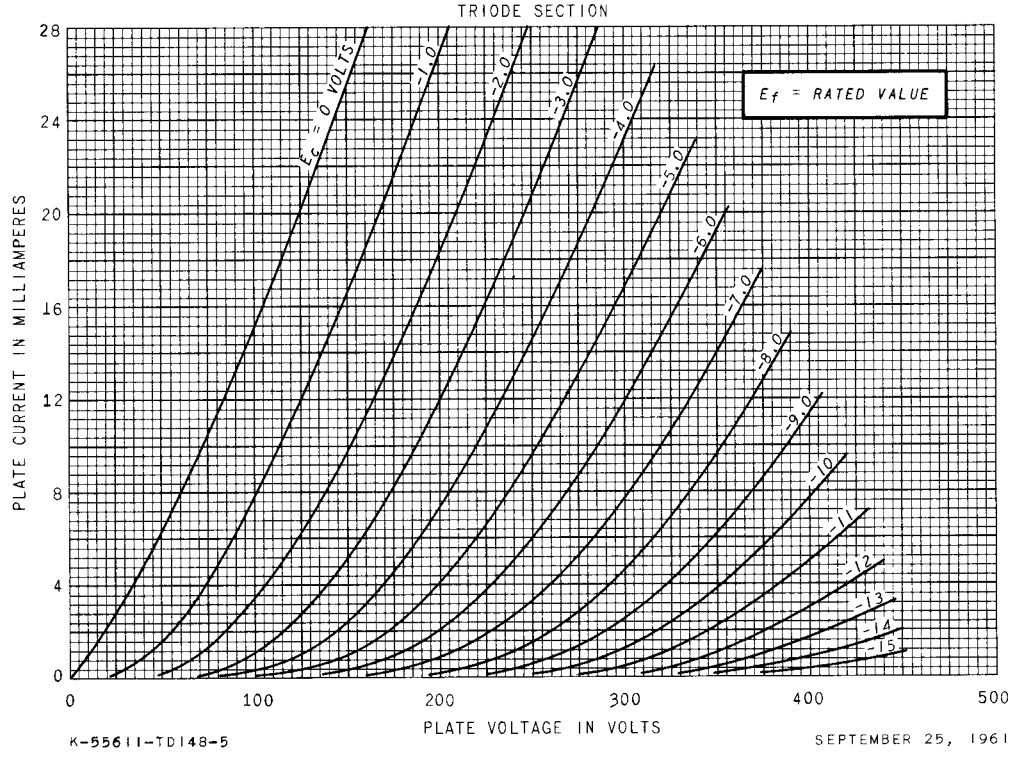
AVERAGE TRANSFER CHARACTERISTICS



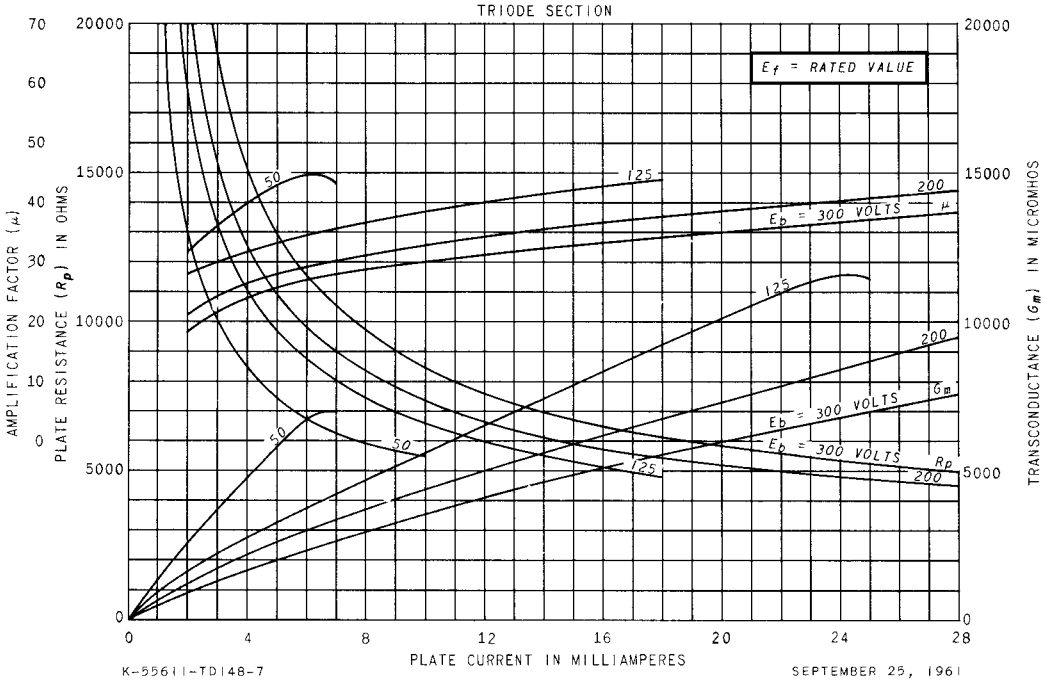
AVERAGE TRANSFER CHARACTERISTICS



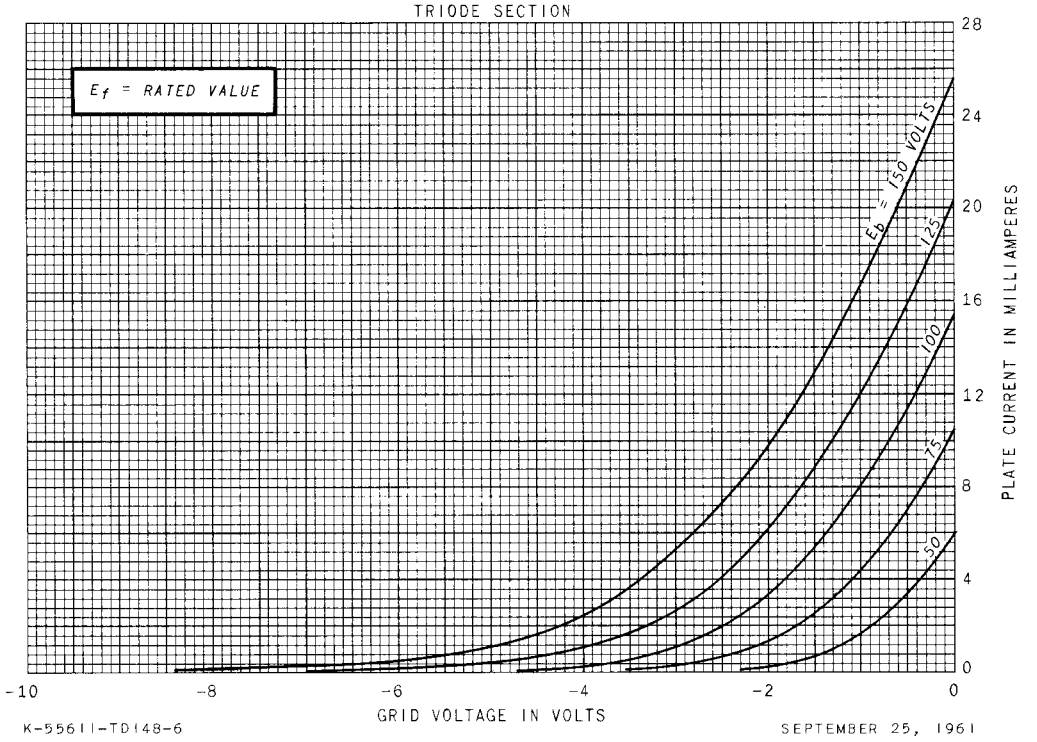
AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Compactron Beam Triode

6JD5

- COLOR TV TYPE
- 35 WATTS PLATE DISSIPATION
- DIFFUSION BONDED CATHODE
- TRANSCONDUCTANCE = 55000 MICROMHOS
- 300 MILLIAMPERES PEAK PLATE CURRENT

The 6JD5 is a compactron beam triode suited for use as a pulse-type high-voltage regulator in high-voltage power supply of color television receivers.

Features of the 6JD5 include a diffusion bonded cathode coating which provides a positive bond between the cathode coating and base material, thereby practically eliminating grid-to-cathode shorts caused by cathode flaking. By operating at a relatively low potential (3500 volts), this pulse-type regulator provides much less stress on internal components than shunt regulators operating in the 25000-volt range.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	6.3 ± 0.6	Volts
Heater Current●	2.4	Amperes

Direct Interelectrode Capacitances, approximate♦

Grid to Plate: (g to p)	1.7	pf
Input: g to (h + k + b.p.)	23	pf
Output: p to (h + k + b.p.)	12	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing

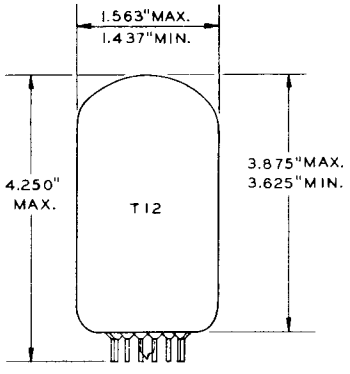
Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	4.250	Inches
Maximum Seated Height	3.875	Inches
Minimum Seated Height	3.625	Inches

MAXIMUM RATINGS

HIGH-VOLTAGE REGULATOR SERVICE§—DESIGN-MAXIMUM VALUES

Peak Plate Voltage	5500	Volts
Plate Dissipation	35	Watts
Peak Plate Current	325	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode⊕		
Total DC and Peak	450	Volts
Grid-Circuit Resistance▲	0.1	Megohms
Bulb Temperature at Hottest Point †	240	C

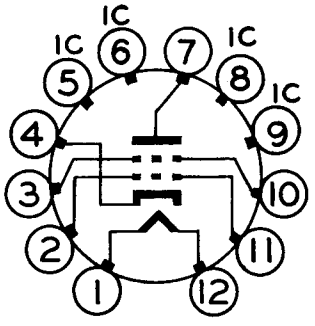
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Grid
Pin 3 - Beam Plate
Pin 4 - Cathode
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Plate
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Beam Plate
Pin 11 - Grid
Pin 12 - Heater

BASING DIAGRAM



EIA 12GY

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pulse Plate Voltage□	3500	Volts
Beam Plate Connected to Cathode at Socket		
Negative DC Grid Voltage	4.4	Volts
Peak Plate Current	300	Milliamperes
Amplification Factor	300	
Transconductance	55000	Micromhos
Plate Resistance, approximate	4600	Ohms
Grid Voltage, approximate		
Eb = 3500 Volts, Ib = 1.0 Milliamperes	-16	Volts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

♦ Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

⊕ Sufficient impedance (220 ohms by-passed with a 0.01 microfarad capacitor is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

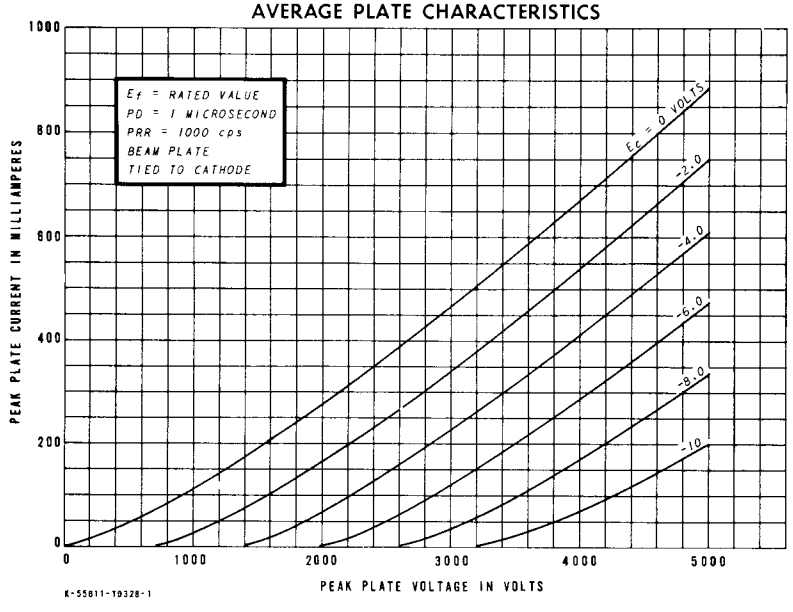
▲ Larger values of grid-circuit resistance may be used if provisions are made to protect the tube.

□ Duty cycle of the pulse must be less than 2.5 percent.

† Measured with an infrared themometer, Ircon Model 700 BC or equivalent, at an ambient temperature of 40° C.

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AVERAGE PLATE CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

6JD6

Sharp-Cutoff Pentode

The 6JD6 is a miniature, frame-grid, sharp-cutoff pentode designed primarily for use in the intermediate-frequency amplifier stages of television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.3	Amperes

Direct Interelectrode Capacitance§

Grid-Number 1 to Plate: (g1 to p), maximum	0.019	pf
Input: g1 to (h + k + g2 + g3 + i.s.)	8.2	pf
Output: p to (h + k + g2 + g3 + i.s.)	3.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

Maximum Diameter	0.875	Inches
Maximum Over-all Length	2.188	Inches
Maximum Seated Height	1.938	Inches

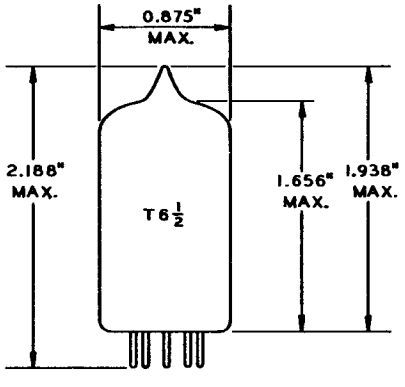
MAXIMUM RATINGS

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PHYSICAL DIMENSIONS

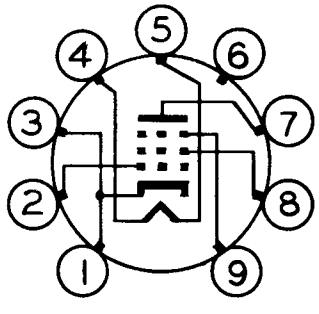


EIA 6-2

TERMINAL CONNECTIONS

Pin 1 - Cathode
Pin 2 - Grid Number 1
Pin 3 - Cathode
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - No Connection
Pin 7 - Plate
Pin 8 - Grid Number 2 (Screen)
Pin 9 - Grid Number 3 (Suppressor) and Internal Shield

BASING DIAGRAM



EIA 9PM

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MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

Plate Voltage	330	Volts
Suppressor Voltage	0	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	2.5	Watts
Screen Dissipation	0.6	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	125	Volts
Suppressor Voltage	0	Volts
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Plate Resistance, approximate	160000	Ohms
Transconductance	14000	Micromhos
Plate Current	15	Milliamperes
Screen Current	4.0	Milliamperes
Grid-Number 1 Voltage, approximate		
Gm = 600 Micromhos	-4.5	Volts

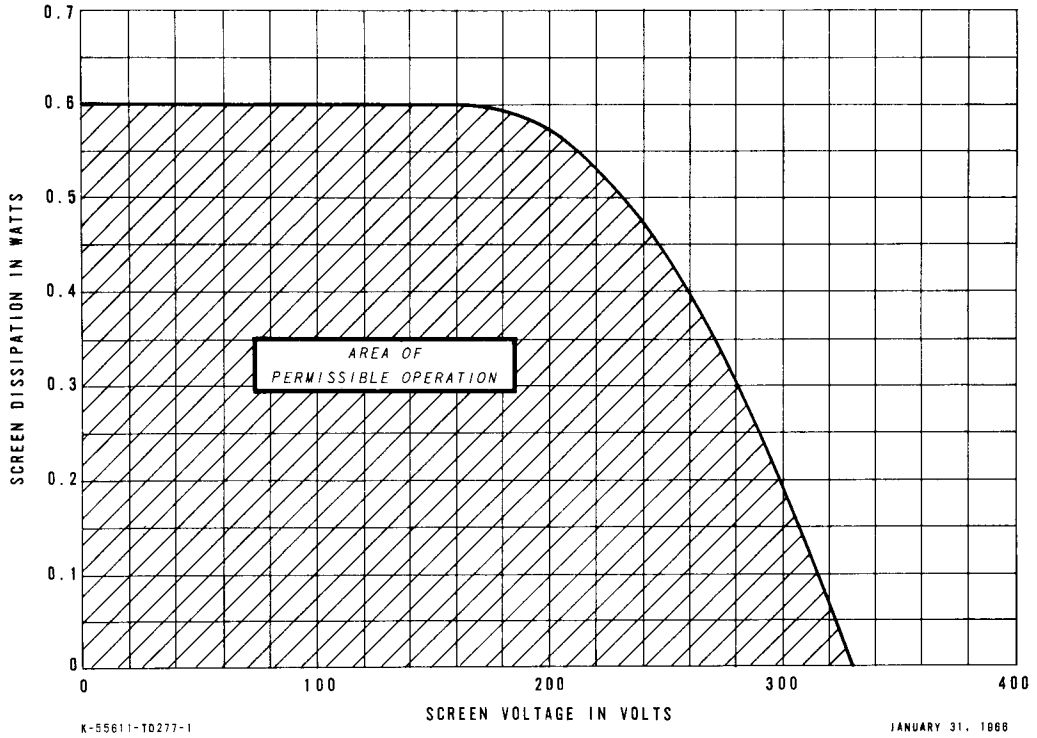
NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

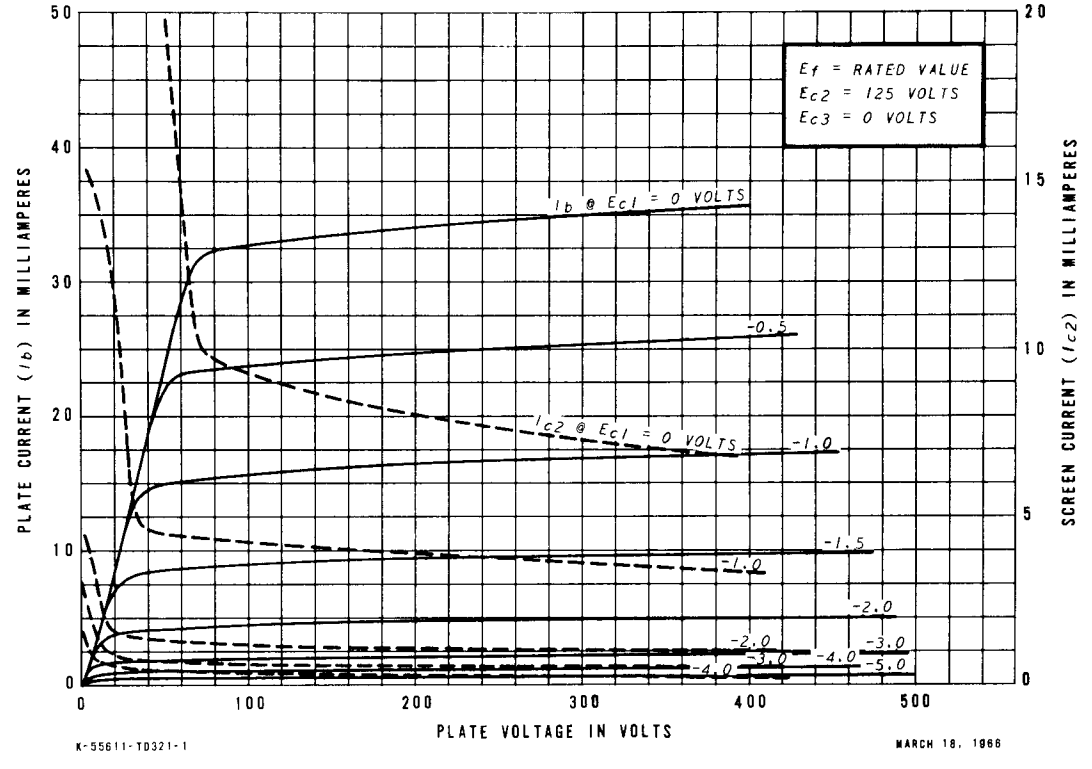
‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

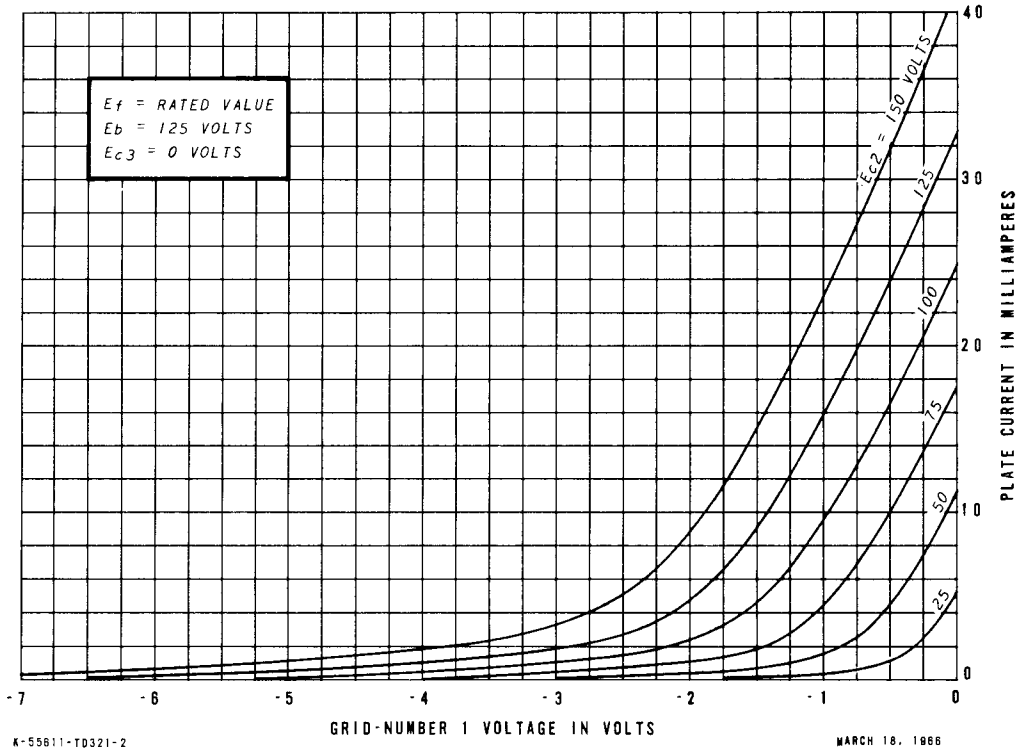
SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

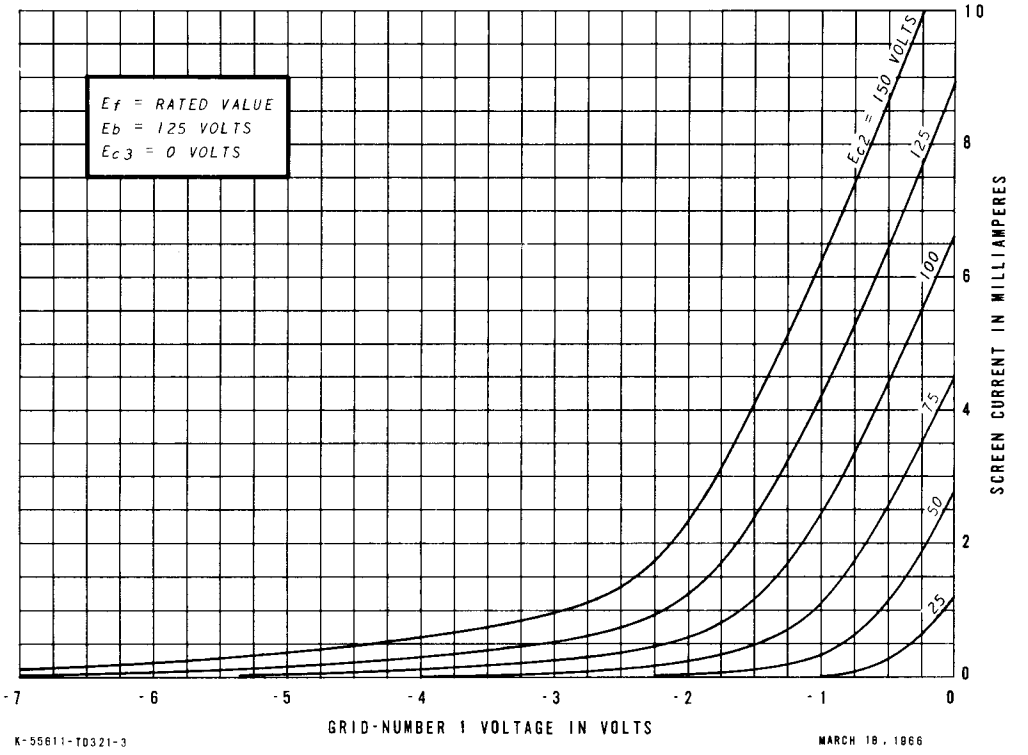


AVERAGE TRANSFER CHARACTERISTICS



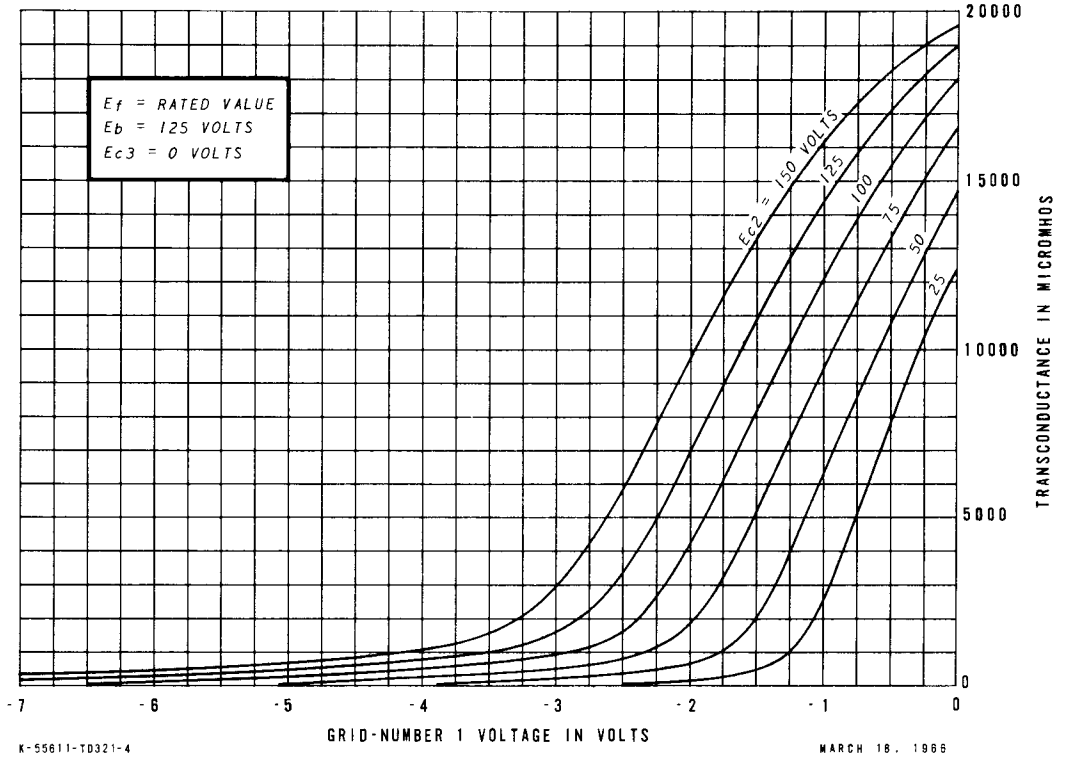
K-55611-TD321-2 MARCH 18, 1966

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD321-3 MARCH 18, 1966

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD321-4

MARCH 18, 1966

—PRODUCT INFORMATION—

Beam Pentode

6JE6-C

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

COLOR TV TYPE | NOVAR CONSTRUCTION | T–12 ENVELOPE | WING FIN CONSTRUCTION

The 6JE6C is a beam pentode featuring Novar construction with a special plate fin. The fin provides improved heat distribution and a greater plate dissipation capability. This in turn increases reliability under rated conditions. It is designed for use as horizontal deflection amplifiers in color television receivers.

GENERAL

ELECTRICAL

Cathode – Coated Unipotential

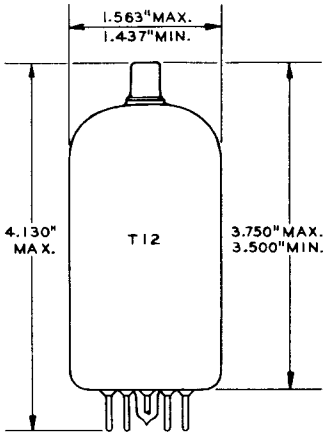
Heater Characteristics and ratings	
Heater Voltage, AC or DC *	6.3±0.6 Volts
Heater Current •	2.5 Amperes
Heater Circuit	Parallel
Maximum Heater Cathode Voltage	
Heater Negative with Respect to Cathode	
Total DC and Peak	200 Volts
Heater Positive with Respect to Cathode	
DC	100 Volts
Total DC and Peak	200 Volts

MECHANICAL

Operating Position – Any
Envelope T–12
Base E9–88 (With Exhaust Tip) or
E9–76 (Without Exhaust Tip)
Top Cap C1–1
Outline Drawing EIA 12–116

Maximum Diameter	1.563 Inches
Maximum Seated Height	3.750 Inches
Maximum Overall Length	4.130 Inches

PHYSICAL DIMENSIONS

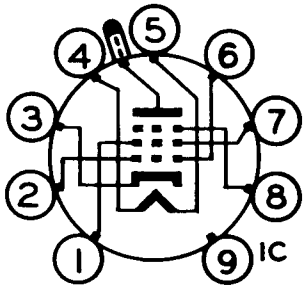


EIA 12–116

TERMINAL CONNECTIONS

Pin 1 – Grid Number 2
Pin 2 – Grid Number 1
Pin 3 – Cathode
Pin 4 – Heater
Pin 5 – Heater
Pin 6 – Grid Number 1
Pin 7 – Grid Number 2
Pin 8 – Grid Number 3 (Beam Plates)
Pin 9 – Internal Connection (Do not use)
Top Cap– Plate

BASING DIAGRAM



9QL

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE— DESIGN-MAXIMUM VALUES

DC Plate Supply Voltage (Boost DC Power Supply)	990	Volts	Maximum
Peak Positive Plate Pulse Voltage (Absolute Maximum)	7500	Volts	Maximum
Peak Negative Plate Pulse Voltage	1200	Volts	Maximum
Positive Grid Number 3 Voltage	75	Volts	Maximum
Grid Number 2 D.C. Voltage	220	Volts	Maximum
Peak Negative Grid Number 1 Voltage	330	Volts	Maximum
Plate Dissipation ▲ ⊕	30	Watts	Maximum
Grid Number 2 Dissipation ⊕	5	Watts	Maximum
Average Cathode Current	350	Milliamperes	Maximum
Peak Cathode Current	1200	Milliamperes	Maximum
Grid Number 1 Circuit Resistance			
With Grid Bias Feedback HV Regulation	0.47	Megohms	Maximum
With DC or Pulse Shunt HV Regulation	10	Megohms	Maximum
Bulb Temperature (At hottest point)	250	°C	Maximum

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Plate Voltage	175	60		Volts
Grid Number 2 Voltage	125	125		Volts
Grid Number 1 Voltage	−25	0		Volts
Grid Number 3 Voltage	§	§		Volts
Plate Current	130	600	♦	Milliamperes
Grid Number 2 Current	2.8	30	♦	Milliamperes
Transconductance	10,500			μmhos
Triode Amplification Factor (Grid Number 2 Connected to Plate) (Eb = Ec2 = 125 Volts ; Ec1 = −25 Volts)	3.0			
Plate Resistance (Approximate)	5500			Ohms
Grid Number 1 Voltage for Ib = 1Ma (Approximate)	−54			Volts

CUTOFF CHARACTERISTICS

Peak Positive Plate Pulse Voltage	5000	5500	5500	6000	Volts
Grid Number 2 Voltage	125	125	125	125	Volts
Grid Number 3 Voltage	0	0	0	0	Volt
Grid Number 1 Voltage (Approximate) Ib = 75μa		−145	−155	−165	Volts
Grid Number 1 Voltage (Approximate) Ib = 1 Ma	−125				Volts

MINIMUM RECOMMENDED GRID DRIVE (See Chart)

Peak Positive Plate Pulse Voltage	5000	5000	6000	Volts
Peak Negative Grid Number 1 Voltage	210	225	240	Volts

AVERAGE CHARACTERISTICS (Cont'd)

SPECIAL TESTS AND RATINGS

Primary Beam – Plate Emission □		
Initial Maximum	100	μa
After 1000 Hrs. of Operation Within Ratings (Maximum)	100	μa

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater variations restricted to maintain heater voltage within the specified tolerance.

• Heater current of a bogey tube at Ef=6.3 volts.

▲ In stages operating wtth a grid leak bias, an adequate cathode–bias resistor or other suitable means is required to protect the tube in the absence of excitation.

♦ Values measured by a method involving a recurrent waveform such that the plate and screen dissipations will be kept within ratings in order to prevent damage to the tube.

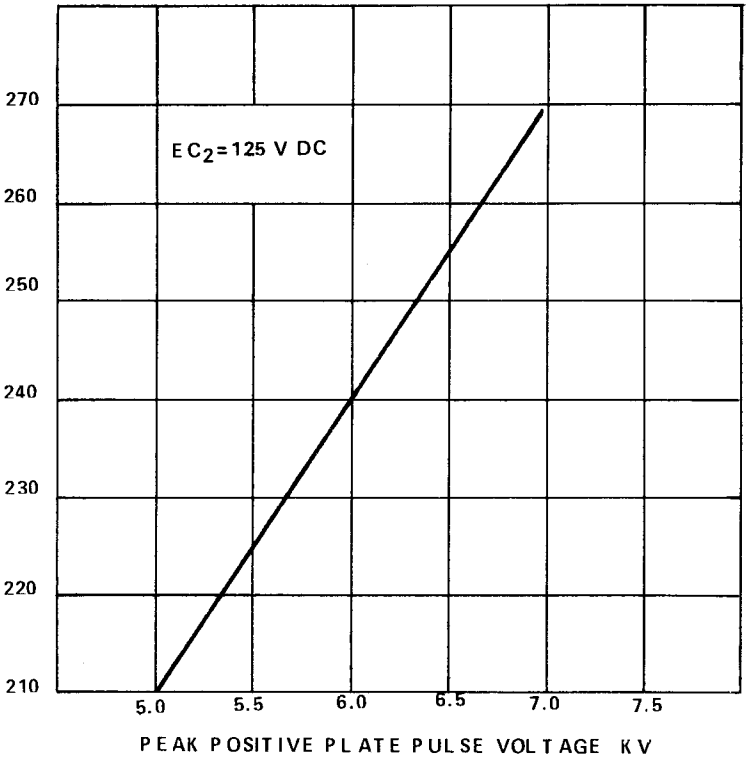
§ Grid Number 3 (Beam Plate) returned to cathode. (At socket)

⊕ Preferred Operation Dissipation Values (Watts – Max.)

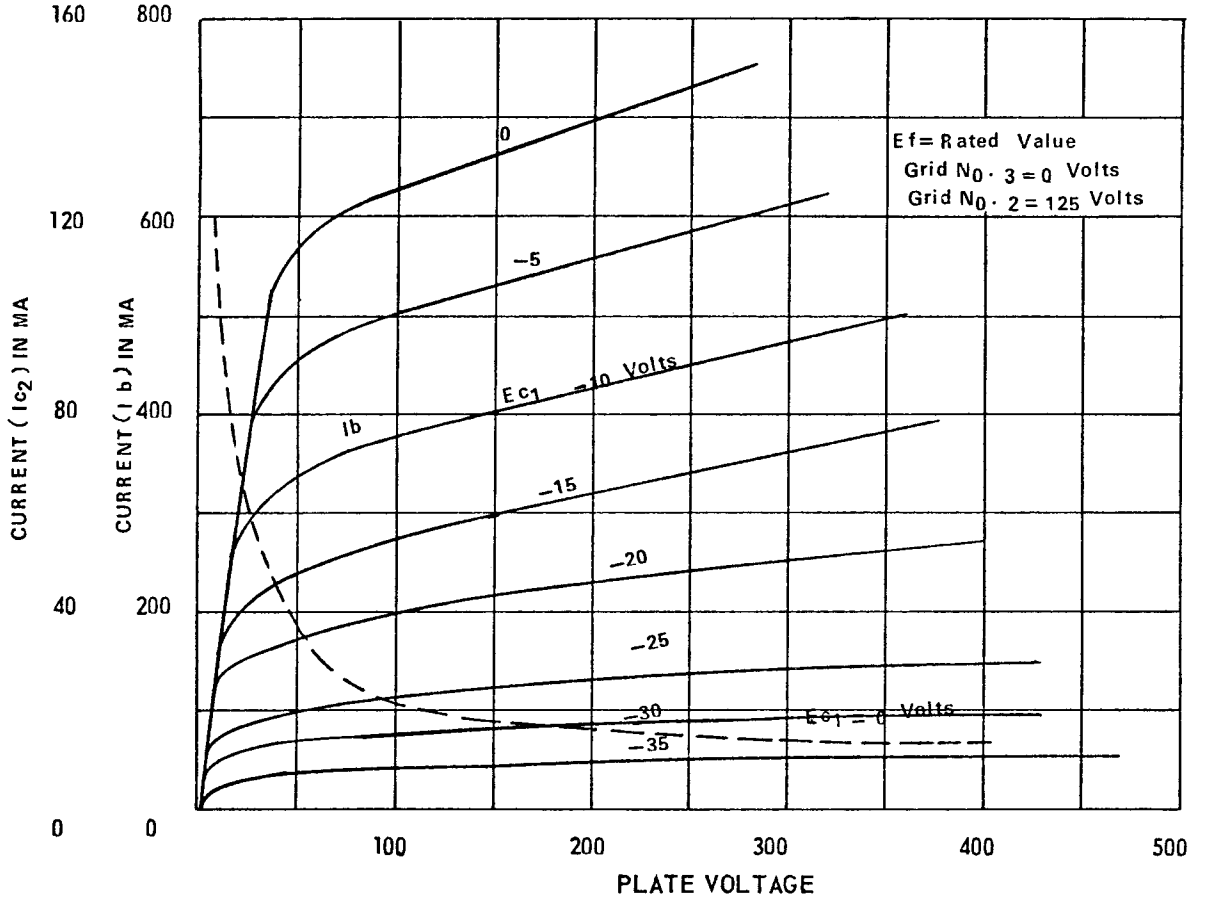
Pp	Pg2
30	3.5
28	4.0
26	4.5
24	5.0

□ Primary beam plate (Grid Number 3) emission is measured by operating the tube at a plate dissipation of 40 watts for mot more than 5 minutes with the beam plate returned to ground through a current meter.

CHART OF RECOMMENDED MINIMUM
PEAK NEGATIVE GRID VOLTAGE VS
PEAK POSITIVE PLATE PULSE VOLTAGE



AVERAGE PLATE CHARACTERISTICS



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ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Sharp-Cutoff Pentode

6JG5

FOR TV VIDEO AMPLIFIER APPLICATIONS

■ COLOR TV TYPE ■ VIDEO AMPLIFIER PENTODE ■ 9-PIN MINIATURE ■ TRANSCONDUCTANCE = 11500 MICROMHOS

The 6JG5 is a miniature sharp-cutoff pentode primarily designed for use as the video output amplifier in color television receivers. Its characteristics are identical to those of the 6GN8 pentode section.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	6.3±0.6	Volts
Heater Current●	0.525	Amperes

Direct Interelectrode Capacitances, approximate▲

Grid-Number 1 to Plate: (g1 to p)	0.10	pf
Input: g1 to (h+k+g2+g3+i.s.)	11	pf
Output: p to (h+k+g2+g3+i.s.)	4.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-6½, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-3

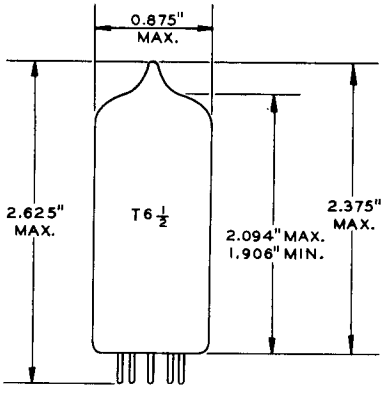
Maximum Diameter	0.875	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.375	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	330	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	5.0	Watts
Screen Dissipation	1.1	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	1.0	Megohms

PHYSICAL DIMENSIONS

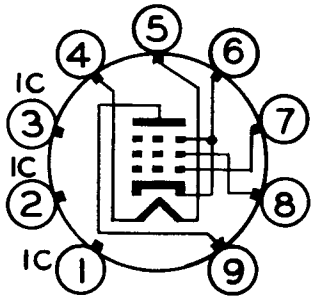


EIA 6-3

TERMINAL CONNECTIONS

Pin 1 - Internal Connection - Do Not Use
Pin 2 - Internal Connection - Do Not Use
Pin 3 - Internal Connection - Do Not Use
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Cathode, Grid-Number 3 and Internal Shield
Pin 7 - Grid-Number 1
Pin 8 - Grid-Number 2 (Screen)
Pin 9 - Plate

BASING DIAGRAM



EIA 9SF

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

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CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	60	200	Volts
Screen Voltage	150	150	Volts
Grid-Number 1 Voltage	0♦	---	Volts
Cathode-Bias Resistor	---	100	Ohms
Plate Resistance, approximate	---	60000	Ohms
Transconductance	---	11500	Micromhos
Plate Current	55	25	Milliamperes
Screen Current	18	5.5	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	---	-10	Volts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

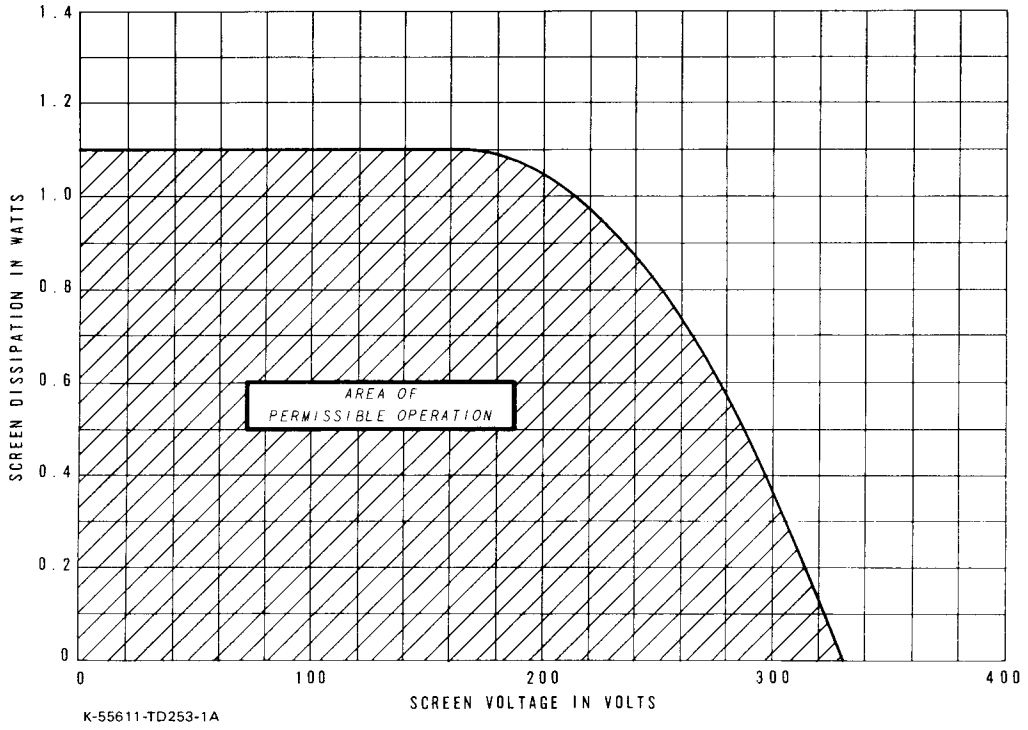
● Heater current of a bogey at Ef = 6.3 volts.

▲ Without external shield.

♦ Applied for short interval (two seconds maximum) so as not to damage tube.

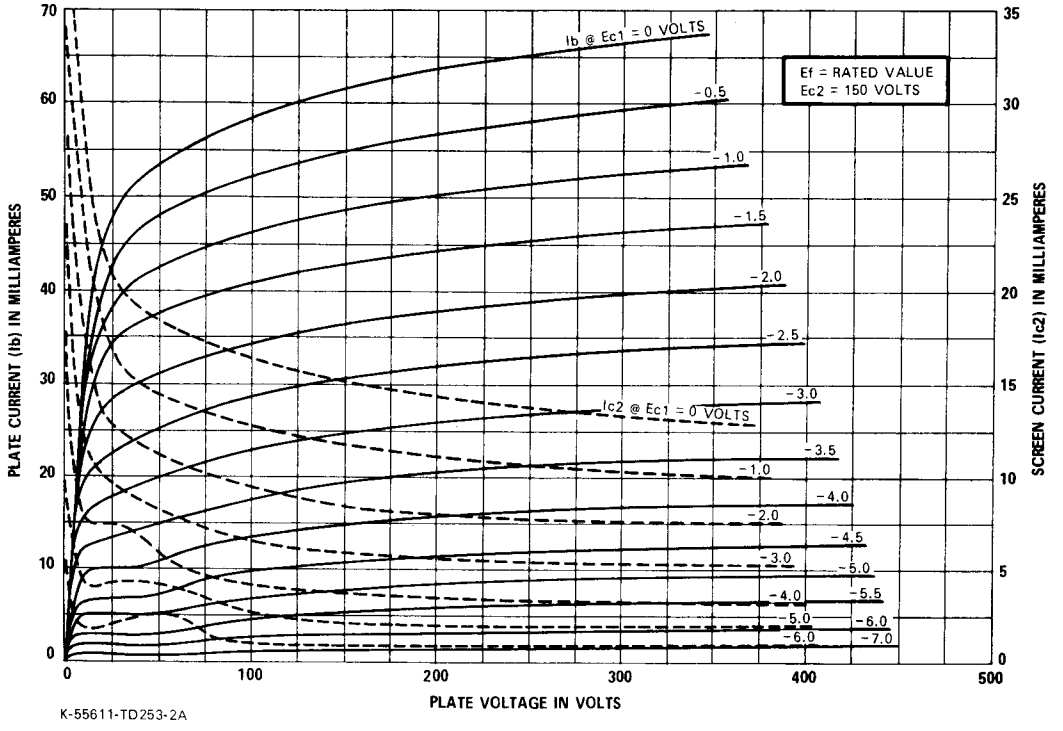
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SCREEN RATING CHART



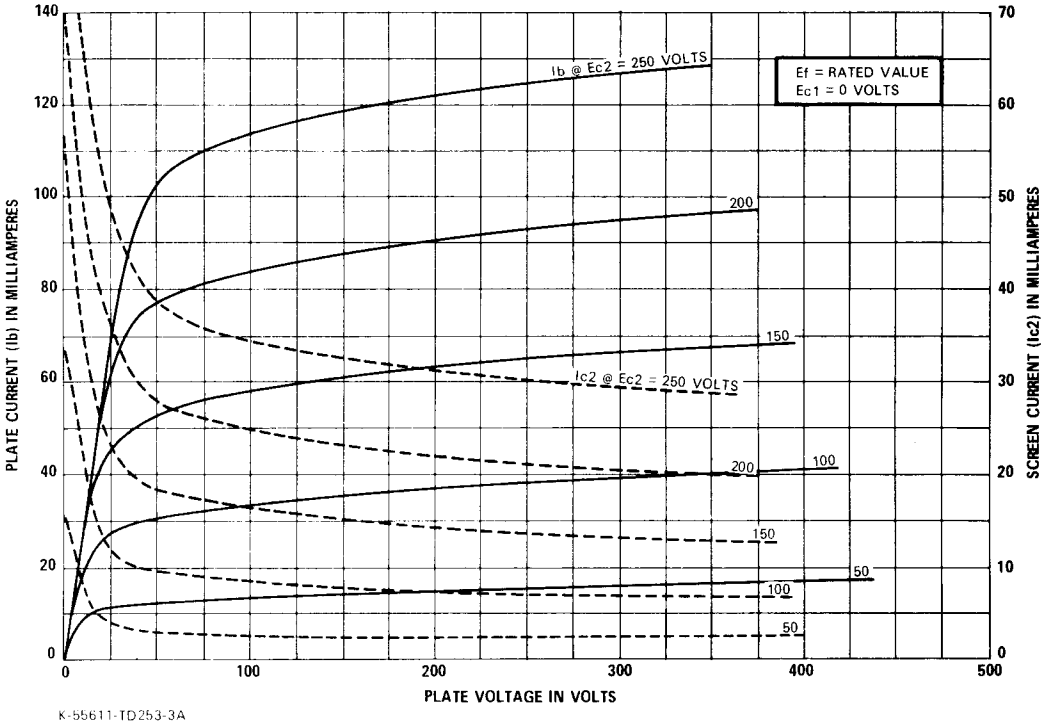
K-55611-TD253-1A

AVERAGE PLATE CHARACTERISTICS



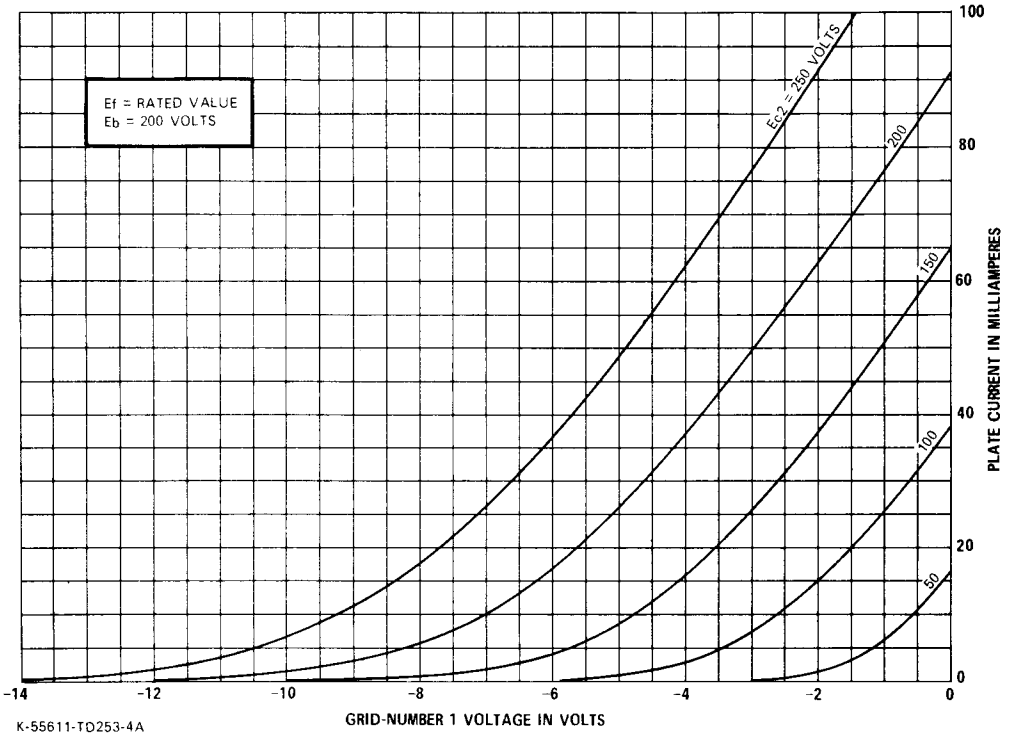
K-55611-TD253-2A

AVERAGE PLATE CHARACTERISTICS



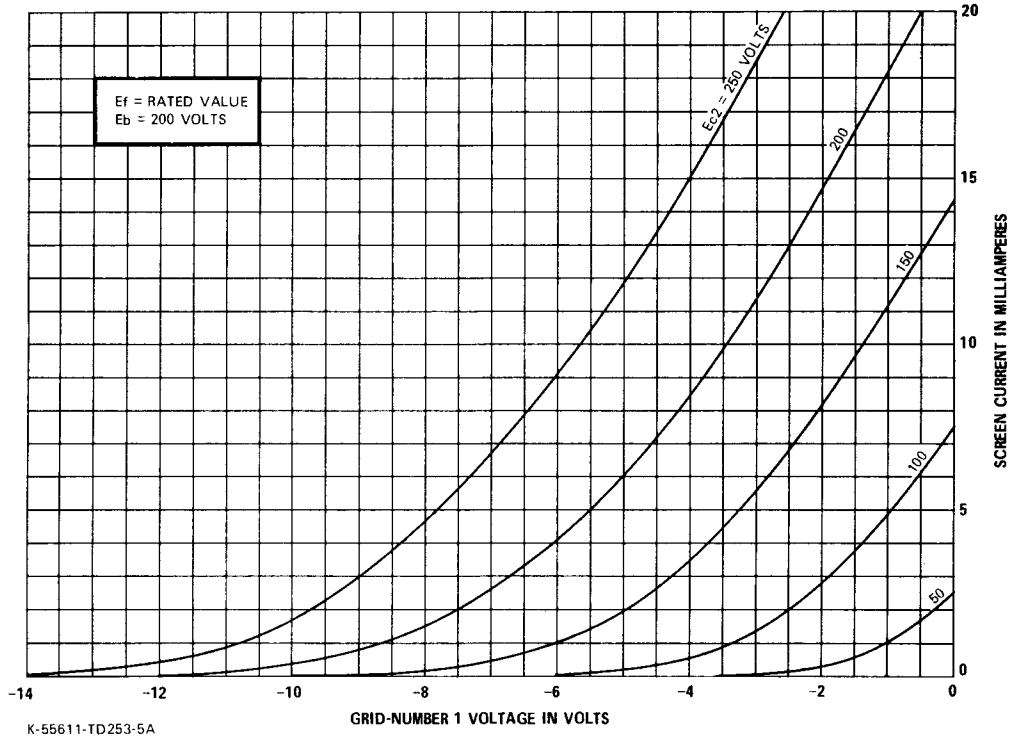
K-55611-TD253-3A

AVERAGE TRANSFER CHARACTERISTICS



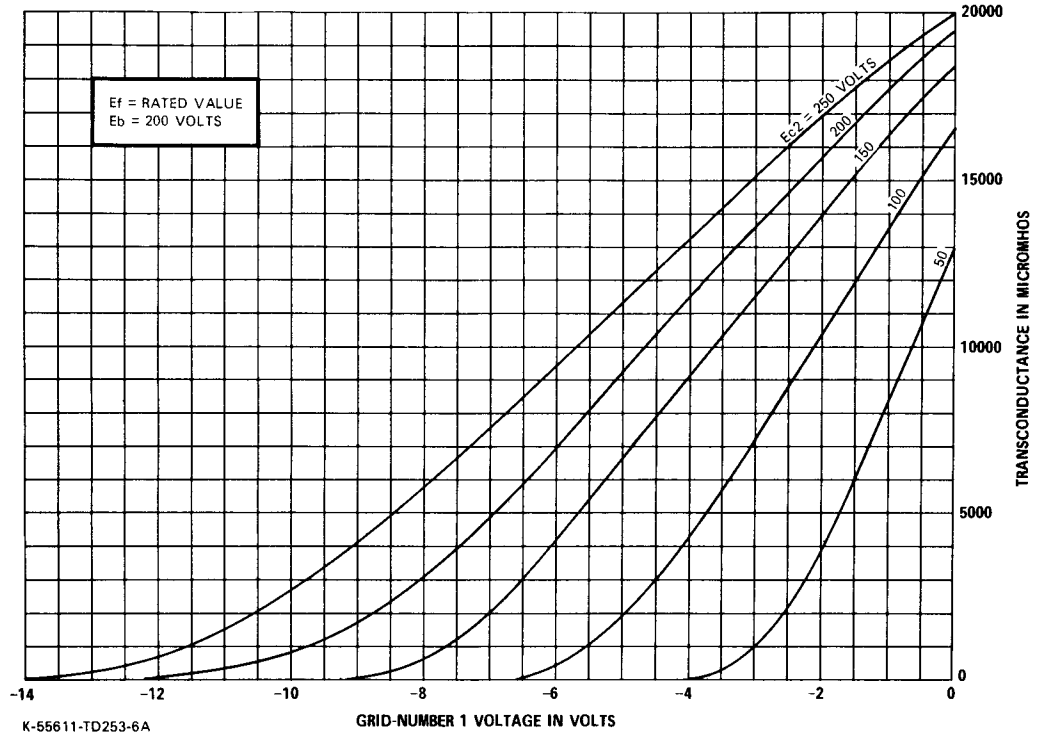
K-55611-TD253-4A

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD253-5A

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD253-6A

Compactron Beam Triode

6JH5

■ COLOR TV TYPE ■ 35 WATTS PLATE DISSIPATION ■ DIFFUSION BONDED CATHODE
■ TRANSCONDUCTANCE = 55000 MICROMHOS ■ 300 MILLIAMPERES PEAK PLATE CURRENT

The 6JH5 is a compactron beam triode suited for use as a pulse-type high-voltage regulator in the high-voltage power supply of color television receivers.

Features of the 6JH5 include a diffusion bonded cathode coating which provides a positive bond between the cathode coating and base material, thereby practically eliminating grid-to-cathode shorts caused by cathode flaking. By operating at a relatively low potential (3500 volts), this pulse-type regulator provides much less stress on internal components than shunt regulators operating in the 25000-volt range.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	6.3 ± 0.6	Volts
Heater Current●	2.4	Amperes

Direct Interelectrode Capacitances, approximate♦

Grid to Plate: (g to p)	1.7	pf
Input: g to (h + k + b.p.)	23	pf
Output: p to (h + k + b.p.)	12	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing

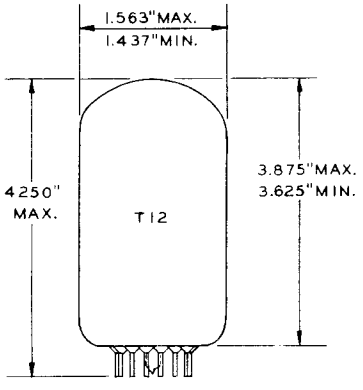
Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	4.250	Inches
Maximum Seated Height	3.875	Inches
Minimum Seated Height	3.625	Inches

MAXIMUM RATINGS

HIGH-VOLTAGE REGULATOR SERVICE§—DESIGN-MAXIMUM VALUES

Peak Plate Voltage	5500	Volts
Plate Dissipation	35	Watts
Peak Plate Current	325	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode⊕		
Total DC and Peak	450	Volts
Grid-Circuit Resistance▲	0.1	Megohms
Bulb Temperature at Hottest Point †	240	°C

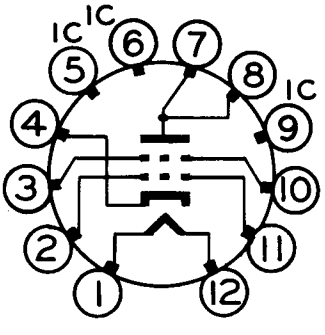
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Grid
Pin 3 - Beam Plate
Pin 4 - Cathode
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Plate
Pin 8 - Plate
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Beam Plate
Pin 11 - Grid
Pin 12 - Heater

BASING DIAGRAM



EIA 12JE

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pulse Plate Voltage□	3500	Volts
Beam Plate Connected to Cathode at Socket		
Negative DC Grid Voltage	4.4	Volts
Peak Plate Current	300	Milliamperes
Amplification Factor	300	
Transconductance	55000	Micromhos
Plate Resistance, approximate	4600	Ohms
Grid Voltage, approximate		
Eb = 3500 Volts, Ib = 1.0 Milliamperes	-16	Volts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

♦ Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

⊕ Sufficient impedance (220 ohms by-passed with a 0.01 microfarad capacitor is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

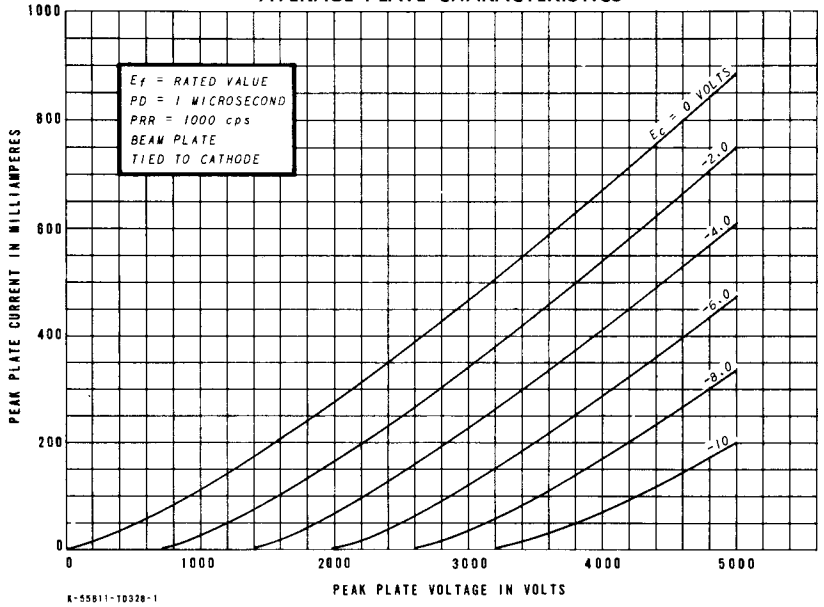
▲ Larger values of grid-circuit resistance may be used if provisions are made to protect the tube.

□ Duty cycle of the pulse must be less than 2.5 percent.

† Measured with an infrared thermometer, Ircon Model 700 BC or equivalent, at an ambient temperature of 40 °C.

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AVERAGE PLATE CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

6JH8
SHEET-BEAM TUBE

DESCRIPTION AND RATING

The 6JH8 is a miniature double-plate sheet-beam tube which incorporates a pair of balanced deflectors to direct the electron beam to either of the two plates and a control grid to vary the intensity of the beam. The resulting unique characteristics of this tube make it especially suited for service as a synchronous detector in color television receivers. In this application, relatively large, balanced output signals of both positive and negative polarities are developed which eliminate the need for phase-inversion functions in the matrix circuits. Other features of the 6JH8 synchronous detector circuit include low oscillator injection power requirements, freedom from the space-charge coupling effects which are present in dual-control pentodes and heptodes, linear output voltages, insensitiveness to variations in oscillator amplitude over a wide range, and a high ratio of plate to accelerator current. The 6JH8 is also suitable for service in the burst gate circuit of color TV receivers and a variety of other switching and gating applications.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.3	Amperes
Direct Interelectrode Capacitances, approximate‡		
Deflector-Number 1 to All	4.8	pf
Deflector-Number 2 to All	4.8	pf
Grid-Number 1 to All except Plates	7.5	pf
Plate-Number 1 to All	5.0	pf
Plate-Number 2 to All	5.0	pf
Grid-Number 1 to Deflector-Number 1, maximum	0.04	pf
Grid-Number 1 to Deflector-Number 2, maximum	0.07	pf
Plate-Number 1 to Plate-Number 2	0.4	pf
Deflector-Number 1 to Deflector-Number 2	0.38	pf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin
Outline Drawing—EIA 6-3

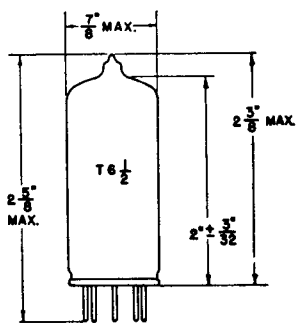
Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 5/8	Inches
Maximum Seated Height	2 3/8	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage, Each Plate	330	Volts
Accelerator Voltage	330	Volts
Peak Positive Deflector Voltage	165	Volts
Peak Negative Deflector Voltage	165	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation, Each Plate	3.0	Watts
Accelerator Dissipation	1.0	Watts
DC Cathode Current	33	Milliamperes
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohm
With Cathode Bias	0.25	Megohm

PHYSICAL DIMENSIONS

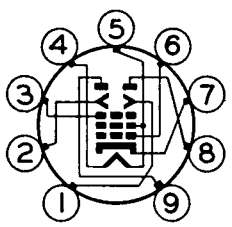


EIA 6-3

TERMINAL CONNECTIONS

Pin 1—Deflector Number 2
Pin 2—Deflector Number 1
Pin 3—Accelerator
Pin 4—Heater
Pin 5—Heater, Internal Shield, and Focus Electrodes§
Pin 6—Grid Number 1 (Control Grid)
Pin 7—Cathode
Pin 8—Plate Number 2
Pin 9—Plate Number 1

BASING DIAGRAM



EIA 9DP

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS WITH DEFLECTORS GROUNDED

Plate-Number 1 Voltage	250	Volts
Plate-Number 2, Connected to Plate-Number 1		
Accelerator Voltage	250	Volts
Deflector-Number 1 Voltage	0	Volts
Deflector-Number 2 Voltage	0	Volts
Cathode-Bias Resistor	220	Ohms
Total Plate Current	14	Milliamperes
Accelerator Current	1.5	Milliamperes
Grid-Number 1 Transconductance	4400	Micromhos
Grid-Number 1 Voltage, approximate Ib (total) = 10 Microamperes	−13	Volts

AVERAGE DEFLECTOR CHARACTERISTICS

Plate-Number 1 Voltage	250	Volts
Plate-Number 2 Voltage	250	Volts
Accelerator Voltage	250	Volts
Cathode-Bias Resistor	220	Ohms
Deflector Switching Voltage, maximum¶	20	Volts
Deflector-Bias Voltage for Minimum Deflector Switching Voltage¶	−14	Volts
Voltage Difference between Deflectors for Ib1 = Ib2, approximate	0	Volts
Plate-Number 1 Current, maximum Ed1 = −15 Volts, Ed2 = +15 Volts	0.7	Milliamperes
Plate-Number 2 Current, maximum Ed1 = +15 Volts, Ed2 = −15 Volts	0.7	Milliamperes
Deflector-Number 1 Current, maximum Ed1 = +25 Volts, Ed2 = −25 Volts	0.1	Milliamperes
Deflector-Number 2 Current, maximum Ed1 = −25 Volts, Ed2 = +25 Volts	0.1	Milliamperes

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ Pin 5 should be connected directly to ground.

¶ Deflector switching voltage is defined as the total voltage change on either deflector with an equal and opposite change on the other deflector required to switch the plate current from one plate to the other.

Note: The 6JH8 should be so located in the equipment that it is not subjected to stray magnetic fields.

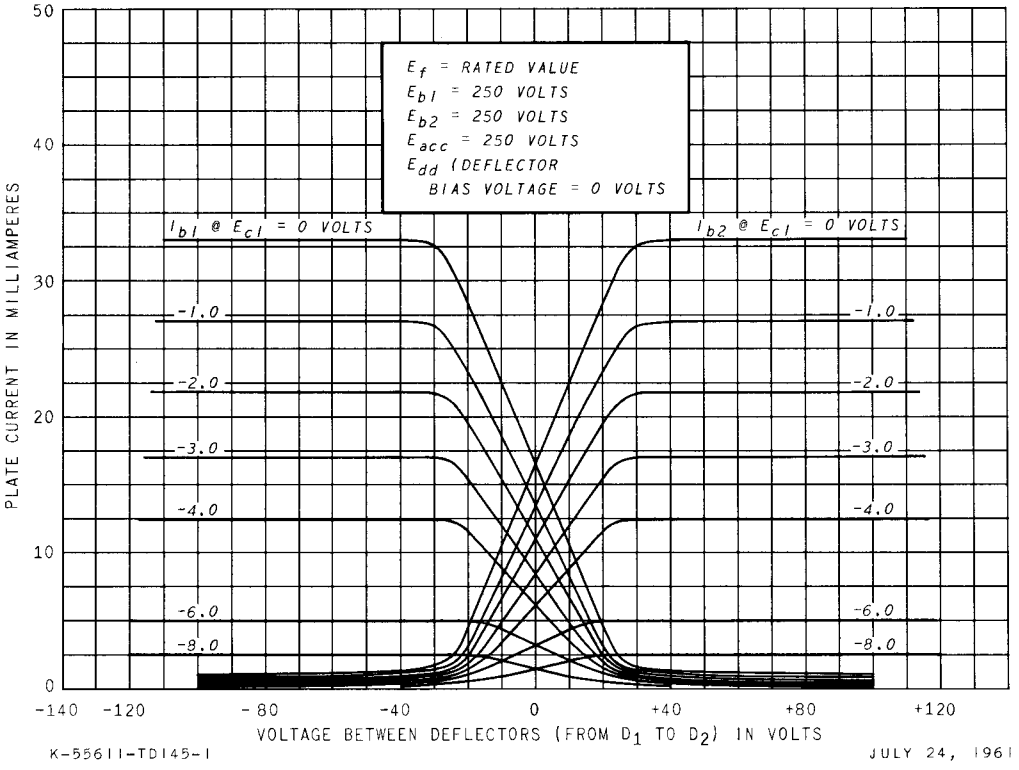
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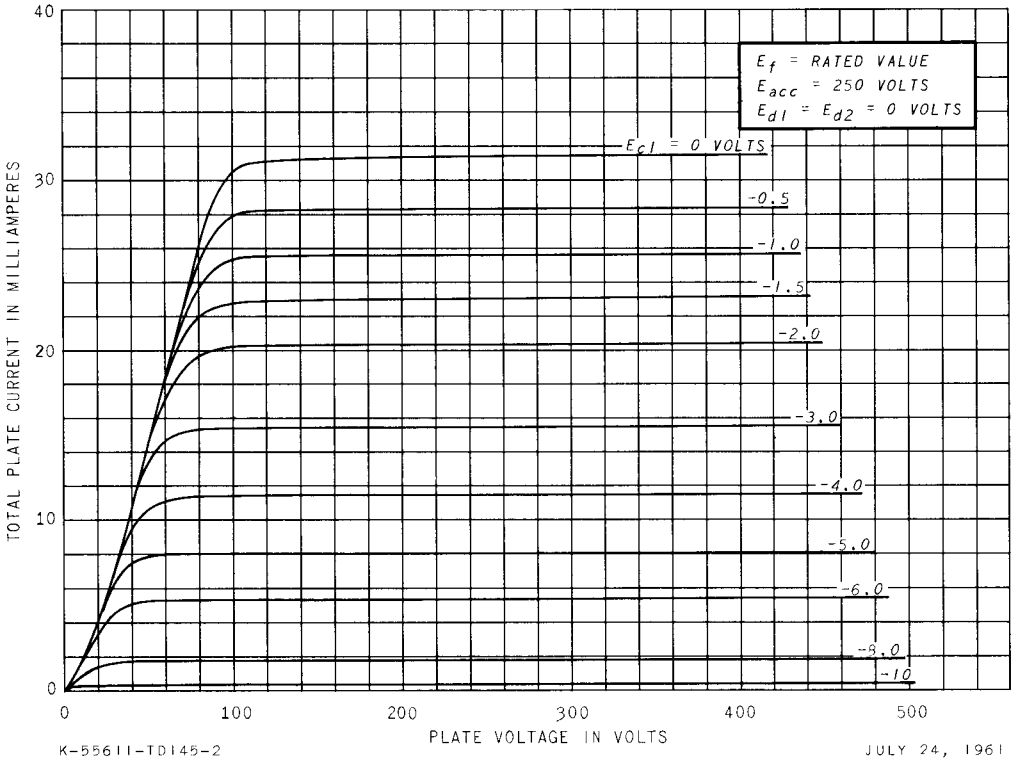
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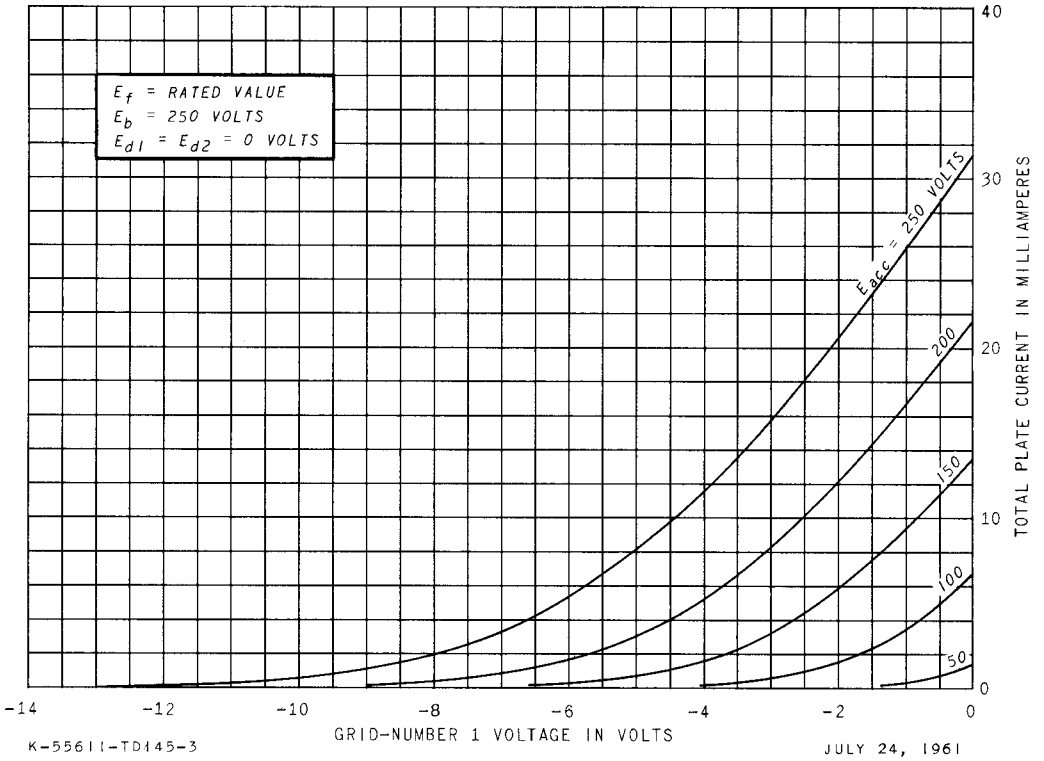
AVERAGE TRANSFER CHARACTERISTICS



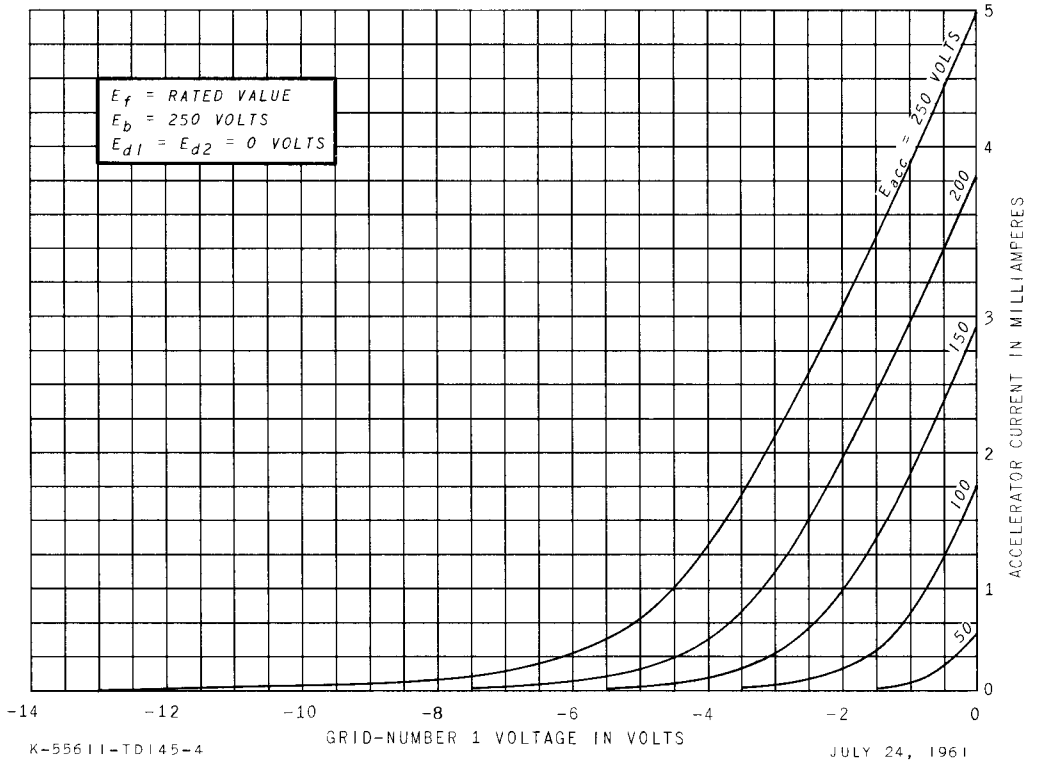
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Compactron Beam Triode

6JK5

- COLOR TV TYPE
- FRAME-GRID CONSTRUCTION
- DIFFUSION BONDED CATHODE
- 35 WATTS PLATE DISSIPATION
- 325 MILLIAMPERES PEAK PLATE CURRENT
- TRANSCONDUCTANCE = 65000 MICROMHOS

The 6JK5 is a compactron frame-grid beam triode suited for use as a pulse-type high-voltage regulator in the high-voltage power supply of color television receivers.

Features of the 6JK5 include a diffusion bonded cathode coating which provides a positive bond between the cathode coating and base material, thereby practically eliminating grid-to-cathode shorts caused by cathode flaking. By operating at a relatively low potential (3500 volts), this pulse-type regulator provides much less stress on internal components than shunt regulators operating in the 25000-volt range.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	6.3 ± 0.6	Volts
Heater Current●	1.8	Amperes

Direct Interelectrode Capacitances, approximate♦

Grid to Plate: (g to p)	1.8	pf
Input: g to (h + k + b.p.)	22	pf
Output: p to (h + k + b.p.)	11	pf

MECHANICAL

Operating Position - Any

Envelope - T-12, Glass

Base - E12-74, Button 12-Pin

Outline Drawing

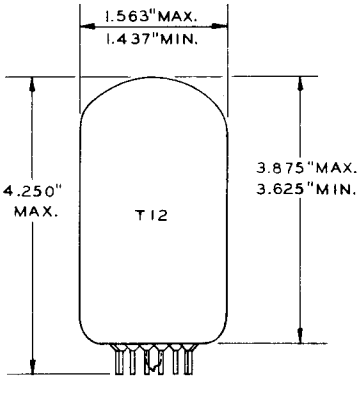
Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	4.250	Inches
Maximum Seated Height	3.875	Inches
Minimum Seated Height	3.625	Inches

MAXIMUM RATINGS

HIGH-VOLTAGE REGULATOR SERVICE§—DESIGN-MAXIMUM VALUES

Peak Plate Voltage	5500	Volts
Plate Dissipation	35	Watts
Peak Plate Current	325	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode⊕		
Total DC and Peak	450	Volts
Grid-Circuit Resistance▲	0.1	Megohms
Bulb Temperature at Hottest Point †	240	°C

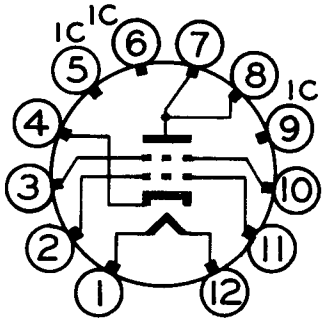
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Grid
Pin 3 - Beam Plate
Pin 4 - Cathode
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Plate
Pin 8 - Plate
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Beam Plate
Pin 11 - Grid
Pin 12 - Heater

BASING DIAGRAM



EIA 12JE

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pulse Plate Voltage□	3500	Volts
Beam Plate Connected to Cathode at Socket		
Negative DC Grid Voltage	4.4	Volts
Peak Plate Current	300	Milliamperes
Amplification Factor	300	
Transconductance	65000	Micromhos
Plate Resistance, approximate	4600	Ohms
Grid Voltage, approximate		
Eb = 3500 Volts, Ib = 1.0 Milliamperes	-13	Volts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

♦ Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

⊕ Sufficient impedance (220 ohms by-passed with a 0.01 microfarad capacitor is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

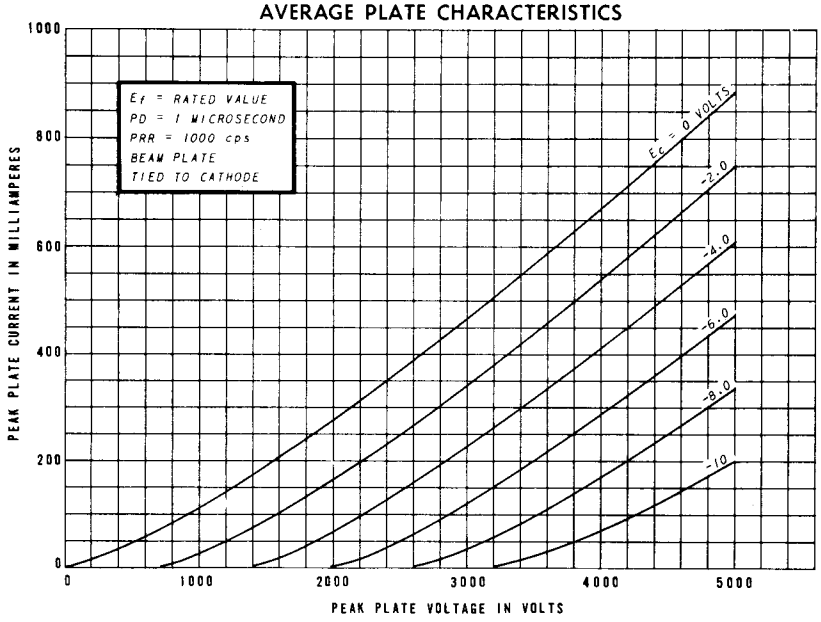
▲ Larger values of grid-circuit resistance may be used if provisions are made to protect the tube.

□ Duty cycle of the pulse must be less than 2.5 percent.

† Measured with an infrared thermometer, Ircon Model 700 BC or equivalent, at an ambient temperature of 40 °C.

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AVERAGE PLATE CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

ELECTRONICS

6JM6

COMPACTRON BEAM PENTODE

DESCRIPTION AND RATING

The 6JM6 is a compactron beam-power pentode primarily designed for use as the horizontal-deflection amplifier in television receivers. A separate connection is provided for the beam plates to minimize "snivets".

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	1.2	Amperes
Direct Interelectrode Capacitances, approximate§		
Grid-Number 1 to Plate:		
(g1 to p)	0.6	pf
Input: g1 to (h + k + g2 + b.p.)	16	pf
Output: p to (h + k + g2 + b.p.)	7.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Top Cap - C1-3, Skirted Miniature
Outline Drawing - EIA 12-79

Maximum Diameter	1.563	Inches
Maximum Over-all Length	3.625	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

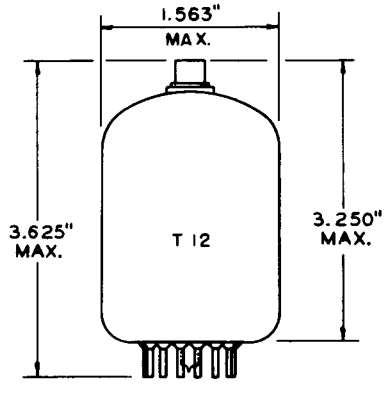
MAXIMUM RATINGS

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PHYSICAL DIMENSIONS

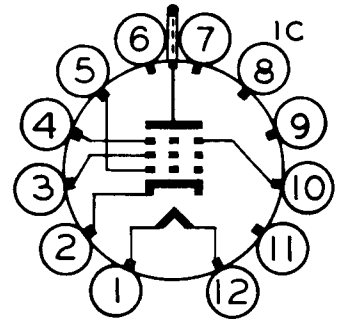


EIA 12-79

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid Number 2 (Screen)
Pin 4 - Beam Plates
Pin 5 - Grid Number 1
Pin 6 - No Connection
Pin 7 - No Connection
Pin 8 - Internal Connection - Do Not Use
Pin 9 - No Connection
Pin 10 - Beam Plates
Pin 11 - No Connection
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12FJ

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MAXIMUM RATINGS (Cont'd)

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE¶—DESIGN-MAXIMUM VALUES

DC Plate-Supply Voltage (Boost + DC Power Supply)	770	Volts
Peak Positive Pulse Plate Voltage	6500	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Positive DC Beam Plate Voltage	70	Volts
Screen Voltage	220	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation#	17.5	Watts
Screen Dissipation	3.5	Watts
DC Cathode Current	175	Milliamperes
Peak Cathode Current	550	Milliamperes
Heater-Cathode Voltage.		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point	220	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage.	5000	60	250	Volts
Beam Plates, Connected to Cathode at Socket				
Screen Voltage	150	150	150	Volts
Grid-Number 1 Voltage	---	0Δ	-22.5	Volts
Plate Resistance, approximate	---	---	18000	Ohms
Transconductance.	---	---	7300	Micromhos
Plate Current.	---	345	65	Milliamperes
Screen Current	---	27	1.8	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 1.0 Milliamperes	-100	---	-42	Volts
Triode Amplification Factor**	---	---	4.4	

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

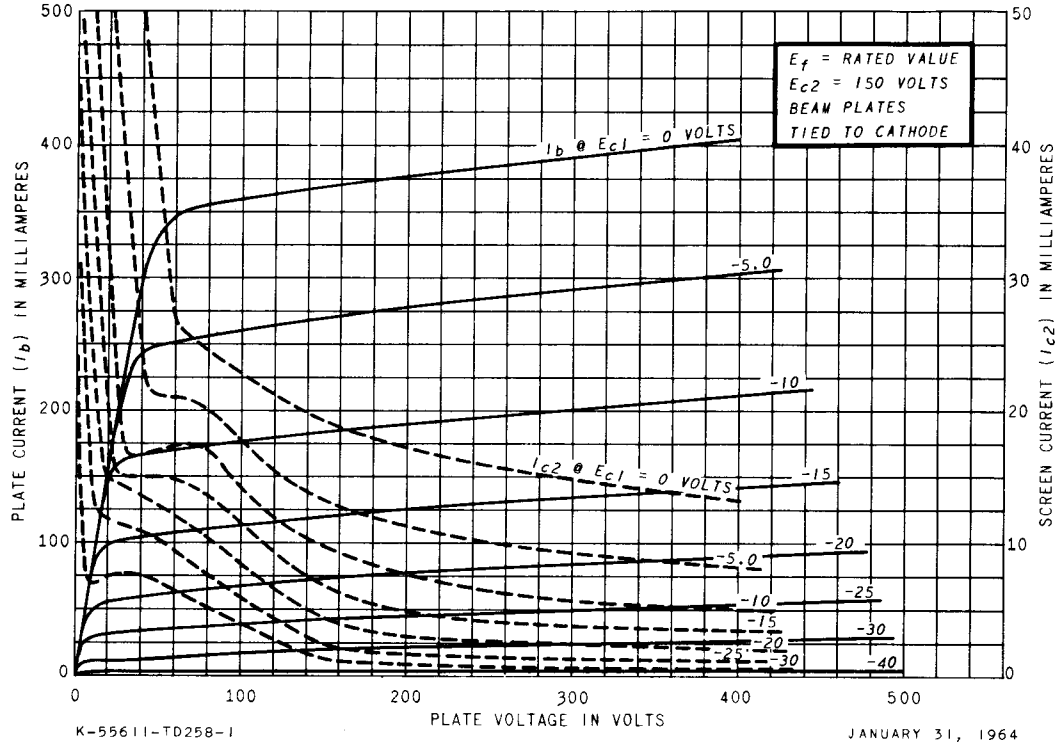
¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

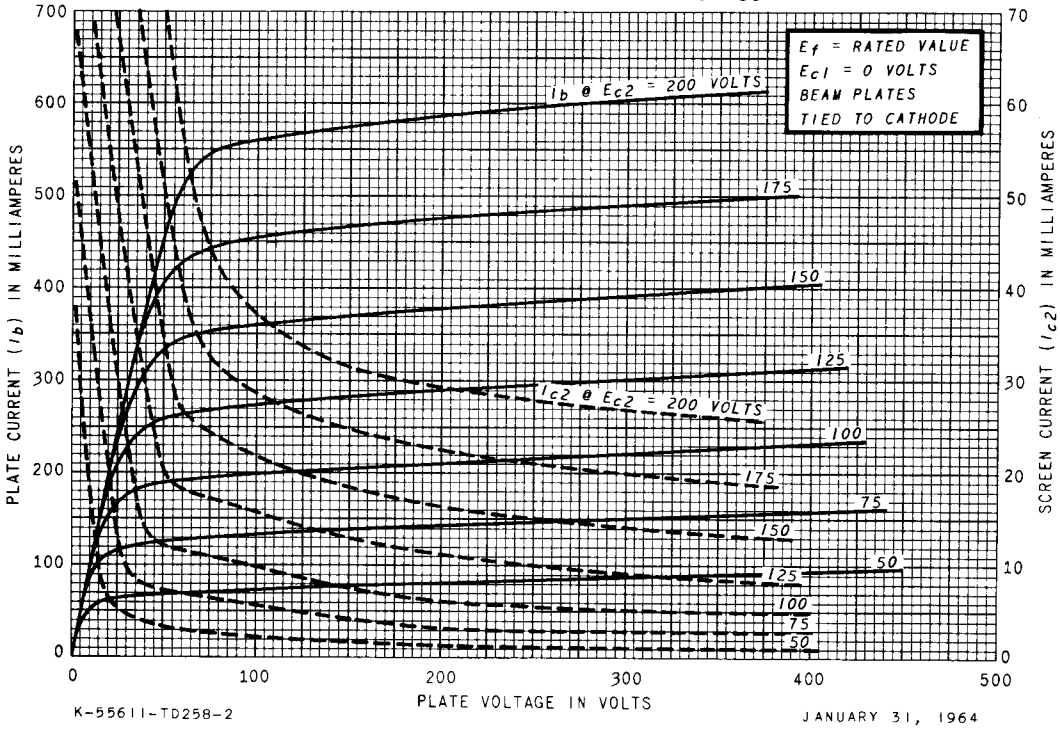
Δ Applied for short interval (two seconds maximum) so as not to damage tube.

** Triode connection (screen tied to plate) with Ef = Ec2 = 150 volts and Ec1 = -22.5 volts.

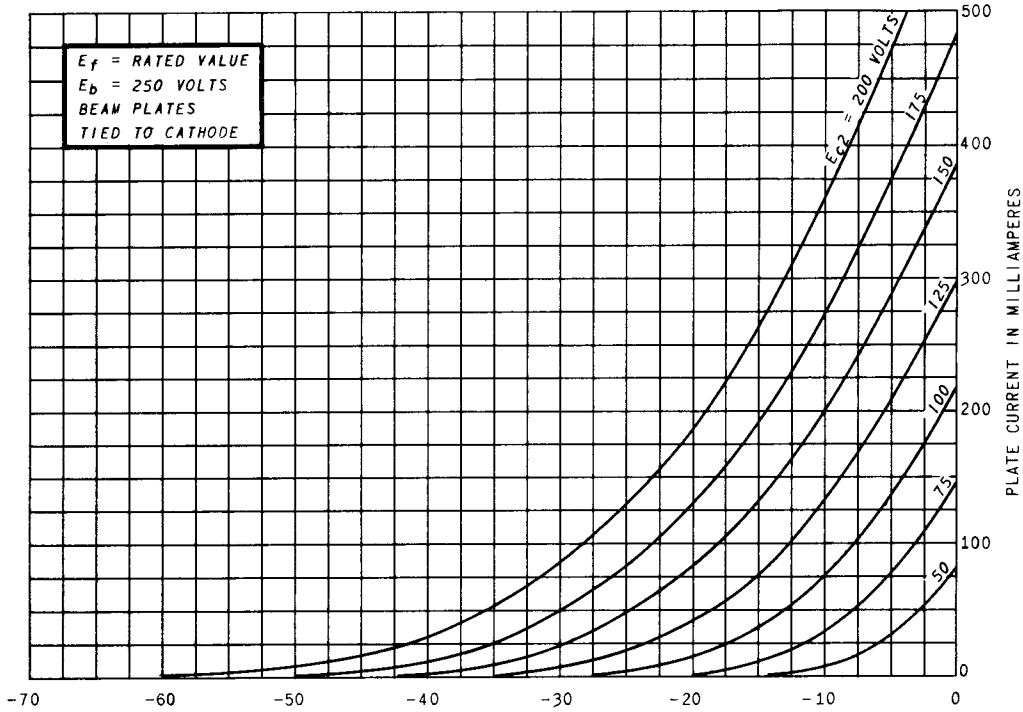
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



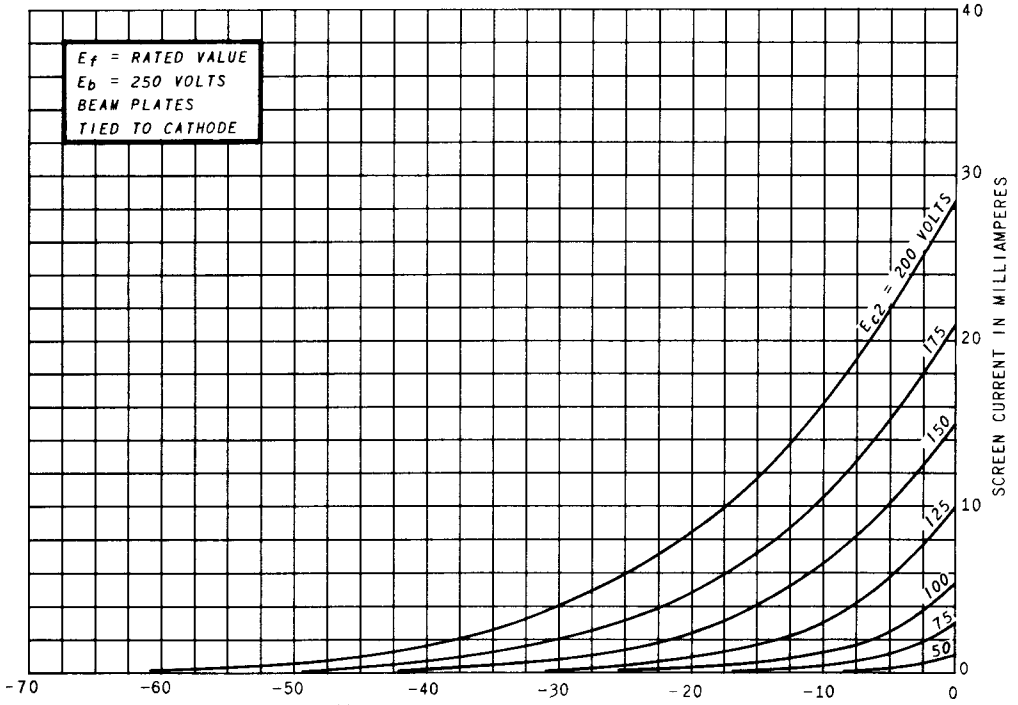
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD258-3

JANUARY 31, 1964

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD258-4

JANUARY 31, 1964

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

6JN6

COMPACTRON BEAM PENTODE

DESCRIPTION AND RATING

The 6JN6 is a compactron beam-power pentode primarily designed for use as the horizontal-deflection amplifier in television receivers. A separate connection is provided for the beam plates to minimize "snivets".

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	1.2	Amperes
Direct Interelectrode Capacitances, approximate§		
Grid-Number 1 to Plate:		
(g1 to p)	0.34	pf
Input: g1 to (h + k + g2 + b.p.)	16	pf
Output: p to (h + k + g2 + b.p.)	7.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing - EIA 12-56

Maximum Diameter	1.563	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches

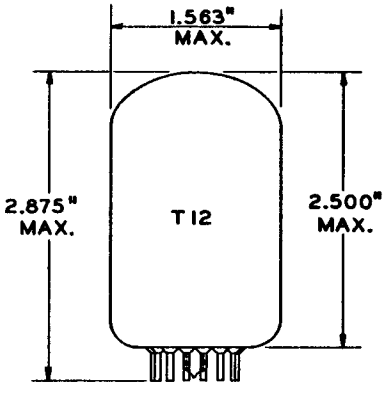
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PHYSICAL DIMENSIONS

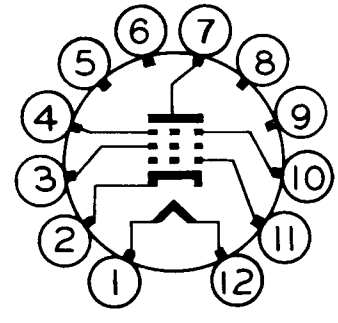


EIA 12-56

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid Number 2 (Screen)
Pin 4 - Beam Plates
Pin 5 - No Connection
Pin 6 - No Connection
Pin 7 - Plate
Pin 8 - No Connection
Pin 9 - No Connection
Pin 10 - Beam Plates
Pin 11 - Grid Number 1
Pin 12 - Heater

BASING DIAGRAM



EIA 12FK

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MAXIMUM RATINGS (Cont'd)

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE¶—DESIGN-MAXIMUM VALUES

DC Plate-Supply Voltage (Boost + DC Power Supply)	770	Volts
Peak Positive Pulse Plate Voltage	6500	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Positive DC Beam Plate Voltage	70	Volts
Screen Voltage	220	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation#	17.5	Watts
Screen Dissipation	3.5	Watts
DC Cathode Current	175	Milliamperes
Peak Cathode Current	550	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point	220	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	60	250	Volts
Beam Plates, Connected to Cathode at Socket				
Screen Voltage	150	150	150	Volts
Grid-Number 1 Voltage	---	0Δ	-22.5	Volts
Plate Resistance, approximate	---	---	18000	Ohms
Transconductance	---	---	7300	Micromhos
Plate Current	---	345	65	Milliamperes
Screen Current	---	27	1.8	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 1.0 Milliamperes	-100	---	-42	Volts
Triode Amplification Factor**	---	---	4.4	

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

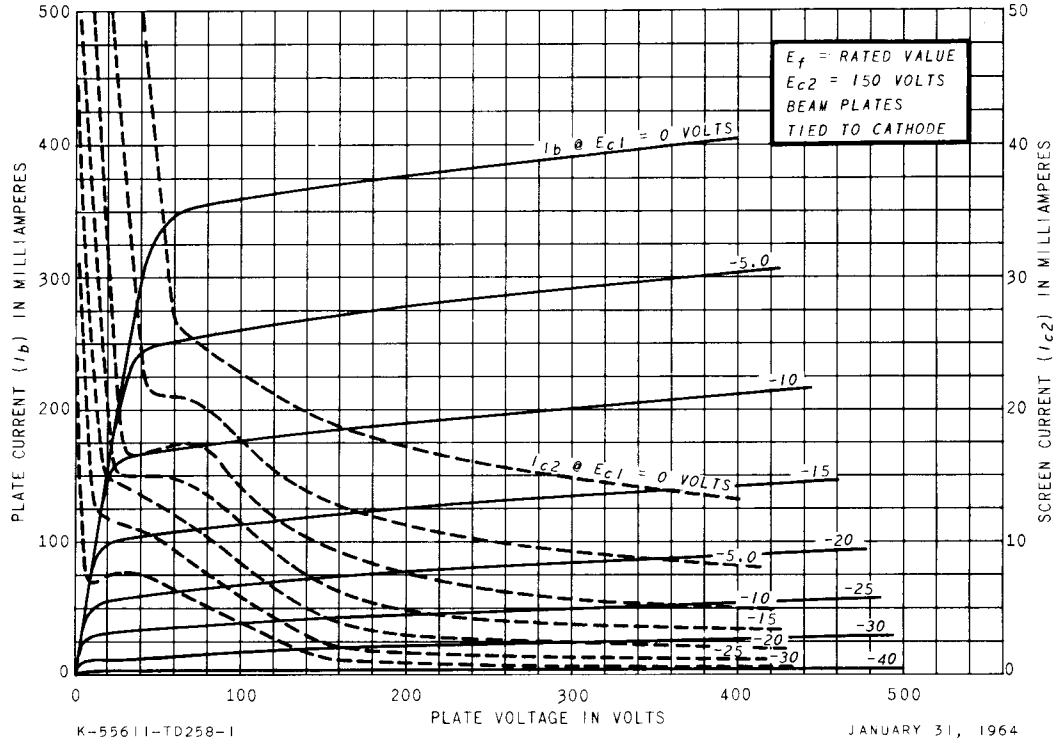
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Δ Applied for short interval (two seconds maximum) so as not to damage tube.

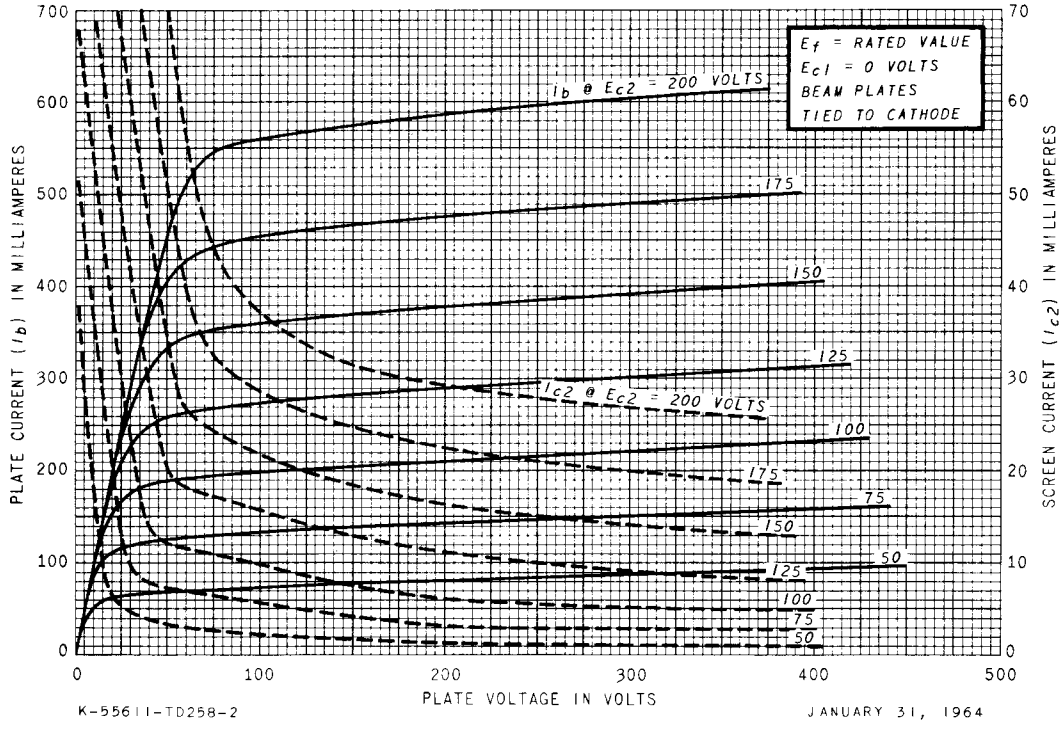
** Triode connection (screen triode to plate) with Eb = Ec2 = 150 volts and Ec1 = -22.5 volts.

AVERAGE PLATE CHARACTERISTICS



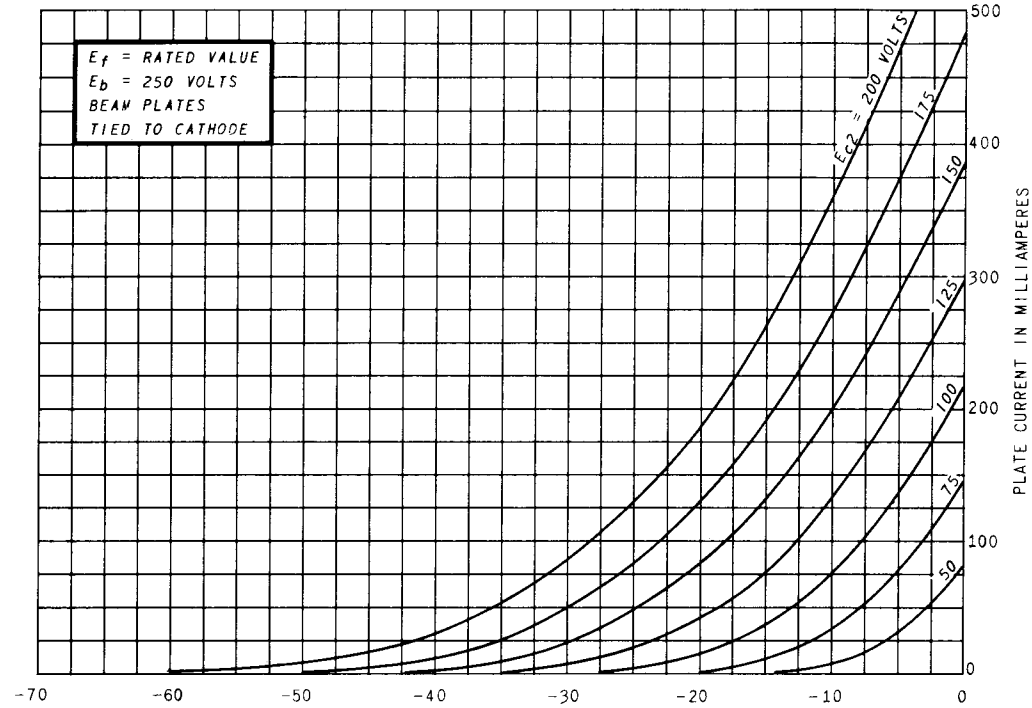
K-55611-TD258-1 JANUARY 31, 1964

AVERAGE PLATE CHARACTERISTICS



K-55611-TD258-2 JANUARY 31, 1964

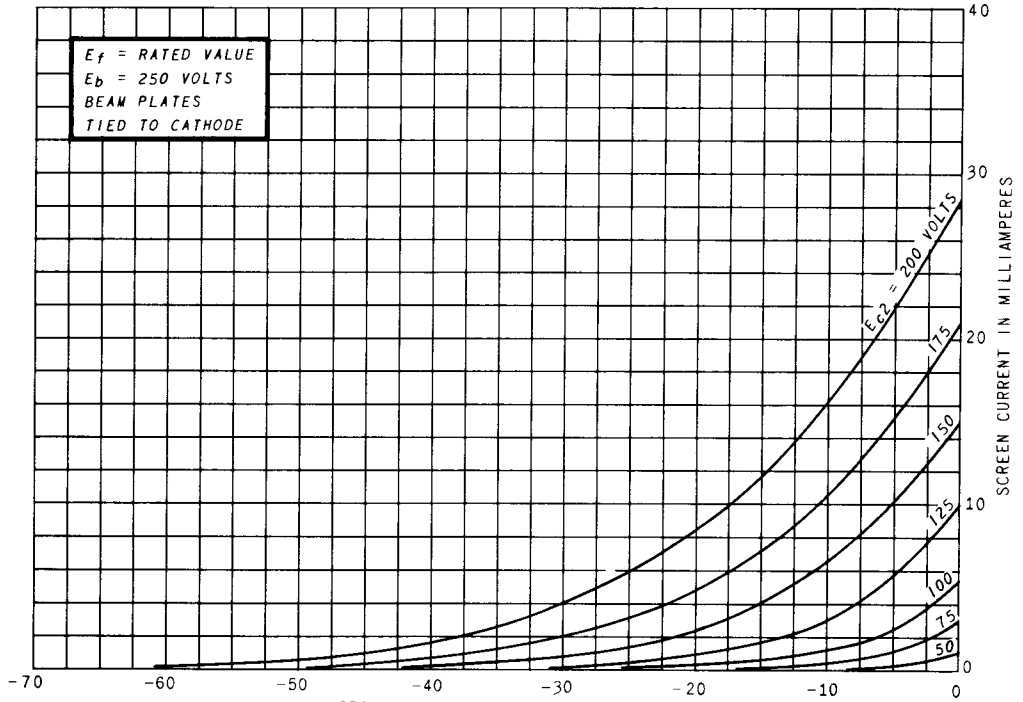
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD258-3

JANUARY 31, 1964

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD258-4

JANUARY 31, 1964

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

6JN8

TRIODE-PENTODE

DESCRIPTION AND RATING

The 6JN8 is a miniature tube containing a sharp-cutoff pentode and a medium-mu triode.

GENERAL

ELECTRICAL

Cathode-Coated Unipotential

Heater Characteristics and Ratings	Series Heater Operation	Parallel Heater Operation	
Heater Voltage, AC or DC	6.3	6.3 ± 0.6*	Volts
Heater Current	0.45 ± 0.03†	0.45‡	Amperes
Heater Warm-up Time§	11	—	Seconds

Direct Interelectrode Capacitances¶

Pentode Section		
Grid-Number 1 to Plate, maximum: (g1 to p)	0.01	pf
Input: Pg1 to (h+Pk+Pg2+Pg3+i.s.)	5.5	pf
Output: Pp to (h+Pk+Pg2+Pg3+i.s.)	3.4	pf
Triode Section		
Grid to Plate: (g to p)	1.7	pf
Input: g to (h+Tk+Pk+Pg3+i.s.)	3.2	pf
Output: p to (h+Tk+Pk+Pg3+i.s.)	2.2	pf

MECHANICAL

Mounting Position—Any

Envelope—T-6½, Glass

Base—E9-1, Small Button 9-Pin

Outline Drawing—EIA 6-2

Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 3/16	Inches
Maximum Seated Height	1 15/16	Inches

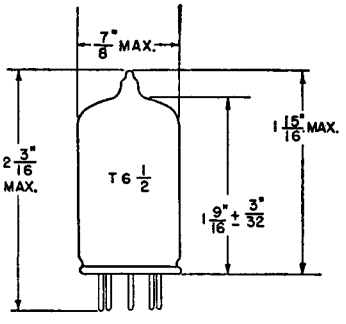
MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section	
Plate Voltage	300	300	Volts
Screen Supply Voltage	300	—	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	2.5	2.5	Watts
Screen Dissipation	0.55	—	Watts

	Pentode Section	Triode Section	
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	2.2	2.2	Megohms
With Cathode Bias	2.2	2.2	Megohms

PHYSICAL DIMENSIONS

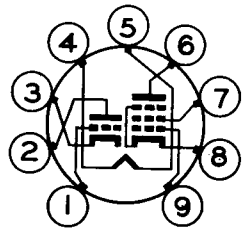


EIA 6-2

TERMINAL CONNECTIONS

Pin 1—Triode Grid
Pin 2—Triode Plate
Pin 3—Triode Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Plate
Pin 7—Pentode Grid Number 2 (Screen)
Pin 8—Pentode Cathode, Grid Number 3 and Internal Shield
Pin 9—Pentode Grid Number 1

BASING DIAGRAM



EIA 9FA

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Pentode Section	Triode Section	
Plate Voltage	125	125	Volts
Screen Voltage	125	———	Volts
Grid-Number 1 Voltage	−1.0	−1.0	Volts
Amplification Factor	———	46	
Plate Resistance, approximate	200000	5400	Ohms
Transconductance	7500	8500	Micromhos
Plate Current	12	13.5	Milliamperes
Screen Current	4.0	———	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	−8	−8	Volts

NOTES

* For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

¶ With external shield (EIA 315) connected to cathode of section under test.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

FOR CURVES PLEASE REFER TO 19JN8

RECEIVING TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky

ELECTRONIC INNOVATIONS IN ACTION

TUBES

Compactron Beam Pentode

6JS6C

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

COLOR TV TYPE | 30 WATT PLATE DISSIPATION | T–12 ENVELOPE | 12 PIN BASE

The 6JS6C is a compactron beam power pentode designed for use as a horizontal deflection amplifier in color television sets.

GENERAL

ELECTRICAL

Cathode – Coated Unipotential

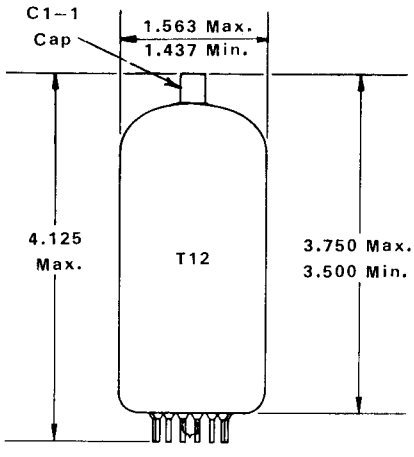
HEATER CHARACTERISTICS AND RATINGS

Heater Circuit	Parallel	
Heater Voltage ●	6.3±0.6	Volts
Heater Current ▲	2.25	Amperes
Maximum Heater Cathode Voltage		
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Heater Positive with Respect to Cathode		
DC	100	Volts
Total DC and Peak	200	Volts
Direct Interelectrode Capacitances, approximate		
Grid–Number 1 to Plate (g1 to p)	0.7	pf
Input g1 to (h+k+g2+g3)	24	pf
Output p to (h+k+g2+g3)	10	pf
Bulb Temperature (At hottest point)	225°C	Max.

MECHANICAL

Operating Position – Any
Envelope – T–12
Base – E12–74, Button 12–Pin
Top Cap – C1–1, Small
Outline Drawing – EIA 12–89

Maximum Diameter	1.563 Inches
Maximum Seated Height	3.750 Inches
Maximum Overall Length	4.125 Inches

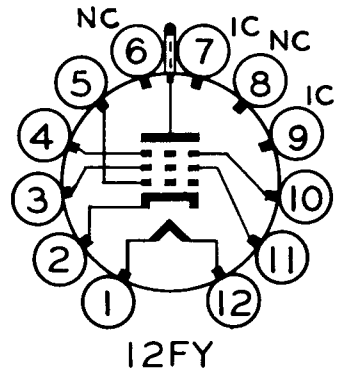


BASE E12 – 74

TERMINAL CONNECTIONS

Pin No. 1 – Heater
Pin No. 2 – Cathode
Pin No, 3 – Grid No. 2
Pin No. 4 – Beam Plates
Pin No. 5 – Grid No. 1
Pin No. 6 – No. Connection
Pin No. 7 – Internal Connection (Do Not Use)
Pin No. 8 – No Connection
Pin No. 9 – Internal Connection (Do Not Use)
Pin No. 10 – Beam Plates
Pin No. 11 – Grid No. 2
Pin No. 12 – Heater
Top Cap – Plate

BASING DIAGRAM



12FY

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

DC Plate Supply Voltage (Boost + DC Power Supply)	990	Volts	Max.
Peak Positive Plate Pulse Voltage (Absolute Maximum)	7500	Volts	Max.
Peak Negative Plate Pulse Voltage	1200	Volts	Max.
Positive Grid No. 3 Voltage	75	Volts	Max.
Grid No. 2 DC Voltage	220	Volts	Max.
Peak Negative Grid No. 1 Voltage	330	Volts	Max.
Plate Dissipation ♦ ⊕	30	Watts	Max
Grid No. 2 Dissipation ⊕	5.5	Watts	Max.
Average Cathode Current	350	Milliamperes	Max.
Peak Cathode Current	1200	Milliamperes	Max.
Grid No. 1 Circuit Resistance			
with Grid Bias Feedback HV Regulation	0.47	Megohms	Max.
with DC or Pulse Shunt HV Regulation	10	Megohms	Max.

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Plate Voltage	175	60	Volts
Grid No. 2 Voltage	125	125	Volts
Grid No. 1 Voltage	−25	0	Volts
Grid No. 3 Voltage	§	§	Volts
Plate Current	130	600 *	Milliamperes
Grid No. 2 Current	2.8	32 *	Milliamperes
Transconductance	11500		μumhos
Triode Amplification Factor (Grid No. 2 Connected to Plate) (Eb = Ec2 = 125 Volts ; Ec1 = −25 Volts)	3.0		
Plate Resistance (Approximate)	5500		Ohms
Grid No. 1 Voltage for Ib = 1 Ma (Approximate)	−54		Volts
Ratio (Plate Current / Grid No. 2 Current)	18.5:1		

HIGH VOLTAGE CUTOFF CHARACTERISTICS

Peak Positive Plate Pulse Votlage	5000	5000	5500	6000	Volts
Grid No. 2 Voltage	125	125	125	125	Volts
Grid No. 3 Voltage	0	0	0	0	Volt
Grid No. 1 Voltage (Approximate) Ib. = 75 μa		−145	−155	−165	Volts
Grid No. 1 Voltage (Approximate) Ib = 1 Ma	−125				Volts

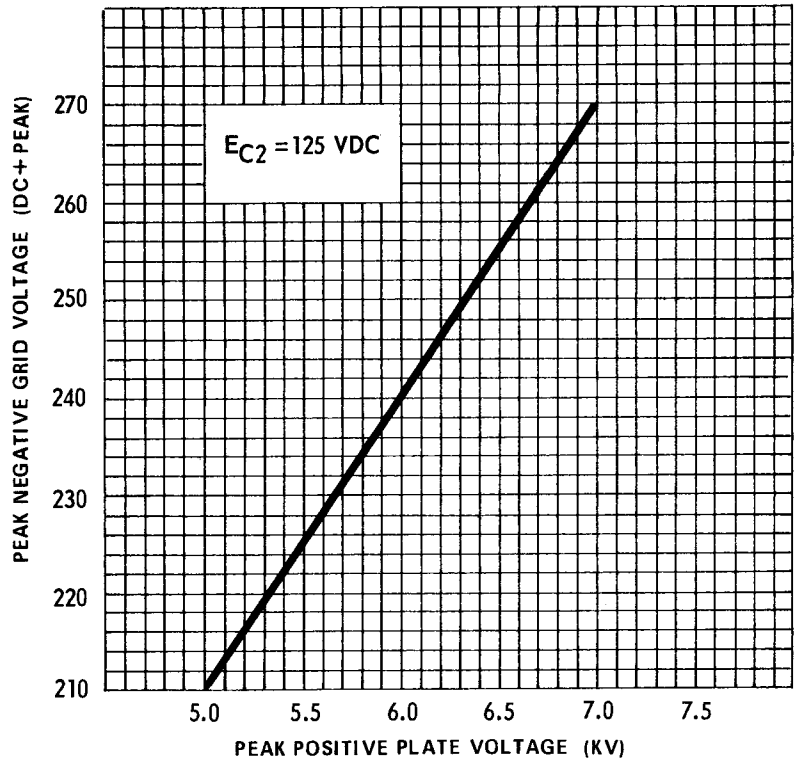
MINIMUM RECOMMENDED GRID DRIVE

Peak Positive Plate Pulse Voltage	5000	5500	6000	Volts
Peak Negative Grid No. 1 Voltage	210	225	240	Volts

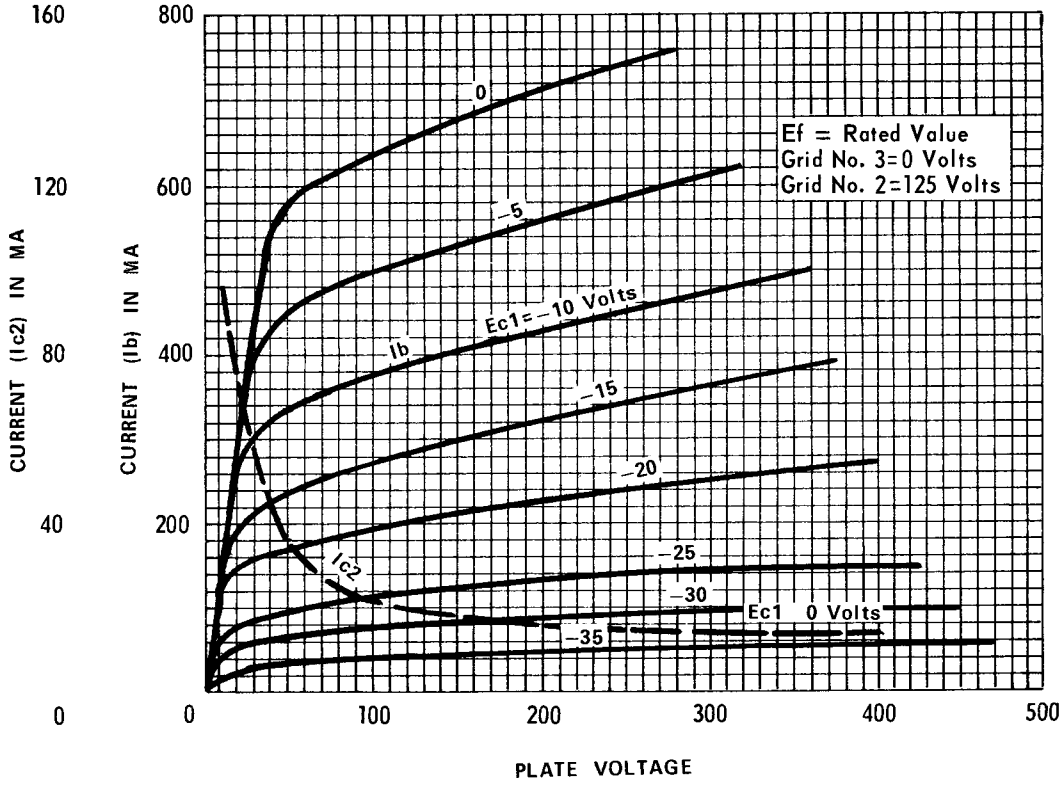
SPECIAL TESTS AND RATINGS

Primary Beam – Plate Emission #		
Initial Maximum	100	μa
After 100 Hrs. of Operation within Ratings (Maximum)	100	μa

CHART OF RECOMMENDED MINIMUM PEAK NEGATIVE GRID VOLTAGE
VS PEAK POSITIVE PLATE PULSE VOLTAGE



AVERAGE PLATE CHARACTERISTICS



NOTES

• The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

▲ Heater current of a bogey tube at Ef = 6.3 volts.

♦ In stages operating with a grid leak bias, an adequate cathode–bias resistor or other suitable means is required to protect the tube in the absence of excitation.

★ Values measured by a method involving a recurrent wave form such that the plate and screen dissipations will be kept within ratings in order to prevent damage to the tube.

§ Grid No. 3 (Beam Plate) returned to cathode. (At Socket)

⊕ Preferred Operation Dissipation Values: (Watts–Max.)

Pp	Pg2
30	4.0
28	4.5
26	5.0
24	5.5

Primary beam plate (Grid No. 3) emission is measured by operating the tube at a plate dissipation of 40 watts for not more than 5 minutes with the beam plate returned to ground through a current meter.

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Quadruple Diode

6JU8-A

The 6JU8-A is a general-purpose quadruple diode of the 9-pin miniature type designed for use in phase-detector and noise-immune color-killer circuits of color television receivers and in FM stereo multiplex equipment.

The 6JU8-A is electrically identical to the 6JU8, but is approximately 7/16" shorter for compact equipment designs.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

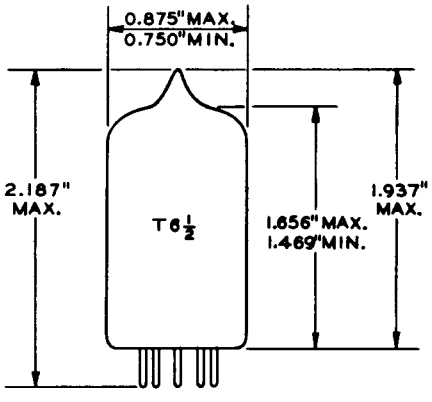
Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.6	Amperes
Direct Interelectrode Capacitances, approximate§		
Plate (Section 1) and Cathode (Section 2) to Cathode (Section 1)	1.8	pf
Plate (Section 1) and Cathode (Section 2) to Plate (Section 2)	2.2	pf
Plate (Section 2) to Heater and Internal Shield	0.62	pf
Plate (Section 3) and Cathode (Section 4) to Cathode (Section 3)	1.9	pf
Plate (Section 3) and Cathode (Section 4) to Plate (Section 4)	2.2	pf
Plate (Section 4) to Heater and Internal Shield	0.94	pf
Cathode (Section 1) to Heater and Internal Shield	1.8	pf
Cathode (Section 3) to Heater and Internal Shield	1.9	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

Maximum Diameter	0.875	Inches
Minimum Diameter	0.750	Inches
Maximum Over-all Length	2.187	Inches
Maximum Seated Height	1.937	Inches

PHYSICAL DIMENSIONS

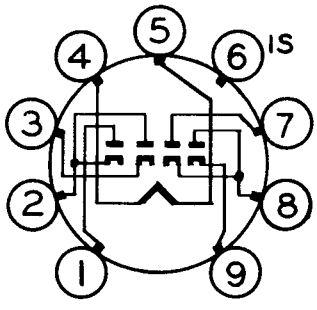


EIA 6-2

TERMINAL CONNECTIONS

Pin 1 - Plate (Section 4)
Pin 2 - Plate (Section 3) and Cathode (Section 4)
Pin 3 - Cathode (Section 3)
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Internal Shield
Pin 7 - Plate (Section 2)
Pin 8 - Plate (Section 1) and Cathode (Section 2)
Pin 9 - Cathode (Section 1)

BASING DIAGRAM



EIA 9PQ

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, Each Section

Peak Inverse Plate Voltage	300	Volts
Steady-State Peak Plate Current	54	Milliamperes
DC Output Current	9.0	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	300	Volts
Heater Negative with Respect to Cathode	300	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, Each Section		
Ib = 60 Milliamperes DC	10	Volts

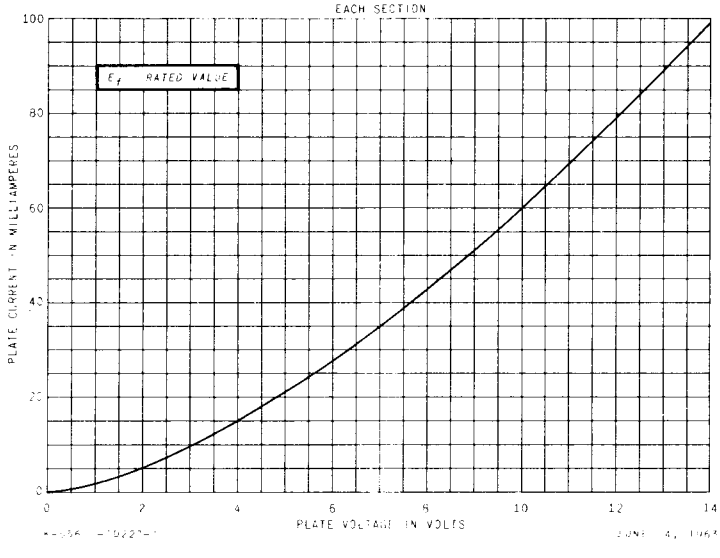
NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

AVERAGE PLATE CHARACTERISTICS
EACH SECTION



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Triode-Pentode

6JV8

The 6JV8 is a general-purpose, multi-unit tube of the 9-pin miniature type containing a high-mu triode and a sharp-cutoff pentode.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

	Series Circuit*	Parallel Circuit‡	
Heater Voltage, AC or DC	6.3	6.3±0.6§	Volts
Heater Current	0.6±0.04§	0.6¶	Amperes
Heater Warm-up Time, Average#	11	---	Seconds

Direct Interelectrode Capacitances△

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp), maximum	0.08	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.)	8.0	pf
Output: Pp to (h + Pk + Pg2 + Pg3 + i.s.)	3.2	pf

Triode Section

Grid to Plate: (Tg to Tp)	2.2	pf
Input: Tg to (h + Tk)	3.0	pf
Output: Tp to (h + Tk)	2.0	pf

Coupling

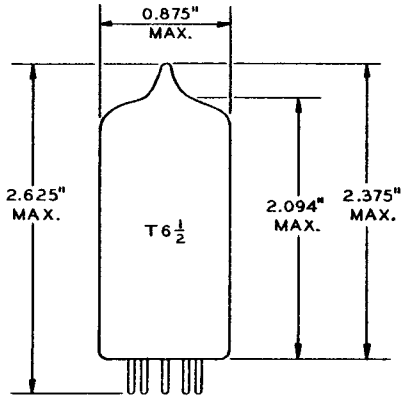
Pentode Grid-Number 1 to Triode Plate: (Pg1 to Tp), maximum	0.012	pf
Pentode Plate to Triode Plate: (Pp to Tp), maximum	0.24	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-3

Maximum Diameter	0.875	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.375	Inches

PHYSICAL DIMENSIONS

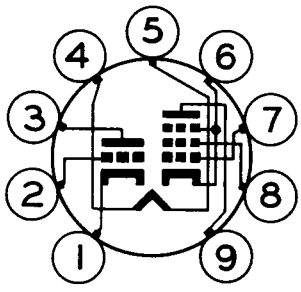


EIA 6-3

TERMINAL CONNECTIONS

Pin 1 - Triode Cathode
Pin 2 - Triode Grid
Pin 3 - Triode Plate
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 7 - Pentode Grid Number 1
Pin 8 - Pentode Grid Number 2 (Screen)
Pin 9 - Pentode Plate

BASING DIAGRAM



EIA 9DX

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Voltage	330	---	Volts
Positive DC Grid-Number 1 Voltage	0	0	Volts
Negative DC Grid-Number 1 Voltage	50	50	Volts
Plate Dissipation	4.0	1.1	Watts
Screen Dissipation	1.7	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	40	60	125	200	Volts
Screen Voltage	125	200	125	200	Volts
Grid-Number 1 Voltage	0	0	-1.0	-2.9	Volts
Plate Resistance, approximate	---	---	100000	150000	Ohms
Transconductance	---	---	11500	10700	Micromhos
Plate Current	28**	51**	22	22	Milliamperes
Screen Current	9.0**	14**	4.0	4.0	Milliamperes
Grid-Number 1 Voltage, approximate					
Ib = 20 Microamperes	---	---	-5.5	-9	Volts

Triode Section

Plate Voltage	200	Volts
Grid Voltage	-2.0	Volts
Amplification Factor	70	
Plate Resistance, approximate	17500	Ohms
Transconductance	4000	Micromhos
Plate Current	4.0	Milliamperes
Grid Voltage, approximate		
Ib = 20 Microamperes	-5	Volts

NOTES

* Operated with the heater in series with the heaters of other tubes having the same bogey heater current.

‡ Operated with the heater in parallel with the heaters of other tubes having the same bogey heater voltage.

§ For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance; for series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

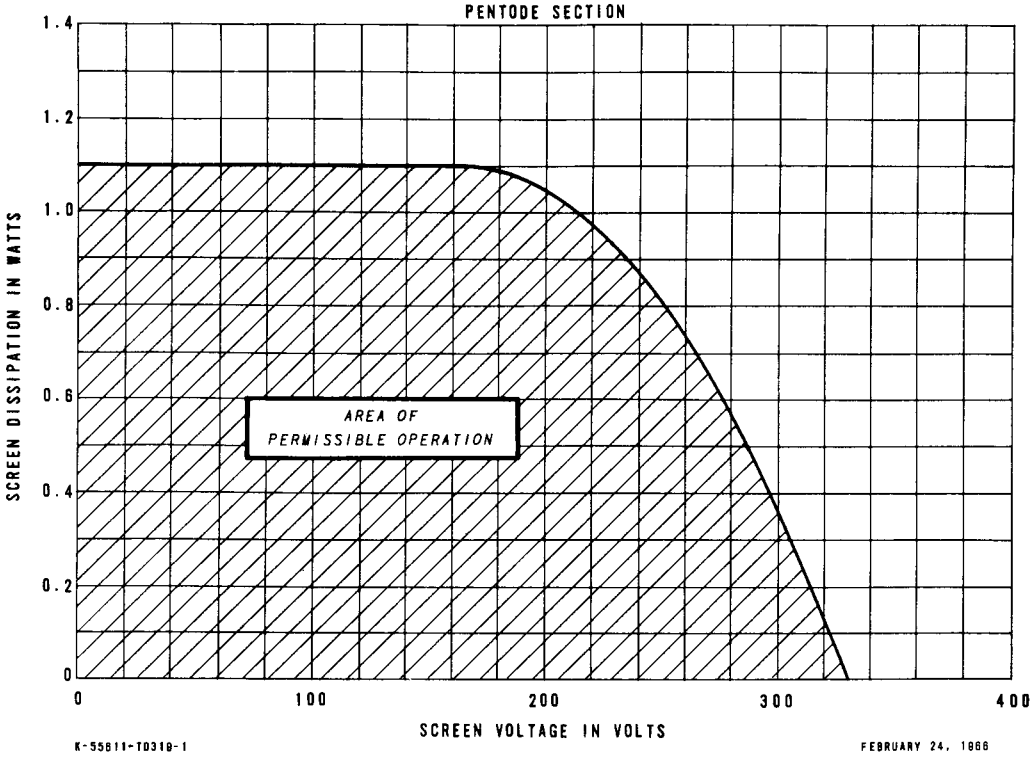
¶ Heater current of a bogey tube at Ef = 6.3 volts.

\# The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

Δ Without external shield.

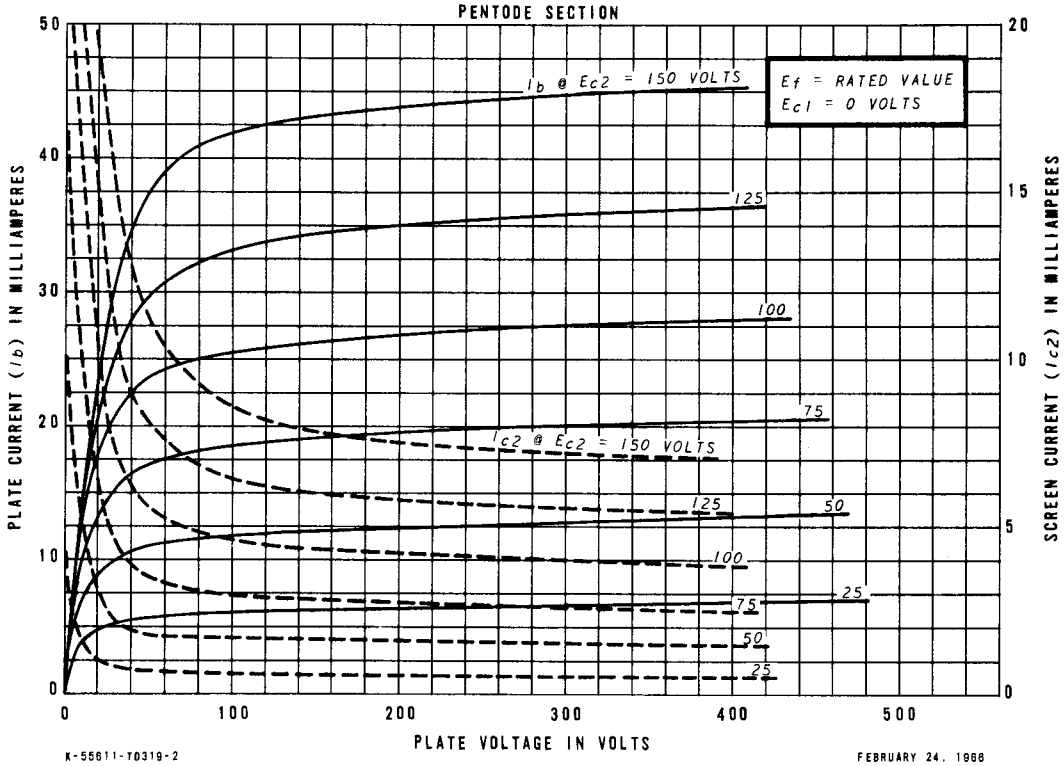
** This value can be measured by a method involving a recurrent waveform such that the plate and screen dissipation will be kept within ratings in order to prevent damage to the tube.

SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

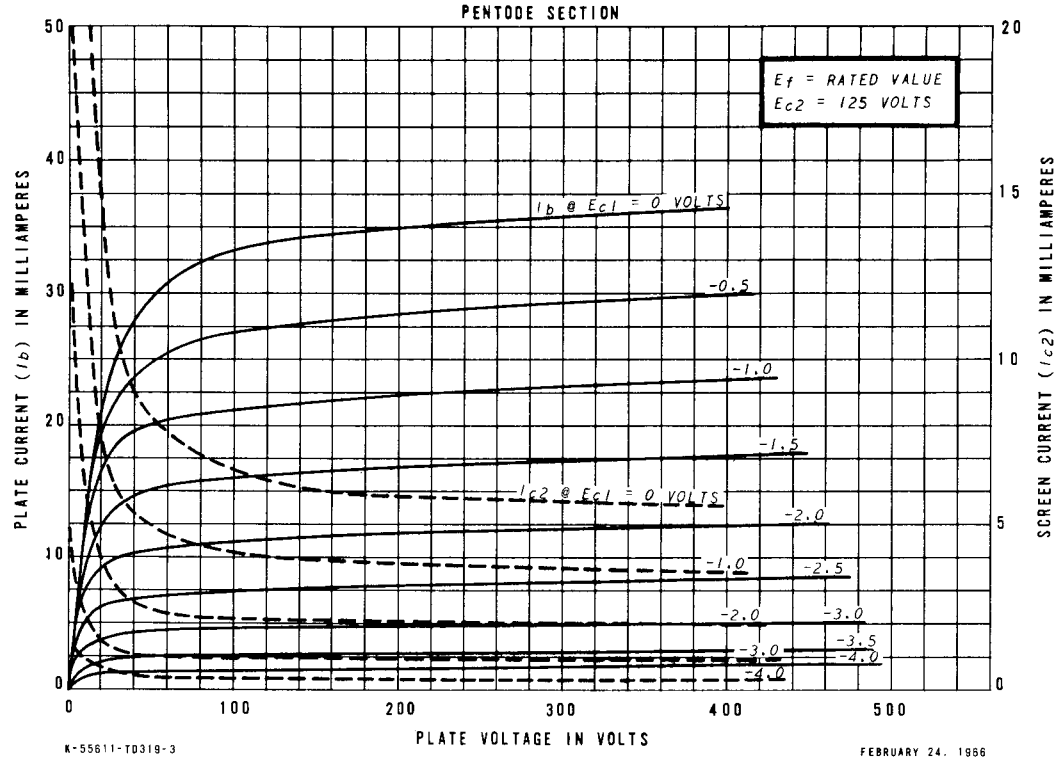


K-55611-TD319-2

FEBRUARY 24, 1966

AVERAGE PLATE CHARACTERISTICS

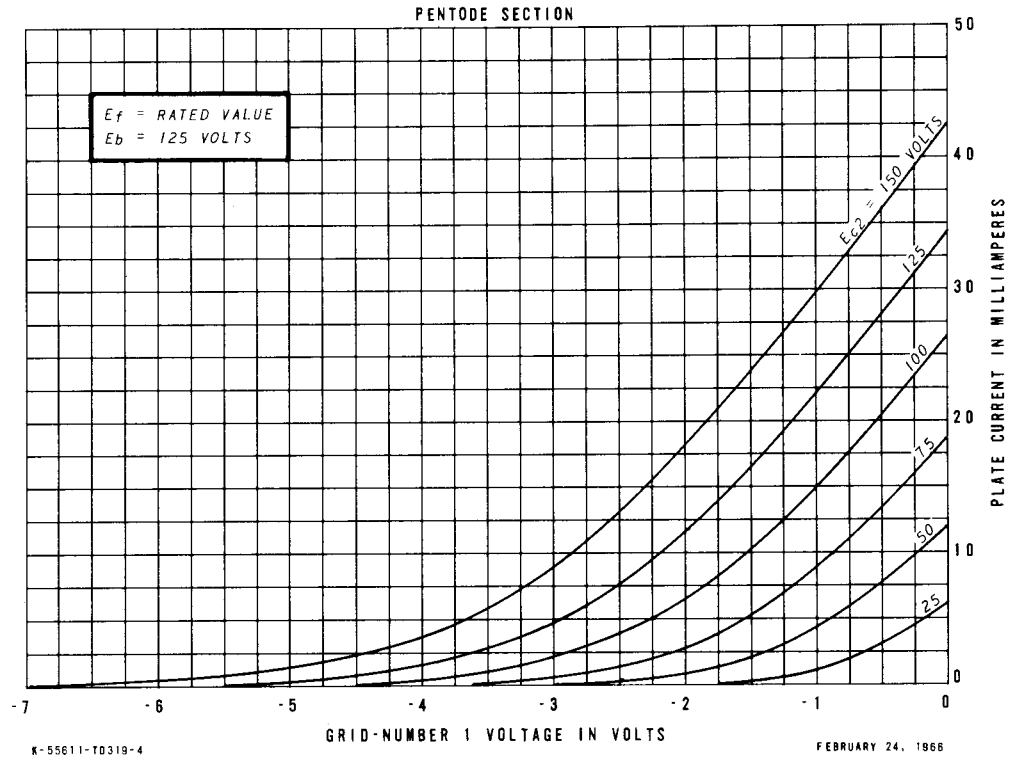
PENTODE SECTION



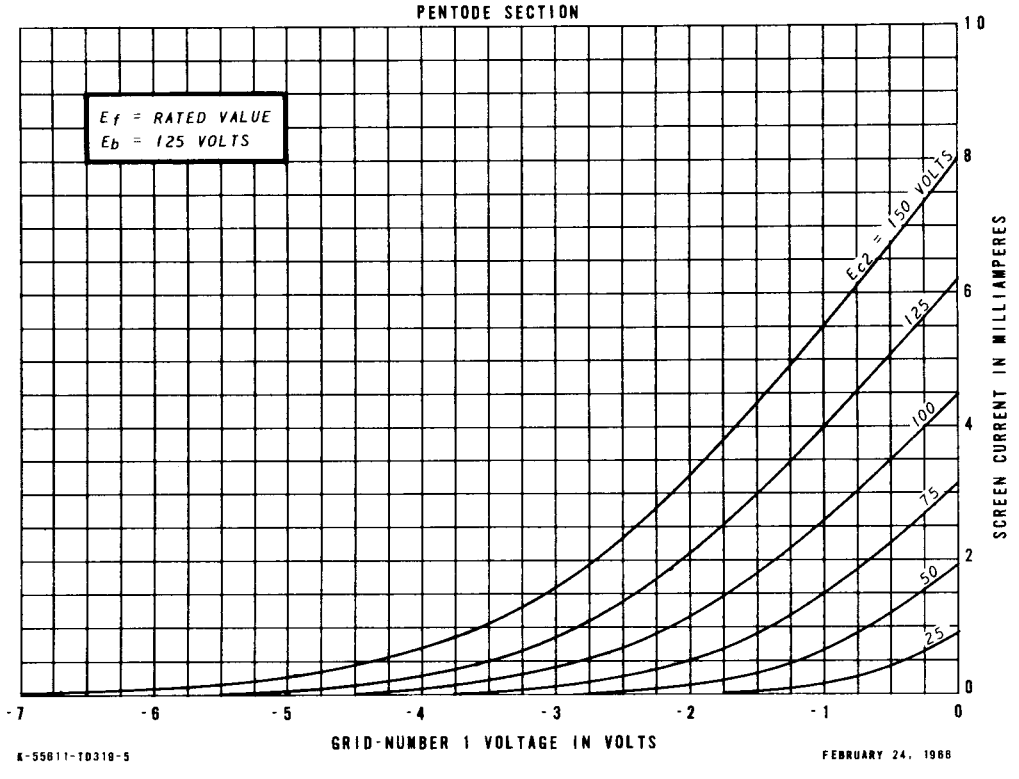
K-55611-TD319-3

FEBRUARY 24, 1966

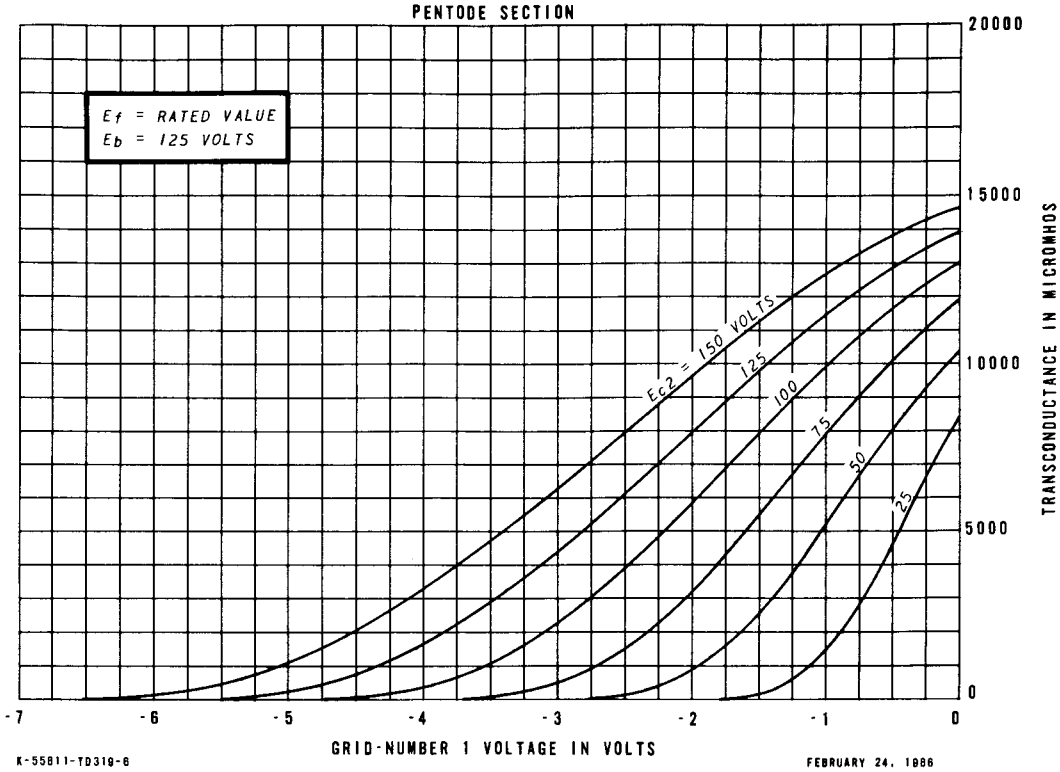
AVERAGE TRANSFER CHARACTERISTICS



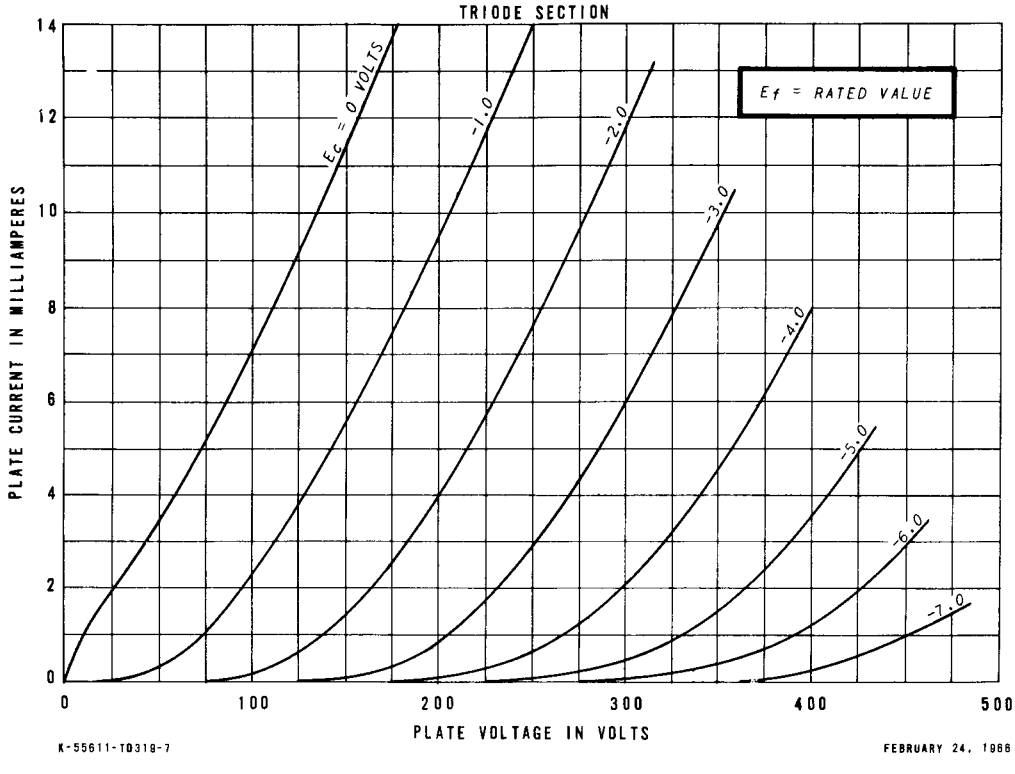
AVERAGE TRANSFER CHARACTERISTICS



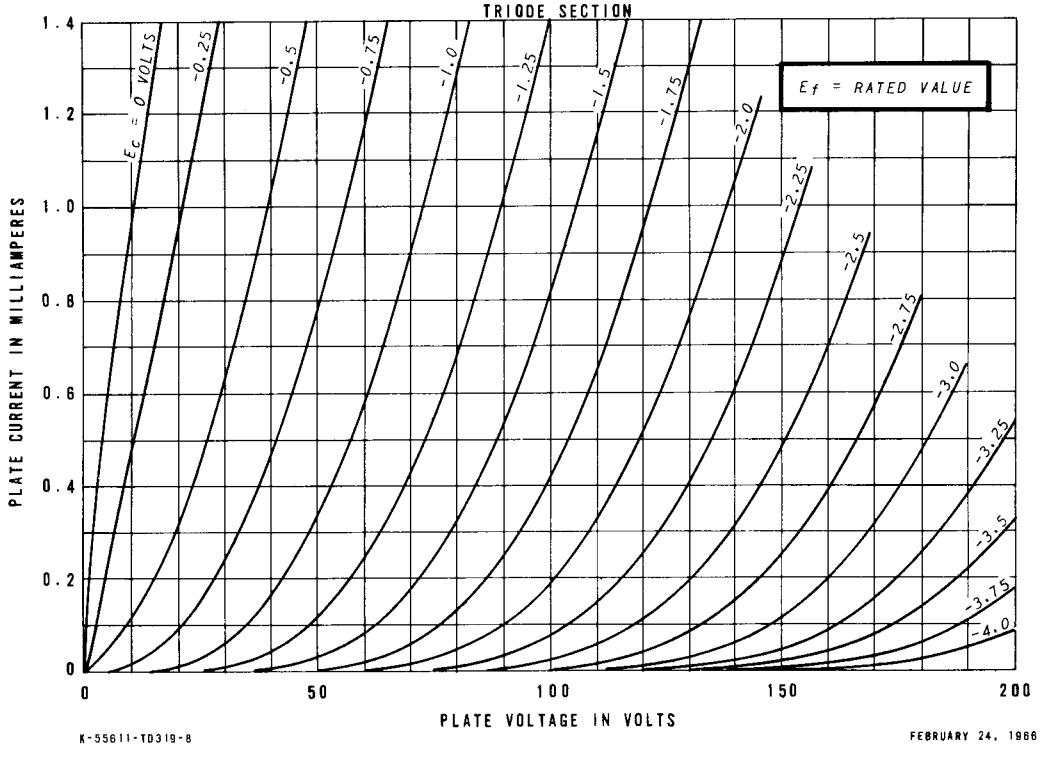
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



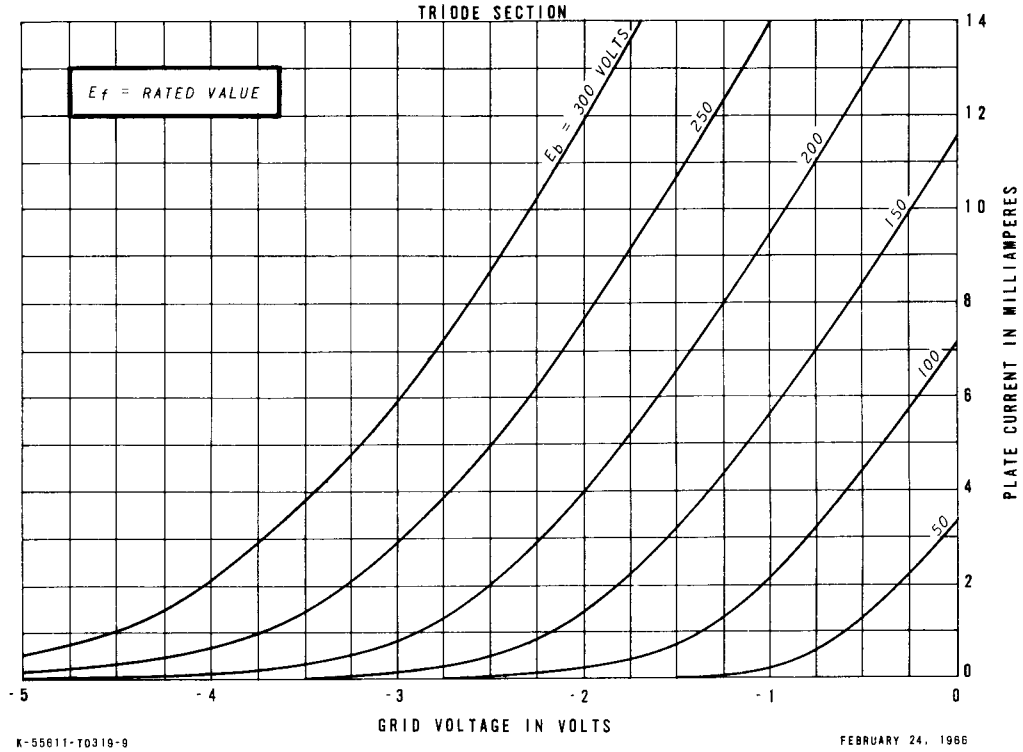
AVERAGE PLATE CHARACTERISTICS



K-55611-TD319-8

FEBRUARY 24, 1966

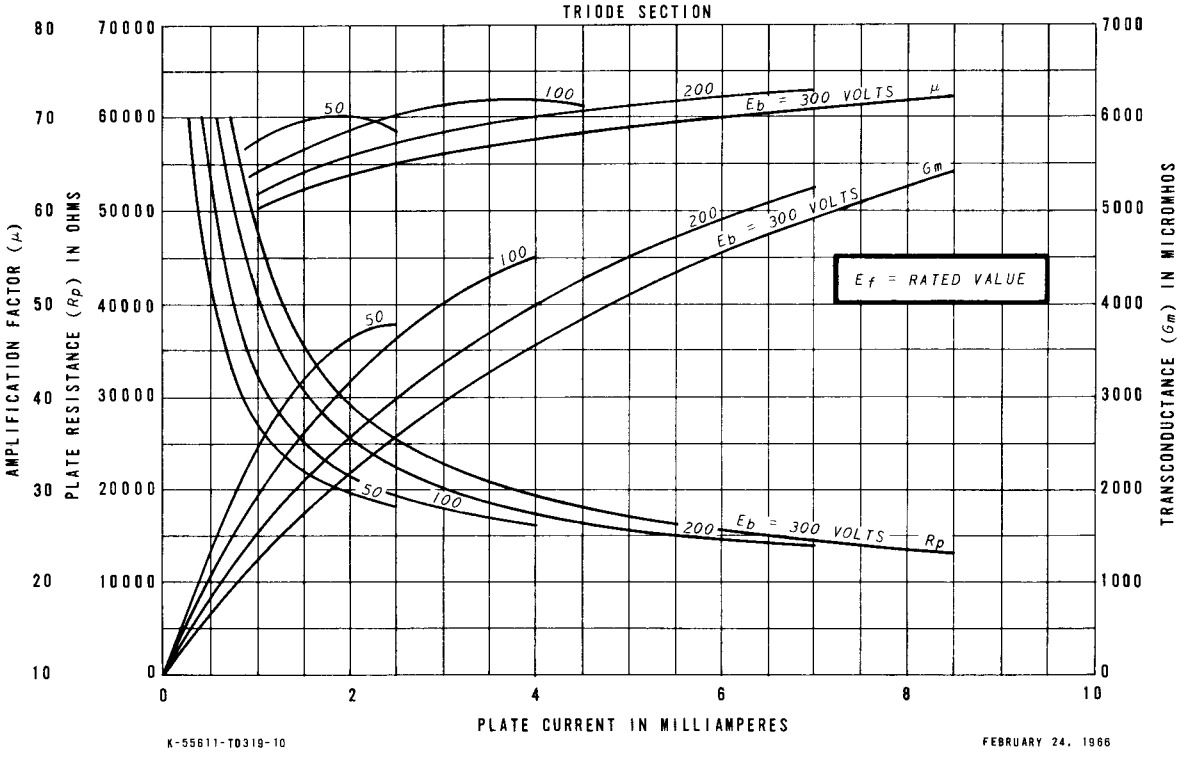
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD319-9

FEBRUARY 24, 1966

AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Triode-Pentode

6JW8

The 6JW8 is a triode-pentode intended primarily for horizontal-oscillator and AFC service in the horizontal-deflection systems of television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	6.3±0.6	Volts
Heater Current ●	0.43	Amperes

Direct Interelectrode Capacitances ▲

Pentode Section

Grid-Number 1 to Plate: maximum (Pg1 to Pp)	0.01	pf
Input: Pg1 to (h+Pk+Pg2+Pg3+i.s.)	5.5	pf
Output: Pp to (h+Pk+Pg2+Pg3+I.s.)	3.4	pf

Triode Section

Grid to Plate: (Tg to Tp)	1.8	pf
Input: Tg to (h+Tk+Pk+ Pg3+i.s.)	3.2	pf
Output: Tp to (h+Tk+Pk+Pg3+i.s.)	1.9	pf

MECHANICAL

Operating Position - Any
Envelope - T-6½, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

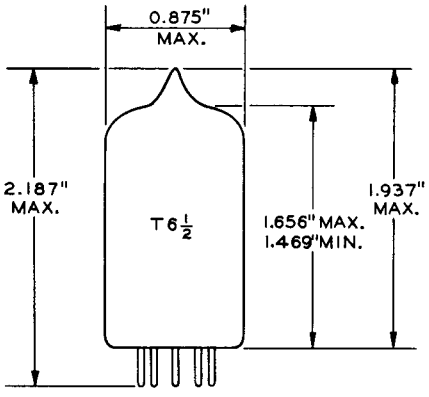
Maximum Diameter	0.875	Inches
Maximum Over-all Length	2.187	Inches
Maximum Seated Height	1.937	Inches

MAXIMUM RATINGS

DESIGN-CENTER VALUES

	Pentode Section	Triode Section	
Plate Voltage	250	250	Volts
Screen Voltage	250	---	Volts
Plate Dissipation	1.2	1.4	Watts
Screen Dissipation	0.2	---	Watts
DC Cathode Current	15	10	Milliamperes
Peak Cathode Current	50	---	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.56	3.0	Megohms
With Cathode Bias	1.0	---	Megohms

PHYSICAL DIMENSIONS

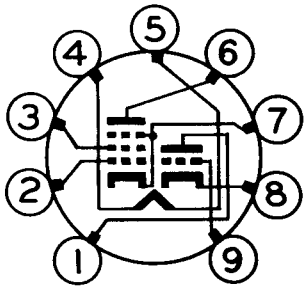


EIA 6-2

TERMINAL CONNECTIONS

Pin 1 - Triode Plate
Pin 2 - Pentode Grid-Number 1
Pin 3 - Pentode Grid-Number 2 (Screen)
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Plate
Pin 7 - Pentode Cathode, Grid-Number 3 and Internal Shield
Pin 8 - Triode Cathode
Pin 9 - Triode Grid

BASING DIAGRAM



EIA 9DC

MAXIMUM RATINGS (Cont'd)

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under normal conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube in average applications, making allowance for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube under normal operating conditions at the stated normal supply voltage.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section		Triode Section	
Plate Voltage	200	100	200	Volts
Screen Voltage	200	100	---	Volts
Grid-Number 1 Voltage	0	-1.0	-2.0	Volts
Amplification Factor	---	---	70	
Plate Resistance, approximate	---	400000	20000	Ohms
Transconductance	---	5500	3500	Micromhos
Plate Current	12.5	6.0	3.5	Milliamperes
Screen Current	3.5	1.7	---	Milliamperes
Grid Voltage, approximate Ic = +0.3 Microamperes	---	---	-1.3	Volts
Grid-Number 1 Voltage, approximate Ic1 = +0.3 Microamperes	---	-1.3	---	Volts
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	-16	---	---	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

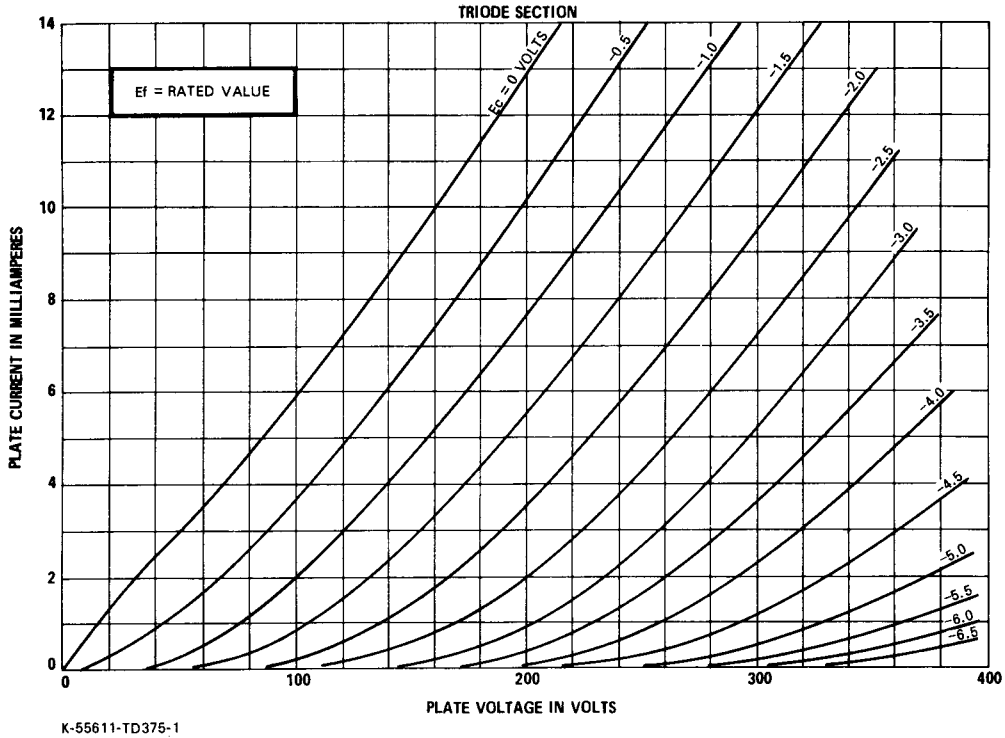
• Heater current of a bogey at Ef = 6.3 volts.

▲ Without external shield.

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AVERAGE PLATE CHARACTERISTICS

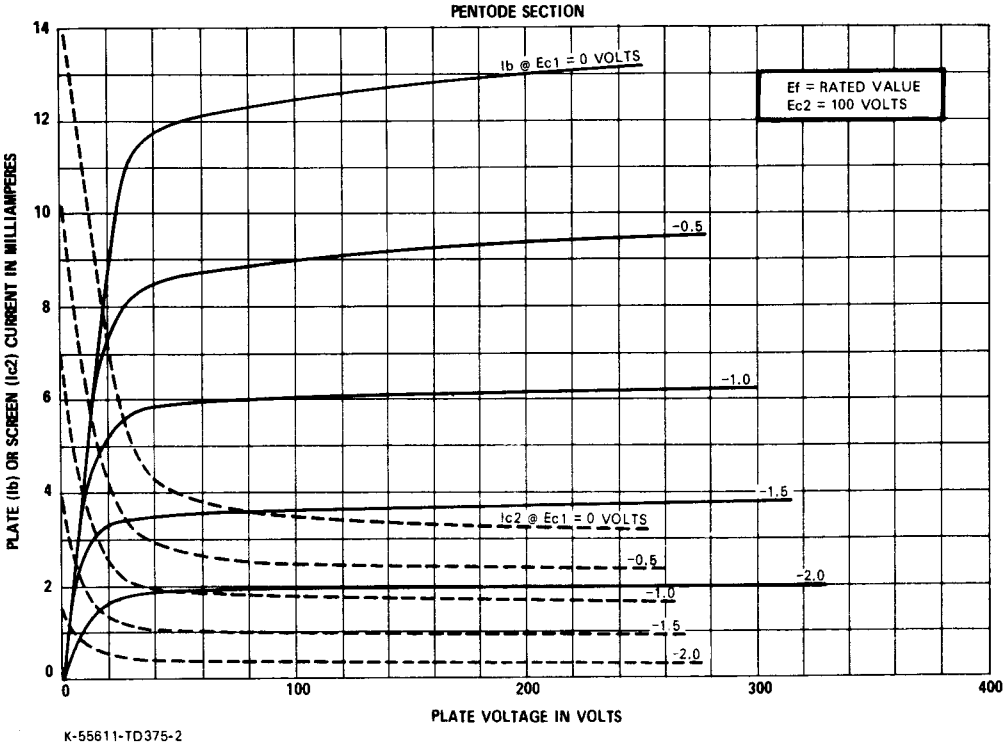
TRIODE SECTION



K-55611-TD375-1

AVERAGE PLATE CHARACTERISTICS

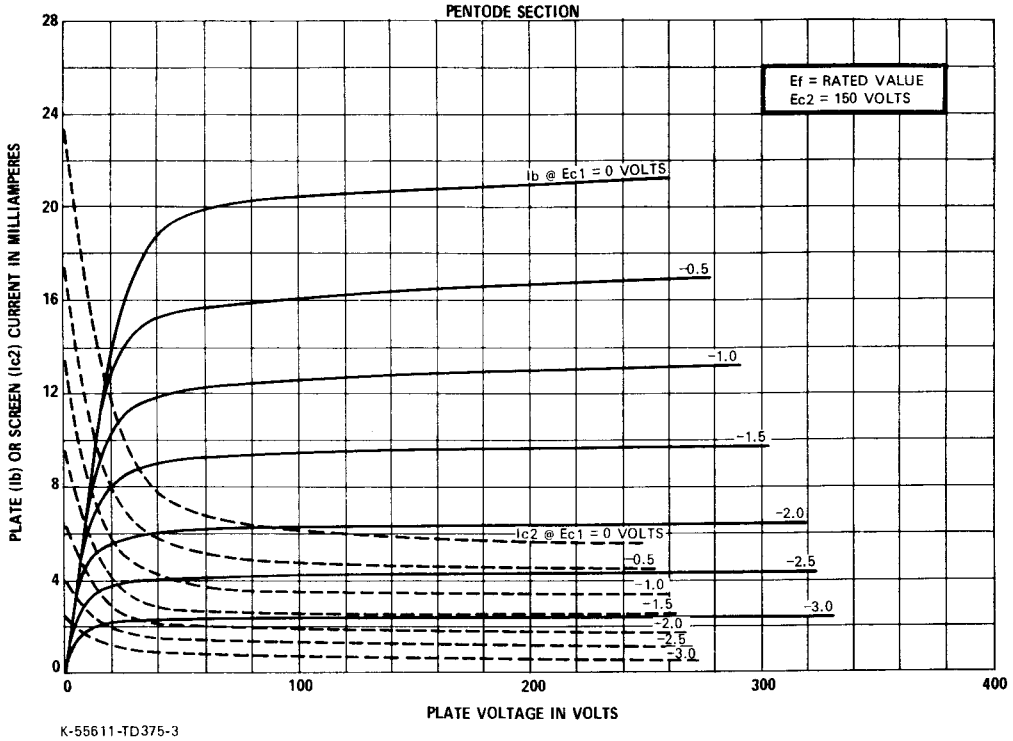
PENTODE SECTION



K-55611-TD375-2

AVERAGE PLATE CHARACTERISTICS

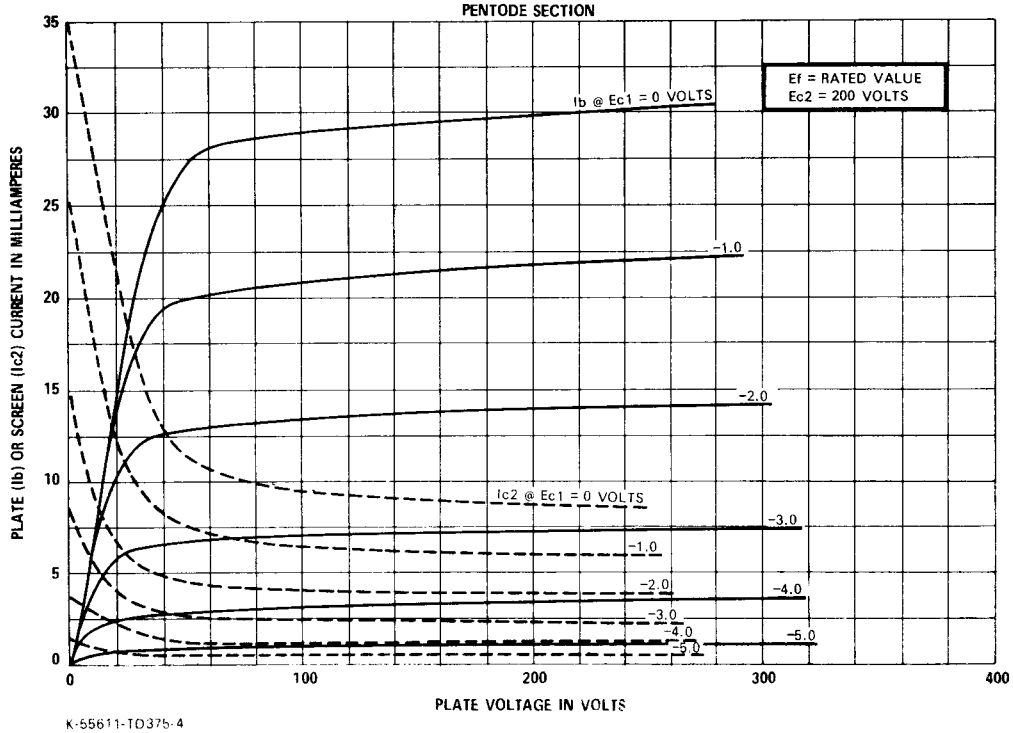
PENTODE SECTION



K-55611-TD375-3

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION



K-55611-TD375-4

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

—PRODUCT INFORMATION—

Compactron Beam Pentode

6JZ6

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

The 6JZ6 is a compactron beam-power pentode designed for use as the horizontal-deflection amplifier in television receivers. A separate connection is provided for the beam plates to minimize "snivets".

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	1.5	Amperes
Direct Interelectrode Capacitances, approximate§		
Grid-Number 1 to Plate: (g1 to p)	0.34	pf
Input: g1 to (h + k + g2 + b.p.)	24	pf
Output: p to (h + k + g2 + b.p.)	8.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Top Cap - C1-3, Skirted Miniature
Outline Drawing - EIA 12-79

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	3.625	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

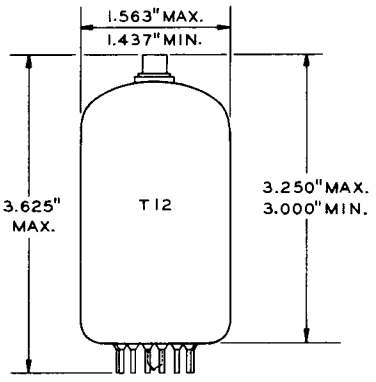
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

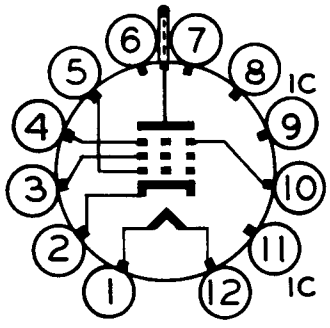


EIA 12-79

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid Number 2 (Screen)
Pin 4 - Beam Plates
Pin 5 - Grid Number 1
Pin 6 - No Connection
Pin 7 - No Connection
Pin 8 - No Connection
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Beam Plates
Pin 11 - Internal Connection - Do Not Use
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12GD

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MAXIMUM RATINGS (Cont'd)

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE¶—DESIGN-MAXIMUM VALUES

DC Plate-Supply Voltage (Boost + DC Power Supply)	770	Volts
Peak Positive Pulse Plate Voltage	6500	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Positive DC Beam Plate Voltage	70	Volts
Screen Voltage	220	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation#	18	Watts
Screen Dissipation	3.5	Watts
DC Cathode Current	230	Milliamperes
Peak Cathode Current	800	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point	220	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	50	130	Volts
Beam Plates, Connected to Cathode at Socket				
Screen Voltage	130	130	130	Volts
Grid-Number 1 Voltage	---	0Δ	-20	Volts
Plate Resistance, approximate	---	---	9900	Ohms
Transconductance	---	---	9000	Micromhos
Plate Current	---	450	46	Milliamperes
Screen Current	---	29	1.8	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 1.0 Milliamperes	-64	---	-32	Volts
Triode Amplification Factor**	---	---	4.8	

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

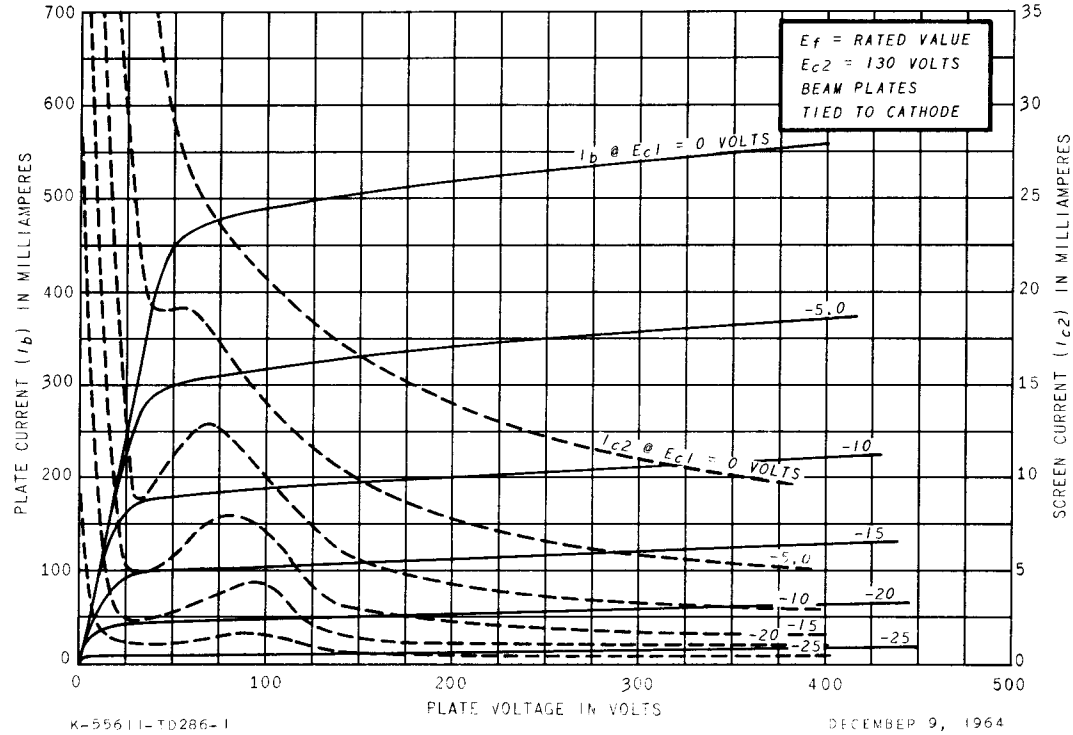
¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

\# In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Δ Applied for short interval (two seconds maximum) so as not to damage tube.

** Triode connection (screen tied to plate) with Eb = Ec2 = 130 volts and Ec1 = -20 volts.

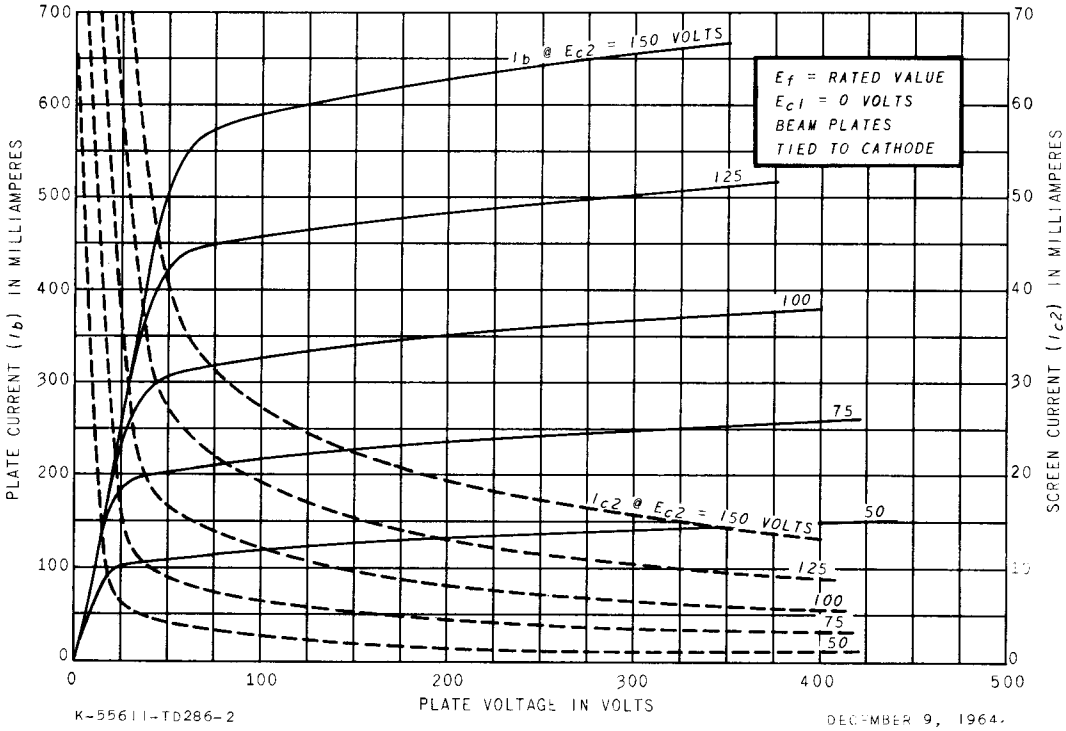
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD286-1

DECEMBER 9, 1964

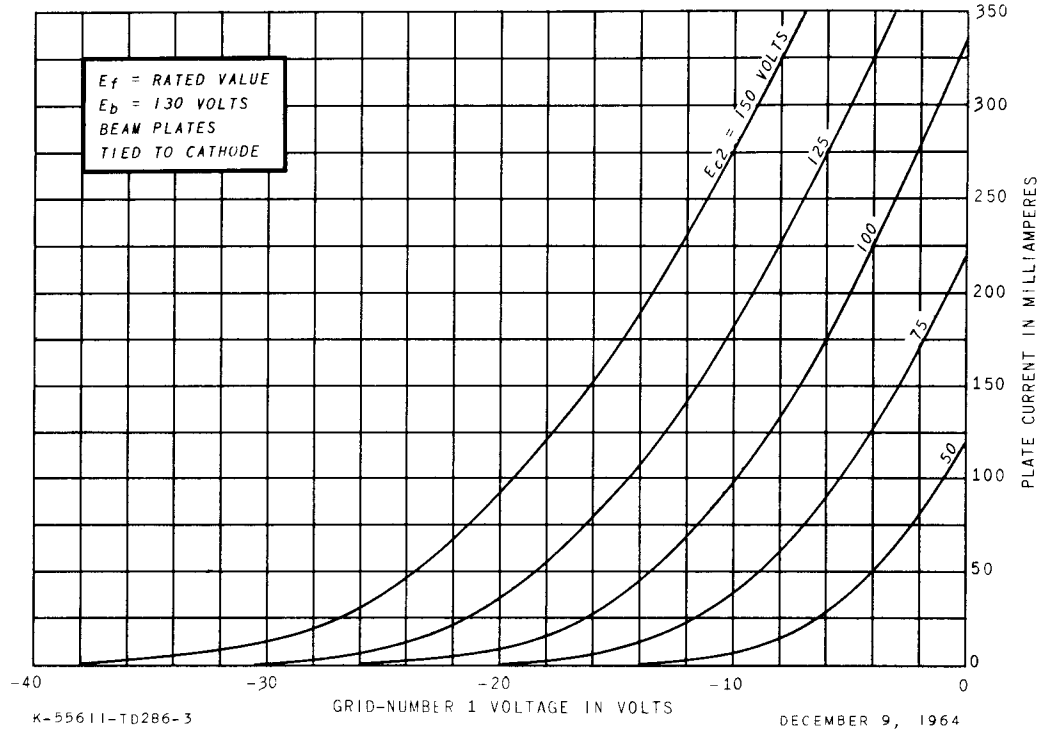
AVERAGE PLATE CHARACTERISTICS



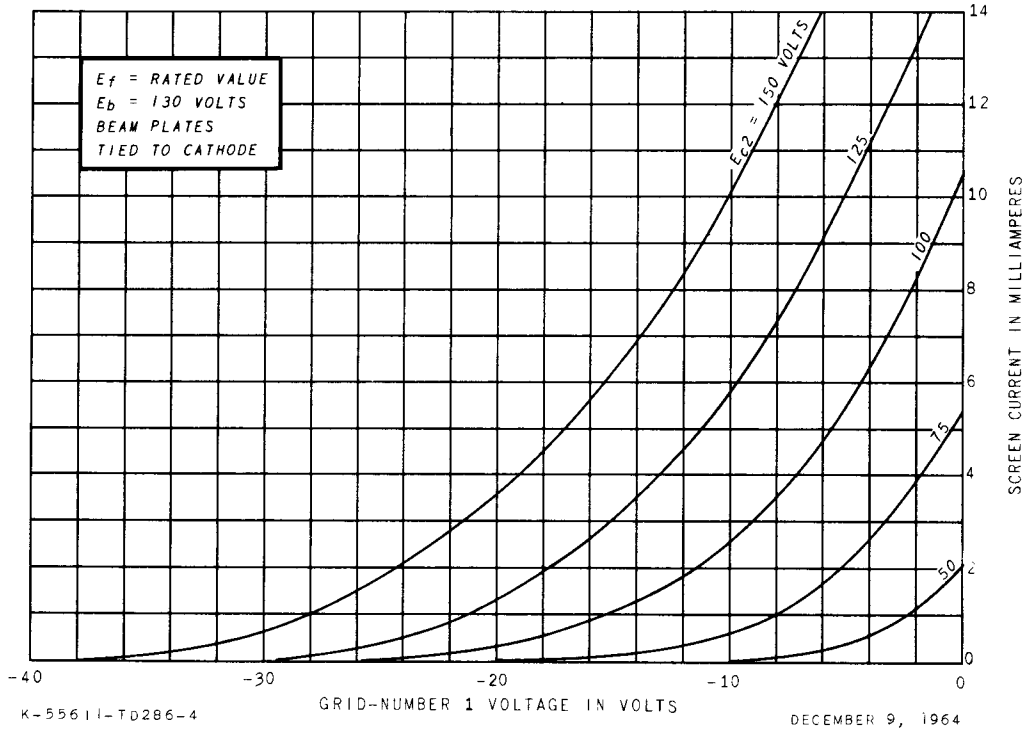
K-5561I-TD286-2

DECEMBER 9, 1964

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

6JZ8

COMPACTRON TRIODE-PENTODE

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6JZ8 is a compactron containing a medium-mu triode and a beam pentode. The triode is designed for service as a vertical-deflection oscillator and the pentode as a vertical-deflection amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	1.2	Amperes

Direct Interelectrode Capacitances§

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.34	pf
Input: Pg1 to (h + Pk + Pg2 + b.p.)	11	pf
Output: Pp to (h + Pk + Pg2 + b.p.)	7.0	pf

Triode Section

Grid to Plate: (Tg to Tp)	3.6	pf
Input: Tg to (h + Tk)	2.2	pf
Output: Tp to (h + Tk)	0.7	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches

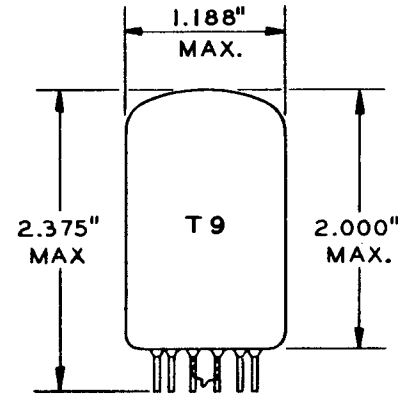
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The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

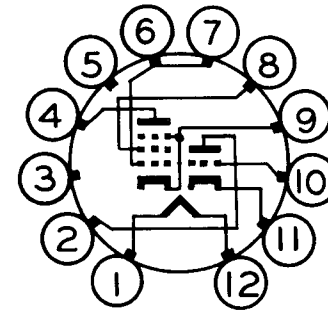


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Triode Plate
Pin 3 - No Connection
Pin 4 - Pentode Plate
Pin 5 - No Connection
Pin 6 - Pentode Grid Number 1
Pin 7 - Pentode Grid Number 1
Pin 8 - Pentode Grid Number 2 (Screen)
Pin 9 - Pentode Cathode and Beam Plates
Pin 10 - Triode Grid
Pin 11 - Triode Cathode
Pin 12 - Heater

BASING DIAGRAM



EIA 12DZ

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

Triode Section-Vertical Oscillator Service¶

DC Plate Voltage	250	Volts
Peak Negative Grid Voltage	400	Volts
Plate Dissipation	1.0	Watts
DC Cathode Current	20	Milliamperes
Peak Cathode Current	70	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	1.0	Megohms
With Cathode Bias	2.2	Megohms

Pentode Section-Vertical Deflection Amplifier Service¶

DC Plate Voltage	250	Volts
Peak Pulse Plate Voltage	2000	Volts
Screen Voltage	200	Volts
Peak Negative Grid-Number 1 Voltage	150	Volts
Plate Dissipation#	7.0	Watts
Screen Dissipation	1.8	Watts
DC Cathode Current	70	Milliamperes
Peak Cathode Current	245	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	1.0	Megohms
With Cathode Bias	2.2	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Triode Section

Plate Voltage	150	Volts
Grid Voltage	-5.0	Volts
Amplification Factor	20	
Plate Resistance, approximate	8500	Ohms
Transconductance	2350	Micromhos
Plate Current	5.5	Milliamperes
Grid Voltage, approximate		
Ib = 10 Microamperes	-11	Volts

Pentode Section

Plate Voltage	45	120	Volts
Screen Voltage	110	110	Volts
Grid-Number 1 Voltage	0Δ	-8.0	Volts
Plate Resistance, approximate	---	11700	Ohms
Transconductance	---	7100	Micromhos
Plate Current	122	46	Milliamperes
Screen Current	16.5	3.5	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 100 Microamperes	---	-25	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

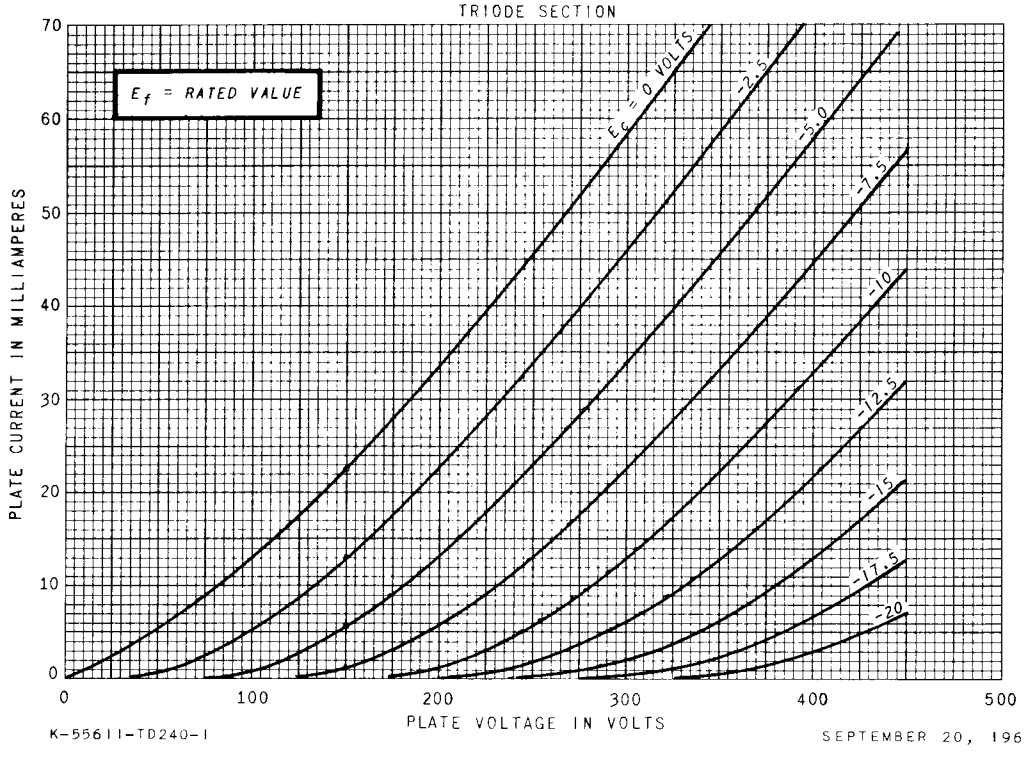
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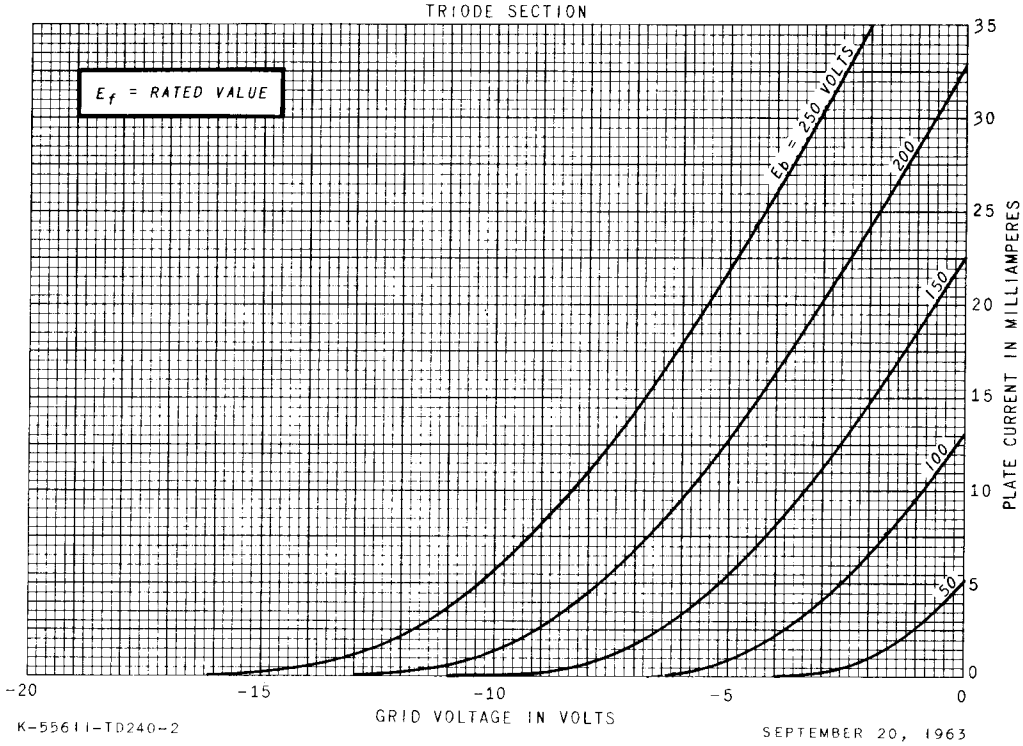
Δ Applied for short interval (two seconds maximum) so as not to damage tube.

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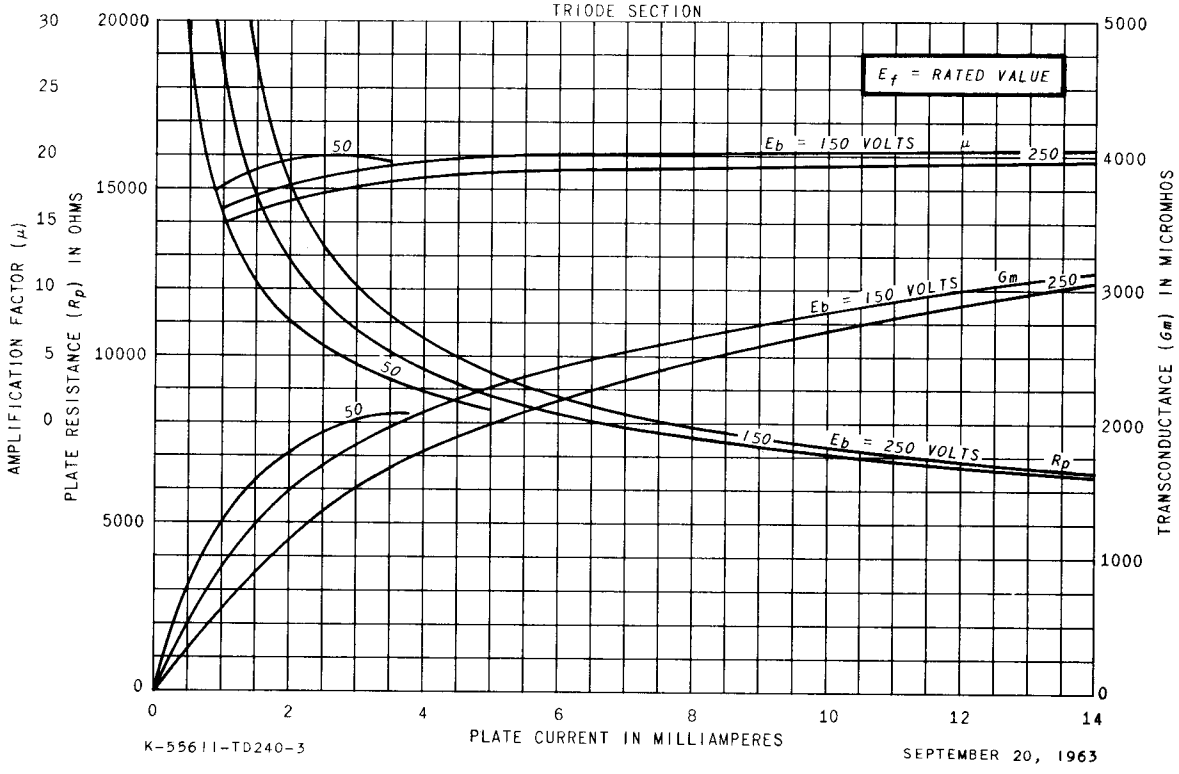
AVERAGE PLATE CHARACTERISTICS



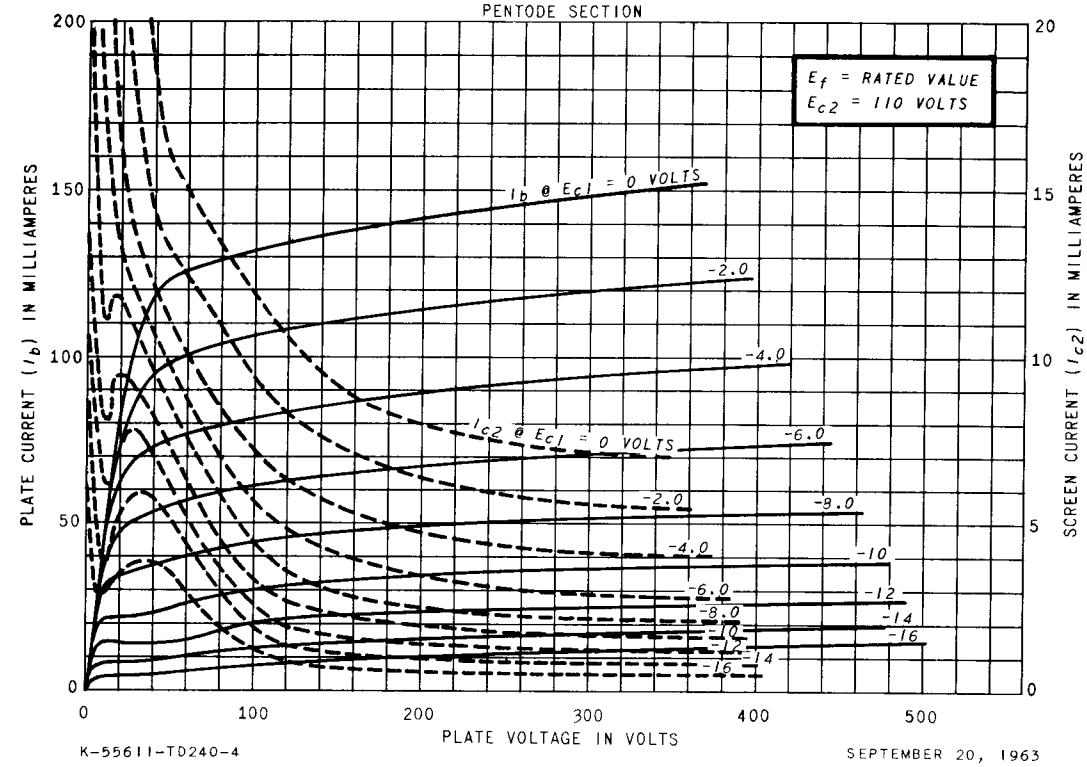
AVERAGE TRANSFER CHARACTERISTICS



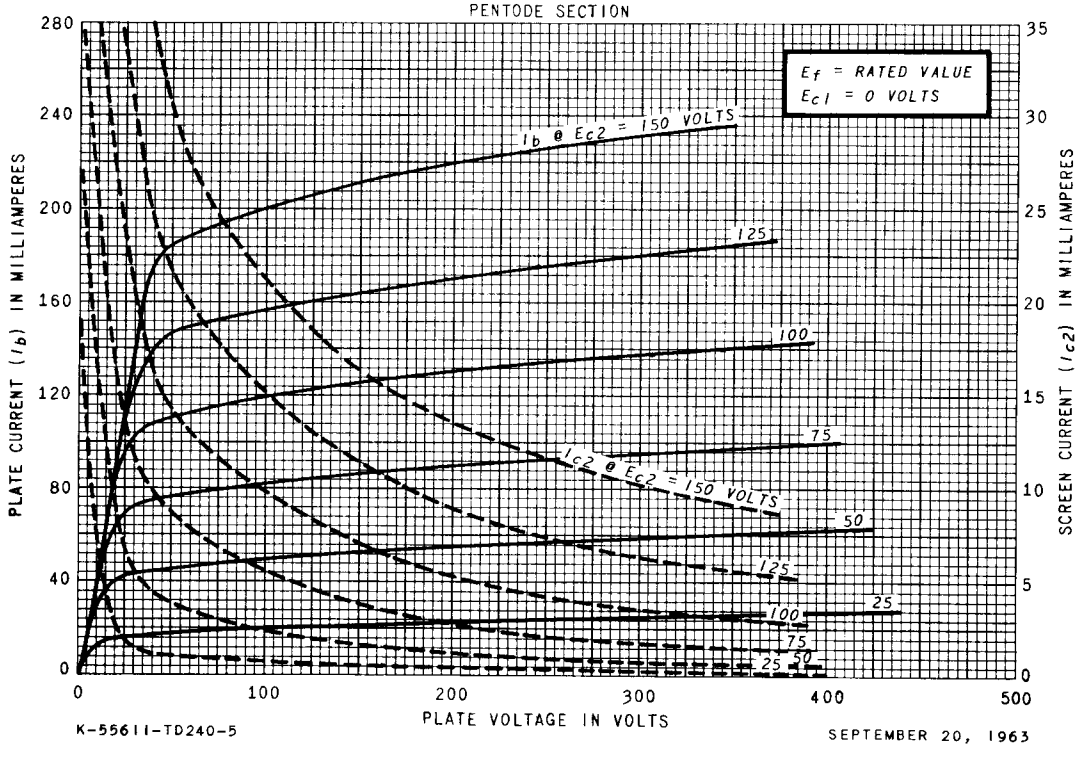
AVERAGE CHARACTERISTICS



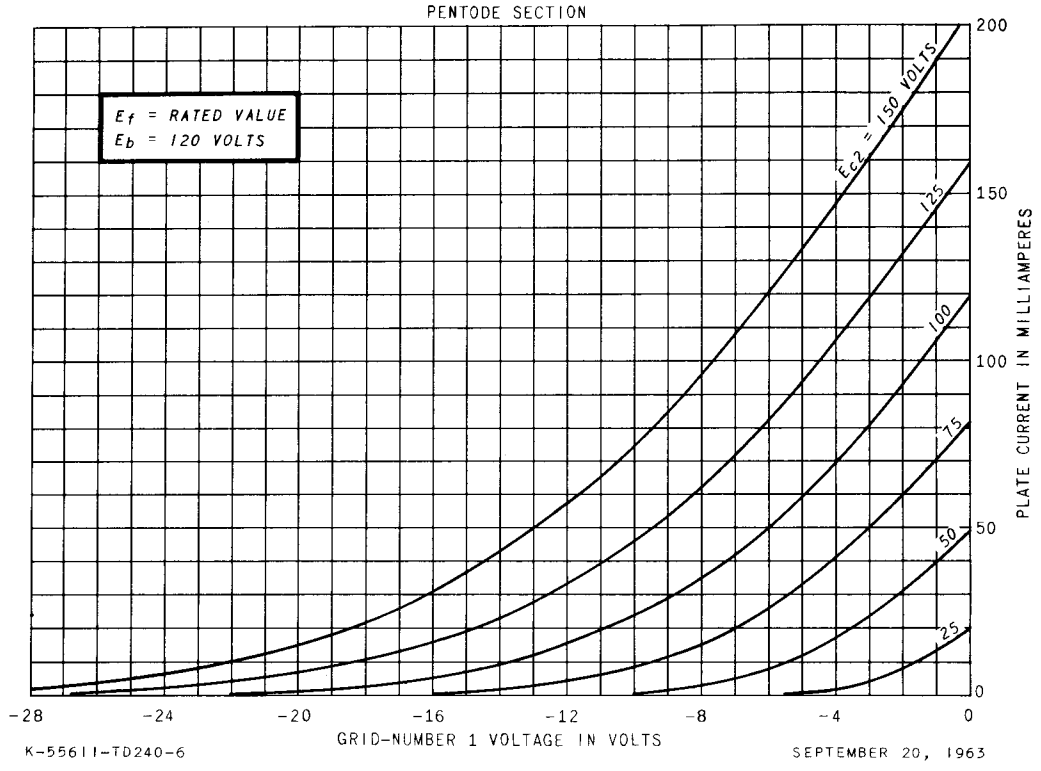
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



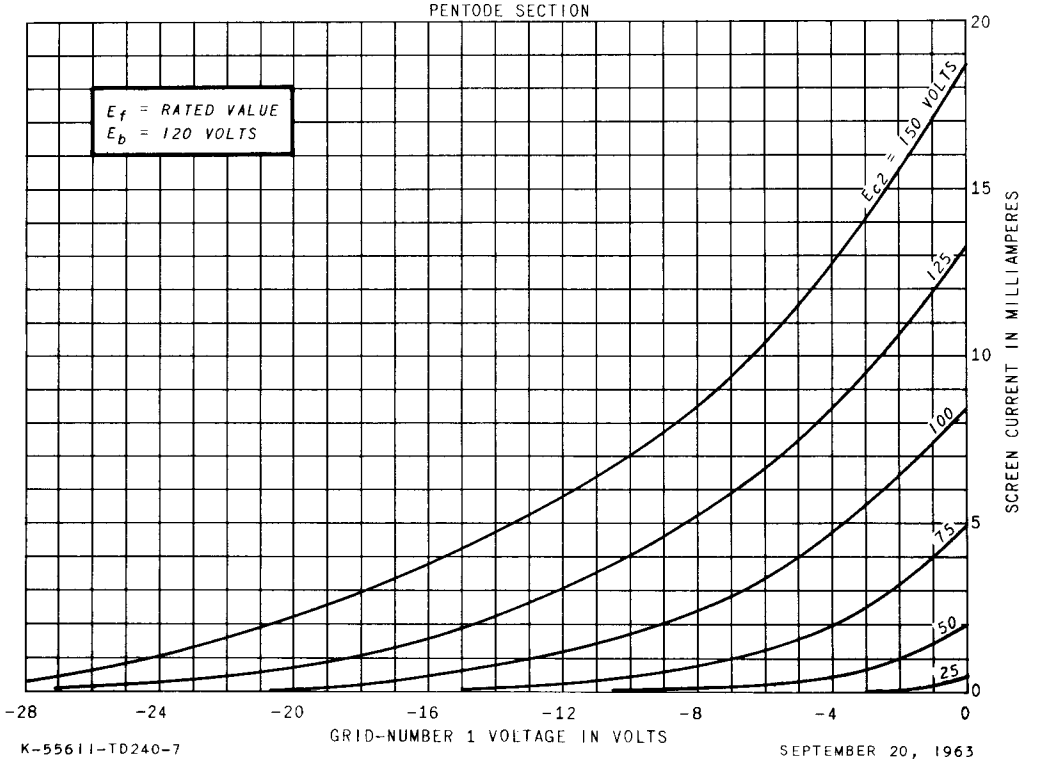
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD240-6

SEPTEMBER 20, 1963

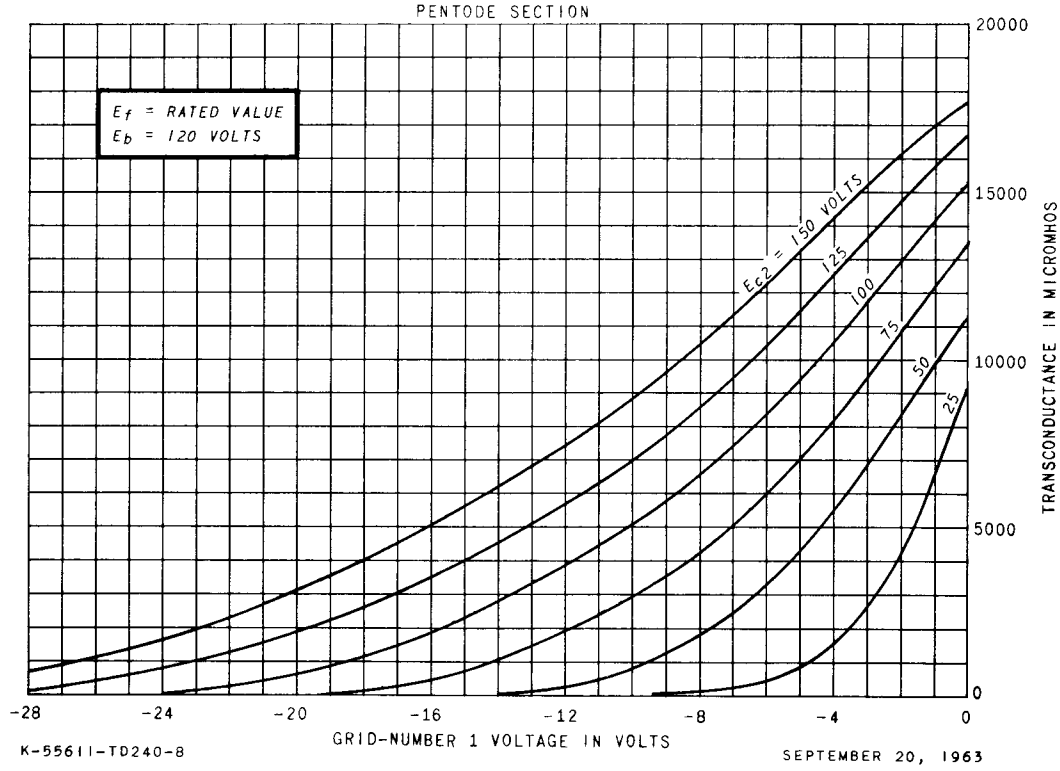
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD240-7

SEPTEMBER 20, 1963

AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

6K11

THREE-SECTION TRIODE

DESCRIPTION AND RATING

The 6K11 is a COMPACTRON device containing two high-mu triodes and one medium-mu triode. Features of the tube include separate pin connections for all three cathodes, grids, and plates; an internal shield between sections 1 and 3; a button base, and a compact glass envelope.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings (Design-Maximum Rating System)

	Series Heater Operation*	Parallel Heater Operation*	
Heater Voltage, AC or DC	6.3†	6.3±0.6	Volts
Heater Current	0.6±0.04	0.6‡	Ampere
Heater Warm-up Time§	11	——	Seconds

Direct Interelectrode Capacitances¶

	Section 1	Section 2	Section 3	
Grid to Plate: (g to p)	1.3	1.3	1.3	μμf
Input: g to (h+k+i.s.)	1.9	1.8	1.8	μμf
Output: p to (h+k+i.s.)	1.8	0.7	1.8	μμf

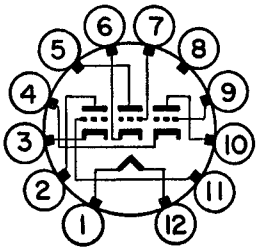
MECHANICAL

Mounting Position—Any

Envelope—T-9, Glass

Base—E12-70, Button 12-Pin

BASING DIAGRAM

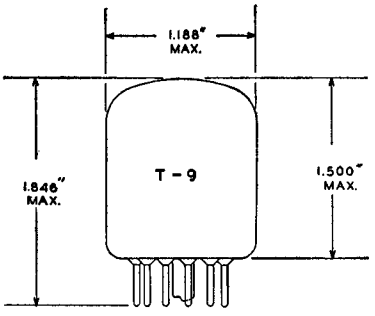


EIA 12BY

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—Plate (Section 3)
Pin 3—Cathode (Section 3)
Pin 4—Cathode (Section 1)
Pin 5—Plate (Section 2)
Pin 6—Cathode (Section 2)
Pin 7—Grid (Section 2)
Pin 8—Internal Shield
Pin 9—Grid (Section 1)
Pin 10—Plate (Section 1)
Pin 11—Grid (Section 3)
Pin 12—Heater

PHYSICAL DIMENSIONS



EIA 9-56

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Section 1	Sections 2 and 3	
Plate Voltage	330	330	Volts
Positive DC Grid Voltage	0	0	Volts
Negative DC Grid Voltage	50	50	Volts
Plate Dissipation	2.75	1.0	Watts
DC Cathode Current	20	——	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts

Design-maximum ratings are limiting values of operating and enviromental conditions applicable to a bogey tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions. The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Section 1	Sections 2 and 3	
Plate Voltage	250	250	Volts
Grid Voltage	−8.5	−2.0	Volts
Amplification Factor	17	100	
Plate Resistance, approximate	7700	62,500	Ohms
Transconductance	2200	1600	Micromhos
Plate Current	10.5	1.2	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	−24	——	Volts

* For parallel heater operation, the equipment designer should design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. For series heater operation, the equipment designer should design so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

† Heater voltage at bogey heater current.

‡ Heater current at bogey heater voltage.

§ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

¶ Without external shield.

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBE

6K6-GT
Description and Rating
PENTODE

The 6K6-GT is a power-amplifier pentode designed for use in the audio-frequency power output stage of television and radio receivers. It may also be used as a triode-connected vertical deflection amplifier in television receivers. Electrically, the 6K6-GT is identical to the type 41.

GENERAL

Cathode - Coated Unipotential		
Heater Voltage, A-C or D-C	6.3	Volts
Heater Current	0.4	Ampere
Envelope - T-9, Glass		
Base - B6-81 or B7-7, Intermediate Shell Octal		
or B6-84 or B7-59, Short Intermediate Shell Octal		
Mounting Position - Any		

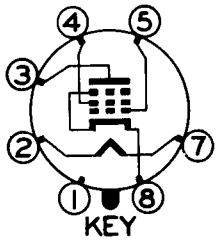
Direct Interelectrode Capacitances, approximate *		
Grid-Number 1 to Plate	0.5	μμf
Input	5.5	μμf
Output	6.0	μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

	Class A1 Amplifier	Vertical Deflection Amplifier † (Triode Connection) §	
D-C Plate Voltage	315	315	Volts
Peak Positive Pulse Plate Voltage ▽	---	1200	Volts
Screen Voltage	285	---	Volts
Peak Negative Grid-Number 1 Voltage	---	250	Volts
Plate Dissipation	8.5	7.0 #	Watts
Screen Dissipation	2.8	---	Watts
D-C Cathode Current	---	25	Milliamperes
Peak Cathode Current	---	75	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
D-C Component	100	100	Volts
Total D-C and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total D-C and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	---	Megohm
With Cathode Bias	0.5	2.2	Megohms

BASING DIAGRAM

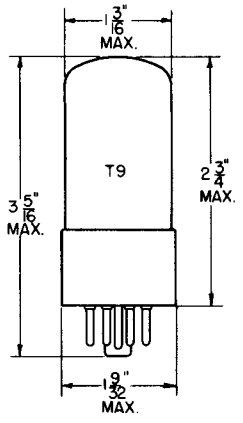


RTMA 7S
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 - No Connection ‡
Pin 2 - Heater
Pin 3 - Plate
Pin 4 - Grid Number 2 (Screen)
Pin 5 - Grid Number 1
Pin 7 - Heater
Pin 8 - Cathode and Grid Number 3

PHYSICAL DIMENSIONS



RTMA 9-11 or 9-41

GENERAL ELECTRIC

Supersedes ET-T306A dated 3-50

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	100	250	315	Volts
Screen Voltage	100	250	250	Volts
Grid-Number 1 Voltage	-7	-18	-21	Volts
Peak AF Grid-Number 1 Voltage	7	18	21	Volts
Plate Resistance, approximate	104000	90000	110000	Ohms
Transconductance	1500	2300	2100	Micromhos
Zero-Signal Plate Current	9.0	32	25.5	Milliamperes
Maximum-Signal Plate Current	9.5	33	28	Milliamperes
Zero-Signal Screen Current	1.6	5.5	4.0	Milliamperes
Maximum-Signal Screen Current	3.0	10	9.0	Milliamperes
Load Resistance	12000	7600	9000	Ohms
Total Harmonic Distortion, approximate	11	11	15	Percent
Maximum-Signal Power Output	0.35	3.4	4.5	Watts

PUSH-PULL CLASS A_1 AMPLIFIER, VALUES FOR TWO TUBES

	Fixed Bias	Cathode Bias	
Plate Voltage	285	285	Volts
Screen Voltage	285	285	Volts
Grid-Number 1 Voltage	-25.5	---	Volts
Cathode-Bias Resistor	---	400	Ohms
Peak AF Grid-to-Grid Voltage	51	51	Volts
Zero-Signal Plate Current	55	55	Milliamperes
Maximum-Signal Plate Current	72	61	Milliamperes
Zero-Signal Screen Current	9.0	9.0	Milliamperes
Maximum-Signal Screen Current	17	13	Milliamperes
Effective Load Resistance, Plate-to-Plate	12000	12000	Ohms
Total Harmonic Distortion	6	4	Percent
Maximum-Signal Power Output	10.5	9.8	Watts

AVERAGE CHARACTERISTICS, TRIODE CONNECTION§

Plate Voltage	250	Volts
Grid-Number 1 Voltage	-18	Volts
Amplification Factor	6.8	
Plate Resistance, approximate	2500	Ohms
Transconductance	2700	Micromhos
Plate Current	37.5	Milliamperes
Grid-Number 1 Voltage, approximate, I_b = 0.5 Milliampere	-48	Volts

* *Without external shield.*

‡ *Pin 1 omitted on bases B6-81 and B6-84.*

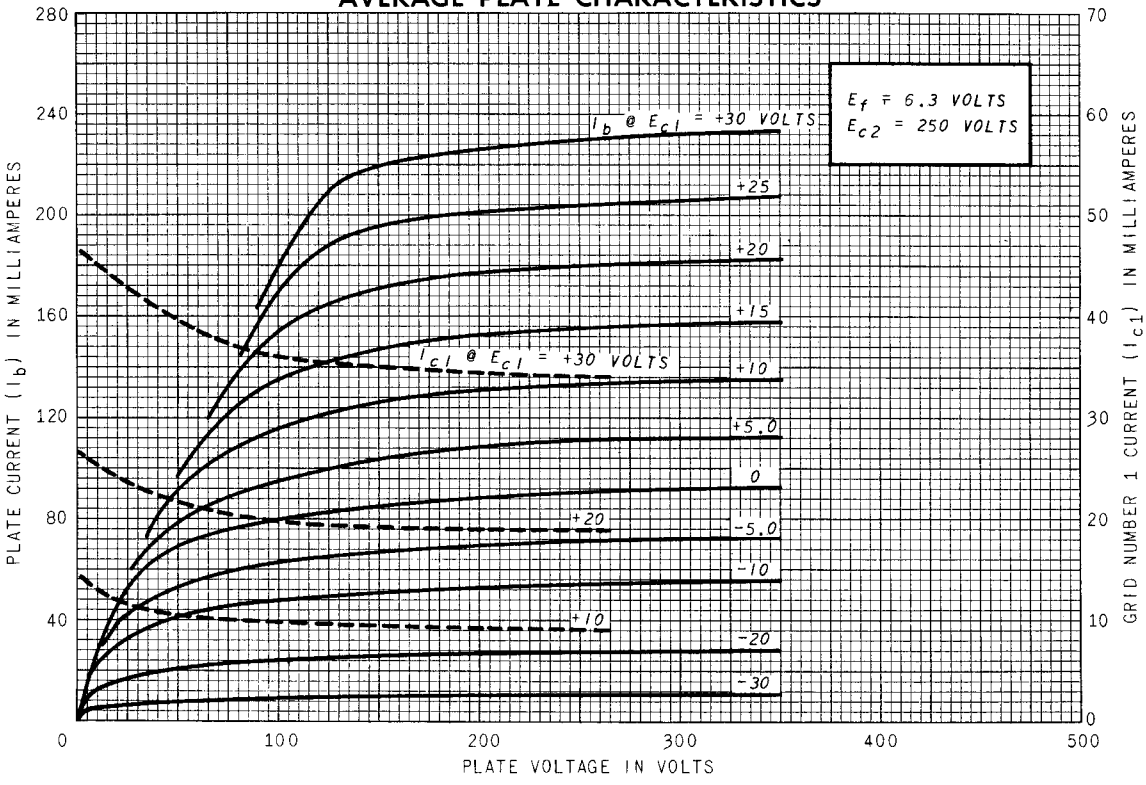
† *For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice for Television Stations; Federal Communications Commission". The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.*

▽ *Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.*

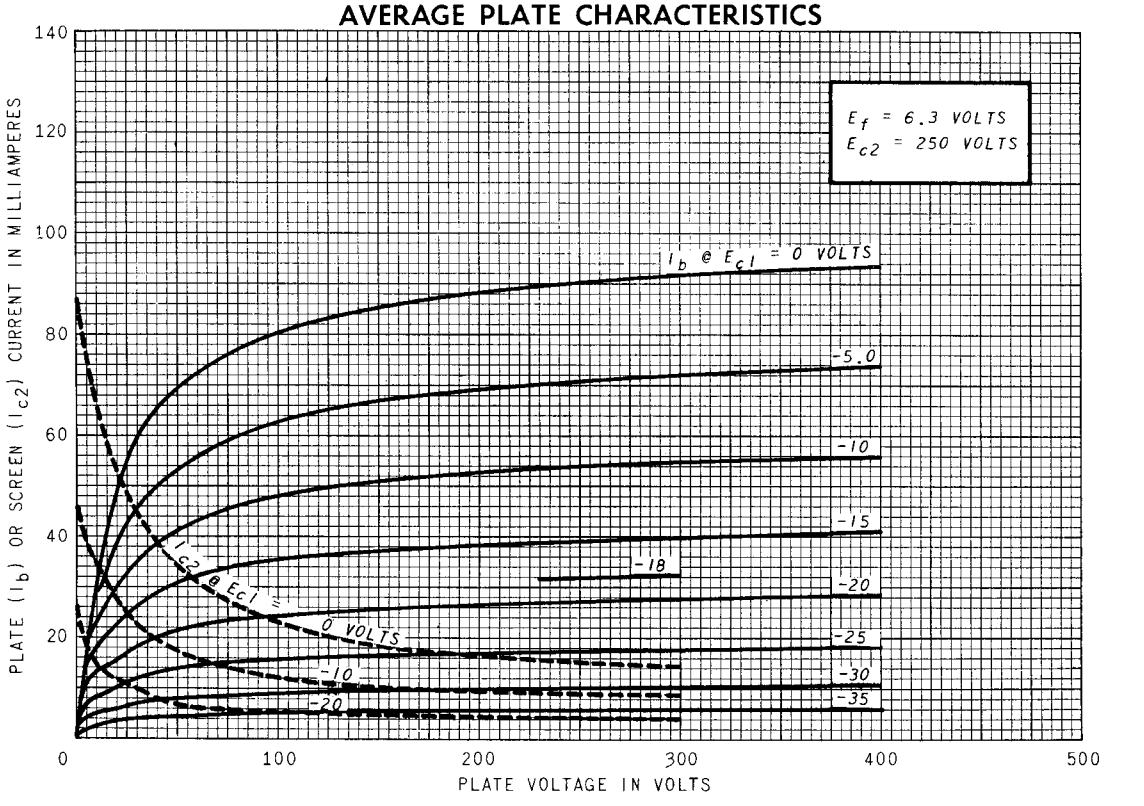
In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

§ *With screen tied to plate.*

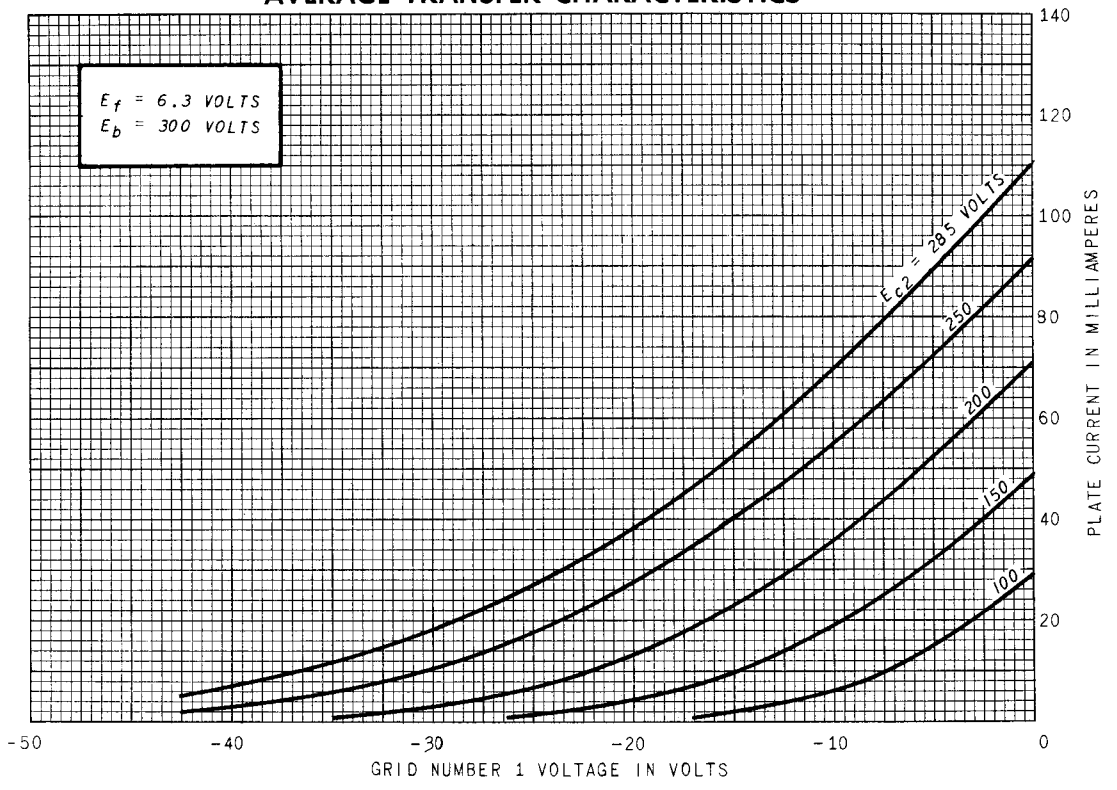
AVERAGE PLATE CHARACTERISTICS



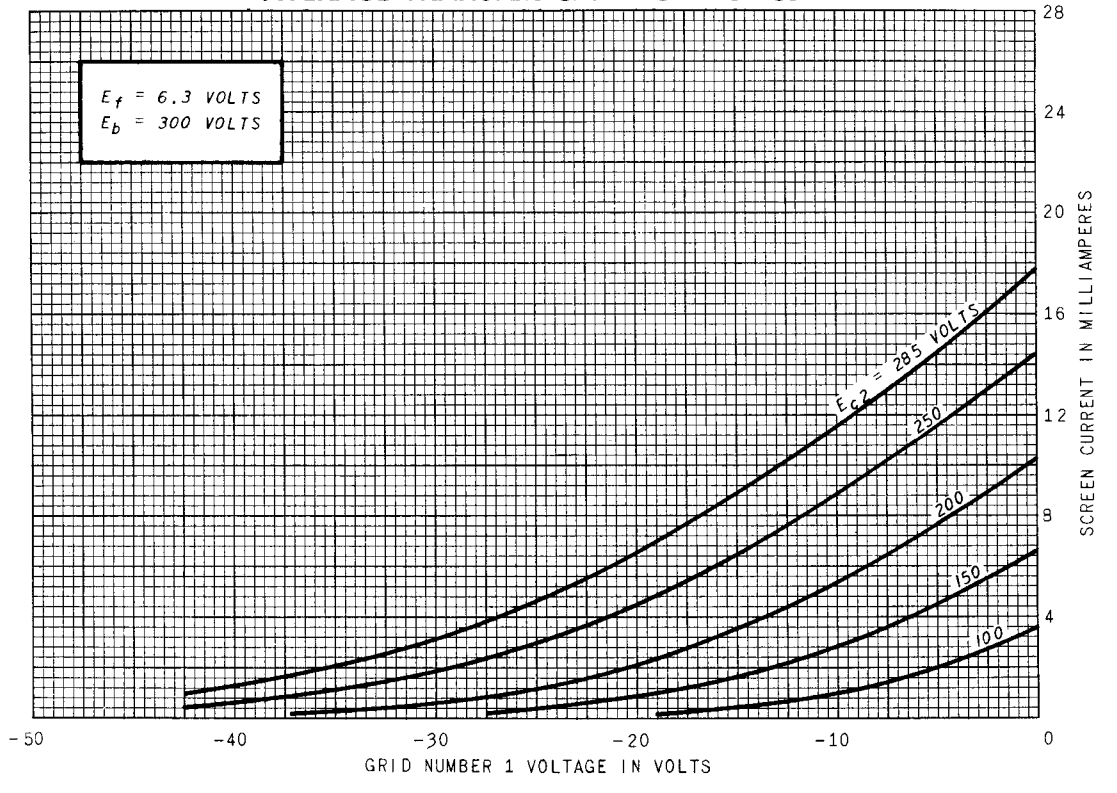
AVERAGE PLATE CHARACTERISTICS



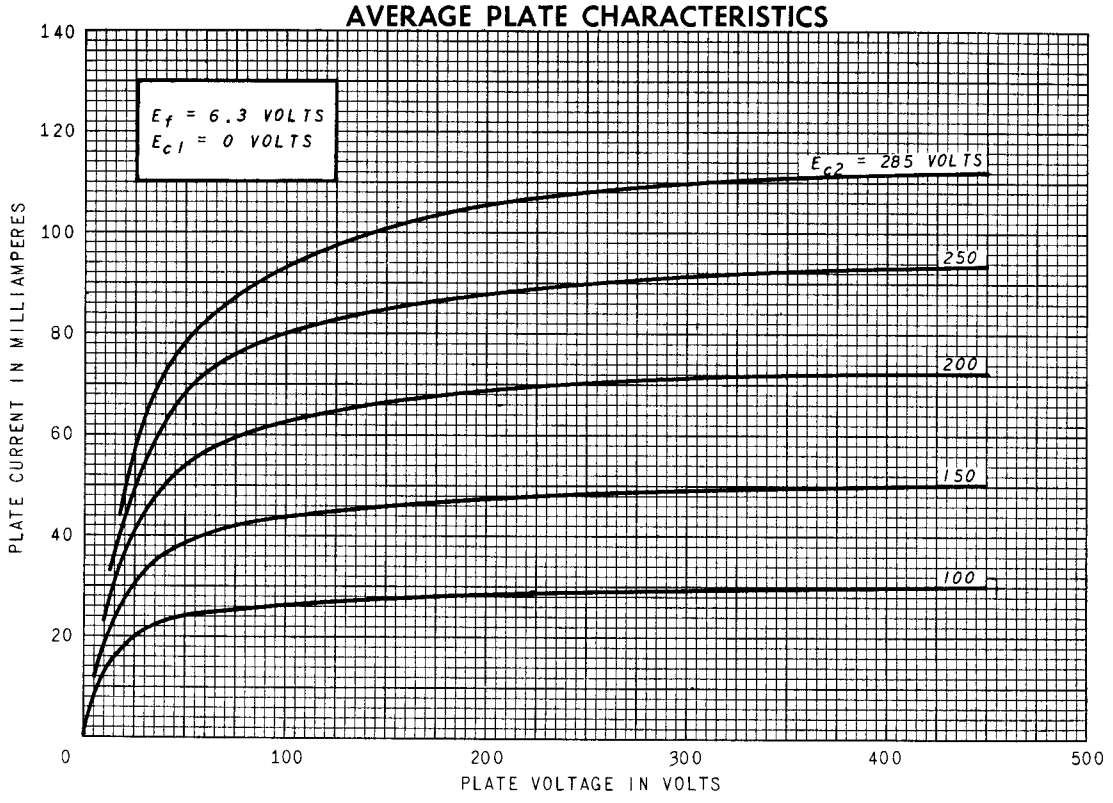
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

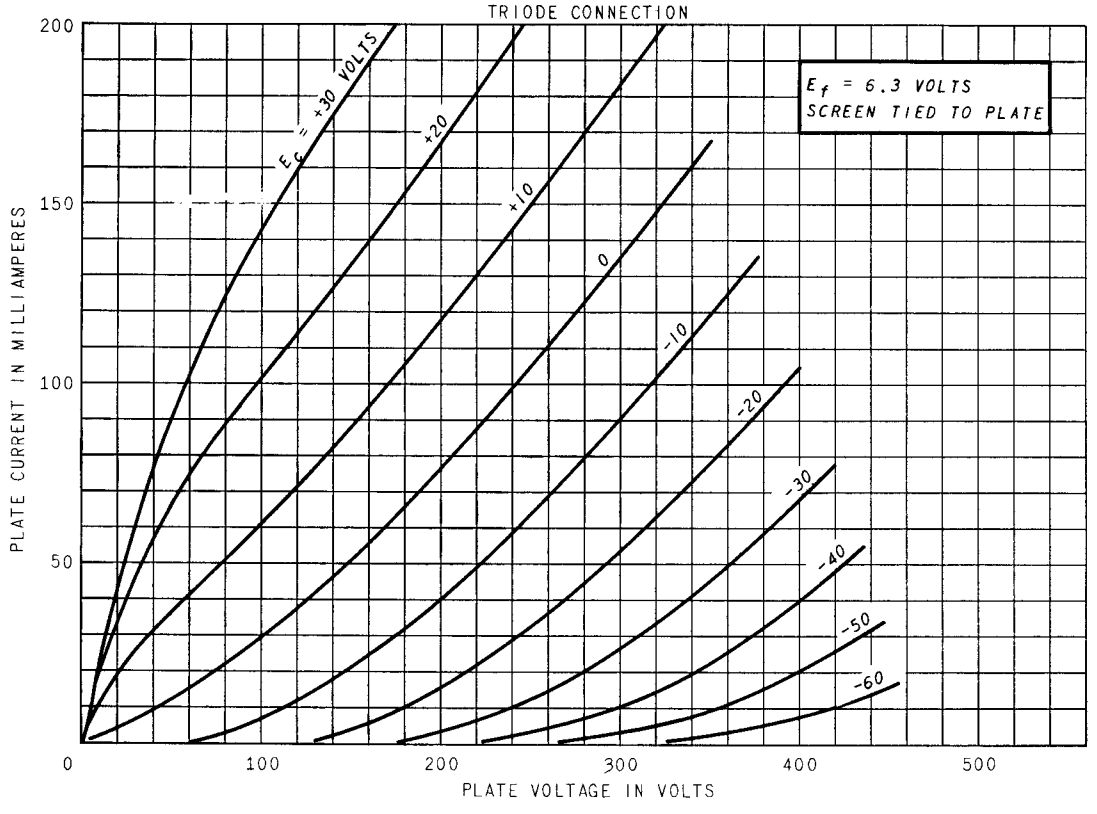


AVERAGE PLATE CHARACTERISTICS

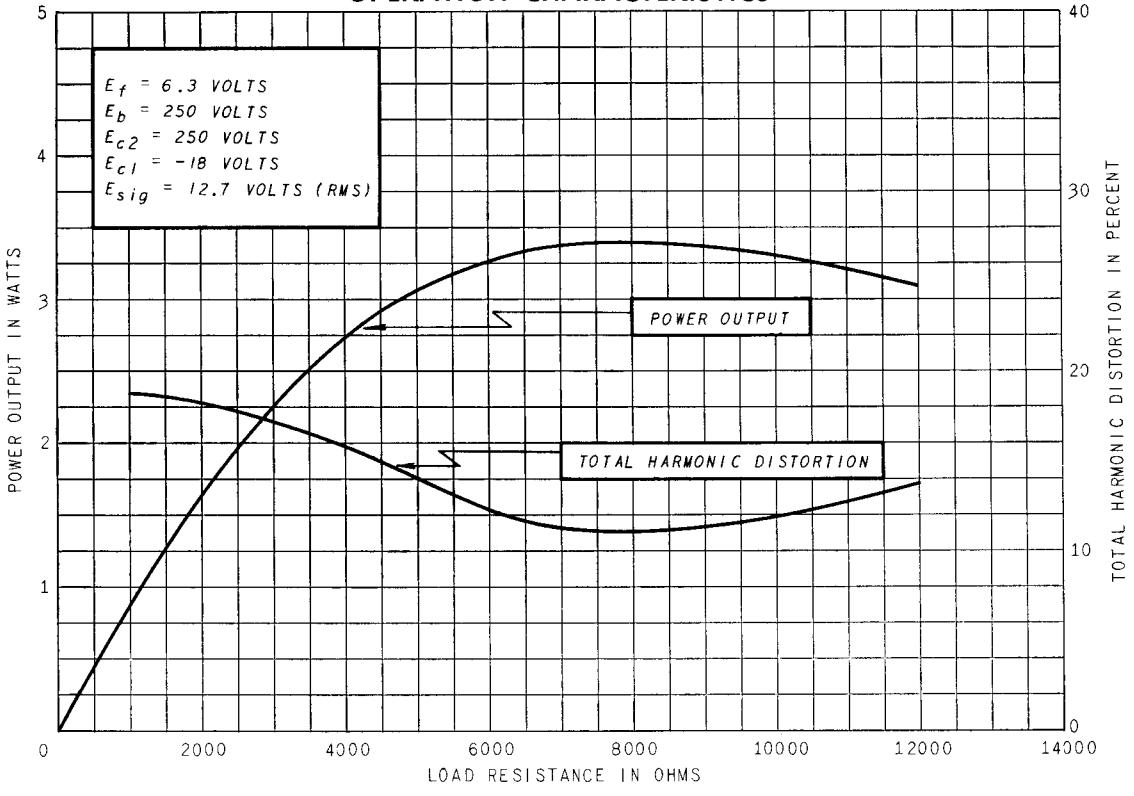


AVERAGE PLATE CHARACTERISTICS

TRIODE CONNECTION



OPERATION CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

Electronic TUBE
KEN-RAD

6K7

Description and Rating

RADIO-FREQUENCY-AMPLIFIER PENTODE

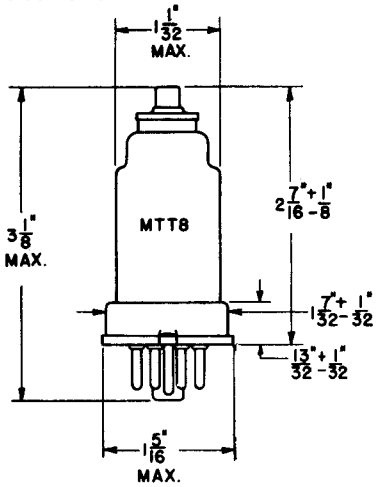
GENERAL DESCRIPTION

Principal Application: The 6K7 is a heater-cathode type pentode amplifier tube with remote cut-off characteristics and is designed for use as a radio-frequency or intermediate-frequency amplifier in a-c or storage battery operated equipment. Except for capacitances the electrical ratings and characteristics of the 6K7 are identical with those of types 78, 6K7-G, and 6K7-GT.

Cathode:	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.3 Ampere
Envelope:	MTT8 Metal Shell
Base:	B7-22 Small Wafer Octal 7-Pin Phenolic
Top Cap:	C1-4 Skirted Miniature

Mounting Position:	Any	
Direct Interelectrode Capacitances: *		
Grid Number 1 to Plate (Max)	0.005	μμf
Input	7	μμf
Output	12	μμf

PHYSICAL DIMENSIONS

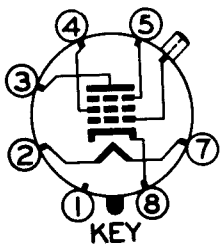


RMA 8-4

TERMINAL CONNECTIONS

Pin 1 - Shell
Pin 2 - Heater
Pin 3 - Plate
Pin 4 - Grid Number 2 (Screen)
Pin 5 - Grid Number 3 (Suppressor)
Pin 7 - Heater
Pin 8 - Cathode
Top Cap - Grid Number 1

BASING DIAGRAM



RMA 7R
BOTTOM VIEW

MAXIMUM RATINGS

	Design Center	Absolute	
Plate Voltage	300	330	Volts
Screen (Grid Number 2) Voltage	125	140	Volts
Screen Supply Voltage	300	330	Volts
Grid Bias Voltage	Never Positive		
Plate Dissipation	2.75	3.03	Watts
Screen Dissipation	0.35	0.39	Watt
D-C Heater-Cathode Voltage	90	100	Volts

** With metal shell connected to cathode.*

CHARACTERISTICS AND TYPICAL OPERATION

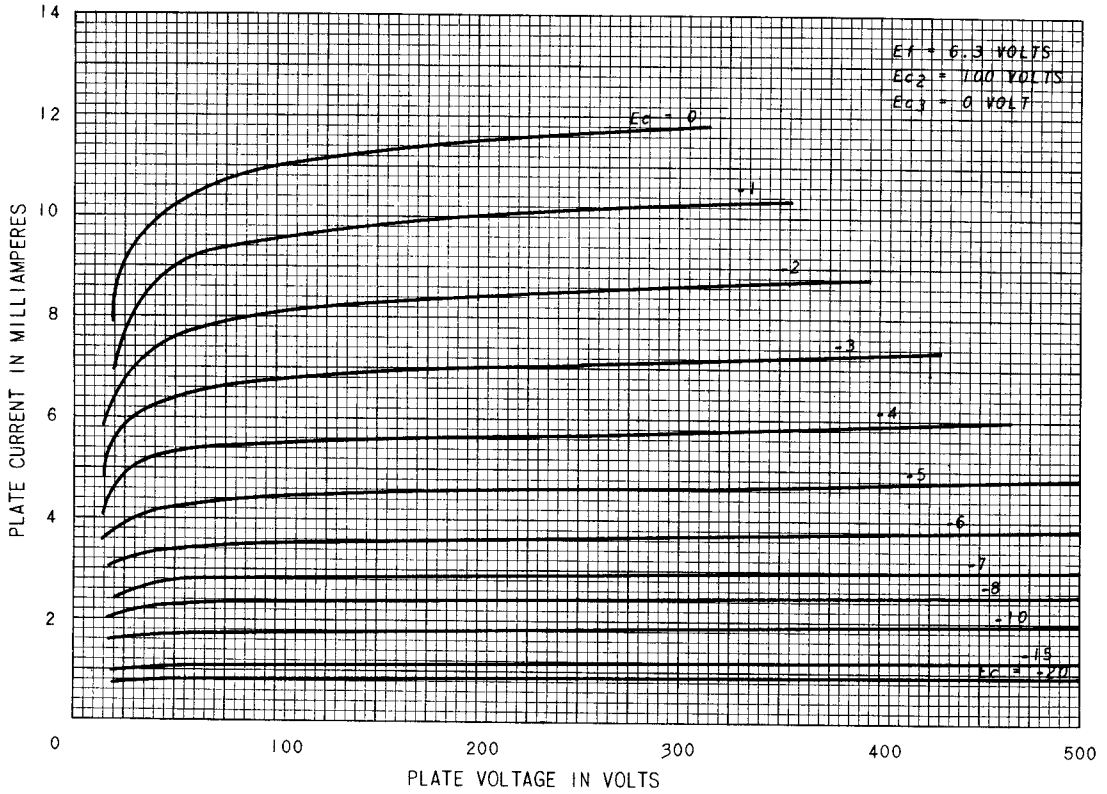
CLASS A AMPLIFIER

Heater Voltage	6.3	6.3	6.3	Volts
Plate Voltage	100	250	250	Volts
Screen Voltage	100	100	125	Volts
Suppressor Voltage **	0	0	0	Volt
Grid Bias Voltage	-1	-3	-3	Volts
Plate Resistance (Approx)	0.15	0.8	0.6	Megohm
Transconductance	1650	1450	1650	Micromhos
Grid Bias Voltage §	-38.5	-42.5	-52.5	Volts
Plate Current	9.5	7.0	10.5	Milliamperes
Screen Current	2.7	1.7	2.7	Milliamperes

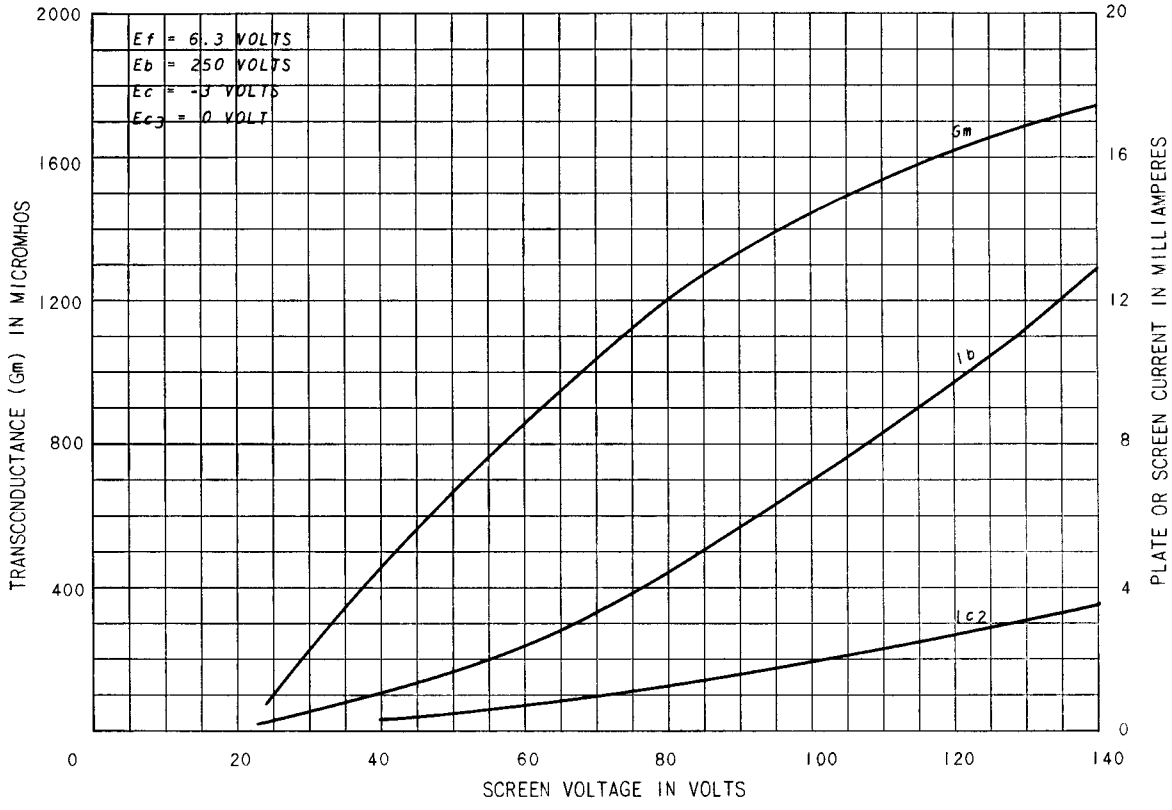
*** Connected to cathode at socket terminal.*

§ Approximate values required to reduce transconductance to 2 micromhos.

AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

Compactron Beam Pentode

6KD6

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

- COLOR TV TYPE
- 33 WATTS PLATE DISSIPATION
- 280 VOLTS B+
- 400 MILLIAMPERES DC CATHODE CURRENT
- OVER 1 AMPERE PEAK CURRENT

The 6KD6 is a compactron beam-power pentode primarily designed for use as the horizontal-deflection amplifier in color television receivers. It is characterized by having a very low knee with a very high peak current of over an ampere. This results in a basic capability to scan 90-degree large screen color picture tubes at 25 KV from 280-volt power supplies. Its low knee minimizes "snivets" without the necessity of supplying special voltages to the beam plates.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	2.85	Amperes

Direct Interelectrode Capacitances, approximate§

Grid-Number 1 to Plate:		
(g1 to p)	0.8	pf
Input: g1 to (h + k + g2 + b.p.)	40	pf
Output: p to (h + k + g2 + b.p.)	16	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Top Cap - C1-2, Skirted Miniature
Outline Drawing - EIA 12-118

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	4.625	Inches
Maximum Seated Height	4.250	Inches
Minimum Seated Height	4.000	Inches

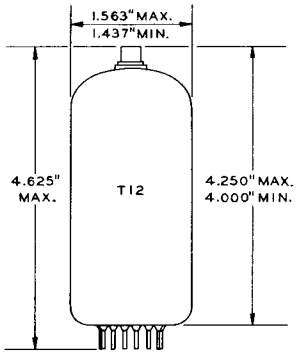
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

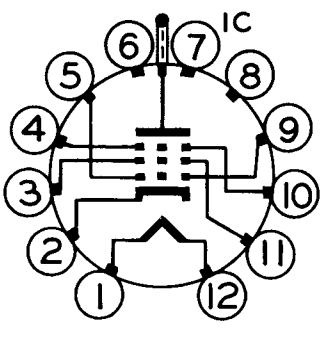


EIA 12-118

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid Number 2 (Screen)
Pin 4 - Beam Plates
Pin 5 - Grid Number 1
Pin 6 - No Connection
Pin 7 - Internal Connection - Do Not Use
Pin 8 - No Connection
Pin 9 - Grid Number 1
Pin 10 - Beam Plates
Pin 11 - Grid Number 2 (Screen)
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12GW

GENERAL ELECTRIC

Supersedes Pages 1 and 2 of 6KD6 PI Sheet dated 1-67

MAXIMUM RATINGS (Cont'd)

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE¶ —
DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

DC Plate-Supply Voltage (Boost + DC Power Supply)	990	Volts
Peak Positive Pulse Plate Voltage	7000	Volts
Positive DC Beam Plate Voltage	20	Volts
Screen Voltage	200	Volts
Peak Negative Grid-Number 1 Voltage	250	Volts
Plate Dissipation# (Absolute-Maximum Value)	33	Watts
Screen Dissipation	5.0	Watts
DC Cathode Current	400	Milliamperes
Peak Cathode Current	1400	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	2.2	Megohms
Beam Plate Circuit Resistance	0.01	Megohms
Bulb TemperatureΔ	225	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	45	60	150	Volts
Beam Plates Connected to Cathode at Socket					
Screen Voltage	110	160	110	110	Volts
Grid-Number 1 Voltage	---	0	0	-22.5	Volts
Plate Resistance, approximate	---	---	---	6000	Ohms
Transconductance	---	---	---	14000	Micromhos
Plate Current	---	1100**	780**	100	Milliamperes
Screen Current	---	110**	44**	2.0	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 1.0 Milliamperes	-125	---	---	-40	Volts
Triode Amplification Factor‡‡	---	---	---	4.0	

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ For operation in a 525-line, 30-frame television system described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

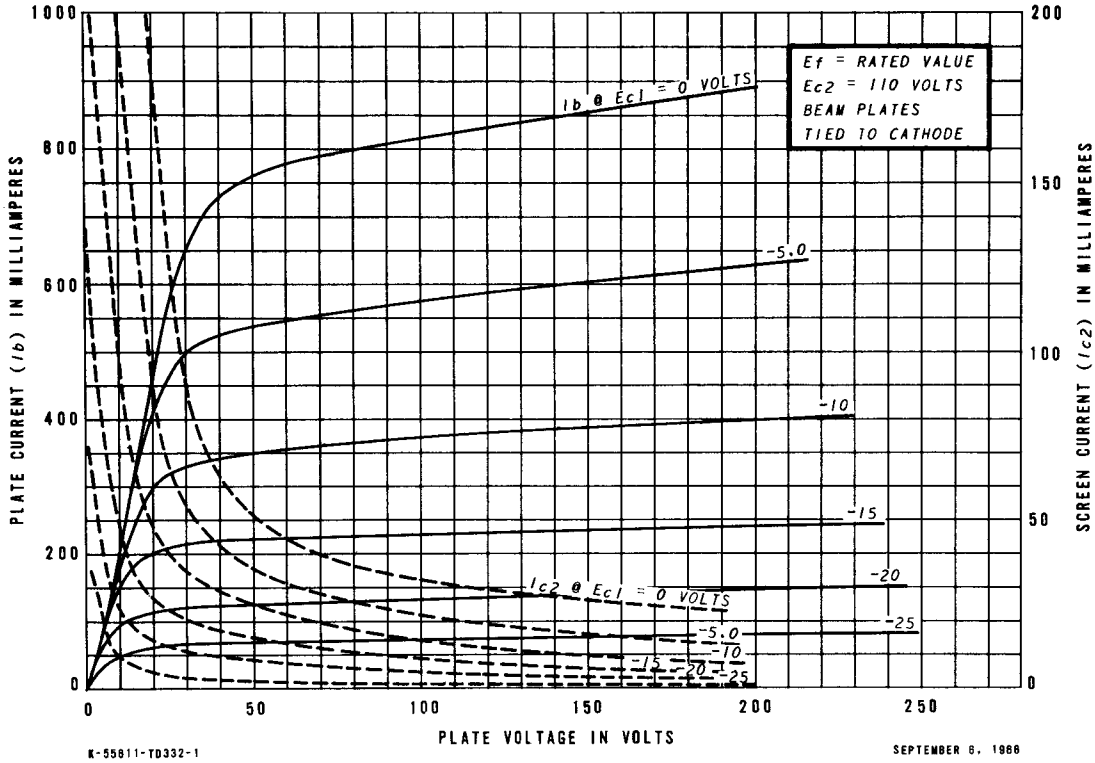
\# In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Δ Measured using a thermocouple attached to a 0.1-inch wide phosphor-bronze ring placed at the hottest location on the bulb.

** Values measured by a method involving a recurrent waveform such that the plate and screen dissipations will be kept within ratings in order to prevent damage to the tube.

‡‡ Triode connection (screen tied to plate) with Eb = Ec2 = 150 volts, and Ec1 = -22.5 volts.

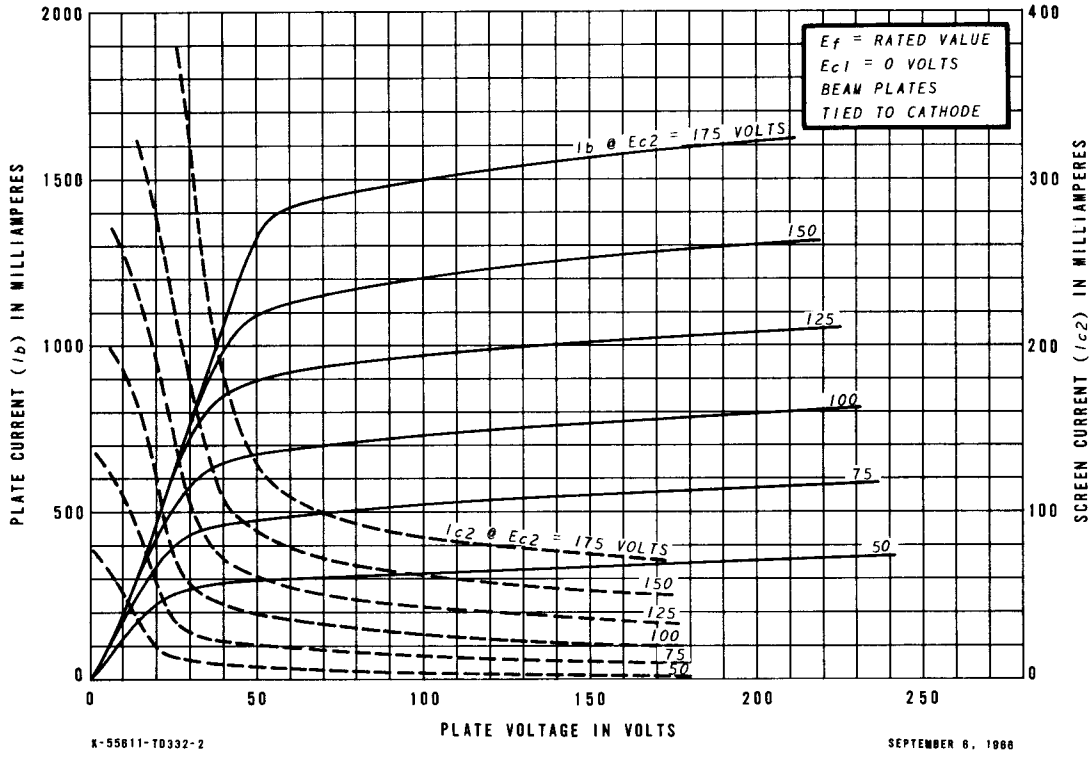
AVERAGE PLATE CHARACTERISTICS



K-55811-TD332-1

SEPTEMBER 6, 1966

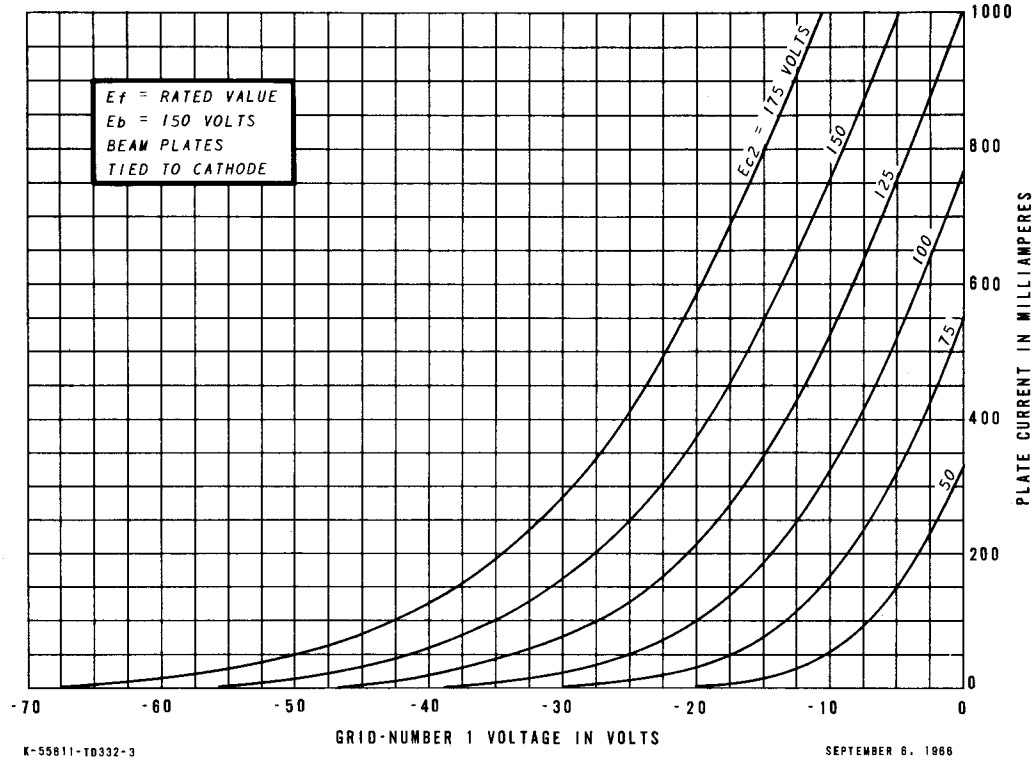
AVERAGE PLATE CHARACTERISTICS



K-55811-TD332-2

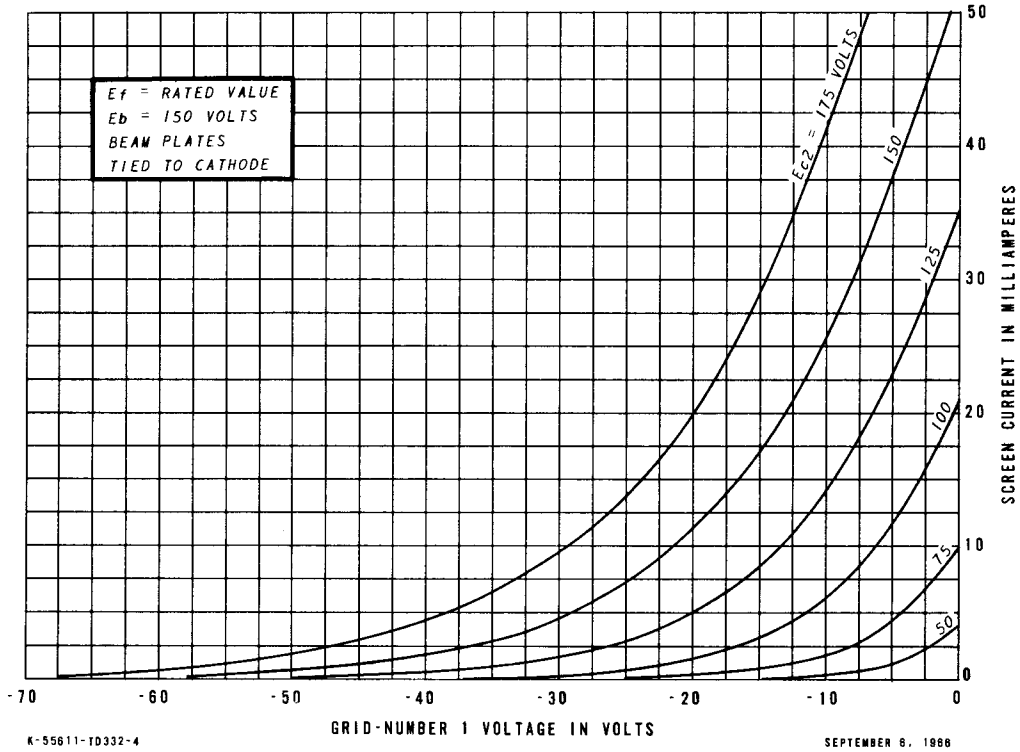
SEPTEMBER 6, 1966

AVERAGE TRANSFER CHARACTERISTICS



K-55811-TD332-3 SEPTEMBER 6, 1966

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD332-4 SEPTEMBER 6, 1966

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

6KR8

TRIODE-PENTODE

DESCRIPTION AND RATING

The 6KR8 is a miniature triode-pentode containing a medium-mu triode and a sharp-cutoff pentode. The pentode is intended for use as a video amplifier and the triode for general-purpose use.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

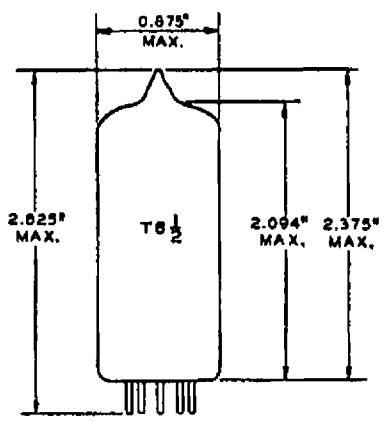
Heater Characteristics and Ratings		
Heater Voltage, AC or DC* . .	6.3±0.6	Volts
Heater Current†	0.75	Amperes
Direct Interelectrode Capacitances‡		
Pentode Section		
Grid-Number 1 to Plate:		
(Pg1 to Pp)	0.075	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.)	13	pf
Output: Pp to (h + Pk + Pg2 + Pg3 + i.s.)	4.4	pf
Triode Section		
Grid to Plate: (Tg to Tp) . .	2.6	pf
Input: Tg to (h + Tk + Pk + Pg3 + i.s.)	3.0	pf
Output: Tp to (h + Tk + Pk + Pg3 + i.s.)	4.2	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-3

Maximum Diameter	0.875	Inches
Maximum Over-all Length. . .	2.625	Inches
Maximum Seated Height . . .	2.375	Inches

PHYSICAL DIMENSIONS

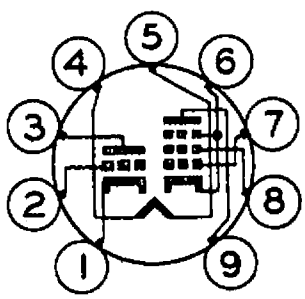


EIA 6-3

TERMINAL CONNECTIONS

Pin 1 - Triode Cathode
Pin 2 - Triode Grid
Pin 3 - Triode Plate
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 7 - Pentode Grid Number 1
Pin 8 - Pentode Grid Number 2 (Screen)
Pin 9 - Pentode Plate

BASING DIAGRAM



EIA 9DX

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

from JEDEC release #4188, March 18, 1963

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	5.0	2.0	Watts
Screen Dissipation	1.1	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.5	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section		Triode Section	
Plate Voltage	35	200	125	Volts
Screen Voltage	100	100	---	Volts
Grid-Number 1 Voltage	0	---	---	Volts
Cathode-Bias Resistor	---	82	68	Ohms
Amplification Factor	---	---	46	
Plate Resistance, approximate	---	60000	4400	Ohms
Transconductance	---	20000	10400	Micromhos
Plate Current	54	19.5	15	Milliamperes
Screen Current	13.5	3.0	---	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes		---	-8	Volts
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes		-4.4	---	Volts

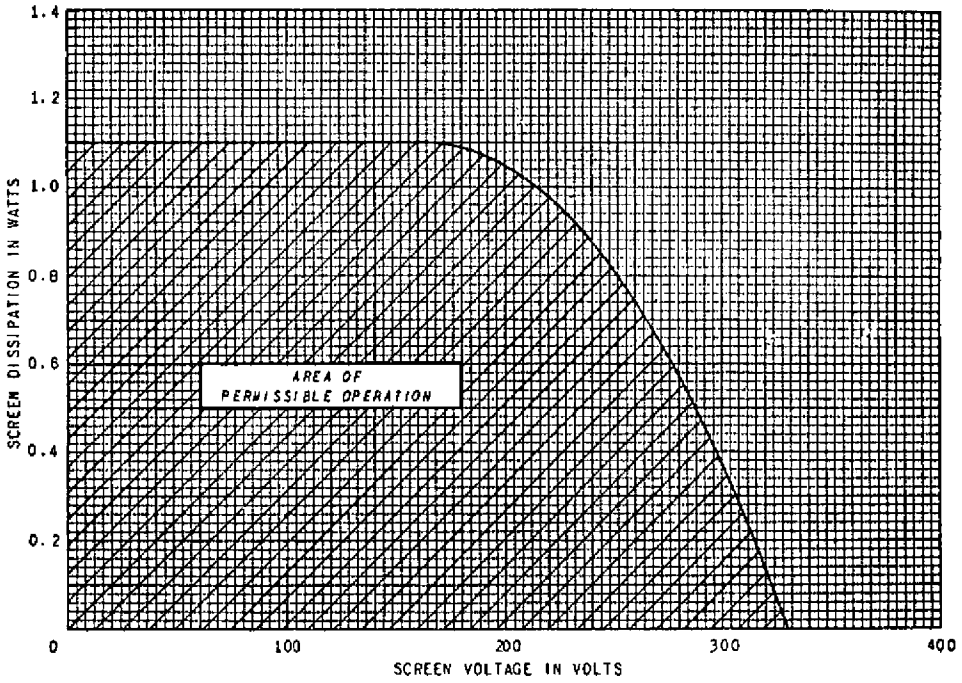
FOOTNOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield

SCREEN RATING CHART



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

—PRODUCT INFORMATION—

Triode-Pentode

6KR8-A

The 6KR8-A is a miniature triode-pentode containing a medium-mu triode and a sharp-cutoff pentode. The pentode is intended for use as a video amplifier and the triode for general-purpose use.

The 6KR8-A is unilaterally interchangeable with the 6KR8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.75	Amperes

Direct Interelectrode Capacitances§

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.075	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.)	13	pf
Output: Pp to (h + Pk + Pg2 + Pg3 + i.s.)	4.4	pf

Triode Section

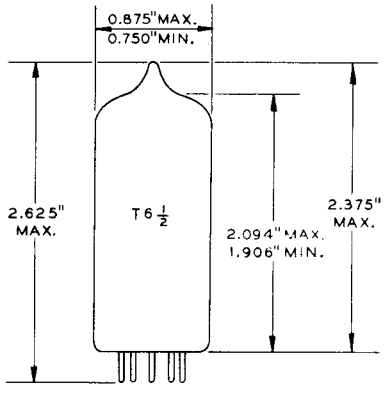
Grid to Plate: (Tg to Tp)	2.6	pf
Input: Tg to (h + Tk + Pk + Pg3 + i.s.)	4.2	pf
Output: Tp to (h + Tk + Pk + Pg3 + i.s.)	3.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-3

Maximum Diameter	0.875	Inches
Minimum Diameter	0.750	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.375	Inches

PHYSICAL DIMENSIONS

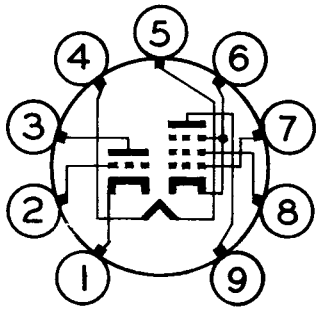


EIA 6-3

TERMINAL CONNECTIONS

Pin 1 - Triode Cathode
Pin 2 - Triode Grid
Pin 3 - Triode Plate
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 7 - Pentode Grid Number 1
Pin 8 - Pentode Grid Number 2 (Screen)
Pin 9 - Pentode Plate

BASING DIAGRAM



EIA 9DX

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	5.0	2.0	Watts
Screen Dissipation	1.5	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.01	0.5	Megohms
With Cathode Bias	0.01	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Pentode Section		Triode Section	
Plate Voltage	35	200	125	Volts
Screen Voltage	100	100	---	Volts
Grid-Number 1 Voltage	0	---	---	Volts
Cathode-Bias Resistor	---	82	68	Ohms
Amplification Factor	---	---	46	
Plate Resistance, approximate	---	60000	4400	Ohms
Transconductance	---	20000	10400	Micromhos
Plate Current	54	19.5	15	Milliamperes
Screen Current	13.5	3.0	---	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 10 Microamperes	---	---	-8	Volts
Grid-Number 1 Voltage, approximate				
Ib = 100 Microamperes	---	-6.3	---	Volts

NOTES

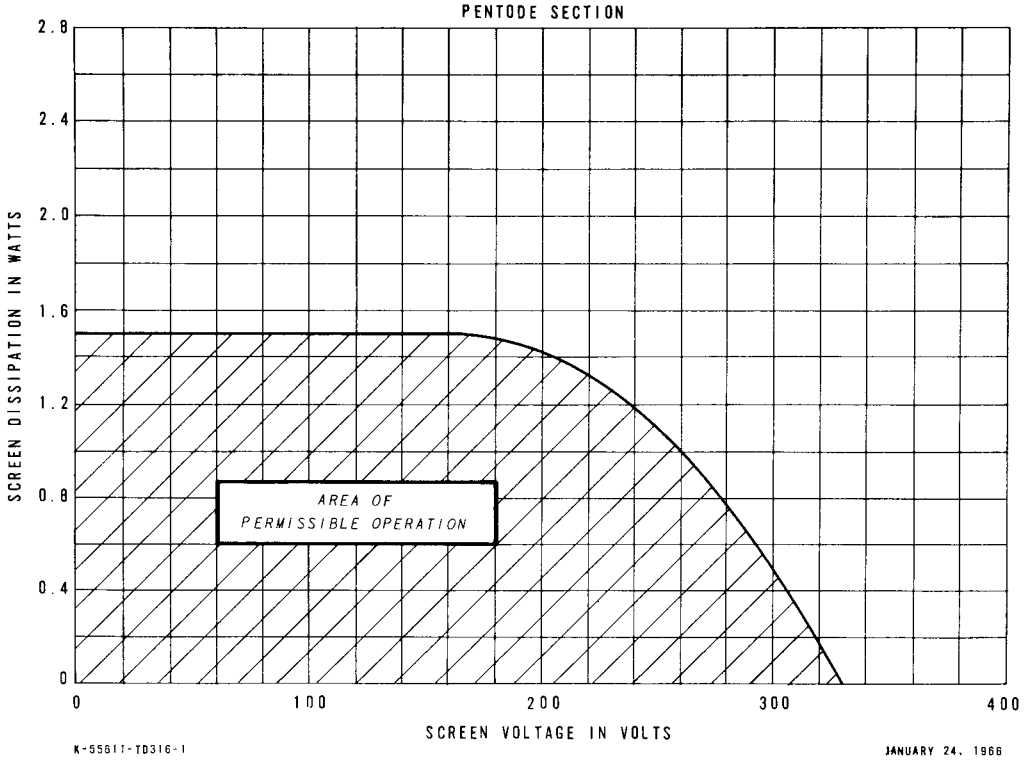
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

SCREEN RATING CHART

PENTODE SECTION

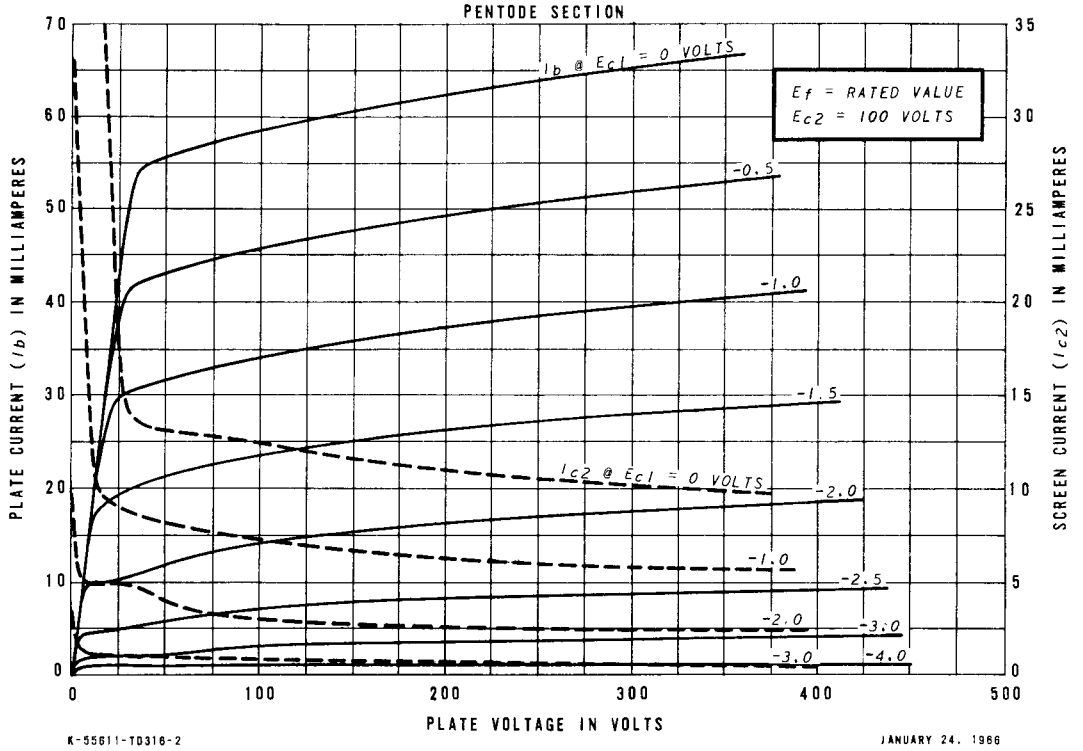


K-55611-TD316-1

JANUARY 24, 1966

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

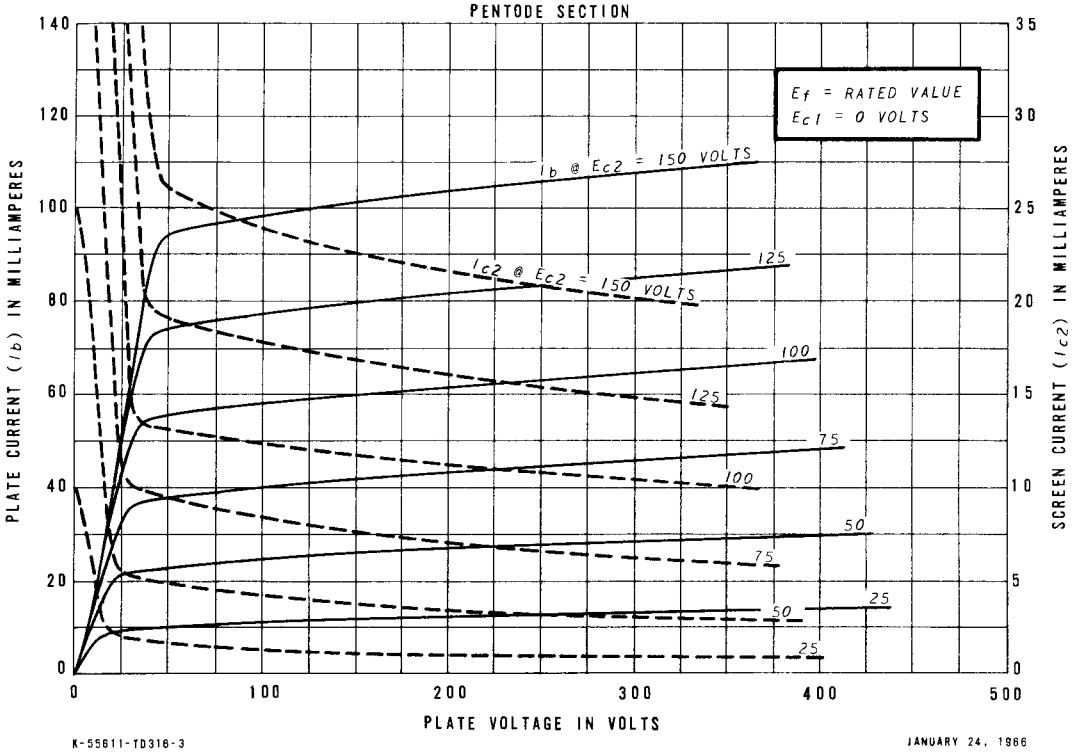


K-55611-TD316-2

JANUARY 24, 1966

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

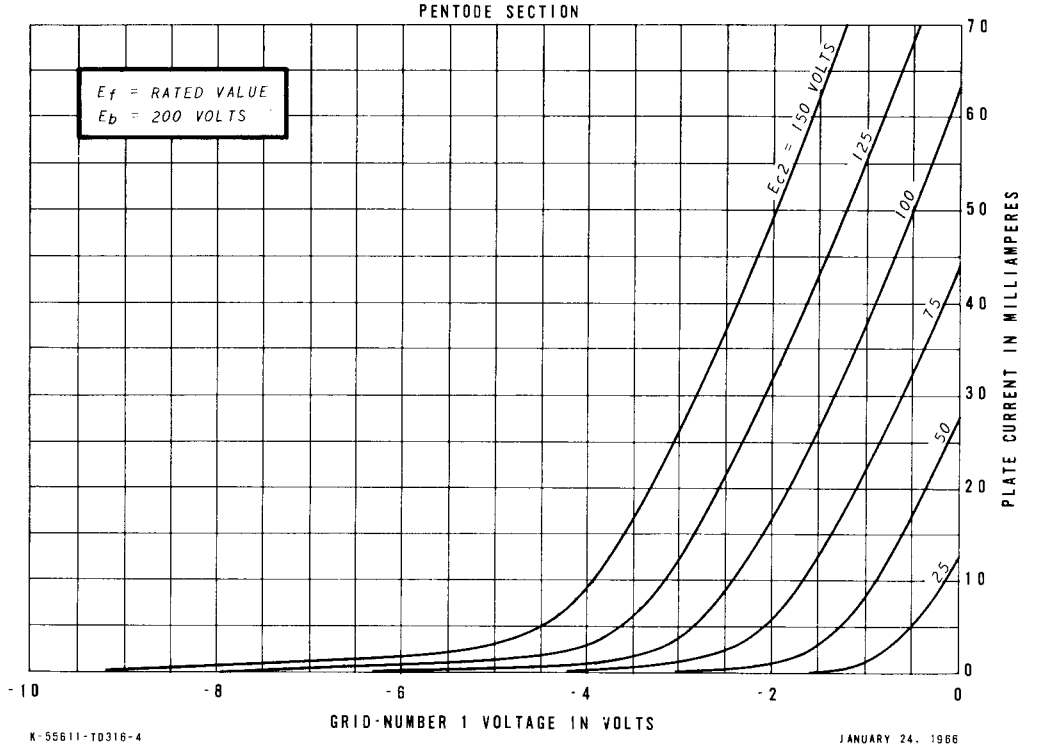


K-55611-TD316-3

JANUARY 24, 1966

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

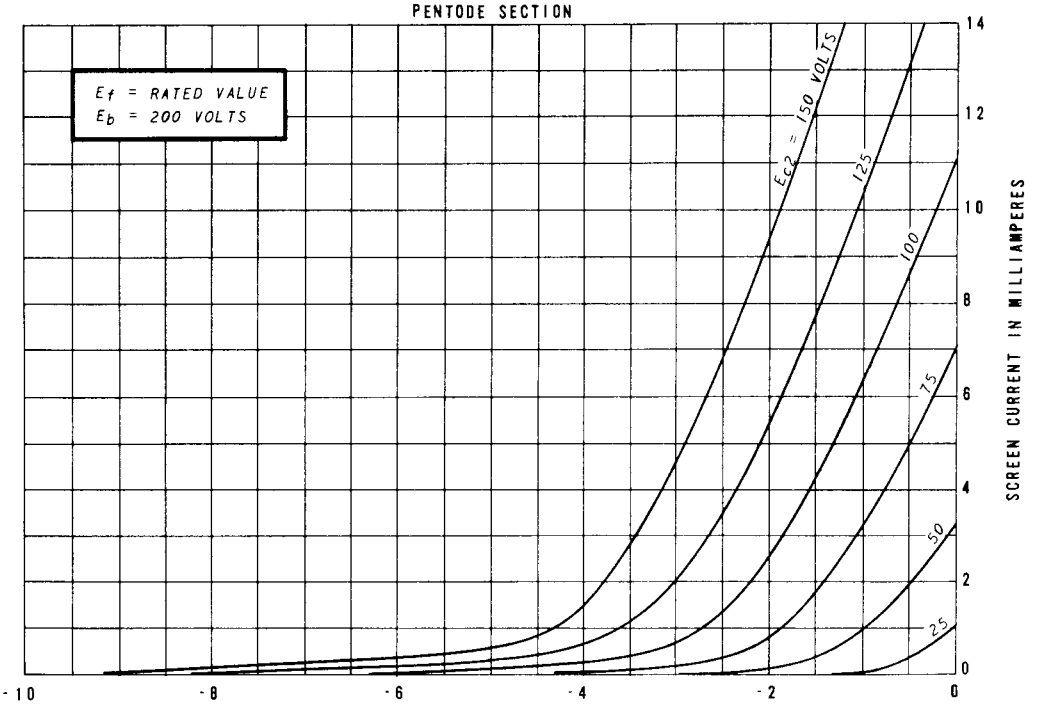


K-55611-TD316-4

JANUARY 24, 1966

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

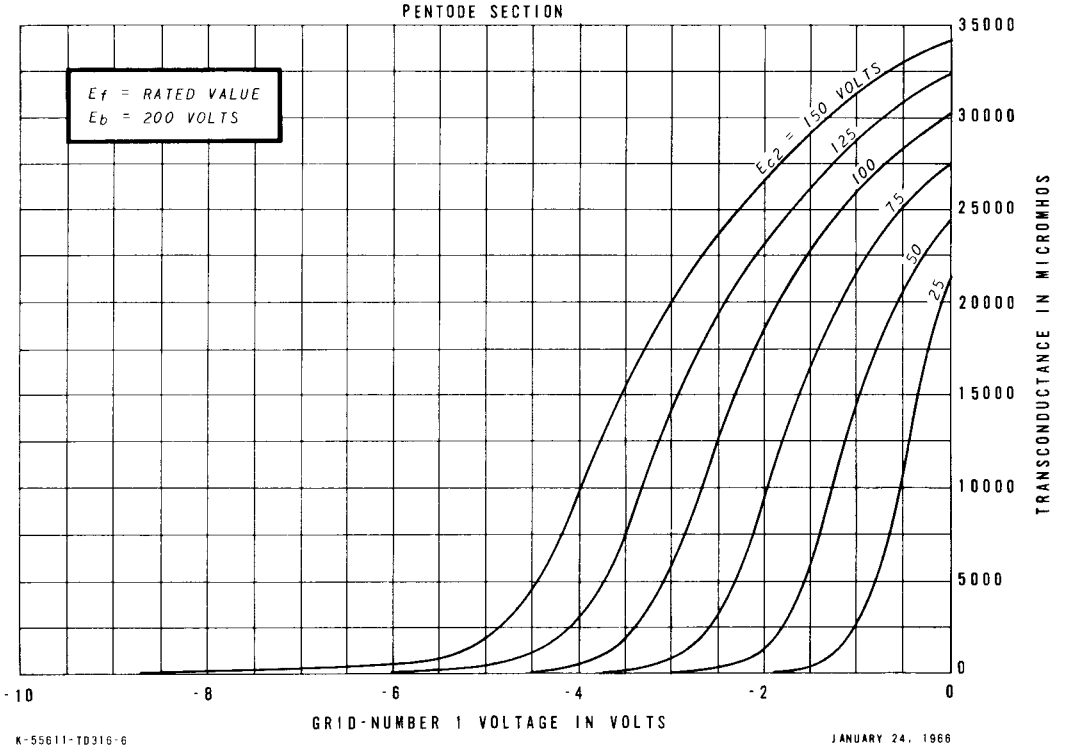


K-55611-TD316-5

JANUARY 24, 1966

AVERAGE TRANSFER CHARACTERISTICS

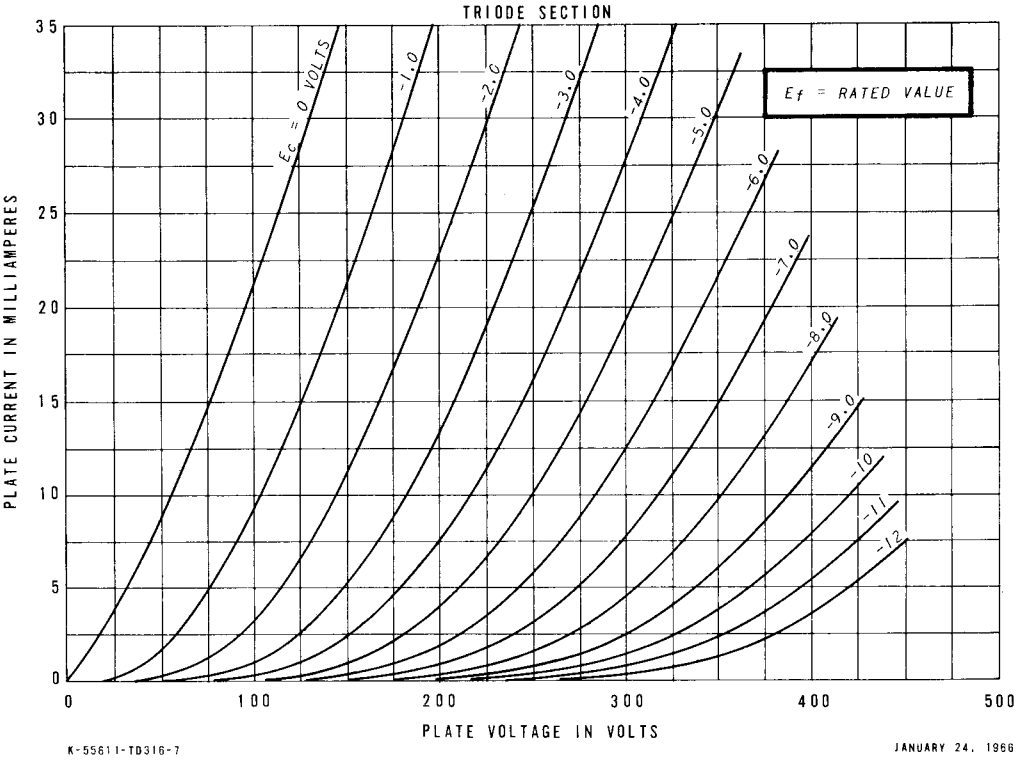
PENTODE SECTION



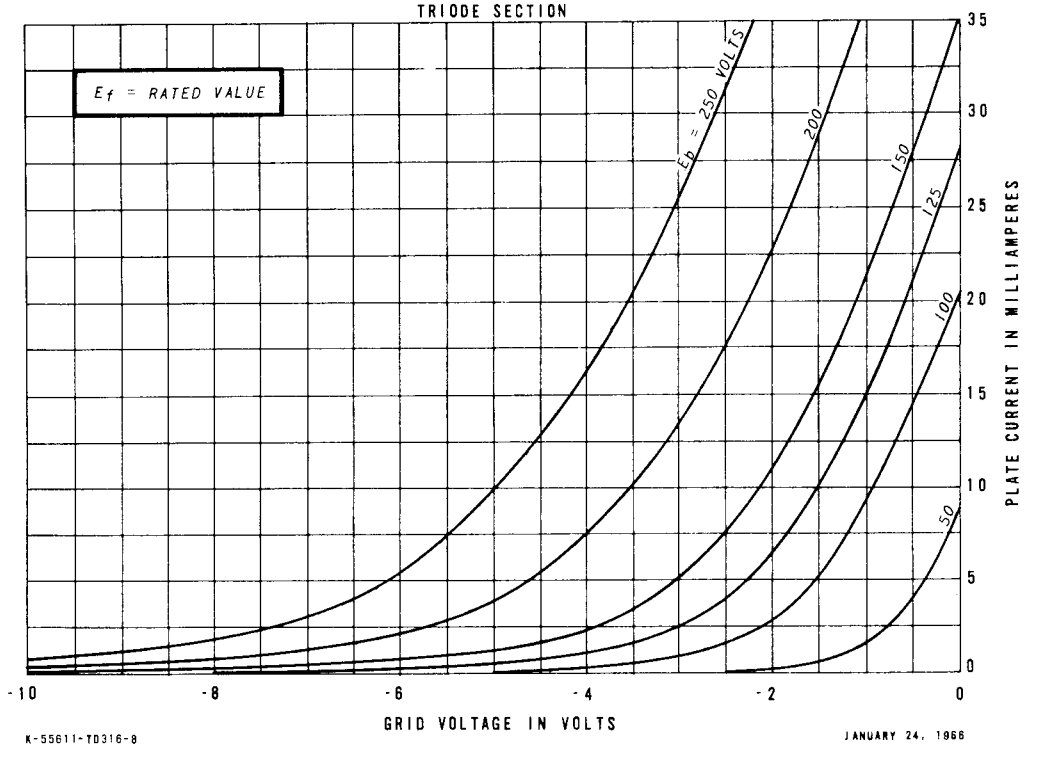
K-55611-TD316-6

JANUARY 24, 1966

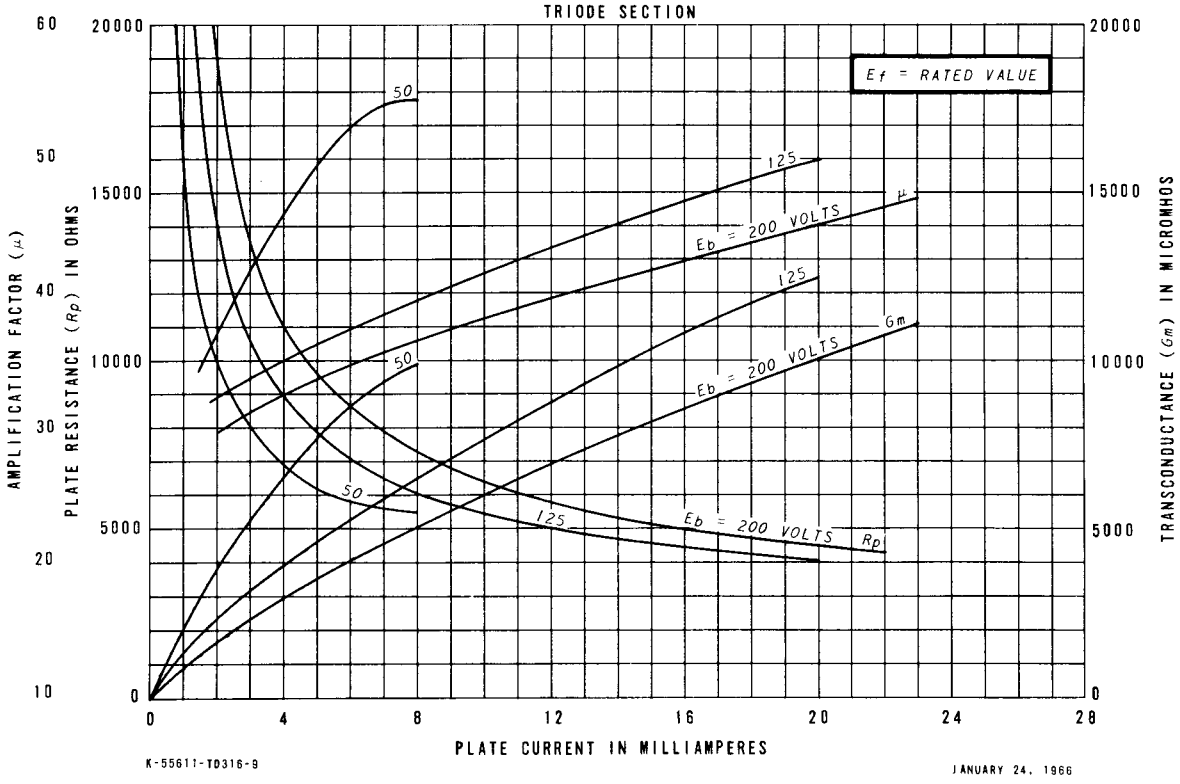
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



ELECTRONIC INNOVATIONS IN ACTION

TUBES

PRODUCT INFORMATION

Gated-Beam Discriminator

FOR FM AND TV LIMITER AND DISCRIMINATOR APPLICATIONS

6KS6

The 6KS6 is a miniature gated-beam tube primarily designed to perform the combined functions of the limiter, discriminator, and audio-voltage amplifier in FM and television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.3	Amperes
Direct Interelectrode Capacitances§		
Grid-Number 1 to All	4.6	pf
Grid-Number 3 to All	3.4	pf
Grid-Number 1 to Grid-Number 3, maximum	0.005	pf

MECHANICAL

Operating Position - Any
Envelope - T-5 1/2, Glass
Base - E7-1, Miniature Button 7-Pin
Outline Drawing - EIA 5-3

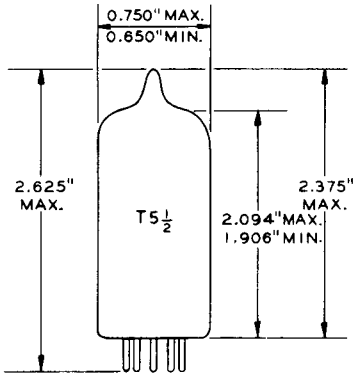
Maximum Diameter	0.750	Inches
Minimum Diameter	0.650	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.375	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate-Supply Voltage	330	Volts
Accelerator-Supply Voltage	330	Volts
Peak Positive Grid-Number 1 Voltage	60	Volts
DC Cathode Current	13	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

PHYSICAL DIMENSIONS

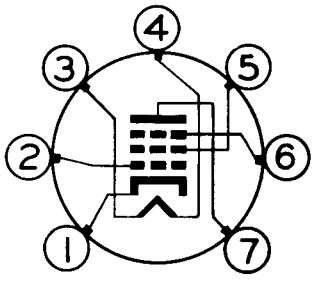


EIA 5-3

TERMINAL CONNECTIONS

Pin 1 - Cathode, Focus Electrode, and Internal Shield
Pin 2 - Grid Number 1 (Signal or Limiter)
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Grid Number 2 (Accelerator)
Pin 6 - Grid Number 3 (Quadrature)
Pin 7 - Plate

BASING DIAGRAM



EIA 7DF

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MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	135	135	135	Volts
Accelerator Voltage	75	---	---	Volts
Accelerator-Supply Voltage	---	280	280	Volts
Accelerator Resistor	---	33000	33000	Ohms
Grid-Number 1 Voltage	0	0	0	Volts
Grid-Number 3 Voltage	+4.0	+4.0	0	Volts
Plate Current	---	5.0	---	Milliamperes
Accelerator Current	4.5	---	---	Milliamperes
Grid-Number 1 Transconductance	---	---	360	Micromhos
Grid-Number 3 Transconductance	---	---	700	Micromhos
Grid-Number 1 Voltage, approximate Ib = 20 Microamperes	---	---	-4	Volts
Grid-Number 3 Voltage, approximate Ib = 20 Microamperes	---	---	-4	Volts

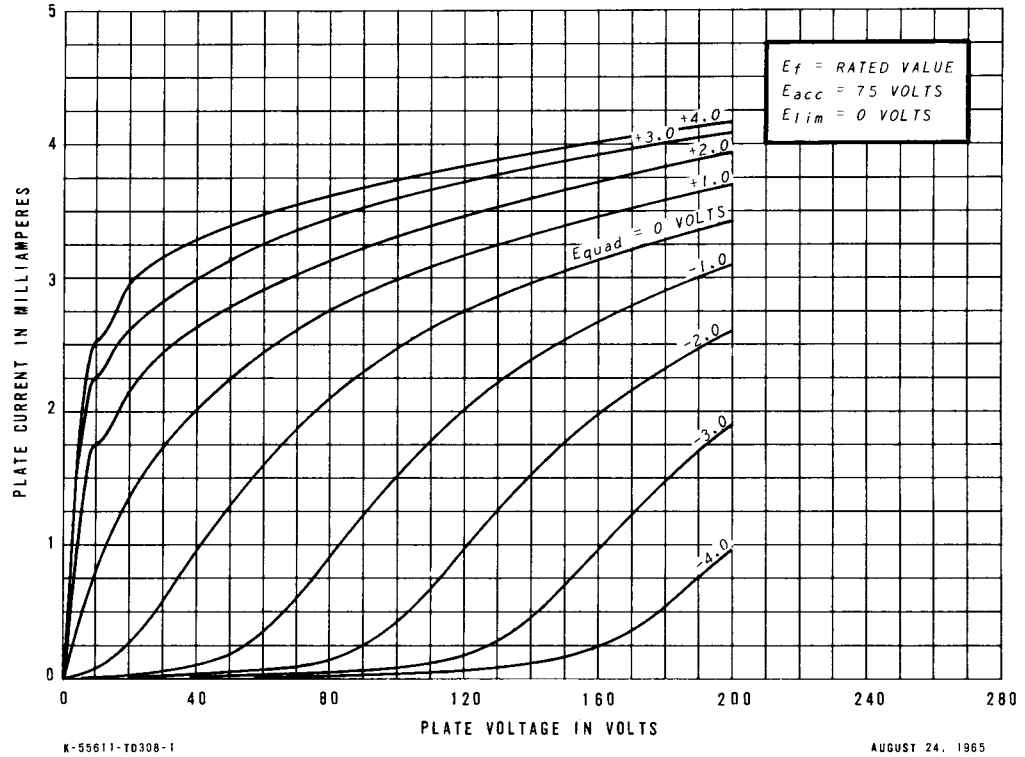
NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

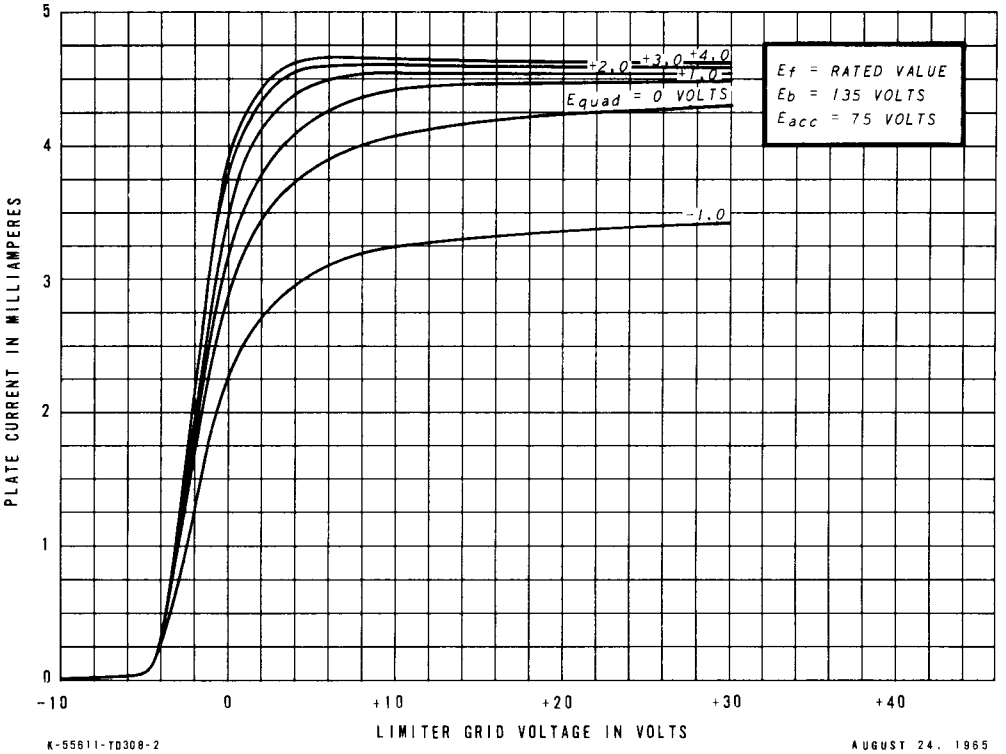
AVERAGE PLATE CHARACTERISTICS



K-55611-TD308-1

AUGUST 24, 1965

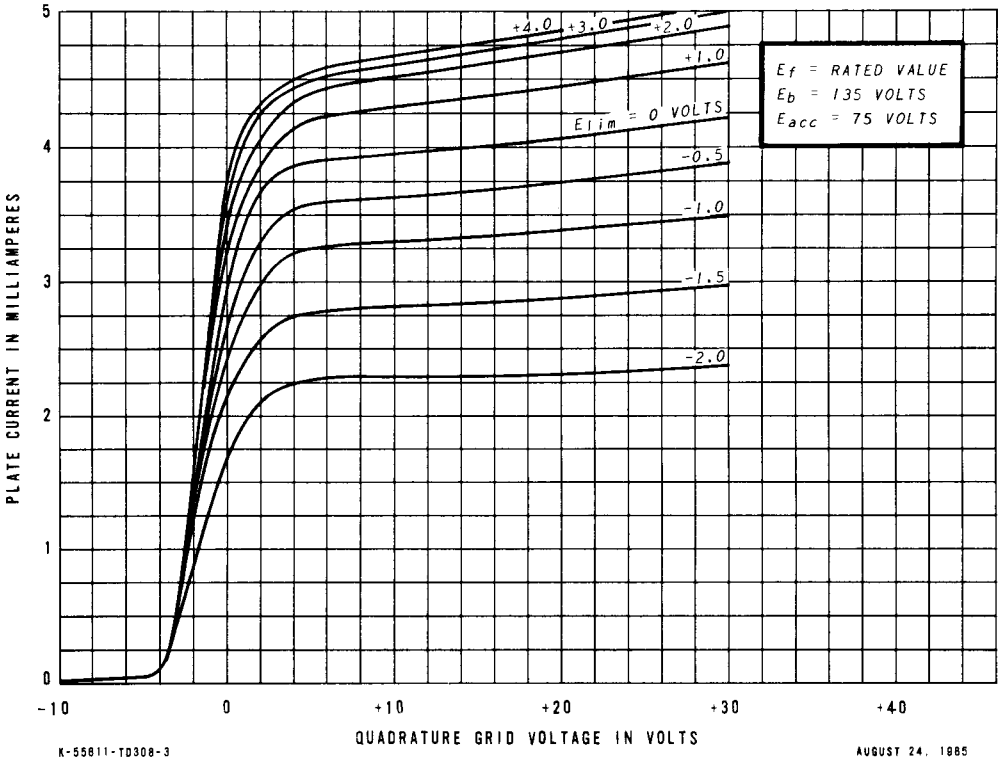
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD308-2

AUGUST 24, 1965

AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Triode-Pentode

6KT8

The 6KT8 is a general-purpose triode-pentode contained in a miniature envelope.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*. . .	6.3±0.6	Volts
Heater Current‡	0.6	Amperes

Direct Interelectrode Capacitances

Pentode Section	**With Shield§**	**Without Shield**	
Grid-Number 1 to Plate: (Pg1 to Pp), maximum .	0.03	0.046	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.) . .	7.5	7.5	pf
Output: Pp to (h + Pk + Pg2 + Pg3 + i.s.) . .	2.8	2.2	pf
Triode Section			
Grid to Plate: (Tg to Tp)	3.0	3.0	pf
Input: Tg to (h + Tk + Pk + Pg3 + i.s.) . .	3.2	3.2	pf
Output: Tp to (h + Tk + Pk + Pg3 + i.s.) . .	2.4	1.6	pf

Coupling	**With Shield§**	**Without Shield**	
Triode Grid to Pentode Plate: (Tg to Pp), maximum.	0.003	0.018	pf
Pentode Grid-Number 1 to Triode Plate: (Pg1 to Tp), maximum	0.002	0.006	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

Maximum Diameter.	0.875	Inches
Minimum Diameter.	0.750	Inches
Maximum Over-all Length . . .	2.188	Inches
Maximum Seated Height	1.938	Inches

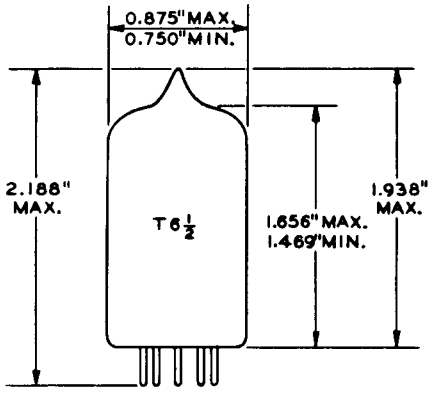
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

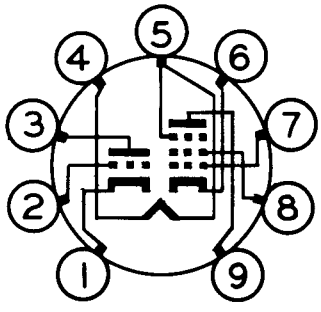


EIA 6-2

TERMINAL CONNECTIONS

Pin 1 - Triode Cathode
Pin 2 - Triode Grid
Pin 3 - Triode Plate
Pin 4 - Heater
Pin 5 - Heater, Pentode Grid Number 3, and Internal Shield
Pin 6 - Pentode Cathode
Pin 7 - Pentode Grid Number 1
Pin 8 - Pentode Grid Number 2 (Screen)
Pin 9 - Pentode Plate

BASING DIAGRAM



EIA 9QP

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	2.5	1.0	Watts
Screen Dissipation	0.55	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Meghoms
With Cathode Bias	1.0	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Pentode Section	Triode Section	
Plate Voltage	125	250	Volts
Screen Voltage	125	---	Volts
Grid-Number 1 Voltage	-1.0	-2.0	Volts
Amplification Factor	---	100	
Plate Resistance, approximate	150000	31500	Ohms
Transconductance	10000	3200	Micromhos
Plate Current	12	1.8	Milliamperes
Screen Current	4.5	---	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 20 Microamperes	-7	-3.5	Volts

NOTES

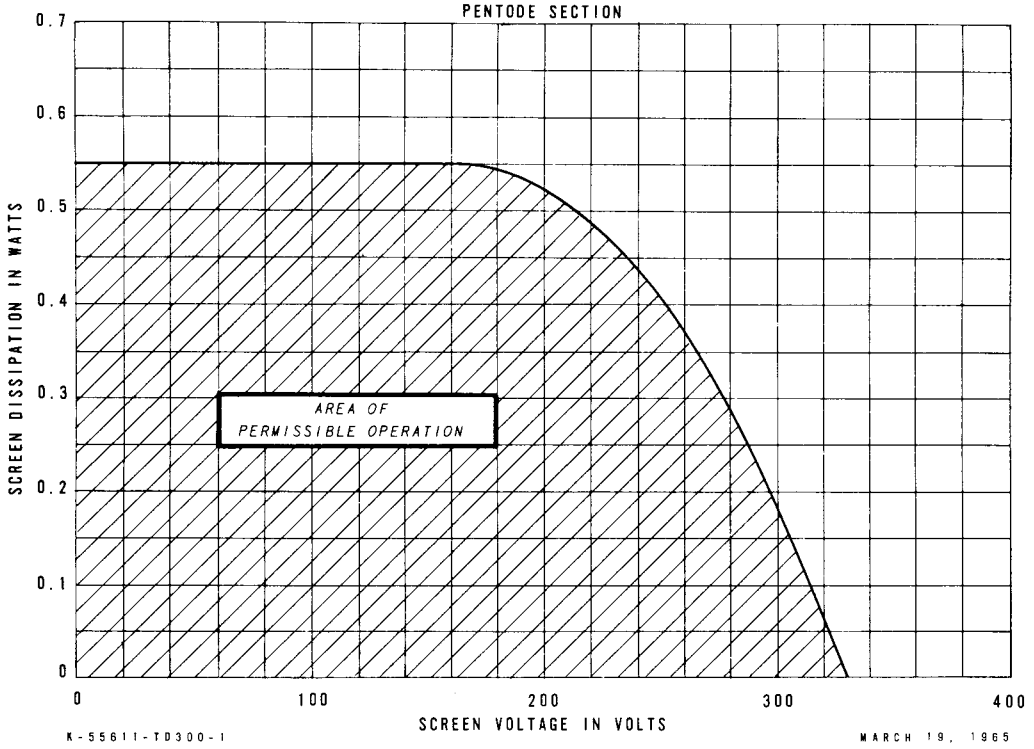
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

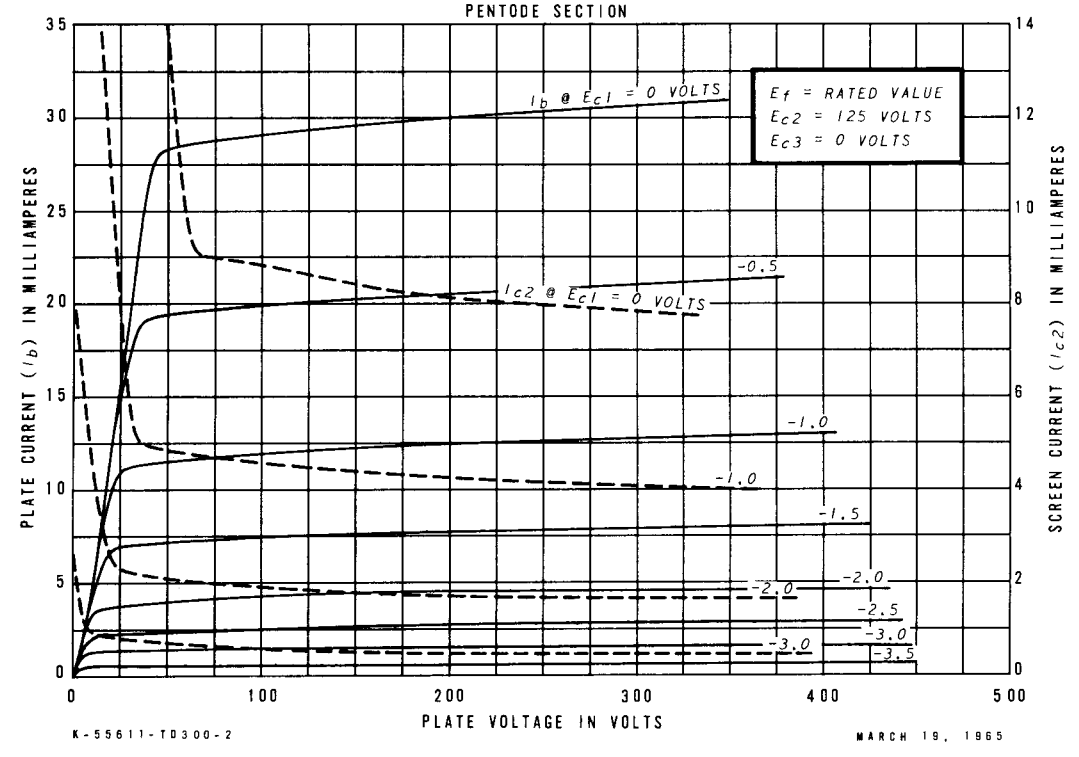
§ With external shield (EIA 315) connected to pins 4 and 5.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

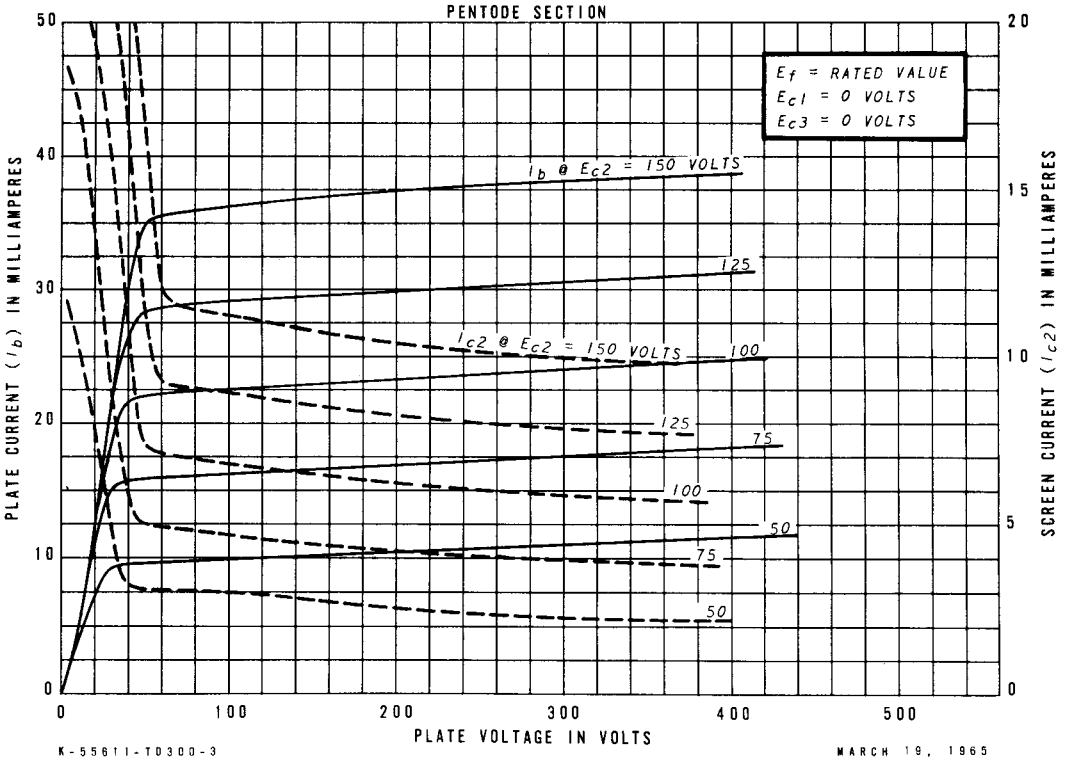
SCREEN RATING CHART



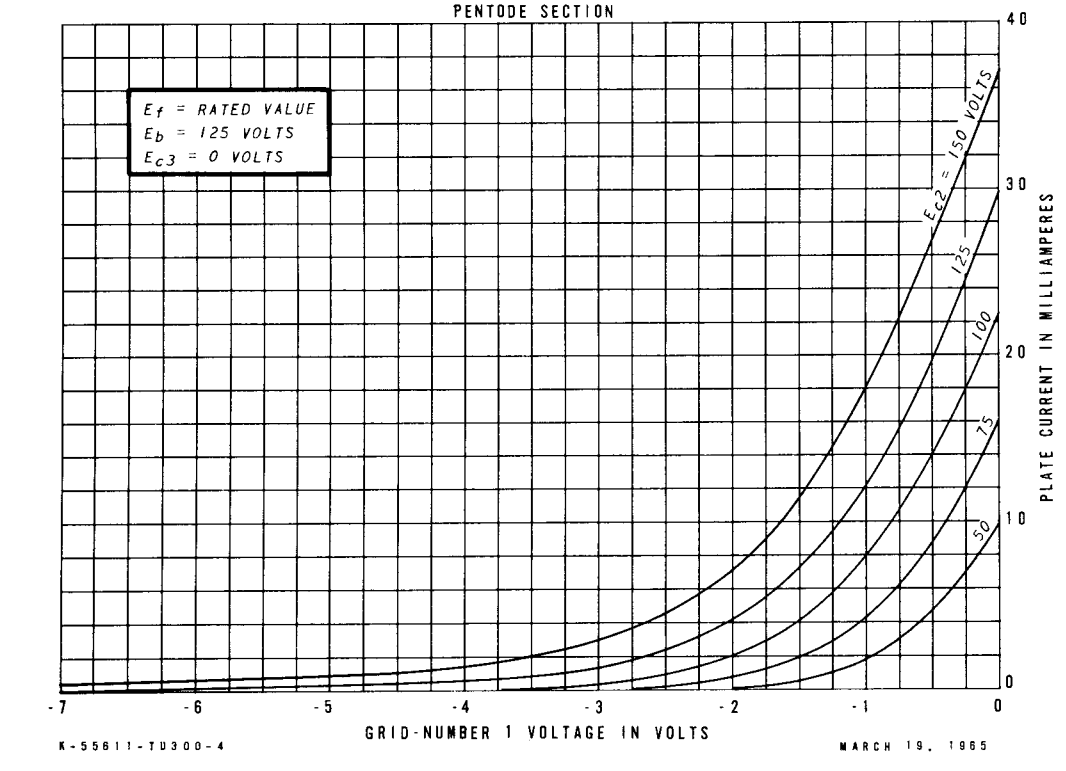
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

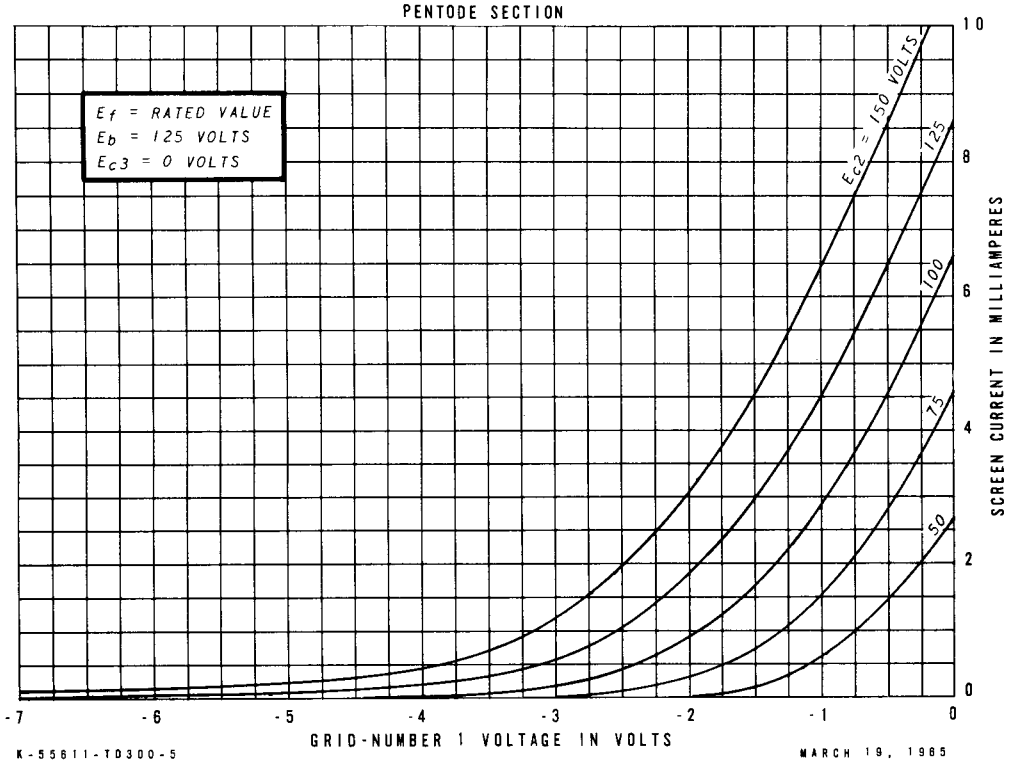


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

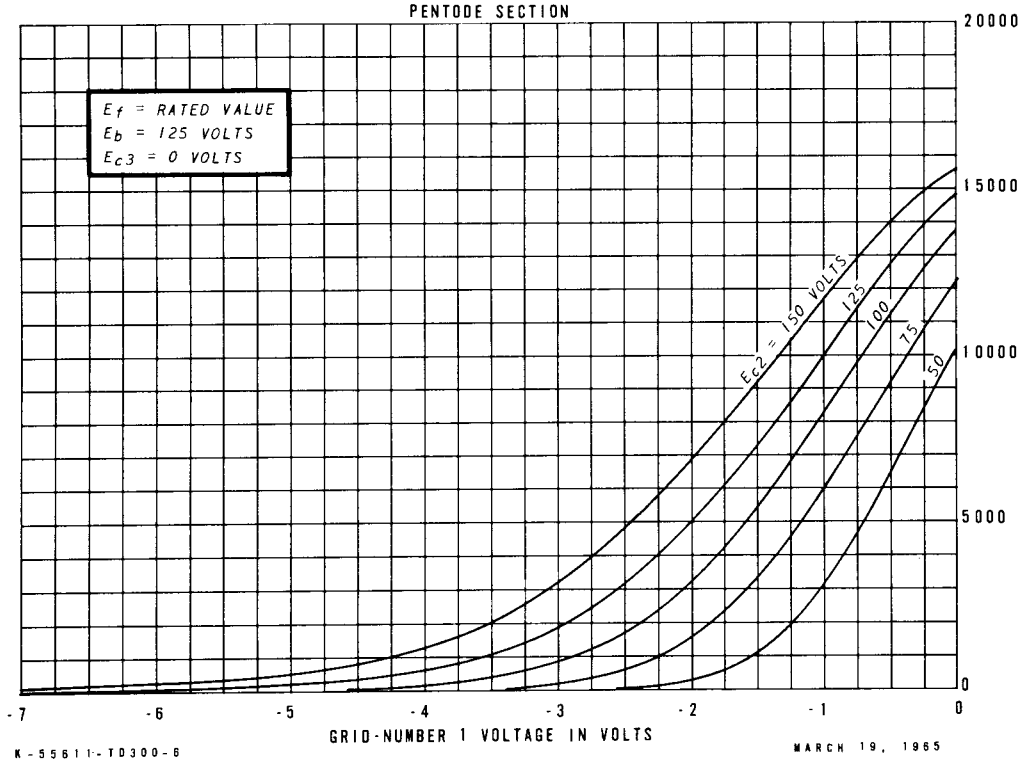


K-55611-TD300-5

MARCH 19, 1965

AVERAGE TRANSFER CHARACTERISTICS

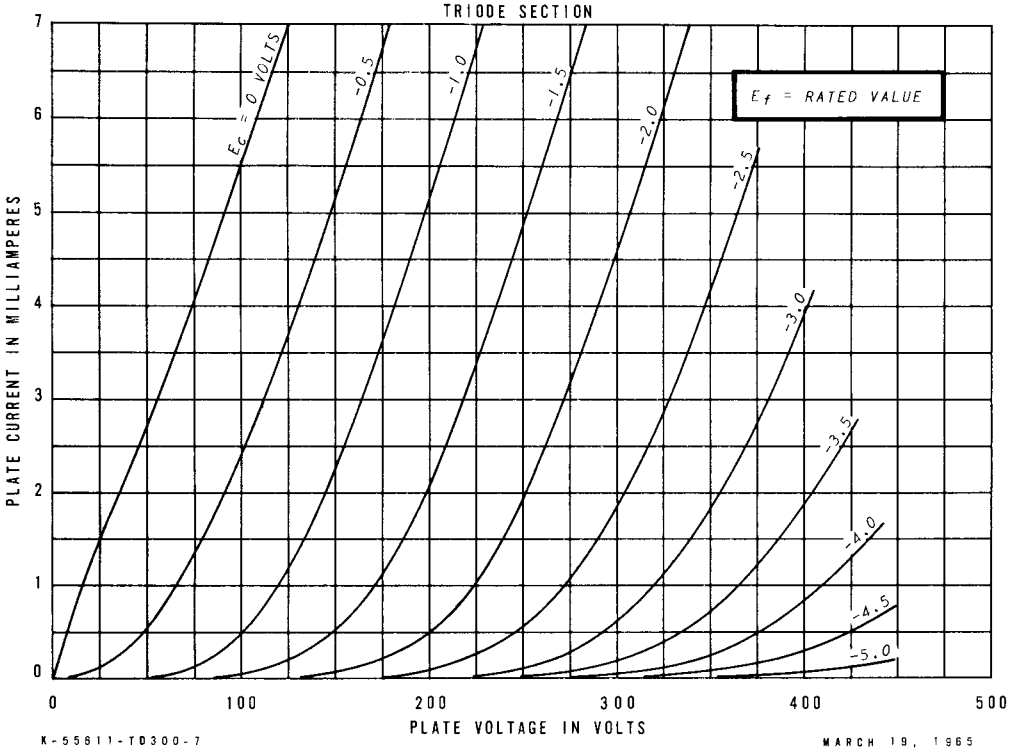
PENTODE SECTION



K-55611-TD300-6

MARCH 19, 1965

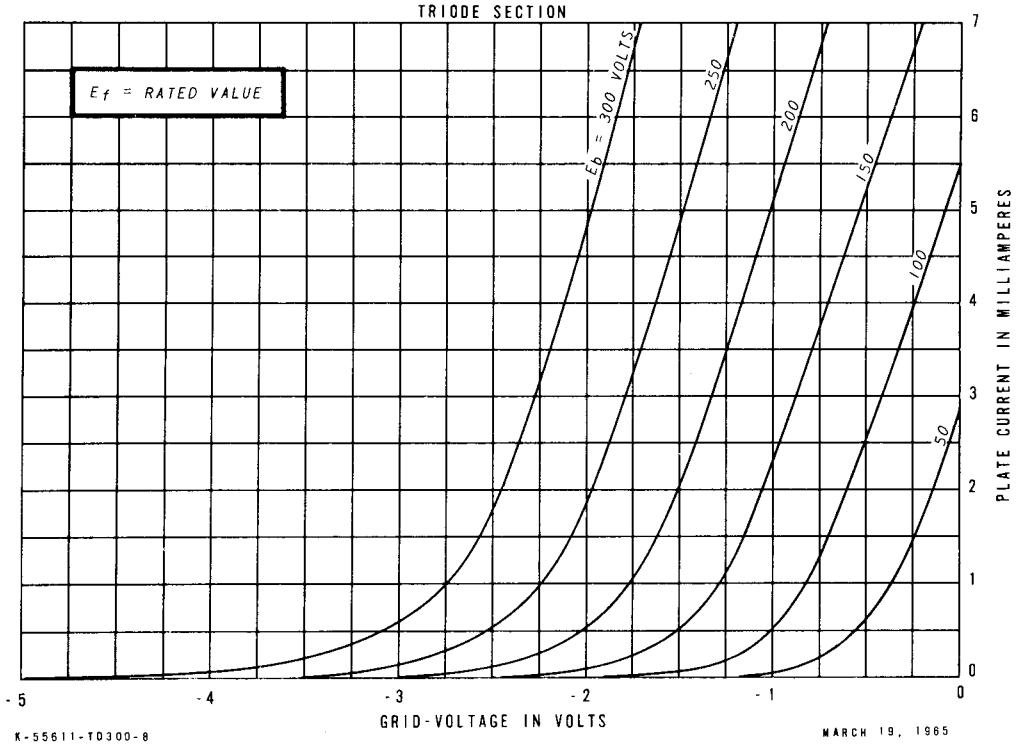
AVERAGE PLATE CHARACTERISTICS



K-55611-TD300-7

MARCH 19, 1965

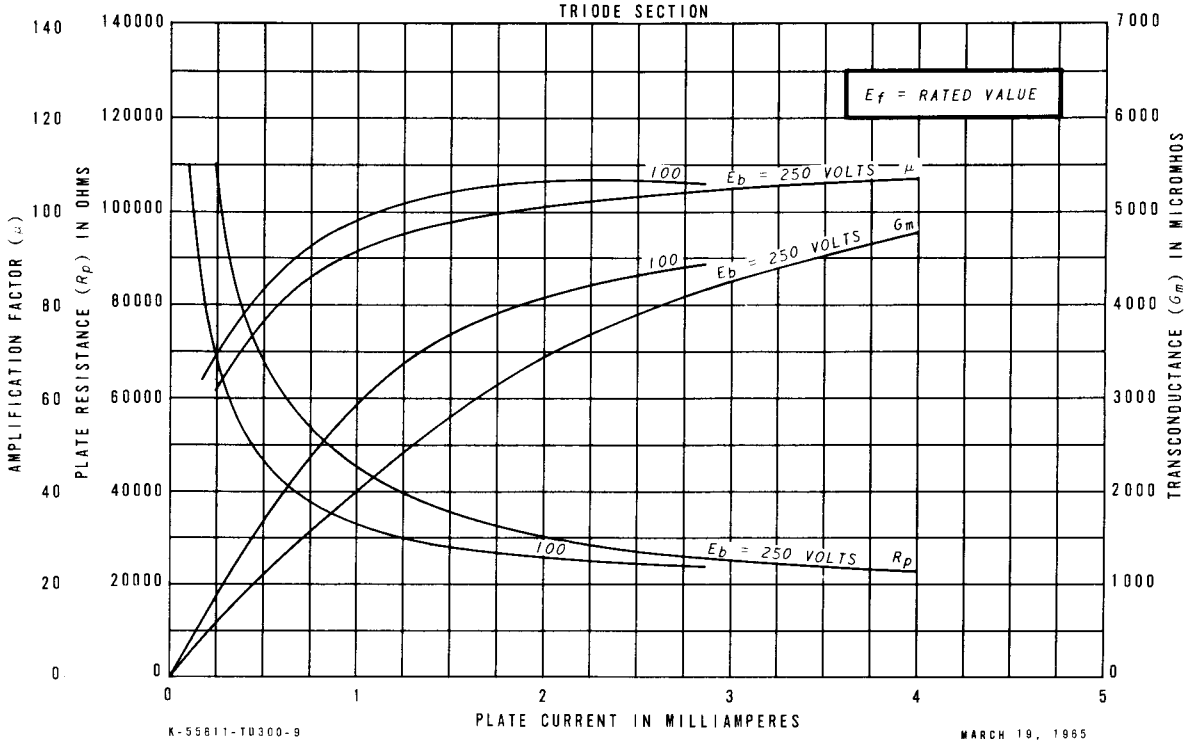
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD300-8

MARCH 19, 1965

AVERAGE CHARACTERISTICS



Electronic TUBES

6L6-GC

BEAM PENTODE

FOR AF POWER AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6L6-GC is a beam-power pentode primarily designed for use in audio-frequency power amplifier applications. Features of the tube include high power output capabilities, high plate and screen dissipation ratings, high efficiency, high power sensitivity, and low distortion. The tube has the same characteristics as the 6L6-GB and may be used in any application for which the 6L6-GB is suitable. The higher ratings of the 6L6-GC, however, are advantageous where greater power-handling capability is required than is available with the GB version.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Voltage, AC or DC . . . . . 6.3 Volts
Heater Current . . . . . 0.9 Amperes
Direct Interelectrode Capacitances, approximate*
- Grid-Number 1 to Plate . . . . . 0.6 μμf
- Input . . . . . 10 μμf
- Output . . . . . 6.5 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-12, Glass
Base—B6-148, or B6-122 Short Medium-Shell Octal 6-Pin
B7-111 or B7-119, Short Medium-Shell Octal 7-Pin
B7-12, Medium-Shell Octal 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES	Triode‡ Connection	Pentode Connection	
Allowable Heater Voltage		5.7 to 6.9	Volts
Plate Voltage	450	500	Volts
Screen Voltage		450†	Volts
Plate Dissipation	30	30	Watts
Screen Dissipation		5.0	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode	200	200	Volts
Heater Negative with Respect to Cathode	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	0.1	Megohms
With Cathode Bias	0.5	0.5	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

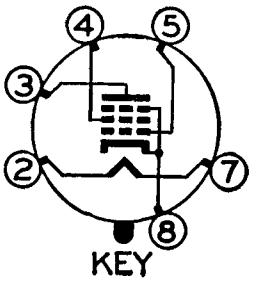
The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

Supersedes ET-T1515, dated 10-58

BASING DIAGRAM

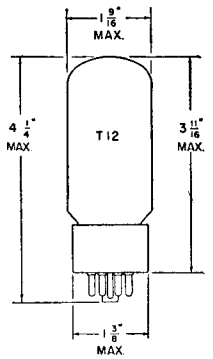


EIA 7AC

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Heater
Pin 3—Plate
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates
Pin 1 Missing on Bases B6-122 and B6-148

PHYSICAL DIMENSIONS



EIA 12-15

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, TRIODE CONNECTION‡

Plate Voltage	250	Volts
Grid-Number 1 Voltage	−20	Volts
Peak AF Grid-Number 1 Voltage	20	Volts
Amplification Factor	8	
Plate Resistance, approximate	1700	Ohms
Transconductance	4700	Micromhos
Zero-Signal Plate Current	40	Milliamperes
Maximum-Signal Plate Current	44	Milliamperes
Load Resistance	5000	Ohms
Total Harmonic Distortion, approximate	5	Percent
Maximum-Signal Power Output	1.4	Watts

CLASS A_1 AMPLIFIER, PENTODE CONNECTION

Plate Voltage	250	300	350	Volts
Screen Voltage	250	200	250	Volts
Grid-Number 1 Voltage	−14	−12.5	−18	Volts
Peak AF Grid-Number 1 Voltage	14	12.5	18	Volts
Plate Resistance, approximate	22500	35000	33000	Ohms
Transconductance	6000	5300	5200	Micromhos
Zero-Signal Plate Current	72	48	54	Milliamperes
Maximum-Signal Plate Current	79	55	66	Milliamperes
Zero-Signal Screen Current	5.0	2.5	2.5	Milliamperes
Maximum-Signal Screen Current	7.3	4.7	7.0	Milliamperes
Load Resistance	2500	4500	4200	Ohms
Total Harmonic Distortion, approximate	10	11	15	Percent
Maximum-Signal Power Output	6.5	6.5	10.8	Watts

PUSH-PULL CLASS A_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	250	270	Volts
Screen Voltage	250	270	Volts
Grid-Number 1 Voltage	−16	−17.5	Volts
Peak AF Grid-to-Grid Voltage	32	35	Volts
Zero-Signal Plate Current	120	134	Milliamperes
Maximum-Signal Plate Current	140	155	Milliamperes
Zero-Signal Screen Current	10	11	Milliamperes
Maximum-Signal Screen Current	16	17	Milliamperes
Effective Load Resistance, Plate-to-Plate	5000	5000	Ohms
Total Harmonic Distortion	2	2	Percent
Maximum-Signal Power Output	14.5	17.5	Watts

PUSH-PULL CLASS AB_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	360	360	450	Volts
Screen Voltage	270	270	400	Volts
Grid-Number 1 Voltage	−22.5	−22.5	−37	Volts
Peak AF Grid-to-Grid Voltage	45	45	70	Volts
Zero-Signal Plate Current	88	88	116	Milliamperes
Maximum-Signal Plate Current	132	140	210	Milliamperes
Zero-Signal Screen Current	5.0	5.0	5.6	Milliamperes
Maximum-Signal Screen Current	15	11	22	Milliamperes
Effective Load Resistance, Plate-to-Plate	6600	3800	5600	Ohms
Total Harmonic Distortion	2	2	1.8	Percent
Maximum-Signal Power Output	26.5	18	55	Watts

PUSH-PULL CLASS AB_2 AMPLIFIER, VALUES FOR TWO TUBES

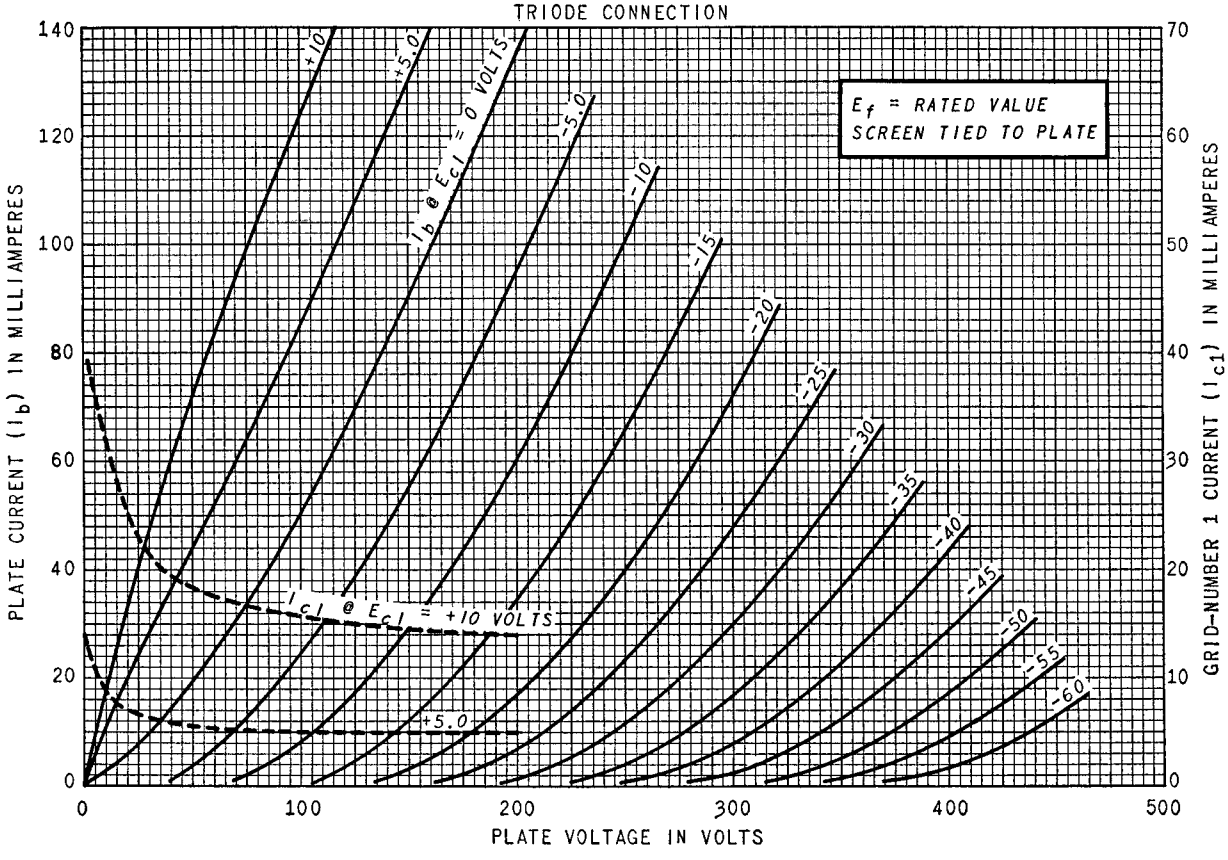
Plate Voltage	360	360	Volts
Screen Voltage	225	270	Volts
Grid-Number 1 Voltage	−18	−22.5	Volts
Peak AF Grid-to-Grid Voltage	52	72	Volts
Zero-Signal Plate Current	78	88	Milliamperes
Maximum-Signal Plate Current	142	205	Milliamperes
Zero-Signal Screen Current	3.5	5.0	Milliamperes
Maximum-Signal Screen Current	11	16	Milliamperes
Effective Load Resistance, Plate-to-Plate	6000	3800	Ohms
Total Harmonic Distortion	2	2	Percent
Maximum-Signal Power Output	31	47	Watts

* Without external shield.

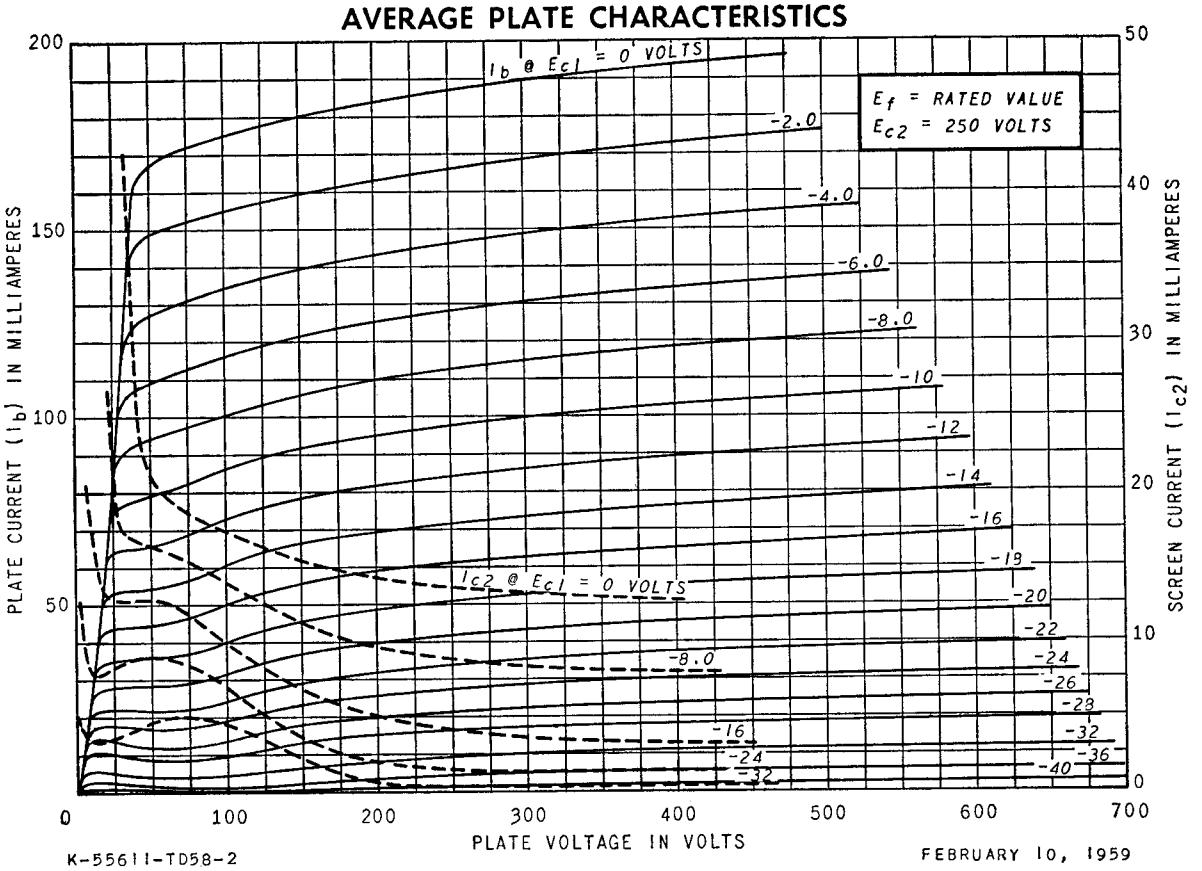
† The maximum screen voltage rating is 500 volts in push-pull circuits where the screen of each tube is connected to a tap on the plate winding of the output transformer.

‡ With screen connected to plate.

AVERAGE PLATE CHARACTERISTICS



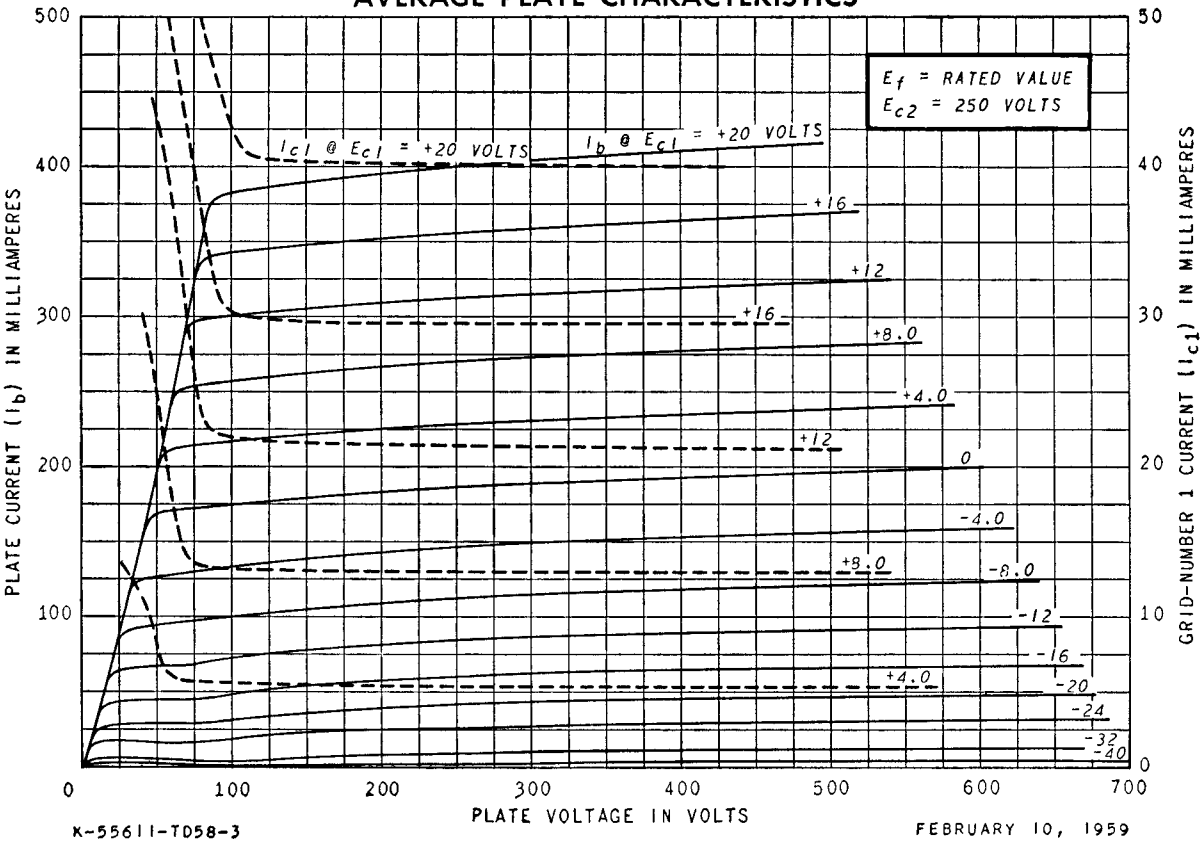
AVERAGE PLATE CHARACTERISTICS



K-55611-TD58-2

FEBRUARY 10, 1959

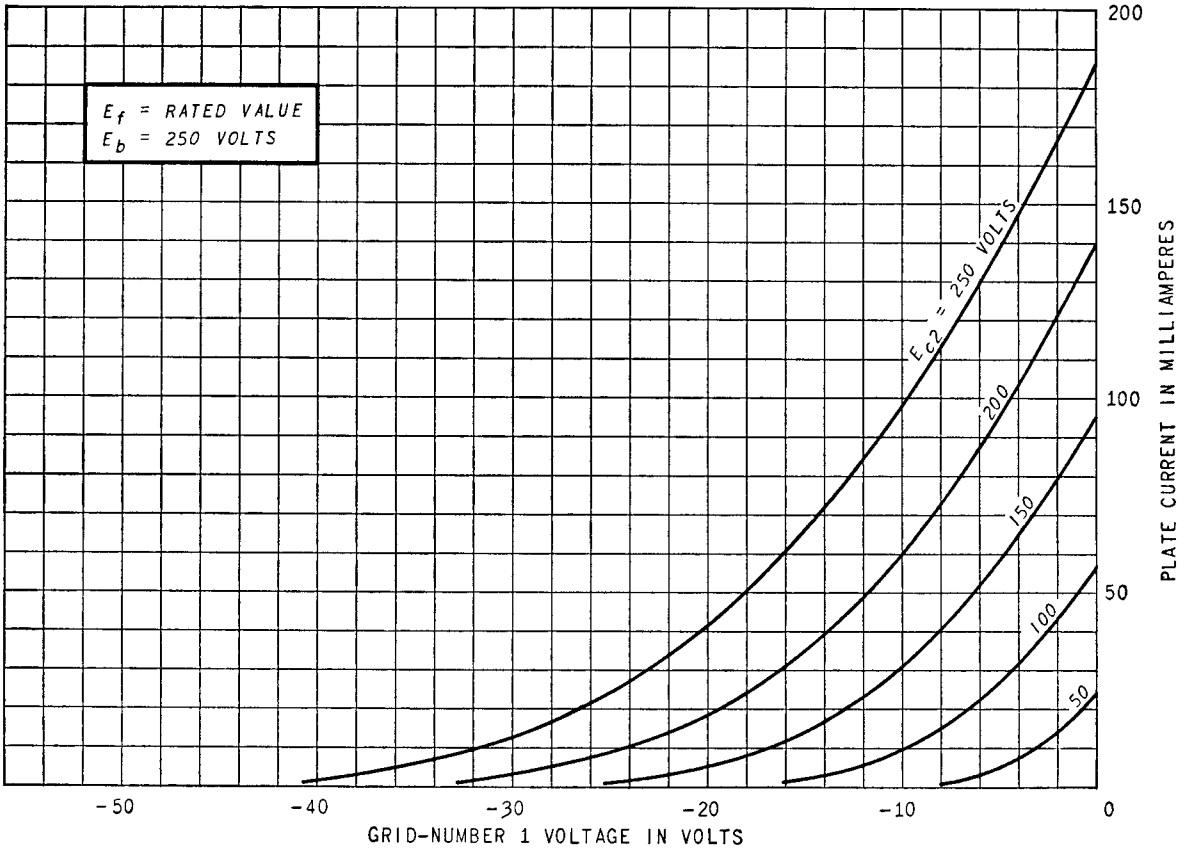
AVERAGE PLATE CHARACTERISTICS



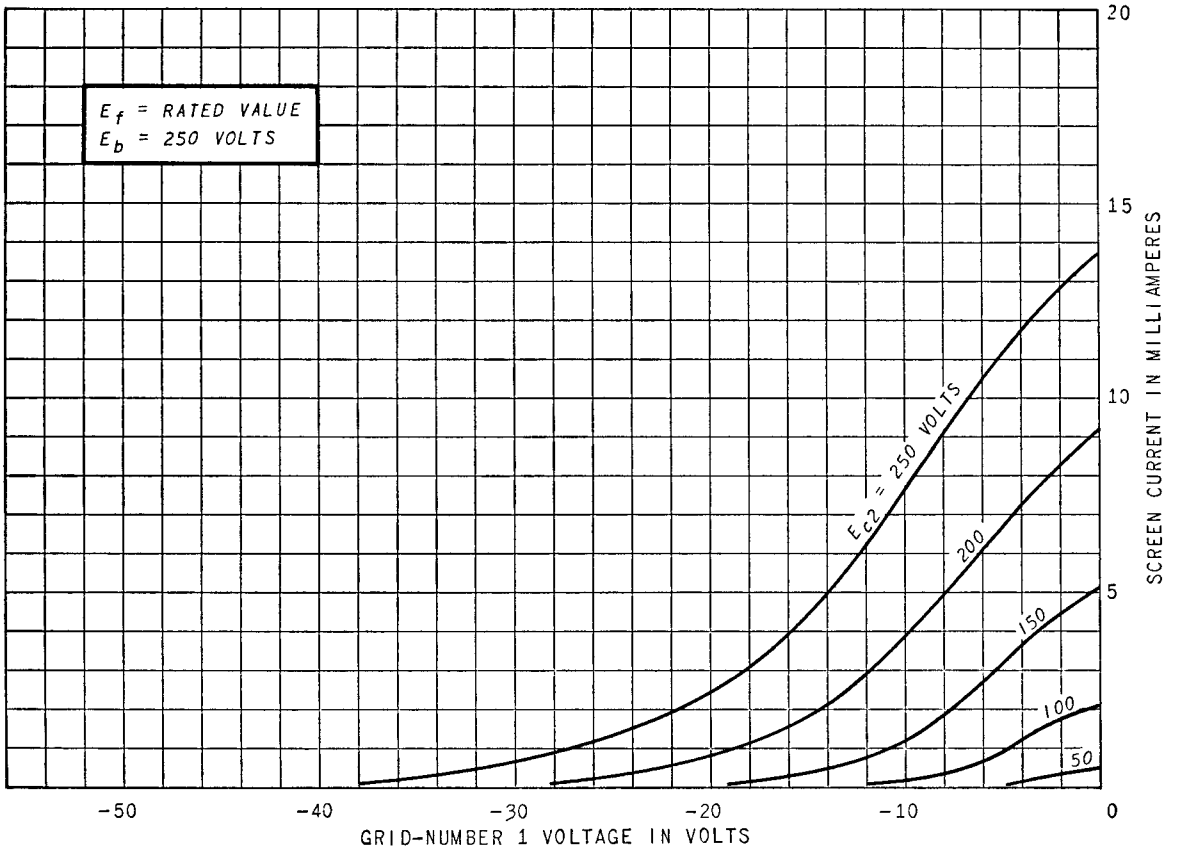
K-55611-TD58-3

FEBRUARY 10, 1959

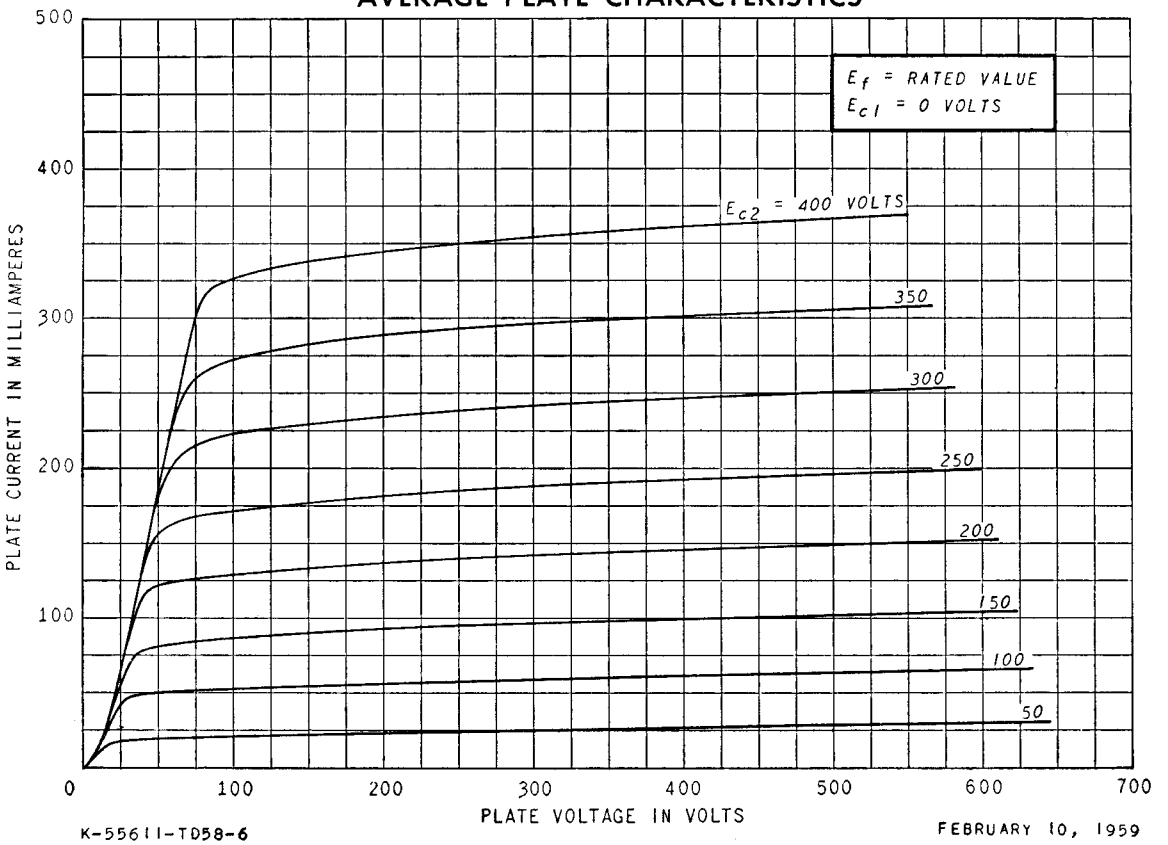
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



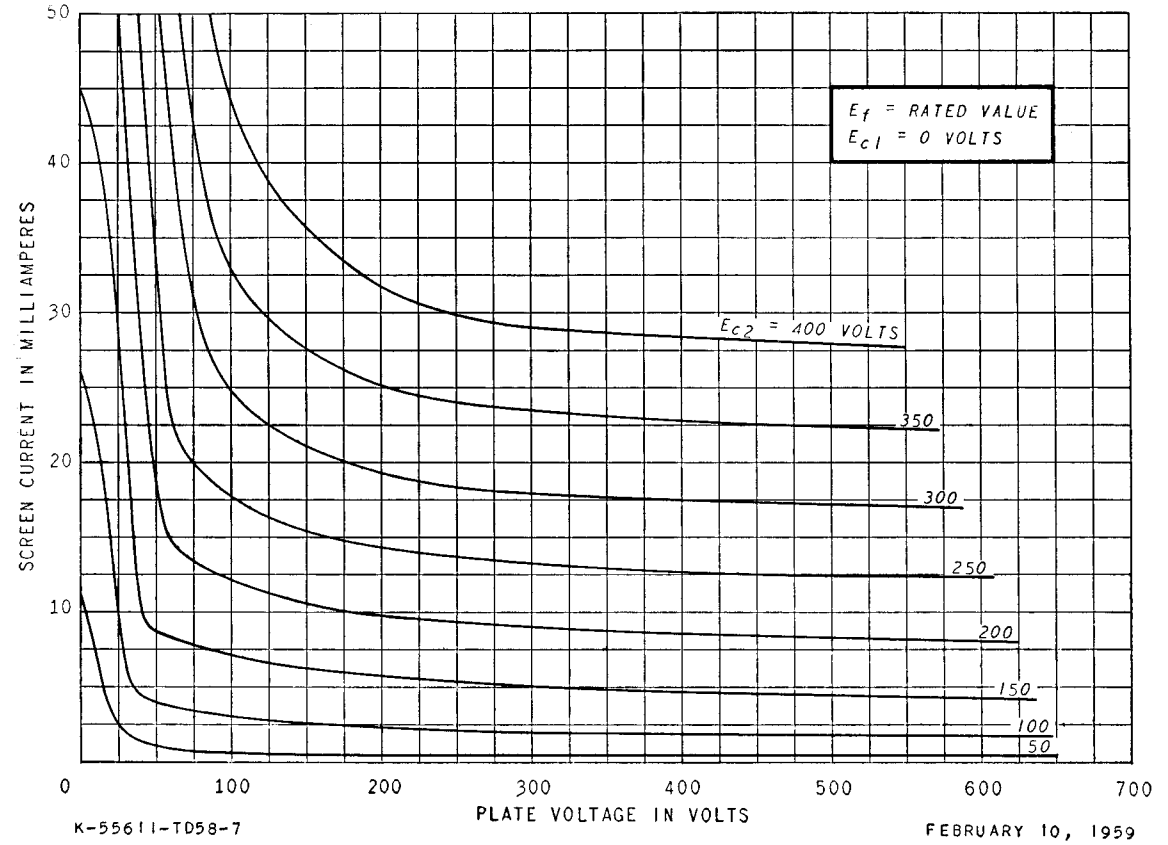
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD58-6

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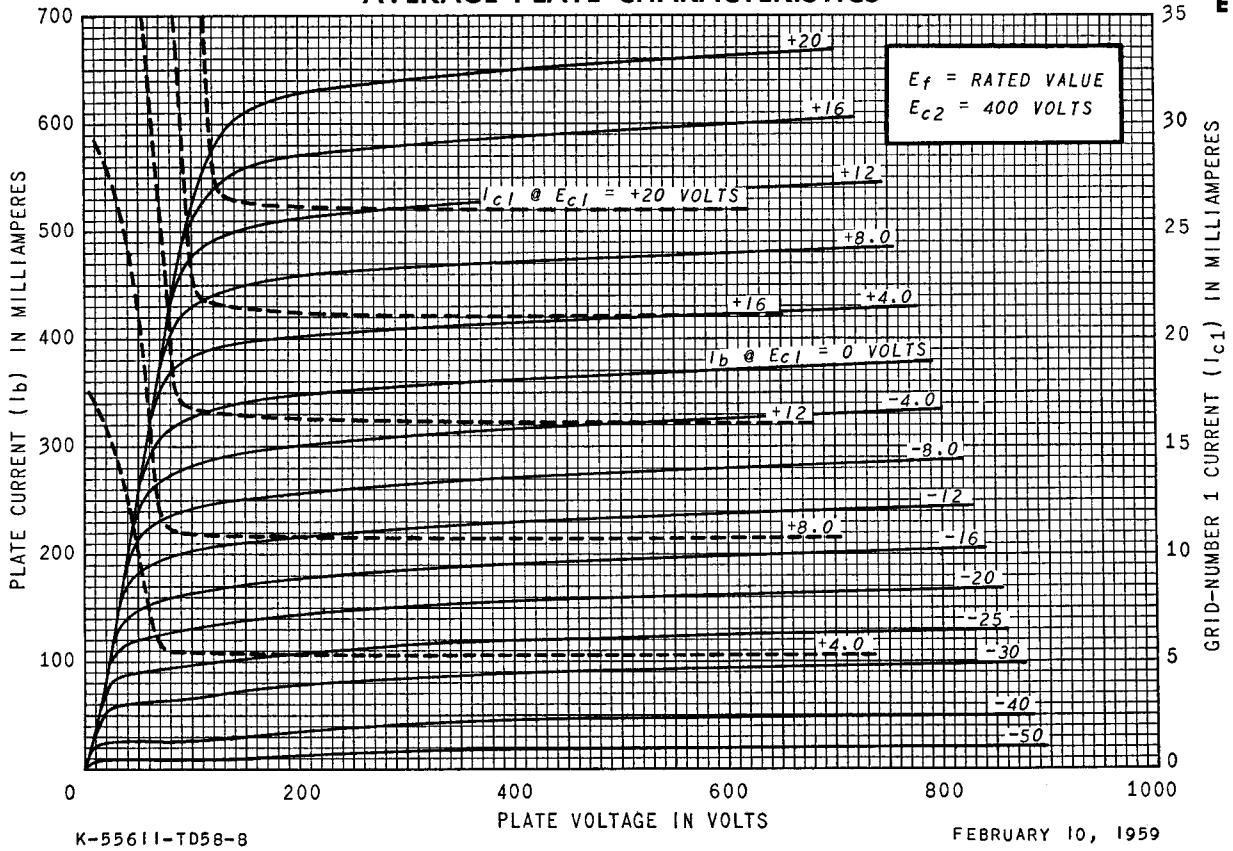
AVERAGE SCREEN CHARACTERISTICS



K-5561I-TD58-7

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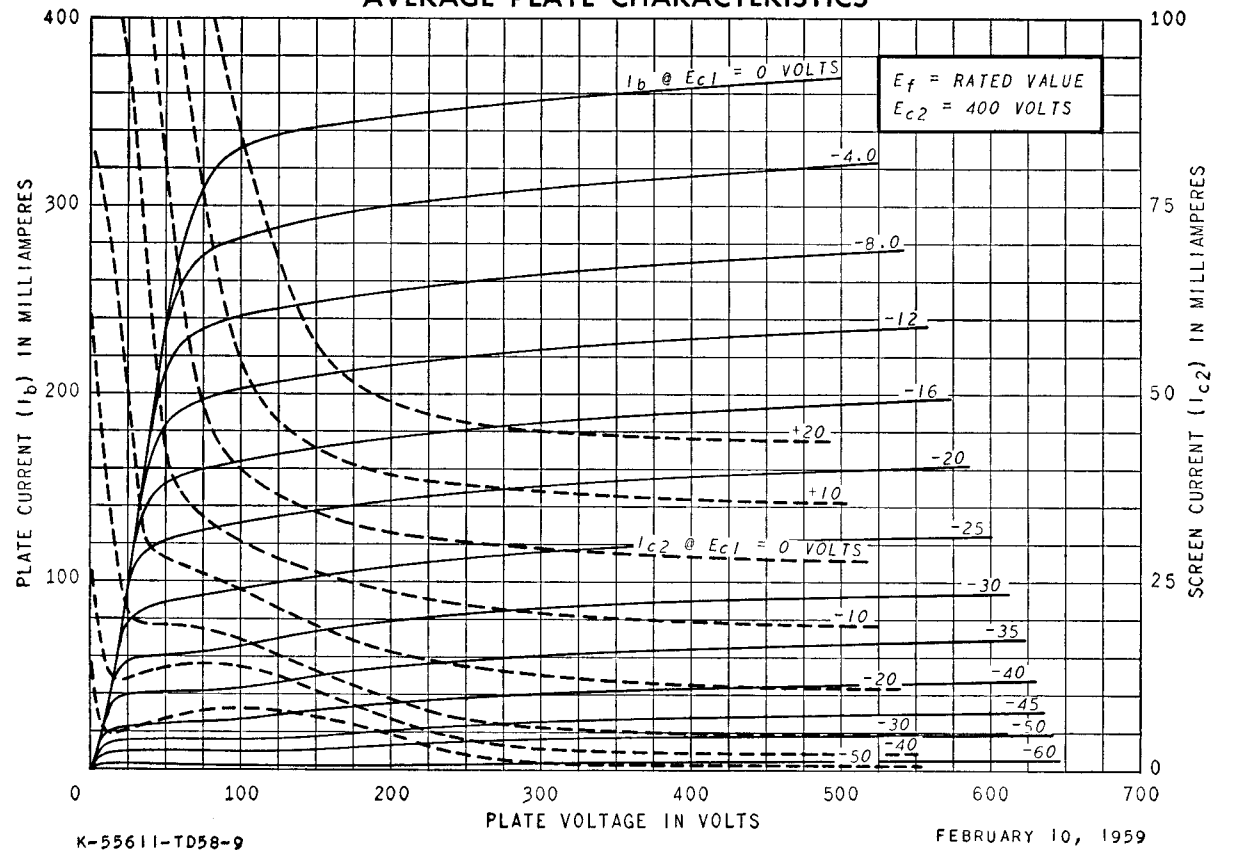
AVERAGE PLATE CHARACTERISTICS



K-55611-TD58-8

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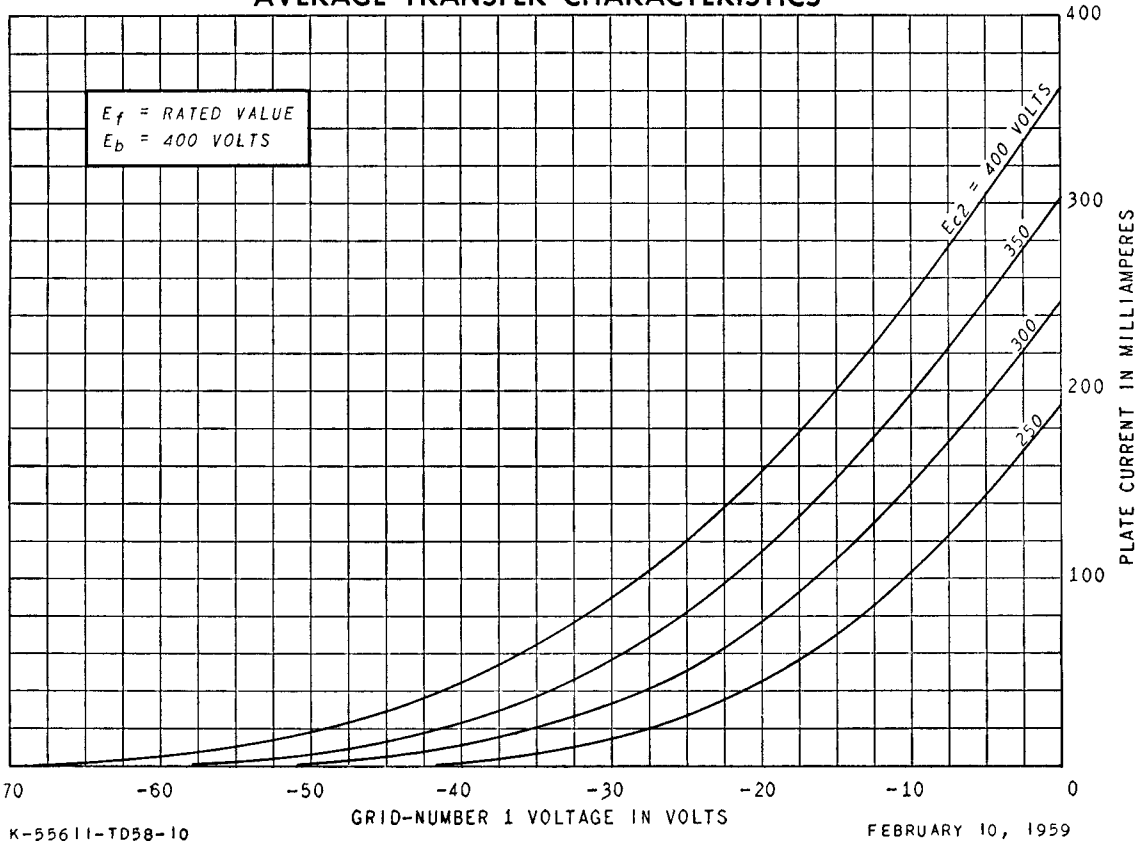
AVERAGE PLATE CHARACTERISTICS



K-55611-TD58-9

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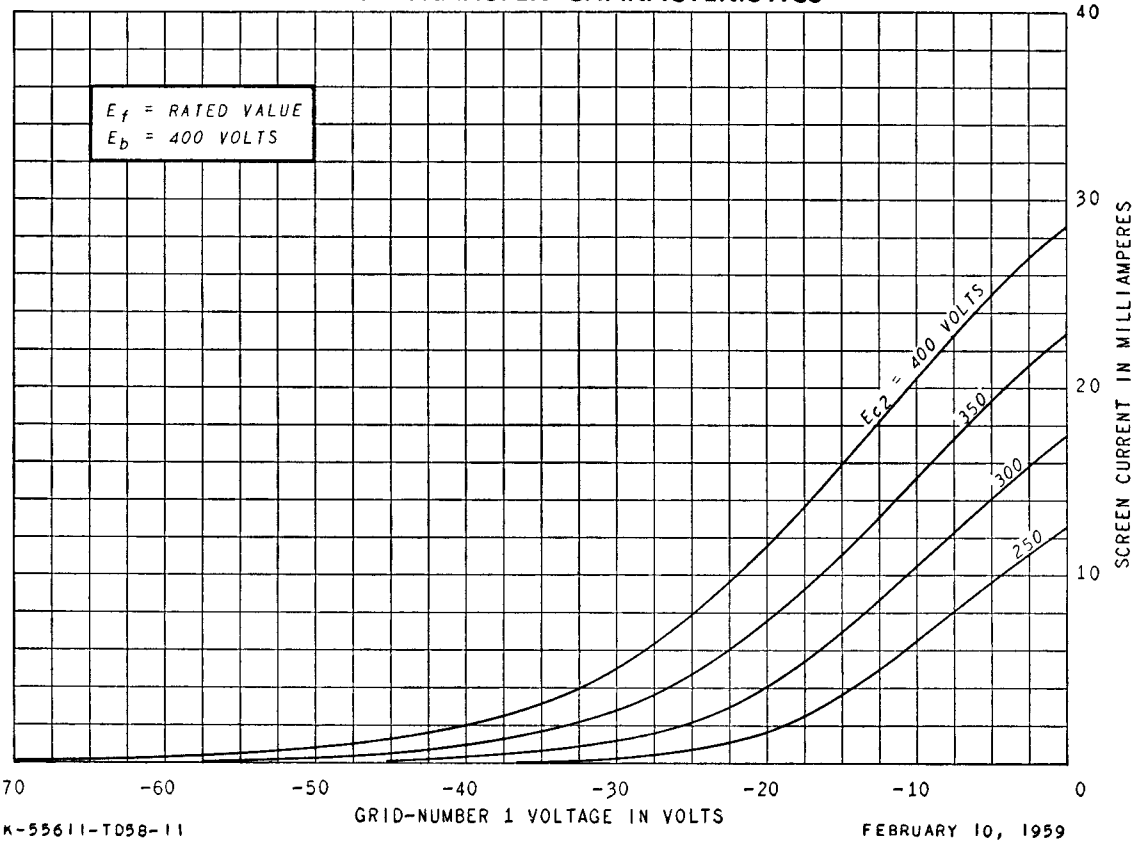
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD58-10

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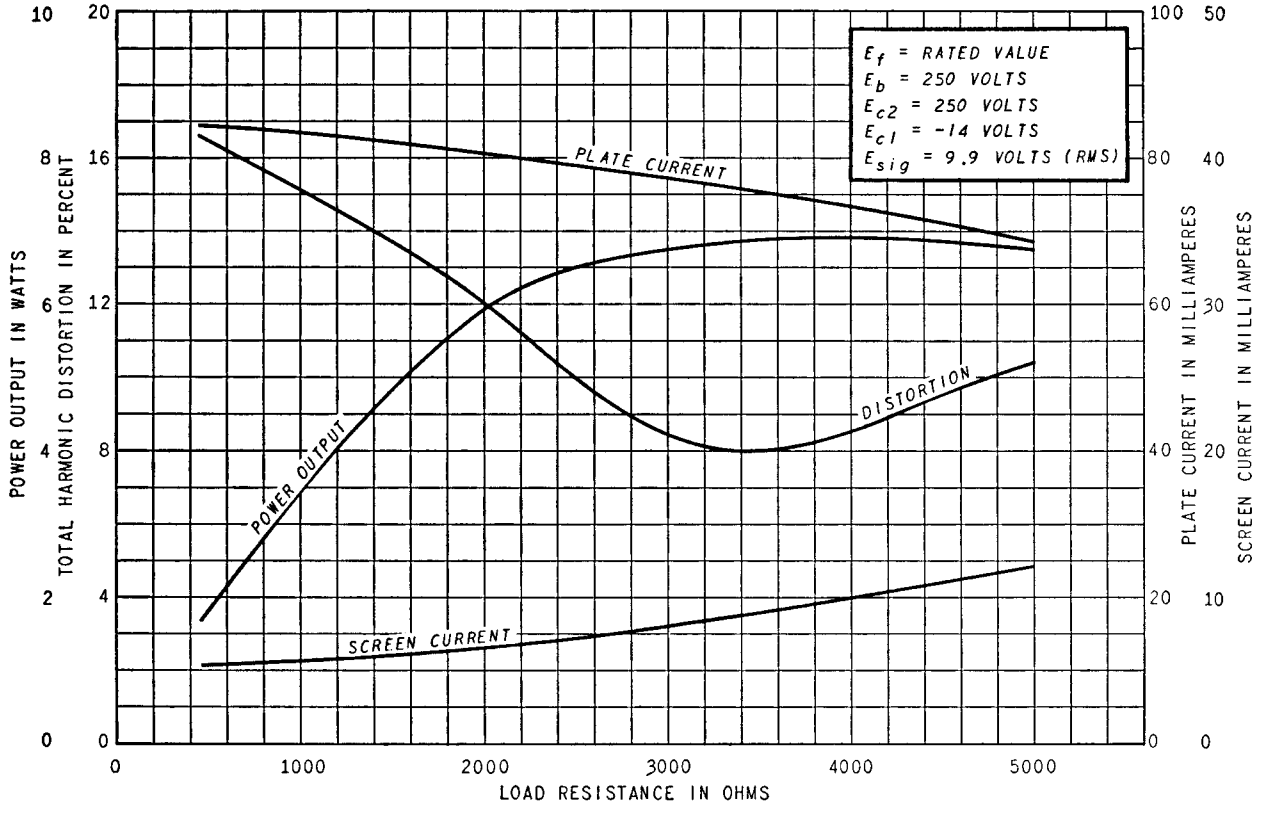
AVERAGE TRANSFER CHARACTERISTICS



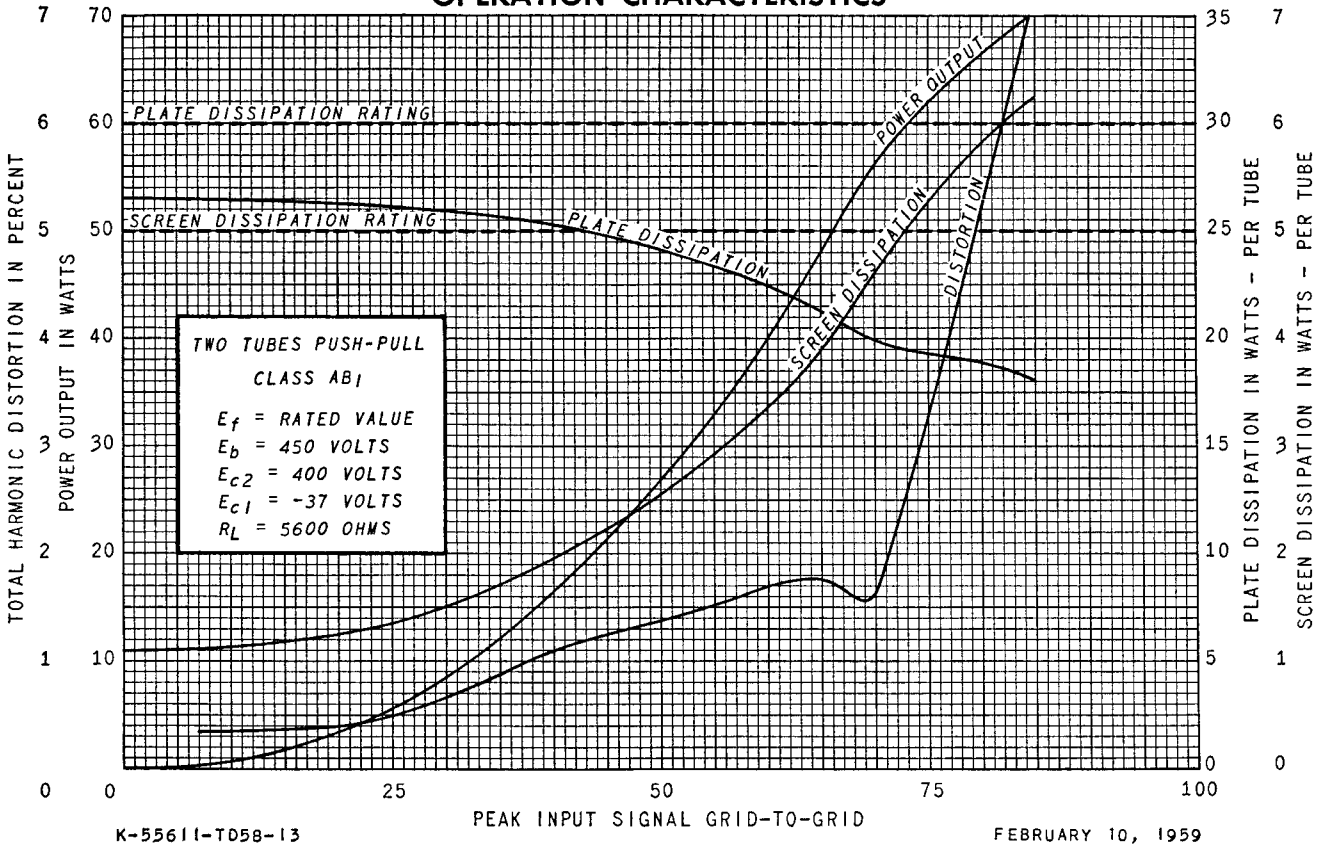
K-55611-TD58-11

FEBRUARY 10, 1959

OPERATION CHARACTERISTICS



OPERATION CHARACTERISTICS



Compactron Beam Pentode

6LB6

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

The 6LB6 is a compactron beam-power pentode primarily designed for use as the horizontal-deflection amplifier in color television receivers. It is characterized by having a very low knee voltage, high plate-to-screen ratio, and high peak current capability. These efficiency factors make the 6LB6 widely adaptable for use in circuits using shunt or variable-bias type regulation with B+ supply voltages from 240 to over 400 volts. Its low knee minimizes "snivets" without the necessity of supplying special voltages to the beam plates.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*. . . .	6.3±0.6	Volts
Heater Current‡	2.25	Amperes

Direct Interelectrode Capacitances, approximate§

Grid-Number 1 to Plate: (g1 to p) .	0.44	pf
Input: g1 to (h + k + g2 + b.p.) .	33	pf
Output: p to (h + k + g2 + b.p.) .	18	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Top Cap - C1-2, Skirted Miniature
Outline Drawing - EIA 12-90

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length. . . .	4.375	Inches
Maximum Seated Height	4.000	Inches
Minimum Seated Height	3.750	Inches

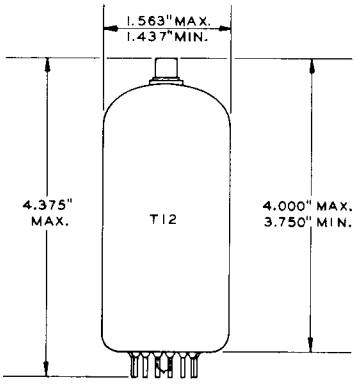
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

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PHYSICAL DIMENSIONS

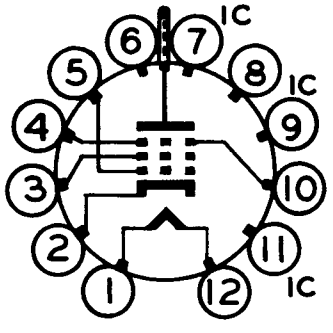


EIA 12-90

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid Number 2 (Screen)
Pin 4 - Beam Plates
Pin 5 - Grid Number 1
Pin 6 - No Connection
Pin 7 - Internal Connection - Do Not Use
Pin 8 - No Connection
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Beam Plates
Pin 11 - Internal Connection - Do Not Use
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12GJ

MAXIMUM RATINGS (Cont'd)

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE¶—

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

DC Plate-Supply Voltage (Boost + DC Power Supply)	990	Volts
Peak Positive Pulse Plate Voltage (Absolute Maximum Value)	7000	Volts
Peak Negative Pulse Plate Voltage	100	Volts
Positive DC Beam Plate Voltage	0	Volts
Screen Voltage	200	Volts
Peak Negative Grid-Number 1 Voltage	300	Volts
Plate Dissipation# (Absolute Maximum Value)	30	Watts
Screen Dissipation	5.0	Watts
DC Cathode Current	315	Milliamperes
Peak Cathode Current	1100	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Number 1 Circuit Resistance		
With Feedback-Type High Voltage Regulation	1.2	Megohms
With Shunt-Type High Voltage Regulation (Switching Mode)	10.0	Megohms
Beam Plate Circuit Resistance	0	Ohms
Bulb Temperature△	200	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	45	50	150	Volts
Beam Plates Connected to Cathode at Socket					
Screen Voltage	110	160	110	110	Volts
Grid-Number 1 Voltage	---	0	---	-20	Volts
Plate Resistance, approximate	---	---	---	6600	Ohms
Transconductance	---	---	---	13400	Micromhos
Plate Current	---	900**	560**	105	Milliamperes
Screen Current	---	110**	46**	2.0	Milliamperes
Grid-Number 1 Voltage, approximate					
Ib = 1.0 Milliamperes	-125	---	---	-40	Volts
Triode Amplification Factor‡‡	---	---	---	4.0	

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

\# In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

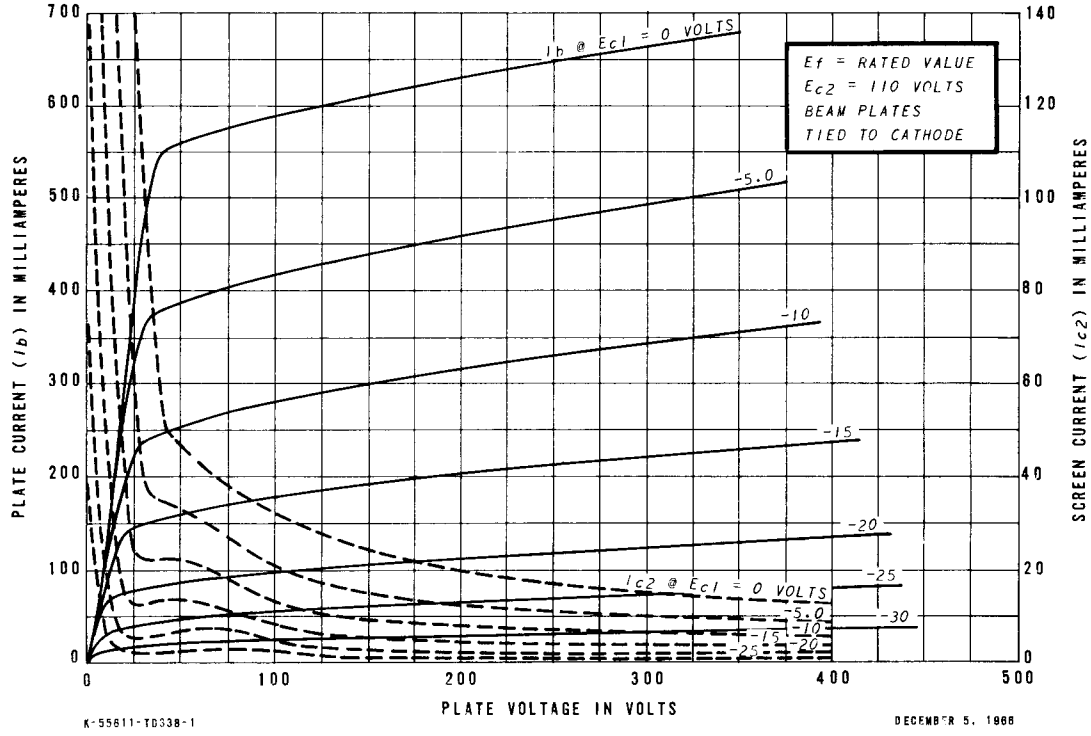
△ Measured using a thermocouple attached to a 0.1-inch wide phosphor-bronze ring placed at the hottest location on the bulb.

** Values measured by a method involving a recurrent waveform such that the plate and screen dissipation will be kept within ratings in order to prevent damage to the tube.

‡‡ Triode connection (screen tied to plate) with Eb = Ec2 = 125 volts, and Ec1 = -25 volts.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

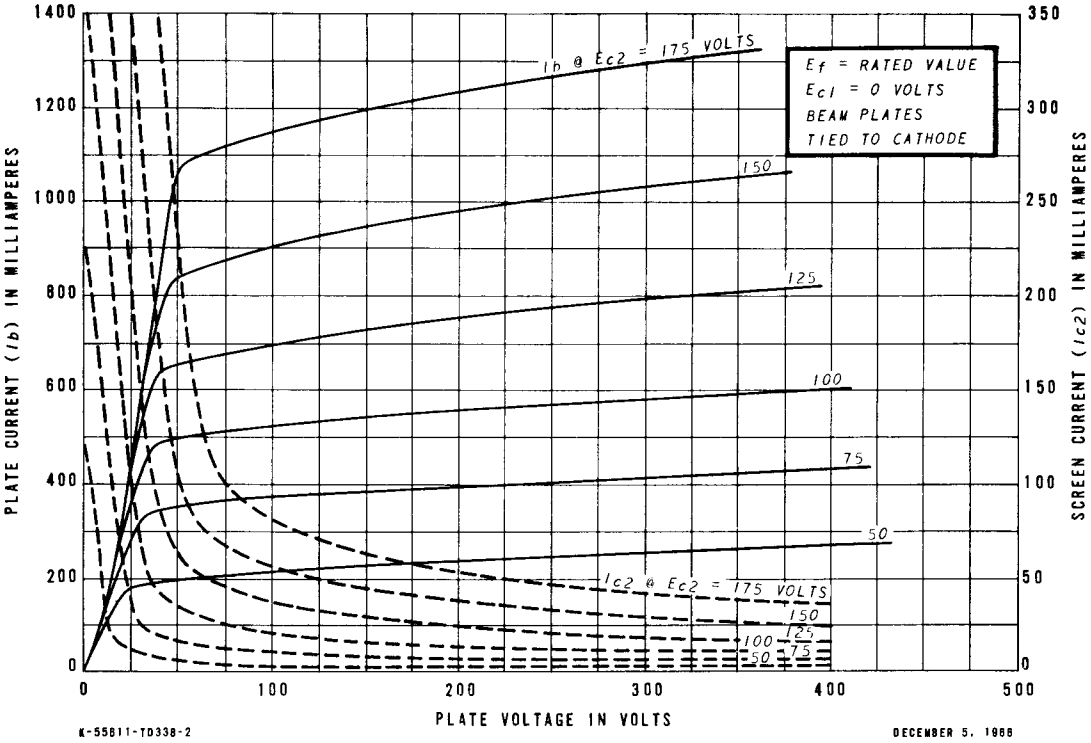
AVERAGE PLATE CHARACTERISTICS



K-55811-TD338-1

DECEMBER 5, 1966

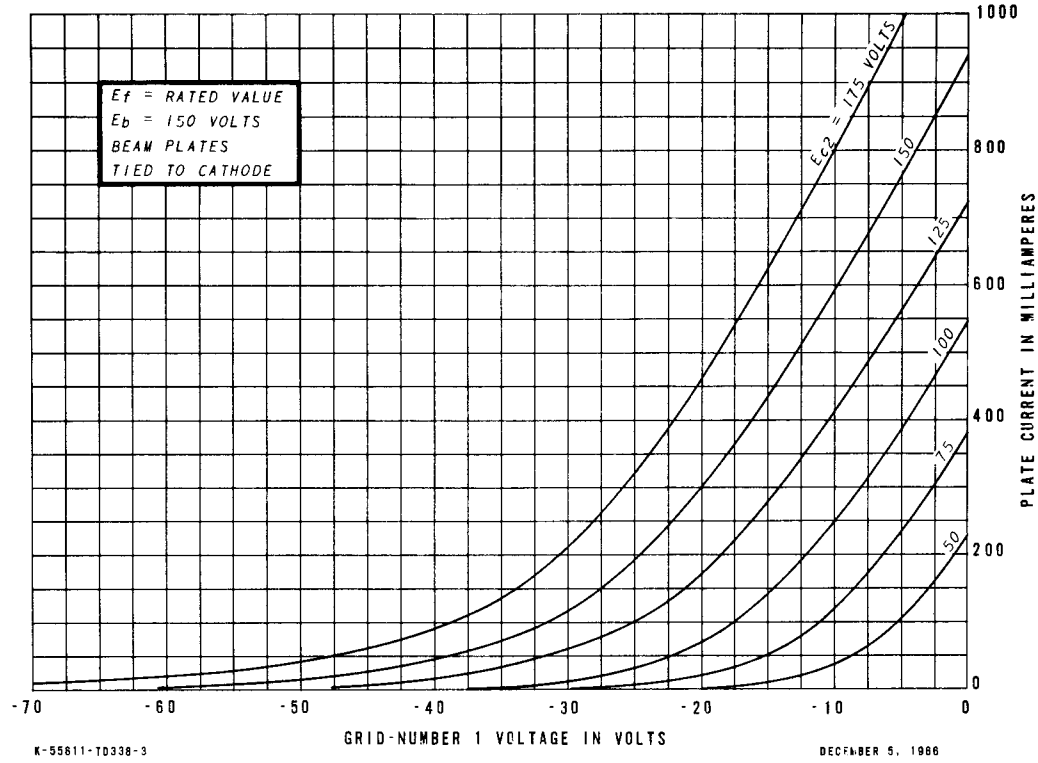
AVERAGE PLATE CHARACTERISTICS



K-55811-TD338-2

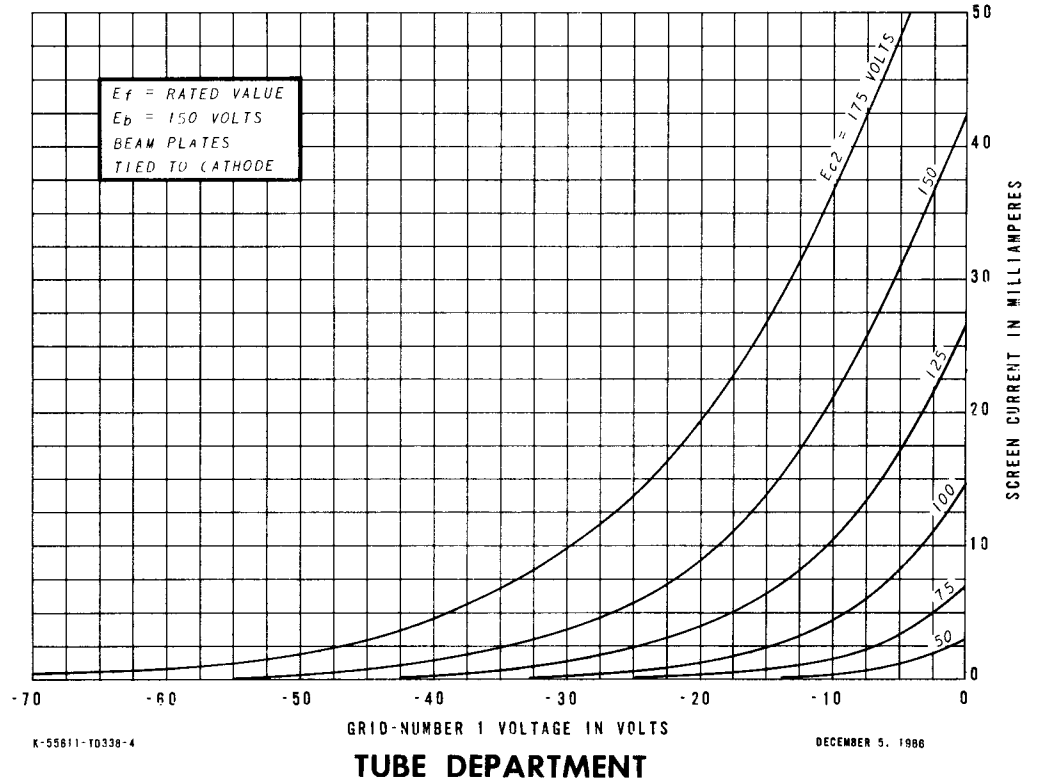
DECEMBER 5, 1966

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD338-3 DECEMBER 5, 1986

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD338-4 DECEMBER 5, 1986

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Twin Pentode

6LE8

FOR COLOR DEMODULATOR APPLICATIONS

● COLOR TV TYPE ● HIGH LEVEL OUTPUT ● INTERNAL MATRIXING ● 11000 MICROMHOS

The 6LE8 is a miniature twin pentode having separate plates and number-3 grids for the two sections with a common screen, number-1 grid, and cathode. It is primarily designed for use as a color demodulator in color television receivers.

The high current of the 6LE8 provides enough voltage output to drive the grids of color picture tubes without further amplification. The common screen grid provides internal matrixing of the red and blue information to provide sufficient drive to the green gun.

The characteristics of the 6LE8 are such that it may be used in either of two modes; (1) chroma information to grid number 1 and two phases of reference signal to the two number-3 grids, or (2) reference signal to grid number 1 and two different phases of chroma information to the two number-3 grids.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

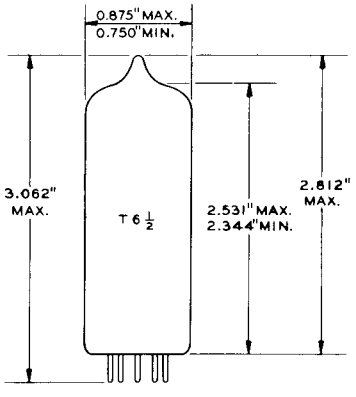
Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.75	Amperes
Direct Interelectrode Capacitances§		
Grid-Number 1 to Plate, Each Section	2.9	pf
Grid-Number 1 to All	15	pf
Grid-Number 3 to All, Each Section	6.5	pf
Plate (Each Section) to All	4.2	pf
Grid-Number 3 (Section 1) to Grid-Number 3 (Section 2), maximum	0.12	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-4

Maximum Diameter	0.875	Inches
Maximum Over-all Length	3.063	Inches
Maximum Seated Height	2.813	Inches

PHYSICAL DIMENSIONS

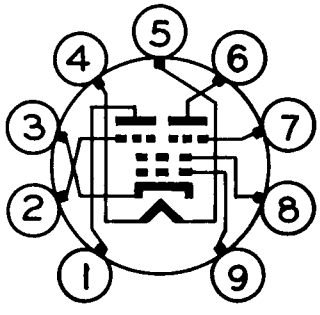


EIA 6-4

TERMINAL CONNECTIONS

Pin 1 - Plate (Section 2)
Pin 2 - Grid Number 3 (Section 2)
Pin 3 - Cathode
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Plate (Section 1)
Pin 7 - Grid Number 3 (Section 1)
Pin 8 - Grid Number 2 (Screen)
Pin 9 - Grid Number 1

BASING DIAGRAM



EIA 9QZ

GENERAL ELECTRIC

Supersedes Pages 1 and 2 of 6LE8 PI Sheet dated 5-66

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage, Each Section	300	Volts
Screen Voltage	150	Volts
Plate Dissipation, Each Section	2.0	Watts
Screen Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	300	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage, plates tied	100	Volts
Screen Voltage	100	Volts
Grid-Number 1 Voltage	-2.5	Volts
Grid-Number 3 Voltage	0	Volts
Transconductance	11000	Micromhos
Plate Current	17	Milliamperes
Screen Current	10.5	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 100 Microamperes	-7	Volts
Plate Current, maximum		
Eb = 250 volts, Ec2 = 100 volts, Ec1 = -2.5 volts, Ec3 = -35 volts	2.0	Milliamperes

NOTES

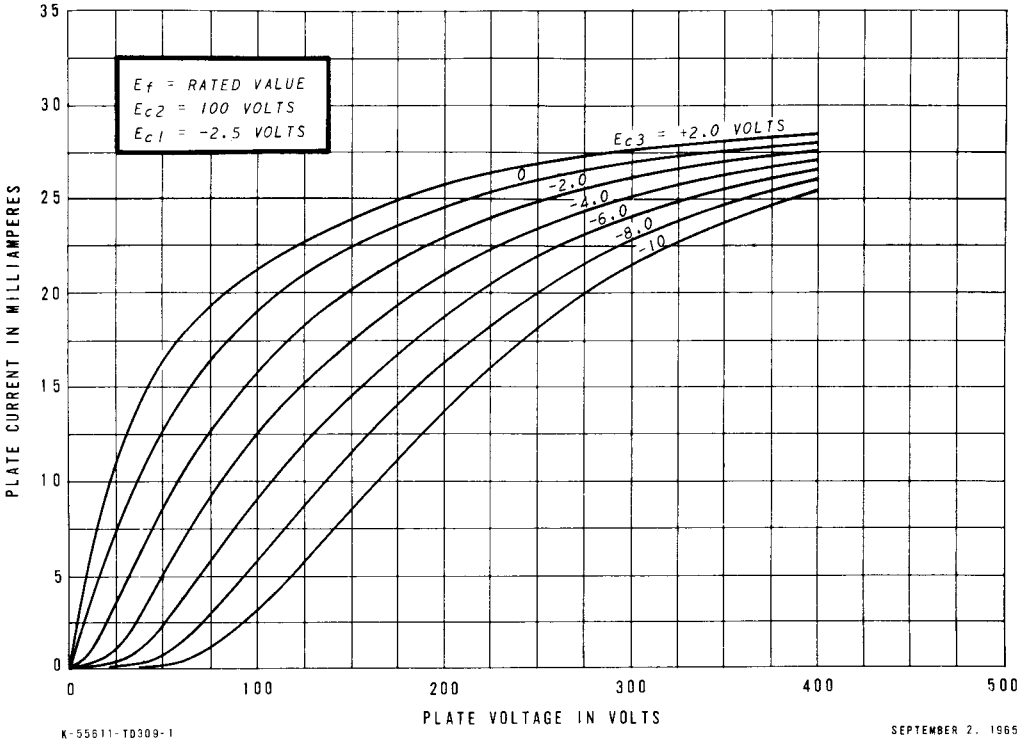
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

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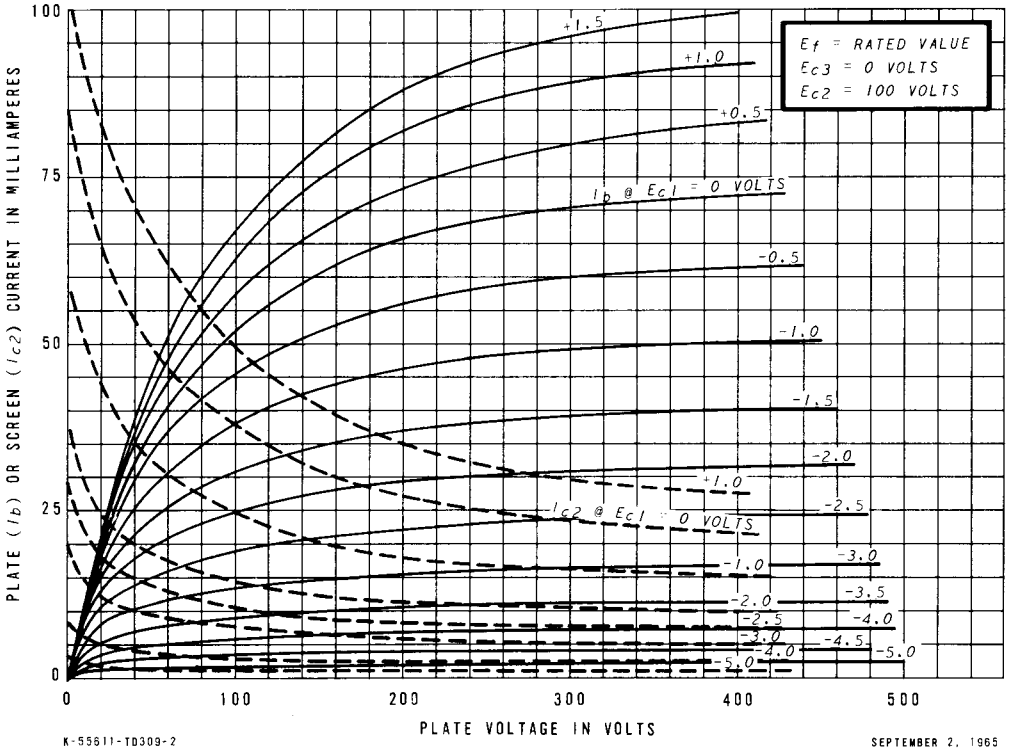
AVERAGE PLATE CHARACTERISTICS



K-55611-TD309-1

SEPTEMBER 2, 1965

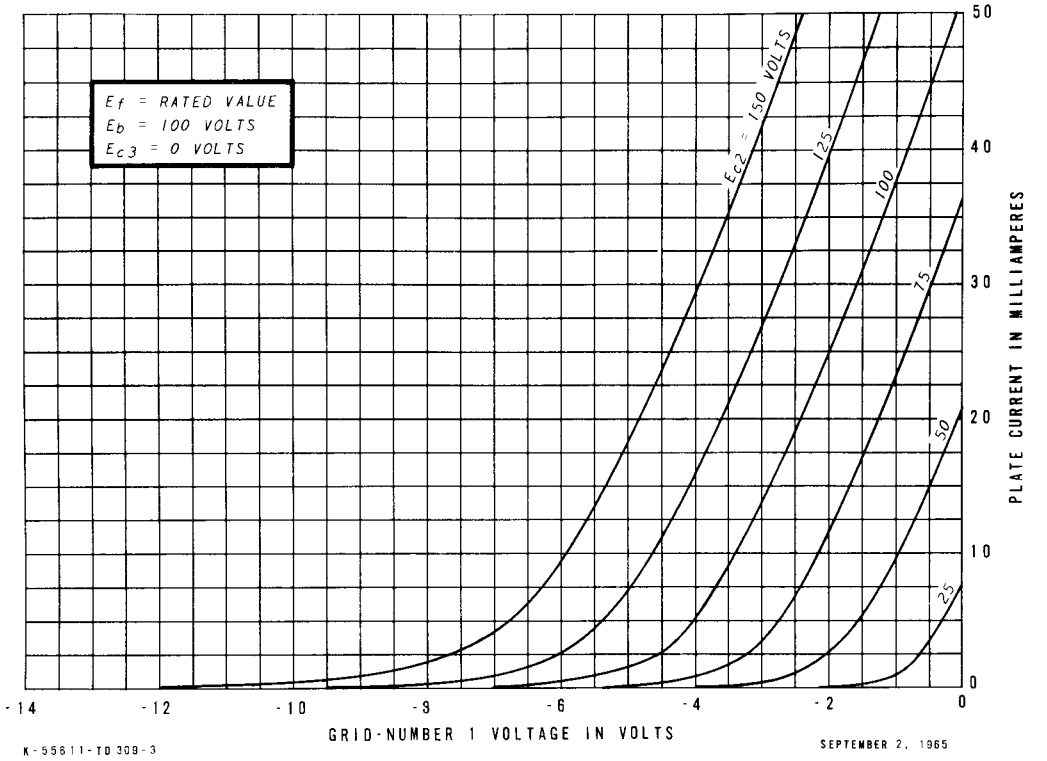
AVERAGE PLATE CHARACTERISTICS



K-55611-TD309-2

SEPTEMBER 2, 1965

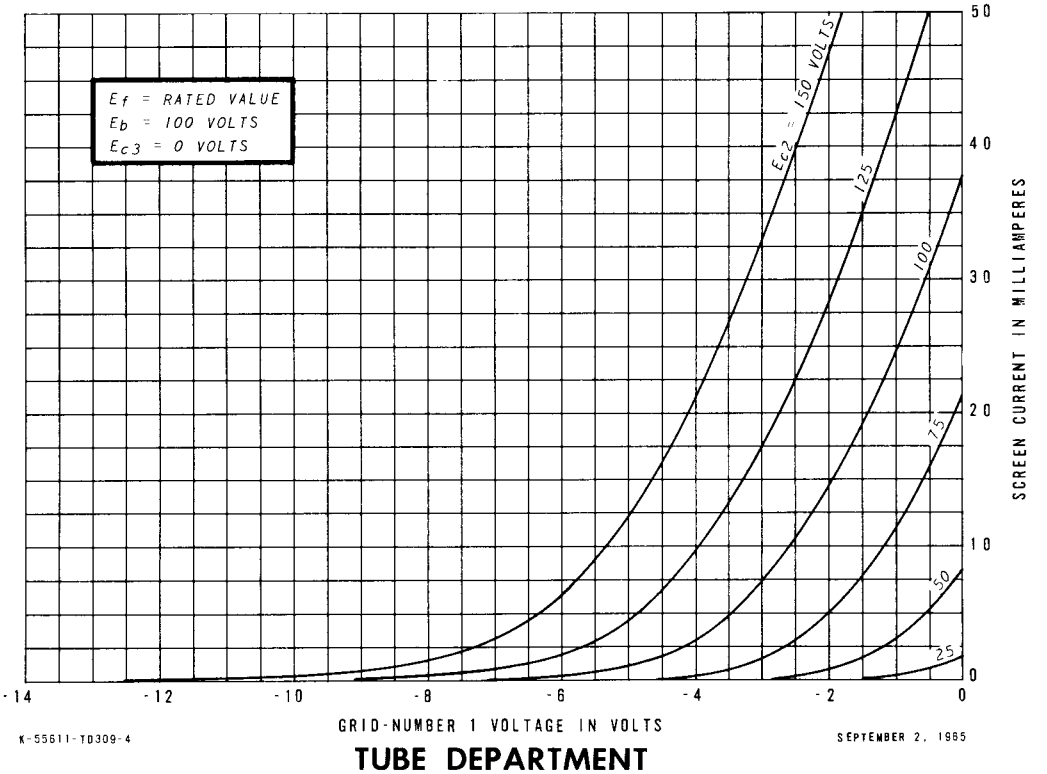
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD309-3

SEPTEMBER 2, 1965

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD309-4

SEPTEMBER 2, 1965

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Compactron Beam Pentode

6LG6

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

- **COLOR TV TYPE**
- **LOW KNEE—MINIMUM "SNIVETS"**
- **28 WATTS PLATE DISSIPATION**
- **LOW GRID DRIVE**

The 6LG6 is a compactron beam-power pentode primarily designed for use as the horizontal-deflection amplifier in color television receivers. It is characterized by having a very low knee voltage, high plate-to-screen ratio, and high peak current capability. These efficiency factors make the 6LG6 widely adaptable for use in circuits using shunt or variable-bias type regulation with B+ supply voltages from 240 to over 400 volts. Its low knee minimizes "snivets" without the necessity of supplying special voltages to the beam plates.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	2.0	Amperes

Direct Interelectrode Capacitances, approximate§

Grid-Number 1 to Plate: (g1 to p)	0.8	pf
Input: g1 to (h + k + g2 + b.p.)	25	pf
Output: p to (h + k + g2 + b.p.)	13	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Top Cap - C1-1, Small
Outline Drawing - EIA 12-89

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	4.125	Inches
Maximum Seated Height	3.750	Inches
Minimum Seated Height	3.500	Inches

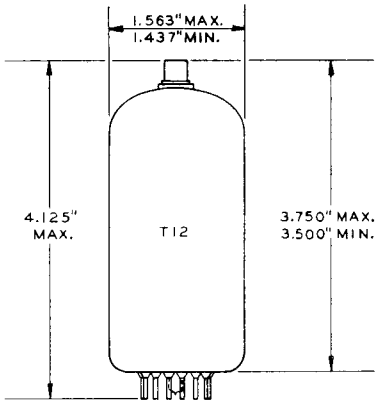
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

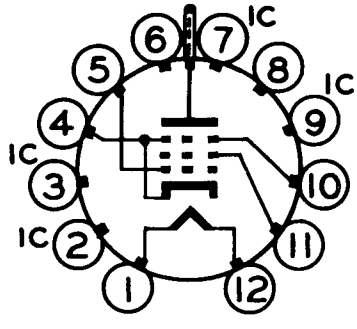


EIA 12-89

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Internal Connection - Do Not Use
Pin 3 - Internal Connection - Do Not Use
Pin 4 - Cathode and Beam Plates
Pin 5 - Grid Number 1
Pin 6 - No Connection
Pin 7 - Internal Connection - Do Not Use
Pin 8 - No Connection
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Cathode and Beam Plates
Pin 11 - Grid Number 2 (Screen)
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12HL

MAXIMUM RATINGS (Cont'd)

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE¶—
DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

DC Plate-Supply Voltage (Boost + DC Power Supply)	900	Volts
Peak Positive Pulse Plate Voltage (Absolute Maximum Value)	7500	Volts
Peak Negative Pulse Plate Voltage	100	Volts
Screen Voltage	200	Volts
Peak Negative Grid-Number 1 Voltage	300	Volts
Plate Dissipation#	28	Watts
Screen Dissipation	5.0	Watts
DC Cathode Current	315	Milliamperes
Peak Cathode Current	1100	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Number 1 Circuit Resistance		
With Feedback Type High Voltage Regulation	1.8	Megohms
With Shunt-Type High Voltage Regulation (Switching Mode)	2.2	Megohms
Bulb TemperatureΔ	225	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	6000	50	175	Volts
Screen Voltage	125	125	125	Volts
Grid-Number 1 Voltage	---	0¢	-23	Volts
Plate Resistance, approximate	---	---	7500	Ohms
Transconductance	---	---	11500	Micromhos
Plate Current	---	600	90	Milliamperes
Screen Current	---	42	1.7	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 1.0 Milliamperes	-125	---	-45	Volts
Triode Amplification Factor**	---	---	3.6	

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

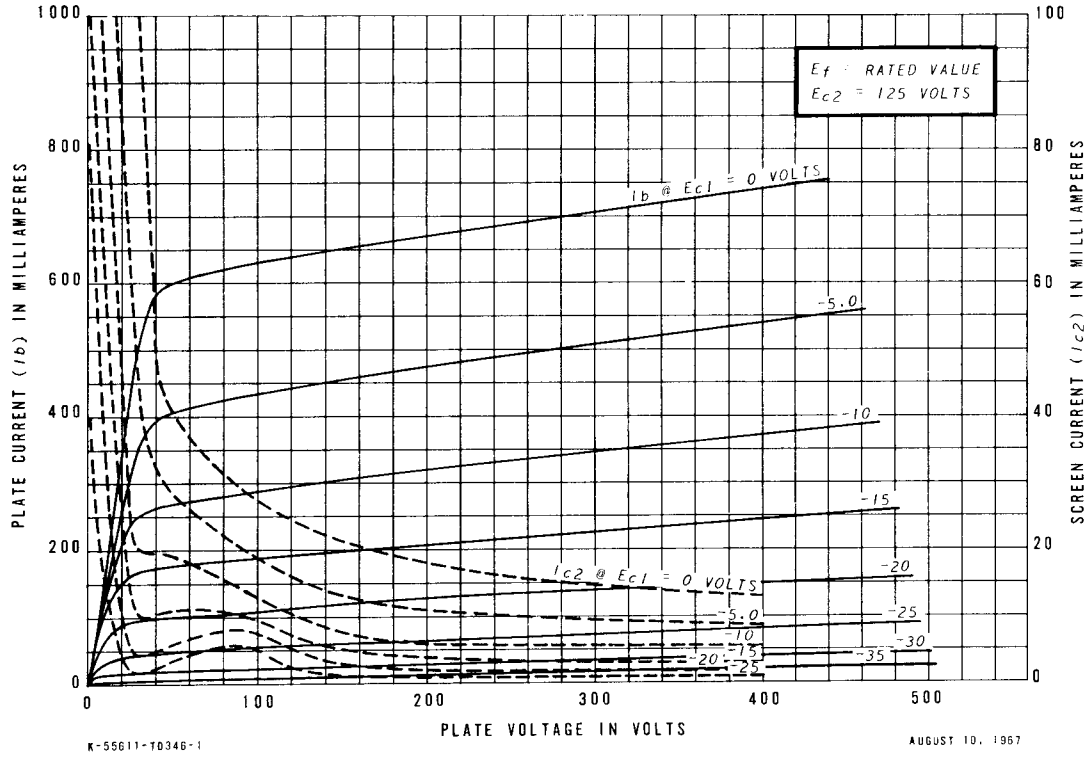
Δ Measured using a thermocouple attached to a 0.1-inch wide phosphor-bronze ring placed at the hottest location on the bulb.

¢ Applied for short interval (two seconds maximum) so as not to damage tube.

** Triode connection (screen tied to plate) with Eb = Ec2 = 125 volts, and Ec1 = -25 volts.

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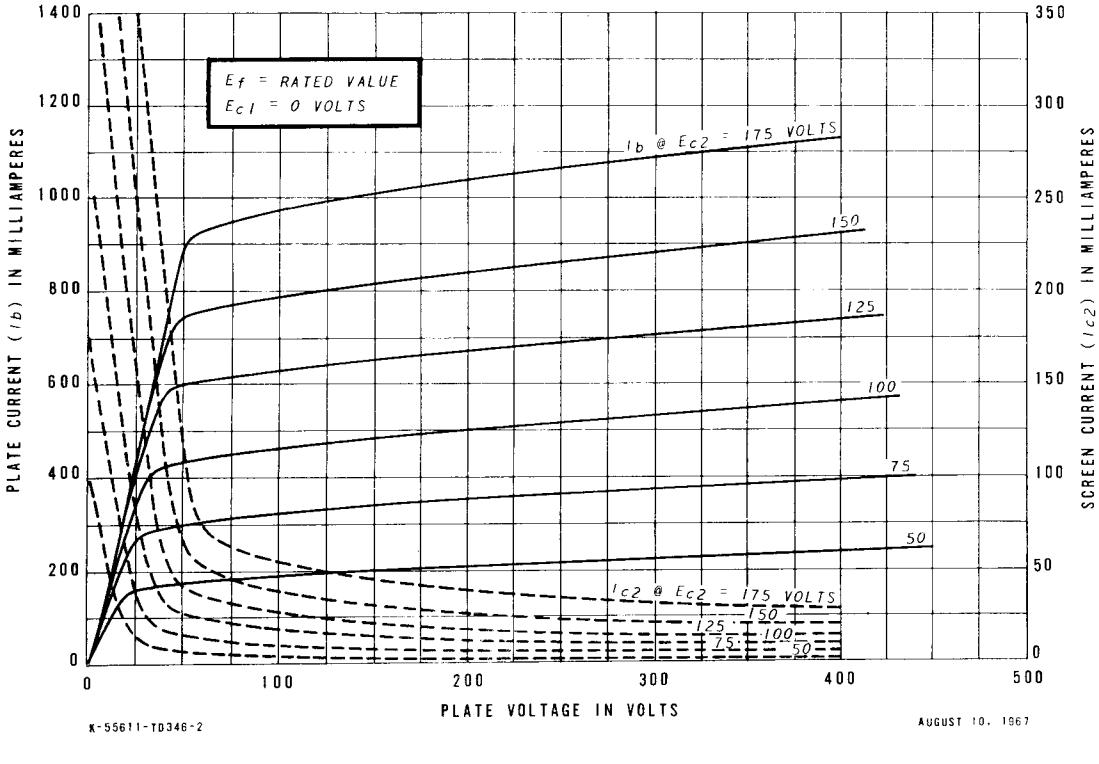
AVERAGE PLATE CHARACTERISTICS



K-55611-TD346-1

AUGUST 10, 1967

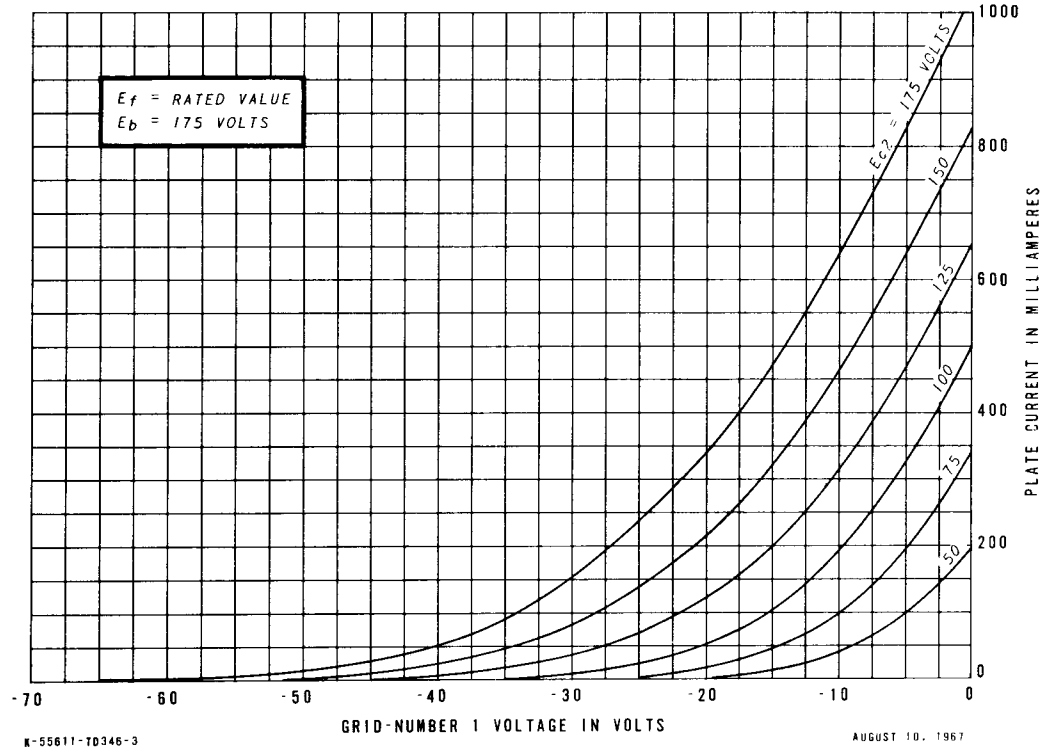
AVERAGE PLATE CHARACTERISTICS



K-55611-TD346-2

AUGUST 10, 1967

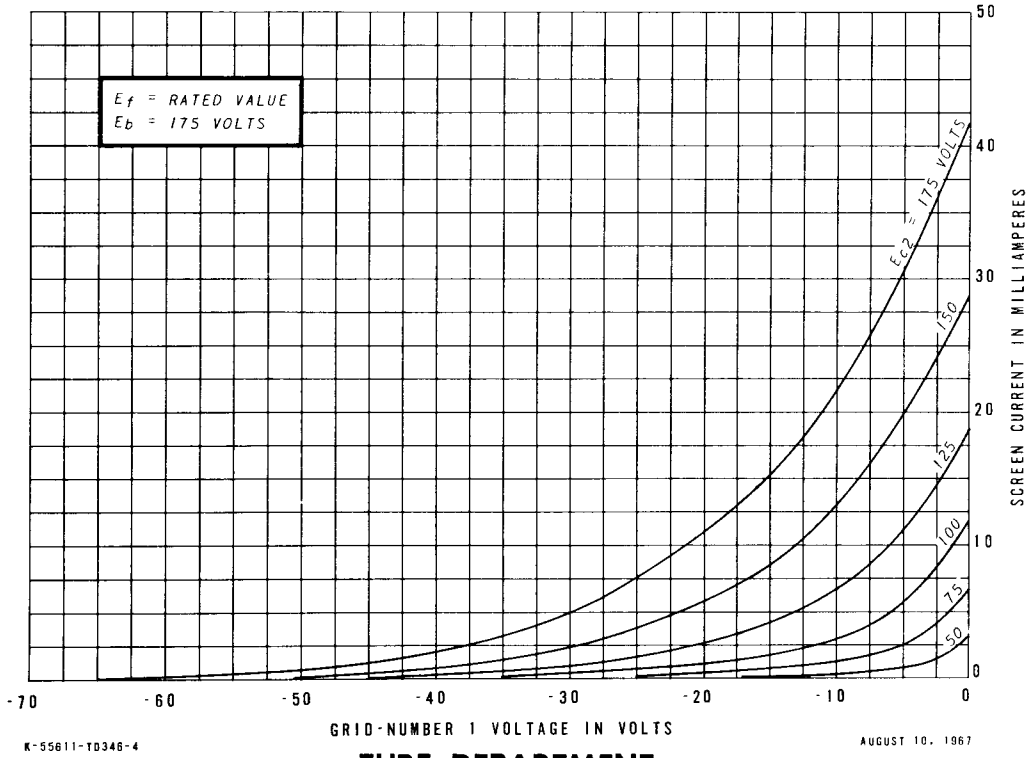
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD346-3

AUGUST 10, 1967

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD346-4

AUGUST 10, 1967

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Beam Triode

6LJ6-A

FOR HV SHUNT REGULATOR APPLICATIONS

■ COLOR TV TYPE ■ 27000 VOLTS DC ■ 40 WATTS PLATE DISSIPATION ■ X-RADIATION RATING

The 6LJ6-A is a low-current, high-voltage, beam triode intended for use as a shunt regulator in the high-voltage power supply of color television receivers.

The 6LJ6-A has a maximum d-c plate-voltage rating of 27,000 volts, a maximum d-c plate current rating of 1.5 milliamperes, and a maximum plate-dissipation rating of 40 watts.

Features of the 6LJ6-A include built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output. The 6LJ6-A also features the utilization of a high voltage shield to minimize the effects of a momentary arc within the tube.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.2	Amperes

Direct Interelectrode Capacitances§

Grid to Plate: (g to p)	1.0	pf
Input: g to (h + k)	2.6	pf
Output: p to (h + k)	1.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - B8-118, Short Medium Shell Octal 8-Pin
Top Cap - C1-48, Small
Outline Drawing - EIA 12-21

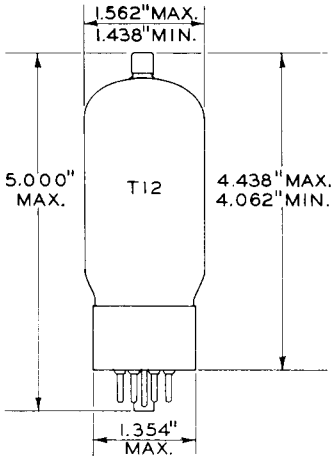
Maximum Diameter	1.562	Inches
Minimum Bulb Diameter	1.438	Inches
Maximum Over-all Length	5.000	Inches
Maximum Seated Height	4.438	Inches
Minimum Seated Height	4.062	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

Plate Voltage (Absolute-Maximum Value)	27000	Volts
Negative DC Grid Voltage	135	Volts
Peak Negative Grid Voltage¶	440	Volts
Plate Dissipation (Absolute-Maximum Value)	40	Watts
DC Plate Current (Absolute-Maximum Value)	1.5	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	Not Recommended	
Heater Negative with Respect to Cathode#	450	Volts
Grid-Circuit Resistance∆	3.0	Megohms

PHYSICAL DIMENSIONS

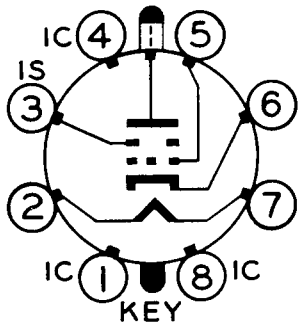


EIA 12-21

TERMINAL CONNECTIONS ¢

Pin 1 - Internal Connection - Do Not Use
Pin 2 - Heater
Pin 3 - Internal Shield¢
Pin 4 - Internal Connection - Do Not Use
Pin 5 - Grid
Pin 6 - Cathode
Pin 7 - Heater
Pin 8 - Internal Connection - Do Not Use
Cap - Plate

BASING DIAGRAM



EIA 8MQ

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Unregulated DC Supply Voltage	36000	Volts
Equivalent Resistance of Unregulated Supply	11	Megohms
DC Reference Voltage	200	Volts
Equivalent Resistance of Reference Supply	1000	Ohms
Effective Grid-Plate Transconductance	200	Micromhos
DC Plate Current for Zero Load Current	1000	Microamperes
DC Plate Current for Load Current of 1 Milliampere	45	Microamperes
Regulated DC Output Voltage at Zero Load Current	25000	Volts
Regulated DC Output Voltage at Load Current of 1 Milliampere	24500	Volts

X-RADIATION RATING

X-radiation, maximum	0.5	mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on data obtained with the use of the Victoreen 440 RF survey meter with a 3 3/8 inch aperture. X-radiation is measured with the face of the meter at a distance of 4 3/4 inches from the external surface of the tube. This rating information is not necessarily applicable when a different radiation measuring instrument or aperture is used.

Operation of the 6LJ6-A outside of the Absolute-Maximum Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

WARNING

X-RADIATION

Operation of the 6LJ6-A outside of the Absolute-Maximum Ratings indicated may produce soft X-rays above 0.5 milliroentgens per hour which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide required shielding.

Precautions must be exercised during the servicing of equipment employing the 6LJ6-A to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 6LJ6-A is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 6LJ6-A in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

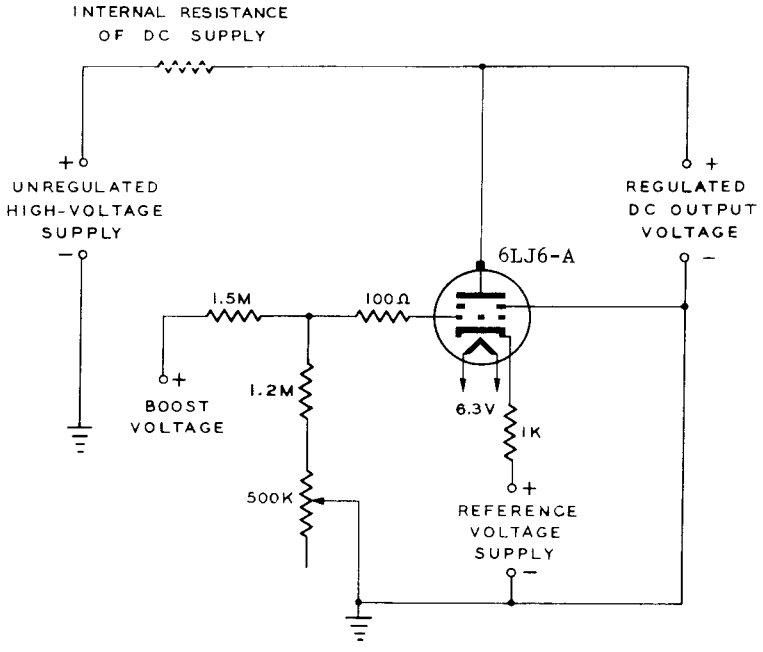
¶ Peak value for duration of 20 seconds maximum during equipment warmup.

\# Sufficient impedance (1000 ohms is recommended) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions to 450 ma. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

Δ With flyback transformer high-voltage supply.

¢ Shield connected directly to ground to minimize the effects of a momentary arc within the tube.

TYPICAL SHUNT REGULATOR CIRCUIT



APPLICATION CONSIDERATIONS

The base pins of the 6LJ6-A fit the standard octal socket. Socket terminals for pins 1, 4, and 8 should not be used for tie points. Tube performance may be adversely affected should this precaution not be followed.

Sufficient impedance (1000 ohms is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short circuit conditions to 450 ma. This protection impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

A unique design feature of the 6LJ6-A is the utilization of a high voltage shield to minimize the effects of a momentary arc within the tube. This shield is brought out to a separate pin so that it can be tied directly to ground, whereas it has been customary in the more conventional tubes of this type to tie the shield directly to the cathode. When the shield is tied to the cathode, any arcing can cause failure of the cathode resistor and/or breakdown of the heater cathode insulation, failures which the 6LJ6-A has been designed to prevent.

The high voltages at which the 6LJ6-A is operated may be very hazardous. Extreme caution should be used while making any circuit adjustments. The 6LJ6-A and all of its associated hardware should be housed in a protective enclosure. It is particularly important that all parts which may be at a high potential with respect to ground be housed in this protective enclosure. The protective enclosure should be constructed with a system of interlocks to prevent anyone from coming in contact with any high potential point in the electrical system. The interlocks should break the primary circuit of the high-voltage supply when any part of the protective enclosure is open, and should prevent the closing of the primary circuit until the protective enclosure is closed and locked.

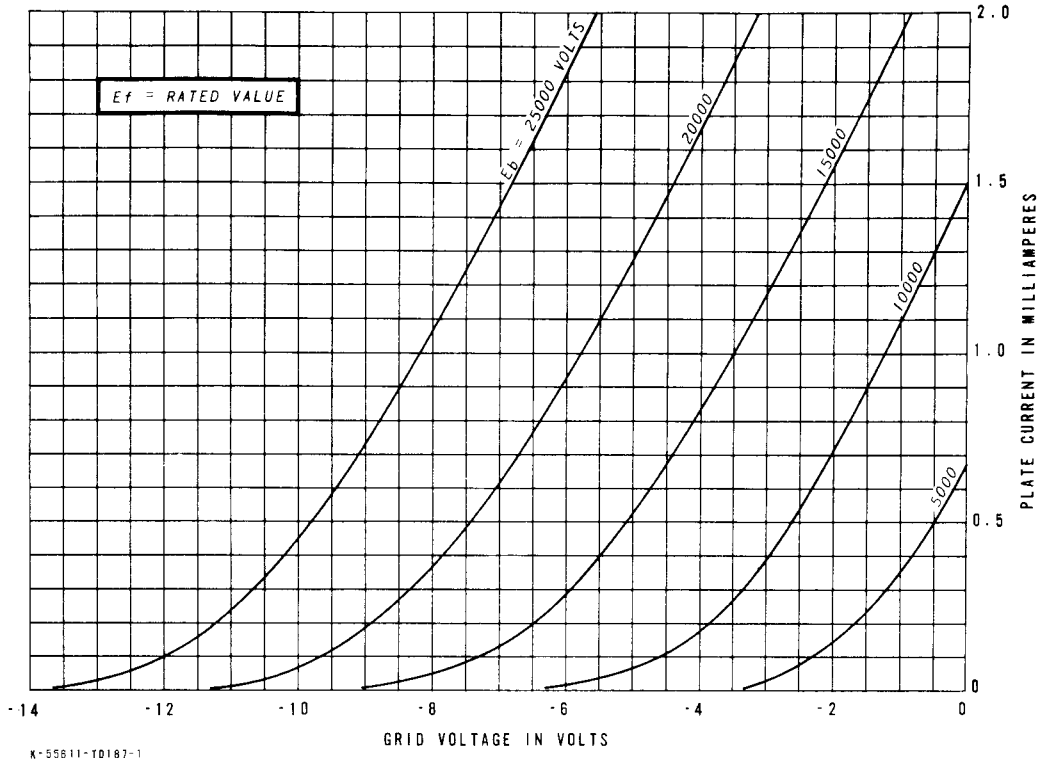
High voltages may appear at points in the circuit which are normally at low potentials as a result of improper circuit connection or of capacitor breakdown. Therefore, before touching any part of the circuit, the power supply switch should be turned off and both terminals of any capacitor should be grounded.

The bulb of the 6LJ6-A becomes hot during operation. Therefore, it is essential that provision be made for free circulation of air around the tube in order to insure sufficient cooling.

The plate of the 6LJ6-A exhibits a dull red color when the tube is operated at maximum plate dissipation. In addition, it may exhibit a bluish glow on the upper half of the bulb inner wall surface during normal operation. This bluish glow is a result of fluorescence and it should not be mistaken for gas.

To prevent any strain from being exerted on the seal of the plate cap, it is important that connection to the plate cap be made by an appropriate connector which has a flexible lead.

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD187-1

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

—PRODUCT INFORMATION—

Triode-Pentode

6LJ8

The 6LJ8 is a miniature tube containing a medium-mu triode and a sharp-cutoff pentode. It is designed primarily for use as a combined triode oscillator and pentode mixer in VHF television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.4	Amperes

Direct Interelectrode Capacitances§

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp), maximum	0.015	pf
Input: Pg1 to (h + k + Pg2 + Pg3 + i.s.)	5.5	pf
Output: Pp to (h + k + Pg2 + Pg3 + i.s.)	3.4	pf

Triode Section

Grid to Plate: (Tg to Tp)	1.4	pf
Input: Tg to (h + k + Pg3 + i.s.)	2.4	pf
Output: Tp to (h + k + Pg3 + i.s.)	2.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

Maximum Diameter	0.875	Inches
Minimum Diameter	0.750	Inches
Maximum Over-all Length	2.187	Inches
Maximum Seated Height	1.937	Inches

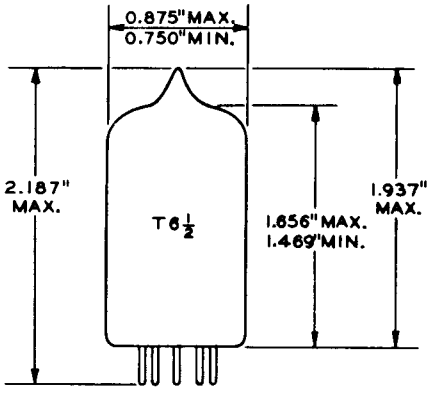
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

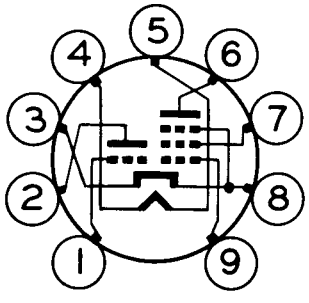


EIA 6-2

TERMINAL CONNECTIONS

Pin 1 - Triode Grid
Pin 2 - Triode Plate
Pin 3 - Cathode
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Plate
Pin 7 - Pentode Grid Number 2 (Screen)
Pin 8 - Cathode and Pentode Grid Number 3 (Suppressor)
Pin 9 - Pentode Grid Number 1

BASING DIAGRAM



EIA 9GF

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES	Pentode Section	Triode Section	
Plate Voltage	280	280	Volts
Screen Supply Voltage	280	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0¶	0	Volts
DC Cathode Current	20	20	Milliamperes
Plate Dissipation	2.0	2.0	Watts
Screen Dissipation	0.5	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	0.5	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER#	Pentode Section	Triode Section	
Plate Voltage	125	125	Volts
Screen Voltage	125	---	Volts
Grid-Number 1 Voltage	0	0	Volts
Cathode-Bias Resistor	33	68	Ohms
Amplification Factor	---	40	
Plate Resistance, approximate	125000	5000	Ohms
Transconductance	13000	8000	Micromhos
Plate Current	12	13	Milliamperes
Screen Current	3.5	---	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 30 Microamperes	-4	-6.5	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ With external shield (EIA 315) connected to cathode.

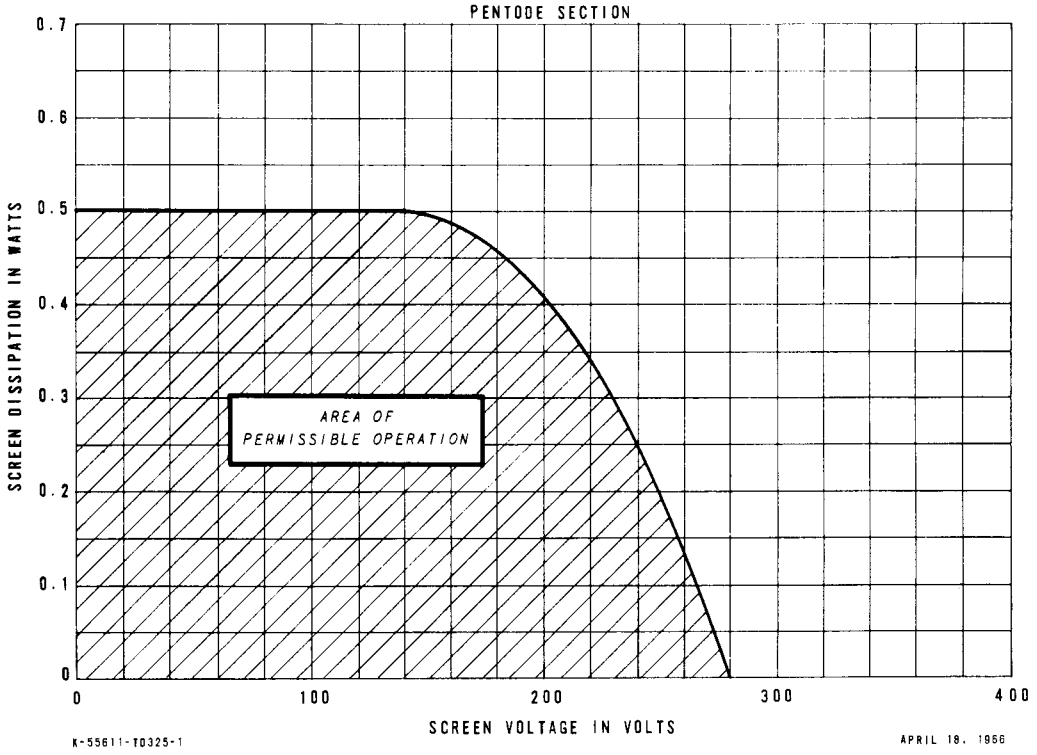
¶ Control grid to cathode spacing of the pentode section of this tube is of such low order of magnitude as to preclude the use of voltage between these elements of more than 30 volts dc or peak ac in commercial tube checkers and shorts-indicating devices, particularly where mechanical excitation of the tube is employed.

\# Each section measured separately and with cathode-bias resistor indicated. Section not under test is floating.

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SCREEN RATING CHART

PENTODE SECTION

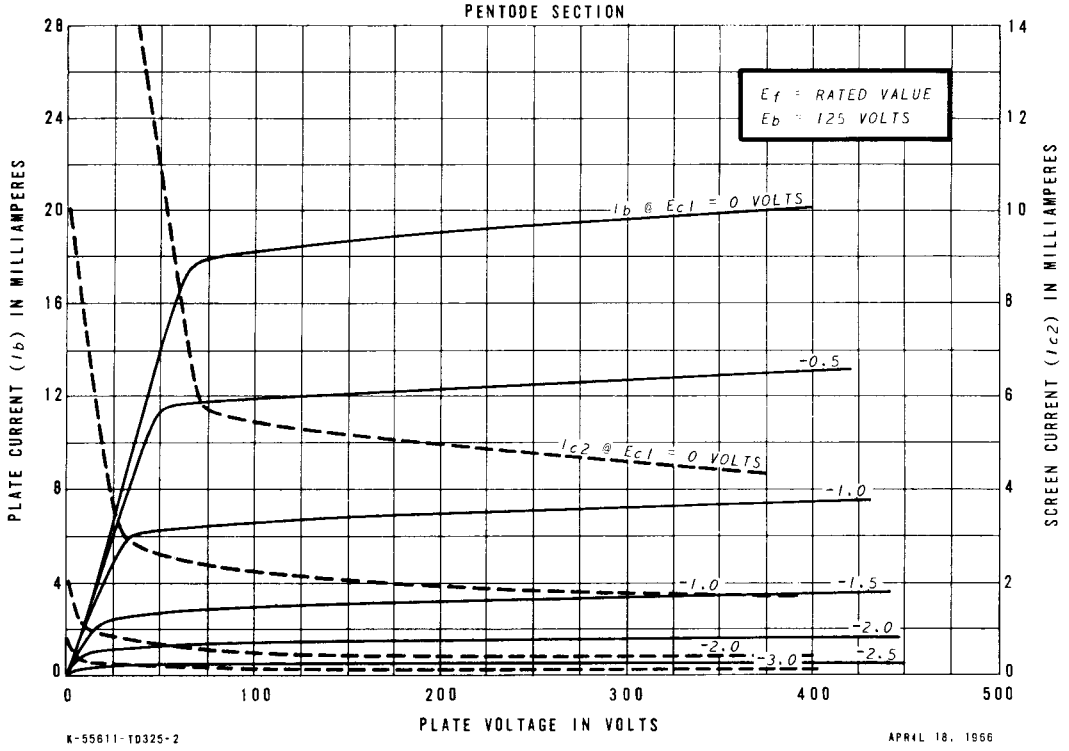


K-55611-TD325-1

APRIL 18, 1966

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

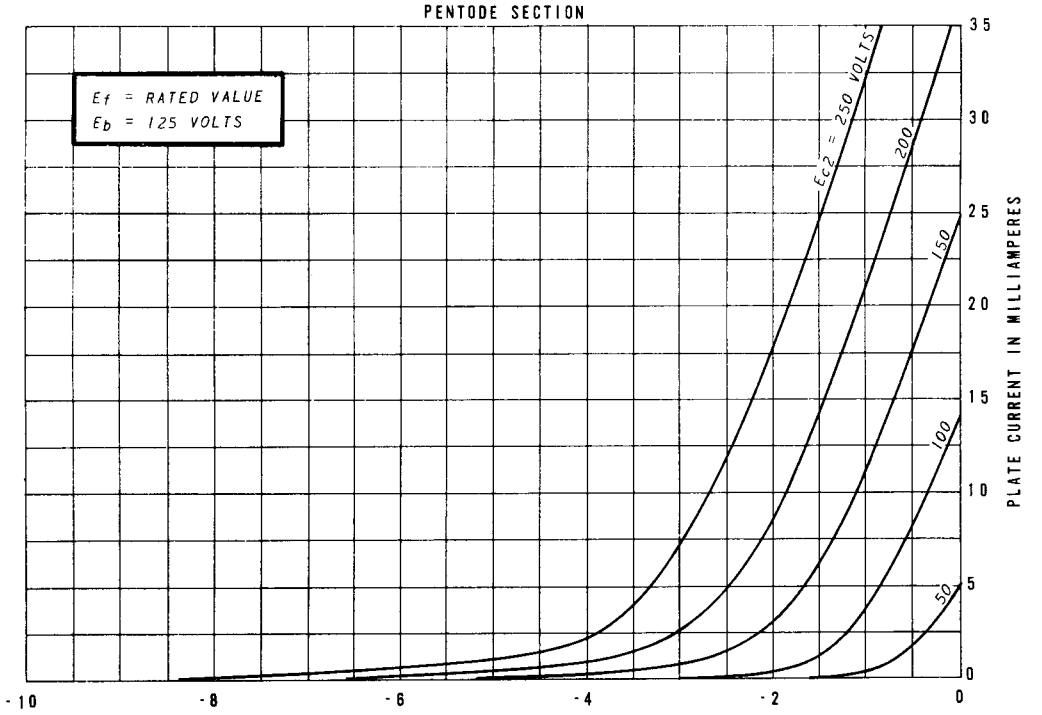


K-55611-TD325-2

APRIL 18, 1966

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

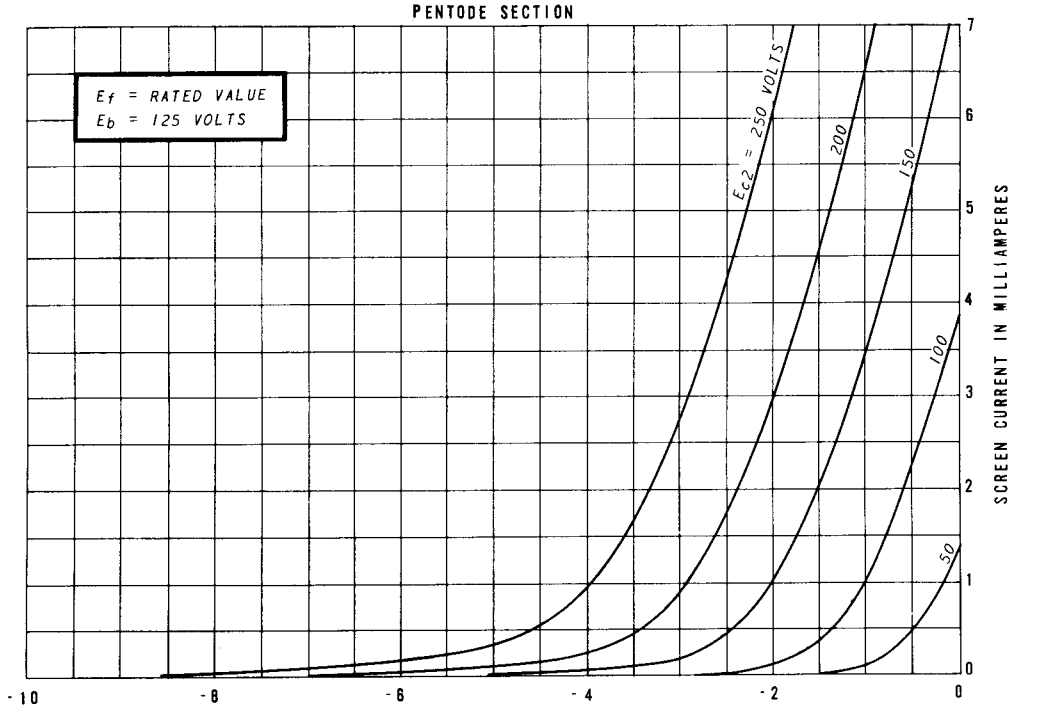


K-55811-TD325-3

APRIL 18, 1966

AVERAGE TRANSFER CHARACTERISTICS

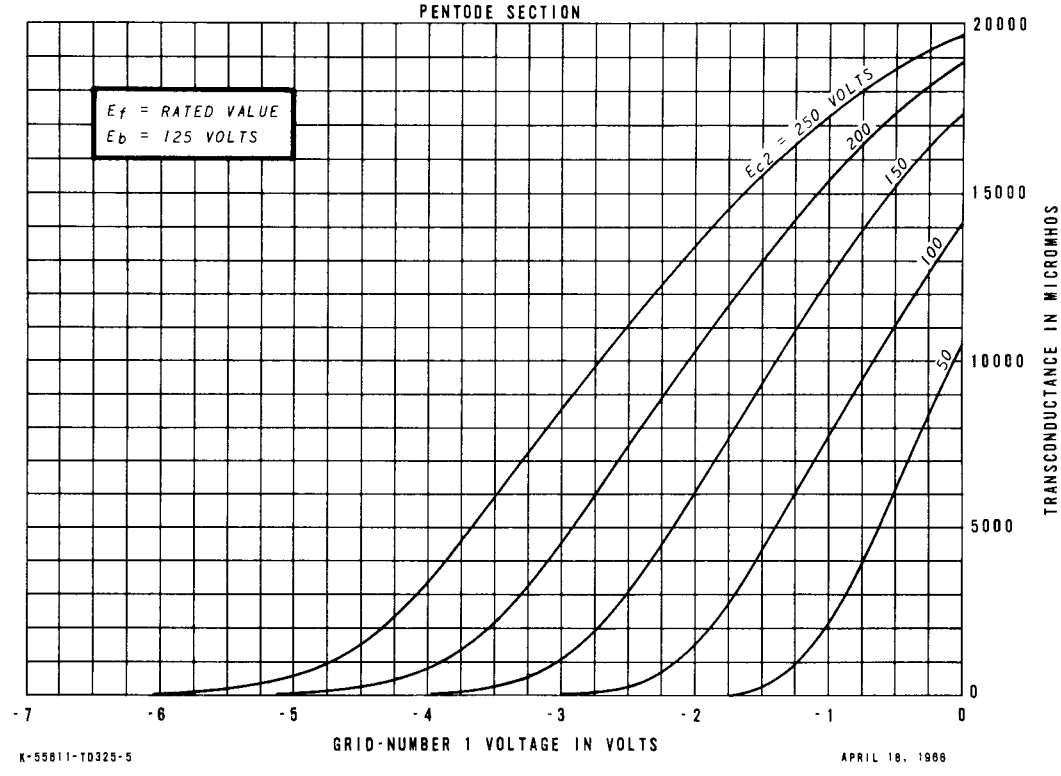
PENTODE SECTION



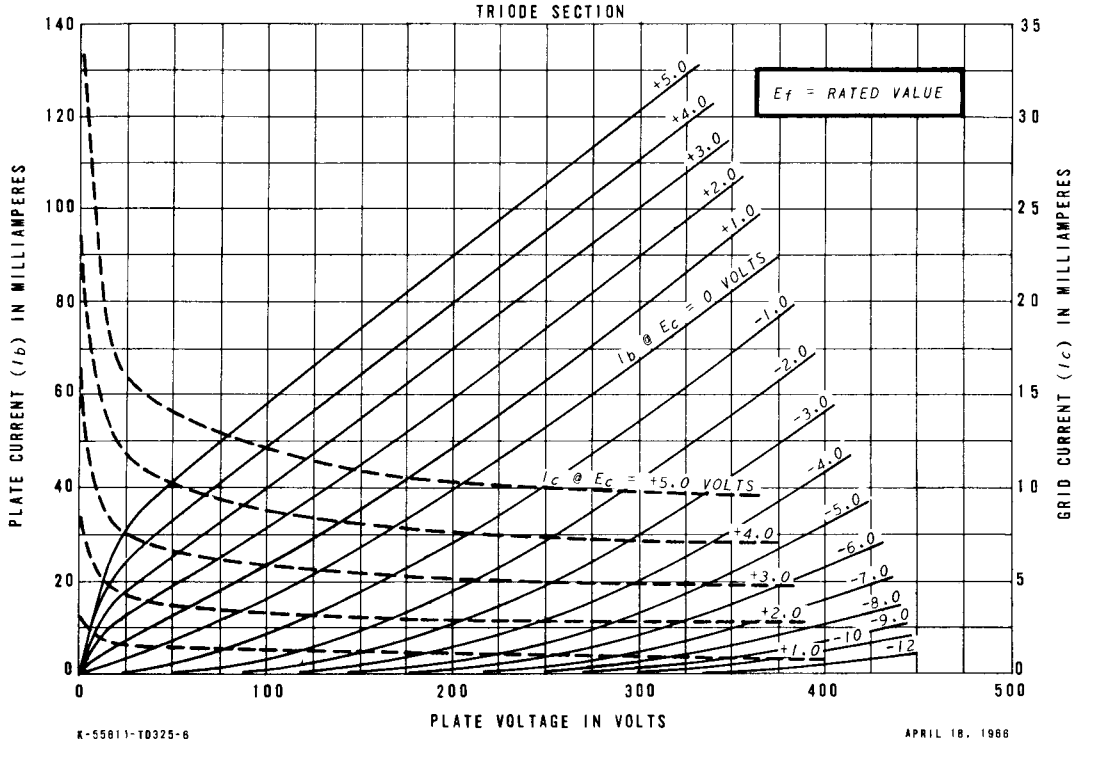
K-55811-TD325-4

APRIL 18, 1966

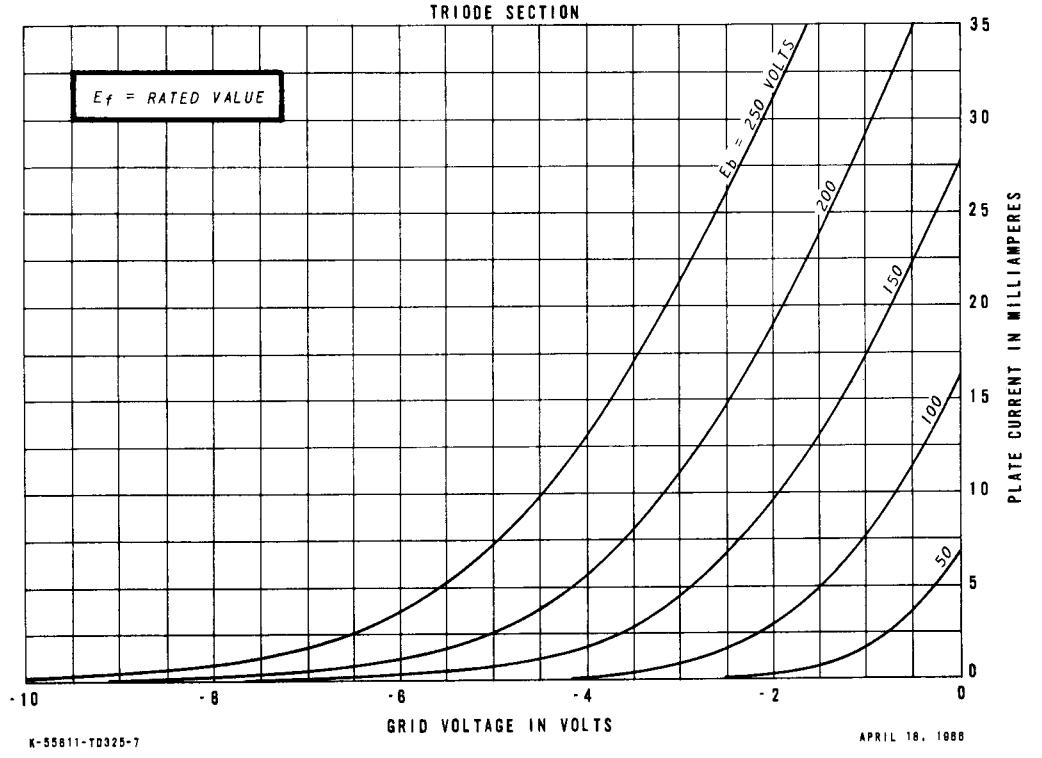
AVERAGE TRANSFER CHARACTERISTICS



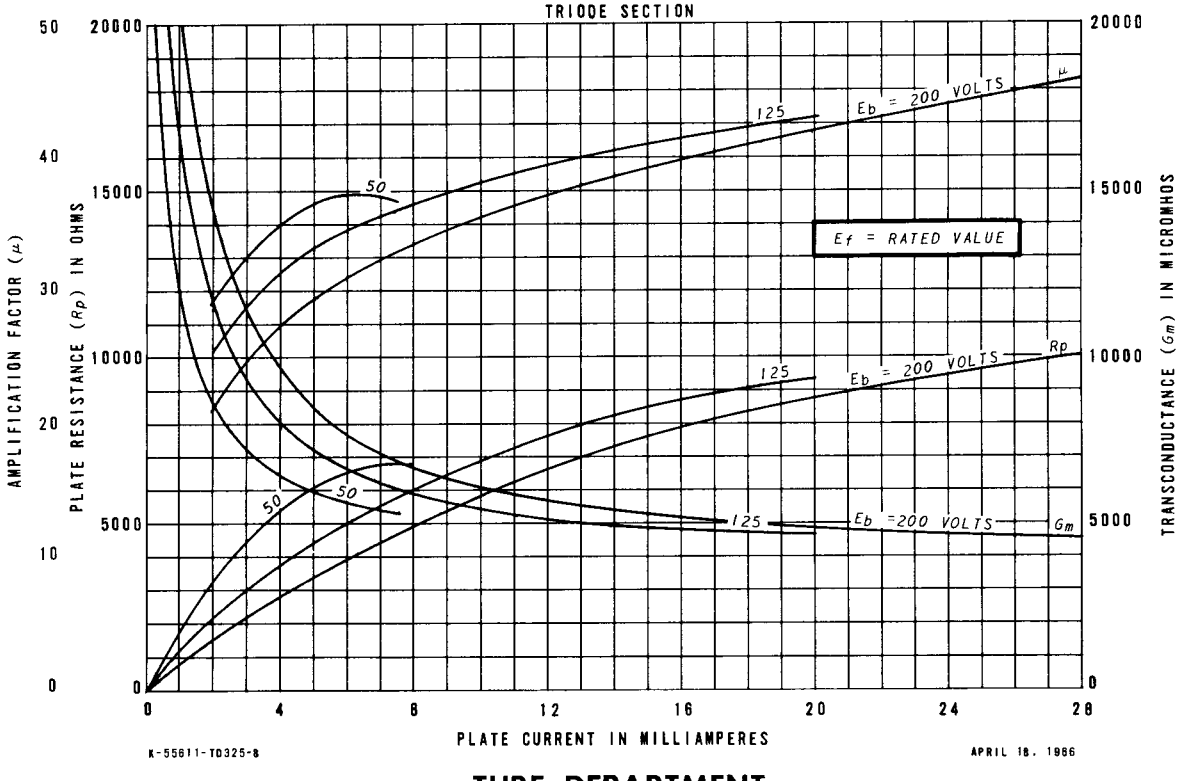
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Beam Pentode

6LQ6

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DARK HEATER | PLATE CURRENT 30 WATTS | NOVAR TYPE | OVERLOAD Pb 200 WATTS

The 6LQ6 is a double–ended high perveance beam power pentode. This tube is especially useful as a horizontal–deflection amplifier tube in color–TV receivers.

Features of the 6LQ6 are, the endurance of excessive plate dissipation, the withstanding of a 200 watt plate dissipation for a period of time sufficient enough to permit conventional receiver protection devices to function and the capability to meet the stringent requirements of color–television deflection circuits.

GENERAL

ELECTRICAL

Cathode – Coated Unipotential

Heater Characteristics and Ratings

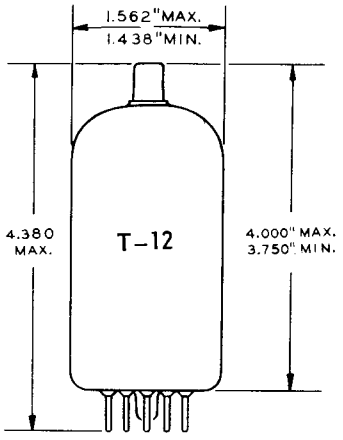
Heater Voltage, AC or DC	6.3	Volts
Heater Current	2.3	Amperes
Direct Interelectrode Capacitances •		
Grid No. 1 to Plate (G1 to P)	0.56	pF
Input G1 to (K,G3,G2,H)	22	pF
Output P to (K,G3,G2,H)	11	pF

MECHANICAL

Operating Position – Any
Envelope T–12
Base E9–88 Large Button Novar 9–Pin with Exhaust Tip
Top Cap C1–1 Small
Outline Drawing EIA 12–117

Maximum Diameter	1.562 Inches
Minimum Diameter	1.438 Inches
Maximum Over–all Length	4.380 Inches
Maximum Seated Height	4.000 Inches
Minimum Seated Height	3.750 Inches

PHYSICAL DIMENSIONS

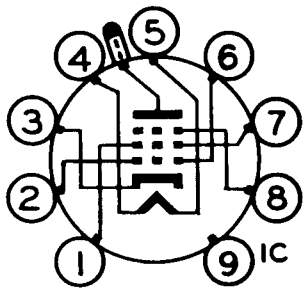


12–117

TERMINAL CONNECTIONS

Pin 1 – Grid No. 2
Pin 2 – Grid No. 1
Pin 3 – Cathode
Pin 4 – Heater
Pin 5 – Heater
Pin 6 – Grid No. 1
Pin 7 – Grid No. 2
Pin 8 – Grid No. 3
Pin 9 – Internal Connection (Do Not Use)
Top Cap – Plate

BASING DIAGRAM



9 Q L

GENERAL ELECTRIC

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER —DESIGN-MAXIMUM VALUES

DC Plate Supply Voltage	990	Volts
Peak Positive-Pulse Plate Voltage ⊕	7500	Volts
Peak Negative-Pulse Plate Voltage	1100	Volts
DC Grid-No. 3 Voltage ‡	75	Volts
DC Grid-No. 2 (Screen-Grid) Voltage	220	Volts
Peak Negative-Pulse Grid-No. 1 (Control-Grid) Voltage	330	Volts
Heater-Cathode Voltage		
Peak	±200	Volts
Average	100	Volts
Heater Voltage, ac or dc	5.7 to 6.9	Volts
Cathode Current		
Peak	1200	Milliamperes
Average	350	Milliamperes
Grid-No. 2 Input	5	Watts
Plate Dissipation §	30	Watts
Temporary Overload Plate Dissipation #	200	Watts
Envelope Temperature (at hottest point on envelope surface)	250 °	C

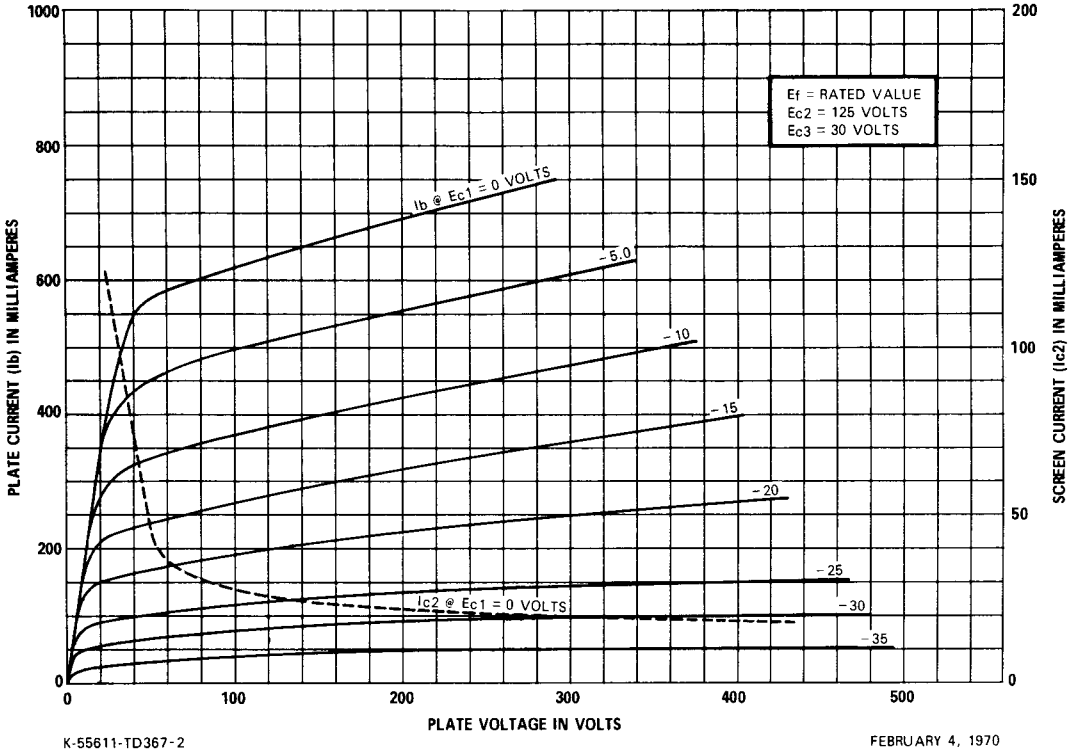
MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance		
For Grid-No. 1 resistor-bias operation	0.47	MΩ
For Plate-pulsed operation (horizontal-deflection circuits only)	10	MΩ

CHARACTERISTICS AND TYPICAL OPERATION

Amplification Factor (Triode Connection) ♦	– –	– –	3 ▲	– –	– –	2.8 ♦	
Plate Resistance (Approx.)	– –	– –	5800	– –	– –	7000	Ω
Transconductance	– –	– –	9600	– –	– –	7500	μ mho
DC Plate Current	– –	580 *	130	– –	710 *	95	Milliampere
DC Grid No.2 Current	– –	40 *	2.8	– –	55 *	2.4	Milliampere
Cutoff DC Grid No. 1 Voltage for I_b =1mA	–120	– –	–54	125	– –	–60	Volt
Heater Voltage	← BOGEY VALUE →						Volt
Peak Positive-Pulse Plate Voltage †	5000	– –	– –	5000	– –	– –	Volt
DC Plate Voltage	– –	55	175	– –	60	175	Volt
DC Grid No. 3 Voltage	30	30	30	30	30	30	Volt
DC Grid No. 2 Voltage	125	125	125	145	145	145	Volt
DC Grid No. 1 Voltage	– –	0	–25	– –	0	–35	Volt

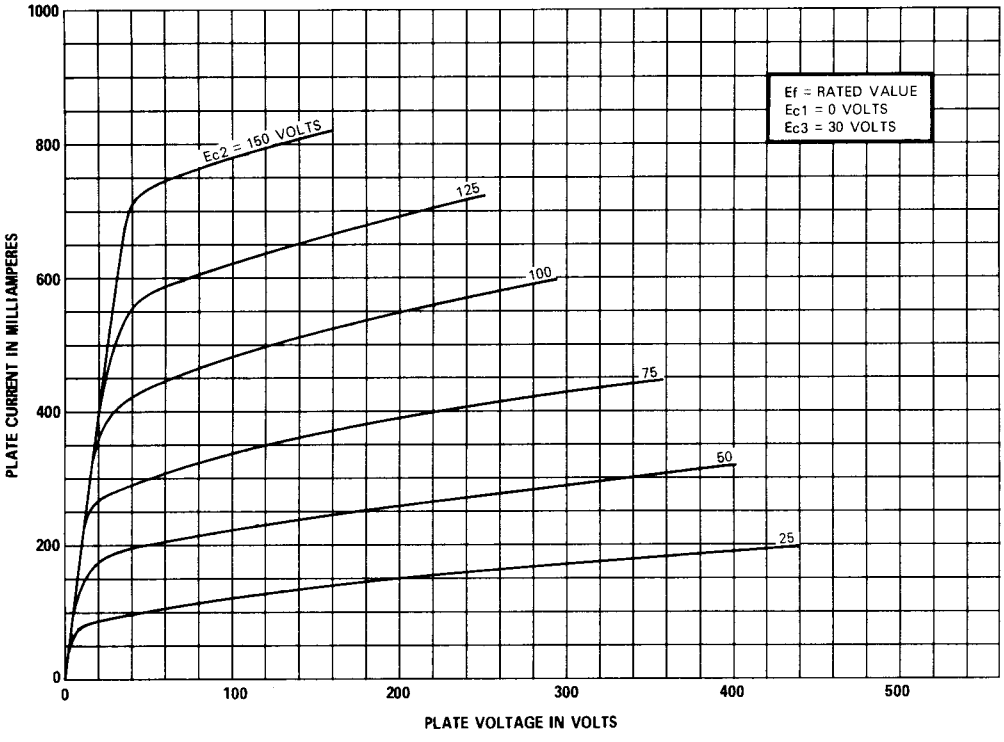
AVERAGE PLATE CHARACTERISTICS



K-55611-TD367-2

FEBRUARY 4, 1970

AVERAGE PLATE CHARACTERISTICS



NOTES

• Without external shield.

♦ With gried No. 3 and grid No. 2 connected respectively to cathode and plate at socket.

▲ Conditions: $E_b = E_{c2} = 125$ V, $E_{c1} = -25$ V.

• Conditions: $E_b = E_{c2} = 145$ V, $E_{c1} = -35$ V.

⋆ This value can be measured by a method involving a re current waveform such that the Maximum Ratings of the tube will not be exceeded.

† Under pulse–duration condition specified in Footnote ⊕

⊕ For operation in a 525–line, 30 frame television system as desrcibed in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

‡ In horizontal–deflection–amplifier swrvice, a positive voltage should be applied to grid No. 3 to reduce interference from "snivets" which may occur in both vhf and uhf television receivers, and to increase power output. A typical value is 30 V.

§ An adequate bias resistor or other means is required to protect the tube in the absence of excitation.

Total continuous or accumulated time not to exceed 40 seconds.

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ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Triode-Pentode

6LR8

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

■ COLOR TV TYPE ■ T-12 ENVELOPE ■ TRIODE-PENTODE

The 6LR8 is a triode-pentode containing a high-mu triode and a beam pentode. The triode is designed for service as a vertical-deflection oscillator, and the pentode as a vertical-deflection amplifier in television receivers. The 6LR8 utilizes a T-12 bulb and features a 9-pin glass button base with a 0.687-inch pin circle.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

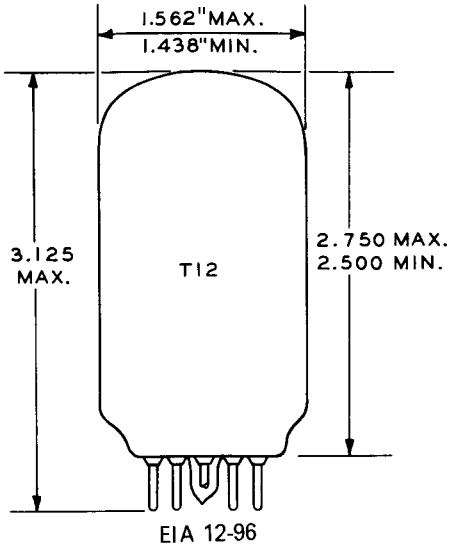
Heater Characteristics and Ratings		
Heater Voltage, AC or DC ★	6.3±0.6	Volts
Heater Current ●	1.5	Amperes
Direct Interelectrode Capacitances ▲		
Pentode Section		
Grid-Number 1 to Plate: maximum (Pg1 to Pp)	0.7	pf
Input: Pg1 to (h+Pk+Pg2+b.p.)	16	pf
Output: Pp to (h+Pk+Pg2+b.p.)	9.0	pf
Triode Section		
Grid to Plate: (Tg to Tp)	6.0	pf
Input: Tg to (h+Tk)	6.5	pf
Output: Tp to (h+Tk)	1.6	pf
Coupling		
Pentode Grid-Number 1 to Triode Plate: (Pg1 to Tp)	0.12	pf
Pentode Plate to Triode Plate: (Pp to Tp), maximum	0.32	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E9-88, Button 9-Pin
Outline Drawing - EIA 12-96

Maximum Diameter	1.562	Inches
Minimum Diameter	1.438	Inches
Maximum Over-all Length	3.125	Inches
Maximum Seated Height	2.750	Inches
Minimum Seated Height	2.500	Inches

PHYSICAL DIMENSIONS

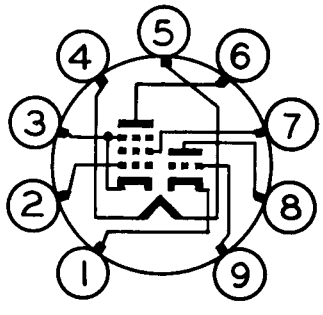


EIA 12-96

TERMINAL CONNECTIONS

Pin 1 - Triode Cathode
Pin 2 - Pentode Grid-Number 1
Pin 3 - Pentode Cathode and Beam Plates
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Plate
Pin 7 - Pentode Grid-Number 2 (Screen)
Pin 8 - Triode Plate
Pin 9 - Triode Grid

BASING DIAGRAM



EIA 9QT

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Vertical Oscillator Service ♦	Vertical Deflection Amplifier ♦	
Plate Voltage	400	400	Volts
Screen Voltage	---	300	Volts
Peak Positive Pulse Plate Voltage	---	2500	Volts
Peak Negative Grid-Number 1 Voltage	400	250	Volts
Plate Dissipation §	2.5	14	Watts
Screen Dissipation §	---	2.75	Watts
Average Cathode Current	30	75	Milliamperes
Peak Cathode Current	105	260	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	---	1.0	Megohm
With Cathode Bias	2.2	2.2	Megohms
Bulb Temperature at Hottest Point ⊕		210	°C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Triode Section	Pentode Section		
Plate Voltage	250	45	135	Volts
Screen Voltage	---	125	120	Volts
Grid-Number 1 Voltage	-4	0 □	-10	Volts
Plate Current	2.3	200	56	Milliamperes
Screen Current	---	20	3.0	Milliamperes
Transconductance	3600	---	9300	Micromhos
Amplification Factor	58	---	6.5 †	
Plate Resistance, approximate	16000	---	12000	Ohms
Grid Voltage, approximate				
Ib = 10 Microamperes	-6.6	---	---	Volts
Grid-Number 1 Voltage, approximate				
Ib = 1.0 Milliampere	---	---	-26	Volts
Grid-Number 1 Voltage, approximate				
Ib = 100 Microamperes	---	---	-30	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

• Heater current of a bogey at Ef = 6.3 volts.

▲ Without external shield.

♦ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

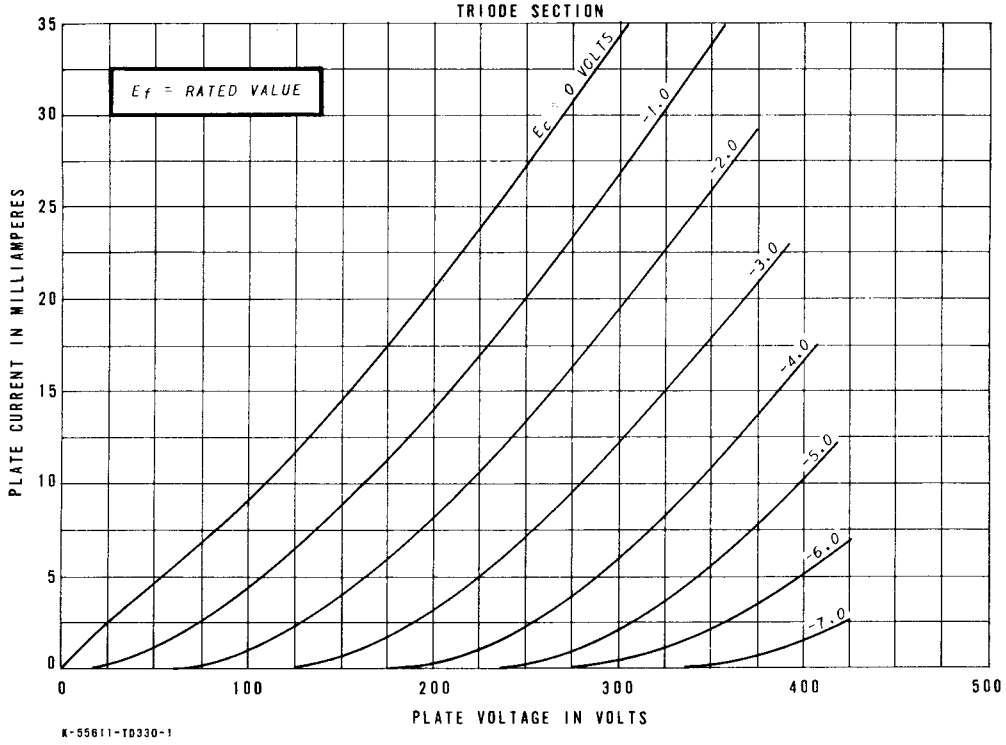
§ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

⊕ Measured with an infrared themometer, Ircon Model 700 BC or equivalent, at an ambient temperature of 40° C.

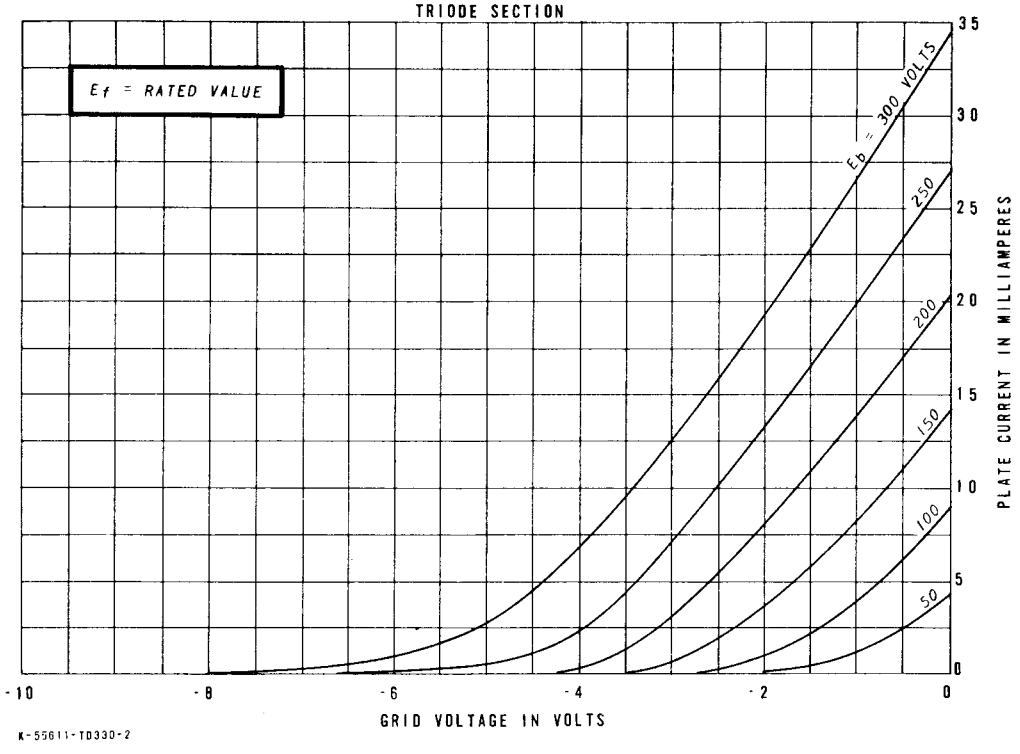
□ Applied for short interval (two seconds maximum) so as not to damage tube.

† Triode connection (screen tied to plate) with Eb = Ec2 = 120 volts, and Ec1 = -10 volts.

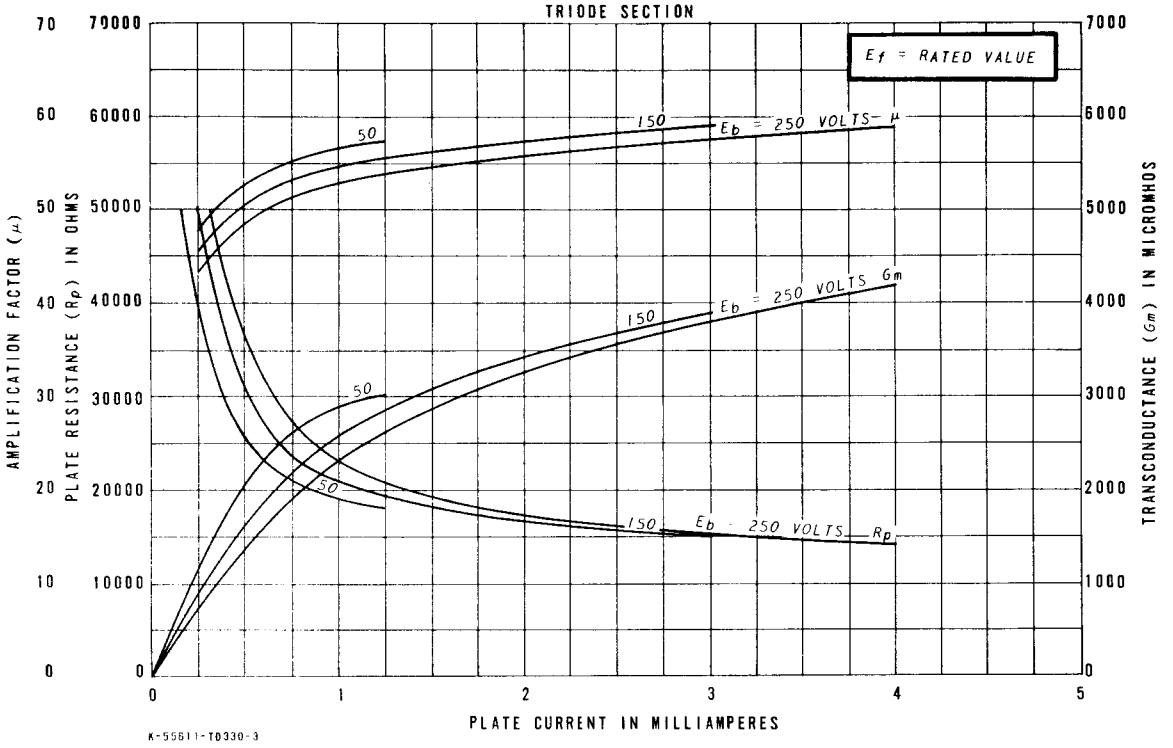
AVERAGE PLATE CHARACTERISTICS



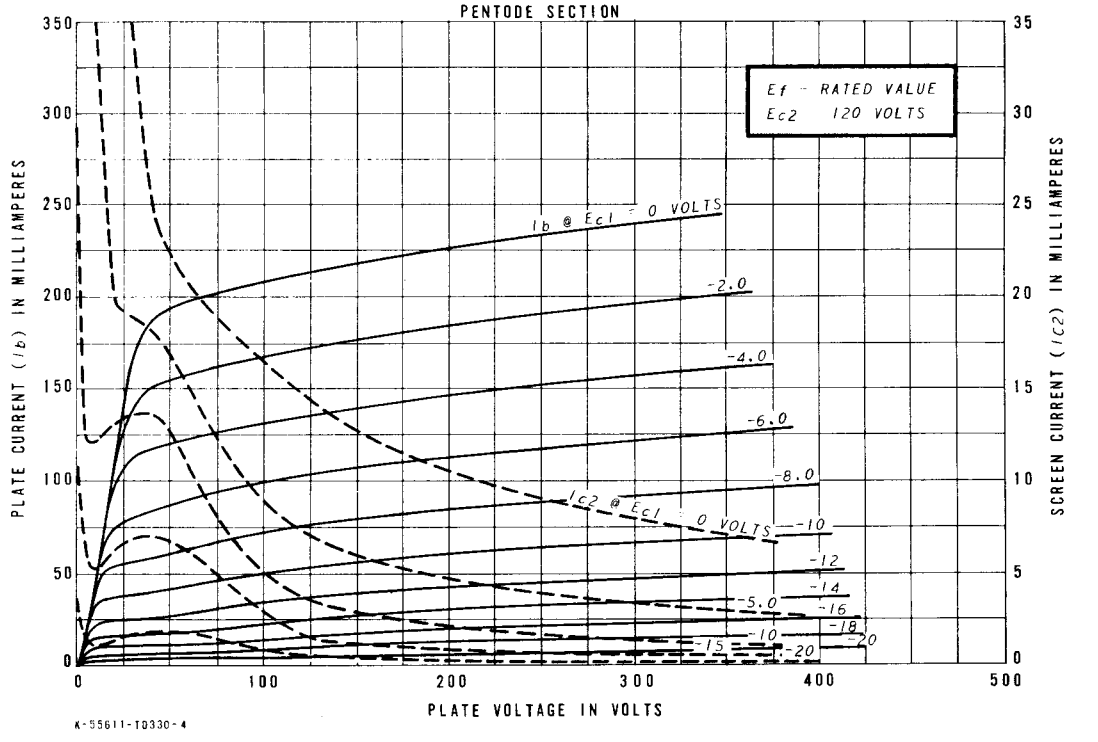
AVERAGE TRANSFER CHARACTERISTICS



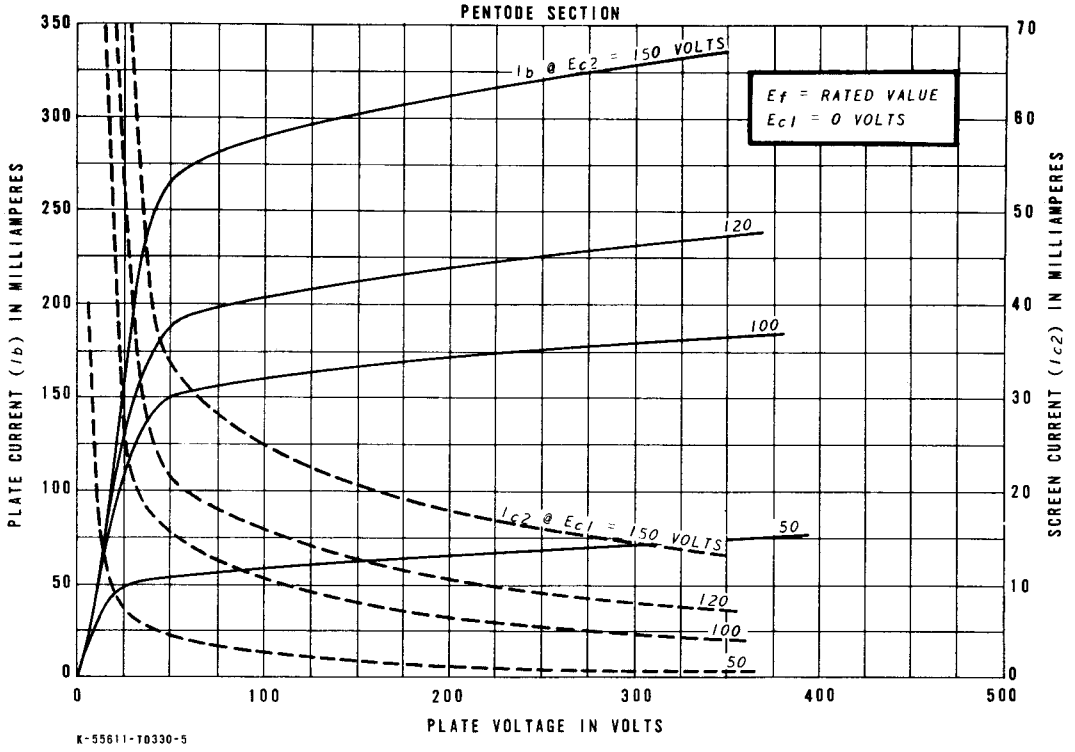
AVERAGE CHARACTERISTICS



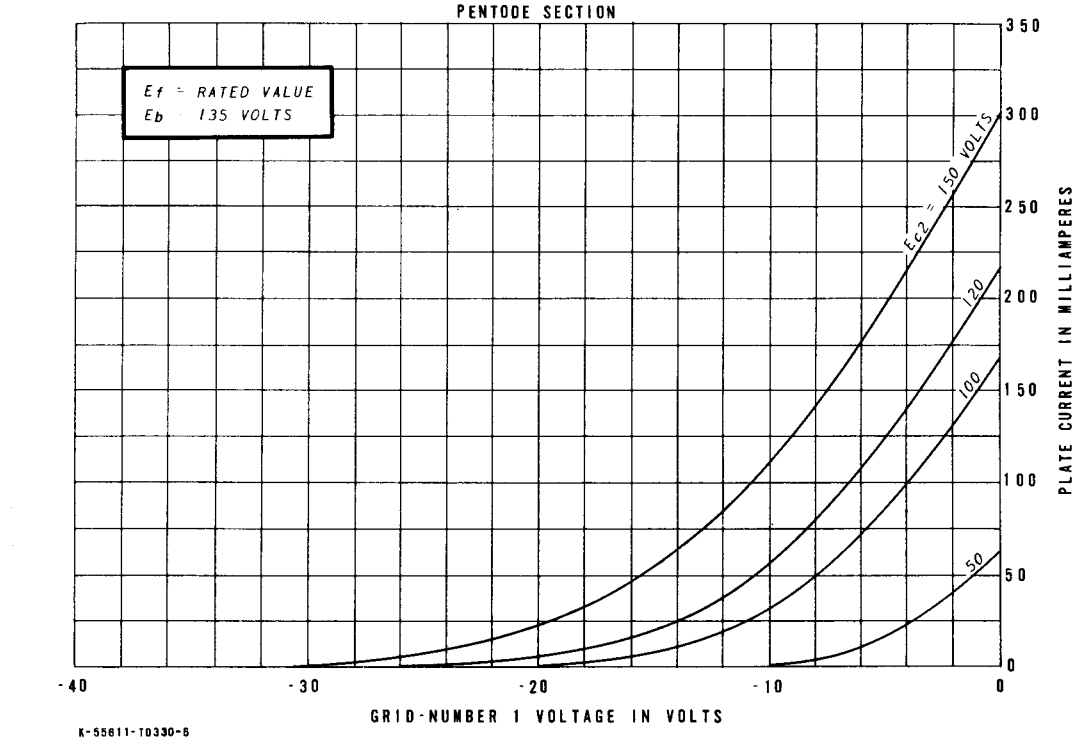
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

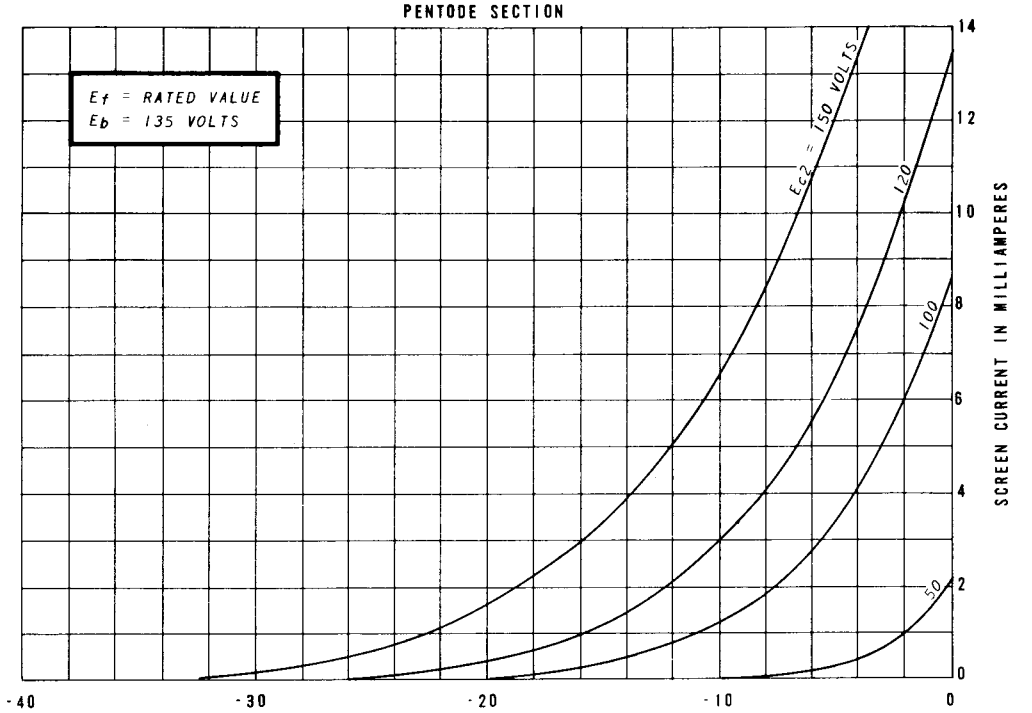


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

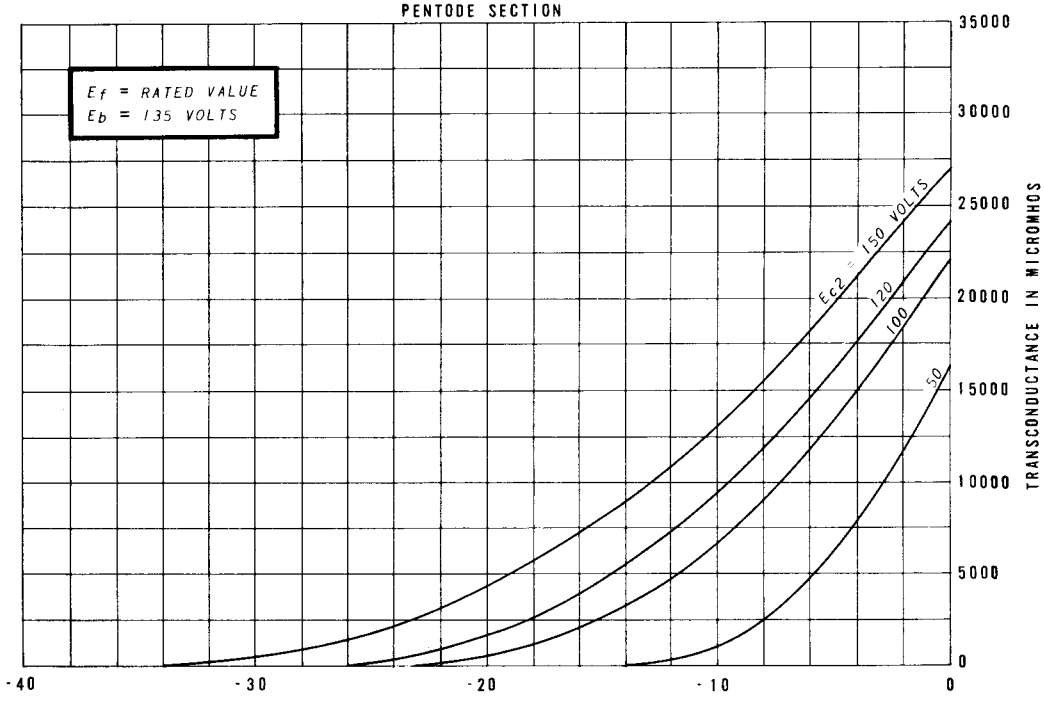
PENTODE SECTION



K-55611-TD330-7

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



K-55611-TD330-8

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

PRODUCT INFORMATION

6LT8

Duplex-Diode Pentode

The 6LT8 is a miniature tube containing a pentode and two diodes. It is intended for horizontal oscillator and AFC service.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

	Series Circuit*	Parallel Circuit‡	
Heater Voltage, AC or DC	6.3	6.3±0.6§	Volts
Heater Current	0.6±0.04¶	0.6#	Amperes
Heater Warm-up Time, Average△	11	---	Seconds

Direct Interelectrode Capacitances**

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.065	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.)	11	pf
Output: Pp to (h + Pk + Pg2 + Pg3 + i.s.)	3.6	pf

Diode Sections

Plate (Section 1) to Cathode: (Dp1 to Dk)	1.4	pf
Plate (Section 2) to Cathode: (Dp2 to Dk)	1.4	pf
Plate to Plate: (Dp1 to Dp2)	1.4	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

Maximum Diameter	0.875	Inches
Minimum Diameter	0.750	Inches
Maximum Over-all Length	2.187	Inches
Maximum Seated Height	1.937	Inches

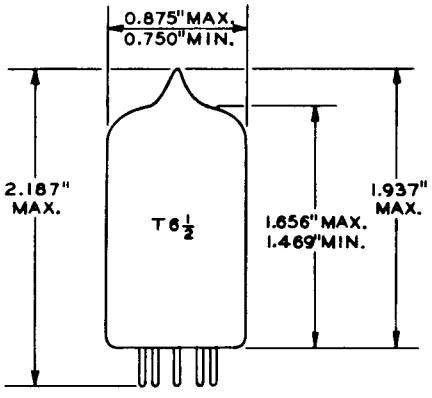
MAXIMUM RATINGS

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PHYSICAL DIMENSIONS

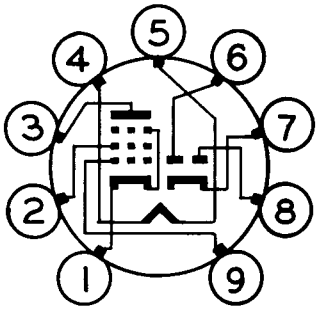


EIA 6-2

TERMINAL CONNECTIONS

Pin 1 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 2 - Pentode Grid Number 2 (Screen)
Pin 3 - Pentode Plate
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Diode Plate (Section 2)
Pin 7 - Diode Cathode
Pin 8 - Diode Plate (Section 1)
Pin 9 - Pentode Grid Number 1

BASING DIAGRAM



EIA 9RL

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

Pentode Section

Plate Voltage	330	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	3.1	Watts
Screen Dissipation	0.65	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	1.0	Megohms

Diode Sections

Diode Current for Continuous Operation, Each Diode	5.0	Milliamperes

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	125	Volts
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Plate Resistance, approximate	200000	Ohms
Transconductance	13000	Micromhos
Plate Current	10	Milliamperes
Screen Current	3.4	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 20 Microamperes	-3.5	Volts

Diode Sections

Average Diode Current, Each Diode		
With 5 Volts DC Applied	20	Milliamperes

NOTES

* Operated with the heater in series with the heaters of other tubes having the same bogey heater current.

‡ Operated with the heater in parallel with the heaters of other tubes having the same bogey heater voltage.

§ For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

¶ For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

Heater current of a bogey tube at Ef = 6.3 volts.

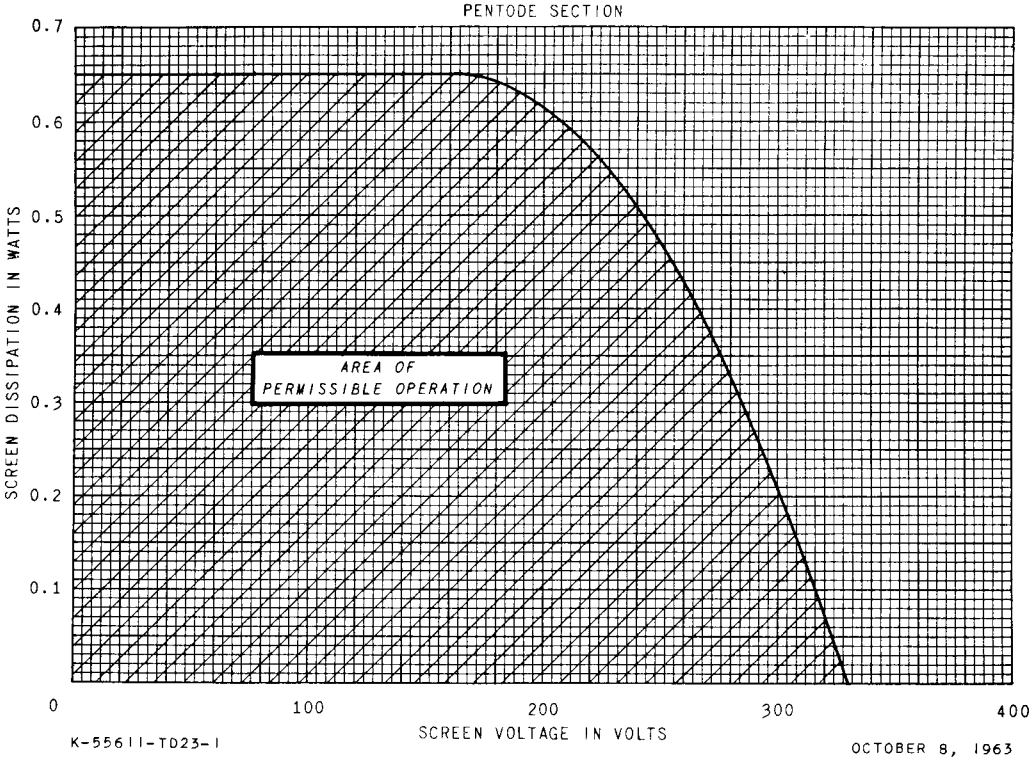
Δ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

** Without external shield.

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SCREEN RATING CHART

PENTODE SECTION

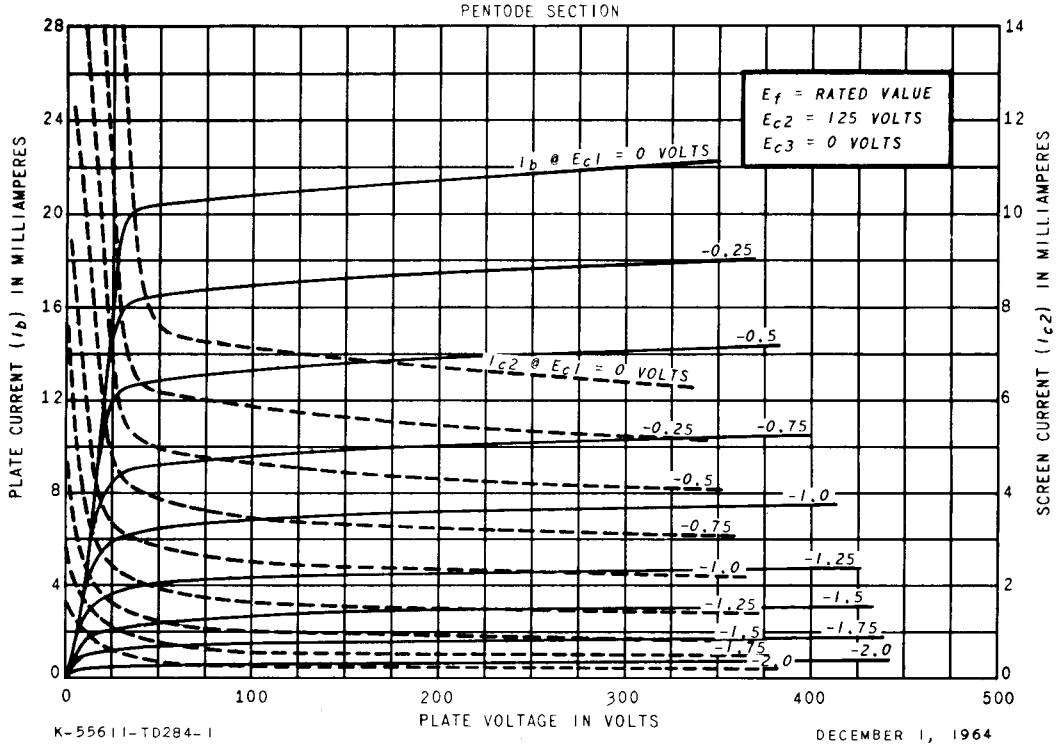


K-55611-TD23-1

OCTOBER 8, 1963

AVERAGE PLATE CHARACTERISTICS

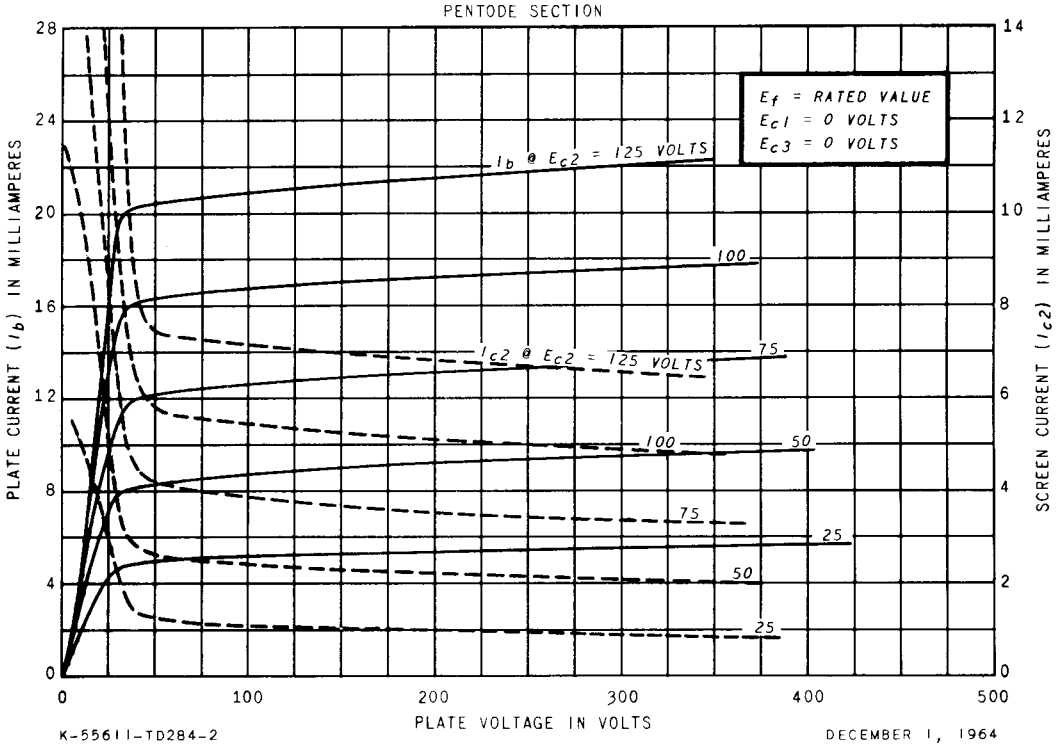
PENTODE SECTION



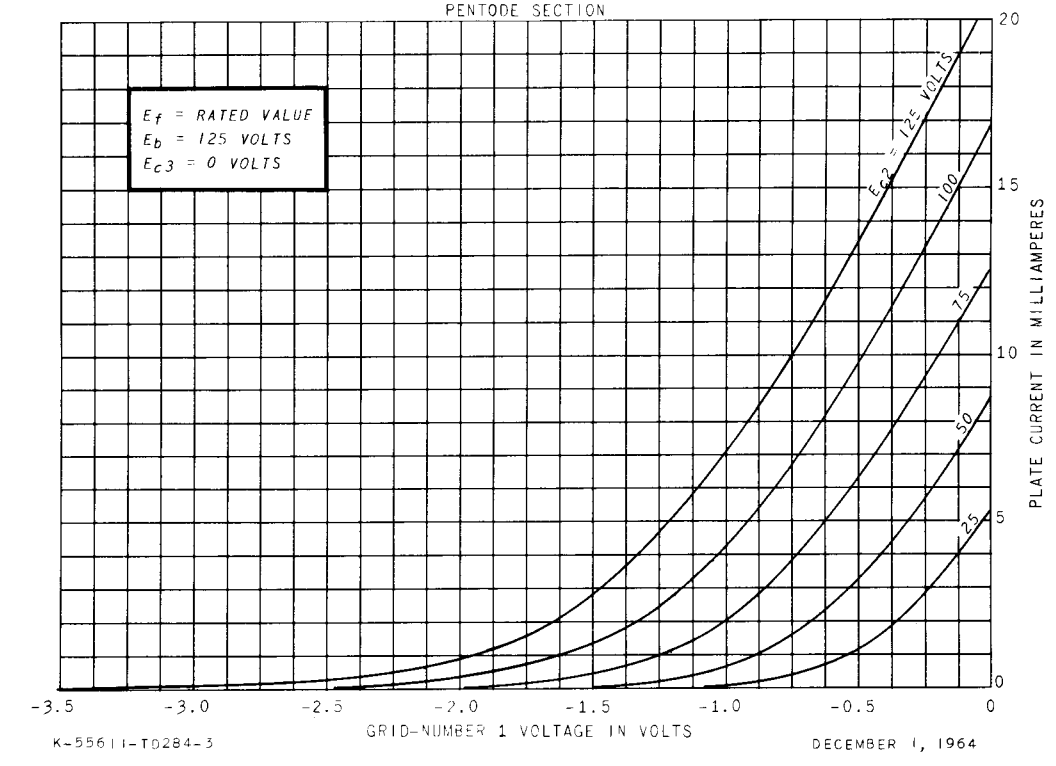
K-55611-TD284-1

DECEMBER 1, 1964

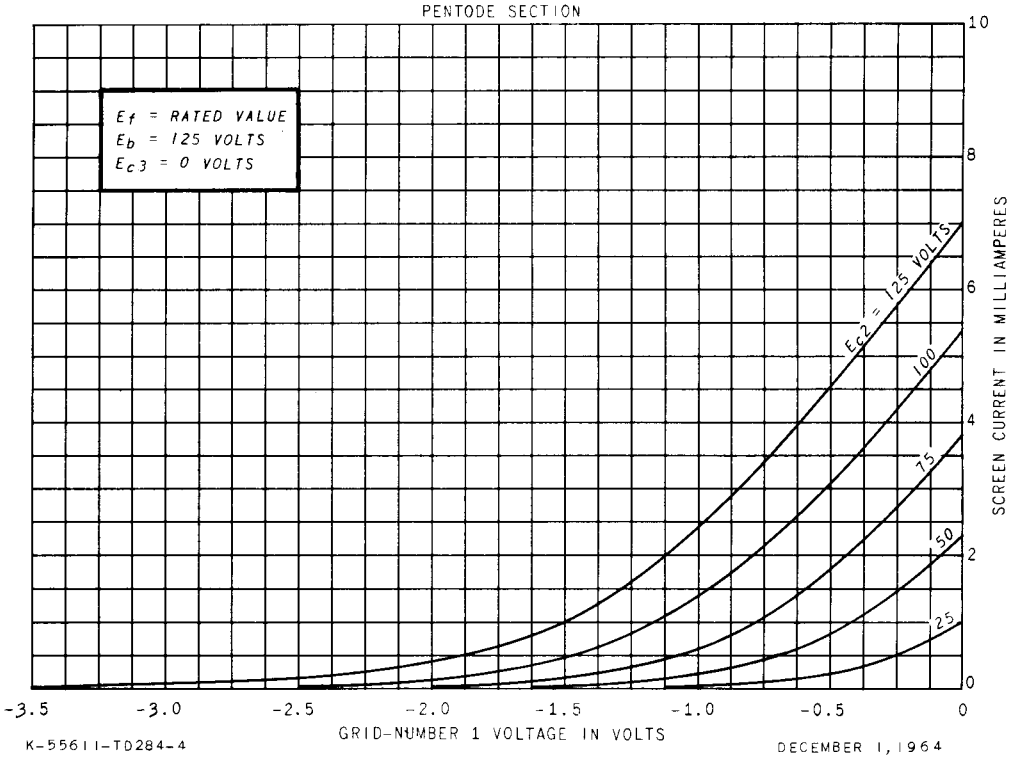
AVERAGE PLATE CHARACTERISTICS



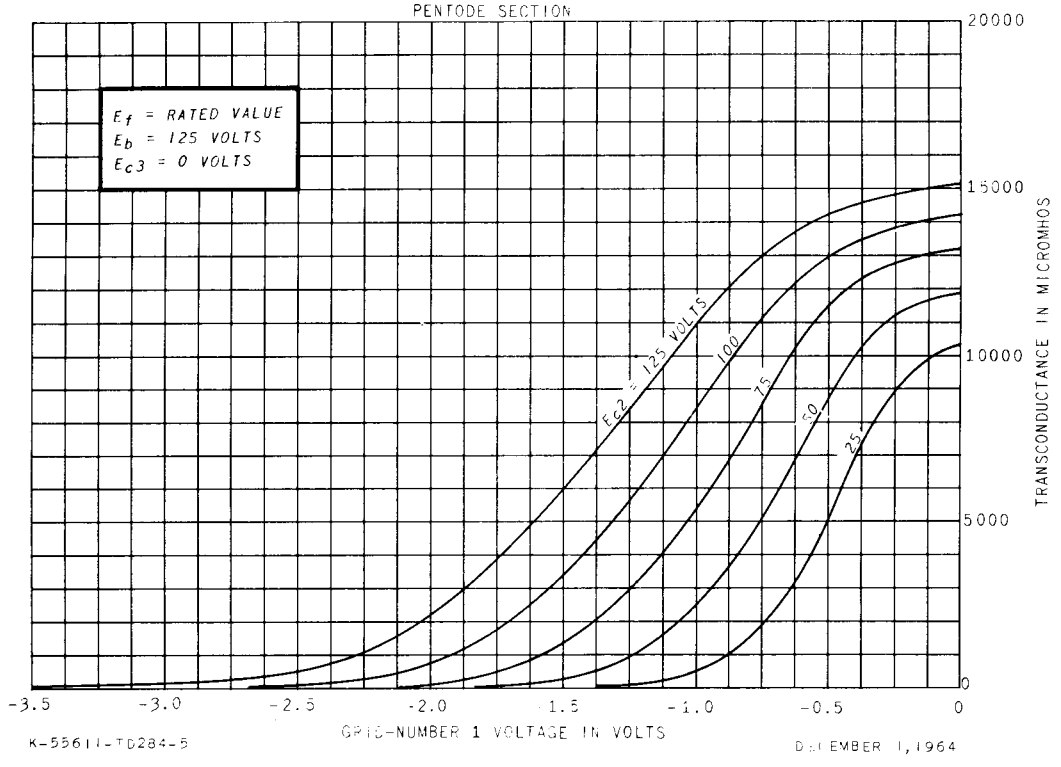
AVERAGE TRANSFER CHARACTERISTICS



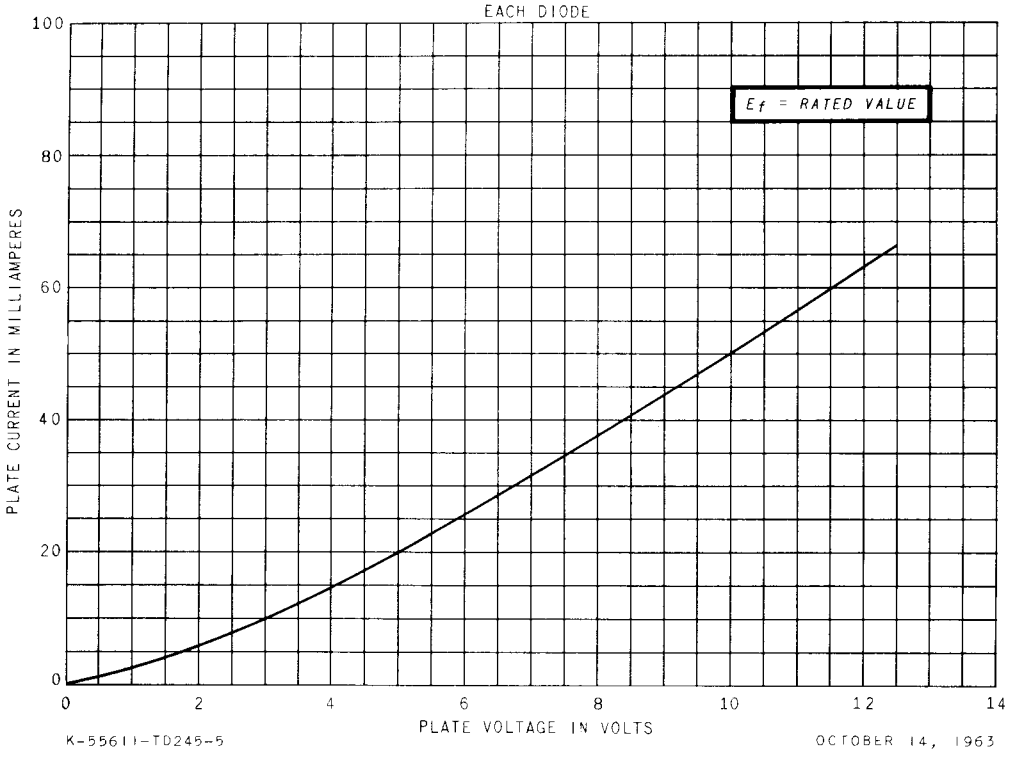
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

—PRODUCT INFORMATION—

Compactron Triode-Pentode

6LU8

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

The 6LU8 is a compactron containing a medium-mu triode and a beam pentode. The triode is designed for service as a vertical-deflection oscillator and the pentode as a vertical-deflection amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	1.5	Amperes

Direct Interelectrode Capacitances§

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.5	pf
Input: Pg1 to (h + Pk + Pg2 + b.p.)	16	pf
Output: Pp to (h + Pk + Pg2 + b.p.)	9.0	pf

Triode Section

Grid to Plate: (Tg to Tp)	6.0	pf
Input: Tg to (h + Tk)	7.0	pf
Output: Tp to (h + Tk)	2.0	pf

Coupling

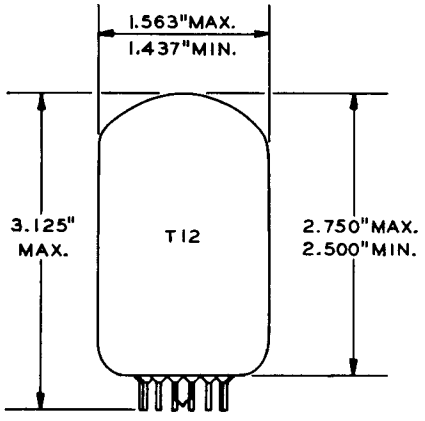
Pentode Grid-Number 1 to Triode Plate: (Pg1 to Tp), max	0.13	pf
Pentode Plate to Triode Plate: (Pp to Tp), max	0.40	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing - EIA 12-57

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	3.125	Inches
Maximum Seated Height	2.750	Inches
Minimum Seated Height	2.500	Inches

PHYSICAL DIMENSIONS

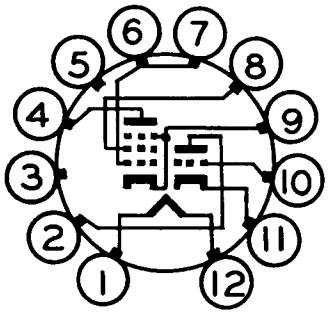


EIA 12-57

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Triode Plate
Pin 3 - No Connection
Pin 4 - Pentode Plate
Pin 5 - No Connection
Pin 6 - Pentode Grid Number 1
Pin 7 - Pentode Grid Number 1
Pin 8 - Pentode Grid Number 2 (Screen)
Pin 9 - Pentode Cathode and Beam Plates
Pin 10 - Triode Grid
Pin 11 - Triode Cathode
Pin 12 - Heater

BASING DIAGRAM



EIA 12DZ

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Triode Section-Vertical Oscillator Service¶

DC Plate Voltage	400	Volts
Peak Negative Grid Voltage	400	Volts
Plate Dissipation	2.5	Watts
DC Cathode Current	30	Milliamperes
Peak Cathode Current	105	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Cathode Bias	2.2	Megohms

Pentode Section-Vertical Deflection Amplifier Service¶

DC Plate Voltage	400	Volts
Peak Pulse Plate Voltage	2500	Volts
Screen Voltage	300	Volts
Peak Negative Grid-Number 1 Voltage	250	Volts
Plate Dissipation#	14	Watts
Screen Dissipation	2.75	Watts
DC Cathode Current	75	Milliamperes
Peak Cathode Current	260	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	1.0	Megohms
With Cathode Bias	2.2	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Triode Section

Plate Voltage	250	Volts
Grid Voltage	-4.0	Volts
Amplification Factor	58	
Plate Resistance, approximate	16000	Ohms
Transconductance	3600	Micromhos
Plate Current	2.3	Milliamperes
Grid Voltage, approximate		
Ib = 10 Microamperes	-6.6	Volts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

Pentode Section

Plate Voltage	45	135	Volts
Screen Voltage	125	120	Volts
Grid-Number 1 Voltage	0Δ	-10	Volts
Plate Resistance, approximate	---	12000	Ohms
Transconductance	---	9300	Micromhos
Plate Current	200	56	Milliamperes
Screen Current	20	3.0	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	---	-30	Volts
Grid-Number 1 Voltage, approximate Ib = 1.0 Milliampere	---	-26	Volts
Triode Amplification Factor**	---	6.5	

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

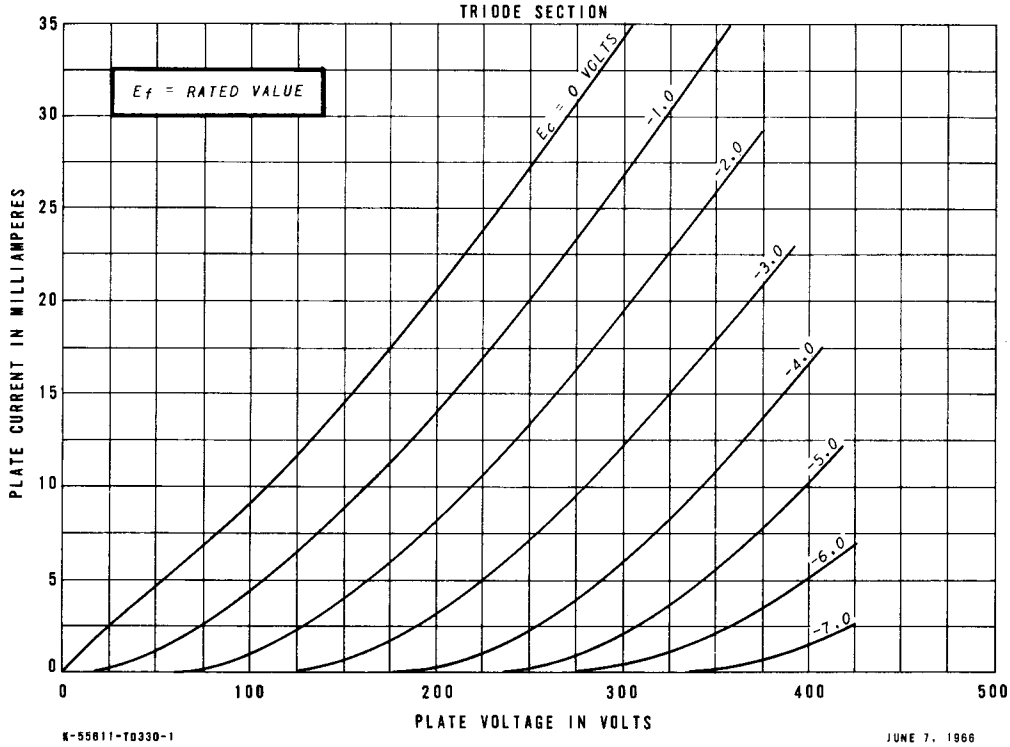
¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

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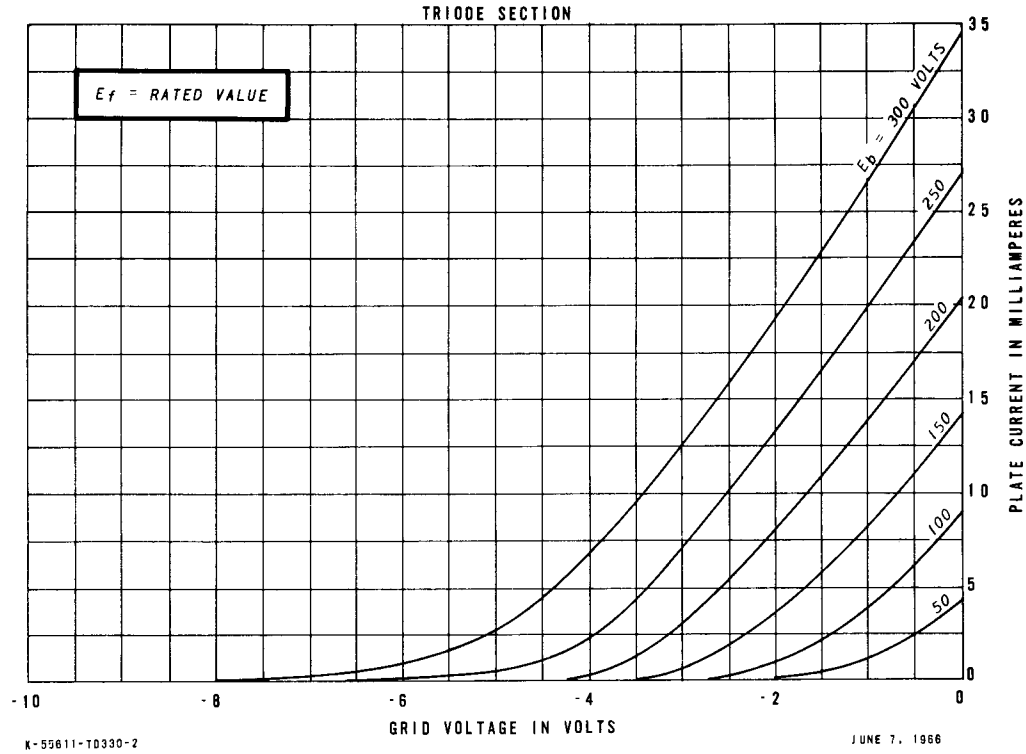
Δ Applied for short interval (two seconds maximum) so as not to damage tube.

** Triode connection (screen tied to plate) with Eb = Ec2 = 120 volts and Ec1 = -10 volts.

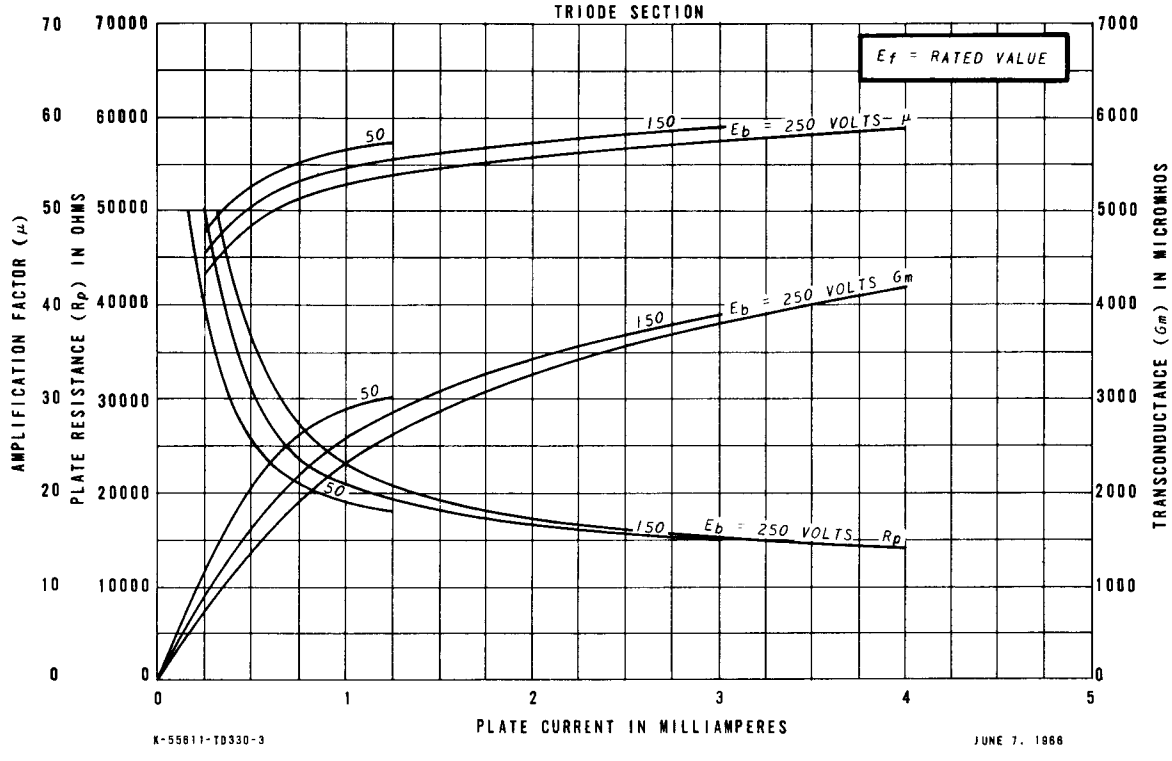
AVERAGE PLATE CHARACTERISTICS



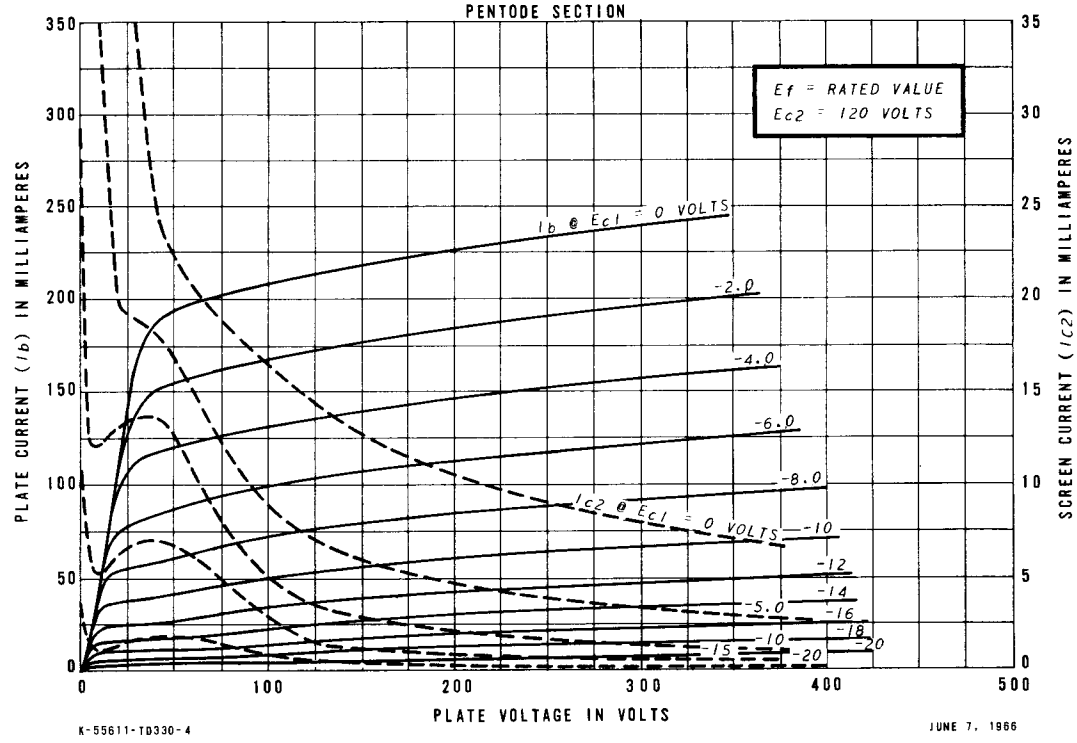
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



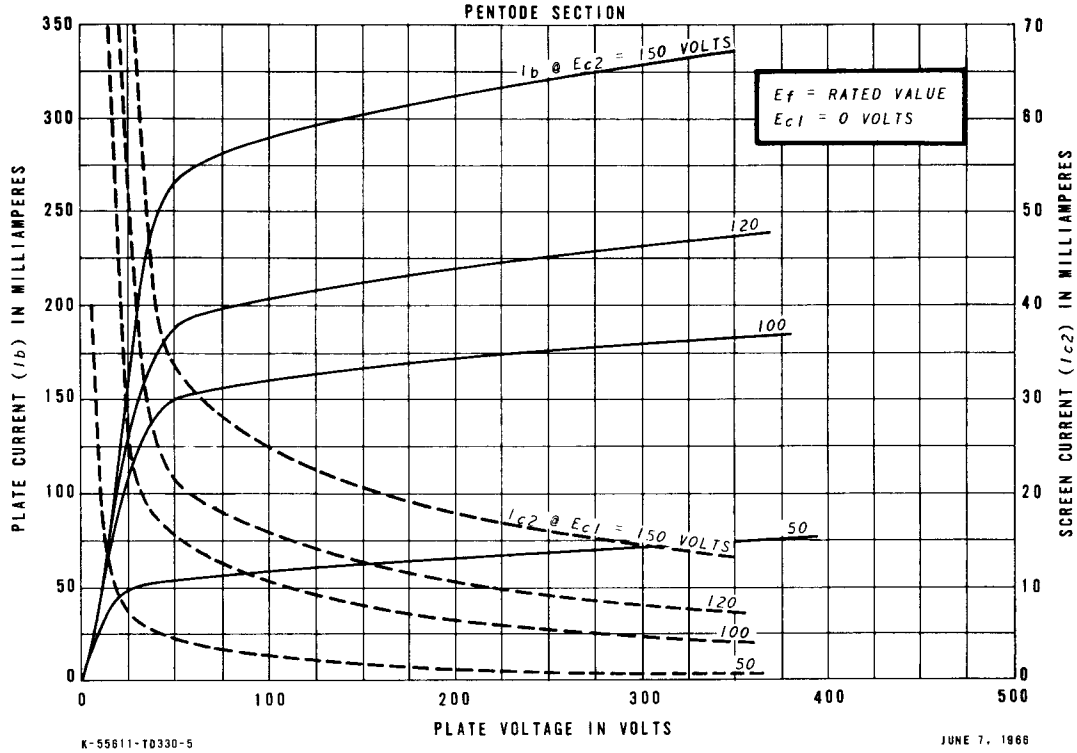
AVERAGE PLATE CHARACTERISTICS



K-55611-TD330-4

JUNE 7, 1966

AVERAGE PLATE CHARACTERISTICS

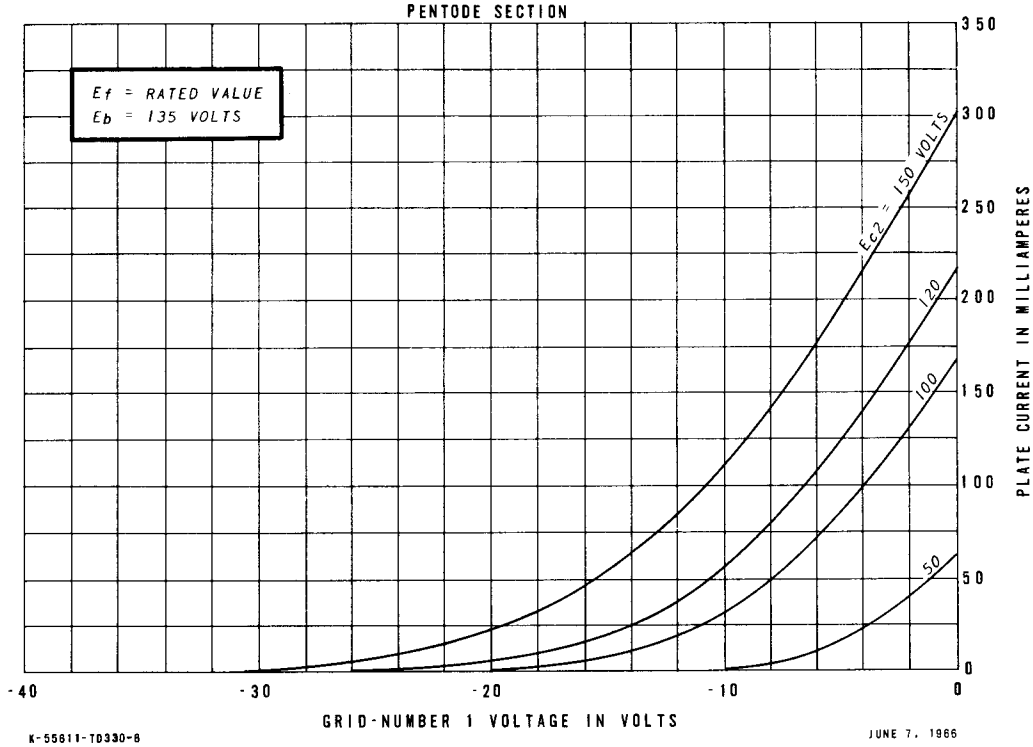


K-55611-TD330-5

JUNE 7, 1966

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

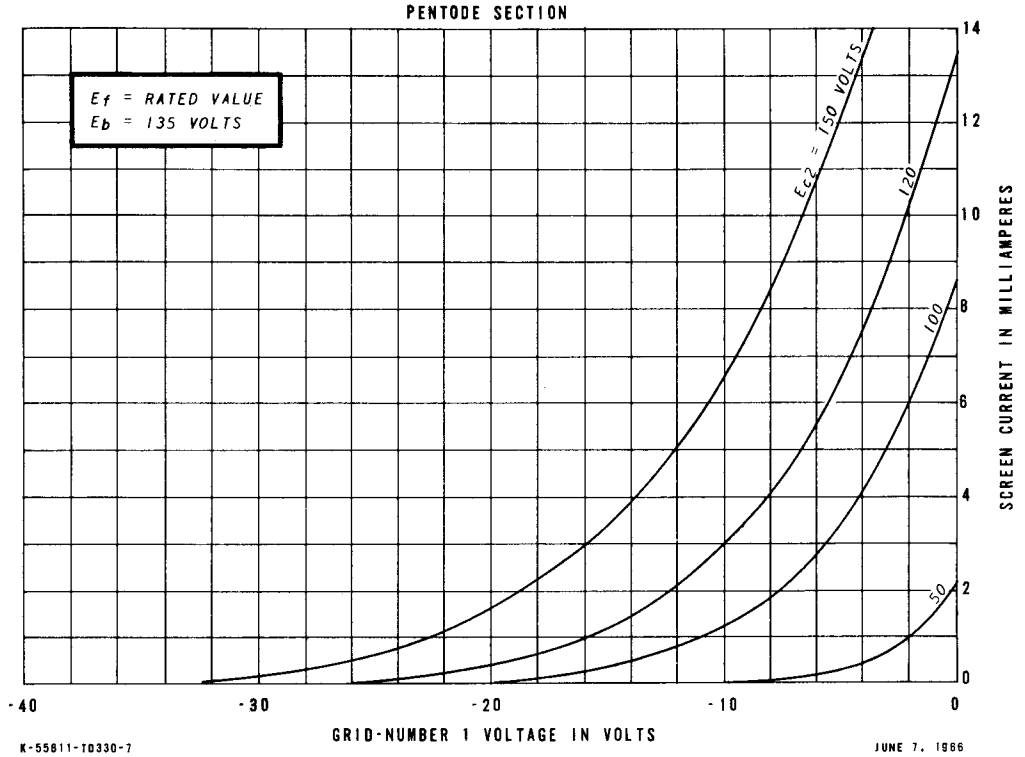


K-55611-TD330-8

JUNE 7, 1966

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

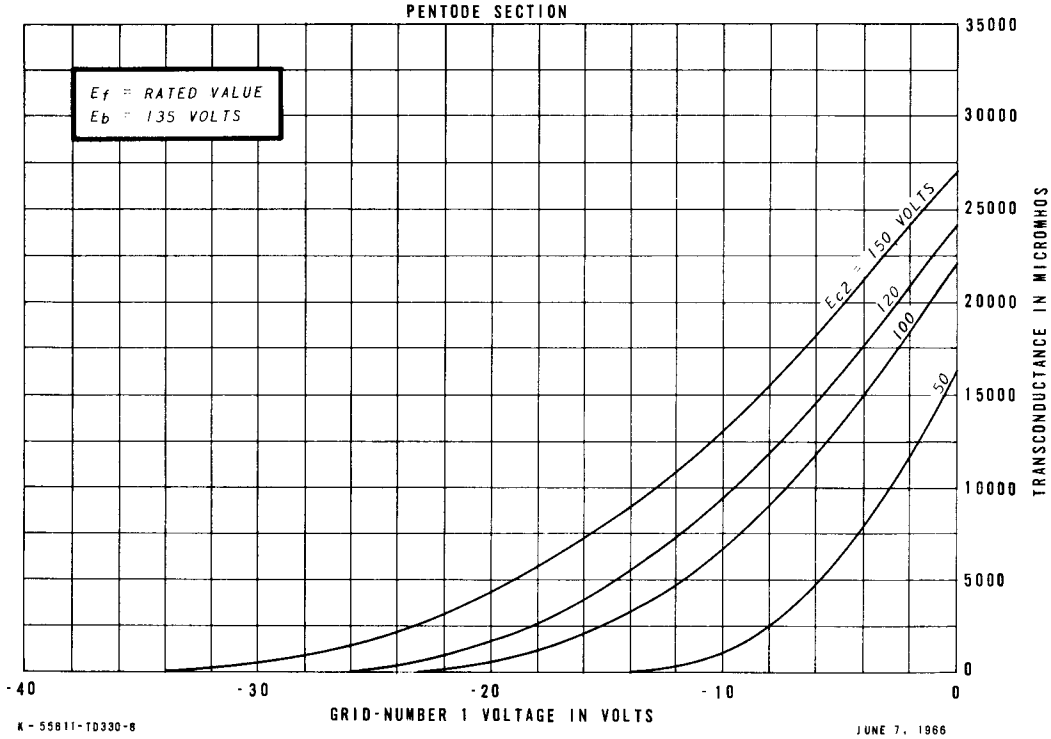


K-55611-TD330-7

JUNE 7, 1966

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



K-55811-T0330-B

JUNE 7, 1966

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Triode-Pentode

6LX8

The 6LX8 is a triode-pentode intended primarily for horizontal-oscillator and AFC service in the horizontal-deflection systems of television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.0	Volts
Heater Current●	0.45±0.03	Amperes
Heater Warm-up Time, average▲	11	Seconds

Direct Interelectrode Capacitances♦

Pentode Section

Grid-Number 1 to Plate: maximum (Pg1 to Pp)	0.01	pf
Input: Pg1 to (h+Pk+Pg2+Pg3+i.s.)	5.5	pf
Output: Pp to (h+Pk+Pg2+Pg3+i.s.)	3.4	pf

Triode Section

Grid to Plate: (Tg to Tp)	1.8	pf
Input: Tg to (h+Tk+Pk+Pg3+i.s.)	3.2	pf
Output: Tp to (h+Tk+Pk+Pg3+i.s.)	1.9	pf

MECHANICAL

Operating Position - Any
Envelope - T-6½, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

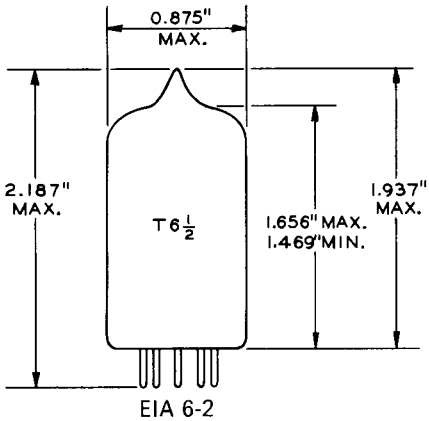
Maximum Diameter	0.875	Inches
Maximum Over-all Length	2.187	Inches
Maximum Seated Height	1.937	Inches

MAXIMUM RATINGS

DESIGN-CENTER VALUES

	Pentode Section	Triode Section	
Plate Voltage	250	250	Volts
Screen Voltage	250	---	Volts
Plate Dissipation	1.2	1.4	Watts
Screen Dissipation	0.2	---	Watts
DC Cathode Current	15	10	Milliamperes
Peak Cathode Current	50	---	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.56	3.0	Megohms
With Cathode Bias	1.0	---	Megohms

PHYSICAL DIMENSIONS

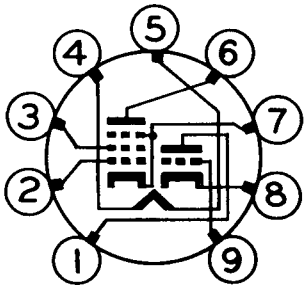


EIA 6-2

TERMINAL CONNECTIONS

Pin 1 - Triode Plate
Pin 2 - Pentode Grid-Number 1
Pin 3 - Pentode Grid-Number 2 (Screen)
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Plate
Pin 7 - Pentode Cathode, Grid-Number 3 and Internal Shield
Pin 8 - Triode Cathode
Pin 9 - Triode Grid

BASING DIAGRAM



EIA 9DC

MAXIMUM RATINGS (Cont'd)

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under normal conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube in average applications, making allowance for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube under normal operating conditions at the stated normal supply voltage.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section		Triode Section	
Plate Voltage	200	100	200	Volts
Screen Voltage	200	100	---	Volts
Grid-Number 1 Voltage	0	-1.0	-2.0	Volts
Amplification Factor	---	---	70	
Plate Resistance, approximate	---	400000	20000	Ohms
Transconductance	---	5500	3500	Micromhos
Plate Current	12.5	6.0	3.5	Milliamperes
Screen Current	3.5	1.7	---	Milliamperes
Grid Voltage, approximate Ic = +0.3 Microamperes	---	---	-1.3	Volts
Grid-Number 1 Voltage, approximate Ic1 = +0.3 Microamperes	---	-1.3	---	Volts
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	-16	---	---	Volts

NOTES

★ Heater voltage for a bogey tube at If = 0.45 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

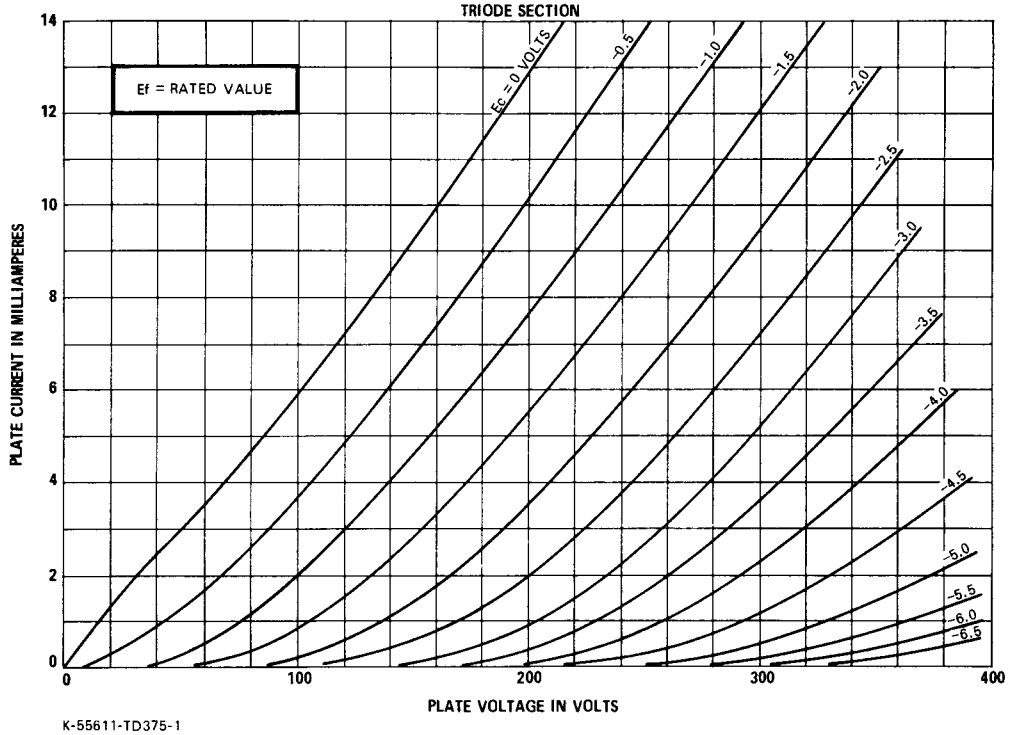
▲ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

♦ Without external shield.

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AVERAGE PLATE CHARACTERISTICS

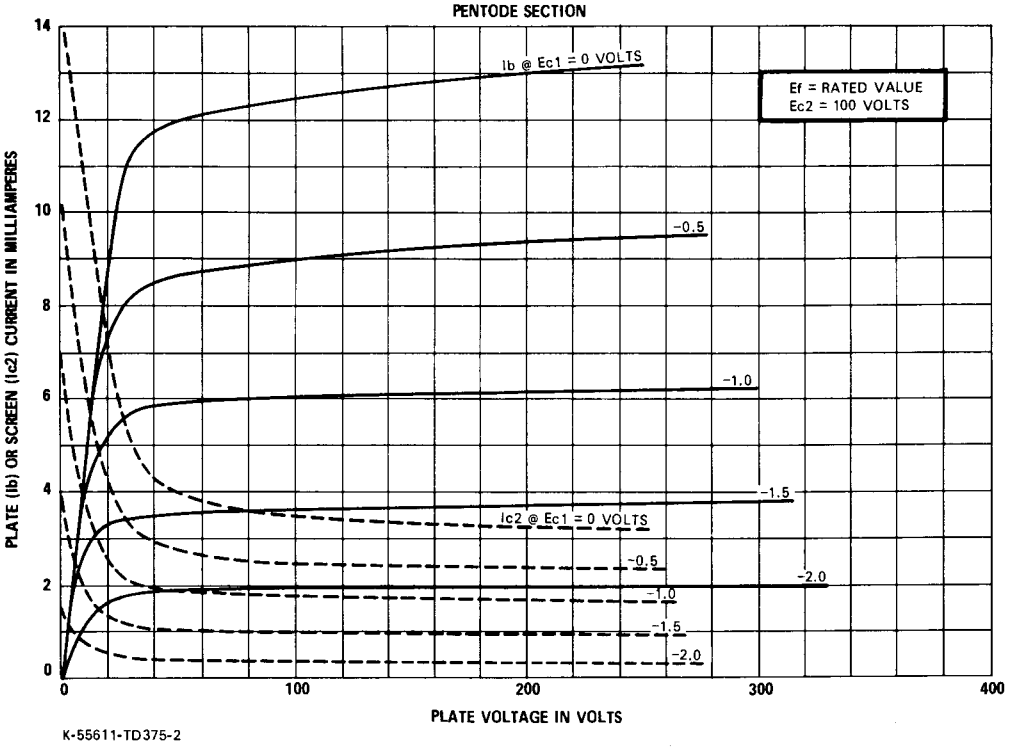
TRIODE SECTION



K-55611-TD375-1

AVERAGE PLATE CHARACTERISTICS

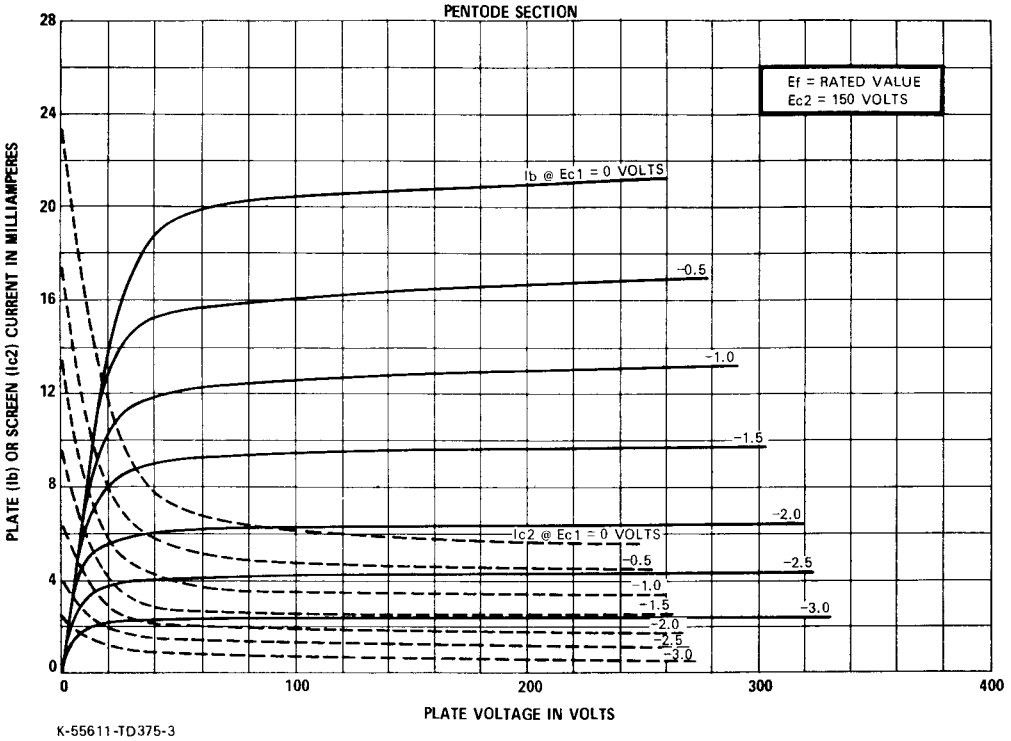
PENTODE SECTION



K-55611-TD375-2

AVERAGE PLATE CHARACTERISTICS

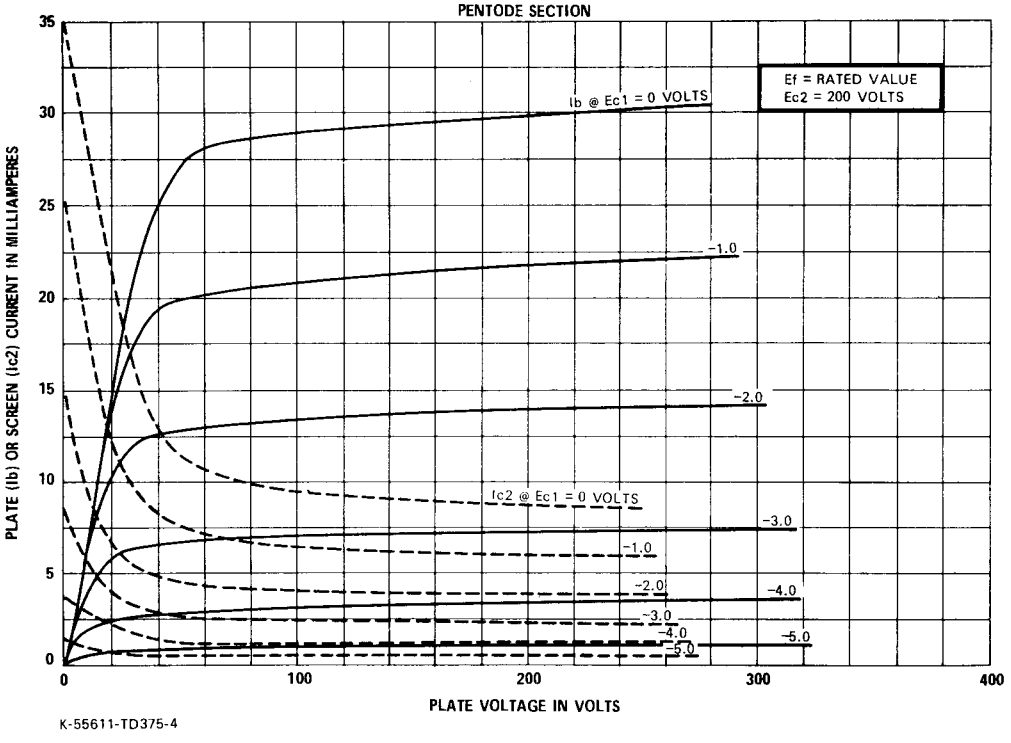
PENTODE SECTION



K-55611-TD375-3

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION



K-55611-TD375-4

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

Triode-Pentode

6LY8

The 6LY8 is a miniature triode-pentode containing a high-mu triode and a sharp-cutoff pentode. The pentode is intended for use as a video amplifier and the triode for general-purpose use.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.75	Amperes

Direct Interelectrode Capacitances§

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.075	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.)	13	pf
Output: Pp to (h + Pk + Pg2 + Pg3 + i.s.)	4.4	pf

Triode Section

Grid to Plate: (Tg to Tp)	3.8	pf
Input: Tg to (h + Tk + Pk + Pg3 + i.s.)	2.6	pf
Output: Tp to (h + Tk + Pk + Pg3 + i.s.)	2.8	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-3

Maximum Diameter	0.875	Inches
Minimum Diameter	0.750	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.375	Inches

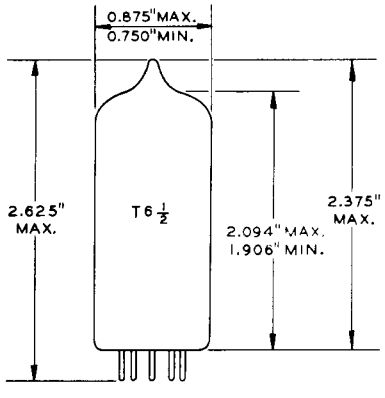
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

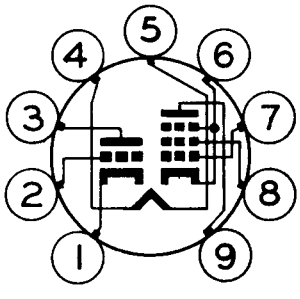


EIA 6-3

TERMINAL CONNECTIONS

Pin 1 - Triode Cathode
Pin 2 - Triode Grid
Pin 3 - Triode Plate
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 7 - Pentode Grid Number 1
Pin 8 - Pentode Grid Number 2 (Screen)
Pin 9 - Pentode Plate

BASING DIAGRAM



EIA 9DX

Supersedes 6LY8 D and R Sheet dated 3-65

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	5.0	1.0	Watts
Screen Dissipation	1.1	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.5	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS		Pentode Section	Triode Section	
Plate Voltage	35	200	250	Volts
Screen Voltage	100	100	---	Volts
Grid-Number 1 Voltage	0	---	-2.0	Volts
Cathode-Bias Resistor	---	82	---	Ohms
Amplification Factor	---	---	100	
Plate Resistance, approximate	---	60000	59000	Ohms
Transconductance	---	20000	1700	Micromhos
Plate Current	54	19.5	1.0	Milliamperes
Screen Current	13.5	3.0	---	Milliamperes
Grid Voltage, approximate				
Ib = 10 Microamperes	---	---	-5	Volts
Grid-Number 1 Voltage, approximate				
Ib = 100 Microamperes	---	-6.3	---	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

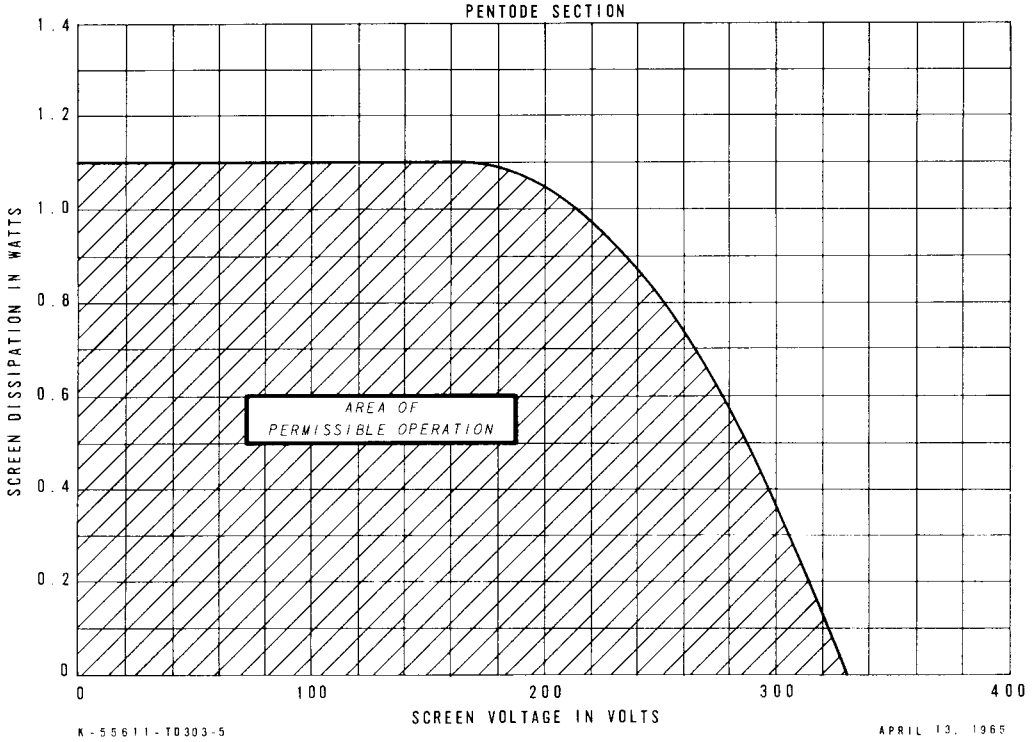
‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

SCREEN RATING CHART

PENTODE SECTION

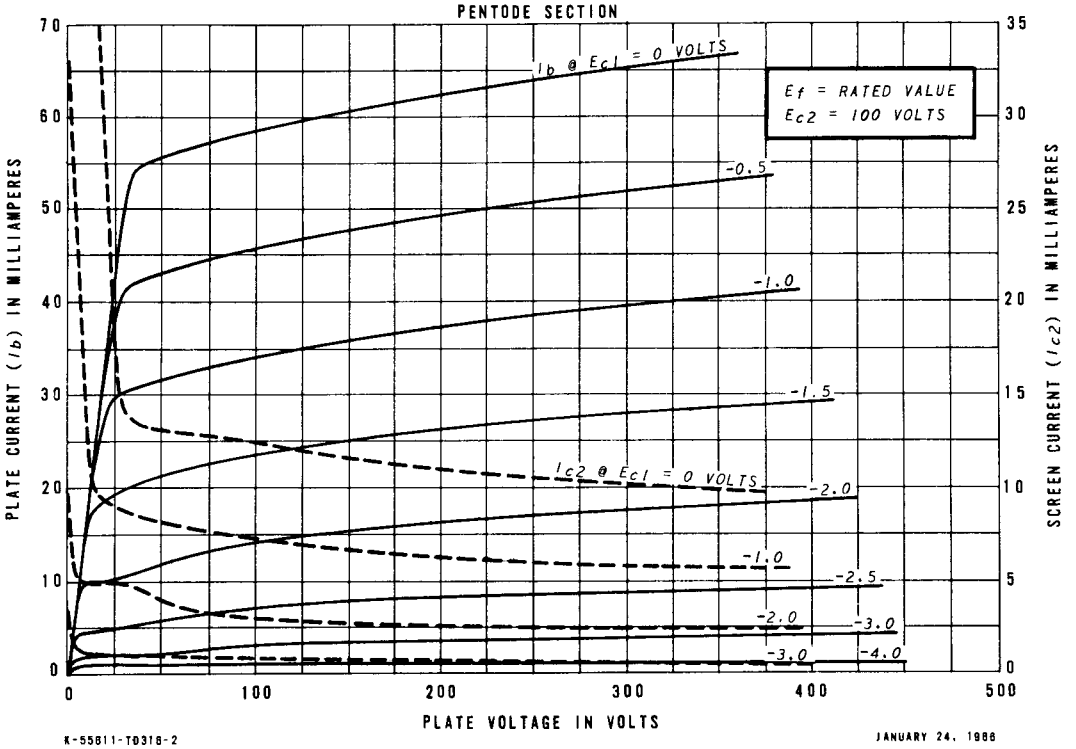


K-55611-T0303-5

APRIL 13, 1965

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

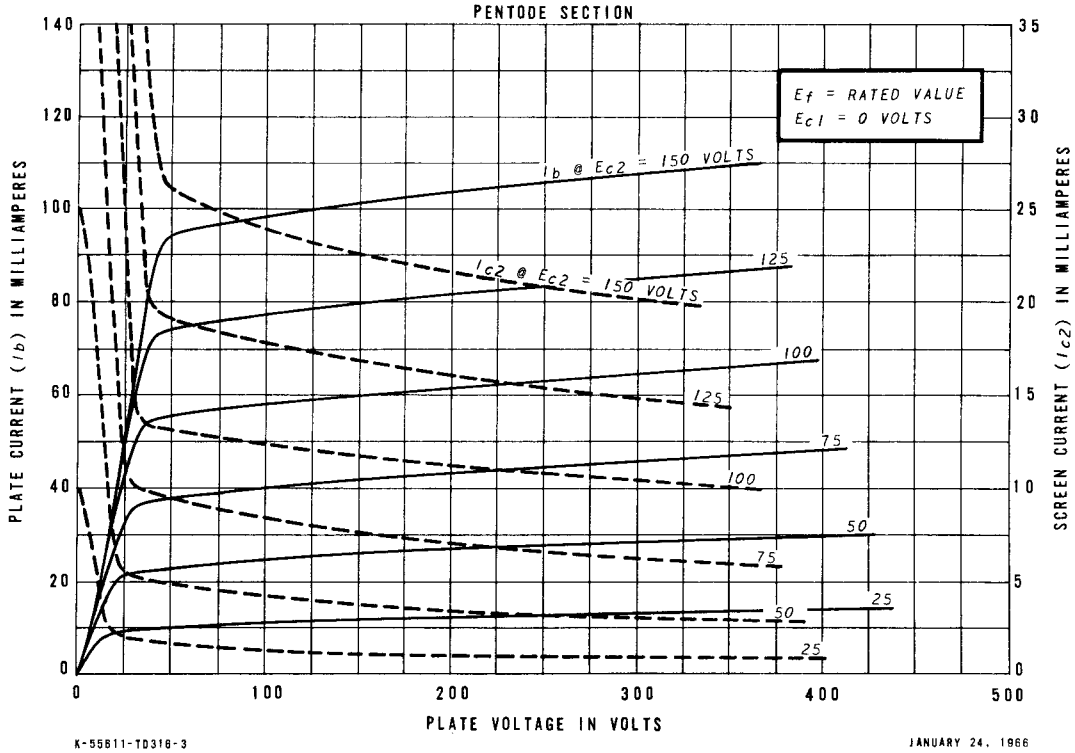


K-55611-T0316-2

JANUARY 24, 1966

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

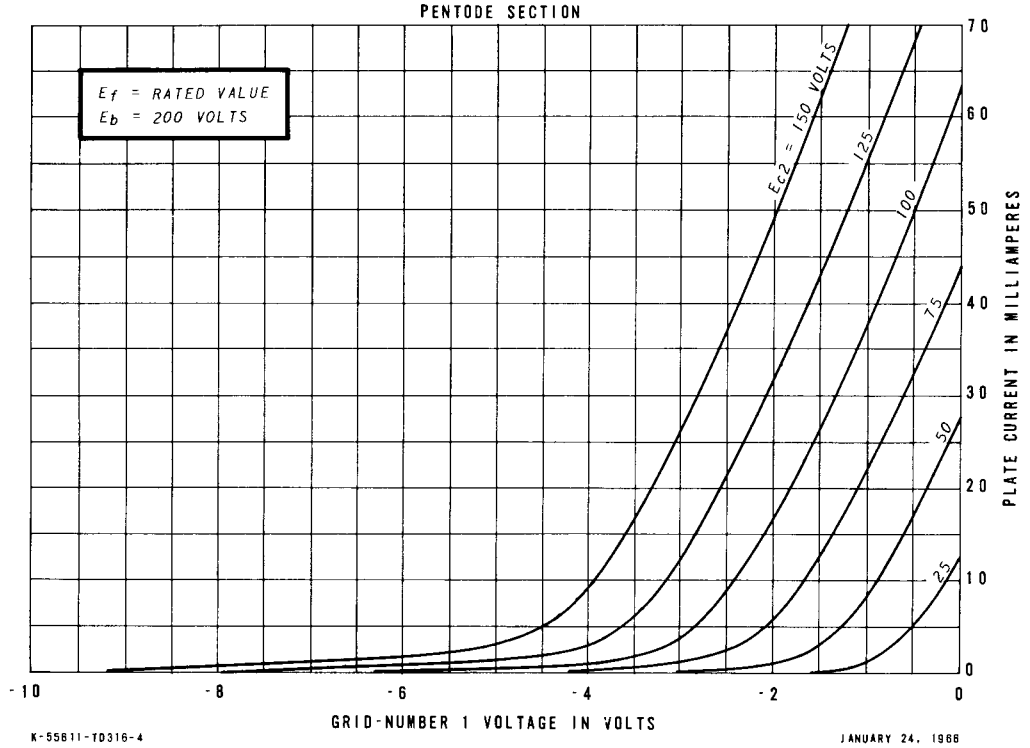


K-55811-TD316-3

JANUARY 24, 1966

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

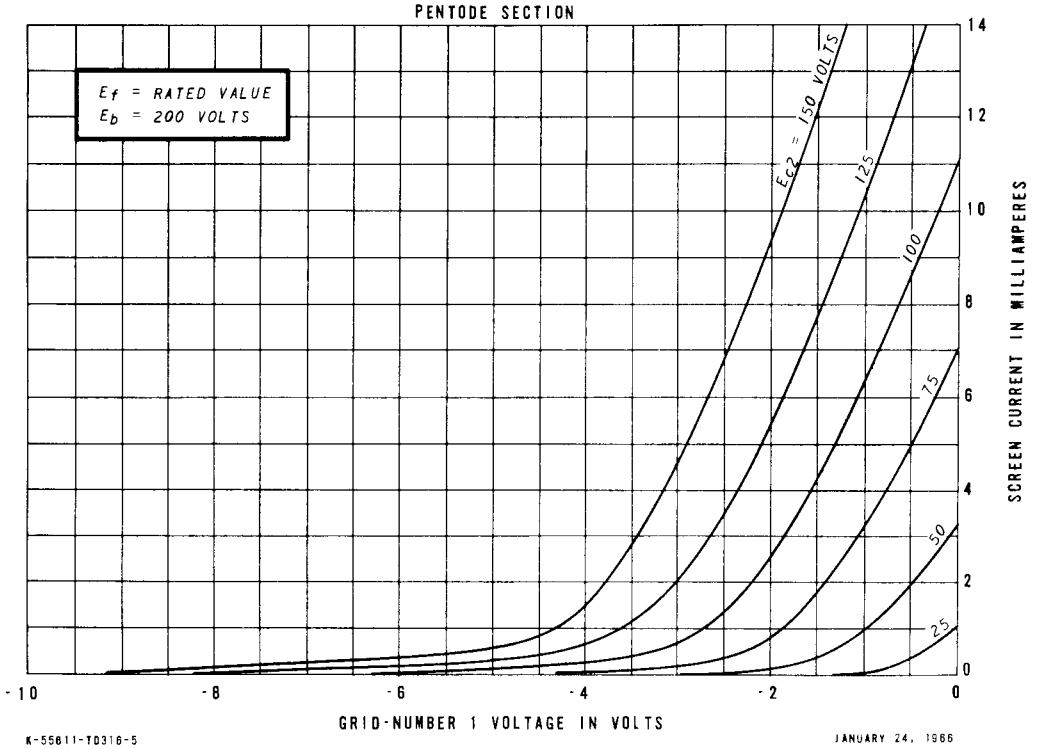


K-55811-TD316-4

JANUARY 24, 1966

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

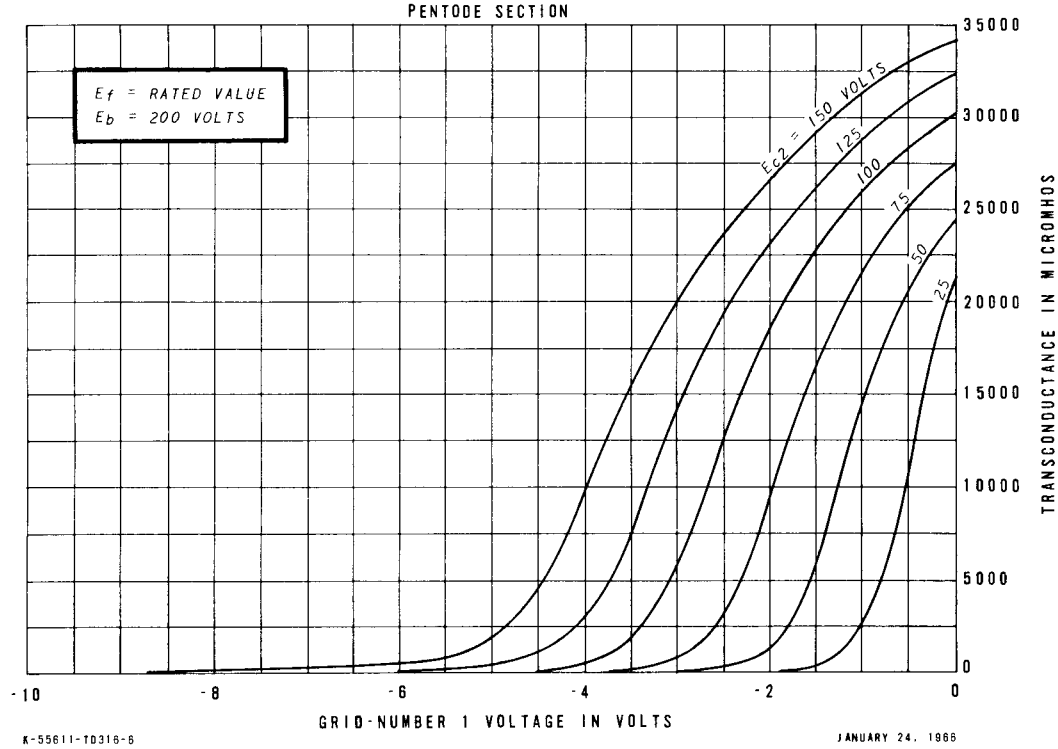


K-55611-T0316-5

JANUARY 24, 1966

AVERAGE TRANSFER CHARACTERISTICS

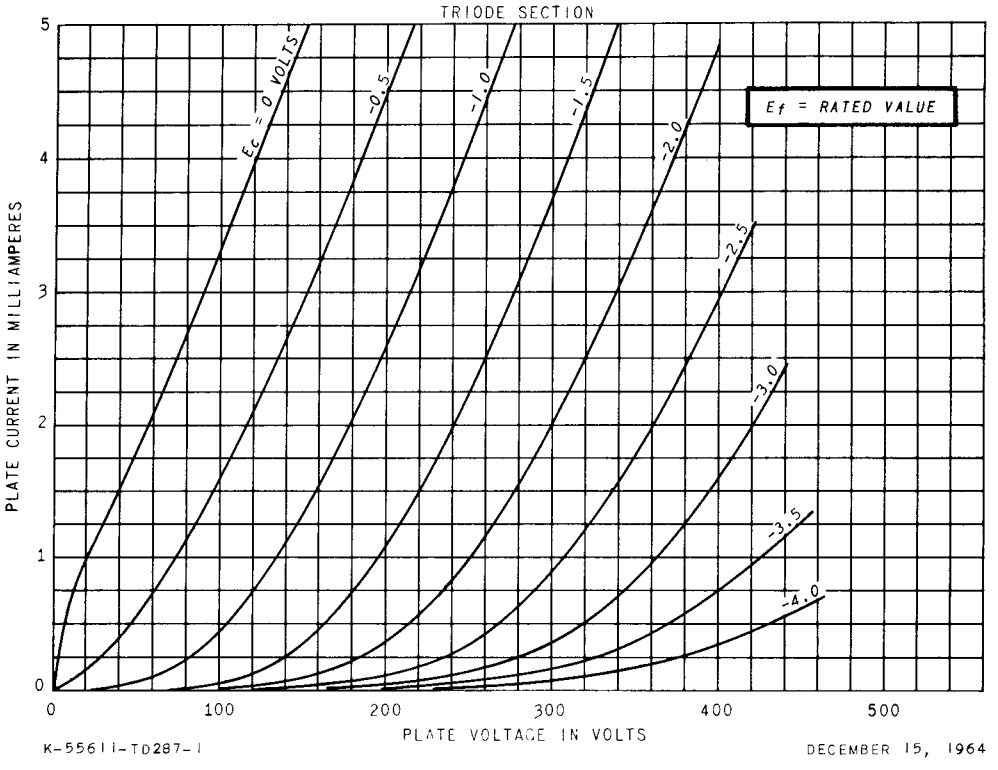
PENTODE SECTION



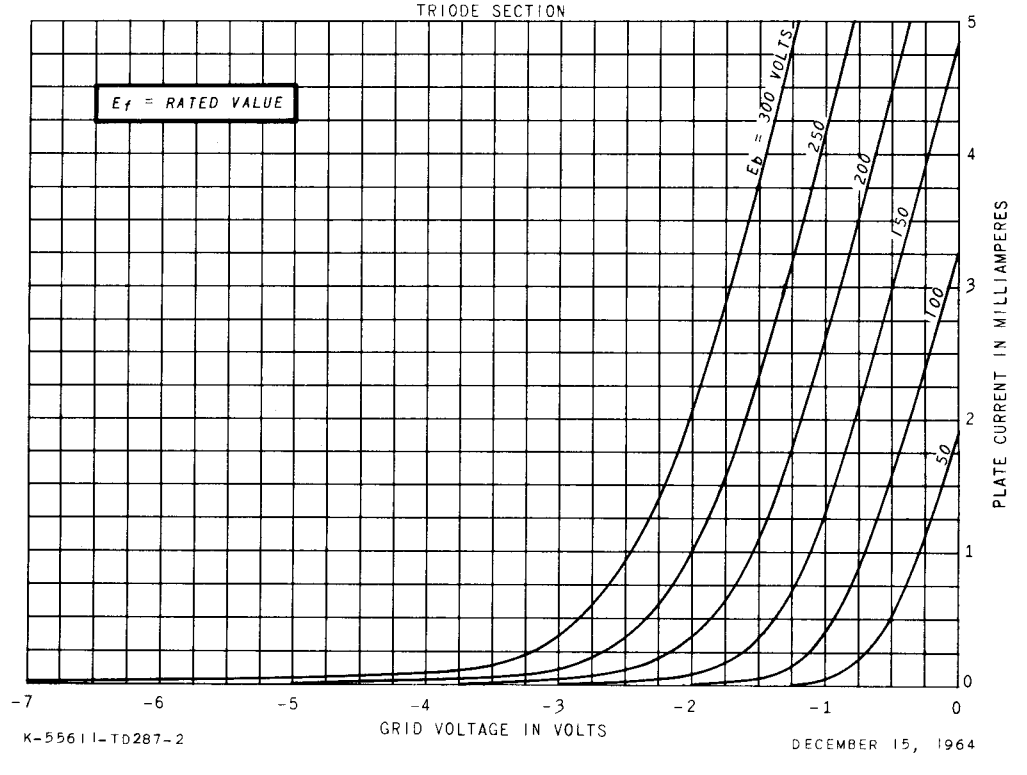
K-55611-T0316-6

JANUARY 24, 1966

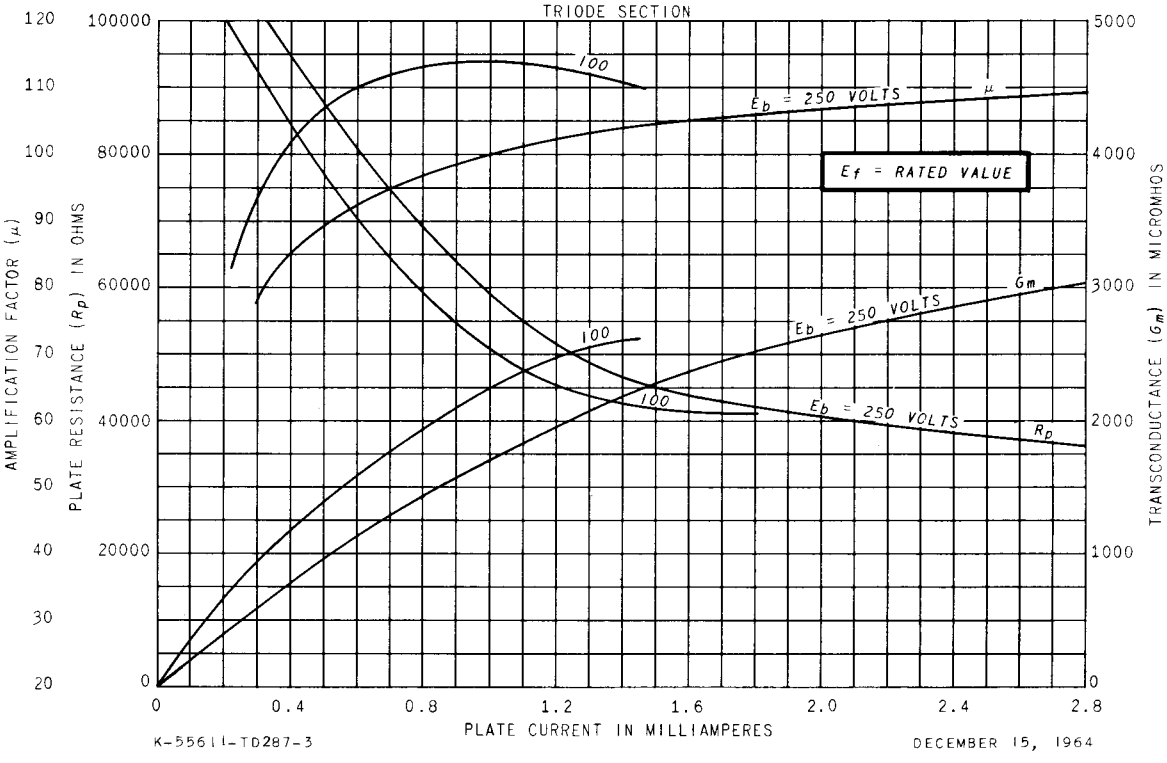
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



COMPACTRON TWIN-TRIODE PENTODE

DESCRIPTION AND RATING

The 6M11 is a compactron containing two high-mu triodes and a sharp-cutoff pentode.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current†	0.77	Amperes
Direct Interelectrode Capacitances‡		
Triode (Each Section)		
Grid to Plate: (Tg to Tp)	1.8	pf
Input: Tg to (Tk + Pk + Pg3 + h + i.s.)	3.4	pf
Output: Tp to (Tk + Pk + Pg3 + h + i.s.)	0.8	pf
Pentode		
Grid-Number 1 to Plate: (Pg1 to Pp)	0.03	pf
Input: Pg1 to (Pk + Pg2 + Pg3 + i.s.)	12	pf
Output: Pp to (Pk + Pg2 + Pg3 + i.s.)	2.8	pf

MECHANICAL

Mounting Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-56

Maximum Diameter	1.188	Inches
Maximum Over-all Length	1.875	Inches
Maximum Seated Height	1.500	Inches

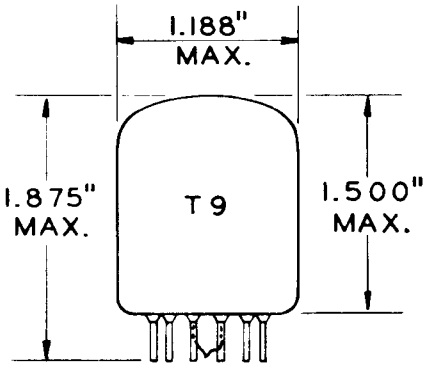
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

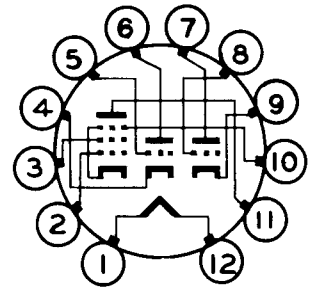


EIA 9-56

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Pentode Grid Number 1
Pin 3 - Pentode Grid Number 2 (Screen)
Pin 4 - Triode Cathode (Section 2)
Pin 5 - Triode Grid (Section 2)
Pin 6 - Triode Plate (Section 2)
Pin 7 - Triode Plate (Section 1)
Pin 8 - Triode Grid (Section 1)
Pin 9 - Triode Cathode (Section 1)
Pin 10 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 11 - Pentode Plate
Pin 12 - Heater

BASING DIAGRAM



EIA 12CA

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

	Pentode Section	Each Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.1	2.25	Watts
Screen Dissipation	0.65	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance			
With Cathode Bias	1.0	0.68	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section	Each Triode Section	
Plate Voltage	125	125	Volts
Screen Voltage	125	---	Volts
Cathode-Bias Resistor	56	120	Ohms
Amplification Factor	---	58	
Plate Resistance, approximate	200000	10000	Ohms
Transconductance	13000	8000	Micromhos
Plate Current	11	8.0	Milliamperes
Screen Current	3.4	---	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 20 Microamperes	-3.5	---	Volts
Grid-Number 1 Voltage, approximate			
Ib = 50 Microamperes	---	-4.5	Volts

FOOTNOTES

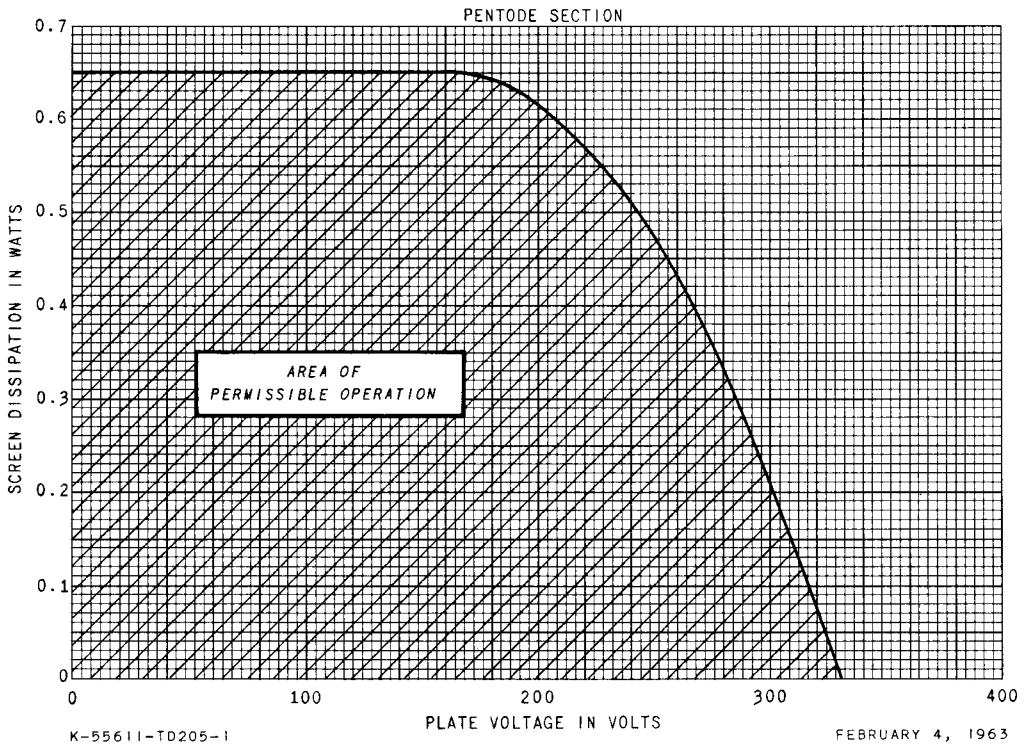
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ With external shield (EIA 308) connected to pin 10.

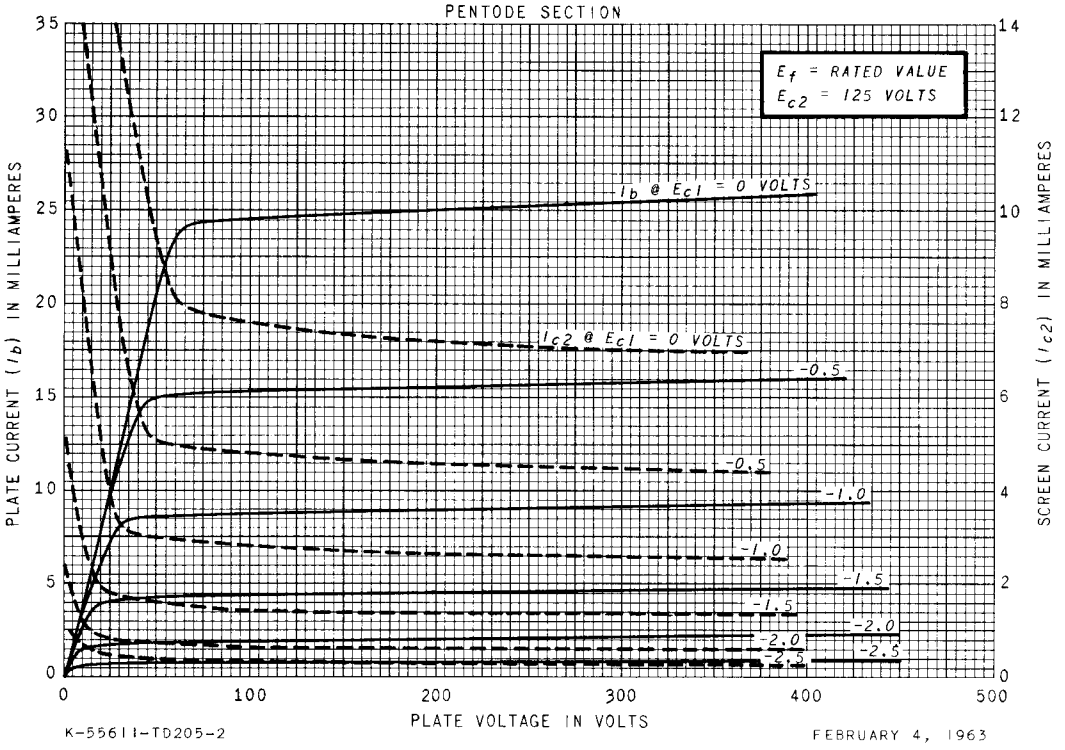
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SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

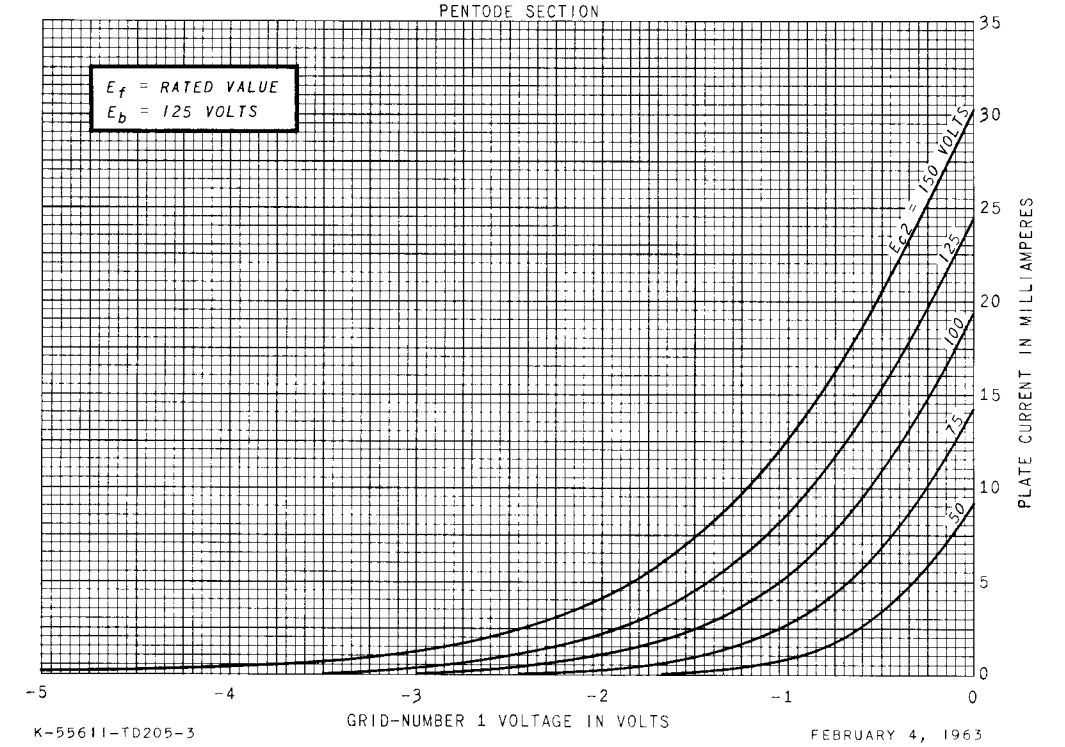


K-5561I-TD205-2

FEBRUARY 4, 1963

AVERAGE TRANSFER CHARACTERISTICS

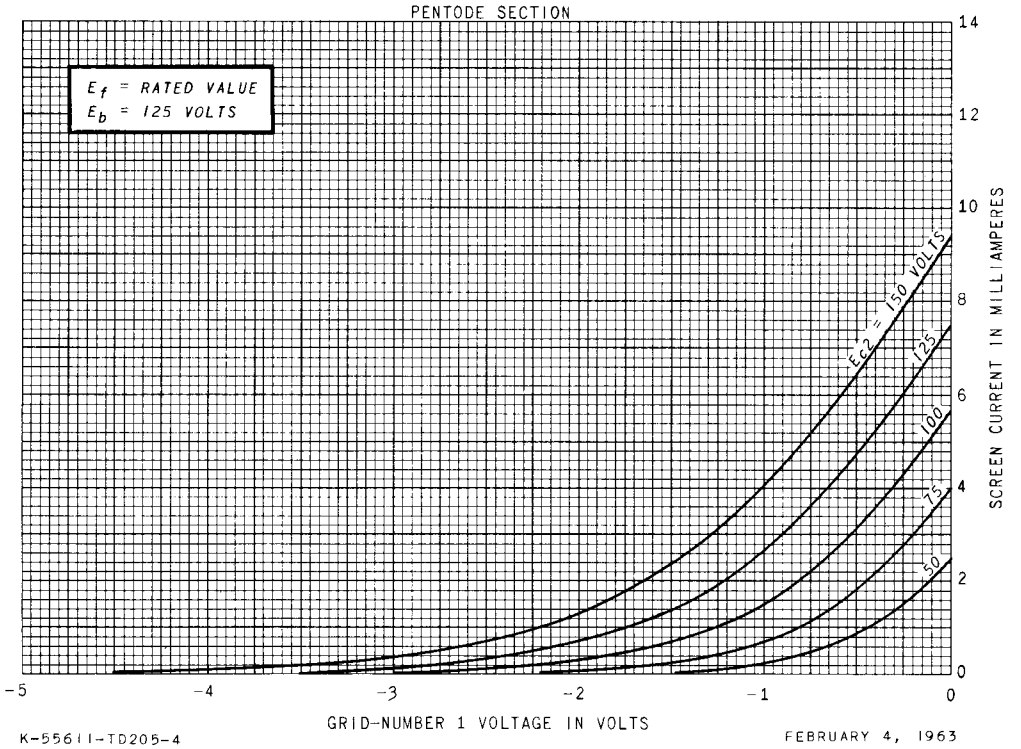
PENTODE SECTION



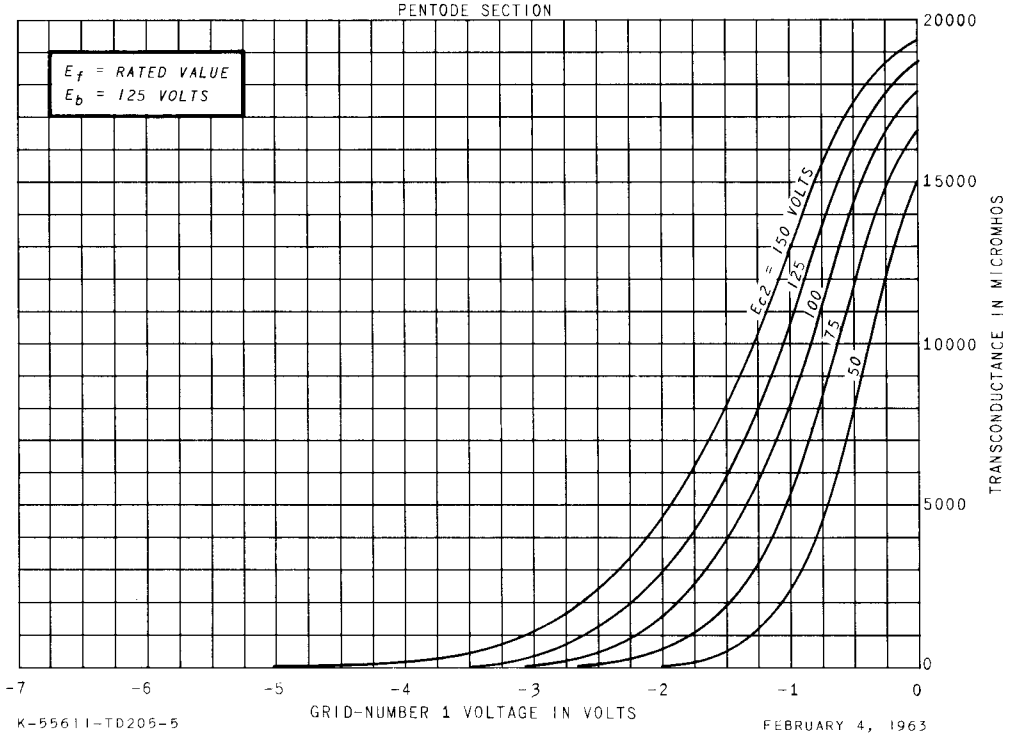
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FEBRUARY 4, 1963

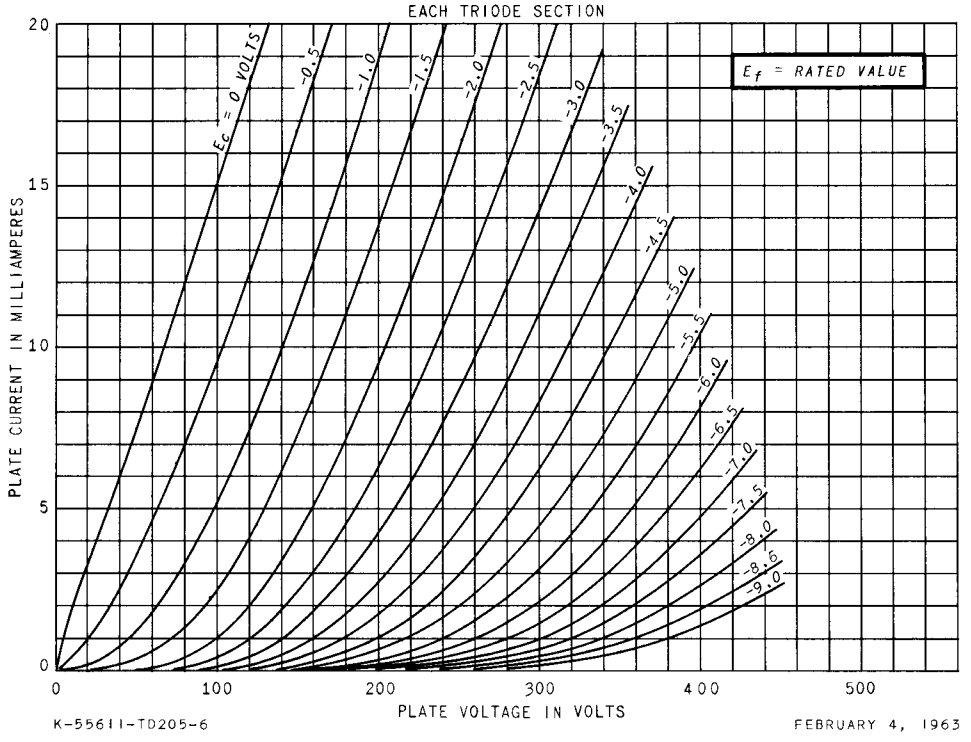
AVERAGE TRANSFER CHARACTERISTICS



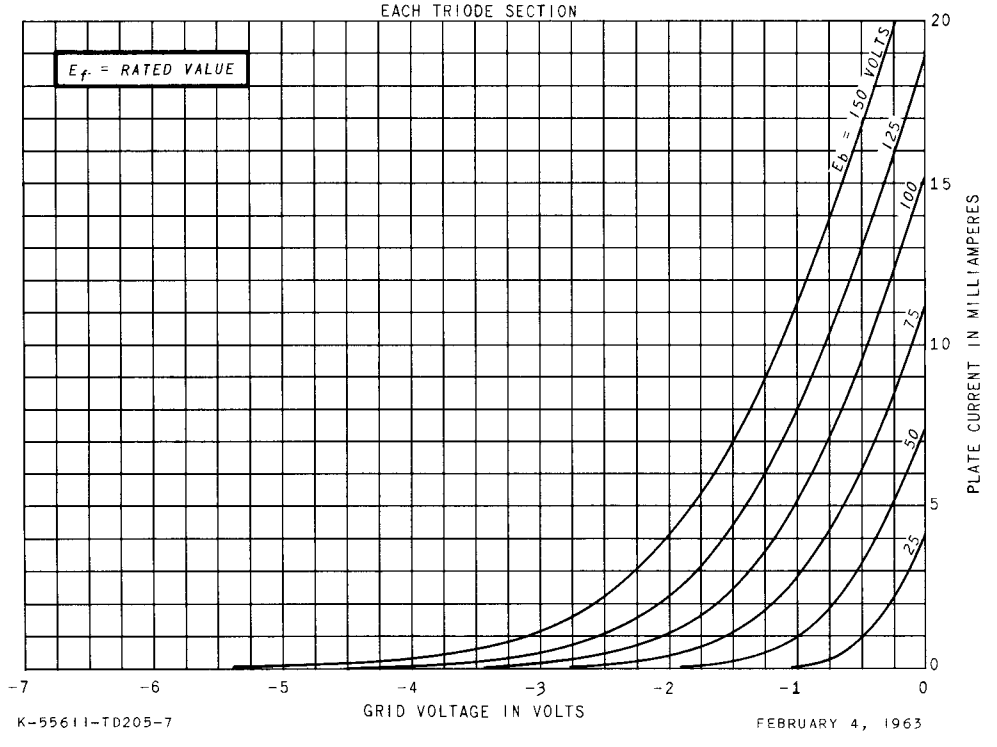
AVERAGE TRANSFER CHARACTERISTICS



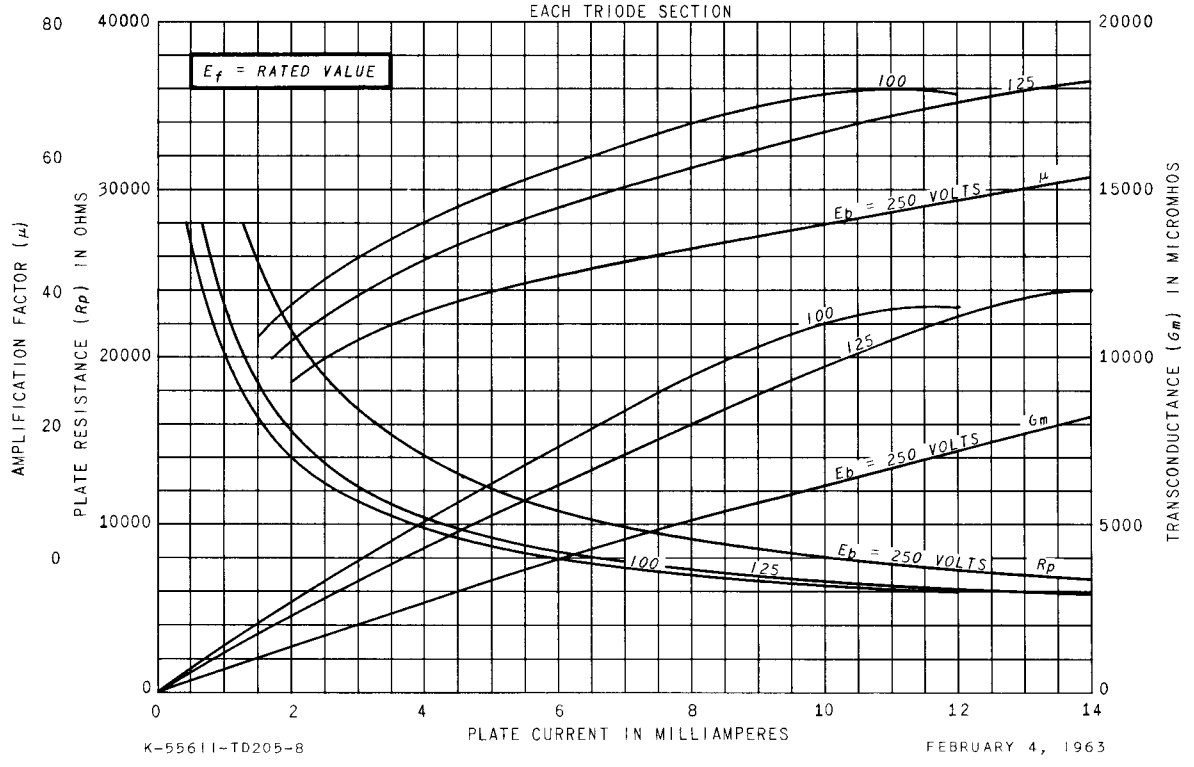
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Beam Triode

6MA6

FOR HV SHUNT REGULATOR APPLICATIONS

■ COLOR TV TYPE ■ 30000 VOLTS DC ■ 40 WATTS PLATE DISSIPATION ■ X-RADIATION RATING

The 6MA6 is a low current, high-voltage, beam triode intended for use as a shunt regulator in the high-voltage power supply of color television receivers.

The 6MA6 has a maximum d-c plate-voltage rating of 30,000 volts, a maximum d-c plate current rating of 1.5 milliamperes, and a maximum plate-dissipation rating of 40 watts.

Features of the 6MA6 include built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output to low levels even under conditions of equipment misadjustment and/or circuit failure mode operation.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	6.3 ± 0.6	Volts
Heater Current ●	0.2	Amperes
Direct Interelectrode Capacitances, approximate ▲		
Grid to Plate: (g to p)	0.03	pf
Input: g to (h+k)	2.4	pf
Output: p to (h+k)	0.88	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - B8-118, Short Medium Shell Octal 8-Pin
Top Cap - C1-50, Small
Outline Drawing - EIA 12-21

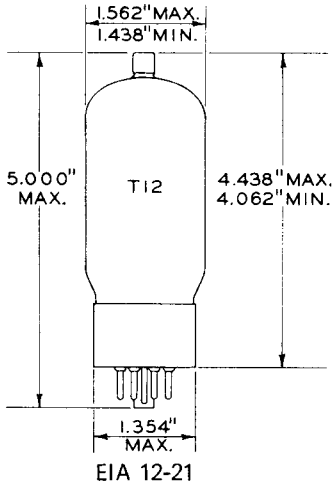
Maximum Diameter	1.562	Inches
Minimum Bulb Diameter	1.438	Inches
Maximum Over-all Length	5.000	Inches
Maximum Seated Height	4.438	Inches
Minimum Seated Height	4.062	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

Plate Voltage (Absolute-Maximum Value)	30000	Volts
Negative DC Grid Voltage	135	Volts
Peak Negative Grid Voltage §	440	Volts
Plate Dissipation (Absolute-Maximum Value)	40	Watts
DC Plate Current (Absolute-Maximum Value)	1.5	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	Not Recommended	
Heater Negative with Respect to Cathode ⊕	450	Volts
Grid-Circuit Resistance □	3.0	Megohms
Bulb Temperature at Hottest Point †	240	°C

PHYSICAL DIMENSIONS

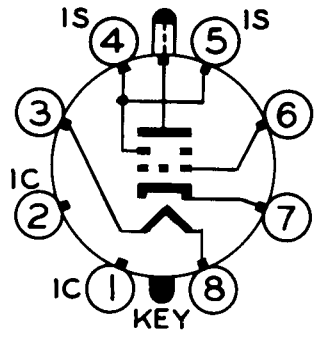


EIA 12-21

TERMINAL CONNECTIONS

Pin 1 - Internal Connection - Do Not Use
Pin 2 - Internal Connection - Do Not Use
Pin 3 - Heater
Pin 4 - Internal Shield ♦
Pin 5 - Internal Shield
Pin 6 - Grid
Pin 7 - Cathode
Pin 8 - Heater
Cap - Plate

BASING DIAGRAM



EIA 8NP

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Unregulated DC Supply Voltage	36000	Volts
Equivalent Resistance of Unregulated Supply	11	Megohms
DC Reference Voltage	200	Volts
Equivalent Resistance of Reference Supply	1000	Ohms
Effective Grid-Plate Transconductance	200	Micromhos
DC Plate Current for Zero Load Current	1000	Microamperes
DC Plate Current for Load Current of 1 Milliampere	45	Microamperes
Regulated DC Output Voltage at Zero Load Current	25000	Volts
Regulated DC Output Voltage at Load Current of 1 Milliampere	24500	Volts

X-RADIATION RATING

	Maximum Plate Voltage	Maximum DC Plate Current	Maximum X-Radiation Output
X-radiation, maximum	27 KV	1.5 mA	0.5 mR/hr
	30 KV	1.3 mA	0.5 mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Sustained operation of the 6MA6 outside of the Absolute-Maximum Values indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute Maximum Ratings are not exceeded over the worst probable range of adjustments and operating conditions for the set.

The X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein, except as noted under "X-Radiation Characteristics."

X-RADIATION CHARACTERISTICS

EQUIPMENT MISADJUSTMENT AND/OR CIRCUIT FAILURE MODE OPERATION

The 6MA6 will produce varying levels of X-radiation depending upon operating conditions. Based on known attenuation factors of the tube construction materials and accumulated sample test data taken initially and during life test, X-radiation is not expected to exceed 0.5 mR/hr under equipment misadjustment and/or circuit failure mode operation of plate voltage and current listed below.

Maximum Plate Voltage	Maximum DC Plate Current	Maximum Expected X-Radiation Output
35 KV	0.1 mA	0.5 mR/hr
34 KV	0.3 mA	0.5 mR/hr
29 KV	1.5 mA	0.5 mR/hr

WARNING

X-RADIATION

Operation of the 6MA6 above the Maximum conditions shown for equipment misadjustment and/or circuit failure mode operation conditions may produce soft X-rays above 0.5 milliroentgens per hour which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide required shielding.

Precautions must be exercised during the servicing of equipment employing the 6MA6 to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 6MA6 is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and in the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 6MA6 in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

▲ Without external shield.

♦ Shield should be connected directly to ground to minimize the effects of a momentary arc within the tube.

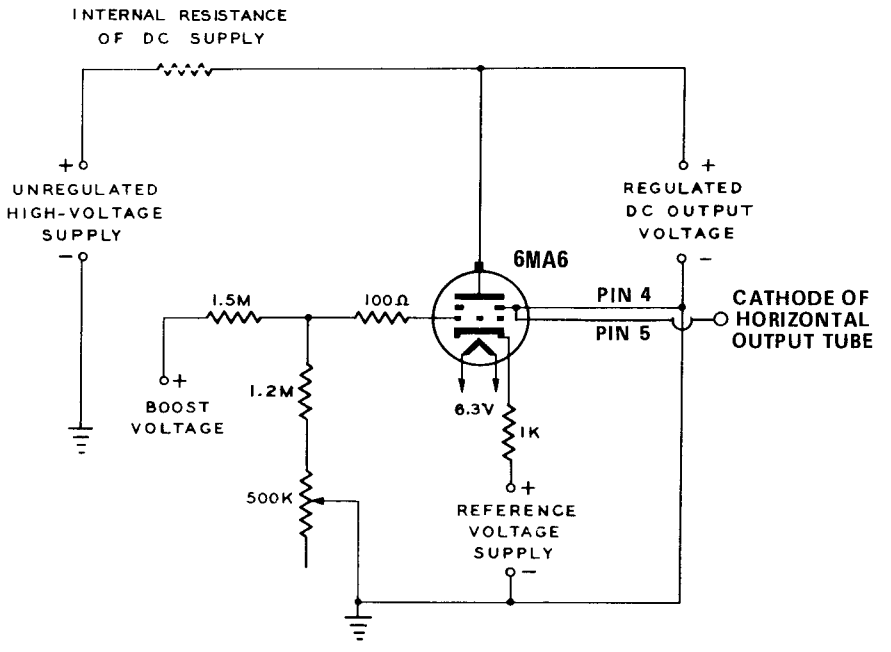
§ Peak value for duration of 20 seconds maximum during equipment warmup.

⊕ Sufficient impedance (1000 ohms is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions to 450 ma. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

□ With flyback transformer high voltage supply.

† Measured with an infrared thermometer, Ircon Model 700 BC or equivalent, at an ambient temperature of 40° C.

TYPICAL SHUNT REGULATOR CIRCUIT



APPLICATION CONSIDERATIONS

The base pins of the 6MA6 fit the standard octal socket. Socket terminals for pins 1 and 2 should not be used for tie points. Tube performance may be adversely affected should this precaution not be followed. It is permissible to tie the cathode of the horizontal output tube to pin 5 of the 6MA6 for circuit connection to ground.

Sufficient impedance (1000 ohms is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions to 450 ma. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

The high voltages at which the 6MA6 is operated may be very hazardous. Extreme caution should be used while making any circuit adjustments. The 6MA6 and all of its associated hardware should be housed in a protective enclosure. It is particularly important that all parts which may be at a high potential with respect to ground be housed in this protective enclosure. The protective enclosure should be constructed with a system of interlocks to prevent anyone from coming in contact with any high potential point in the electrical system. The interlocks should break the primary circuit of the high-voltage supply when any part of the protective enclosure is open, and should prevent the closing of the primary circuit until the protective enclosure is closed and locked.

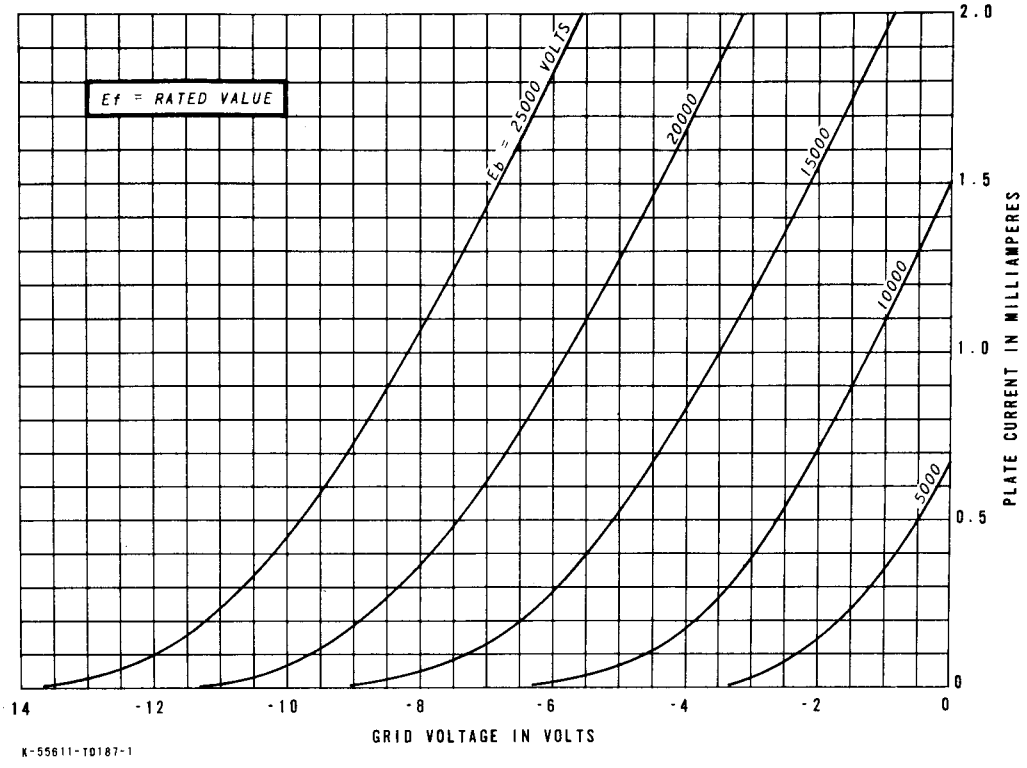
High voltages may appear at points in the circuit which are normally at low potentials as a result of improper circuit connection or of capacitor breakdown. Therefore, before touching any part of the circuit, the power supply switch should be turned off and both terminals of any capacitor be grounded.

The bulb of the 6MA6 becomes hot during operation. Therefore, it is essential that provision be made for free circulation of air around the tube in order to insure sufficient cooling.

The plate of the 6MA6 exhibits a dull red color when the tube is operated at maximum plate dissipation. In addition, it may exhibit a bluish glow on the upper half of the bulb inner wall surface during normal operation. This bluish glow is a result of fluorescence and it should not be mistaken for gas.

To prevent any strain from being exerted on the seal of the plate cap, it is important that connection to the plate cap be made by an appropriate connector which has a flexible lead.

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD187-1

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

Triple Triode

6MD8

■ COLOR TV TYPE ■ CHROMA MATRIXING AMPLIFIER ■ MEDIUM-MU ■ LOW B+ OPERATION

The 6MD8 is a medium-mu triple triode intended for use in the matrixing circuits of color television receivers. It can also be used in phase-inverter, multivibrator, and general-purpose amplifier applications.

The 6MD8 utilizes a T-9 bulb and features a 9-pin glass button base with a 0.687-inch pin circle.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.9	Amperes

Direct Interelectrode Capacitances§

	Section 1	Section 2	Section 3	
Grid to Plate: (g to p)	3.0	3.0	3.0	pf
Input: g to (h + k)	3.6	3.6	3.4	pf
Output: p to (h + k)	0.48	0.48	0.36	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E9-89, Button 9-Pin
Outline Drawing - EIA 9-108

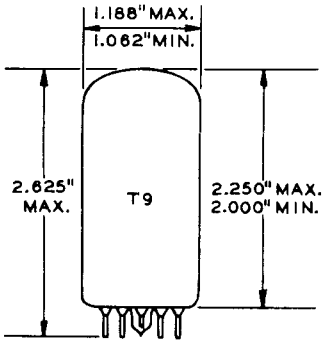
Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation, Each Plate	3.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	1.0	Megohms

PHYSICAL DIMENSIONS

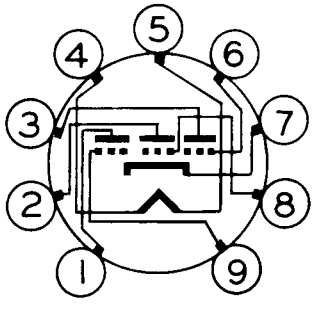


EIA 9-108

TERMINAL CONNECTIONS

Pin 1 - Plate (Section 3)
Pin 2 - Plate (Section 2)
Pin 3 - Plate (Section 1)
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Grid (Section 1)
Pin 7 - Cathode
Pin 8 - Grid (Section 2)
Pin 9 - Grid (Section 3)

BASING DIAGRAM



EIA 9RQ

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage	250	Volts
Grid Voltage	-10.5	Volts
Amplification Factor	17	
Plate Resistance, approximate	5500	Ohms
Transconductance	3100	Micromhos
Plate Current	11.5	Milliamperes
Plate Current, approximate Ec = -14 volts	4	Milliamperes
Grid Voltage, approximate Ib = 50 Microamperes	-23	Volts

NOTES

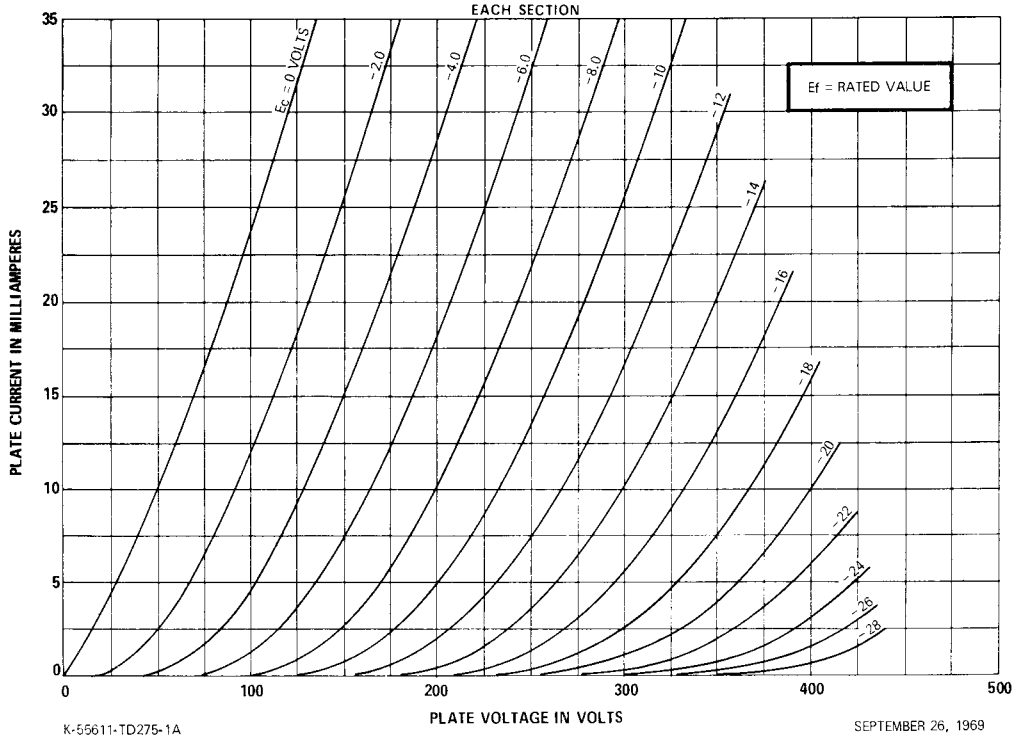
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

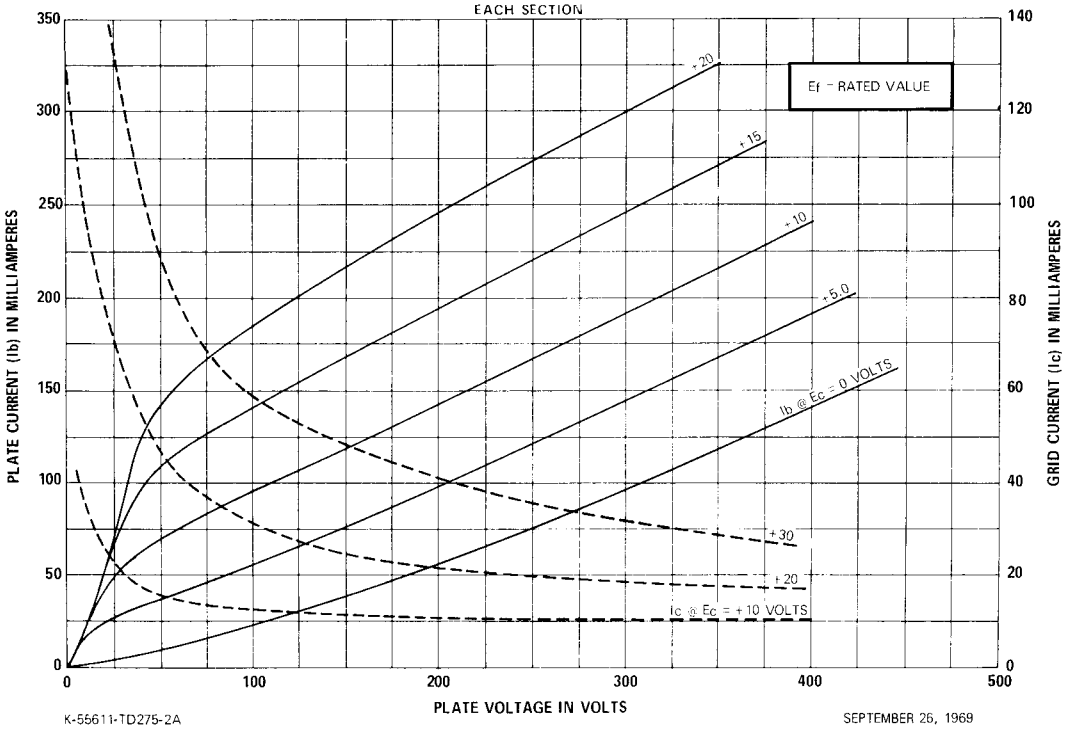
§ Without external shield.

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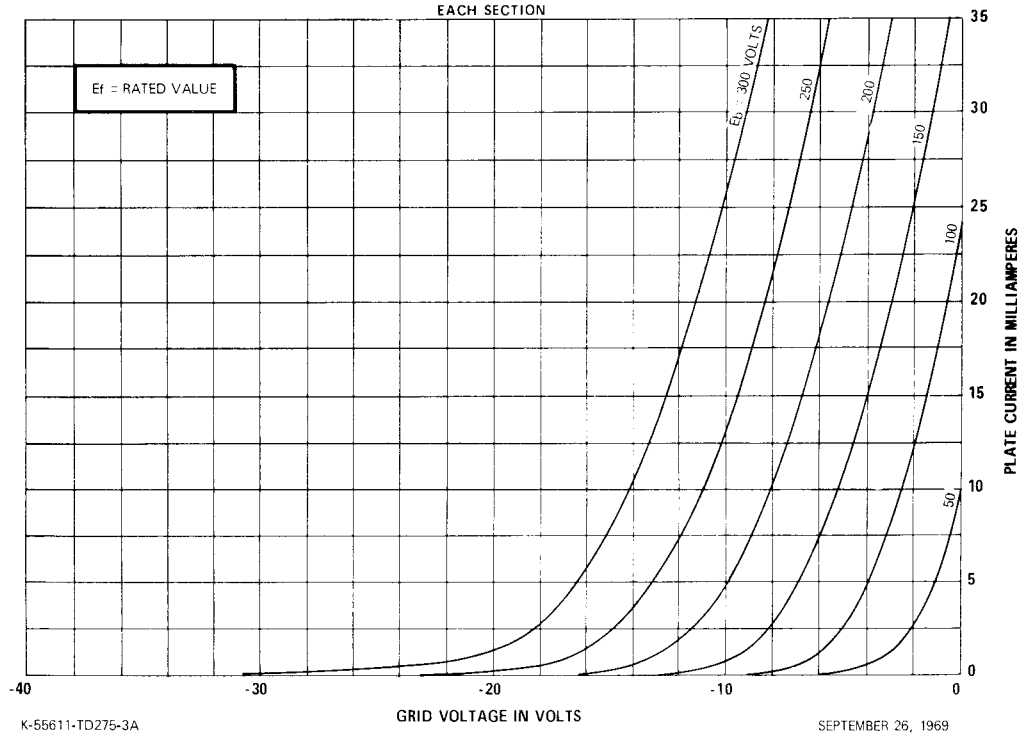
AVERAGE PLATE CHARACTERISTICS



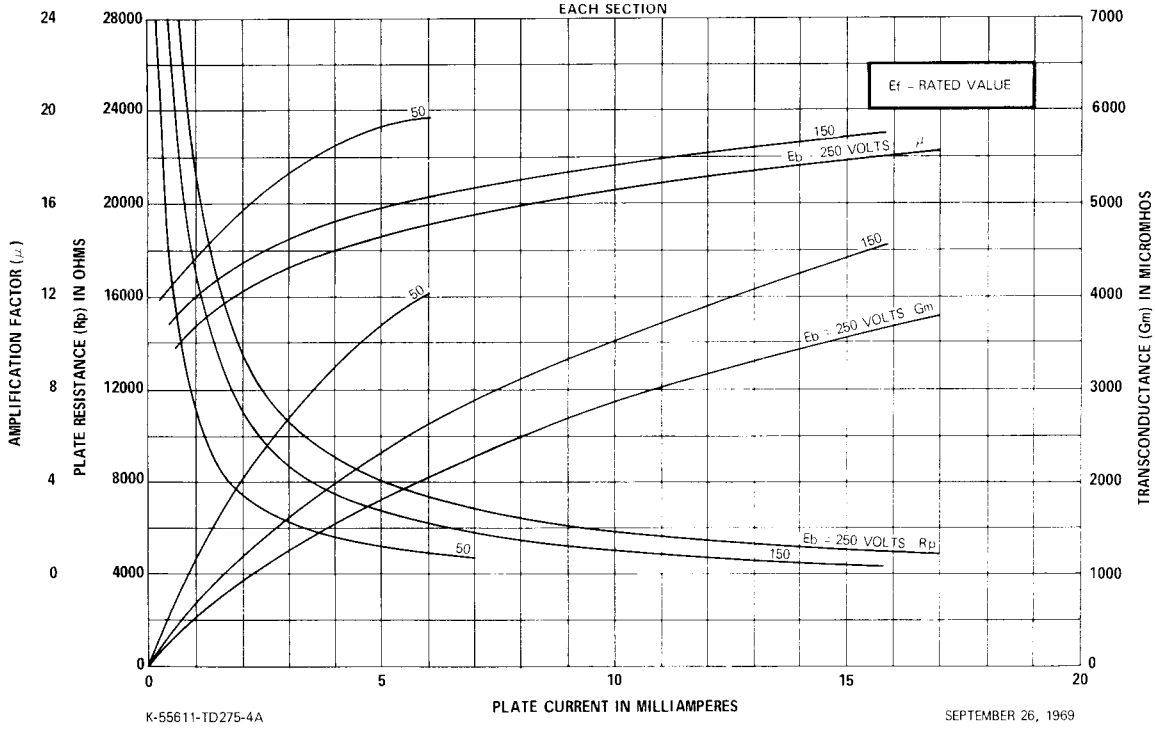
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Compactron Beam Pentode

6MH6

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

- COLOR TV TYPE
- 38.5 WATTS PLATE DISSIPATION
- 280 VOLTS B+
- 500 MILLIAMPERES DC CATHODE CURRENT
- OVER 1 AMPERE PEAK CURRENT

The 6MH6 is a compactron beam–power pentode primarily designed for use as the horizontal–deflection amplifier in color television receivers. It is characterized by having a very low knee with a very high peak current of over an ampere. This results in a basic capability to scan 90–degree large screen color picture tubes at 26 KV from 280–volt power supplies. Its low knee minimizes "snivets" without the necessity of supplying special voltages to the beam plates.

GENERAL

ELECTRICAL

Cathode–Coated Unipotential

Heater Characteristics and Ratings

Heater Votage, AC or DC ★	6.3 ± 0.6	VOLTS
Heater Current ●	2.65	Amperes

Direct Interelectrode Capacitances, approximate ♦

Grid Number 1 to Plate: (g1 to p)	1.0	pf
Input g1 to (h+k+g2+b.p.)	40	pf
Output: p to (h+k+g2+b.p.)	20	pf

MECHANICAL

Operating Position – Any

Envelope – T-12, Glass

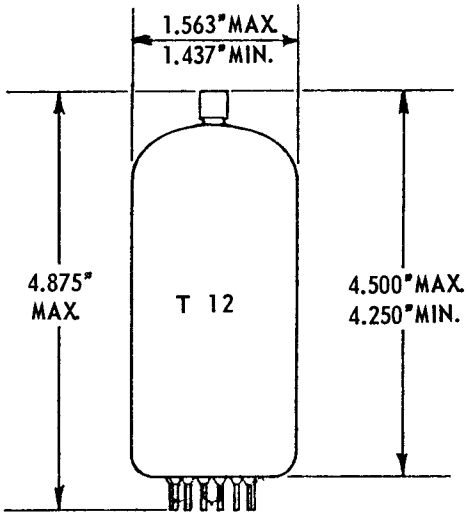
Base – E12–74, Button 12 Pin

Top Cap– C1–1, Small

Outline Drawing – EIA 12–136

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over–all Length	4.875	Inches
Maximum Seated Height	4.500	Inches
Minimum Seated Height	4.250	Inches

PHYSICAL DIMENSIONS

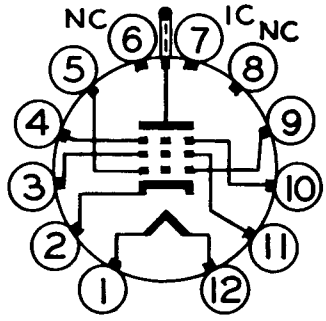


EIA 12–136

TERMINAL CONNECTIONS

Pin 1 – Heater
Pin 2 – Cathode
Pin 3 – Grid–Number 2 (Screen)
Pin 4 – Beam Plates
Pin 5 – Grid–Number 1
Pin 6 – No Connection
Pin 7 – Internal Connection (Do not use)
Pin 8 – No Connection
Pin 9 – Grid–Number 1
Pin 10– Beam Plates
Pin 11– Grid–Number 2 (Screen)
Pin 12– Heater
Cap – Plate.

BASING DIAGRAM



EIA 12GW

GENERAL ELECTRIC

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE▲— DESIGN-MAXIMUM VALUES UNLESS OTHERWISE STATED

Peak Positive Pulse Plate Voltage	8000	Volts
Positive DC Beam Plate Voltage¶	50	Volts
Screen Voltage	275	Volts
Peak Negative Grid-Number 1 Voltage	300	Volts
Plate Dissipation□ (Absolute-Maximum Value)	38.5	Watts
Screen Dissipation	7.0	Watts
DC Cathode Current	500	Milliamperes
Peak Cathode Current	1750	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance§		
With Feedback-Type High Voltage Regulation	1.2	Megohms
With Shunt-Type High Voltage Regulation (Switching Mode)	2.2	Megohms
Beam Plate Circuit Resistance¶	10000	Ohms
Bulb Temperature⊕	275	°C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	7000	45	60	175	Volts
Beam Plates Connected to Cathode at Socket					
Screen Voltage	175	160	110	110	Volts
Grid-Number 1 Voltage	---	0	0	−21	Volts
Plate Resistance, Approximate	---	---	---	6000	Ohms
Transconductance	---	---	---	14000	Micromhos
Plate Current	---	1100†	760†	125	Milliamperes
Screen Current	---	110†	42†	3.3	Milliamperes
Grid-Number 1 Voltage, Approximate Ib = 1.0 Milliamperes	160	---	---	−40	Volts
Triode Amplification Factor‡	---	---	---	4.0	

MINIMUM RECOMMENDED GRID DRIVE

Peak Positive Pulse Plate Voltage	6000	7000	Volts
Peak Negative Grid-Number 1 Voltage for Eg2 = 150 Volts	210	230	Volts
Peak Negative Grid-Number 1 Voltage for Eg2 = 200 Volts	235	260	Volts

NOTES

♦ Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef=6.3 volts.

♦ Without external shield.

▲ For operation in a 525–line, 30–frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

□ In stages operating with grid–leak bias, an adequate cathode–bias resistor or other suitable means is required to protect the tube in the absence of excitation.

¶ Resistance up to 10,000 ohms is permitted providing the positive beam plate voltage does not ecceed the rated value. Bypassing the resistor in the beam plate circuit is not recommended,

§ The circuit design has to be such that negative control grid currents up to 5 microamperes do not have any detrimental effect upon tube adjustment or circuit performance. Care should be taken so that the limiting values for plate dissipation, screen dissipation, and cathode current are not exceeded with 5 microamperes grid current.

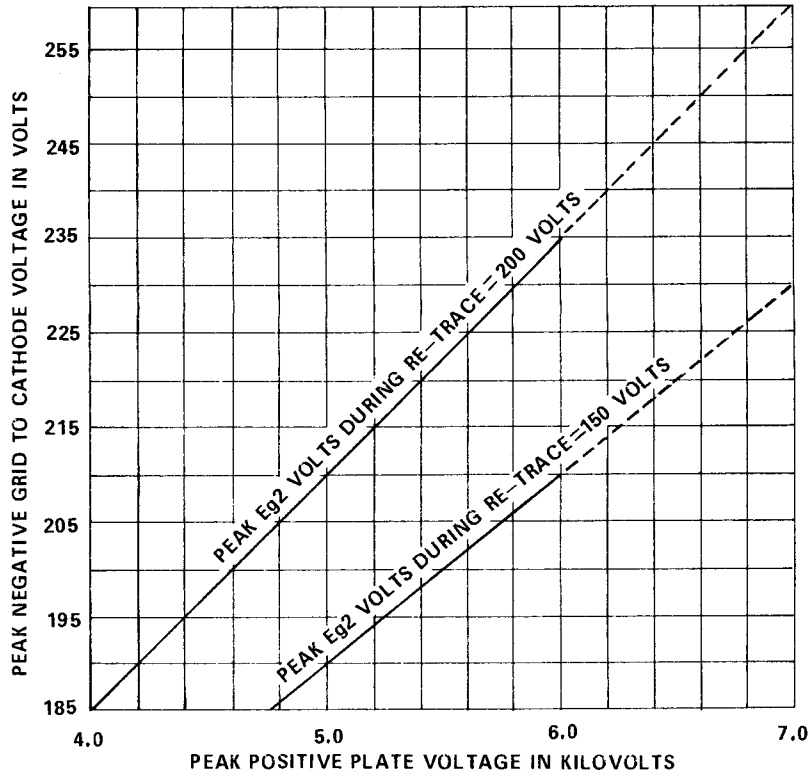
⊕ Measured with an infrared themometer, Ircon Model 700 BC or equivalent.

† Values measured by a method involving a recurrent waveform such that the plate and screen dissipation will be kept within rating in order to prevent damage to the tube.

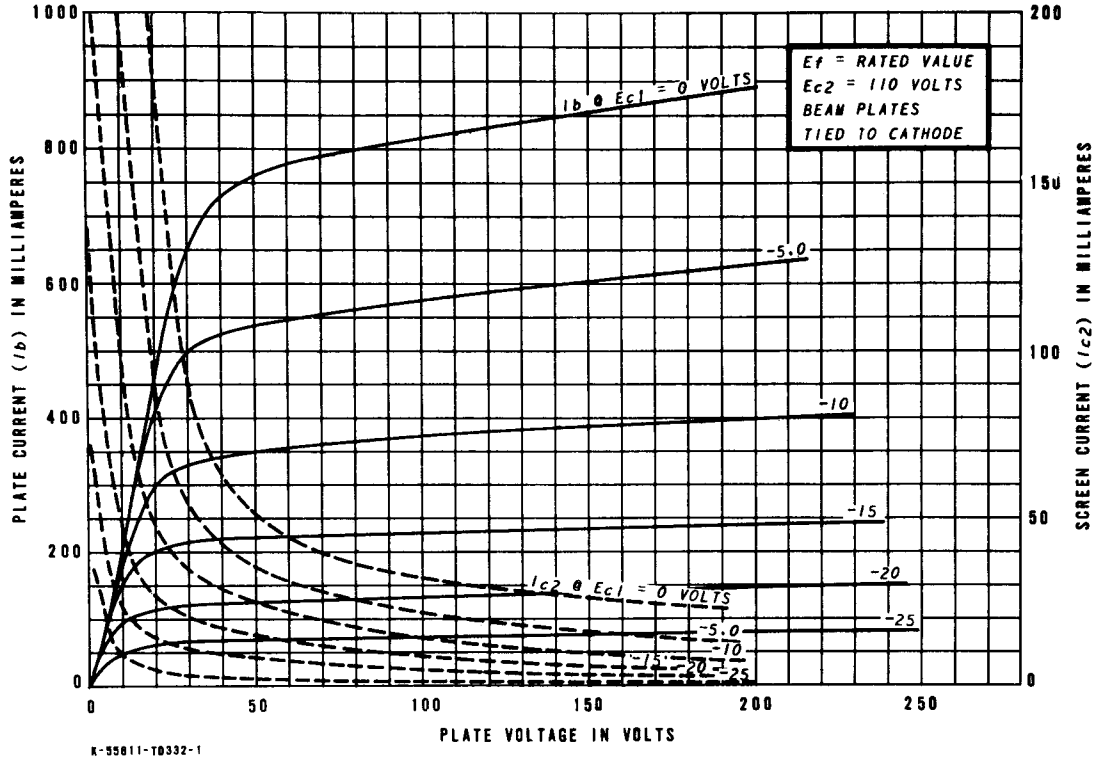
‡ Triode connection (screen tied to plate) with Eb=Ec2=175 volts, and Ec1= –21 volts.

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RECOMMENDED MINIMUM PEAK NEGATIVE GRID VOLTAGE vs PEAK POSITIVE PULSE PLATE VOLTAGE

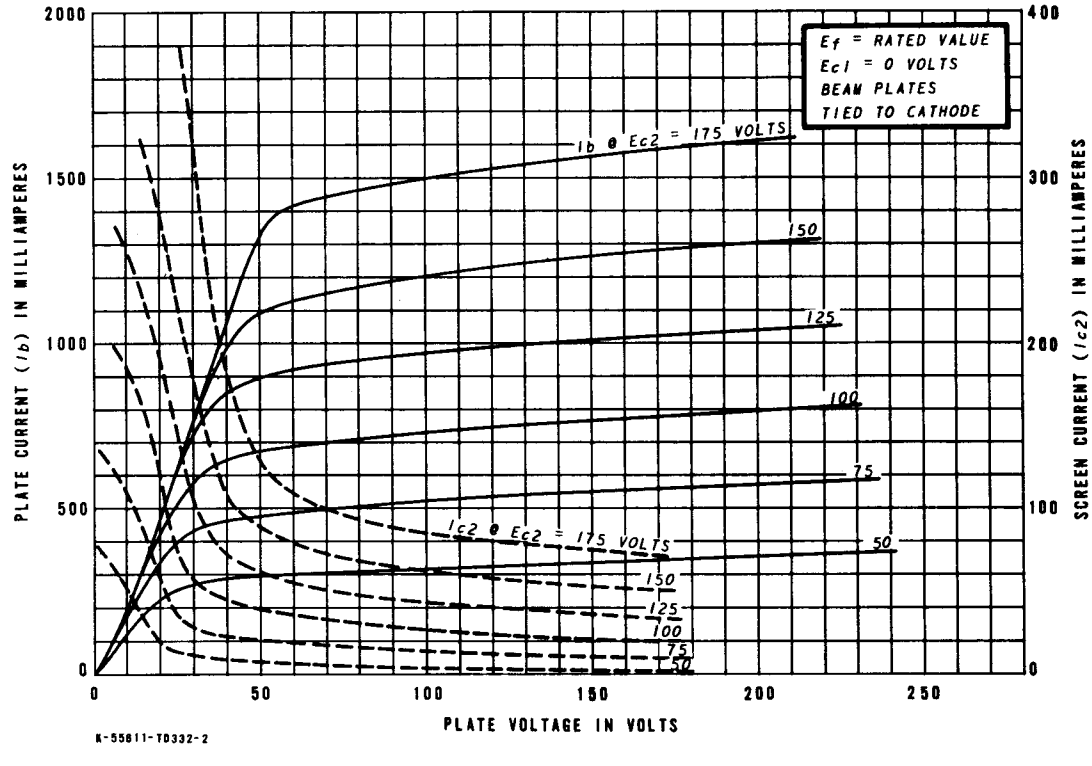


AVERAGE PLATE CHARACTERISTICS



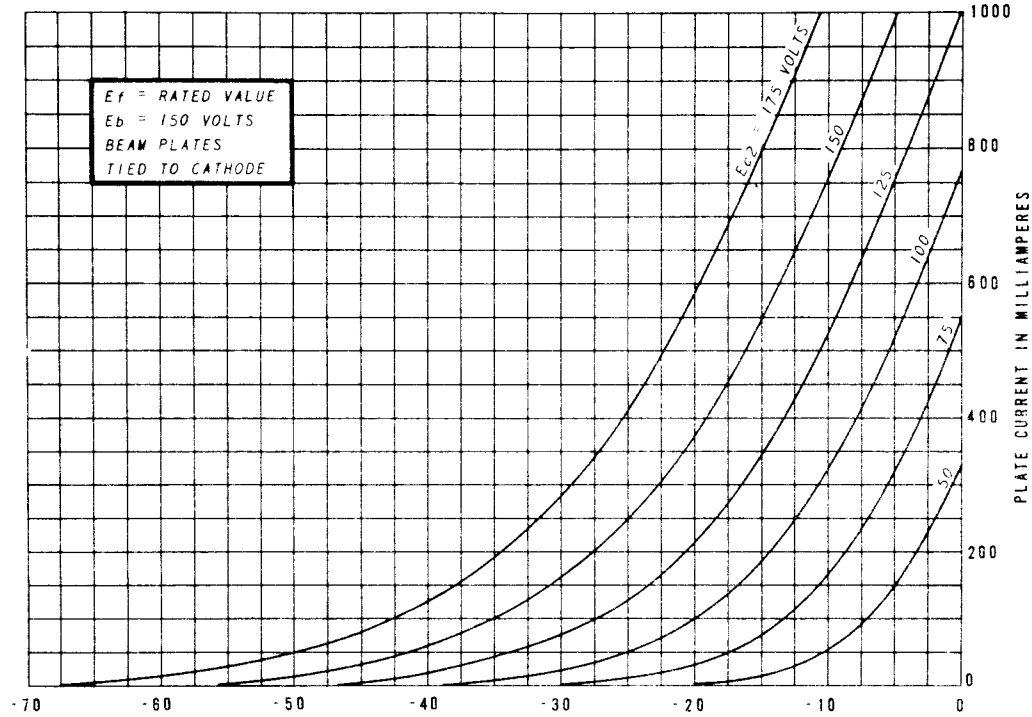
K-55811-TD332-1

AVERAGE PLATE CHARACTERISTICS



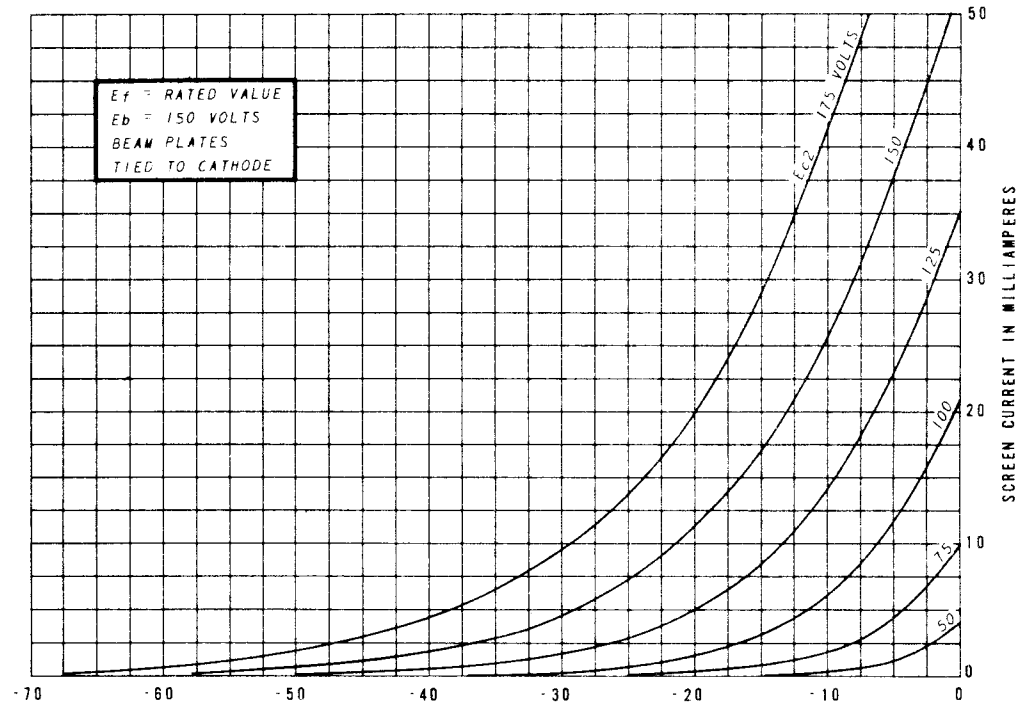
K-55811-TD332-2

AVERAGE TRANSFER CHARACTERISTICS



K-55611-T0332-3

AVERAGE TRANSFER CHARACTERISTICS



K-55611-T0332-4

TUBE PRODUCTS DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

Compactron Triple Triode

6MJ8

The 6MJ8 is a compactron triple triode intended for use as a chroma matrixing amplifier in color television receivers. Combining three triodes in one envelope allows all three picture tube guns to be driven by a single tube.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.9	Amperes

Direct Interelectrode Capacitances§

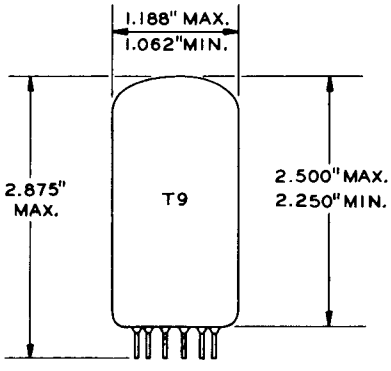
	Section 1	Section 2	Section 3	
Grid to Plate: (g to p)	2.8	2.8	2.8	pf
Input: g to (h + k)	2.9	2.9	3.0	pf
Output: p to (h + k)	0.36	0.6	0.7	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-60

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches
Minimum Seated Height	2.250	Inches

PHYSICAL DIMENSIONS

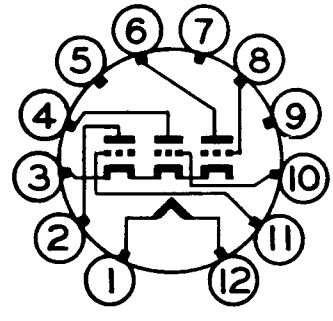


EIA 9-60

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate (Section 3)
Pin 3 - Cathode
Pin 4 - Plate (Section 2)
Pin 5 - No Connection
Pin 6 - Plate (Section 1)
Pin 7 - No Connection
Pin 8 - Grid (Section 1)
Pin 9 - No Connection
Pin 10 - Grid (Section 2)
Pin 11 - Grid (Section 3)
Pin 12 - Heater

BASING DIAGRAM



EIA 12HG

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	3.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	250	Volts
Grid Voltage	-10.5	Volts
Amplification Factor	17	
Plate Resistance, approximate	5600	Ohms
Transconductance	3000	Micromhos
Plate Current	10	Milliamperes
Grid Voltage, approximate		
Ib = 4.0 Milliamperes	-14	Volts
Grid Voltage, approximate		
Ib = 50 Microamperes	-23	Volts

NOTES

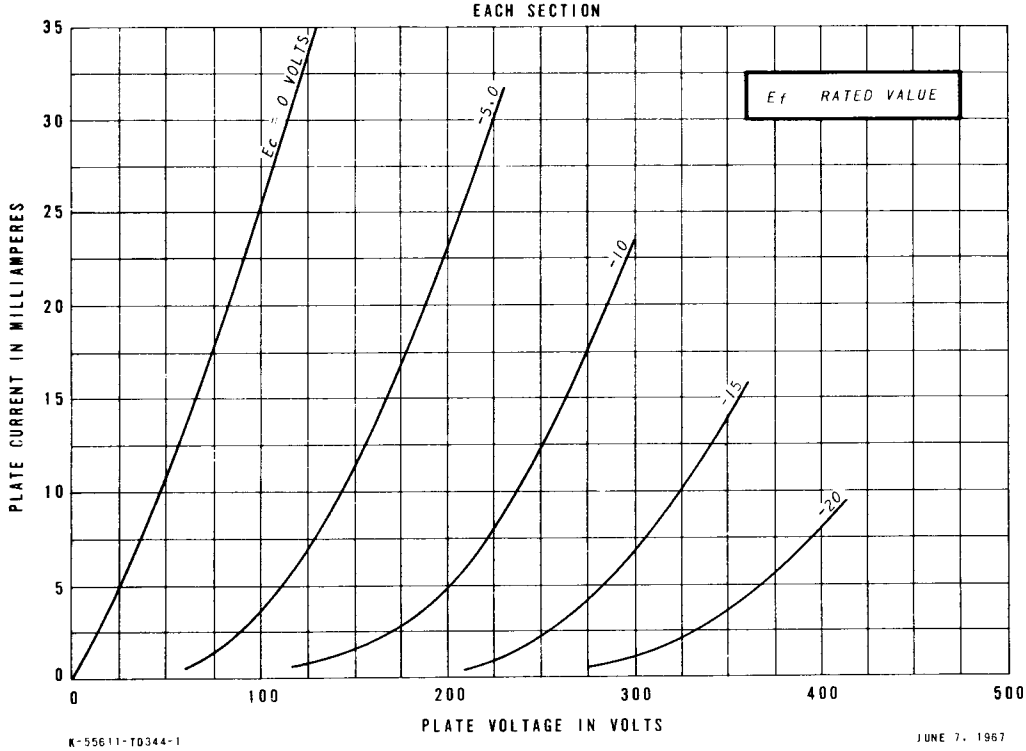
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

AVERAGE PLATE CHARACTERISTICS

EACH SECTION



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

6MN8

Compactron Triple Triode

- COLOR TV TYPE
- CHROMA MATRIXING AMPLIFIER
- LOW B+ OPERATION

The 6MN8 is a compactron triple triode intended for use as a chroma matrixing amplifier in color television receivers. Combining three triodes in one envelope allows one tube to drive all three picture tube guns.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current■	0.9	Amperes

Direct Interelectrode Capacitances♦

	Section 1	Section 2	Section 3	
Grid to Plate: (g to p)	2.6	2.6	2.6	pf
Input: g to (h + k)	4.6	4.6	4.6	pf
Output: p to (h + k)	0.33	0.57	0.65	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-60

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches
Minimum Seated Height	2.250	Inches

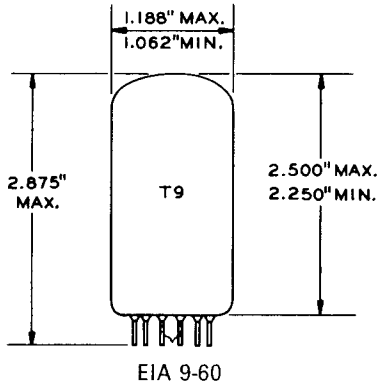
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

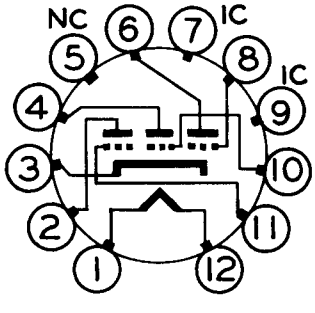


EIA 9-60

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate (Section 3)
Pin 3 - Cathode
Pin 4 - Plate (Section 2)
Pin 5 - No Connection
Pin 6 - Plate (Section 1)
Pin 7 - Internal Connection - Do Not Use
Pin 8 - Grid (Section 1)
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Grid (Section 2)
Pin 11 - Grid (Section 3)
Pin 12 - Heater

BASING DIAGRAM



EIA 12HU

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MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	3.0	Watts
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION▲

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	200	125	Volts
Grid Voltage	-4.0	-1.0	Volts
Amplification Factor	40	47	
Plate Resistance, approximate	10000	6250	Ohms
Transconductance	4000	7500	Micromhos
Plate Current	4.8	11	Milliamperes
Grid Voltage, approximate			
Ib = 50 Microamperes	-11	-5	Volts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

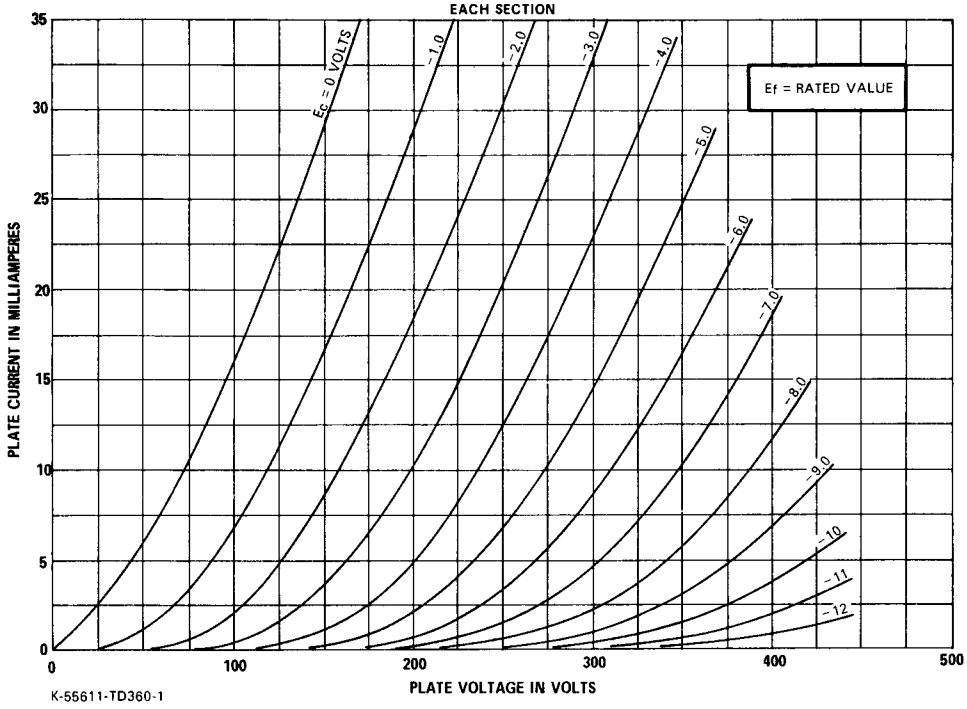
■ Heater current of a bogey tube at Ef = 6.3 volts.

♦ Without external shield.

▲ Control grid to cathode spacing on this type is of such low order of magnitude as to preclude the use of voltage between these elements of more than 100 volts dc or peak ac in commercial tube checkers and short indicator devices, particularly where mechanical excitation of the tube is employed.

AVERAGE PLATE CHARACTERISTICS

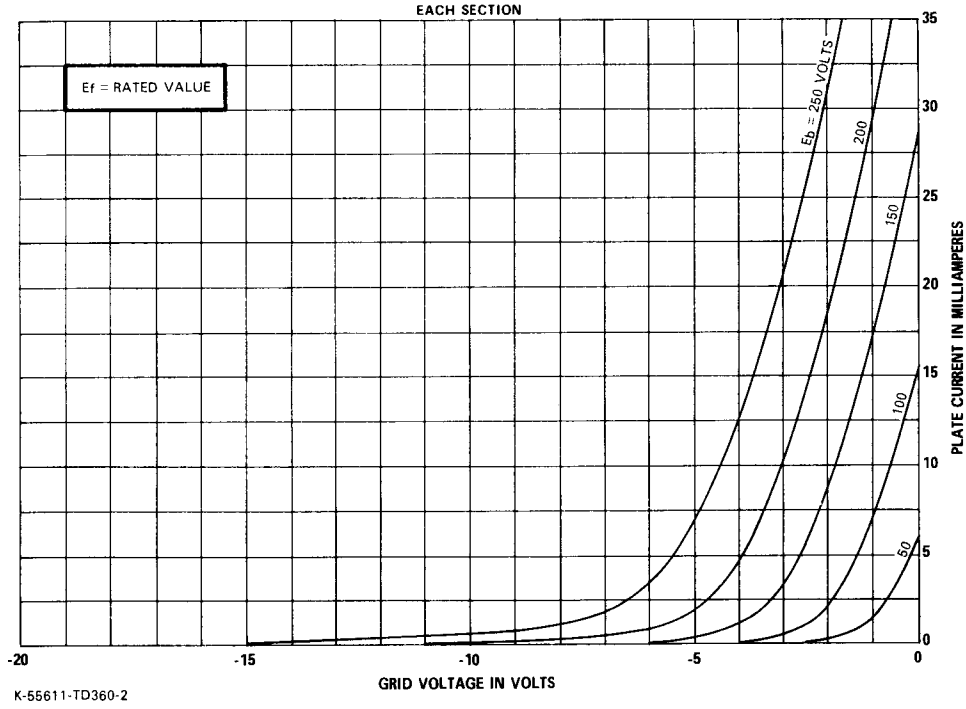
EACH SECTION



K-55611-TD360-1

AVERAGE TRANSFER CHARACTERISTICS

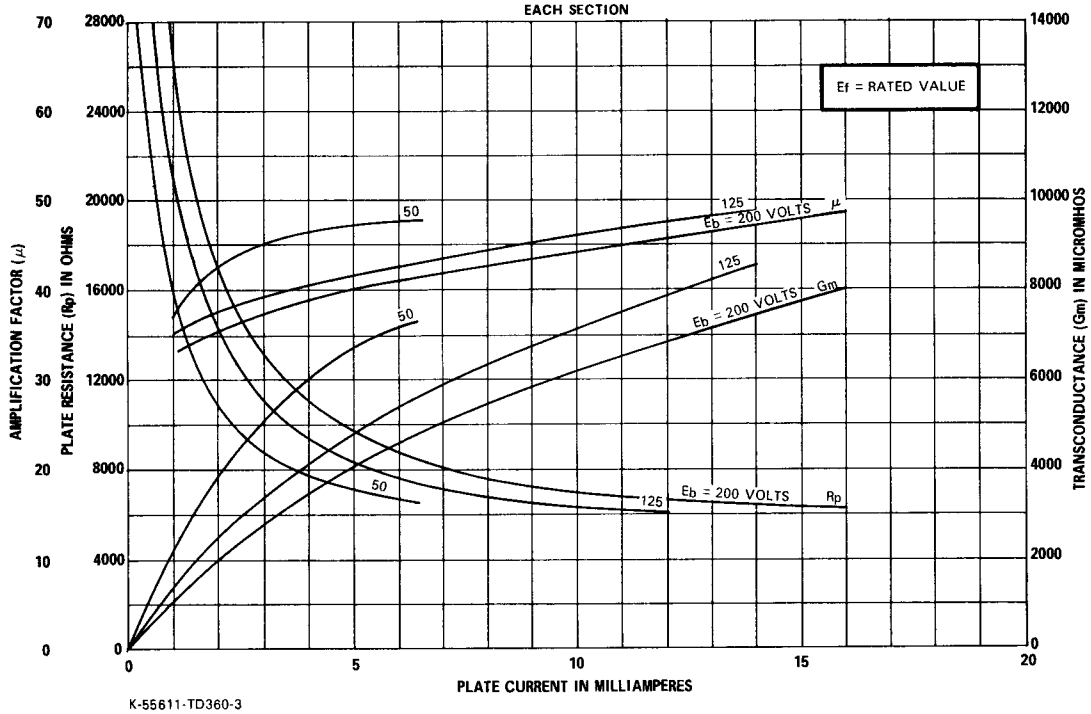
EACH SECTION



K-55611-TD360-2

AVERAGE CHARACTERISTICS

EACH SECTION



K-55611-TD360-3

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBE
KEN-RAD

6N7

Description and Rating

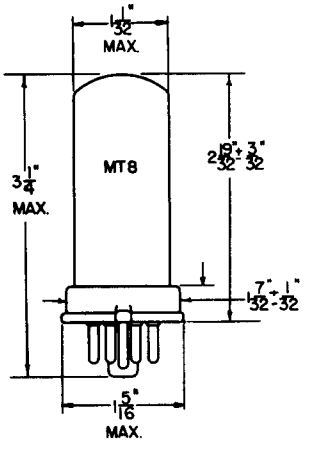
POWER-AMPLIFIER TWIN TRIODE

GENERAL DESCRIPTION

Principal Application: The 6N7 is a heater-cathode type twin triode designed for use as a class B power amplifier in the output stage of a-c or battery operated equipment. It may also be used in other applications such as a biased detector, oscillator phase inverter or class A amplifier. The 6N7 electrical ratings and characteristics are identical with those of the 6A6 and 6N7-G.

Cathode:	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.8 Ampere
Envelope:	MT-8 Metal Shell
Base:	8B-21 Small Wafer Octal 8-Pin Phenolic
Mounting Position:	Any

PHYSICAL DIMENSIONS

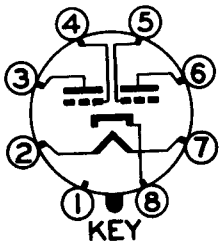


RMA 8-6

TERMINAL CONNECTIONS

Pin 1 - Shell
Pin 2 - Heater
Pin 3 - Plate - Unit Number 2
Pin 4 - Grid - Unit Number 2
Pin 5 - Grid - Unit Number 1
Pin 6 - Plate - Unit Number 1
Pin 7 - Heater
Pin 8 - Cathode

BASING DIAGRAM



RMA 8B
BOTTOM VIEW

MAXIMUM RATINGS

EACH UNIT

CLASS B POWER AMPLIFIER

	Design Center	Absolute	
Plate Voltage	300	330	Volts
Peak Plate Current	125	140	Milliamperes
Average Plate Dissipation	5.50	6.05	Watts
D-C Heater-Cathode Voltage	90	100	Volts

CLASS A AMPLIFIER

Plate Voltage	300	330	Volts
Plate Dissipation	1.0	1.1	Watts
D-C Heater-Cathode Voltage	90	100	Volts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS B POWER AMPLIFIER **

	Ideal	Typical	
Heater Voltage	6.3	6.3	Volts
Zero-Signal Plate Voltage	300	300	Volts
D-C Grid Bias Voltage	0	0	Volt
Peak A-F Grid-to-Grid Voltage °	58	82 *	Volts
Grid-Circuit Impedance per Unit	0	516 §	Ohms
Plate Supply Impedance	0	1000	Ohms
Zero-Signal D-C Plate Current	35	35	Milliamperes
Maximum-Signal D-C Plate Current	70	70	Milliamperes
Peak Grid Current per Unit	20	22	Milliamperes
Effective Plate to Plate Load Resistance	8000	8000	Ohms
Third Harmonic Distortion	3.5	7.5	Per Cent
Fifth Harmonic Distortion	1.5	2.5	Per Cent
Total Harmonic Distortion	4	8	Per Cent
Maximum-Signal Power Output	10	10	Watts

CLASS A AMPLIFIER - AS DRIVER Δ

Heater Voltage	6.3	6.3	Volts
Plate Voltage	250	294	Volts
Grid Bias Voltage φ	-5	-6	Volts
Amplification Factor	35	35	
Plate Resistance	11300	11000	Ohms
Transconductance	3100	3200	Micromhos
Plate Current	6	7	Milliamperes

Note:

Approximately 20 watts power output may be obtained in a class B output stage by using two 6N7 tubes with the units of each tube connected in parallel and operated with 300 volts on each plate and with a 5000-ohm plate-to-plate load.

** *Unless otherwise specified the values shown are for the two units.*

* *Includes peak voltage drop through the grid circuit impedance.*

° *For values of power output shown.*

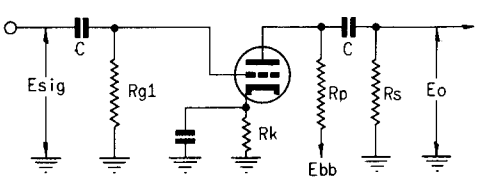
§ *At 400 cycles for class B stage in which the effective resistance per grid circuit is 500 ohms, and the leakage reactance of the coupling transformer is 50 millihenrys.*

Δ *Triode units connected in parallel.*

φ *The d-c resistance in the grid circuit of the 6N7 as a class A amplifier should not exceed 0.5 megohm for self-bias operation and 0.1 megohm for fixed bias operation.*

CLASS A RESISTANCE-COUPLED AMPLIFIER

Rp Meg.	Rg1 Meg.	Rs Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	*	0.10	2000	17	13	1300	19	34	1100	20	58
0.10	*	0.24	2200	20	18	1600	22	43	1300	23	78
0.24	*	0.24	4300	22	17	3000	24	41	2700	25	72
0.24	*	0.51	5100	23	20	3600	25	49	3300	27	85
0.51	*	0.51	7500	24	19	5100	26	44	4300	27	73
0.51	*	1.0	8200	25	23	6200	28	52	5100	29	91
0.24	10	0.24	---	22	13	---	25	33	---	27	56
0.24	10	0.51	---	24	17	---	27	43	---	29	72
0.51	10	0.51	---	25	15	---	27	38	---	29	66
0.51	10	1.0	---	27	19	---	29	46	---	30	80

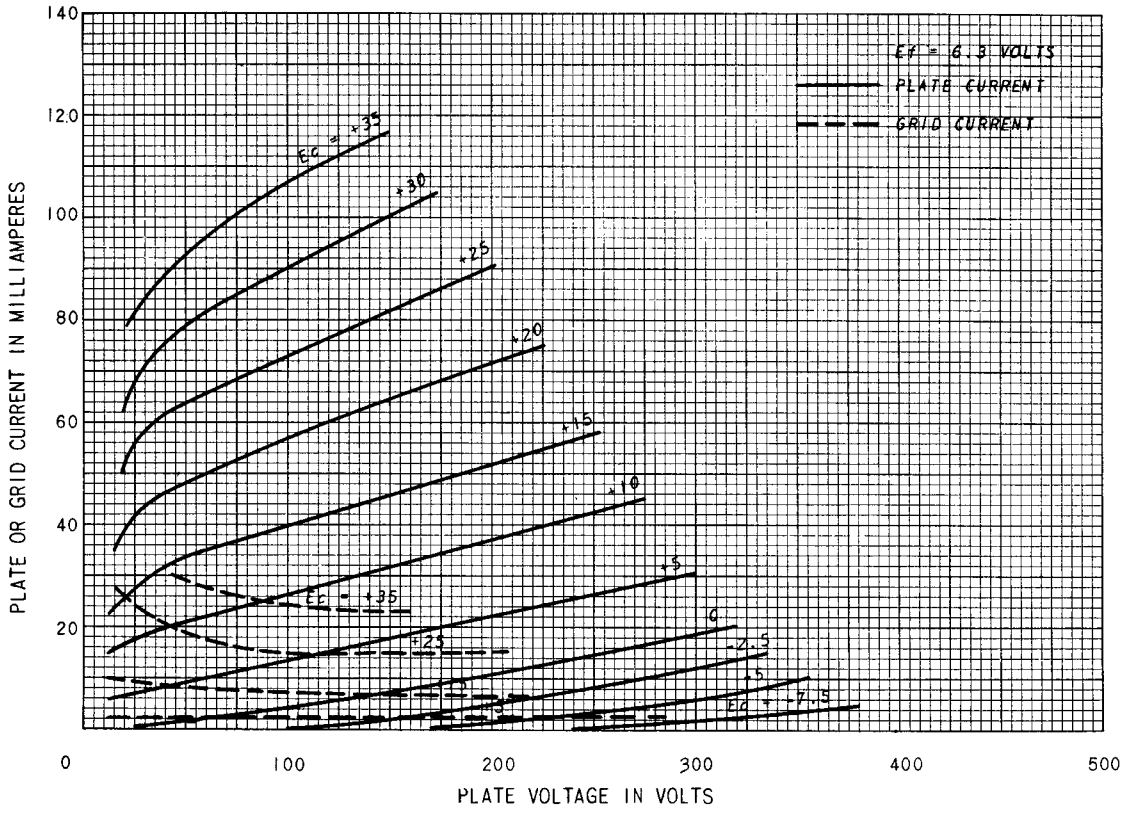


Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data generator impedence is negligible. *Value of Rg1 is non-critical.

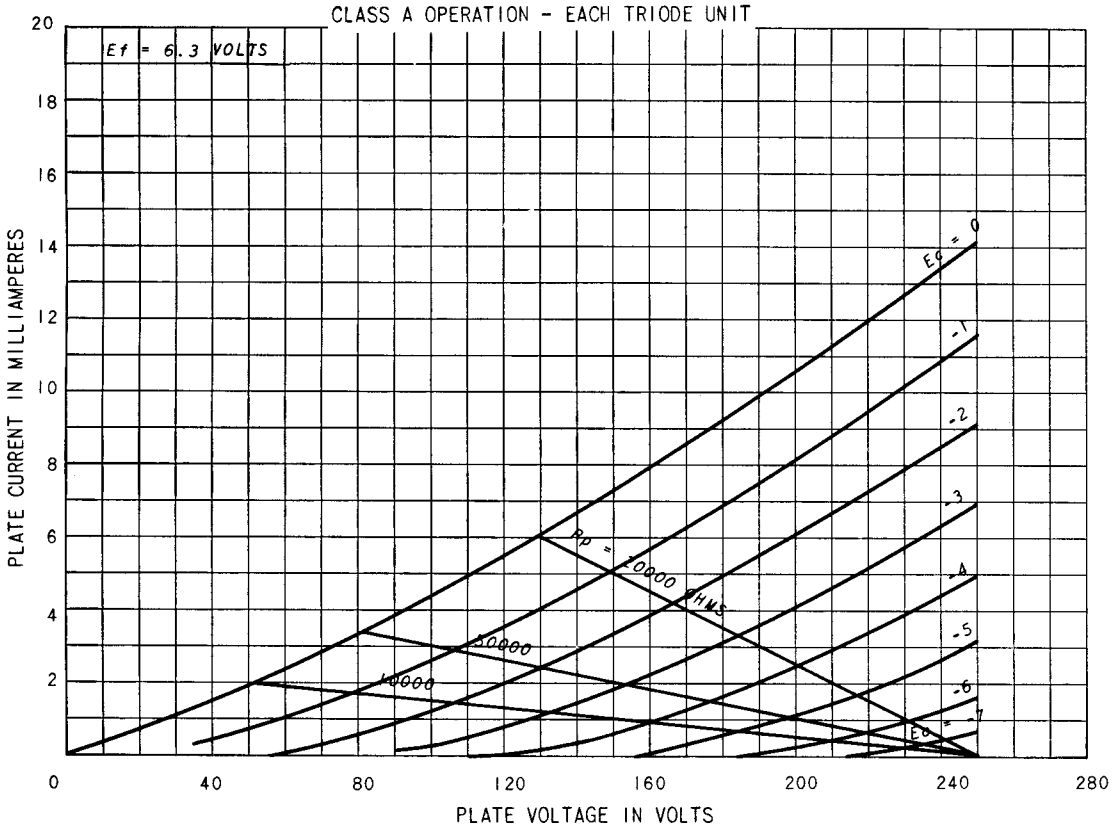
AVERAGE PLATE CHARACTERISTICS

EACH TRIODE UNIT



AVERAGE PLATE CHARACTERISTICS

CLASS A OPERATION - EACH TRIODE UNIT



Electronic TUBES

6S4-A

TRIODE

FOR TV VERTICAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6S4-A is a miniature medium-mu triode for use as the vertical-deflection amplifier in television receivers. The tube features relatively high plate current at low plate voltages and is capable of withstanding the high pulse voltages normally encountered in this application.

The 6S4-A also exhibits a controlled heater warm-up characteristic which makes it especially suited for use in television receivers which employ series-connected heaters. When the 6S4-A is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.6 ± 6%	Amperes
Heater Warm-up Time*	11	Seconds
Direct Interelectrode Capacitances, approximate†		
Grid to Plate	2.4	μμf
Input	4.2	μμf
Output	0.6	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED	Vertical-Deflection Amplifier‡	
DC Plate Voltage	550	Volts
Peak Positive Pulse Plate Voltage	2200§	Volts
Peak Negative Grid Voltage	250	Volts
Plate Dissipation¶	8.5	Watts
DC Cathode Current	30	Milliamperes
Peak Cathode Current	105	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Cathode Bias	2.2	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

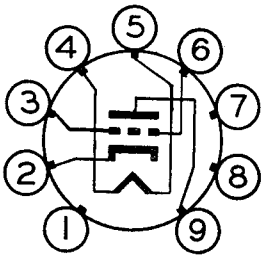
The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

Supersedes ET-T958, dated 4-55

BASING DIAGRAM

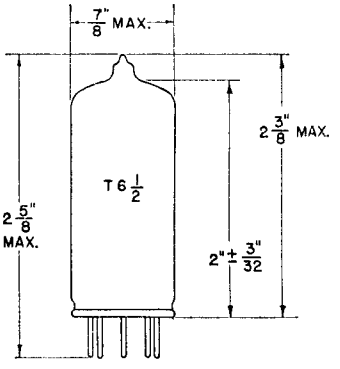


EIA 9AC

TERMINAL CONNECTIONS

Pin 1—Internal Connection—Do Not Use
Pin 2—Cathode
Pin 3—Grid
Pin 4—Heater
Pin 5—Heater
Pin 6—Grid
Pin 7—Internal Connection—Do Not Use
Pin 8—Internal Connection—Do Not Use
Pin 9—Plate

PHYSICAL DIMENSIONS



EIA 6-3

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	250	250	Volts
Grid Voltage	−15	−8	Volts
Amplification Factor		16.5	
Plate Resistance, approximate		3700	Ohms
Transconductance		4500	Micromhos
Plate Current	4.0	24	Milliamperes
Grid Voltage, approximate Ib = 50 Microamperes		−22	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

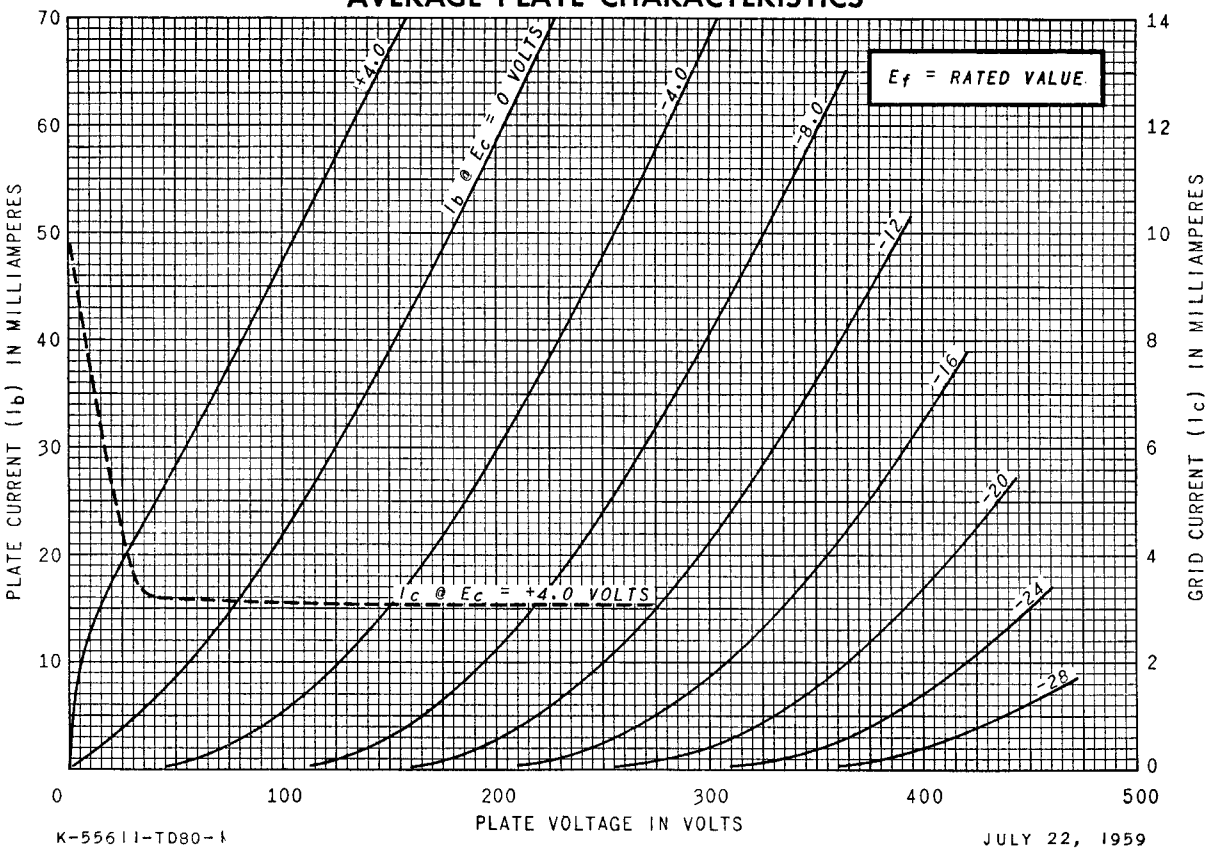
† Without external shield.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

¶ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

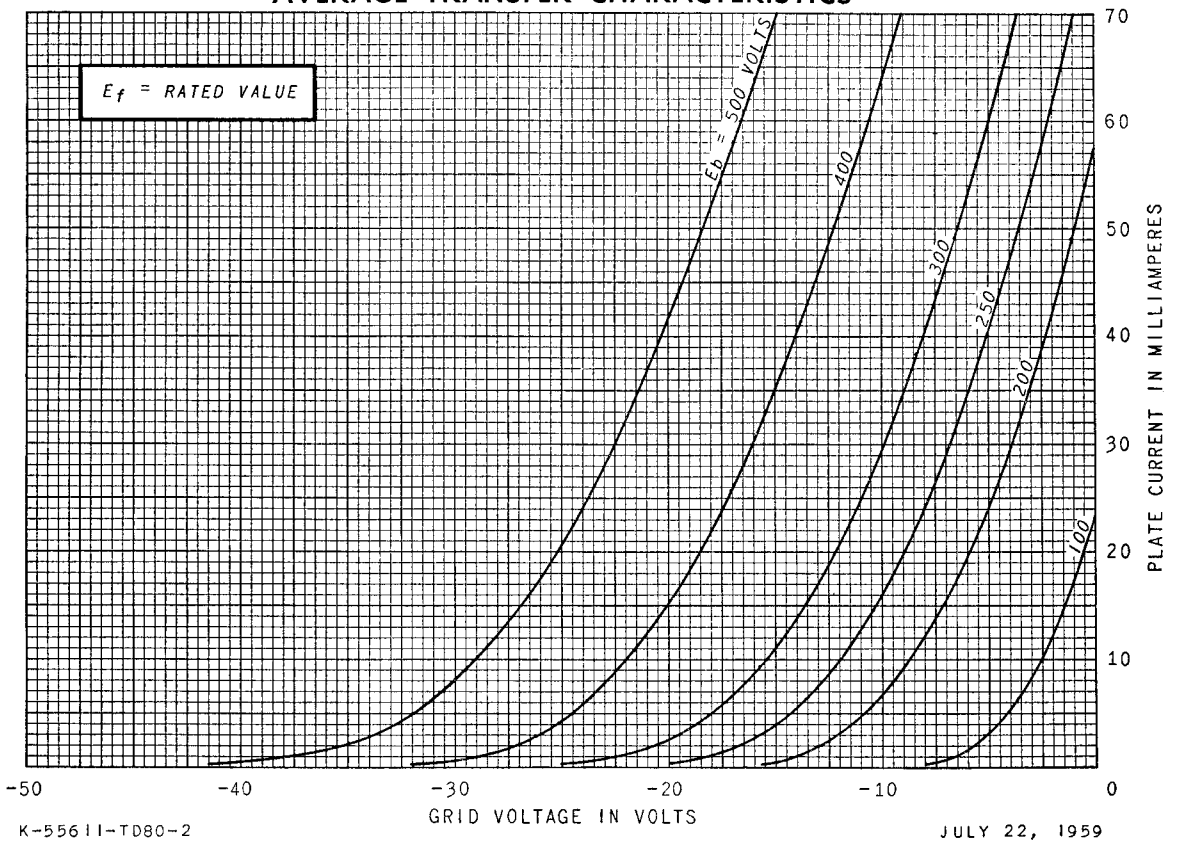
AVERAGE PLATE CHARACTERISTICS



K-55611-TD80-1

JULY 22, 1959

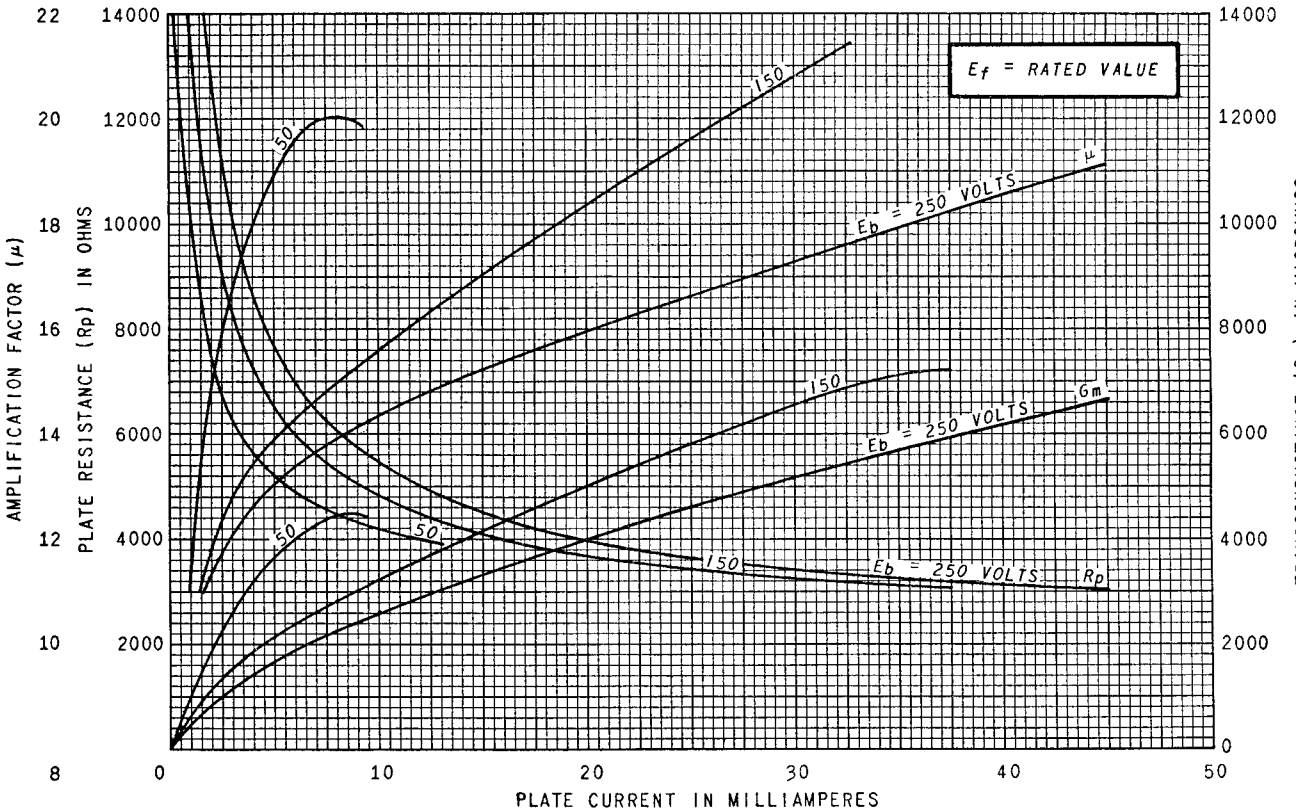
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD80-2

JULY 22, 1959

AVERAGE CHARACTERISTICS



K-5561I-TD80-3

JULY 22, 1959

Electronic TUBES

6SA7—12SA7

HEPTODE

FOR PENTAGRID CONVERTER APPLICATIONS

DESCRIPTION AND RATING

The 6SA7 and 12SA7 are metal pentagrid converters which are identical except for heater ratings. Each type is intended to perform the combined functions of the mixer and oscillator in superheterodyne receivers, especially those of the all-wave type. The 6SA7 and 12SA7 are constructed to provide excellent frequency stability.

GENERAL

Cathode—Coated Unipotential

	6SA7	12SA7	
Heater Voltage, AC or DC	6.3	12.6	Volts
Heater Current	0.3	0.15	Amperes

Envelope—MT-8, Metal Shell
Base—B8-21, Small Wafer Octal 8-Pin
Mounting Position—Any
Direct Interelectrode Capacitances*

Grid-Number 3 to All	9.5	μμf
Plate to All	9.5	μμf
Grid-Number 1 to All	7.0	μμf
Cathode to All Except Grid-Number 1	5.0	μμf
Grid-Number 1 to All Except Cathode	4.4	μμf
Grid-Number 3 to Plate, maximum	0.25	μμf
Grid-Number 3 to Grid-Number 1, maximum	0.15	μμf
Grid-Number 1 to Plate, maximum	0.06	μμf
Grid-Number 1 to Cathode	2.6	μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES

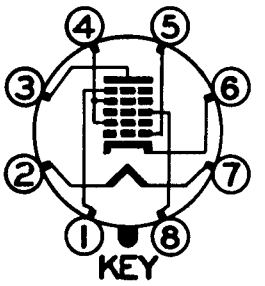
Plate Voltage	300	Volts
Screen-Supply Voltage	300	Volts
Screen Voltage	100	Volts
Positive DC Grid-Number 3 Voltage	0	Volts
Negative DC Grid-Number 3 Voltage	50	Volts
Plate Dissipation	1.0	Watts
Screen Dissipation	1.0	Watts
DC Cathode Current	14	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts

* With pin 1 connected to pin 6.

GENERAL ELECTRIC

Supersedes ET-T328B dated 2-51 and ET-T378B dated 1-52

BASING DIAGRAM

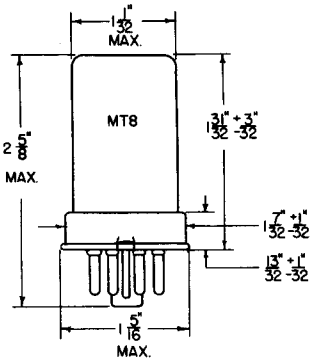


RETMA 8R
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1—Shell and Grid Number 5
Pin 2—Heater
Pin 3—Plate
Pin 4—Grids Number 2 and 4 (Screen)
Pin 5—Grid Number 1 (Oscillator Grid)
Pin 6—Cathode
Pin 7—Heater
Pin 8—Grid Number 3 (Mixer Grid)

PHYSICAL DIMENSIONS



RETMA 8-1

CHARACTERISTICS AND TYPICAL OPERATION

CONVERTER SERVICE†

Plate Voltage	100	250	Volts
Screen Voltage	100	100	Volts
Grid-Number 3 Voltage	−2	−2	Volts
Grid-Number 1 Voltage, RMS	10	10	Volts
Grid-Number 1 Resistance	20000	20000	Ohms
Plate Resistance, approximate	0.5	1.0	Megohms
Conversion Transconductance	425	450	Micromhos
Plate Current	3.3	3.5	Milliamperes
Screen Current	8.5	8.5	Milliamperes
Grid-Number 1 Current	0.5	0.5	Milliamperes
Cathode Current	12.3	12.5	Milliamperes
Grid-Number 3 Voltage, approximate, G_c = 10 Micromhos	−25	−25	Volts
Grid-Number 3 Voltage, approximate, G_c = 100 Micromhos	−9	−9	Volts

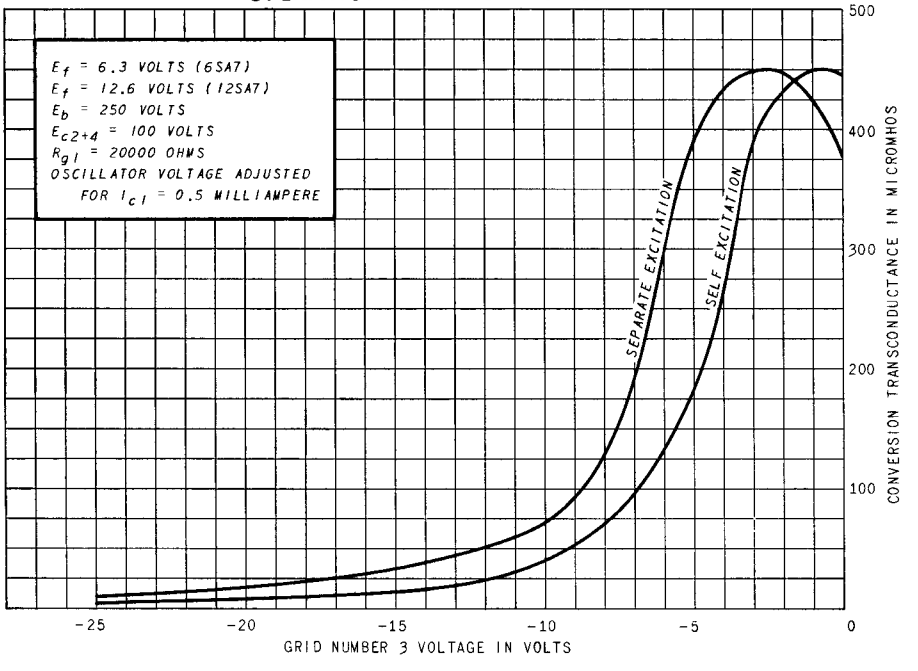
OSCILLATOR CHARACTERISTICS (NOT OSCILLATING)

Plate Voltage	100	Volts
Screen—Connected to Plate		
Grid-Number 3 Voltage	0	Volts
Grid-Number 1 Voltage	0	Volts
Amplification Factor‡	14	
Transconductance‡	4500	Micromhos
Cathode Current	25	Milliamperes
Grid-Number 1 Voltage, approximate, I_b = 10 Microamperes	−14	Volts

† Characteristics shown are obtained in the standard RTMA conversion conductance test set which uses separate excitation. The characteristics under these conditions correspond very closely with those obtained in a self-excited oscillatory circuit operating with zero bias.

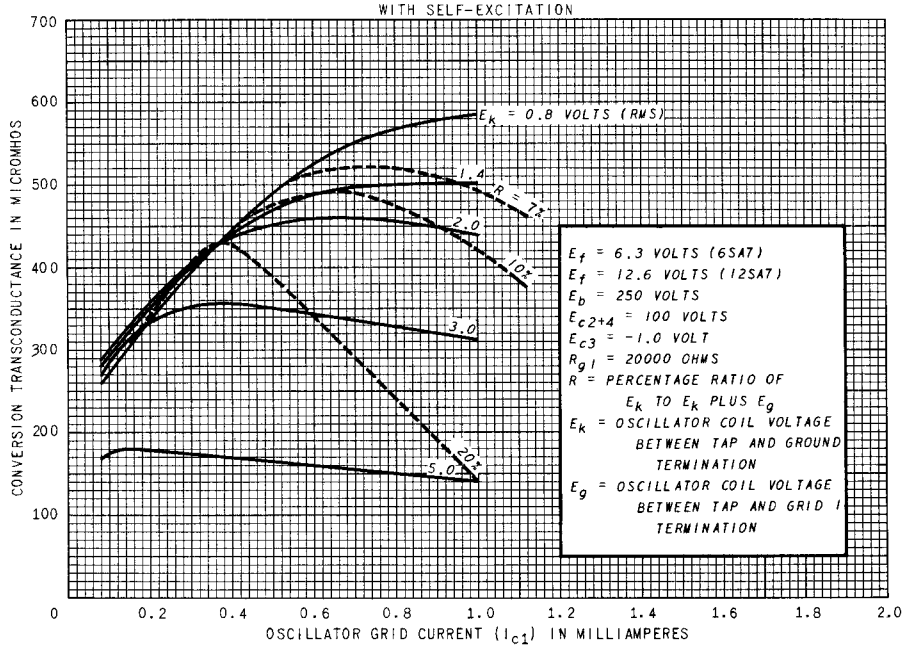
‡ Between grid number 1 and grids number 2 and 4 connected to plate.

OPERATION CHARACTERISTICS



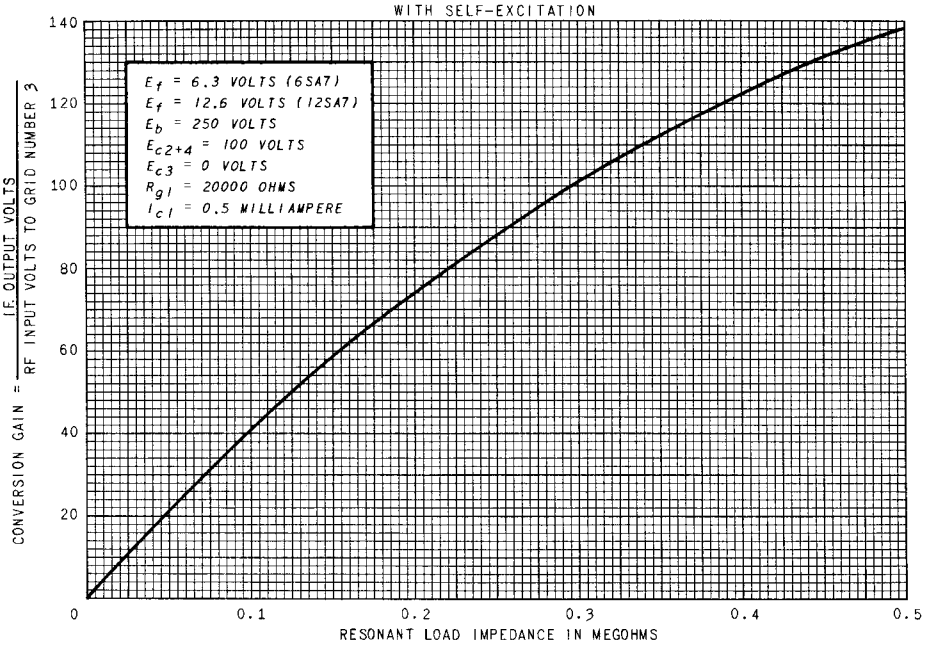
OPERATION CHARACTERISTICS

WITH SELF-EXCITATION



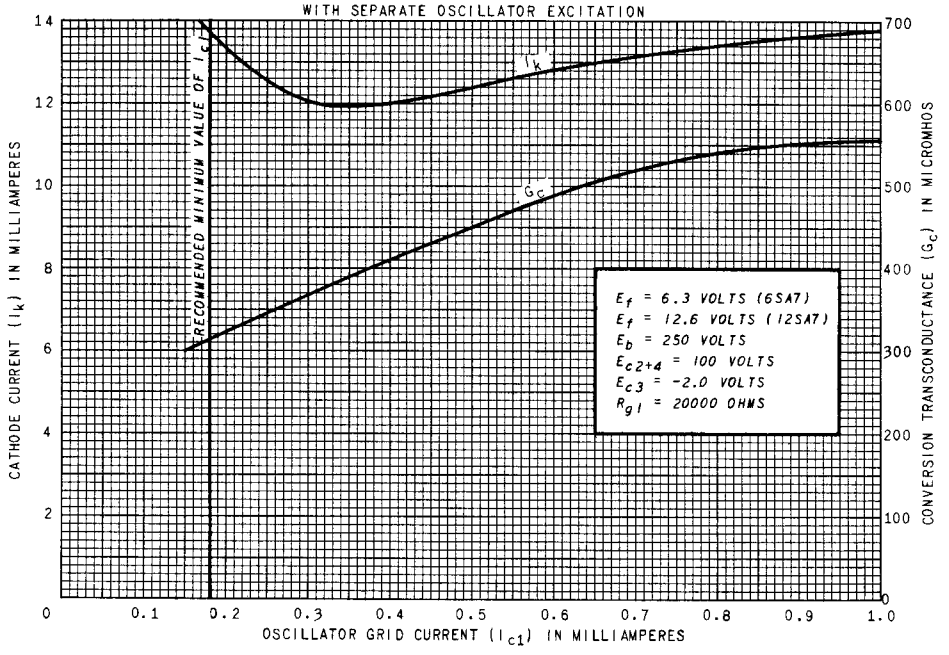
OPERATION CHARACTERISTICS

WITH SELF-EXCITATION



OPERATION CHARACTERISTICS

WITH SEPARATE OSCILLATOR EXCITATION



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6SC7—12SC7

TWIN TRIODE

FOR AF VOLTAGE AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6SC7 is a high-mu twin triode designed primarily for use as an AF voltage amplifier. Featuring a special shielding arrangement to reduce hum, the tube is well suited for low-level audio amplifier service.

Except for heater ratings the 12SC7 is identical to the 6SC7.

GENERAL

ELECTRICAL

	6SC7	12SC7	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	6.3	12.6	Volts
Heater Current	0.3	0.15	Amperes
Direct Interelectrode Capacitances, approximate*			
Grid to plate	2.0		μμf
Input	2.0		μμf
Output	3.0		μμf

MECHANICAL

Mounting Position—Any
Envelope—MT-8, Metal Shell
Base—B8-21, Small Wafer Octal 8-Pin
* With pin 1 connected to pin 6.

MAXIMUM RATINGS

DESIGN-CENTER VALUES, EACH SECTION

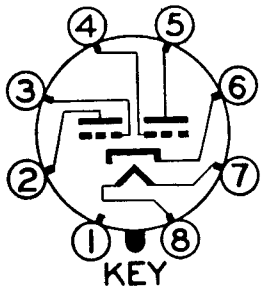
Plate Voltage	250	Volts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	250	Volts
Grid Voltage	−2.0	Volts
Amplification Factor	70	
Plate Resistance, approximate	53000	Ohms
Transconductance	1325	Micromhos
Plate Current	2.0	Milliamperes

BASING DIAGRAM

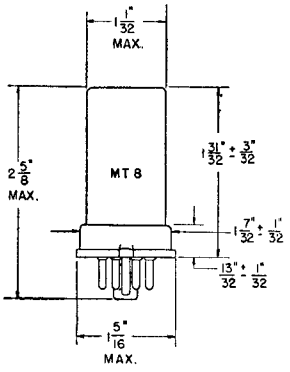


RETMA 8S

TERMINAL CONNECTIONS

Pin 1—Shell
Pin 2—Plate Number 2
Pin 3—Grid Number 2
Pin 4—Grid Number 1
Pin 5—Plate Number 1
Pin 6—Cathode
Pin 7—Heater
Pin 8—Heater

PHYSICAL DIMENSIONS



RETMA 8-1

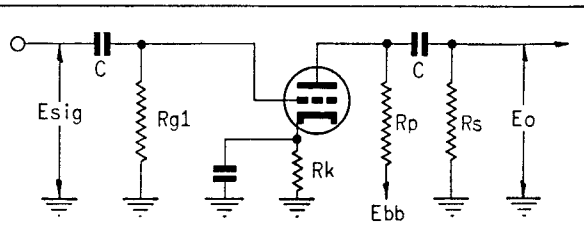
GENERAL ELECTRIC

Supersedes ET-T331, dated 5-46 and ET-T380, dated 5-46

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

Rp Meg	Rg1 Meg	Rs Meg	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	*	0.10	1800	19	6.0	910	25	18	680	29	32
0.10	*	0.24	2000	25	8.0	1000	29	24	750	34	42
0.24	*	0.24	3300	28	9.0	1800	35	23	1300	39	40
0.24	*	0.51	3600	33	10	2000	40	30	1500	42	51
0.51	*	0.51	5600	35	8.5	3000	43	27	2200	46	46
0.51	*	1.0	6200	38	12	3300	46	35	2400	49	55
0.24	10	0.24	0	29	7.5	0	36	23	0	39	44
0.24	10	0.51	0	33	10	0	41	30	0	43	55
0.51	10	0.51	0	36	9.5	0	44	26	0	46	51
0.51	10	1.0	0	40	12	0	48	36	0	50	62

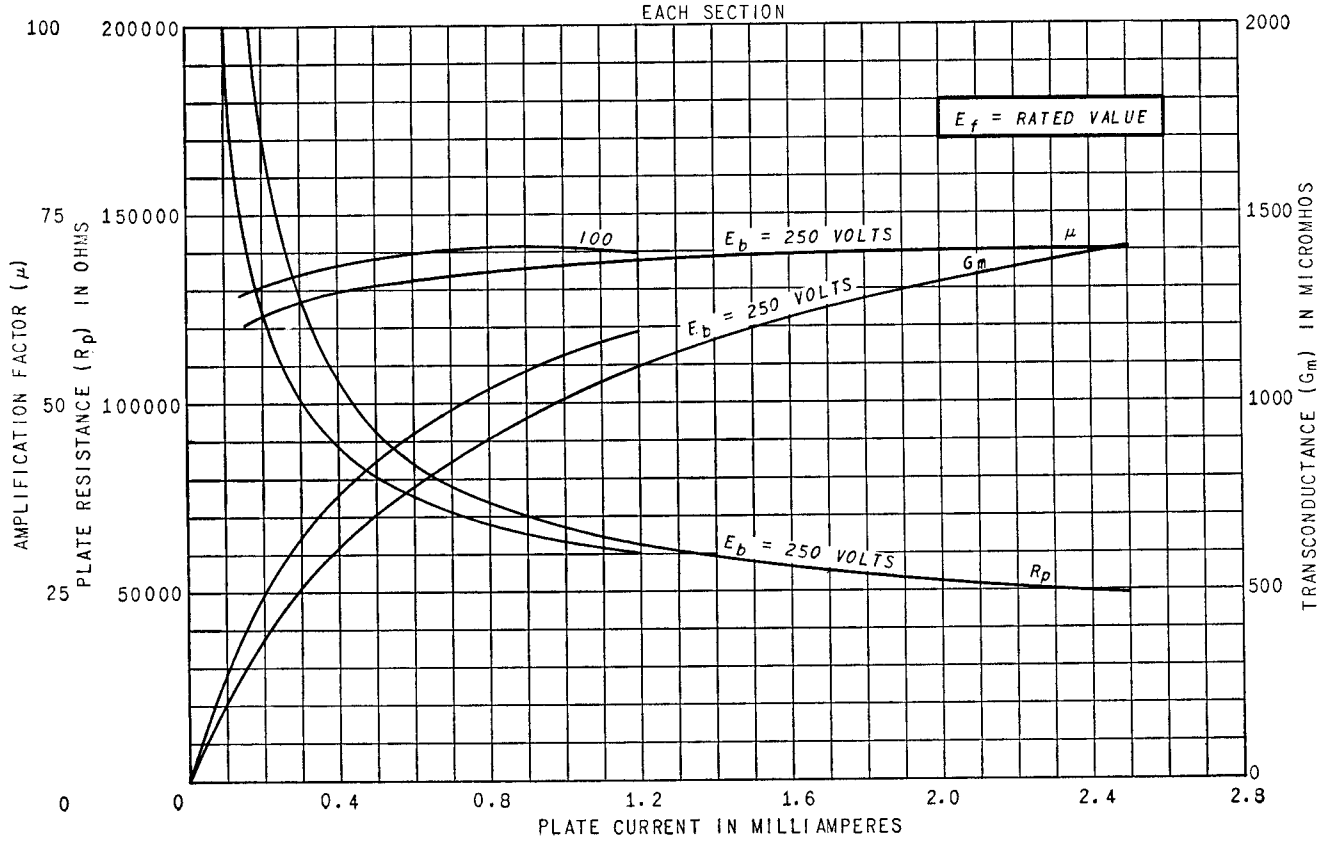


Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

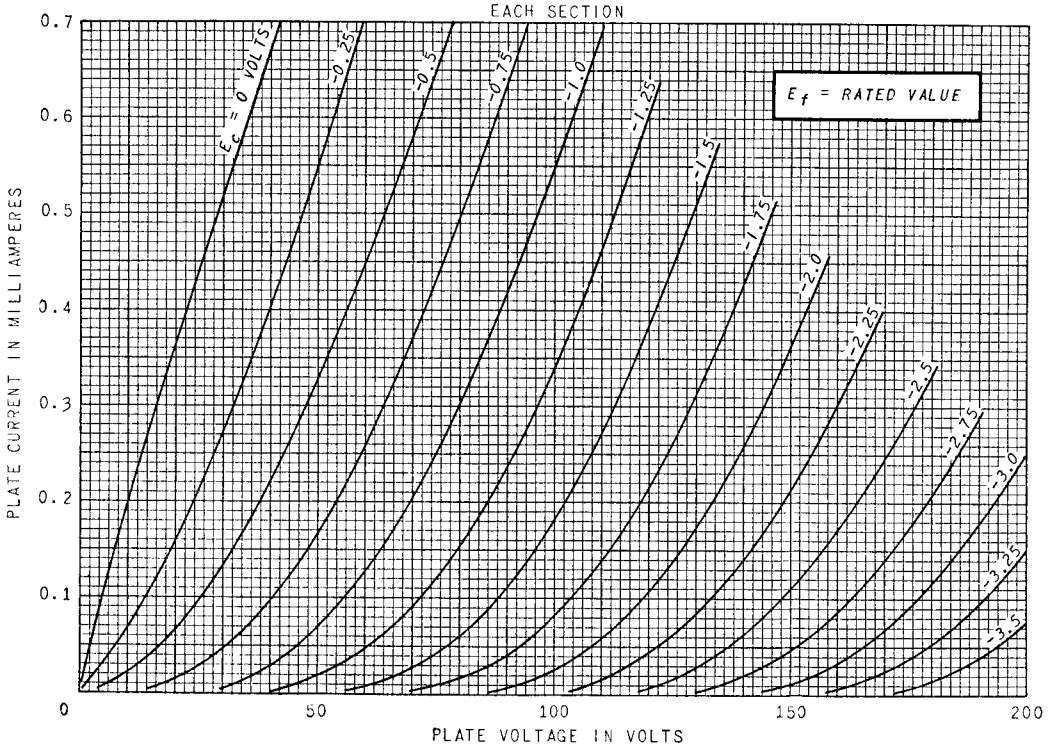
Notes: 1. Eo is maximum rms voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts rms output. 3. For zero-bias data generator impedance is negligible. *Value of Rg1 is non-critical.

AVERAGE CHARACTERISTICS

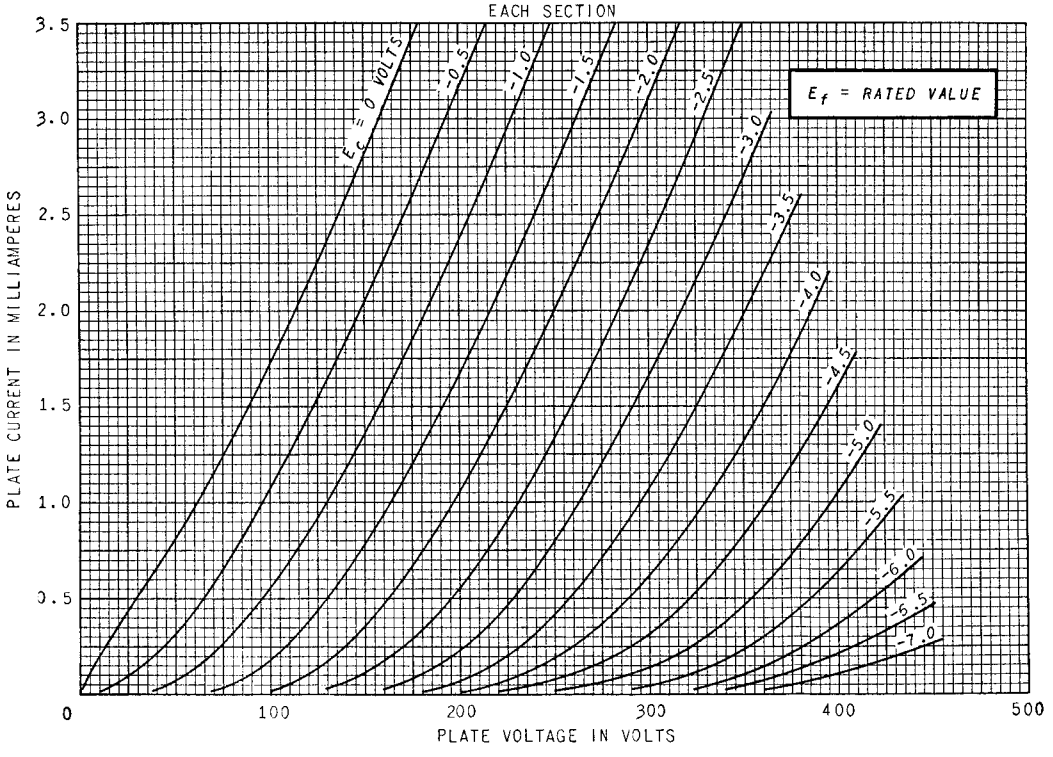
EACH SECTION



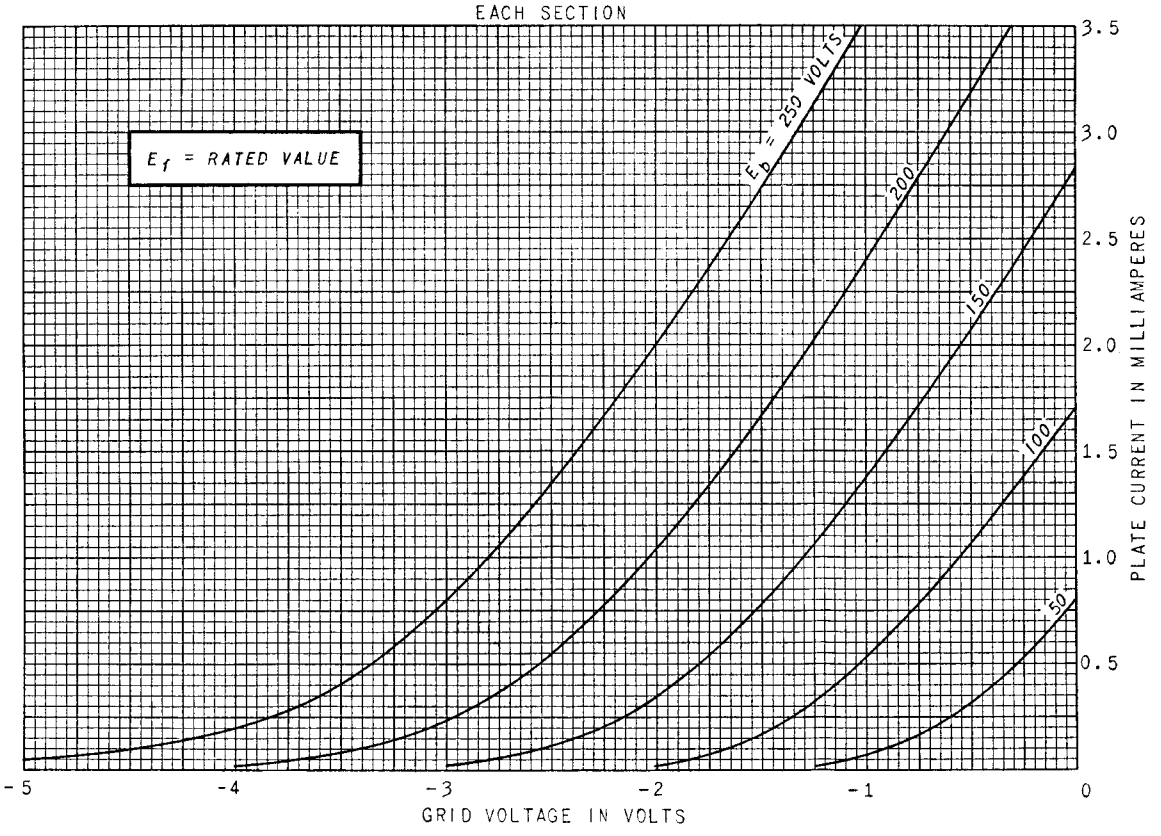
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBE

6SG7
Description and Rating
PENTODE

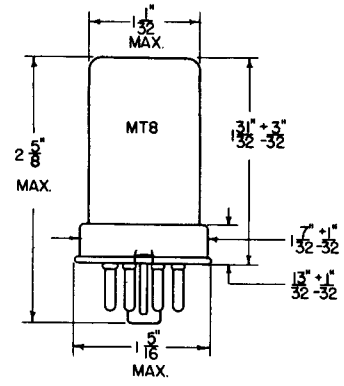
GENERAL DESCRIPTION

Principal Application: The 6SG7 is a remote-cutoff pentode designed for use as a high-gain radio- or intermediate-frequency amplifier. Features of the tube include high transconductance, low grid-plate capacitance, and a dual cathode connection to reduce undesired coupling between cathode circuits.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.3 Ampere
Envelope	MT-8, Metal Shell
Base	B8-21, Small Wafer Octal 8-Pin

Mounting Position	Any	
Direct Interelectrode Capacitances: #		
Grid 1 to Plate (Max)	0.003	μμf
Input	8.5	μμf
Output	7.0	μμf

PHYSICAL DIMENSIONS

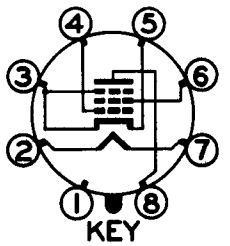


RTMA 8-1

TERMINAL CONNECTIONS

Pin 1 - Shell and Internal Shield
Pin 2 - Heater
Pin 3 - Cathode and Grid Number 3 (Suppressor)
Pin 4 - Grid Number 1
Pin 5 - Cathode
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Heater
Pin 8 - Plate

BASING DIAGRAM



RTMA 8BK
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES

Plate Voltage	300	Volts
Screen Supply Voltage	300	Volts
Screen Voltage	200	Volts
Positive D-C Grid Number 1 Voltage	0	Volts
Plate Dissipation	3	Watts
Screen Dissipation	0.6	Watt
Heater-Cathode Voltage	90	Volts

 # Measured with pin 1 connected to pin 3

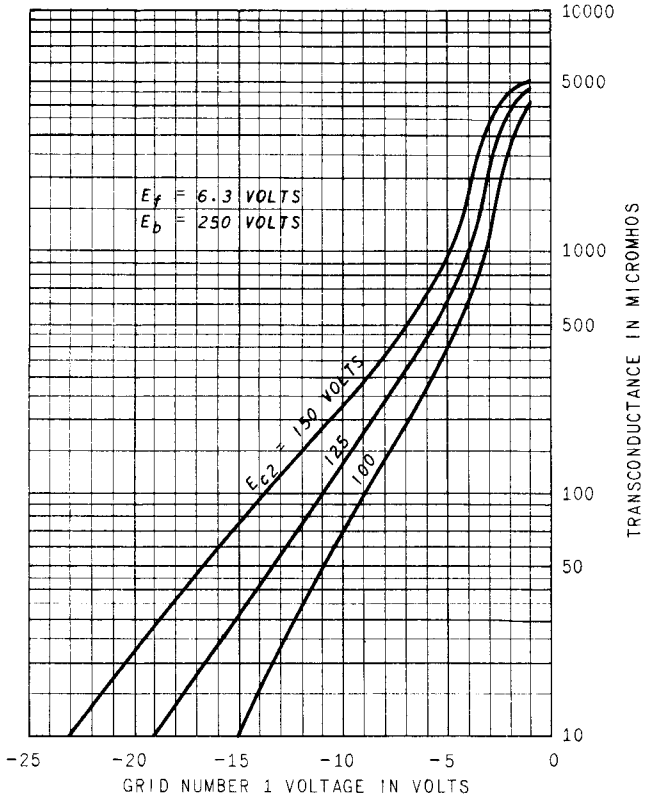
Supersedes ET-T334 dated 5-46

CHARACTERISTICS AND TYPICAL OPERATION

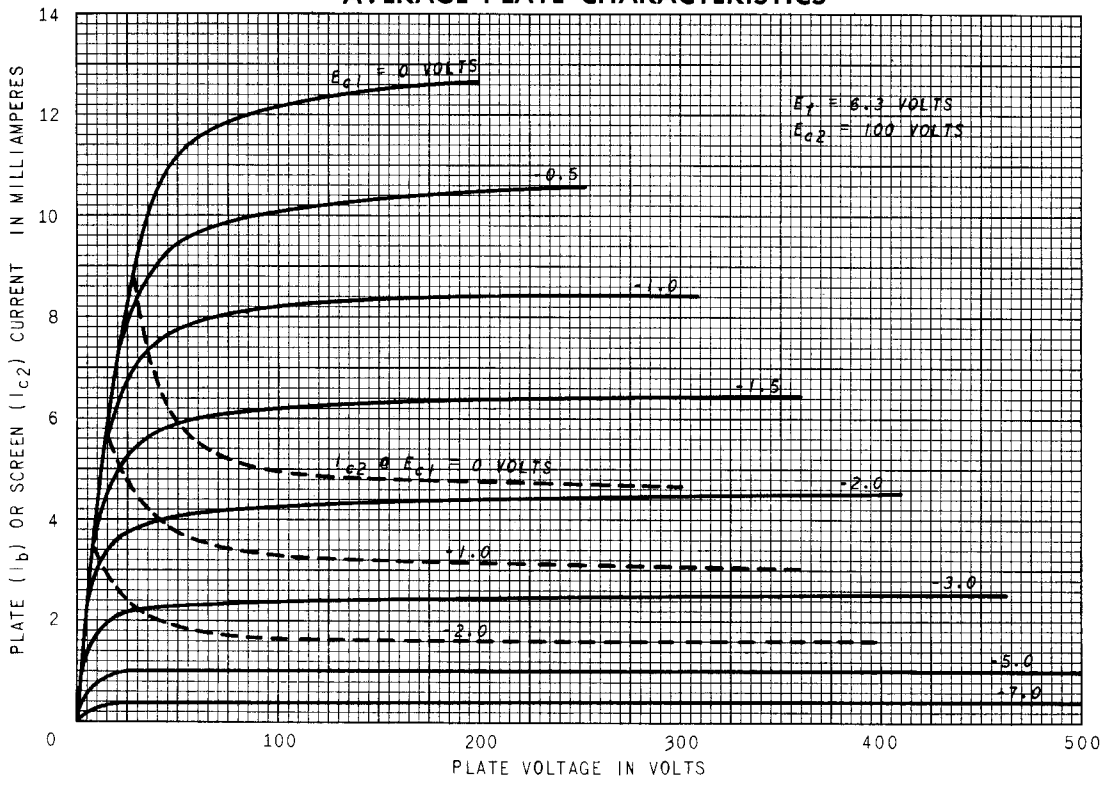
CLASS A_1 AMPLIFIER

Plate Voltage	100	250	250	Volts
Screen Voltage	100	125	150	Volts
Grid Number 1 Voltage	-1	-1	-2.5	Volts
Plate Resistance (Approx)	0.25	0.9	>1.0	Megohm
Transconductance	4100	4700	4000	Micromhos
Plate Current	8.2	11.8	9.2	Milliamperes
Screen Current	3.2	4.4	3.4	Milliamperes
Grid Number 1 Voltage (Approx) for G_m = 10 Micromhos	-15	-19	-23	Volts

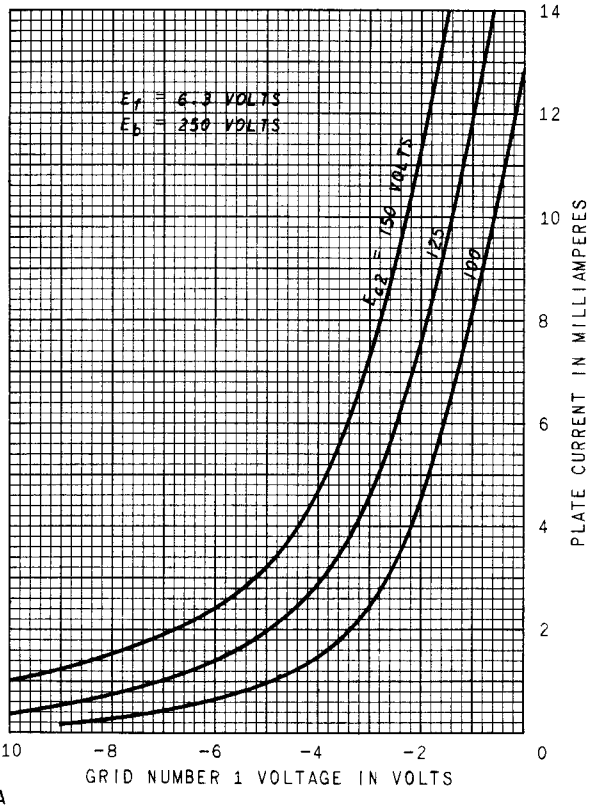
AVERAGE CHARACTERISTICS

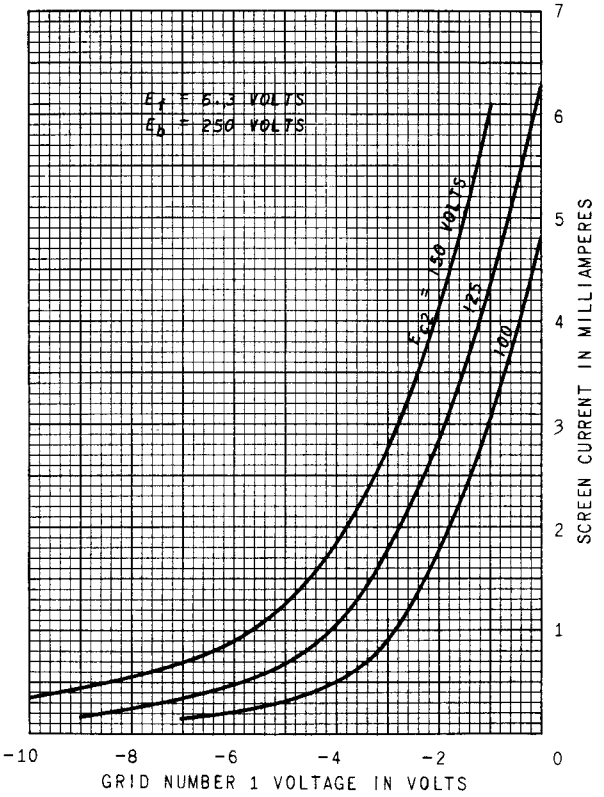


AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS





GE Electronic TUBE — KEN-RAD

6SH7
Description and Rating

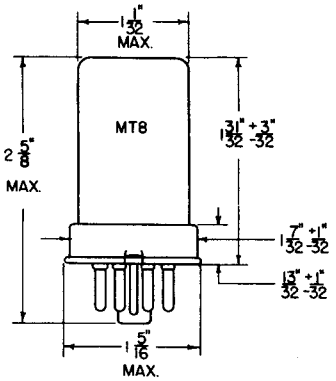
RADIO-FREQUENCY-AMPLIFIER PENTODE

GENERAL DESCRIPTION

Principal Application: The type 6SH7 is a sharp cut-off amplifier pentode designed for use as a high-gain radio-frequency or intermediate-frequency amplifier. The 6SH7 is not recommended for use as a high-gain audio amplifier because undesirable hum may be encountered.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.3 Ampere
Envelope	MT-8 Metal Shell
Base	B8-21 Small Wafer Octal 8-Pin, Phenolic
Mounting Position	Any
Direct Interelectrode Capacitances: *	
Grid to Plate (Max)	0.003 μμf
Input	8.5 μμf
Output	7.0 μμf

PHYSICAL DIMENSIONS

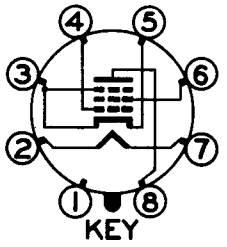


RMA 8-1

TERMINAL CONNECTIONS

Pin 1 - Shell and Internal Shield
Pin 2 - Heater
Pin 3 - Cathode and Grid Number 3
Pin 4 - Grid Number 1
Pin 5 - Cathode
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Heater
Pin 8 - Plate

BASING DIAGRAM



RMA 8BK
BOTTOM VIEW

MAXIMUM RATINGS

	Design Center	Absolute	
Plate Voltage	300	330	Volts
Screen (Grid Number 2) Voltage	150	165	Volts
Screen Supply Voltage	300	330	Volts
Grid Bias Voltage	Never Positive		
Plate Dissipation	3.0	3.3	Watts
Screen Dissipation	0.70	0.77	Watts
D-C Heater-Cathode Voltage	90	100	Volts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A AMPLIFIER

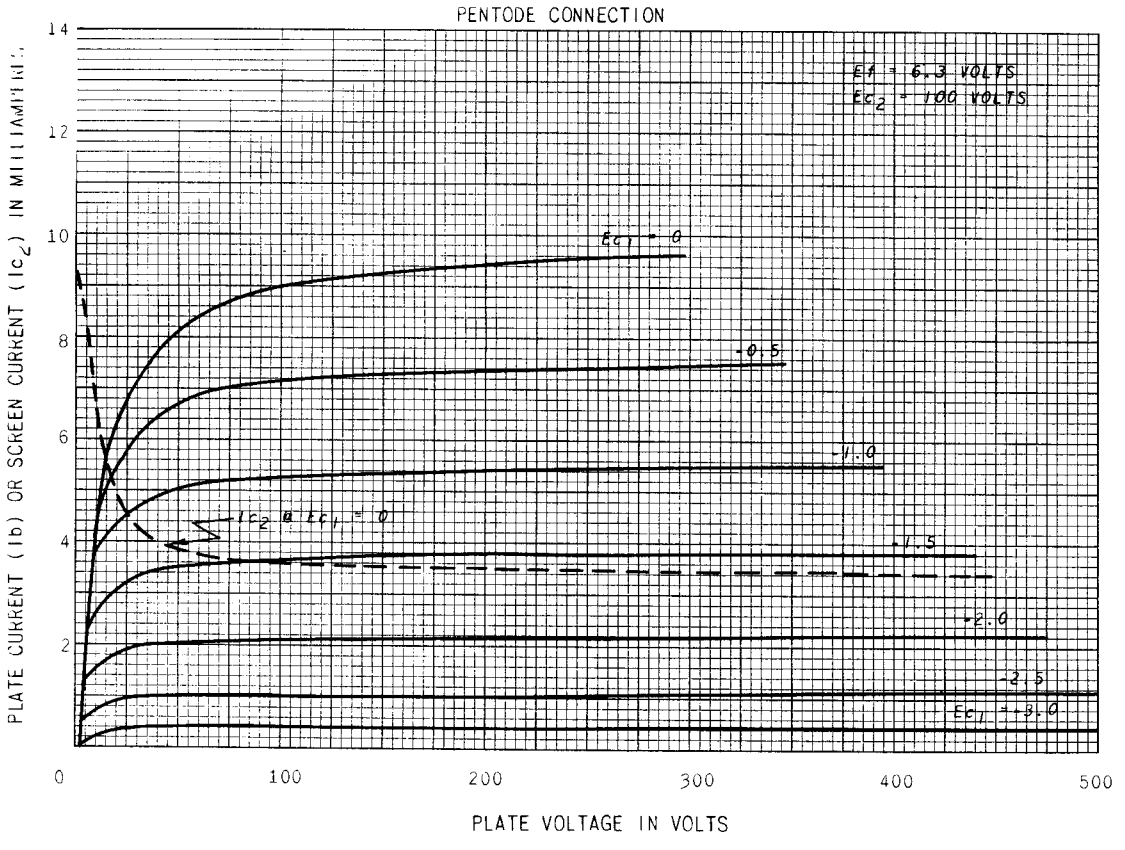
Heater Voltage	6.3	6.3	Volts
Plate Voltage	100	250	Volts
Screen Grid Voltage	100	150	Volts
Grid Bias Voltage	-1	-1	Volt
Plate Resistance (Approx)	0.35	0.9	Megohm
Transconductance	4000	4900	Micromhos
Grid Bias Voltage **	-4	-5.5	Volts
Plate Current	5.3	10.8	Milliamperes
Screen Current	2.1	4.1	Milliamperes

(For notes see page 2)

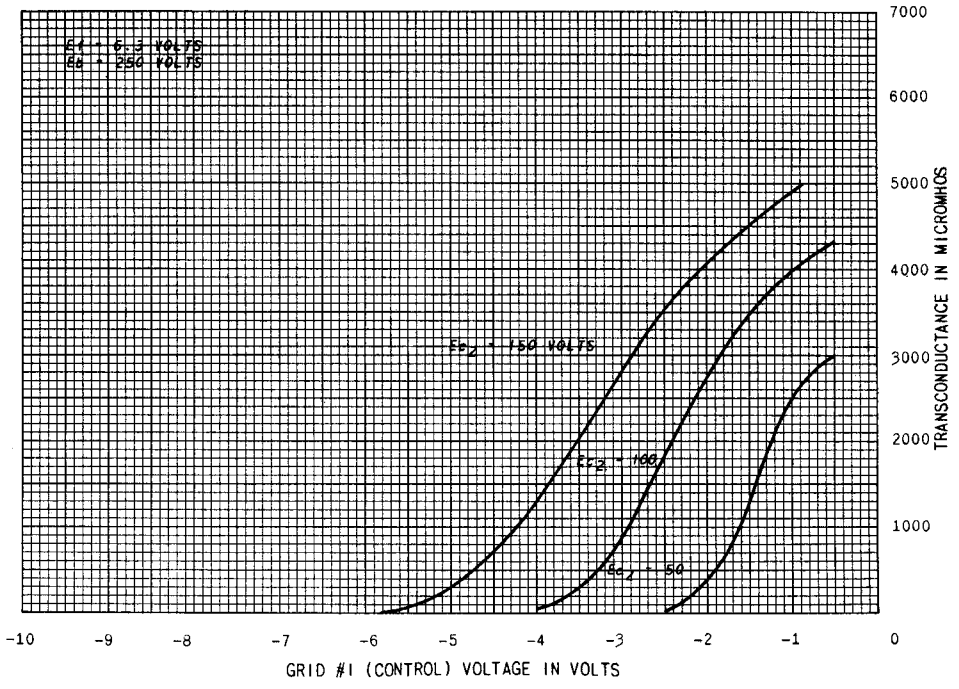
* *Measured with shell and internal shield conneced to cathode.*

** *Approximate values for plate current of 10 microamperes.*

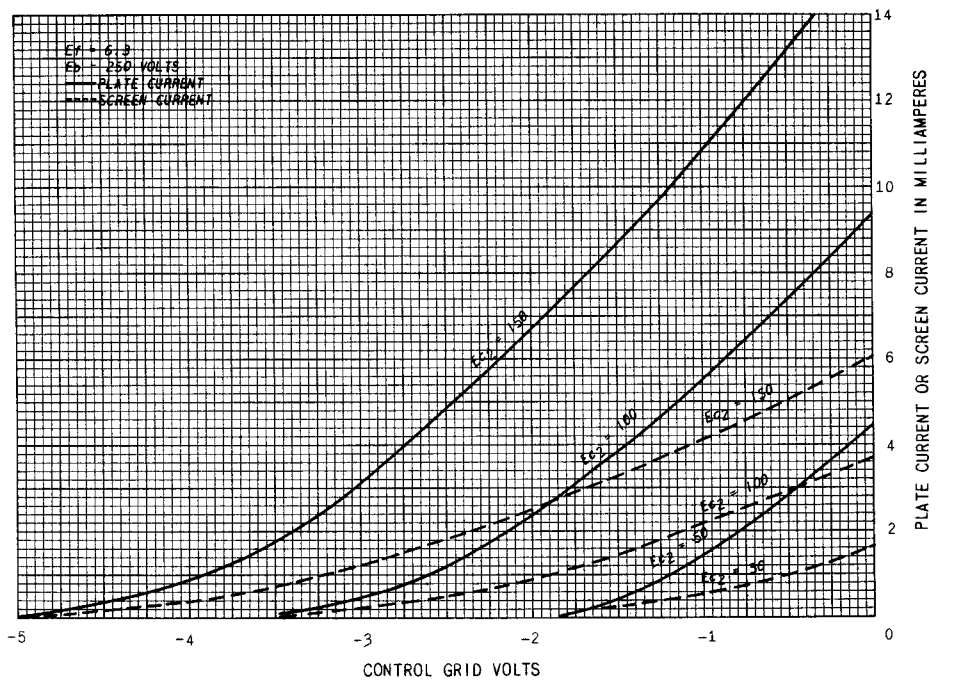
AVERAGE PLATE CHARACTERISTICS



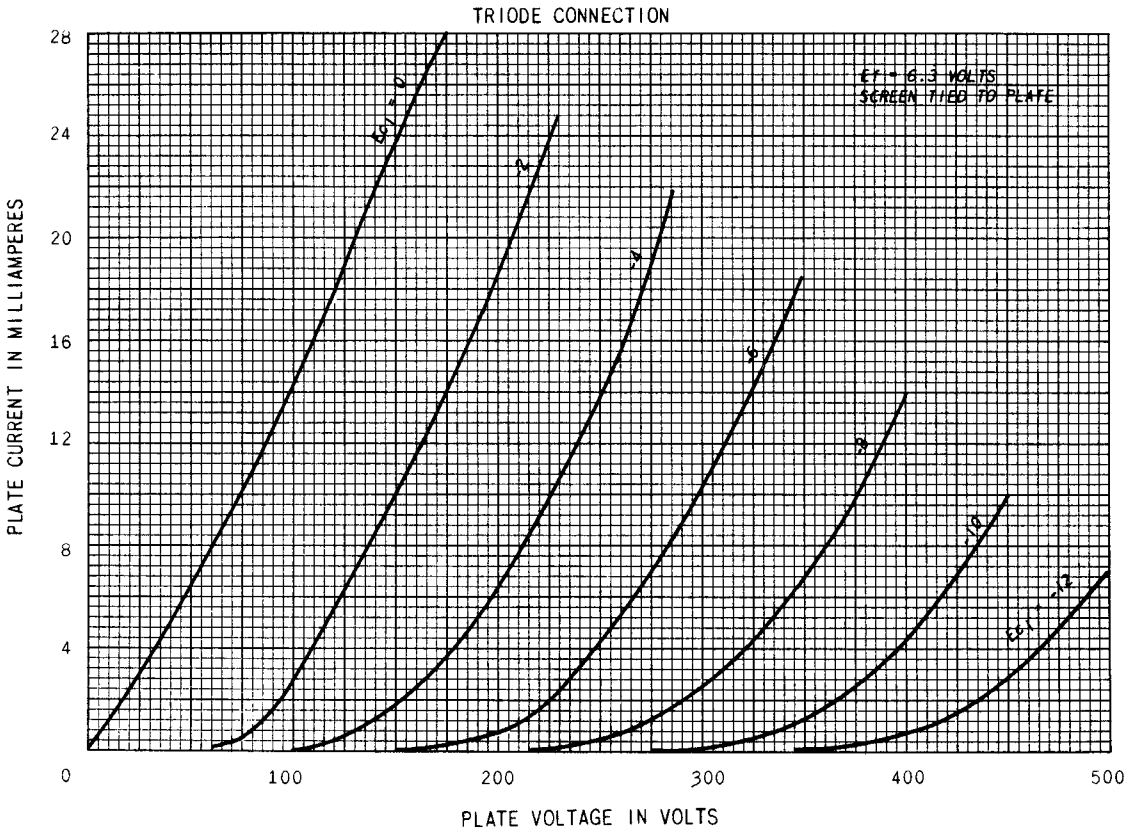
AVERAGE CHARACTERISTICS



AVERAGE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

Electronic TUBES

6SJ7—12SJ7

PENTODE

FOR AF AND RF AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6SJ7 is a metal sharp-cutoff pentode designed for use as a biased detector or high-gain amplifier.

The 12SJ7 is identical to the 6SJ7 except for heater ratings.

GENERAL

ELECTRICAL

	6SJ7	12SJ7	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	6.3	12.6	Volts
Heater Current	0.3	0.15	Amperes
Direct Interelectrode Capacitances			
Pentode Connection*			
Grid-Number 1 to Plate, maximum	0.005		μμf
Input	6.0		μμf
Output	7.0		μμf
Triode Connection†			
Grid-Number 1 to Plate	2.8		μμf
Input	3.4		μμf
Output	11		μμf

MECHANICAL

Mounting Position—Any
Envelope—MT-8, Metal Shell
Base—B8-21, Small Wafer Octal 8-Pin

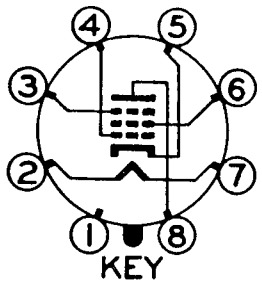
MAXIMUM RATINGS

DESIGN-CENTER VALUES	Pentode Connection	Triode Connection†	
Plate Voltage	300	250	Volts
Screen-Supply Voltage	300	...	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	2.5	2.5	Watts
Screen Dissipation	0.7	...	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode	90	90	Volts
Heater Negative with Respect to Cathode	90	90	Volts
Grid-Number 1 Circuit Resistance			
With Cathode Bias	1.0	1.0	Megohms

GENERAL ELECTRIC

Supersedes ET-T336, dated 5-46

BASING DIAGRAM

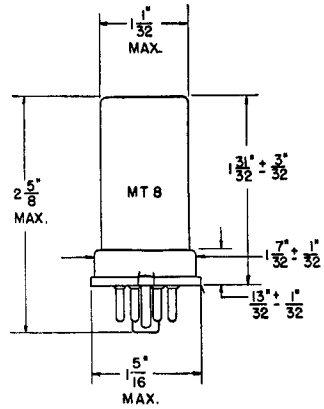


RETMA 8N

TERMINAL CONNECTIONS

Pin 1—Shell and Internal Shield
Pin 2—Heater
Pin 3—Grid Number 3 (Suppressor)
Pin 4—Grid Number 1
Pin 5—Cathode
Pin 6—Grid Number 2 (Screen)
Pin 7—Heater
Pin 8—Plate

PHYSICAL DIMENSIONS



RETMA 8-1

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	100	250	Volts
Suppressor, Connected to Cathode at Socket			
Screen Voltage	100	100	Volts
Grid-Number 1 Voltage	−3.0	−3.0	Volts
Plate Resistance, approximate	0.7	1.0	Megohms
Transconductance	1575	1650	Micromhos
Plate Current	2.9	3.0	Milliamperes
Screen Current	0.9	0.8	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	−8	−8	Volts

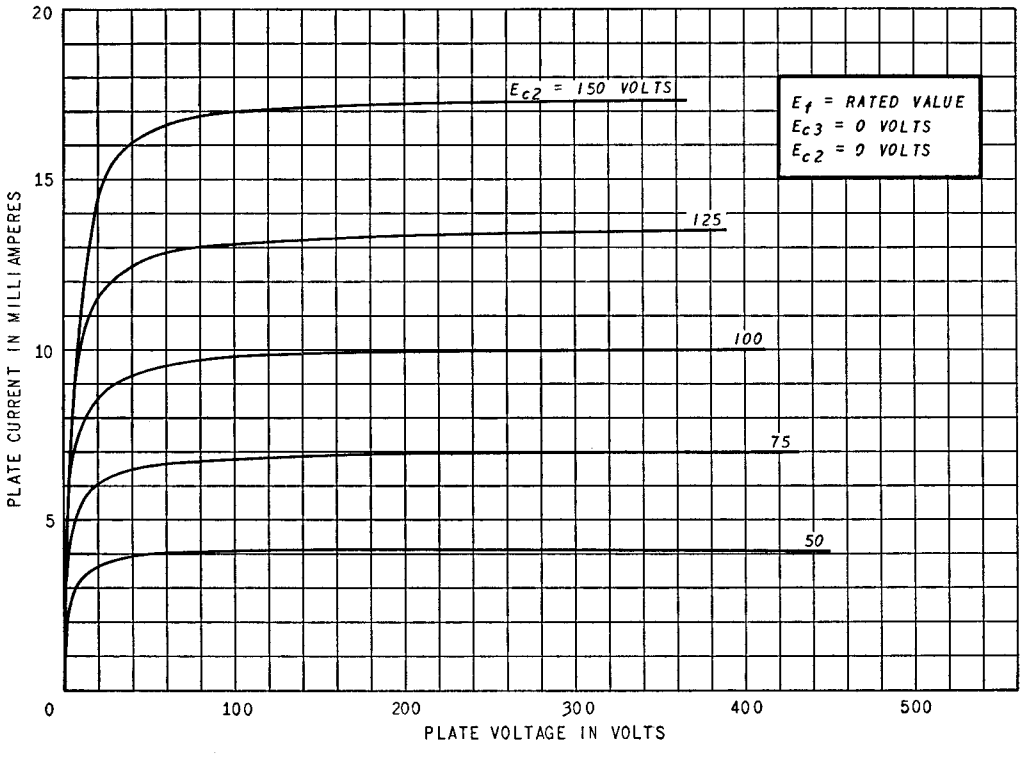
CLASS A_1 AMPLIFIER, TRIODE CONNECTION†

Plate Voltage	180	250	Volts
Grid-Number 1 Voltage	−6.0	−8.5	Volts
Amplification Factor	19	19	
Plate Resistance, approximate	8250	7600	Ohms
Transconductance	2300	2500	Micromhos
Plate Current	6.0	9.2	Milliamperes

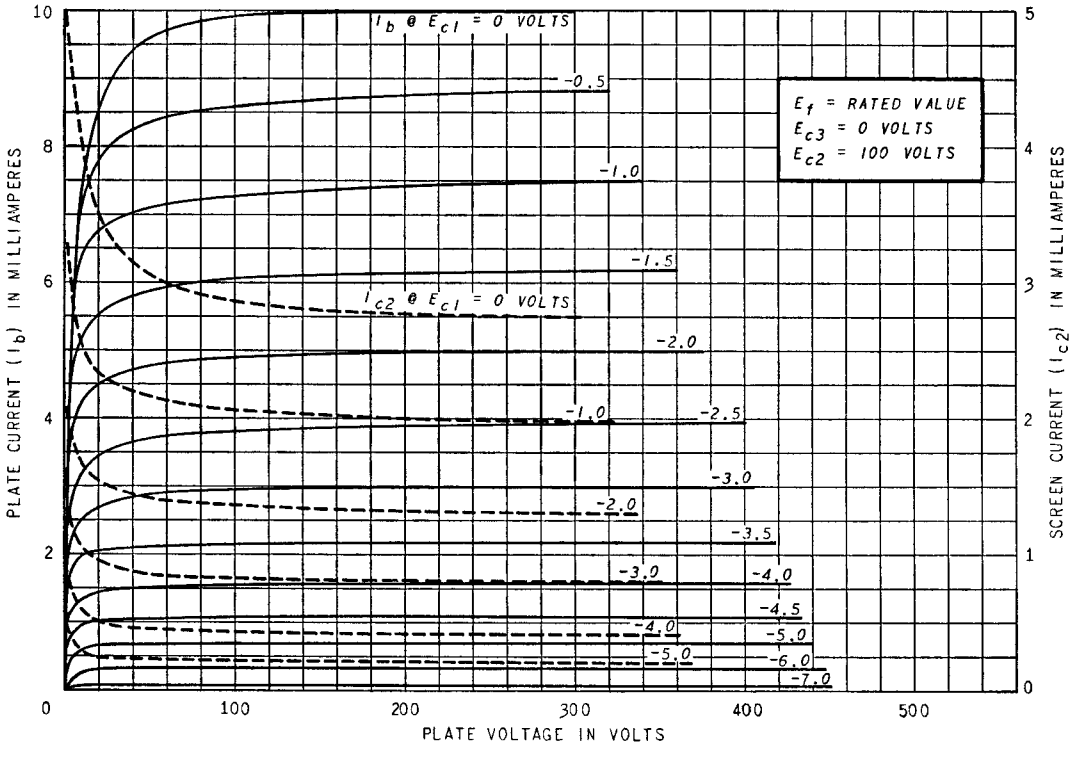
* With shell and internal shield connected to cathode.

† With screen and suppressor connected to plate.

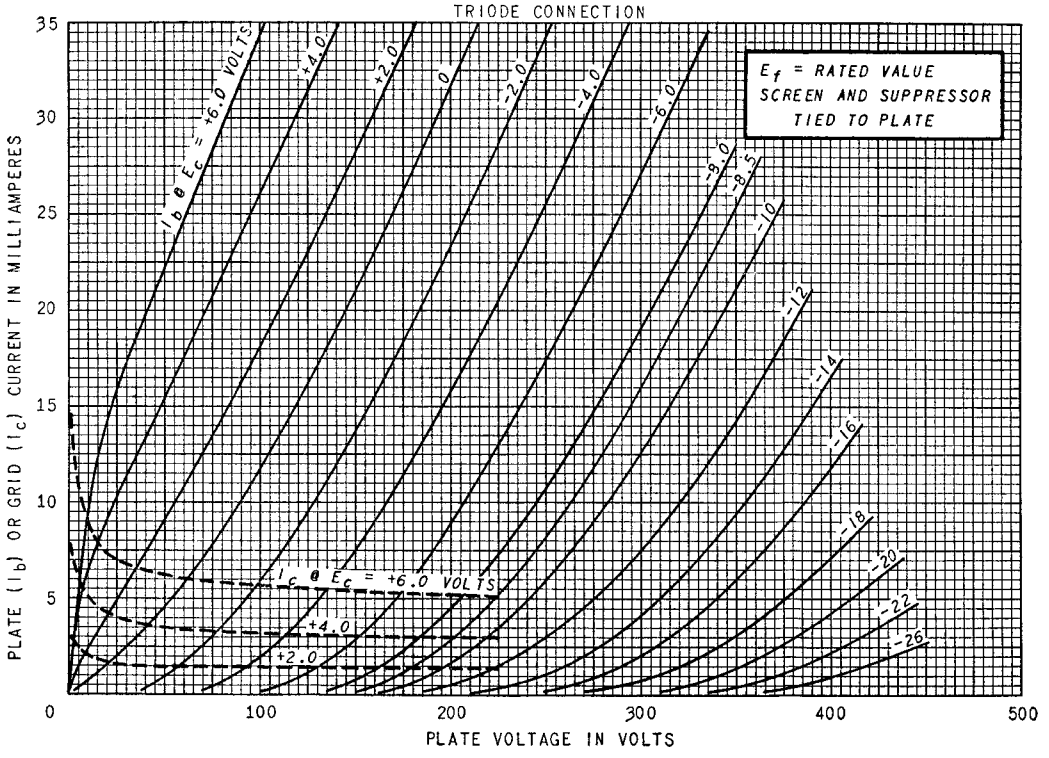
AVERAGE PLATE CHARACTERISTICS



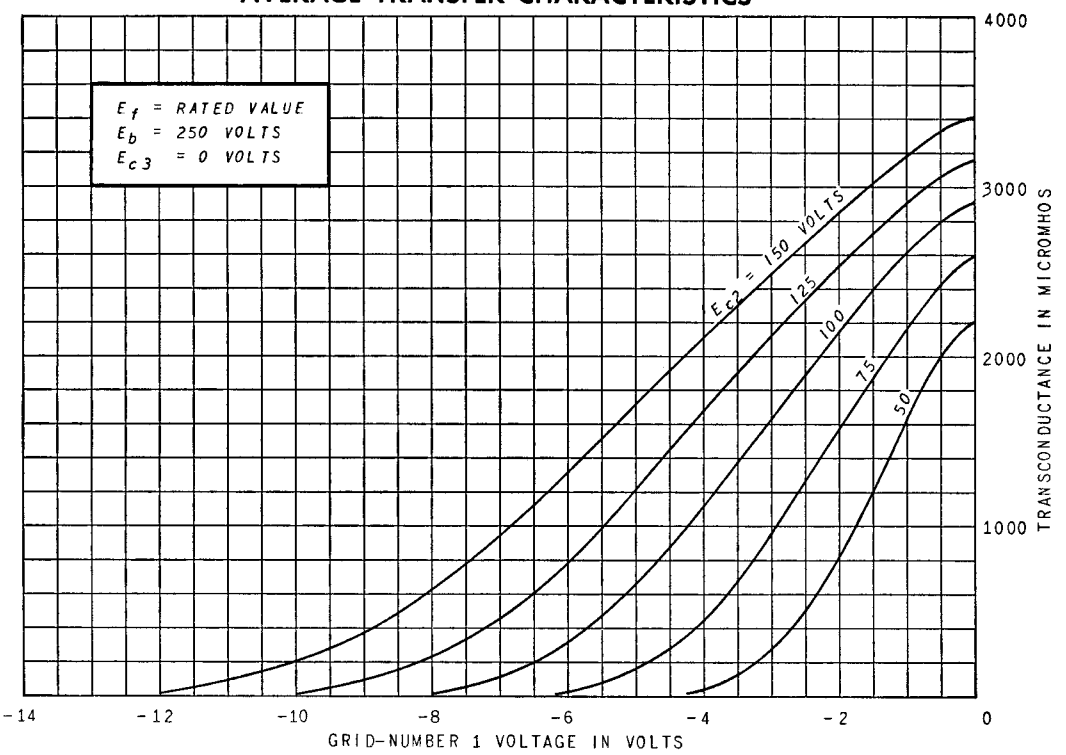
AVERAGE PLATE CHARACTERISTICS



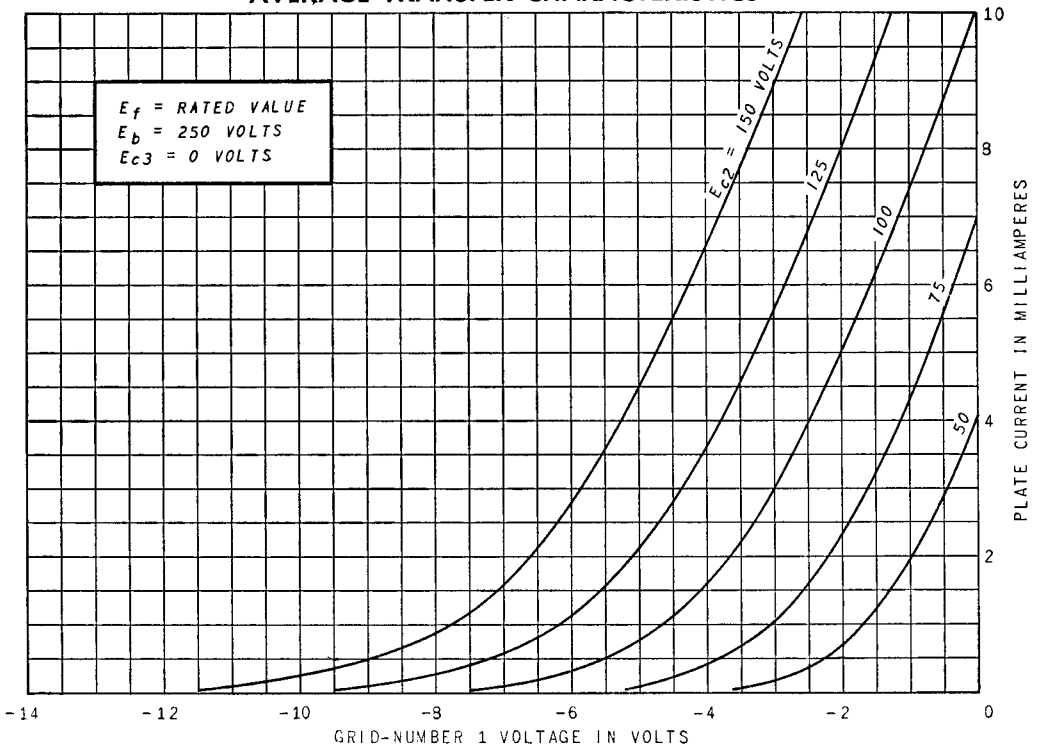
AVERAGE PLATE CHARACTERISTICS



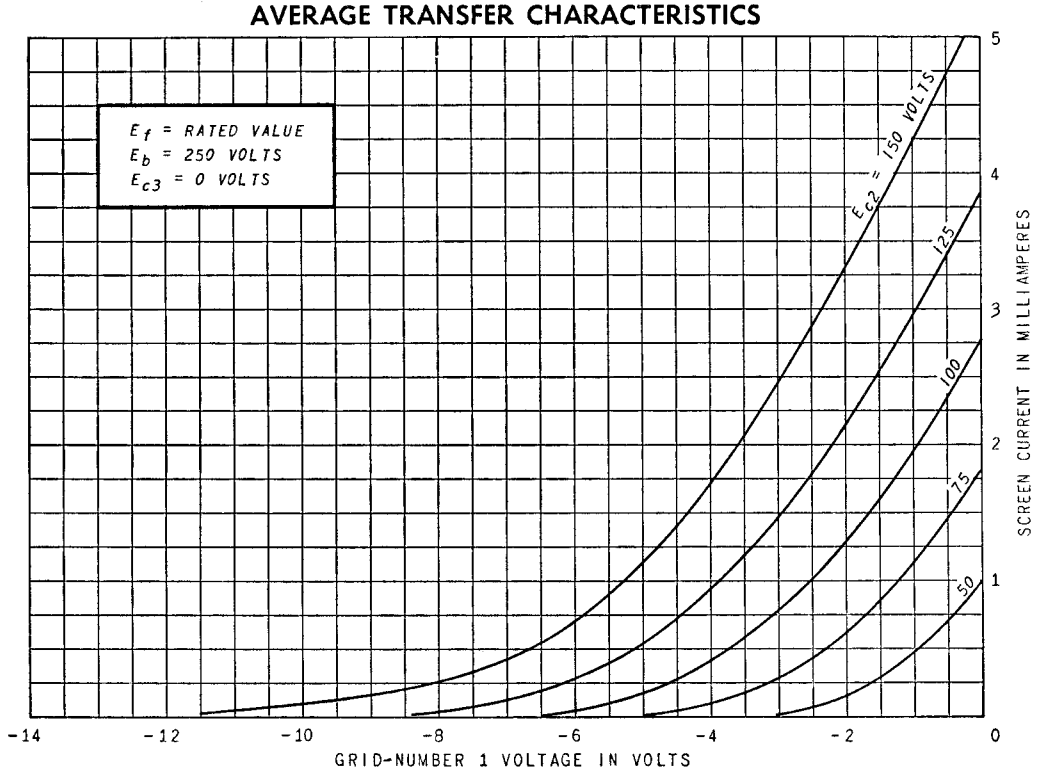
AVERAGE TRANSFER CHARACTERISTICS



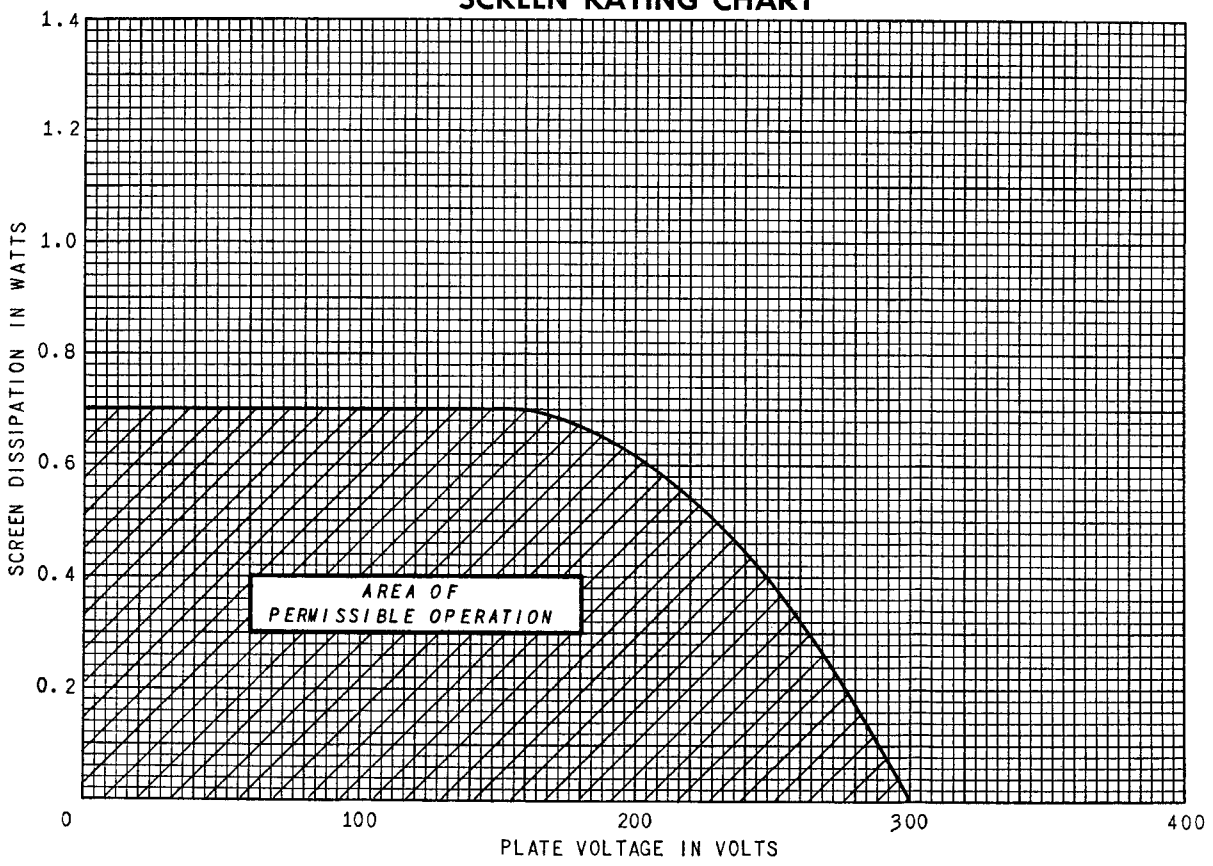
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



SCREEN RATING CHART



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBE

6SK7-12SK7
Description and Rating
PENTODE

The 6SK7 and 12SK7 are remote-cutoff pentodes which are identical except for heater ratings. Each type is designed for use as a high-gain radio-frequency or intermediate-frequency amplifier in radio receivers. Because of its remote-cutoff characteristic, this type will handle large signal voltages without cross-modulation or modulation-distortion and is suitable for use in receivers which employ automatic-volume-control.

GENERAL

Cathode - Coated Unipotential

	6SK7	12SK7	
Heater Voltage, A-C or D-C	6.3	12.6	Volts
Heater Current	0.3	0.15	Ampere

Envelope - MT-8, Metal Shell
Base - B8-21, Small Wafer Octal 8-Pin
Mounting Position - Any

Direct Interelectrode Capacitances *

Grid-Number 1 to Plate, maximum	0.003	μμf
Input	6.0	μμf
Output	7.0	μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	300	Volts
Screen-Supply Voltage	300	Volts
Screen Voltage - See Screen Rating Chart		
Positive D-C Grid-Number 1 Voltage	0	Volts
Plate Dissipation	4.0	Watts
Screen Dissipation	0.4	Watt
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts

CHARACTERISTICS AND TYPICAL OPERATION

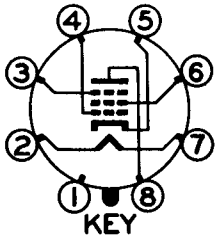
CLASS A_1 AMPLIFIER

Plate Voltage	100	250	Volts
Suppressor Voltage +	0	0	Volts
Screen Voltage	100	100	Volts
Grid-Number 1 Voltage	-1	-3	Volts
Plate Resistance, approximate	0.12	0.8	Megohm
Transconductance	2350	2000	Micromhos
Plate Current	13	9.2	Milliamperes
Screen Current	4.0	2.6	Milliamperes
Grid-Number 1 Voltage, approximate, G_m = 10 Micromhos	-35	-35	Volts

* *With pin 1 connected to pin 5.*

\+ *Pin 3 connected to pin 5 at socket.*

BASING DIAGRAM

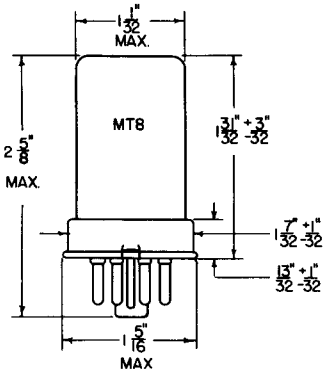


RTMA 8N
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 - Shell and Internal Shield
Pin 2 - Heater
Pin 3 - Grid Number 3 (Suppressor)
Pin 4 - Grid Number 1
Pin 5 - Cathode
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Heater
Pin 8 - Plate

PHYSICAL DIMENSIONS

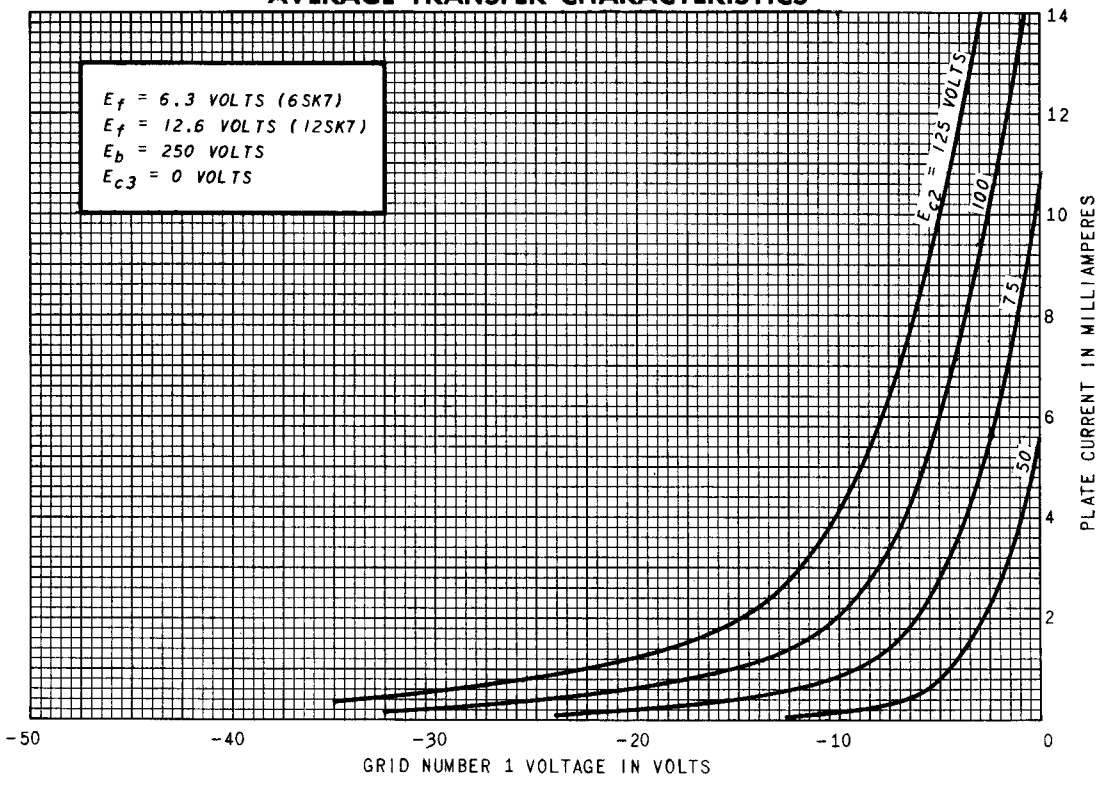


RTMA 8-1

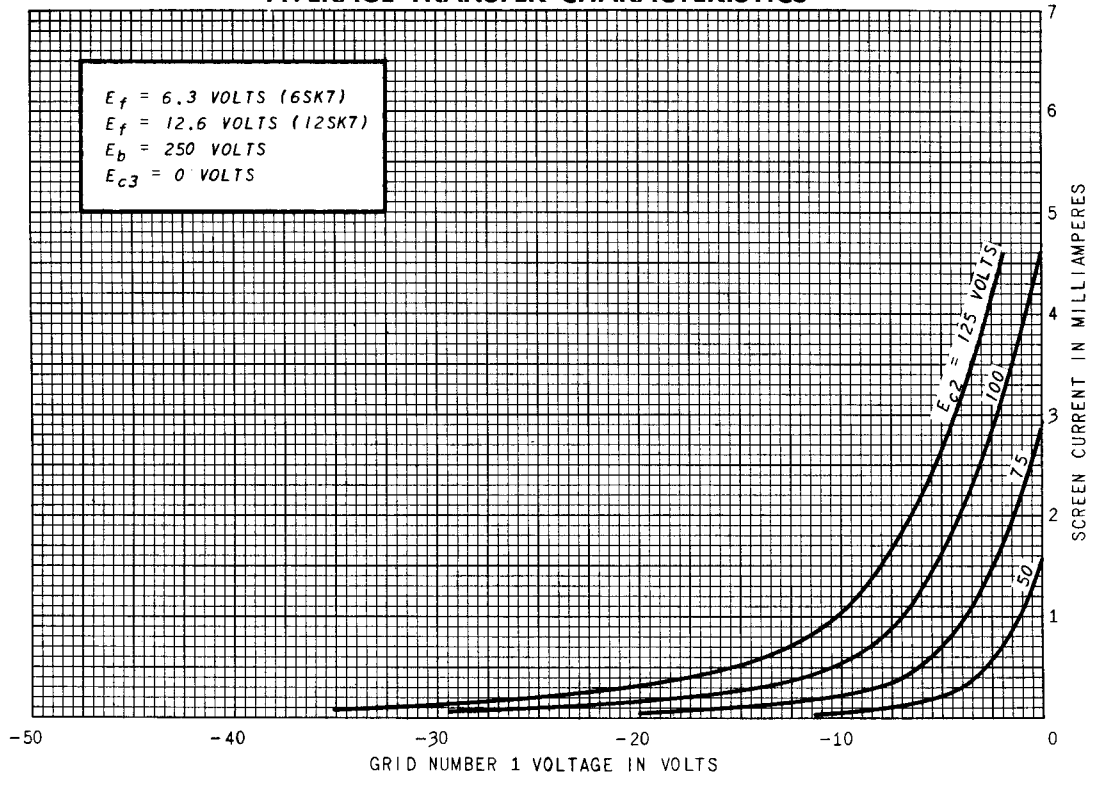
GENERAL ELECTRIC

Supersedes ET-T337A dated 4-50 and ET-T386 dated 5-46

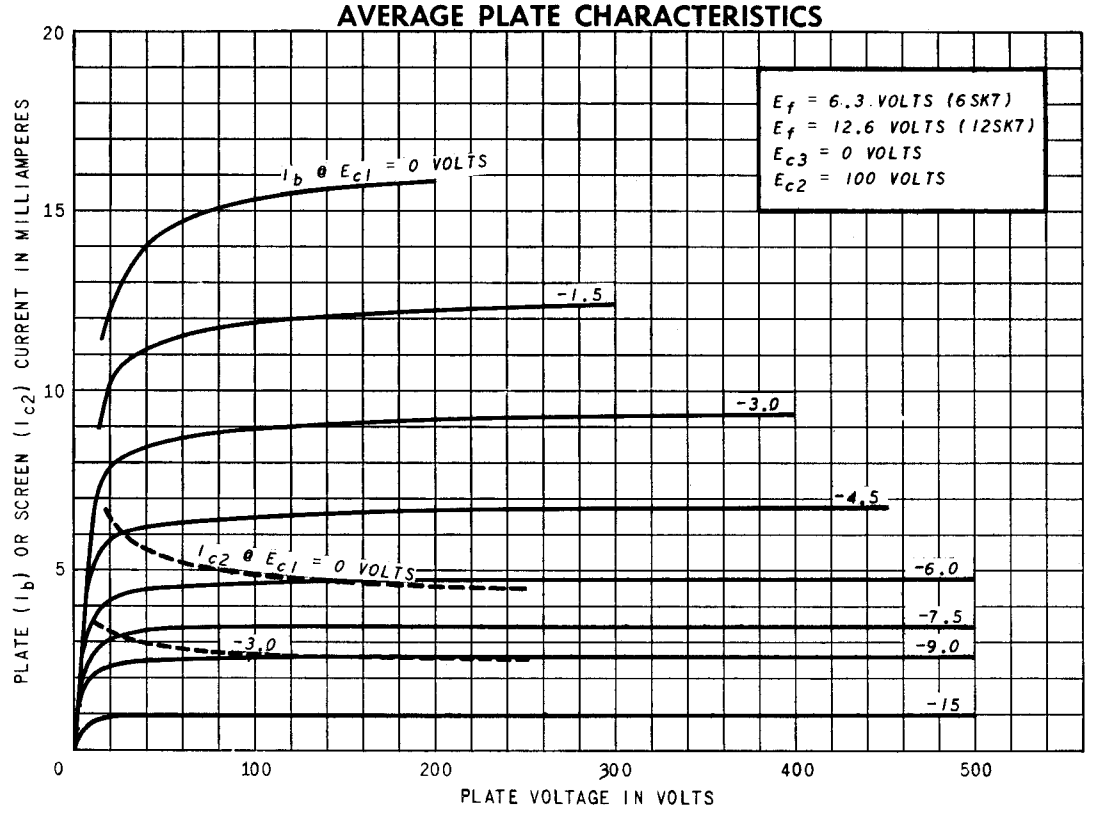
AVERAGE TRANSFER CHARACTERISTICS



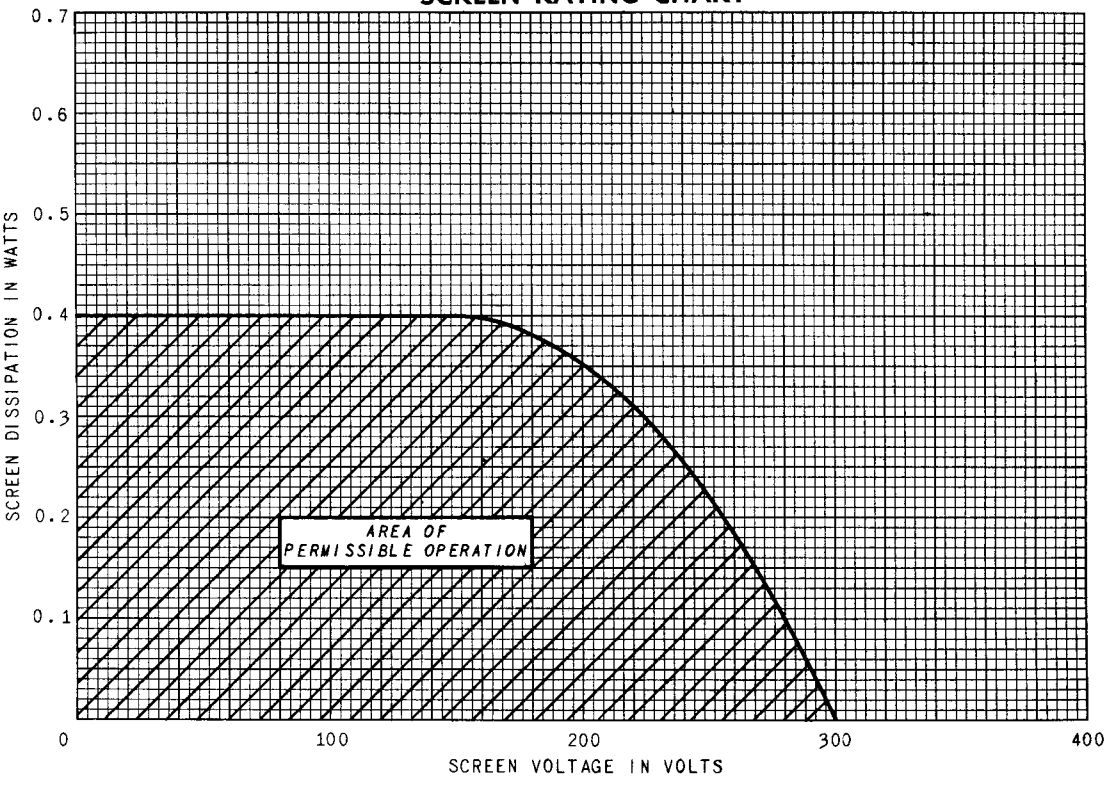
AVERAGE TRANSFER CHARACTERISTICS



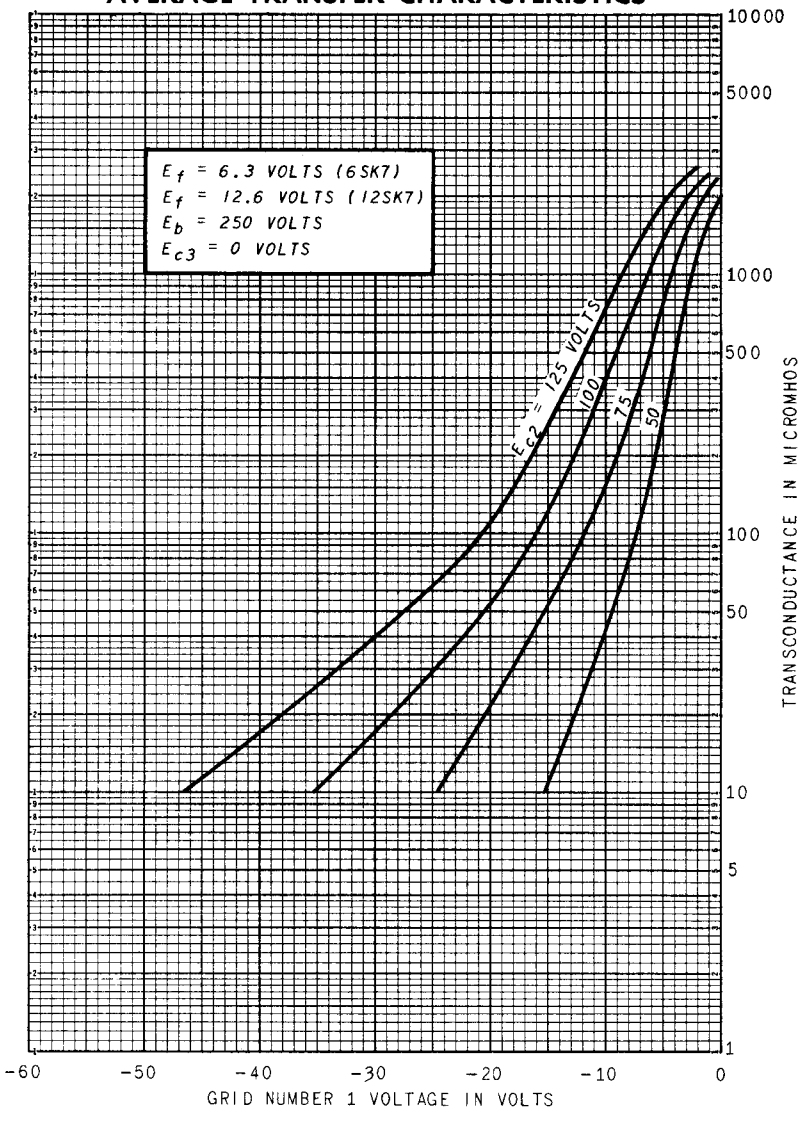
AVERAGE PLATE CHARACTERISTICS



SCREEN RATING CHART



AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

Electronic TUBES

6SL7-GT—12SL7-GT

TWIN TRIODE

DESCRIPTION AND RATING

The 6SL7-GT is a high-mu twin triode designed for use in resistance-coupled circuits as a voltage amplifier or phase inverter.

The 12SL7-GT is identical to the 6SL7-GT except for heater ratings.

GENERAL

ELECTRICAL

	6SL7-GT	12SL7-GT	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	6.3	12.6	Volts
Heater Current	0.3	0.15	Amperes

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B8-6, Intermediate-Shell Octal 8-Pin
or B8-46, Short Intermediate-Shell Octal 8-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES, EACH SECTION

Plate Voltage	300	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts

CHARACTERISTICS AND TYPICAL OPERATION

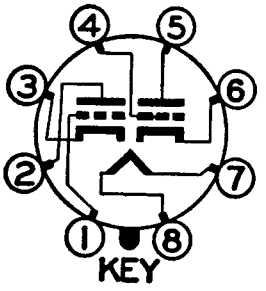
CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	250	Volts
Grid Voltage	−2.0	Volts
Amplification Factor	70	
Plate Resistance, approximate	44000	Ohms
Transconductance	1600	Micromhos
Plate Current	2.3	Milliamperes

GENERAL ELECTRIC

Supersedes ET-T339, dated 5-46

BASING DIAGRAM

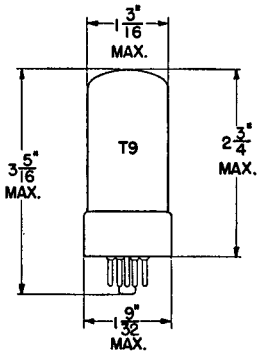


RETMA 8BD

TERMINAL CONNECTIONS

Pin 1—Grid (Section 2)
Pin 2—Plate (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Grid (Section 1)
Pin 5—Plate (Section 1)
Pin 6—Cathode (Section 1)
Pin 7—Heater
Pin 8—Heater

PHYSICAL DIMENSIONS

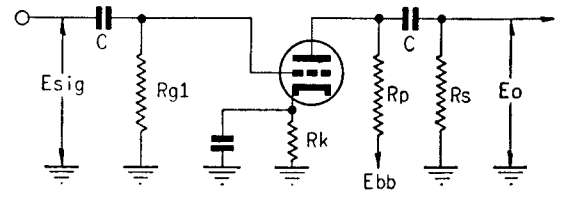


RETMA 9-11 OR 9-41

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	0.10	0.10	1500	26	6.6	1200	30	19	1100	32	35
0.10	0.24	0.10	1700	31	9.5	1400	36	26	1300	37	47
0.24	0.24	0.10	3200	35	7.6	2200	40	24	2100	42	44
0.24	0.51	0.10	3800	39	10	2700	44	30	2500	46	54
0.51	0.51	0.10	7100	39	7.9	4400	45	23	3800	48	45
0.51	1.0	0.10	8000	41	9.9	5200	47	29	4700	50	53
0.24	0.24	10	0	34	6.0	0	42	21	0	45	42
0.24	0.51	10	0	38	8.3	0	46	28	0	48	52
0.51	0.51	10	0	38	6.8	0	47	22	0	50	43
0.51	1.0	10	0	41	8.7	0	50	27	0	53	52

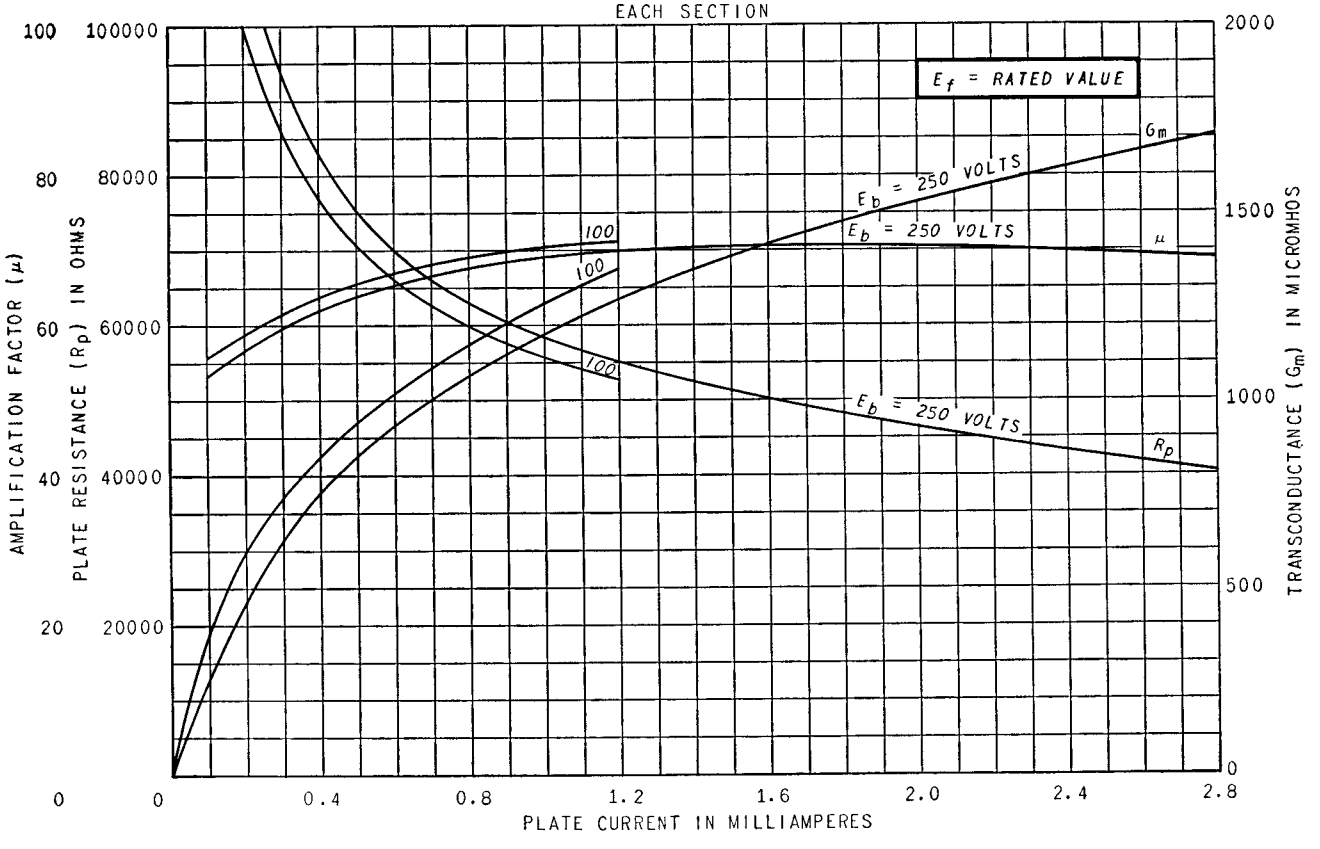


Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

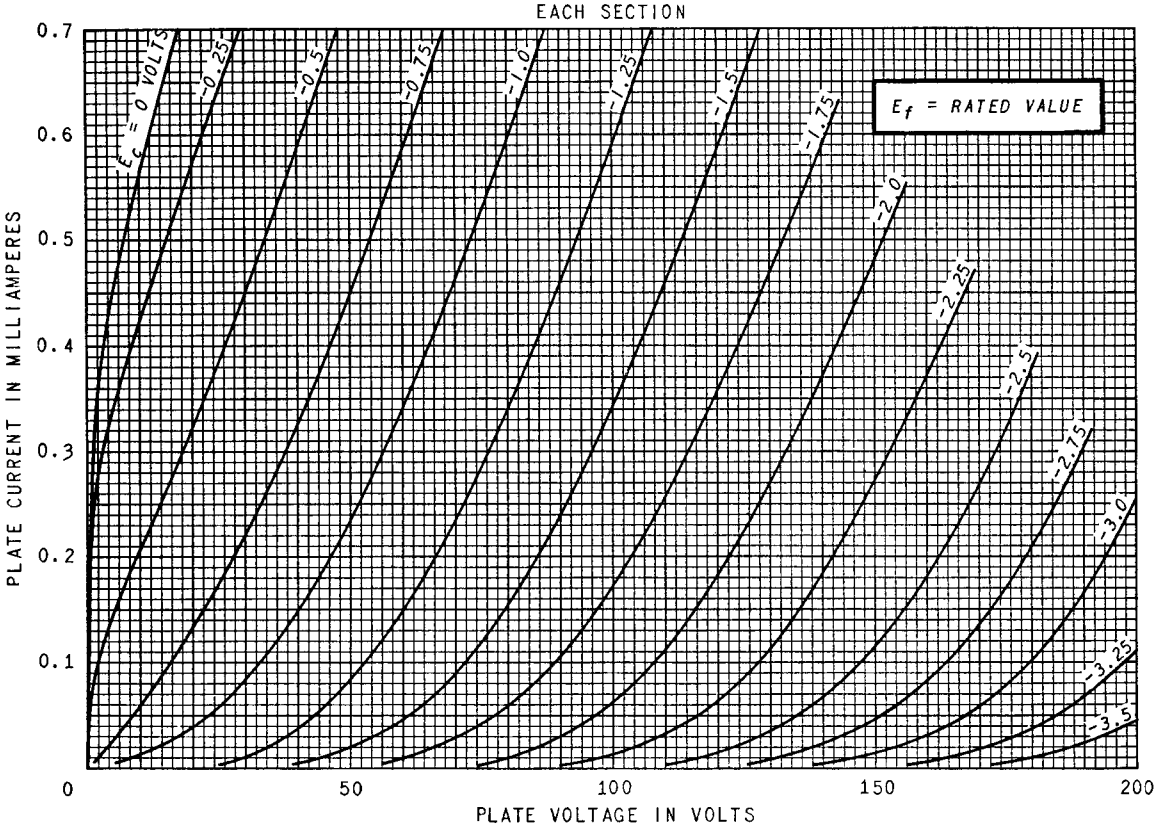
Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

AVERAGE CHARACTERISTICS

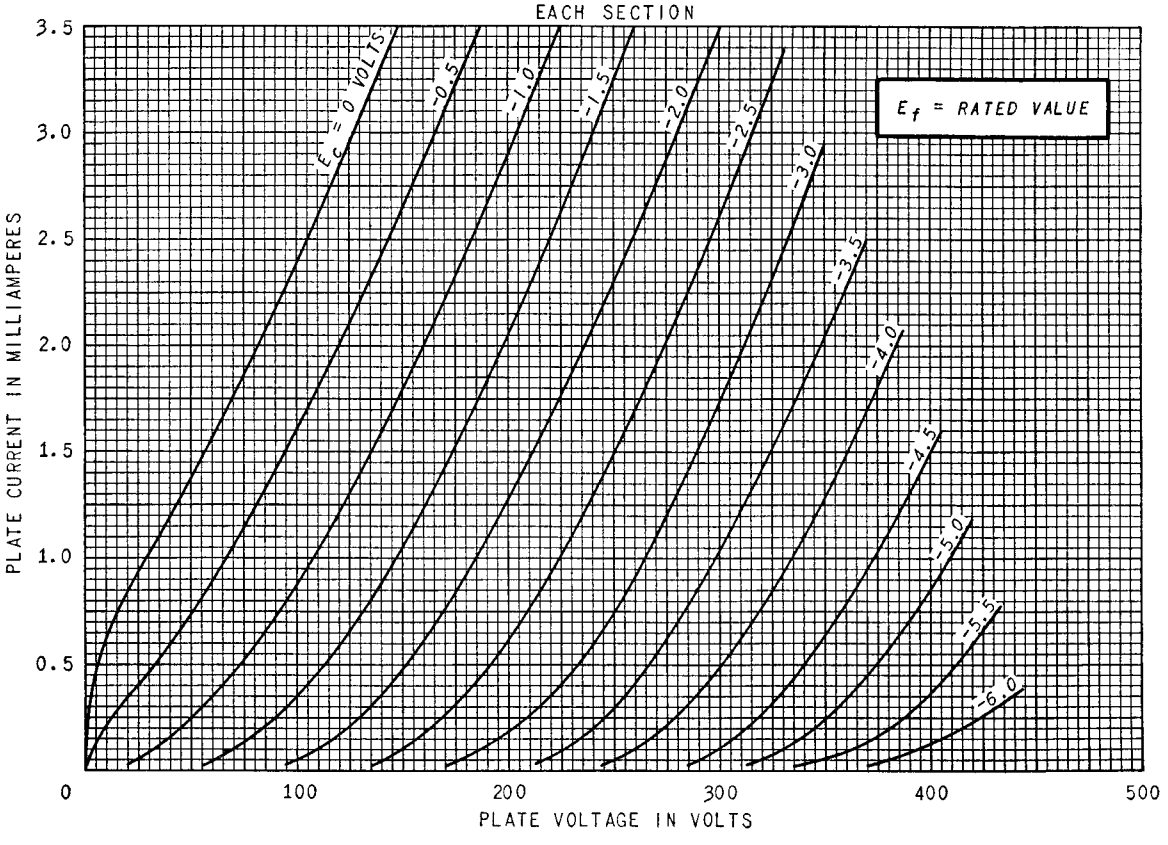
EACH SECTION



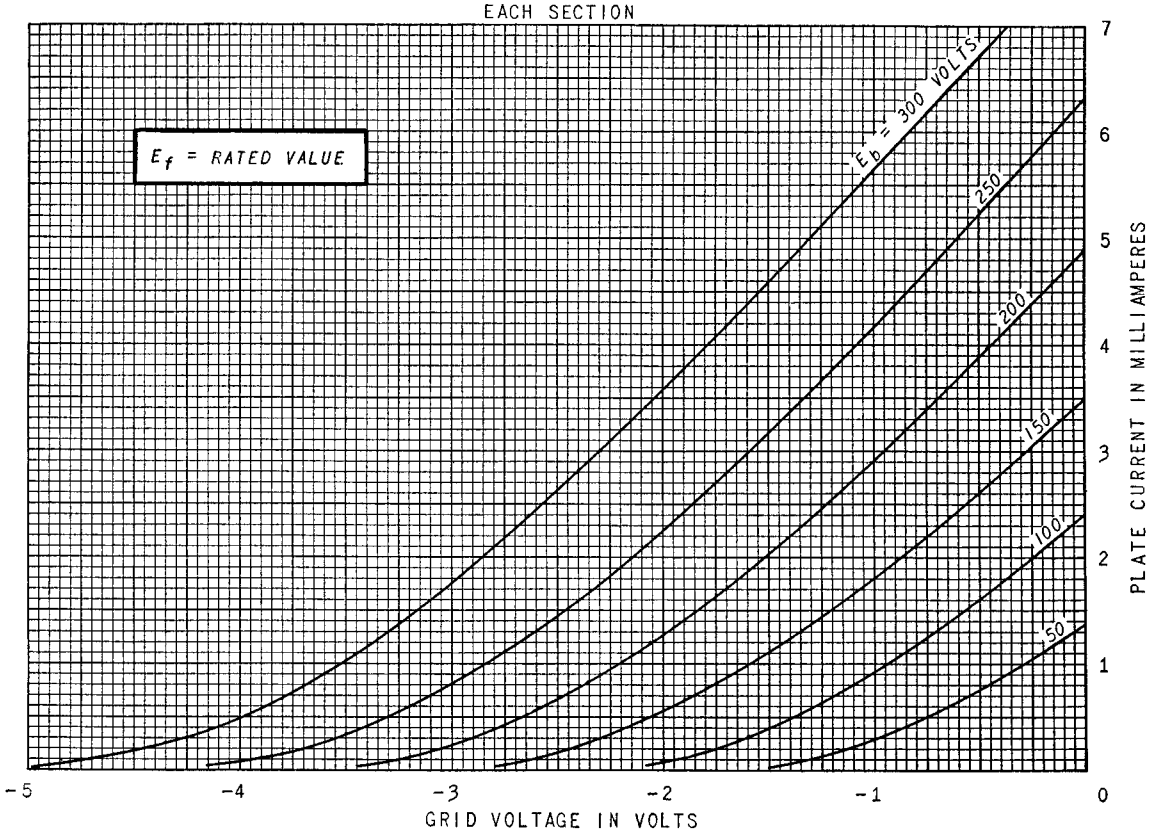
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6SN7-GTB—6SN7-GTA—12SN7-GTA

TWIN TRIODE

DESCRIPTION AND RATING

The 6SN7-GTB is a medium-mu twin triode suitable for use in a wide variety of general-purpose amplifier and phase-inverter applications. It is also especially useful as a blocking oscillator, multivibrator, or vertical-deflection amplifier in television receivers.

Electrically and physically the 6SN7-GTB is a replacement for the 6SN7-GTA. In addition, however, the 6SN7-GTB exhibits a controlled heater warm-up characteristic which makes the tube especially suited for use in television receivers which employ series-connected heaters. When the 6SN7-GTB is used in conjunction with other 600-milliampere types which have essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up.

Except for heater and heater warm-up time ratings, the 12SN7-GTA is identical to the 6SN7-GTB.

GENERAL

Electrical

Cathode—Coated Unipotential

	6SN7-GTA	6SN7-GTB	12SN7-GTA	
Heater Voltage, AC or DC	6.3	6.3	12.6	Volts
Heater Current	0.6	0.6	0.3	Amperes
Heater Warm-up Time*		10.5	...	Seconds

Direct Interelectrode Capacitances†

	Section 1	Section 2	
Grid to Plate	4.0	3.8	μμf
Input	2.2	2.6	μμf
Output	0.7	0.7	μμf

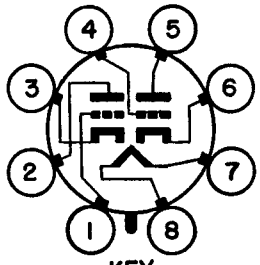
Mechanical

Mounting Position—Any

Envelope—T-9, Glass

Base—B8-6, Intermediate Shell Octal 8-Pin
or B8-58, Short Intermediate Shell Octal 8-Pin

BASING DIAGRAM

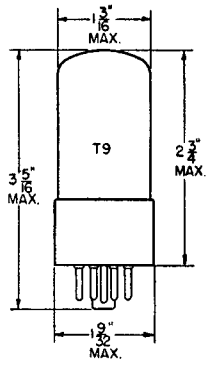


RETMA 8BD

TERMINAL CONNECTIONS

Pin 1—Grid (Section 2)
Pin 2—Plate (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Grid (Section 1)
Pin 5—Plate (Section 1)
Pin 6—Cathode (Section 1)
Pin 7—Heater
Pin 8—Heater

PHYSICAL DIMENSIONS



RETMA 9-11
or 9-41

GENERAL ELECTRIC

Supersedes ET-T714A dated 6-53

MAXIMUM RATINGS

DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED, EACH SECTION

	Class A Amplifier	Vertical-Deflection Amplifier‡
DC Plate Voltage	450	450 Volts
Peak Positive Pulse Plate Voltage		1500§ Volts
Peak Negative Grid Voltage		250 Volts
Plate Dissipation, Each Plate	5.0	5.0π Watts
Total Plate Dissipation, Both Plates	7.5	7.5π Watts
DC Cathode Current	20	20 Milliamperes
Peak Cathode Current		70 Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	100 Volts
Total DC and Peak	200	200 Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	200 Volts
Grid Circuit Resistance		
With Fixed Bias	1.0	.. Megohms
With Cathode Bias	1.0	2.2 Megohms

	Vertical-Oscillator Service‡	Horizontal-Oscillator Service‡
DC Plate Voltage	450	450 Volts
Peak Negative Grid Voltage	400	600 Volts
Plate Dissipation, Each Plate	5.0	5.0 Watts
Total Plate Dissipation, Both Plates	7.5	7.5 Watts
DC Cathode Current	20	20 Milliamperes
Peak Cathode Current	70	300 Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	100 Volts
Total DC and Peak	200	200 Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	200 Volts
Grid Circuit Resistance		
With Fixed Bias	2.2	2.2 Megohms
With Cathode Bias	2.2	2.2 Megohms

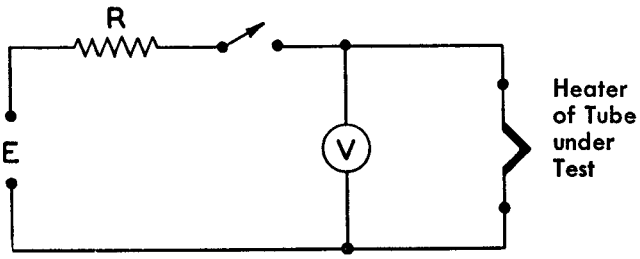
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	90	250	250	Volts
Grid Voltage	0	−12.5	−8	Volts
Amplification Factor	20	...	20	
Plate Resistance, approximate	6700	...	7700	Ohms
Transconductance	3000	...	2600	Micromhos
Plate Current	10	1.3	9.0	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	−7	...	−18	Volts

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E = 25 volts (RMS or DC), V_1 = 5.0 volts (RMS or DC), and R = 31.5 ohms.

† Without external shield.



‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

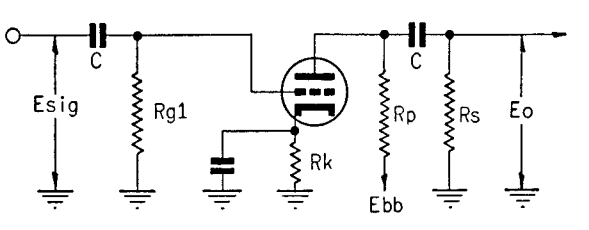
§ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

π In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

R_p Meg.	R_s Meg.	R_{g1} Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	0.10	0.10	3300	14	13	2200	14	26	1800	14	40
0.10	0.24	0.10	3600	14	16	2700	15	33	2200	15	51
0.24	0.24	0.10	7500	14	16	5100	15	30	4300	15	44
0.24	0.51	0.10	9100	14	19	6800	15	39	5100	15	54
0.51	0.51	0.10	13000	14	16	9100	15	30	6800	16	40
0.51	1.0	0.10	15000	14	19	10000	16	32	7500	16	45
0.24	0.24	10	0	15	13	0	16	33	0	17	46
0.24	0.51	10	0	16	17	0	17	38	0	18	62
0.51	0.51	10	0	16	14	0	18	32	0	18	53
0.51	1.0	10	0	17	18	0	18	41	0	19	68

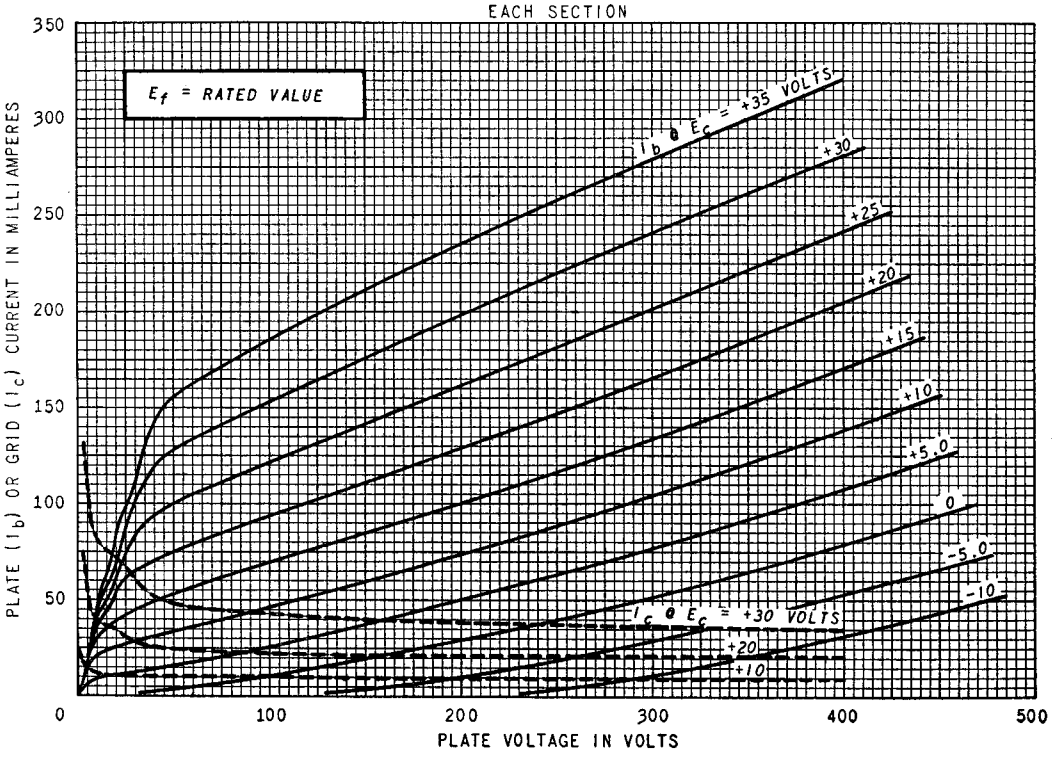


Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

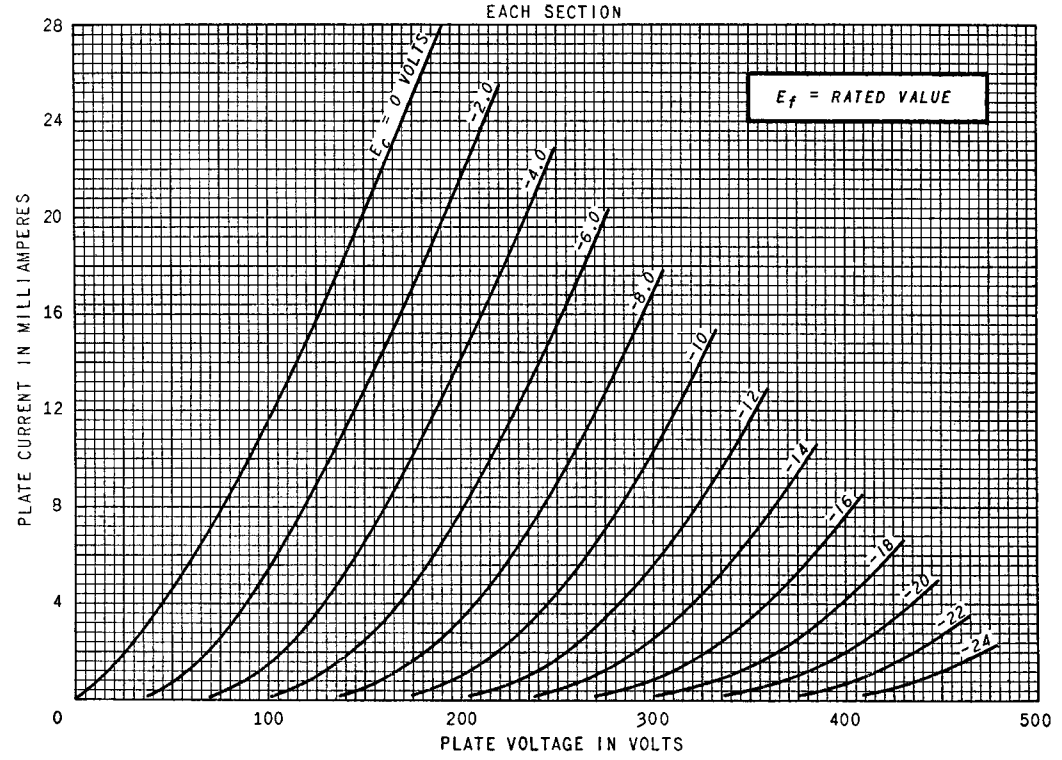
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



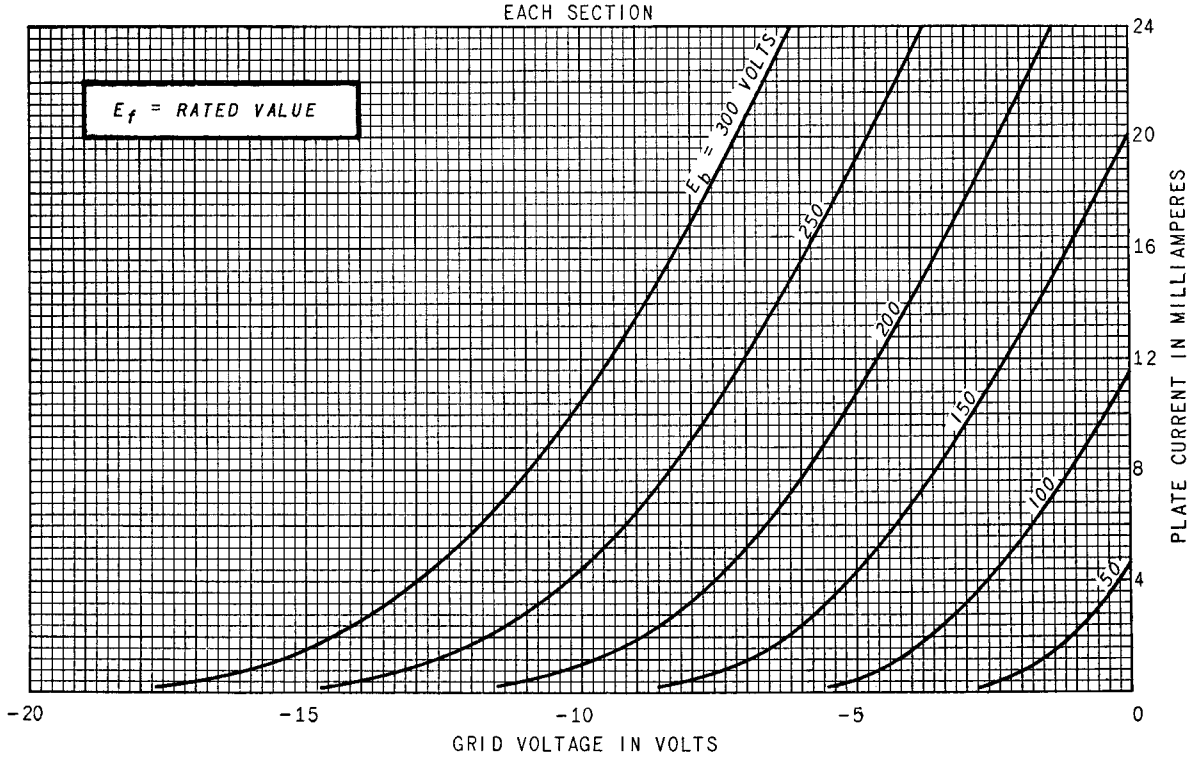
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



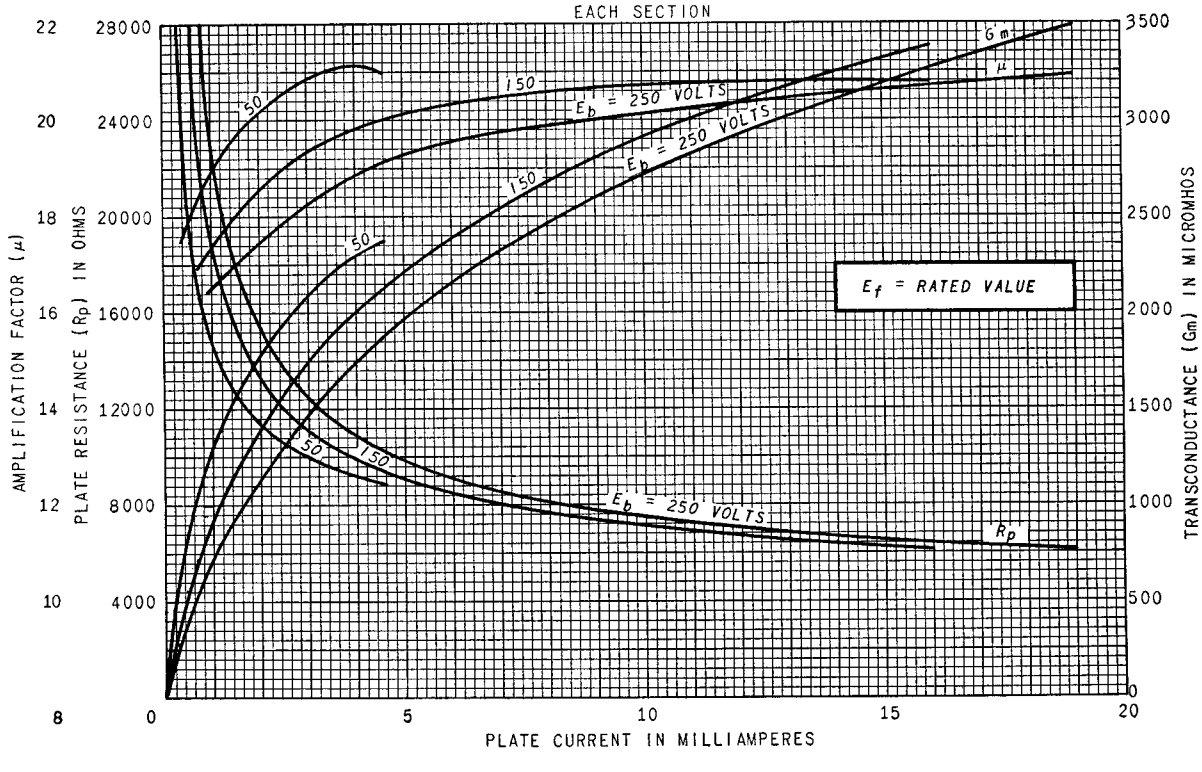
AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION



AVERAGE CHARACTERISTICS

EACH SECTION



Electronic TUBE

6SQ7 - 12SQ7

Description and Rating

DUPLEX-DIODE TRIODE

The 6SQ7 and 12SQ7 are metal duplex-diode high-mu triodes which are identical except for heater ratings. Each type is intended primarily for use as a combined detector, amplifier, and automatic-volume-control tube in radio receivers. The triode section incorporates a high amplification factor and is capable of providing a relatively large undistorted output voltage from a very small input signal.

GENERAL

Cathode - Coated Unipotential

	6SQ7	12SQ7	
Heater Voltage, A-C or D-C	6.3	12.6	Volts
Heater Current	0.3	0.15	Ampere

Envelope - MT-8, Metal Shell
Base - B8-21, Small Wafer Octal 8-Pin
Mounting Position - Any

Direct Interelectrode Capacitances *

Grid to Diode I Plate, maximum	0.03	μμf
Diode Input, Each Section	2.6	μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	300	Volts
Positive D-C Grid Voltage	0	Volts
Plate Dissipation	0.5	Watt
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Diode Current for Continuous Operation, Each Diode	1.0	Milliampere

CHARACTERISTICS AND TYPICAL OPERATION

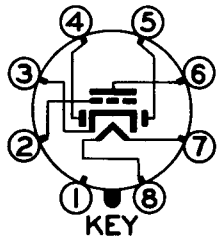
CLASS A_1 AMPLIFIER

Plate Voltage	100	250	Volts
Grid Voltage	-1	-2	Volts
Amplification Factor	100	100	
Plate Resistance, approximate	110000	85000	Ohms
Transconductance	925	1175	Micromhos
Plate Current	0.5	1.1	Milliamperes

Average Diode Current, Each Diode
With 10 Volts D-C Applied 2.0 Milliamperes

** With pin 1 connected to pin 3.*

BASING DIAGRAM

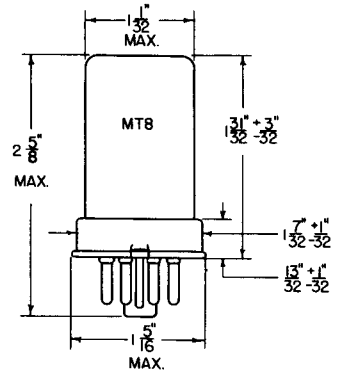


KEY
RTMA 8Q
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 - Shell
Pin 2 - Triode Grid
Pin 3 - Cathode
Pin 4 - Diode Number 2 Plate
Pin 5 - Diode Number 1 Plate
Pin 6 - Triode Plate
Pin 7 - Heater
Pin 8 - Heater

PHYSICAL DIMENSIONS



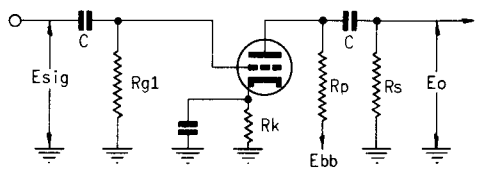
RTMA 8-1

GENERAL ELECTRIC

Supersedes ET-T342B dated 4-50 and ET-T390B dated 6-52

CLASS A RESISTANCE-COUPLED AMPLIFIER

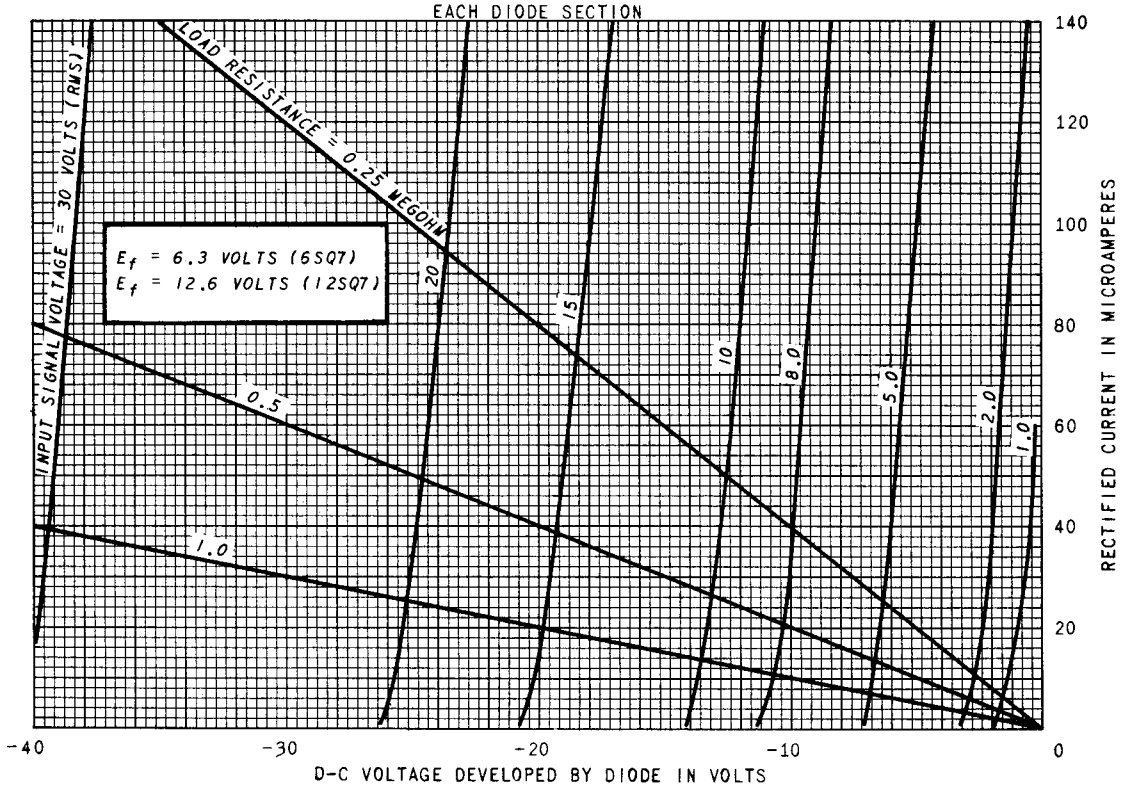
Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	0.10	0.1	4300	22	5.0	2400	29	15	2000	31	28
0.10	0.24	0.1	4700	27	7.0	2700	35	20	2200	38	37
0.24	0.24	0.1	7500	31	7.5	4300	42	20	3300	46	36
0.24	0.51	0.1	8200	40	10	4700	50	26	3900	52	50
0.51	0.51	0.1	13000	39	9.5	7500	53	24	5600	58	47
0.51	1.0	0.1	15000	43	11	8200	58	31	6200	62	56
0.24	0.24	10	0	39	4.5	0	45	19	0	49	38
0.24	0.51	10	0	45	6.5	0	52	24	0	57	48
0.51	0.51	10	0	48	7.0	0	59	22	0	62	42
0.51	1.0	10	0	52	8.5	0	62	25	0	66	55



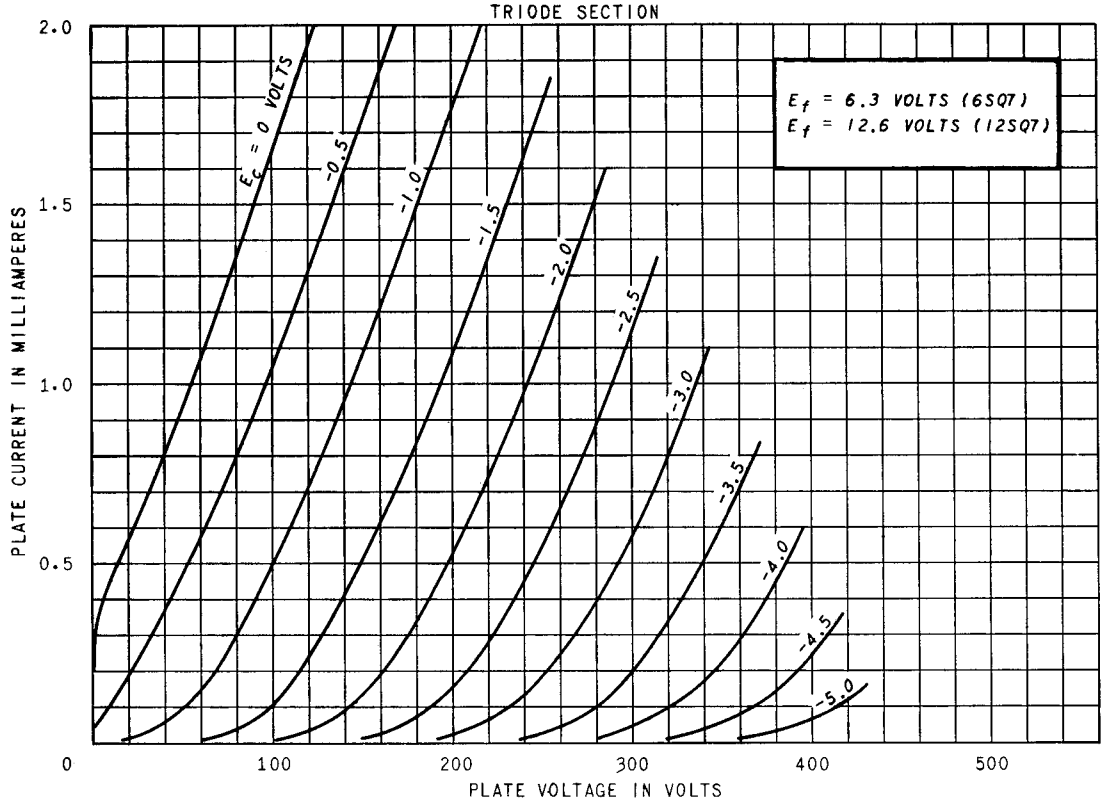
Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

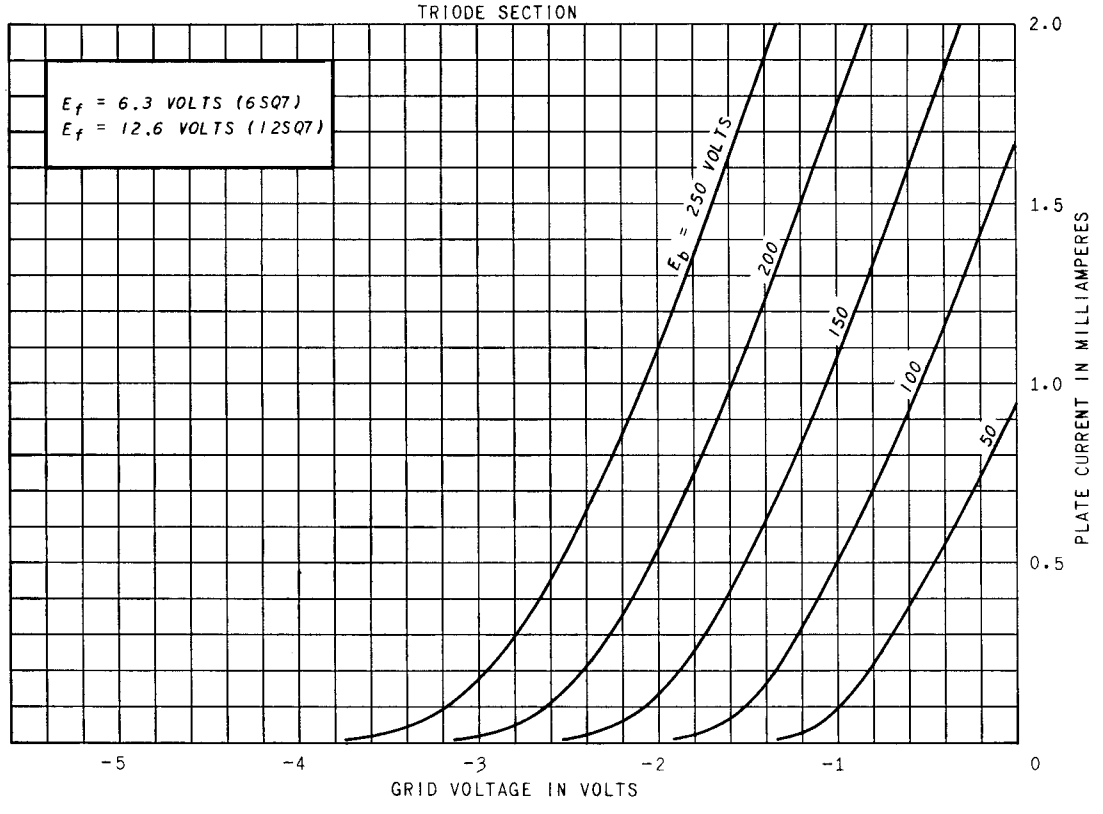
OPERATION CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

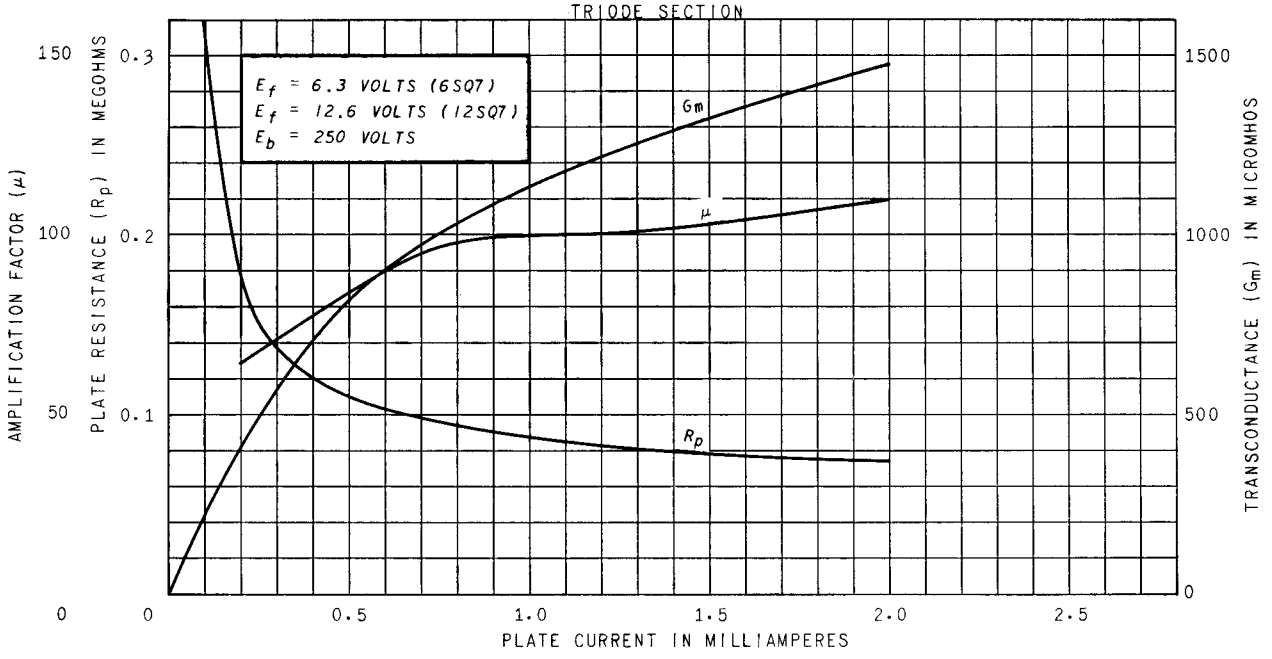


AVERAGE TRANSFER CHARACTERISTICS



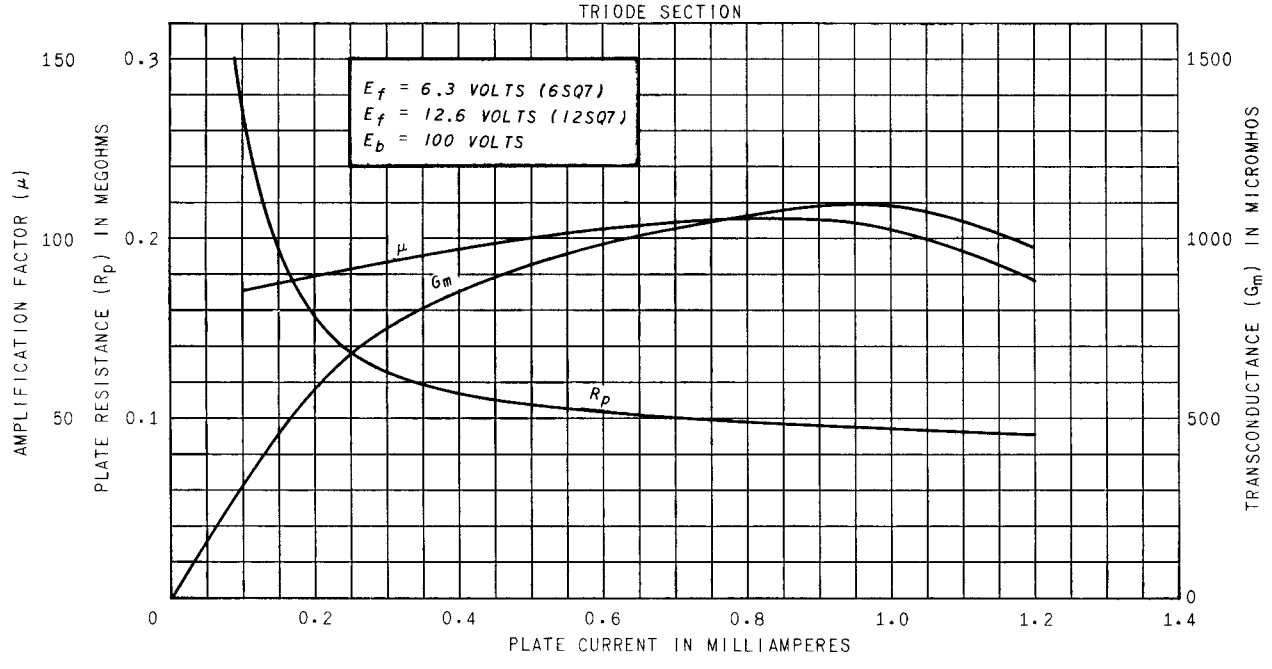
AVERAGE CHARACTERISTICS

TRIODE SECTION



AVERAGE CHARACTERISTICS

TRIODE SECTION



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

ET-T821
6-53

Electronic TUBES

6T8—5T8—19T8

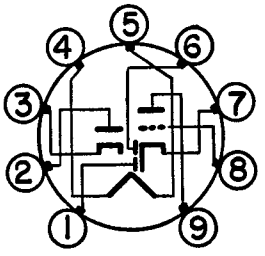
TRIPLE-DIODE TRIODE

DESCRIPTION AND RATING

The 6T8 is a miniature triple-diode, high-mu triode intended primarily for use as a combined AM detector, FM detector, and audio-frequency voltage amplifier in radio and television receivers. For flexibility in circuit design, one of the three high-perveance diodes is provided with a separate cathode connection.

The 5T8, 6T8, and 19T8 are alike except for heater ratings and heater-cathode voltage ratings. The 19T8 is particularly suited for use in a-c/d-c radio receivers; while the 5T8, as a result of its controlled heater warm-up characteristic, is especially well suited for use in television receivers which employ series-connected heaters. When the 5T8 is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

BASING DIAGRAM



RETMA 9E

TERMINAL CONNECTIONS

Pin 1—Diode Number 3 Plate
Pin 2—Diode Number 2 Plate
Pin 3—Diode Number 2 Cathode and Shield
Pin 4—Heater
Pin 5—Heater
Pin 6—Diode Number 1 Plate
Pin 7—Cathode and Shield
Pin 8—Triode Grid
Pin 9—Triode Plate

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

	5T8	6T8	19T8	
Heater Voltage, AC or DC	4.7	6.3	18.9	Volts
Heater Current	0.6	0.45	0.15	Amperes
Heater Warm-up Time*	11.0	...	...	Seconds
Direct Interelectrode Capacitances†				
⊕ Triode Grid to Plate			1.8	μμf
Triode Input			1.6	μμf
⊕ Triode Output			1.1	μμf
Grid to Any Diode Plate, maximum			0.035	μμf
Diode-Number 1 Input			3.8	μμf
Diode-Number 2 Input			4.5	μμf
Diode-Number 3 Input			3.8	μμf
Diode-Number 2 Cathode to All			8.5	μμf

MECHANICAL

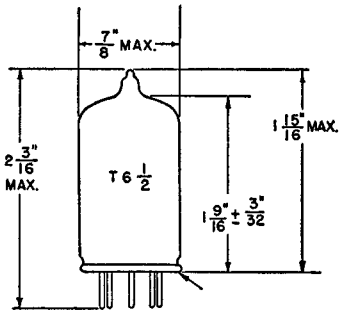
Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage			300	Volts
Positive DC Grid Voltage			0	Volts
Plate Dissipation			1.0	Watts
Heater-Cathode Voltage	5T8	6T8	19T8	
Heater Positive with Respect to Cathode				
DC Component	100	—		Volts
Total DC and Peak	200	90		Volts
Heater Negative with Respect to Cathode				
Total DC and Peak	200	90		Volts
Diode Current for Continuous Operation, Each Diode	5.0	5.0		Milliamperes

PHYSICAL DIMENSIONS



RETMA 6-2

GENERAL ELECTRIC

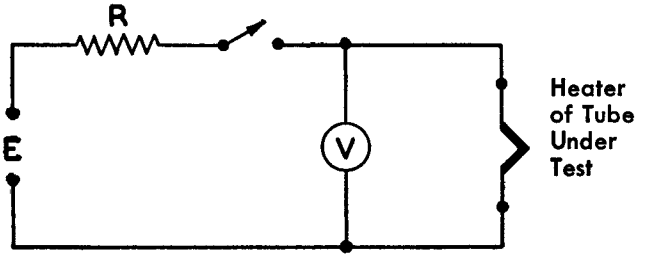
Supersedes ET-T471B dated 2-51 and ET-T472B dated 12-50

CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier

Plate Voltage	100	250	Volts
Grid Voltage	−1	−3	Volts
Amplification Factor	70	70	
Plate Resistance, approximate	54000	58000	Ohms
Transconductance	1300	1200	Micromhos
Plate Current	0.8	1.0	Milliamperes
Average Diode Current, Each Diode With 5.0 Volts DC Applied		20	Milliamperes

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E = 18.7 volts (RMS or DC), V_1 = 3.73 volts (RMS or DC), and R = 23.5 ohms.

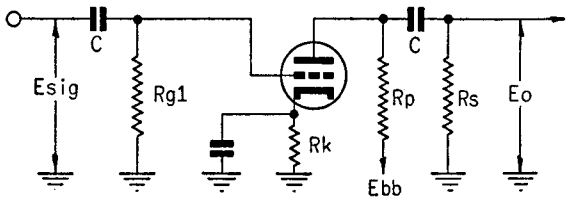


† Without external shield.

⊕ Indicates a change in ratings on the 6T8 and 19T8.

CLASS A RESISTANCE-COUPLED AMPLIFIER

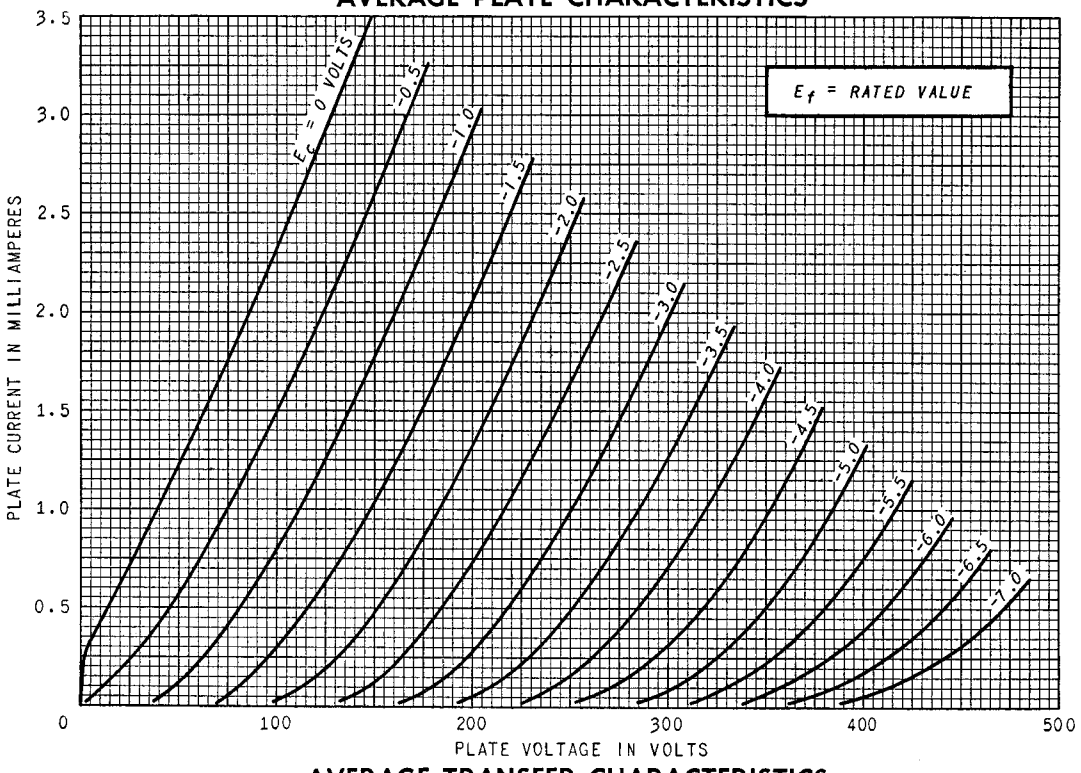
R_p Meg.	R_s Meg.	R_{g1} Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	0.10	0.10	5700	21	7.0	2400	29	18	1800	33	35
0.10	0.24	0.10	6100	26	9.0	2700	34	23	2000	38	42
0.24	0.24	0.10	9100	30	10	4300	40	24	3000	44	43
0.24	0.51	0.10	10000	34	13	4700	45	31	3300	49	52
0.51	0.51	0.10	15000	37	14	7500	47	28	5600	51	50
0.51	1.0	0.10	16000	40	16	8200	50	35	6200	55	60
0.24	0.24	10	0	31	5.0	0	44	19	0	48	40
0.24	0.51	10	0	37	7.0	0	49	25	0	52	52
0.51	0.51	10	0	39	7.5	0	51	22	0	54	44
0.51	1.0	10	0	42	10	0	54	28	0	58	56



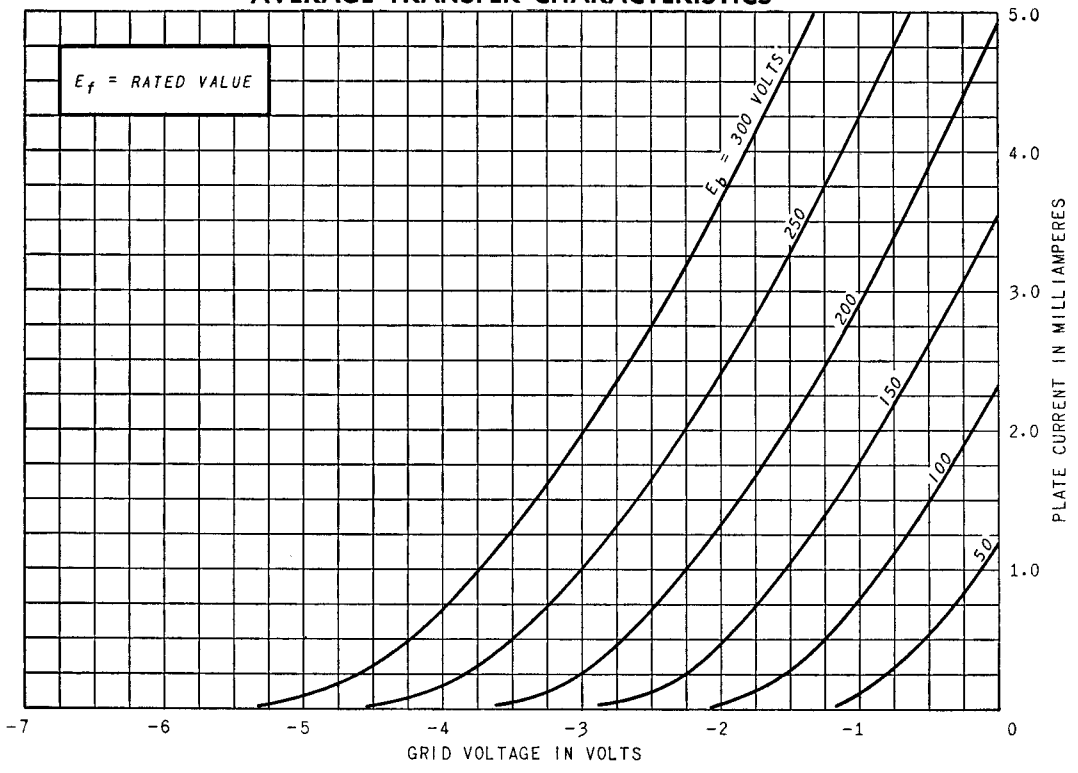
Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

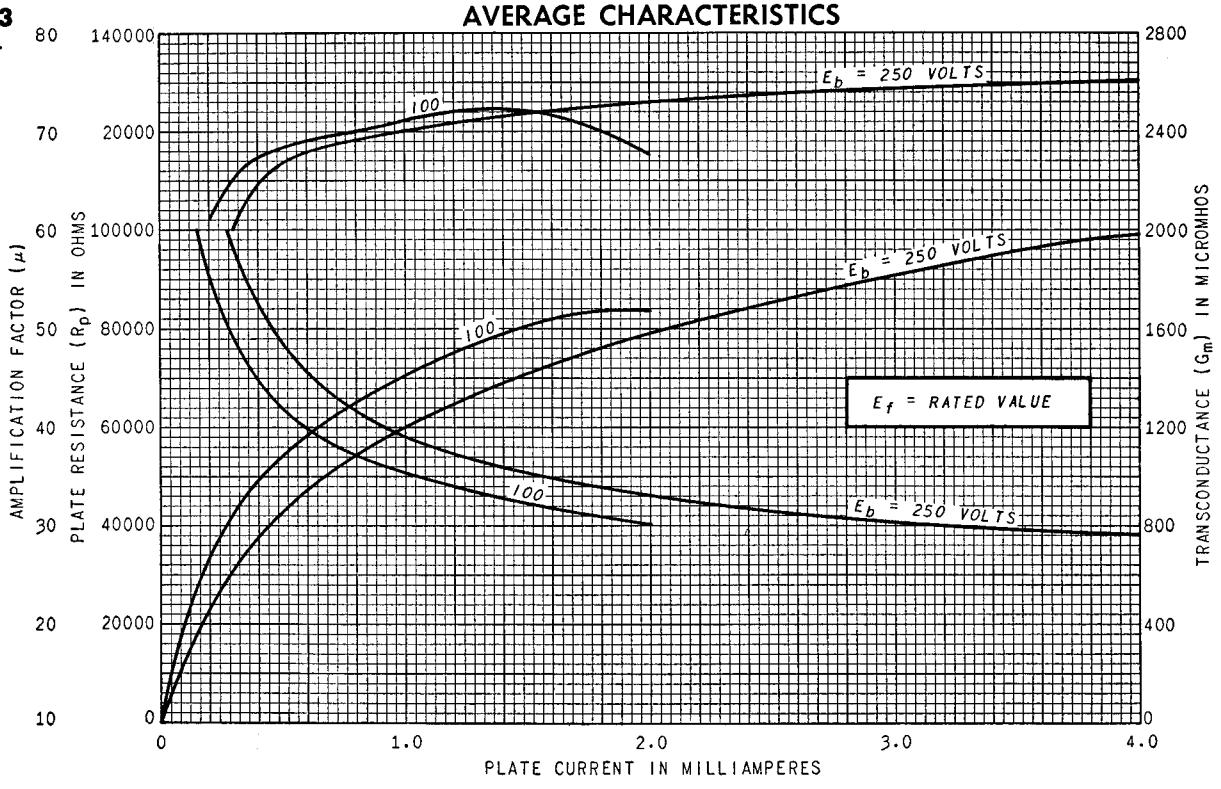
AVERAGE PLATE CHARACTERISTICS



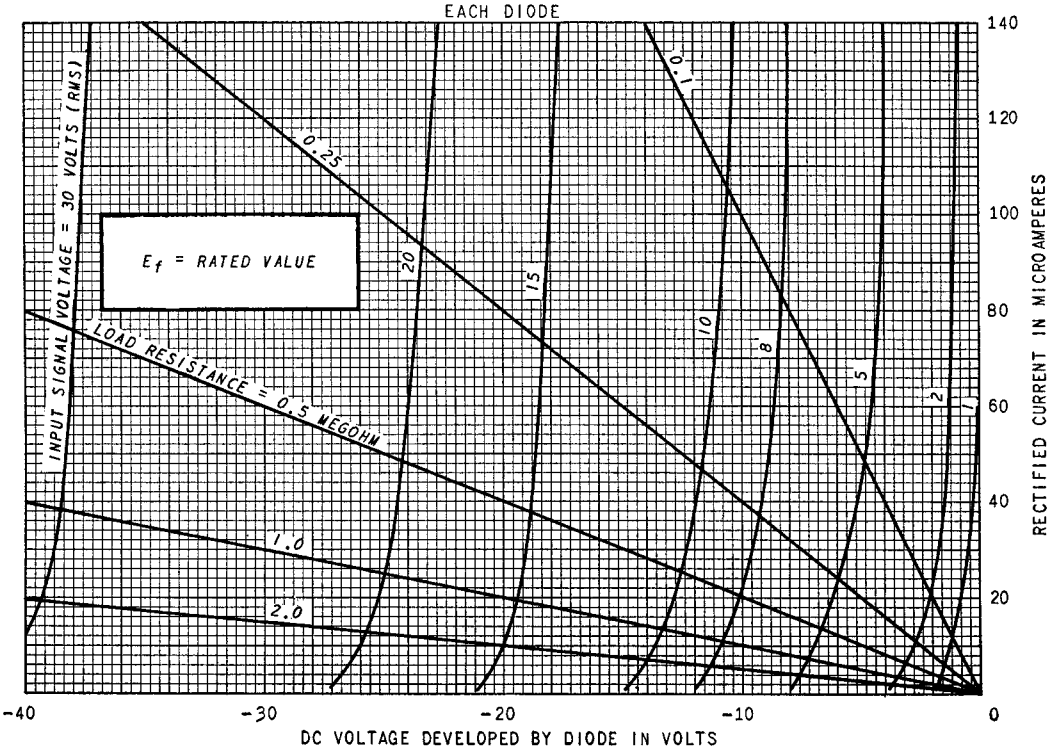
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



OPERATION CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Electronic TUBES

6T8-A

TRIPLE-DIODE TRIODE

FOR DETECTOR AND AF VOLTAGE AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6T8-A is identical to the 6T8, except for a controlled heater warm-up characteristic and the heater-cathode voltage ratings. As a result of the controlled warm-up characteristic, the 6T8-A is especially suited for use in television receivers that employ 450-milliampere, series-connected heaters. Refer to the 6T8 Description and Rating sheet for complete data.

GENERAL

Heater Voltage, AC or DC	6.3	Volts
Heater Current	0.45	Amperes
Heater Warm-up Time*	11	Seconds

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Heater-Cathode Voltage

Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	100	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

ELECTRONICS

6T9

COMPACTRON TRIODE-PENTODE

DESCRIPTION AND RATING

The 6T9 is a compactron containing a high-mu triode and a power pentode. The triode is intended for audio voltage-amplifier service and the pentode for audio power-amplifier service.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.93	Amperes

Direct Interelectrode Capacitances§

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.2	pf
Input: Pg1 to (h + Pk + Pg2 + b.p. + i.s.)	11	pf
Output: Pp to (h + Pk + Pg2 + b.p. + i.s.)	11	pf

Triode Section

Grid to Plate: (Tg to Tp)	2.6	pf
Input: Tg to (h + Tk + i.s.)	3.4	pf
Output: Tp to (h + Tk + i.s.)	1.1	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches

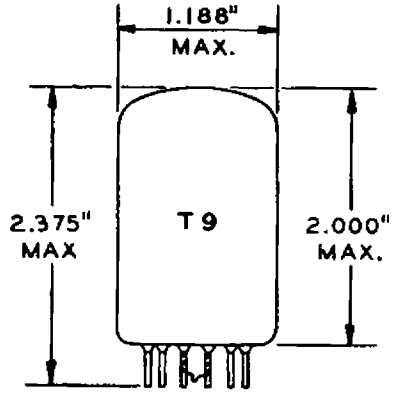
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

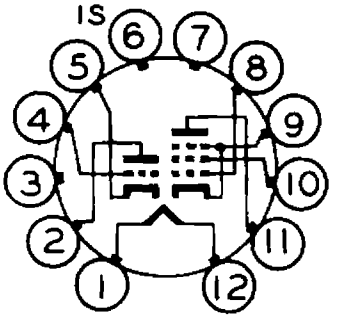


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Triode Plate
Pin 3 - No Connection
Pin 4 - Triode Grid
Pin 5 - Triode Cathode
Pin 6 - Internal Shield
Pin 7 - No Connection
Pin 8 - Pentode Grid Number 1
Pin 9 - Pentode Cathode and Beam Plates
Pin 10 - Pentode Grid Number 2 (Screen)
Pin 11 - Pentode Plate
Pin 12 - Heater

BASING DIAGRAM



EIA 12FM

GENERAL ELECTRIC

from JEDEC release #4403, Sept. 9, 1963

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES	Pentode Section	Triode Section	
Plate Voltage	275	300	Volts
Screen Voltage	275	---	Volts
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	12	1.5	Watts
Screen Dissipation	2.0	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	0.5	1.0	Megohms
With Self-Bias	---	¶	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER	Pentode Section (Power Amplifier)	Triode Section (Voltage Amplifier)	
Plate Voltage	250	250	Volts
Screen Voltage	250	---	Volts
Grid-Number 1 Voltage	-8.0	-2.0	Volts
Peak AF Grid Number-1 Voltage	8.0	---	Volts
Amplification Factor	---	95	
Plate Resistance, approximate	100000	45000	Ohms
Transconductance	6500	2100	Micromhos
Plate Current	---	1.5	Milliamperes
Zero-Signal Plate Current	35	---	Milliamperes
Maximum-Signal Plate Current	39	---	Milliamperes
Zero-Signal Screen Current	2.5	---	Milliamperes
Maximum-Signal Screen Current	7.0	---	Milliamperes
Load Resistance	5000	---	Ohms
Total Harmonic Distortion, approximate	10	---	Percent
Maximum-Signal Power Output	4.2	---	Watts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ In applications where the triode section is to be used with self-bias, a maximum resistance of 10 megohms is permissible, provided that the plate supply voltage and plate load resistance are such that the plate dissipation can never exceed 0.25 watts.

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RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Compactron
Dissimilar Double Pentode

6T10

● QUADRATURE FM DETECTOR ● HIGH B+ ● AUDIO POWER PENTODE ● 4.2 WATTS AUDIO OUTPUT

The 6T10 is a compactron containing a sharp-cutoff, dual-control pentode (Section 2) and a power pentode (Section 1). The dual-control pentode is designed for use as an FM detector and the power pentode as an audio-frequency output amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*. . . .	6.3±0.6	Volts
Heater Current	0.95	Amperes

Direct Interelectrode Capacitances‡

Section 1

Grid-Number 1 to Plate: (1g1 to 1p) .	0.22	pf
Input: 1g1 to (h + 1k + 1g2 + b.p. + 2k + i.s.).	11	pf
Output: 1p to (h + 1k + 1g2 + b.p. + 2k + i.s.).	10	pf

Section 2

Grid-Number 1 to Plate: (2g1 to 2p)	0.032	pf
Grid-Number 3 to Plate: (2g3 to 2p) .	3.0	pf
Grid-Number 1 to All Except Plate: 2g1 to (h + 2k + 2g2 + 2g3 + i.s.).	6.5	pf
Grid-Number 3 to All: 2g3 to (h + 2k + 2g1 + 2g2 + 2p + i.s.) . . .	7.5	pf
Grid-Number 1 to Grid-Number 3: (2g1 to 2g3)	0.12	pf

Coupling

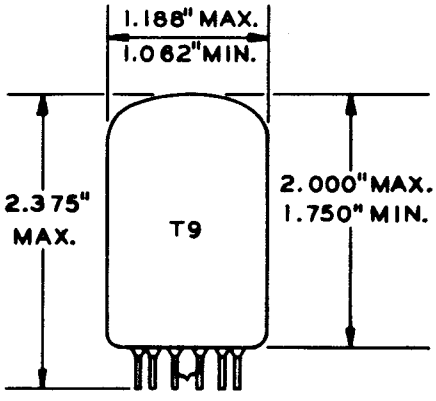
Plate, Section 1 to Plate, Section 2: (1p to 2p).	0.13	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter.	1.188	Inches
Minimum Diameter.	1.062	Inches
Maximum Over-all Length . . .	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

PHYSICAL DIMENSIONS

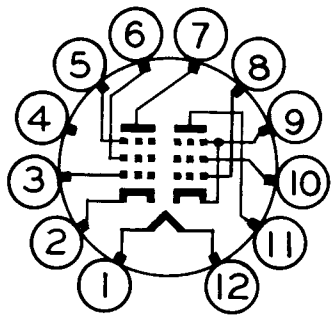


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode and Internal Shield (Section 2)
Pin 3 - Grid Number 1 (Section 2)
Pin 4 - No Connection
Pin 5 - Grid Number 3 (Suppressor) (Section 2)
Pin 6 - Grid Number 2 (Screen) (Section 2)
Pin 7 - Plate (Section 2)
Pin 8 - Grid Number 1 (Section 1)
Pin 9 - Cathode and Beam Plates (Section 1)
Pin 10 - Grid Number 2 (Screen) (Section 1)
Pin 11 - Plate (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12EZ

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Section 1

Plate Voltage	275	Volts
Screen Voltage	275	Volts
Plate Dissipation	10	Watts
Screen Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	0.5	Megohms

Section 2

Plate Voltage	330	Volts
Suppressor Voltage	28	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	1.7	Watts
Screen Dissipation	1.1	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Section 1

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	-8.0	Volts
Peak AF Grid-Number 1 Voltage	8.0	Volts
Plate Resistance, approximate	10000	Ohms
Transconductance	6500	Micromhos
Zero-Signal Plate Current	35	Milliamperes
Maximum-Signal Plate Current	39	Milliamperes
Zero-Signal Screen Current	2.5	Milliamperes
Maximum-Signal Screen Current	7.0	Milliamperes
Load Resistance	5000	Ohms
Total Harmonic Distortion, approximate	10	Percent
Maximum-Signal Power Output	4.2	Watts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

AVERAGE CHARACTERISTICS

Section 2

Plate Voltage	150	Volts
Suppressor Voltage	0	Volts
Screen Voltage	100	Volts
Cathode-Bias Resistor	560	Ohms
Plate Resistance, approximate	0.15	Megohms
Grid-Number 1 Transconductance	1000	Micromhos
Grid-Number 3 Transconductance	400	Micromhos
Plate Current	1.3	Milliamperes
Screen Current	2.1	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 30 Microamperes	-4.5	Volts
Grid-Number 3 Voltage, approximate Ib = 50 Microamperes	-4.5	Volts

NOTES

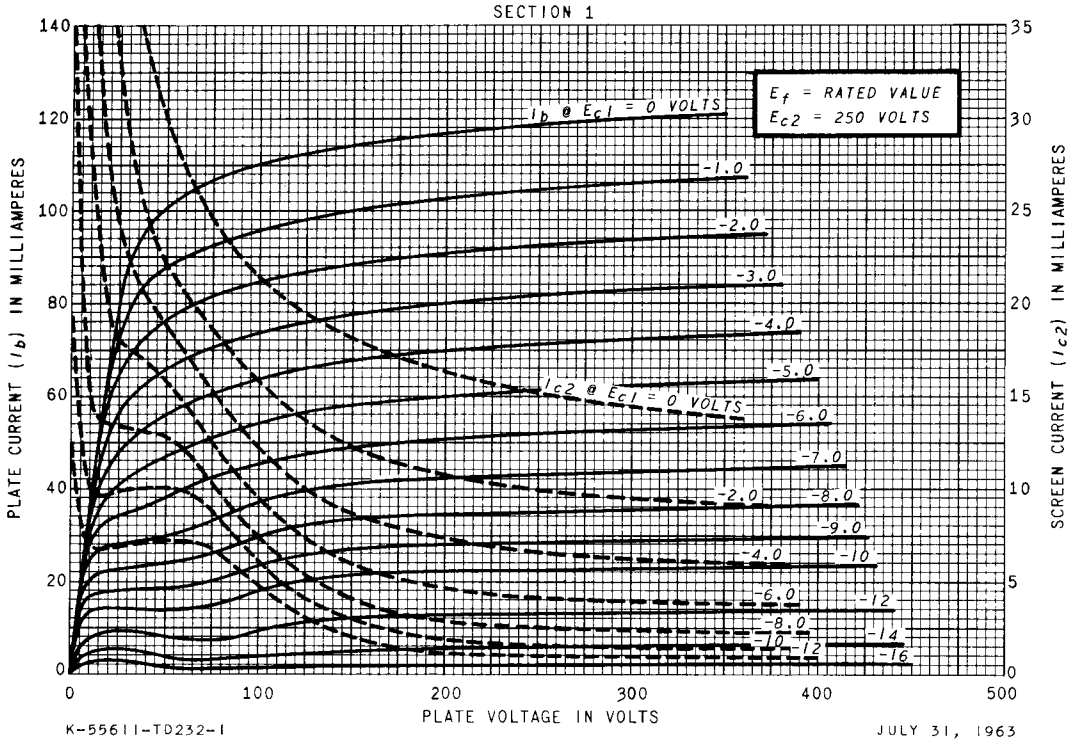
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

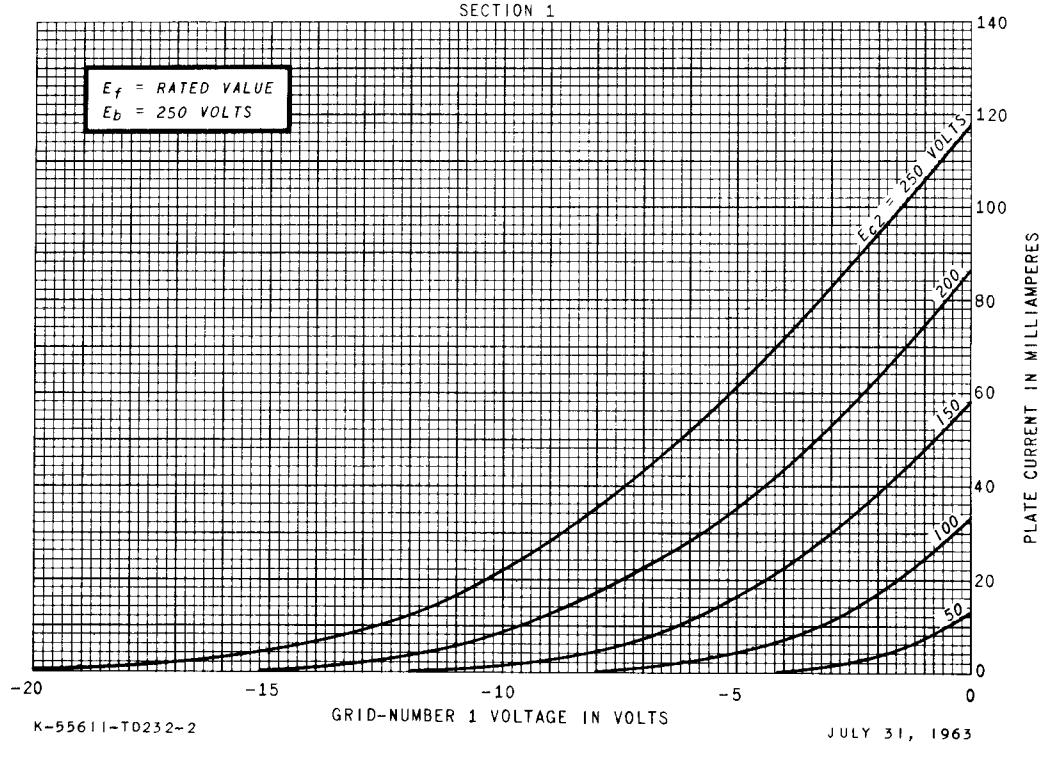
‡ Without external shield.

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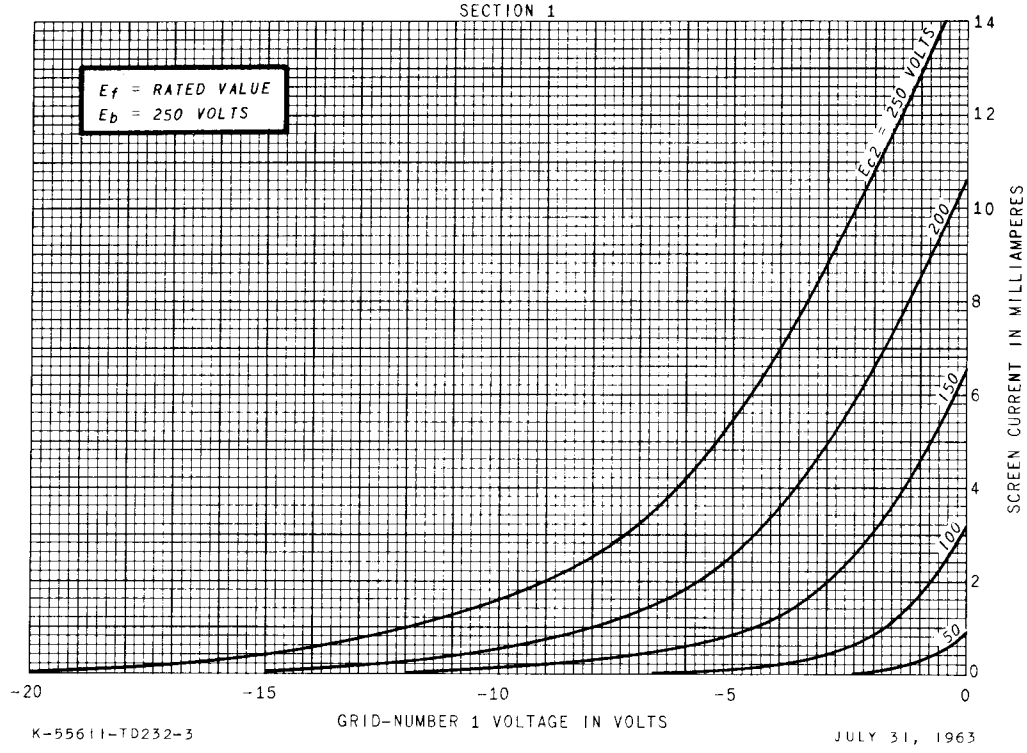
AVERAGE PLATE CHARACTERISTICS



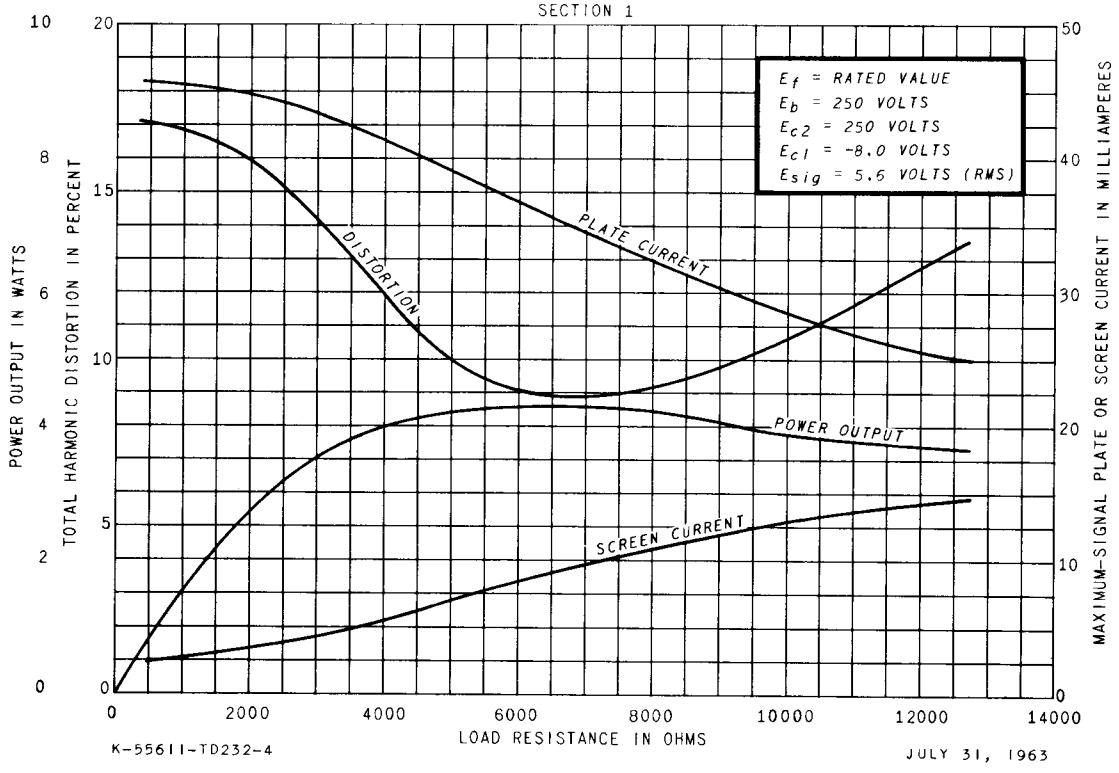
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

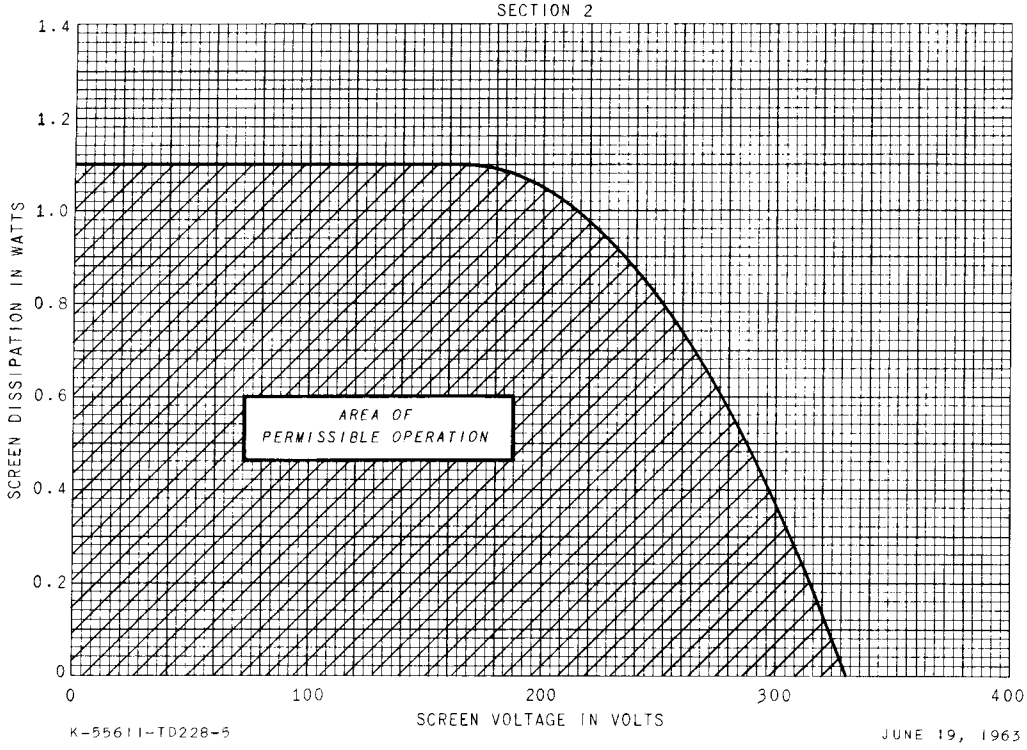


OPERATION CHARACTERISTICS



SCREEN RATING CHART

SECTION 2

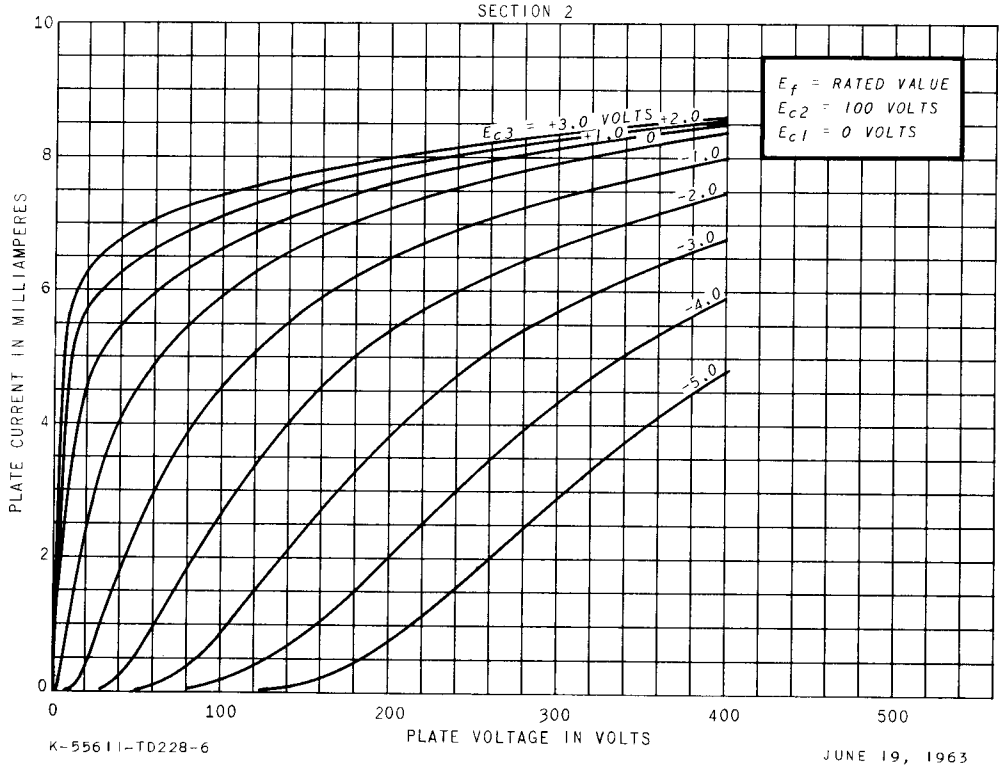


K-5561I-TD228-5

JUNE 19, 1963

AVERAGE PLATE CHARACTERISTICS

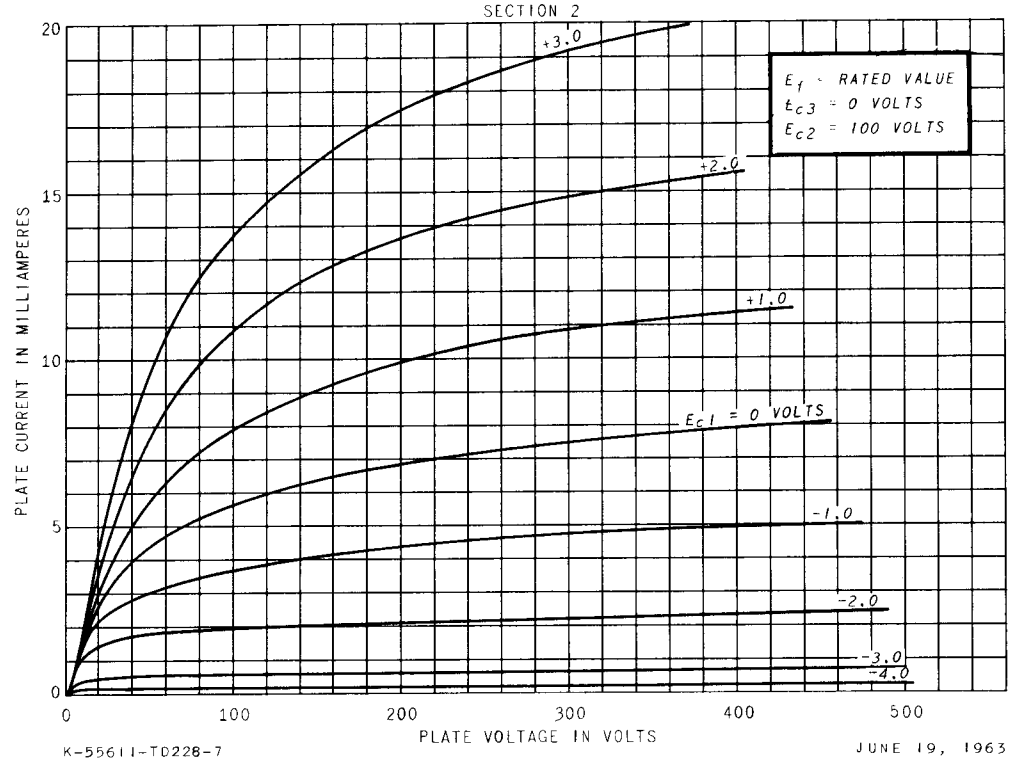
SECTION 2



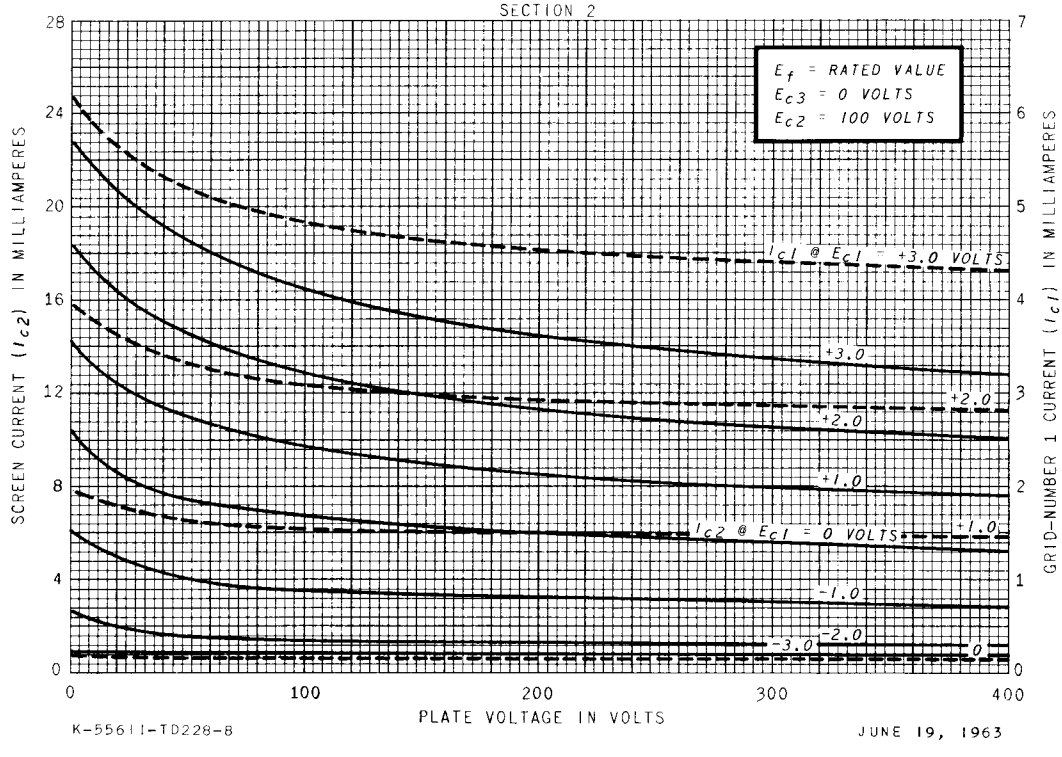
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JUNE 19, 1963

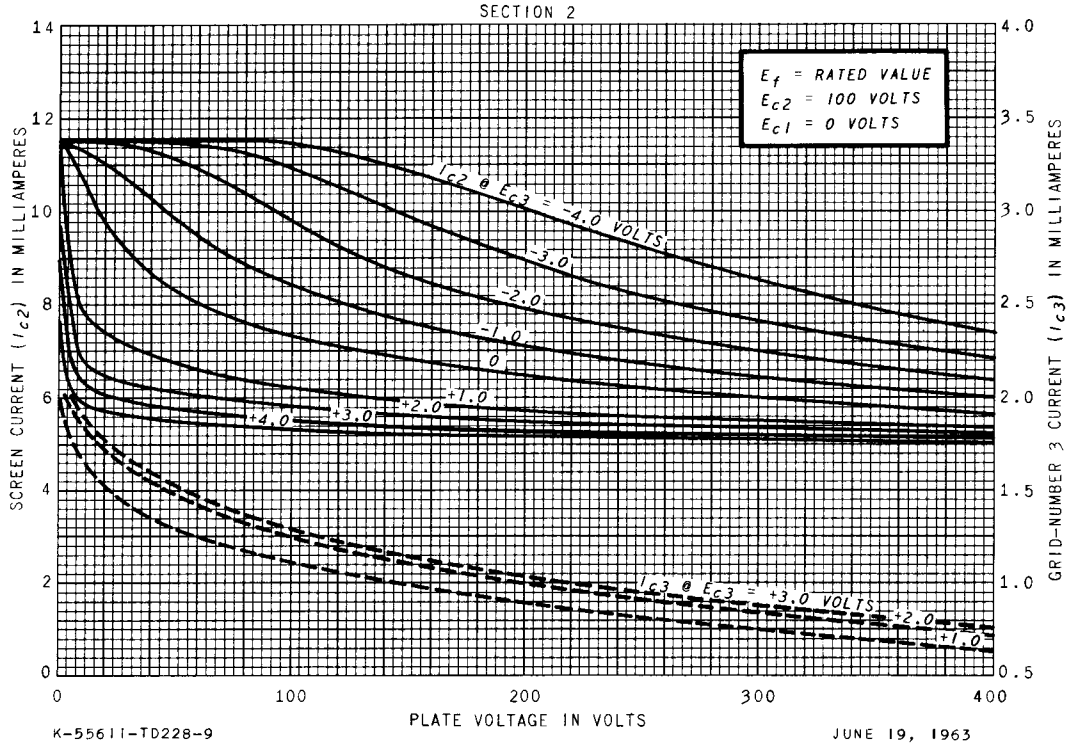
AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



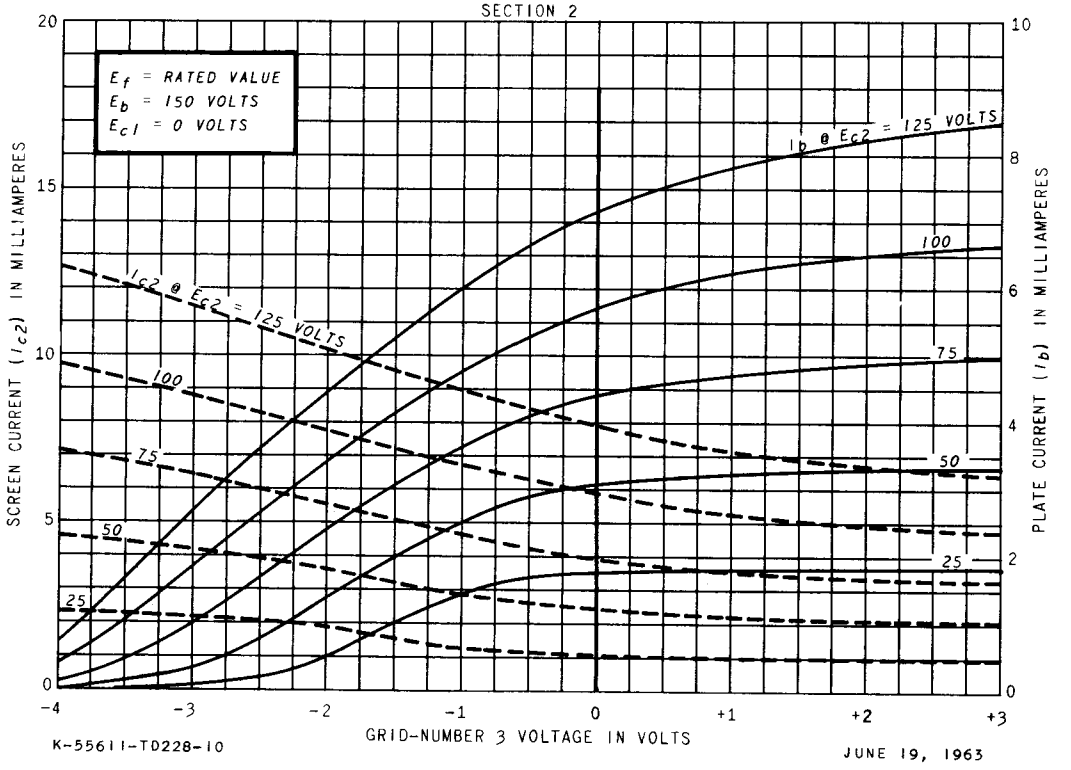
AVERAGE CHARACTERISTICS



K-55611-TD228-9

JUNE 19, 1963

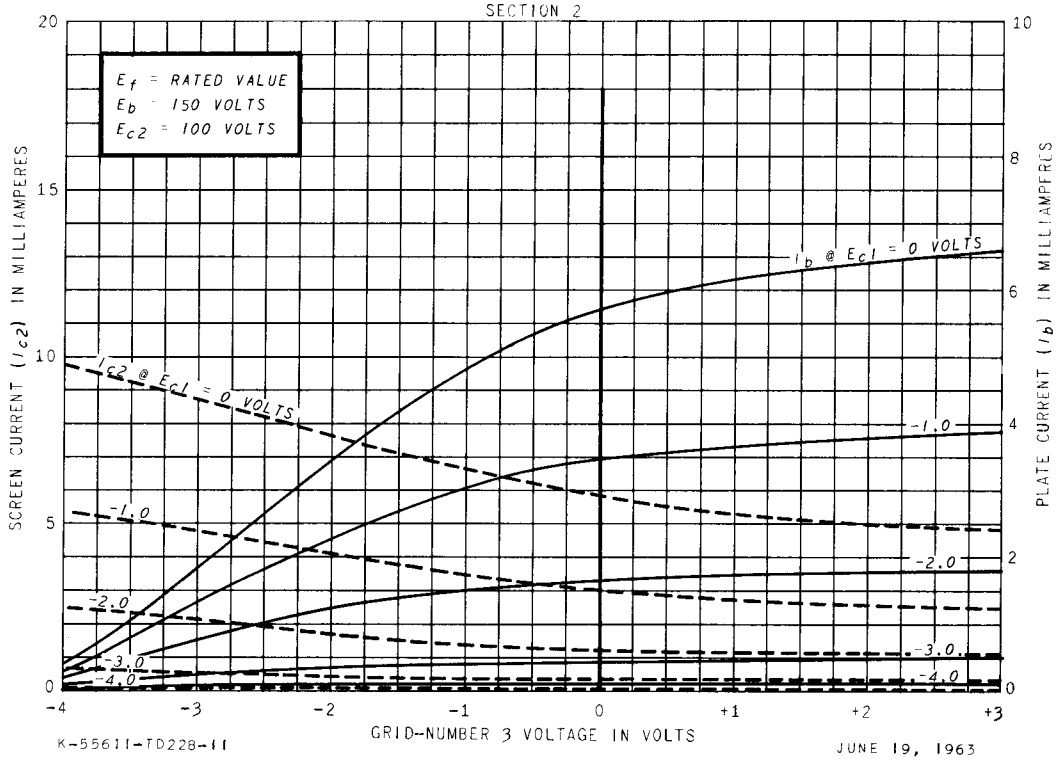
AVERAGE TRANSFER CHARACTERISTICS



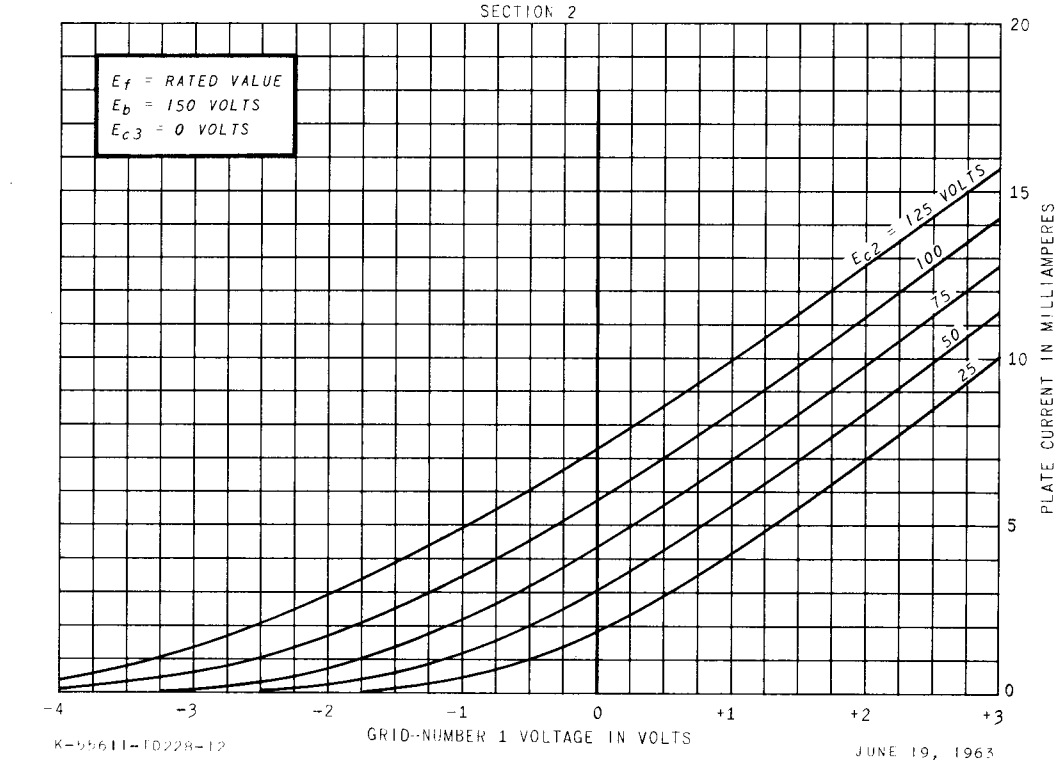
K-55611-TD228-10

JUNE 19, 1963

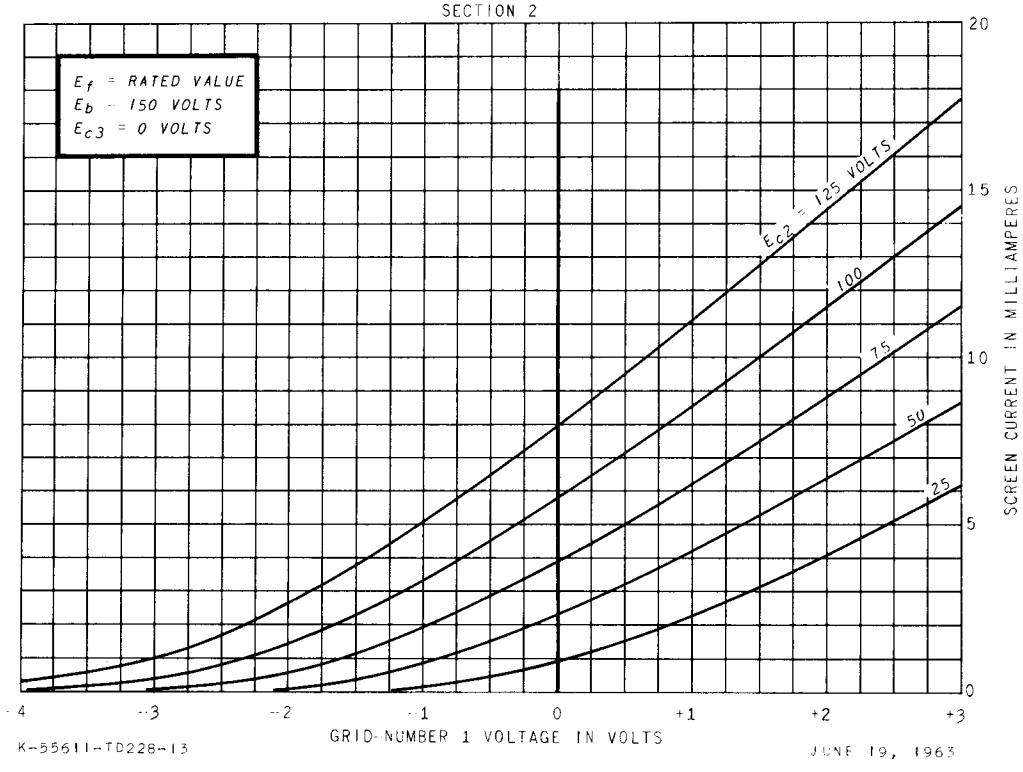
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

6U8-A/5U8

TRIODE-PENTODE

DESCRIPTION AND RATING

The 6U8-A is a miniature tube which contains a sharp-cutoff pentode and a medium-mu triode in one envelope. Each section has a separate cathode and is electrically independent. The tube is primarily intended for service as a combined triode oscillator and pentode mixer in television and FM receivers, although it is also suitable for a wide variety of general-purpose applications.

Except for heater ratings, the 5U8 is identical to the 6U8-A.

GENERAL

ELECTRICAL

	5U8	6U8-A	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	4.7	6.3	Volts
Heater Current	0.6±6%	0.45±6%	Ampere
Heater Warm-up Time*	11	11	Seconds
Direct Interelectrode Capacitances			

	With Shield†	Without Shield	
Pentode Section			
Grid-Number 1 to Plate: (Pg1 to Pp), max.	0.007	0.015	μμf
Input: Pg1 to (h+Pk+Pg2+Pg3+i.s.)	5.0	5.0	μμf
Output: Pp to (h+Pk+Pg2+Pg3+i.s.)	3.5	2.6	μμf
Heater to Cathode: h to (Pk+Pg3+i.s.)	3.0#	3.0	μμf
Triode Section			
Grid to Plate: (Tg to Tp)	1.8	1.8	μμf
Input: Tg to (Tk+h+Pk+Pg3+i.s.)	2.8	2.8	μμf
Output: Tp to (Tk+h+Pk+Pg3+i.s.)	2.0	1.5	μμf
Heater to Cathode: (h to Tk)	3.0#	3.0	μμf
Pentode Grid-Number 1 to Triode Plate: (Pg1 to Tp), maximum	0.2	0.2	μμf
Pentode Plate to Triode Plate: (Pp to Tp), maximum	0.02	0.1	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	——	Volts
Screen Voltage—See Screen Rating Chart, Page 2			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.0	2.5	Watts
Screen Dissipation	0.55	——	Watt

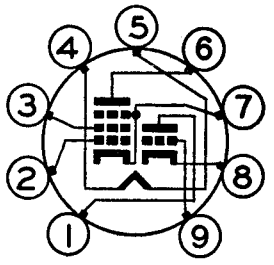
(Cont'd on Page 2)

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GENERAL ELECTRIC

Supersedes ET-T1270 dated 3-56

BASING DIAGRAM

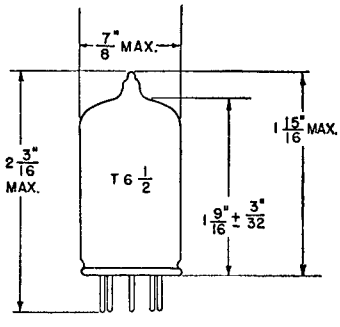


EIA 9AE

TERMINAL CONNECTIONS

Pin 1—Triode Plate
Pin 2—Pentode Grid Number 1
Pin 3—Pentode Grid Number 2 (Screen)
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Plate
Pin 7—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 8—Triode Cathode
Pin 9—Triode Grid

PHYSICAL DIMENSIONS



EIA 6-2

MAXIMUM RATINGS (Cont'd)

	Pentode Section	Triode Section	
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.5	——	Megohm
With Cathode Bias	1.0	——	Megohm

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

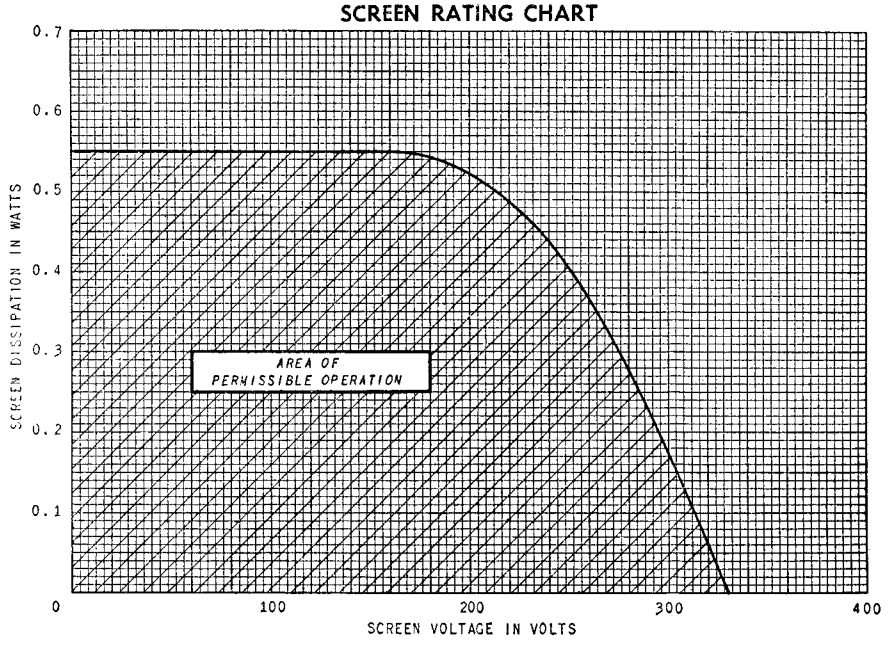
CLASS A_1 AMPLIFIER	Pentode Section		Triode Section	
Plate Voltage	100	125	125	Volts
Screen Voltage	70	110	——	Volts
Grid-Number 1 Voltage	0	−1.0	−1.0	Volt
Amplification Factor	——	——	40	
Plate Resistance, approximate	——	200,000	5300	Ohms
Transconductance	5500	5000	7500	Micromhos
Plate Current	——	9.5	13.5	Milliamperes
Screen Current	——	3.5	——	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 20 Microamperes	——	−8	−9	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (EIA 315) connected to pin 4 unless otherwise indicated.

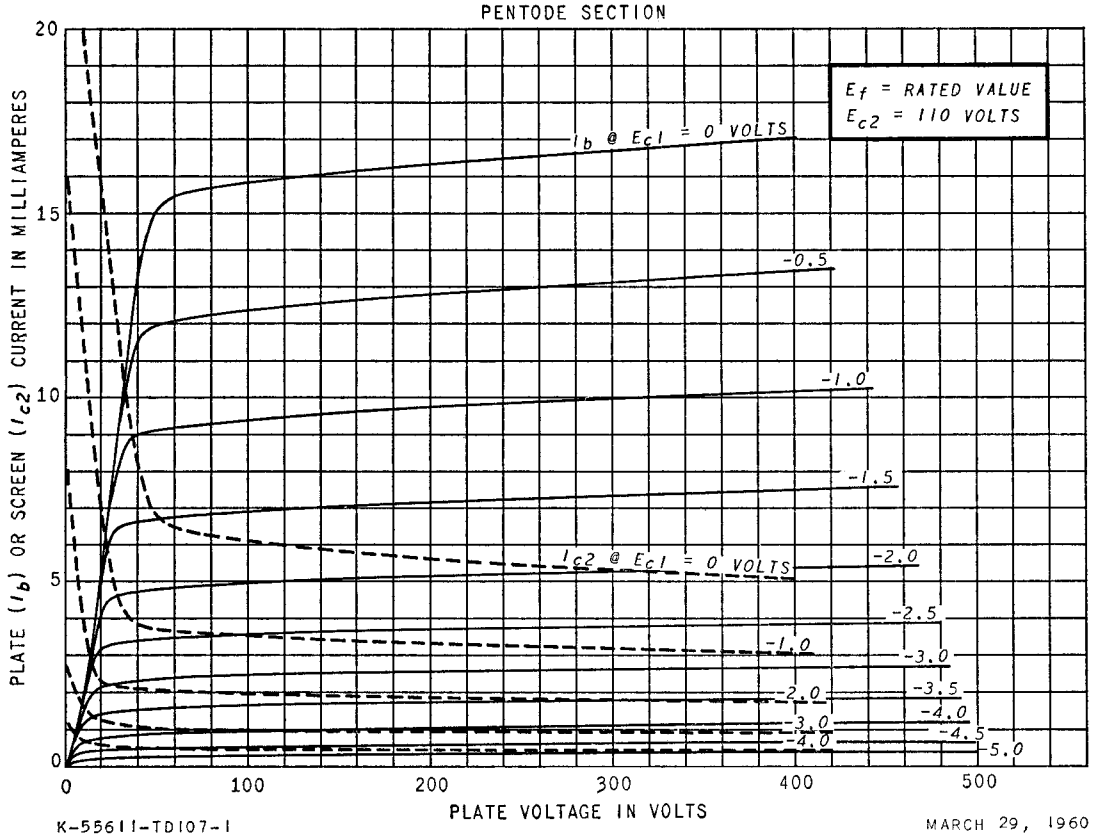
With external shield (EIA 315) connected to pin 6.

SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

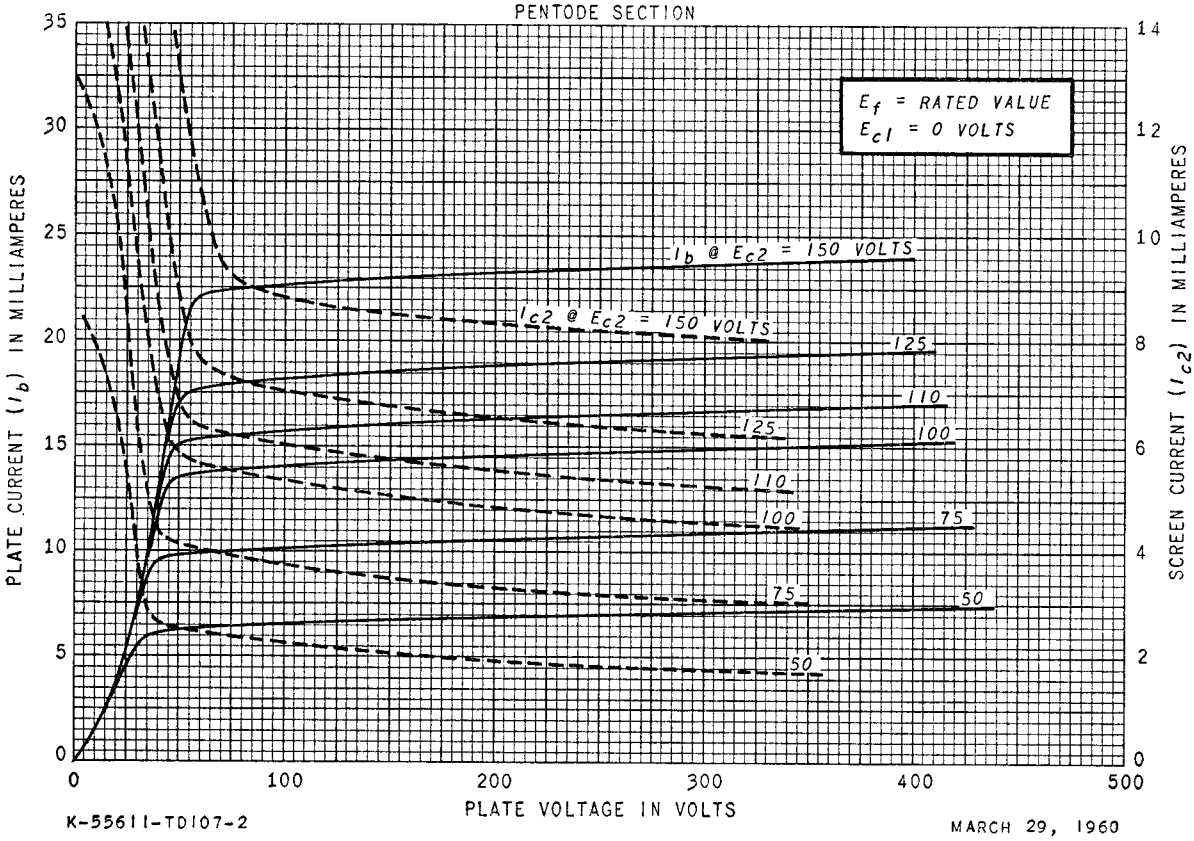


K-55611-TD107-1

MARCH 29, 1960

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

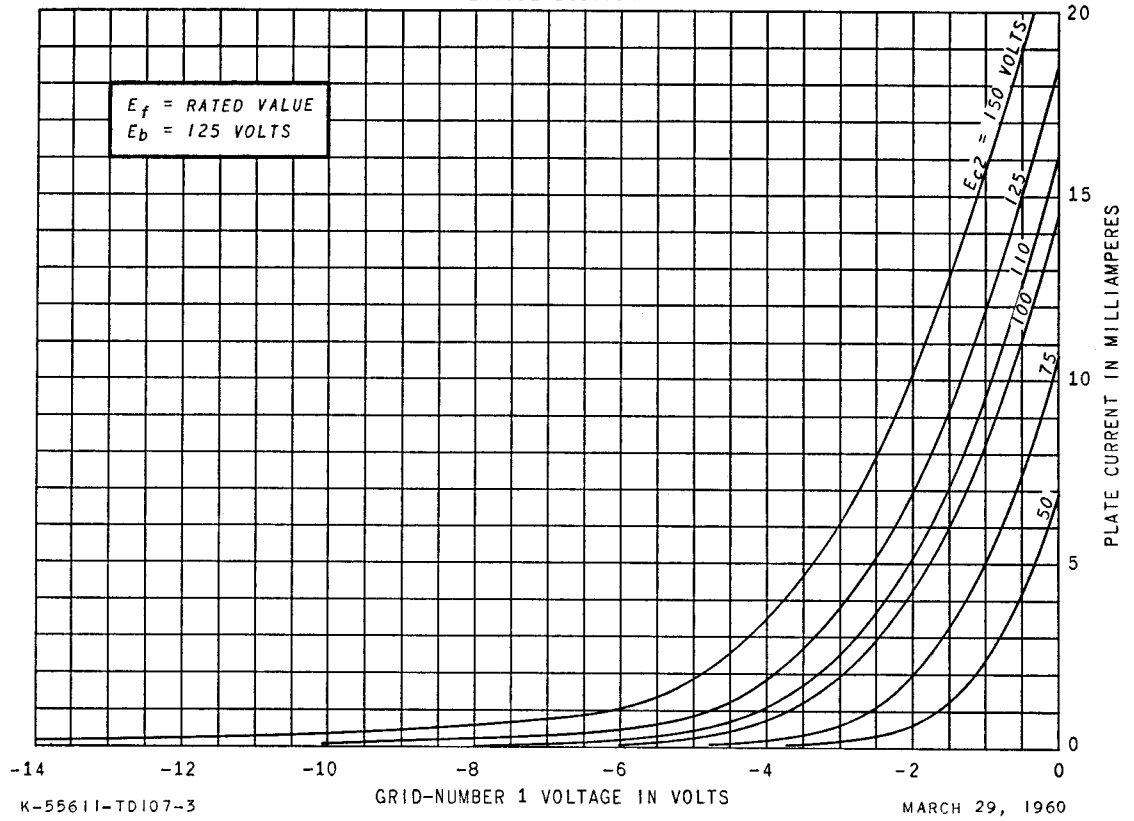


K-55611-TD107-2

MARCH 29, 1960

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

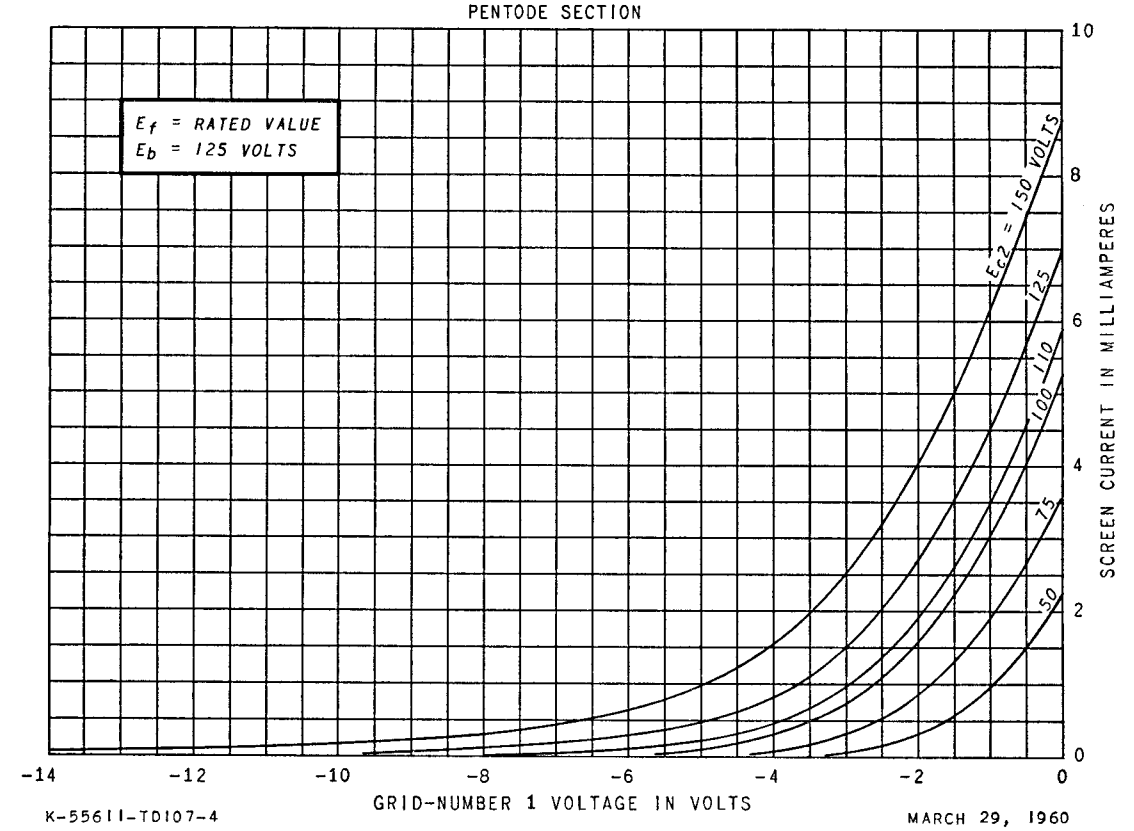


K-55611-TD107-3

MARCH 29, 1960

AVERAGE TRANSFER CHARACTERISTICS

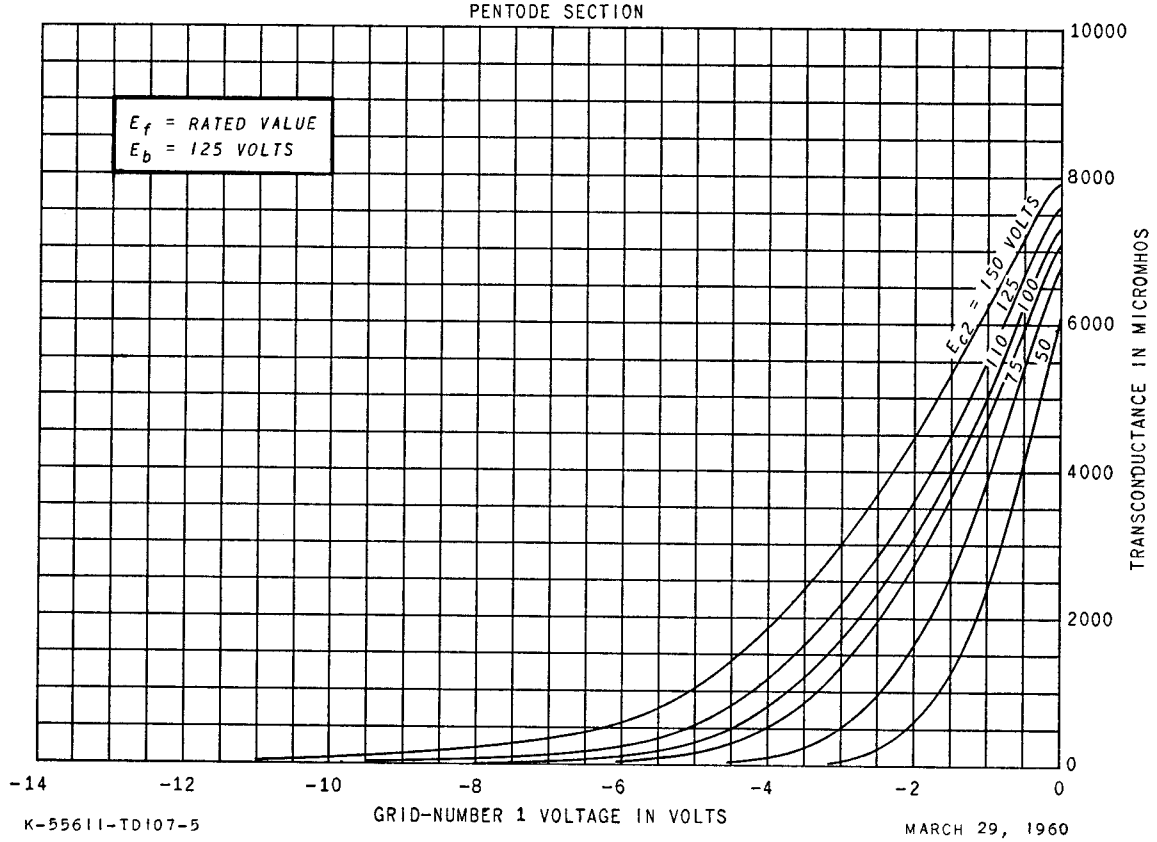
PENTODE SECTION



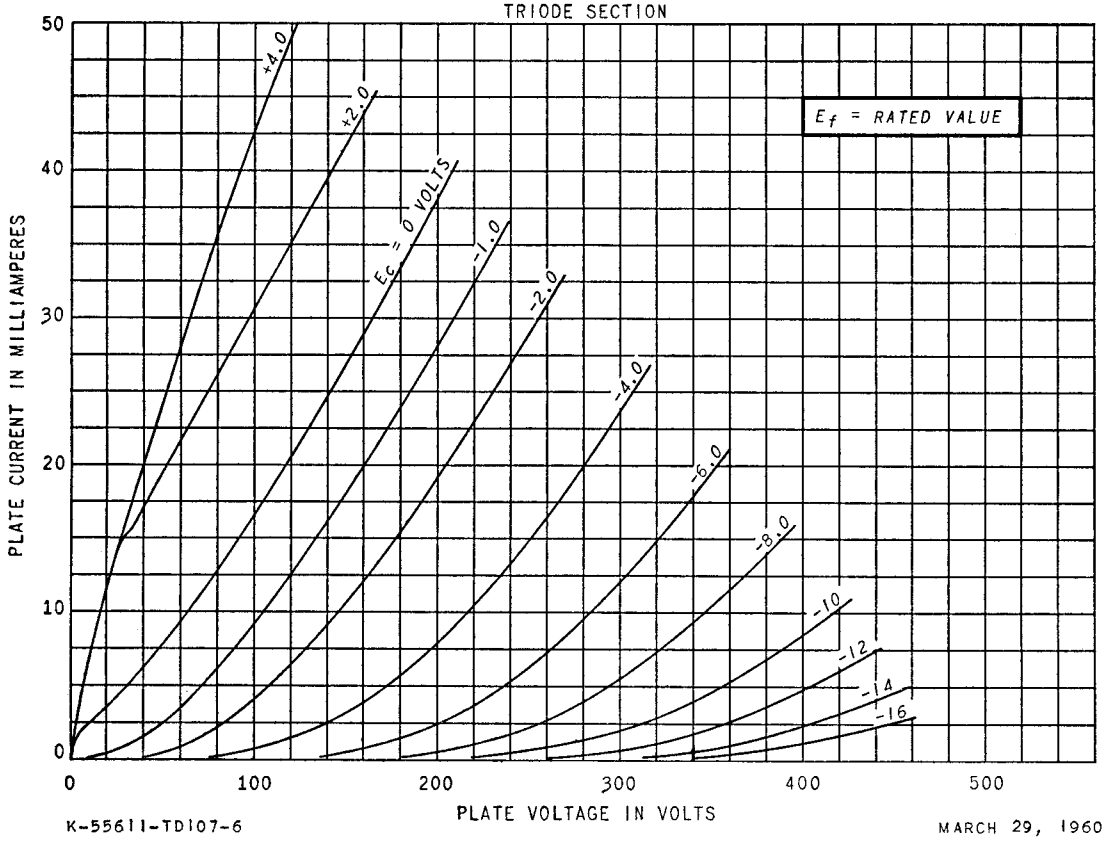
K-55611-TD107-4

MARCH 29, 1960

AVERAGE TRANSFER CHARACTERISTICS

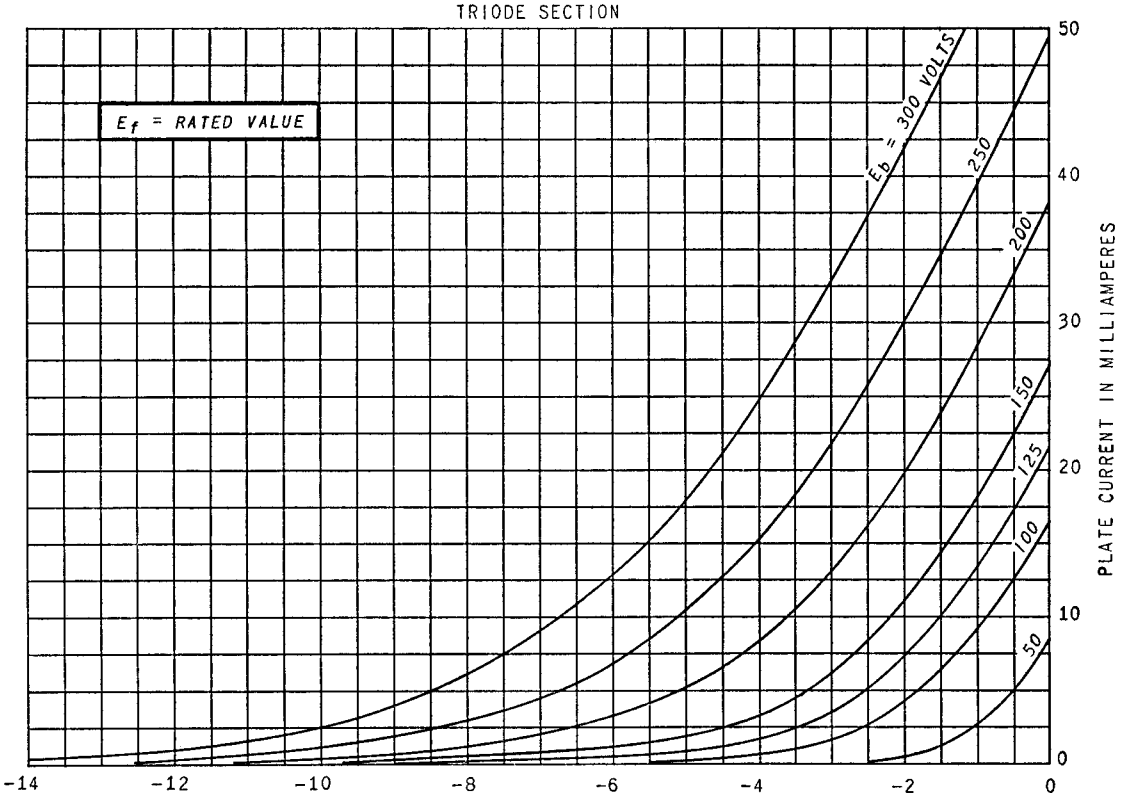


AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION

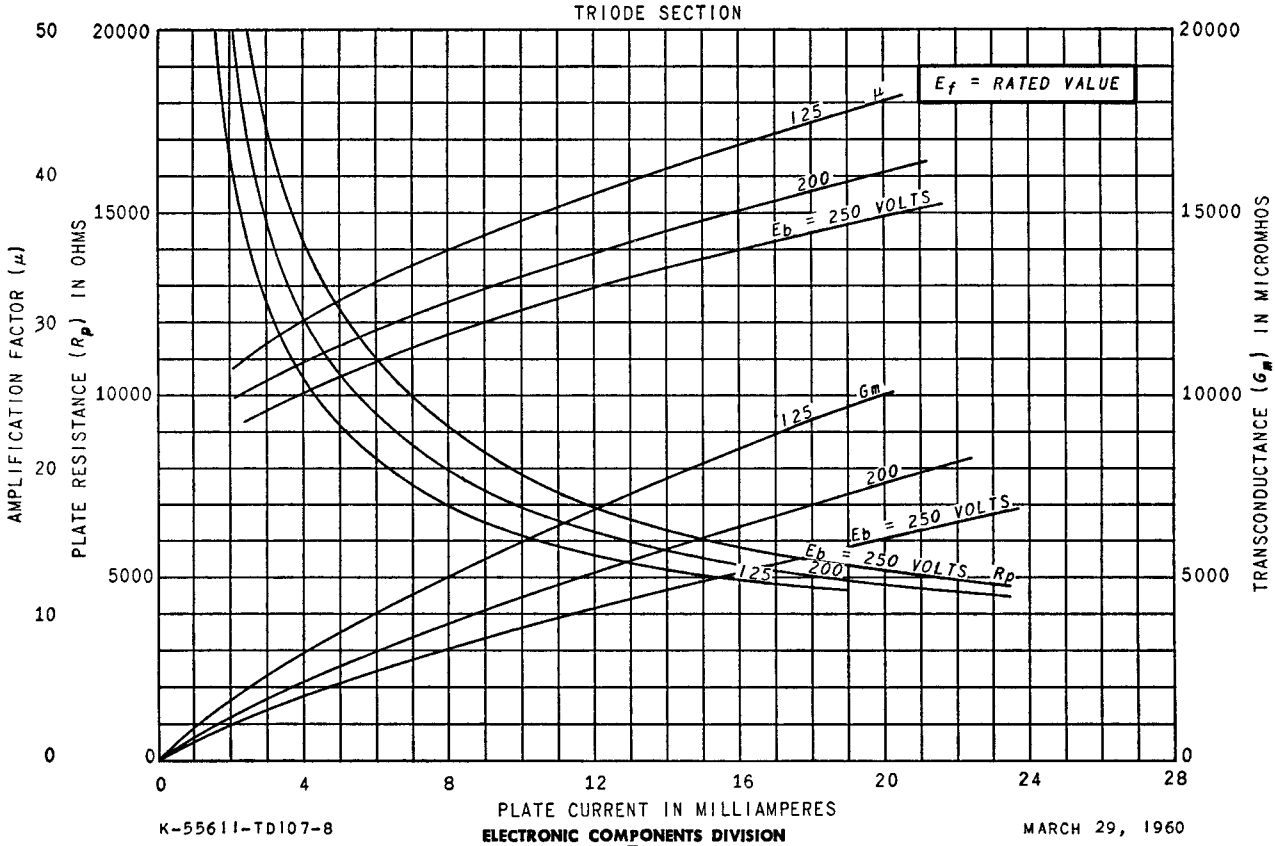


K-5561I-TD107-7

MARCH 29, 1960

AVERAGE CHARACTERISTICS

TRIODE SECTION



K-5561I-TD107-8

MARCH 29, 1960

ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5,N. Y.

PRINTED IN U.S.A.

ELECTRONICS

6U10

COMPACTRON THREE-SECTION TRIODE

DESCRIPTION AND RATING

The 6U10 is a compactron containing two medium-mu triodes and one high-mu triode.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

	Series Circuit*	Parallel Circuit‡	
Heater Voltage, AC or DC	6.3	6.3±0.6§	Volts
Heater Current	0.6±0.04§	0.6¶	Amperes
Heater Warm-up Time, Average#	11	---	Seconds

Direct Interelectrode Capacitances△

	Section 1	Section 2	Section 3	
Grid to Plate: (g to p)	1.3	1.3	1.2	pf
Input: g to (h + k)	1.7	1.5	1.8	pf
Output: p to (h + k)	0.26	0.28	0.9	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-56

Maximum Diameter	1.188	Inches
Maximum Over-all Length	1.875	Inches
Maximum Seated Height	1.500	Inches

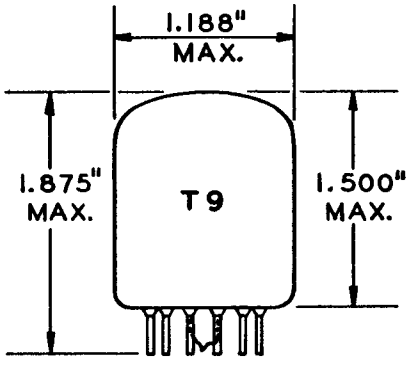
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

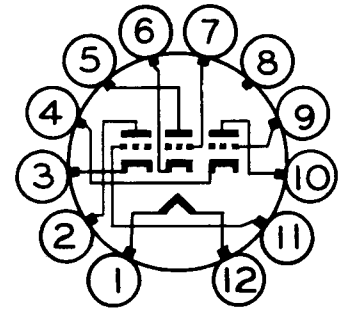


EIA 9-56

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate (Section 3)
Pin 3 - Cathode (Section 3)
Pin 4 - Cathode (Section 1)
Pin 5 - Plate (Section 2)
Pin 6 - Cathode (Section 2)
Pin 7 - Grid (Section 2)
Pin 8 - No Connection
Pin 9 - Grid (Section 1)
Pin 10 - Plate (Section 1)
Pin 11 - Grid (Section 3)
Pin 12 - Heater

BASING DIAGRAM



EIA 12FE

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES	Sections 1 and 3	Section 2	
Plate Voltage	330	330	Volts
Positive DC Grid Voltage	0	0	Volts
Negative DC Grid Voltage	50	50	Volts
Plate Dissipation	2.0	1.0	Watts
DC Cathode Current	20	---	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	275	200	Volts
Grid Circuit Resistance**			
With Fixed Bias	1.0	0.5	Megohms
With Cathode Bias	2.0	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Sections 1 and 3	Section 2	
Plate Voltage	200	200	Volts
Grid Voltage	-6.0	-1.5	Volts
Amplification Factor	17.5	98	
Plate Resistance, approximate	7700	61000	Ohms
Transconductance	2300	1600	Micromhos
Plate Current	9.6	1.2	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes	-15	---	Volts
Grid Voltage, approximate Ib = 35 Microamperes	---	-3	Volts

NOTES

* Operated with the heater in series with the heaters of other tubes having the same bogey heater current.

‡ Operated with the heater in parallel with the heaters of other tubes having the same bogey heater voltage.

§ For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance; for series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

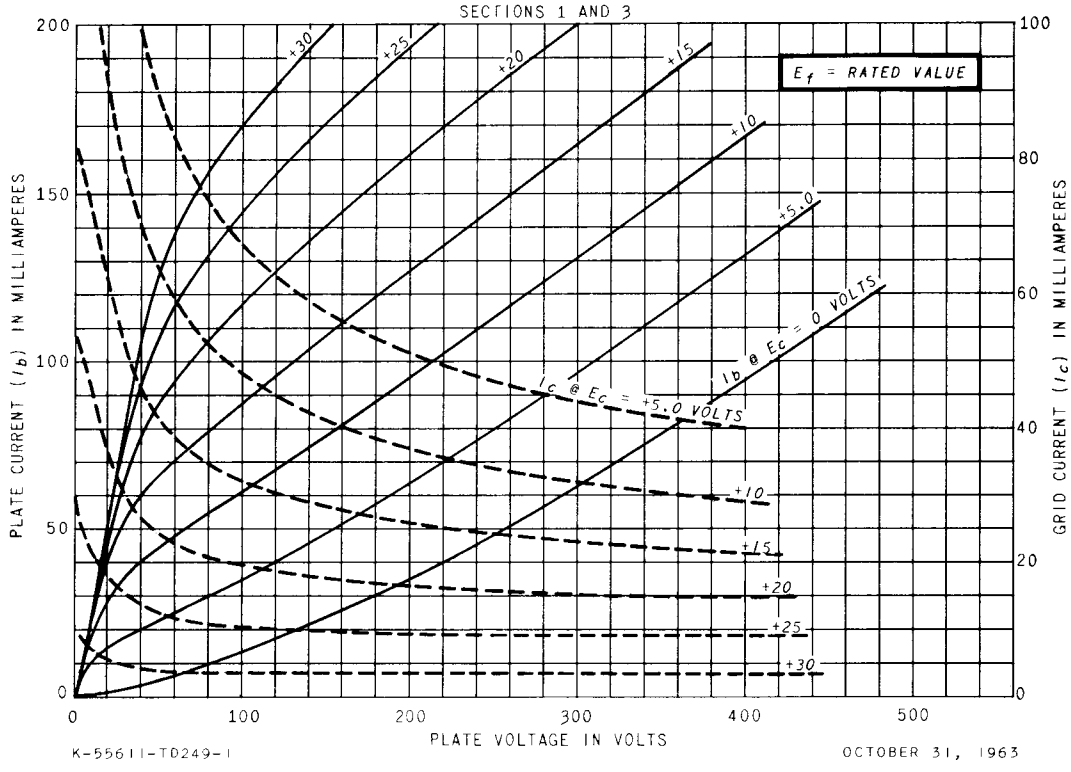
¶ Heater current of a bogey tube at Ef = 6.3 volts.

The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

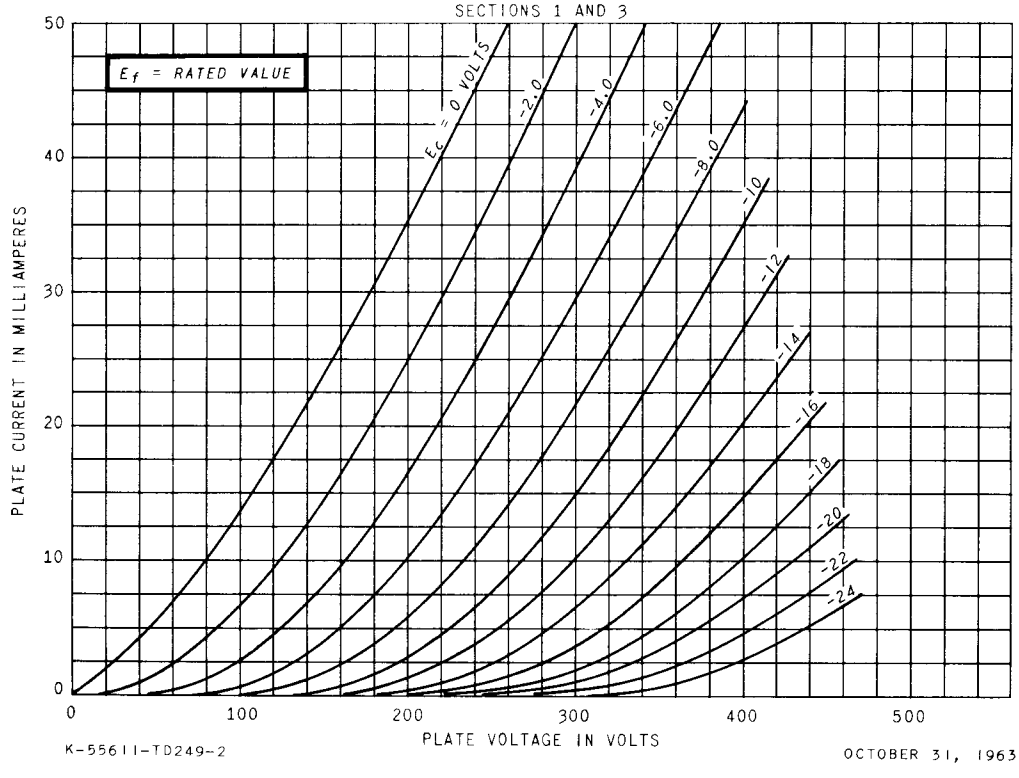
Δ Without external shield.

** In applications where self-bias is used with Section 2, a maximum grid curcuit resistance of 10 megohms is permissible, provided that the plate supply voltage and load resistance are such that the plate dissipation can never exceed 0.5 watts.

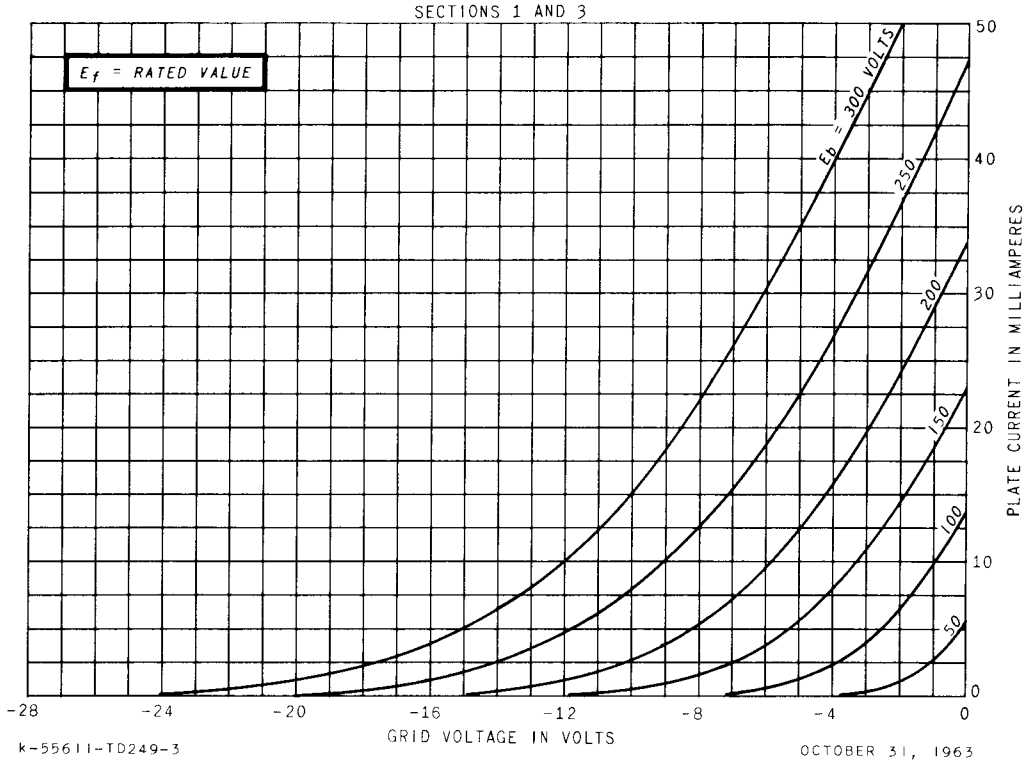
AVERAGE PLATE CHARACTERISTICS



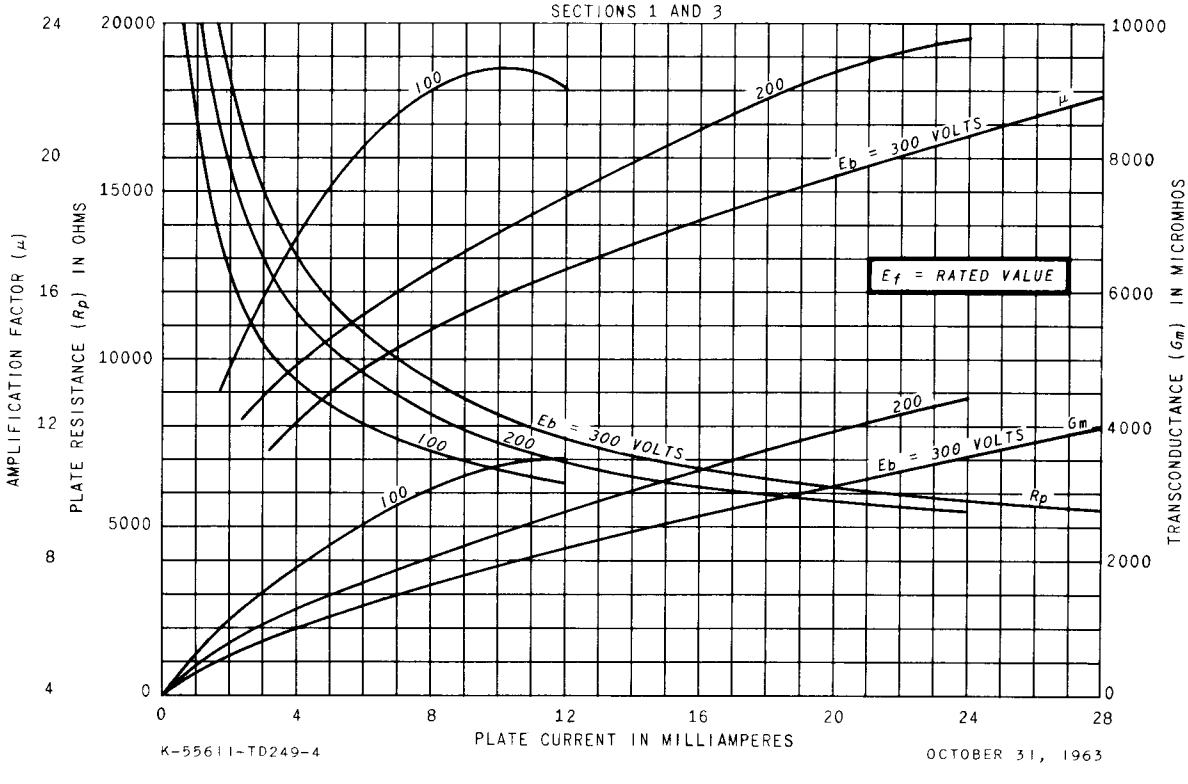
AVERAGE PLATE CHARACTERISTICS



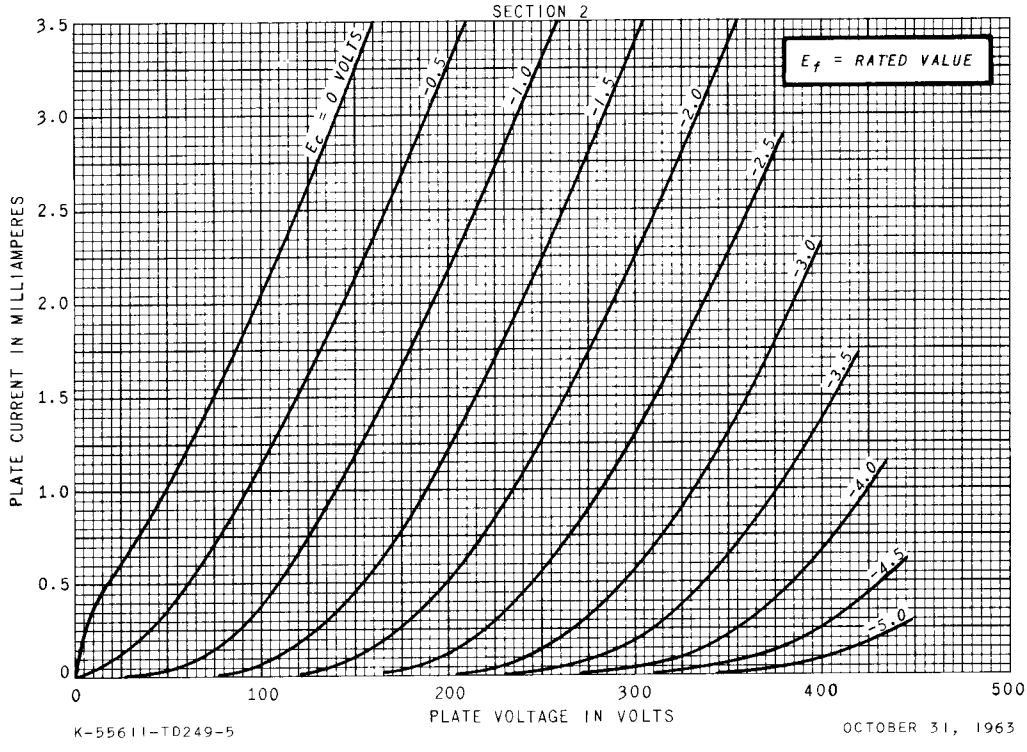
AVERAGE TRANSFER CHARACTERISTICS



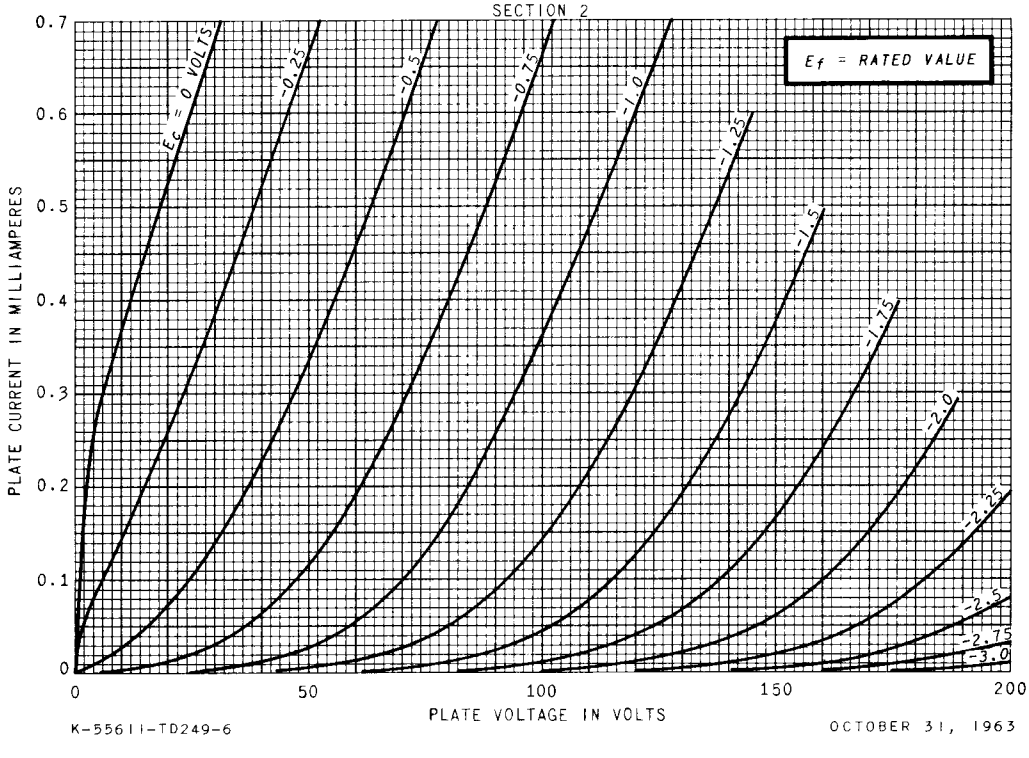
AVERAGE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

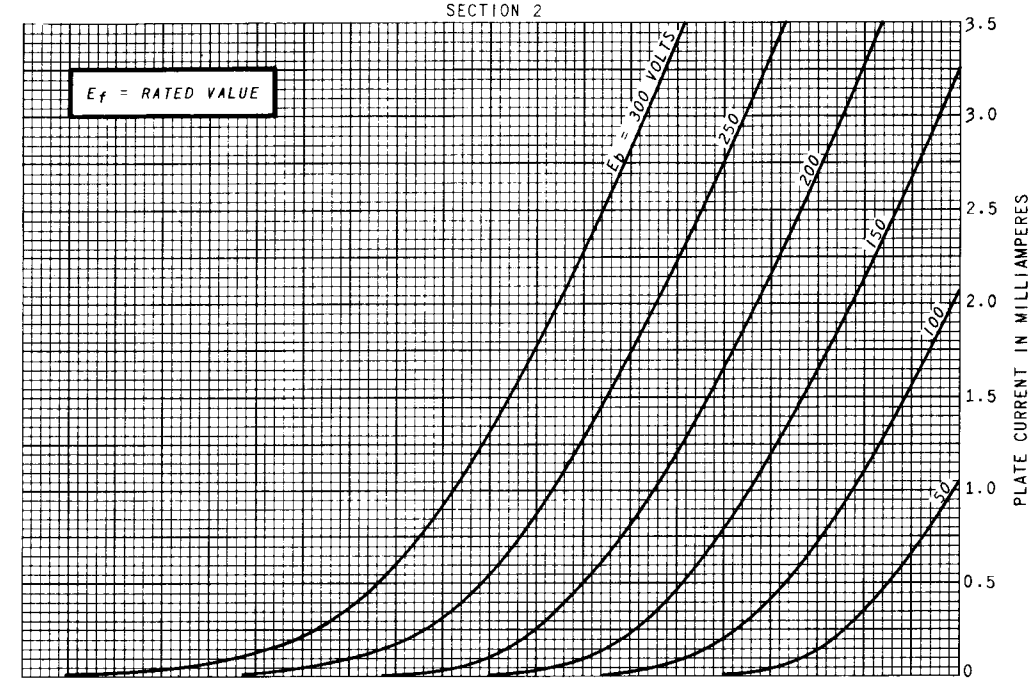


AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

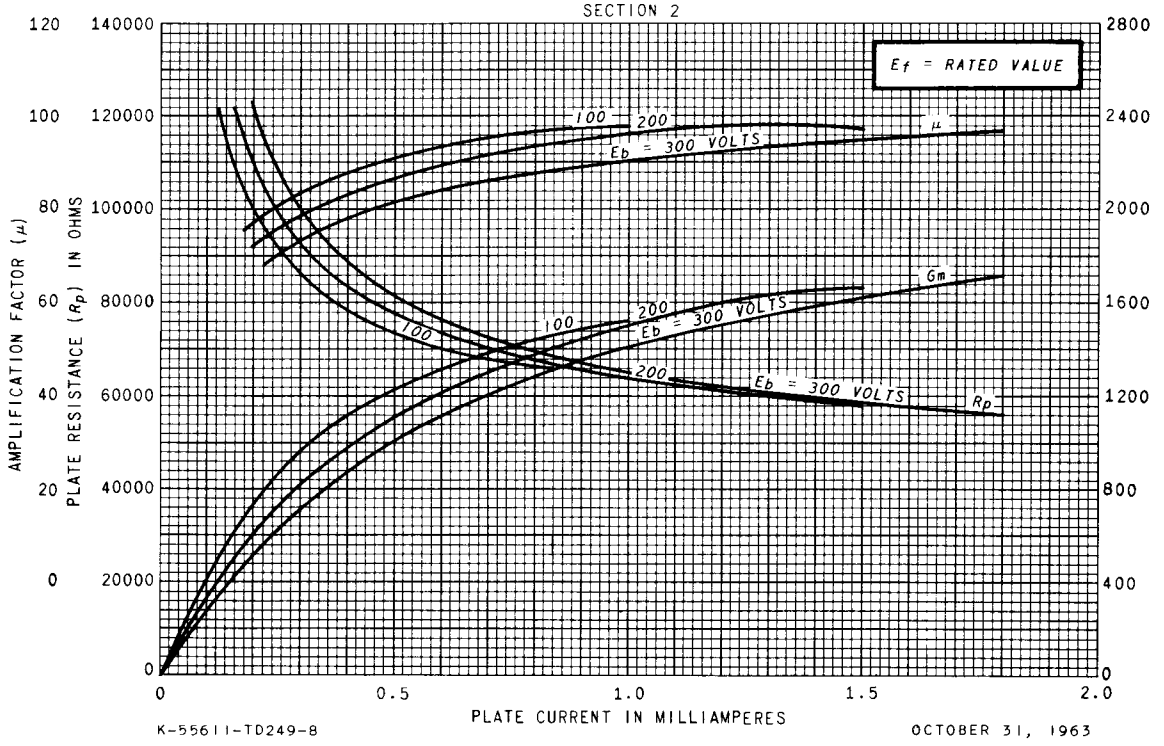


K-55611-TD249-7

OCTOBER 31, 1963

AVERAGE CHARACTERISTICS

SECTION 2



K-55611-TD249-8

OCTOBER 31, 1963

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

6V6-GT—5V6-GT

BEAM PENTODE

DESCRIPTION AND RATING

The 6V6-GT is a beam-power pentode designed for use in the audio-frequency power output stage of television and radio receivers. In this application, it is capable of supplying high power output with high sensitivity, high efficiency, and low third and higher-order harmonic distortion. The 6V6-GT may also be used as a triode-connected vertical-deflection amplifier in television receivers.

Except for heater ratings, the 5V6-GT is identical to the 6V6-GT. In addition, the 5V6-GT, as a result of its controlled heater warm-up characteristic, is especially suited for use in television receivers which employ series-connected heaters. When the 5V6-GT is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	5V6-GT	6V6-GT	
Heater Voltage, AC or DC	4.7	6.3	Volts
Heater Current	0.6	0.45	Amperes
Heater Warm-up Time*	11	____	Seconds
Direct Interelectrode Capacitances, approximate†			
Grid-Number 1 to Plate	0.7		$\mu\mu f$
Input	9.0		$\mu\mu f$
Output	7.5		$\mu\mu f$

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B6-81 or B7-7, Intermediate Shell Octal
or B6-84 or B7-59, Short Intermediate Shell Octal

MAXIMUM RATINGS

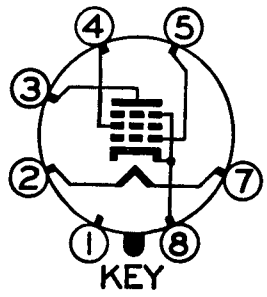
DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

	Class A_1 Amplifier	Vertical-Deflection Amplifier§ (Triode Connection)π	
DC Plate Voltage	315	315	Volts
Peak Positive Pulse Plate Voltage	—	1200▲	Volts
Screen-Supply Voltage	315	—	Volts
Screen Voltage	285	—	Volts
Peak Negative Grid-Number 1 Voltage	—	250	Volts
Plate Dissipation♦	12	9.0	Watts
Screen Dissipation	2.0	—	Watts
DC Cathode Current	—	35	Milliamperes
Peak Cathode Current	—	105	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	—	Megohms
With Cathode Bias	0.5	2.2	Megohms

GENERAL ELECTRIC

Supersedes ET-T351D, dated 6-53

BASING DIAGRAM



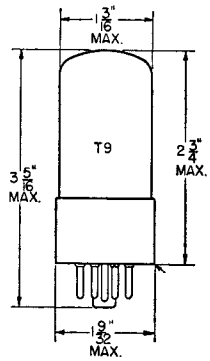
RETMA 7AC

TERMINAL CONNECTIONS

Pin 1—No Connection‡
Pin 2—Heater
Pin 3—Plate
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates

‡ Pin 1 omitted on bases B6-81 and B6-84.

PHYSICAL DIMENSIONS



RETMA 9-11
or 9-41

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	180	250	315	Volts
Screen Voltage	180	250	225	Volts
Grid-Number 1 Voltage	−8.5	−12.5	−13.0	Volts
Peak AF Grid-Number 1 Voltage	8.5	12.5	13.0	Volts
Plate Resistance, approximate	50000	50000	80000	Ohms
Transconductance	3700	4100	3750	Micromhos
Zero-Signal Plate Current	29	45	34	Milliamperes
Maximum-Signal Plate Current	30	47	35	Milliamperes
Zero-Signal Screen Current	3.0	4.5	2.2	Milliamperes
Maximum-Signal Screen Current	4.0	7.0	6.0	Milliamperes
Load Resistance	5500	5000	8500	Ohms
Total Harmonic Distortion, approximate	8	8	12	Percent
Maximum-Signal Power Output	2.0	4.5	5.5	Watts

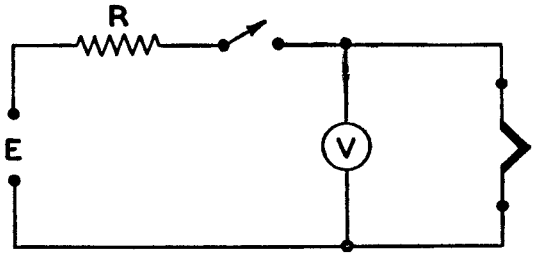
PUSH-PULL CLASS AB_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	250	285	Volts
Screen Voltage	250	285	Volts
Grid-Number 1 Voltage	−15	−19	Volts
Peak AF Grid-to-Grid Voltage	30	38	Volts
Zero-Signal Plate Current	70	70	Milliamperes
Maximum-Signal Plate Current	79	92	Milliamperes
Zero-Signal Screen Current	5.0	4.0	Milliamperes
Maximum-Signal Screen Current	13	13.5	Milliamperes
Effective Load Resistance, Plate-to-Plate	10000	8000	Ohms
Total Harmonic Distortion	5	3.5	Percent
Maximum-Signal Power Output	10	14	Watts

AVERAGE CHARACTERISTICS, TRIODE CONNECTIONπ

Plate Voltage	250	Volts
Grid-Number 1 Voltage	−12.5	Volts
Amplification Factor	9.8	
Plate Resistance, approximate	1960	Ohms
Transconductance	5000	Micromhos
Plate Current	49.5	Milliamperes
Grid-Number 1 Voltage, approximate I_b = 0.5 Milliampere	−36	Volts

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E = 18.7 volts (RMS or DC), V_1 = 3.73 volts (RMS or DC), and R = 23.5 ohms.



† Without external shield.

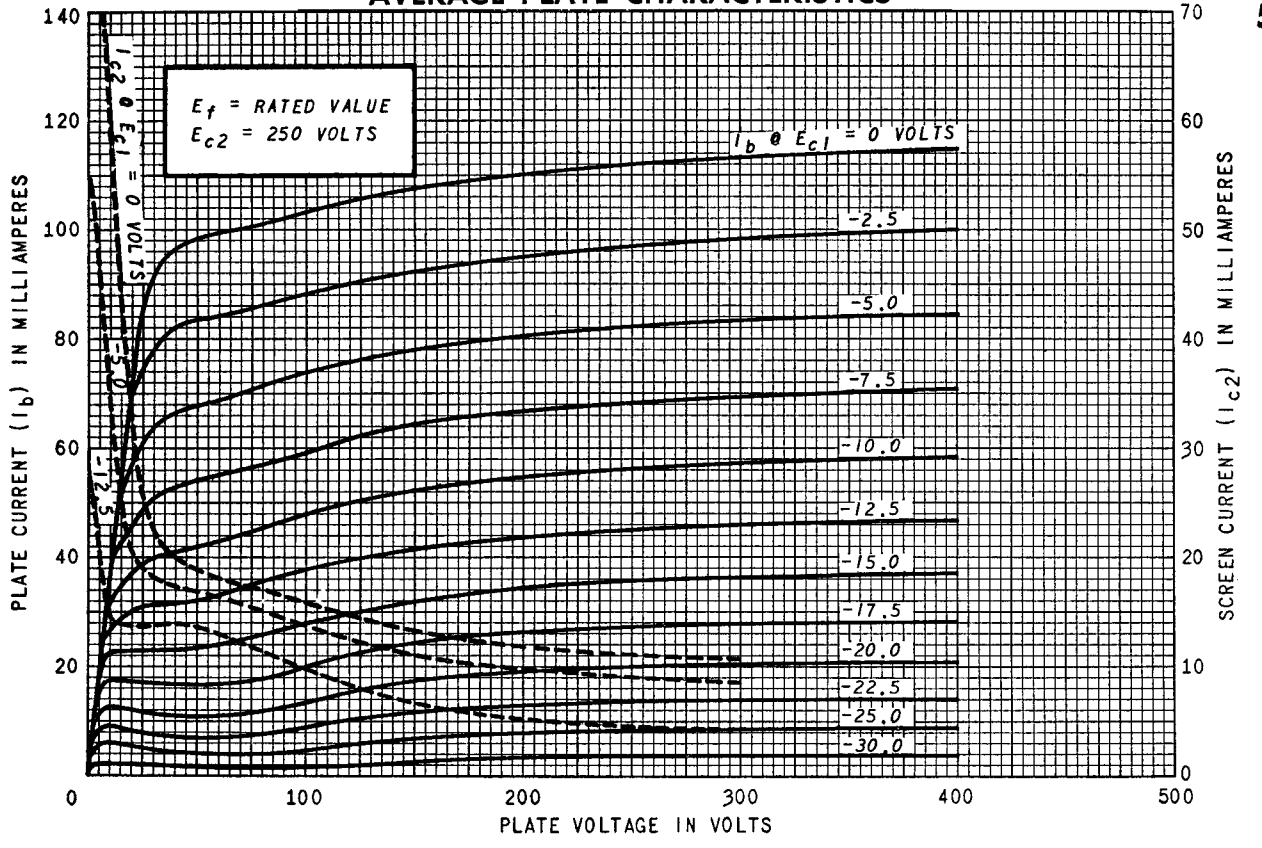
§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

π With screen connected to plate.

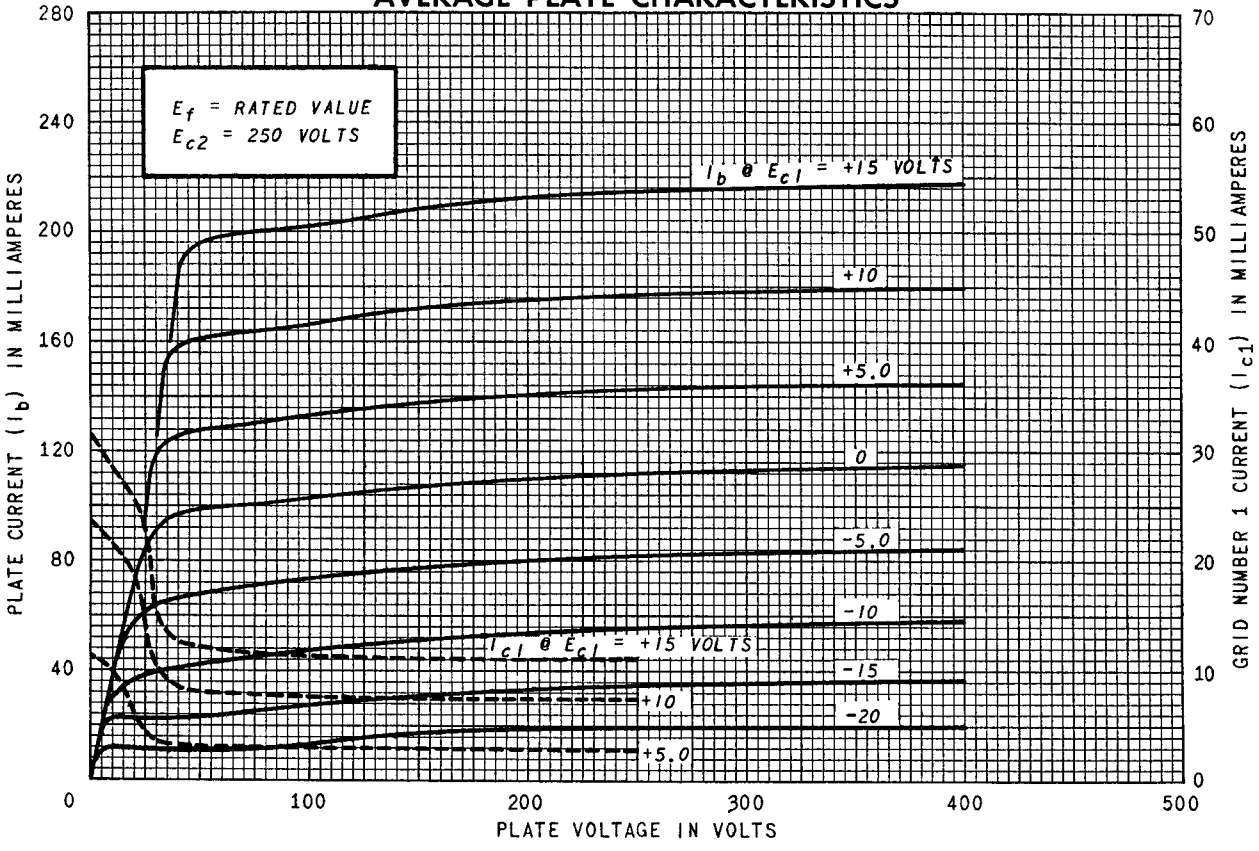
▲ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

♦ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

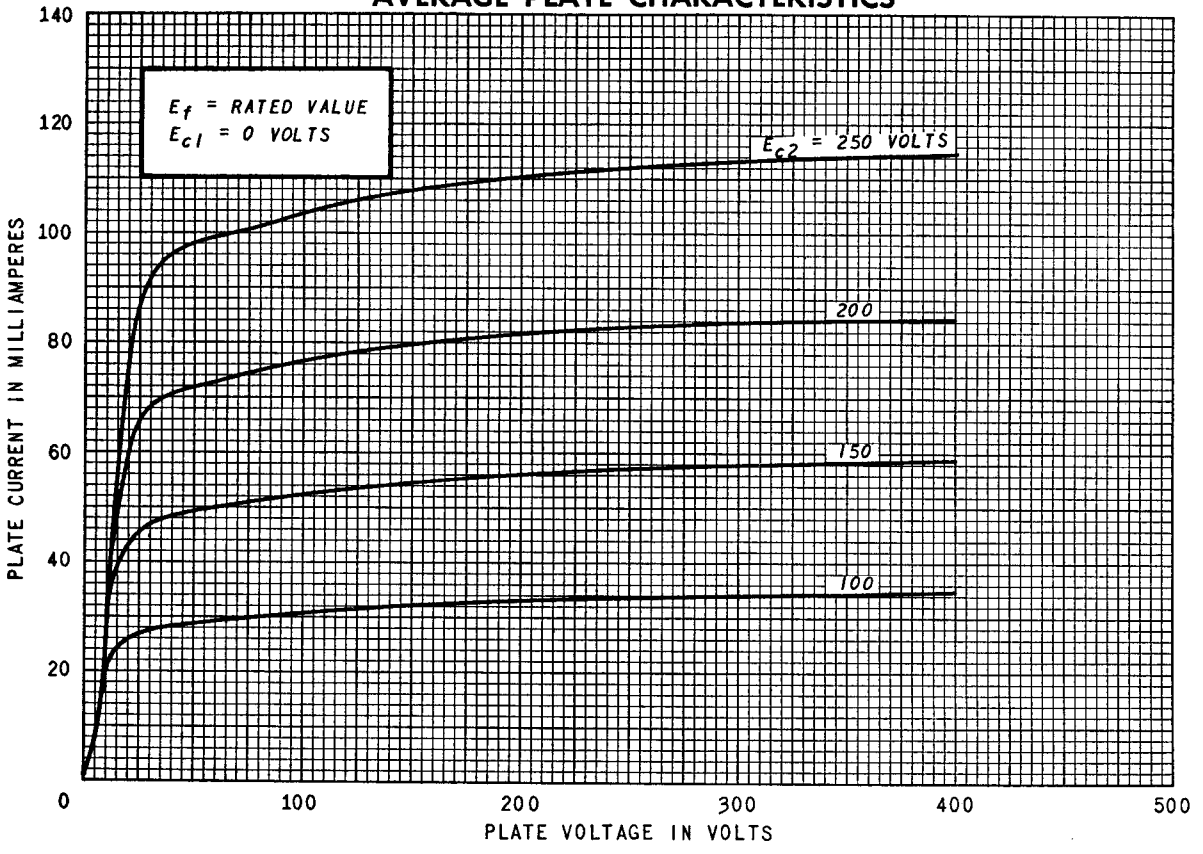
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

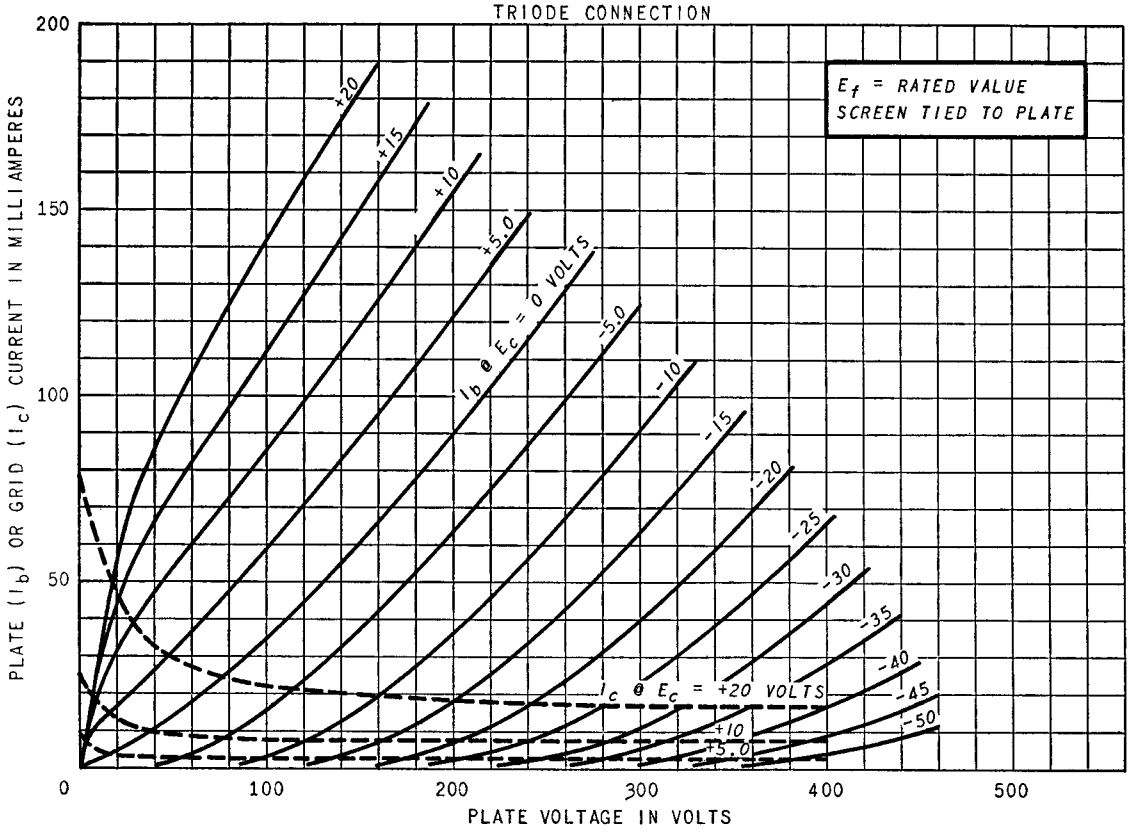


AVERAGE PLATE CHARACTERISTICS

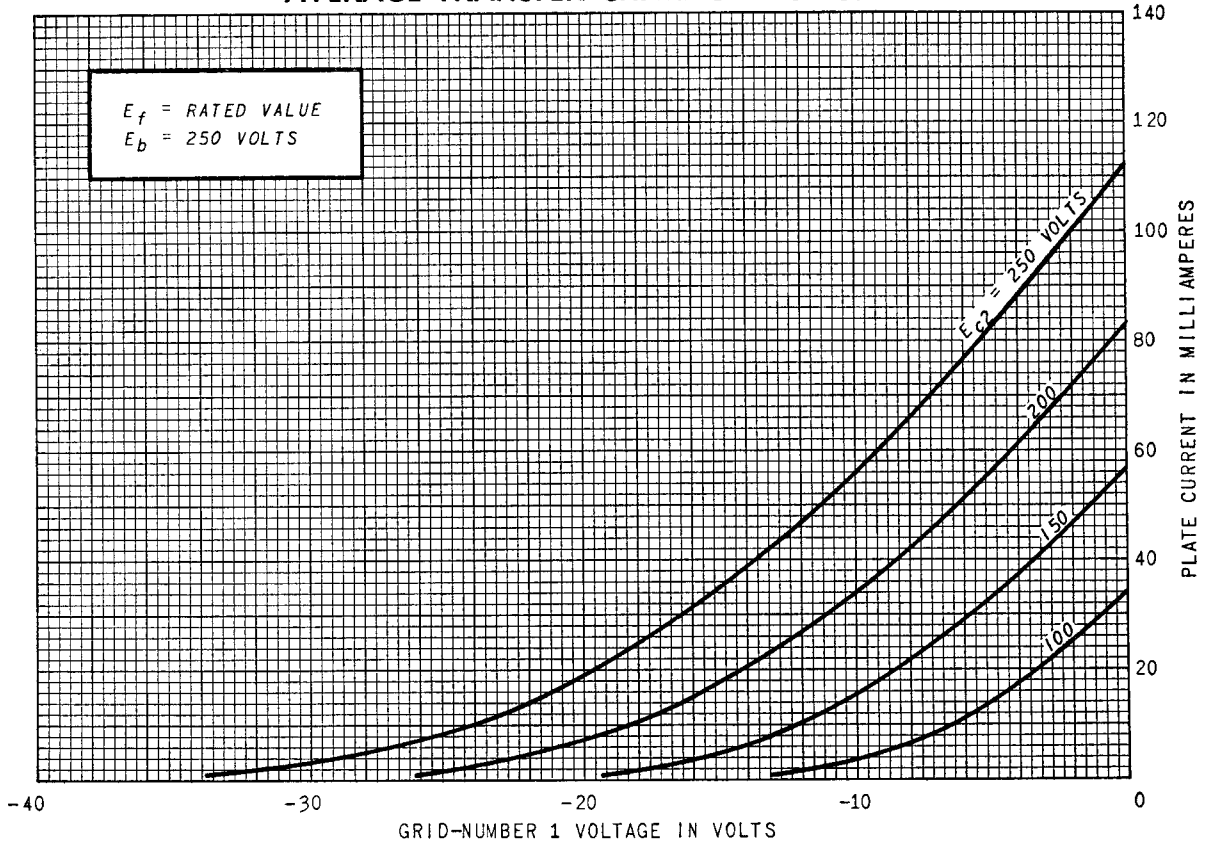


AVERAGE PLATE CHARACTERISTICS

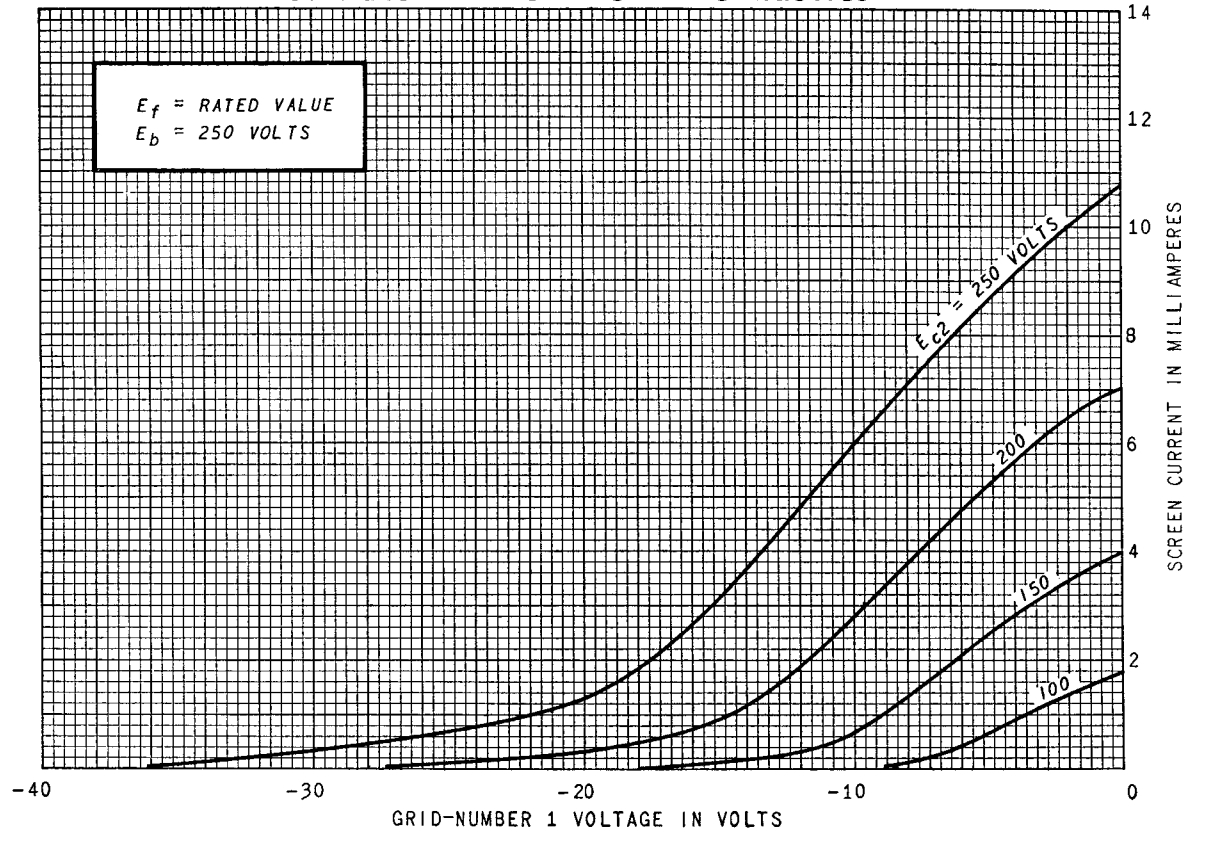
TRIODE CONNECTION



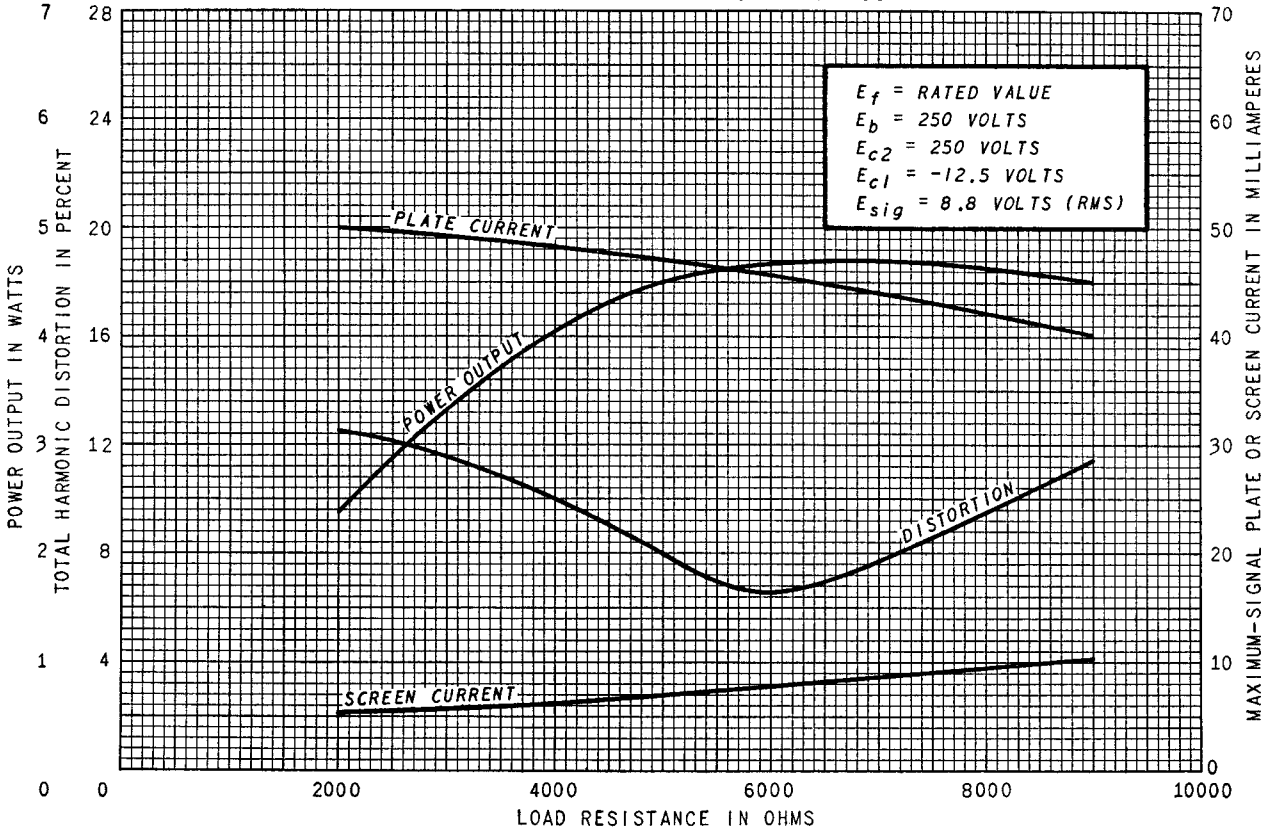
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



OPERATION CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

PRINTED IN U.S.A.

—PRODUCT INFORMATION—

6V6-GTA

Beam Pentode

The 6V6-GTA is a beam-power pentode designed for use in the audio-frequency power output stage of television and radio receivers. In this application, it is capable of supplying high power output with high sensitivity, high efficiency, and low third and higher-order harmonic distortion. The 6V6-GTA may also be used as a triode-connected vertical-deflection amplifier in television receivers.

Except for heater ratings, the 6V6-GTA is identical to the 6V6-GT.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

	Series Circuit*	Parallel Circuit‡	
Heater Voltage, AC or DC	6.3	6.3±0.6§	Volts
Heater Current	0.45±0.03§	0.45¶	Amperes
Heater Warm-up Time, Average#	11	---	Seconds
Direct Interelectrode Capacitances, Approximate△			
Grid-Number 1 to Plate: (g1 to p)	0.7		pf
Input: g1 to (h + k + g2 + b.p.)	9.0		pf
Output: p to (h + k + g2 + b.p.)	7.5		pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - B6-81 or B7-7, Intermediate Shell Octal or B6-84 or B7-59, Short Intermediate Shell Octal
Outline Drawing - EIA 9-11 or 9-41

Maximum Diameter	1.281	Inches
Maximum Bulb Diameter	1.188	Inches
Maximum Over-all Length	3.313	Inches
Maximum Seated Height	2.750	Inches

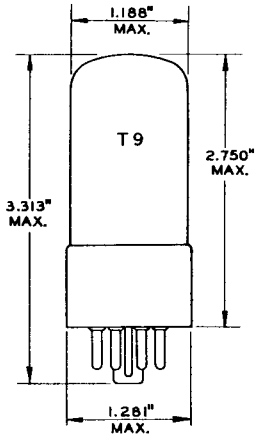
MAXIMUM RATINGS

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The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

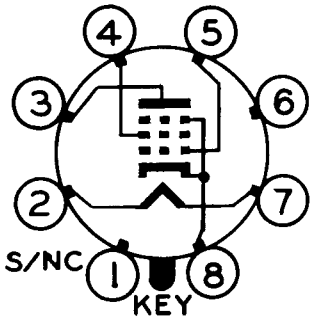


EIA 9-11 or 9-41

TERMINAL CONNECTIONS

Pin 1 - No Connection¢
Pin 2 - Heater
Pin 3 - Plate
Pin 4 - Grid Number 2 (Screen)
Pin 5 - Grid Number 1
Pin 6 - No Connection
Pin 7 - Heater
Pin 8 - Cathode and Beam Plates

BASING DIAGRAM



EIA 7AC

GENERAL ELECTRIC

Supersedes 6V6-GTA D and R Sheet dated 7-63

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

	Class A_1 Amplifier	Vertical Deflection Amplifier** (Triode Connection)‡‡	
DC Plate Voltage	350	350	Volts
Peak Positive Pulse Plate Voltage	---	1200§§	Volts
Screen Voltage	315	---	Volts
Peak Negative Grid-Number 1 Voltage	---	275	Volts
Plate Dissipation¶¶	14	10	Watts
Screen Dissipation	2.2	---	Watts
DC Cathode Current	---	40	Milliamperes
Peak Cathode Current	---	115	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	---	Megohms
With Cathode Bias	0.5	2.2	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	180	250	315	Volts
Screen Voltage	180	250	225	Volts
Grid-Number 1 Voltage	-8.5	-12.5	-13	Volts
Peak AF Grid-Number 1 Voltage	8.5	12.5	13	Volts
Plate Resistance, approximate	50000	50000	80000	Ohms
Transconductance	3700	4100	3750	Micromhos
Zero-Signal Plate Current	29	45	34	Milliamperes
Maximum-Signal Plate Current	30	47	35	Milliamperes
Zero-Signal Screen Current	3.0	4.5	2.2	Milliamperes
Maximum-Signal Screen Current	4.0	7.0	6.0	Milliamperes
Load Resistance	5500	5000	8500	Ohms
Total Harmonic Distortion, approximate	8	8	12	Percent
Maximum-Signal Power Output	2.0	4.5	5.5	Watts

PUSH-PULL CLASS AB_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	250	285	Volts
Screen Voltage	250	285	Volts
Grid-Number 1 Voltage	-15	-19	Volts
Peak AF Grid-to-Grid Voltage	30	38	Volts
Zero-Signal Plate Current	70	70	Milliamperes
Maximum-Signal Plate Current	79	92	Milliamperes
Zero-Signal Screen Current	5.0	4.0	Milliamperes
Maximum-Signal Screen Current	13	13.5	Milliamperes
Effective Load Resistance, Plate-to-Plate	10000	8000	Ohms
Total Harmonic Distortion	.5	3.5	Percent
Maximum-Signal Power Output	10	14	Watts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

AVERAGE CHARACTERISTICS, TRIODE CONNECTION

Plate Voltage	250	Volts
Grid-Number 1 Voltage	-12.5	Volts
Amplification Factor	9.8	
Plate Resistance, approximate	1960	Ohms
Transconductance	5000	Micromhos
Plate Current	49.5	Milliamperes
Grid Number 1 Voltage, approximate Ib = 0.5 Milliamperes	-36	Volts

NOTES

* Operated with the heater in series with the heaters of other tubes having the same bogey heater current.

‡ Operated with the heater in parallel with the heaters of other tubes having the same bogey heater current.

§ For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance; for series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

¶ Heater current of a bogey tube at Ef = 6.3 volts.

The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

Δ Without external shield.

¢ Pin 1 is omitted on bases B6-81 and B6-84.

** For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

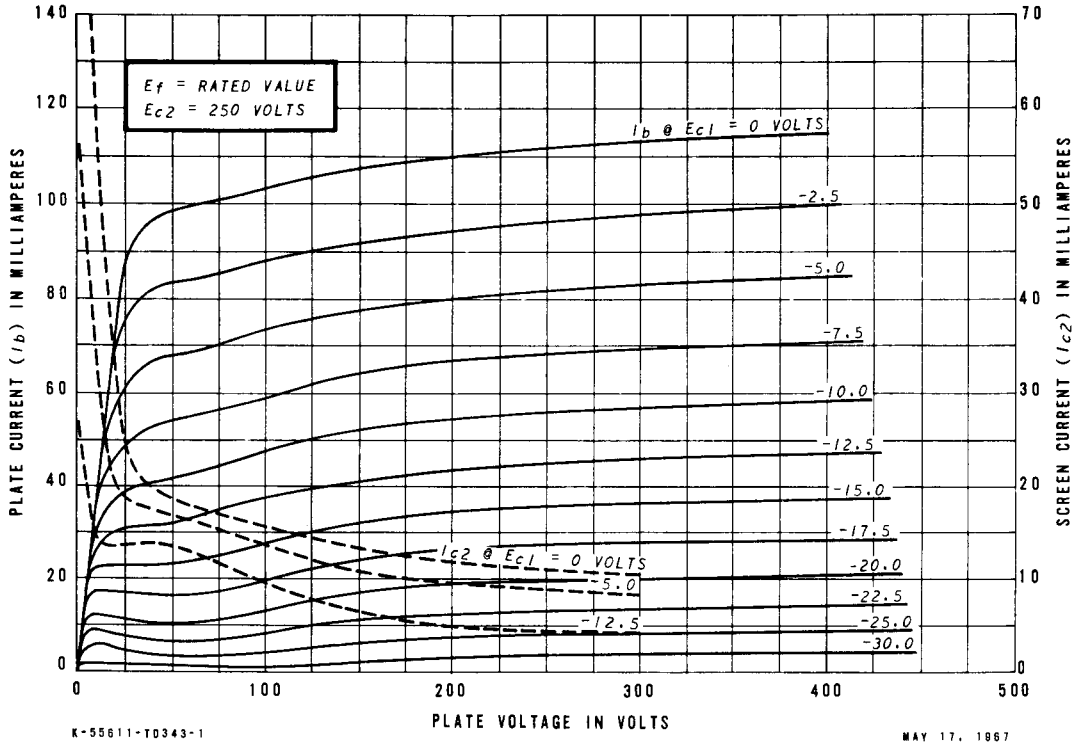
‡‡ With screen connected to plate.

§§ Value given is to be considered as an Absolute-Maximum rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

¶¶ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

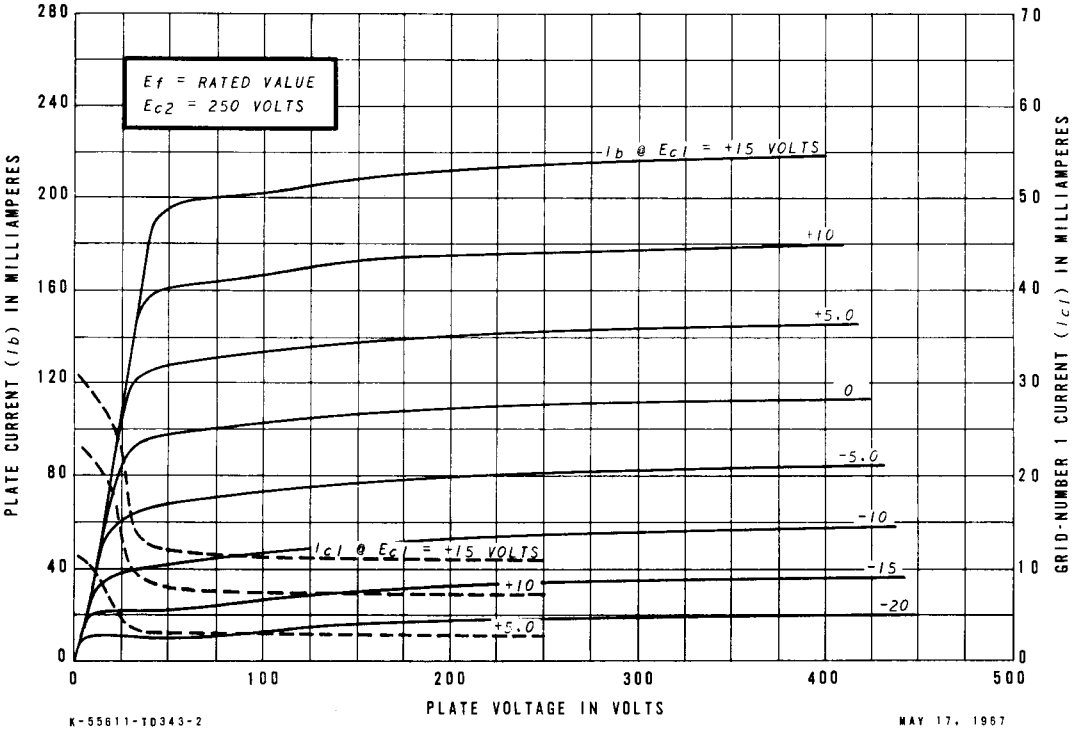
AVERAGE PLATE CHARACTERISTICS



K-55611-TD343-1

MAY 17, 1967

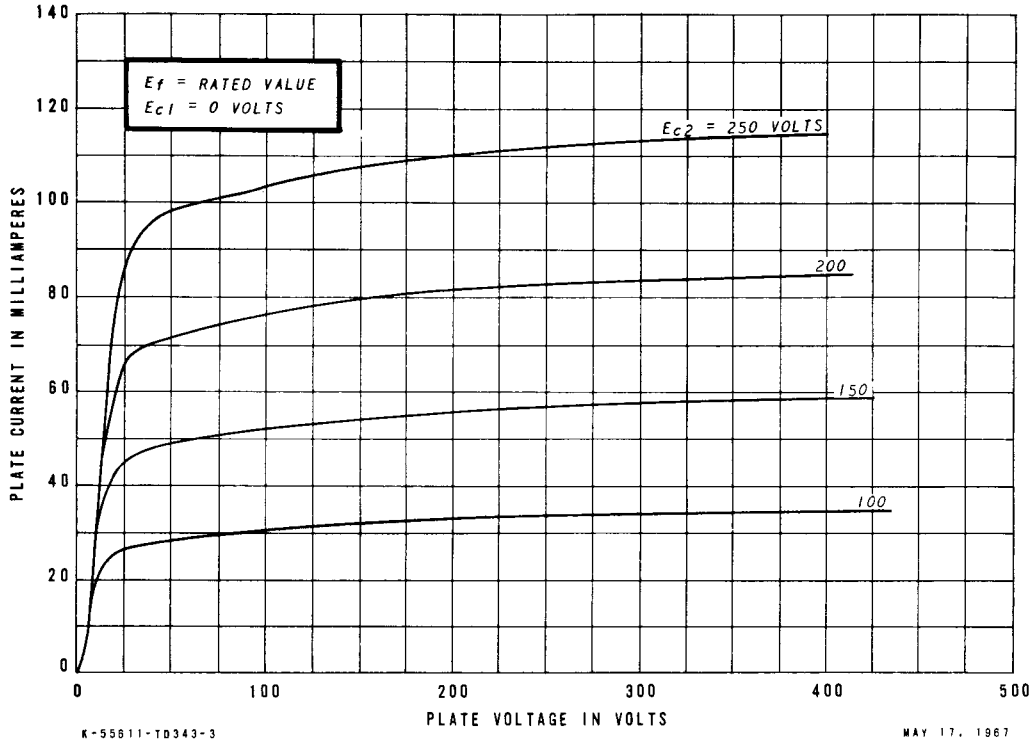
AVERAGE PLATE CHARACTERISTICS



K-55611-TD343-2

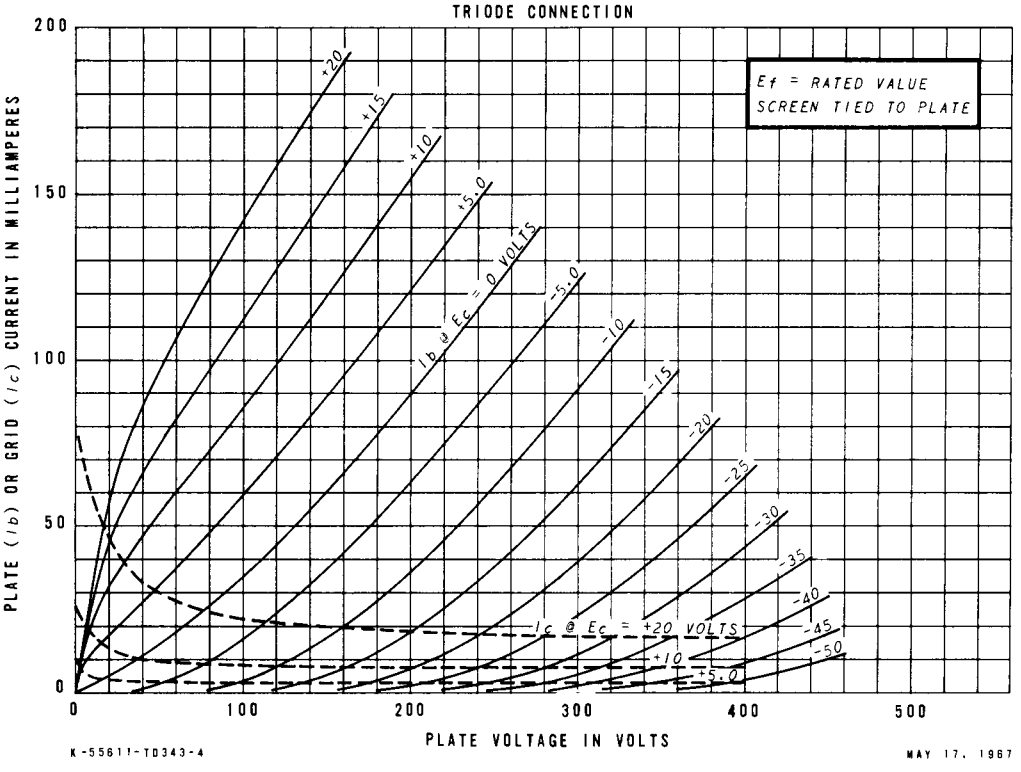
MAY 17, 1967

AVERAGE PLATE CHARACTERISTICS

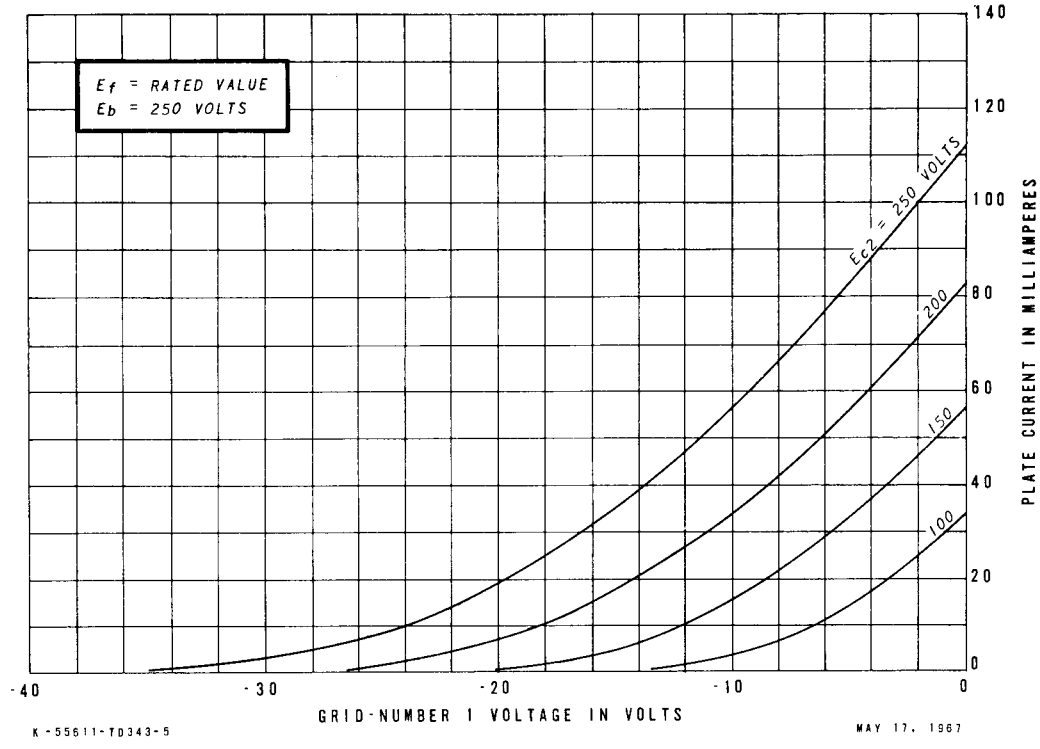


AVERAGE PLATE CHARACTERISTICS

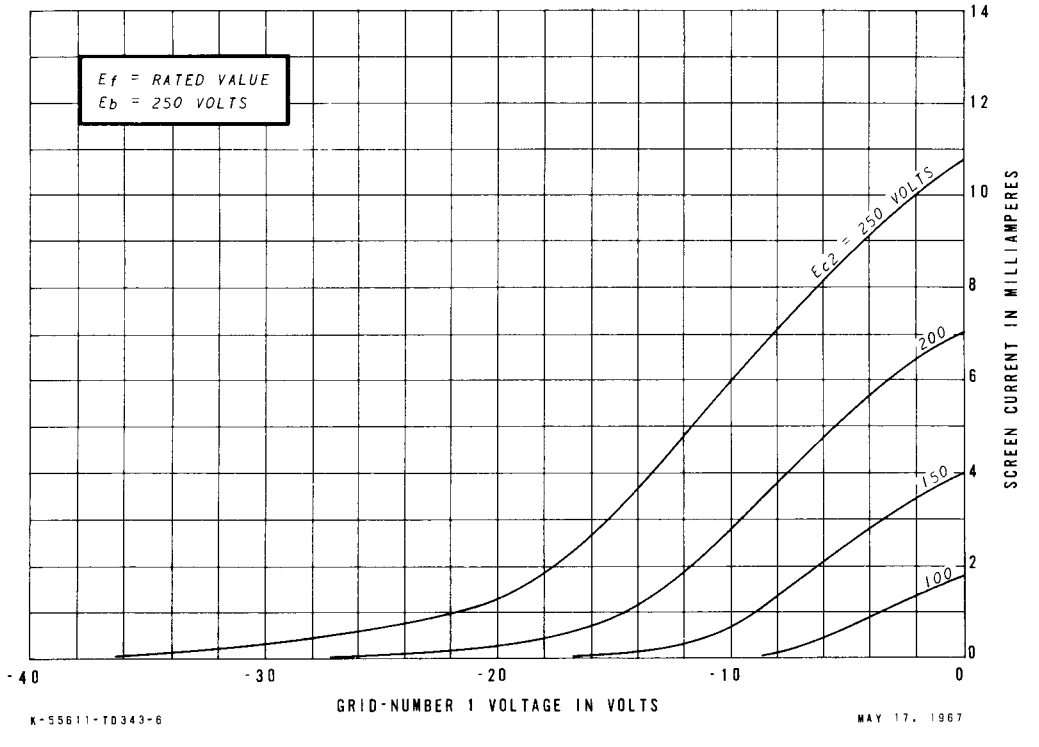
TRIODE CONNECTION



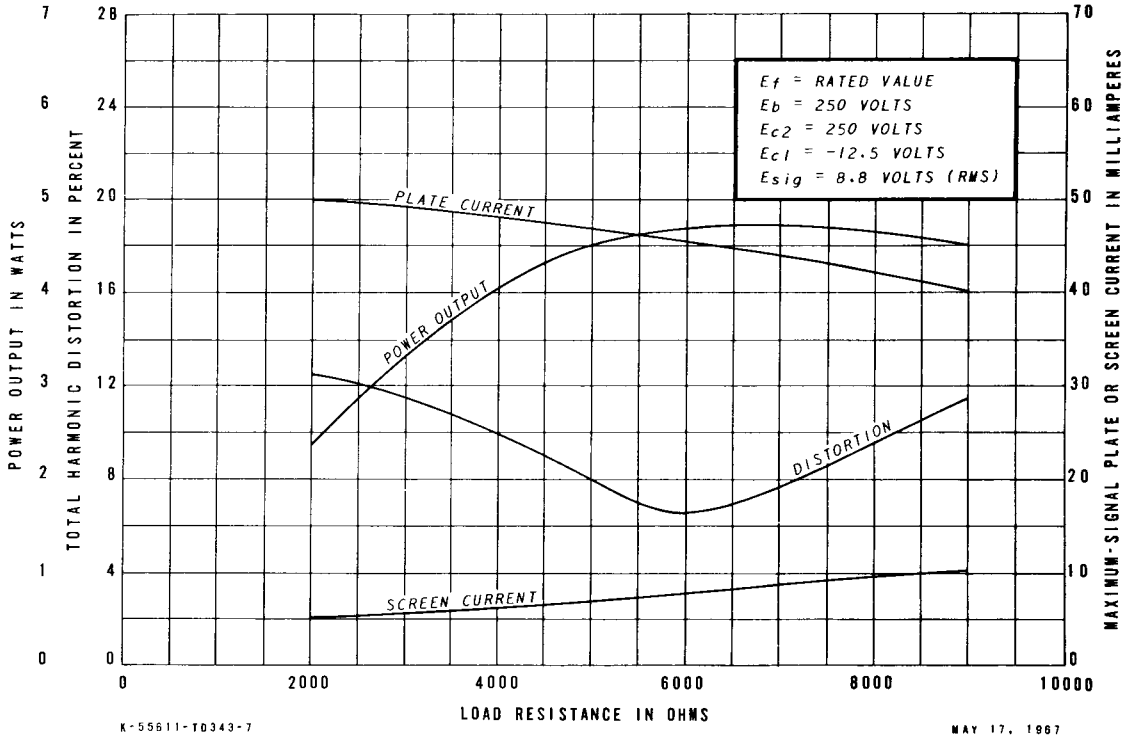
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



OPERATION CHARACTERISTICS



Electronic TUBE

6W4-GT - 25W4-GT
Description and Rating

DIODE

FOR TV DAMPING DIODE APPLICATIONS

The 6W4-GT and 25W4-GT are high-vacuum, heater-cathode type diodes each of which is intended for use as the damping diode in the horizontal-deflection circuit of television receivers. Except for heater ratings and direct interelectrode capacitances, the 6W4-GT and 25W4-GT are identical. Each type exhibits a high-perveance characteristic and is capable of withstanding the relatively high pulse voltages normally encountered in this application.

GENERAL

Cathode - Coated Unipotential

	6W4-GT	25W4-GT	
Heater Voltage, A-C or D-C	6.3	25.0	Volts
Heater Current	1.2	0.3	Amperes

Envelope - T-9, Glass
Base - B5-82 or B6-8, Intermediate Shell Octal
or B5-85 or B6-60, Short Intermediate Shell Octal
Mounting Position - Any

Direct Interelectrode Capacitances, approximate *

	6W4-GT	25W4-GT	
Cathode to Plate and Heater	13	17	μμf
Plate to Cathode and Heater	6.0	6.0	μμf
Heater to Cathode	7.0	11	μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

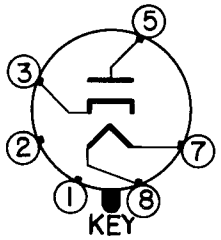
	Damper Service ‡	
Peak Inverse Plate Voltage §	3850	Volts
Plate Dissipation	3.5	Watts
Steady-State Peak Plate Current	750	Milliamperes
D-C Output Current	125	Milliamperes

Heater-Cathode Voltage	6W4-GT	25W4-GT	
Heater Positive with Respect to Cathode			
D-C Component	100	100	Volts
Total D-C and Peak	300	200	Volts
Heater Negative with Respect to Cathode §			
D-C Component	500	---	Volts
Total D-C and Peak	2300	500	Volts

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
AT 250 Milliamperes D-C	21	Volts

BASING DIAGRAM

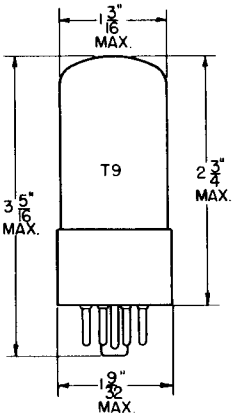


RTMA 4CG
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 - No Connection +
Pin 2 - No Connection
Pin 3 - Cathode
Pin 5 - Plate
Pin 7 - Heater
Pin 8 - Heater

PHYSICAL DIMENSIONS



RTMA 9-11 or 9-41

GENERAL ELECTRIC

Supersedes ET-T565A dated 8-50 and ET-T573A dated 7-50

* *Without external shield.*

† *Pin 1 omitted on bases B5-82 and B5-85.*

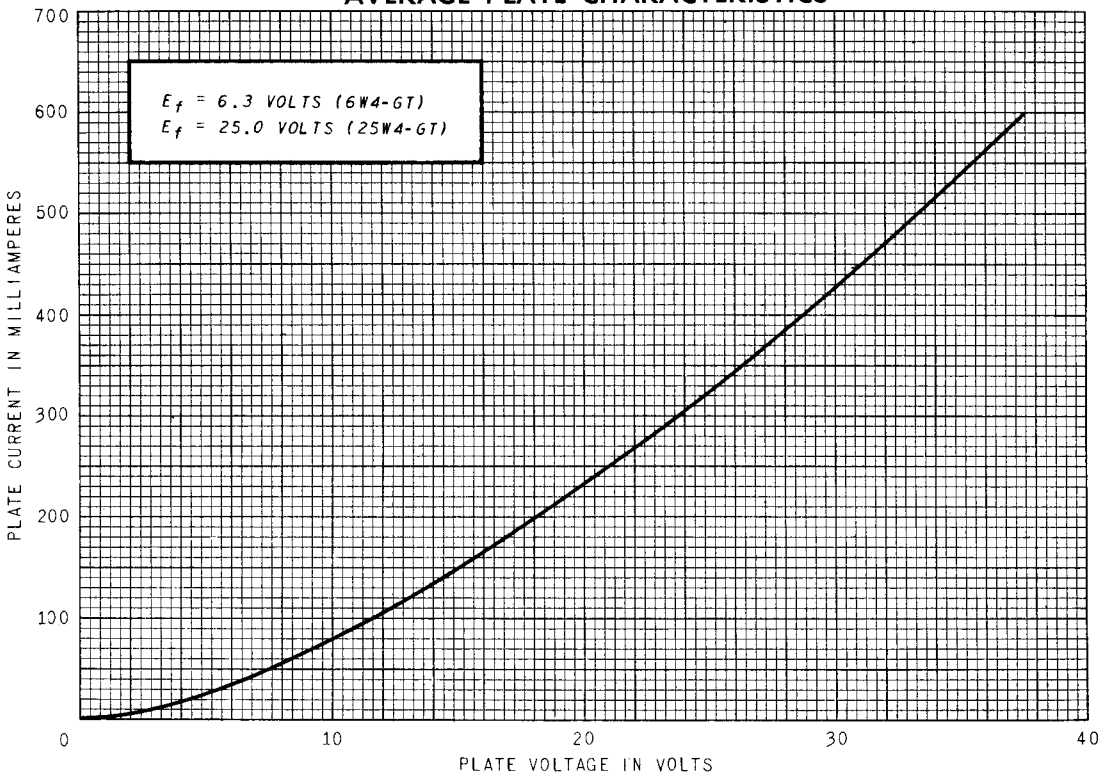
‡ *For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice for Television Stations; Federal Communications Commission". The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.*

§ *Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.*

Note: Socket terminals 1, 2, 4 and 6 should not be used.

Operation of this tube as a power rectifier is not recommended.

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

Electronic TUBES

6W4-GTA

DIODE

FOR TV DAMPING-DIODE APPLICATIONS

DESCRIPTION AND RATING

The 6W4-GTA is a single heater-cathode type diode for use as the damping diode in the horizontal-deflection circuit of television receivers. It is unilaterally interchangeable with the 6W4-GT.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings (Design-Maximum Rating System)

Heater Voltage, AC or DC*	6.3 ±0.6	Volts
Heater Current†	1.2	Amperes
Direct Interelectrode Capacitances, approximate‡		
Cathode to Plate and Heater: k to (p+h)	8.0	μμf
Plate to Cathode and Heater: p to (k+h)	6.0	μμf
Heater to Cathode: (h to k)	3.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B5-82, Intermediate-Shell Octal 5-Pin

MAXIMUM RATINGS

TV DAMPER SERVICE—DESIGN-MAXIMUM VALUES§

Peak Inverse Plate Voltage	3950	Volts
Plate Dissipation	4.0	Watts
Steady-State Peak Plate Current	840	Milliamperes
DC Output Current	140	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	800	Volts
Total DC and Peak	3950	Volts

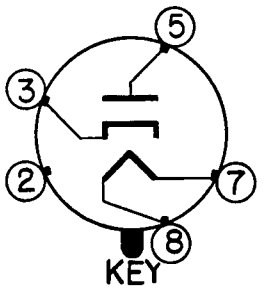
Design-maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions. The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM

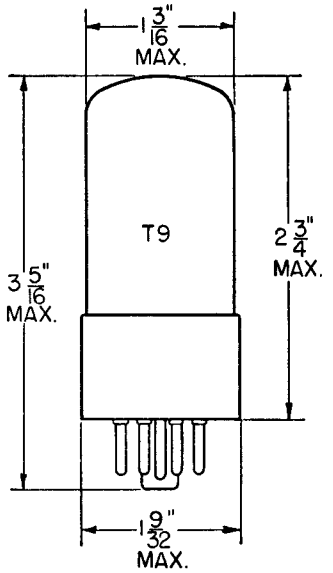


EIA 4CG

TERMINAL CONNECTIONS

Pin 2—No Connection
Pin 3—Cathode
Pin 5—Plate
Pin 7—Heater
Pin 8—Heater

PHYSICAL DIMENSIONS



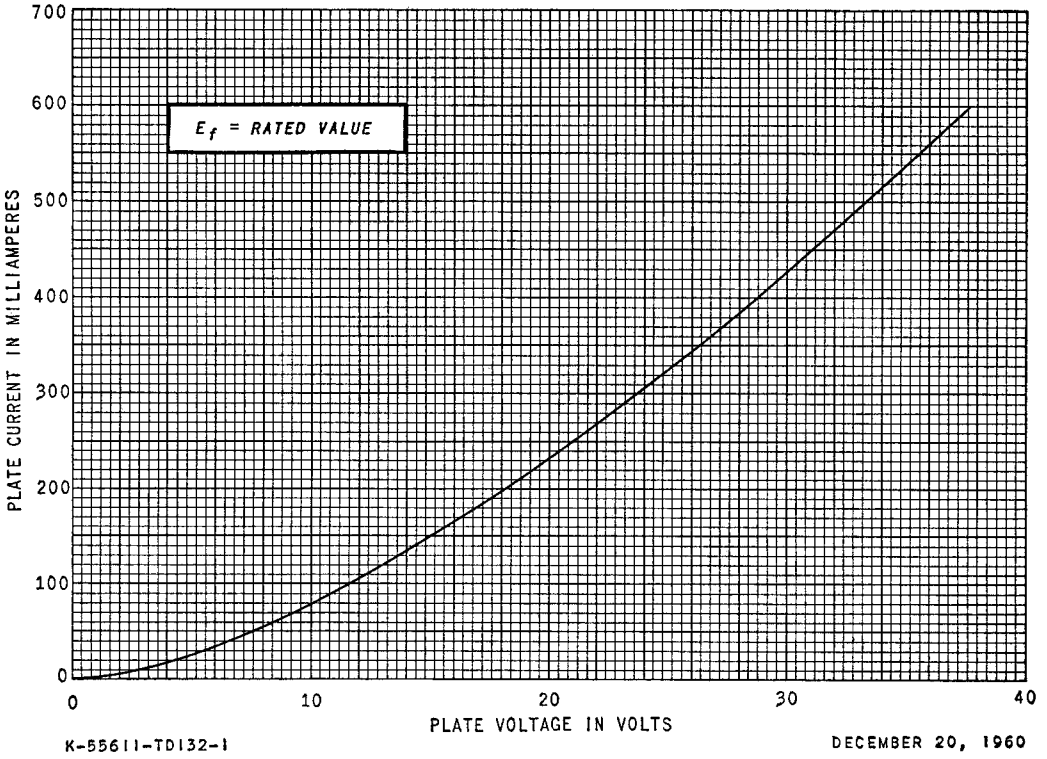
EIA 9-11

AVERAGE CHARACTERISTICS

Tube Voltage Drop (Ib = 250 Milliamperes DC)	21	Volts

* The equipment designer should design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.
† Heater current at bogey heater voltage.
‡ Without external shield.
§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

AVERAGE PLATE CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

Electronic TUBES

6W6-GT—12W6-GT—25W6-GT

BEAM PENTODE

FOR TV VERTICAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6W6-GT is a beam-power pentode intended for service as a triode-connected or pentode-connected vertical-deflection amplifier in television receivers. It is also extremely useful as an audio-frequency power-output tube. In this application the 6W6-GT is capable of delivering relatively large power output at low plate supply voltages and features high power sensitivity and high plate efficiency.

The 6W6-GT, 12W6-GT, and 25W6-GT are alike, except for heater ratings and heater-cathode ratings. The 12W6-GT exhibits a controlled heater warm-up characteristic which makes it especially suited for use in television receivers that employ 600-milliampere, series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	6W6-GT	12W6-GT	25W6-GT	
Heater Voltage, AC or DC	6.3	12.6	25.0	Volts
Heater Current	1.2	0.6	0.3	Amperes
Heater Warm-up Time*		11	...	Seconds
Direct Interelectrode Capacitances, approximate†				
Grid-Number 1 to Plate		0.8		μμf
Input		15		μμf
Output		9.0		μμf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B6-81 or B7-7, Intermediate Shell Octal
or B6-84 or B7-59, Short Intermediate Shell Octal

MAXIMUM RATINGS

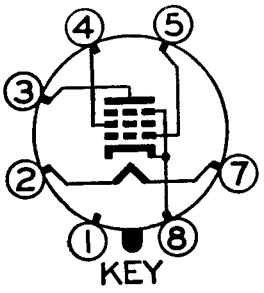
CLASS A_1 AMPLIFIER SERVICE—DESIGN-CENTER VALUES

Plate Voltage	300		Volts
Screen Voltage	150		Volts
Plate Dissipation	10		Watts
Screen Dissipation	1.25		Watts
Heater-Cathode Voltage	12W6-GT	6W6-GT 25W6-GT	
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
DC Component	200	...	Volts
Total DC and Peak	300	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	0.1	Megohms
With Cathode Bias	0.5	0.5	Megohms

GENERAL ELECTRIC

Supersedes ET-T727A, dated 6-53 and ET-T808A, dated 1-53

BASING DIAGRAM

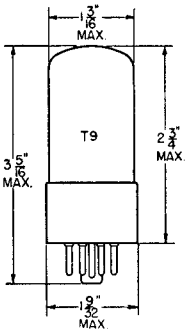


RETMA 7AC

TERMINAL CONNECTIONS

Pin 1—No Connection‡
Pin 2—Heater
Pin 3—Plate
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates

PHYSICAL DIMENSIONS



RETMA 9-11 OR 9-41

MAXIMUM RATINGS (Cont'd)

VERTICAL-DEFLECTION AMPLIFIER SERVICE§ DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED	Triode△ Connection	Pentode Connection	
DC Plate Voltage	300	300	Volts
Peak Positive Pulse Plate Voltage	1200♦	1500♦	Volts
Screen Voltage		150	Volts
Peak Negative Grid-Number 1 Voltage	250	250	Volts
Plate Dissipationϕ	7.5	7.0	Watts
Screen Dissipationϕ		1.0	Watts
DC Cathode Current	60	60	Milliamperes
Peak Cathode Current	180	180	Milliamperes

Heater-Cathode Voltage	12W6-GT	6W6-GT 25W6-GT	12W6-GT	6W6-GT 25W6-GT	
Heater Positive with Respect to Cathode					
DC Component	100	100	100	100	Volts
Total DC and Peak	200	200	200	200	Volts
Heater Negative with Respect to Cathode					
DC Component	200	...	200	...	Volts
Total DC and Peak	300	200	300	200	Volts
Grid-Number 1 Circuit Resistance					
With Cathode Bias	2.2	2.2	2.2	2.2	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	110	200	Volts
Screen Voltage	110	125	Volts
Grid-Number 1 Voltage	−7.5	...	Volts
Cathode-Bias Resistor		180	Ohms
Peak AF Grid-Number 1 Voltage	7.5	8.5	Volts
Plate Resistance, approximate	13000	28000	Ohms
Transconductance	8000	8000	Micromhos
Zero-Signal Plate Current	49	46	Milliamperes
Maximum-Signal Plate Current	50	47	Milliamperes
Zero-Signal Screen Current	4.0	2.2	Milliamperes
Maximum-Signal Screen Current	10	8.5	Milliamperes
Load Resistance	2000	4000	Ohms
Total Harmonic Distortion, approximate	10	10	Percent
Maximum-Signal Power Output	2.1	3.8	Watts

AVERAGE CHARACTERISTICS, TRIODE CONNECTION△

Plate Voltage	225	Volts
Grid-Number 1 Voltage	−30	Volts
Amplification Factor	6.2	
Plate Resistance, approximate	1600	Ohms
Transconductance	3800	Micromhos
Plate Current	22	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 0.5 Milliampere	−42	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

‡ Pin 1 omitted on bases B6-81 and B6-84.

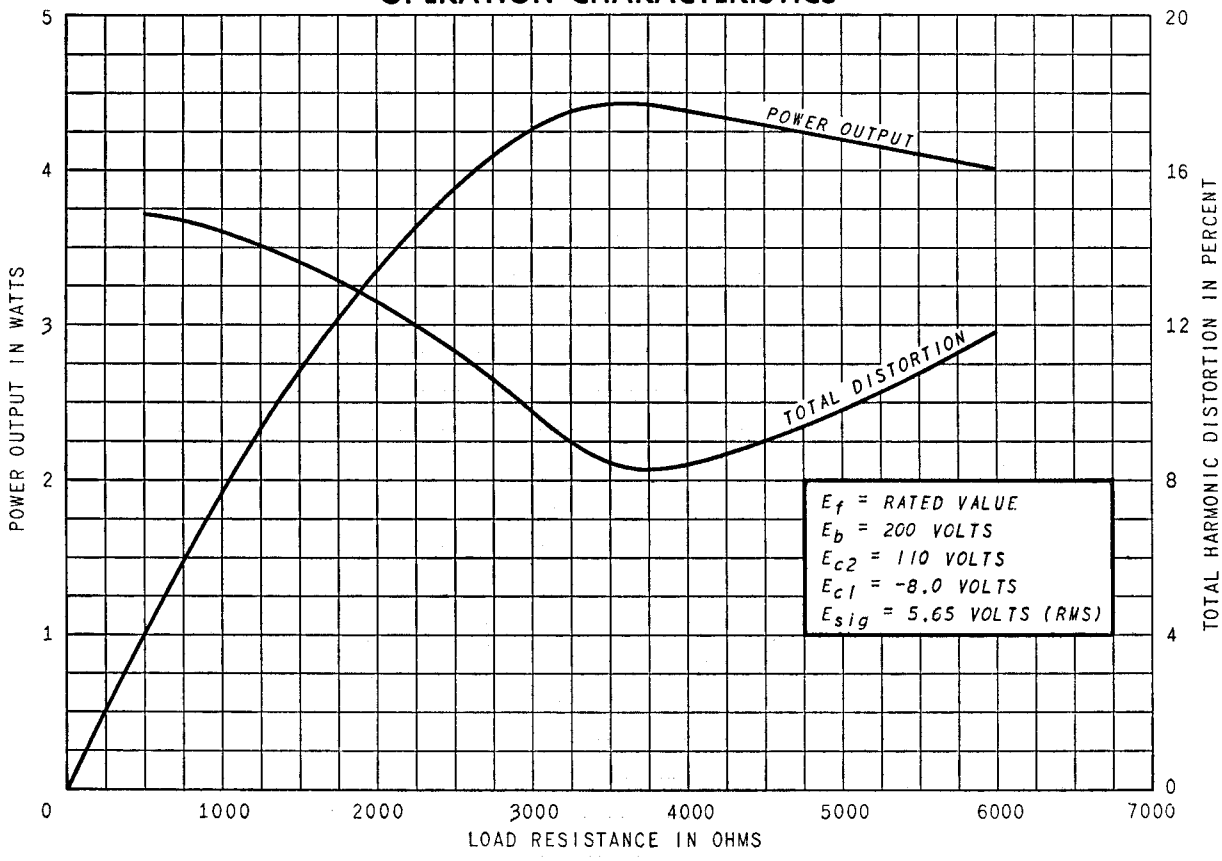
§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

△ With screen connected to plate.

♦ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

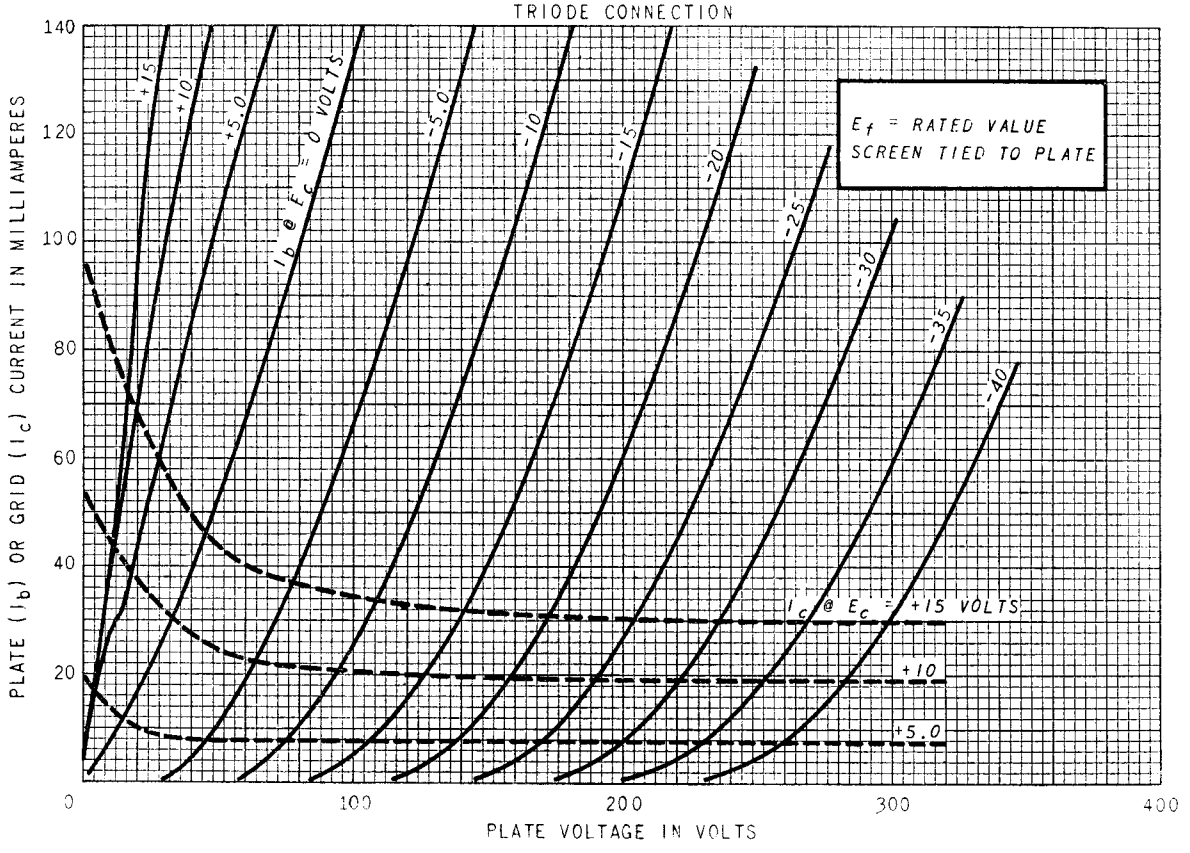
ϕ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

OPERATION CHARACTERISTICS

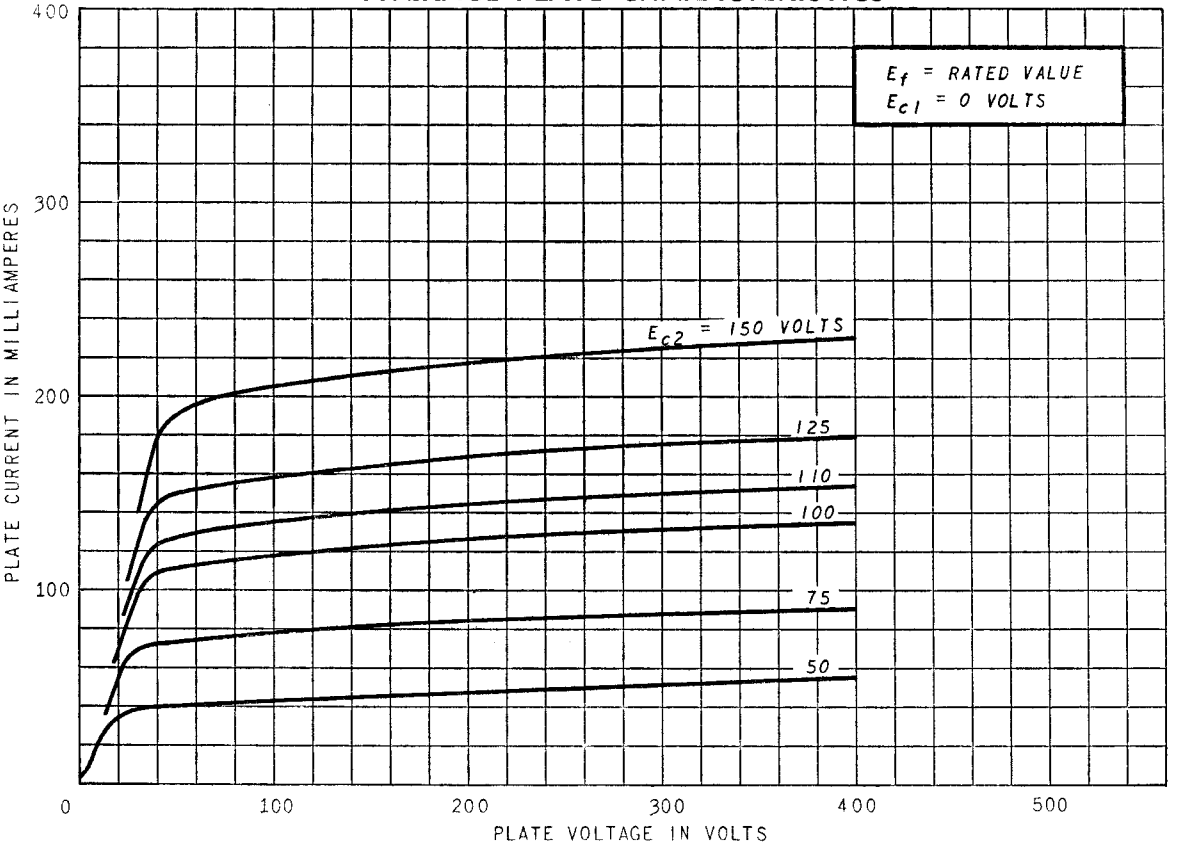


AVERAGE PLATE CHARACTERISTICS

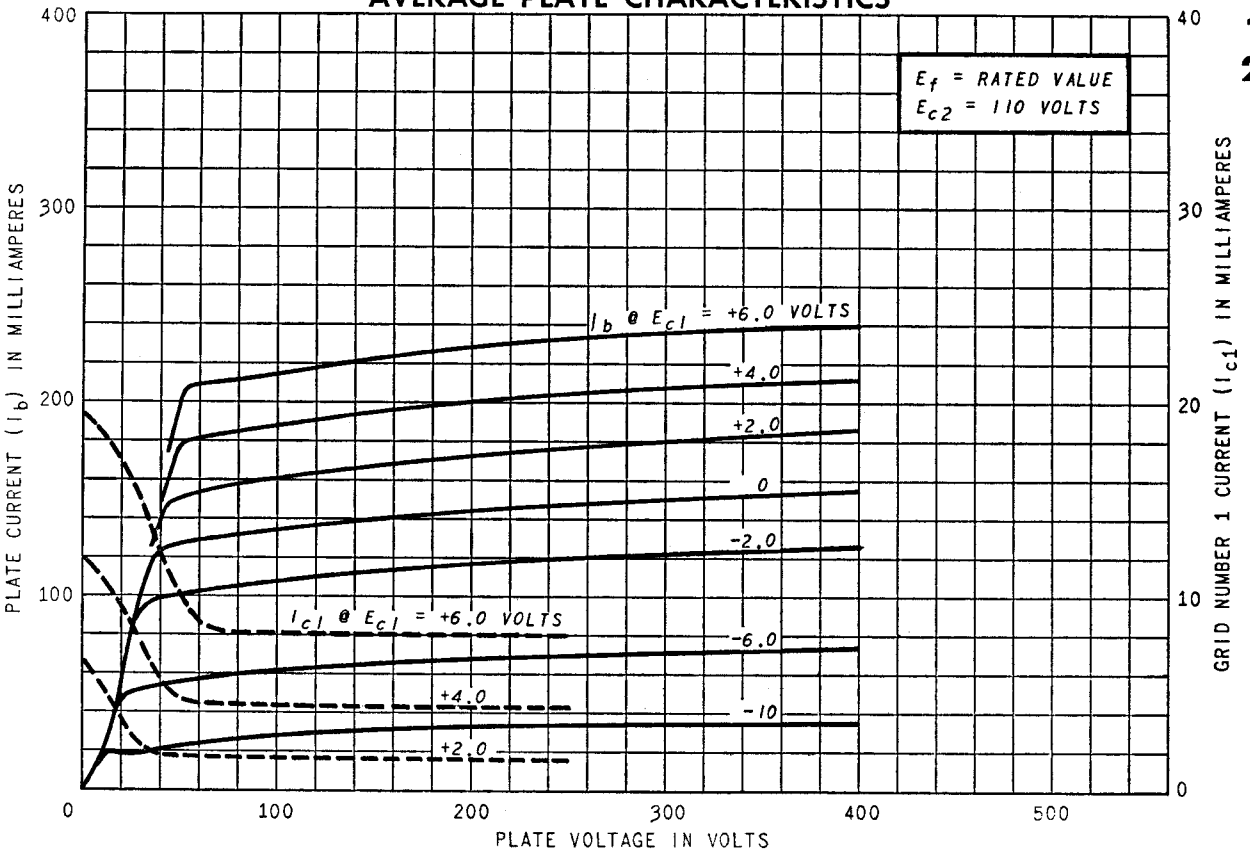
TRIODE CONNECTION



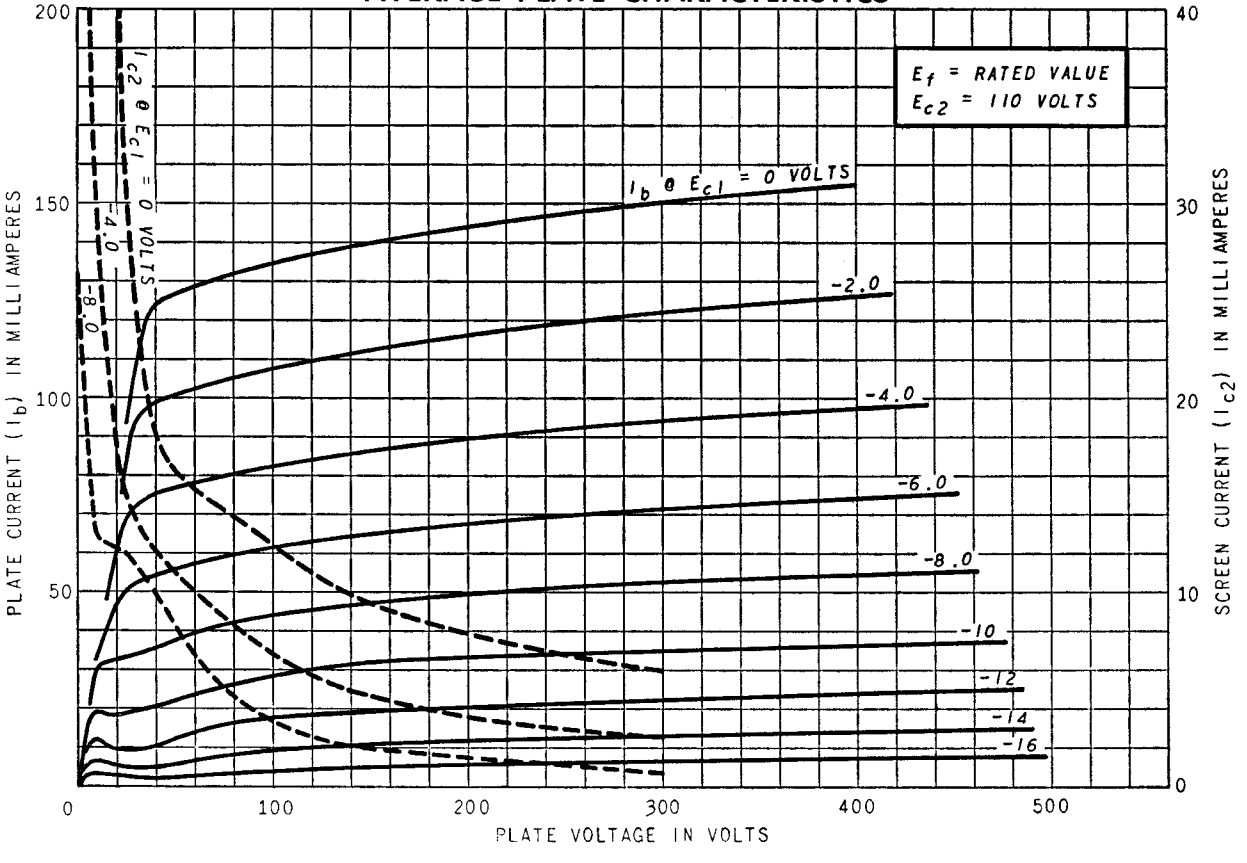
AVERAGE PLATE CHARACTERISTICS



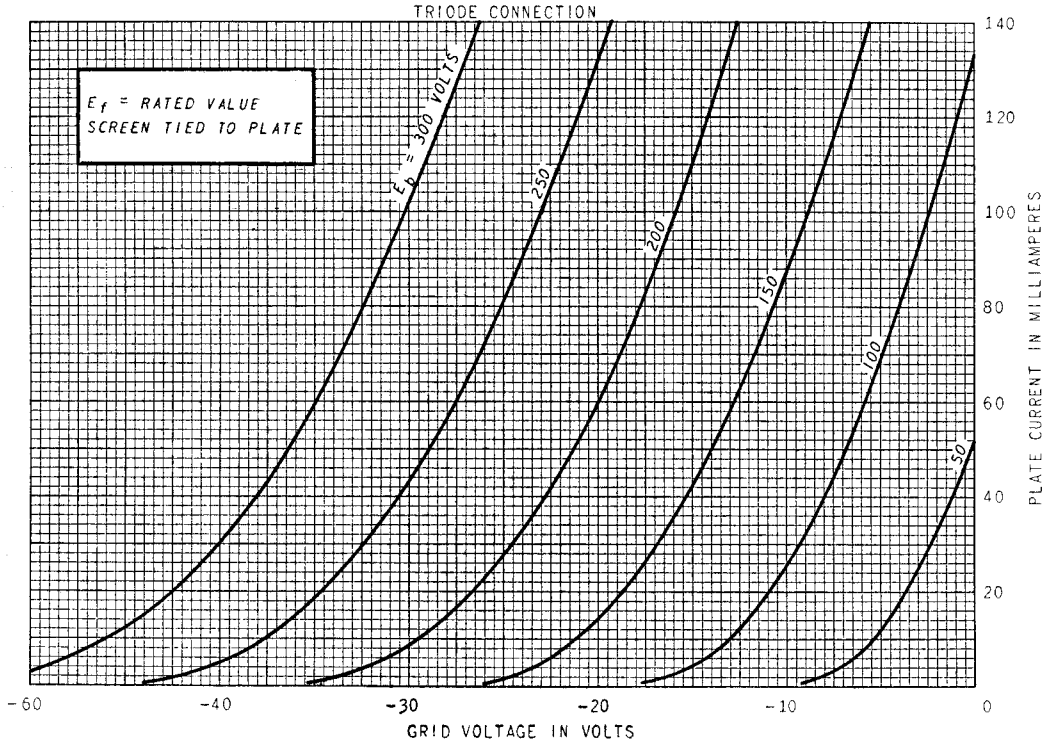
AVERAGE PLATE CHARACTERISTICS



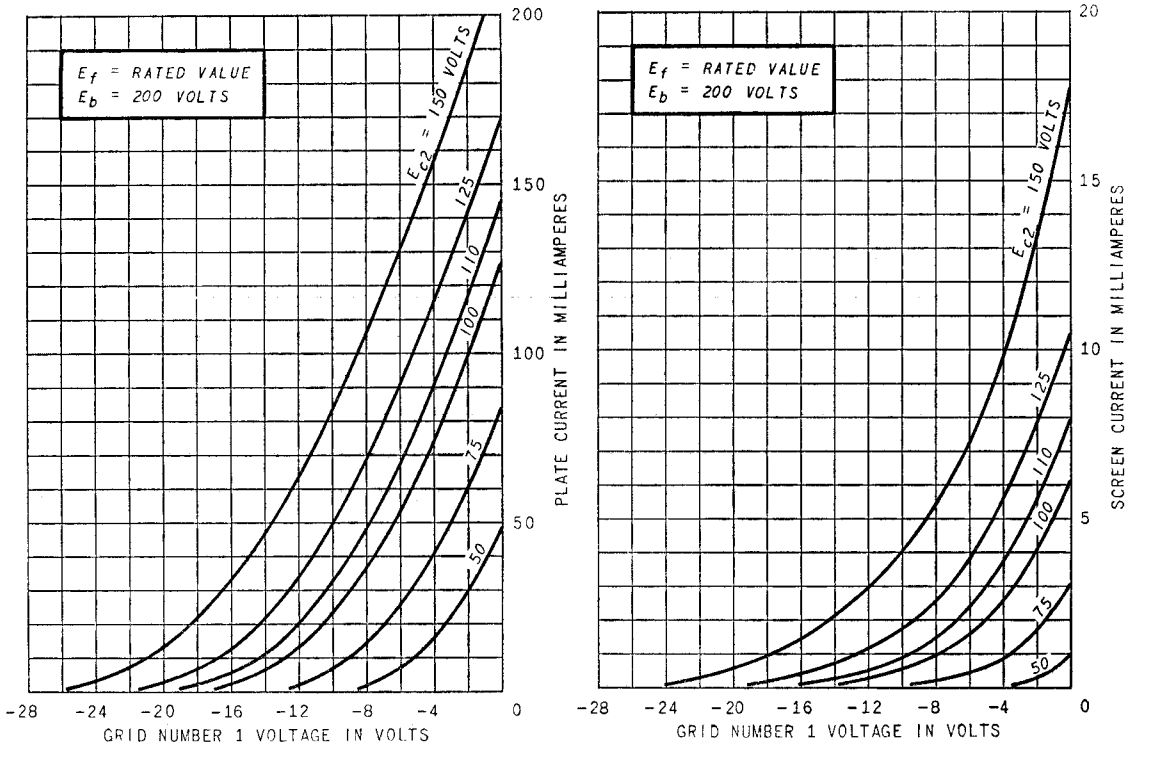
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

6X4

TWIN DIODE

FOR FULL-WAVE POWER-RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 6X4 is a miniature heater-cathode type twin diode designed for full-wave rectifier operation in compact power supplies. The tube is intended for service in automobile and a-c radio receivers.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ±10%*	Volts
Heater Current	0.6	Amperes

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

RECTIFIER SERVICE—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	1250	Volts
AC Plate-Supply Voltage per Plate—See Rating Chart I†		
Steady-State Peak Plate Current per Plate	245	Milliamperes
Transient Peak Plate Current per Plate, Maximum Duration 0.2 Second	1.1	Amperes
DC Output Current—See Rating Chart I†		
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	450	Volts

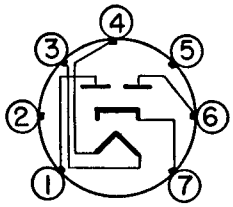
Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

GENERAL ELECTRIC

BASING DIAGRAM

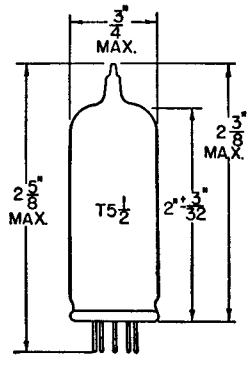


EIA 5BS

TERMINAL CONNECTIONS

Pin 1—Plate Number 2
Pin 2—No Connection
Pin 3—Heater
Pin 4—Heater
Pin 5—No Connection
Pin 6—Plate Number 1
Pin 7—Cathode

PHYSICAL DIMENSIONS



EIA 5-3

CHARACTERISTICS AND TYPICAL OPERATION

FULL-WAVE RECTIFIER	Choke Input-Filter	Capacitor Input-Filter	Vibrator Operation Capacitor Input-Filter	
AC Plate-Supply Voltage per Plate, RMS	450	325	...	Volts
Filter Input Capacitor	...	10	10	μf
Filter Input Choke	10	...	...	Henrys
Total Plate-Supply Resistance per Plate	...	525	...	Ohms
DC Output Current	70	70	70	Milliamperes
DC Output Voltage at Filter Input				
For DC Output Current of 35 Milliamperes	350	365	...	Volts
For DC Output Current of 70 Milliamperes	340	310	240	Volts
Tube Voltage Drop				
Ib=70 Milliamperes DC per Plate		22	...	Volts

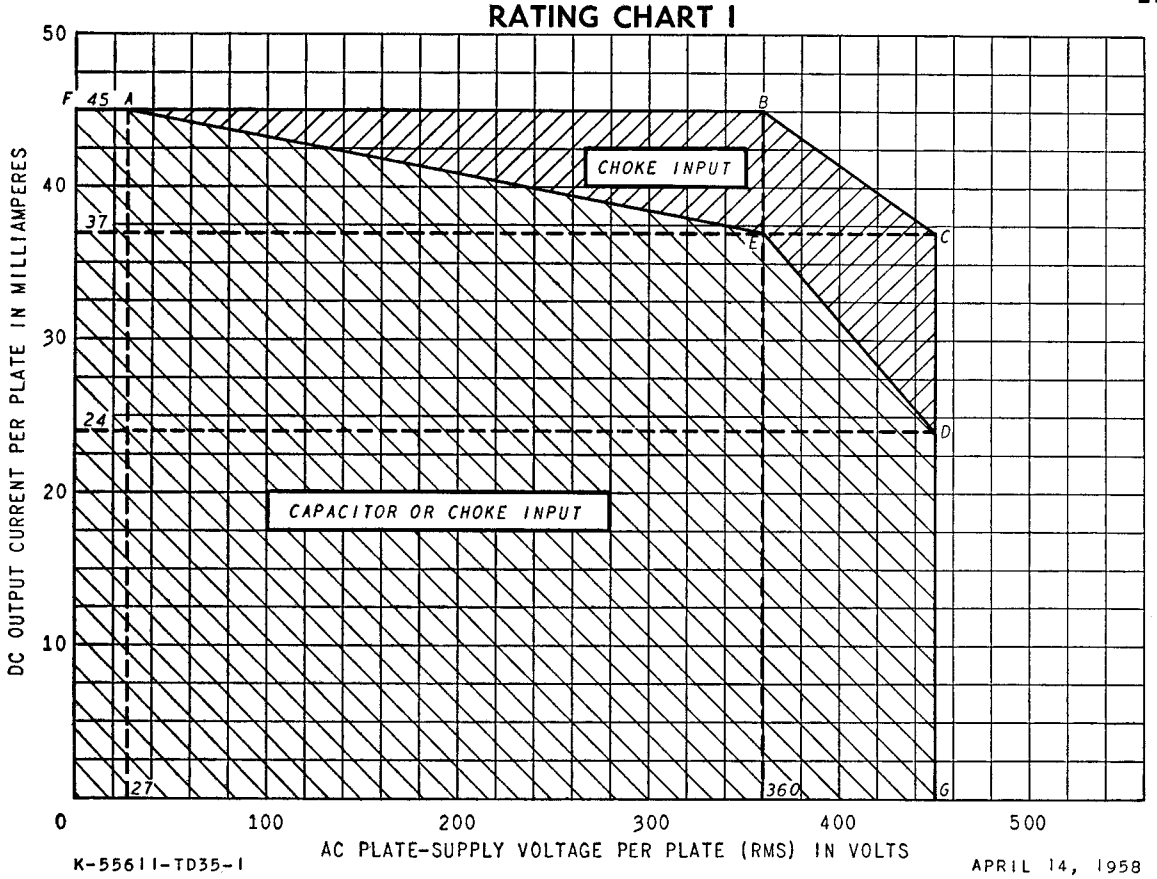
* When used in automotive service from a 6-volt battery source, the permissible range in heater voltage is from 5.0 to 8.0 volts.

† To simplify the application of the maximum ratings to circuit design, the Design-Maximum ratings are presented in chart form as Rating Charts I, II, and III. Rating Chart I presents the maximum ratings for a-c plate-supply voltage and d-c output current. Rating Chart II provides a convenient method for checking conformance with the maximum steady-state peak-plate-current rating. Rating Chart III offers a convenient method for checking conformance with the maximum transient peak-plate-current rating. Rating Chart I applies to both capacitor-input and choke-input filters, while Rating Charts II and III apply to capacitor-input filters only.

Operating points should be so selected that the boundary limits of a-c plate-supply voltage and d-c output current on Rating Chart I, and maximum d-c output current per plate and rectification efficiency on Rating Chart II, are not exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, and environmental conditions. On Rating Chart I the boundary FAEDG defines the limits for capacitor-input filter operation, and the boundary FABCDG defines the limits for choke-input filter operation.

Rating Chart III shows the minimum value of plate-supply resistance (R_s) required to remain within the transient peak-plate-current rating. The value of R_s should be such that it lies to the left of the line on Rating Chart III at the highest probable value of line voltage.

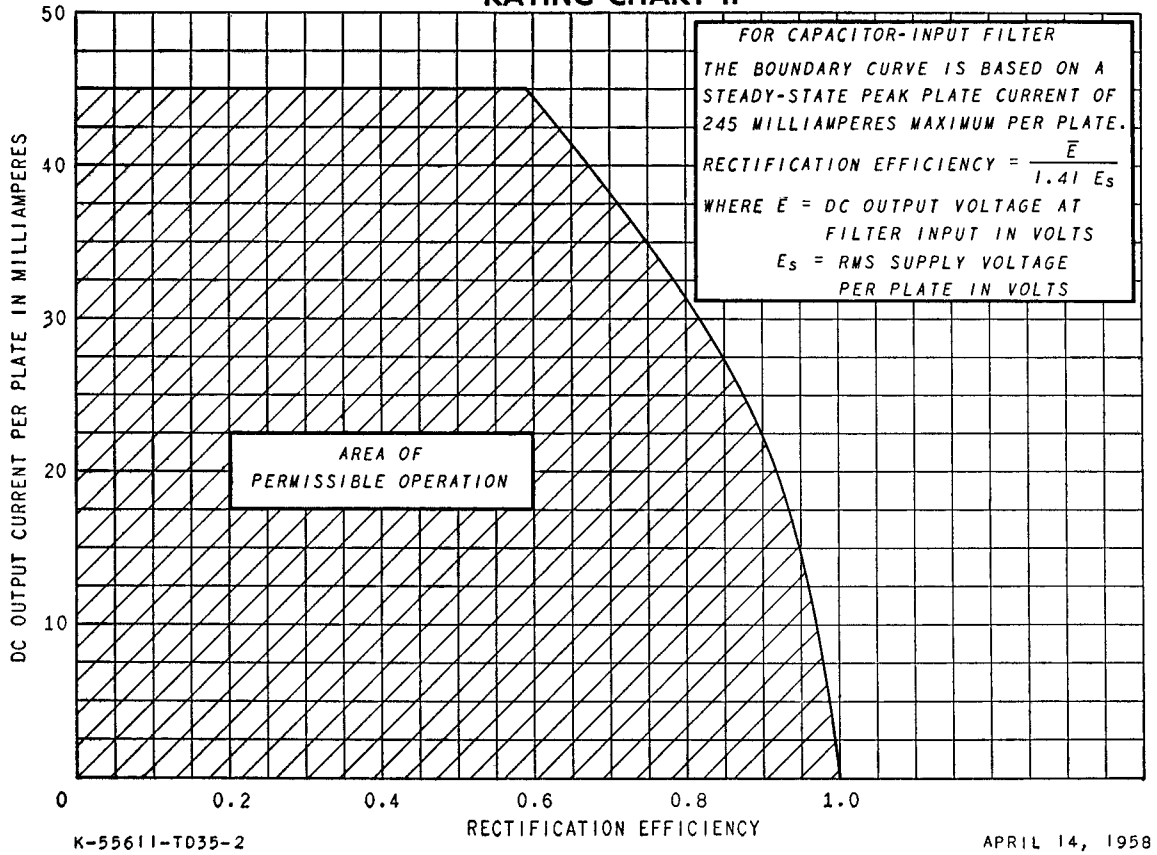
RATING CHART I



K-55611-TD35-1

APRIL 14, 1958

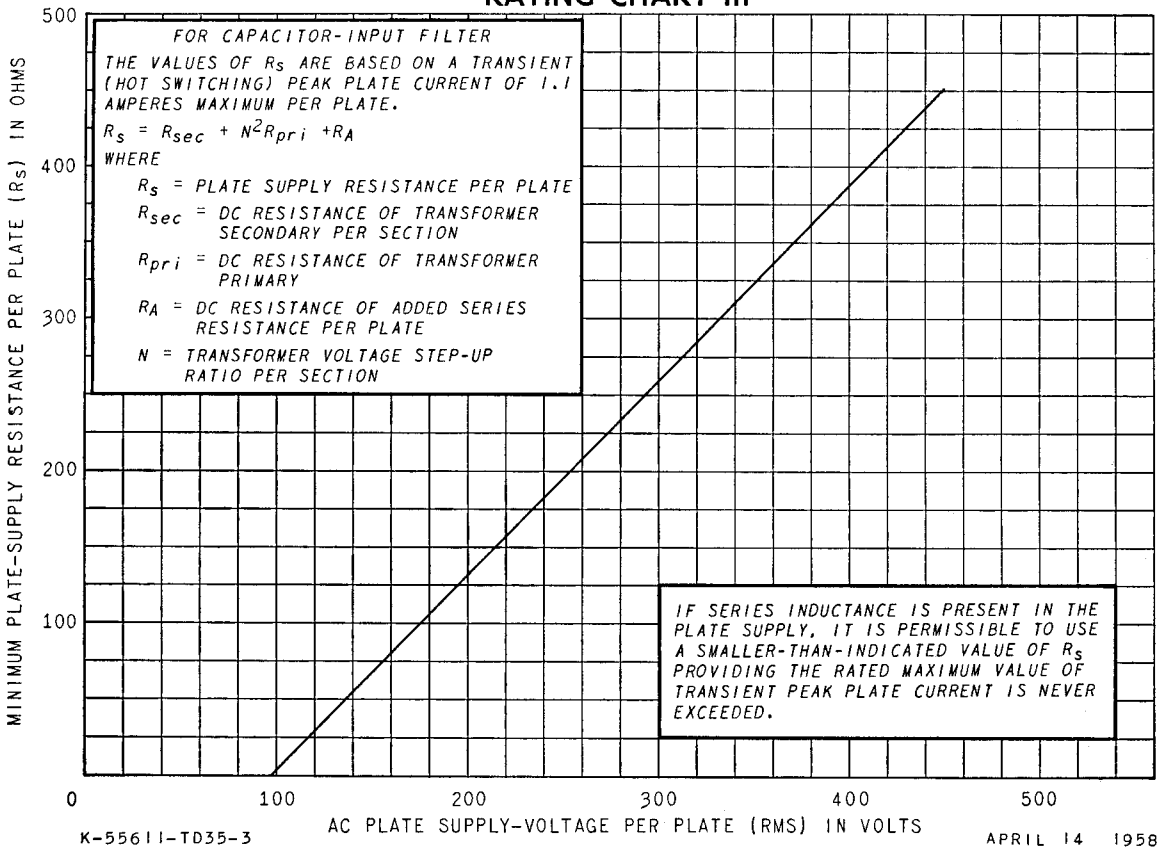
RATING CHART II



K-55611-TD35-2

APRIL 14, 1958

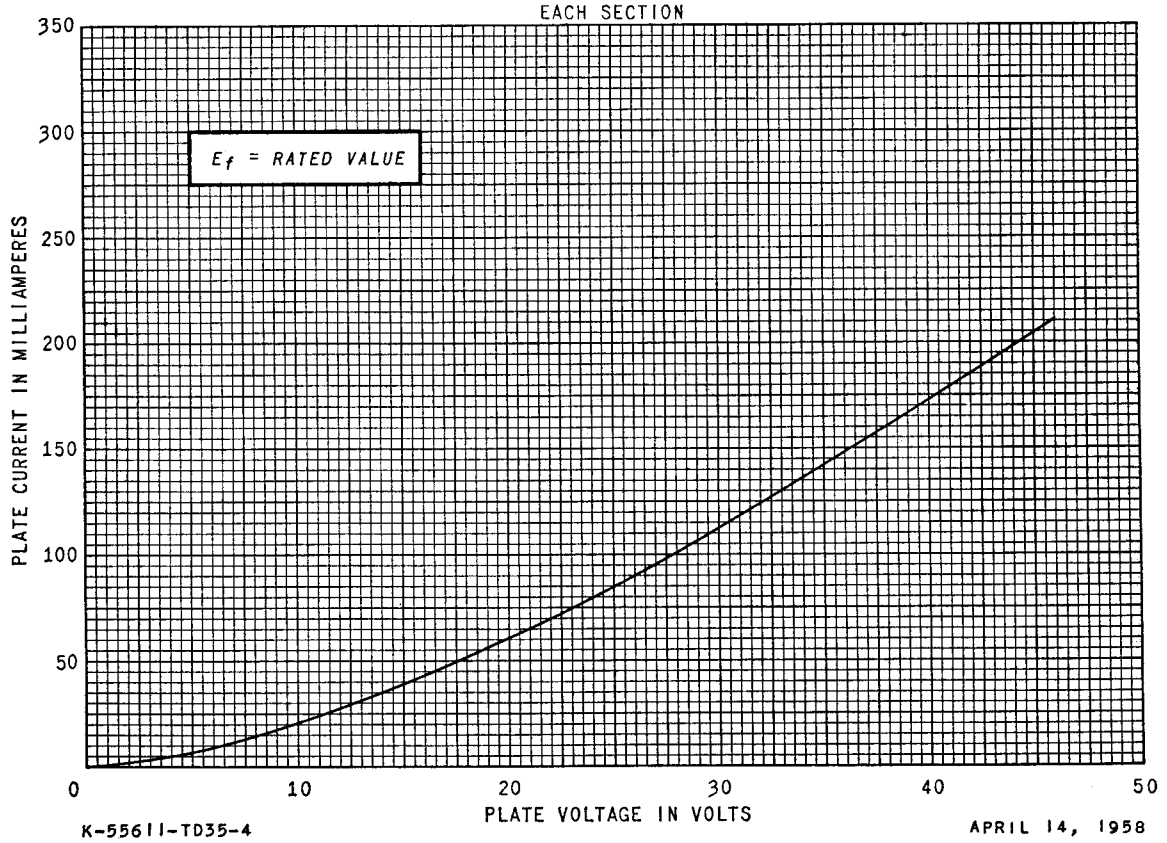
RATING CHART III



K-55611-TD35-3

APRIL 14 1958

AVERAGE PLATE CHARACTERISTICS

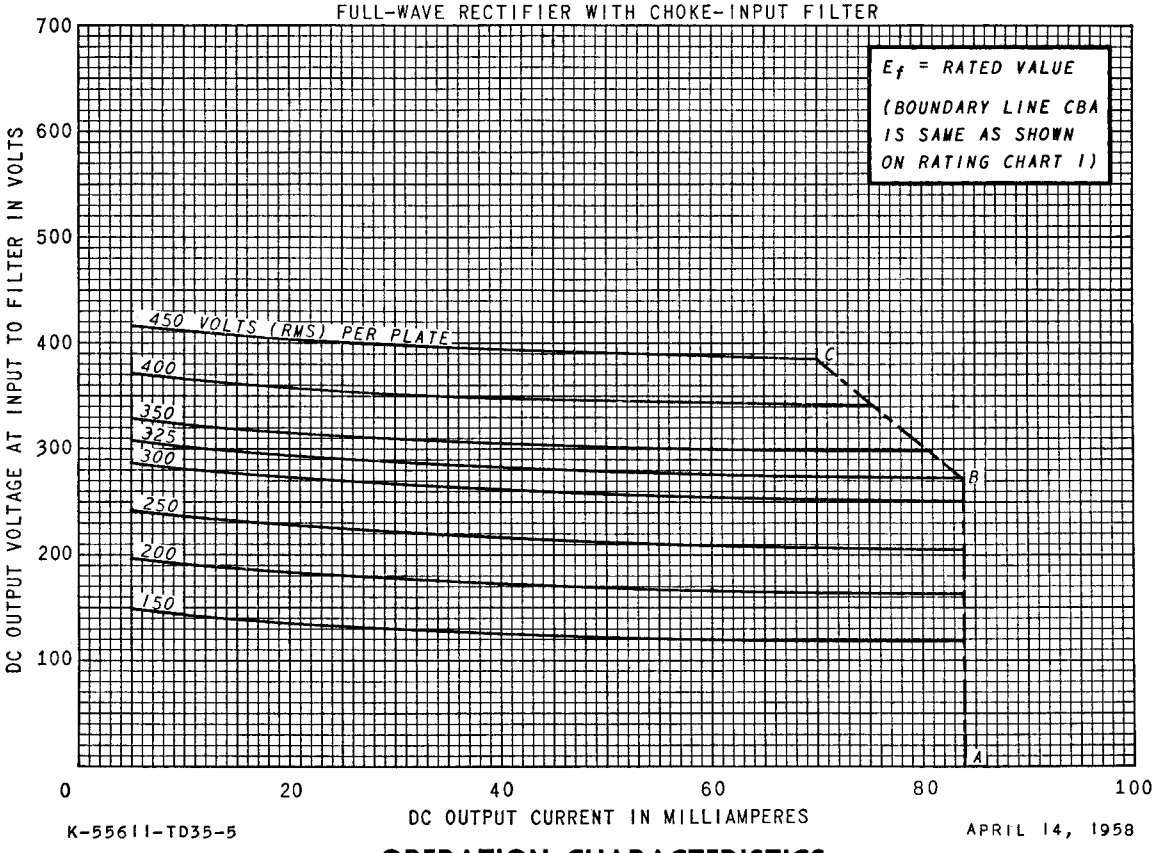


K-55611-TD35-4

APRIL 14, 1958

OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER

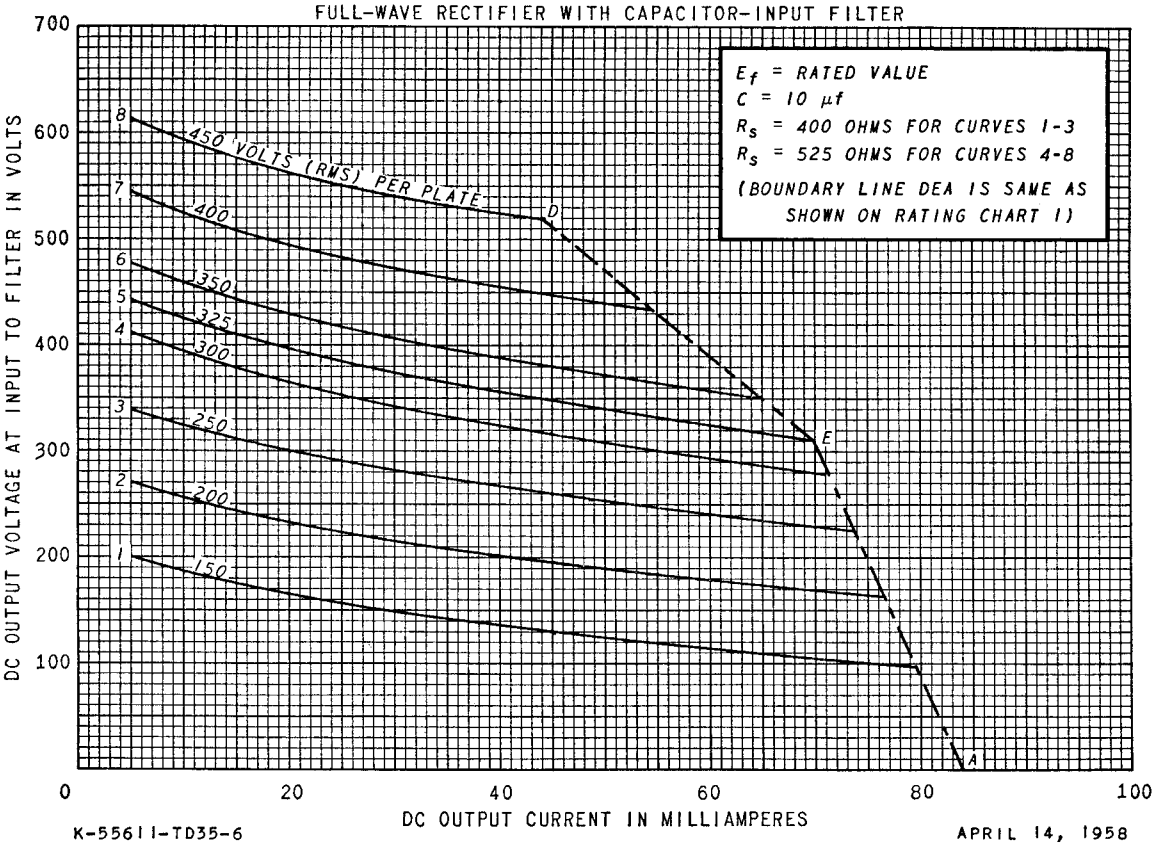


K-55611-TD35-5

APRIL 14, 1958

OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER



K-55611-TD35-6

APRIL 14, 1958

Electronic TUBE

6X5-GT
Description and Rating

TWIN DIODE

FOR FULL-WAVE POWER RECTIFIER APPLICATIONS

The 6X5-GT is a full-wave high-vacuum rectifier designed for use in the power supply of automobile and a-c radio receivers.

GENERAL

Cathode - Coated Unipotential		
Heater Voltage, A-C or D-C	6.3	Volts
Heater Current	0.6	Ampere
Envelope - T-9, Glass		
Base - B5-82 or B6-8, Intermediate Shell Octal		
or B5-85 or B6-60, Short Intermediate Shell Octal		
Mounting Position - Any		

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Peak Inverse Plate Voltage	1250	Volts
Steady-State Peak Plate Current per Plate	210	Milliamperes
D-C Output Current	70	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	450	Volts
Heater Negative with Respect to Cathode	450	Volts

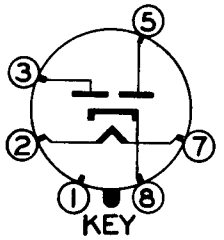
CHARACTERISTICS AND TYPICAL OPERATION

FULL-WAVE RECTIFIER

	Capacitor Input Filter	Choke Input Filter	
A-C Plate-Supply Voltage per Plate, RMS	325	450	Volts
Filter Input Capacitor	4	---	Microfarads
Filter Input Choke	---	8	Henrys
Total Effective Plate-Supply Impedance per Plate	150	---	Ohms
D-C Output Current	70	70	Milliamperes
D-C Output Voltage at Filter Input			
For D-C Output Current of 35 Milliamperes	405	385	Volts
For D-C Output Current of 70 Milliamperes	370	380	Volts
Tube Voltage Drop			
At 70 Milliamperes D-C per Plate	22		Volts

* *Pin 1 omitted on bases B5-82 and B5-85.*

BASING DIAGRAM

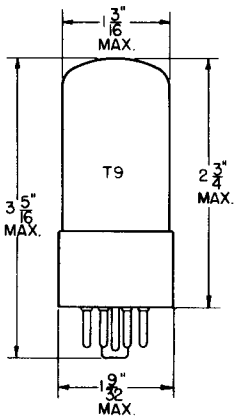


RTMA 6S
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 - No Connection*
Pin 2 - Heater
Pin 3 - Plate Number 2
Pin 5 - Plate Number 1
Pin 7 - Heater
Pin 8 - Cathode

PHYSICAL DIMENSIONS



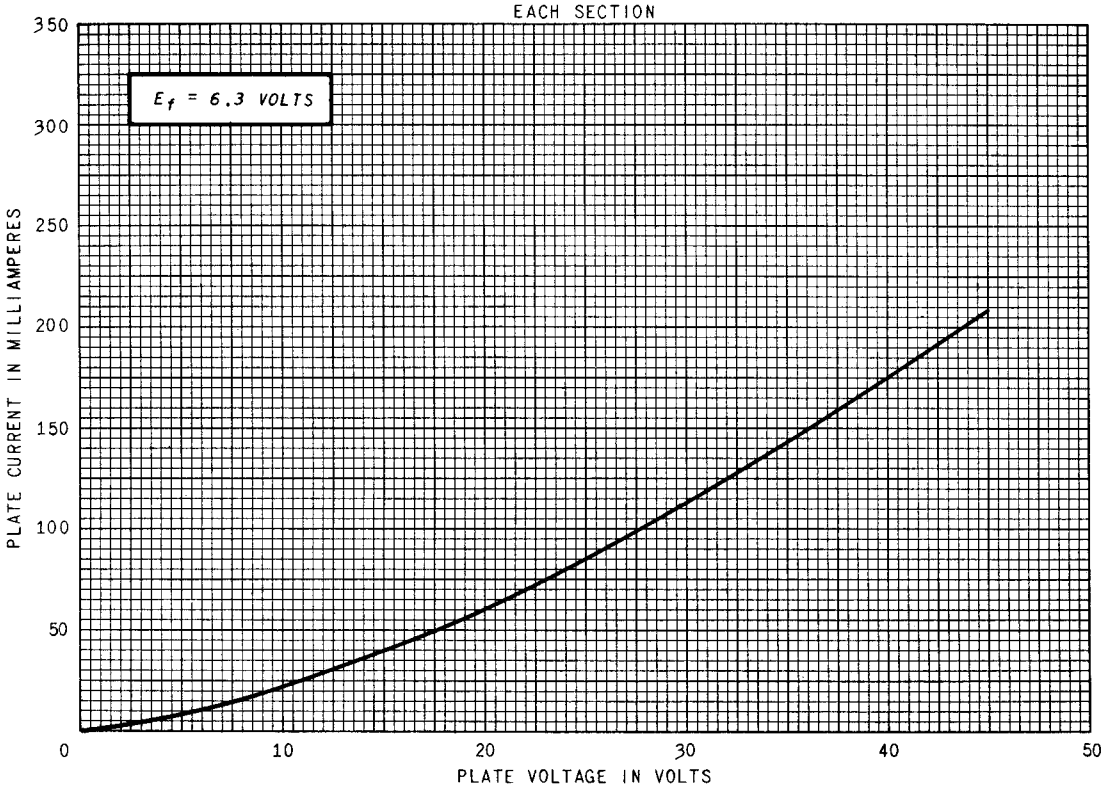
RTMA 9-11 or 9-41

GENERAL ELECTRIC

Supersedes ET-T357A dated 5-50

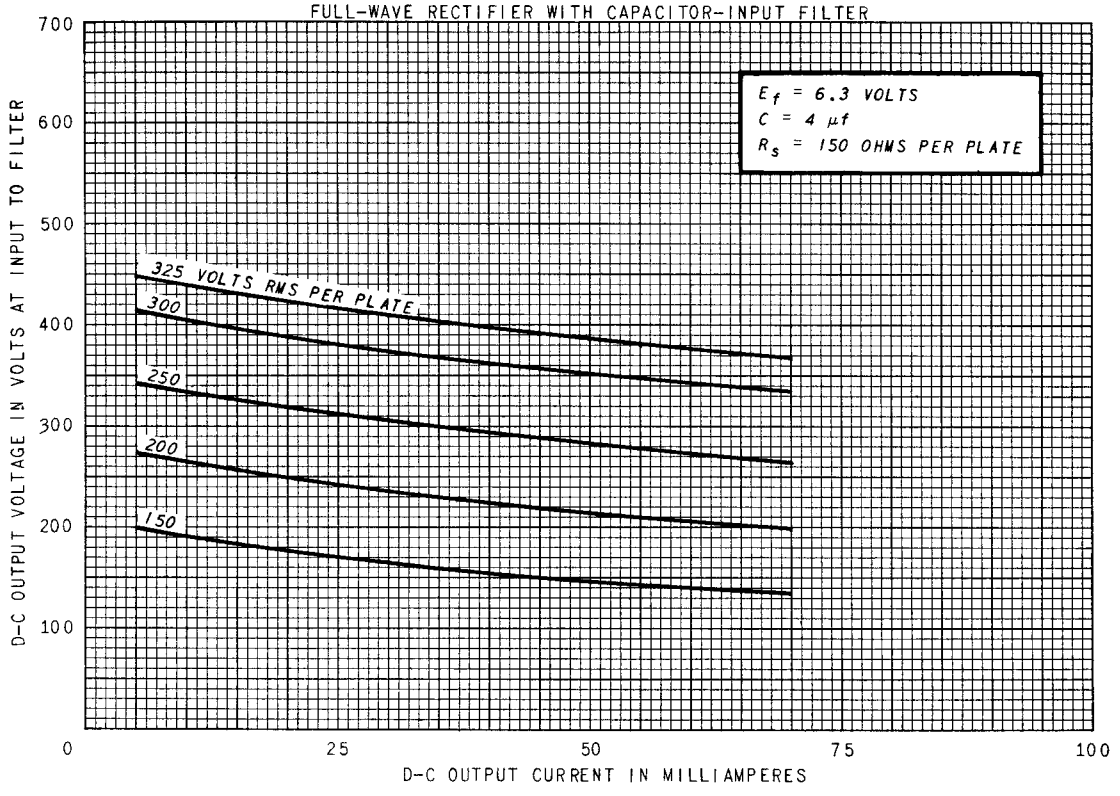
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



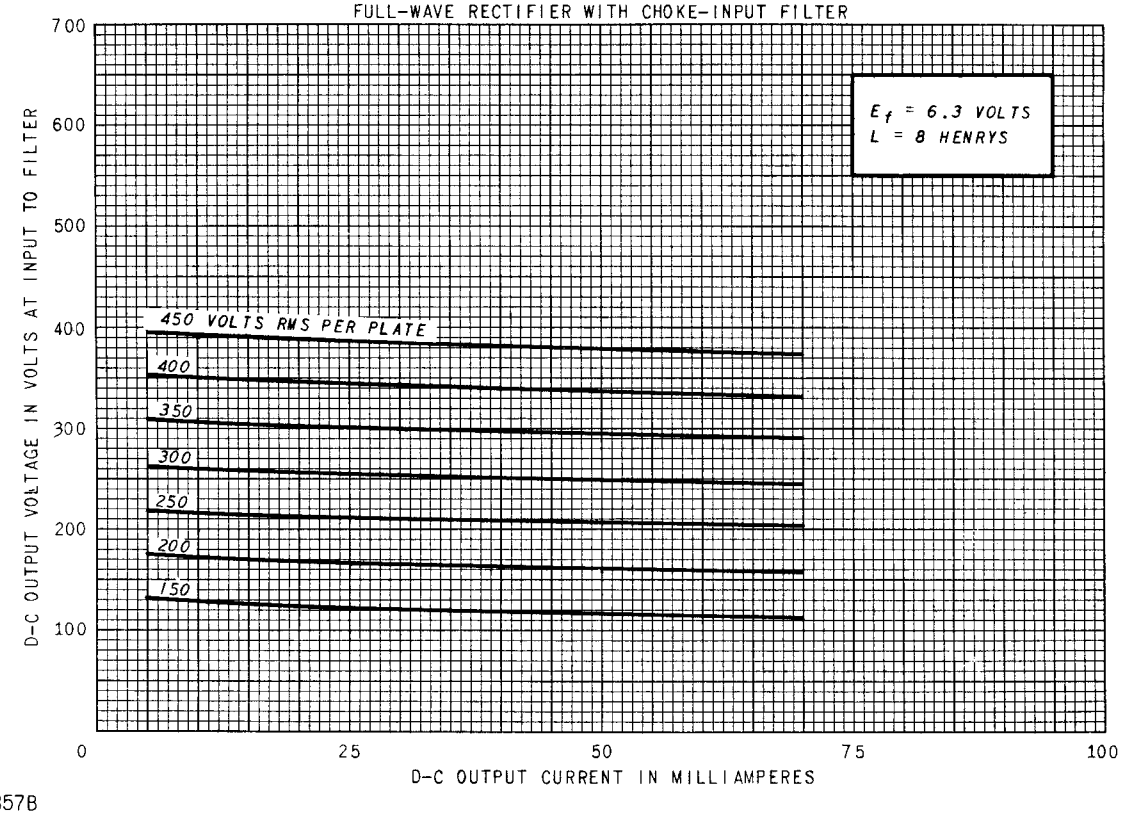
OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER



OPERATION CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER



Electronic TUBES

6X8 — 5X8

TRIODE-PENTODE

FOR VHF CONVERTER APPLICATIONS

DESCRIPTION AND RATING

The 6X8 is a miniature tube incorporating a medium-mu triode and a sharp-cutoff pentode in one envelope. It is designed primarily for use as a combined triode oscillator and pentode mixer in television and FM receivers. Its performance in this application is comparable to that obtainable with a 6AG5 mixer and an oscillator which consists of a single section of a 6J6.

Except for heater ratings and heater-cathode voltage ratings, the 5X8 is identical to the 6X8. The 5X8, as the result of its 600-milliampere heater rating and its controlled heater warm-up characteristic, is particularly suited for use in television receivers which employ series-connected heaters. When the 5X8 is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

GENERAL

ELECTRICAL

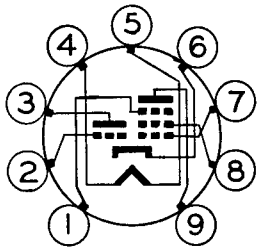
Cathode—Coated Unipotential	5X8	6X8
Heater Voltage, AC or DC	4.7	6.3 Volts
Heater Current	0.6	0.45 Amperes
Heater Warm-up Time*	11	.. Seconds

Direct Interelectrode Capacitances	With Shield†	Without Shield
Pentode Section		
Grid-Number 1 to Plate, maximum	0.06	0.09 μμf
Input	4.5	4.3 μμf
Output	1.4	0.7 μμf
Triode Section		
Grid to Plate	1.4	1.4 μμf
Input	2.6	2.0 μμf
Output	1.0	0.5 μμf
Pentode Section, Triode Connection‡		
Grid-Number 1 to Plate	1.3	1.4 μμf
Input	3.2	3.0 μμf
Output	2.0	1.6 μμf
Pentode Grid-Number 1 to Triode Plate, maximum	0.035	0.045 μμf
Pentode Plate to Triode Plate, maximum	0.008	0.040 μμf
Heater to Cathode	5.2	5.2 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

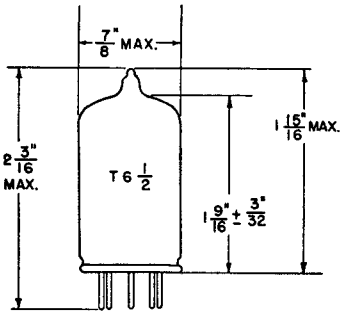


RETMA 9AK

TERMINAL CONNECTIONS

Pin 1—Pentode Grid Number 3 (Suppressor)
Pin 2—Triode Grid
Pin 3—Triode Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Cathode
Pin 7—Pentode Grid Number 1
Pin 8—Pentode Grid Number 2 (Screen)
Pin 9—Pentode Plate

PHYSICAL DIMENSIONS



RETMA 6–2

GENERAL ELECTRIC

Supersedes ET-T854, dated 4-54

MAXIMUM RATINGS

CONVERTER SERVICE—DESIGN-CENTER VALUES

PENTODE SECTION AS MIXER	Pentode Connection	Triode Connection‡
Plate Voltage	250	250 Volts
Suppressor Voltage	0	. . . Volts
Screen-Supply Voltage	250	. . . Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	0 Volts
Negative DC Grid-Number 1 Voltage	40	40 Volts
Plate Dissipation	2.0	2.4 Watts
Screen Dissipation	0.4	. . . Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	100 Volts
Heater Negative with Respect to Cathode	100	100 Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	0.1 Megohms
With Cathode Bias	0.5	0.5 Megohms

TRIODE SECTION AS OSCILLATOR	
Plate Voltage	250 Volts
Positive DC Grid Voltage	0 Volts
Negative DC Grid Voltage	40 Volts
Plate Dissipation	1.5 Watts
Grid Input	0.5 Watts
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	100 Volts
Heater Negative with Respect to Cathode	100 Volts
Grid Circuit Resistance	
With Fixed Bias	0.1 Megohms
With Cathode Bias	0.5 Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS—PENTODE SECTION	Pentode Connection	Triode Connection‡	
Plate Voltage	250	150	Volts
Suppressor, Connected to Cathode at Socket			
Screen Voltage	150	...	Volts
Cathode-Bias Resistor	200	250	Ohms
Amplification Factor	...	42	
Plate Resistance, approximate	750000	7900	Ohms
Transconductance	4600	4000	Micromhos
Plate Current	7.7	7.8	Milliamperes
Screen Current	1.6	...	Milliamperes
Grid-Number 1 Voltage, approximate $I_b = 10$ Microamperes	−10	−10	Volts

AVERAGE CHARACTERISTICS—TRIODE SECTION		
Plate Voltage	100	Volts
Cathode-Bias Resistor	100	Ohms
Amplification Factor	40	
Plate Resistance, approximate	6900	Ohms
Transconductance	5800	Micromhos
Plate Current	8.5	Milliamperes
Grid Voltage, approximate $I_b = 10$ Microamperes	−10	Volts

CONVERTER SERVICE

PENTODE SECTION AS MIXER WITH SEPARAT EEXCITATION	Pentode Connection	Triode Connection‡	
Plate Voltage	150	150	Volts
Suppressor, Connected to Cathode at Socket			
Screen Voltage	150	...	Volts
Grid-Number 1 Supply Voltage	−3.5	−3.5	Volts
Grid-Number 1 Circuit Resistance	120000	120000	Ohms
Oscillator Voltage at Grid-Number 1, RMS	2.6	2.6	Volts
Plate Current	6.2	7.8	Milliamperes
Screen Current	1.8	...	Milliamperes
Grid-Number 1 Current	2.0	2.0	Microamperes
Conversion Transconductance	2100	2800	Micromhos

TRIODE SECTION AS 250 MEGACYCLE OSCILLATORπ		
Plate Voltage	150	Volts
Grid Resistor	2700	Ohms
Plate Current	13	Milliamperes
Grid Current	3.6	Milliamperes
Power Output, approximate	0.5	Watts

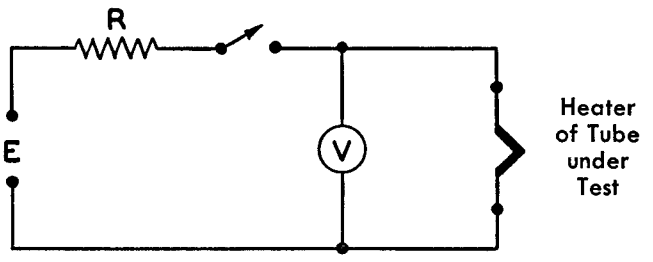
*Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals (V) to increase from zero to the heater test voltage (V_1). For this type, E = 18.7 volts (RMS or DC), V_1 = 3.73 volts (RMS or DC), and R = 23.5 ohms.

†With external shield (RETMA 315) connected to cathode unless otherwise indicated.

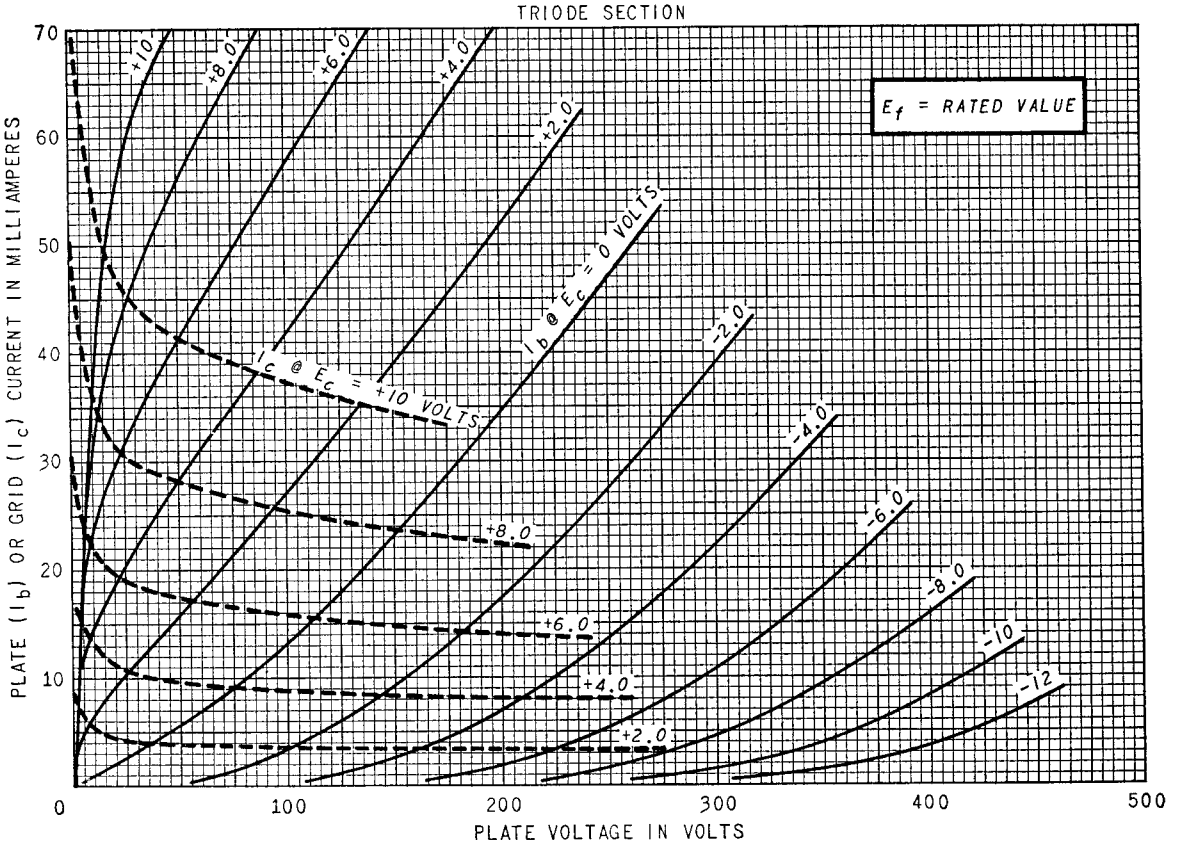
‡With screen connected to plate and suppressor connected to cathode.

§With external shield (RETMA 315) connected to ground.

πIn TV or FM receivers, the oscillator should generally be operated with less power input than shown in the data in order to avoid over-excitation and excessive oscillator radiation.

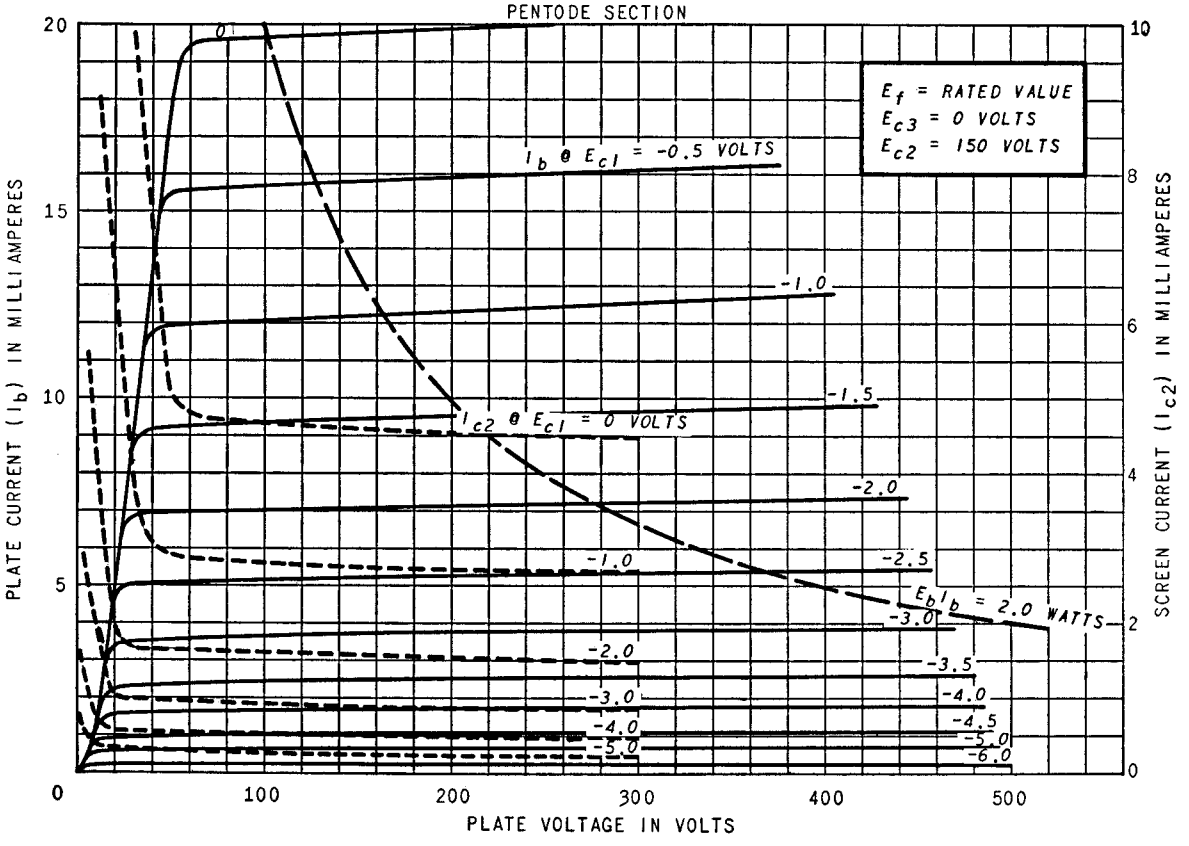


AVERAGE PLATE CHARACTERISTICS



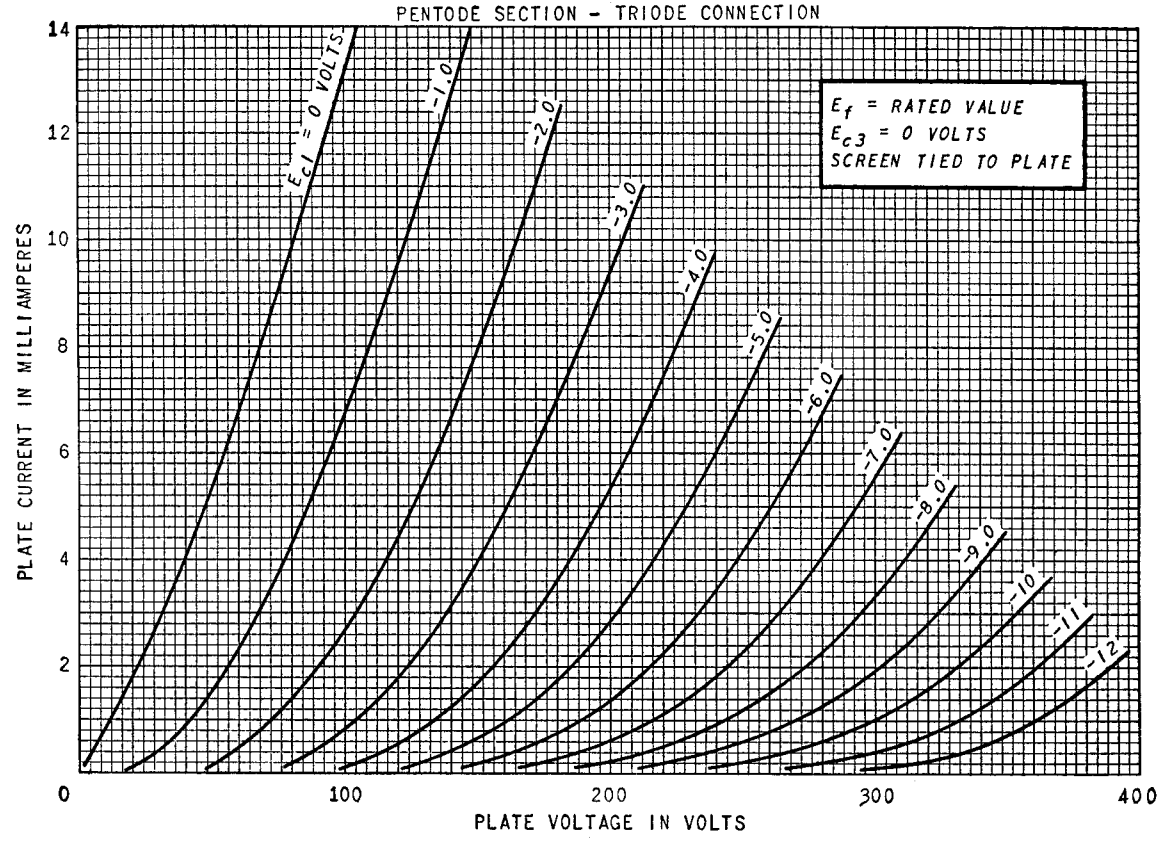
AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION



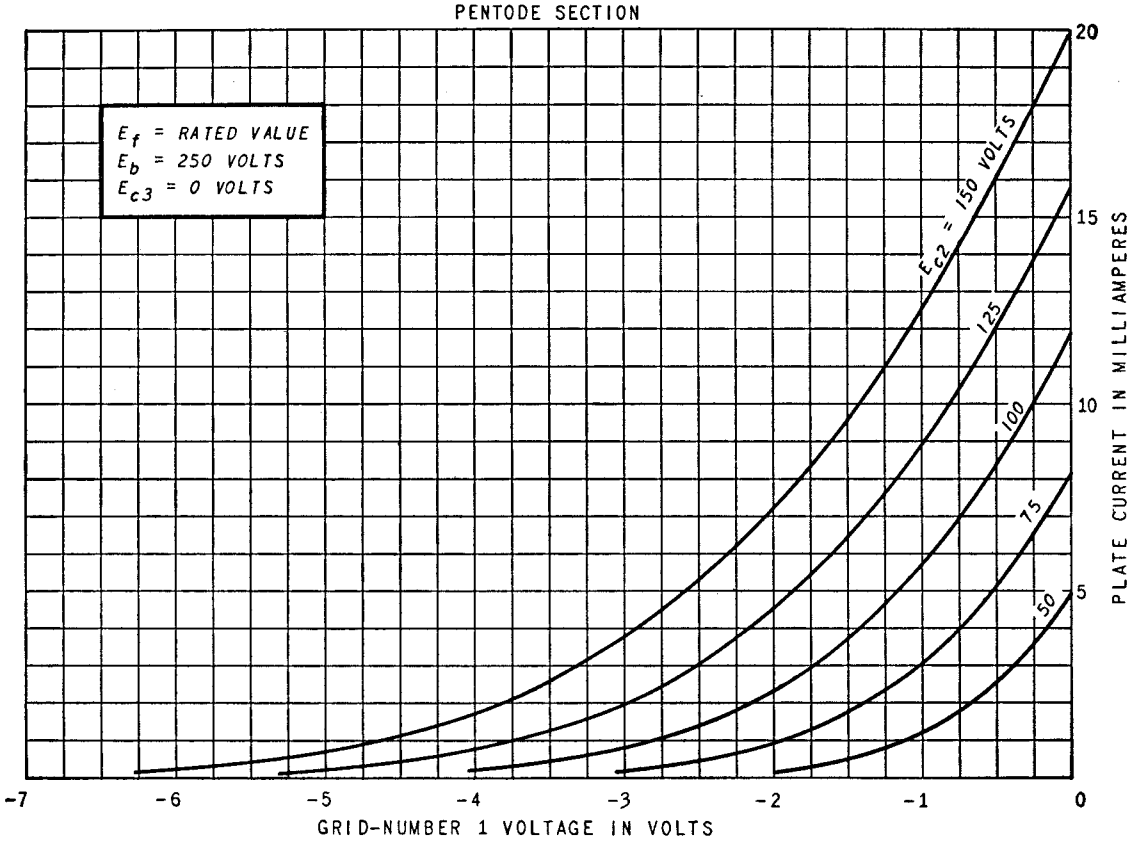
AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION - TRIODE CONNECTION



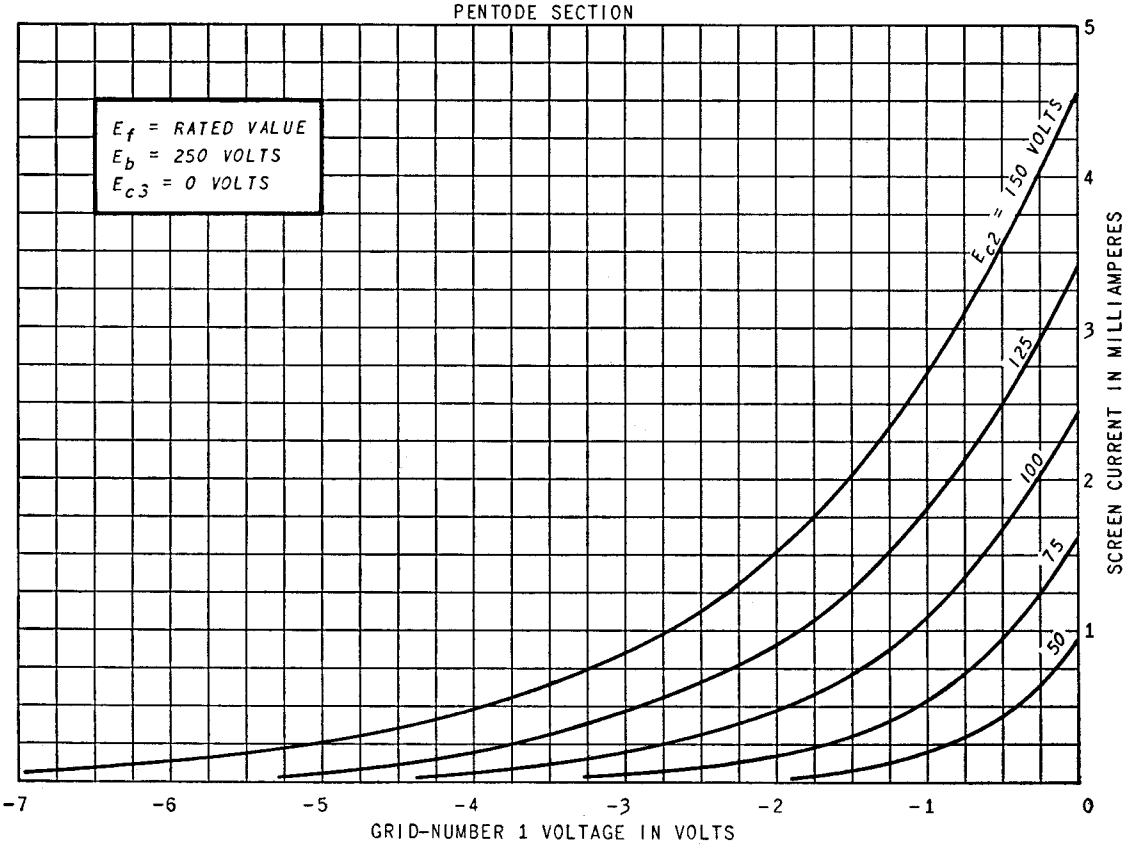
AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

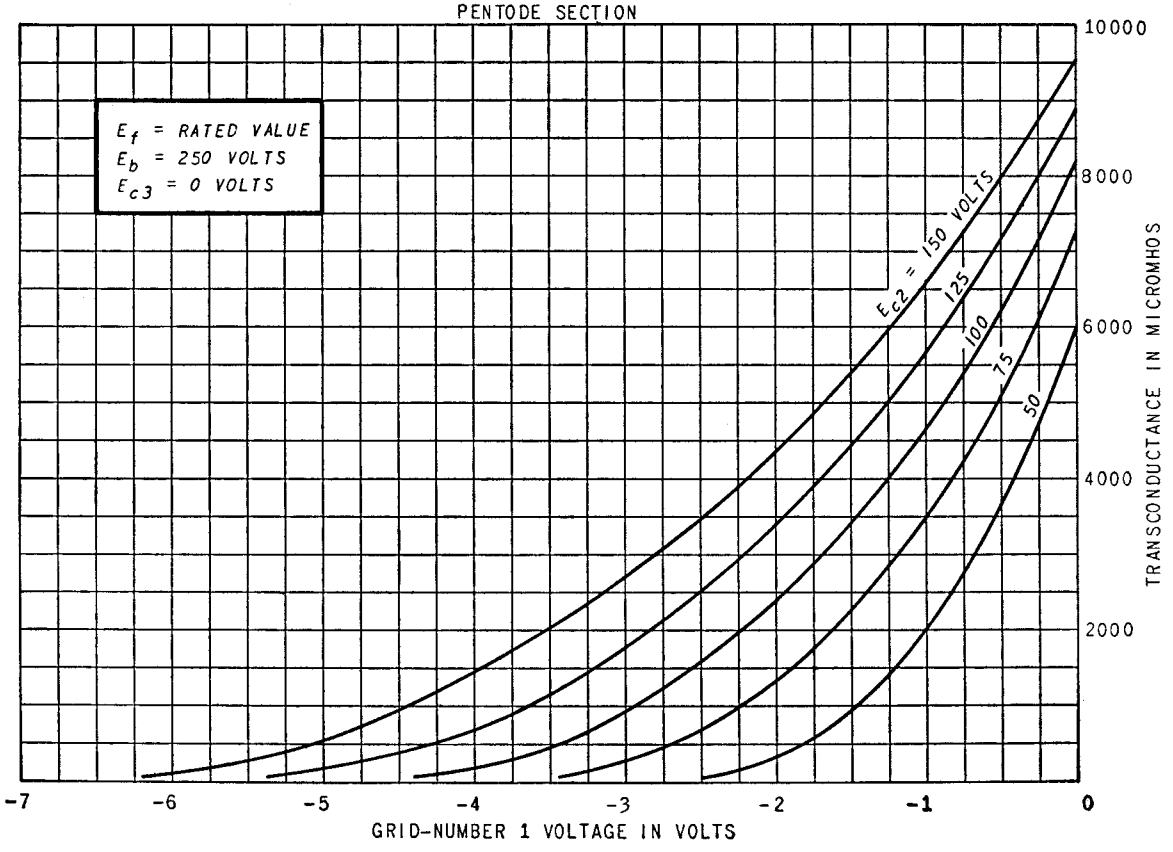


AVERAGE TRANSFER CHARACTERISTICS

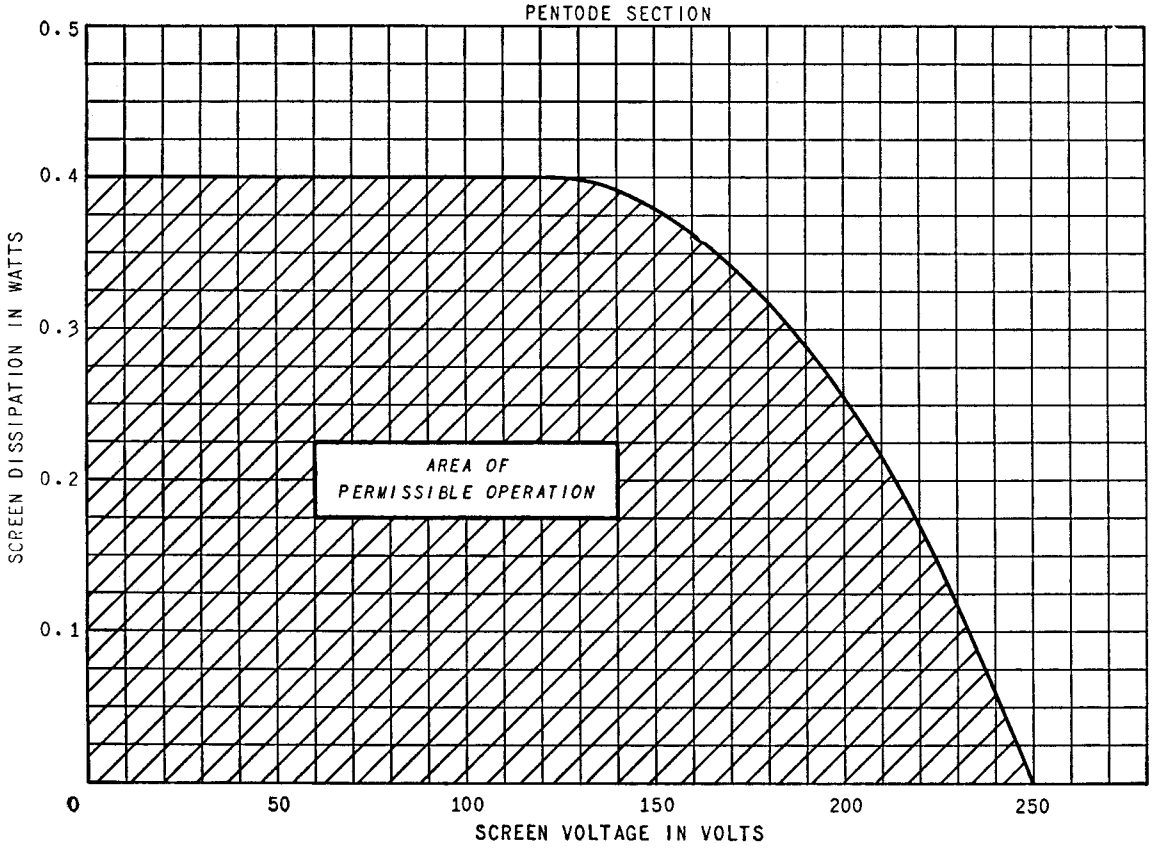
PENTODE SECTION



AVERAGE TRANSFER CHARACTERISTICS

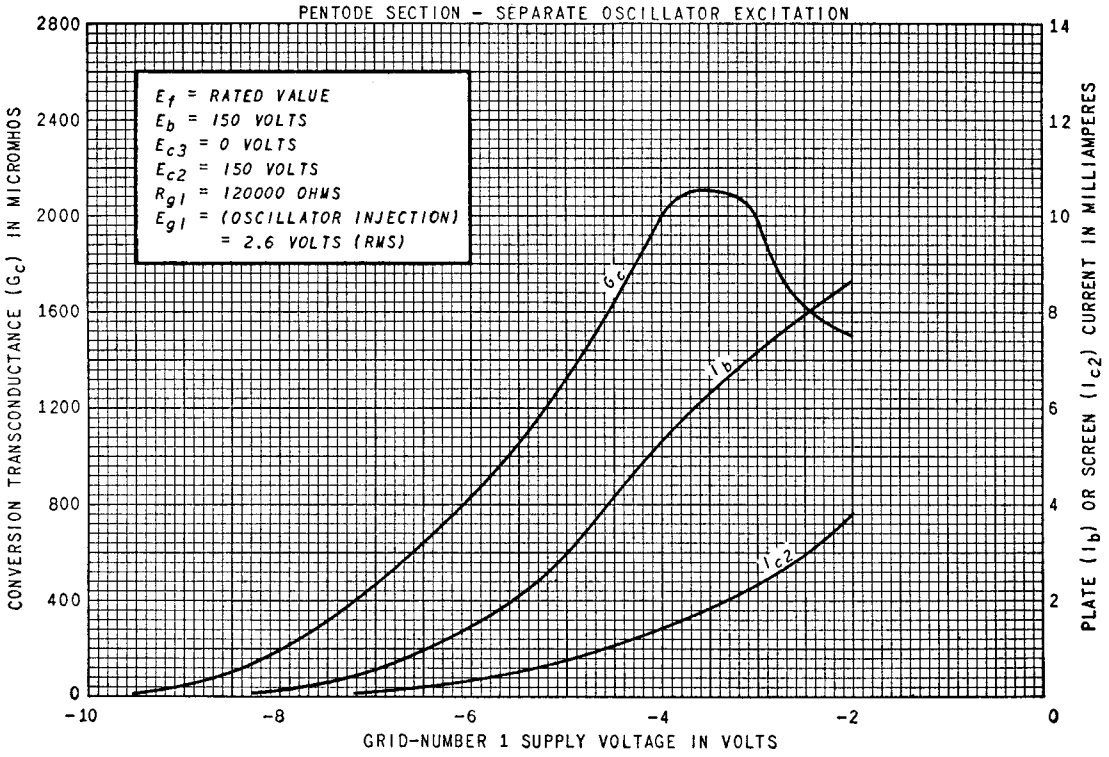


SCREEN RATING CHART



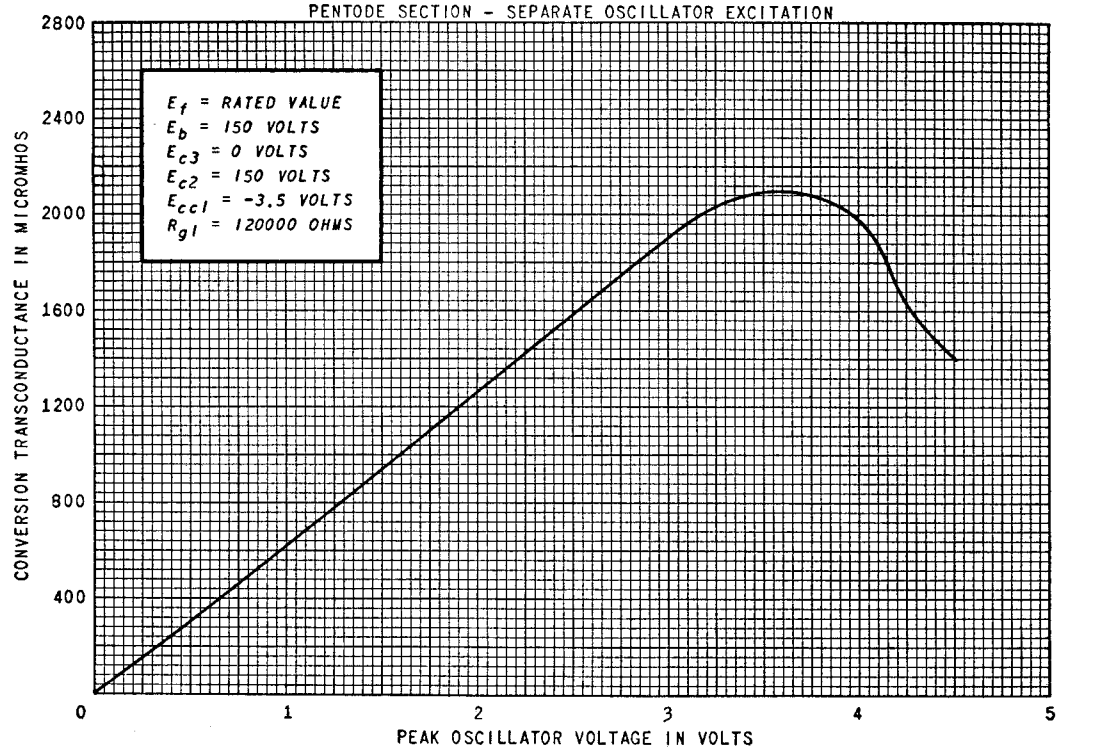
OPERATION CHARACTERISTICS

PENTODE SECTION - SEPARATE OSCILLATOR EXCITATION



OPERATION CHARACTERISTICS

PENTODE SECTION - SEPARATE OSCILLATOR EXCITATION



TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

Electronic TUBES

6Y6-GT

BEAM PENTODE

DESCRIPTION AND RATING

The 6Y6-GT is a beam power pentode primarily intended for use as an audio-frequency power amplifier. It is particularly useful in applications where the available supply voltage is relatively low. The 6Y6-GT differs from the 6Y6-G in only one respect, the straight-sided T-9 construction.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3	Volts
Heater Current	1.25	Amperes

MECHANICAL

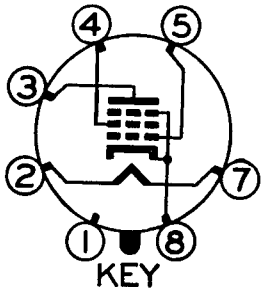
Mounting Position—Any
Envelope—T-9, Glass
Base—B6-81 or B7-7, Intermediate Shell Octal
or B6-84 or B7-59, Short Intermediate Shell Octal

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	200	Volts
Screen Voltage	135	Volts
Plate Dissipation	12.5	Watts
Screen Dissipation	1.75	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	180	Volts
Heater Negative with Respect to Cathode	180	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.5	Megohms

BASING DIAGRAM



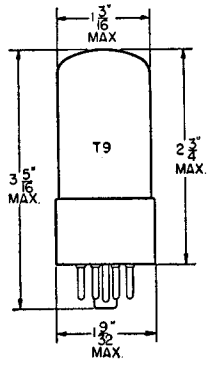
RETMA 7AC

TERMINAL CONNECTIONS

Pin 1—No Connection*
Pin 2—Heater
Pin 3—Plate
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates

* Pin 1 omitted on bases B6-81 and B6-84.

PHYSICAL DIMENSIONS



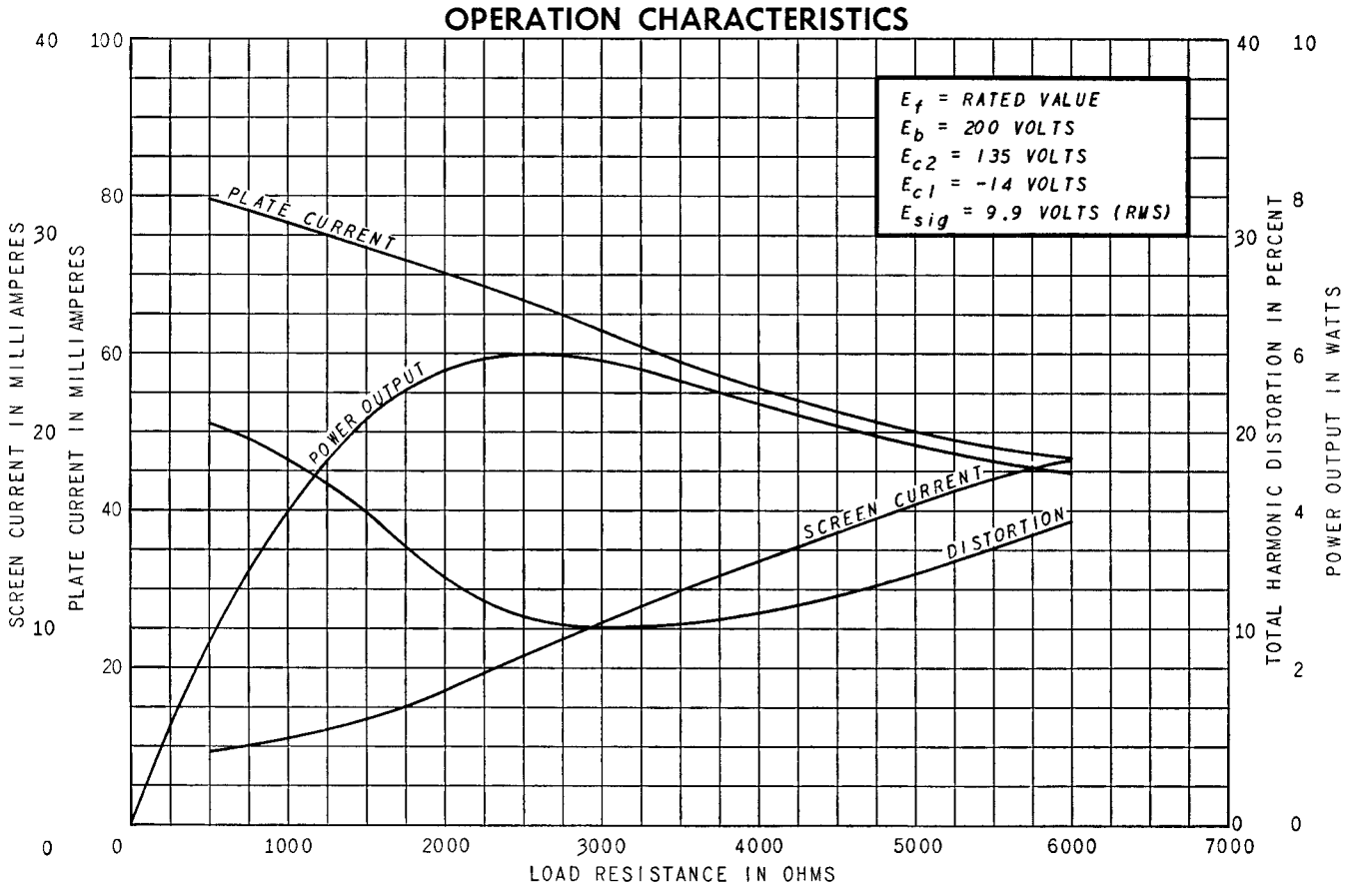
RETMA 9-11 OR 9-41

GENERAL ELECTRIC

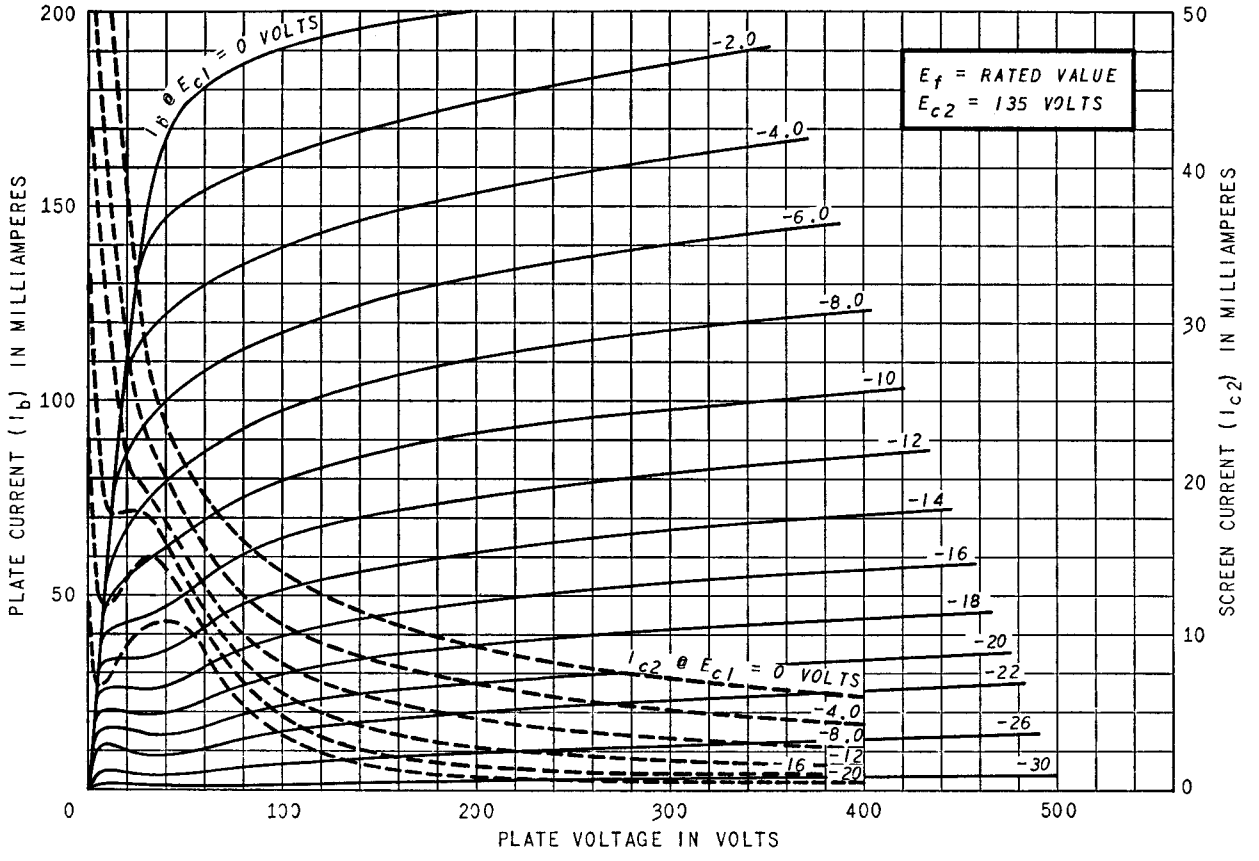
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

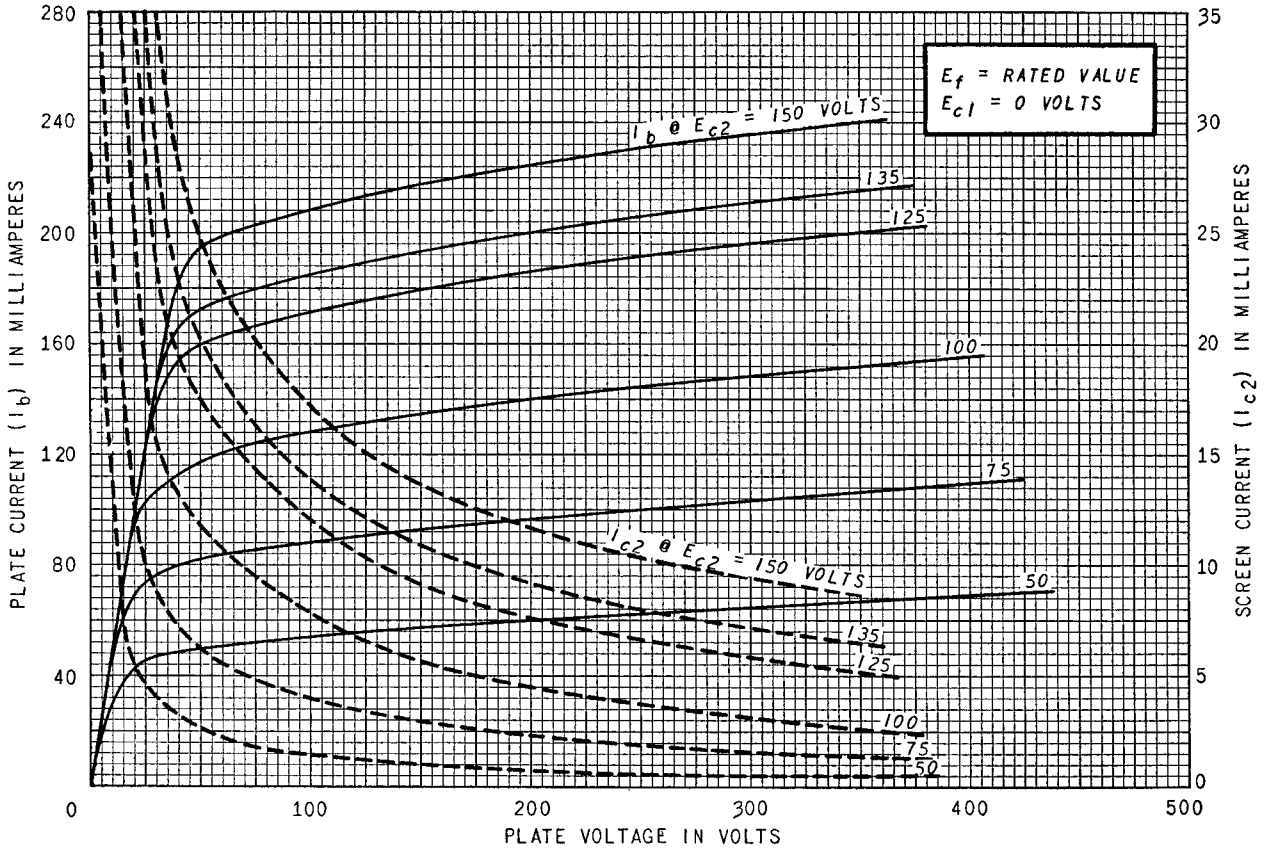
Plate Voltage	135	200	Volts
Screen Voltage	135	135	Volts
Grid-Number 1 Voltage	−13.5	−14	Volts
Peak AF Grid-Number 1 Voltage	13.5	14	Volts
Plate Resistance, approximate	9300	18300	Ohms
Transconductance	7000	7100	Micromhos
Zero-Signal Plate Current	58	61	Milliamperes
Maximum-Signal Plate Current	60	66	Milliamperes
Zero-Signal Screen Current	3.5	2.2	Milliamperes
Maximum-Signal Screen Current	11.5	9.0	Milliamperes
Load Resistance	2000	2600	Ohms
Total Harmonic Distortion, approximate	10	10	Percent
Maximum-Signal Power Output	3.6	6.0	Watts



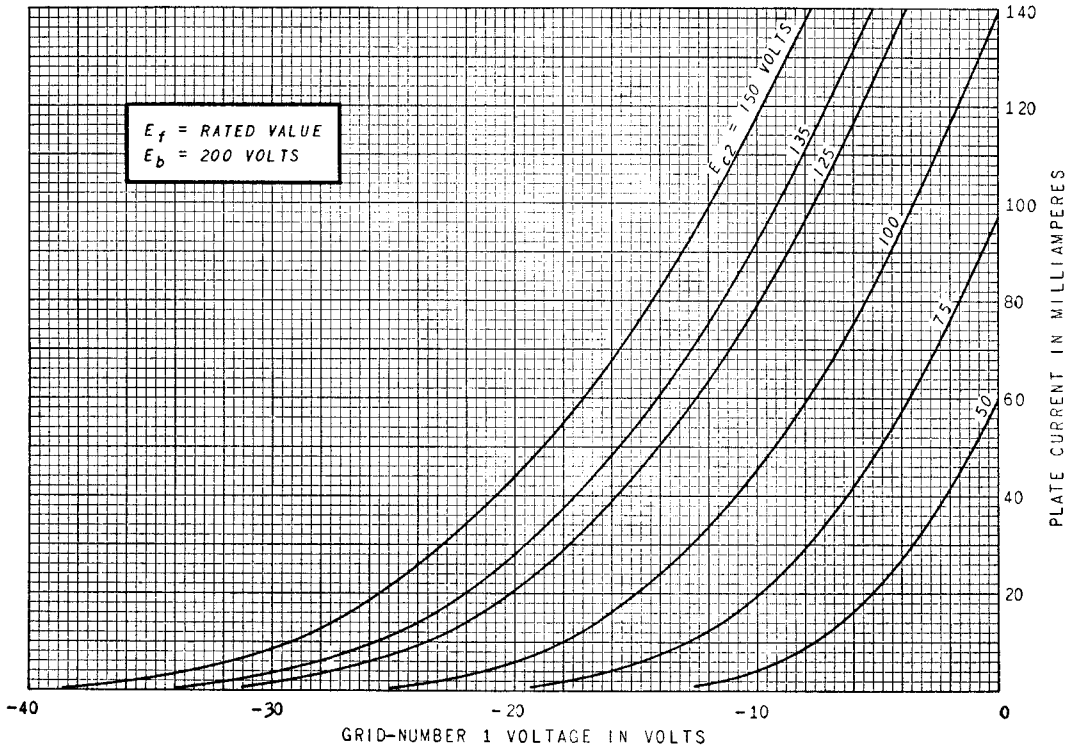
AVERAGE PLATE CHARACTERISTICS



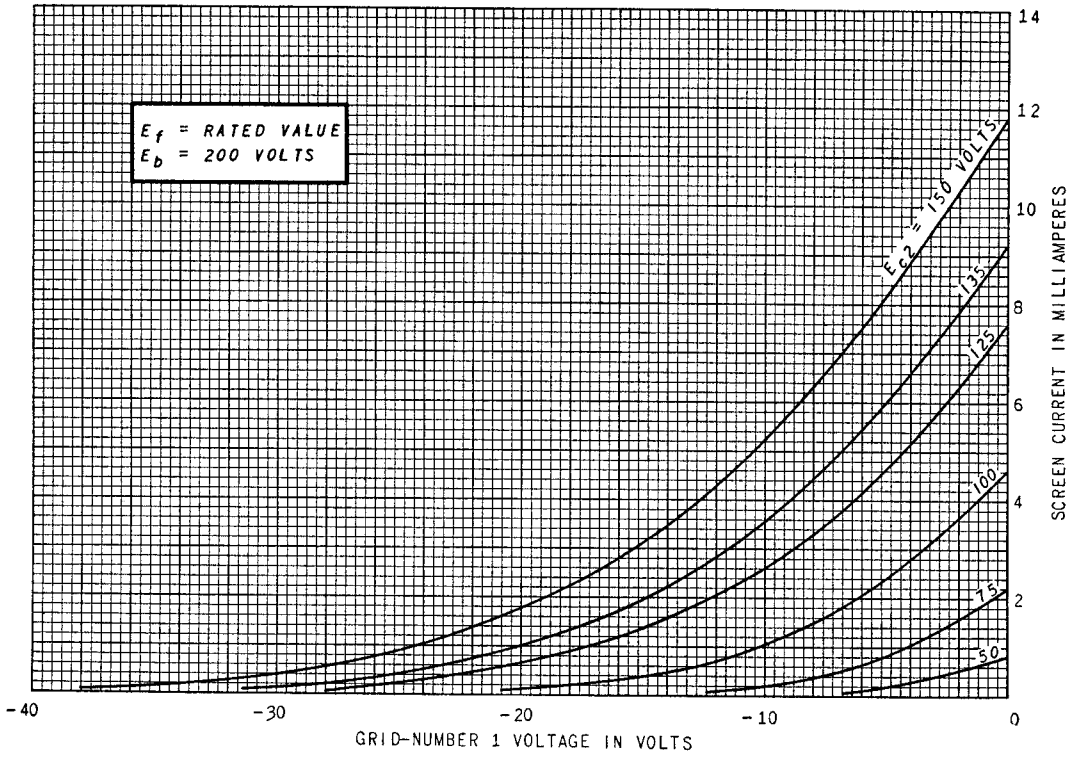
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

PRODUCT INFORMATION

Compactron Pentode — Gated-Beam Discriminator

6Z10

The 6Z10 is a compactron containing a gated-beam discriminator and a beam pentode. The gated-beam discriminator is suitable for FM and TV limiter and discriminator applications, and the beam pentode for audio power output service.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.95	Amperes

Direct Interelectrode Capacitances§

Gated-Beam Discriminator Section

Grid-Number 1 to Grid-Number 3	0.009	pf
Grid-Number 1 to All	4.4	pf
Grid-Number 3 to All	3.2	pf

Pentode Section

Grid-Number 1 to Plate	0.22	pf
Input	11	pf
Output	7.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

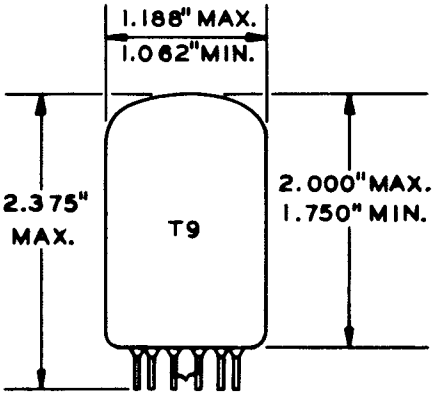
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

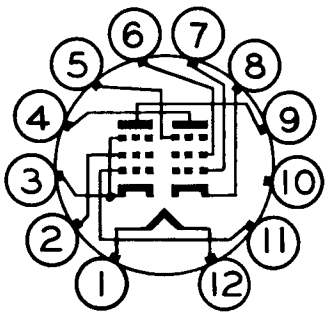


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Pentode Grid Number 2 (Screen)
Pin 3 - Pentode Cathode and Beam Plates
Pin 4 - Gated-Beam Discriminator Plate
Pin 5 - Gated-Beam Discriminator Grid Number 3 (Quadrature)
Pin 6 - Gated-Beam Discriminator Grid Number 2 (Accelerator)
Pin 7 - Gated-Beam Discriminator Grid Number 1
Pin 8 - Gated-Beam Discriminator Cathode and Internal Shields
Pin 9 - Pentode Plate
Pin 10 - No Connection
Pin 11 - Pentode Grid Number 1
Pin 12 - Heater

BASING DIAGRAM



EIA 12BT

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

Gated-Beam Discriminator Section

Plate-Supply Voltage	330	Volts
Accelerator-Supply Voltage	330	Volts
Peak Positive Grid-Number 1 Voltage	60	Volts
DC Cathode Current	13	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Pentode Section

Plate Voltage	275	Volts
Screen Voltage	275	Volts
Plate Dissipation	10	Watts
Screen Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	0.5	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Gated-Beam Discriminator Section

Plate Voltage	135	135	135	Volts
Accelerator Voltage	75	---	---	Volts
Accelerator-Supply Voltage	---	280	280	Volts
Accelerator Resistor	---	33000	33000	Ohms
Grid-Number 1 Voltage	0	0	0	Volts
Grid-Number 3 Voltage	+4.0	+4.0	0	Volts
Plate Current	---	5.0	---	Milliamperes
Accelerator Current	4.5	---	---	Milliamperes
Grid-Number 1 Transconductance	---	---	360	Micromhos
Grid-Number 3 Transconductance	---	---	700	Micromhos
Grid-Number 1 Voltage, approximate				
Ib = 20 Microamperes	---	---	-4	Volts
Grid-Number 3 Voltage, approximate				
Ib = 20 Microamperes	---	---	-4	Volts

CLASS A_1 AMPLIFIER

Pentode Section

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	-8.0	Volts
Peak AF Grid-Number 1 Voltage	8.0	Volts
Plate Resistance, approximate	100000	Ohms
Transconductance	6500	Micromhos
Zero-Signal Plate Current	35	Milliamperes
Maximum-Signal Plate Current	39	Milliamperes
Zero-Signal Screen Current	3.0	Milliamperes
Maximum-Signal Screen Current	13	Milliamperes
Load Resistance	5000	Ohms
Total Harmonic Distortion, approximate	8.5	Percent
Maximum-Signal Power Output	4.2	Watts

NOTES

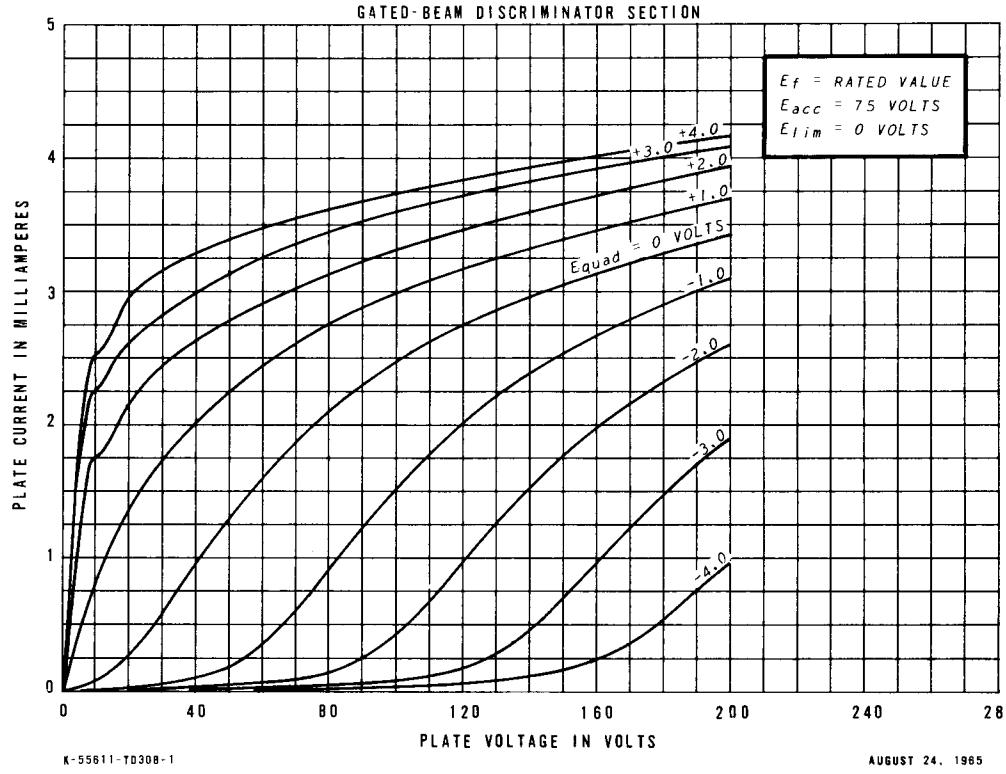
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

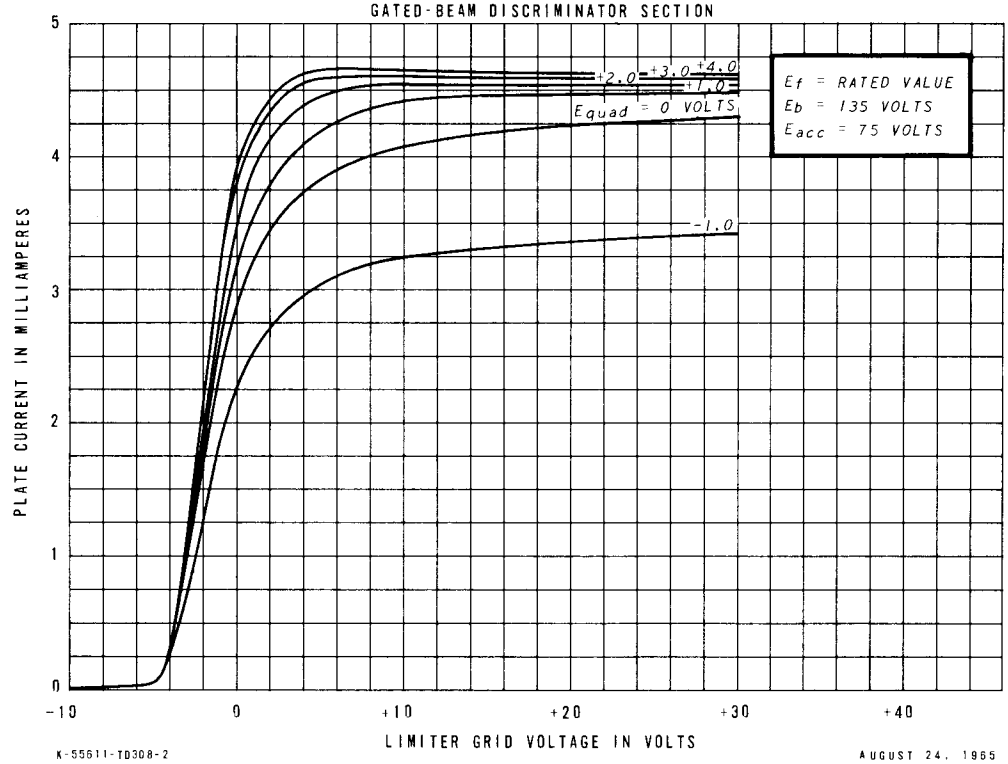
The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

GATED-BEAM DISCRIMINATOR SECTION

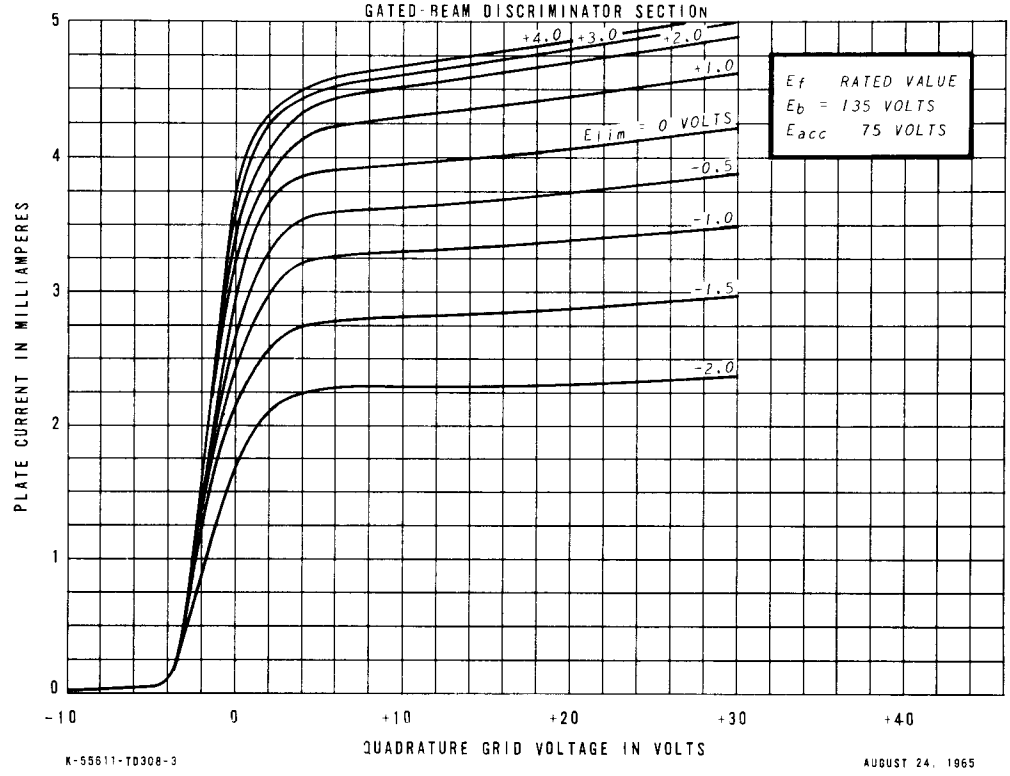


K-55611-TD308-2

AUGUST 24, 1965

AVERAGE TRANSFER CHARACTERISTICS

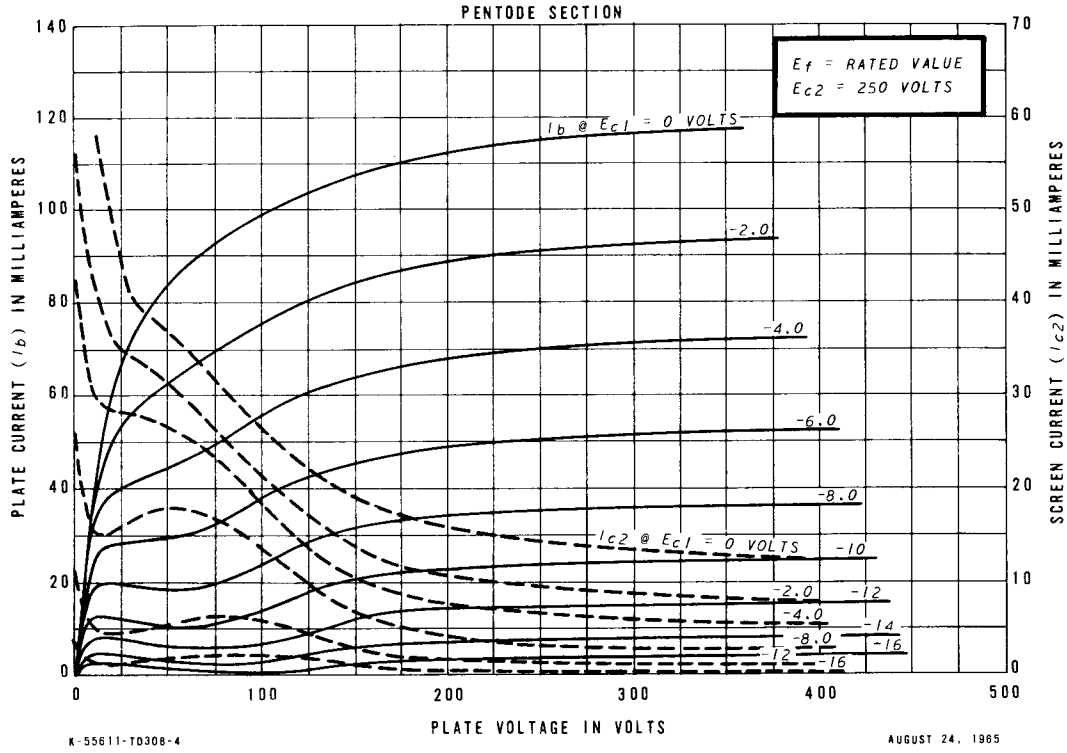
GATED-BEAM DISCRIMINATOR SECTION



K-55611-TD308-3

AUGUST 24, 1965

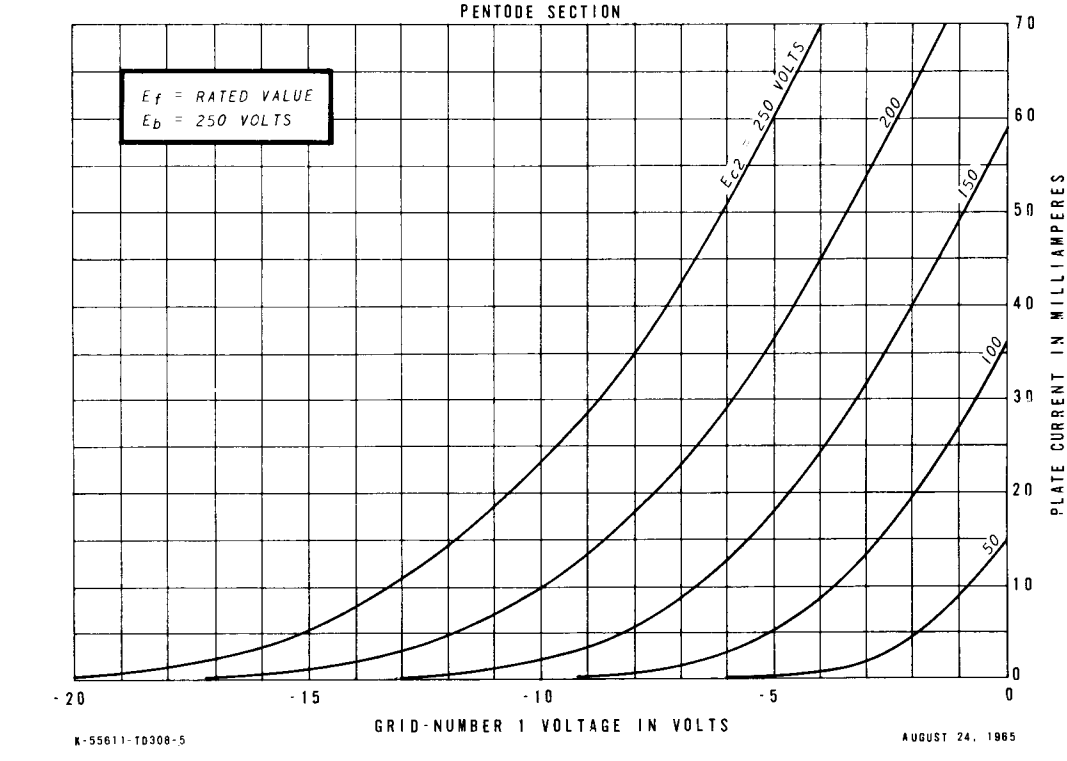
AVERAGE PLATE CHARACTERISTICS



K-55611-TD308-4

AUGUST 24, 1965

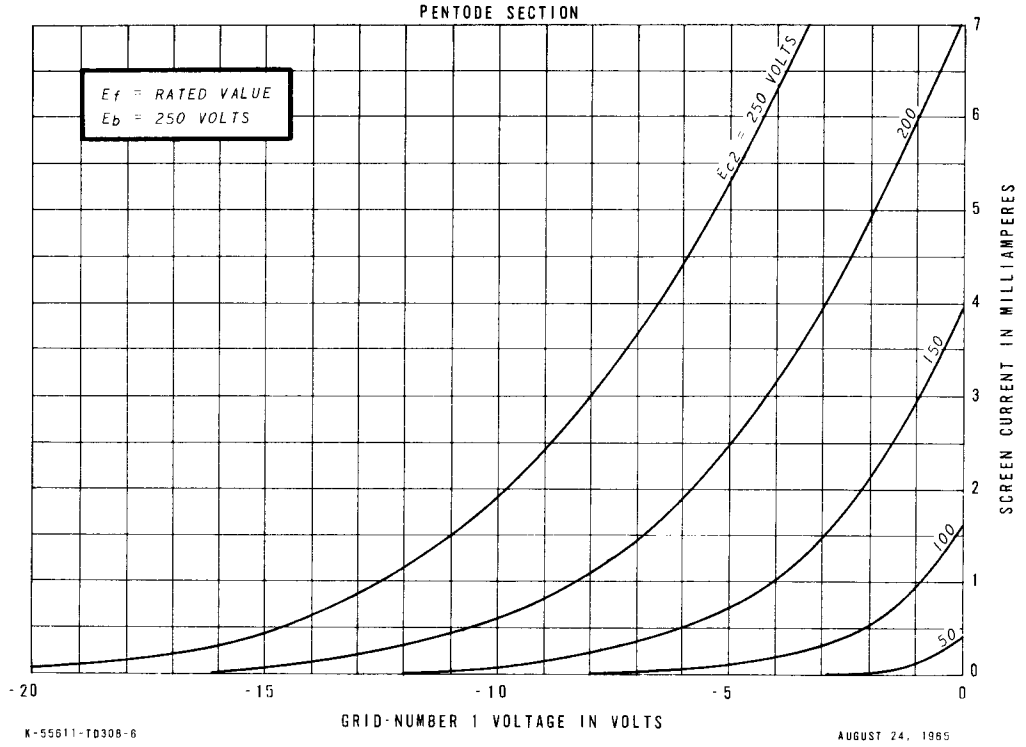
AVERAGE TRANSFER CHARACTERISTICS



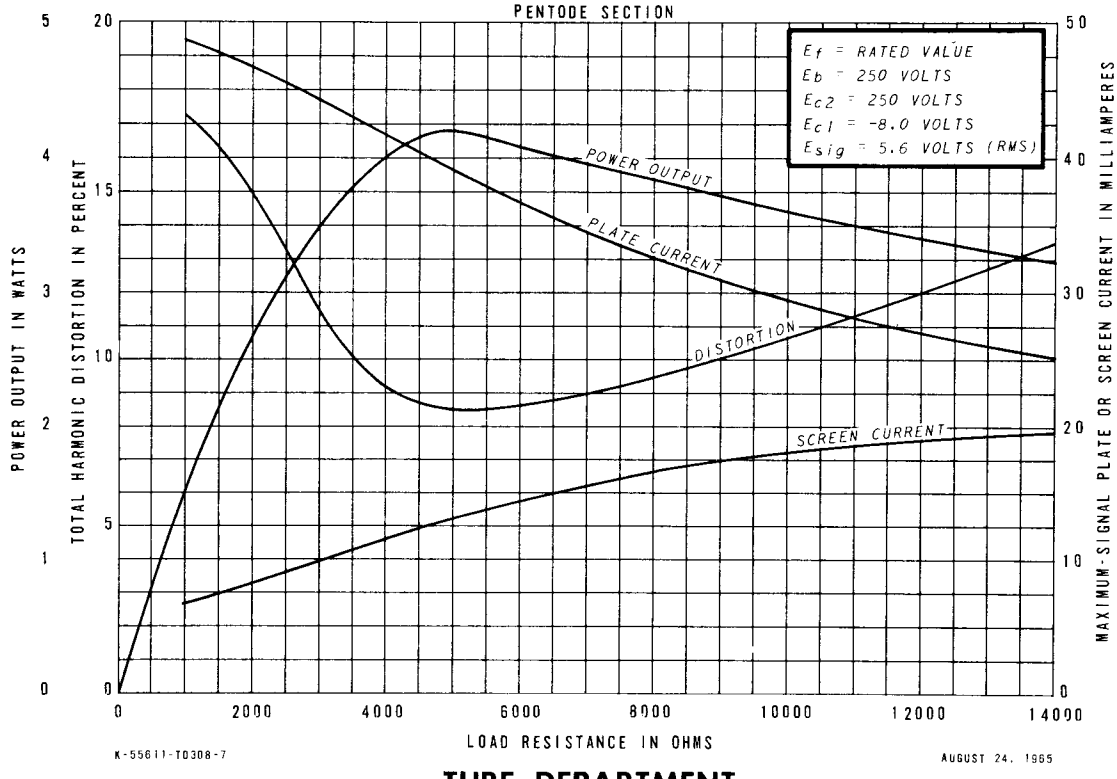
K-55611-TD308-5

AUGUST 24, 1965

AVERAGE TRANSFER CHARACTERISTICS



OPERATION CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

7AKP19 AND 7AKP25
CATHODE RAY TUBE

7-INCH RECTANGULAR, GLASS

FACE PLATE - SPHERICAL, CLEAR

FOCUS - ELECTROSTATIC

PERSISTENCE - LONG

DEFLECTION - ELECTROSTATIC

POST ACCELERATION

TWO GUNS

ALUMINIZED

DESCRIPTION AND RATING

The 7AKP19 and 7AKP25 are 4 by 6-inch rectangular faced cathode ray tubes with electrostatic-focus and deflection for radar and oscillographic applications that require a long persistence. They have two electron guns and use post-acceleration. A particular feature of the 7AKP25 is the phosphor which is more burn-resistant than that in the 7AKP19, and which eliminates the initial blue flash characteristic of the P7 phosphor.

GENERAL
Data and Ratings Are Per Gun Unless Otherwise Specified

ELECTRICAL

Heater Voltage	6.3 Volts
Heater Current	0.6 ± 10% Amperes

Focusing Method - Electrostatic
Deflecting Method - Electrostatic

Direct Interelectrode Capacitances, maximum

Cathode to All Other Electrodes	7 uuf
Grid No. 1 to All Other Electrodes	8 uuf
D1 to D2	6 uuf
D3 to D4	6 uuf
D1 to All Other Electrodes	11.5 uuf
D2 to All Other Electrodes	11.5 uuf
D3 to All Other Electrodes	11.5 uuf
D4 to All Other Electrodes	11.5 uuf

OPTICAL	7AKP19	7AKP25
Phosphor Number	P19	P25
Fluorescent Color	Orange	Orange
Phosphorescent Color	Orange	Orange
Persistencd	Long	Long

Faceplate - Clear

MECHANICAL

Over-all Length . . . . . 17-7/8 ± 3/8 Inches
Greatest Bulb Dimensions
Diagonal . . . . . 6-5/8 ± 1/16 Inches
Width . . . . . .6-1/32 ± 1/16 Inches
Height . . . . . .4-1/32 ± 1/16 Inches
Minimum Useful Screen Dimensions, along tube axis . . 3-1/4 by 5-1/4 Inches

Post-Accelerator Bulb Contact - Special Molded Cap
Base - 25 Pin, JETEC No. B25-139
Basing - Special
Bulb Contact Alignment
Post-Accelerator Contact Aligns with Trace of D1-D2 ± 10 Degrees
Post-Accelerator Contact on Same Side as Pin No. 1

Base Alignment
D1-D2 Trace Aligns with Pin No. 1 and Tube Axis ± 10 Degrees
Positive Voltage on D1 Deflects Beam Approximately Toward Pin No. 1
Positive Voltage on D3 Deflects Beam Approximately Toward Pin No. 12

Angle between D3-D4 and D1-D2 Traces. . . . . 90 ± 1 Degrees
Angle between Corresponding Traces . . . . . 1 Max. Degrees
D1-D2 Trace Aligns with Bulb Wall . . . . . Within ± 3 Degrees

Mounting Position - Any

MAXIMUM RATINGS

DESIGN-CENTER VALUES*
Per Gun Unless Otherwise Specified

Post-Accelerator Voltage	10,000 Max. Volts DC
Anode Voltage#	4,950 Max. Volts DC
Ratio Post-Accelerator Voltage to Anode Voltage	2.0 Max.
Anode Current	##
Focusing-Electrode Voltage	2500 Max. Volts DC
Grid No. 1 Voltage	
Negative-Bias Value	200 Max. Volts DC
Positive-Bias Value	0 Max. Volts DC
Positive-Peak Value	2 Max. Volts
Peak Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	.180 Max. Volts
Heater Positive with Respect to Cathode	.180 Max. Volts
Peak Voltage between Anode and Any Deflecting Electrode	1000 Max. Volts

TYPICAL OPERATING CONDITIONS
Per Gun Unless Otherwise Specified

Post-Accelerator Voltage	7300 Volts DC
Anode Voltage	4000 Volts DC
Focusing-Electrode Voltage	1150 to 1500 Volts DC
Grid No. 1 Voltage**	-50 to -120 Volts DC
Deflection Factors	
D1 and D2	180 to 225 Volts DC per Inch
D3 and D4	140 to 170 Volts DC per Inch
Focusing-Electrode Current	-15 to +10 Microamperes
Spot Position, undeflected+	Within 15 mm Square
Line Width A++	0.30 Max. Millimeters
Line Width B++	0.50 Max. Millimeters

MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5 Max. Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

#Anode, grid No. 2, and grid No. 4 which are connected together within the tube are referred to herein as anode.

##The phosphor screen may be damaged if the exciting current density is greater than 1.4 microamperes per square centimeter for the P25, and 0.06 microamperes per square centimeter for the P19.

**For visual extinction of focused undeflected spot.

+The design-center positions of the undeflected spots are located ± 1/2 inch from the center of the tube face on a vertical line through the center of the face.

++ Measured in accordance with specification MIL-E-1C paragraph 4.12.6.1 at an anode No. 3 (post-accelerator anode) current of 2.0 microamperes d-c.

Electronic Components Division
Cathode Ray Tube Department
Electronics Park - Syracuse, New York

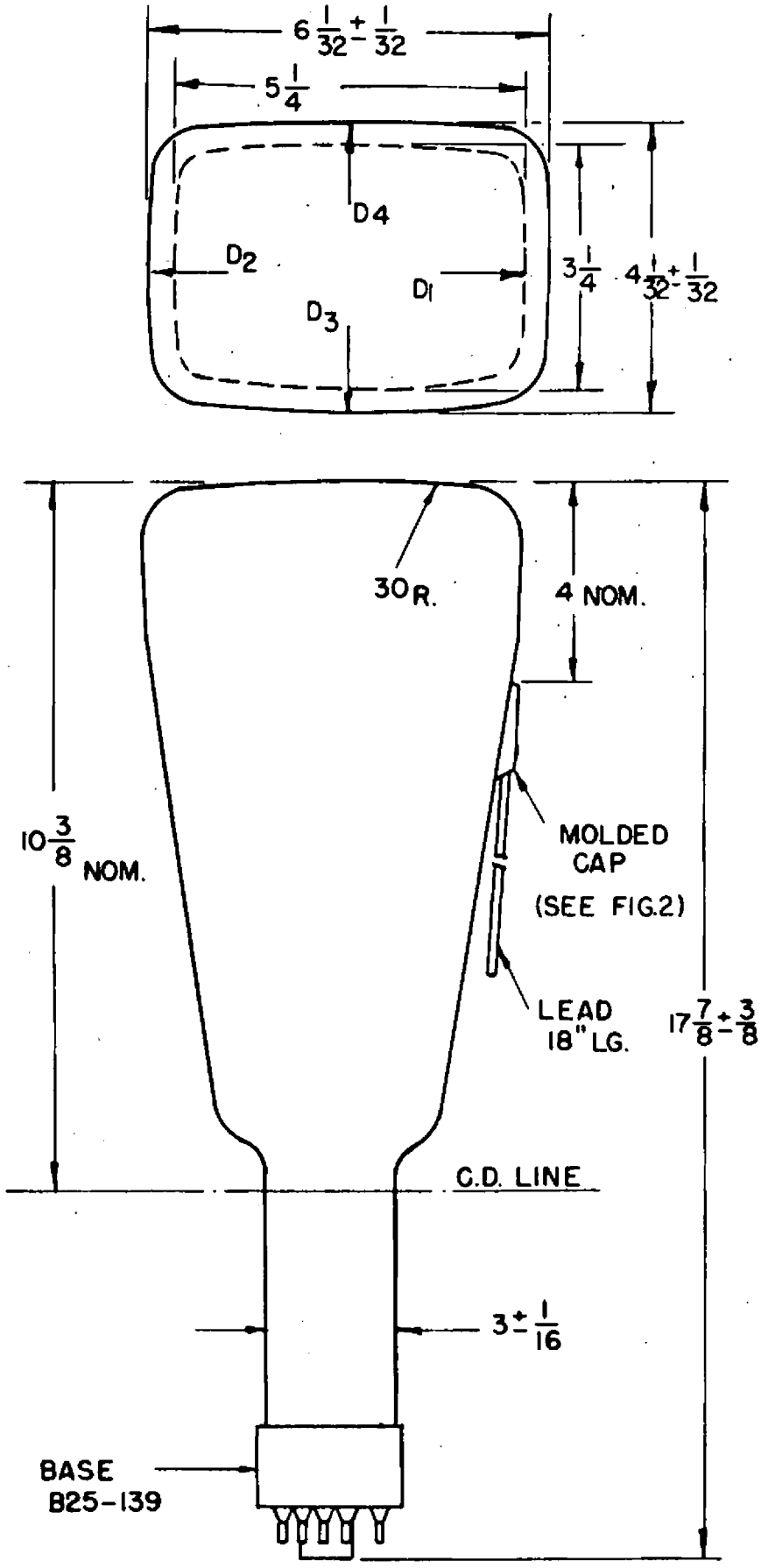
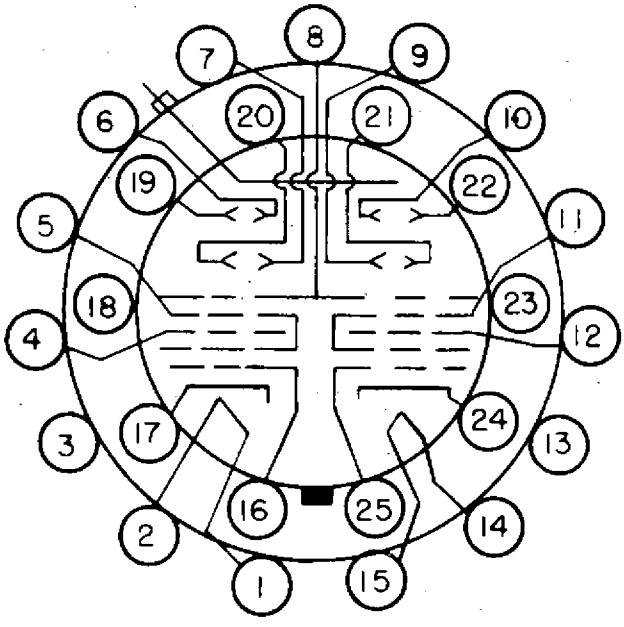

6 1/32 + 1/32
5 1/4
D4
D2
D1
D3
3 1/4
4 1/32 + 1/32
30 R.
4 NOM.
10 3/8 NOM.
MOLDED CAP
(SEE FIG.2)
LEAD 18" LG.
17 7/8 + 3/8
C.D. LINE
3 + 1/16
BASE B25-139

FIG. 1



BOTTOM VIEW

UNIT A		UNIT B	
PIN NO.	ELEMENT	PIN NO.	ELEMENT
14	HEATER	1	HEATER
15	HEATER	2	HEATER
24	CATHODE	17	CATHODE
25	GRID NO. 1	16	GRID NO. 1
12	FOCUSING ELECTRODE	4	FOCUSING ELECTRODE
22	DEFLECTOR D1	6	DEFLECTOR D1
10	DEFLECTOR D2	19	DEFLECTOR D2
9	DEFLECTOR D3	20	DEFLECTOR D3
21	DEFLECTOR D4	7	DEFLECTOR D4
11	ANODE	5	ANODE
13	NO CONNECTION	3	NO CONNECTION
23	NO CONNECTION	18	NO CONNECTION
		8	SHIELD

CAP - POST ACCELERATOR

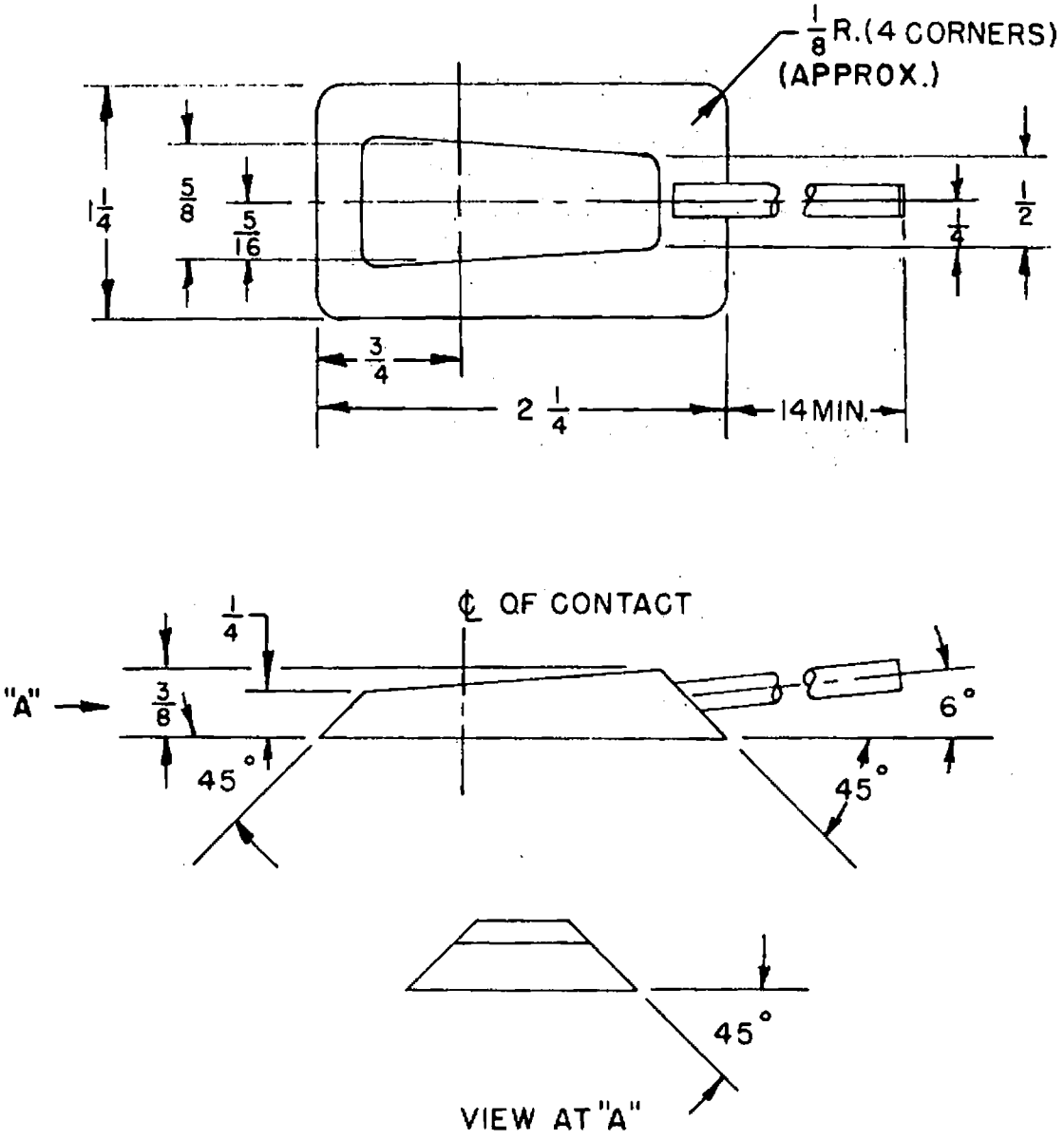


FIG. 2

DIMENSIONS ARE MAXIMUM UNLESS OTHERWISE SPECIFIED.

7ARP4

CATHODE-RAY TUBE

7-INCH ROUND, GLASS
FOCUS--ELECTROSTATIC
DEFLECTION--MAGNETIC
50-DEGREE DEFLECTION ANGLE

FACEPLATE--SPHERICAL, CLEAR
HIGH-RESOLUTION GUN
PERSISTENCE--SHORT
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 7ARP4 is a 7-inch electrostatic-focus and magnetic-deflection cathode-ray tube for radar and oscillographic applications that requires a short persistence. It has a high-resolution electron gun with a low-voltage focusing lens which provides substantially automatic focus independent of variations in line voltage. The fluorescent screen is aluminized to increase light output, reduce undesirable screen charging, and prevent ion-spot blemish.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes

Focusing Method--Electrostatic
Deflecting Method--Magnetic

Deflection Angle, approximate	50	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf

OPTICAL

Phosphor Number -	P-4
Fluorescent Color -	White
Phosphorescent Color -	White
Persistence -	Short

Faceplate--Clear with transparent conductive coating.

GENERAL ELECTRIC COMPANY

CATHODE-RAY TUBE DEPARTMENT

Syracuse, N. Y.

from JETEC release #2266, Aug. 25, 1958

MECHANICAL

Over-all Length	13-1/4±1/4	Inches
Greatest Bulb Diameter	7-3/16±1/8	Inches
Minimum Useful Screen Diameter	6	Inches

Bulb Number, ASA Designation--J57½C1 with transparent conductive coating.
Bulb Contact--Rescessed Small-cavity Cap, JETEC No. J1-21
Base--Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing, JETEC Designation--12M
Bulb Contact Alignment
Anode Contact Aligns with Pin-No. 3 Position±10 Degrees.

Mounting Position--Any

MAXIMUM RATINGS*

DESIGN CENTER VALUES†

Anode Voltage‡	11,000	Max Volts DC
Anode Input §	6	Max Watts
Focusing-Electrode Voltage	-500 to +1000	Max Volts DC
Grid-No. 2 Voltage	700	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	180	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	180	Max Volts DC
Heater Positive with Respect to Cathode	180	Max Volts DC

TYPICAL OPERATING CONDITIONS*

Anode Voltage ▲	10,000	Volts DC
Focusing-Electrode Voltage for Focus**	-50 to 250	Volts DC
Focusing-Electrode Current	-15 to 15	Microamperes
Grid-No. 2 Voltage	330	Volts DC
Grid-No. 1 Voltage ♦	-30 to -67	Volts DC
Line Width Aϕ	0.19	Max mm
Spot Position, undeflected ♥	10	mm.

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Tesistance	1.5	Max Megohms

* All Voltages are measured with respect to cathode.

† The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten-percent.

‡ Anode, grid-No. 3, and grid-No. 5 which are connected together within the tube are referred to herein as anode.

§ Anode input equals the product of anode voltage and average current measured at the terminal.

** At a cathode current of 100ua DC.

▲ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 7000 volts.

◆ For visual extinction of undeflected focused spot.

ø Measured in accordance with MIL-E-1C specifications, paragraph 4.12.6.2, at an anode current of 100 microamperes.

● The center of the undeflected, unfocused spot will fall within a circle of 10mm radius concentric with the tube face.

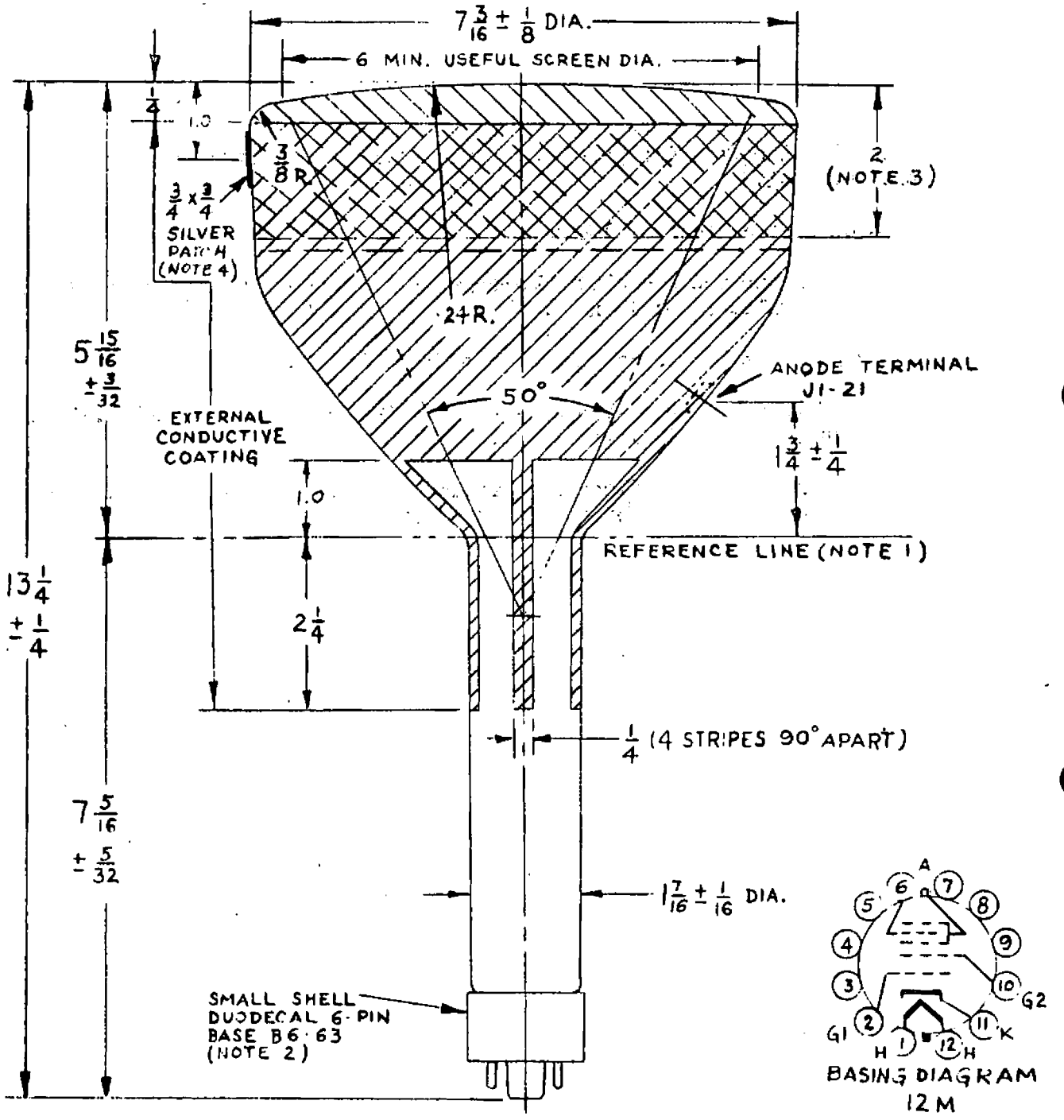


Figure 1

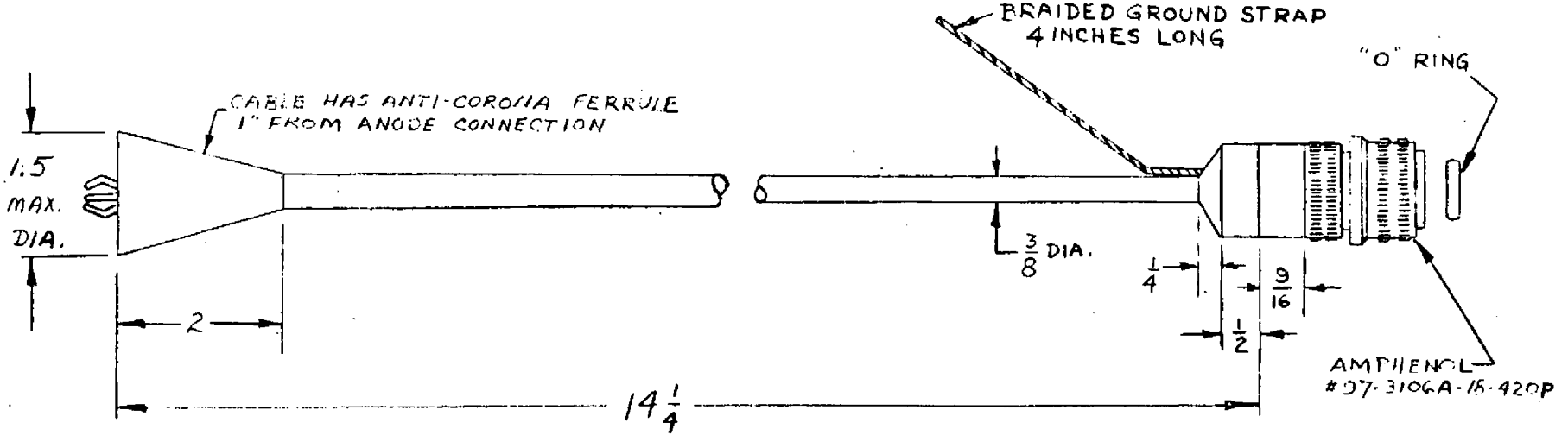
Notes:

1. Reference line is determined by the plane of the upper edge of the reference line gage (E.I.A. No.112) when the gage is resting on the bulb cone.

2. Anode terminal aligns with pin no. 3 position ± 10 degrees.

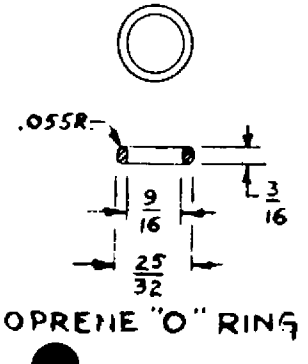
3. Tube face to have transparent conductive coating with maximum resistance of 2,000 Ω/cm^2.

4. This area represents a 3/4" x 3/4" patch of silver paint with no lacquer coating and is the bulb ground contact.



POTTED LEAD WITH AMPHENOL CONNECTOR
(PERMANENTLY AFFIXED TO ANODE TERMINAL)

FIG. 2



NEOPRENE "O" RING

7ATP7

CATHODE RAY TUBE

7-INCH ROUND, GLASS	POST ACCELERATION
FOCUS -- ELECTROSTATIC	PERSISTENCE -- LONG
DEFLECTION -- ELECTROSTATIC	FACEPLATE -- SPHERICAL, CLEAR

DESCRIPTION AND RATING

The 7ATP7 is a cathode ray tube for radar and oscillographic applications. A feature of this tube is post acceleration which assures maximum deflection sensitivity with high brightness.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes

Focusing Method -- Electrostatic
Deflecting Method -- Electrostatic

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	6.0	uuf
Grid No. 1 to All Other Electrodes	7.0	uuf
D1 to D2	3.0	uuf
D3 to D4	2.0	uuf
D1 to All Other Electrodes	8.0	uuf
D2 to All Other Electrodes	8.0	uuf
D3 to All Other Electrodes	4.5	uuf
D4 to All Other Electrodes	4.5	uuf

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

from JEDEC release #2412, March 23, 1959

OPTICAL

Phosphor Number -- P7
Fluorescent Color -- Blue-White
Phosphorescent Color -- Yellow
Persistence -- Long

Faceplate -- Clear

MECHANICAL

Over-all Length	17-1/8 ± 3/8	Inches
Greatest Bulb Diameter	7-3/8 ± 3/16	Inches
Minimum Useful Screen Diameter	6.5	Inches

Bulb Contact -- Recessed Small-ball Cap, JETEC No. J1-22
Base -- 12-Pin Medium Shell Dihelptal JETEC No. B12-37
Basing -- JETEC Designation 14J
Bulb Contact Alignment
J1-22 Contact Aligns with Trace of D1-D2 ± 10 Degrees
J1-22 Contact on Same Side as Pin No. 5

Base Alignment
D1-D2 Trace Aligns with Pin.No. 5 and Tube Axis ± 10 Degrees
Positive Voltage on D1 Deflects Beam Approximately Toward Pin No. 5
Positive Voltage on D3 Deflects Beam Approximately Toward Pin No. 2

Trace Alignment
Angle Between D3-D4 and D1-D2 Traces . . . . . 90 ± 1 Degrees

Mounting Position -- Any

RATINGS

DESIGN-CENTER VALUES*

Post Accelerator Voltage	6,000	Max Volts DC
Anode Voltage+	2,000	Max Volts DC
Radio Post Accelerator Voltage to Anode Voltage	2.5	Max
Anode Input/	6	Max Watts
Focusing Electrode Voltage	1,100	Max Volts DC
Grid No. 1 Voltage		
Negative-Bias Value	200	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	180	Max Volts
Heater Positive with Respect to Cathode	180	Max Volts
Peak Voltage between Anode and Any Deflecting Electrode	1,500	Max Volts

TYPICAL OPERATING CONDITIONS

Post Accelerator Voltage	4,000	Volts DC
Anode Voltage	2,000	Volts DC
Focusing Electrode Voltage	392 to 672	Volts DC
Grid No. 1 Voltageϕ	-40 to -80	Volts DC
Modulation Factor#	38	Max Volts
Deflecting Factors		
D1 and D2	72 to 108	Volts DC per Inch
D3 and D4	64 to 96	Volts DC per Inch
Focusing-Electrode Current for any Operating Condition	-25 to +25	Microamperes
Spot Position, Undeflected**	Within a 20	Millimeter Square
Line Width A++	0.45	Millimeters
Line Width B++	0.55	Millimeters

CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5	Max Megohms
Resistance in Any Deflecting Electrode Circuit##	5.0	Max Megohms

* The maximum ratings provide a ten percent safety factor in accordance with the standard design-center system of rating cathode ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

\+ Anode, grid No. 2 and grid No. 4 which are connected together within the tube are referred to herein as anode.

/ Anode input equals the product of anode voltage and average current measured at the terminal.

ϕ For visual extinction of focused undeflected spot.

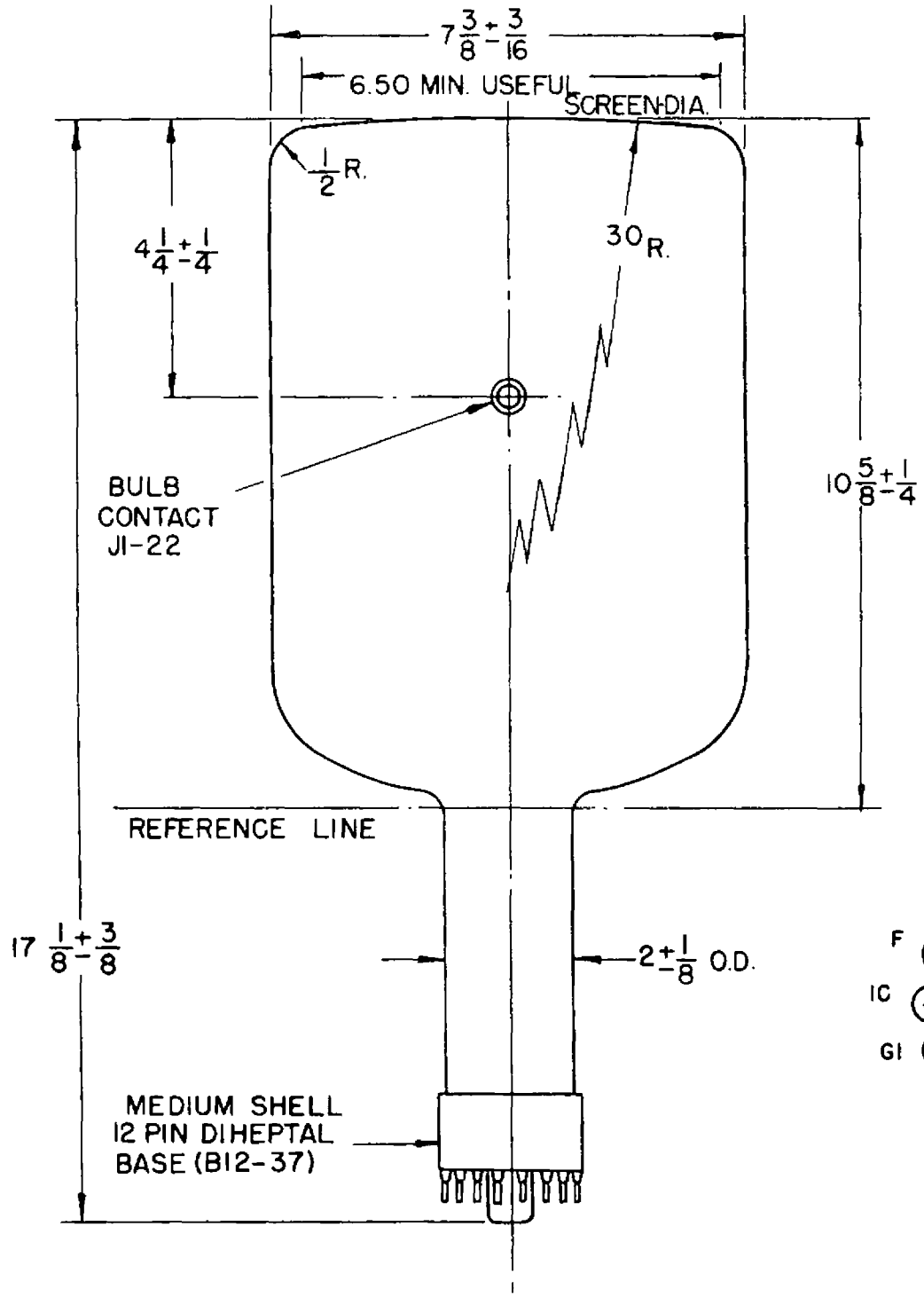
\# For an I_{b3} of 25 microamperes d-c in accordance with MIL-E-1C specification.

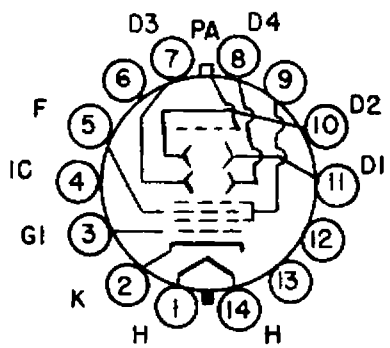
** With post accelerator anode voltage of 4,000 volts, the center of the focused undeflected spot will lie within a square of 20 millimeters radius centered on the tube face.

++ Measured with specification MIL-E-1C, paragraph 4.12.6.1, at an anode No. 3 (post-acceleration) current of 25 microamperes d-c.

It is recommended that the deflection electrode resistance be approximately equal.

:mm





BASING DIAGRAM
14J

NOTES

1. REFERENCE LINE - POINT WHERE RING GAGE 2.063 +.001,-.000 I.D, 1/2 LONG WILL STOP.
2. BULB CONTACT ALIGNS WITH PIN NO. 5 POSITION ±10 DEGREES.

7BH
CATHODE RAY TUBE

5-1/2 - SQUARE, GLASS

FOCUS - ELECTROSTATIC

DEFLECTION - ELECTROSTATIC

FACE PLATE - SPHERICAL, CLEAR

SPIRAL ACCELERATOR

DUAL BEAM

ALUMINIZED

DESCRIPTION AND RATING

The General Electric Type 7BH is a 5-1/2 inch square, two beam, electrostatic deflection and focus cathode ray tube having improved deflection sensitivity and display accuracy. The deflection electrode and acceleration electrode connections are brought out through a collar base to minimize lead inductance and capacity.

The screen is aluminized for greater light output and to minimize screen charging effects.

GENERAL

ELECTRICAL*

Focusing Method - Electrostatic
Deflecting Method - Electrostatic

Direct Interelectrode Capacitances, Approx.

Cathode to All	5.0 µµf
Grid No. 1 to All	6.0 µµf
D1 to D2	3.0 µµf
D3 to D4	3.0 µµf
D1 to All	10.5 µµf
D2 to All	10.5 µµf
D3 to All	10.5 µµf
D4 to All	10.5 µµf

OPTICAL

Phosphor Number	1	2	7	11
Fluorescent Color	Green	Blue-Green	Blue-White	Blue
Phosphorescent Color	-	Green	Yellow	-
Persistence	Medium	Long	Long	Short

Faceplate - Sperical, Clear

MECHANICAL

Over-all Length	19-5/8 ± 1/4 Inches
Greatest Bulb Dimensions	
Diagonal	6-29/32 Inches
Width and Height	5-1/2 ± 1/16 Inches
Minimum Useful Screen Dimensions (along tube axis)	4-1/2 Inches
Bulb Contact	J1-22
Collar	A14-93
Base	B12-37
Basing	Special
Collar and Base Alignment	
Collar Pin No. 1 and Base Key each aligns with the D3D4 trace	± 10 Degrees

Positive Voltage on D1 deflects the beam approximately toward Base Pin No. 4
Positive Voltage on D3 deflects the beam approximately toward Base Key

Bulb Contact Alignment:	
Bulb Contact aligns with D3D4 trace	± 10 Degrees
Bulb Contact is on same side as the Base Key	
Trace Alignment:	
D1D2 trace aligns with D3D4 trace	90 ± 1 Degrees
Corresponding traces of each gun align within	1 Degree
D1D2 trace aligns with bulb wall within	2 Degrees

MAXIMUM RATINGS
(Absolute Maximum Values)

Heater Voltage	6.3 Volts
Heater Current at 6.3 Volts	0.6 ± 10% Ampere
Post Accelerator Voltage	10,000 Max. Volts DC
Accelerator Voltage	5,000 Max. Volts DC
Accelerator Input	6 Max. Watts
Ratio Post Accelerator Voltage to Accelerator Voltage	3 Max.
Focusing Electrode Voltage	3,000 Max. Volts DC
Grid No. 1 Voltage	
Negative Bias Value	200 Max. Volts DC
Positive Bias Value	0 Max. Volts DC
Positive Peak Value	0 Max. Volts

Peak Heater to Cathode Voltage
Heater negative with respect to cathode. . . . . 180 Max. Volts
Heater positive with respect to cathode. . . . . 180 Max. Volts

Peak Voltage between Accelerator and any
Deflection Electrode . . . . . 750 Max. Volts

TYPICAL OPERATING CONDITIONS

Post Accelerator Voltage	7500 Volts
Accelerator Voltage	2300 Volts
Focusing Electrode Voltage	460 to 775 Volts
Grid No. 1 Voltage#	-45 to -80 Volts
Modulation ##	16 Volts Max.
Line Width "A"##	.50 MM Max.
Deflection Factors:	
D1 and D2	60 to 83 Volts DC/Inch
D3 and D4	48 to 70 Volts DC/Inch
Pattern Distortion**	3% Max.
Tracking Error	2% Max.
Interaction Factor ◇	14×10^{-6} In./Volt DC Max.
Spot Position (Undeflected) ◇◇	Within a 10-mm square
Focusing Electrode Current for any operating condition	-15 to +10 Microamperes
Anode No. 3 Current	30 Max. Microamperes

MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5 Max. Megohms
Resistance in any Deflecting-Electrode Circuit	1.0 Max. Megohms

NOTES

*Values are for each unit unless otherwise stated.

#Visual extinction of the focused, undeflected spot.

##For a beam current of 2 μADC., measured in accordance with MIL-E-1 specifications.

**The edges of a raster pattern whose mean dimensions are 75% of the useful screen width, will not deviate from the mean dimension by more than the specified amount.

ΨWhen one-inch vertical (3D4) traces are superimposed at the center of the tube and deflected horizontally ± 2 inches by voltages proportional to the relative deflection factors, horizontal separation of corresponding points on the lines shall nowhere be greater than 2% of the deflection.

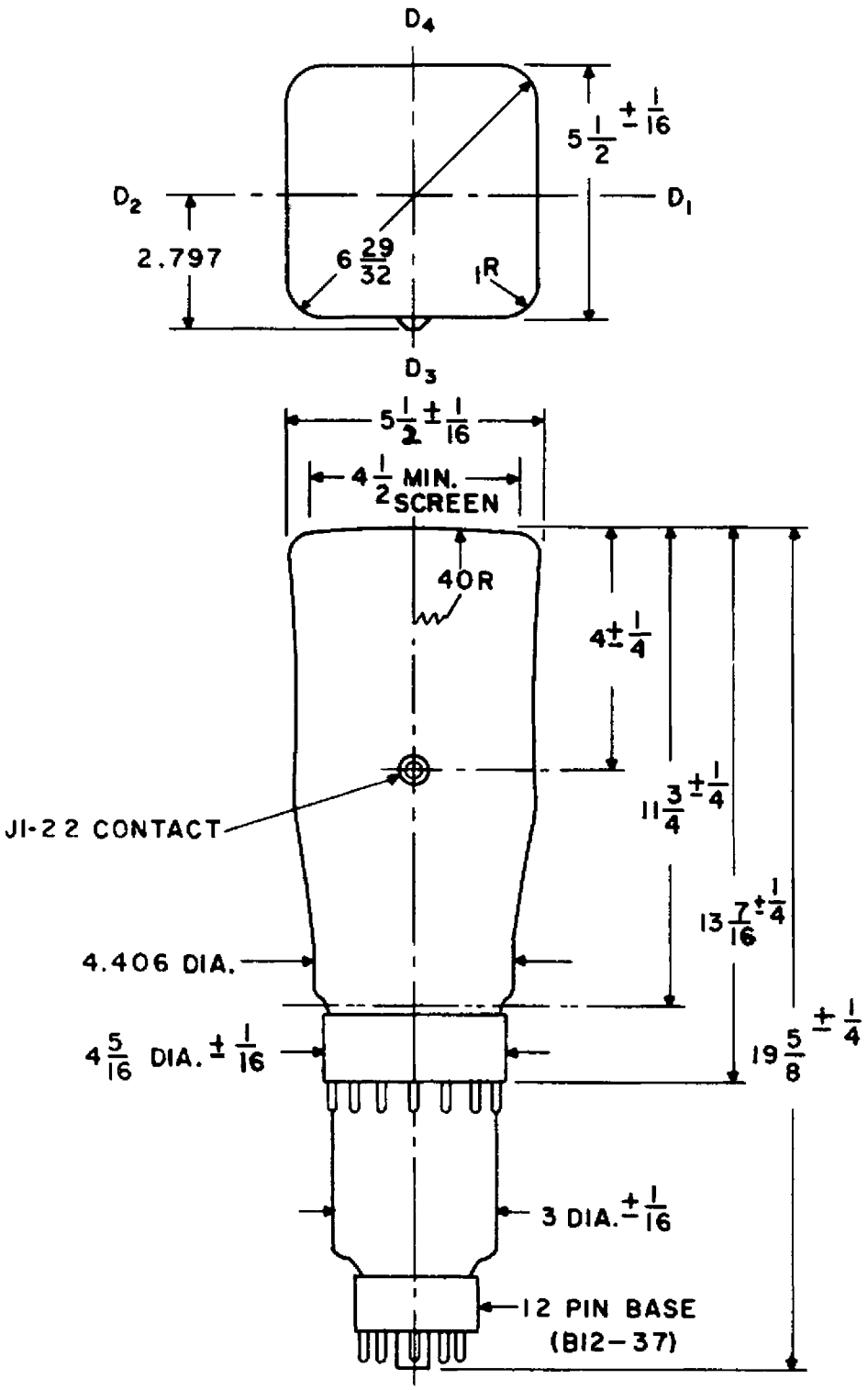
◇The deflection of one beam when balanced DC voltages are applied to the deflection-electrodes of the other beam will not be greater than the indicated value.

◇◇With the free deflecting electrodes connected to the accelerator, and the tube shielded against external influences, the undeflected, focused spot will fall within a 10-mm square centered with respect to the tube face center.

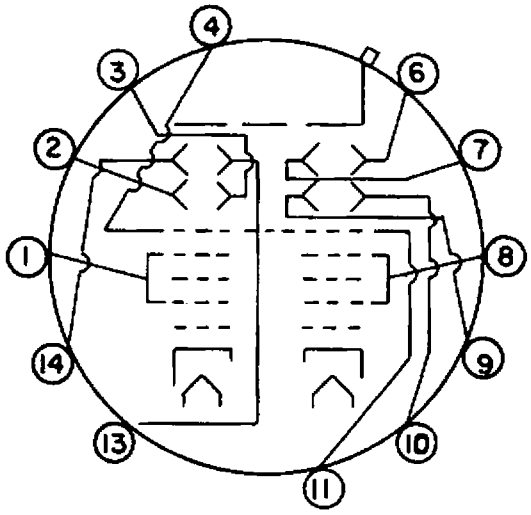
ΨΨIt is recommended that the deflecting-electrode circuit resistances be approximately equal. Higher resistance values up to 5.0 megohms may be used for low beam current operation.

ΨWhen the tube is cut off (no beam current), the post accelerator anode (A_3) will draw 30 μAdc maximum.

Electronic Components Division
Cathode Ray Tube Department
Electronics Park - Syracuse, New York



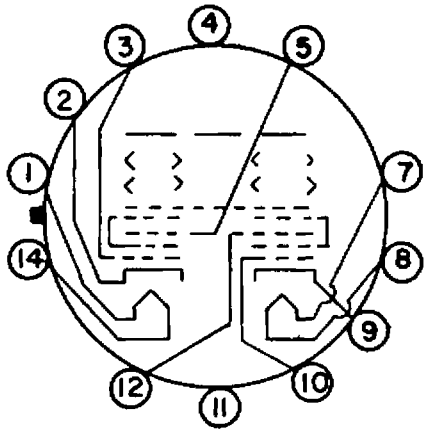
1. COLLAR PINS 4 & 11 (SHIELD) ARE COMMON TO BOTH BEAMS.
2. JI-22 CONTACT, COLLAR PIN 1 AND BASE KEY EACH ALIGN WITH D_3-D_4 TRACE ± 10.



BASING DIAGRAM – COLLAR CONNECTIONS

	PIN NO.	CONNECTION
BEAM "A"	1.	ACCELERATOR
	2.	DEFLECTOR D3
	3	DEFLECTOR D4
	4	SHIELD
	13	DEFLECTOR D2
	14	DEFLECTOR D1

	PIN NO.	CONNECTION
BEAM "B"	6	DEFLECTOR D1
	7	DEFLECTOR D2
	8	ACCELERATOR
	9	DEFLECTOR D4
	10	DEFLECTOR D3
	11	SHIELD



BASING DIAGRAM – BASE CONNECTIONS

	PIN NO.	CONNECTION
BEAM A	1	HEATER
	2	CATHODE
	3	GRID NO 1
	4	INTERNAL CONNECTION
	5	FOCUS ELECTRODE
	14	HEATER

	PIN NO.	CONNECTION
BEAM B	7	HEATER
	8	HEATER
	9	CATHODE
	10	GRID NO 1
	11	INTERNAL CONNECTION
	12	FOCUS ELECTRODE

7BK
P1, P2, P7, P19, ~~P22~~, P25
CATHODE RAY TUBE

5 1/2 x 5 1/2 INCH SQUARE, GLASS — FACEPLATE - SPERICAL, CLEAR

ELECTROSTATIC FOCUS — POST ACCELERATION

ELECTROSTATIC DEFLECTION — ALUMINIZED

========== DESCRIPTION AND RATING ==========

The 7BK-- is a 5 1/2 x 5 1/2 inch square faced Cathode-ray tube employing electrostatic focus and deflection. Features of the tube are low pattern distortion, high deflection sensitivity and high brightness.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6±10%	Amperes

Focusing Method - Electrostatic
Deflecting Method - Electrostatic

Direct Inter-electrode Capacitances, Approximate

Cathode to All Other Electrodes	6	μμf
Grid No. 1 to All Other Electrodes	7	μμf
D1 to D2	1.5	μμf
D3 to D4	1.3	μμf
D1 to All Other Electrodes	6.5	μμf
D2 to All Other Electrodes	6.5	μμf
D3 to All Other Electrodes	5.5	μμf
D4 to All Other Electrodes	5.5	μμf

OPTICAL

Phosphor Number	P1	P2	P7	P19	~~P22~~	P25
Fluorescent Color	Green	Blue-Green	Blue	Orange	Red,Blue,Green	Orange
Phosphorescent Color	Green	Green	Yellow	Orange	Red,Blue,Green	Orange
Persistence	Medium	Long	Long	Long	Medium	Long

Faceplate - Clear

MECHANICAL

Over-all Length	21 1/2 ± 1/4	Inches
Greatest Bulb Dimensions		
Diagonal	6 29/32 ± 1/16	Inches
Width	5 1/2 ± 1/16	Inches
Height	5 1/2 ± 1/16	Inches

Minimum Useful Screen Dimensions (along tube axis)

Neck Contacts - Small Ball Contacts, JETEC No. J1-25

P.A. Bulb Contact - Recessed Small-ball Cap, JETEC No. J1-22
Base--12 Pin, JEDEC No. B12-37
Bulb Contact Alignment
J1-22 Contact Aligns with 3D4 Trace ± 10 Degrees
J1-22 Contact on Same Side as Pin-No. 2

Base Alignment
D1-D2 Aligns with Pin No. 5 and Tube Axis ±10 degrees
Positive Voltage on D1 Deflects Beam Approximately Toward Pin No. 5
Positive Voltage on D3 Deflects Beam Approximately Toward Pin No. 2

Trace Alignment

Angle Between D3-D4 and D1-D2 Traces	90 ± 1	Degrees
D1-D2 Trace Aligns with bulb wall	± 2	Degrees

Mounting Position - Any

MAXIMUM RATINGS

DESIGN CENTER VALUES*

Post-Accelerator Voltage	12,000	Max. Vd-c
Anode Voltage	4,000	Max. Vd-c
Ratio Post-Accelerator Voltage to Anode Voltage	4.0	Max.
Anode Input **	6	Max. Watts
Focusing-Electrode Voltage	1,800	Max. Vd-c
Grid No. 1 Voltage		
Negative-Bias Value	200	Max. Vd-c
Positive-Bias Value	0	Max. Vd-c
Positive-Peak Value	2	Max. Vd-c
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	180	Max. Vd-c
Heater Positive with Respect to Cathode	180	Max. Vd-c
Peak Voltage Between Anode and Any Deflection Electrode	850	Max. Volts

TYPICAL OPERATING CODITIONS

Post-Accelerator	9,200 Vd-c
Anode Voltage	3,400 Vd-c
Focusing Electrode Voltage	700 to 1050 Vd-c
Grid No. 1 Voltage++	-70 to -120 Vd-c
Deflection Factors	
D1 to D2	75 to 95 Vd-c/In.
D3 to D4	70 to 90 Vd-c/In.
Deflection Factor Uniformity ##	3% Max.
Focusing Electrode Current	-15 to +10 Microamperes
Line Width A***	.35 mm Max.
Spot Position+++	5/16 In. Radius Circle

MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5 Max. Megohms
Resistance in any Deflecting Electrode Circuit###	3.0 Max. Megohms

* The maximum ratings provide a ten per cent safety factor in accordance with the standard design center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design center values are not exceeded by more than ten per cent.

** The phosphor screen may be damaged if the exciting current density is greater than 1.4 microamperes per square centimeter for P25, and if greater than .06 microamperes per square centimeter for P19.

++ For visual extinction of undeflected focused spot.

Deflection factor for deflection of 75% of useful screen dimensions, shall not differ from deflection factor for deflection of 25% of the useful screen dimensions by more than the indicated value.

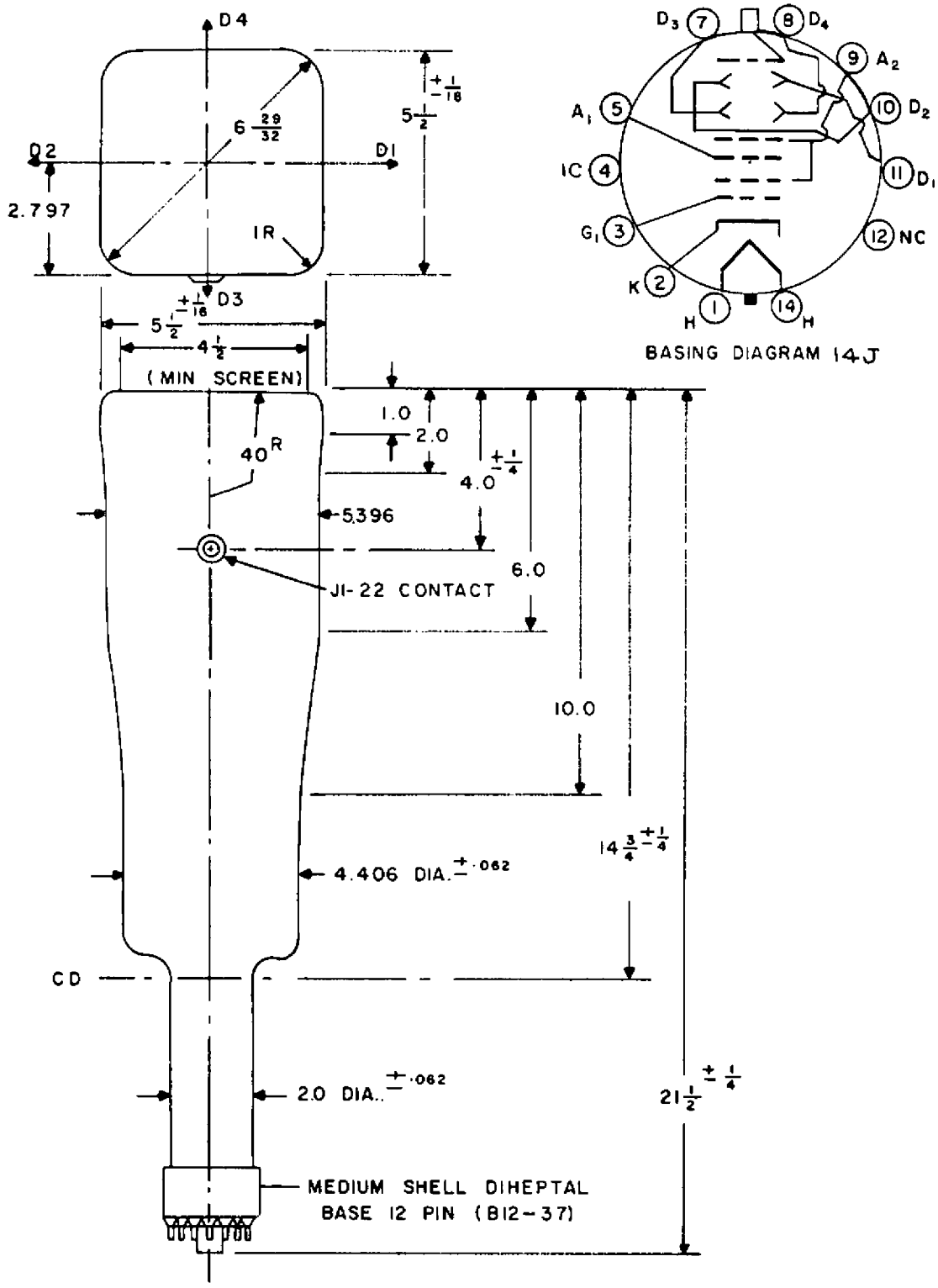
*** Measured in accordance with MIL-E-1 specifications using Ib3=2μAdc.

+++ The center of the focused undeflected spot will be within a circle of 5/16 inch radius, centered on the tube face.

It is recommended that the deflection electrode resistance be approximately equal.

dl

7BK P__



J1-22 CONTACT ALIGNS
WITH PIN NO. 2

7BLP7
CATHODE RAY TUBE

7-INCH ROUND, GLASS	FACE PLATE - SPHERICAL, CLEAR
FOCUS - ELECTROSTATIC	LONG PERSISTENCE
DEFLECTION - ELECTROSTATIC	POST ACCELERATION
TWO GUNS	ALUMINIZED

DESCRIPTION AND RATING

The 7BLP7 is a 7-inch flat faced dual beam cathode ray tube with electrostatic-focus and deflection for radar and oscillographic applications.

GENERAL

Data and Ratings Are Per Gun Unless Otherwise Specified

ELECTRICAL

Heater Voltage	6.3 Volts
Heater Current	0.6 ± 10% Amperes

Focusing Method - Electrostatic
Deflecting Method - Electrostatic

Direct Interelectrode Capacitances, maximum

Cathode to All Other Electrodes	7 µµf
Grid No. 1 to All Other Electrodes	8 µµf
D1 to D2	6 µµf
D3 to D4	6 µµf
D1 to All Other Electrodes	11.5 µµf
D2 to All Other Electrodes	11.5 µµf
D3 to All Other Electrodes	11.5 µµf
D4 to All Other Electrodes	11.5 µµf

OPTICAL

Phosphor Number	P7
Fluorescent Color	Blue-White
Phosphorescent Color	Yellow
Persistence	Long

Faceplate - Clear

from JEDEC release #3323, June 26, 1961

MECHANICAL

Over-all Length . . . . . 21 ± 3/8 Inches
Greatest Bulb Diameter. . . . . 7 ± 1/16 Inches
Minimum Useful Screen Diameter. . . . . .6-1/8 Inches

Post-Accelerator Bulb Contact - Recessed Small Ball Cap - JEDEC No. J1-22
Base - 25 Pin, JEDEC No. B25-139
Basing - Special
Bulb Contact Alignment
Post-Accelerator Contact Aligns with Trace of D1-D2 ± 10 Degrees
Post-Accelerator Contact on Same Side as Pin No. 12

Base Alignment
D1-D2 Trace Aligns with Pin No. 12 and Tube Axis ± 10 Degrees
Positive Voltage on D1 Deflects Beam Approximately Toward Pin No. 12
Positive Voltage on D3 Deflects Beam Approximately Toward Pin No. 8

Angle between D3-D4 and D1-D2 Traces . . . . . .90 ± 1 Degrees
Angle between Corresponding Traces . . . . . .1.5 Max. Degrees

Mounting Position - Any

MAXIMUM RATINGS

DESIGN-CENTER VALUES*
Per Gun Unless Otherwise Specified

Post-Accelerator Voltage	10,000 Max.	Volts DC
Anode Voltage#	5,000 Max.	Volts DC
Ratio Post-Accelerator Voltage to Anode Voltage	2.0 Max.	
Anode Input ‡	6 Max.	Watts
Focusing-Electrode Voltage	2500 Max.	Volts DC
Grid No. 1 Voltage		
Negative-Bias Value	200 Max.	Volts DC
Positive-Bias Value	0 Max.	Volts DC
Positive-Peak Value	2 Max.	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	180 Max.	Volts
Heater Positive with Respect to Cathode	180 Max.	Volts
Peak Voltage between Anode and Any Deflecting Electrode	700 Max.	Volts

TYPICAL OPERATING CONDITIONS
Per Gun Unless Otherwise Specified

Post-Accelerator Voltage	6000 Volts DC
Anode Voltage	3000 Volts DC
Focusing-Electrode Voltage	800 to 1150 Volts DC
Grid No. 1 Voltage**	-50 to -90 Volts DC
Deflection Factors	
D1 and D2	70 to 92 Volts DC per Inch
D3 and D4	64 to 82 Volts DC per Inch
Focusing-Electrode Current	-15 to +10 Microamperes
Spot Position, undeflected+	Within 15 mm Square
Line Width A++	0.45 Max. Millimeters
Line Width B++	0.60 Max. Millimeters
Useful Scan ◇	
Anode No. 3 Current ⊞	30 Max. Microamperes

MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5 Max. Megohms
Resistance in Any Deflecting Electrode Circuit	5.0 Max. Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

#Anode, grid No. 2, and grid No. 4 which are connected together within the tube are referred to herein as anode.

**For visual extinction of focused undeflected spot.

+The undeflected spot positions shall be within 15 mm squares whose centers are located 5/8 inch from the center of the tube face, A in the +D1 direction, B in the +D2 direction.

++Measured in accordance with specification MIL-E-1 paragraph 4.12.6.1 at an anode No. 3 (post-accelerator anode) current of 2.5 microamperes d-c.

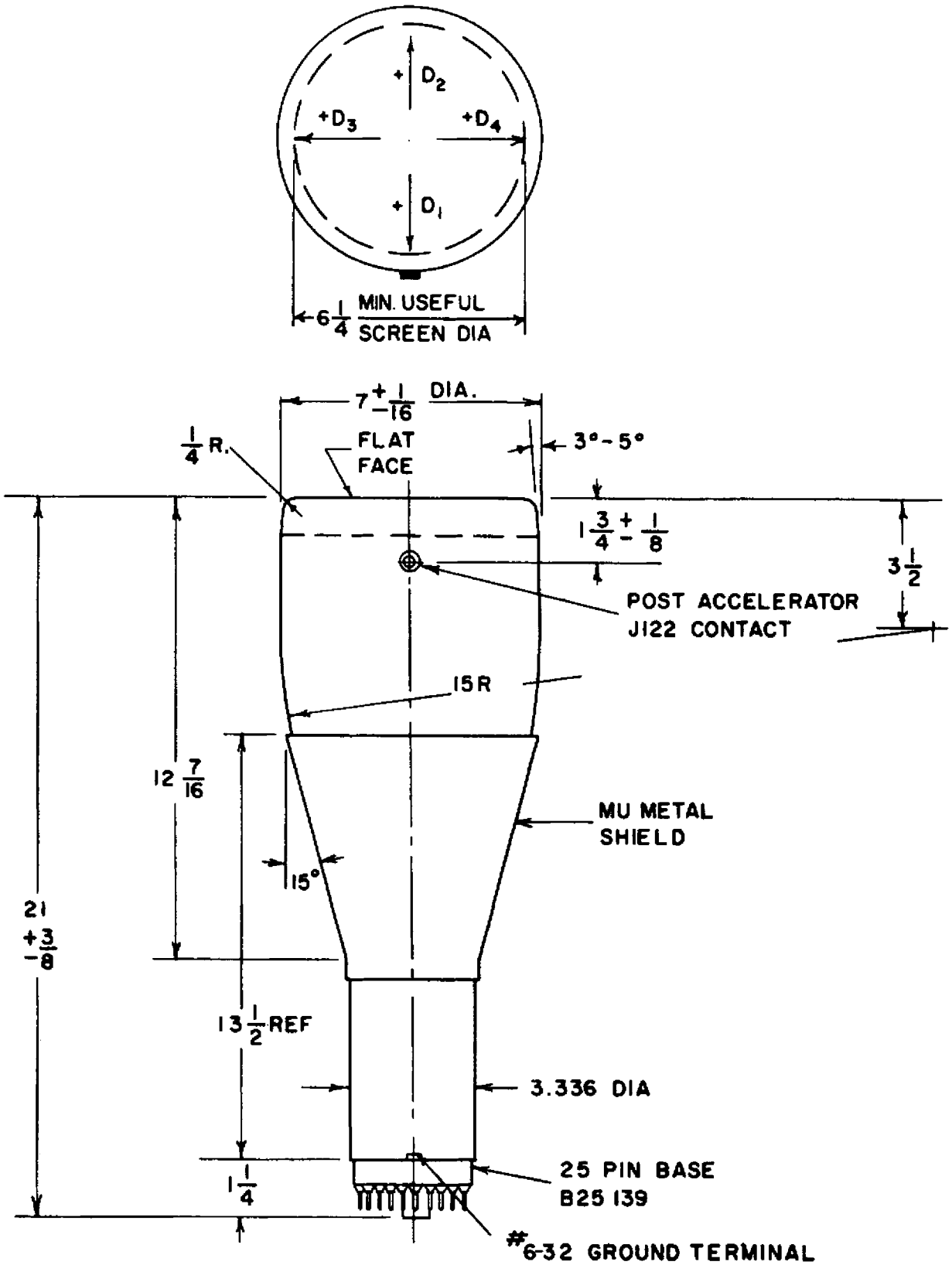
‡Anode input equals the product of anode voltage and average current measured at the terminal.

◇ Gun A
+D2 direction - 1.5 inches from tube center
+D1 direction - Full scan
+D3 direction - 2 inches from tube center
+D4 direction - 2 inches from tube center

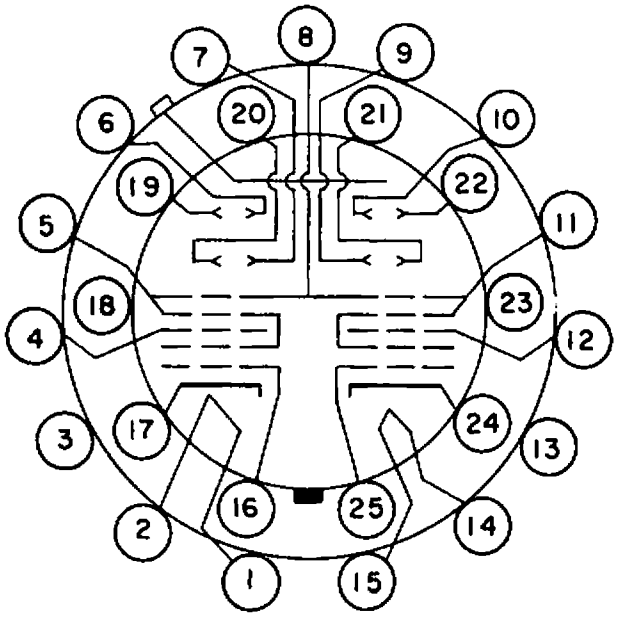
Gun B
+D1 direction - 1.5 inches from tube center
+D2 direction - Full scan
+D3 direction - 2 inches from tube center
+D4 direction - 2 inches from tube center

⊞ When the tube is cut off (no beam current), the post accelerator anode (A3) will draw 30 μAdc maximum.

Electronic Components Division
Cathode Ray Tube Department
Electronics Park - Syracuse, New York


+D2
+D3
+D4
+D1
6 1/4 MIN. USEFUL SCREEN DIA
7 +1/-16 DIA.
1/4 R.
FLAT FACE
3°-5°
1 3/4 +1/-1/8
3 1/2
POST ACCELERATOR J122 CONTACT
15R
12 7/16
MU METAL SHIELD
15°
21 +3/-8
13 1/2 REF
3.336 DIA
1 1/4
25 PIN BASE B25 139
#6-32 GROUND TERMINAL

7BL P7



BOTTOM VIEW

UNIT A		UNIT B	
PIN NO	ELEMENT	PIN NO	ELEMENT
14	HEATER	1	HEATER
15	HEATER	2	HEATER
24	CATHODE	17	CATHODE
25	GRID NO. 1	16	GRID NO. 1
12	FOCUSING ELECTRODE	4	FOCUSING ELECTRODE
22	DEFLECTOR D3	6	DEFLECTOR D3
10	DEFLECTOR D4	19	DEFLECTOR D4
9	DEFLECTOR D1	20	DEFLECTOR D1
21	DEFLECTOR D2	7	DEFLECTOR D2
11	ANODE	5	ANODE
13	NO CONNECTION	3	NO CONNECTION
23	NO CONNECTION	18	NO CONNECTION
		8	SHIELD

CAP - POST ACCELERATOR

7BL P7

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release No. 418

June 30, 1945

RMA TYPE 7BP1 CATHODE RAY TUBE

sponsor:
General Electric Co.

Electrical

Focusing Method - Magnetic
Deflecting Method - Magnetic
Maximum solid deflecting Angle - 55 Degrees
Phosphor - P1
Direct Interelectrode Capacitances

	Minimum	Maximum	
Cathode to all other electrodes	3	10	uuf
Grid No. 1 to all other electrodes	6	11	uuf
Grid No. 2 to all other electrodes	3	12	uuf

Mechanical

Over-all Length	13¼ ± 3/8	Inches
Greatest Diameter of Bulb	7 ± 1/8	Inches
Minimum Usable Screen Diameter	6	Inches

Base - Wafer Octal 8-pin, sleeve
Basing - RMA 5AN
Bulb Contact - Snap Terminal
Spot Center *15 mm Radius

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

	Typical Operation		Maximum Ratings	
Heater Voltage†			6.3	Volts
Heater Current			0.6	Amperes
High Voltage Electrode	4000	7000	7700	Volts
Grid No. 1 (Control Electrode) Voltage	-50 ± 50%‡	-50 ± 50%‡	Never Positive	
Grid No. 2 (Accelerating Electrode) Voltage	250	250	750	Volts
Grid No. 2 Current, maximum	10	10	Microamperes	
D-c Heater-Cathode Potential¶			-125	Volts
Grid Circuit Resistance			1.5	Megohms

* The center of the undeflected unfocused spot will fall within a circle of given radius concentric with the tube face.

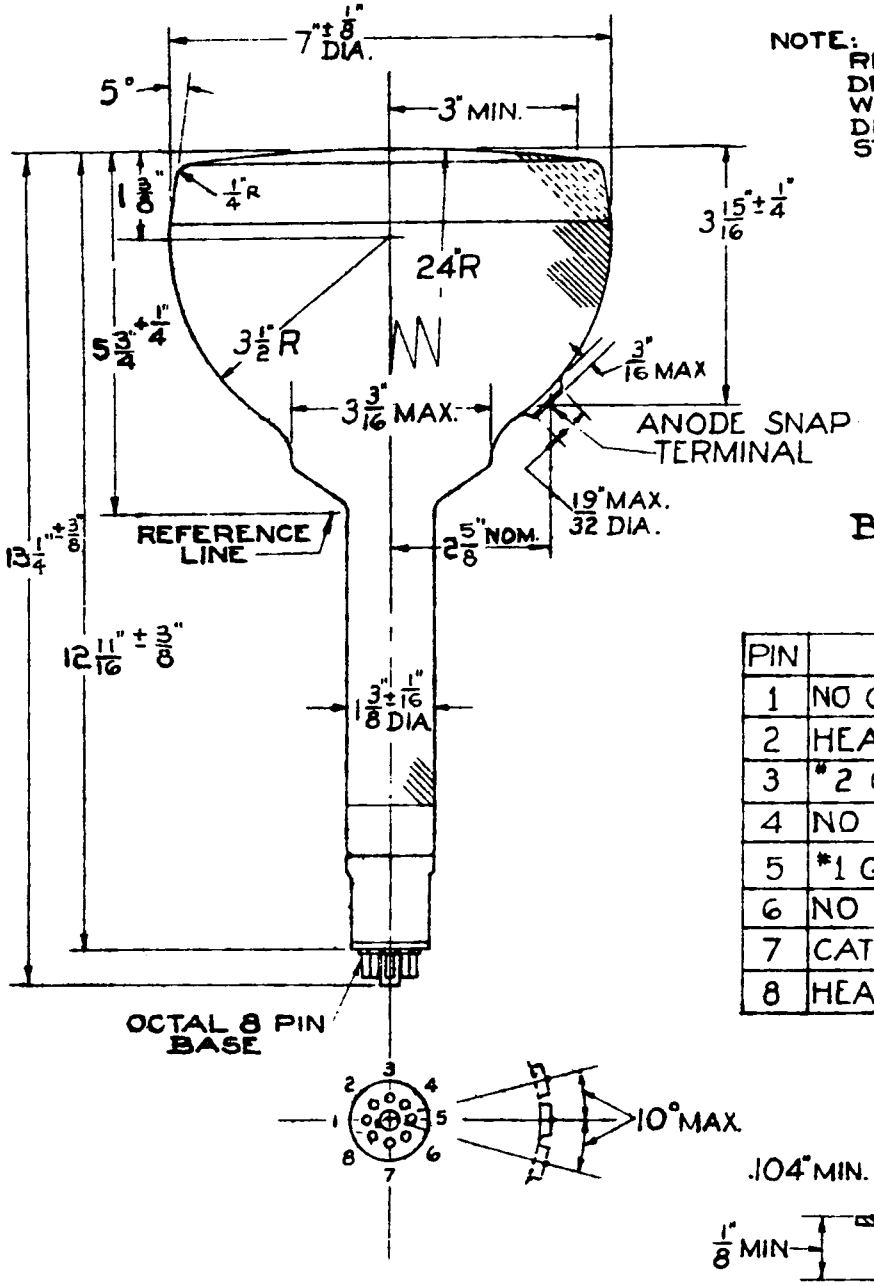
† Heater voltage and heater current allowable variation ± 10 per cent.

‡ Cutoff voltage which is necessary for visual extinction of a stationary focused spot.

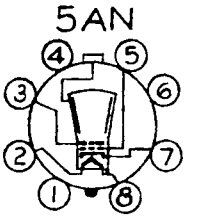
¶ With heater negative. Cathode should be connected to the midtap or to one side of heater supply.

RMA Release No. 418
June 30, 1945

RMA TYPE 7BP1

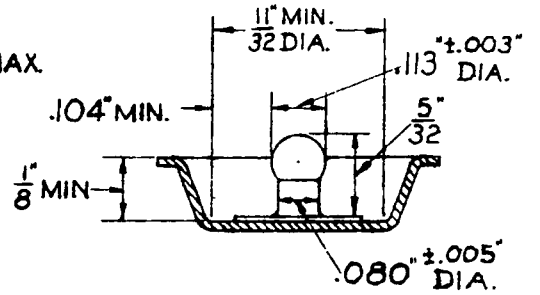


NOTE: REFERENCE LINE IS DETERMINED BY A POINT WHERE A GAUGE 1.430" ± .005" DIA. AND 2" LONG WILL STOP AGAINST BULB BODY.



BASING DIAGRAM

PIN	CONNECTION
1	NO CONNECTION
2	HEATER
3	#2 GRID
4	NO CONNECTION
5	#1 GRID
6	NO CONNECTION
7	CATHODE
8	HEATER



ENLARGED VIEW OF SNAP TERMINAL

Electronic TUBES

7BP7-B

CATHODE-RAY TUBE

7-INCH ROUND, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
53-DEGREE DEFLECTION ANGLE
FACEPLATE—SPHERICAL, CLEAR
HIGH-RESOLUTION GUN
PERSISTENCE—LONG

DESCRIPTION AND RATING

The 7BP7-B is a magnetic-focus and -deflection direct-view glass cathode-ray tube for oscilloscope and radar applications that require a long persistence. A particular feature of this tube is the high-resolution electron gun which provides a smaller spot size, an improved spot shape, high resolution, and considerable depth of focus.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes

Focusing Method—Magnetic
Deflecting Method—Magnetic

Deflection Angle, approximate	53	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	8.0	μμf

OPTICAL

Phosphor Number—P7
  Fluorescent Color—Blue-White
  Phosphorescent Color—Yellow
  Persistence—Long
Faceplate—Clear

MECHANICAL

Over-all Length	13¼ ± ⅜	Inches
Greatest Bulb Diameter	7 ± ⅛	Inches
Minimum Useful Screen Diameter	6	Inches
Neck Length	7½	Inches

Bulb Number, ASA Designation—J56R or J56T
Bulb Contact—Recessed Small-ball Cap, JETEC No. J1-22
Base—Long Medium-shell Octal 8-Pin, JETEC No. B8-65
Basing—JETEC Designation—5AN
Bulb Contact Alignment
  Anode Contact Aligns with Pin No. 5 ± 10 Degrees

Mounting Position—Any

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	8000 Max	Volts DC
Grid-No. 2 Voltage	700 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	180 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Grid-No. 1 Drive from Cutoff	65 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	7000	Volts DC
Grid-No. 2 Voltage	250	Volts DC
Grid-No. 1 Voltage¶	−25 to −70	Volts DC
Focusing-Coil Current▲, approximate	111	Milliamperes DC
Line Width A♦	0.28	Millimeters
Spot Position‡	12.0	Millimeters

MAXIMUM CIRCUIT VALUES

Grid-No. 1-Circuit Resistance	1.5 Max	Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

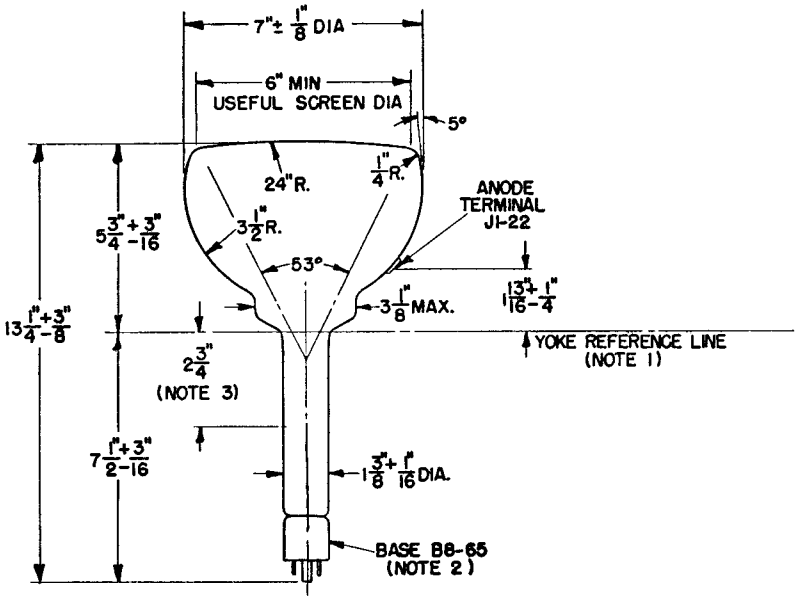
§Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 4000 volts.

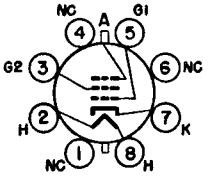
¶For visual extinction of undeflected focused spot.

▲For RETMA focusing coil No. 106 with distance from the yoke reference line to center of air gap equal to 2¾ inches.

♦Measured in accordance with specification MIL-E-1C paragraph 4.12.6.2 at an anode current of 200 microamperes.

‡The center of the undeflected, unfocused spot will fall within a circle of 12 millimeters radius concentric with the tube face.





BASING DIAGRAM
5AN

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE POINT WHERE A GAGE 1.430" $^{+.003}_{.000}$" I.D. AND 2" LONG WILL STOP AGAINST THE BULB BODY.
2. ANODE TERMINAL ALIGNS WITH PIN-NO. 5 ±10 DEGREES.
3. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.

K-69087-72A660

1-4-57

Z-4432

CATHODE-RAY TUBE

7-INCH ROUND, GLASS

FACEPLATE -- SPHERICAL, CLEAR

FOCUS -- ELECTROSTATIC

HIGH-RESOLUTION GUN

DEFLECTION -- MAGNETIC

PERSISTENCE -- LONG

57-DEGREE DEFLECTION ANGLE

DESCRIPTION AND RATING

The Z-4432 is an electrostatic-focus and magnetic-deflection cathode-ray tube for oscillographic applications requiring a long persistence.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 + 10%	Amperes

Focusing Method -- Electrostatic
Deflecting Method -- Magnetic

Deflection Angle, approximate	57	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	6.5	uuf
Grid-No. 1 to All Other Electrodes	8.0	uuf

OPTICAL

Phosphor Number -- P7
- Fluorescent Color -- Blue-White
- Phosphorescent Color -- Yellow
- Persistence -- Long

Faceplate -- Clear

G E N E R A L E L E C T R I C C O M P A N Y

from JETEC release #1674, July 2, 1956

MECHANICAL

Over-all Length	13-7/16 ± 3/8	Inches
Greatest Bulb Diameter	7 ± 1/8	Inches
Minimum Useful Screen Diameter	6-1/2	Inches

Bulb Number, ASA Designation -- J56E
Bulb Contact -- Recessed Small-ball Cap, JETEC No. J1-22
Base -- Long Medium Shell Octal, 8 Pin, JETEC No. B8-65
Basing, JETEC Designation -- 6AZ
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 2 ± 10 Degrees

Mounting Position -- Any

MAXIMUM RATINGS

DESIGN-CENTER VALUES *

Anode Voltage	8000	Max Volts DC
Focusing-Electrode Voltage	2400	Max Volts DC
Grid-No. 2 Voltage	300	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	180	Max Volts
Heater Positive with Respect to Cathode	180	Max Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage +	7000	Volts DC
Focusing-Electrode Voltage for Focus	955 to 1780	Volts DC
Grid-No. 2 Voltage	250	Volts DC
Grid-No. 1 Voltage #	-22.5 to -67.5	Volts DC
Spot Position **	15	mm

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5	Max Megohms

* The maximum ratings provide a ten percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

+ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 4,000 volts.

For visual extinction of undeflected focused spot.

** The center of the undeflected, unfocused spot will fall within a circle of 15 millimeters radius concentric with the tube face.

Cathode-Ray Tube Sub-Department

GENERAL ELECTRIC COMPANY

Syracuse, N. Y.

Electronic TUBES

7EY6

BEAM PENTODE

FOR TV VERTICAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 7EY6 is a beam-power pentode designed for use as the vertical-deflection amplifier in television receivers that employ 110-degree-deflection picture tubes. Features of the tube include high perveance and high plate dissipation. In addition, the 7EY6 incorporates a controlled heater warm-up characteristic which makes it especially suited for use in television receivers that employ series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	7.2	Volts
Heater Current	0.6 ±6%	Amperes
Heater Warm-up Time*	11	Seconds
Direct Interelectrode Capacitances, approximate†		
Grid-Number 1 to Plate	0.7	μμf
Input	8.5	μμf
Output	7.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B6-81, Intermediate-Shell Octal 6-Pin

MAXIMUM RATINGS

VERTICAL-DEFLECTION AMPLIFIER SERVICE‡
DESIGN-MAXIMUM VALUES

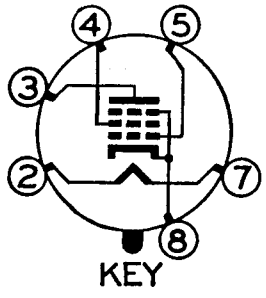
DC Plate Voltage	350	Volts
Peak Pulse Plate Voltage	2500	Volts
Screen Voltage	300	Volts
Plate Dissipation§	11	Watts
Screen Dissipation§	2.75	Watts
DC Cathode Current	60	Milliamperes
Peak Cathode Current	180	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	2.2	Megohms
With Fixed Bias	1.0	Megohms
Bulb Temperature at Hottest Point	200	C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

BASING DIAGRAM

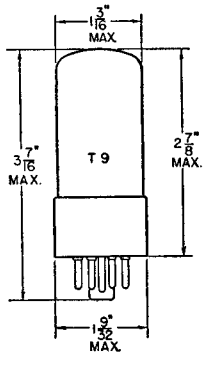


EIA 7AC

TERMINAL CONNECTIONS

Pin 2—Heater
Pin 3—Plate
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates

PHYSICAL DIMENSIONS



EIA 9-15

GENERAL ELECTRIC

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	50	250	Volts
Screen Voltage	250	250	Volts
Grid-Number 1 Voltage	0¶	−17.5	Volts
Plate Resistance, approximate	...	60000	Ohms
Transconductance	...	4400	Micromhos
Plate Current	153	44	Milliamperes
Screen Current	21	3.0	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	...	−48	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

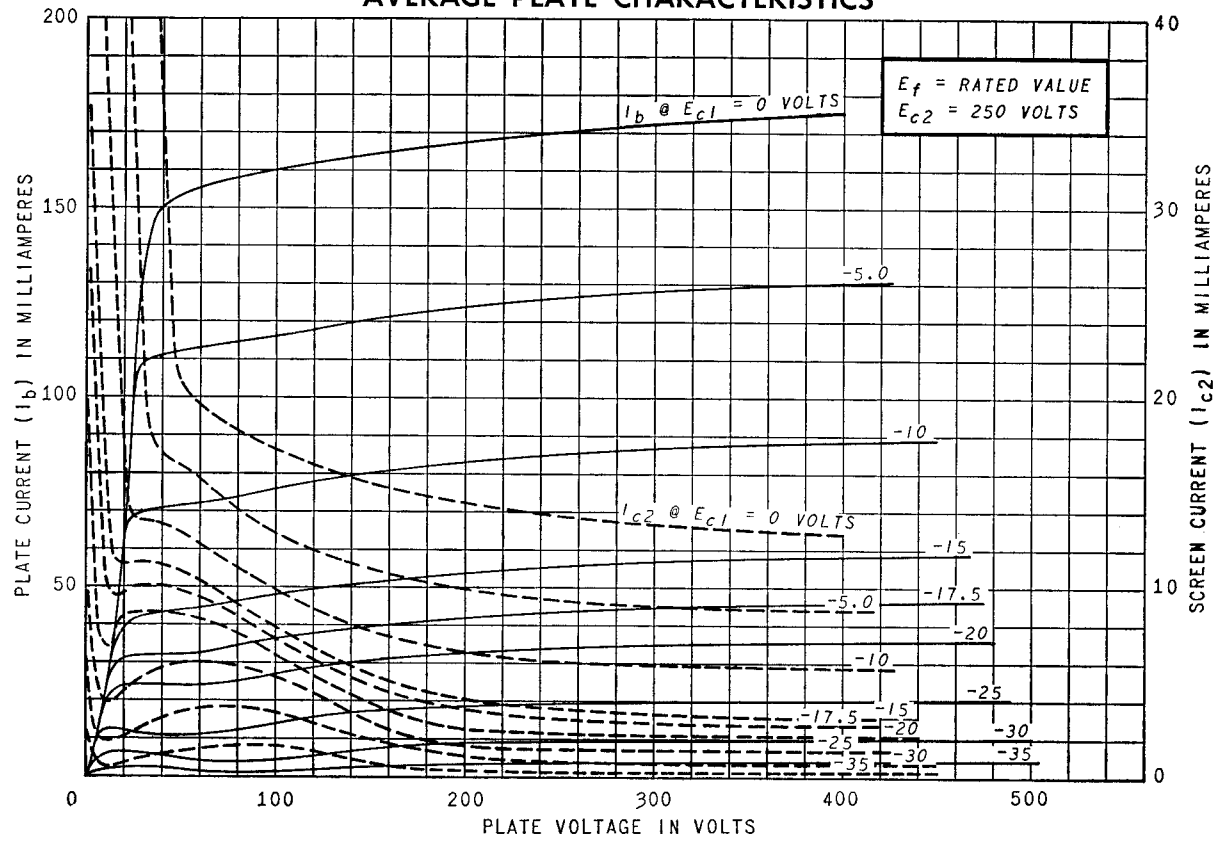
† Without external shield.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

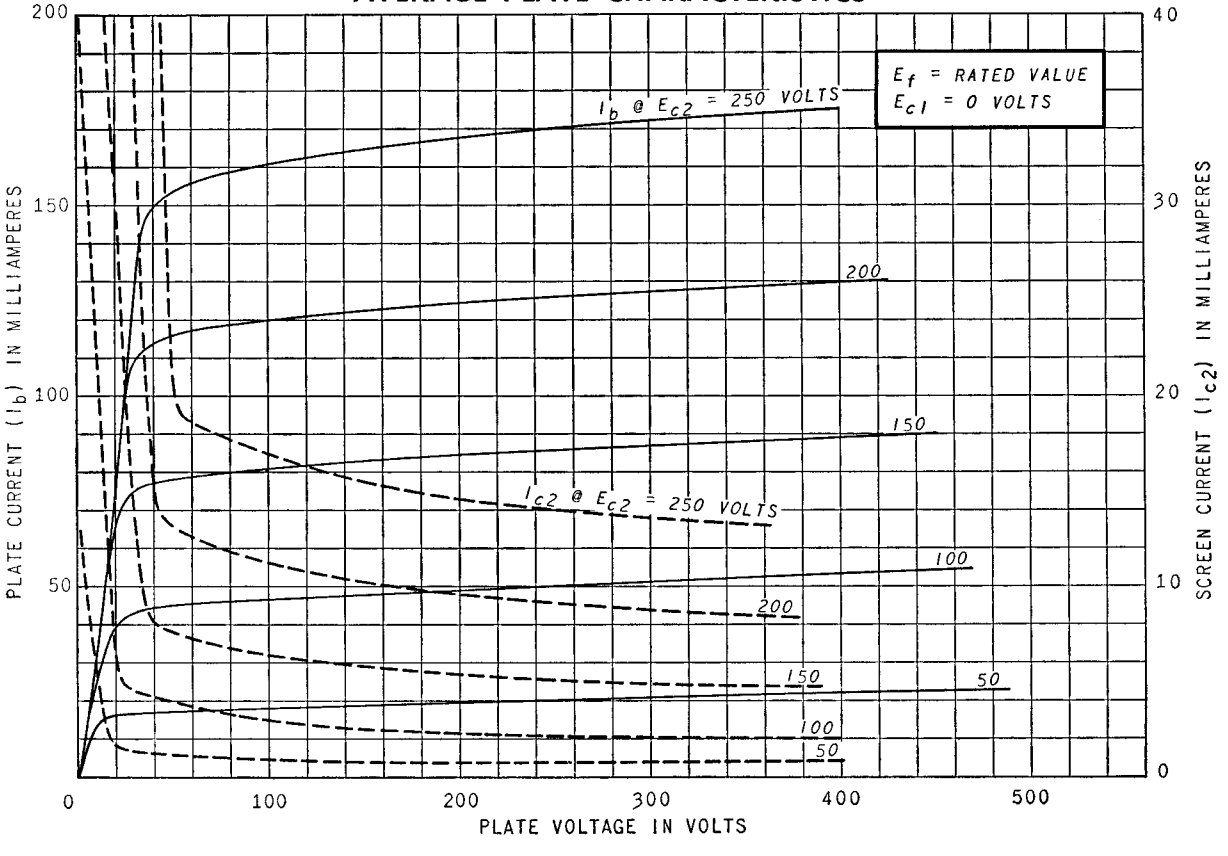
§ In stages operating with grid leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

¶ Applied for short interval (two seconds maximum) so as not to damage tube.

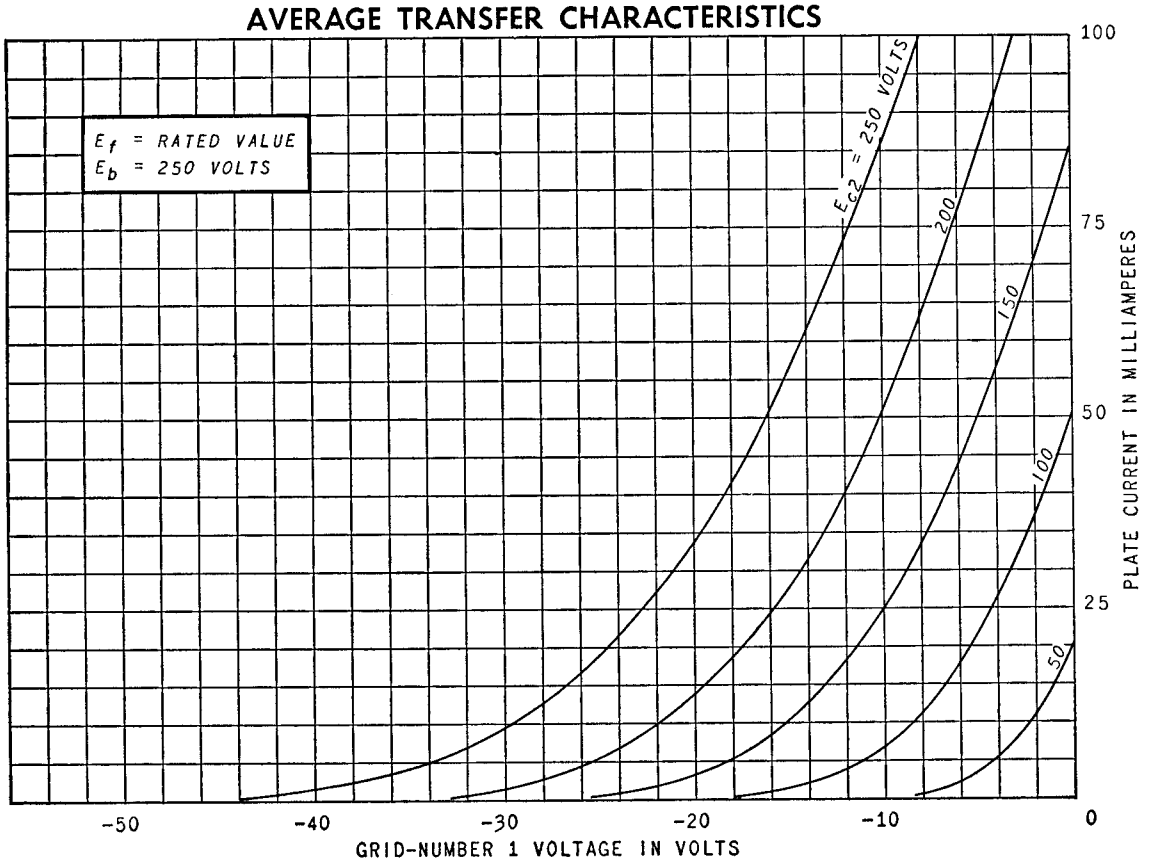
AVERAGE PLATE CHARACTERISTICS



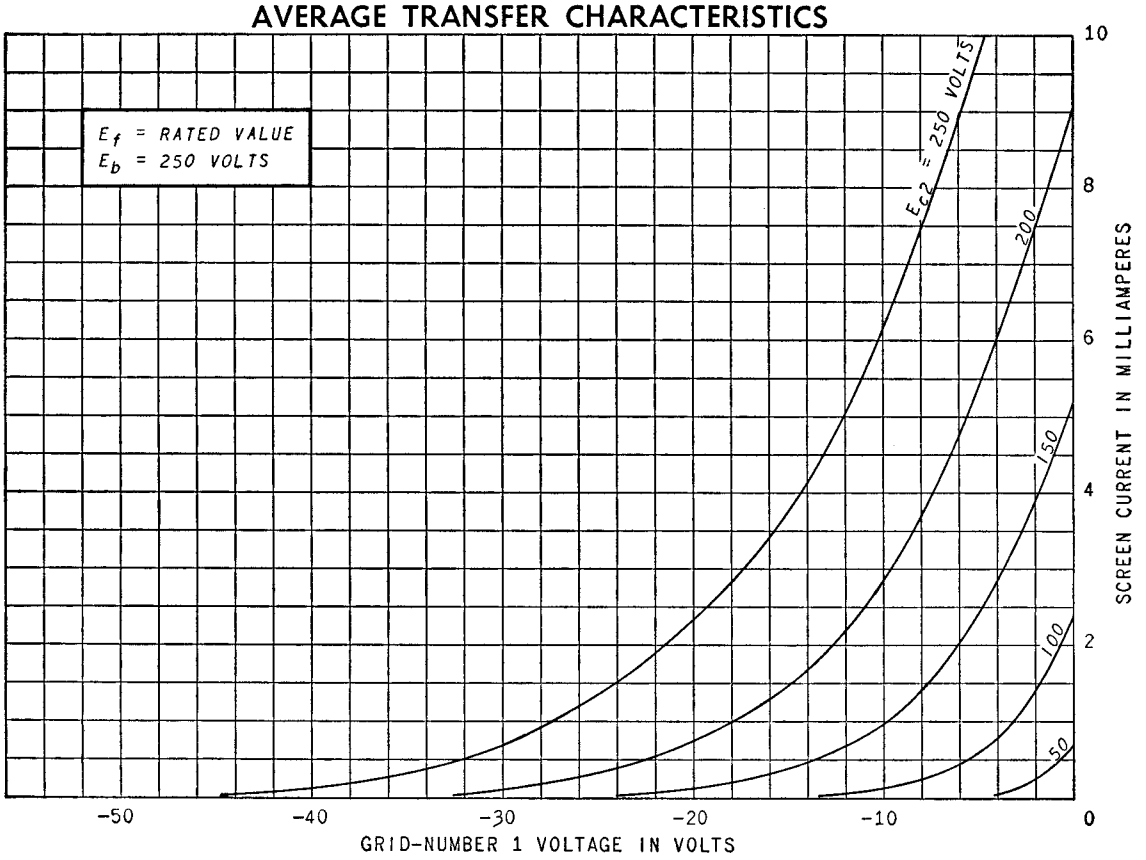
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



GE Electronic TUBE — K KEN-RAD

7F8

Description and Rating

TWIN TRIODE

GENERAL DESCRIPTION

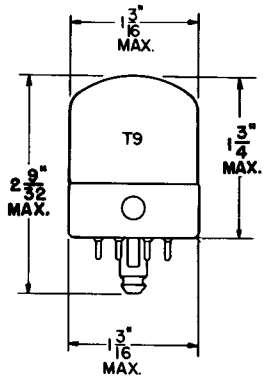
Principal Application: The 7F8 is a twin triode designed for use as a grounded-grid radio-frequency amplifier or as a frequency converter at frequencies up to 300 megacycles.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.3 Ampere
Envelope	T-9 Glass
Base:	D8-1 Locking-In 8-Pin
Mounting Position	Any

Direct Interelectrode Capacitances: *

(Per Section)		
Grid to Plate	1.2	μμf
Grid to Cathode	2.6	μμf
Plate to Cathode	1.4	μμf
Heater to Cathode **	2.6	μμf
Grid to Grid	0.1	μμf
Plate to Plate (Max)	0.5	μμf

PHYSICAL DIMENSIONS

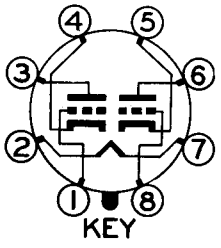


RMA 9-32

TERMINAL CONNECTIONS

Pin 1 - Grid (Section Number 2)
Pin 2 - Heater
Pin 3 - Plate (Section Number 2)
Pin 4 - Cathode (Section Number 2)
Pin 5 - Cathode(Section Number 1)
Pin 6 - Plate (Section Number 1)
Pin 7 - Heater
Pin 8 - Grid (Section Number 1)

BASING DIAGRAM



RMA 8BW
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES: EACH SECTION

Plate Voltage	300	Volts
Plate Dissipation (Total for Both Sections)	3.5	Watts
Grid Voltage (Positive Bias Value)	0	Volts
Peak Heater-Cathode Voltage	90	Volts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER: EACH SECTION

Plate Voltage	250	Volts
Cathode-Bias Resistor#	500	Ohms
Amplification Factor	48	
Plate Resistance (Approximate)	14500	Ohms
Transconductance	3300	Micromhos
Plate Current	6.0	Milliamperes
Grid Bias Voltage ##	-11	Volts

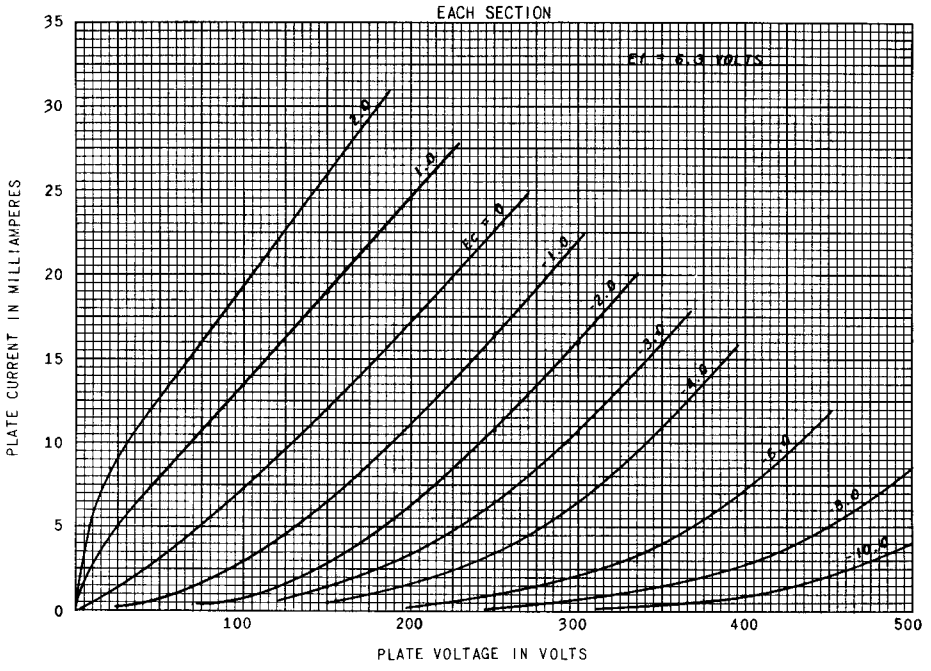
* *With external shield connected to cathode.*

** *With external shield connected to ground.*

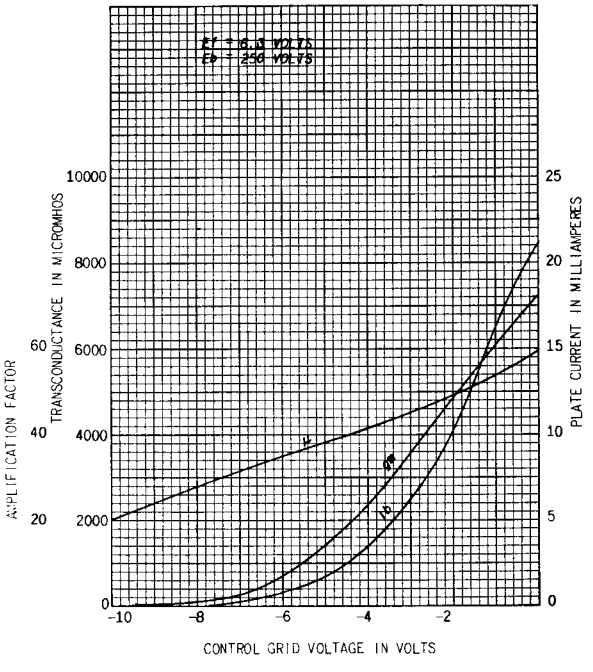
\# *The d-c resistance in the grid circuit, under rated maximum conditions, should not exceed 0.5 megohm for cathode-bias operation.*

\#\# *For 10 microamperes plate current.*

AVERAGE PLATE CHARACTERISTICS



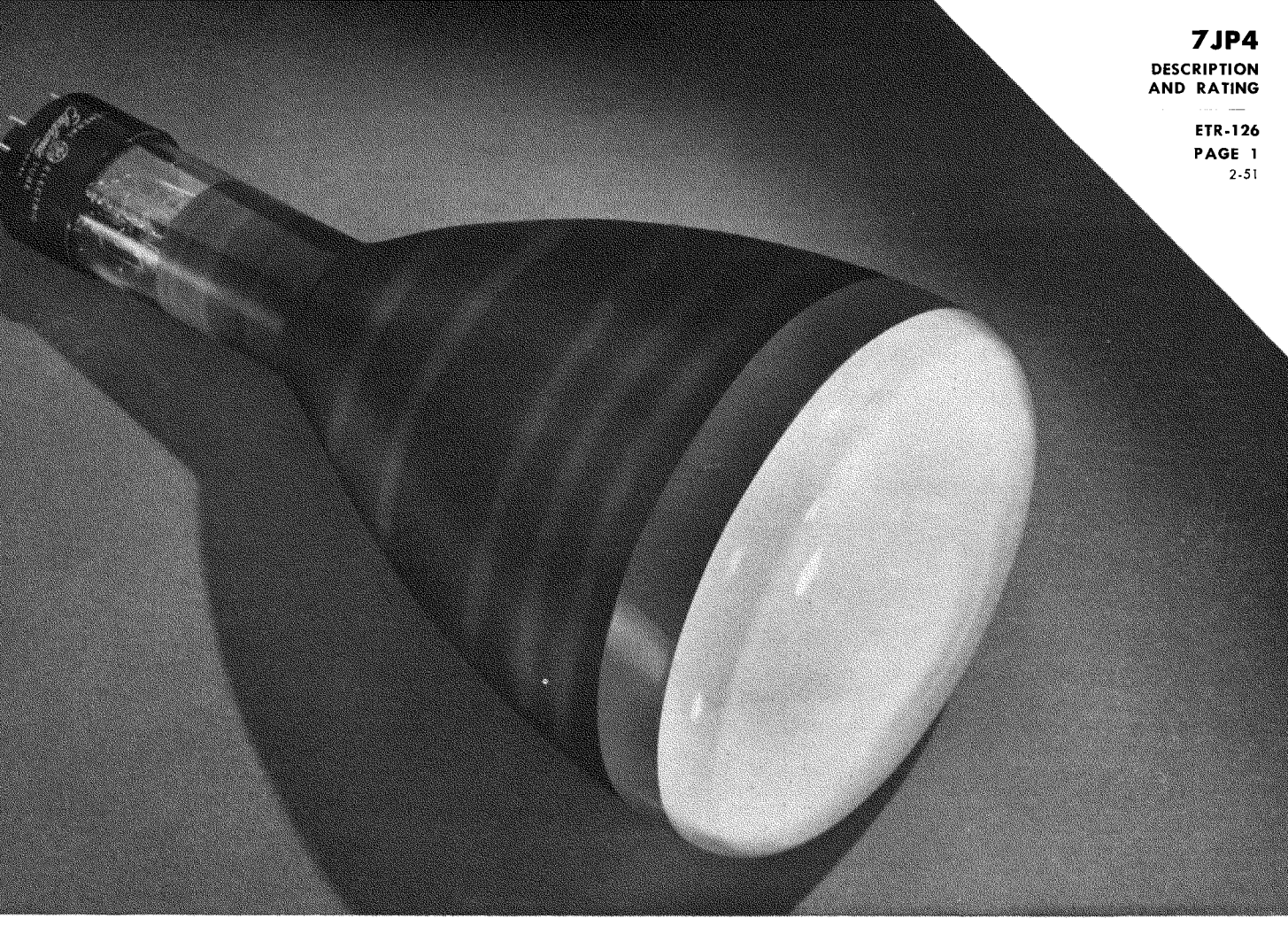
AVERAGE CHARACTERISTICS



Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.



TELEVISION PICTURE TUBE

DESCRIPTION

The 7JP4 is an electrostatic focus and deflection direct-view picture tube for television applications. It provides 4 by 5½-inch pictures. A feature of this tube is the zero-first-anode-current electron gun. The 7JP4 is also suitable for use in oscillograph service.

TECHNICAL INFORMATION

GENERAL CHARACTERISTICS

Electrical

Heater voltage	6.3	volts
Heater current	0.6 ± 10%	amperes
Focusing method—Electrostatic		
Deflecting method—Electrostatic		
Phosphor—P4		
Fluorescence—White		
Persistence—Medium		
Direct interelectrode capacitances, nominal		
Cathode to all other electrodes	9.5	uuf
Grid No. 1 to all other electrodes	8.5	uuf
D1 to D2	3.5	uuf
D3 to D4	2.0	uuf
D1 to all other electrodes except D2	7.5	uuf
D2 to all other electrodes except D1	7.5	uuf
D3 to all other electrodes except D4	6.0	uuf
D4 to all other electrodes except D3	6.0	uuf

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical:

Over-all length	$14\frac{1}{2} \pm \frac{3}{8}$ inches
Greatest diameter of bulb	$7 \pm \frac{1}{8}$ inches
Minimum useful screen diameter	6 inches
Base	Medium shell diheptal 12-pin B12-37
Basing	14G

Base alignment

D1-D2 Trace aligns with Pin No. 5 and tube axis ±10 degrees

Positive voltage on D1 deflects beam approximately toward Pin No. 5

Positive voltage on D3 deflects beam approximately toward Pin No. 2

MAXIMUM RATINGS

Design center values:

Anode No. 2 voltage	6000 max	volts d-c
Anode No. 1 voltage	2800 max	volts d-c
Grid No. 1 voltage		
Negative-bias value	200 max	volts d-c
Positive-bias value*	0 max	volts d-c
Positive-peak value	2 max	volts
Peak heater-cathode voltage**		
Heater negative with respect to cathode		
During equipment warm-up period not to exceed 15 seconds	410 max	volts d-c
After equipment warm-up period	125 max	volts d-c
Heater positive with respect to cathode	125 max	volts d-c
Peak voltage between anode No. 2 and any deflecting electrode	750 max	volts

*With 0 volts on grid No. 1 and 4000 to 6000 volts on anode No. 2 the effective resistance of the anode No. 2 supply must be adequate to limit the anode No. 2 input power to 6 watts.

**Cathode should be returned to one side or to the midtap of heater-transformer winding.

RECOMMENDED OPERATING CONDITIONS

Anode No. 2 voltage	3000	6000 volts
Anode No. 1 voltage (for focus)#	810 to 1200	1620 to 2400 volts
Grid No. 1 voltage##	−36 to −84	−72 to −168 volts
Deflection factors		
D1 and D2δ	31 to 41	volts d-c per inch per kilovolt of Eb_2
D3 and D4	25 to 34	volts d-c per inch per kilovolt of Eb_2
For anode No. 2 voltage between 3000 and 6000 volts		
Anode No. 1 voltage	27% to 40% of Eb_2	volts
Grid No. 1 voltage##	1.2% to 2.8% of Eb_2	volts
Anode No. 1 current for any operating condition	−15 to +10	microamperes

#With the combined grid No. 1 bias voltage and video-signal voltage adjusted for a highlight brightness of 12 foot-lamberts on a 4 by $5\frac{1}{2}$-inch picture area.

##For visual extinction of undeflected focused spot.

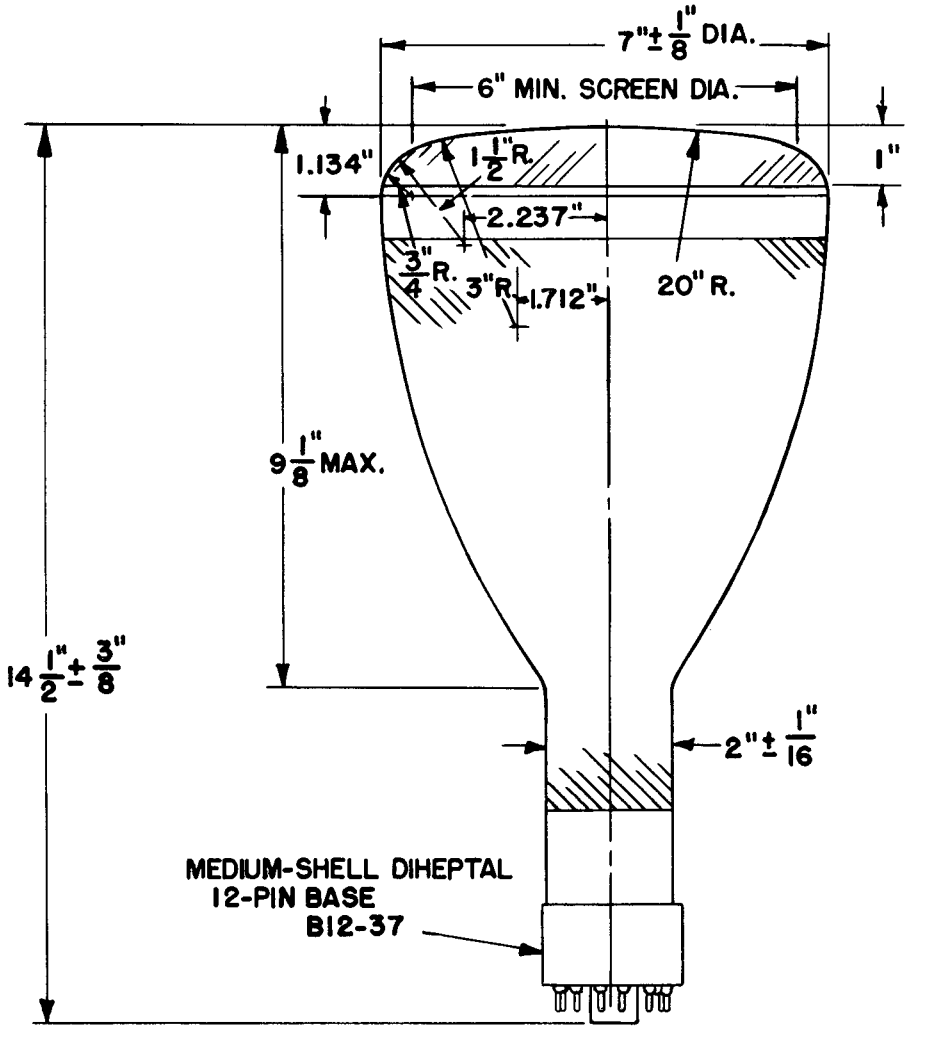
δTo obtain maximum deflection sensitivity, deflecting electrodes D1 and D2 are designed to produce less than full screen deflection. It is therefore recommended that for television service these electrodes be used for vertical deflection.

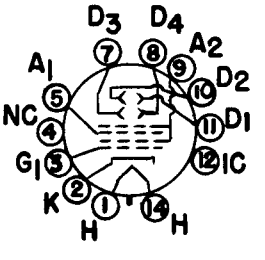
MAXIMUM CIRCUIT VALUES

Grid No. 1 circuit resistance	1.5 max	megohms
Resistance in any deflecting-electrode circuit***	5.0 max	megohms

***It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

OUTLINE
7JP4





Electronic TUBES

7UP7 AND 7UP7-A

CATHODE-RAY TUBE

7-INCH ROUND, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
7UP7-A—HIGH-RESOLUTION GUN
53-DEGREE DEFLECTION ANGLE
FACEPLATE—SPHERICAL, CLEAR
PERSISTENCE—LONG
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 7UP7 is a magnetic-focus and -deflection, direct-view cathode-ray tube intended for radar and oscillographic applications that require a long persistence. A particular feature of this tube is the high-quality fluorescent screen which is aluminized to increase light output, reduce undesirable screen charging, and prevent ion-spot blemish.

The 7UP7-A is identical except that it has a high-resolution electron gun which gives a small spot size, an improved spot shape, increased resolution, and greater depth of focus.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes

Focusing Method—Magnetic
Deflecting Method—Magnetic

Deflection Angle, approximate	53	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	8.5	μμf

OPTICAL

Phosphor Number—P7
Fluorescent Color—Blue-White
Phosphorescent Color—Yellow
Persistence—Long

Faceplate—Clear

MECHANICAL

Over-all Length	13¼ ± ⅜	Inches
Greatest Bulb Diameter	7 ± ⅛	Inches
Minimum Useful Screen Diameter	6	Inches

Bulb Number, ASA Designation—J56R
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Long Medium-shell Octal 8-Pin, JETEC No. B8-65 or
Long Medium-shell Octal 5-Pin, JETEC No. B5-80
Basing, JETEC Designation—5AN
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 5 ± 10 Degrees

Mounting Position—Any

Supersedes ET-T1153 dated 1-55

MAXIMUM RATINGS

DESIGN-CENTER VALUES*	7UP7	7UP7-A	
Anode Voltage†	12,000	12,000 Max	Volts DC
Grid-No. 2 Voltage	700	700 Max	Volts DC
Grid-No. 1 Voltage			
Negative-Bias Value	180	180 Max	Volts DC
Positive-Bias Value	0	0 Max	Volts DC
Positive-Peak Value	2	2 Max	Volts
Peak Grid-No. 1 Drive from Cutoff	65	65 Max	Volts
Peak Heater-Cathode Voltage‡			
Heater Negative with Respect to Cathode	180	180 Max	Volts
Heater Positive with Respect to Cathode	180	180 Max	Volts
Line Width Aϕ	...	0.28	Millimeters
Spot Position♥	...	12	Millimeters

TYPICAL OPERATING CONDITIONS

Anode Voltage§	7000	Volts DC
Grid-No. 2 Voltage	250	Volts DC
Grid-No. 1 Voltageπ	−25 to −70	Volts DC
Focusing-Coil Current▲, approximate	111	Milliamperes DC

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

‡Cathode should be returned to one side or to the midtap of the heater transformer winding.

ϕMeasured in accordance with MIL-E-1C, paragraph 4.12.6.2, at an anode current of 100 microamperes.

♥The center of the undeflected, unfocused spot will fall within a circle of 12 millimeters radius concentric with the tube face.

§Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 5000 volts.

πFor visual extinction of undeflected focused spot.

▲For RETMA focusing coil No. 106 with distance from the yoke reference line to center of air gap equal to 2¾ inches.

—PRODUCT INFORMATION—

8AC10

Compactron Triple Triode

The 8AC10 is a compactron containing three high-mu triodes. It is designed for use primarily as a color-difference amplifier in color television receivers.

Except for heater characteristics and ratings, the 8AC10 is identical to the 6AC10.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	8.4	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

Compactron Triode-Pentode

8AL9

■ COLOR TV TYPE ■ HIGH-Gm (30000 MICROMHOS), FRAME-GRID PENTODE ■ HIGH-MU, HIGH-Gm TRIODE

The 8AL9 is a compactron containing a sharp-cutoff, high-transconductance, frame-grid pentode and a triode. The pentode is intended for video amplifier service and the triode for general-purpose applications in color television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	8.6	Volts
Heater Current●	0.6±0.04	Amperes
Heater Warm-up Time, average▲	11	Seconds

Direct Interelectrode Capacitances♦

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.16	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.)	17	pf
Output: Pp to (h + Pk + Pg2 + Pg3 + i.s.)	6.4	pf

Triode Section

Grid to Plate: (Tg to Tp)	2.8	pf
Input: Tg to (h + Tk + i.s.)	3.6	pf
Output: Tp to (h + Tk + i.s.)	2.2	pf

Coupling

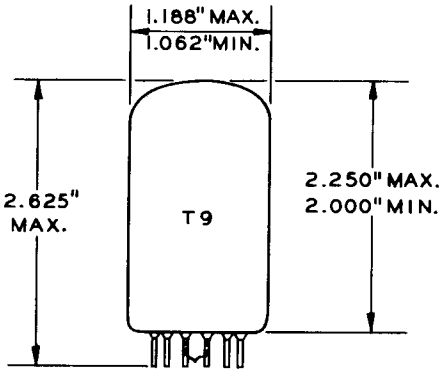
Triode Grid to Pentode Plate: (Tg to Pp), maximum	0.7	pf
Pentode Grid Number 1 to Triode Plate: (Pg1 to Tp), maximum	0.02	pf
Pentode Plate to Triode Plate: (Pp to Tp), maximum	0.4	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

PHYSICAL DIMENSIONS

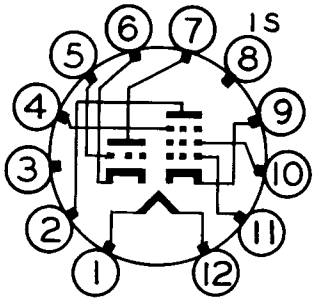


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Pentode Plate
Pin 3 - No Connection
Pin 4 - Pentode Grid Number 3 (Suppressor)
Pin 5 - Triode Grid
Pin 6 - Triode Cathode
Pin 7 - Triode Plate
Pin 8 - Internal Shield
Pin 9 - Pentode Cathode
Pin 10 - Pentode Grid Number 2 (Screen)
Pin 11 - Pentode Grid Number 1
Pin 12 - Heater

BASING DIAGRAM



EIA 12HE

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Voltage	200	---	Volts
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	10	1.5	Watts
Screen Dissipation	1.5	---	Watts
Heater-Cathode Voltage			
Heater Positive with respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	0.5	Megohms
With Cathode Bias	0.25	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Pentode Section		Triode Section	
Plate Voltage	55	250	200	Volts
Screen Voltage	125	150	---	Volts
Grid-Number 1 Voltage	0	---	---	Volts
Cathode-Bias Resistor	---	56	270	Ohms
Amplification Factor	---	---	59	
Plate Resistance, approximate	---	40000	9200	Ohms
Transconductance	---	30000	6300	Micromhos
Plate Current	56	28	7.6	Milliamperes
Screen Current	21	5.6	---	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 100 Microamperes	---	−5.4	−6.3	Volts

NOTES

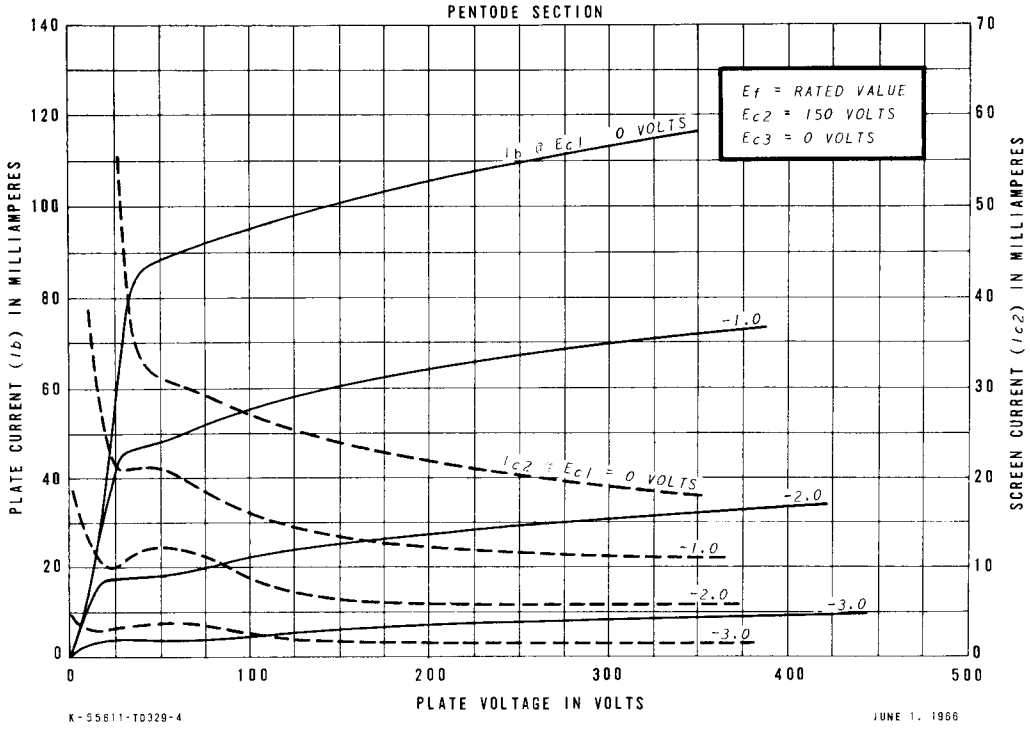
★ Heater voltage for a bogey tube at If = 0.6 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

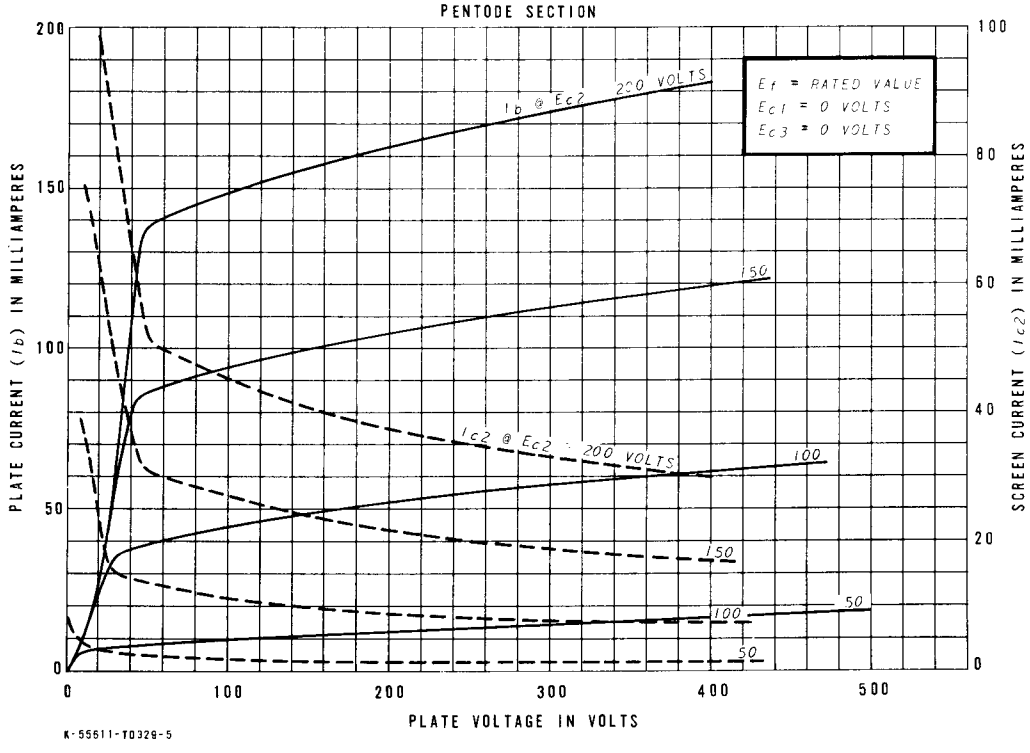
▲ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

♦ Without external shield.

AVERAGE PLATE CHARACTERISTICS

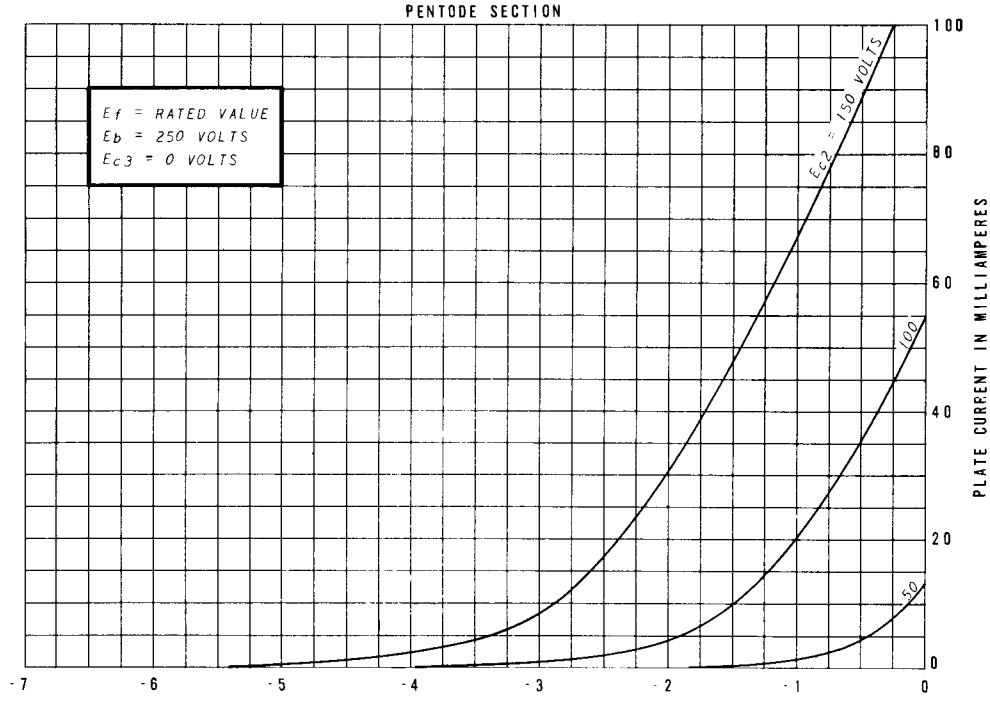


AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

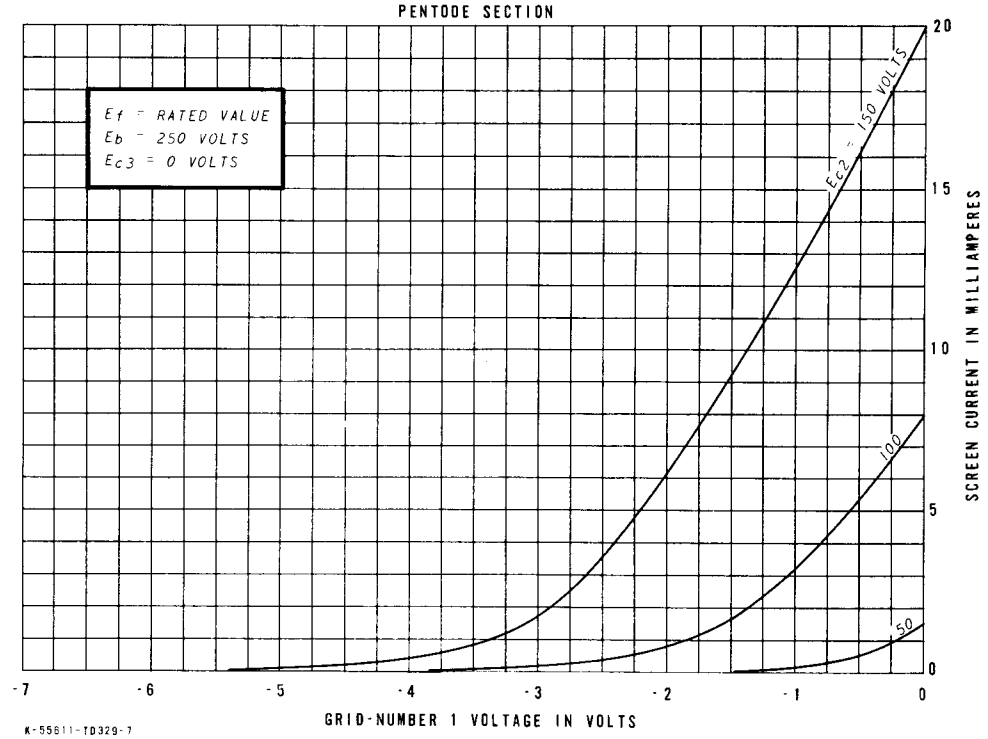
PENTODE SECTION



K-55611-TD329-6

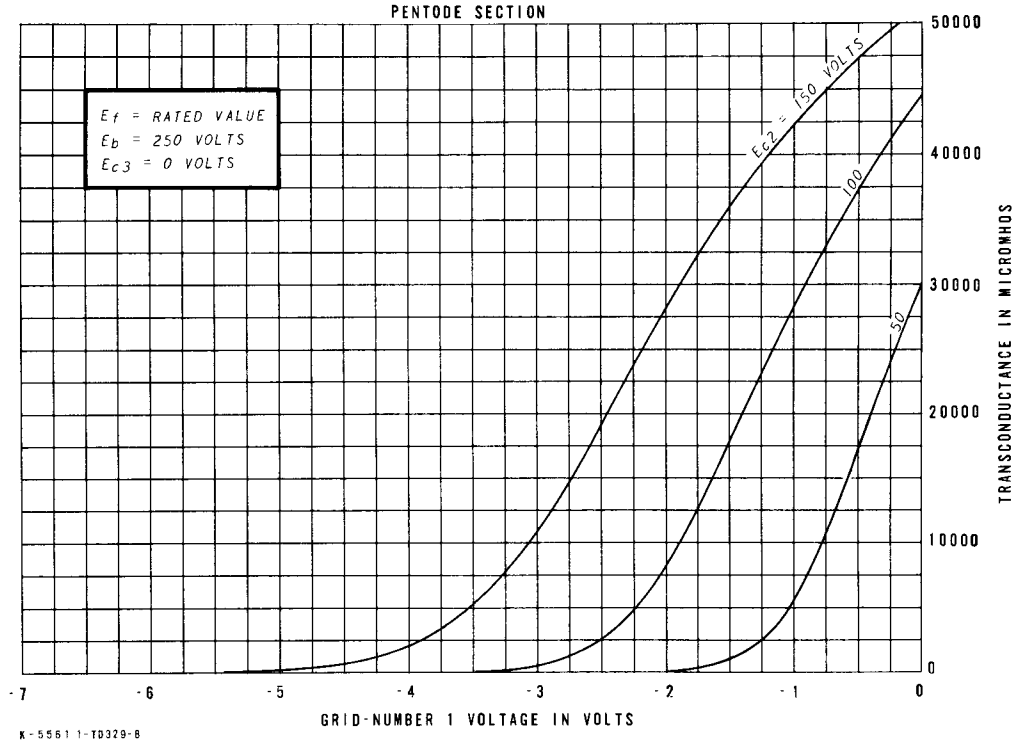
AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

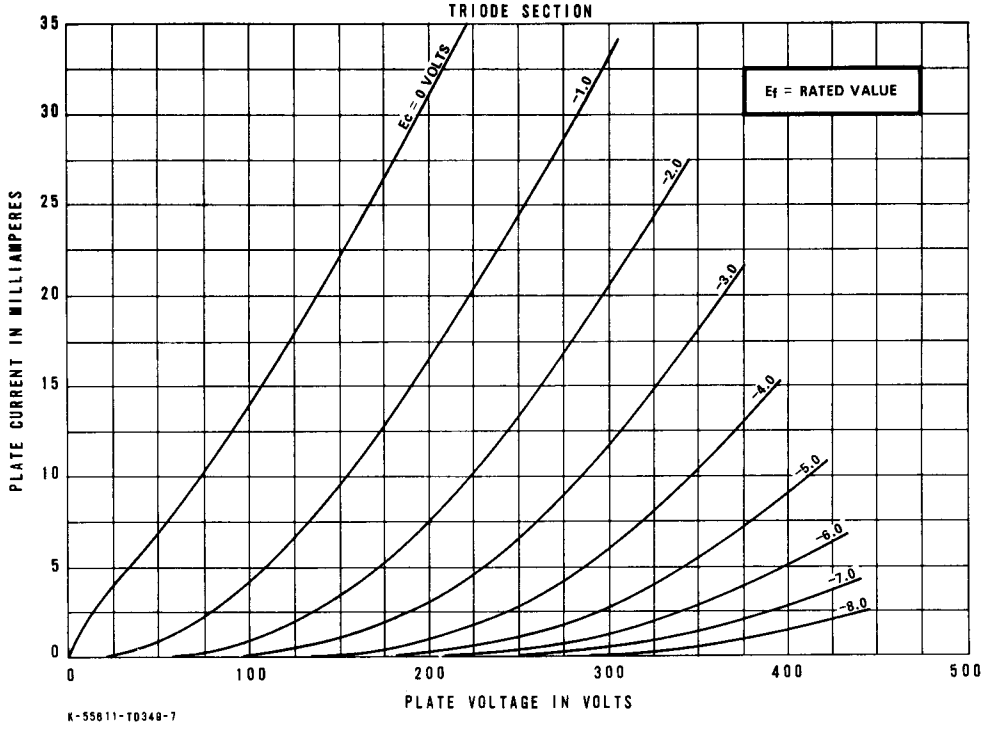


K-55611-TD329-7

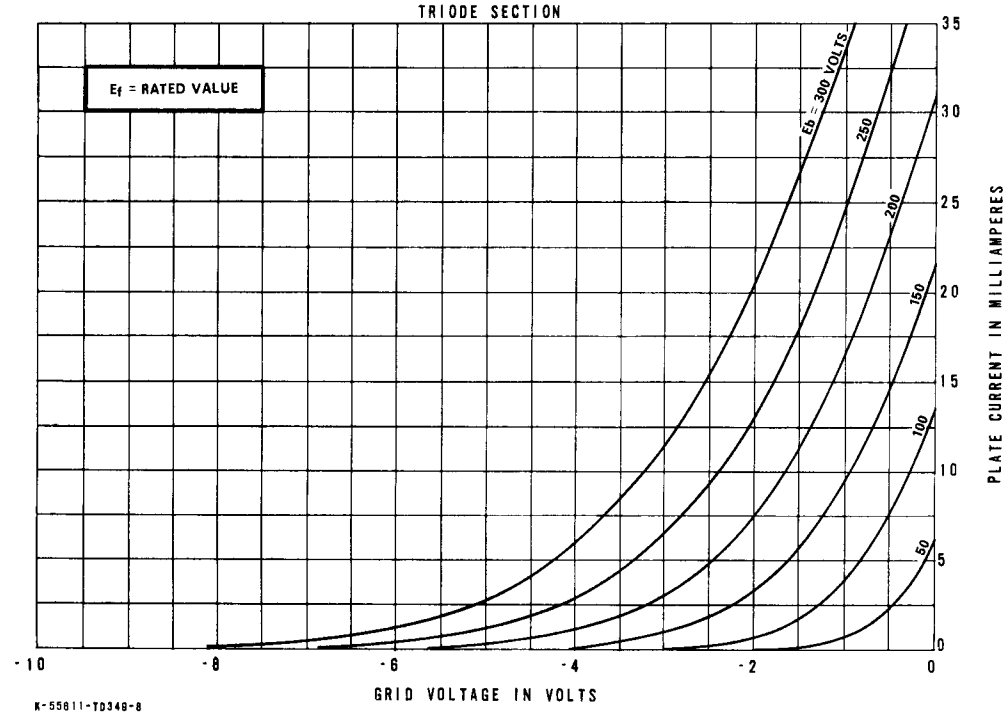
AVERAGE TRANSFER CHARACTERISTICS



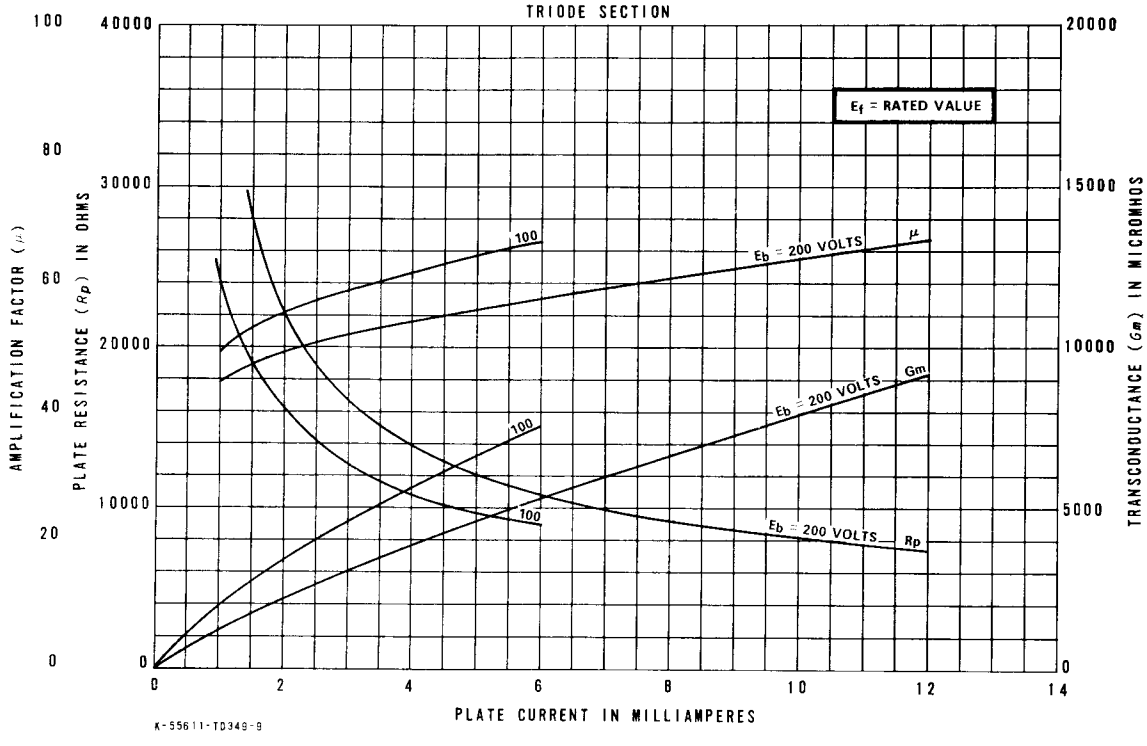
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301



TELEVISION PICTURE TUBE

DESCRIPTION

The 8AP4-A is a magnetic-focus and -deflection, direct-view picture tube for television applications. It provides a 5¼- by 7-inch picture. Features of this tube are a metal-cone envelope, an electron gun designed to be used with an external ion-trap magnet, and a high-quality, neutral-density faceplate which increases picture contrast and detail under high ambient light conditions.

TECHNICAL INFORMATION

GENERAL

Electrical

Heater voltage	6.3	volts
Heater current	0.6 ± 10%	ampere
Focusing method—magnetic		
Deflecting method—magnetic		
Deflecting angle, approximate	54	degrees
Phosphor—P4		
Fluorescence—white		
Persistence—medium		
Faceplate—neutral density		
Light transmission, approximate	76	percent
Direct interelectrode capacitances, approximate		
Cathode to all other electrodes	5	uuf
Grid—No. 1 to all other electrodes	6	uuf

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

Over-all length	$14\frac{1}{4} \pm \frac{3}{8}$	inches
Greatest diameter of bulb	$8\frac{1}{2} \pm \frac{3}{16}$	inches
Picture dimensions (with rounded sides)		
Width	7	inches
Height	$5\frac{1}{4}$	inches

Anode contact—metal cone rim
Base—small-shell duodecal 5-pin, B5-57
Basing—12H

MAXIMUM RATINGS Design Center Values

Anode voltage	9000 max	volts d-c
Grid—No. 1 voltage		
Negative—bias value	125 max	volts d-c
Positive—bias value	0 max	volts d-c
Positive—peak value	2 max	volts
Peak heater—cathode voltage*		
Heater negative with respect to cathode		
During warm-up period not to exceed 15 seconds	410 max	volts d-c
After equipment warm-up period	140 max	volts d-c
Heater positive with respect to cathode	140 max	volts d-c

RECOMMENDED OPERATING CONDITIONS

Anode voltage (average brightness = 20 foot-lamberts)	7000	volts
Grid—No. 1 voltage**	−27 to −63	volts
Focusing-coil current (RTMA coil No. 106 at $3\frac{1}{4}$-inches), approximate	115	milliamperes
Ion-trap field intensity***, approximate	45	gausses

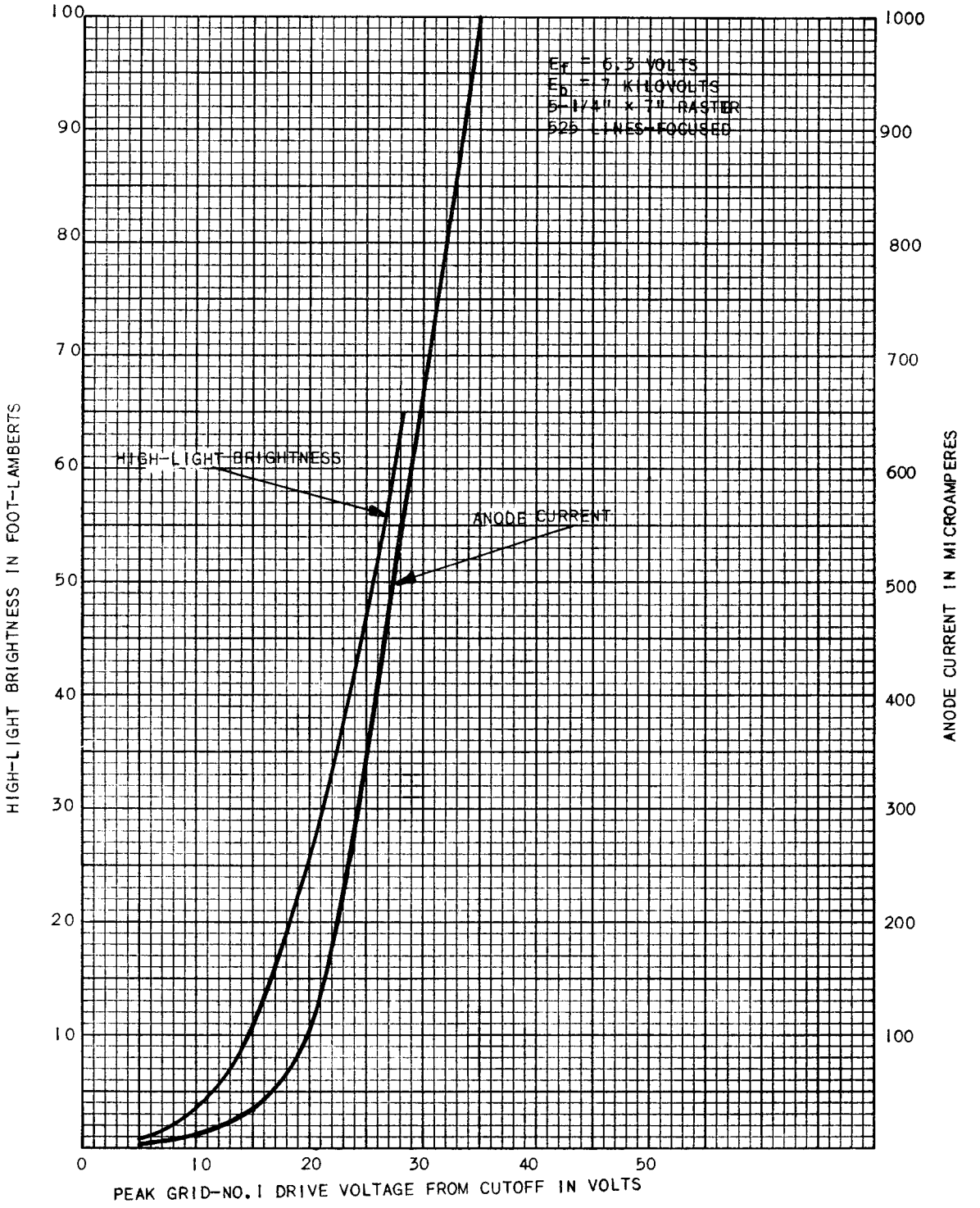
MAXIMUM CIRCUIT VALUES

Grid—No. 1 circuit resistance	1.5 max	megohms

*Cathode should be returned to one side or to the midtap of the heater transformer winding.
**For visual extinction of undeflected focused spot.
***Single-field ion-trap magnet adjusted to optimum position.

8AP4-A

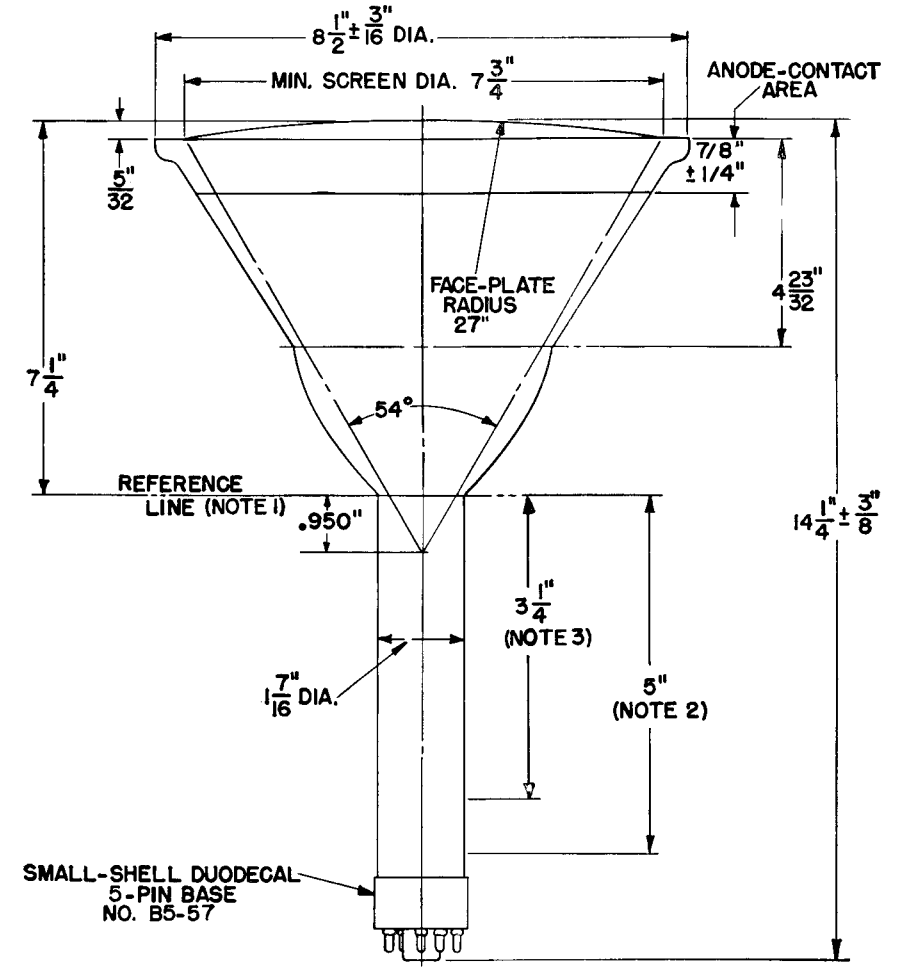
AVERAGE CHARACTERISTICS



K-69087-72A347

1-26-51

OUTLINE
8AP4-A



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RTMA NO. 112) WHEN THE GAGE IS RESTING ON THE GLASS CONE.
2. NOMINAL POSITION OF ION-TRAP MAGNET.
3. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.

N15130AZ 3-22-50

Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

PRODUCT INFORMATION

8AR11 - 8B10

8AR11
8B10

8AR11 Compactron Twin Pentode. The 8AR11 is a compactron containing two remote-cutoff pentodes. It is designed primarily for intermediate-frequency amplifier service in television receivers.

Except for heater characteristics and ratings, the 8AR11 is identical to the 6AR11 and 11AR11.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC‡	8.4	Volts
Heater Current§	0.6±0.04	Amperes
Heater Warm-up Time, Average¶	11	Seconds

8B10 Compactron Duplex-Diode Twin Triode. The 8B10 is a compactron containing two diodes and two triodes. The triode sections have separate cathodes and the diode sections have a common cathode. The diodes are intended for horizontal phase-detector service and the triodes for horizontal oscillator service.

Except for heater characteristics and ratings, the 8B10 is identical to the 6B10.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	8.5	Volts
Heater Current§	0.45±0.03	Amperes
Heater Warm-up Time, Average¶	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ Heater voltage for a bogey tube at If = 0.6 amperes.

§ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

¶ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Compactron Triode-Twin Pentode

8BA11

The 8BA11 is a compactron triode - twin pentode. The medium-mu triode section may be used as a vertical-deflection oscillator. The twin pentode incorporates separate plates and number-3 grids for the two sections together with a common screen, number-1 grid, and cathode. This section is intended for combined sync-AGC applications in television receivers.

Except for heater characteristics, the 8BA11 is identical to the 6BA11.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	8.4	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

8BM11

COMPACTRON DISSIMILAR DOUBLE PENTODE

DESCRIPTION AND RATING

The 8BM11 is a compactron containing a semiremote-cutoff pentode (Section 1) and a sharp-cutoff pentode (Section 2). It is intended for intermediate-frequency amplifier service in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	8.4	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, average§	11	Seconds

Direct Interelectrode Capacitances¶

Section 1

Grid-Number 1 to Plate: (1g1 to 1p)	0.016	pf
Input: 1g1 to (h + 1k + 1g2 + 1g3 + i.s.)	6.5	pf
Output: 1p to (h + 1k + 1g2 + 1g3 + i.s.)	2.4	pf

Section 2

Grid-Number 1 to Plate: (2g1 to 2p)	0.015	pf
Input: 2g1 to (h + 2k + 2g2 + 2g3 + 1g3 + i.s.)	7.5	pf
Output: 2p to (h + 2k + 2g2 + 2g3 + 1g3 + i.s.)	2.6	pf

Coupling

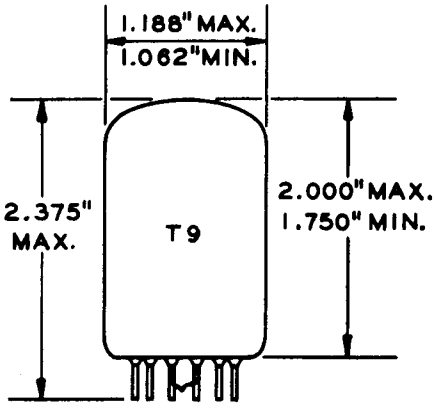
Grid-Number 1 (Section 1) to Plate (Section 2): (1g1 to 2p), maximum	0.001	pf
Grid-Number 1 (Section 2) to Plate (Section 1): (2g1 to 1p), maximum	0.10	pf
Grid-Number 1 (Section 1) to Grid-Number 1 (Section 2): (1g1 to 2g1), maximum	0.001	pf
Plate (Section 1) to Plate (Section 2): (1p to 2p) maximum	0.002	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

PHYSICAL DIMENSIONS

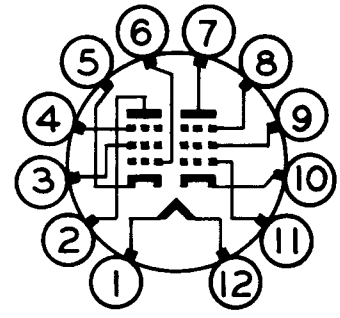


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate (Section 2)
Pin 3 - Grid Number 2 (Screen) (Section 2)
Pin 4 - Grid Number 3 (Suppressor) (Section 2)
Pin 5 - Cathode (Section 2)
Pin 6 - Grid Number 1 (Section 2)
Pin 7 - Plate (Section 1)
Pin 8 - Grid Number 3 (Suppressor) (Section 1) and Internal Shield
Pin 9 - Grid Number 2 (Screen) (Section 1)
Pin 10 - Cathode (Section 1)
Pin 11 - Grid Number 1 (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12FU

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Section 1

Plate Voltage	160	Volts
Suppressor Voltage	0	Volts
Screen Voltage	160	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	2.2	Watts
Screen Dissipation	0.55	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	1.0	Megohms

Section 2

Plate Voltage	160	Volts
Suppressor Voltage	0	Volts
Screen Voltage	160	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	2.2	Watts
Screen Dissipation	0.55	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	0.25	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Section 1

Plate Voltage	125	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Plate Resistance, approximate	220000	Ohms
Transconductance	8800	Micromhos
Plate Current	14	Milliamperes
Screen Current	3.6	Milliamperes
Grid-Number 1 Voltage, approximate		
Gm = 50 Micromhos	-16.5	Volts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

Section 2

Plate Voltage	125	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	125	Volts
Cathode-Bias Resistor	120	Ohms
Plate Resistance, approximate	300000	Ohms
Transconductance	8500	Micromhos
Plate Current	9.0	Milliamperes
Screen Current	2.5	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 20 Microamperes	-5.5	Volts

NOTES

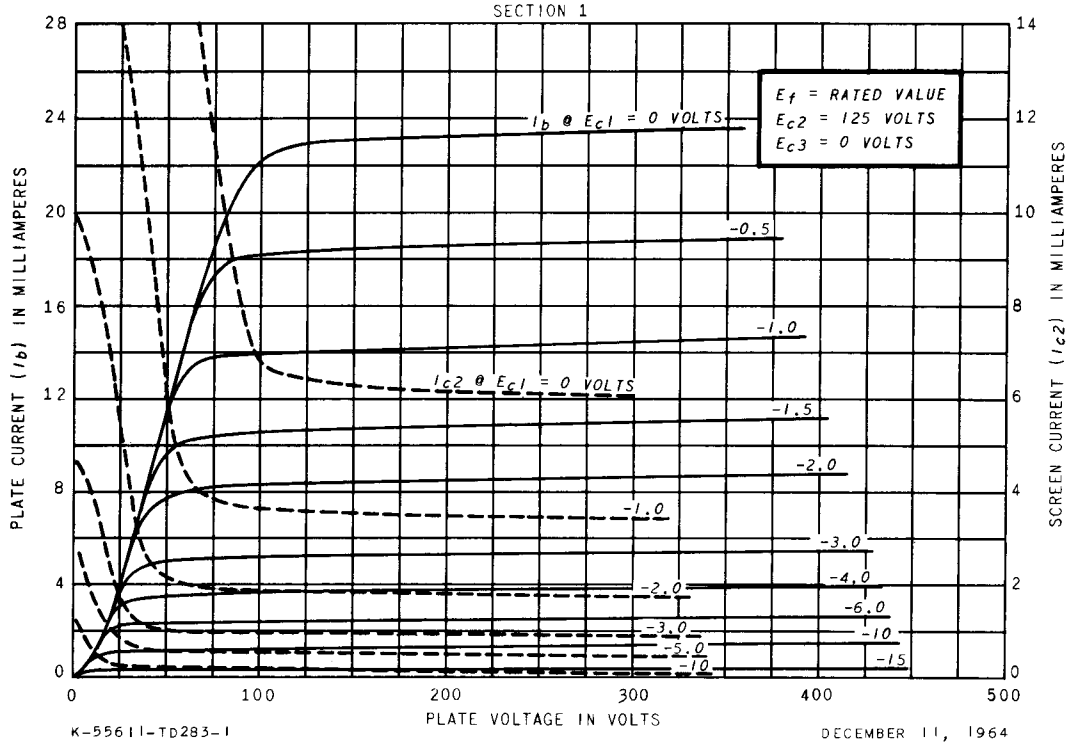
* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

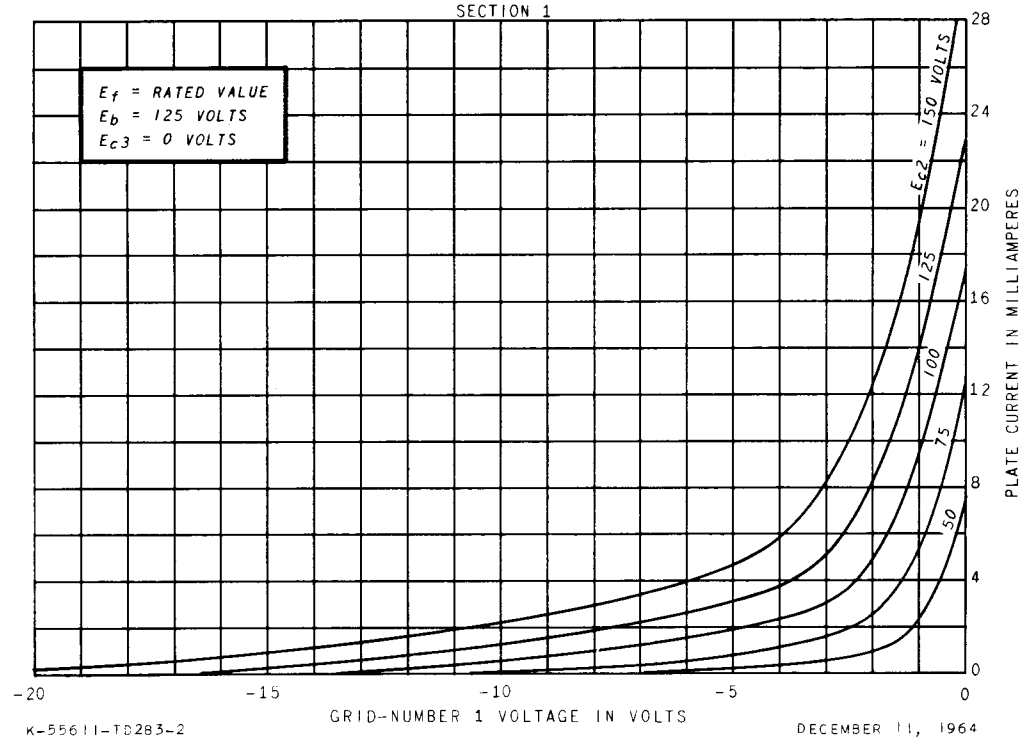
§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ With external shield (EIA 309) connected to cathode of section under test.

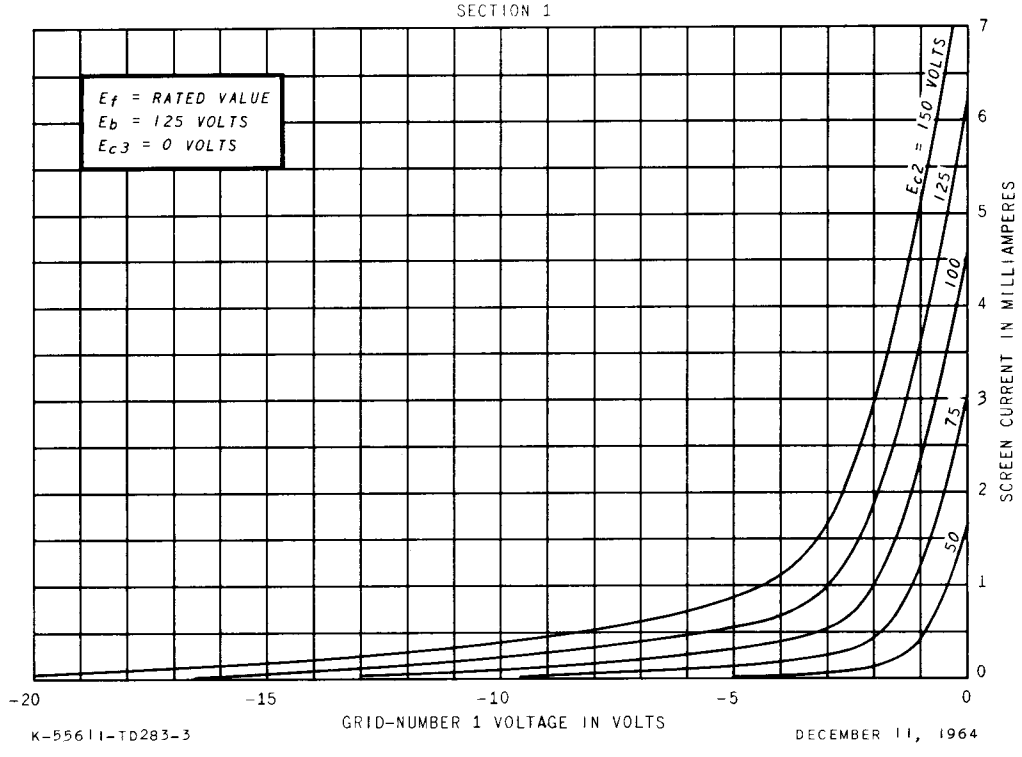
AVERAGE PLATE CHARACTERISTICS



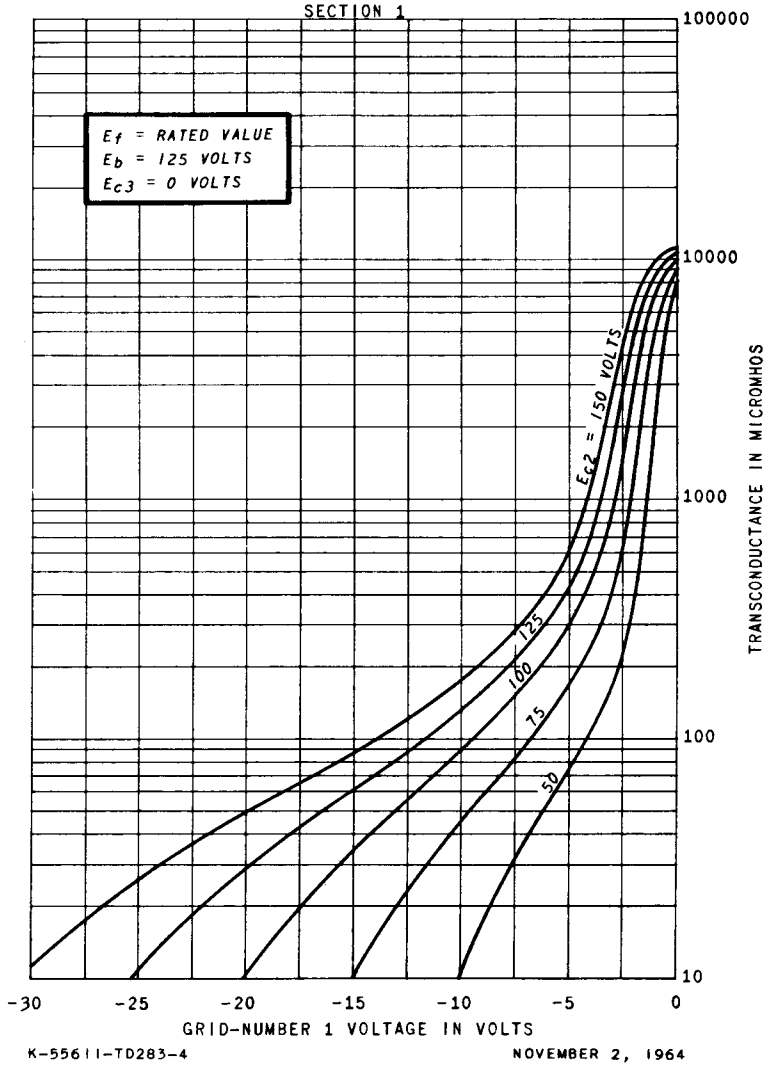
AVERAGE TRANSFER CHARACTERISTICS



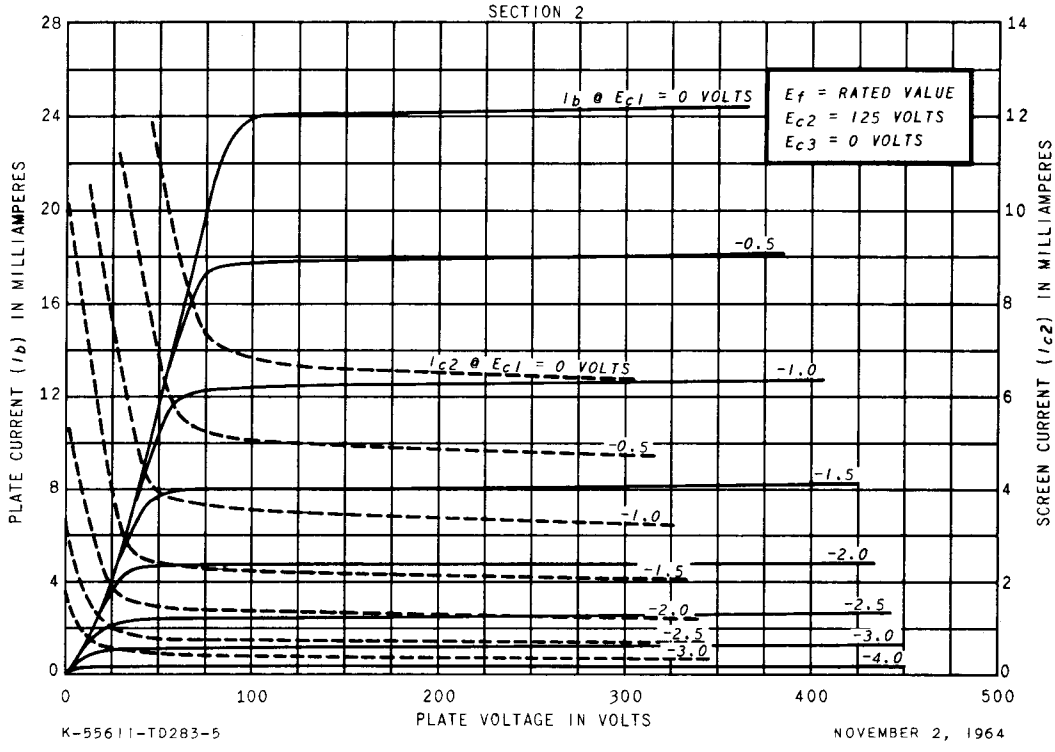
AVERAGE TRANSFER CHARACTERISTICS



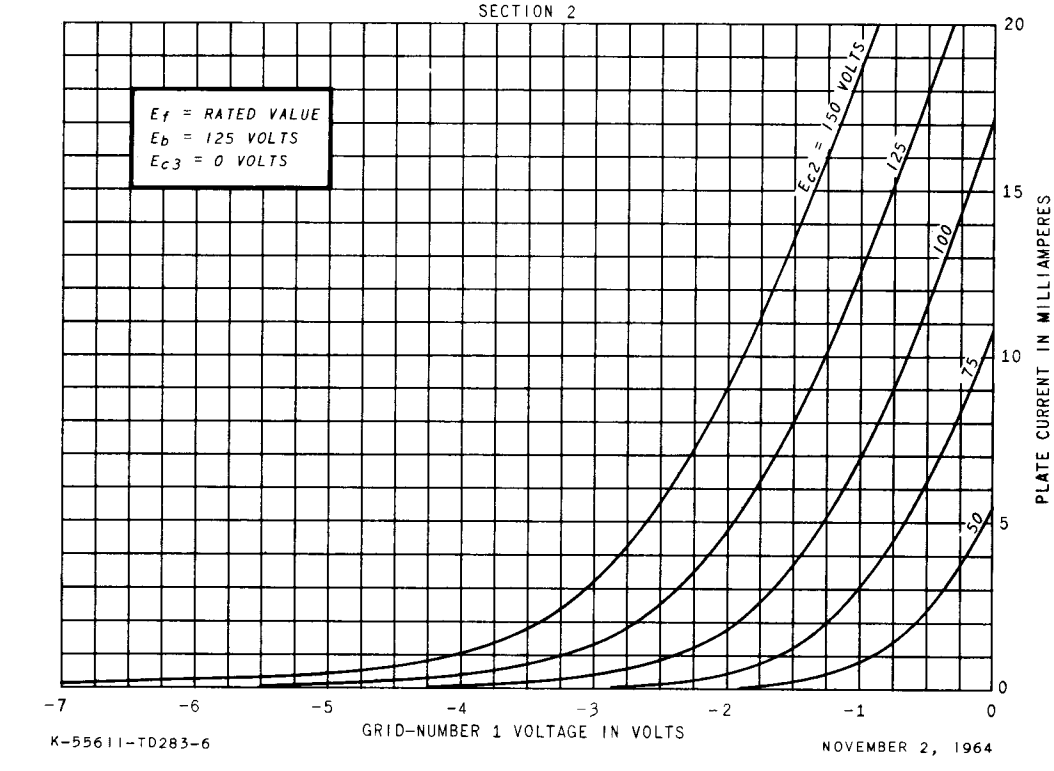
AVERAGE TRANSFER CHARACTERISTICS



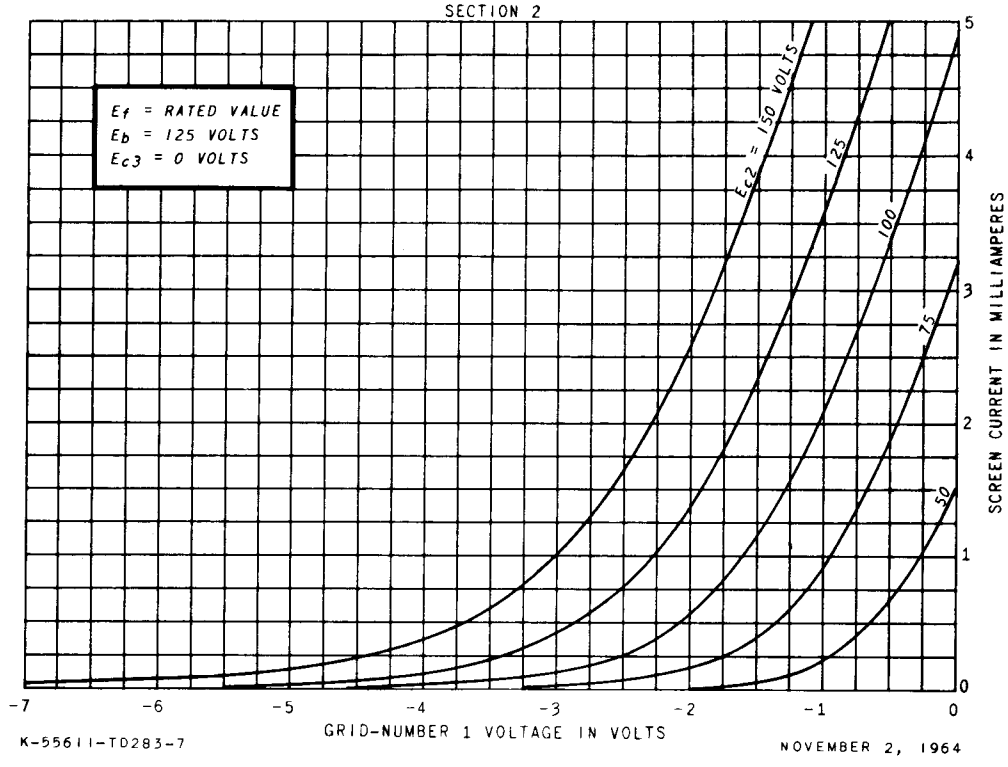
AVERAGE PLATE CHARACTERISTICS



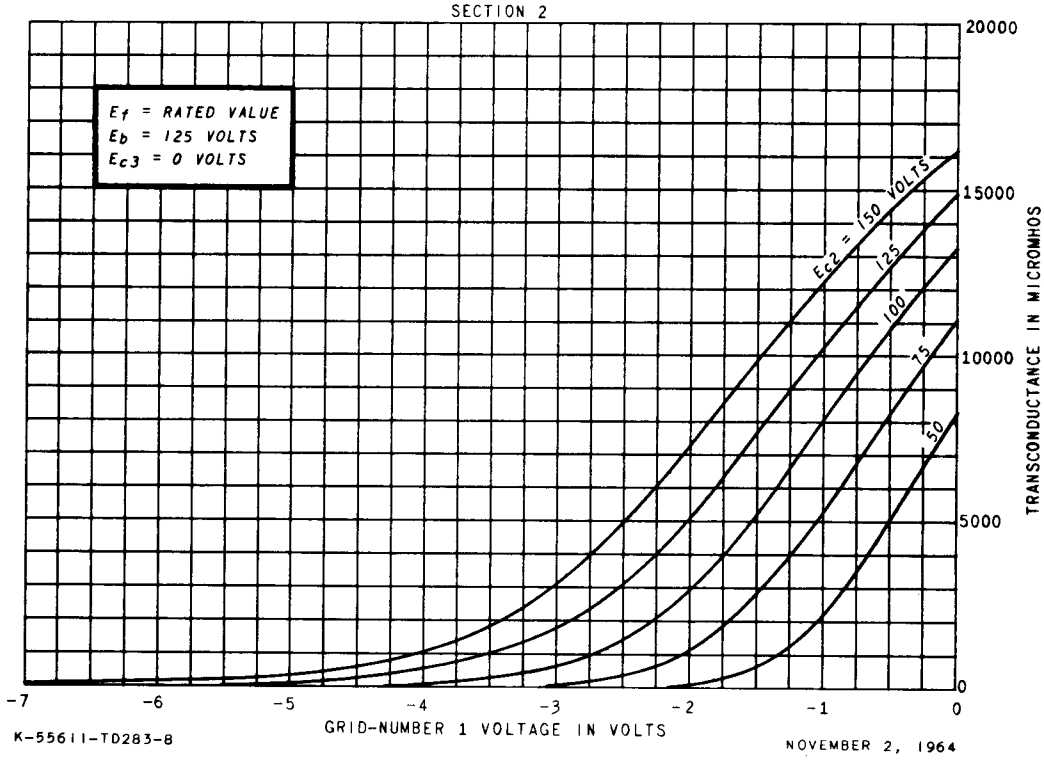
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

8BN11

Compactron Twin Pentode

The 8BN11 is a compactron containing two sharp-cutoff pentodes. It is intended primarily for intermediate-frequency amplifier service in television receivers.

Except for heater characteristics and ratings, the 8BN11 is identical to the 6BN11.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	8.4	Volts
Heater Current‡	0.6±0.04	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.6 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

PRODUCT INFORMATION

Compactron Dissimilar Double Pentode

8BQ11

The 8BQ11 is a compactron containing a remote-cutoff pentode (Section 1) and a sharp-cutoff pentode (Section 2). It is intended primarily for use in the intermediate-frequency stages of television receivers.

Except for heater characteristics, the 8BQ11 is identical to the 11BQ11.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	8.4	Volts
Heater Current‡	0.6±0.04	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.6 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

PRODUCT INFORMATION

8BU11

Compactron Twin-Triode Pentode

The 8BU11 is a compactron containing two medium-mu triodes and a sharp-cutoff pentode.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	7.8	Volts
Heater Current‡	0.6±0.04	Amperes
Heater Warm-up Time, Average§	11	Seconds
Direct Interelectrode Capacitances¶		

Triode (Section 1)

Grid to Plate: (T1g to T1p)	1.7	pf
Input: T1g to (T1k + Pk + Pg3 + h + i.s.)	3.2	pf
Output: T1p to (T1k + Pk + Pg3 + h + i.s.)	2.0	pf

Triode (Section 2)

Grid to Plate: (T2g to T2p)	1.8	pf
Input: T2g to (T1k + T2k + Pk + Pg3 + h + i.s.)	3.0	pf
Output: T2p to (T1k + T2k + Pk + Pg3 + h + i.s.)	1.7	pf

Pentode Section

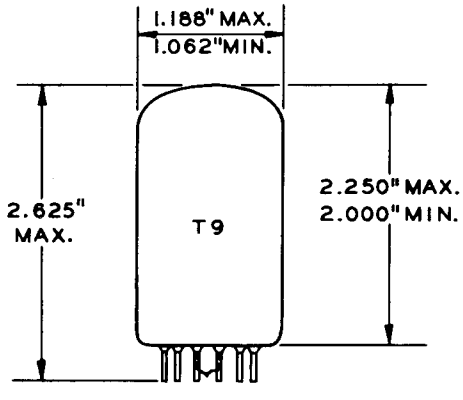
Grid-Number 1 to Plate: (Pg1 to Pp)	0.11	pf
Input: Pg1 to (T1k + Pk + Pg2 + Pg3 + h + i.s.)	5.0	pf
Output: Pp to (T1k + Pk + Pg2 + Pg3 + h + i.s.)	2.4	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

PHYSICAL DIMENSIONS

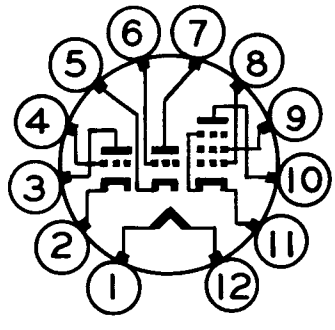


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Triode Cathode (Section 2)
Pin 3 - Triode Plate (Section 2)
Pin 4 - Triode Grid (Section 2)
Pin 5 - Triode Cathode (Section 1) and Internal Shield
Pin 6 - Triode Grid (Section 1)
Pin 7 - Triode Plate (Section 1)
Pin 8 - Pentode Grid Number 1
Pin 9 - Pentode Grid Number 2 (Screen)
Pin 10 - Pentode Plate
Pin 11 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 12 - Heater

BASING DIAGRAM



EIA 12FP

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Pentode Section

Plate Voltage	330	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	2.5	Watts
Screen Dissipation	0.55	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Each Triode Section

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.8	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	125	Volts
Screen Voltage	125	Volts
Grid-Number 1 Voltage	-1.0	Volts
Plate Resistance, approximate	200000	Ohms
Transconductance	7500	Micromhos
Plate Current	12	Milliamperes
Screen Current	4.0	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 30 Microamperes	-8	Volts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

Each Triode Section

Plate Voltage	125	Volts
Cathode-Bias Resistor	68	Ohms
Amplification Factor	43	
Plate Resistance, approximate	5000	Ohms
Transconductance	8600	Micromhos
Plate Current	13.5	Milliamperes
Grid-Voltage, approximate Ib = 100 Microamperes	-8	Volts

NOTES

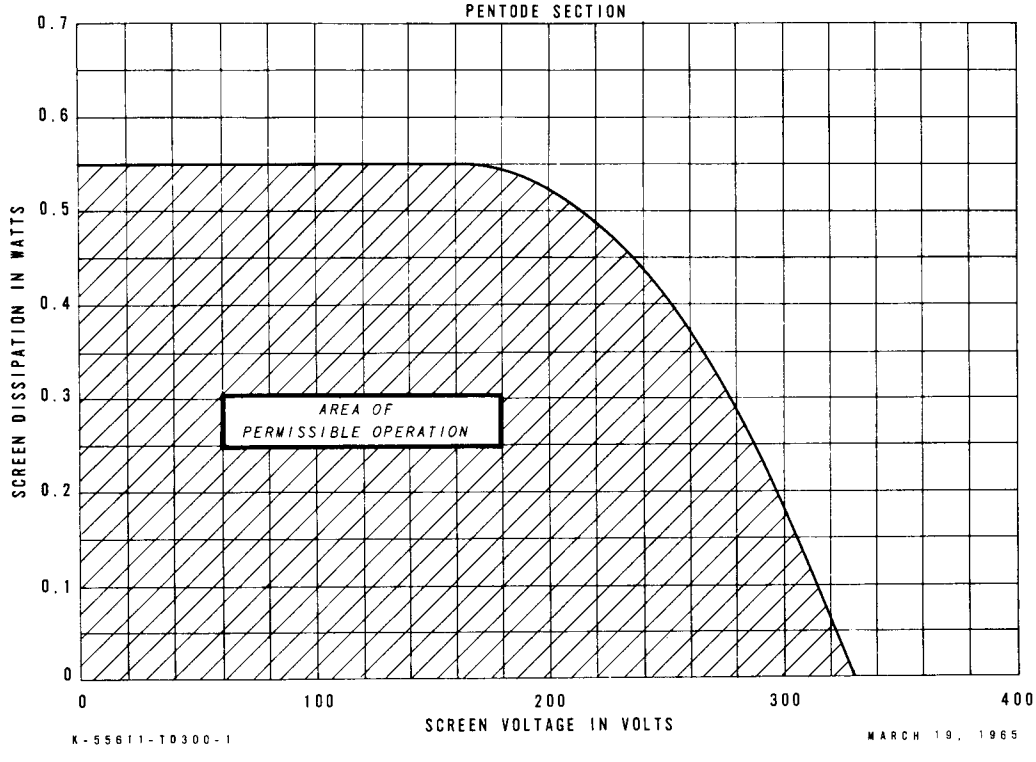
* Heater voltage for a bogey tube at If = 0.6 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

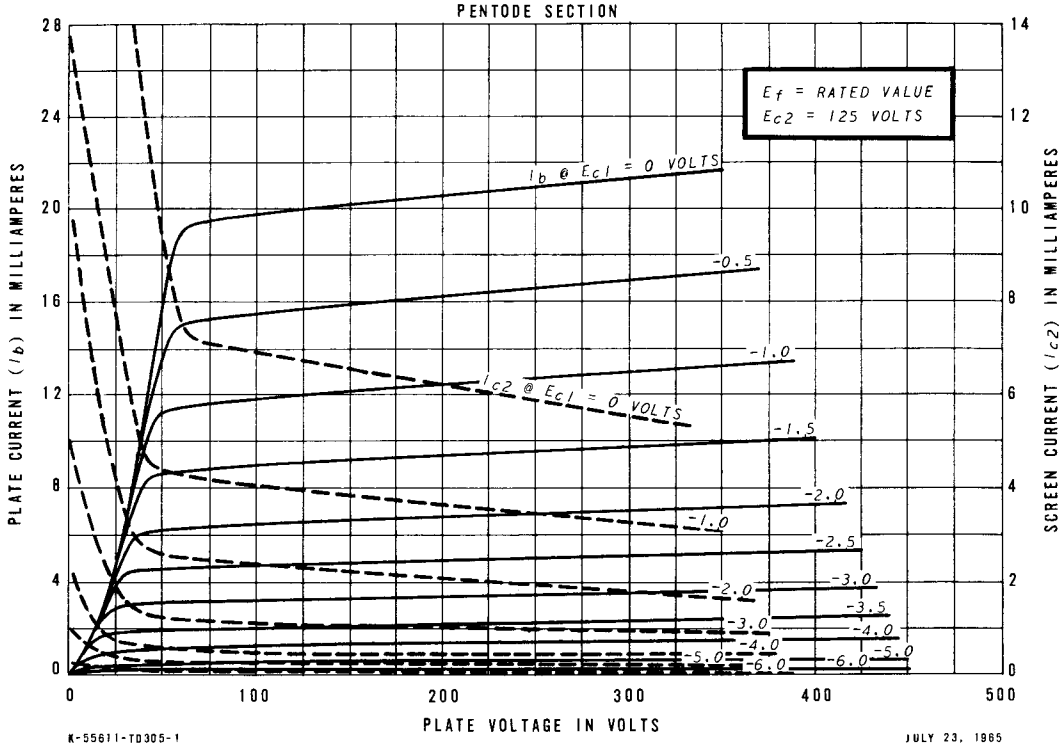
§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ Without external shield.

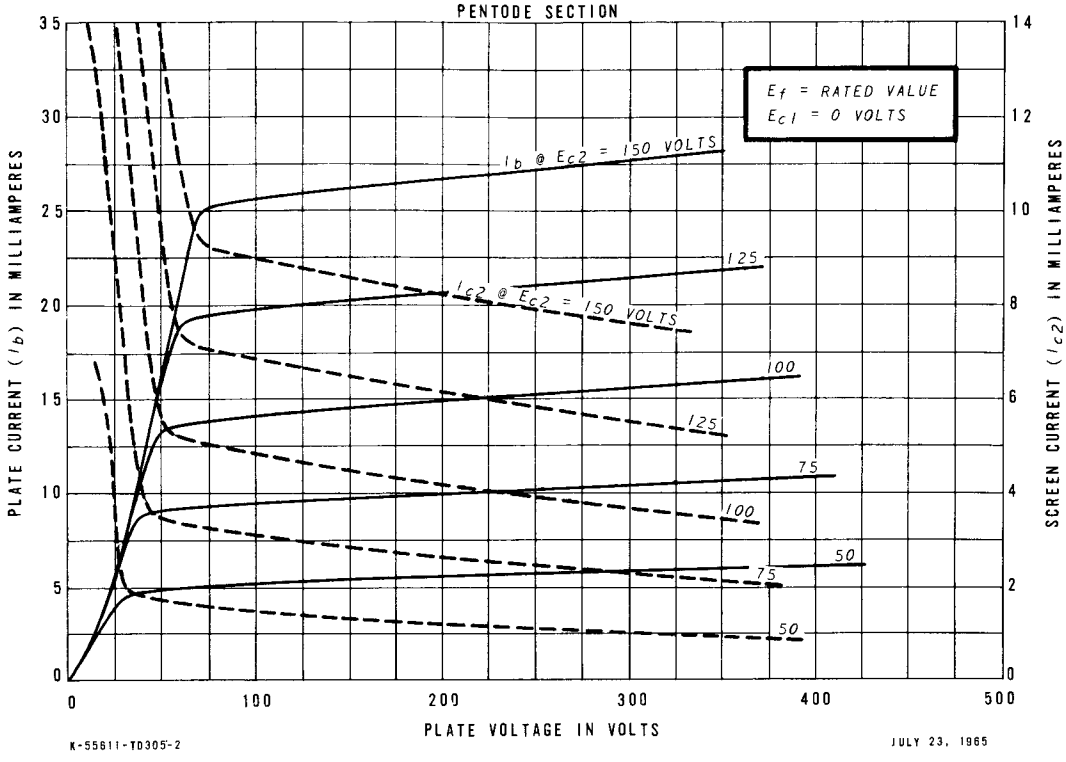
SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

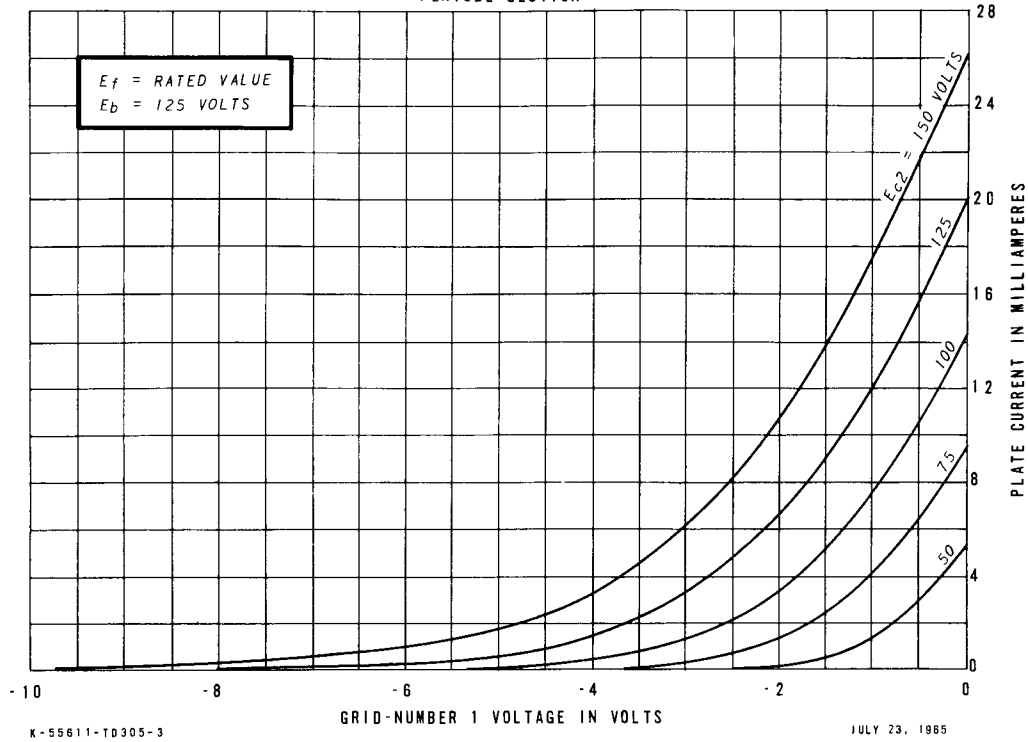


AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

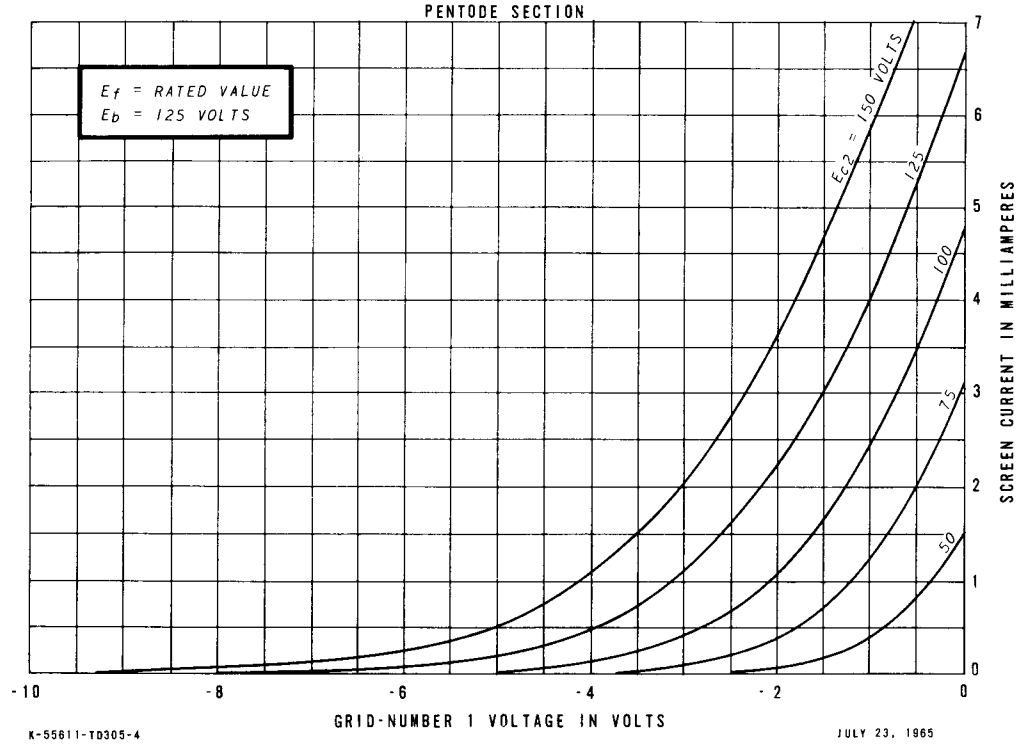


K-55611-TD305-3

JULY 23, 1965

AVERAGE TRANSFER CHARACTERISTICS

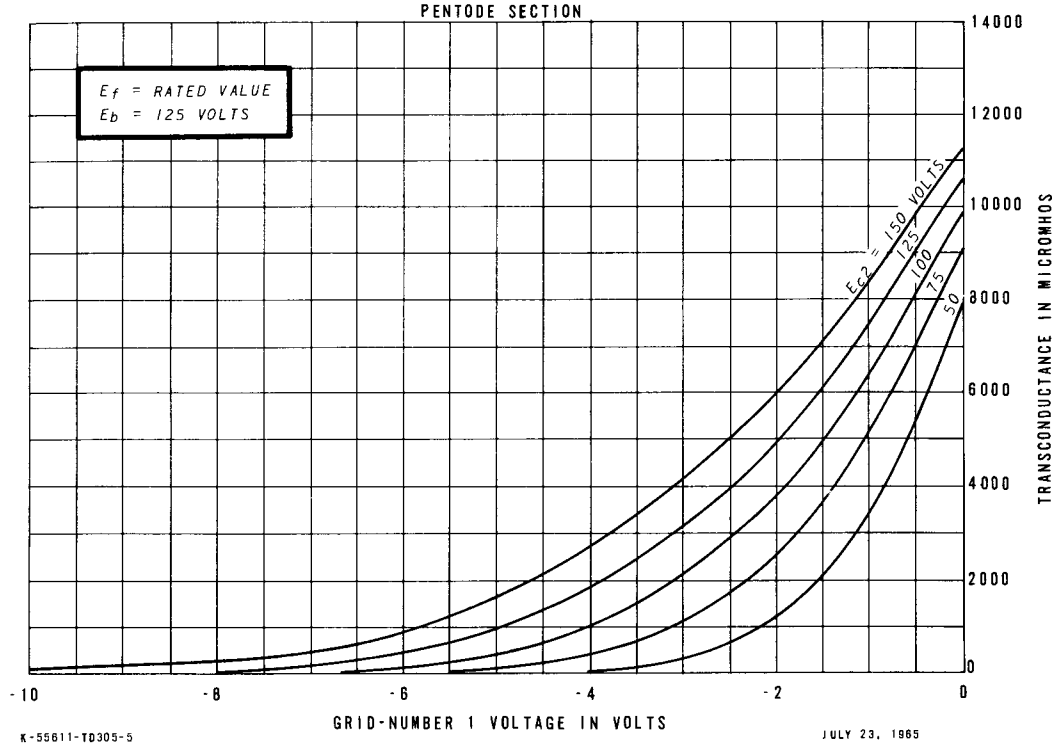
PENTODE SECTION



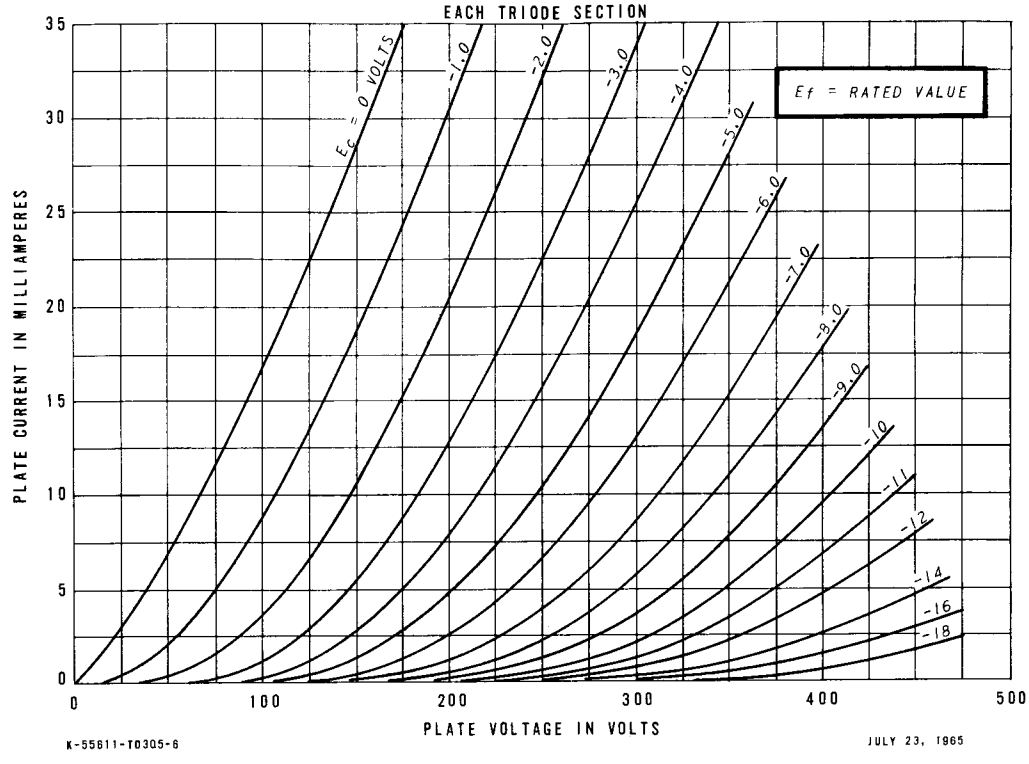
K-55611-TD305-4

JULY 23, 1965

AVERAGE TRANSFER CHARACTERISTICS

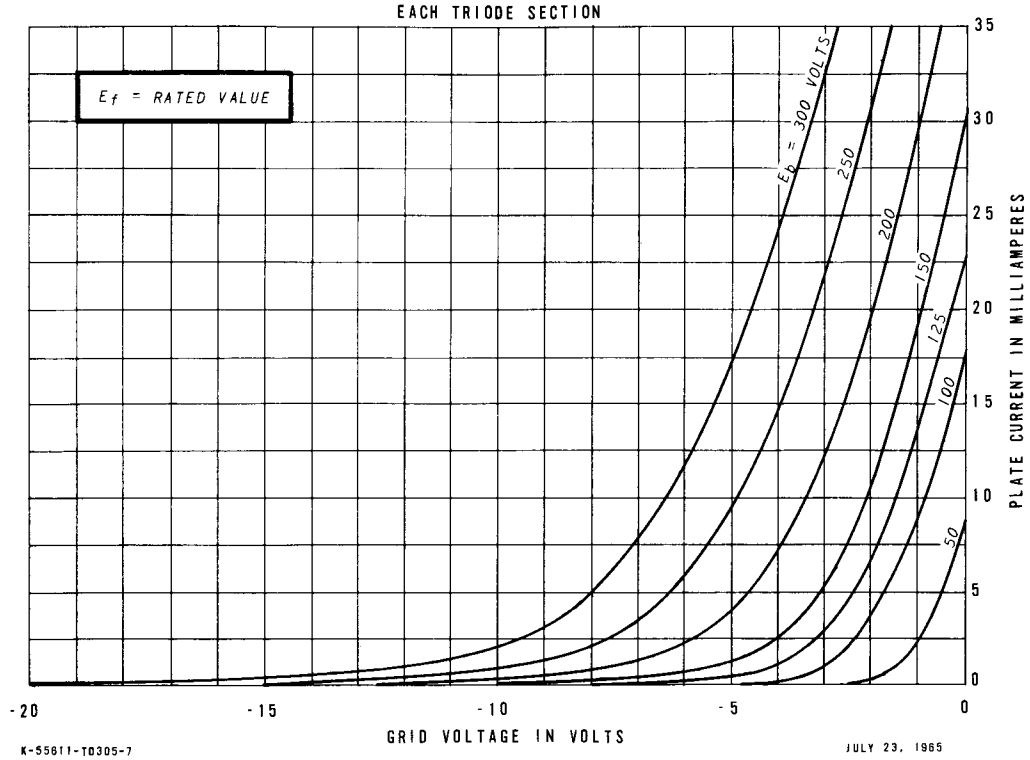


AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

EACH TRIODE SECTION

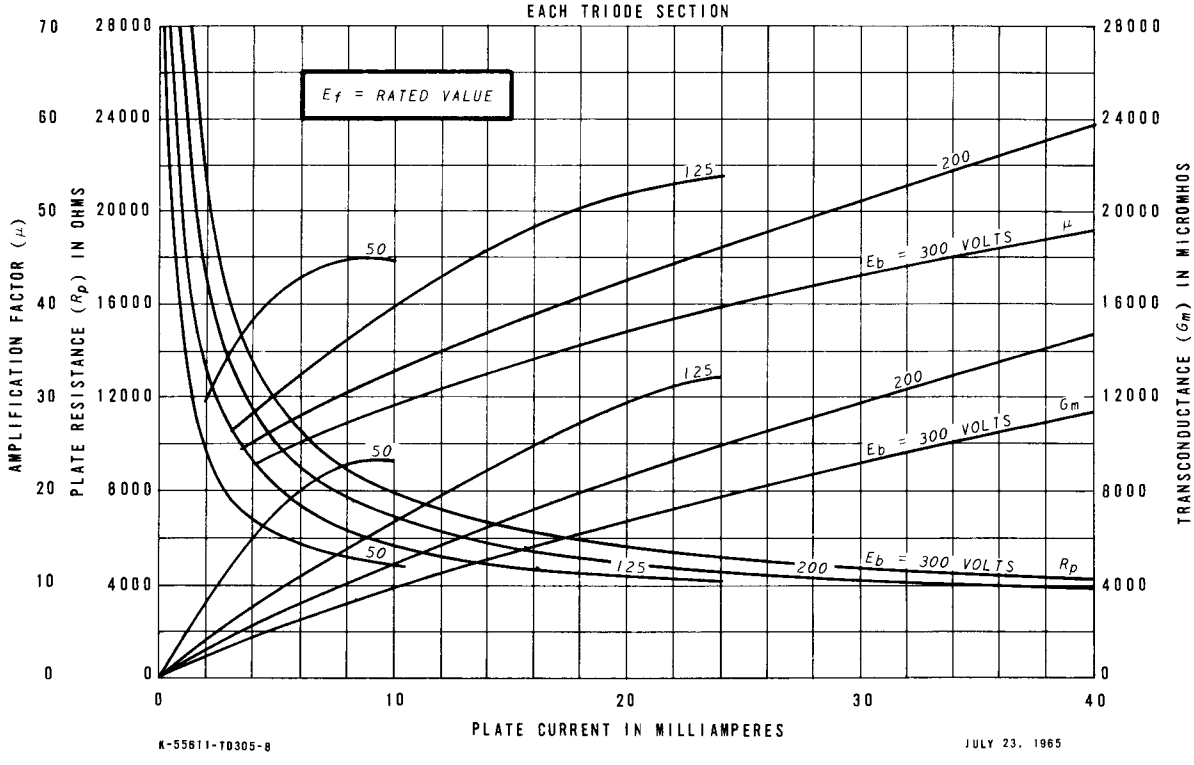


K-55611-TD305-7

JULY 23, 1965

AVERAGE CHARACTERISTICS

EACH TRIODE SECTION



K-55611-TD305-8

JULY 23, 1965

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Compactron Twin Pentode

8CB11

■ COLOR TV TYPE

■ TRANSCONDUCTANCE = 13000 MICROMHOS

The 8CB11 is a compactron containing two sharp-cutoff pentodes. It is intended primarily for intermediate-frequency amplifier service in color television receivers, and is also useful for bandpass amplifier, burst amplifier, and low-level video amplifier applications.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	8.4	Volts
Heater Current●	0.6 ± 0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds

Direct Interelectrode Capacitances, approximate§

Section 1

Grid-Number 1 to Plate: (1g1 to 1p)	0.028	pf
Input: 1g1 to (h + 1k + 1g2 + 1g3 + 2g3 + i.s.)	12	pf
Output: 1p to (h + 1k + 1g2 + 1g3 + 2g3 + i.s.)	2.6	pf

Section 2

Grid-Number 1 to Plate: (2g1 to 2p)	0.02	pf
Input: 2g1 to (h + 2k + 2g2 + 2g3 + 1g3 + i.s.)	12	pf
Output: 2p to (h + 2k + 2g2 + 2g3 + 1g3 + i.s.)	2.8	pf

Coupling

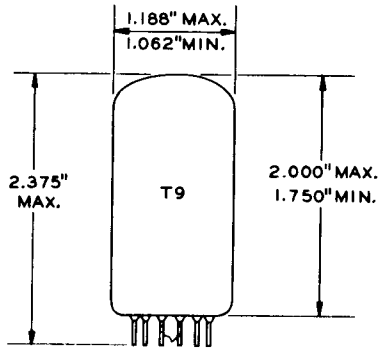
Plate, Section 1, to Plate, Section 2: (1p to 2p), maximum	0.004	pf
Grid-Number 1, Section 1, to Plate, Section 2: (1g1 to 2p), maximum	0.001	pf
Grid-Number 1, Section 2, to Plate, Section 1: (2g1 to 1p), maximum	0.002	pf
Grid-Number 1, Section 1, to Grid-Number 1, Section 2: (1g1 to 2g1), maximum	0.001	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

PHYSICAL DIMENSIONS

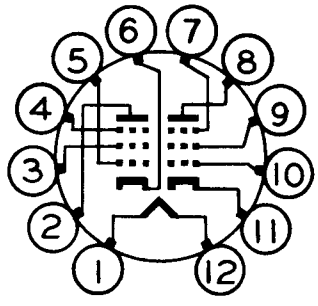


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate (Section 2)
Pin 3 - Grid Number 2 (Screen) (Section 2)
Pin 4 - Grid Number 3 (Suppressor) (Section 2)
Pin 5 - Grid Number 1 (Section 2)
Pin 6 - Cathode (Section 2)
Pin 7 - Grid Number 3 (Suppressor) (Section 1) and Internal Shield
Pin 8 - Plate (Section 1)
Pin 9 - Grid Number 2 (Screen) (Section 1)
Pin 10 - Grid Number 1 (Section 1)
Pin 11 - Cathode (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12DM

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, Each Section

Plate Voltage	330	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	3.1	Watts
Screen Dissipation	0.65	Watts
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	0.25	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, Each Section

Plate Voltage	125	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Plate Resistance, approximate	0.2	Megohms
Transconductance	13000	Micromhos
Plate Current	11	Milliamperes
Screen Current	3.8	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 20 Microamperes	−3	Volts

NOTES

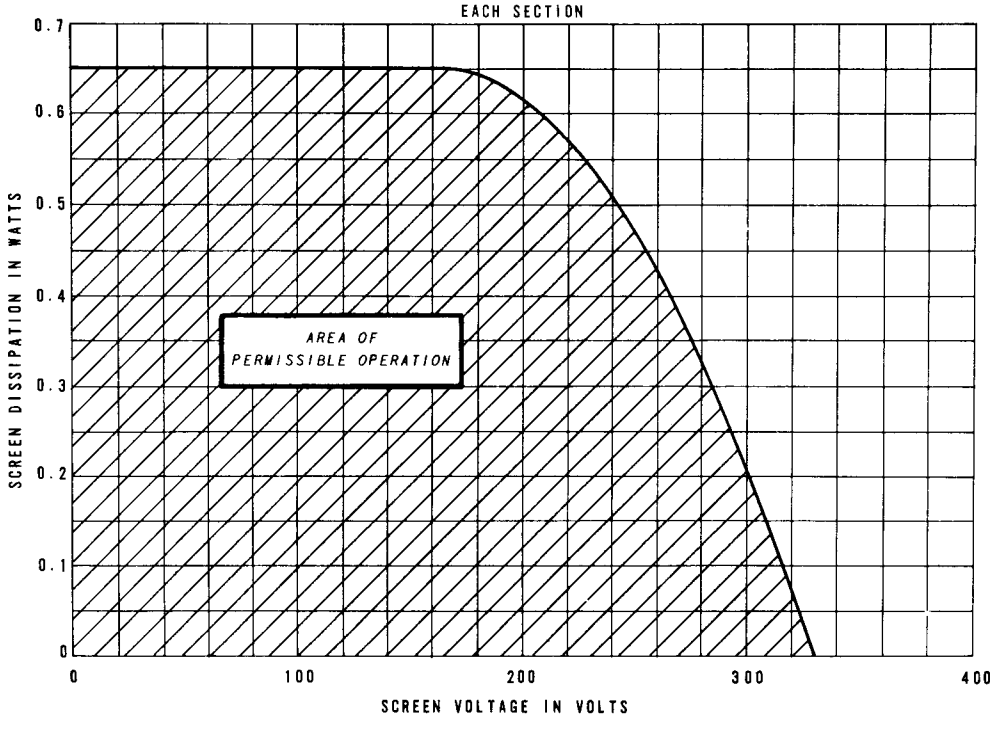
★ Heater voltage for a bogey tube at If = 0.6 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

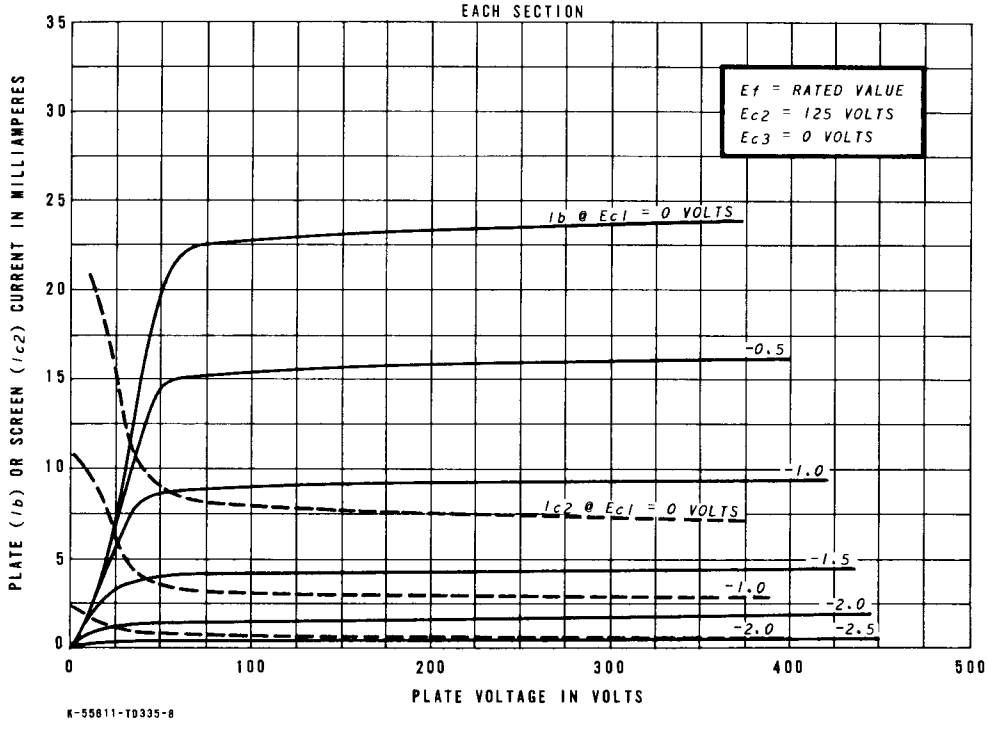
♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

§ With external shield (EIA 309) connected to cathode of section under test.

SCREEN RATING CHART



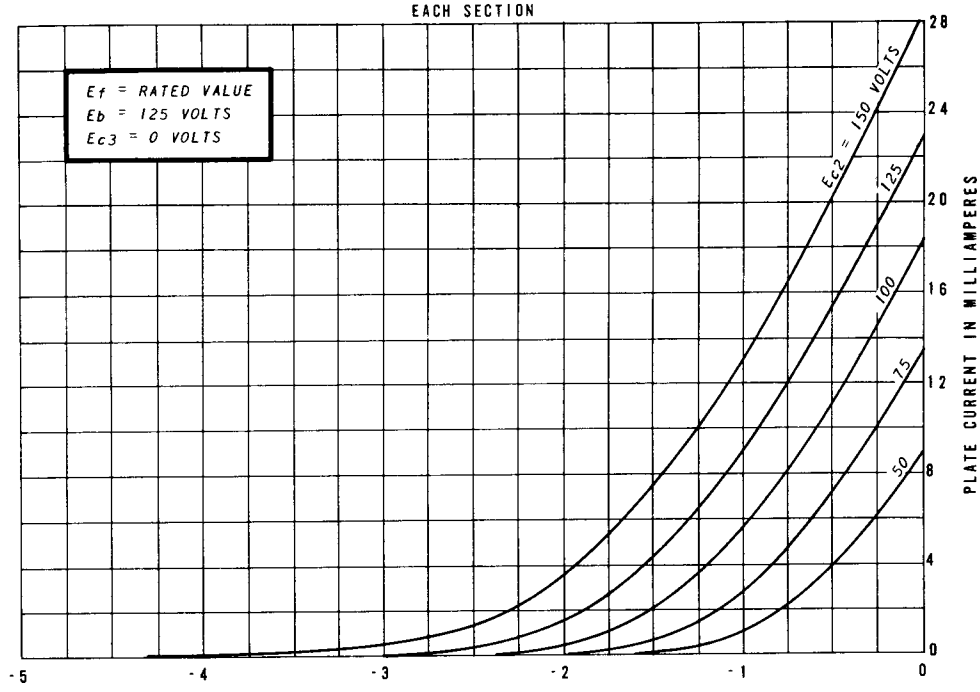
AVERAGE PLATE CHARACTERISTICS



K-55811-TD335-8

AVERAGE TRANSFER CHARACTERISTICS

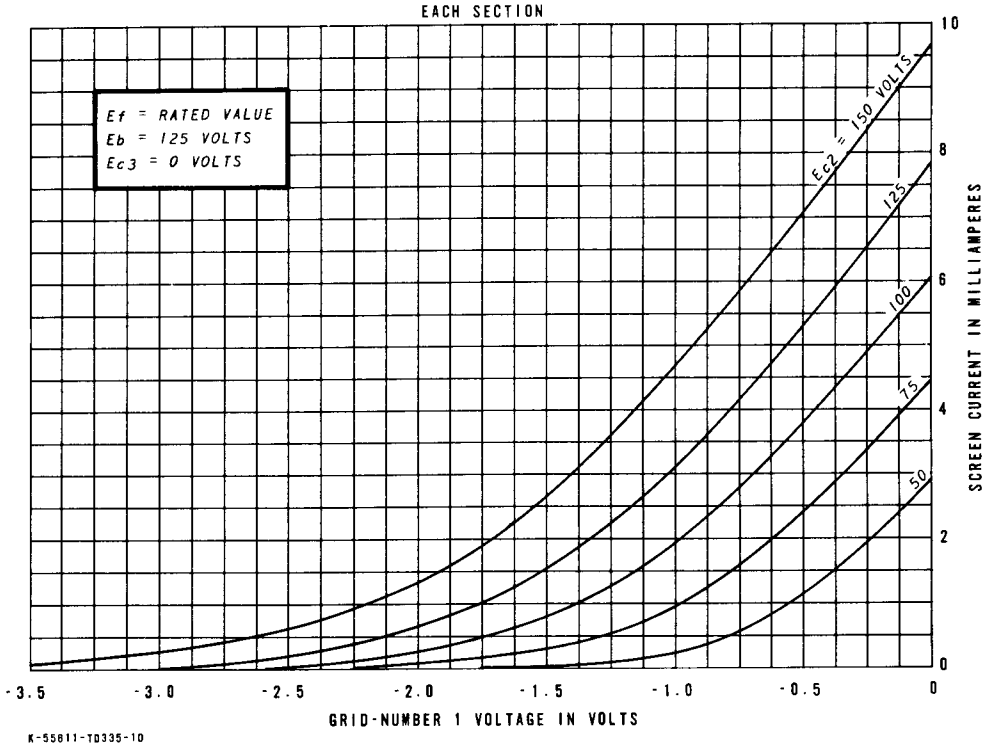
EACH SECTION



K-55811-TD335-9

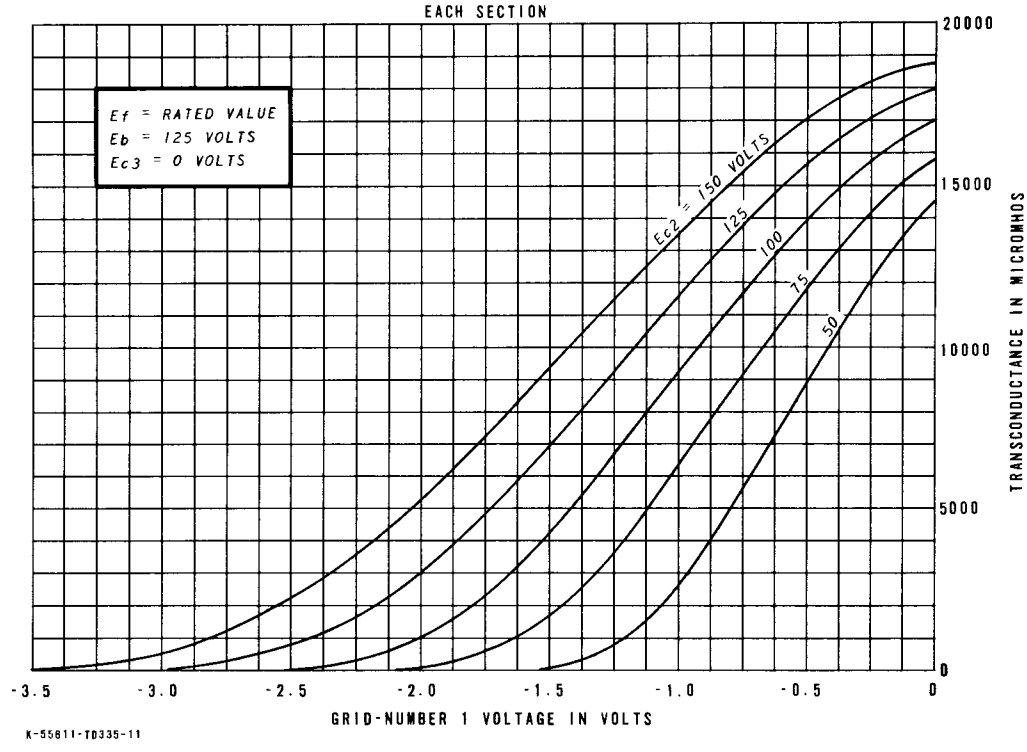
AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION



K-55811-TD335-10

AVERAGE TRANSFER CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

CATHODE RAY TUBE

8-INCH, RECTANGULAR, GLASS	7-3/16 BY 5-3/8 INCH PICTURE SIZE
ELECTROSTATIC FOCUS	FACEPLATE: SPHERICAL, GRAY
MAGNETIC DEFLECTION	HIGH RESOLUTION
70-DEGREE DEFLECTION ANGLE	ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 8RP4 is an eight inch electrostatic focus and magnetic deflection cathode ray tube for monitor use in closed circuit television, studio broadcasting, and industrial applications. Outstanding features include a 70° deflection angle for a better center to edge focusing characteristic with a reduced deflection power requirement and a high resolution, non-ion trap electron gun.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.3 ± 10%	Amperes

Focusing Method - Electrostatic
Deflecting Method - Magnetic

Deflection Angle, Approximate		
Diagonal	70	Degrees
Horizontal	64	Degrees
Vertical	50	Degrees

Direct Interelectrode Capacitances, Approximate		
Cathode to All Other Electrodes	5	μμf
Grid No. 1 to All Other Electrodes	6	μμf

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

from JEDEC release #4067, Jan. 7, 1963

OPTICAL

Phosphor Number - P4
Fluorescent Color - White
Phosphorescent Color - White
Persistence - Short
Faceplate - Gray

Light Transmission at Center, Approximate	80	Percent

MECHANICAL

Over-all Length	11-1/2 ± 1/4	Inches
Neck Length	5-3/16 ± 3/16	Inches
Greatest Bulb Dimensions		
Diagonal	8-7/16 ± 1/8	Inches
Width	6-1/16 ± 1/8	Inches
Height	7-7/8 ± 1/16	Inches
Minimum Useful Screen Dimensions		
Diagonal	7-13/16	Inches
Width	7-3/16	Inches
Height	5-3/8	Inches
Area	35.5	Square Inches

Bulb Contact - Recessed Small - Cavity Cap, JETEC No. J1-22
Base - B7-208
Basing, JETEC Designation - 8MC
Anode Contact Aligns With Pin No. 1 Position ± 30 Degrees.
Bulb Contoured to Fit 110° Deflection Yoke.
Mounting Position - Any

Net Weight, Approximate	3	Pounds

MAXIMUM RATINGS

DESIGN CENTER VALUES +

Anode Voltage	20,000	Max. Volts DC
Focusing Electrode Voltage	+600	Max. Volts DC
Grid No. 2 Voltage	700	Max. Volts DC
Grid No. 1 Voltage		
Negative-Bias Value	-120	Max. Volts DC
Positive-Bias Value	0	Max. Volts DC

DESIGN CENTER VALUES + (Continued)

Peak Heater-Cathode Voltage		
Heater Negative With Respect to Cathode	180	Max. Volts
Heater Positive With Respect to Cathode	180	Max. Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage	16,000	Volts DC
Grid No. 2 Voltage	300	Volts DC
Grid No. 1 Voltage *	-33 to -72	Volts DC
Focusing Electrode Voltage	-100 to +400	Volts DC
Line Width "A"+++	.012	Inches Max.

MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5	Max. Meg.

NOTES:

\+ The maximum ratings provide a ten percent safety factor in accordance with the standard design center system of rating cathode ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design center values are not exceeded by more than ten percent.

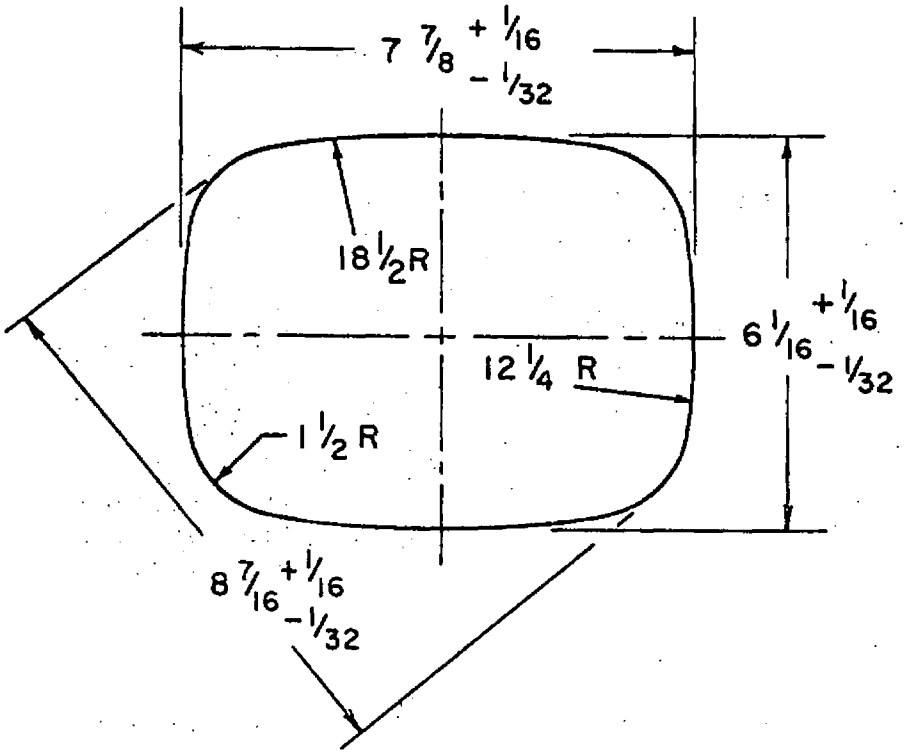
* For visual extinction of focused raster.

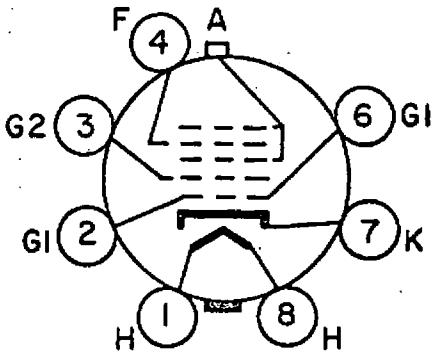
+++ Measured in accordance with MIL-E-1 paragraph 4.12.6.2 at an anode current of 100μa.

WARNING:

If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

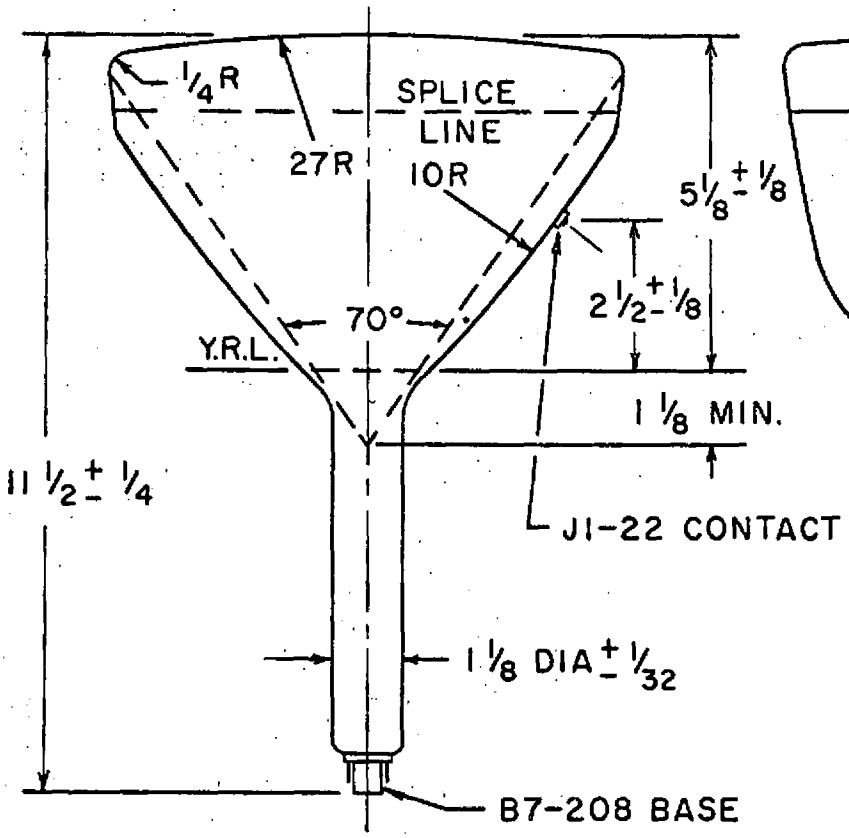
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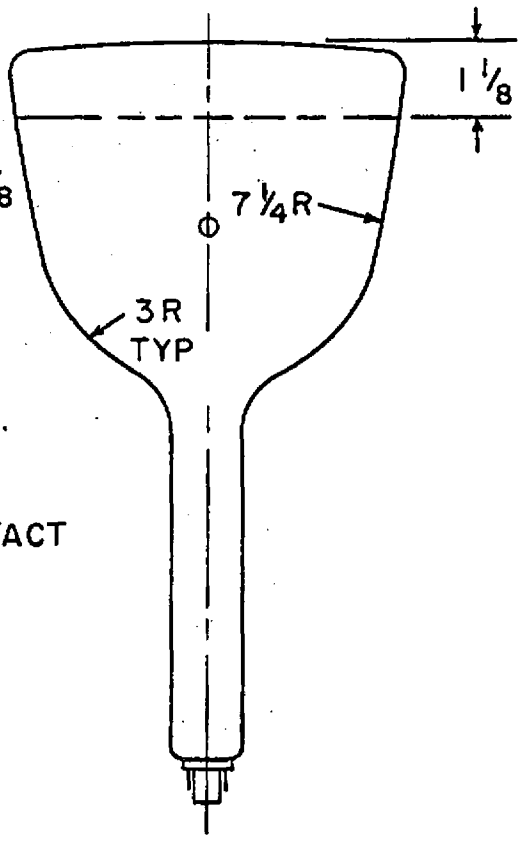




BASING DIAGRAM
8MC

NOTE:
PIN NO. 1 TO ALIGN
WITH J1-22 CONTACT





Y.R.L. IS DETERMINED BY THE UPPER
EDGE OF E.I.A. GAUGE NO. 126

CATHODE RAY TUBE

8-INCH ROUND, GLASS	FACEPLATE: SPHERICAL, 40" R, CLEAR
ELECTROSTATIC FOCUS	LONG PERSISTENCE
ELECTROSTATIC DEFLECTION	POST ACCELERATION
TWO GUNS	ALUMINIZED

Description and Rating

The 8SP7 is an 8-inch dual beam cathode ray tube with electrostatic focus and deflection for sonar and oscillographic applications.

GENERAL

Data and Ratings Are Per Gun Unless Otherwise Specified

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes

Focusing Method - Electrostatic
Deflecting Method - Electrostatic

Direct Interelectrode Capacitances, Maximum

Cathode to All Other Electrodes	7	µµf
Grid No. 1 to All Other Electrodes	8	µµf
D1 to D2	6	µµf
D3 to D4	6	µµf
D1 to All Other Electrodes	11.5	µµf
D2 to All Other Electrodes	11.5	µµf
D3 to All Other Electrodes	11.5	µµf
D4 to All Other Electrodes	11.5	µµf

PICKUP TUBE OPERATION
POWER TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

from JEDEC release #4294, June 10, 1963

OPTICAL

Phosphor Number	P7
Fluorescent Color	Blue-White
Phosphorescent Color	Yellow
Persistence	Long

Faceplate - Clear

MECHANICAL

Over-all Length	19 ± 3/8	Inches
Greatest Bulb Diameter.	8-3/8 ± 1/16	Inches
Minimum Useful Screen Diameter	7-1/2	Inches

Post Accelerator Bulb Contact - Recessed Small Ball Cap - JEDEC No. J1-22
Base - 25 Pin, JEDEC NO. B25-139
Basing - Special
Bulb Contact Alignment
Post Accelerator Contact Aligns With Trace of D1-D2 ± 10 Degrees
Post Accelerator Contact on Same Side as Pin No. 4

Base Alignment
D1-D2 Trace Aligns with Pin No. 4 and Tube Axis ± 10 Degrees
Positive Voltage on D1 Deflects Beam Approximately Toward Pin No. 4
Positive Voltage on D3 Deflects Beam Approximately Toward Pin No. 15

Angle Between D3-D4 and D1-D2 Traces	90 ± 1	Degrees
Angle Between Corresponding Traces.	1.5	Max. Degrees

Mounting Position - Any

MAXIMUM RATINGS

DESIGN-CENTER VALUES *
(Per Gun Unless Otherwise Specified)

Post Accelerator Voltage	6,000	Max. Volts DC
Anode Voltage #	3,000	Max. Volts DC
Ratio Post Accelerator Voltage to Anode Voltage ...	2.0	Max.
Anode Input‡	6	Max. Watts

DESIGN-CENTER VALUES * (Continued)

Focusing-Electrode Voltage	1,500	Max. Volts DC
Grid No. 1 Voltage		
Negative-Bias Value	200	Max. Volts DC
Positive-Bias Value	0	Max. Volts DC
Positive-Peak Value	2	Max. Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	180	Max. Volts
Heater Positive with Respect to Cathode	180	Max. Volts
Peak Voltage Between Anode and Any Deflecting Electrode	700	Max. Volts

TYPICAL OPERATING CONDITIONS
(Per Gun Unless Otherwise Specified)

Post Accelerator Voltage	6,000	Volts DC
Anode Voltage	3,000	Volts DC
Focusing-Electrode Voltage	575 to 875	Volts DC
Grid No. 1 Voltage **	-60 to -95	Volts DC
Deflection Factors		
D1 and D2 Gun A	80 to 110	Volts DC Per Inch
D1 and D2 Gun B	118 to 150	Volts DC Per Inch
D3 and D4	62 to 98	Volts DC Per Inch
Focusing-Electrode Current	-15 to +10	Microamperes
Spot Position, Undeflected +	Within 15 mm	Square
Line Width A ++	.50	Max. Millimeters
Line Width B ++	.65	Max. Millimeters
Useful Scan ◇		

MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5	Max. Megohms
Resistance in Any Deflecting Electrode Circuit	5.0	Max. Megohms

NOTES

* The maximum ratings provide a ten percent safety factor in accordance with the standard design-center system of rating cathode ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

NOTES: (Continued)

\# Anode, Grid No. 2 and Grid No. 4 which are connected together within the tube are referred to herein as anode.

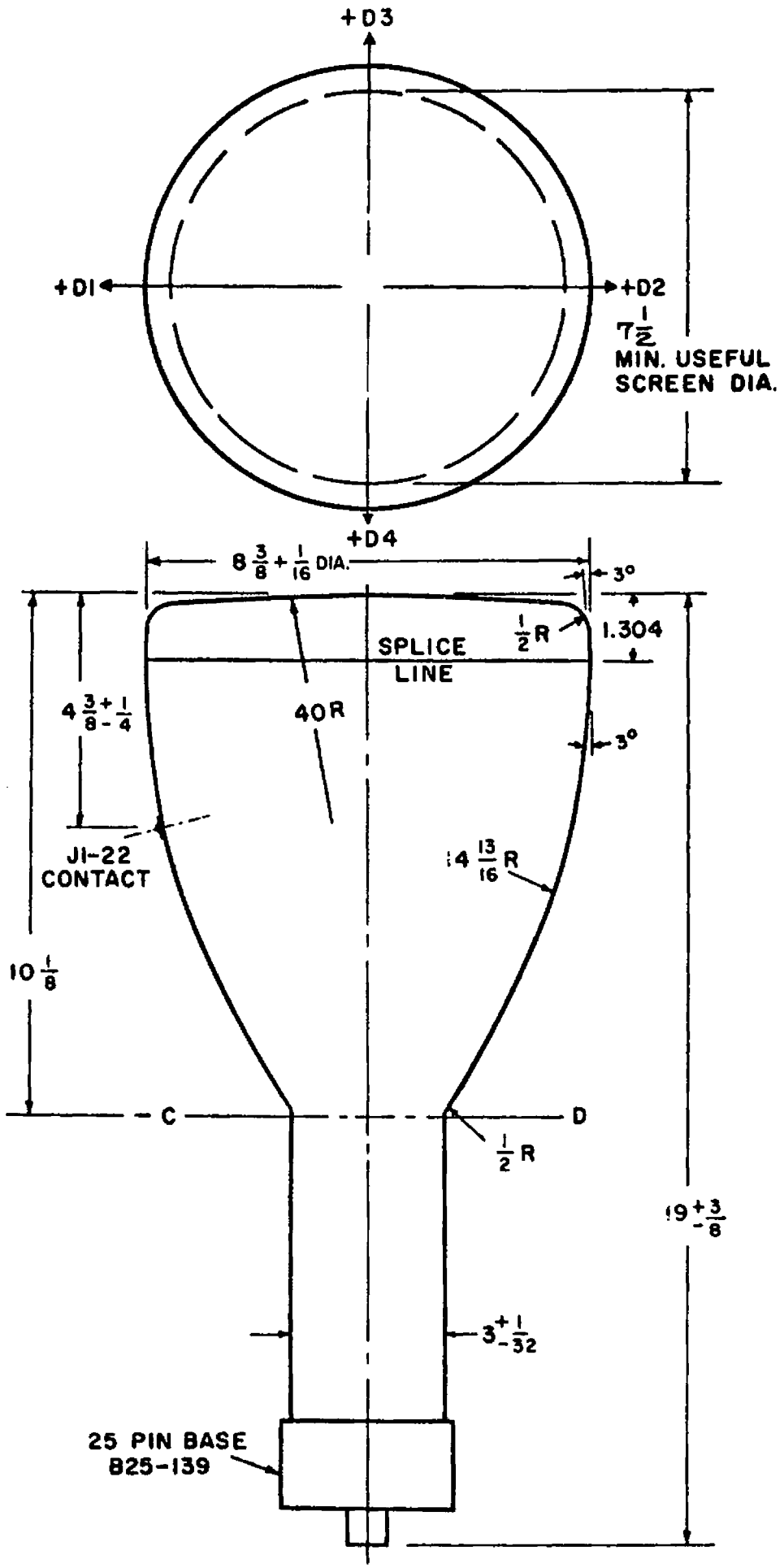
** For visual extinction of focused undeflected spot.

\+ The undeflected spot positions shall be within 15 mm squares whose centers are located as shown in Figure 1.

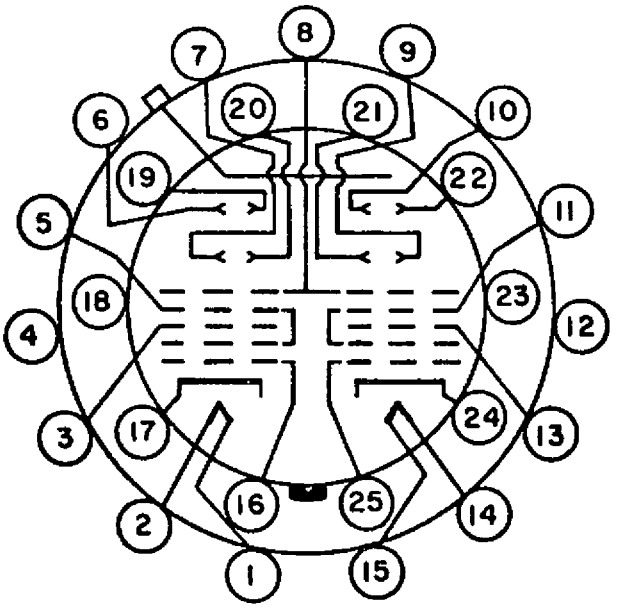
++ Measured in accordance with specification MIL-E-1 paragraph 4.12.6.1 at an anode No. 3 (post-accelerator anode) current of 25 microamperes dc. Line width "A" is measured at the useful scan center for each gun. Line width "B" is measured at ± 2-1/2 inches from the line width "A" point in the 3D4 direction.

‡ Anode input equals the product of anode voltage and average current measured at the terminal.

◇ Minimum useful scan areas for each gun are shown in Figure 2.


+D3
+D1
+D2
+D4
7 1/2
MIN. USEFUL
SCREEN DIA.
8 3/8 + 1/16 DIA.
3°
1/2 R
1.304
SPLICE
LINE
4 3/8 - 1/4
40R
3°
J1-22
CONTACT
14 13/16 R
10 1/8
C
D
1/2 R
19 +3/8
3 +1/32
25 PIN BASE
B25-139

8SP7



BASING DIAGRAM

UNIT A		UNIT B	
PIN NO.	ELEMENT	PIN NO.	ELEMENT
14	HEATER	1	HEATER
15	HEATER	2	HEATER
24	CATHODE	17	CATHODE
25	GRID NO. 1	16	GRID NO. 1
13	FOCUSING ELECTRODE	3	FOCUSING ELECTRODE
22	DEFLECTOR D3	19	DEFLECTOR D3
10	DEFLECTOR D4	6	DEFLECTOR D4
21	DEFLECTOR D1	7	DEFLECTOR D1
9	DEFLECTOR D2	20	DEFLECTOR D2
11	ANODE	5	ANODE
12	NO CONNECTION	4	NO CONNECTION
23	NO CONNECTION	18	NO CONNECTION
		8	SHIELD

CAP-POST ACCELERATOR

8SP7

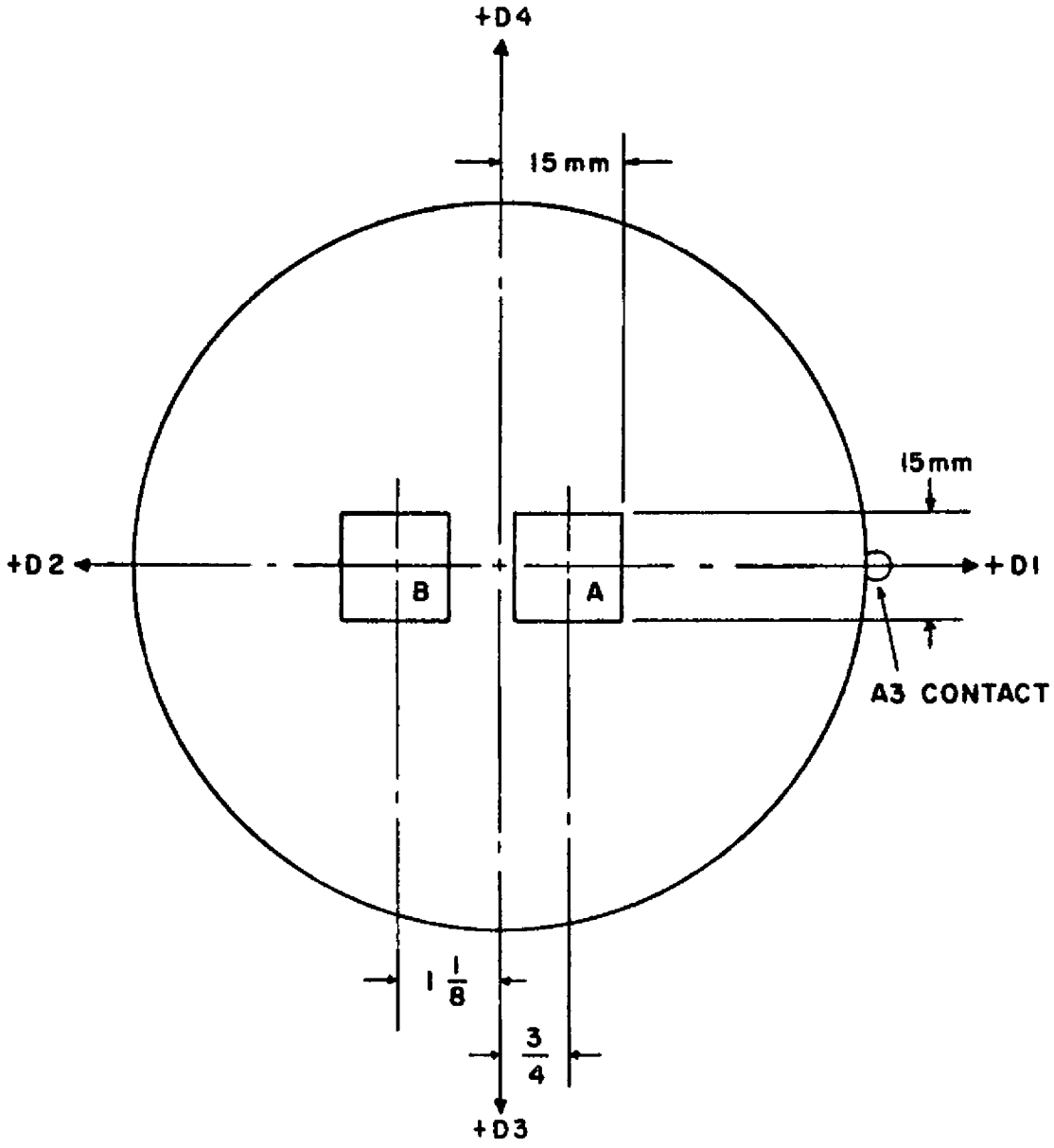


FIG. 1

8SP7

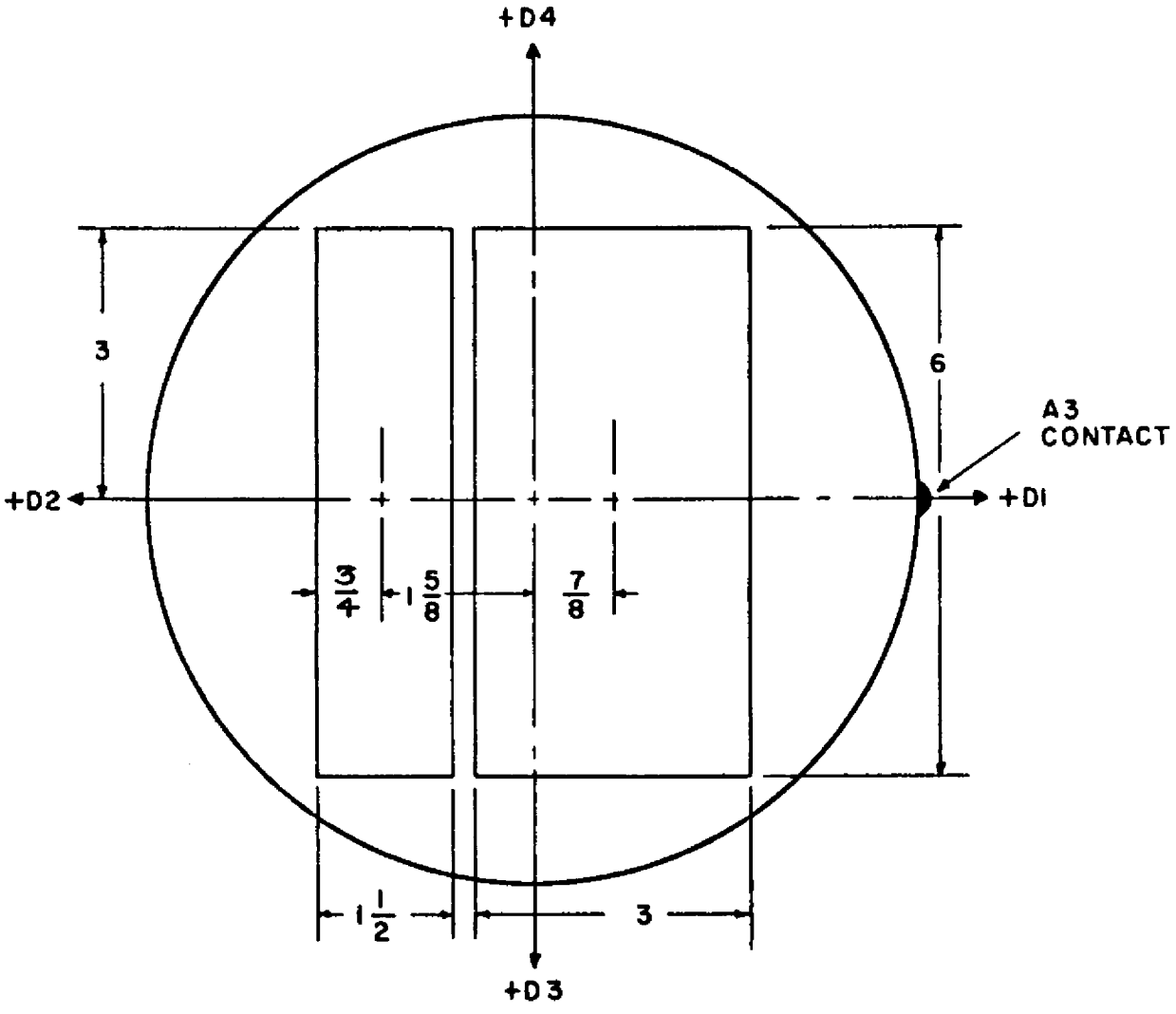


FIG. 2

Compactron Triode-Pentode

9AH9

The 9AH9 is a compactron containing a medium-mu triode and a sharp-cutoff, frame-grid pentode. The pentode is designed primarily for video amplifier service and the triode for color blanker or general purpose applications in color television receivers.

Except for heater characteristics and ratings, the 9AH9 is identical to the 6AH9.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	8.8	Volts
Heater Current●	0.6 ± 0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Compactron Triple Triode

9AK10

The 9AK10 is a compactron containing three high-mu triodes. It is designed primarily for service as a color-difference amplifier in color television receivers and is particularly suited for use with solid-state demodulators. Except for heater characteristics and ratings, the 9AK10 is identical to the 6AK10.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	9.5	Volts
Heater Current●	0.6 ± 0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

sponsor:
General Electric Co.

RMA Release No. 380

June 15, 1944

CATHODE-RAY TUBE

Type 9GP7

PHYSICAL CHARACTERISTICS

Focusing Method		Magnetic	
Deflecting Method		Magnetic	
Maximum Solid Deflecting Angle		55°	
Phosphor		P7	
Direct Electrode Capacitances			
	Min	Max	
Cathode to all other electrodes	6	11	uuf
Grid No. 1 to all other electrodes	3	10	uuf
Grid No. 2 to all other electrodes	3	12	uuf
Overall Length		17 ± 1	Inches
Greatest Diameter of Bulb		9 ± 1/8	Inches
Minimum Useable Screen Diameter		7 3/4	Inches
Base		Octal 8-Pin, Sleeve	
Basing RMA Designation - 5 AN			
Bulb Contact		Medium Metal Cap	
Spot Center ≠		20 mm Radius	

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

	Typical Operation		Maximum Ratings	
Heater Voltage §, a-c		6.3		Volts
Heater Current		0.6		Amp
High Voltage Electrode	4000	7000	7700	Volts
Grid No. 1 (Control Electrode) Voltage	-45*	-45 ± 50%*	Never Positive	
Grid No. 2 (Accelerating Electrode) Voltage	250	250	330	Volts
Grid No. 2 Current	100	100		ua
D-c Heater-Cathode Potential #			-125	Volts
Grid Circuit Resistance			1.5	Megohms

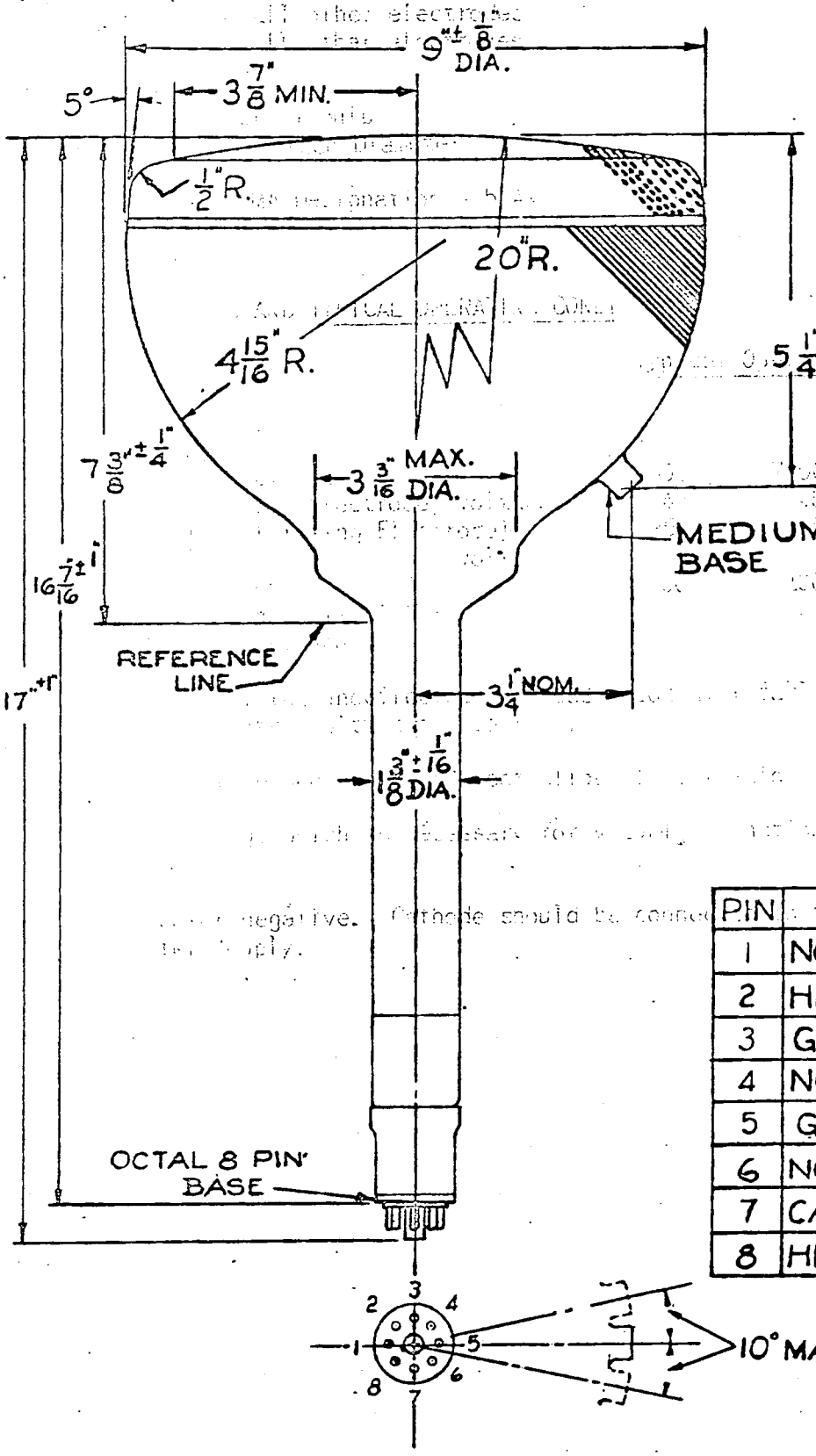
≠ The center of the undeflected unfocused spot will fall within a circle of given radius concentric with the tube face.

§ Heater voltage and heater current allowable variation ± 10%.

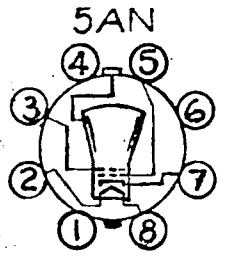
* Cutoff voltage which is necessary for visual extinction of a stationary focused spot.

\# With heater negative. Cathode should be connected to the midtap or to one side of heater supply.

Release No. 380
June 15, 1944



NOTE:
REFERENCE LINE IS DETERMINED BY A POINT WHERE GAUGE 1.430" ± .003" DIA. AND 2" LONG WILL STOP AGAINST BULB BODY.



BASING DIAGRAM

PIN	CONNECTION
1	NO CONNECTION
2	HEATER
3	GRID #2
4	NO CONNECTION
5	GRID #1
6	NO CONNECTION
7	CATHODE
8	HEATER

OUTLINE

9GP7 CATHODE-RAY TUBE

sponsor:
General Electric Co.

RMA Release No. 380
June 15, 1944

CATHODE-RAY TUBE

Type 9LP7

PHYSICAL CHARACTERISTICS

	Min	Max	
Focusing Method		Magnetic	
Deflecting Method		Magnetic	
Maximum Solid Deflecting Angle		55 Degrees	
Phosphor		P7	
Direct Interelectrode Capacitance			
Cathode to all other electrodes	2.5	8.5	uuf
Grid No. 1 to all other electrodes	8	15	uuf
Grid No. 2 to all other electrodes	6	13	uuf
Over-all Length		14 31/32 ± 11/32	Inches
Greatest Diameter of Bulb		9 + 1/8	Inches
Minimum Useable Screen Diameter		8 1/2	Inches
Base		Wafer Octal 8-Pin, Sleeve	
Basing RMA Designation - 5AN			
Bulb Contact		Medium Metal Cap	
Spot Center*		18 mm Radius	

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

	Typical Operation				Maximum Ratings	
Heater Voltage ⁄ a-c				6.3		Volts
Heater Current				0.6		Amperes
High Voltage Electrode	4000	4000	7000	7000	7700	Volts
Grid No. 1 (Control Electrode) Voltage	-80±25% §	-40±25% §	-80±25% §	-40±25% §	Never Positive	
Grid No. 2 (Accelerating Electrode) Voltage	250	125	250	125	330	Volts
Grid No. 2 Current	500	500	500	500		ua
Grid Circuit Resistance					1.5	Megohms
D-c Heater-cathode Potential #					-125	Volts

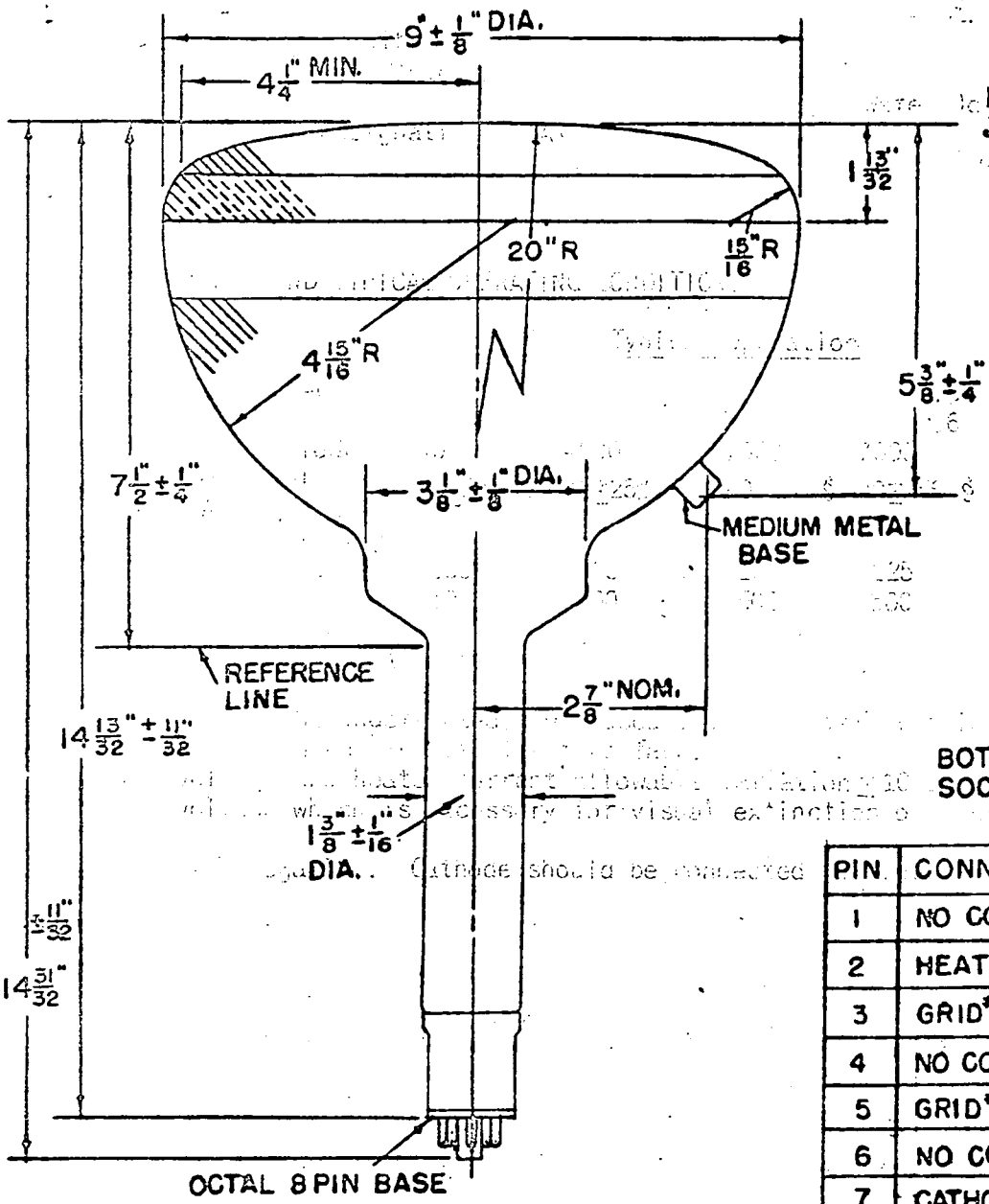
* The center of the undeflected, unfocused spot will fall within a circle of the given radius concentric with the tube face.

⁄ Heater voltage and heater current allowable variation ±10%.

§ Cutoff voltage which is necessary for visual extinction of a stationary focused spot.

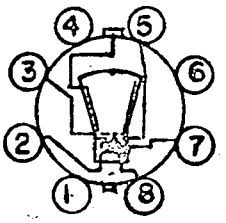
\# With heater negative. Cathode should be connected to midtap or one side of heater supply.

Release No. 380
June 15, 1944



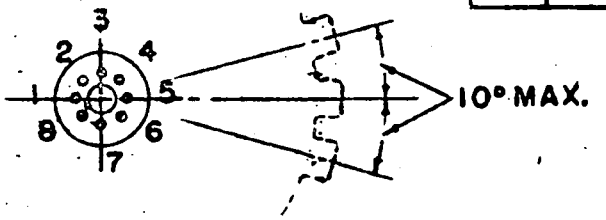
NOTE: REFERENCE LINE IS DETERMINED BY A POINT WHERE A GAUGE 1.430" ±.005" DIA. AND 2" LONG WILL STOP AGAINST BULB BODY

5AN



BOTTOM VIEW OF SOCKET CONNECTION

PIN	CONNECTIONS
1	NO CONNECTION
2	HEATER
3	GRID #2
4	NO CONNECTION
5	GRID #1
6	NO CONNECTION
7	CATHODE
8	HEATER



OUTLINE

9LP7 CATHODE-RAY TUBE

9MN8

Compactron Triple Triode

The 9MN8 is a compactron triple triode intended for use as a chroma matrixing amplifier in color television receivers. Combining three triodes in one envelope allows one tube to drive all three picture tube guns.

Except for heater characteristics and ratings, the 9MN8 is identical to the 6MN8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	9.5	Volts
Heater Current●	0.6 ± 0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

9QP4

CATHODE-RAY TUBE

9-INCH RECTANGULAR, GLASS
FOCUS—ELECTROSTATIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
$7\frac{11}{16}$ BY $6\frac{1}{8}$ INCH PICTURE SIZE
FACEPLATE—SPHERICAL, CLEAR
ION-TRAP GUN
PERSISTENCE—SHORT

DESCRIPTION AND RATING

The 9QP4 is a television picture tube especially designed to feature small size, light weight, and a low-current heater for series-string operation.

The reduction in size and weight over other tubes with comparable characteristics makes it particularly suitable for use in small, light weight, portable television receivers.

Since the tube is designed primarily for series-string operation, its use will permit the circuit simplification and power reduction possible in such service.

GENERAL

ELECTRICAL

Heater Voltage	4.7 ± 10%	Volts
Heater Current	0.3	Amperes
Heater Warm-up time	11	Seconds

Focusing Method—Electrostatic
Deflecting Method—Magnetic
Deflection Angle, approximate

Diagonal	70	Degrees
Horizontal	61	Degrees
Vertical	49	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	6	μμf
Grid-No. 1 to All Other Electrodes	4	μμf

OPTICAL

Phosphor Number—P4
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Clear

MECHANICAL

Over-all Length	$12\frac{3}{4} \pm \frac{5}{16}$ Inches
Greatest Bulb Dimensions	
Diagonal	$8\frac{5}{8} + \frac{1}{8} - \frac{1}{16}$ Inches
Width	$8\frac{7}{32} + \frac{1}{8} - \frac{1}{16}$ Inches
Height	$6\frac{11}{16} + \frac{1}{8} - \frac{1}{16}$ Inches
Minimum Useful Screen Dimensions	
Diagonal	$8\frac{1}{4}$ Inches
Width	$7\frac{11}{16}$ Inches
Height	$6\frac{1}{8}$ Inches
Neck Length	$6\frac{1}{2}$ Inches

Base—Small-shell Duodecal 7-Pin, JETEC No. B7-179
Basing, JETEC Designation—12AD

Mounting Position—Any

Net Weight, approximate	2 Pounds

MAXIMUM RATINGS*

CATHODE-DRIVE SERVICE

DESIGN-CENTER VALUES†

Anode Voltage‡	6800 Max Volts DC
Focusing-Electrode Voltage for Focus	−100 to +500 Max Volts DC
Grid-No. 2 Voltage	300 Max Volts DC
Cathode to Grid-No. 1 Voltage§	
Negative-Bias Value	0 Max Volts DC
Positive-Bias Value	100 Max Volts DC
Negative-Peak Value	2 Max Volts
Positive-Peak Value	130 Max Volts
Peak Heater-Cathode Voltage	
Heater Negative with Respect to Cathode	
During Warm-up Period not to Exceed 15 Seconds	200 Max Volts
After Equipment Warm-up Period	150 Max Volts
Heater Positive with Respect to Cathode	150 Max Volts

TYPICAL OPERATING CONDITIONS*

CATHODE-DRIVE SERVICE

Anode Voltageπ	5500 Volts DC
Focusing-Electrode Voltage for Focus	0 to 400 Volts DC
Focusing-Electrode Current	−15 to +25 Microamperes DC
Grid-No. 2 Voltage	200 Volts DC
Cathode to Grid-No. 1 Voltage ◆	+28 to +52 Volts DC
Ion-Trap Field Intensity △, approximate	22 Gausses

Grid- No. 1 Circuit Resistance.....1.5 Max Megohms

* Voltages are positive with respect to Grid-No. 1 unless otherwise specified.

† The maximum ratings provide a ten percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

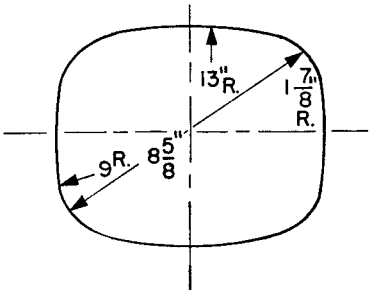
‡ Anode, Grid-No. 3, and Grid-No. 5 which are connected together within the tube are referred to herein as anode.

§ Grid-No. 1 must not be positive with respect to cathode at any time during warm-up or subsequent operation.

π Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 3500 volts.

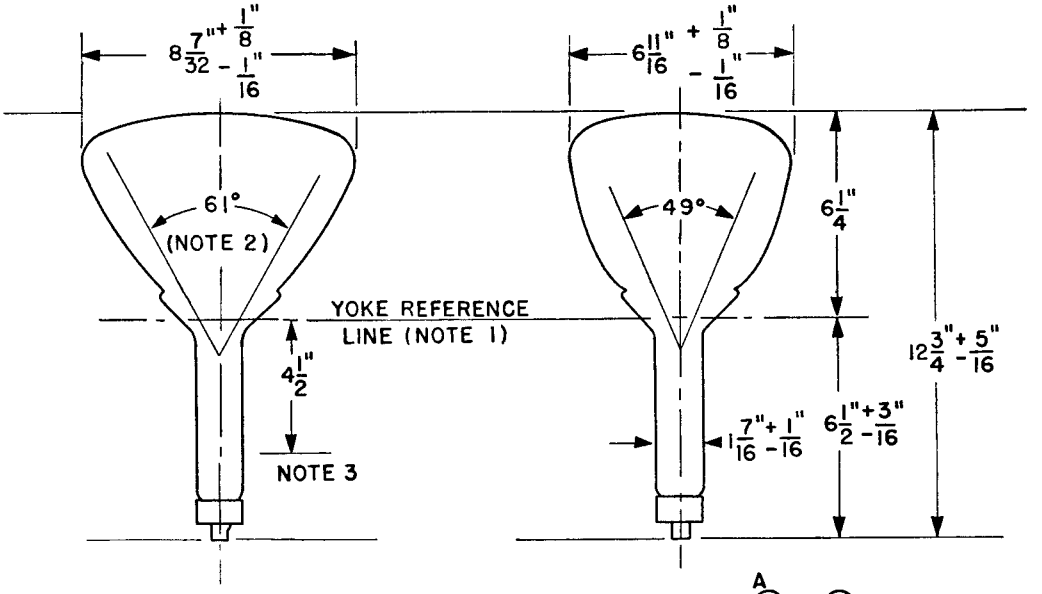
♦ For visual extinction of focused raster.

△Single-field ion-trap magnet adjusted to optimum position, equivalent to 22 milliamperes through RETMA ion-trap magnet No. 117.



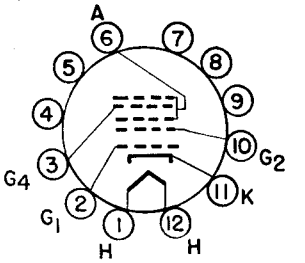
SCREEN DIMENSIONS

DIAGONAL	8-1/4"
WIDTH	7-11/16"
HEIGHT	6-1/8"
AREA	43 SQ. IN



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. APPROXIMATE POSITION OF ION-TRAP MAGNET



BASING DIAGRAM
12AD

9QP4-A
CATHODE RAY TUBE

9 INCH RECTANGULAR, GLASS	7-11/16 BY 6-1/8 INCH PICTURE SIZE
FOCUS - ELECTROSTATIC	FACEPLATE - SPHERICAL, GRAY
DEFLECTION - MAGNETIC	ION-TRAP GUN
70 DEGREE DEFLECTION ANGLE	PERSISTENCE - SHORT

DESCRIPTION AND RATING

The 9QP4-A is a television picture tube designed to feature small size, lightweight, and a low current heater for series-string operation.

The reduction in size and weight over other tubes with comparable characteristics makes it particularly suitable for use in small, lightweight portable television receivers.

Since the tube is designed primarily for series-string operation, its use will permit the circuit simplification and power reduction possible in such service.

GENERAL

ELECTRICAL

Heater Voltage	4.7 ± 10 %	Volts
Heater Current	0.3	Amperes
Heater Warm-up Time	11	Seconds

Focusing Method - Electrostatic
Deflecting Method - Magnetic
Deflection Angle, approximate

Diagonal	70	Degrees
Horizontal	61	Degrees
Vertical	49	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	6	uuf
Grid-No. 1 to All Other Electrodes	4	uuf

OPTICAL

Phosphor Number - P4
Fluorescent Color - White
Phosphorescent Color - White
Persistence - Short

from JETEC release #2164, Sept. 29, 1958

Faceplate - Gray		
Light Transmission At Center, approximate	83	Percent

MECHANICAL

Over-all Length	12-3/4 ± 5/16	Inches
Greatest Bulb Dimensions		
Diagonal	8-5/8 + 1/8 - 1/16	Inches
Width	8-7/32 + 1/8 - 1/16	Inches
Height	6-11/16 +1/8 - 1/16	Inches
Minimum Useful Screen Dimensions		
Diagonal	8-1/4	Inches
Width	7-11/16	Inches
Height	6-1/8	Inches
Neck Length	6-1/2	Inches

Base - Small-shell Duodecal 7 Pin, JETEC No. B7-179
Basing, JETEC Designation - 12AD

Mounting Position - Any		
Net Weight, approximate	3-1/2	Pounds

MAXIMUM RATINGS *
Cathode-Drive-Service

DESIGN-CENTER VALUES †

Anode Voltage ‡	6800	Max Volts DC
Focusing-Electrode Voltage for Focus	- 100 to + 500	Max Volts DC
Grid-No.2 Voltage	300	Max Volts DC
Cathode to Grid No. 1 Voltage §		
Negative-Bias Value	0	Max Volts DC
Positive-Bias Value	100	Max Volts DC
Negative-Peak Value	2	Max Volts
Positive-Peak Value	130	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to exceed 15 seconds	200	Max Volts
After Equipment Warm-up Period	150	Max Volts
Heater Positive with Respect to Cathode	150	Max Volts

TYPICAL OPERATING CONDITIONS *
Cathode-Drive-Service

Anode Voltage //	5500	Volts DC
Focusing-Electrode Voltage for Focus	0 to 400	Volts DC
Focusing-Electrode Current	- 15 to + 25	Microamperes DC

Grid-No. 2 Voltage	200	Volts DC
Cathode to Grid-No. 1 Voltage ◆	+ 28 to + 52	Volts DC
Ion-Trap Field Intensitity △, approximate	22	Gausses
Grid-No. 1 Circuit Resistance	1.5	Max Megohms

* Voltages are positive with respect to Grid-No. 1 unless otherwise specified.

† The maximum ratings provide a ten percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

‡ Anode, Grid-No.3 and Grid-No. 5 which are connected together within the tube are referred to herein as Anode.

§ Grid-No. 1 must not be positive with respect to cathode at any time during warm-up or subsequent operation.

// Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less that 3500 volts.

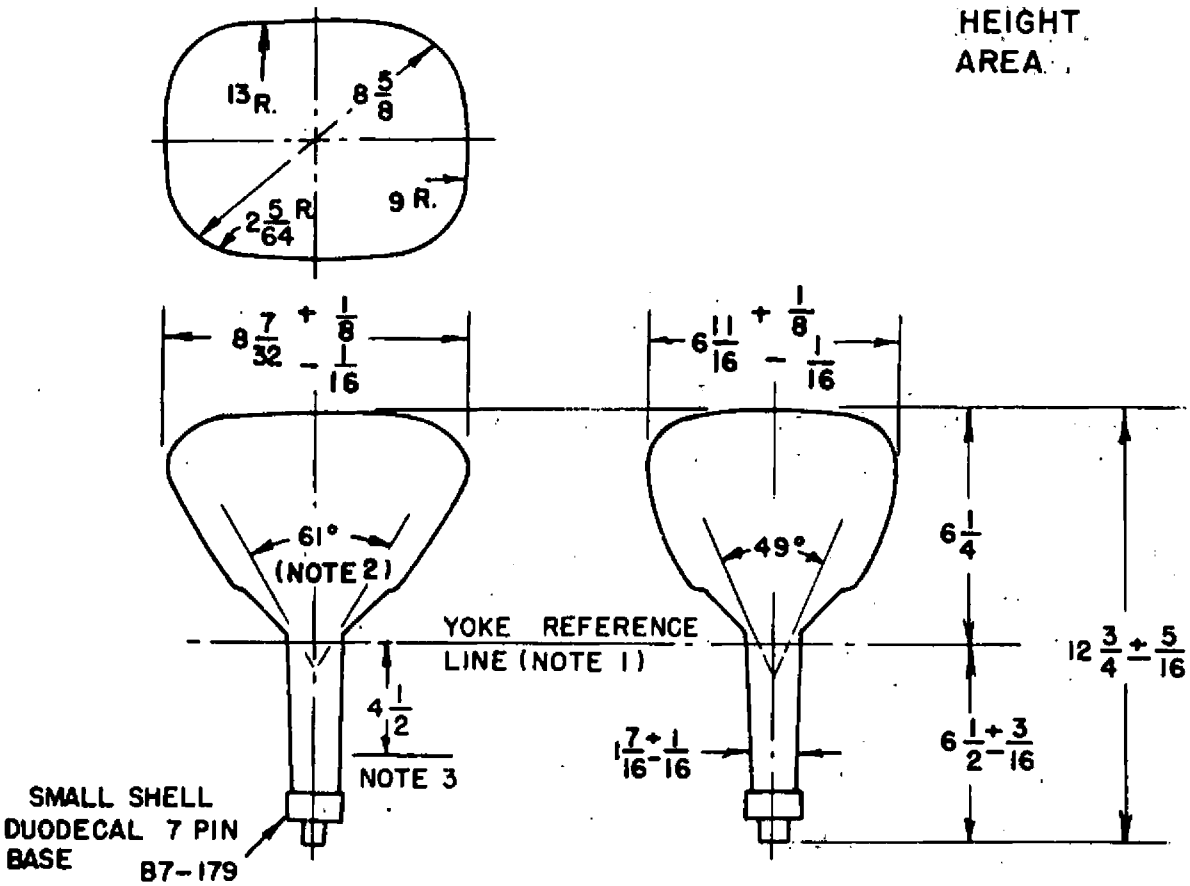
◆ For visual extinction of focused raster.

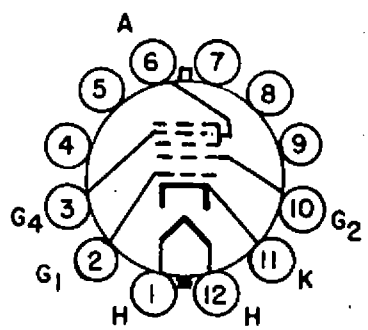
△ Single-field ion-trap magnet adjusted to optimum position, equivalent to 22 milliamperes through EIA ion-trap magnet No. 117.

GENERAL ELECTRIC COMPANY
ELECTRONICS COMPONENTS DIVISION
CATHODE RAY TUBE DEPARTMENT
SYRACUSE, N.Y.

SCREEN DIMENSIONS

DIAGONAL	8-1/4"
WIDTH	7-11/16"
HEIGHT	6-1/8"
AREA	43 SQ. IN.





BASING DIAGRAM
12AD

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE-LINE GAGE (EIA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. APPROXIMATE POSITION OF ION-TRAP MAGNET.

Electronic TUBES

10BP4-A

CATHODE-RAY TUBE

9⅛- BY 6¾-INCH PICTURE SIZE

10-INCH ROUND, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
50-DEGREE DEFLECTION ANGLE
FACEPLATE—SPHERICAL, GRAY
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 10BP4-A is a magnetic-focus and deflection, direct-view picture tube for television applications. It provides a 9⅛- by 6¾-inch picture. Features of this tube are an electron gun designed to be used with an external ion-trap magnet for the prevention of ion-spot blemish, and a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	2500	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	74	Percent

Supersedes ETR-129 dated 8-51

MECHANICAL

Over-all Length	$17\frac{5}{8} \pm \frac{3}{8}$	Inches
Greatest Bulb Diameter	$10\frac{1}{2} \pm \frac{1}{16}$	Inches
Minimum Useful Screen Diameter	$9\frac{1}{8}$	Inches
Neck Length	$8\frac{3}{16}$	Inches

Bulb Number, ASA Designation—J84C
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 3 Position ±30 Degrees

Mounting Position—Any
Net Weight, approximate . . . . . 10½ Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	12,000 Max	Volts DC
Grid-No. 2 Voltage	410 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	140 Max	Volts
Heater Positive with Respect to Cathode	140 Max	Volts

TYPICAL OPERATING CONDITIONS

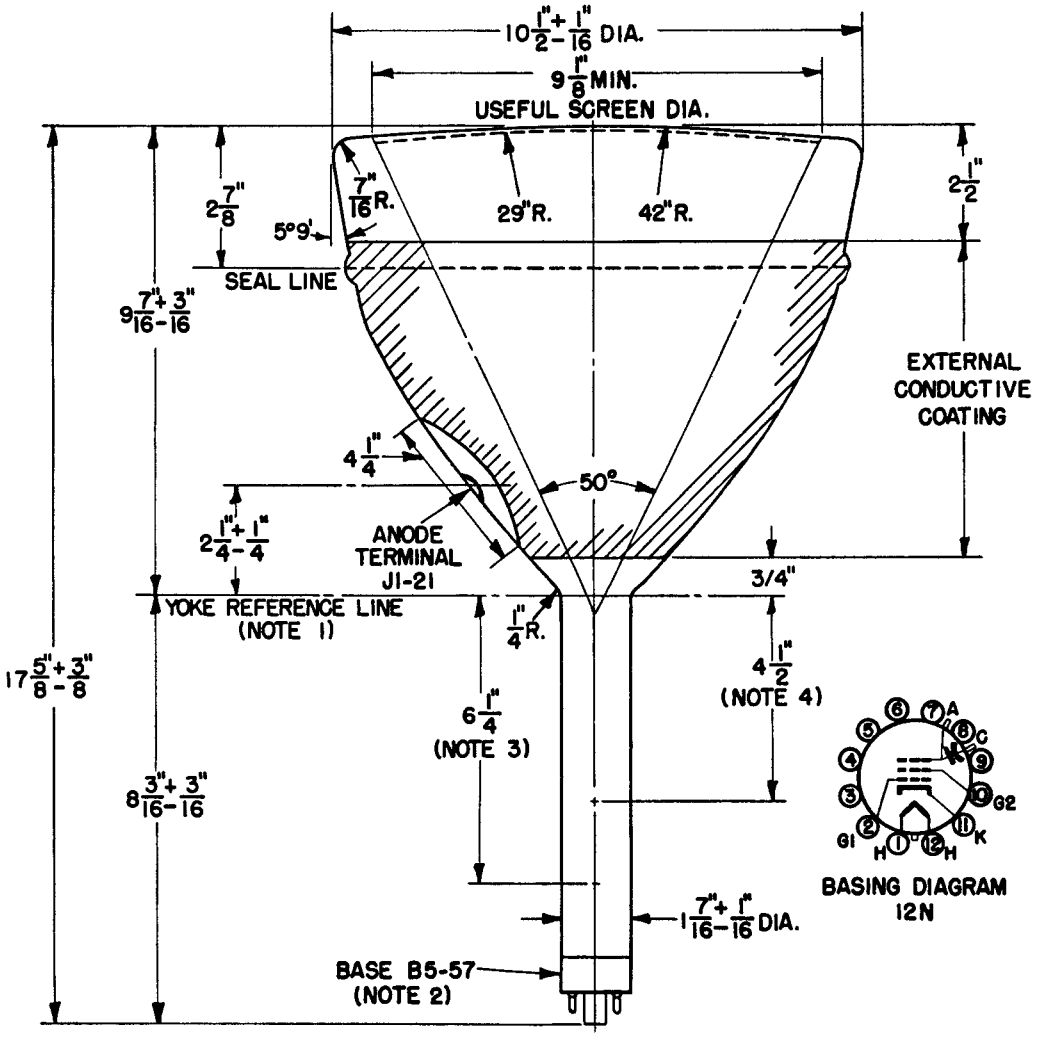
Anode Voltage§	11,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	100	Milliamperes DC
Ion-Trap Field Intensity♦, approximate	33	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.
† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.
‡ Cathode should be returned to one side or to the midtap of the heater transformer winding.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 8000 volts.
π For visual extinction of focused raster.
▲ For JETEC focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 4½ inches.
♦ Double-field ion-trap magnet adjusted to optimum position.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 112) WHEN THE GAGE IS RESTING ON THE CONE.
2. ANODE TERMINAL ALIGNS WITH PIN-NO. 3 POSITION ±30 DEGREES.
3. APPROXIMATE POSITION OF ION-TRAP MAGNET.
4. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.

N20075AZ

8-2-54

Electronic TUBES

10C8

TRIODE-PENTODE

DESCRIPTION AND RATING

The 10C8 is a miniature triode-pentode designed for use in compact, 300-milliampere, series-string television receivers. The pentode section may be used as a general-purpose amplifier or as a triode-connected vertical-deflection amplifier. The high-mu triode section is suitable for use as a vertical oscillator, AF voltage amplifier, or as a sync separator, clipper, or amplifier.

The 10C8 has a controlled heater warm-up characteristic as required for use in television receivers that employ series-connected heaters. Other features of the tube include relatively small size, low power requirements, and high performance capabilities at the low d-c supply voltages normally available in these applications.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	10.5	Volts
Heater Current	0.3 ± 6%	Amperes
Heater Warm-up Time*	11	Seconds
Direct Interlectrode Capacitances†		
Pentode Section		
Grid-Number 1 to Plate, maximum	0.04	μμf
Input	7.0	μμf
Output	2.2	μμf
Triode Section		
Grid to Plate	1.6	μμf
Input	2.4	μμf
Output	0.20	μμf
Pentode Grid-Number 1 to Triode Plate, maximum	0.008	μμf
Triode Grid to Pentode Plate, maximum	0.006	μμf
Pentode Plate to Triode Plate, maximum	0.06	μμf

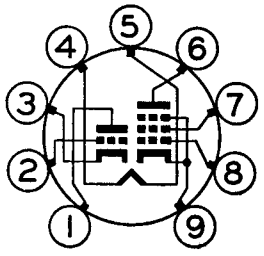
MECHANICAL

Mounting Position—Any

Envelope—T-6½, Glass

Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

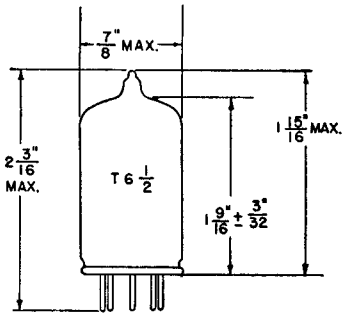


RETMA 9DA

TERMINAL CONNECTIONS

Pin 1—Triode Plate
Pin 2—Triode Grid
Pin 3—Triode Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Plate
Pin 7—Pentode Grid Number 2 (Screen)
Pin 8—Pentode Grid Number 1
Pin 9—Pentode Cathode, Grid Number 3, and Internal Shield

PHYSICAL DIMENSIONS



RETMA 6-2

GENERAL ELECTRIC

MAXIMUM RATINGS

	Pentode Section	Triode Section
CLASS A_1 AMPLIFIER SERVICE—DESIGN-MAXIMUM VALUES		
Plate Voltage	300	300 Volts
Screen-Supply Voltage	300	.... Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	0 Volts
Plate Dissipation	2.2	2.0 Watts
Screen Dissipation	0.55	.... Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	100 Volts
Total DC and Peak	200	200 Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	200 Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	0.5 Megohms
With Cathode Bias	1.0	1.0 Megohms

VERTICAL OSCILLATOR AND AMPLIFIER SERVICE DESIGN-MAXIMUM VALUES	Vertical-deflection Amplifier‡ (Pentode Section-triode Connection§)	Vertical Oscillator Service‡ (Triode Section)
DC Plate Voltage	300	300 Volts
Peak Positive Pulse Plate Voltage	1000	.... Volts
Peak Negative Grid Voltage	250	400 Volts
Plate Dissipation	2.5♦	1.0 Watts
DC Cathode Current	18	12 Milliamperes
Peak Cathode Current	55	35 Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	100 Volts
Total DC and Peak	200	200 Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	200 Volts
Grid Circuit Resistance		
With Fixed Bias	...	2.2 Megohms
With Cathode Bias	2.2	2.2 Megohms
With Grid-Leak Bias	2.2	2.2 Megohms

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Pentode Section (Triode-Connection§)	Pentode Section	Triode Section	
Plate Voltage	135	135	250	Volts
Screen Voltage	...	135	...	Volts
Grid-Number 1 Voltage	0¶	...	...	Volts
Cathode-Bias Resistor	...	100	390	Ohms
Amplification Factor	...	...	53	
Plate Resistance, approximate	...	190000	12000	Ohms
Transconductance	...	8000	4400	Micromhos
Plate Current	33	11.5	7.3	Milliamperes
Screen Current	...	3.2	...	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 10 Microamperes	...	...	−10	Volts
Ib = 50 Microamperes	...	−6	...	Volts
Triode Amplification Factor§	...	40	...	

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

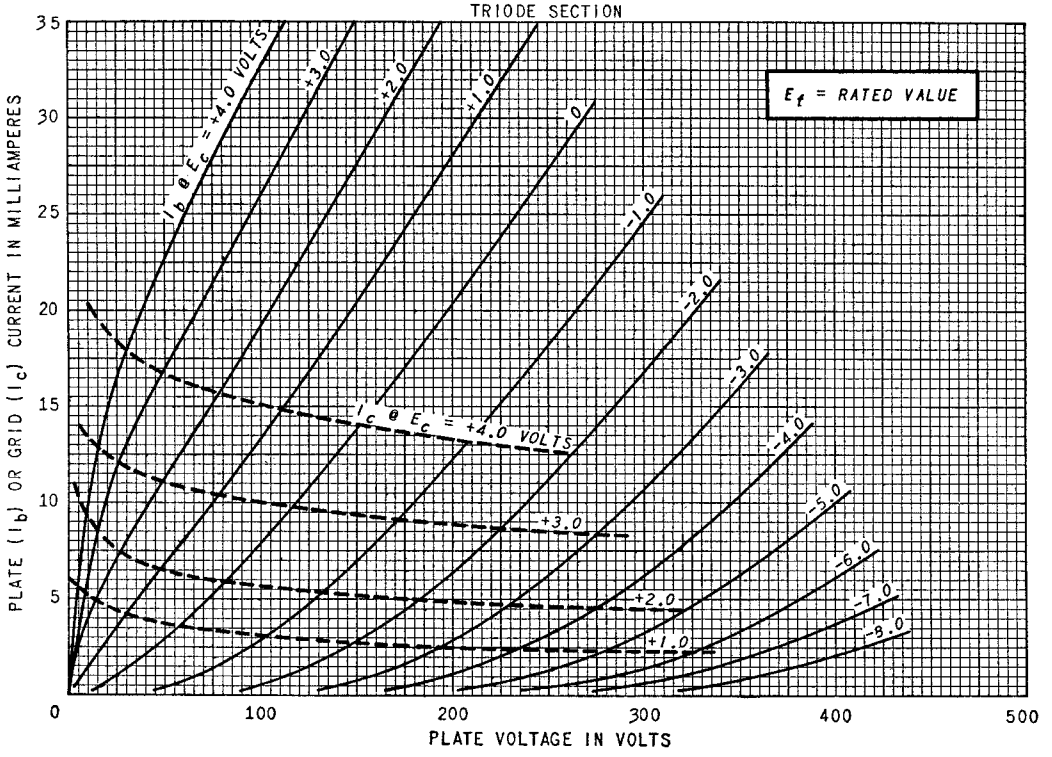
‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ With screen connected to plate.

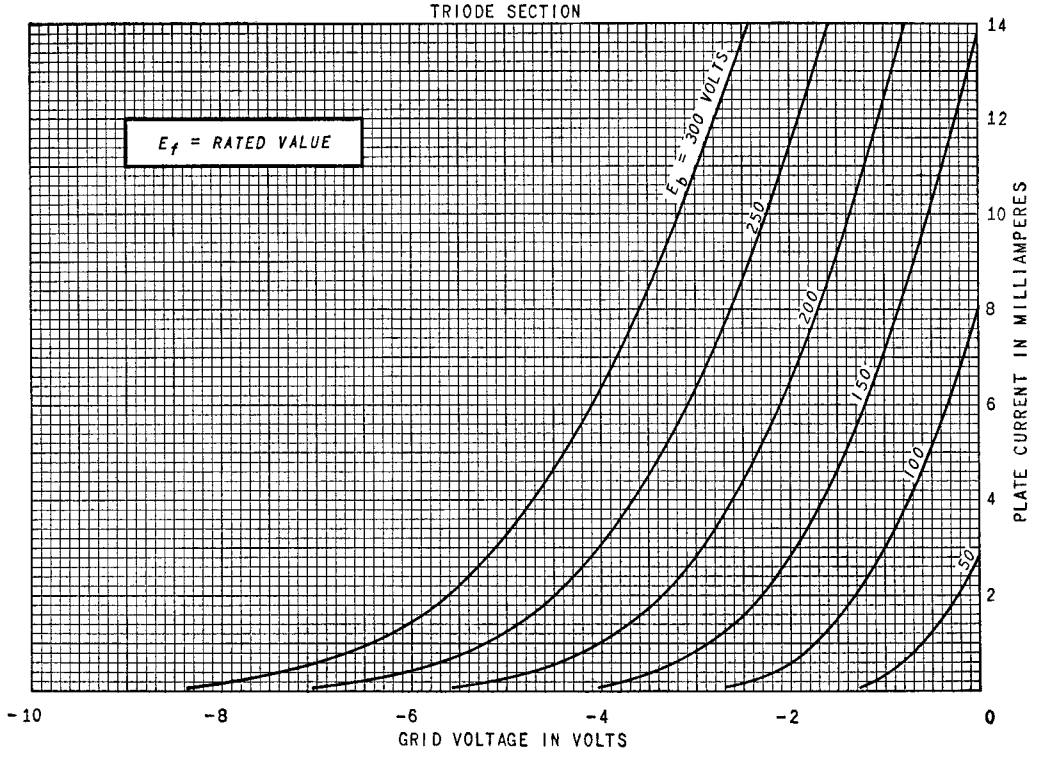
♦ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

¶ Applied for short interval (two seconds maximum) so as not to damage tube.

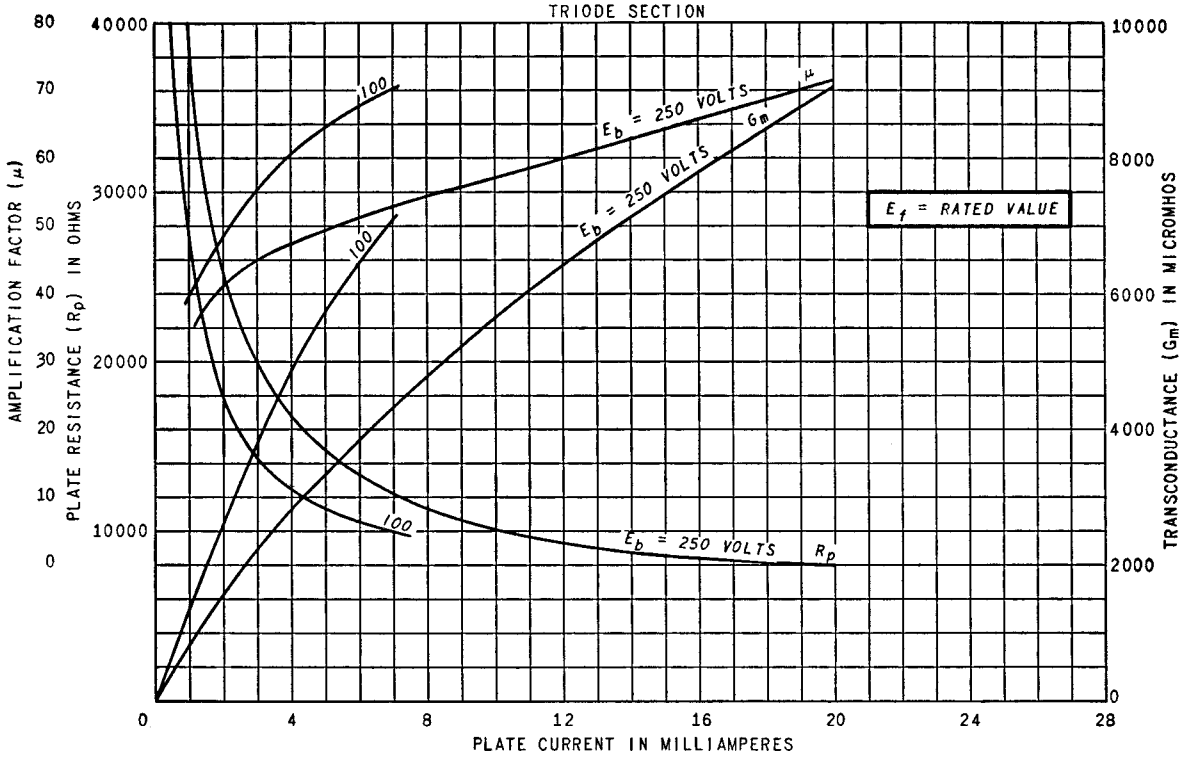
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

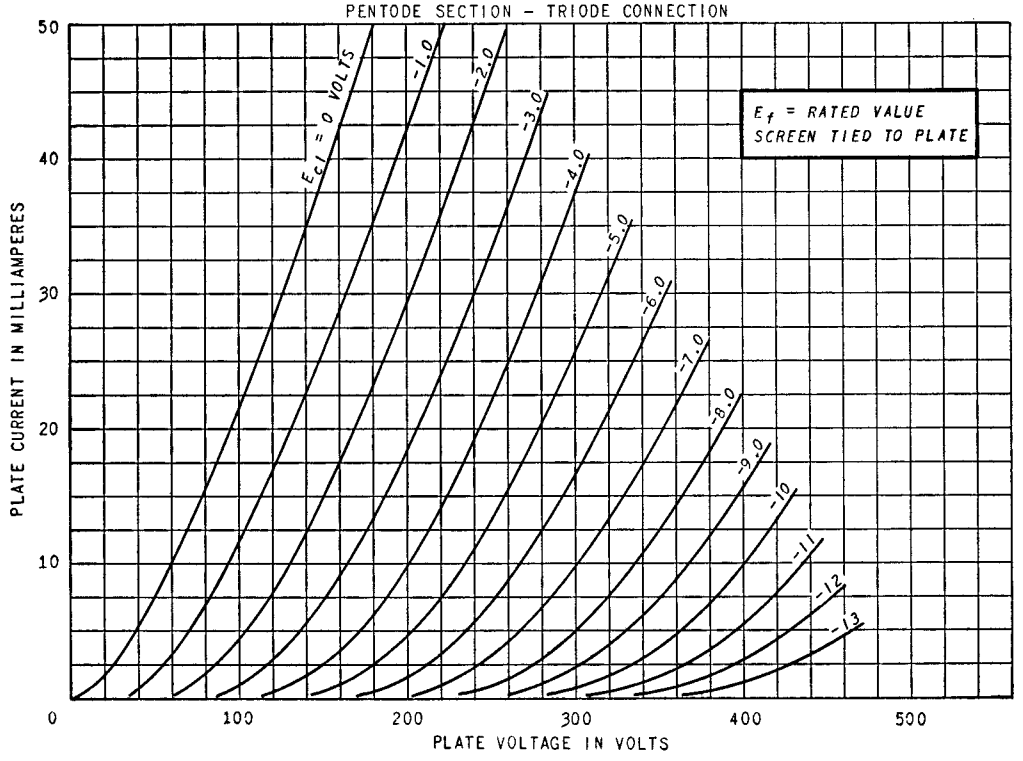


AVERAGE CHARACTERISTICS



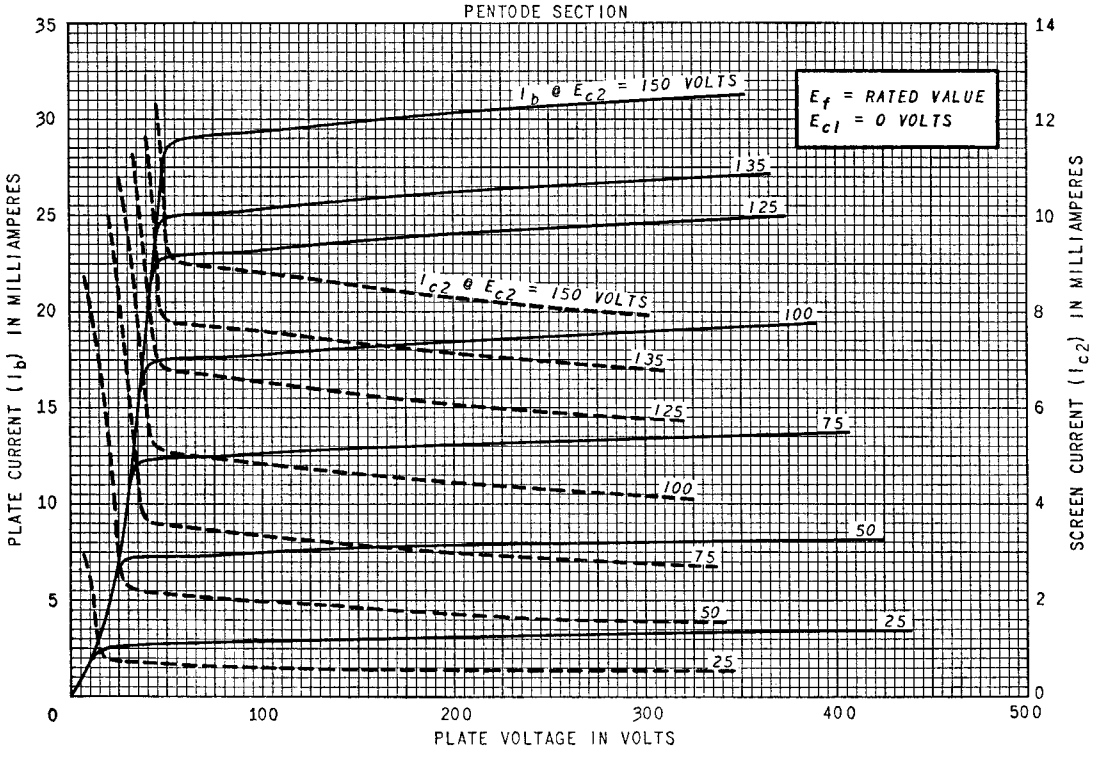
AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION – TRIODE CONNECTION

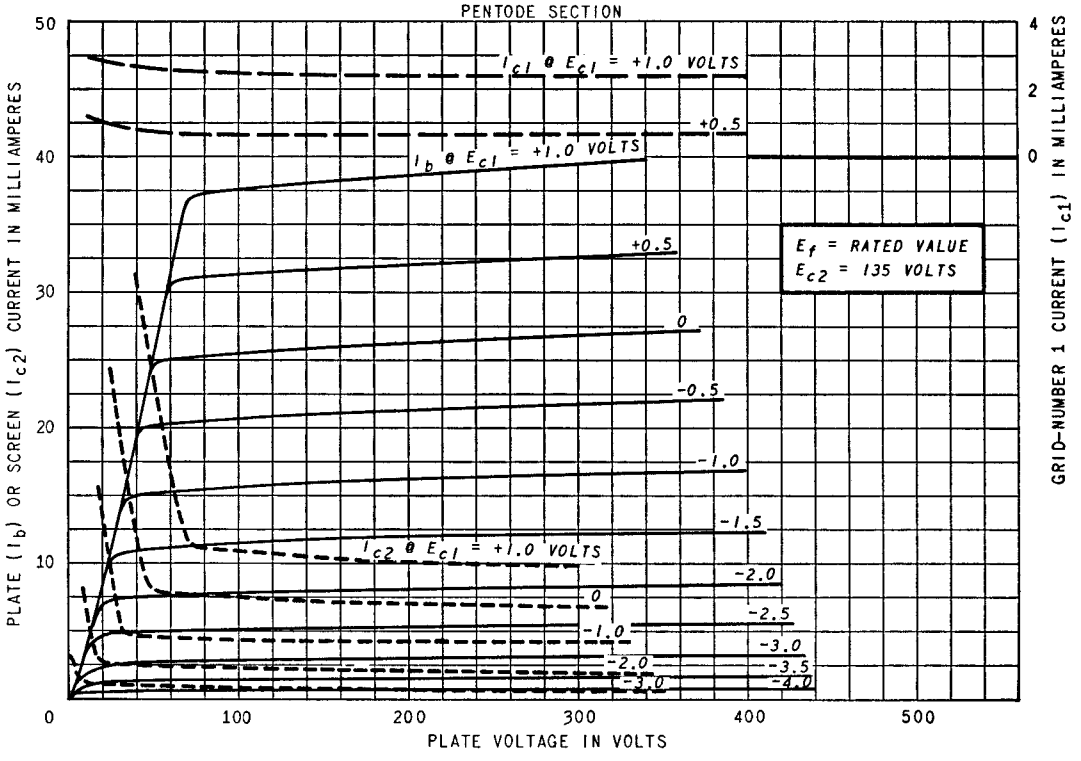


AVERAGE PLATE CHARACTERISTICS

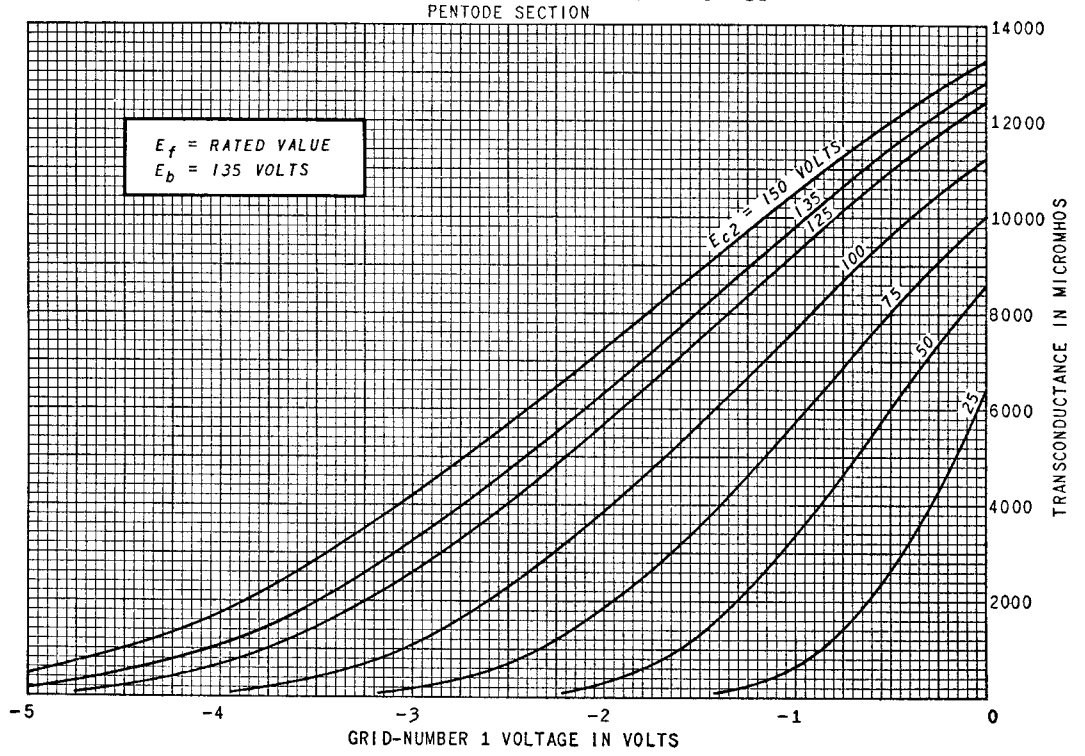
PENTODE SECTION



AVERAGE PLATE CHARACTERISTICS

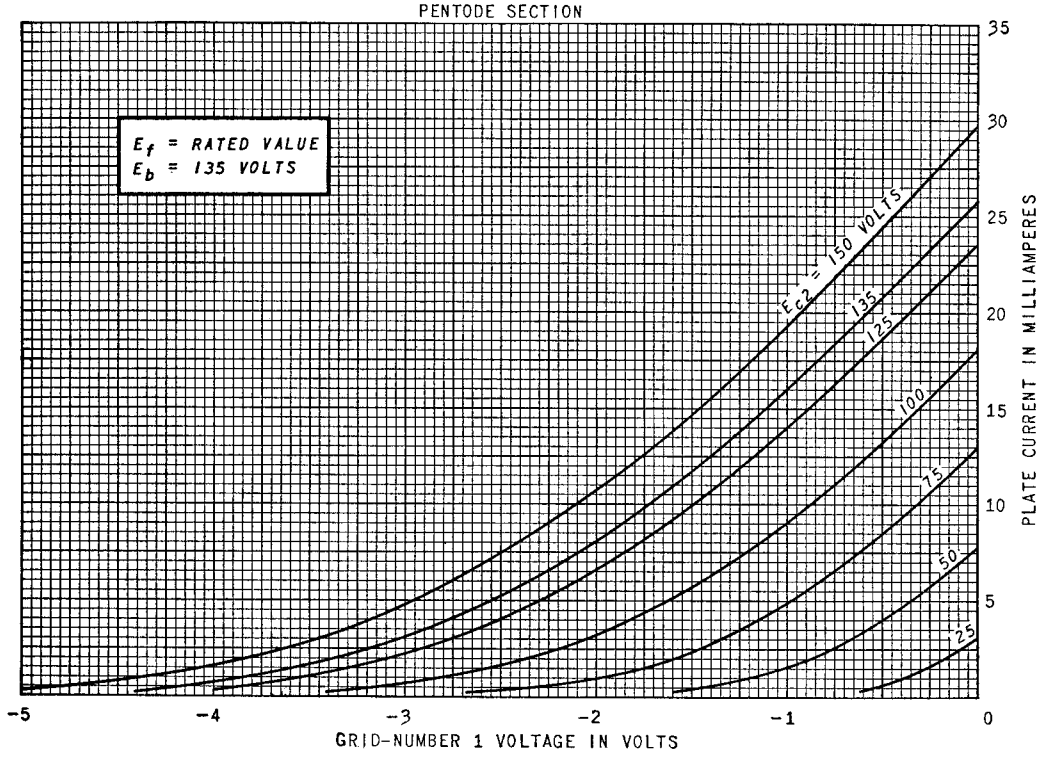


AVERAGE TRANSFER CHARACTERISTICS



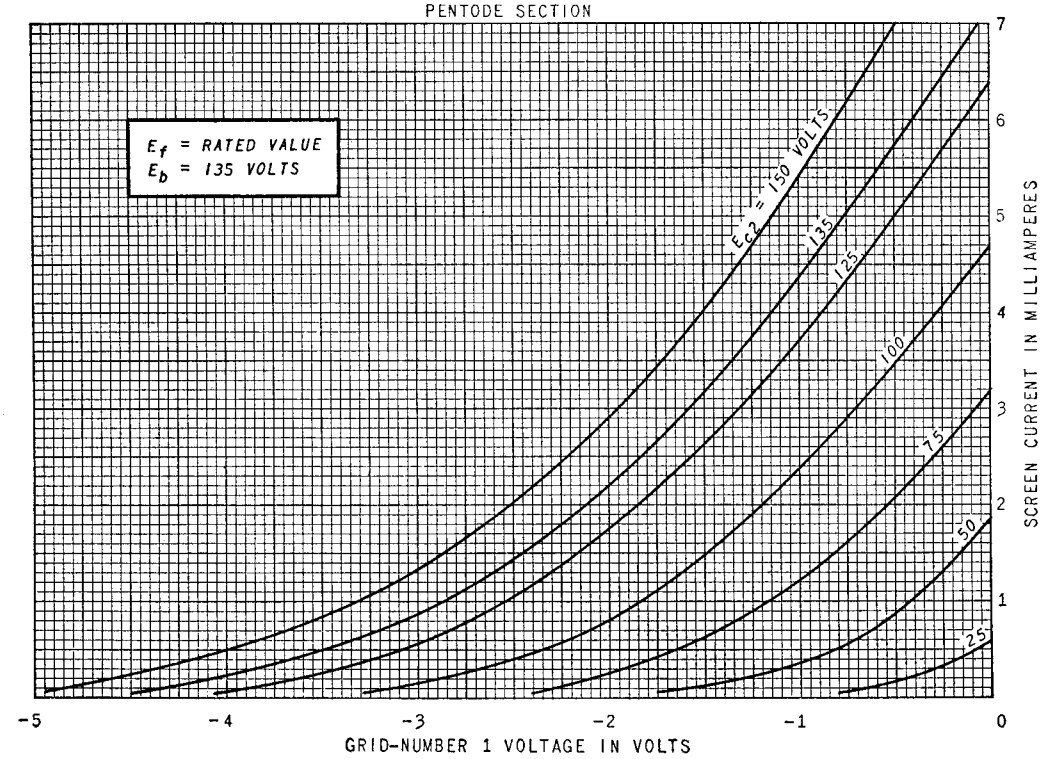
AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

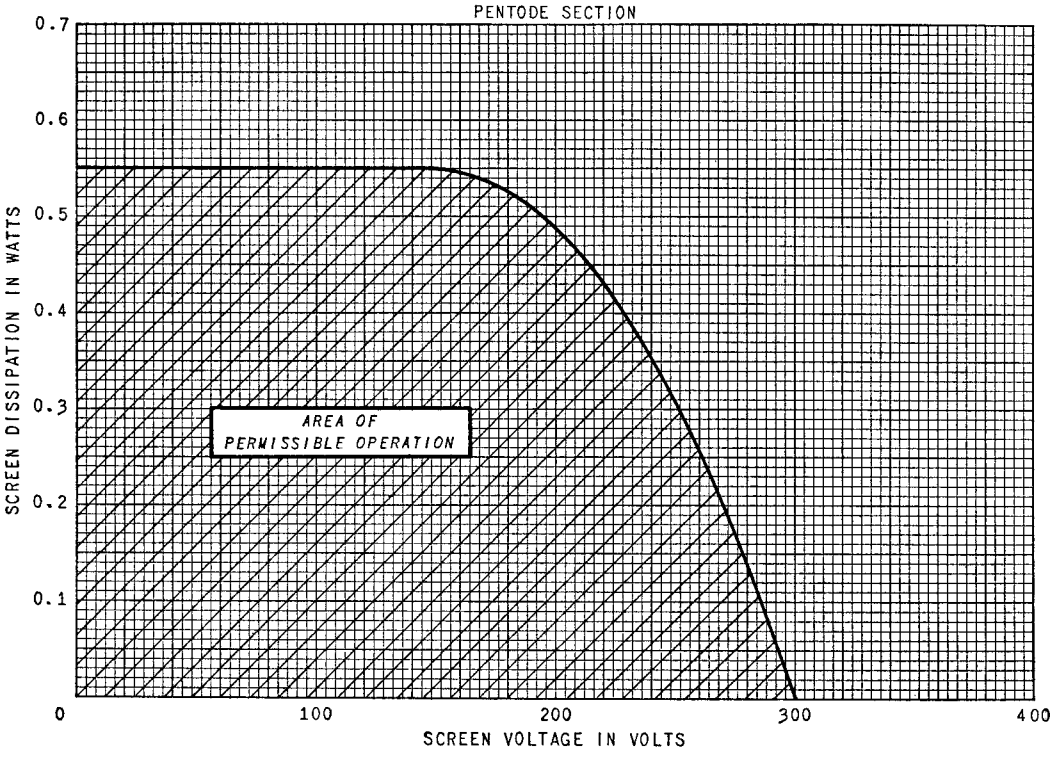


AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



SCREEN RATING CHART



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronics Department

G E N E R A L E L E C T R I C

The 10DP4 is a ten-inch cathode-ray picture tube with a direct-view screen and semi-flat face for television receiving application. Features of this tube are electrostatic focus requiring no appreciable focus current, and a metal-backed screen to prevent screen burning by ions and to increase screen brightness.

GENERAL CHARACTERISTICS

Electrical		
Heater Voltage	6.3 ± 10%	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method - Electrostatic		
Deflecting Method - Magnetic		
Maximum Deflecting Angle	50	Degrees
Phosphor - P4		
Fluorescence - White		
Persistence - Medium		
Direct Interelectrode Capacitances, Nominal		
Cathode to All Other Electrodes	6	uuf
Grid No. 1 to All Other Electrodes	10	uuf
Mechanical		
Overall Length	17 5/8 ± 3/8	Inches
Greatest Diameter of Bulb	10 1/2 ± 1/8	Inches
Minimum Useful Screen Diameter	9	Inches
Bulb Contact JETEC Designation	J1 - 21	
Base JETEC Designation	Small-shell Duodecal 7-Pin	
Basing JETEC Designation	12C	

MAXIMUM RATINGS Design Center Values

Anode No. 2 Voltage	10000 Max	Volts D-C
Anode No. 1 Voltage	3600 Max	Volts D-C
Grid No. 2 Voltage	410 Max	Volts D-C
Grid No. 1 Voltage		
Negative-Bias Value	150 Max	Volts D-C
Positive-Bias Value	0 Max	Volts D-C
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage*		
Heater Negative With Respect to Cathode After Equipment Warm-up Period	125 Max	Volts D-C
Heater Positive With Respect to Cathode At Any Time	125 Max	Volts D-C
Heater Negative With Respect to Cathode During Equipment Warm-up Period Not to Exceed 15 Seconds	410 Max	Volts D-C

from RMA release # 602, Sept 5, 1947

TYPICAL OPERATING CONDITIONS

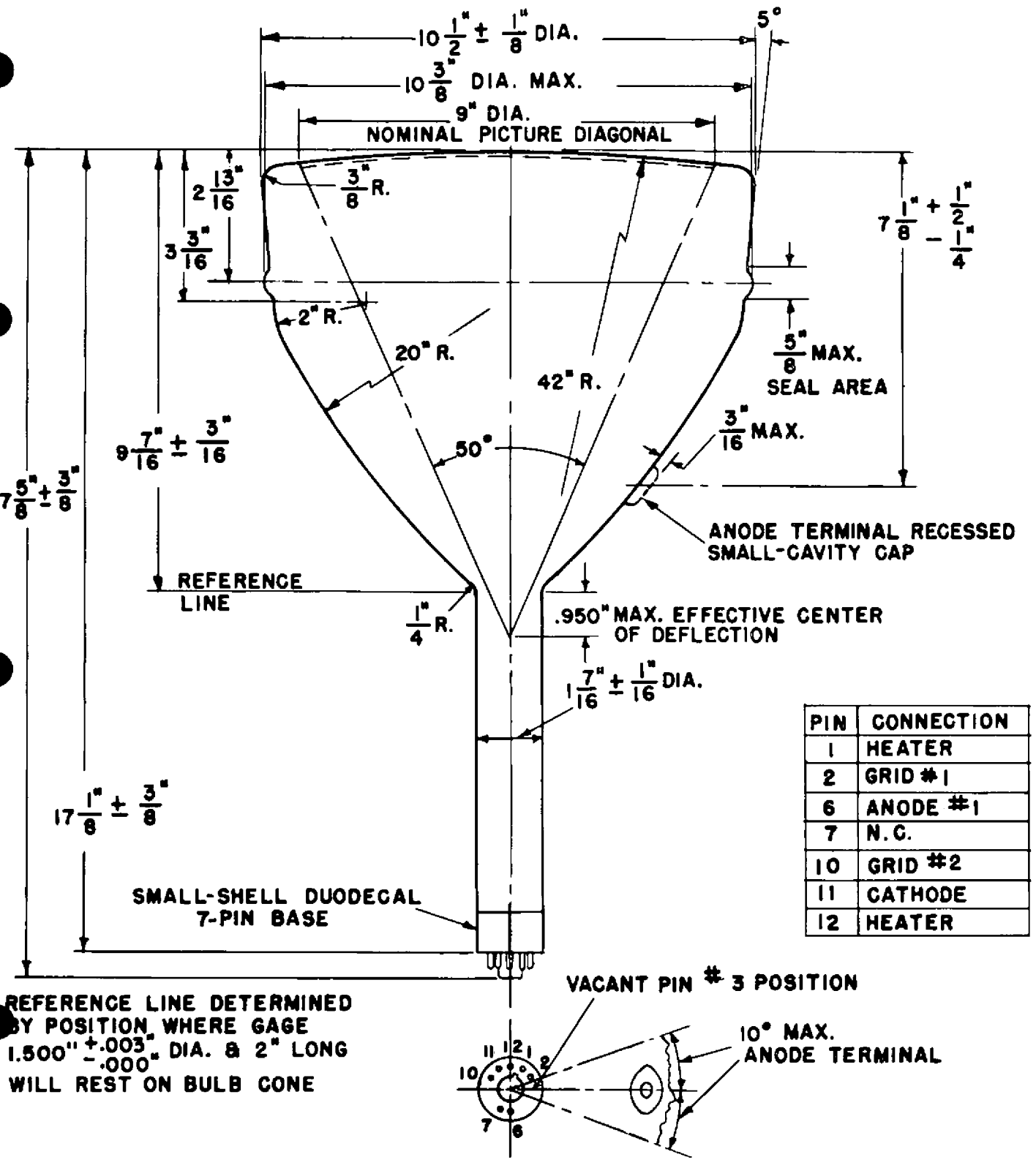
Anode No. 2 Voltage		9000	Volts D-C
Anode No. 1 Voltage	2550 to	3250	Volts D-C
Grid No. 2 Voltage		250	Volts D-C
Grid No. 1 Voltage⁄	36 to	84	Volts D-C
Spot Position (Undeflected)		16 Max	Millimeters

MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance		1.5 Max	Megohms

* Cathode should be returned to one side or to the mid-tap of the heater transformer winding.

⁄ Visual extinction of undeflected focused spot.



PIN	CONNECTION
1	HEATER
2	GRID #1
6	ANODE #1
7	N.C.
10	GRID #2
11	CATHODE
12	HEATER

N20076AZ

OUTLINE-CATHODE-RAY TUBE

10DP4

7 45
9'
5'

REVISIONS	MADE BY	INSPECTED BY	
2 W. Zimbeck JR-10724 Oct 29, 1951	W. SIMPSON March 23, 1949 W. Jones July 31, 1951	R E Walker July 28, 1951	95532

GENERAL ELECTRIC
ELECTRONICS DEPARTMENT — TUBE DIVISION

N20076AZ
SHEET NO. ..... CONT. ON SHEET .....

PRINTS TO

10GK6 – 10GN8

10GK6 Beam Pentode. The 10GK6 is a miniature tube containing a general-purpose power pentode that may be used either in audio output amplifier or video power output amplifier stages of television receivers.

Except for heater characteristics and ratings, the 10GK6 is identical to the 6GK6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	10.6	Volts
Heater Current●	0.45 ± 0.03	Amperes
Heater Warm-up Time, average♦	11	Seconds

10GN8 Triode-Pentode. The 10GN8 is a miniature tube containing a sharp-cutoff pentode and a high-mu triode. The pentode section is intended primarily for use as a video amplifier. The triode section is suitable for use as a voltage amplifier or sync separator.

Except for heater characteristics and ratings, the 10GN8 is identical to the 6GN8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	10.5	Volts
Heater Current●	0.45 ± 0.03	Amperes
Heater Warm-up Time, average♦	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.45 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

—PRODUCT INFORMATION—

Compactron Beam Pentode

10JA5

FOR TV VERTICAL-DEFLECTION AMPLIFIER APPLICATIONS

- COLOR TV TYPE
- PLATE DISSIPATION 19 WATTS
- VERTICAL OUTPUT PENTODE
- HIGH PERVEANCE

The 10JA5 is a compactron beam-power pentode primarily designed for use as the vertical-deflection amplifier in color television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

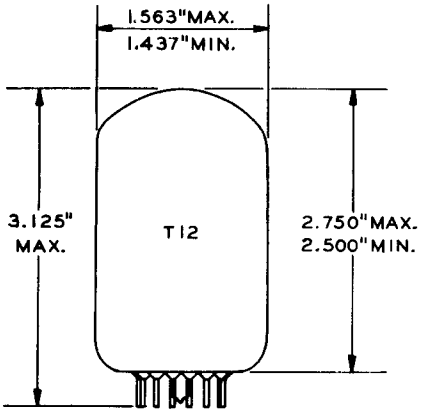
Heater Voltage, AC or DC★	10.5	Volts
Heater Current●	0.6 ± 0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds
Direct Interelectrode Capacitances, approximate▲		
Grid-Number 1 to Plate: (g1 to p)	0.66	pf
Input: g1 to (h+k+g2+b.p)	14	pf
Output: p to (h+k+g2+b.p.)	7.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing - EIA 12-57

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	3.125	Inches
Maximum Seated Height	2.750	Inches
Minimum Seated Height	2.500	Inches

PHYSICAL DIMENSIONS

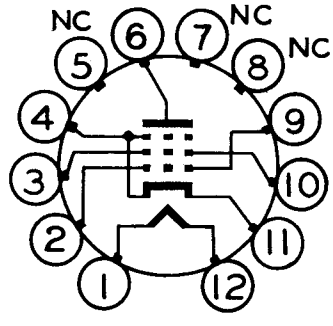


EIA 12-57

TERMINAL CONNECTIONS ⊕

Pin 1 - Heater
Pin 2 - Grid Number 1
Pin 3 - Grid Number 2 (Screen)
Pin 4 - Cathode and Beam Plates
⊕ Pin 5 - No Connection
Pin 6 - Plate
⊕ Pin 7 - No Connection
⊕ Pin 8 - No Connection
Pin 9 - Grid Number 1
Pin 10 - Grid Number 2 (Screen)
Pin 11 - Cathode and Beam Plates
Pin 12 - Heater

BASING DIAGRAM



EIA 12EY

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MAXIMUM RATINGS

VERTICAL-DEFLECTION AMPLIFIER SERVICE □ — DESIGN-MAXIMUM VALUES

DC Plate Voltage	400	Volts
Peak Pulse Plate Voltage	2500	Volts
Screen Voltage	300	Volts
Peak Negative Grid-Number 1 Voltage	250	Volts
Plate Dissipation †	19	Watts
Screen Dissipation	2.75	Watts
DC Cathode Current	110	Milliamperes
Peak Cathode Current	260	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	1.0	Megohms
With Cathode Bias	2.2	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	45	135	Volts
Screen Voltage	125	125	Volts
Grid-Number Voltage	0‡	−10	Volts
Plate Resistance, approximate	---	12000	Ohms
Transconductance	---	10300	Micromhos
Plate Current	210	95	Milliamperes
Screen Current	20	4.2	Milliamperes
Grid-Number Voltage, approximate			
Ib = 100 Microamperes	---	−33	Volts

NOTES

★ Heater voltage for a bogey tube at If = 0.600 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

▲ Without external shield.

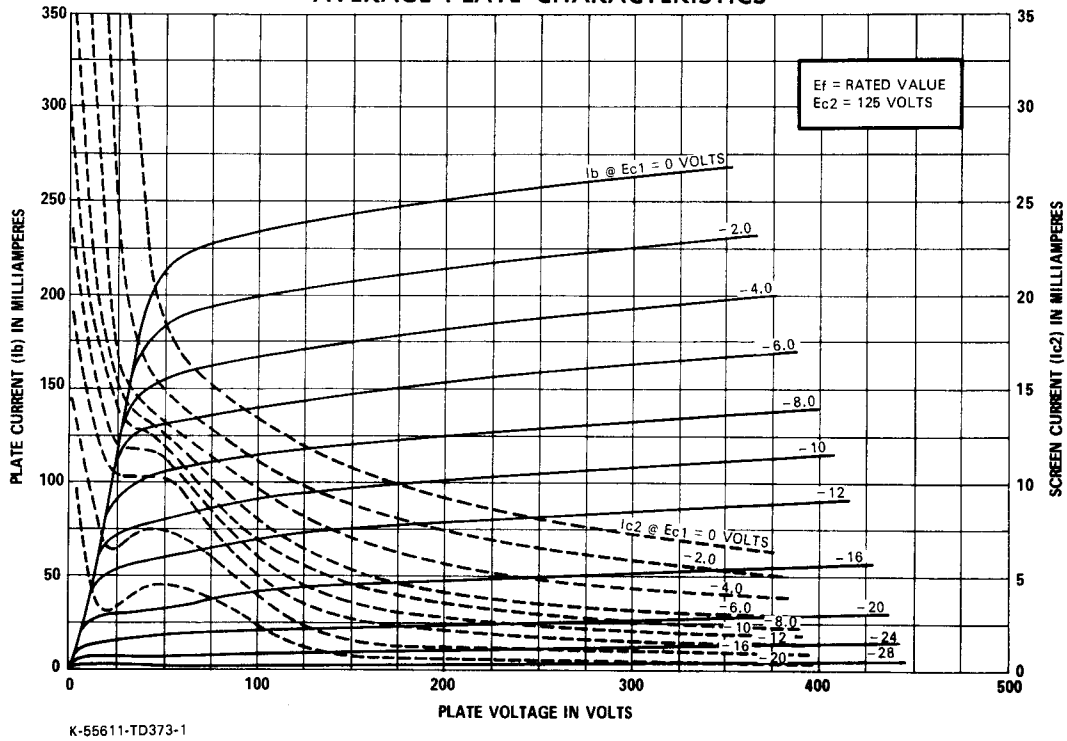
⊕ Socket terminals 5, 7, and 8 should not be used as tie points.

□ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

† In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

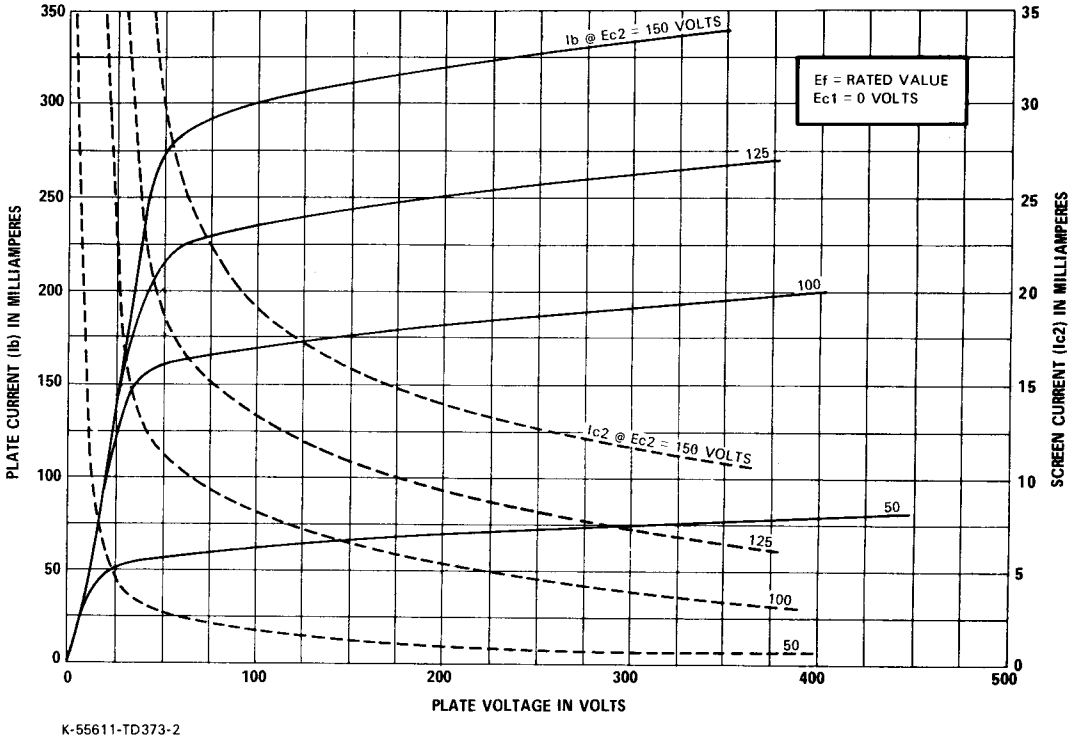
‡ Applied for short interval (two seconds maximum) so as not to damage tube.

AVERAGE PLATE CHARACTERISTICS



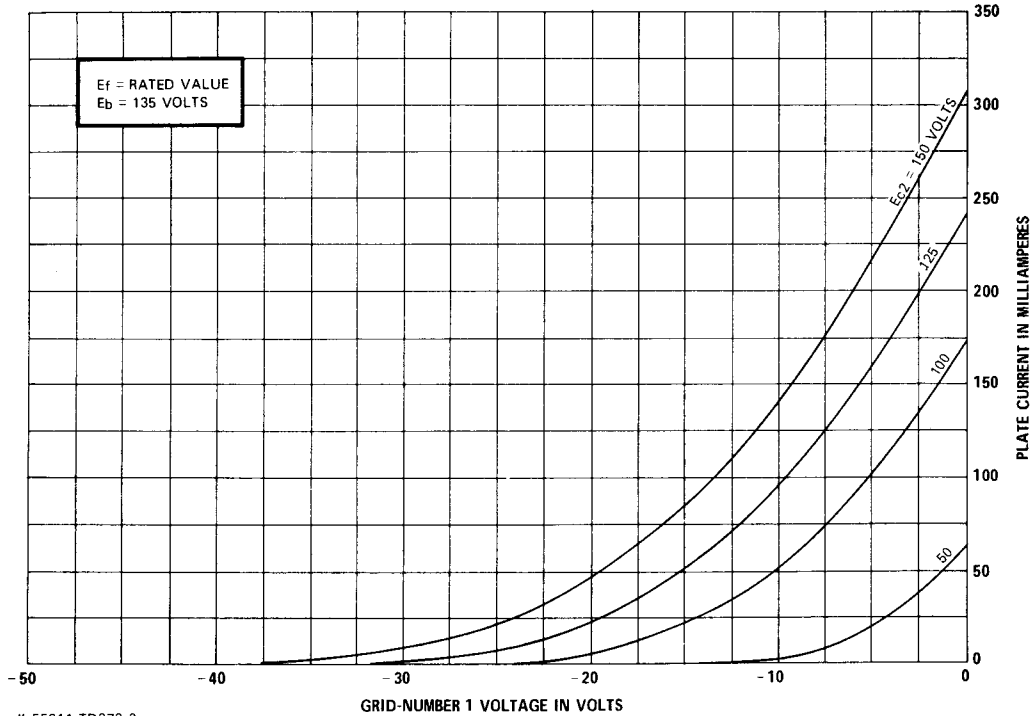
K-55611-TD373-1

AVERAGE PLATE CHARACTERISTICS



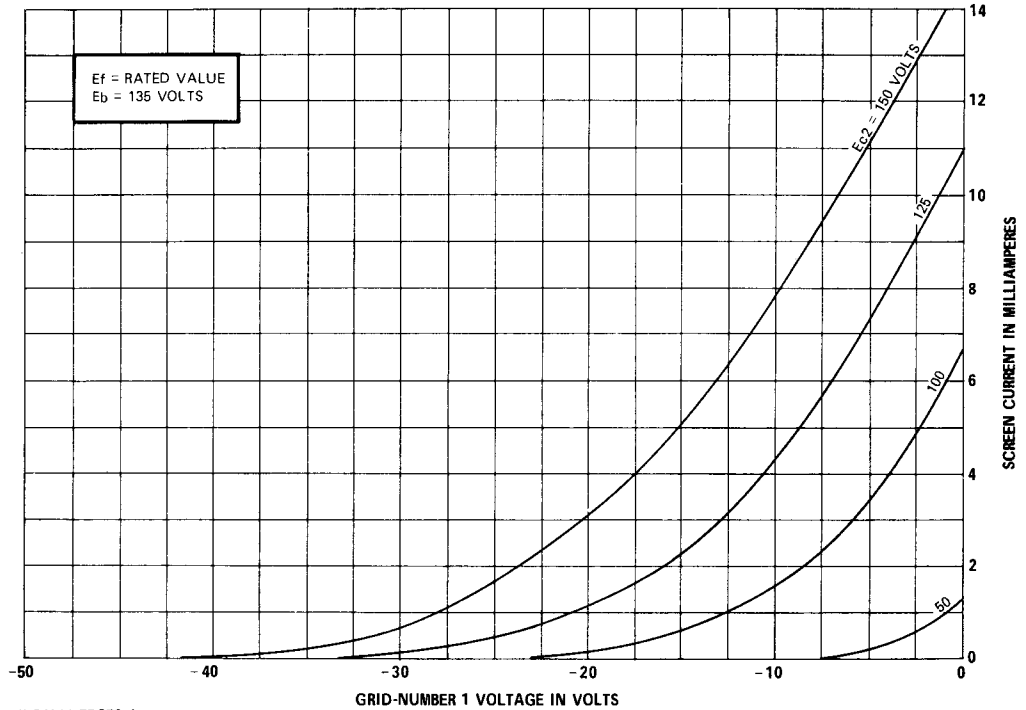
K-55611-TD373-2

AVERAGE TRANSFER CHARACTERISTICS



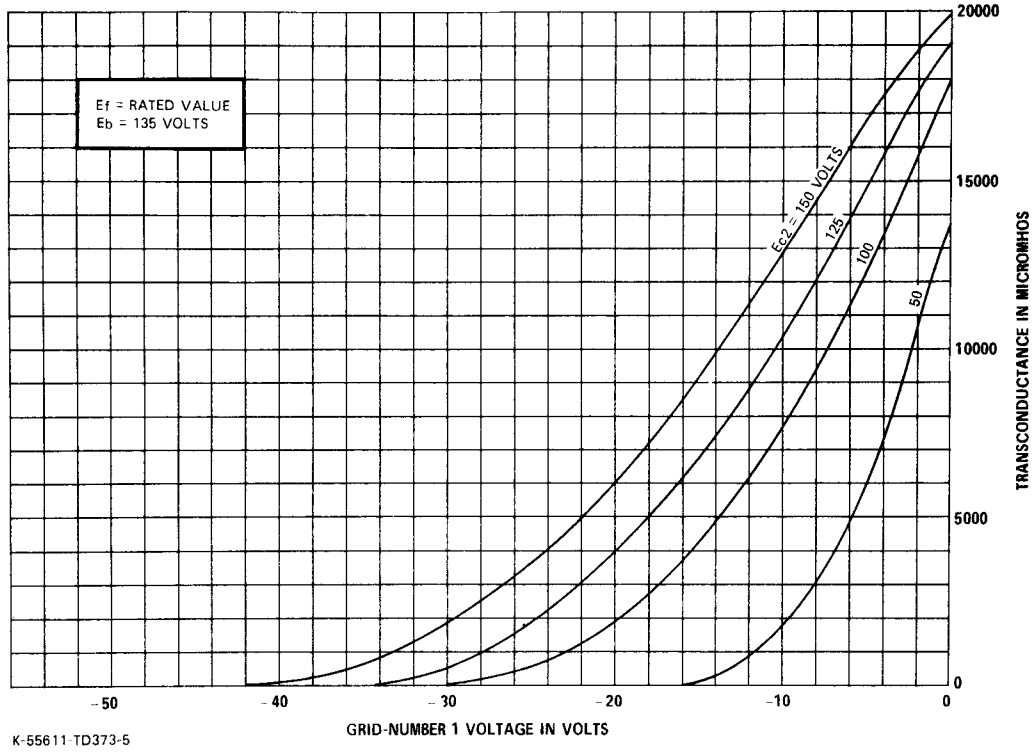
K-55611-TD373-3

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD373-4

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD373-5

TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

10JY8
TRIODE-PENTODE

DESCRIPTION AND RATING

The 10JY8 is a 9-pin miniature tube containing a medium-mu triode and a sharp-cutoff pentode. The triode is intended for sync separator service and the pentode for video amplifier service.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	10.5	Volts
Heater Current†	0.45 ± 0.03	Amperes
Heater Warm-up Time‡	11	Seconds

Direct Interelectrode Capacitances§

Pentode Section		
Grid-Number 1 to Plate: (Pg1 to Pp)	0.08	pf
Input: Pg1 to (h+Pk+Pg2+Pg3+i.s.)	10	pf
Output: Pp to (h+Pk+Pg2+Pg3+i.s.)	4.6	pf
Triode Section		
Grid to Plate: (Tg to Tp)	2.8	pf
Input: Tg to (h+Tk+Pk+Pg3+i.s.)	4.2	pf
Output: Tp to (h+Tk+Pk+Pg3+i.s.)	3.2	pf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin
Outline Drawing—EIA 6-3

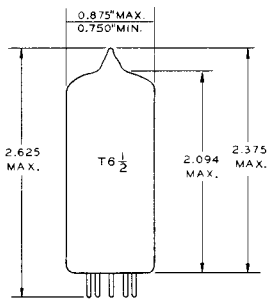
Maximum Diameter	0.875	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.375	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	...	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	5.0	2.0	Watts
Screen Dissipation	1.1	...	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
DC Component	...	200	Volts
Total DC and Peak	200	300	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

PHYSICAL DIMENSIONS

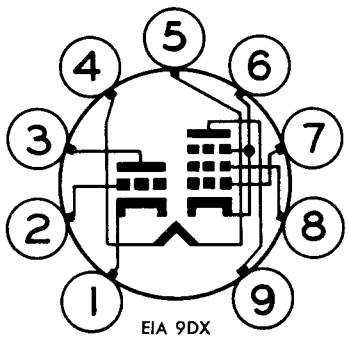


EIA 6-3

TERMINAL CONNECTIONS

Pin 1—Triode Cathode
Pin 2—Triode Grid
Pin 3—Triode Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Cathode, Number 3, and Internal Shield
Pin 7—Pentode Grid Number 1
Pin 8—Pentode Grid Number 2 (Screen)
Pin 9—Pentode Plate

BASING DIAGRAM



EIA 9DX

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MAXIMUM RATINGS (Continued)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Pentode Section		Triode Section	
Plate Voltage	50	200	125	Volts
Screen Voltage	150	150	.....	Volts
Grid-Number 1 Voltage	0¶	.....	.....	Volts
Cathode-Bias Resistor	....	100	68	Ohms
Amplification Factor	....	.....	46	
Plate Resistance, approximate	....	55000	4400	Ohms
Transconductance	....	11000	10400	Micromhos
Plate Current	60	24	15	Milliamperes
Screen Current	18	4.8	.....	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	....	.....	−8	Volts
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	....	−10	.....	Volts

FOOTNOTES

* Heater voltage for bogey tube at If = 0.45 amperes.

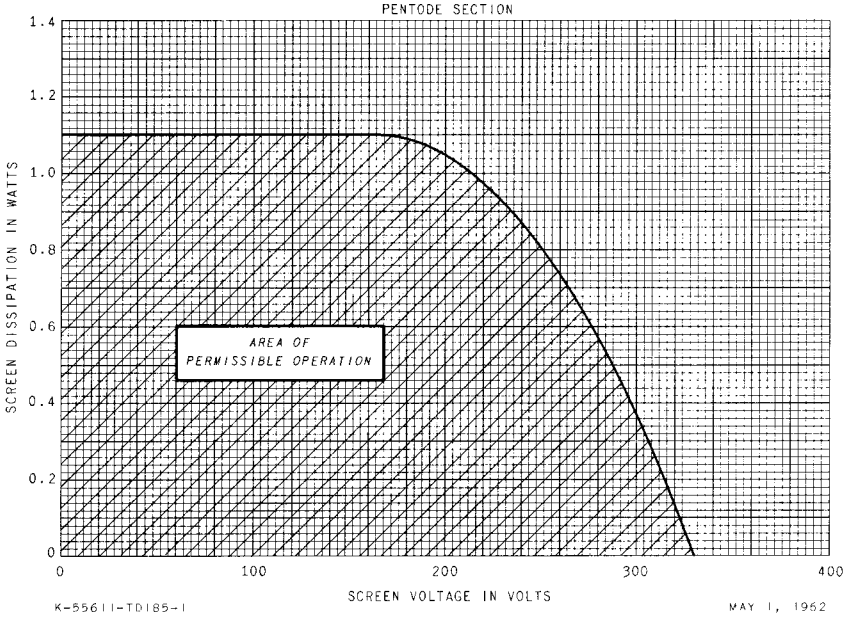
† For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

‡ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

§ Without external shield.

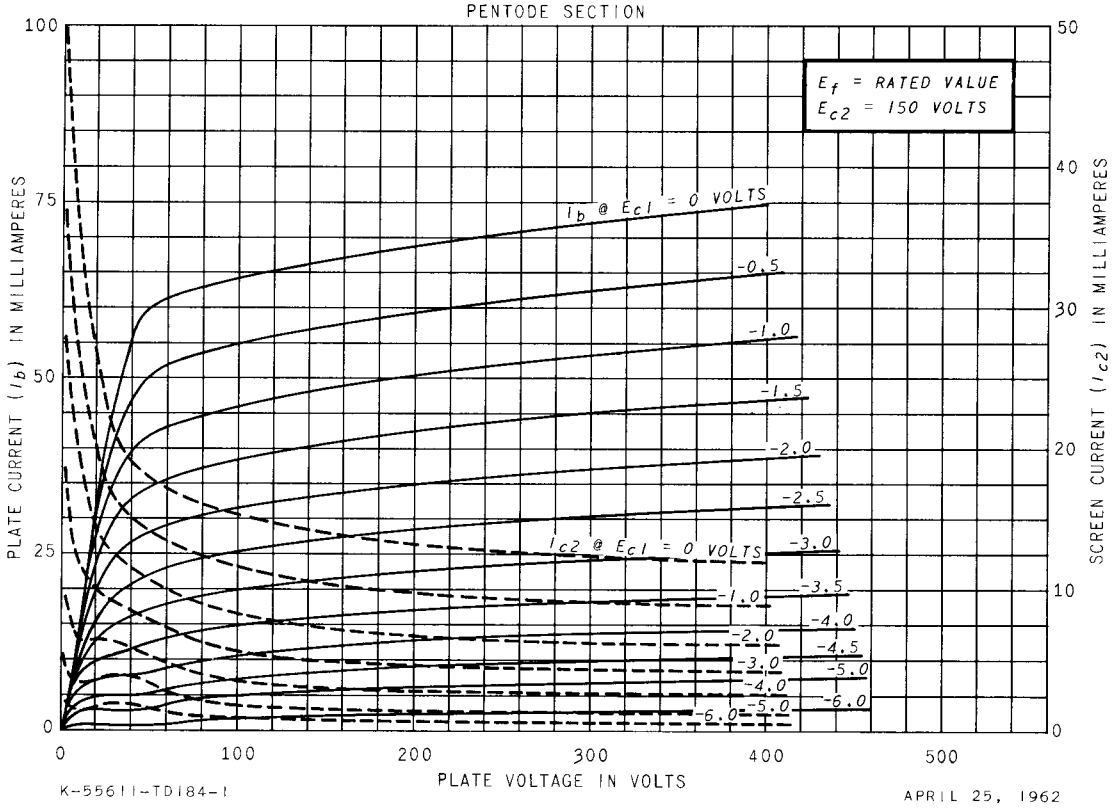
¶ Applied for short interval (two seconds maximum) so as not to damage tube.

SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

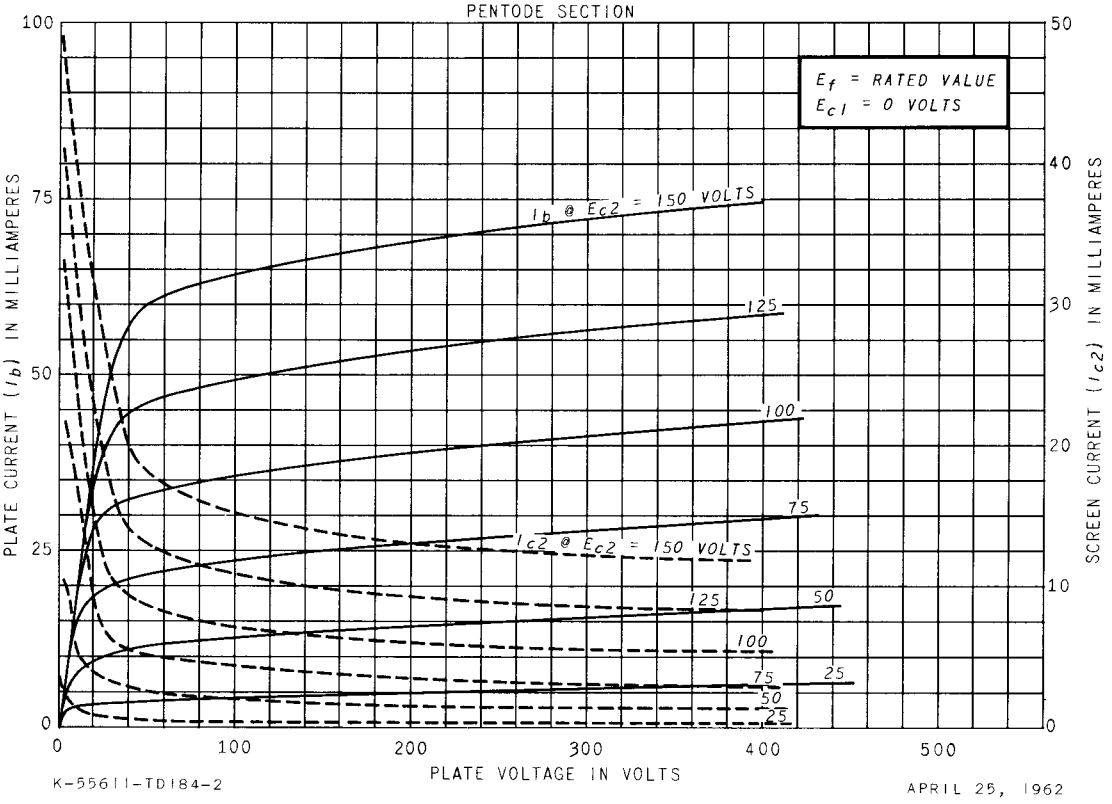


K-5561I-TD184-1

APRIL 25, 1962

AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

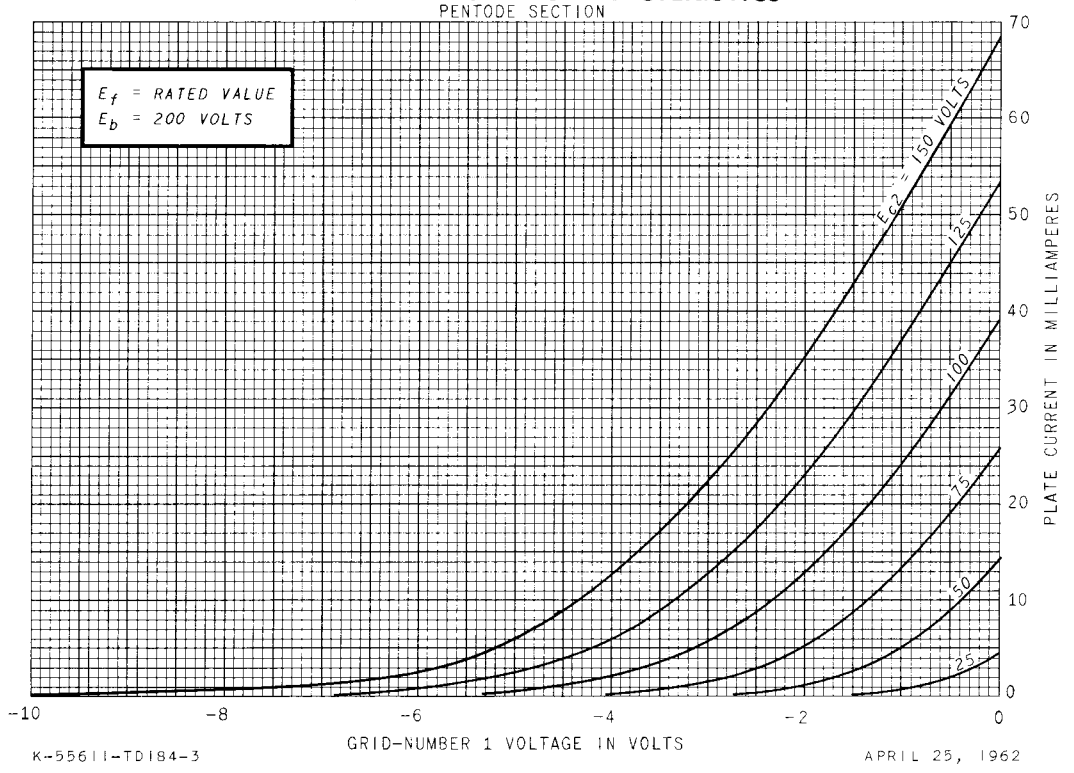


K-5561I-TD184-2

APRIL 25, 1962

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

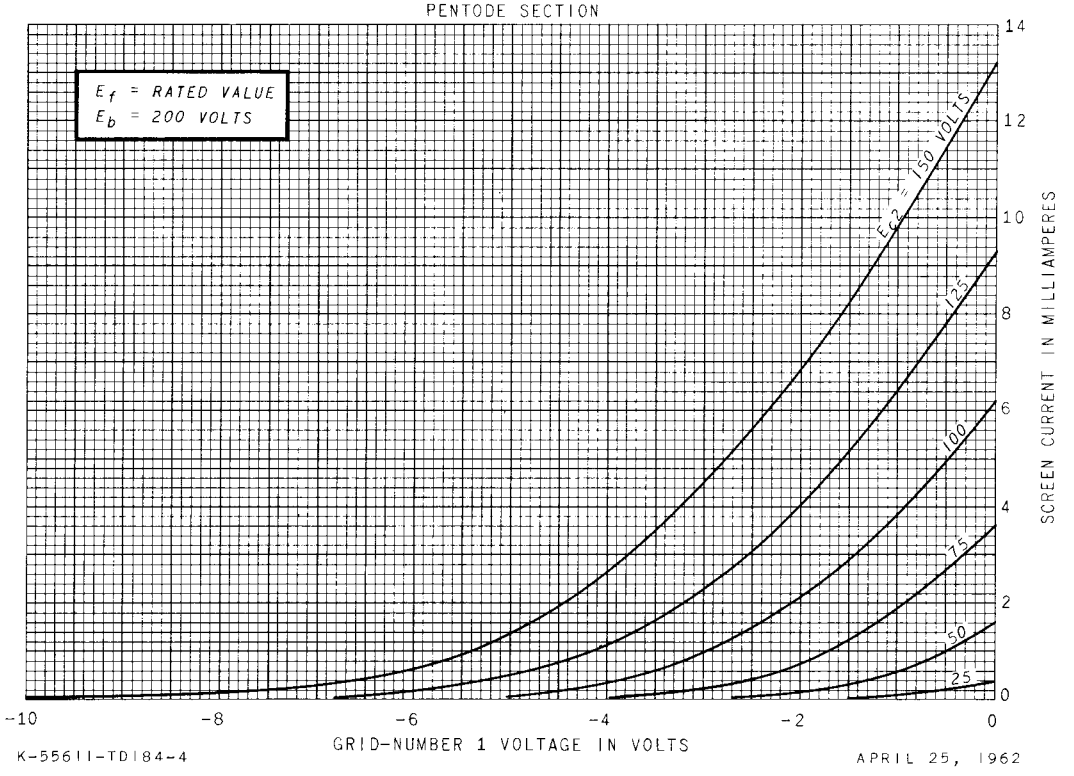


K-5561I-TDI84-3

APRIL 25, 1962

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

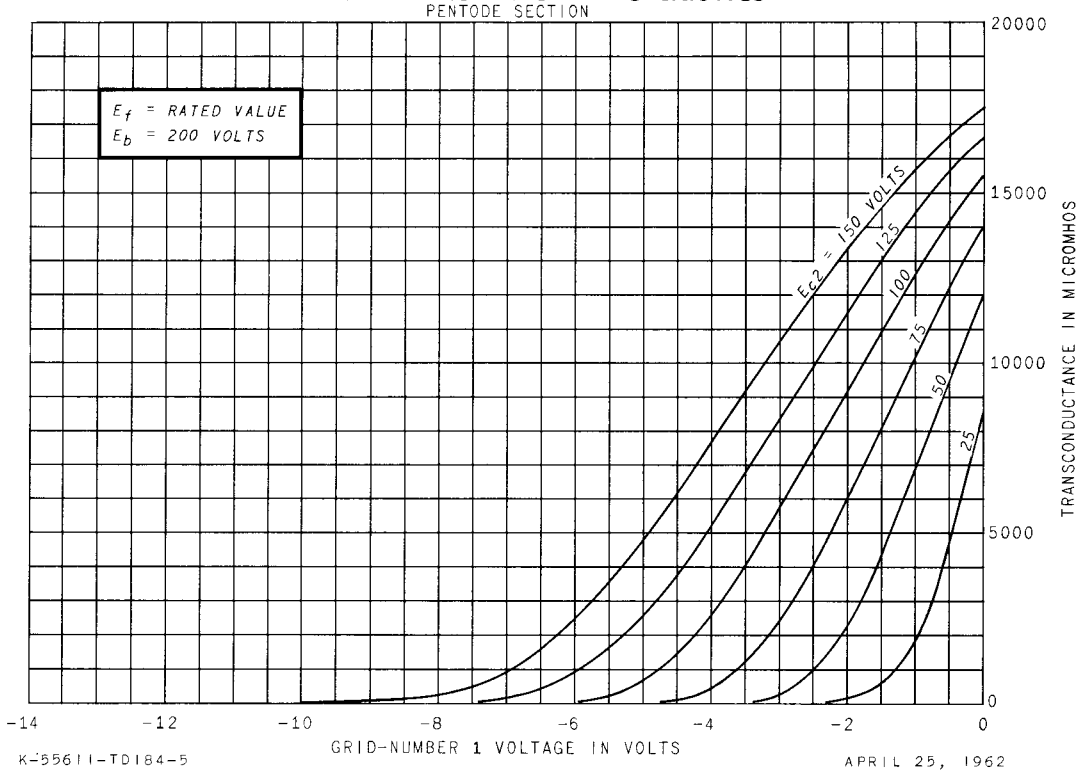


K-5561I-TDI84-4

APRIL 25, 1962

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

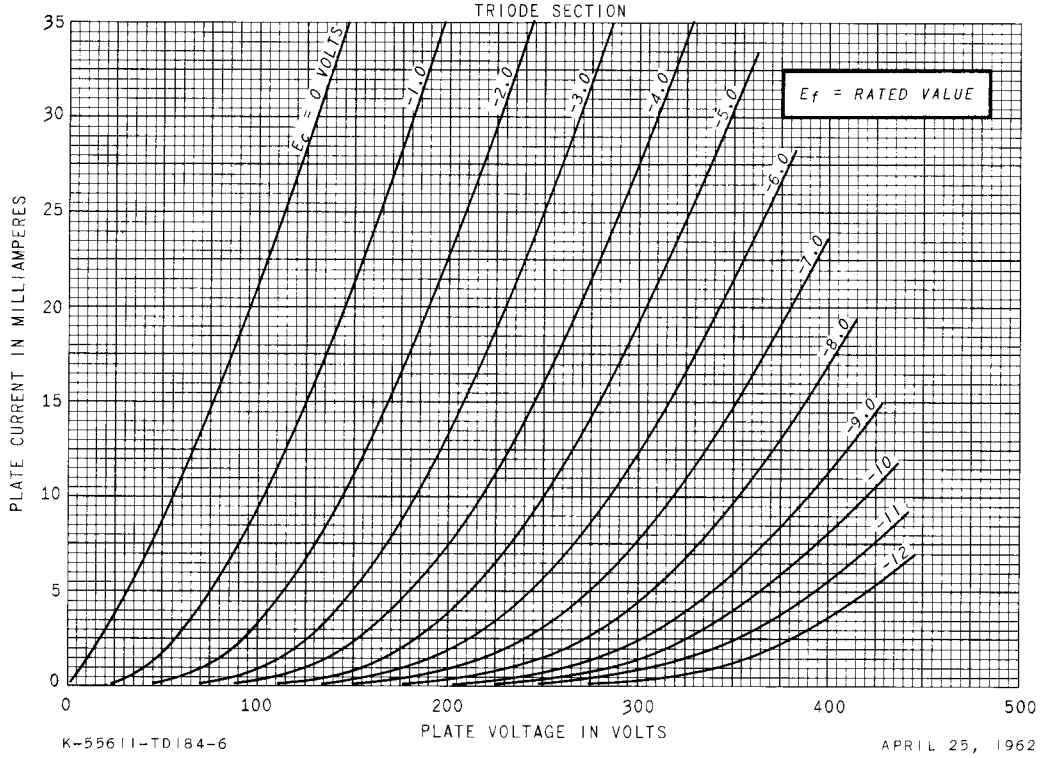


K-5561I-TDI84-5

APRIL 25, 1962

AVERAGE PLATE CHARACTERISTICS

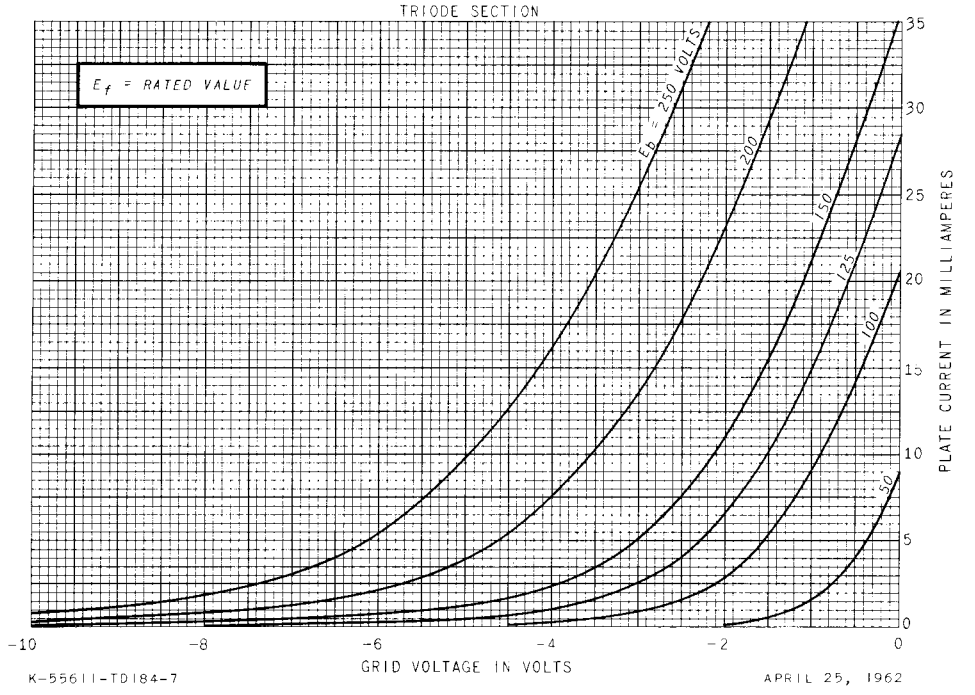
TRIODE SECTION



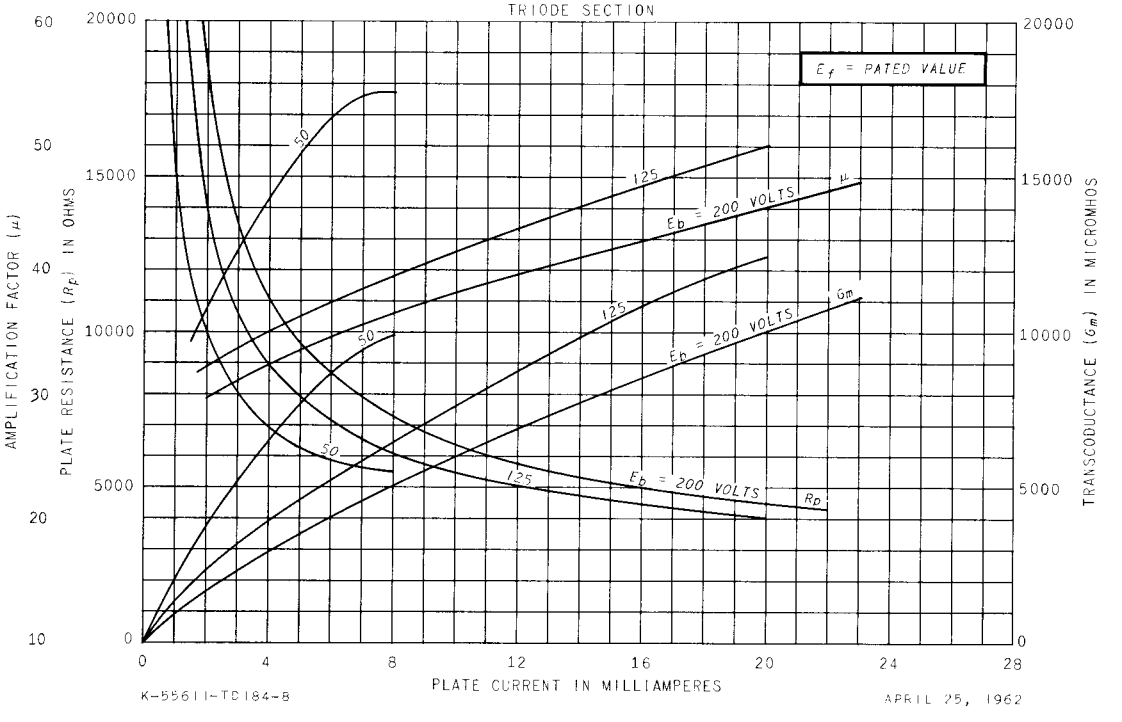
K-5561I-TDI84-6

APRIL 25, 1962

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

10KR8

TRIODE-PENTODE

DESCRIPTION AND RATING

The 10KR8 is a miniature triode-pentode containing a medium-mu triode and a sharp-cutoff pentode. The pentode is intended for use as a video amplifier and the triode for general-purpose use.

Except for heater characteristics, the 10KR8 is identical to the 6KR8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	10.5	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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ELECTRONICS

10LW8
TRIODE-PENTODE

DESCRIPTION AND RATING

The 10LW8 is a miniature triode-pentode containing a high-mu triode and a sharp-cutoff pentode. The pentode is intended for use as a video amplifier and the triode for general-purpose use.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	10.5	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, average§	11	Seconds

Direct Interelectrode Capacitances¶

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.08	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.)	12	pf
Output: Pp to (h + Pk + Pg2 + Pg3 + i.s.)	4.4	pf

Triode Section

Grid to Plate: (Tg to Tp)	3.6	pf
Input: Tg to (h + Tk + Pk + Pg3 + i.s.)	2.8	pf
Output: Tp to (h + Tk + Pk + Pg3 + i.s.)	3.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-3

Maximum Diameter	0.875	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.375	Inches

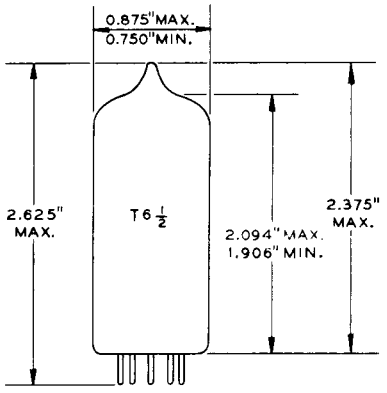
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

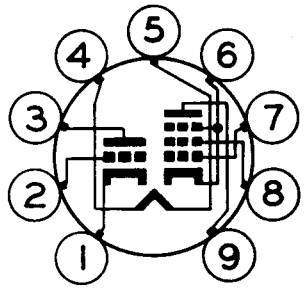


EIA 6-3

TERMINAL CONNECTIONS

Pin 1 - Triode Cathode
Pin 2 - Triode Grid
Pin 3 - Triode Plate
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 7 - Pentode Grid Number 1
Pin 8 - Pentode Grid Number 2 (Screen)
Pin 9 - Pentode Plate

BASING DIAGRAM



EIA 9DX

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	4.0	1.5	Watts
Screen Dissipation	1.5	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.5	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Pentode Section		Triode Section	
Plate Voltage	35	200	200	Volts
Screen Voltage	100	100	---	Volts
Grid-Number 1 Voltage	0	---	-2.0	Volts
Cathode-Bias Resistor	---	82	---	Ohms
Amplification Factor	---	---	75	
Plate Resistance, approximate	---	60000	18700	Ohms
Transconductance	---	19000	4000	Micromhos
Plate Current	48	16.5	2.6	Milliamperes
Screen Current	12.5	2.8	---	Milliamperes
Grid Voltage, approximate				
Ib = 30 Microamperes	---	---	-4	Volts
Grid-Number 1 Voltage, approximate				
Ib = 100 Microamperes	---	-5.5	---	Volts

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

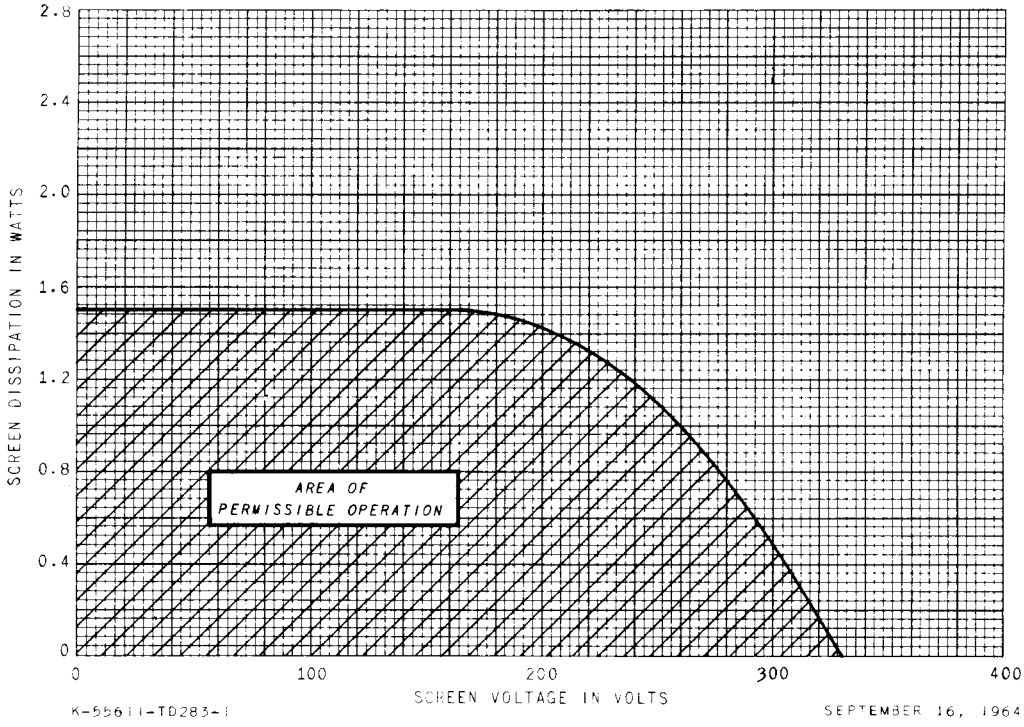
‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

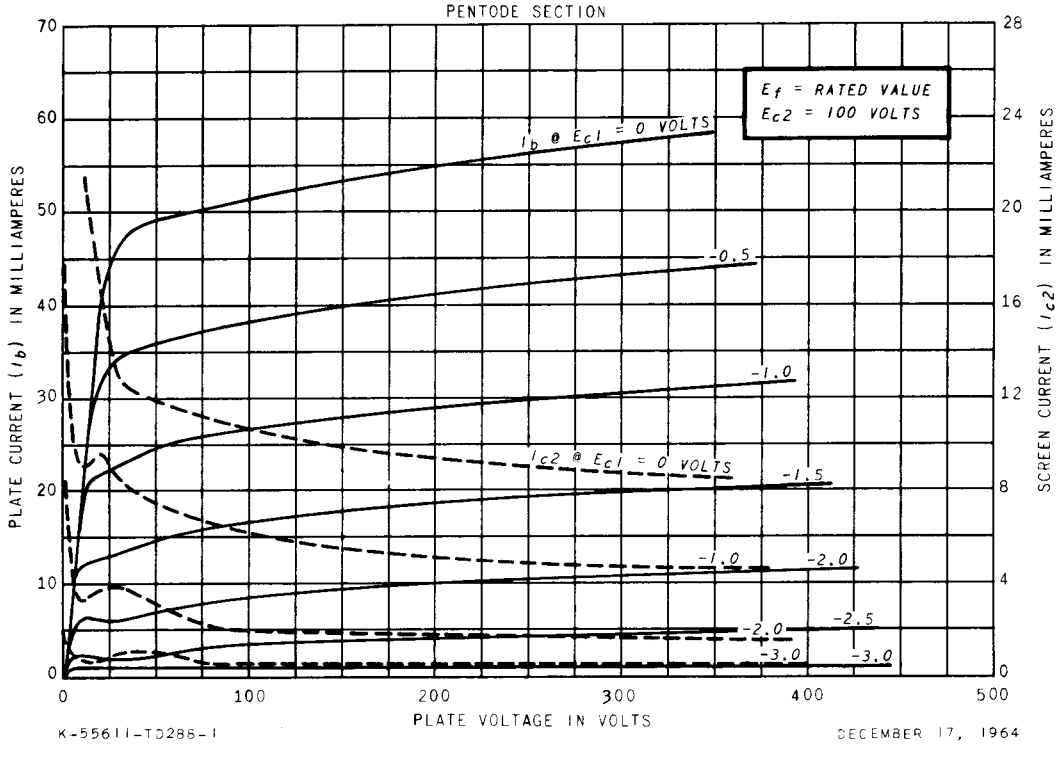
¶ Without external shield.

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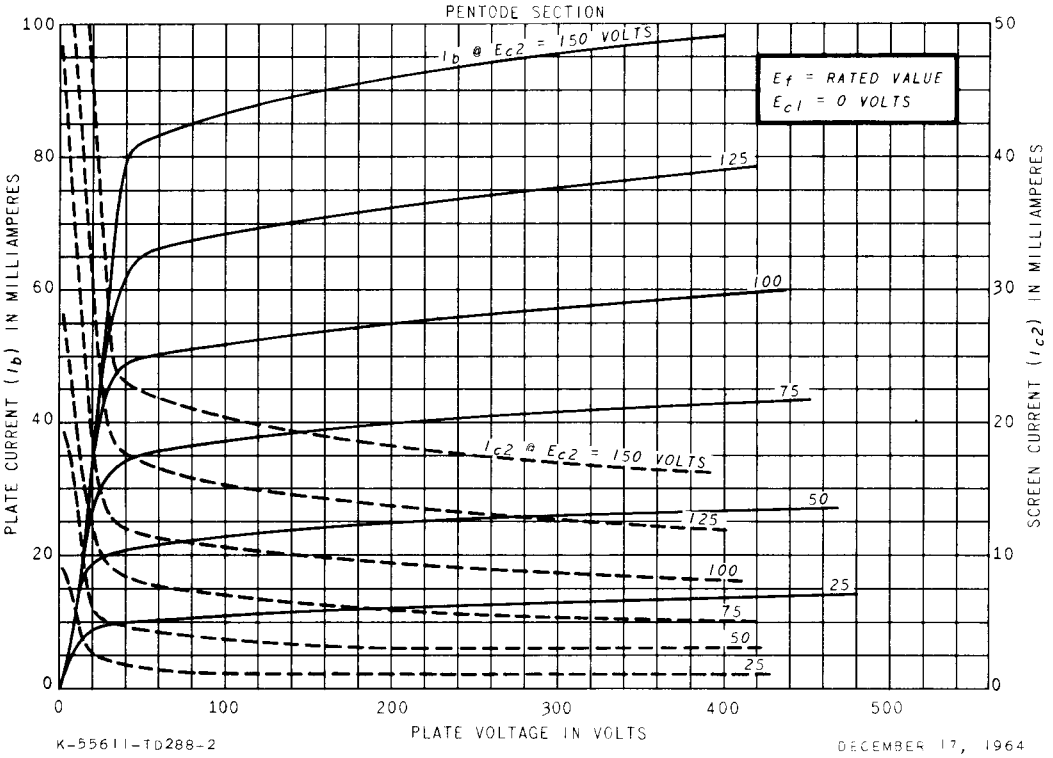
SCREEN RATING CHART



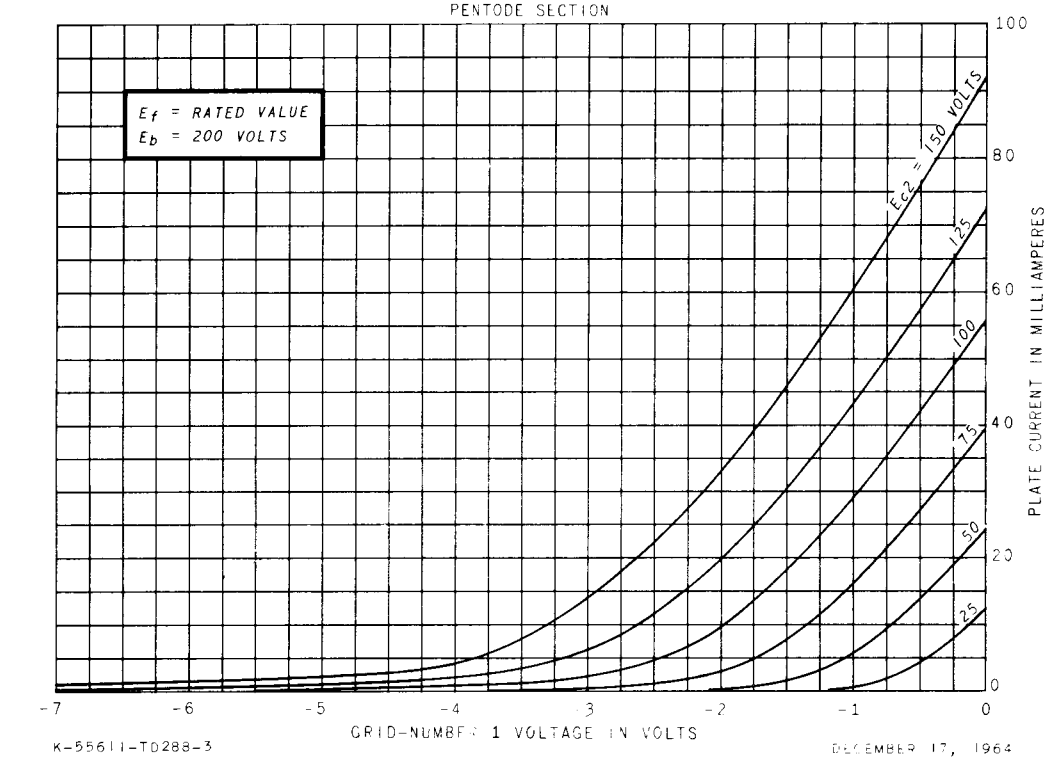
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

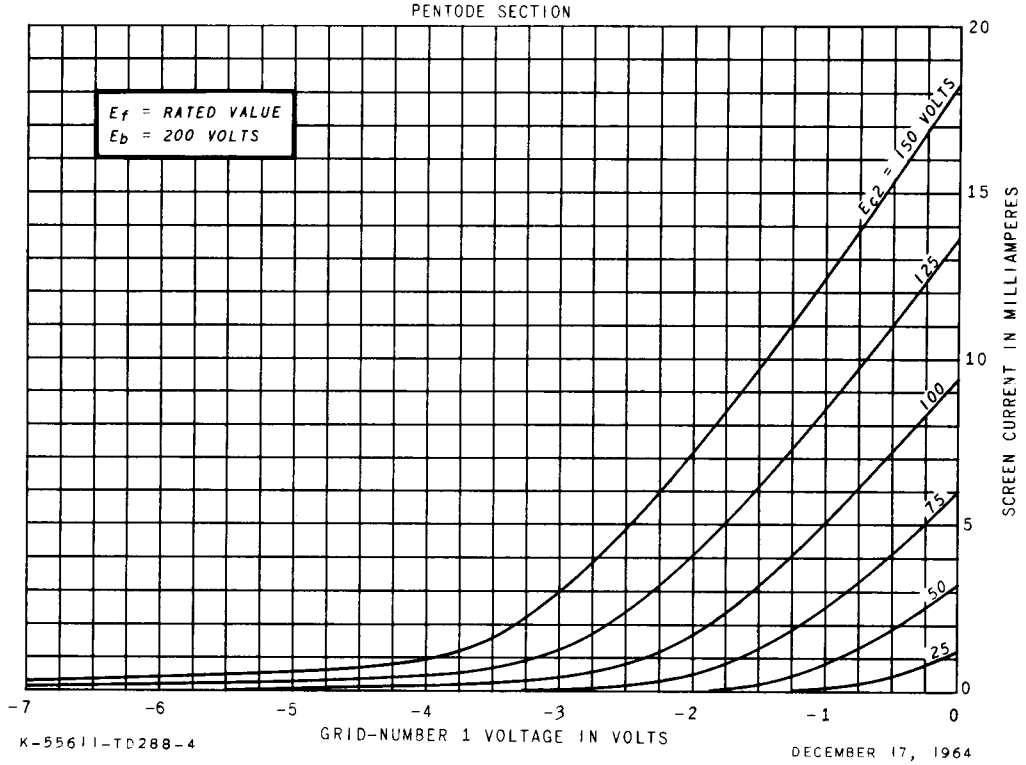


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

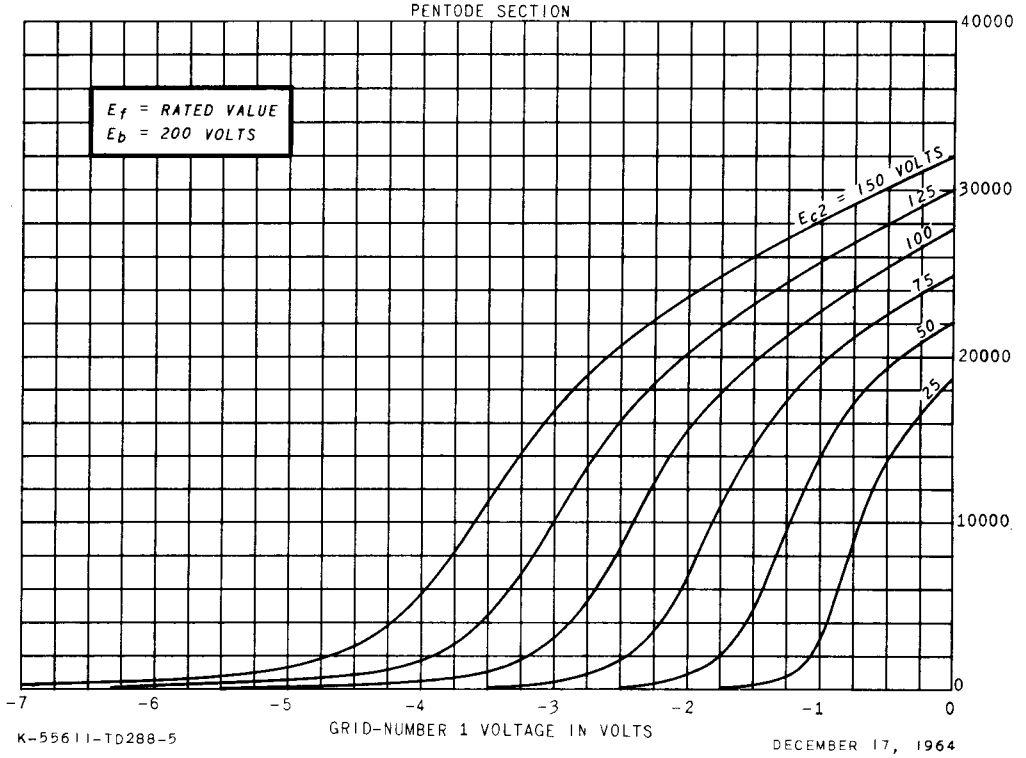


K-55611-TD288-4

DECEMBER 17, 1964

AVERAGE TRANSFER CHARACTERISTICS

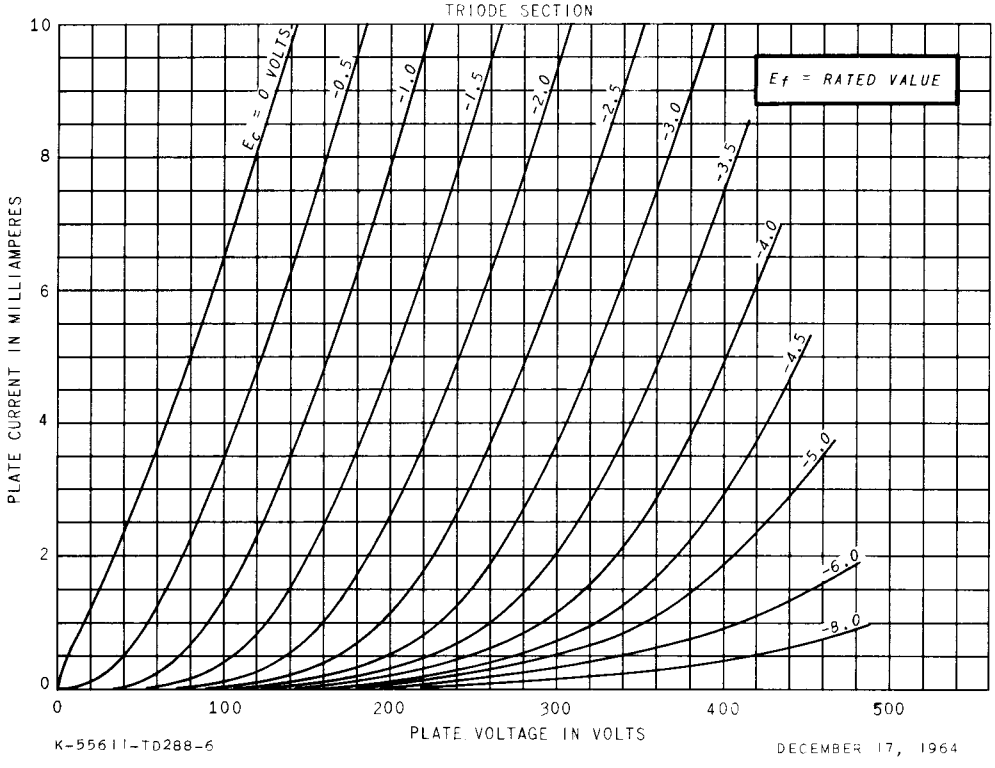
PENTODE SECTION



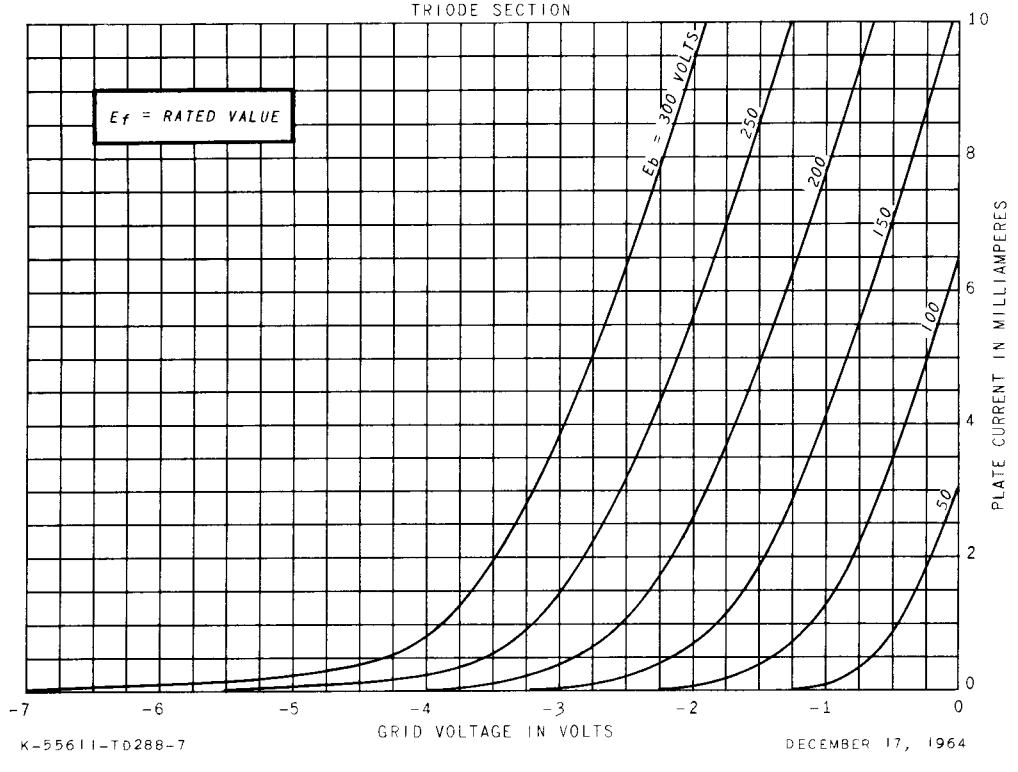
K-55611-TD288-5

DECEMBER 17, 1964

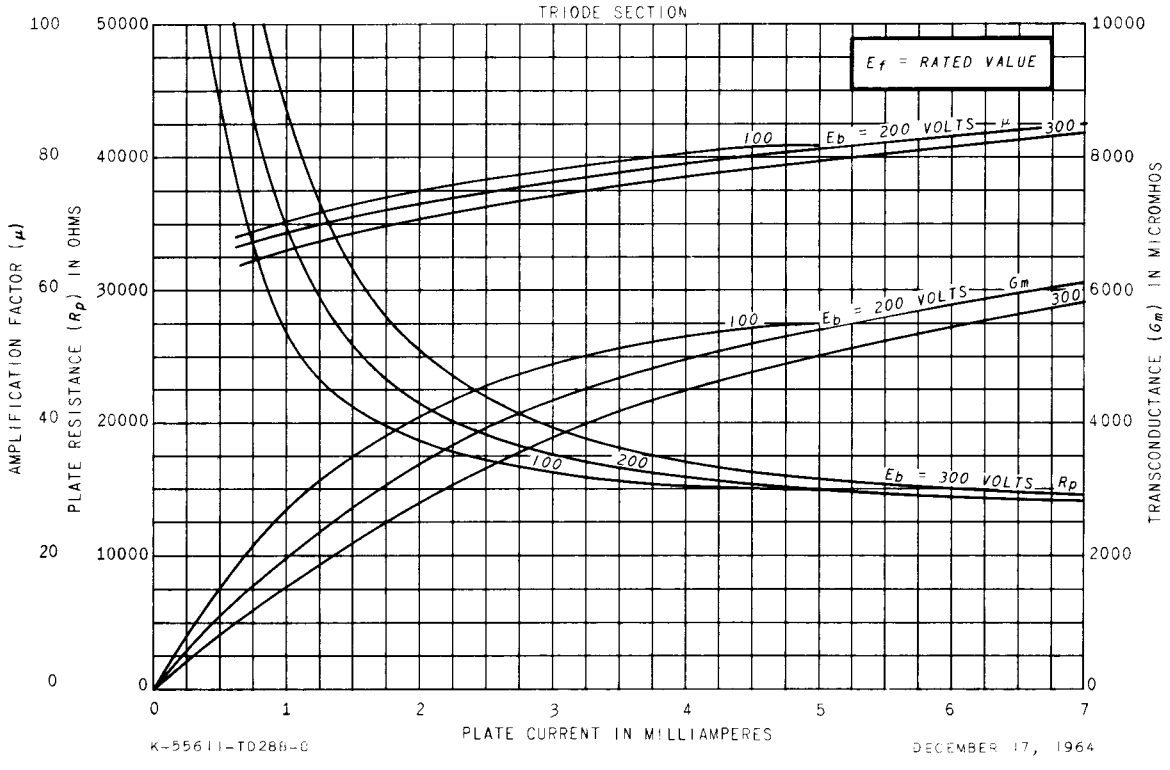
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



PRODUCT INFORMATION

10LZ8

Triode-Pentode

The 10LZ8 is a miniature triode-pentode containing a high-mu triode and a sharp-cutoff pentode. The pentode is intended for use as a video amplifier and the triode for general-purpose use.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	10.5	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

Direct Interelectrode Capacitances¶

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.075	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.)	9.5	pf
Output: Pp to (h + Pk + Pg2 + Pg3 + i.s.)	4.4	pf

Triode Section

Grid to Plate: (Tg to Tp)	3.8	pf
Input: Tg to (h + Tk + Pk + Pg3 + i.s.)	2.6	pf
Output: Tp to (h + Tk + Pk + Pg3 + i.s.)	3.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-3

Maximum Diameter	0.875	Inches
Minimum Diameter	0.750	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.375	Inches

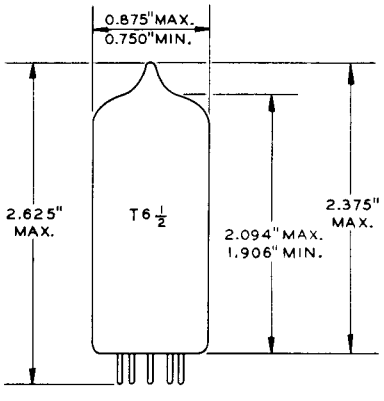
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

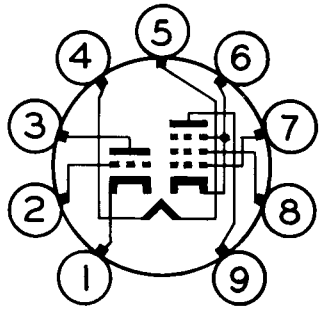


EIA 6-3

TERMINAL CONNECTIONS

Pin 1 - Triode Cathode
Pin 2 - Triode Grid
Pin 3 - Triode Plate
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 7 - Pentode Grid Number 1
Pin 8 - Pentode Grid Number 2 (Screen)
Pin 9 - Pentode Plate

BASING DIAGRAM



EIA 9DX

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES	Pentode Section	Triode Section	
Plate Voltage	225	300	Volts
Screen Voltage	160	---	Volts
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	4.5	1.0	Watts
Screen Dissipation	2.0	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.5	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Pentode Section			Triode Section	
Plate Voltage	30	30	200	250	Volts
Screen Voltage	140	140	140	---	Volts
Grid-Number 1 Voltage	0	-1.0	-2.0	-2.0	Volts
Amplification Factor	---	---	---	110	
Plate Resistance, approximate	---	---	150000	52000	Ohms
Transconductance	---	11000	9500	2100	Micromhos
Plate Current	30	16	12	1.1	Milliamperes
Screen Current	13.5	9.5	2.5	---	Milliamperes
Grid Voltage, approximate					
Ib = 10 Microamperes	---	---	---	-3.6	Volts
Grid-Number 1 Voltage, approximate					
Ib = 500 Microamperes	---	-4	-4.2	---	Volts

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

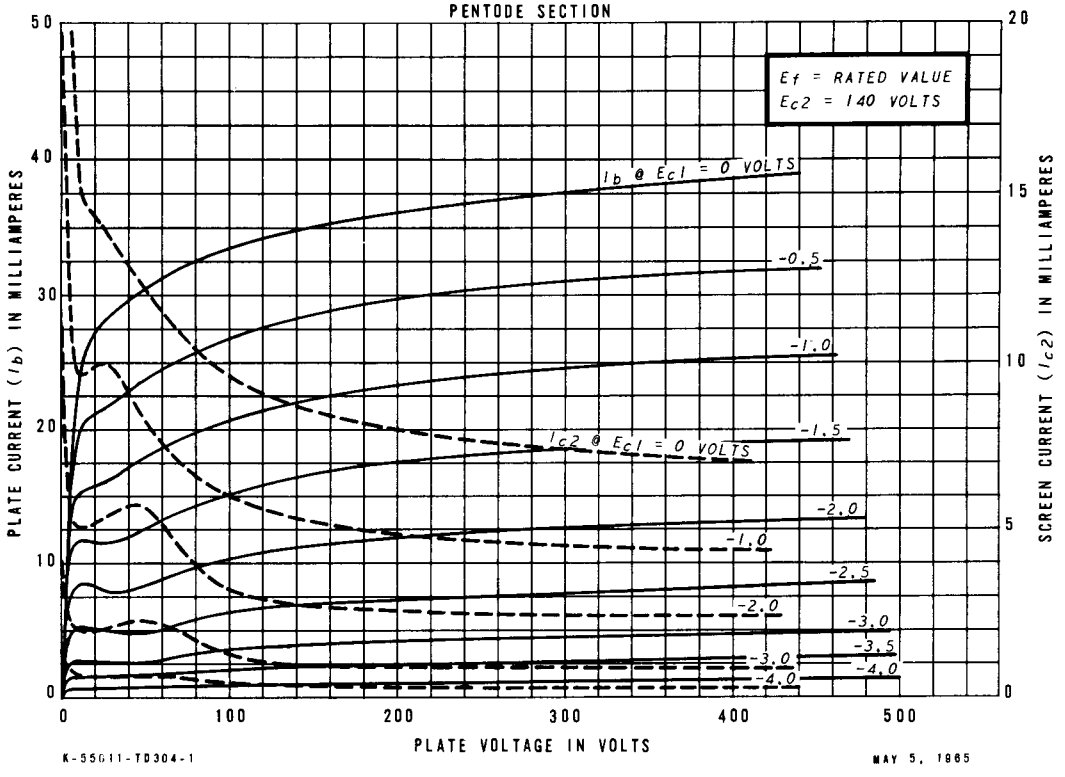
‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

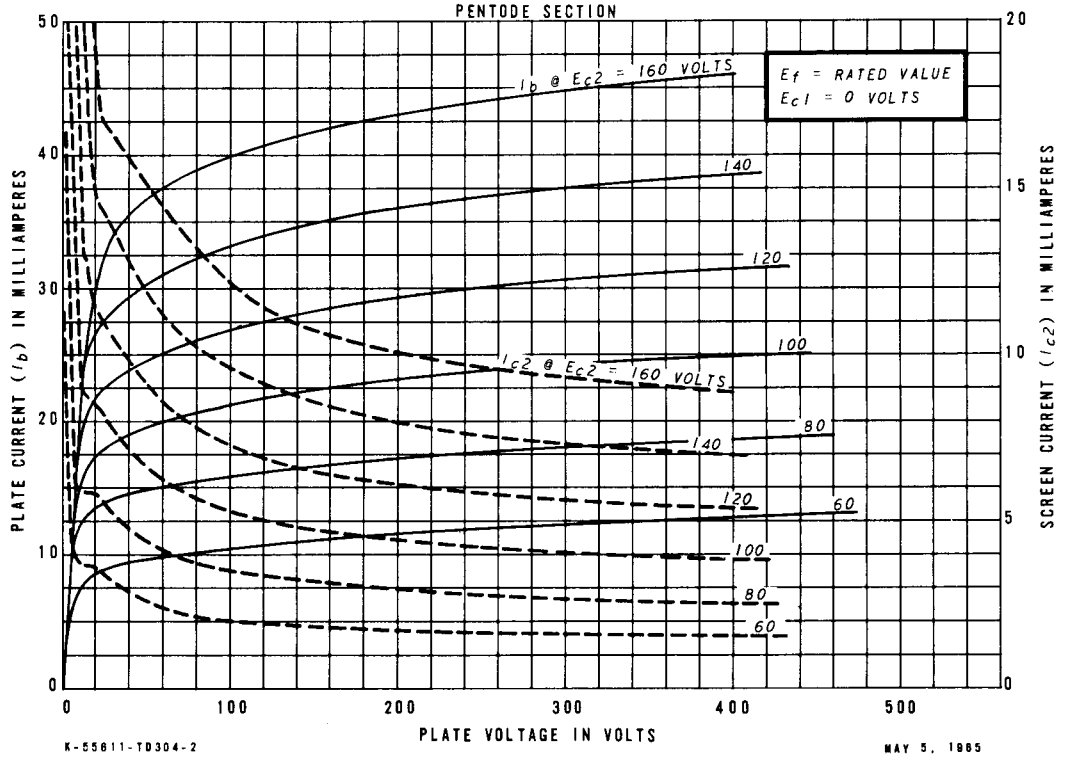
¶ Without external shield.

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AVERAGE PLATE CHARACTERISTICS

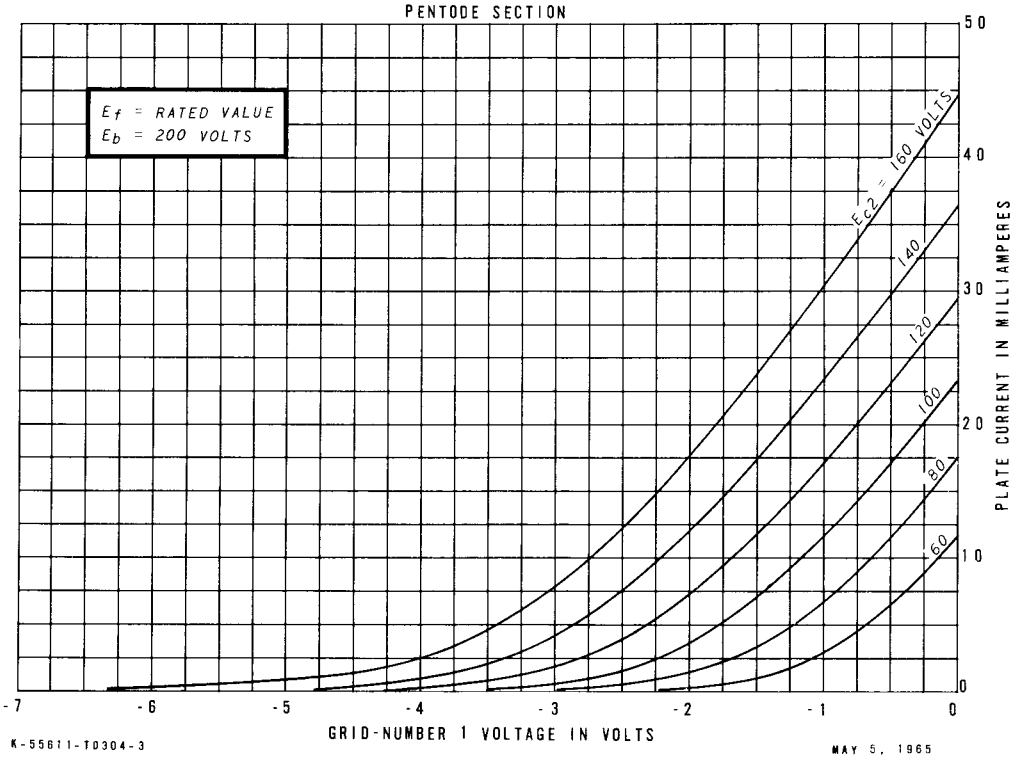


AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

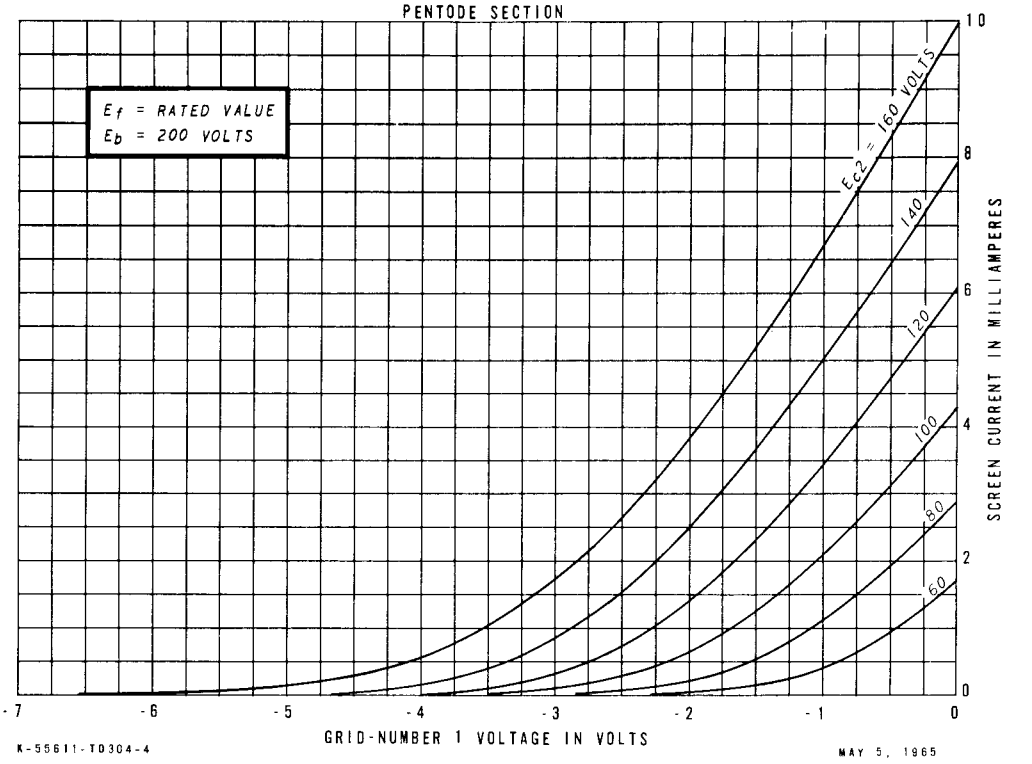


K-55611-T0304-3

MAY 5, 1965

AVERAGE TRANSFER CHARACTERISTICS

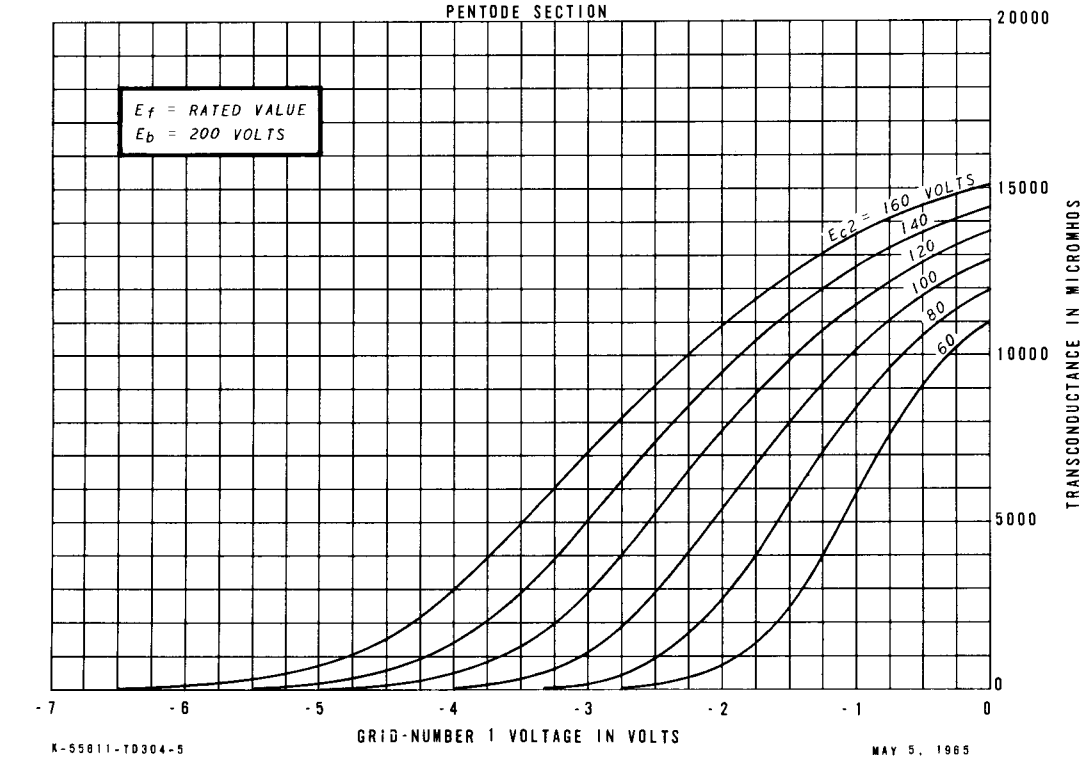
PENTODE SECTION



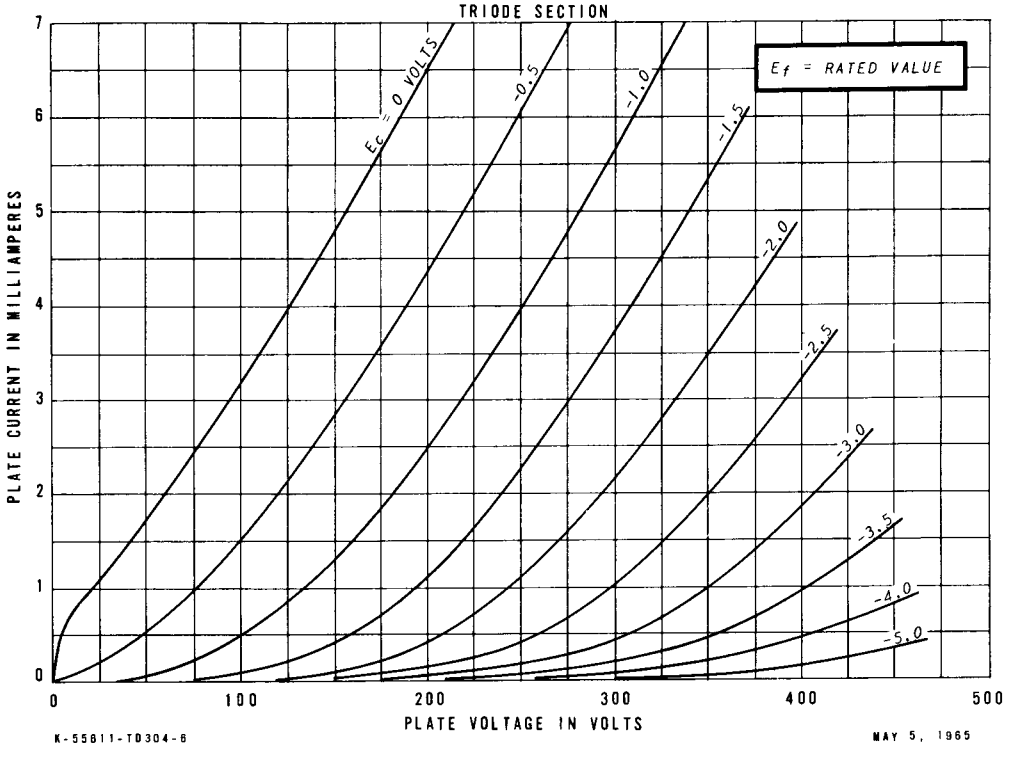
K-55611-T0304-4

MAY 5, 1965

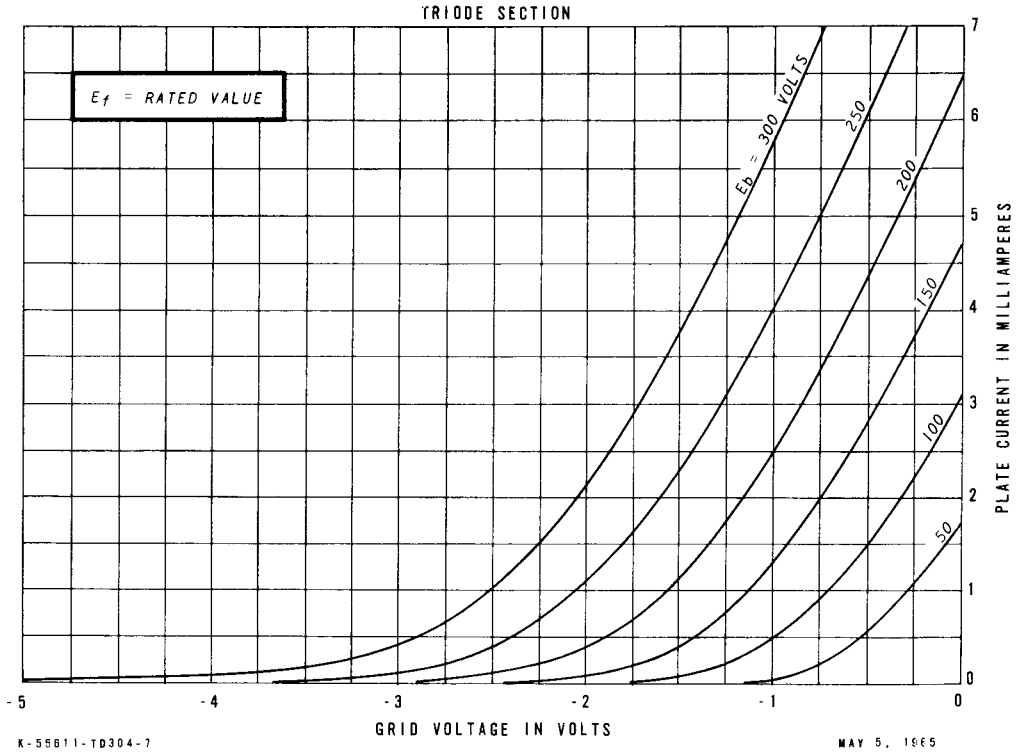
AVERAGE TRANSFER CHARACTERISTICS



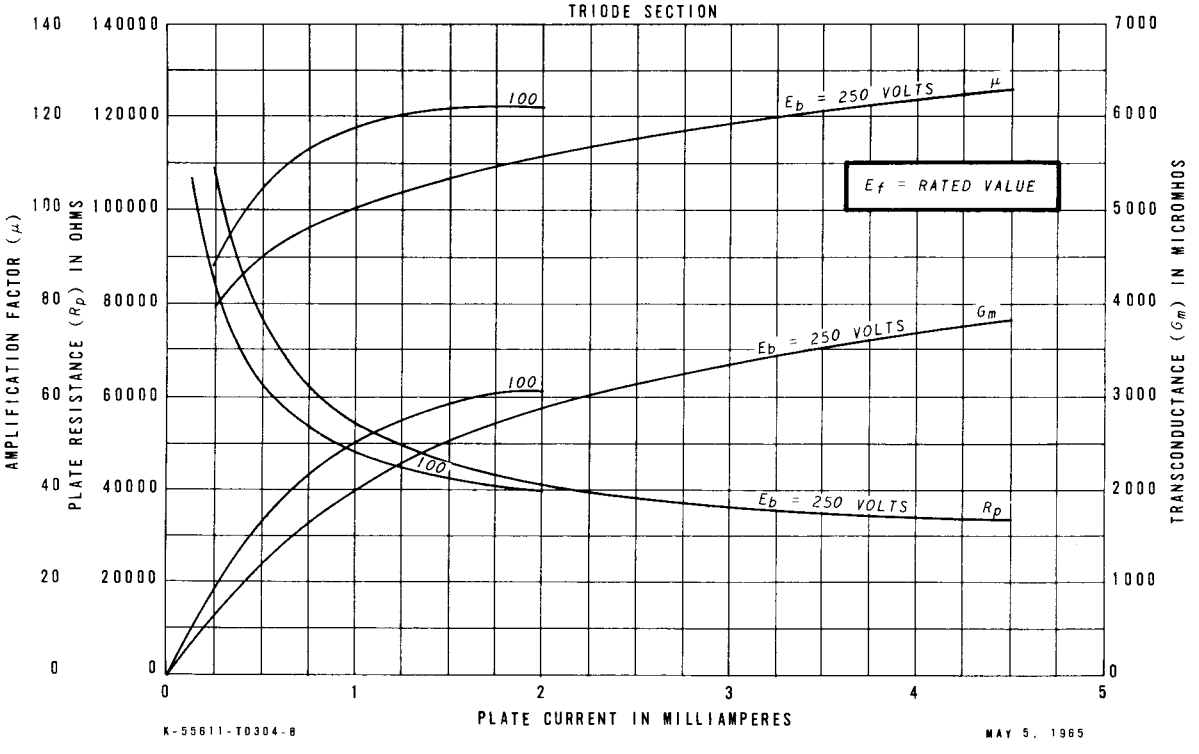
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

10T10

Compactron Dissimilar Double Pentode

The 10T10 is a compactron containing a sharp-cutoff, dual-control pentode (Section 2) and a power pentode (Section 1). The dual-control pentode is designed for use as an FM detector and the power pentode as an audio-frequency output amplifier in television receivers.

Except for heater characteristics and ratings, the 10T10 is identical to the 6T10.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	9.8	Volts
Heater Current■	0.6 ± 0.04	Amperes
Heater Warm-up Time, Average♦	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

■ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Compactron Pentode — Gated-Beam Discriminator

10Z10

The 10Z10 is a compactron containing a gated-beam discriminator and a beam pentode. The gated-beam discriminator is suitable for FM and TV limiter and discriminator applications, and the beam pentode for audio power output service.

Except for heater characteristics and ratings, the 10Z10 is identical to the 6Z10.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	10	Volts
Heater Current●	0.6 ± 0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

11AP4

CATHODE RAY TUBE

11 INCH, RECTANGULAR, GLASS	FACEPLATE -- SPHERICAL GRAY
FOCUS -- ELECTROSTATIC	INTEGRAL PLASTIC IMPLOSION BARRIER
DEFLECTION -- MAGNETIC	ALUMINIZED SCREEN
110 DEGREE DEFLECTION	EXTERNAL CONDUCTIVE COATING

----------DESCRIPTION AND RATING----------

The 11AP4 is a 11 inch electrostatic-focus and magnetic deflection glass lightweight picture tube employing an integral plastic implosion barrier. Other outstanding features include a short over-all length, a small neck diameter and a non ion trap gun designed for operation at an intermediate Grid no. 2 voltage for use in cathode-drive circuits. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angle, Approximate	
Horizontal	99 degrees
Vertical	82 degrees
Diagonal	110 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes, approx.	5 uuf
Grid #1 to all other electrodes, approx.	6 uuf
External Conductive Coating to Anode	750 max. uuf
	500 min. uuf
Heater Current at 6.3 volts	450 $\pm$ 23 ma.
Heater Warm-Up Time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center (Approximate)	48 Percent

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

from JEDEC release #4275, May 27, 1963

MECHANICAL DATA

Overall Length	8-15/16 ± 1/4 inches
Greatest Dimensions of Tube	
Diagonal	10-15/16 ± 1/8 inches
Width	9-13/16 ± 1/8 inches
Height	8-1/16 ± 1/8 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	10-1/4 inches
Horizontal Axis	9 inches
Vertical Axis	7-1/16 inches
Area	60 sq. inches
Neck Length	4-1/4 ± 1/8 inches
Bulb Contact	JEDEC No. J1-21
Base	JEDEC No. B7-208
Basing	8HR
Bulb Contact Alignment	
Anode Contact Aligns with Base Pin No. 4 ± 30 degrees	

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to Grid No. 1.

Maximum Anode Voltage	15,000 volts
Minimum Anode Voltage	9,000 volts
Maximum Grid #4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid #2 Voltage	100 volts
Maximum Grid #2 Voltage	250 volts
Cathode Voltage	
Maximum Positive Value	140 volts DC
Maximum Positive Peak Value	200 volts
Maximum Negative Value	0 volts DC
Maximum Negative Peak Value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 volts
Maximum Heater-Cathode Voltage	
Heater Negative with respect to Cathode	
During Warm-Up period not to exceed 15 sec.	410 volts
After equipment warm-up period	200 volts
Heater Positive with respect to Cathode	200 volts

TYPICAL OPERATING CONDITIONS (Cathode-Drive Service)

Anode Voltage	11,000 volts DC
Grid #4 Voltage (Focusing Electrode, Notes 2&3)	250 volts DC
Grid #2 Voltage	150 volts DC
Cathode to Grid #1 Voltage for cut-off (note 1)	31 to 49 volts

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5 max. megohm
Grid #2 Circuit Resistance	0.1 min. megohm
Focusing Electrode Circuit Resistance	0.1 min. megohm

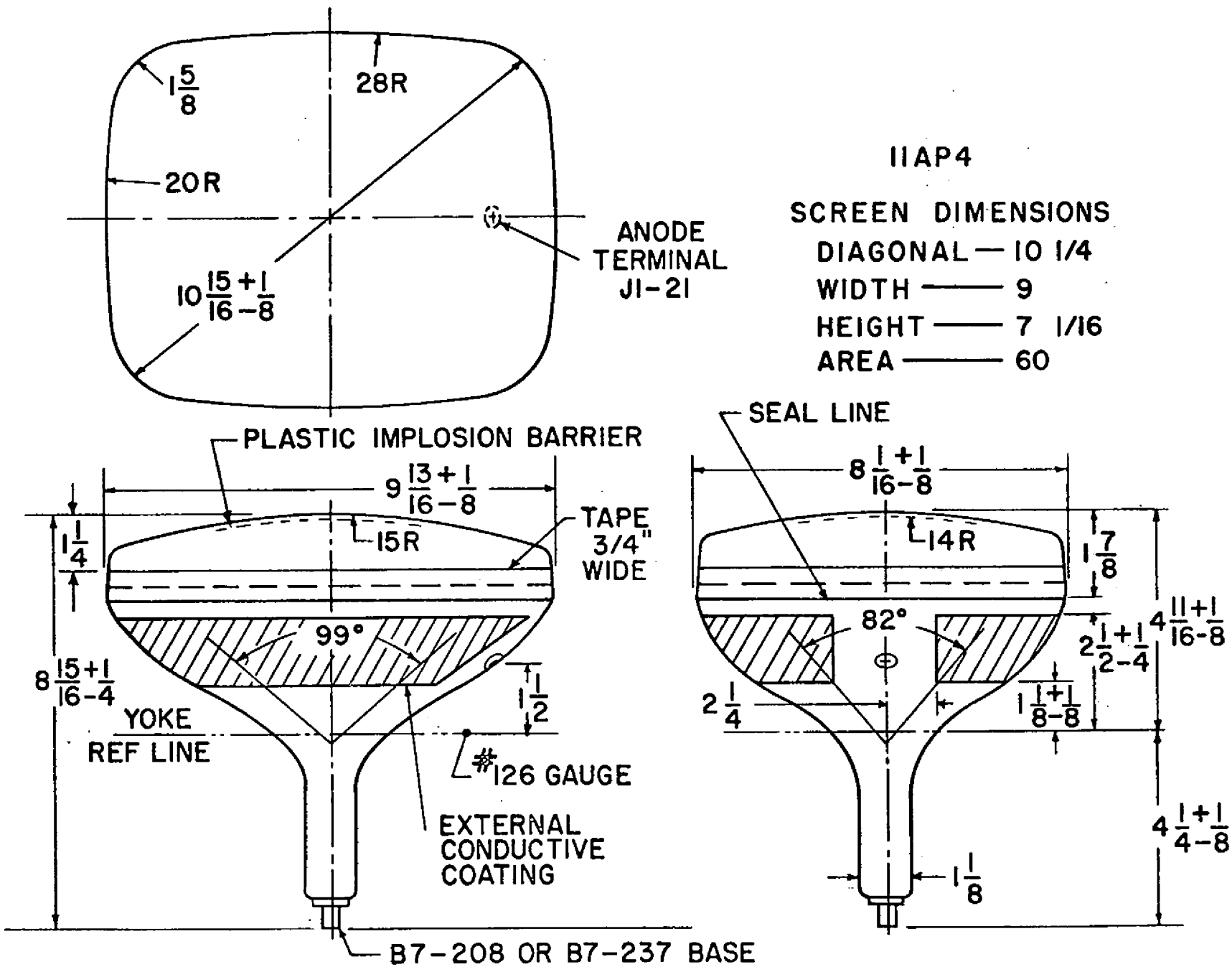
Protective resistance in Grid #2 and focusing electrical circuits is advisable to prevent damage to tube. If applicable, one resistor common to both circuits may be used.

NOTES:

1. Visual extinction of focused raster.

2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 ua on a 9" x 7-1/16" pattern from RCA 2F21 monoscope or equivalent.

3. Individual tubes will have satisfactory focus at some value between 0 and 400 volts.


11AP4
SCREEN DIMENSIONS
DIAGONAL — 10 1/4
WIDTH — 9
HEIGHT — 7 1/16
AREA — 60
1 5/8
28R
20R
10 15/16 +1/8
ANODE TERMINAL J1-21
PLASTIC IMPLOSION BARRIER
9 13/16 +1/8
TAPE 3/4" WIDE
15R
1 1/4
99°
8 15/16 +1/4
1 1/2
YOKE REF LINE
#126 GAUGE
EXTERNAL CONDUCTIVE COATING
B7-208 OR B7-237 BASE
SEAL LINE
8 1/16 +1/8
14R
1 7/8
82°
2 1/2 +1/4
4 11/16 +1/8
2 1/4
1 1/8 +1/8
4 1/4 +1/8
1 1/8

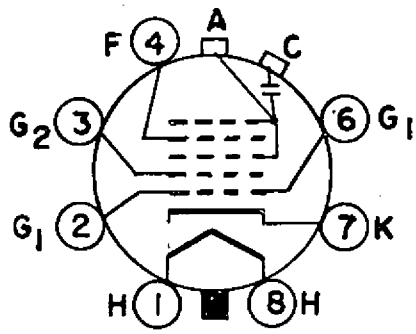
OUTLINE NOTES

1. The reference line is determined by the intersection of the plane C-C of gage (EIA No. 126) with the glass funnel.

2. Deflection angle on the diagonal is 110^{o}.

3. Anode terminal aligns with pin no. 4 $\pm$30 degrees.

4. Use a non-rigidly mounted socket with flexible leads. Bottom circumference of base wafer will fall within 1-3/4 inch diameter circle concentric with the bulb axis.



BASING DIAGRAM
8 HR

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

ELECTRONICS

11BQ11

COMPACTRON DISSIMILAR DOUBLE PENTODE

DESCRIPTION AND RATING

The 11BQ11 is a compactron containing a remote-cutoff pentode (Section 1) and a sharp-cutoff pentode (Section 2). It is intended primarily for use in the intermediate-frequency amplifier stages of television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	11.2	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, average§	11	Seconds

Direct Interelectrode Capacitances¶

Section 1

Grid-Number 1 to Plate: (1g1 to 1p)	0.022	pf
Input: 1g1 to (1k + 1g2 + 1g3 + h + i.s.)	10	pf
Output: 1p to (1k + 1g2 + 1g3 + h + i.s.)	2.8	pf

Section 2

Grid-Number 1 to Plate: (2g1 to 2p)	0.024	pf
Input: 2g1 to (2k + 2g2 + 2g3 + 1g3 + h + i.s.)	11	pf
Output: 2p to (2k + 2g2 + 2g3 + 1g3 + h + i.s.)	2.8	pf

Coupling

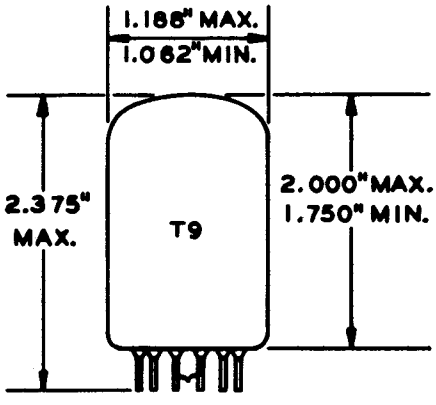
Plate to Plate: (1p to 2p), maximum	0.015	pf
Grid-Number 1, Section 1, to Plate, Section 2: (1g1 to 2p), maximum	0.002	pf
Grid-Number 1, Section 2, to Plate, Section 1: (2g1 to 1p), maximum	0.008	pf
Grid-Number 1, Section 1, to Grid-Number 1, Section 2: (1g1 to 2g1), maximum	0.002	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

PHYSICAL DIMENSIONS

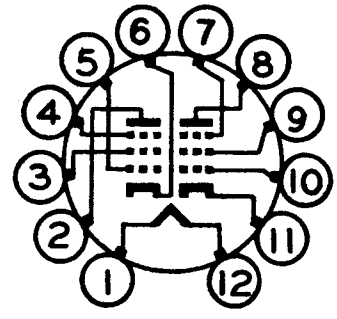


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate (Section 2)
Pin 3 - Grid Number 2 (Screen) (Section 2)
Pin 4 - Grid Number 3 (Suppressor) (Section 2)
Pin 5 - Grid Number 1 (Section 2)
Pin 6 - Cathode (Section 2)
Pin 7 - Grid Number 3 (Suppressor) (Section 1) and Internal Shield
Pin 8 - Plate (Section 1)
Pin 9 - Grid Number 2 (Screen) (Section 1)
Pin 10 - Grid Number 1 (Section 1)
Pin 11 - Cathode (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12DM

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

SECTION 1

Plate Voltage	330	Volts
Suppressor Voltage	0	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	3.1	Watts
Screen Dissipation	0.65	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	1.0	Megohms

SECTION 2

Plate Voltage	330	Volts
Suppressor Voltage	0	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	3.1	Watts
Screen Dissipation	0.65	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	0.25	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

SECTION 1

Plate Voltage	125	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Plate Resistance, approximate	0.2	Megohms
Transconductance	10500	Micromhos
Plate Current	11	Milliamperes
Screen Current	3.5	Milliamperes
Grid-Number 1 Voltage, approximate		
Gm = 50 Micromhos	-15	Volts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

SECTION 2

Plate Voltage	125	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Plate Resistance, approximate	0.2	Megohms
Transconductance	13000	Micromhos
Plate Current	11	Milliamperes
Screen Current	3.8	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 20 Microamperes	-3	Volts

NOTES

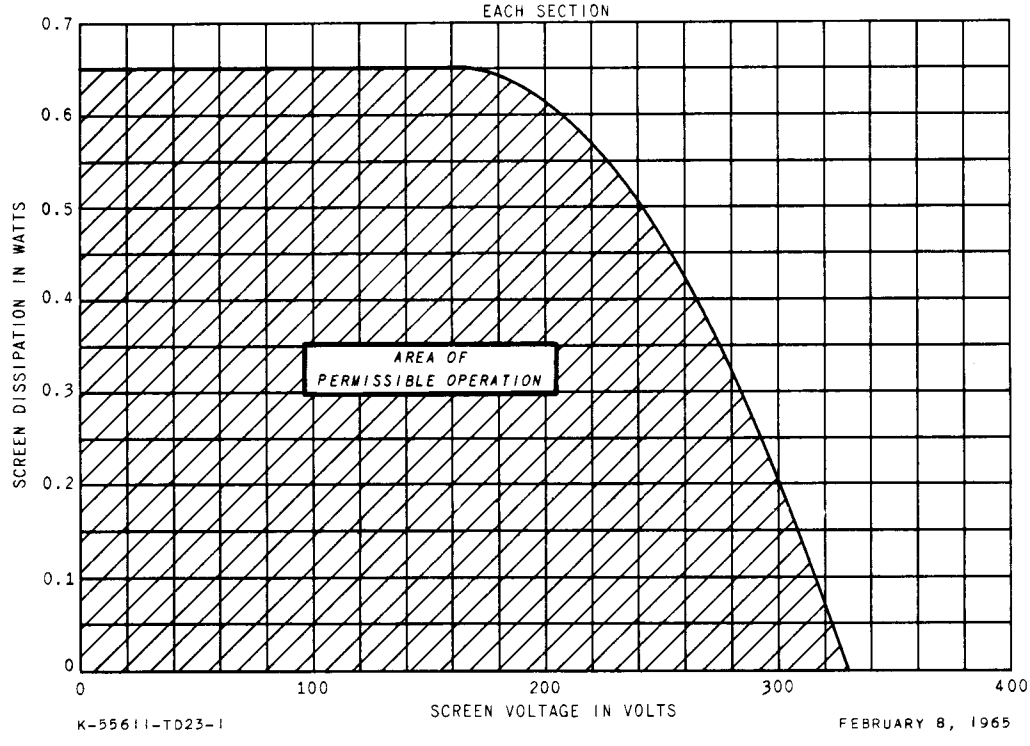
* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

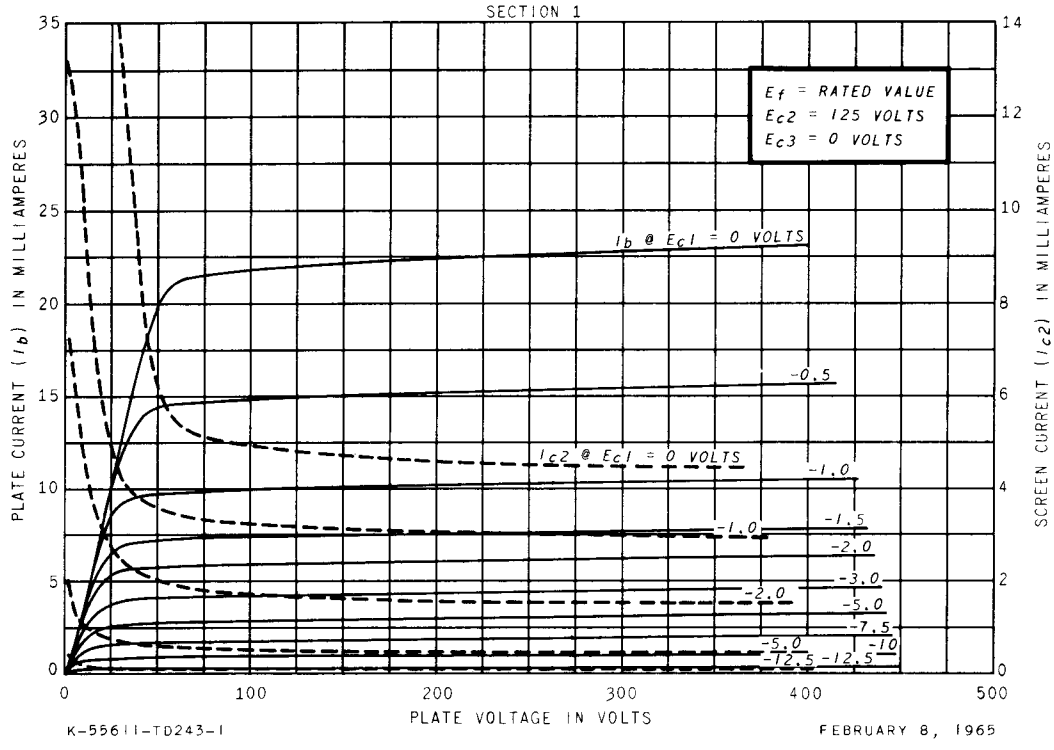
§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ With external shield (EIA 309) connected to cathode of section under test.

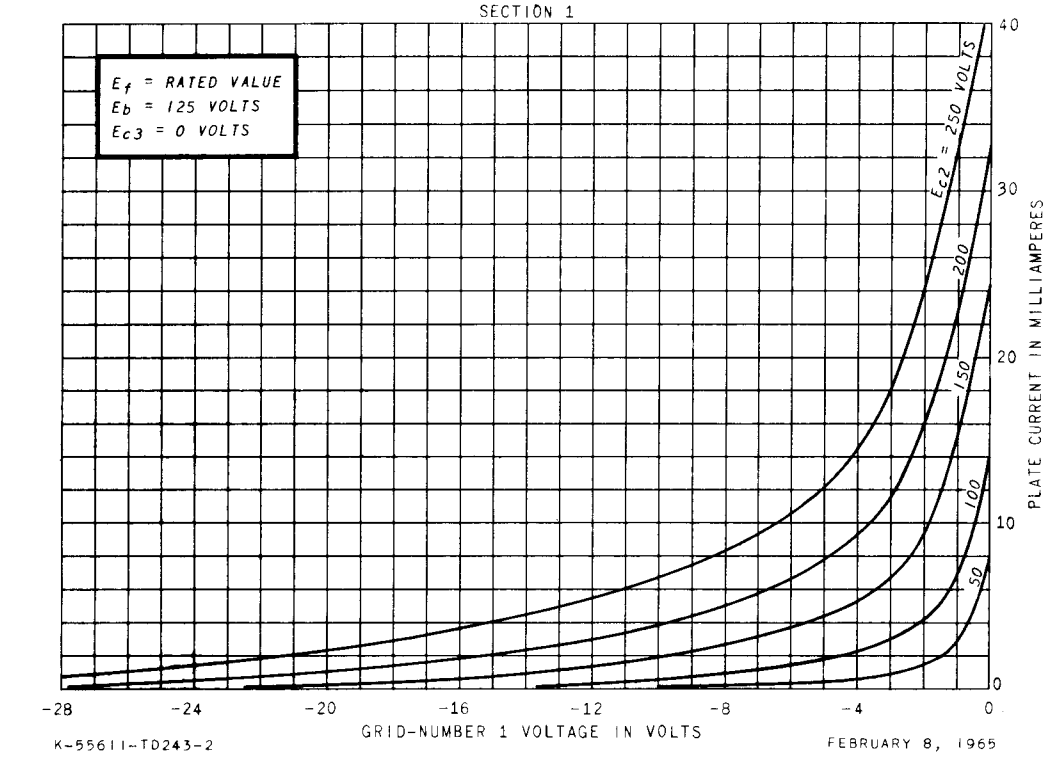
SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

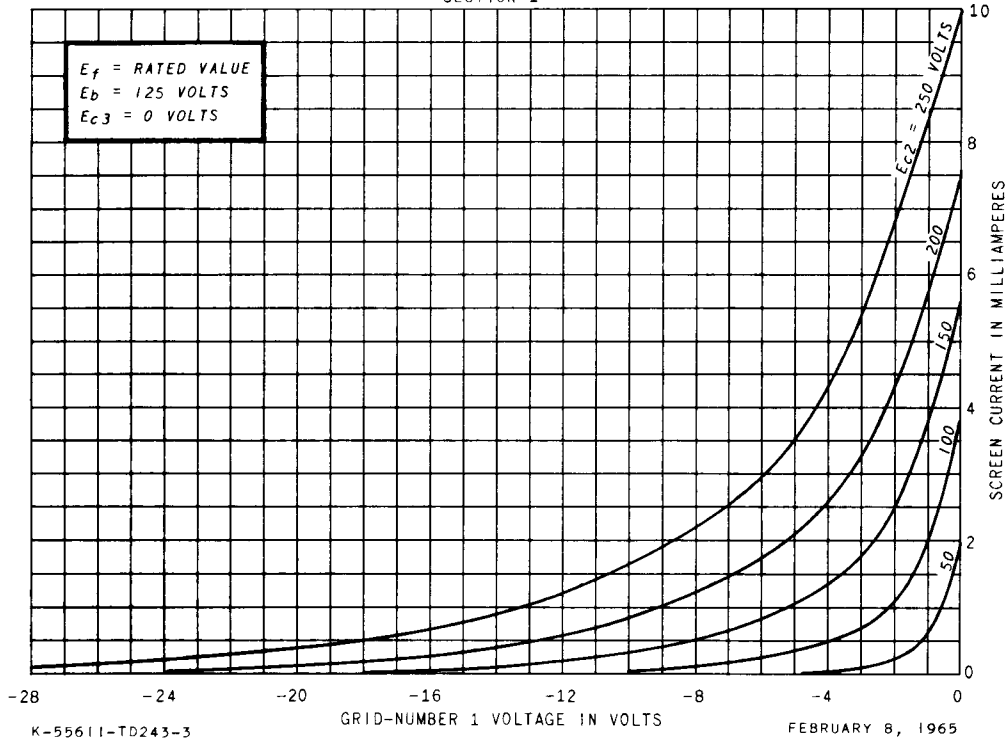


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

SECTION 1

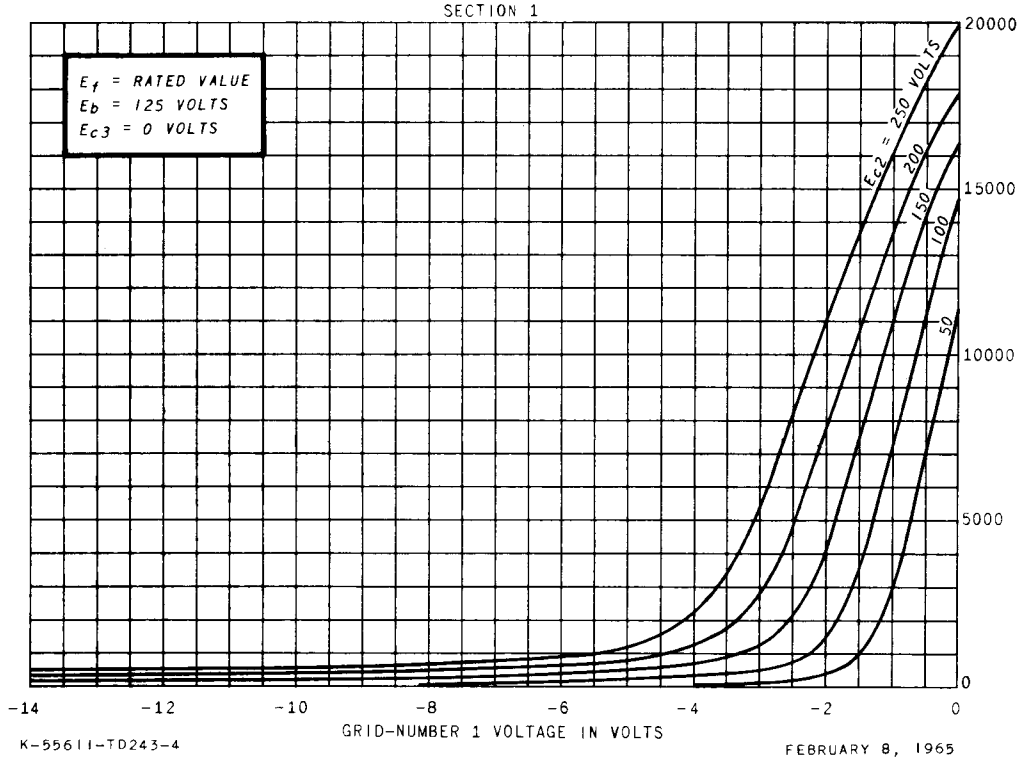


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FEBRUARY 8, 1965

AVERAGE TRANSFER CHARACTERISTICS

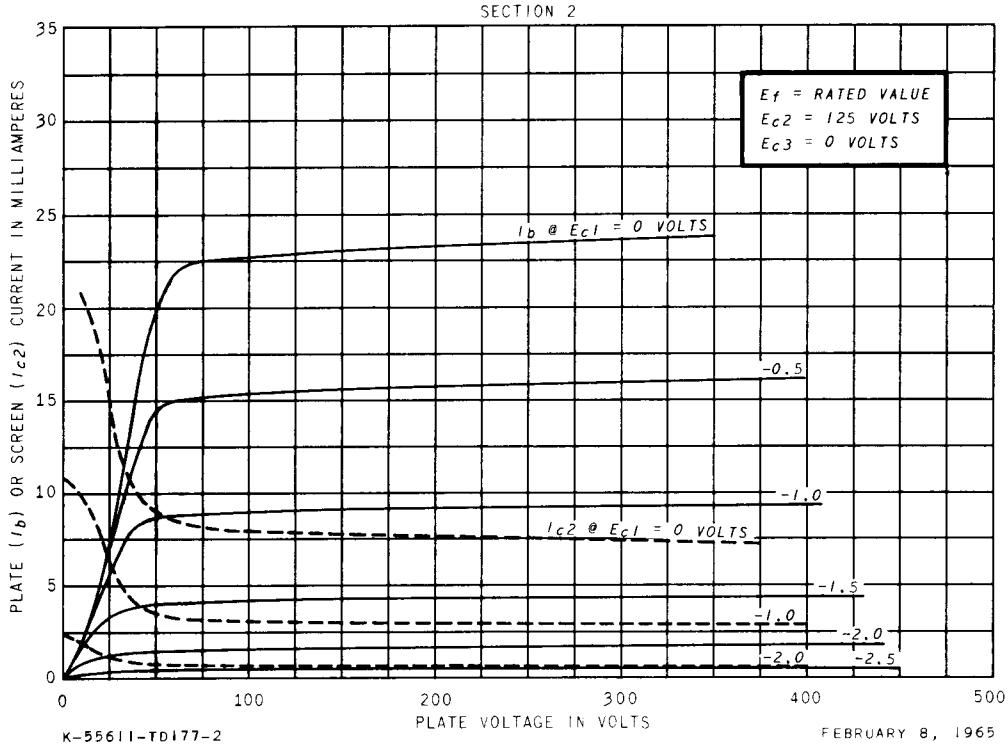
SECTION 1



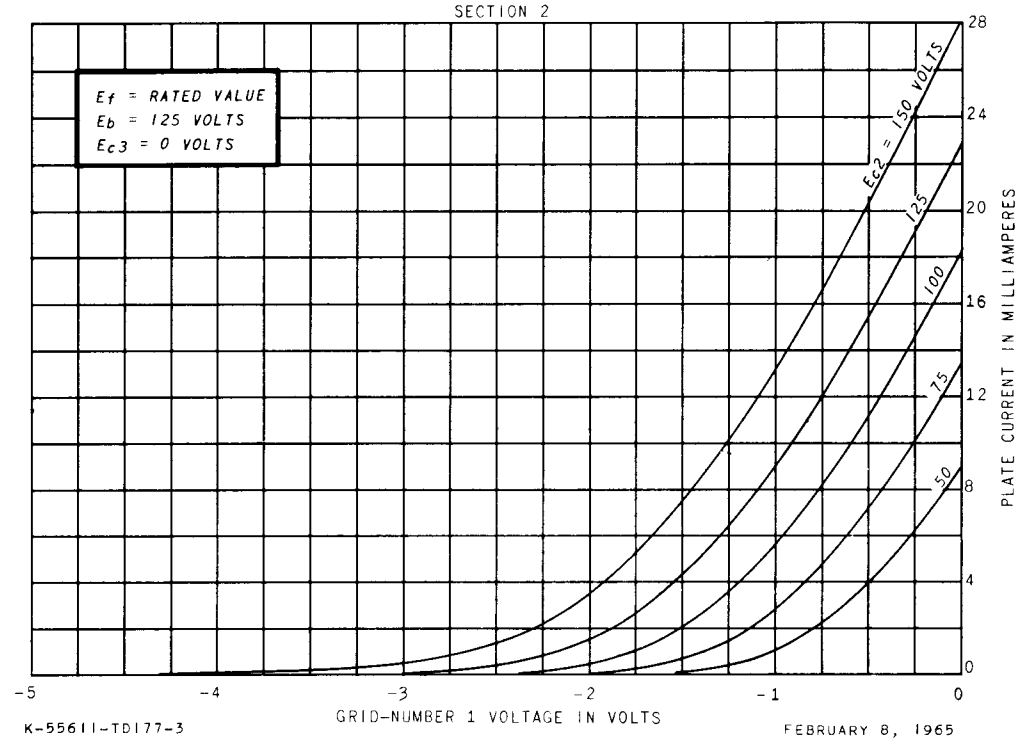
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FEBRUARY 8, 1965

AVERAGE PLATE CHARACTERISTICS

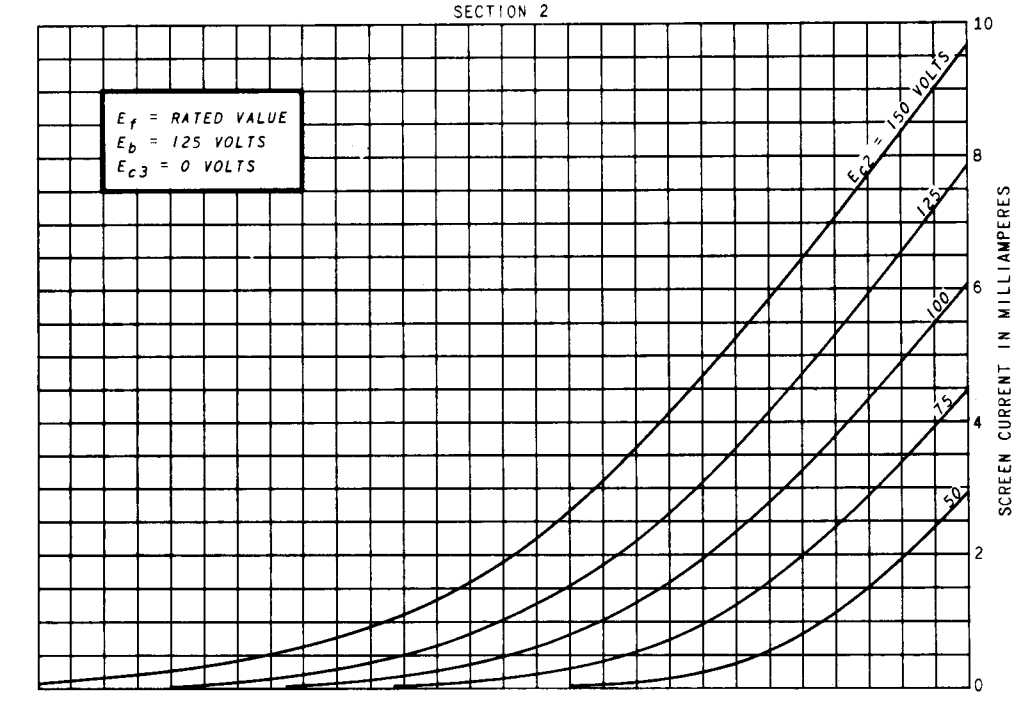


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

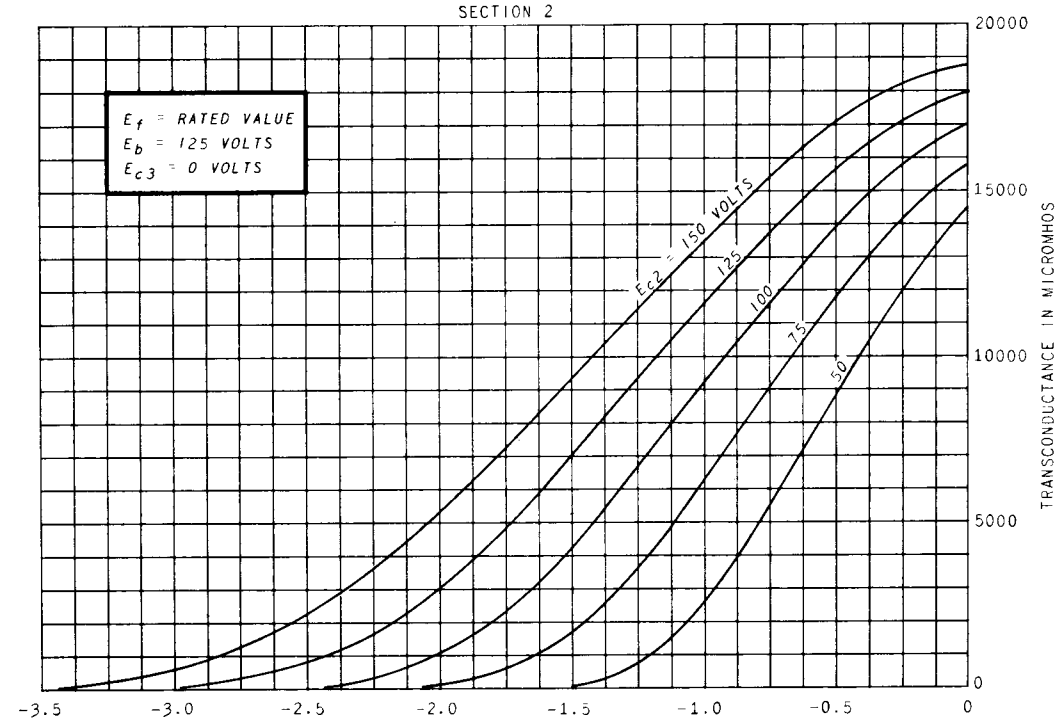


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FEBRUARY 8, 1965

AVERAGE TRANSFER CHARACTERISTICS

SECTION 2



K-55611-TD177-5

FEBRUARY 8, 1965

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Compactron Dissimilar-Double-Triode Pentode

11BT11

The 11BT11 is a compactron containing a high-mu triode, a medium-mu triode, and a sharp-cutoff, frame-grid pentode. The pentode is intended for video amplifier service and the triodes for general-purpose applications.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	10.7	Volts
Heater Current‡	0.6±0.04	Amperes
Heater Warm-up Time, Average§	11	Seconds

Direct Interelectrode Capacitances¶

Triode (Section 1)

Grid to Plate: (1Tg to 1Tp)	1.9	pf
Input: 1Tg to (1Tk + Pg3 + h + i.s.)	2.8	pf
Output: 1Tp to (1Tk + Pg3 + h + i.s.)	2.0	pf

Triode (Section 2)

Grid to Plate: (2Tg to 2Tp)	2.6	pf
Input: 2Tg to (2Tk + 1Tk + Pg3 + h + i.s.)	4.6	pf
Output: 2Tp to (2Tk + 1Tk + Pg3 + h + i.s.)	3.6	pf

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.13	pf
Input: Pg1 to (Pk + 1Tk + Pg2 + Pg3 + h + i.s.)	13	pf
Output: Pp to (Pk + 1Tk + Pg2 + Pg3 + h + i.s.)	4.6	pf

Coupling

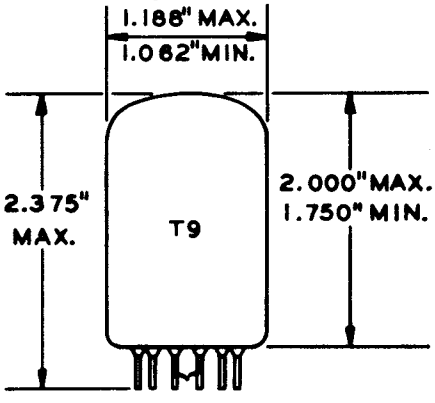
Pentode Plate to Triode Plate (Section 2): (Pp to 2Tp), maximum	0.08	pf
Triode Plate (Section 1) to Triode Plate (Section 2): (1Tp to 2Tp), maximum	0.19	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

PHYSICAL DIMENSIONS

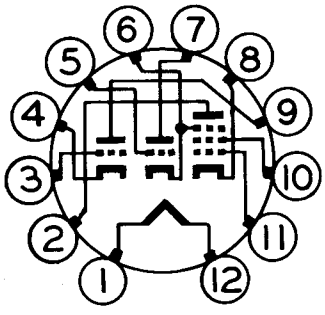


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Pentode Plate
Pin 3 - Triode Grid (Section 2)
Pin 4 - Triode Cathode (Section 2)
Pin 5 - Triode Grid (Section 1)
Pin 6 - Triode Cathode (Section 1), Pentode Grid Number 3, and Internal Shield
Pin 7 - Triode Plate (Section 1)
Pin 8 - Pentode Cathode
Pin 9 - Triode Plate (Section 2)
Pin 10 - Pentode Grid Number 2 (Screen)
Pin 11 - Pentode Grid Number 1
Pin 12 - Heater

BASING DIAGRAM



EIA 12GS

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Pentode Section

Plate Voltage	165	Volts
Screen Voltage	165	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	3.5	Watts
Screen Dissipation	1.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	50000	Ohms
With Cathode Bias	100000	Ohms

Triode (Section 1)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Triode (Section 2)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	35	150	Volts
Screen Voltage	100	100	Volts
Grid-Number 1 Voltage	0	---	Volts
Cathode-Bias Resistor	---	82	Ohms
Plate Resistance, approximate	---	51000	Ohms
Transconductance	---	19000	Micromhos
Plate Current	54	17.4	Milliamperes
Screen Current	13.5	3.2	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	---	-6.6	Volts

Triode (Section 1)

Plate Voltage		200	Volts
Cathode-Bias Resistor		270	Ohms
Amplification Factor		69	
Plate Resistance, approximate		12500	Ohms
Transconductance		5500	Micromhos
Plate Current		7.1	Milliamperes
Grid Voltage, approximate Ib = 50 Microamperes		-5.5	Volts

Triode (Section 2)

Plate Voltage		200	Volts
Cathode-Bias Resistor		470	Ohms
Amplification Factor		40	
Plate Resistance, approximate		7600	Ohms
Transconductance		5300	Micromhos
Plate Current		7.2	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes		-8	Volts

NOTES

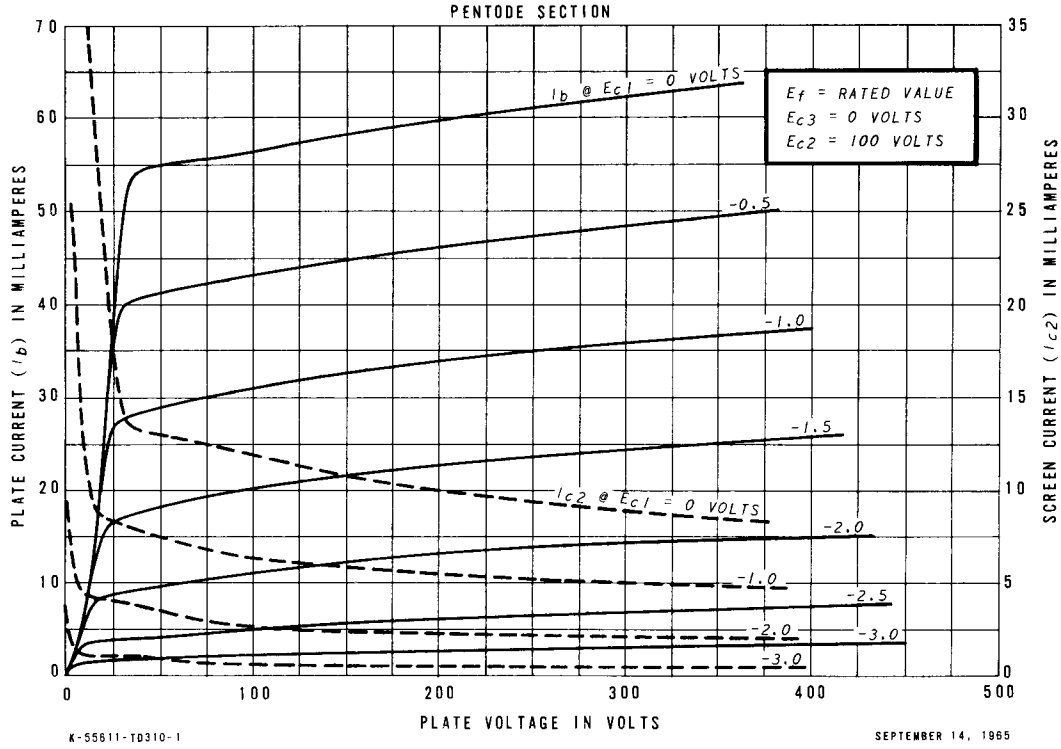
* Heater voltage for a bogey tube at If = 0.6 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ Without external shield.

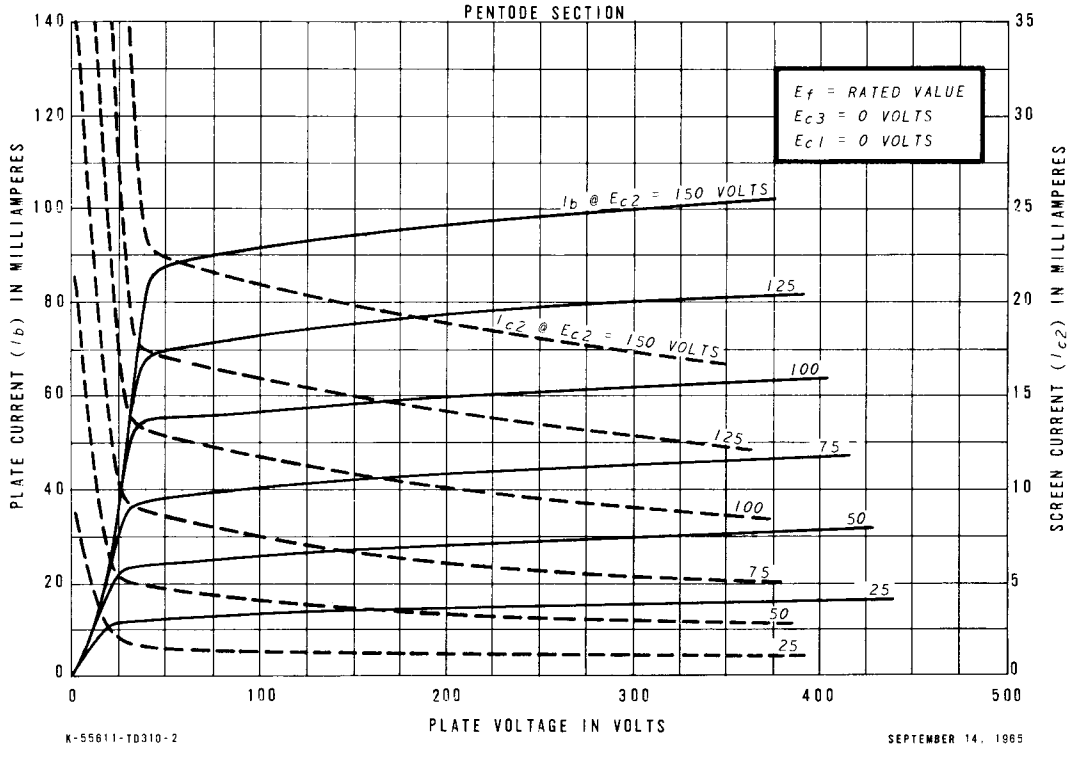
AVERAGE PLATE CHARACTERISTICS



K-55611-TD310-1

SEPTEMBER 14, 1965

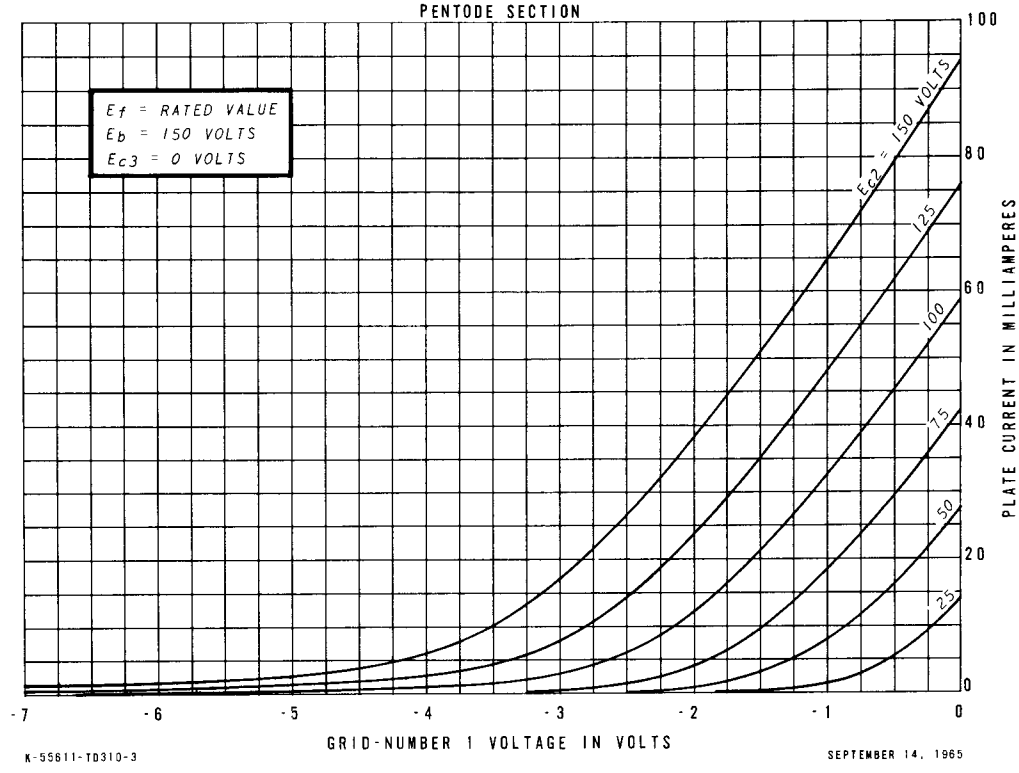
AVERAGE PLATE CHARACTERISTICS



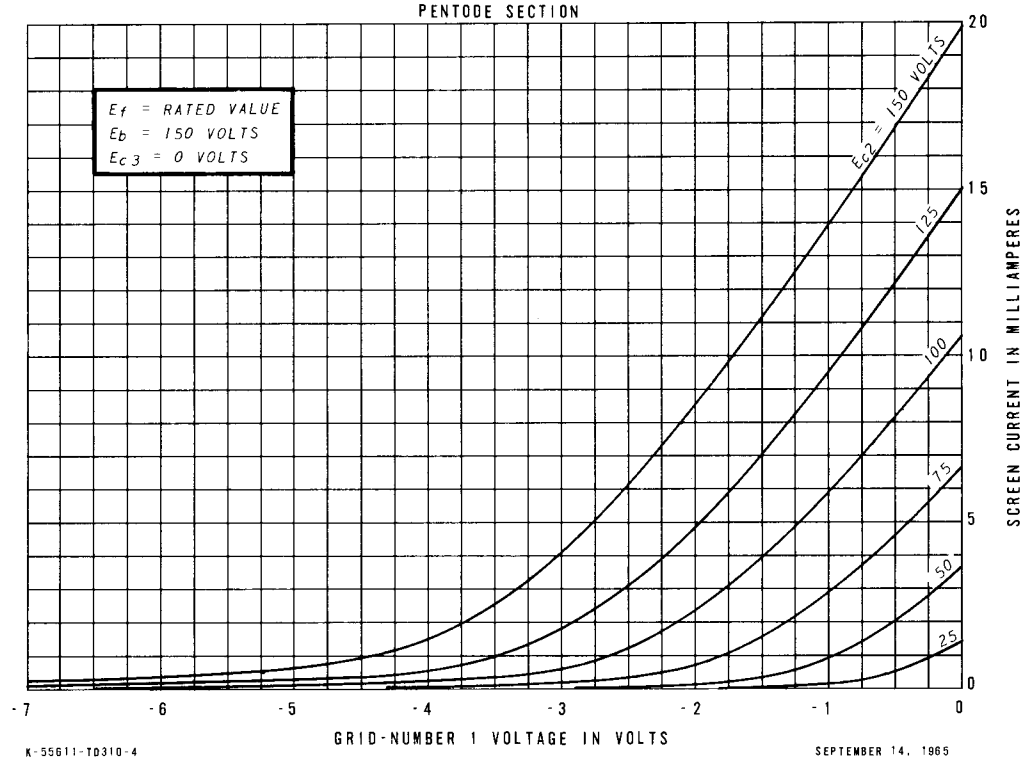
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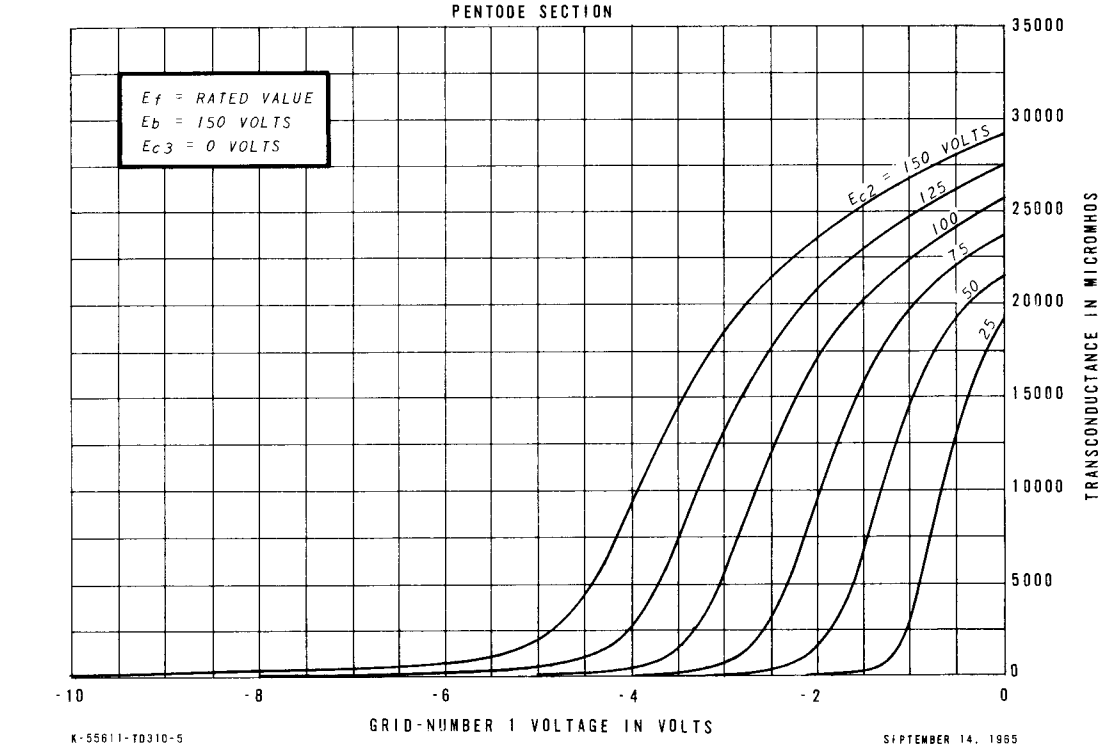
AVERAGE TRANSFER CHARACTERISTICS



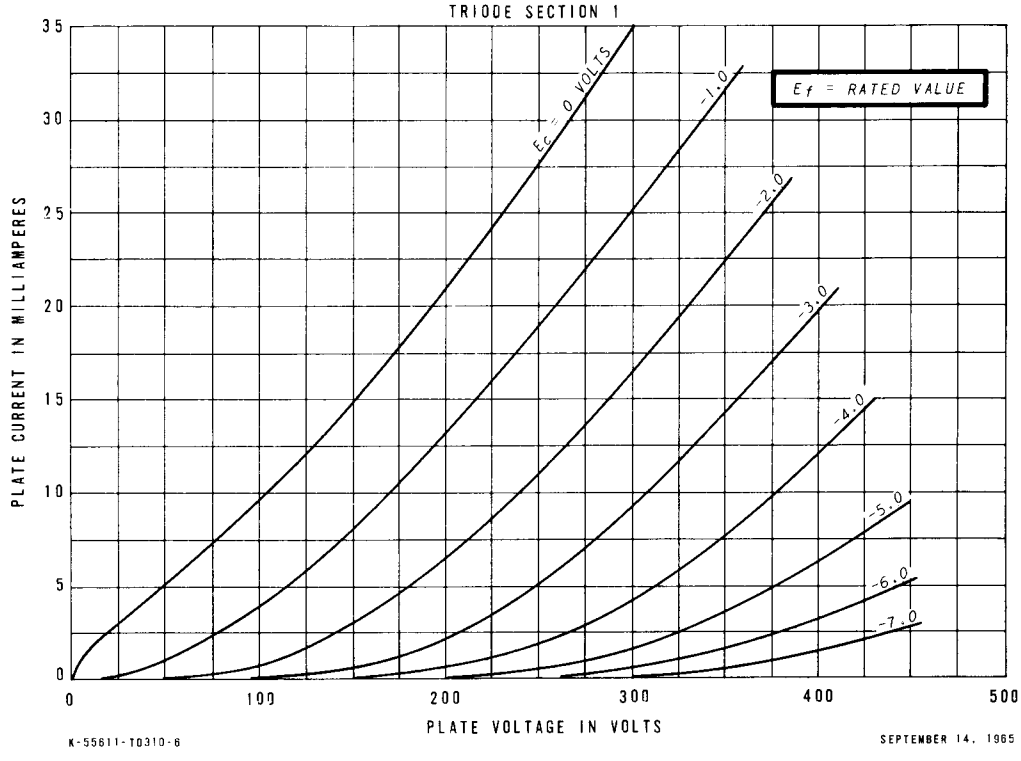
AVERAGE TRANSFER CHARACTERISTICS



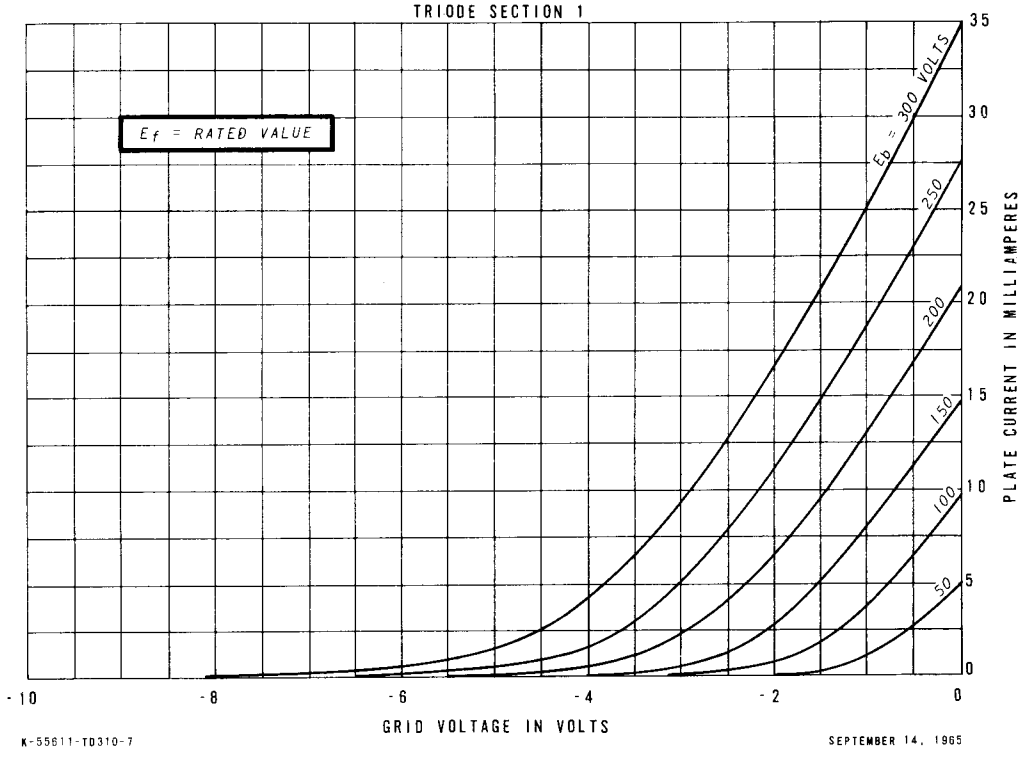
AVERAGE TRANSFER CHARACTERISTICS



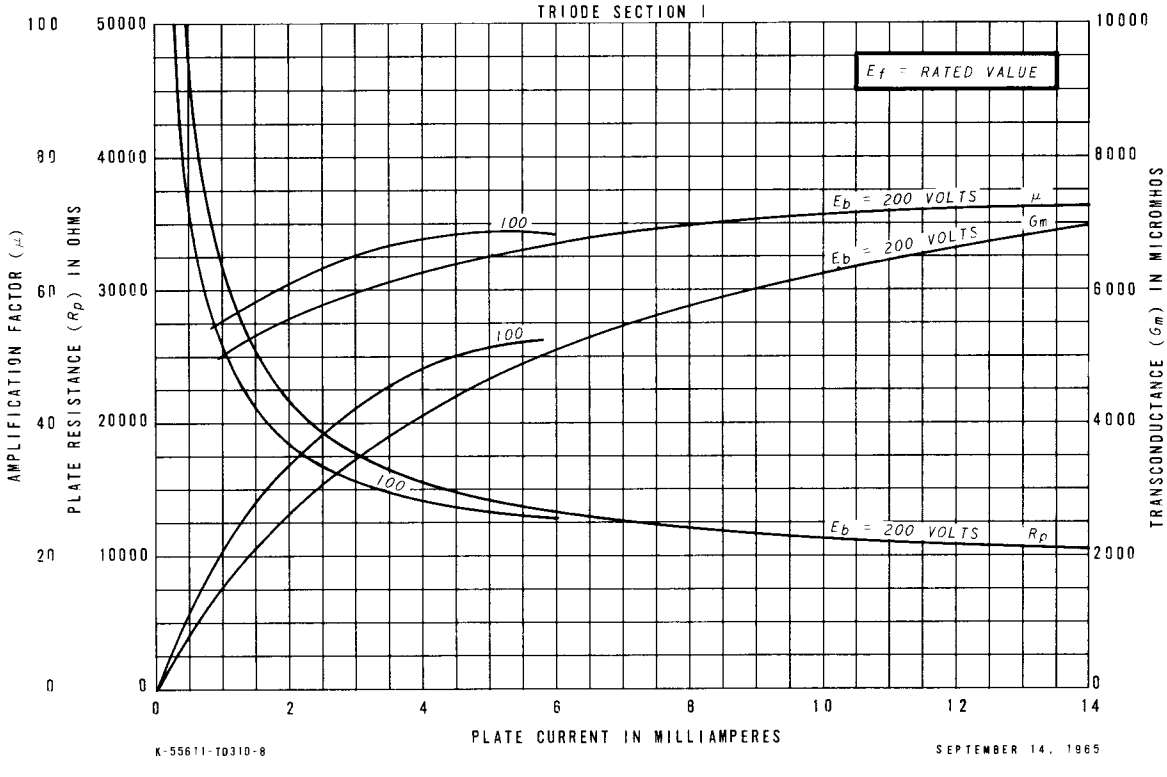
AVERAGE PLATE CHARACTERISTICS



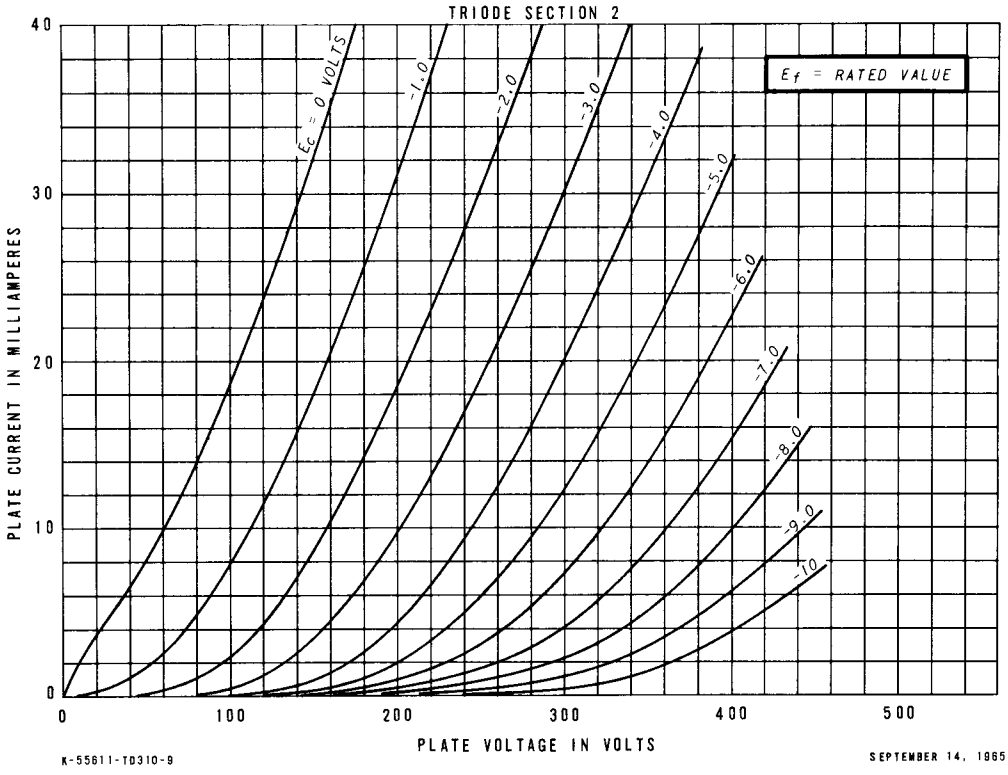
AVERAGE TRANSFER CHARACTERISTICS



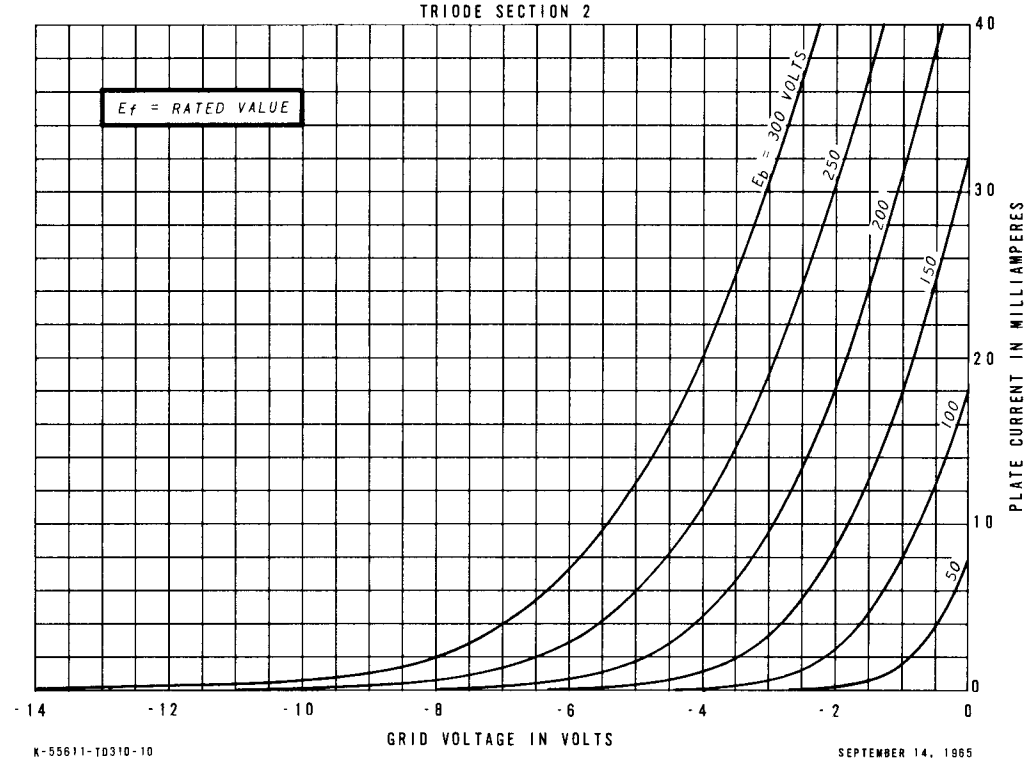
AVERAGE CHARACTERISTICS



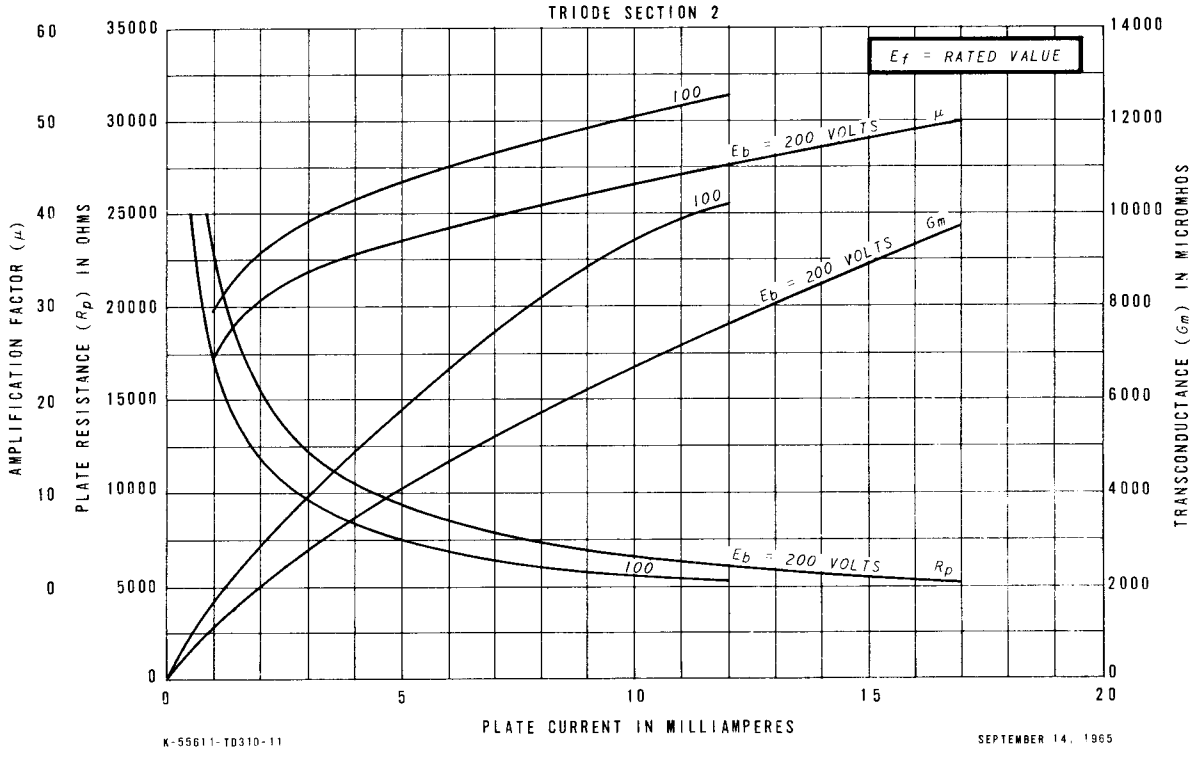
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Compactron Dissimilar-Double-Triode Pentode

11CA11

The 11CA11 is a multifunction compactron containing a high-gain, frame-grid video amplifier pentode which is particularly well suited for color television use. It also contains two high-mu, high-transconductance triodes designed for cathode follower and video amplifier applications.

Except for heater characteristics and ratings, the 11CA11 is identical to the 6CA11.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	10.7	Volts
Heater Current‡	0.6±0.04	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.6 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

11CF11

Compactron Dissimilar-Double-Triode Pentode

- COLOR TV TYPE
- FRAME-GRID VIDEO AMPLIFIER
- 21200 MICROMHOS
- MULTI-FUNCTION
- HIGH TRANSCONDUCTANCE TRIODES

The 11CF11 is a multi-function compactron containing a high-gain, frame-grid video amplifier pentode which is particularly well suited for color television use. It also contains two high-mu, high-transconductance triodes designed for cathode follower and video amplifier applications.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	10.7	Volts
Heater Current■	0.6 ± 0.04	Amperes
Heater Warm-up Time, Average♦	11	Seconds

Direct Interelectrode Capacitances▲

Triode (Section 1)

Grid to Plate: (T1g to T1p)	2.7	pf
Input: T1g to (T1k + T2k + Pg3 + h + i.s.)	4.7	pf
Output: T1p to (T1k + T2k + Pg3 + h + i.s.)	4.0	pf

Triode (Section 2)

Grid to Plate: T2g to T2p)	2.1	pf
Input: T2g to (T2k + T1k + Pg3 + h + i.s.)	2.8	pf
Output: T2p to (T2k + T1k + Pg3 + h + i.s.)	2.0	pf

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.13	pf
Input: Pg1 to (Pk + T2k + Pg2 + Pg3 + h + i.s.)	12.3	pf
Output: Pp to (Pk + T2k + Pg2 + Pg3 + h + i.s.)	4.6	pf

Coupling

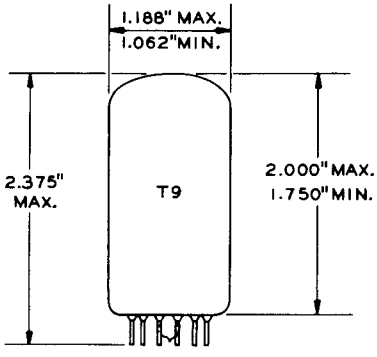
Pentode Plate to Triode Plate (Section 2): (Pp to T2p), maximum	0.04	pf
Triode Plate (Section 1) to Triode Plate (Section 2): (T1p to T2p), maximum	0.10	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

PHYSICAL DIMENSIONS

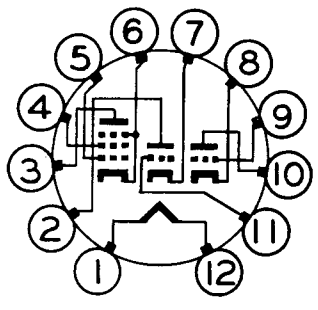


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Triode Plate (Section 2)
Pin 3 - Pentode Plate
Pin 4 - Pentode Grid Number 2 (Screen)
Pin 5 - Pentode Grid Number 1
Pin 6 - Pentode Cathode and Beam Plate
Pin 7 - Triode Cathode (Section 2)
Pin 8 - Triode Cathode (Section 1)
Pin 9 - Triode Grid (Section 1)
Pin 10 - Triode Plate (Section 1)
Pin 11 - Triode Grid (Section 2)
Pin 12 - Heater

BASING DIAGRAM



EIA 12HW

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Pentode Section

Plate Voltage	330	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	5.0	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	50000	Ohms
With Cathode Bias	100000	Ohms

Triode (Section 1)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Triode (Section 2)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.5	Watts
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	40	200	Volts
Screen Voltage	120	120	Volts
Grid-Number 1 Voltage	0	---	Volts
Cathode-Bias Resistor	---	65	Ohms
Plate Resistance, approximate	---	490000	Ohms
Transconductance	---	21200	Micromhos
Plate Current	68	27.5	Milliamperes
Screen Current	17.6	4.9	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 100 Microamperes	---	-5.0	Volts

Triode (Section 1)

Plate Voltage	200	Volts
Cathode-Bias Resistor	270	Ohms
Amplification Factor	69	
Plate Resistance, approximate	12400	Ohms
Transconductance	5500	Micromhos
Plate Current	7.1	Milliamperes
Grid Voltage, approximate		
Ib = 100 Microamperes	-5.5	Volts

Triode (Section 2)

Plate Voltage	200	Volts
Cathode-Bias Resistor	270	Ohms
Amplification Factor	59	
Plate Resistance, approximate	9200	Ohms
Transconductance	6300	Micromhos
Plate Current	7.6	Milliamperes
Grid Voltage, approximate		
Ib = 100 Microamperes	-6.3	Volts

NOTES

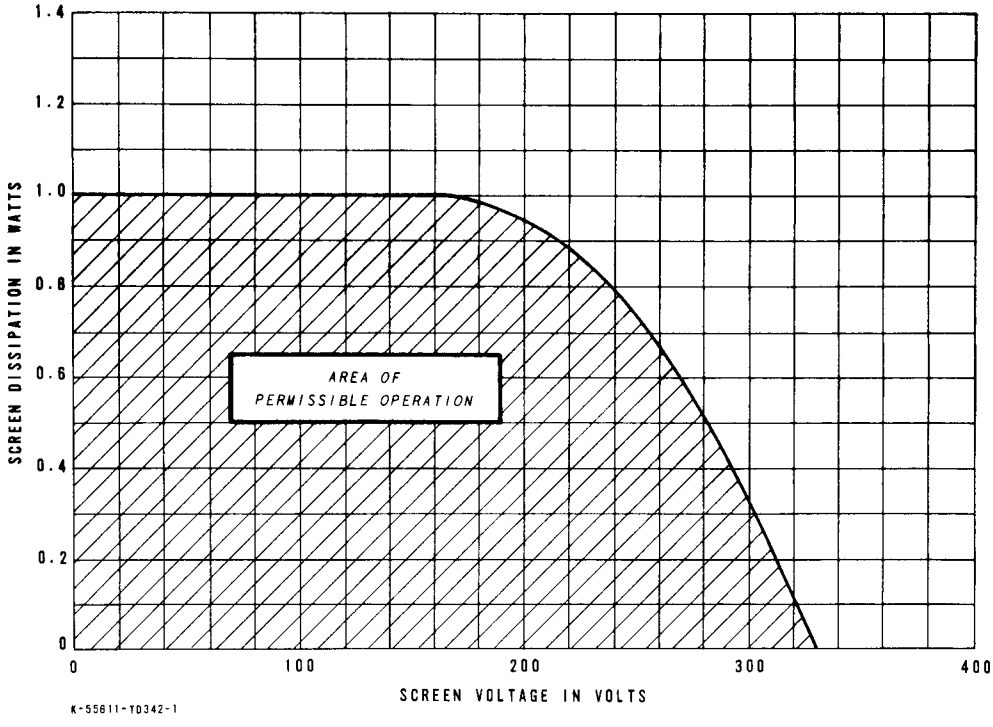
★ Heater voltage for a bogey tube at If = 0.6 amperes.

■ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

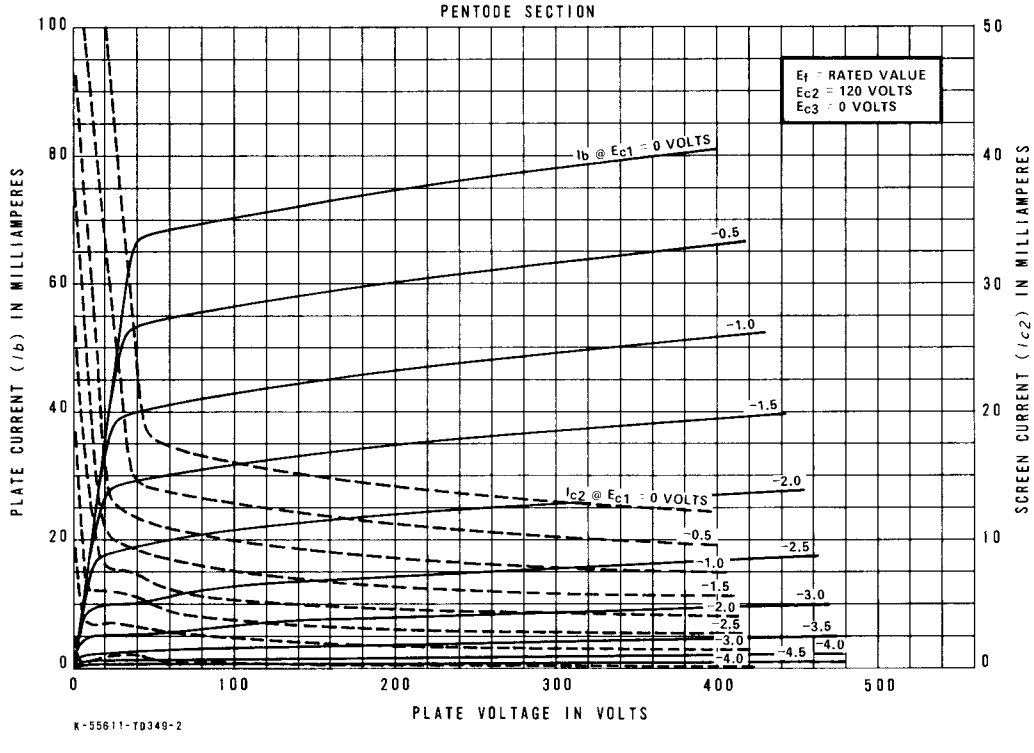
▲ Without external shield.

SCREEN RATING CHART

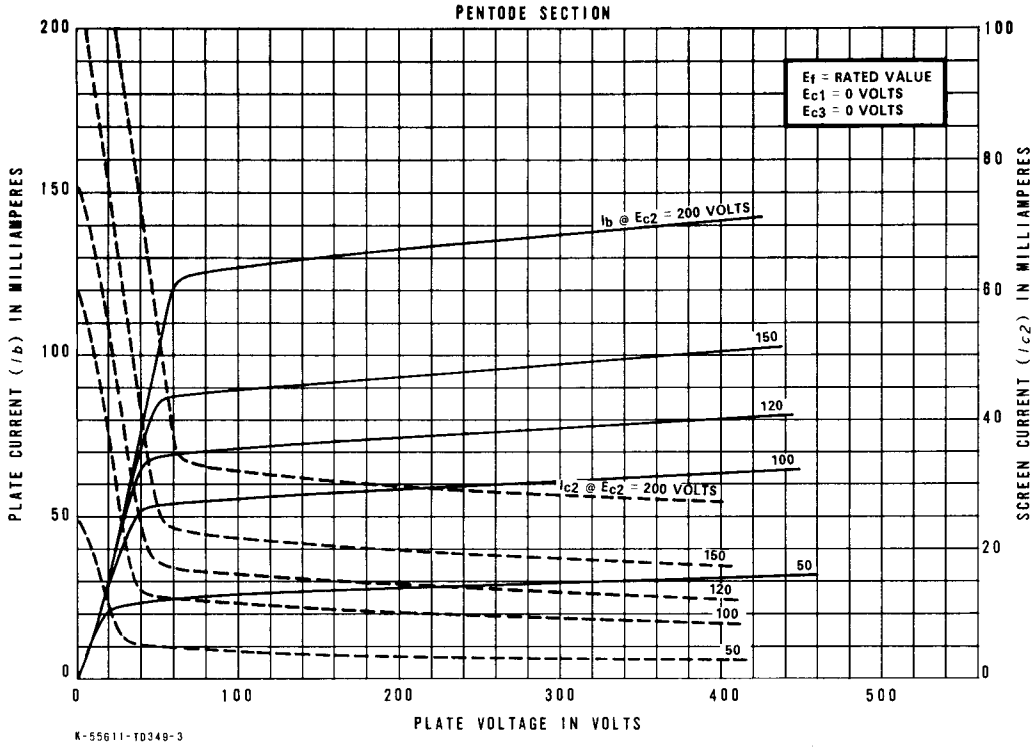


AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

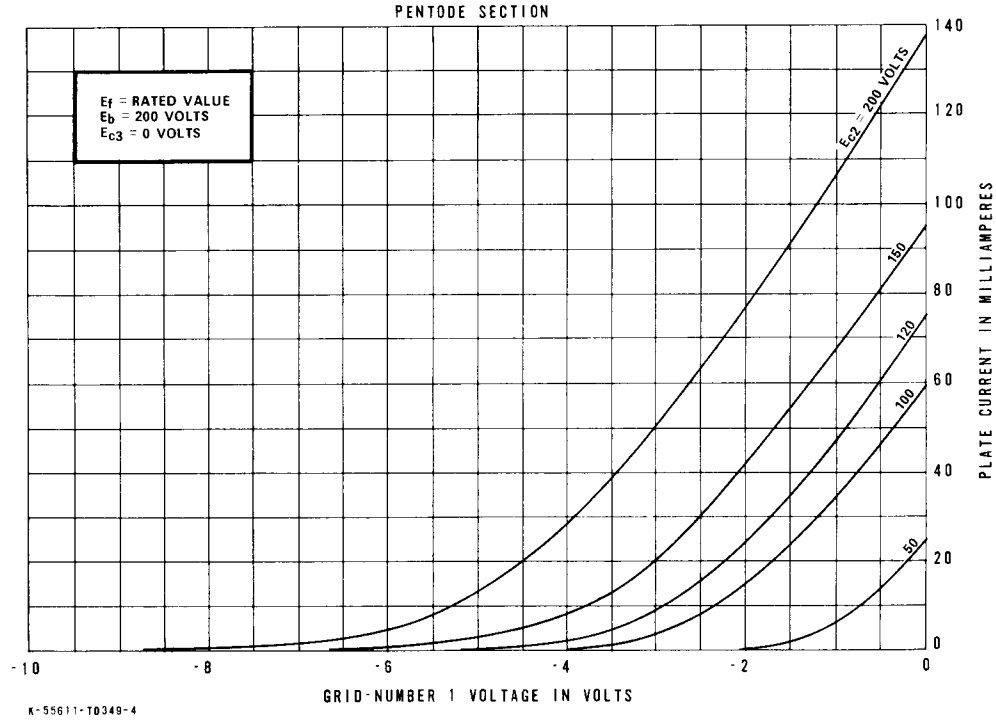


AVERAGE PLATE CHARACTERISTICS



K-55611-T0348-3

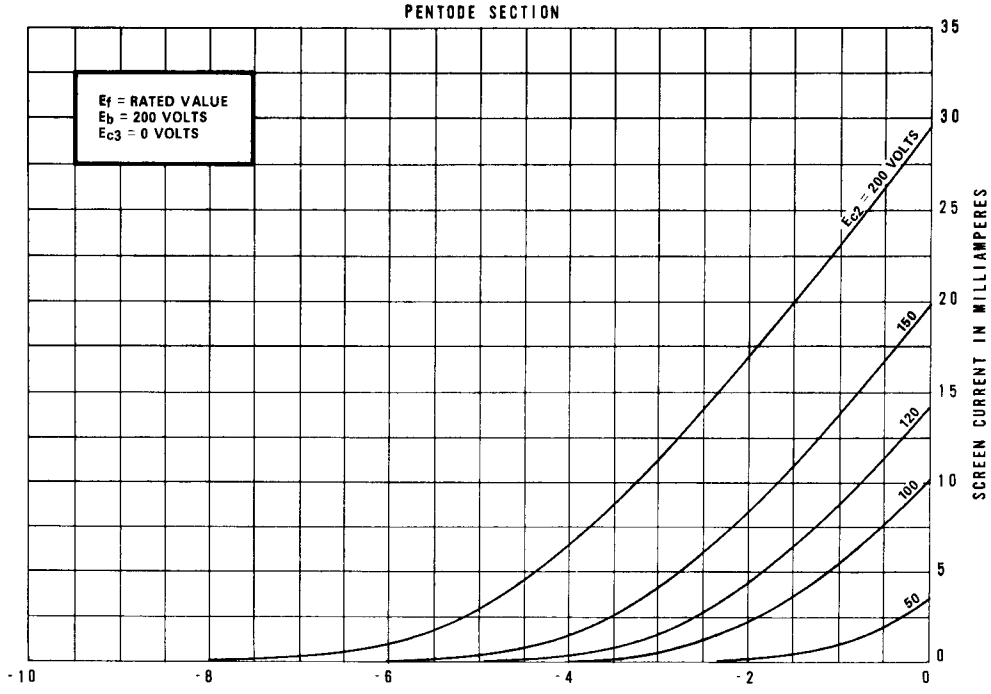
AVERAGE TRANSFER CHARACTERISTICS



K-55611-T0349-4

AVERAGE TRANSFER CHARACTERISTICS

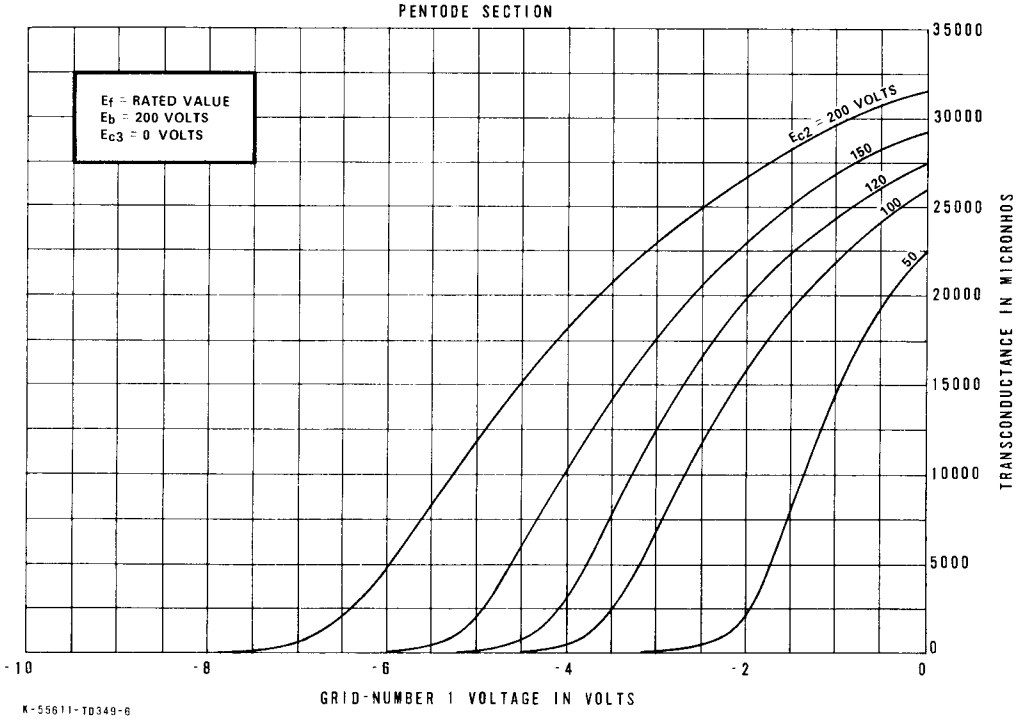
PENTODE SECTION



K-55611-TD349-5

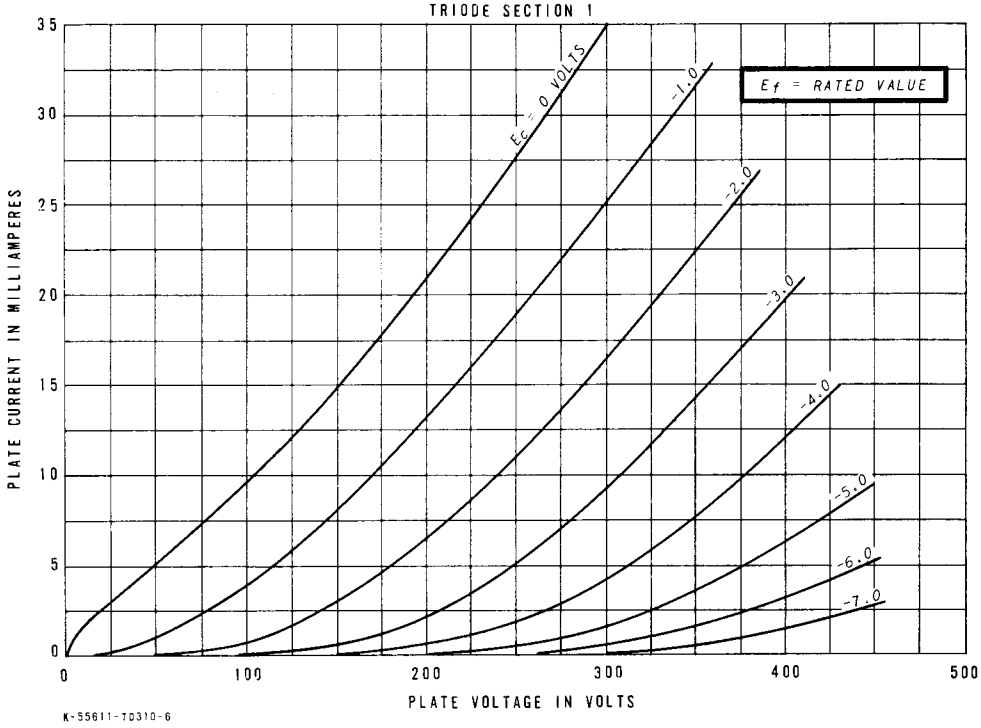
AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

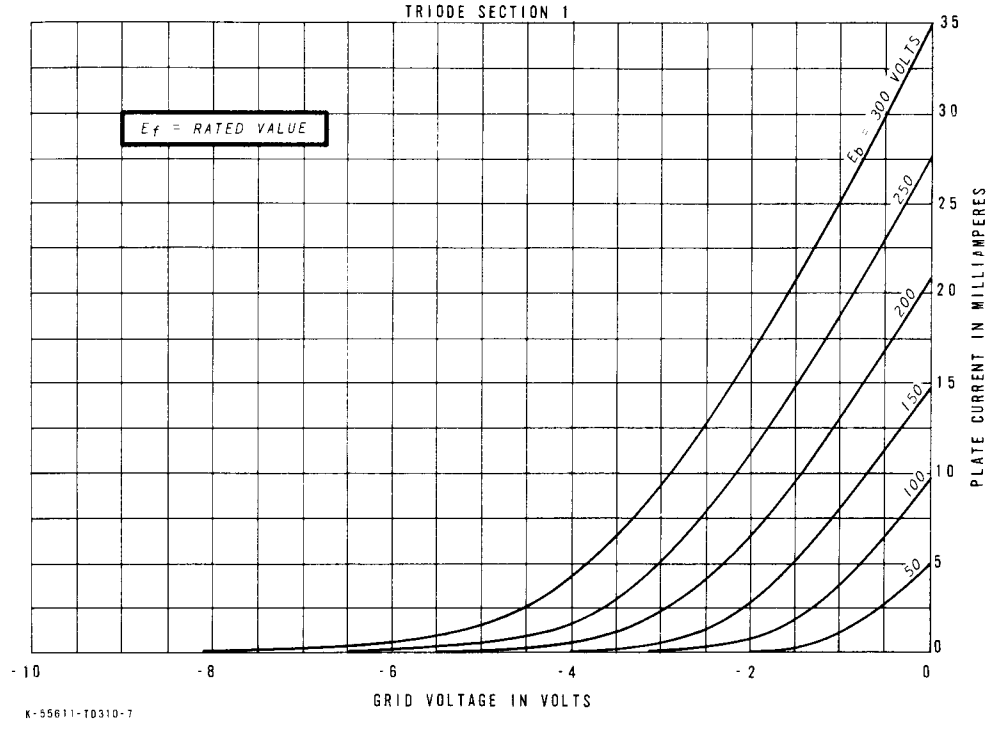


K-55611-TD349-6

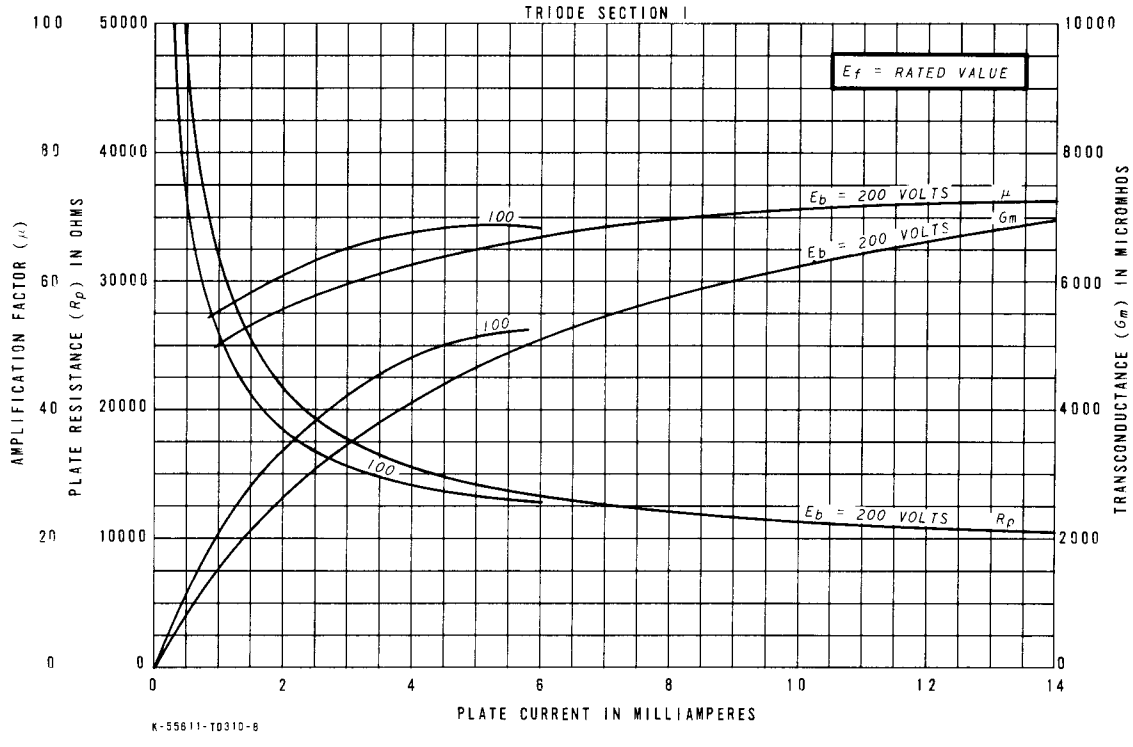
AVERAGE PLATE CHARACTERISTICS



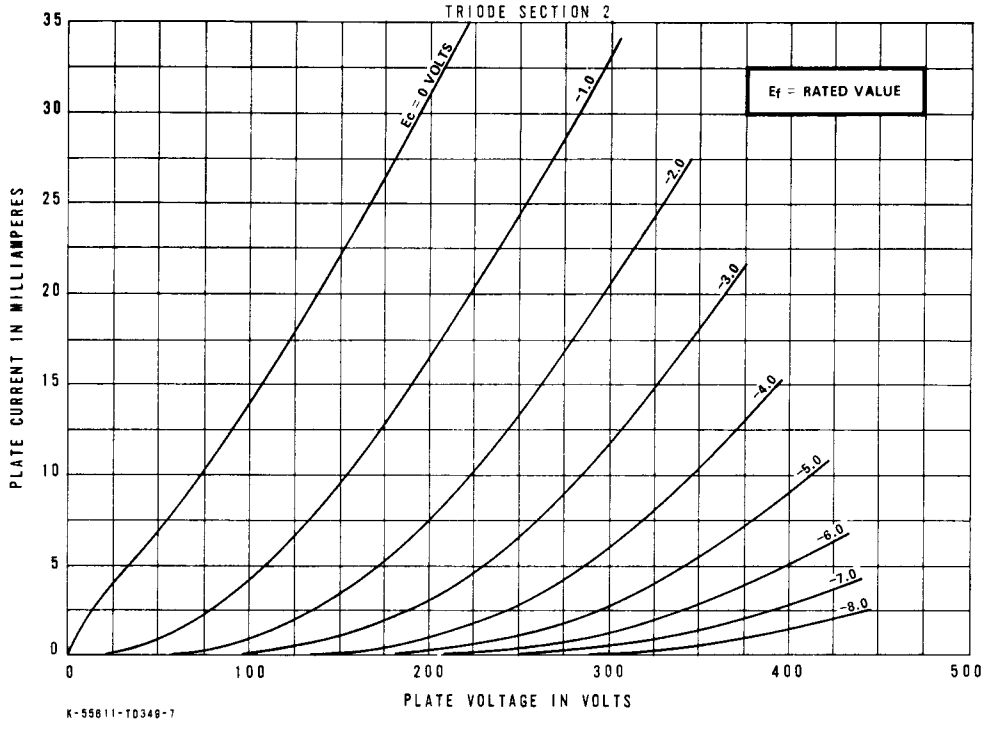
AVERAGE TRANSFER CHARACTERISTICS



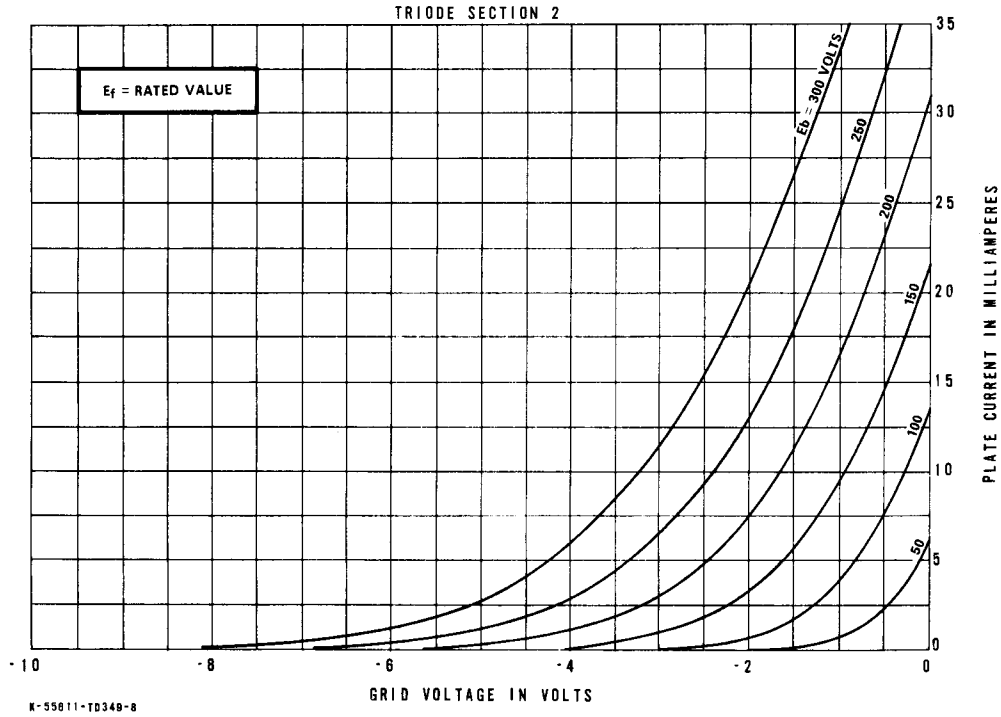
AVERAGE CHARACTERISTICS



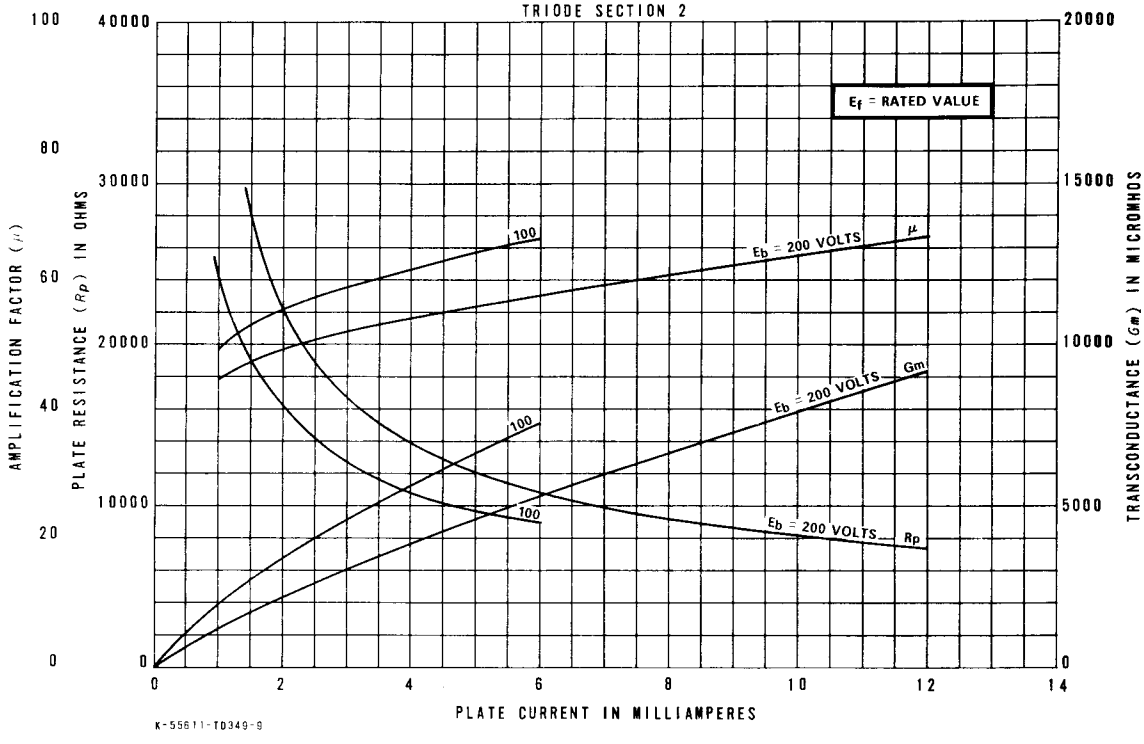
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

PRODUCT INFORMATION

Compactron
Dissimilar Double Triode

11FY7

The 11FY7 is a compactron containing two dissimilar triode sections, designed for use as a combined vertical-deflection oscillator and amplifier in television receivers. Section 1 is intended for service as an oscillator and Section 2 as an amplifier.

Except for heater characteristics, the 11FY7 is identical to the 6FY7 and 15FY7.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	11	Volts
Heater Current‡	0.6±0.04	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.6 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Compactron Triple Triode

12AC10-A

- COLOR TV TYPE
- IMPROVED LINEARITY
- HIGH GAIN
- TRANSCONDUCTANCE = 5,800 MICROMHOS
- AMPLIFICATION FACTOR = 62

The 12AC10-A is a compactron containing three high-mu triodes. It is designed for use primarily as a color-difference amplifier in color television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	12.6	Volts
Heater Current ●	0.3±0.02	Amperes
Heater Warm-up Time, Average ♦	11	Seconds

Direct Interelectrode Capacitances ▲

	Section 1	Section 2	Section 3	
Grid to Plate: (g to p)	1.3	1.2	1.2	pf
Input: g to (h+k)	2.4	2.6	2.6	pf
Output: p to (h+k)	0.22	0.30	0.44	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 12-56

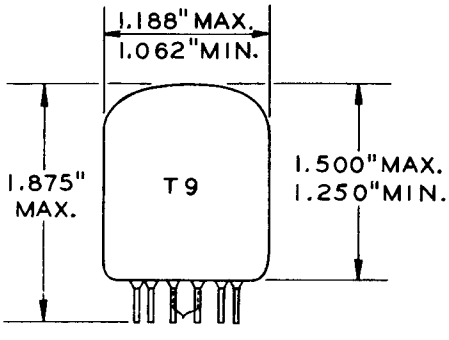
Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	1.875	Inches
Maximum Seated Height	1.500	Inches
Minimum Seated Height	1.250	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330	Volts
Plate Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance	0.5	Megohms

PHYSICAL DIMENSIONS

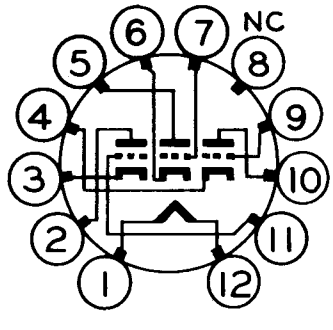


EIA 9-56

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate (Section 3)
Pin 3 - Cathode (Section 3)
Pin 4 - Cathode (Section 1)
Pin 5 - Plate (Section 2)
Pin 6 - Cathode (Section 2)
Pin 7 - Grid (Section 2)
Pin 8 - No Connection
Pin 9 - Grid (Section 1)
Pin 10 - Plate (Section 1)
Pin 11 - Grid (Section 3)
Pin 12 - Heater

BASING DIAGRAM



EIA 12FE

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage	200	Volts
Cathode-Bias Resistor	150	Ohms
Amplification Factor	62	
Plate Resistance, approximate	10,700	Ohms
Transconductance	5,800	Micromhos
Plate Current	9.0	Milliamperes
Grid Voltage, approximate		
Ib = 100 Microamperes	−5	Volts

NOTES

★ Heater voltage for a bogey tube at If = 0.3 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

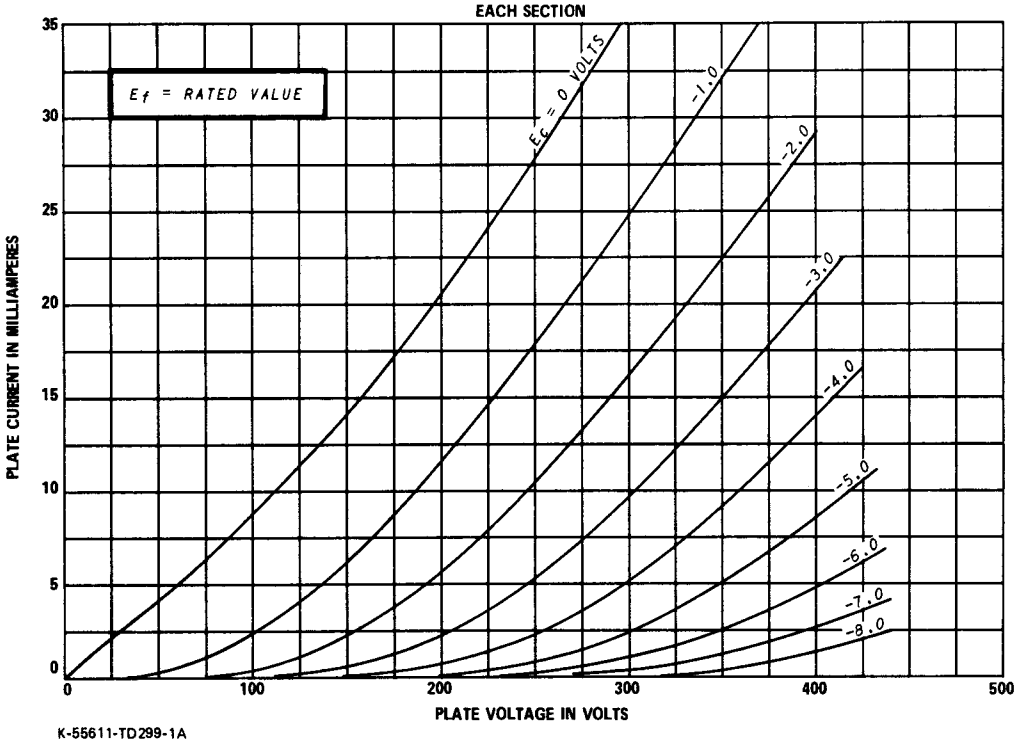
♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

▲ Without external shield.

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AVERAGE PLATE CHARACTERISTICS

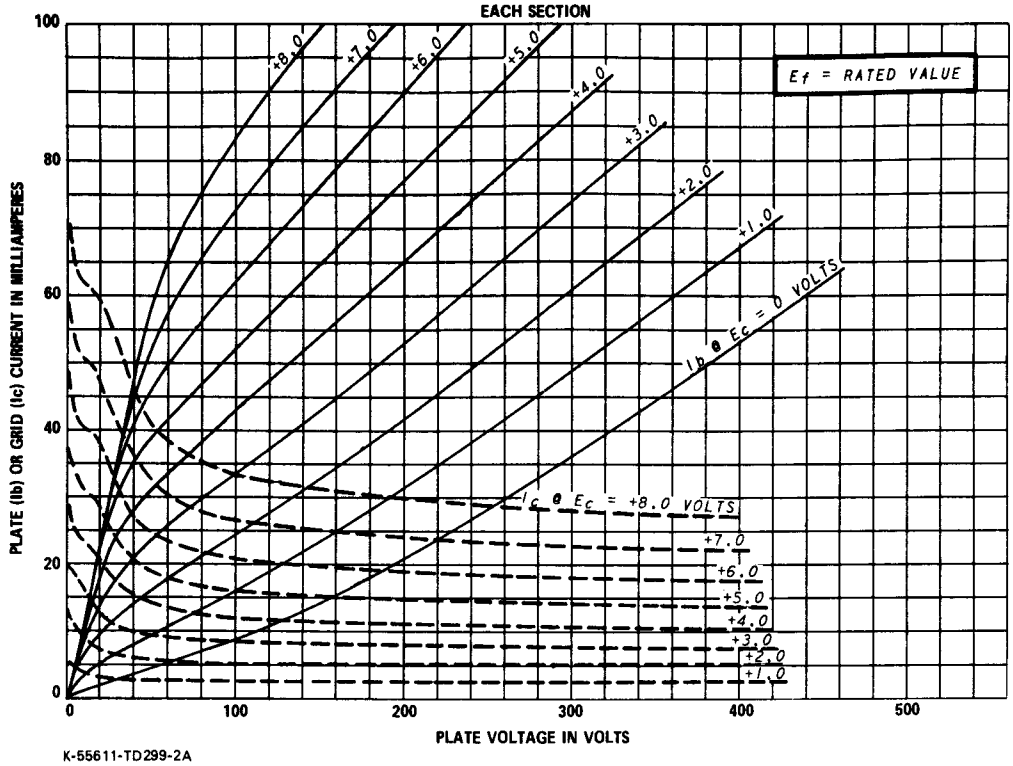
EACH SECTION



K-55611-TD299-1A

AVERAGE PLATE CHARACTERISTICS

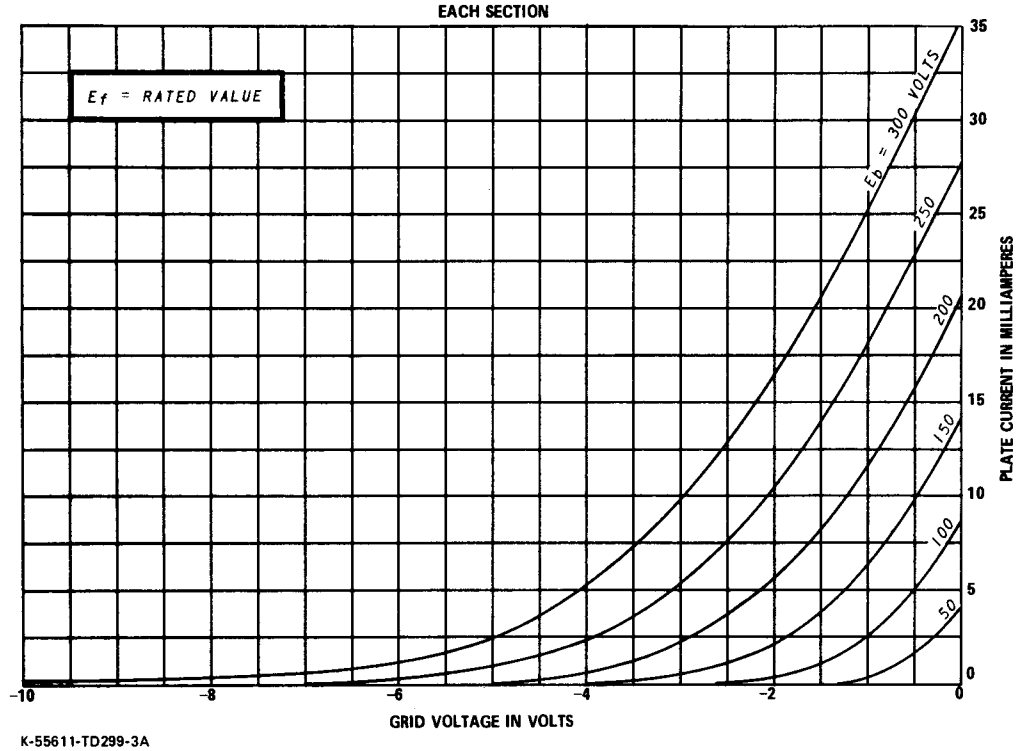
EACH SECTION



K-55611-TD299-2A

AVERAGE TRANSFER CHARACTERISTICS

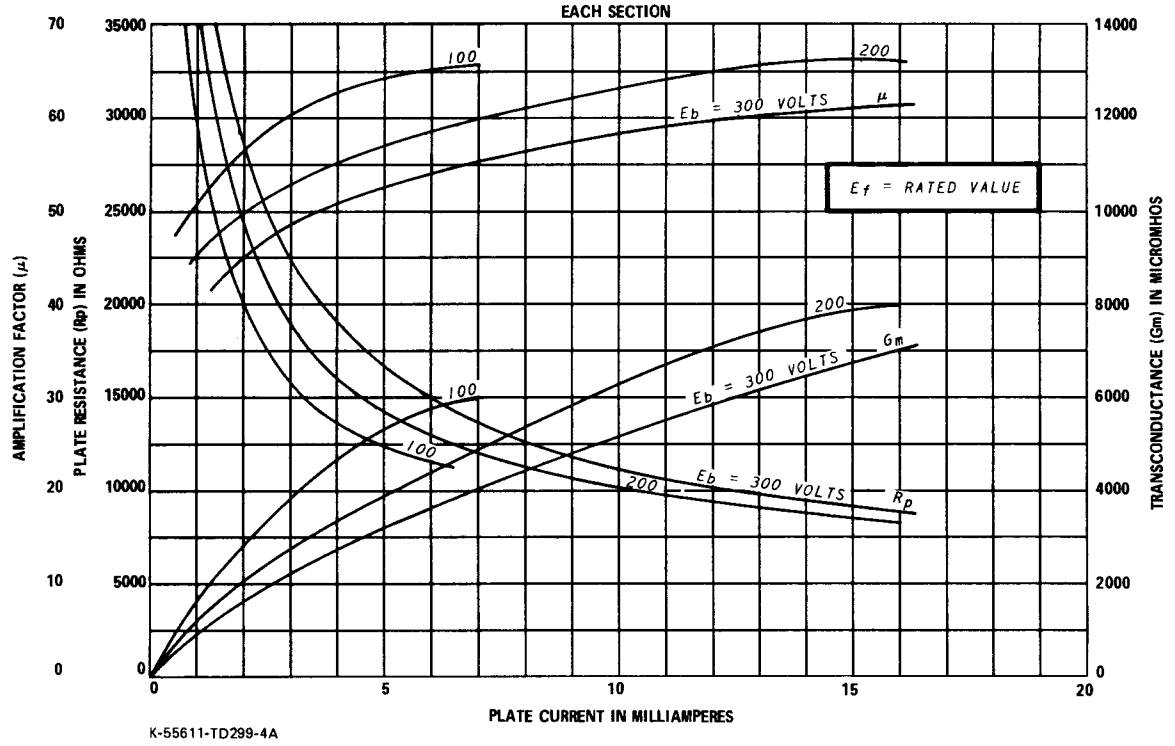
EACH SECTION



K-55611-TD299-3A

AVERAGE CHARACTERISTICS

EACH SECTION



K-55611-TD299-4A

GENERAL ELECTRIC

TUBE PRODUCTS DEPARTMENT
OWENSBORO, KENTUCKY 42301

Electronic TUBES

12AD6

HEPTODE

FOR PENTAGRID CONVERTER APPLICATIONS IN AUTOMOBILE RECEIVERS

DESCRIPTION AND RATING

The 12AD6 is a miniature heptode primarily intended to perform the combined functions of mixer and oscillator in automobile radio receivers. The tube is specially designed to operate with plate and screen voltages supplied directly from a 12-volt storage battery.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential			
Heater Voltage, AC or DC		12.6*	Volts
Heater Current		0.15	Amperes
Direct Interelectrode Capacitances	With Shield†	Without Shield	
Grid-Number 3 to All	8.0	8.0	μμf
Plate to All	13	8.0	μμf
Grid-Number 1 to All	5.5	5.5	μμf
Cathode to All Except Grid-Number 1	20	15	μμf
Grid-Number 3 to Plate, maximum	0.25	0.3	μμf
Grid-Number 1 to Grid-Number 3, maximum	0.15	0.15	μμf
Grid-Number 1 to Plate, maximum	0.05	0.1	μμf
Grid-Number 1 to Cathode	3.0	3.0	μμf

MECHANICAL

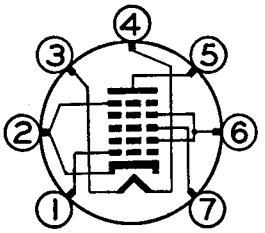
Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	30	Volts
Screen-Supply Voltage	30	Volts
Screen Voltage	30	Volts
Positive DC Grid-Number 3 Voltage	0	Volts
Negative DC Grid-Number 3 Voltage	30	Volts
DC Cathode Current	20	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	30	Volts
Heater Negative with Respect to Cathode	30	Volts
Grid-Number 3 Circuit Resistance	10	Megohms

BASING DIAGRAM

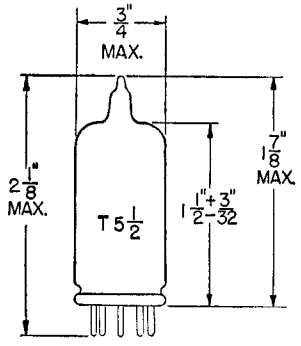


RETMA 7CH

TERMINAL CONNECTIONS

Pin 1—Grid Number 1 (Oscillator Grid)
Pin 2—Cathode and Grid Number 5
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Numbers 2 and 4 (Screen)
Pin 7—Grid Number 3 (Signal Grid)

PHYSICAL DIMENSIONS



RETMA 5-2

GENERAL ELECTRIC

CHARACTERISTICS AND TYPICAL OPERATION

CONVERTER SERVICE

Plate Voltage	12.6	Volts
Screen Voltage	12.6	Volts
Grid-Number 3 Supply Voltage	0	Volts
Grid-Number 3 Resistor (Bypassed)	2.2	Megohms
Grid-Number 1 Voltage, RMS, approximate	1.6	Volts
Grid-Number 1 Resistor	33000	Ohms
Plate Resistance, approximate	1.0	Megohms
Conversion Transconductance	260	Micromhos
Plate Current	0.45	Milliamperes
Screen Current	1.5	Milliamperes
Grid-Number 1 Current	0.050	Milliamperes
Grid-Number 3 Voltage, approximate $G_c = 5$ Micromhos	−2.2	Volts
Grid-Number 3 Voltage, approximate $G_c = 20$ Micromhos	−1.8	Volts

OSCILLATOR CHARACTERISTICS, NOT OSCILLATING

Plate Voltage	12.6	Volts
Screen, Connected to Plate		
Grid-Number 3 Voltage	0	Volts
Grid-Number 1 Voltage	0	Volts
Amplification Factor‡	9.0	
Transconductance‡	3800	Micromhos
Cathode Current	5.0	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	−4	Volts

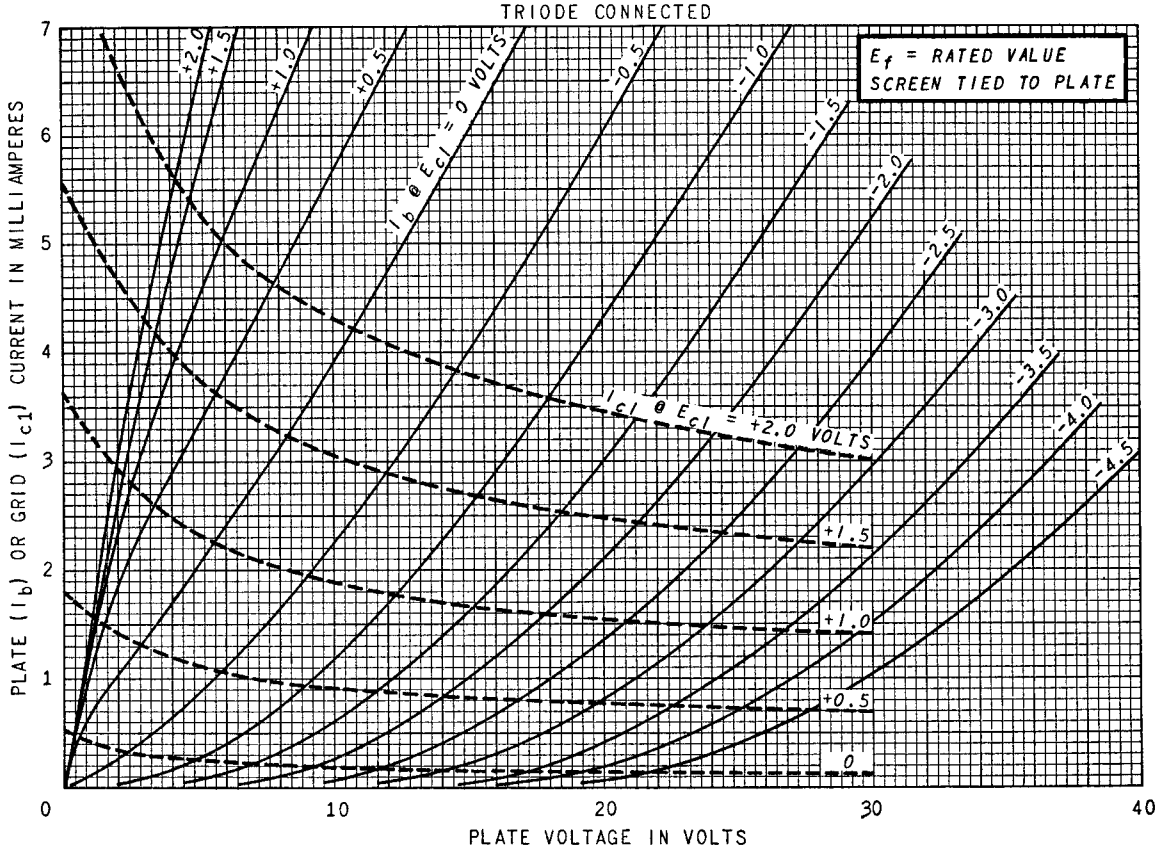
* When used in automobile service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectancy at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

† With external shield (RETMA 316) connected to pin 2.

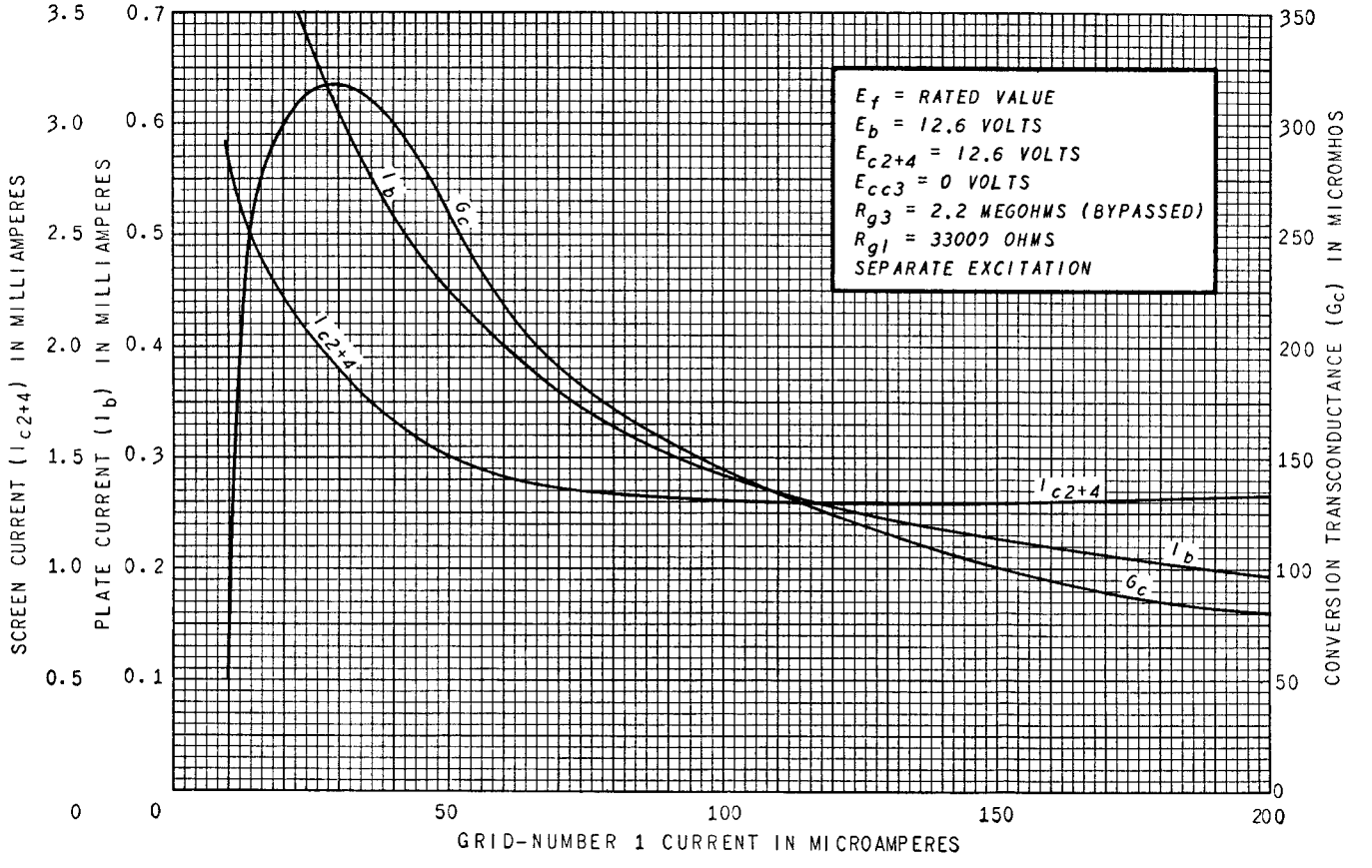
‡ Between grid-number 1 and grids number 2 and 4 connected to plate.

AVERAGE PLATE CHARACTERISTICS

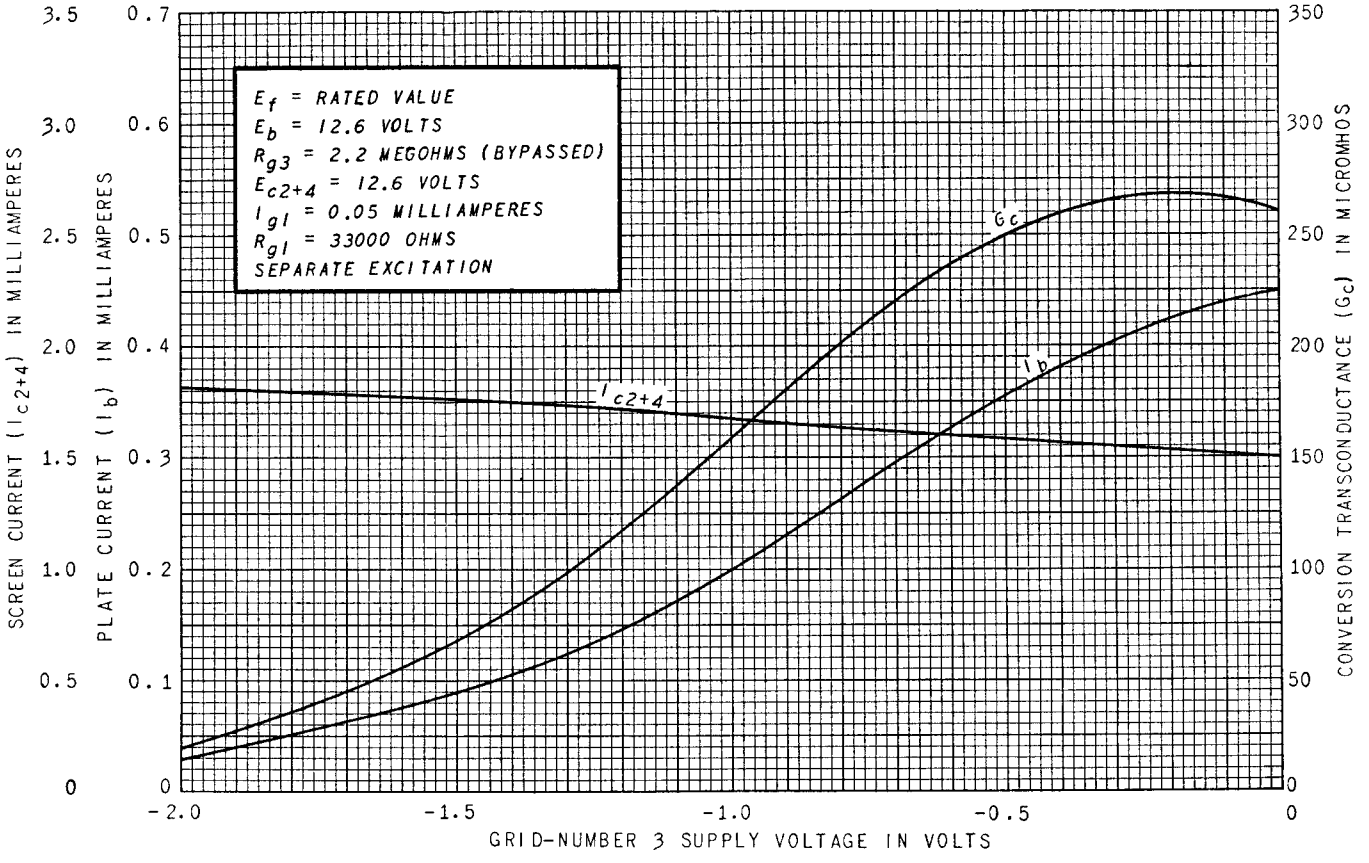
TRIODE CONNECTED



AVERAGE CHARACTERISTICS



AVERAGE CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

PRODUCT INFORMATION

Compactron Dissimilar Double Pentode

12AE10

The 12AE10 is a compactron containing a sharp-cutoff, dual-control pentode (Section 2) and a power pentode (Section 1). The dual-control pentode is intended for use as an FM detector and the power pentode as an audio-frequency output amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	12.6	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

Direct Interelectrode Capacitances¶

Section 1

Grid-Number 1 to Plate: (1g1 to 1p)	0.2	pf
Input: 1g1 to (h + 1k + 2k + 1g2 + b.p. + i.s.)	9.5	pf
Output: 1p to (h + 1k + 2k + 1g2 + b.p. + i.s.)	10	pf

Section 2

Grid-Number 1 to Plate: (2g1 to 2p)	0.036	pf
Grid-Number 3 to Plate: (2g3 to 2p)	3.2	pf
Grid-Number 1 to All Except Plate: 2g1 to (h + 2k + 2g2 + 2g3 + i.s.)	6.5	pf

Section 2 (Cont'd)

Grid-Number 3 to All: 2g3 to (h + 2k + 2g1 + 2g2 + 2p + i.s.)	8.0	pf
Grid-Number 1 to Grid-Number 3: (2g1 to 2g3)	0.14	pf

Coupling

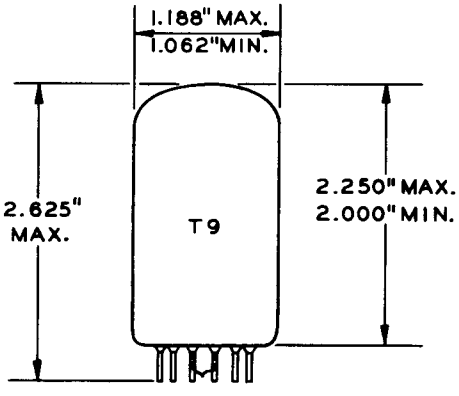
Plate (Section 1) to Plate (Section 2): (1p to 2p)	0.15	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

PHYSICAL DIMENSIONS

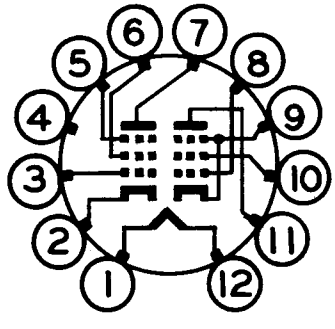


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode (Section 2) and Internal Shield
Pin 3 - Grid Number 1 (Section 2)
Pin 4 - No Connection
Pin 5 - Grid Number 3 (Suppressor) (Section 2)
Pin 6 - Grid Number 2 (Screen) (Section 2)
Pin 7 - Plate (Section 2)
Pin 8 - Grid Number 1 (Section 1)
Pin 9 - Cathode and Beam Plates (Section 1)
Pin 10 - Grid Number 2 (Screen) (Section 1)
Pin 11 - Plate (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12EZ

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Section 1

Plate Voltage	165	Volts
Screen Voltage	150	Volts
Plate Dissipation	6.0	Watts
Screen Dissipation	1.25	Watts
DC Cathode Current	60	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	1.0	Megohms

Section 2

Plate Voltage	330	Volts
Suppressor Voltage	28	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	1.7	Watts
Screen Dissipation	1.1	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Section 1

Plate Voltage	145	Volts
Screen Voltage	110	Volts
Grid-Number 1 Voltage	-7.0	Volts
Peak AF Grid-Number 1 Voltage	7.0	Volts
Plate Resistance, approximate	33000	Ohms
Transconductance	5600	Micromhos
Zero-Signal Plate Current	34	Milliamperes
Maximum-Signal Plate Current	39	Milliamperes
Zero-Signal Screen Current	6.5	Milliamperes
Maximum-Signal Screen Current	9.3	Milliamperes
Load Resistance	2500	Ohms
Total Harmonic Distortion, approximate	12	Percent
Maximum-Signal Power Output	1.45	Watts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

AVERAGE CHARACTERISTICS

Section 2

Plate Voltage	150	Volts
Suppressor Voltage	0	Volts
Screen Voltage	100	Volts
Cathode-Bias Resistor	560	Ohms
Plate Resistance, approximate	0.15	Megohms
Grid-Number 1 Transconductance	1000	Micromhos
Grid-Number 3 Transconductance	400	Micromhos
Plate Current	1.3	Milliamperes
Screen Current	2.0	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	-4.5	Volts
Grid-Number 3 Voltage, approximate Ib = 10 Microamperes	-4.5	Volts

NOTES

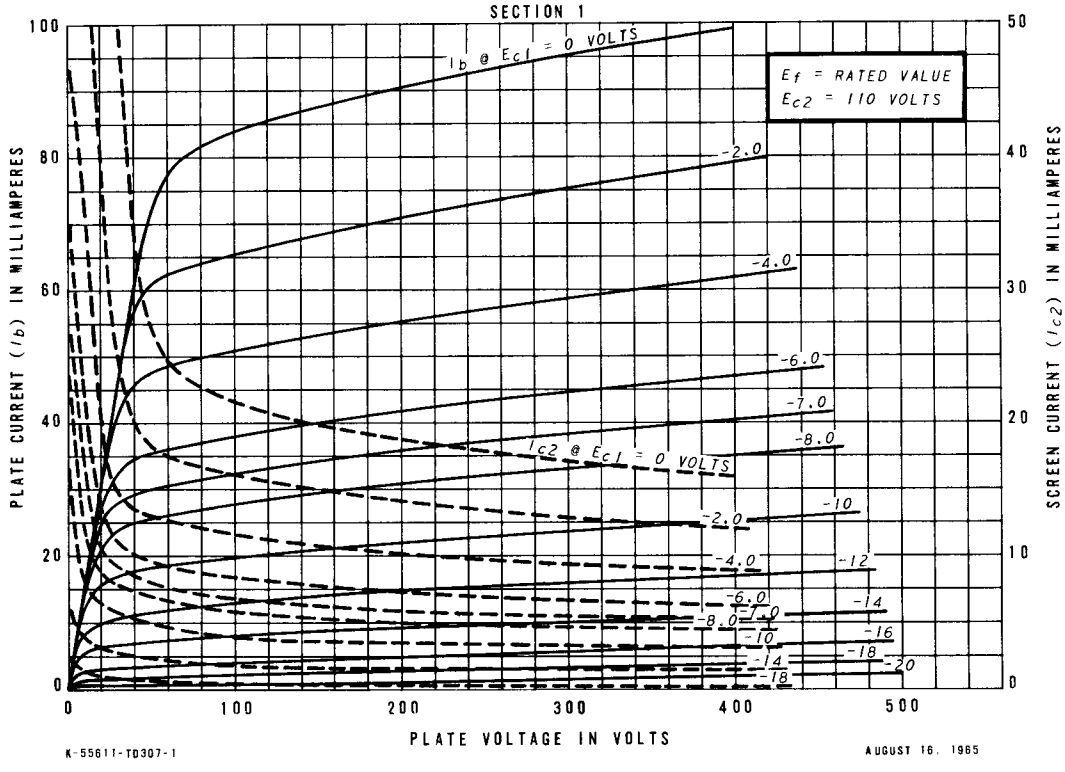
* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater current.

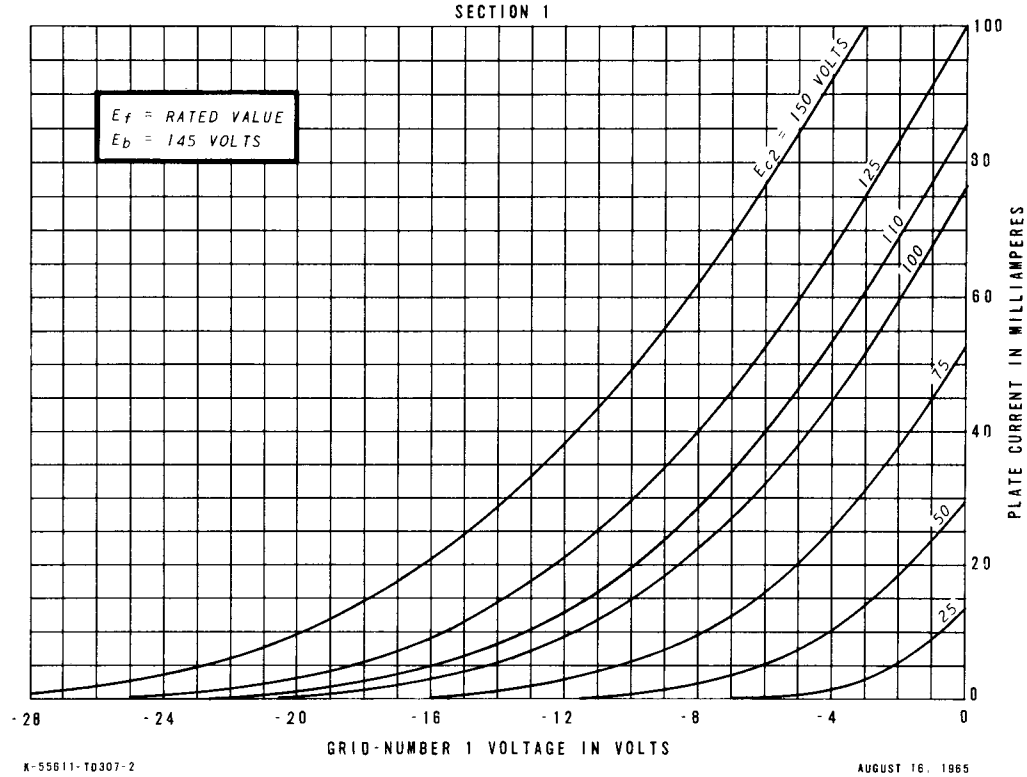
¶ Without external shield.

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

SECTION 1

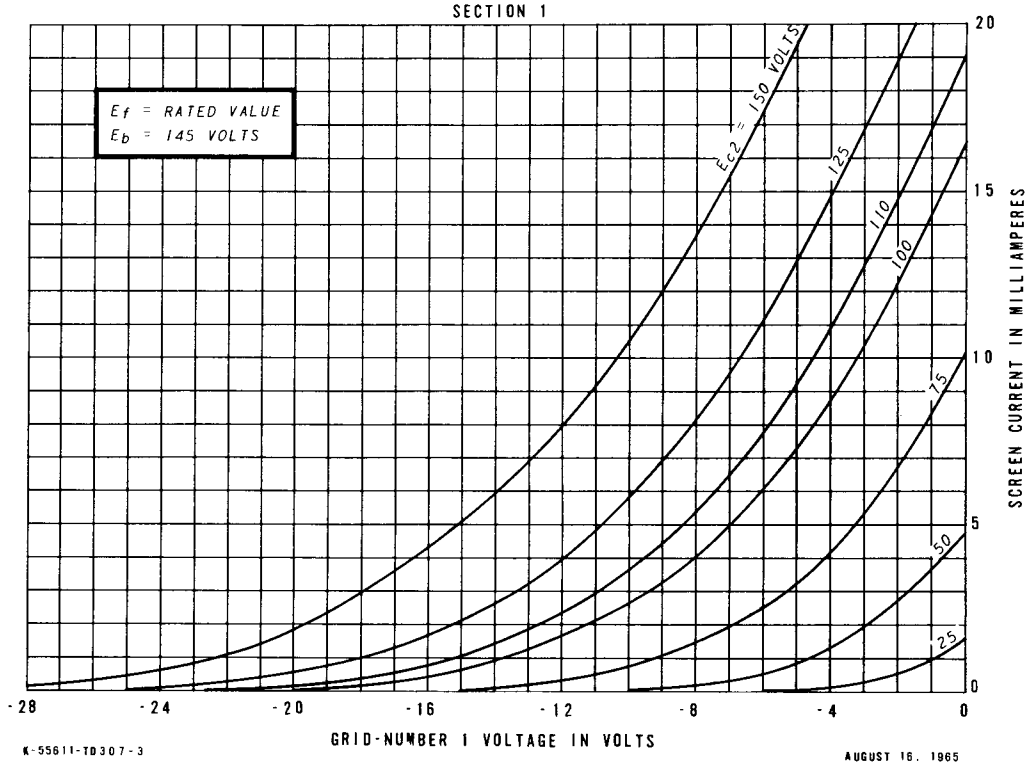


K-55611-TD307-2

AUGUST 16, 1965

AVERAGE TRANSFER CHARACTERISTICS

SECTION 1

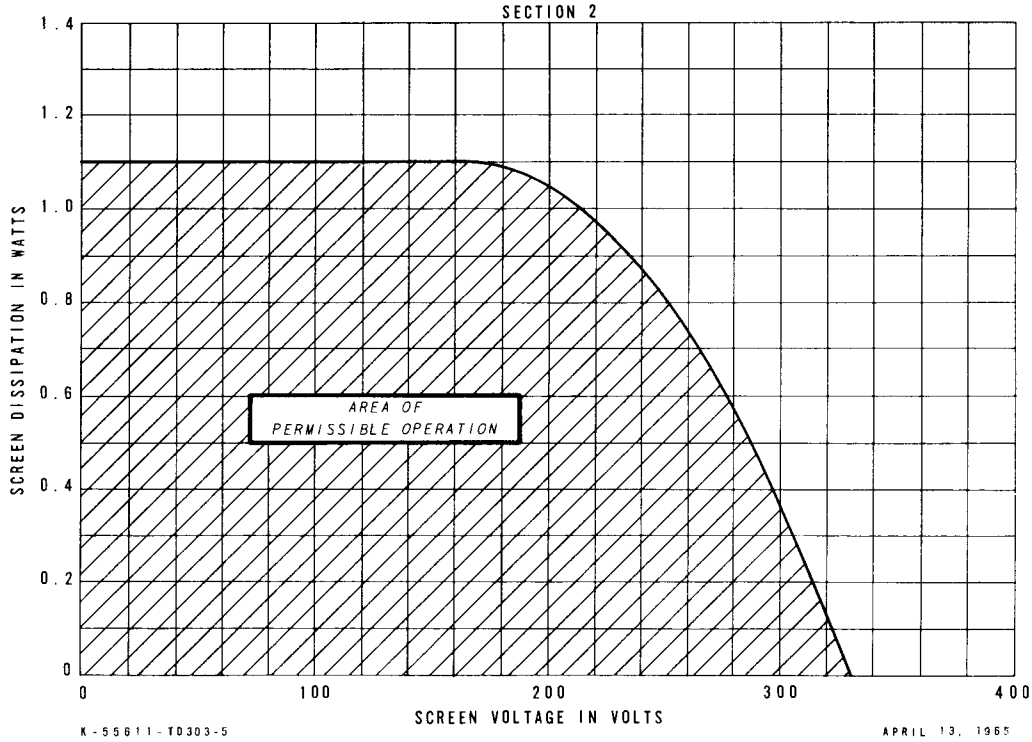


K-55611-TD307-3

AUGUST 16, 1965

SCREEN RATING CHART

SECTION 2

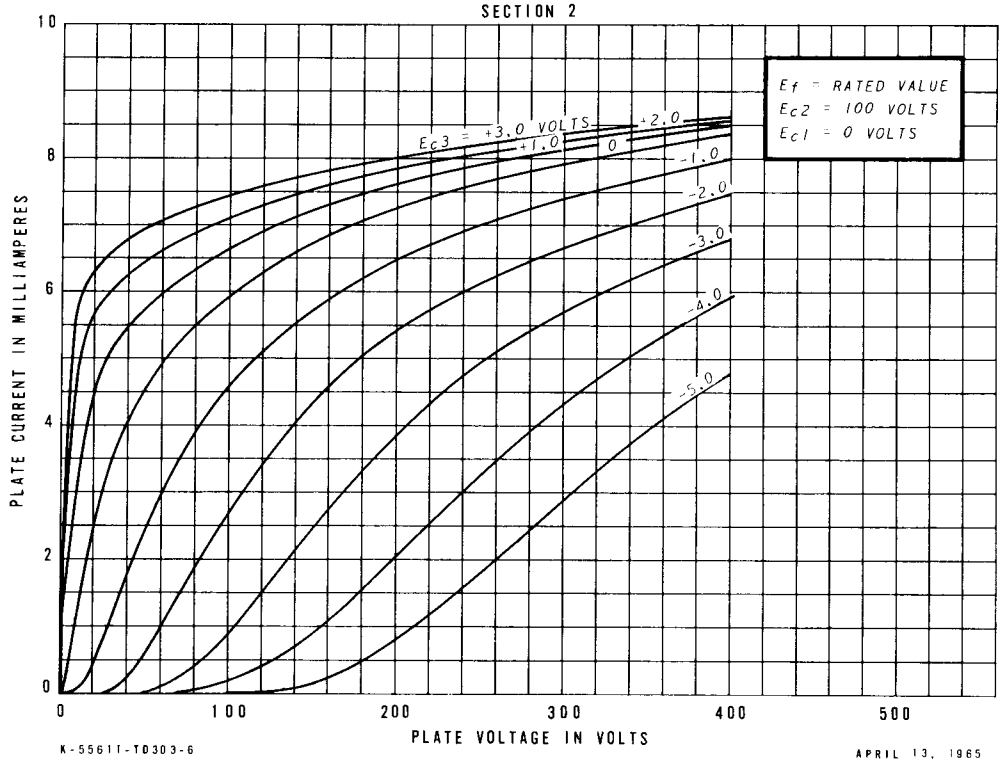


K-55611-TD303-5

APRIL 13, 1965

AVERAGE PLATE CHARACTERISTICS

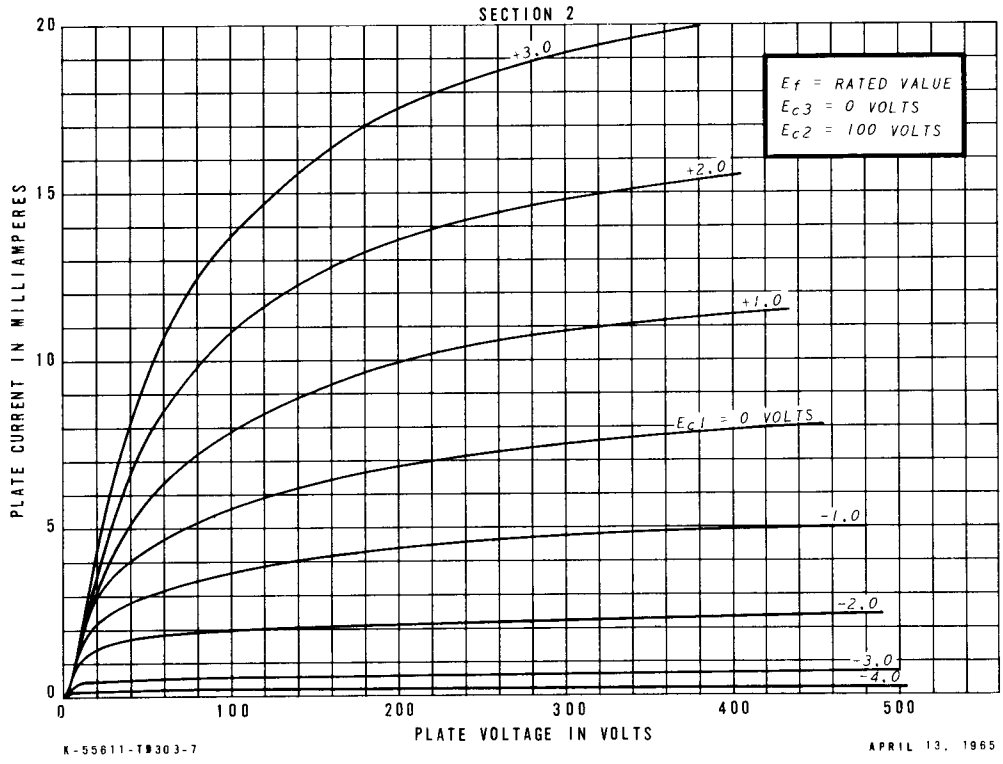
SECTION 2



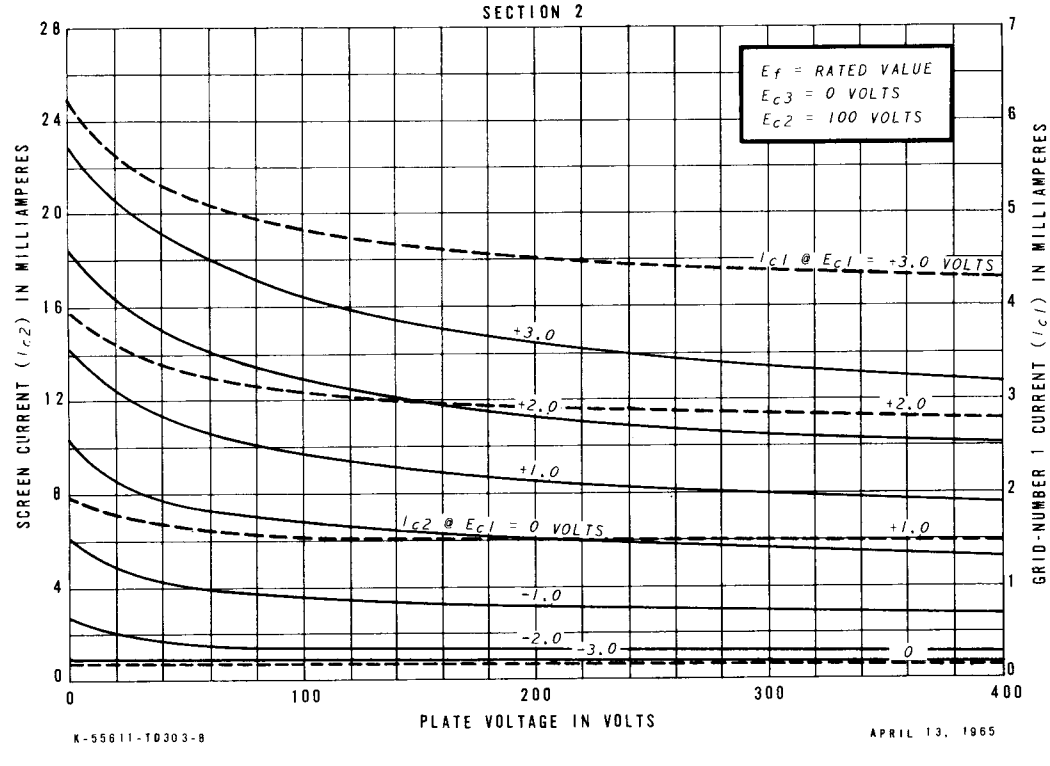
K-55611-TD303-6

APRIL 13, 1965

AVERAGE PLATE CHARACTERISTICS

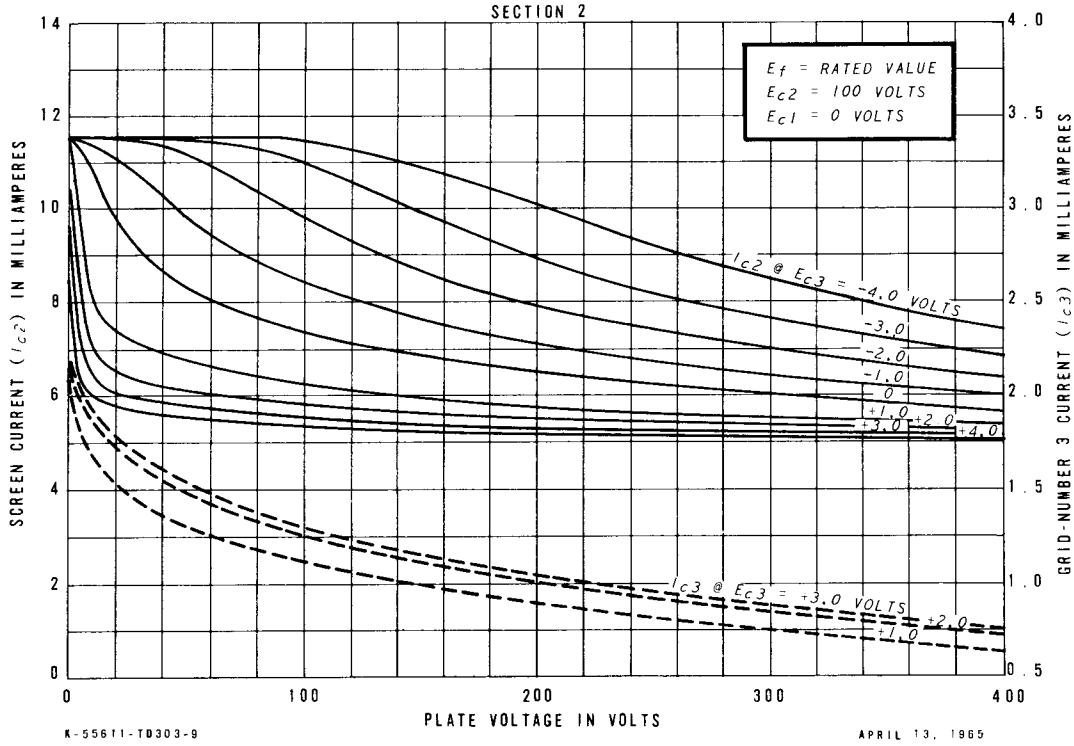


AVERAGE CHARACTERISTICS



AVERAGE CHARACTERISTICS

SECTION 2

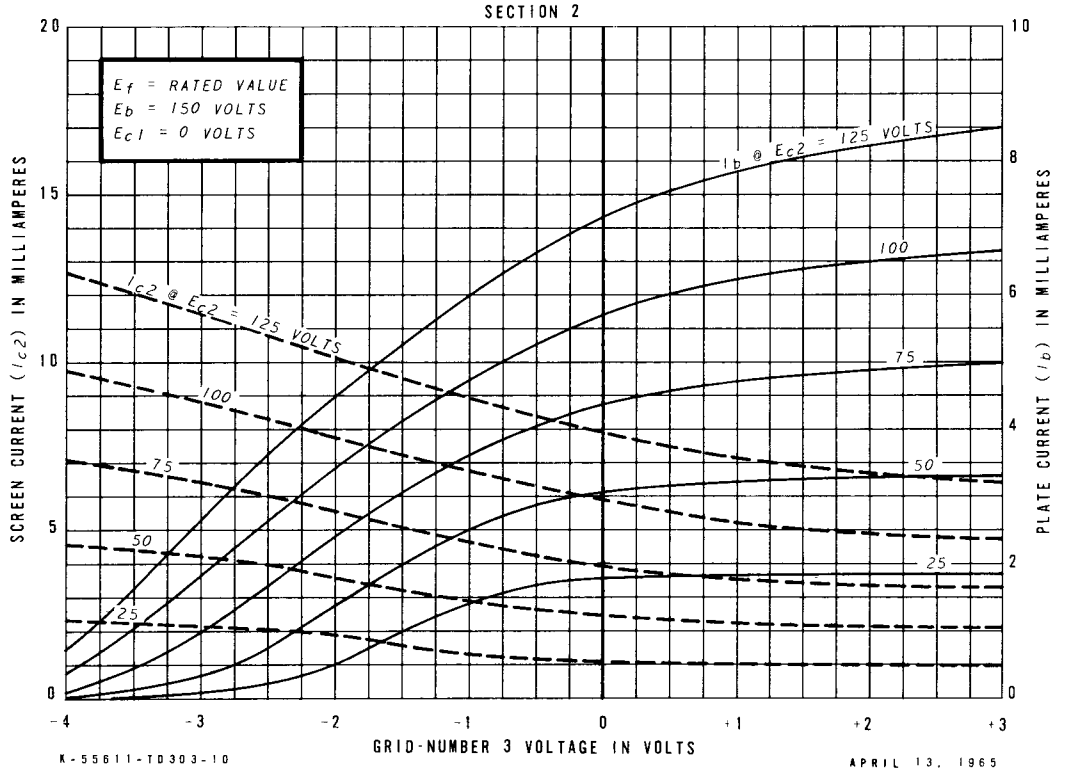


K-55611-TD303-9

APRIL 13, 1965

AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

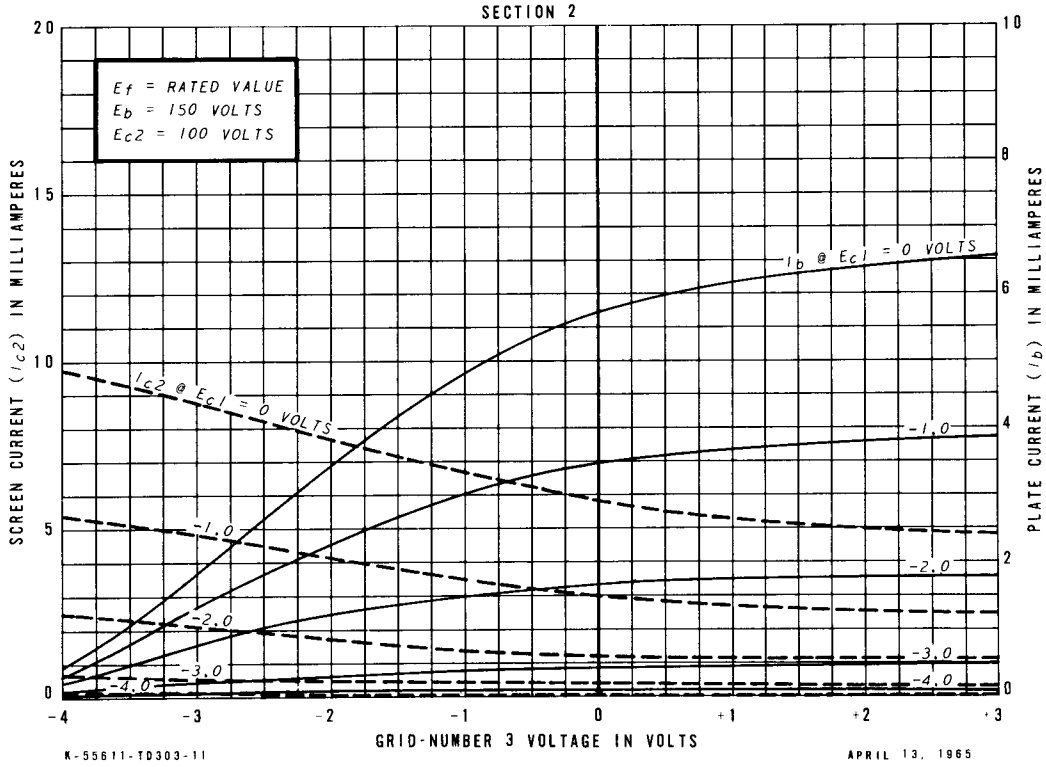


K-55611-TD303-10

APRIL 13, 1965

AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

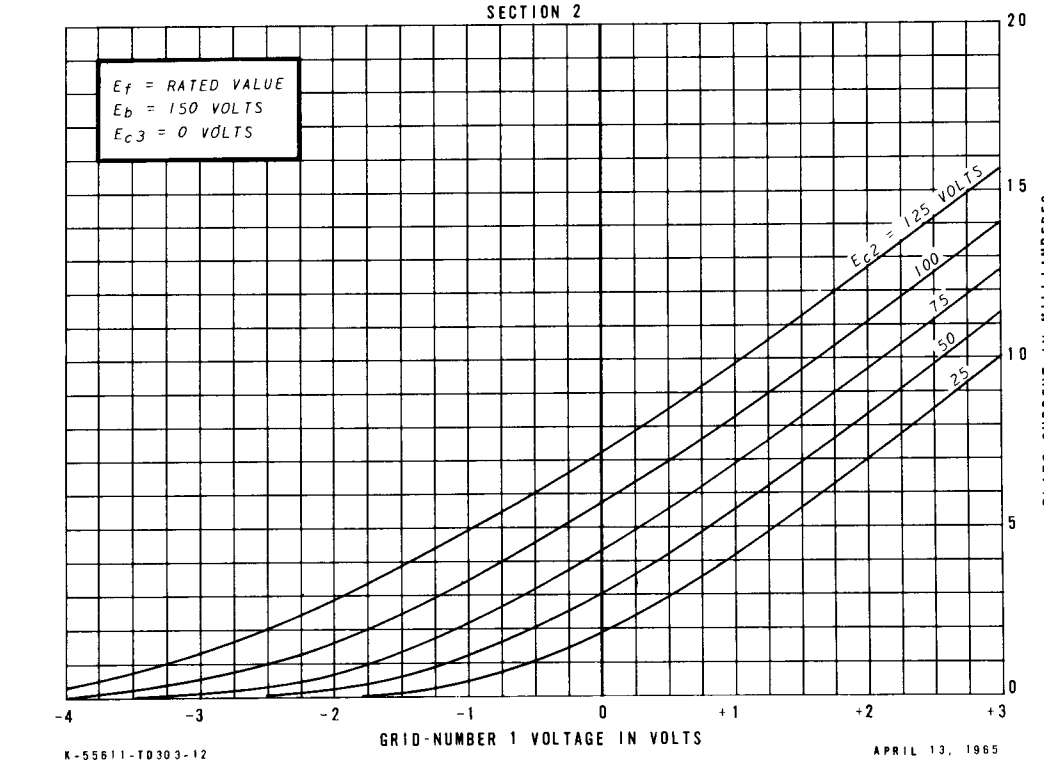


K-55611-TD303-11

APRIL 13, 1965

AVERAGE TRANSFER CHARACTERISTICS

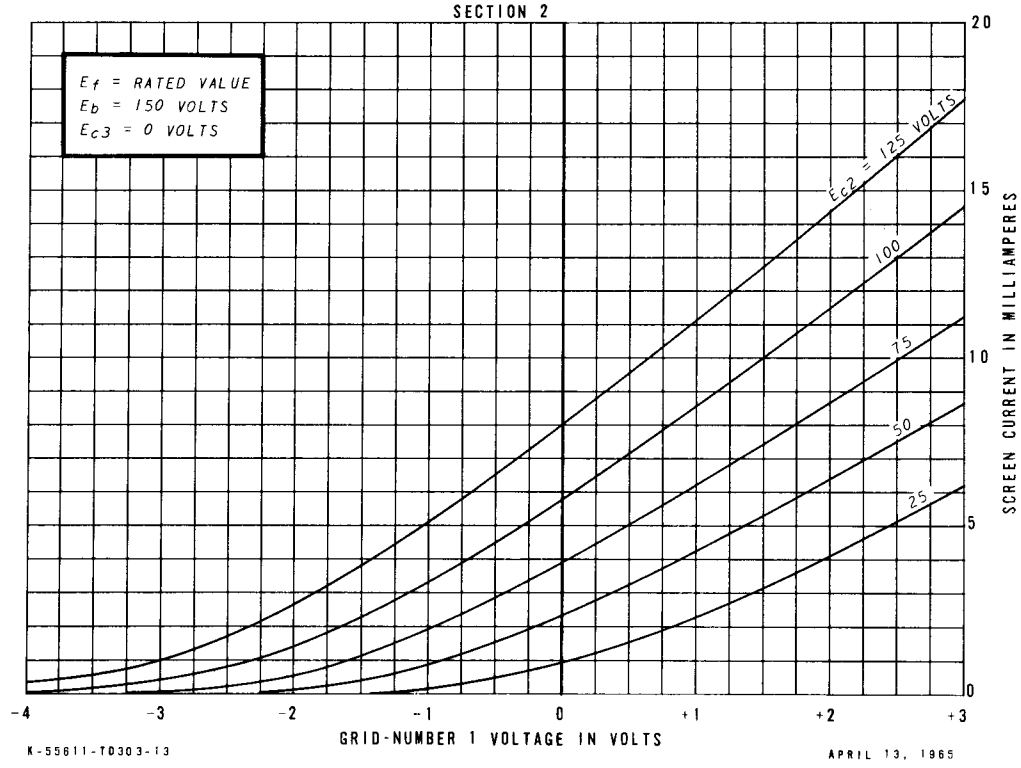
SECTION 2



K-55611-TD303-12

APRIL 13, 1965

AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

12AE6-A

DUPLEX-DIODE TRIODE

DESCRIPTION AND RATING

The 12AE6-A is a miniature tube containing a medium-mu triode and two diodes. Intended for use as a combined AF voltage amplifier, audio detector, and AVC rectifier in automobile radio receivers, the tube is specially designed to operate with its plate voltage supplied directly from a 12-volt storage battery.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	12.6*	Volts
Heater Current	0.15	Amperes
Direct Interelectrode Capacitances†		
Grid to Plate: (Tg to Tp)	2.0	μμf
Input: Tg to (h+k)	1.8	μμf
Output: Tp to (h+k)	1.1	μμf
Diode Plate to Diode Plate: (Dp to Dp)	0.9	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	30	Volts
DC Cathode Current	20	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	30	Volts
Heater Negative with Respect to Cathode	30	Volts
Grid-Circuit Resistance	10	Megohms
Diode Current for Continuous Operation, Each Diode	1.0	Milliamperes

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

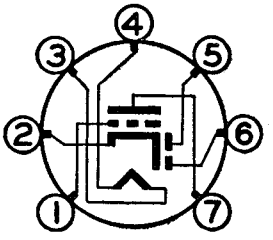
These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all tubes.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply-voltage.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM

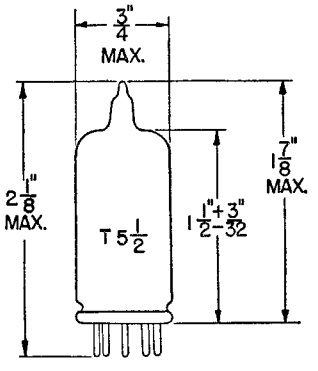


EIA 7BT

TERMINAL CONNECTIONS

Pin 1—Grid
Pin 2—Cathode
Pin 3—Heater
Pin 4—Heater
Pin 5—Diode Number 2 Plate
Pin 6—Diode Number 1 Plate
Pin 7—Triode Plate

PHYSICAL DIMENSIONS



EIA 5-2

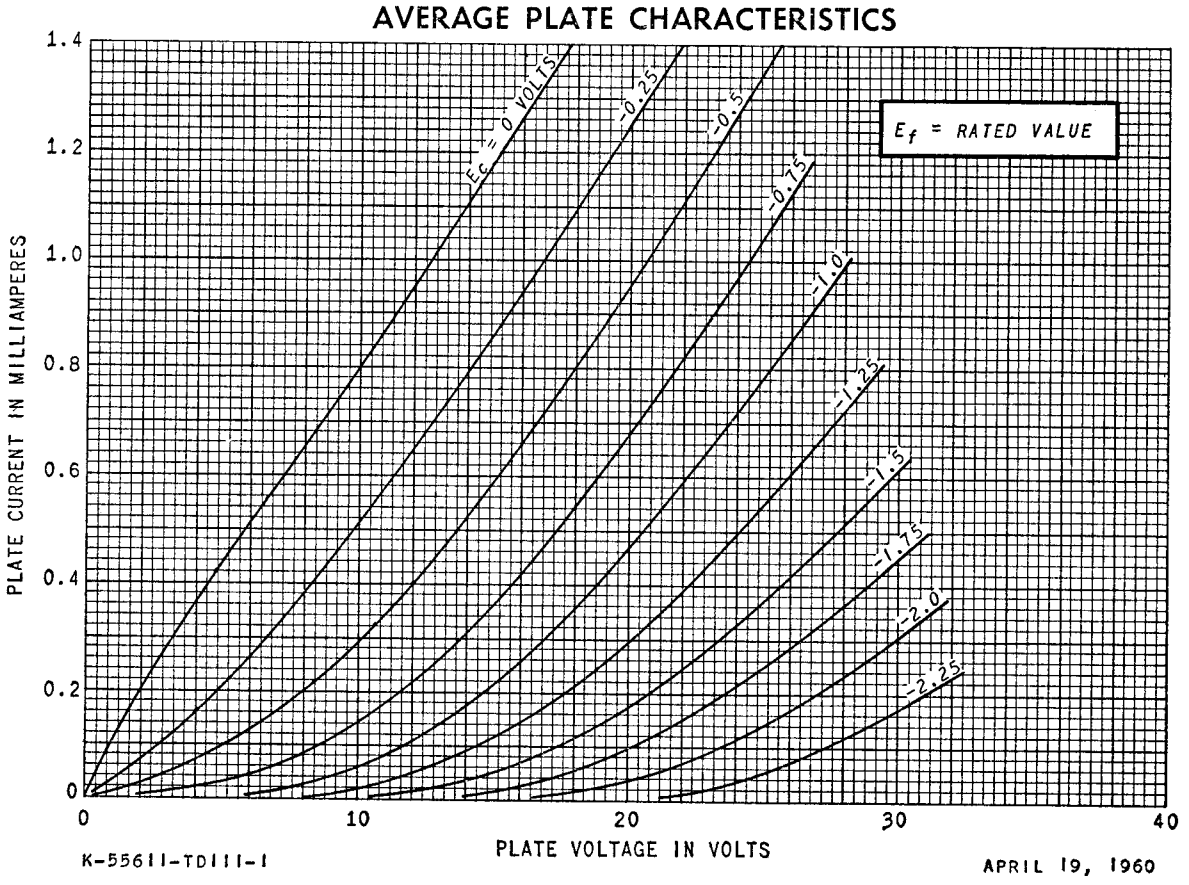
CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	12.6	12.6	Volts
Grid Voltage	0	——	Volts
Grid Resistor	——	10	Megohms
Amplification Factor	16.7	14.3	
Plate Resistance, approximate	13,000	20,000	Ohms
Transconductance	1300	715	Micromhos
Plate Current	1.0	0.32	Milliamperes
Average Diode Current, Each Diode With 10 Volts DC Applied		2.0	Milliamperes

* When used in automobile service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectancy at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

† Without external shield.



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

Electronic TUBES

12AF6

PENTODE

FOR RF AND IF AMPLIFIER APPLICATIONS IN AUTOMOBILE RECEIVERS

DESCRIPTION AND RATING

The 12AF6 is a miniature pentode intended for use as a radio-frequency or intermediate-frequency amplifier in automobile radio receivers. The tube is specially designed to operate with plate and screen voltages supplied directly from a 12-volt storage battery.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Voltage, AC or DC . . . . . 12.6* Volts
Heater Current . . . . . 0.15 Amperes
Direct Interelectrode Capacitances†
Grid-Number 1 to Plate, maximum . . . . . 0.006 μμf
Input . . . . . 5.5 μμf
Output . . . . . 4.8 μμf

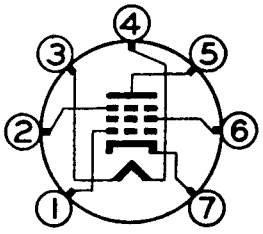
MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

* When used in automotive service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectancy at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

† Without external shield.

BASING DIAGRAM

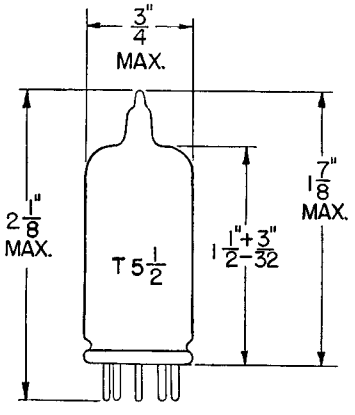


RETMA 7BK

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Internal Shield and Grid Number 3 (Suppressor)
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Cathode

PHYSICAL DIMENSIONS



RETMA 5-2

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	16 Volts
Screen Voltage	16 Volts
Positive DC Grid-Number 1 Voltage	0 Volts
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	16 Volts
Heater Negative with Respect to Cathode	16 Volts
Grid-Number 1 Circuit Resistance	2.2 Megohms

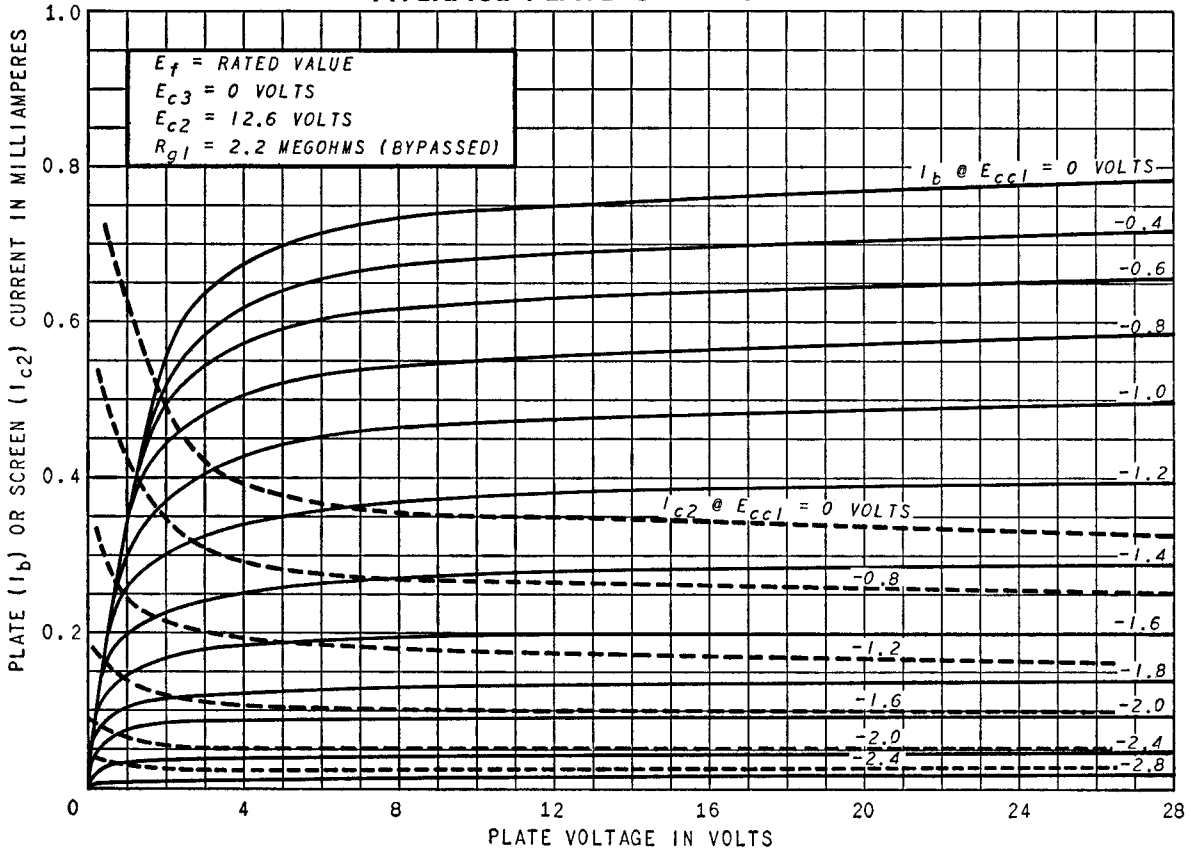
Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur. To obtain satisfactory circuit performance, therefore, the equipment designer must establish the circuit design so that no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

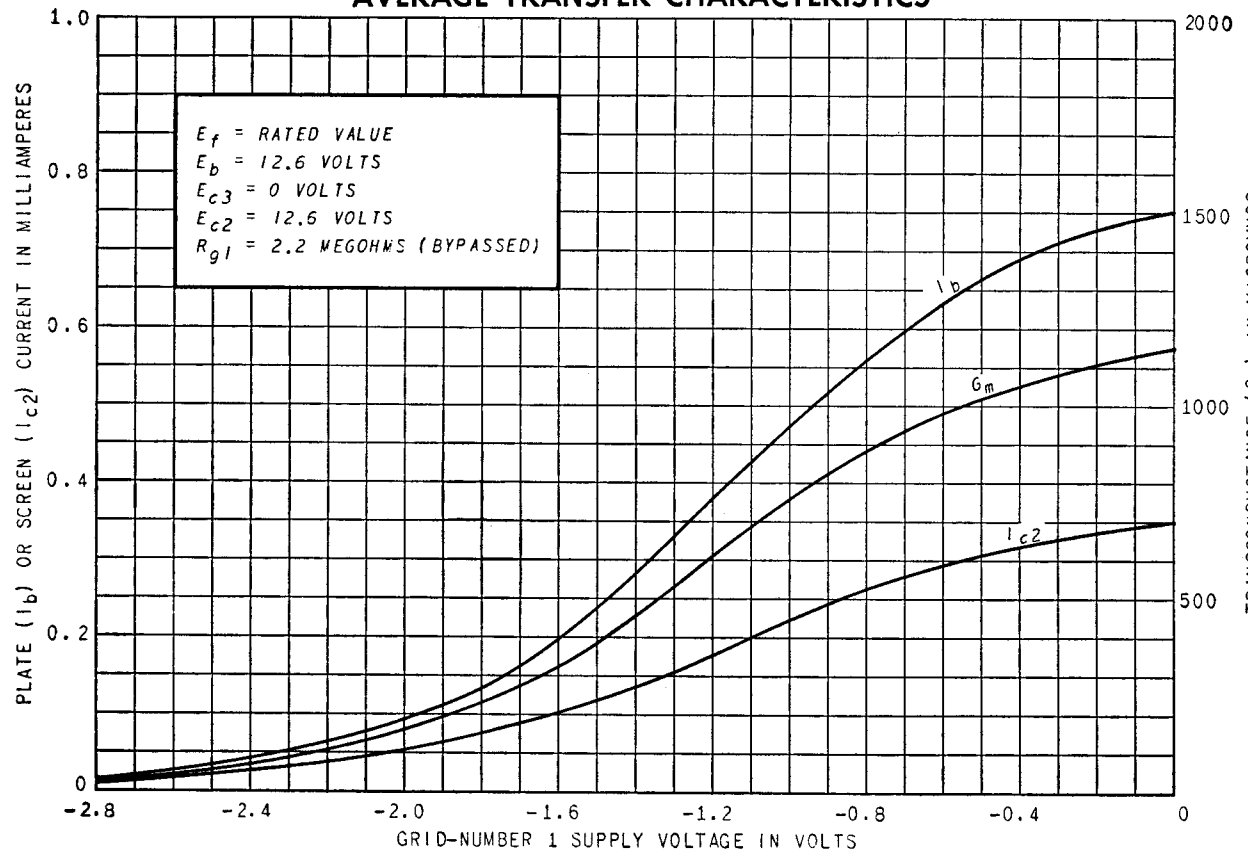
CLASS A_1 AMPLIFIER

Plate Voltage	12.6 Volts
Suppressor Voltage	0 Volts
Screen Voltage	12.6 Volts
Grid-Number 1 Supply Voltage	0 Volts
Grid-Number 1 Resistor (bypassed)	2.2 Megohms
Plate Resistance, approximate	0.3 Megohms
Transconductance	1150 Micromhos
Plate Current	0.75 Milliamperes
Screen Current	0.35 Milliamperes
Grid-Number 1 Voltage, approximate	
G_m = 40 Micromhos	−2.7 Volts

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBES

12AQ5

BEAM PENTODE

DESCRIPTION AND RATING

The 12AQ5 is a miniature beam-power pentode intended primarily for use in the audio-frequency output stage of automobile receivers which operate from 12-volt storage batteries. Within the limitations of its maximum ratings, the performance of the 12AQ5 is equivalent to that of the 12V6-GT.

GENERAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	12.6	Volts
Heater Current	0.225	Amperes
Envelope—T-5½, Glass		
Base—E7-1, Miniature Button 7-Pin		
Mounting Position—Any		
Direct Interelectrode Capacitances, approximate*		
Grid-Number 1 to Plate	0.4	μμf
Input	8.0	μμf
Output	8.5	μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Plate Dissipation	12	Watts
Screen Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.5	Megohms
Bulb Temperature at Hottest Point	250	C

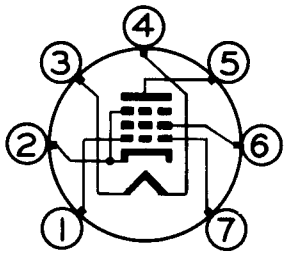
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	180	250	Volts
Screen Voltage	180	250	Volts
Grid-Number 1 Voltage	−8.5	−12.5	Volts
Peak AF Grid-Number 1 Voltage	8.5	12.5	Volts
Plate Resistance, approximate	58000	52000	Ohms
Transconductance	3700	4100	Micromhos
Zero-Signal Plate Current	29	45	Milliamperes
Maximum-Signal Plate Current, approximate	30	47	Milliamperes
Zero-Signal Screen Current	3.0	4.5	Milliamperes
Maximum-Signal Screen Current, approximate	4.0	7.0	Milliamperes
Load Resistance	5500	5000	Ohms
Total Harmonic Distortion, approximate	8	8	Percent
Maximum-Signal Power Output	2.0	4.5	Watts

* Without external shield.

BASING DIAGRAM



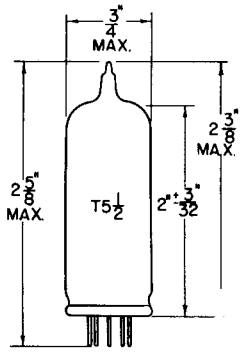
RETMA 7BZ

BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode and Beam Plates
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Grid Number 1

PHYSICAL DIMENSIONS



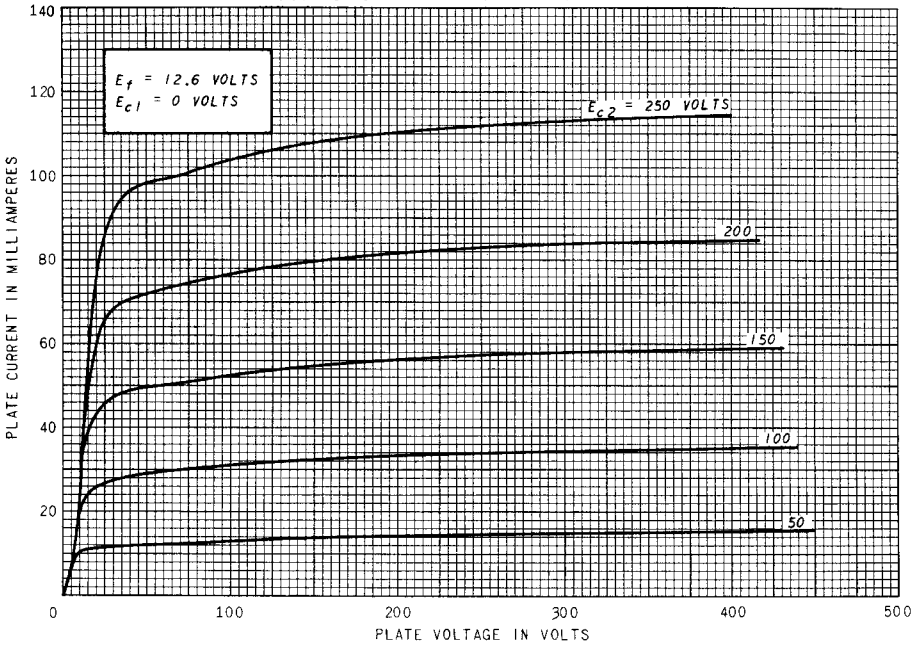
RETMA 5-3

CHARACTERISTICS AND TYPICAL OPERATION

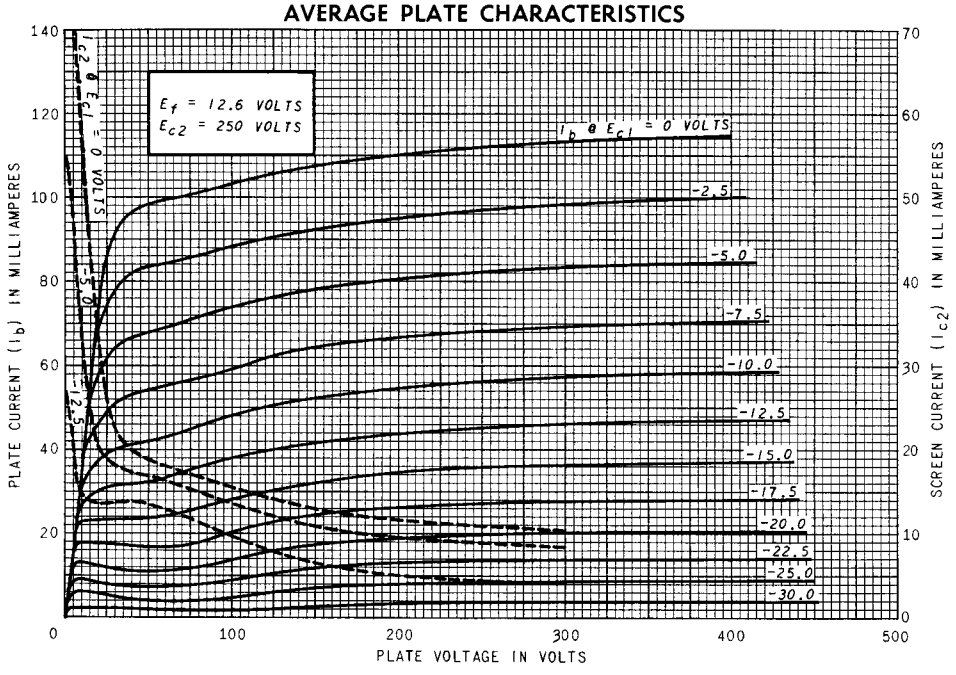
PUSH-PULL CLASS AB_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	−15	Volts
Peak AF Grid-to-Grid Voltage	30	Volts
Zero-Signal Plate Current	70	Milliamperes
Maximum-Signal Plate Current, approximate	79	Milliamperes
Zero-Signal Screen Current	5.0	Milliamperes
Maximum-Signal Screen Current, approximate	13	Milliamperes
Effective Load Resistance, Plate-to-Plate	10000	Ohms
Total Harmonic Distortion, approximate	5	Percent
Maximum-Signal Power Output	10	Watts

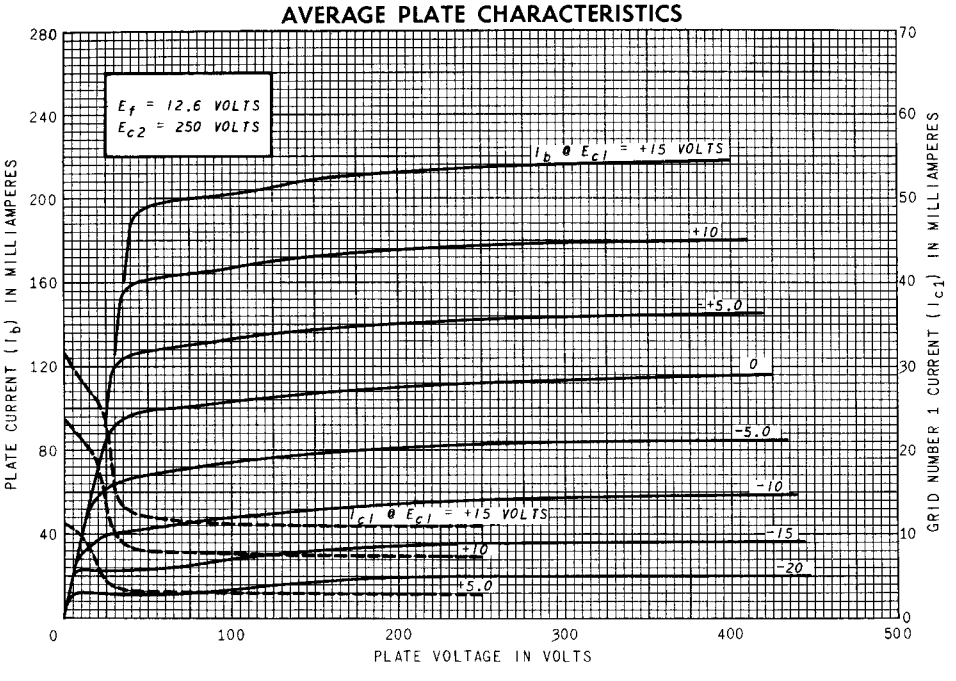
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

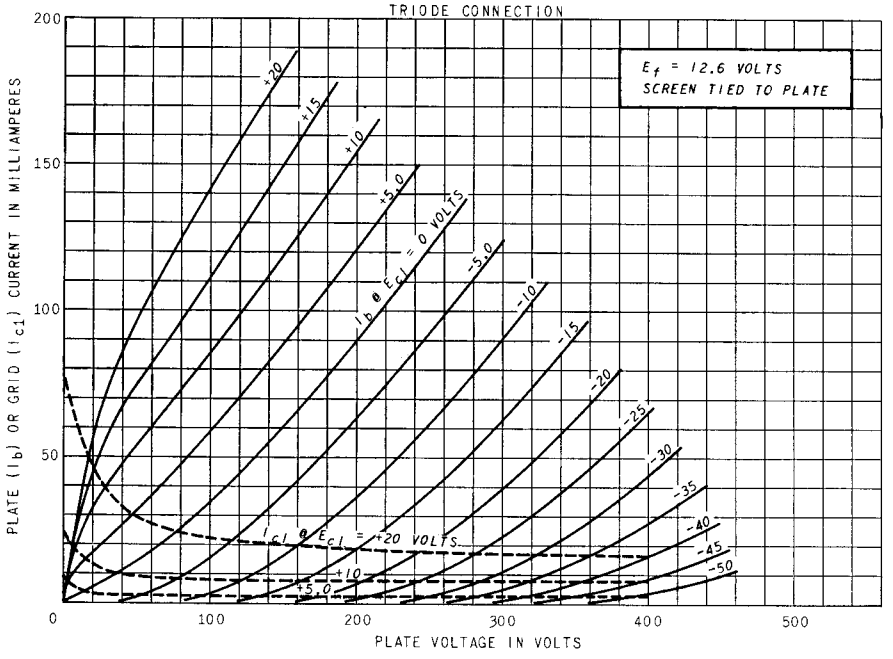


AVERAGE PLATE CHARACTERISTICS

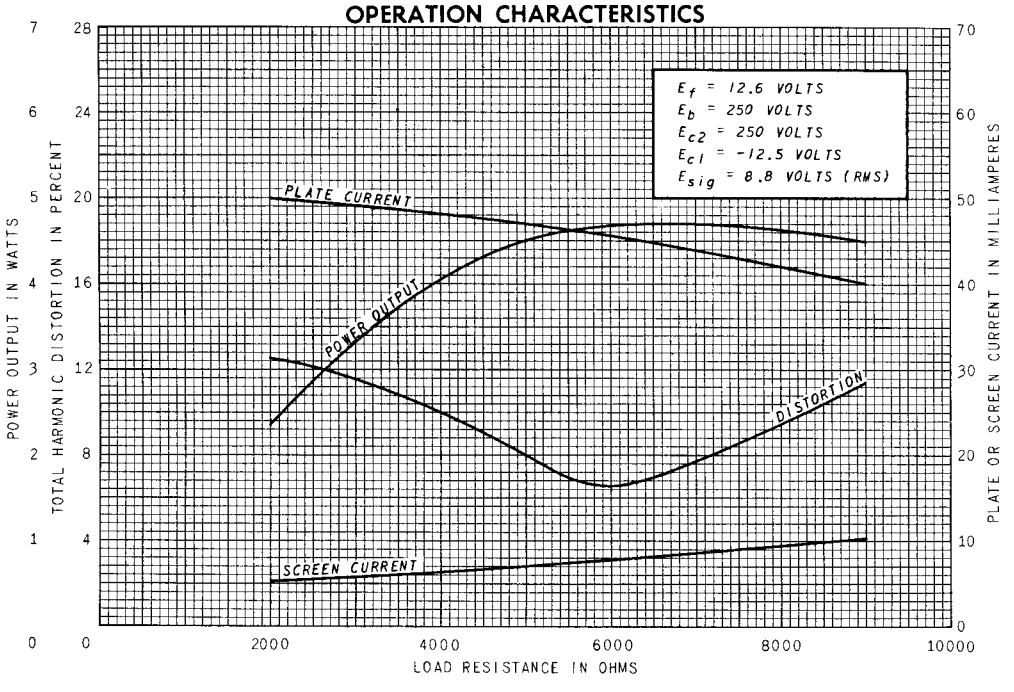


AVERAGE PLATE CHARACTERISTICS

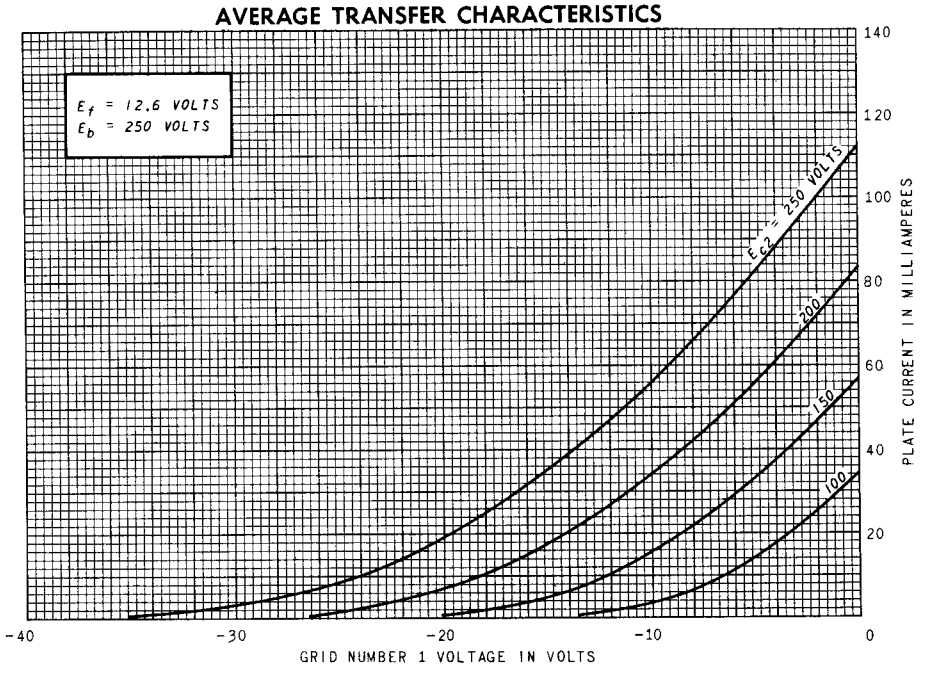
TRIODE CONNECTION



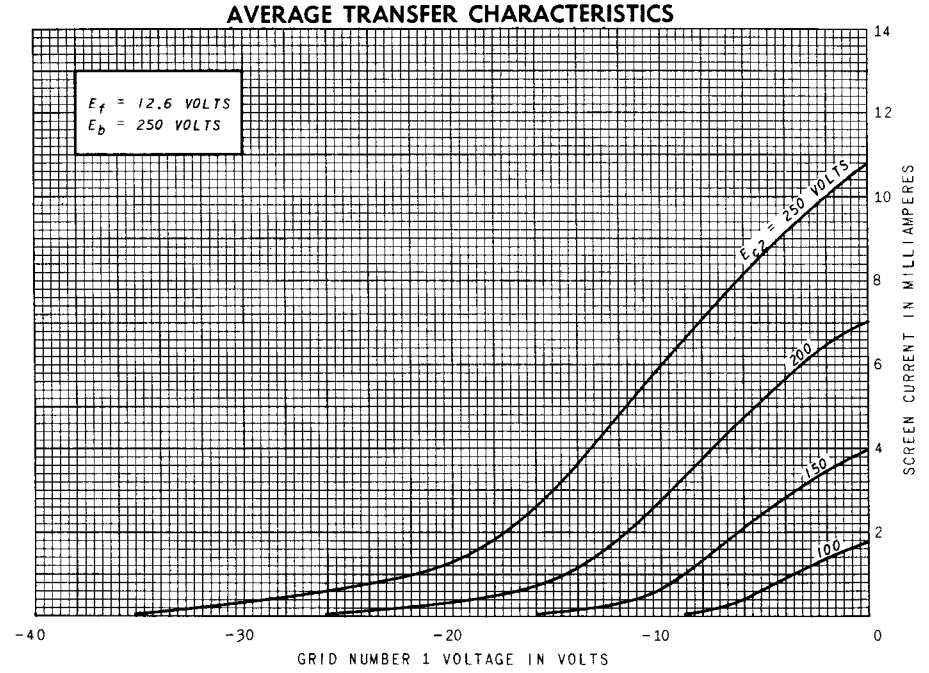
OPERATION CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



12ARP-
CATHODE RAY TUBE

12-1/2 - INCH

FOCUS - ELECTROSTATIC

DEFLECTION - ELECTROSTATIC

FACE PLATE: SPHERICAL, 40" R

DUAL BEAM

POST ACCELERATION

ALUMINIZED

DESCRIPTION AND RATING

The General Electric Type 12ARP- is a 12-1/2 inch diameter, dual beam, electrostatic focus and deflection cathode ray tube, having minimum pattern distortion, deflection defocusing, and tracking error.

An aluminized screen is used for greater light output and for stabilization of screen potential.

GENERAL

ELECTRICAL

Focusing Method	Electrostatic
Deflecting Method	Electrostatic

Direct Interelectrode Capacitances, Approx.

Cathode to all other electrodes	6.0 µµf
Grid #1 to all other electrodes	7.0 µµf
D1 to D2	4.0 µµf
D3 to D4	3.5 µµf
D1 to all other electrodes	10.0 µµf
D2 to all other electrodes	10.0 µµf
D3 to all other electrodes	10.0 µµf
D4 to all other electrodes	10.0 µµf

OPTICAL

Phosphor Number	2	7	14	19	25
Fluorescent Color	Green	Blue	Purple	Orange	Orange
Phosphorescent Color	Green	Yellow	Orange	Orange	Orange
Persistence	Long	Long	Med.-Long	Very Long	Very Long

Faceplate - Clear

MECHANICAL

Over-all Length	24 7/8±3/8 Inches
Greatest Diameter of Bulb	12 7/12±1/16 Inches
Minimum Useful Screen Diameter	11 Inches

from JEDEC release #3294, May 29, 1961

Bulb Contact	J1-22
Neck Contacts	J1-25
Base	B12-37
Basing	Special

Bulb Contact Alignment:
- J1-22 contact aligns with trace of D1D2 . . . . . ± 10 Degrees
- J1-22 contact on same side as Pin #4

Base Alignments:
- D1D2 trace aligns with Pin #4 and tube axis . . . . . ± 10 Degrees
- Positive voltage on D1 deflects beam approximately toward Pin #4
- Positive voltage on D3 deflects beam approximately toward Pin #1

Angle between D3D4 and D1D2 traces . . . . . 90 ± Degrees

RATINGS
(Design Center Values)[1]

Heater Voltage	6.3 Volts
Heater Current at 6.3 Volts	0.6 ± 10% Ampere
Post Accelerator Voltage	16,000 Max. Volts DC
Accelerator Voltage	10,000 Max. Volts DC
Accelerator Input	6 Max. Watts
Focusing Electrode Voltage	4,000 Max. Volts DC
Ratio Post Accelerator Voltage to Accelerator Voltage	2.0 Max.

Grid #1 Voltage

Negative Bias Value	300 Max. Volts DC
Positive Bias Value	0 Max. Volts DC
Positive Peak Value	0 Max. Volts

Peak Heater-Cathode Voltage

Heater negative with respect to cathode	180 Max. Volts
Heater positive with respect to cathode	180 Max. Volts

Peak Voltage between Accelerator and any Deflection Electrode	2,500 Max. Volts

TYPICAL OPERATING CONDITIONS[1]

Post Accelerator Voltage	7,700 Volts
Accelerator Voltage	7,500 Volts
Focusing Electrode Voltage	1,750 to 2,500 Volts
Grid #1 Voltage[3]	-150 to -225 Volts

Deflection Factors:

D1 and D2	130 to 180 Volts DC per Inch

D3 and D4	130 to 180 Volts DC per Inch
Line Width "A"[3]	.015 Inch Max.
Tracking Accuracy[4]	0.15 Inch
Interaction Factor	14×10^{-5} Max. Inches per Volt
Deflection Defocusing[6]	
Spot Position[7]	Within a 5/8" Radius Circle

MAXIMUM CIRCUIT VALUES

Grid #1 Circuit Resistance	1.5 Max. Megohms
Resistance in any Deflecting-Electrode Circuit[8]	5.0 Max. Megohms

NOTES:

1. The values shown are for each unit unless otherwise stated.

2. The visual extinction of the focused, undeflected spot.

3. For a beam current of 2 μAdc, measured in accordance with MIL-E-1 specifications,

4. The measurement of tracking error shall be made as follows:

   The focused spots of both guns shall be moved by means of a common d-c voltage along the 1D2 axis until the spot of gun A is at +3 inches from the center of the tube. Then by means of a small correction voltage the spot of gun B shall be moved to the same 1D2 position. The spots then shall be moved by means of the common d-c voltage in the opposite direction until the spot of the less sensitive gun reaches -3 inches by means of a voltage divider. The procedure is repeated until 1D2 deflection factor compensation is complete. The entire procedure is then duplicated along the 3D4 axis with a distance from the center of ±3 inches. Then by means of the two common d-c voltages the spots shall be tracked over the area within a circle 10 inches in diameter. If desired, a small correction voltage may be applied to the plates of one gun to allow optimum spot positioning for minimum over-all tracking error.

   The separation of spots over the tracking area shall not exceed .15 inches.

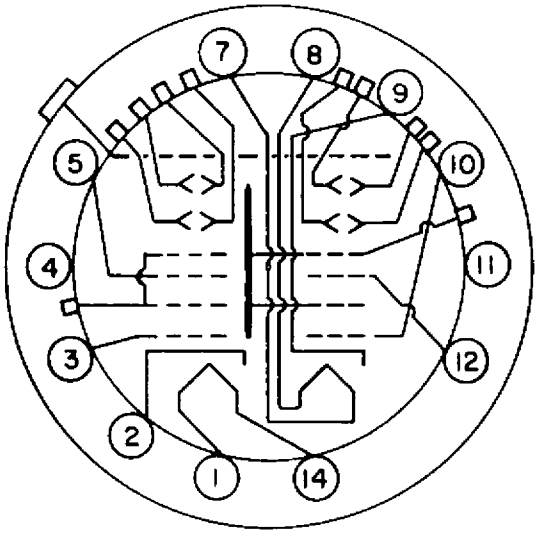
5. Deflection per unit volt of one beam at any position of the beam within its useful scan when a balanced voltage of at least plus or minus 300 volts is applied to the 1D2 deflection electrodes of the other electron gun shall be not greater than the value specified herein.

6. Defocusing of the spot resulting from all causes is a minimum within an area 10 inches in diameter. Specifically, the degradation in spot size anywhere within a circle 10 inches in diameter compared to the spot size of compromise focus will not exceed 1.5 to 1.

7. When the tube is operated at typical operating conditions, with Ec1 adjusted to avoid damage to the screen, with each of the deflecting electrodes connected to the accelerator, and with the tube shielded against external influences, the spot will fall within a 5/8-inch radius circle, centered on the tube face.

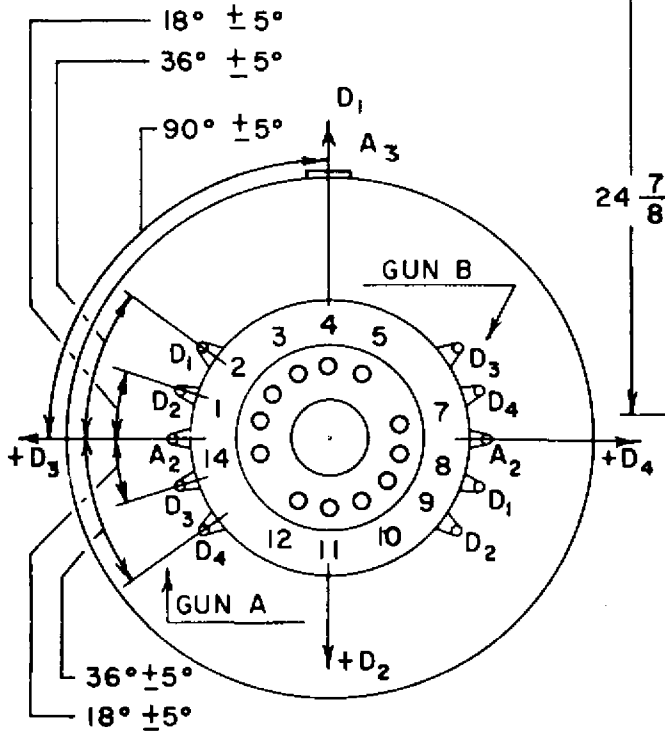
8. It is recommended that the deflection electrode circuit resistances be approximately equal.

12ARP___

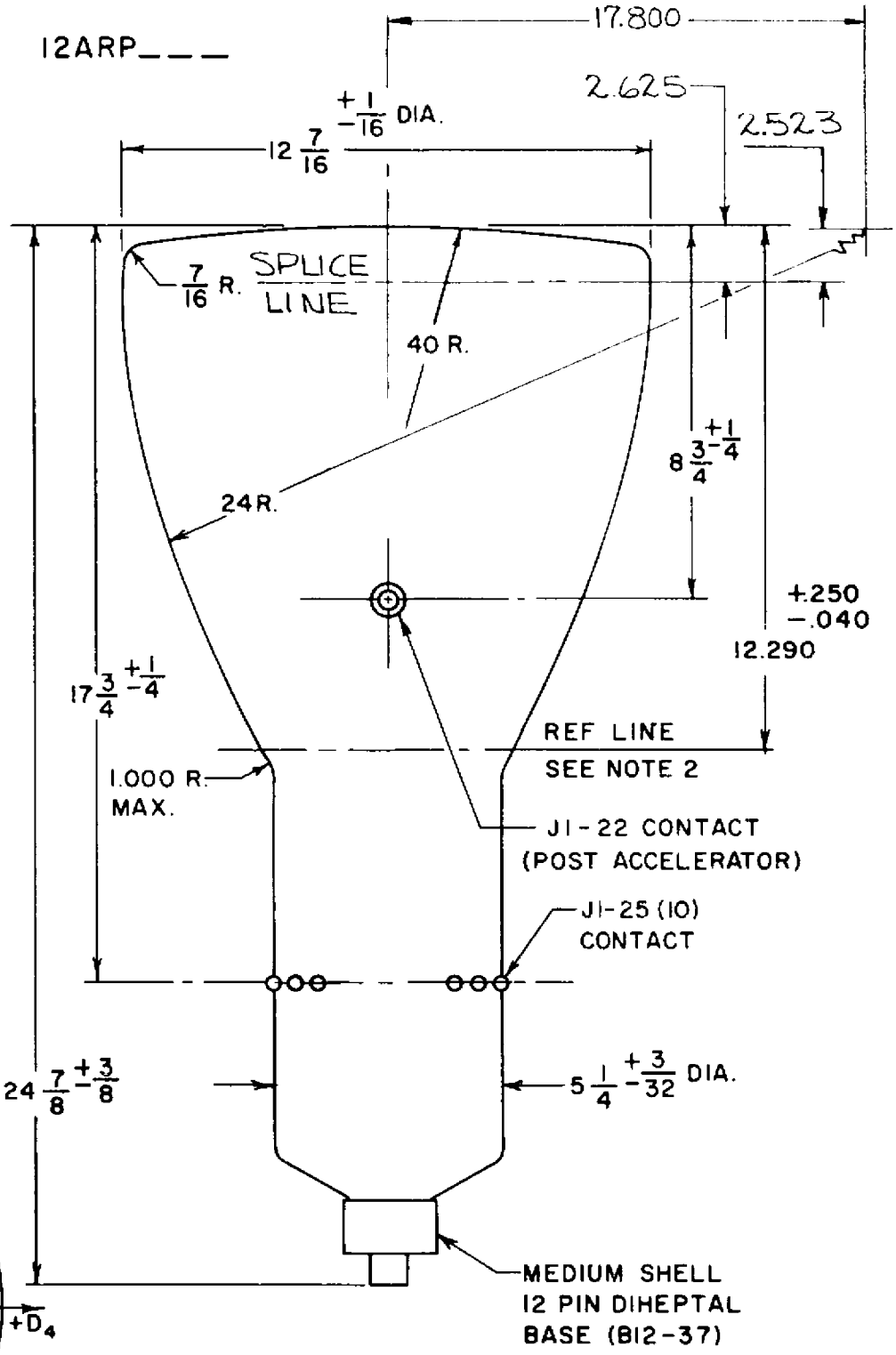


BASING DIAGRAM

GUN A	GUN B
1. HEATER	7. HEATER
2. CATHODE	8. HEATER
3. GRID NO. 1	9. CATHODE
5. FOCUSING ELECTRODE	10. GRID NO. 1
14. HEATER	12. FOCUSING ELECTRODE



BOTTOM VIEW



NOTES : (1) BASE PIN #4 ALIGNS WITH J1-22 CONTACT

(2) REFERENCE LINE IS THAT POINT WHERE A 5.750 ± .003 INCH DIAMETER RING GUAGE WILL STOP

GENERAL ELECTRIC

INDUSTRIAL AND MILITARY CATHODE RAY TUBES

12AS
P7, P14, P19, P25
CATHODE RAY TUBE

12-INCH ROUND GLASS

FOCUS -- ELECTROSTATIC

DEFLECTION -- ELECTROSTATIC

POST ACCELERATION

PERSISTENCE -- LONG

ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 12AS' is a cathode ray tube for radar and oscillographic applications. Features of this tube are post-acceleration which assures maximum deflection sensitivity with high brightness and an aluminized screen to increase light output, reduce undesirable screen charging, and prevent ion-spot blemish.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes

Focusing Method -- Electrostatic
Deflecting Method -- Electrostatic

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	6.0	μμf
Grid-No. 1 to All Other Electrodes	7.5	μμf
D1 to D2	4.0	μμf
D3 to D4	3.0	μμf
D1 to All Other Electrodes	12.0	μμf
D2 to All Other Electrodes	12.0	μμf
D3 to All Other Electrodes	6.5	μμf
D4 to All Other Electrodes	6.5	μμf

OPTICAL

Phosphor Number	P7	P14	P19	P25
Fluorescent Color	Blue-White	Purple	Orange	Orange
Phosphorescent Color	Yellow	Orange	Orange	Orange
Persistence	Long	Medium Long	Long	Long

from JEDEC release #3323, June 26, 1961

MECHANICAL

Over-all Length	22-3/4 ± 3/8	Inches
Greatest Bulb Diameter	12-7/16 + 1/16 - 3/32	Inches
Minimum Useful Screen Diameter	11.0	Inches

Neck Contacts - Small Ball Caps, JETEC No. J1-25
Bulb Contact - Recessed Small-cavity Cap., JETEC No. J1-22
Base - Medium Shell Diheptha1 - JETEC No. B12-37

Bulb Contact Alignment
J1-22 Contact Aligns with Trace D3-D4 ± 10 Degrees

Base Alignment
Pin No. 11 aligns with J1-22 contact ± 10°

Neck Contact Alignment
D1-D2 Trace Aligns With Neck Button (A2) and Tube Axis ± 10 Degrees.
Positive Voltage on D1 Deflects Beam Approximately Away from A2.
Positive Voltage on D3 Deflects Beam Approximately Away from Post Accelerator Button.

Trace Alignment
Angle Between D3-D4 and D1-D2 Traces. . . . . 90 ± 1 Degrees

Mounting Position -- Any

RATINGS

DESIGN CENTER VALUES *

Post-Accelerator Voltage	16,000	Max Volts DC
Anode Voltage +	8,000	Max Volts DC
Ratio-Post Accelerator Voltage to Anode Voltage	2.5	Max
Anode Input ++	6	Max Watts
Focusing-Electrode Voltage	3,000	Max Volts DC
Grid No. 2 Voltage	700	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	300	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative With Respect to Cathode	180	Max Volts
Heater Positive With Respect to Cathode	180	Max Volts
Peak Voltage Between Anode and Any Deflecting Electrode	1,500	Max Volts

TYPICAL OPERATING CONDITIONS

Post Accelerator Voltage	9,700	Volts DC
Anode Voltage	6,100	Volts DC

TYPICAL OPERATING CONDITIONS (Cont'd)

Focusing-Electrode Voltage	1,750 to 2,220	Volts DC
Grid No. 2 Voltage	300	Volts DC
Grid No. 1 Voltage #	-40 to -77	Volts DC
Modulation Factor ⫪	30	Max Volts
Deflecting Factors		
D1 and D2	115 to 135	Volts DC Per Inch
D3 and D4	115 to 135	Volts DC Per Inch
Focusing Electrode for any Operating Condition	-15 to +10	Microamperes
Spot Position Undeflected ⌀	within a 20	Millimeter Square
Line Width A △	.5	Max Millimeters

CIRCUIT VALUES

Grid No. 1 Circuit Resistance	2.0	Max Megohms
Resistance in any Deflecting Electrode Circuit ◇	5.0	Max Megohms

* The maximum ratings provide a ten percent safety factor in accordance with the standard design-center system of rating cathode ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

\+ Anode, Grid No. 2 and Grid No. 4 which are connected together within the tube are referred to herein as anode.

++ Anode input equals the product of anode voltage and average current measured at the terminal.

\# For visual extinction of focused undeflected spot.

⫪ For a lb3 of 25 microamperes d-c in accordance with MIL-E-1 specification.

⌀ With post-accelerator anode voltage of 9,700 volts, the center of the focused undeflected spot will lie within a square of 20 millimeters radius centered on the tube face.

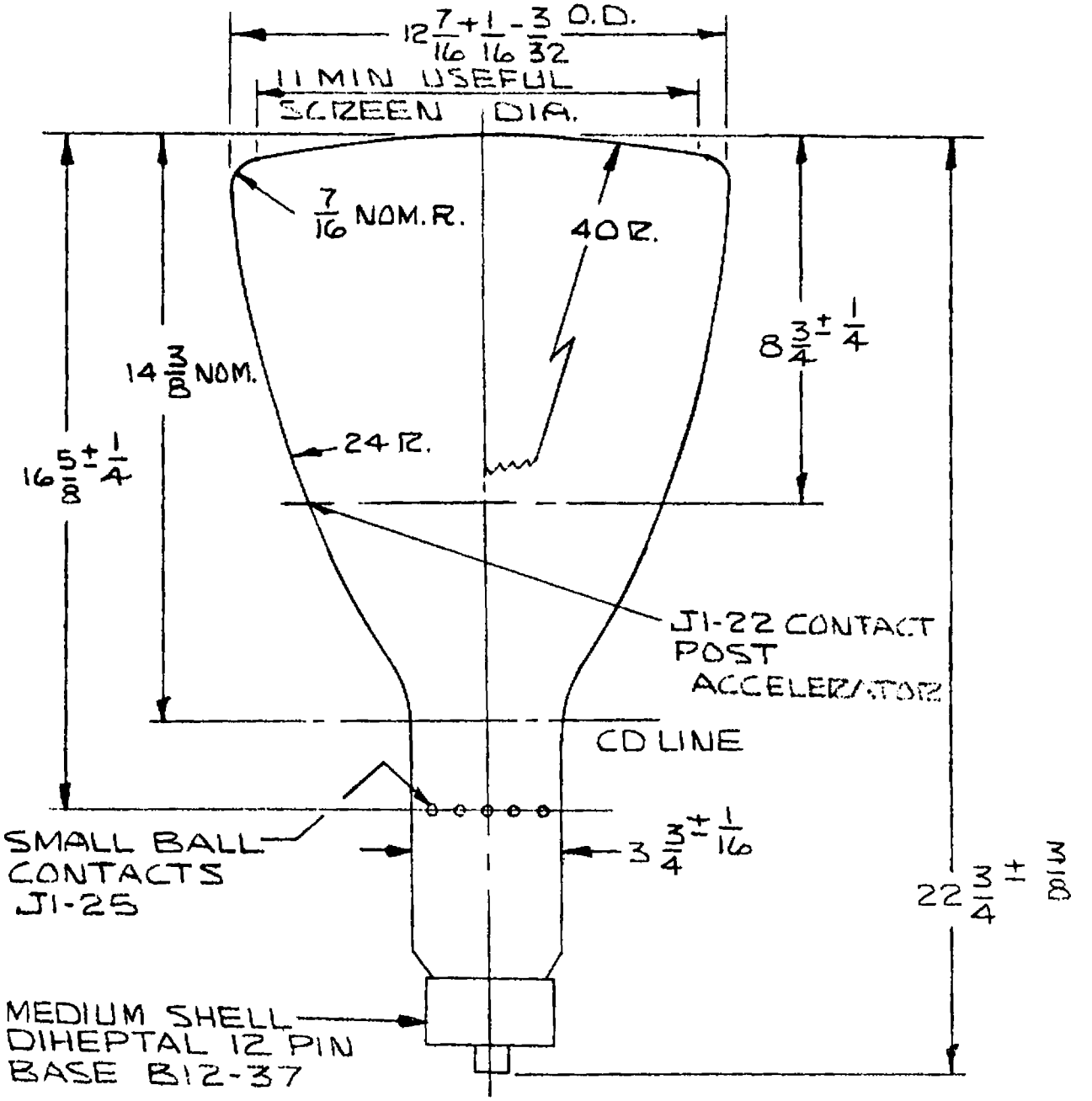
△ Measured with specification MIL-E-1, paragraph 4.12.6.1, at an anode No. 3 (post-acceleration) current of 25 microamperes d.c.

◇ It is recommended that the deflection electrode resistance be approximately equal.

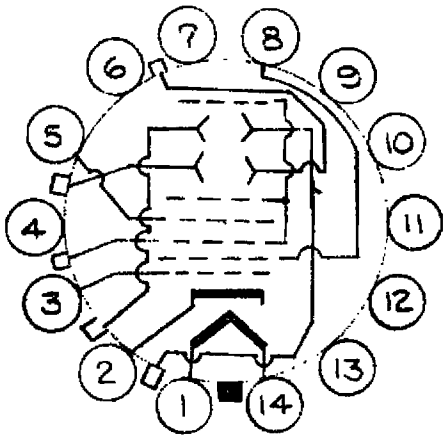
Cathode Ray Tube Department

GENERAL ELECTRIC COMPANY

Syracuse, N.Y.


12 7/16 +1/16 -3/32 O.D.
11 MIN USEFUL SCREEN DIA.
7/16 NOM. R.
40 R.
14 3/8 NOM.
8 3/4 ± 1/4
16 5/8 ± 1/4
24 R.
J1-22 CONTACT POST ACCELERATOR
CD LINE
SMALL BALL CONTACTS J1-25
3 3/4 ± 1/16
22 3/4 ± 3/8
MEDIUM SHELL DIHEPTAL 12 PIN BASE B12-37

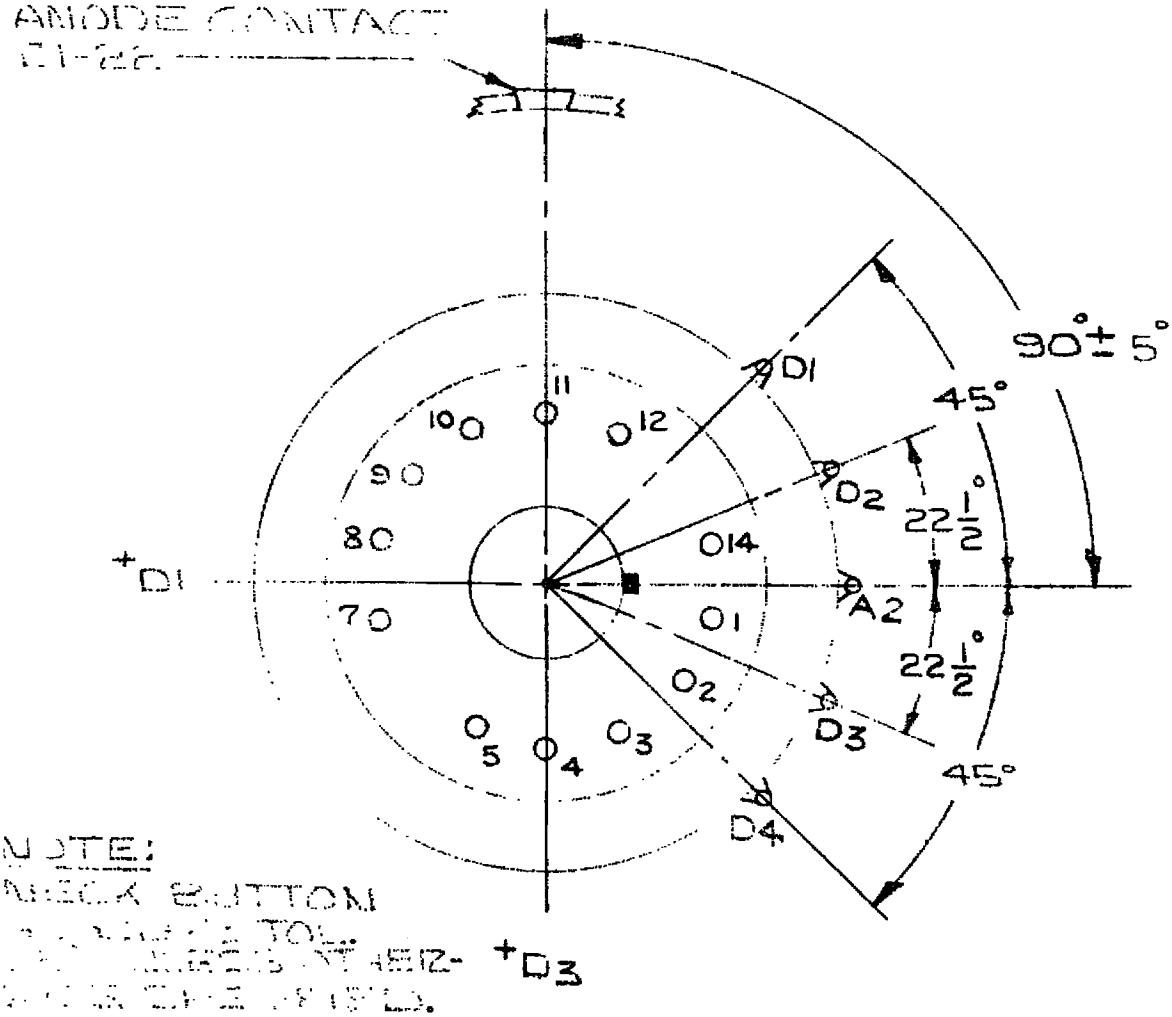
12ASP---



BASING DIAGRAM

12ASP---

PIN NO.	ELEMENT
1	HEATER
2	CATHODE
3	GRID NO.1
5	FOCUSING ELECTRODE
8	GRID NO.2
14	HEATER



NOTE:
NECK BUTTOM
TO
WITHIN
CHES MAX'D.

BOTTOM VIEW

Electronic TUBES

12AT7

TWIN TRIODE

DESCRIPTION AND RATING

The 12AT7 is a miniature, high-mu, twin triode designed for use as a grounded-grid radio-frequency amplifier or as a combined oscillator and mixer at frequencies below approximately 300 megacycles.

GENERAL

ELECTRICAL

	Series	Parallel	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	12.6	6.3	Volts
Heater Current	0.15	0.3	Amperes

Direct Interelectrode Capacitances	With Shield*	Without Shield	
Grid to Plate, Each Section	1.5	1.5	μμf
Input, Each Section	2.2	2.2	μμf
Output, Section 1	1.2	0.5	μμf
Output, Section 2	1.5	0.4	μμf
Heater to Cathode, Each Section	2.4	2.4	μμf

Grounded-Grid Operation	With Shield†	Without Shield	
Plate to Cathode, Each Section	0.2	0.2	μμf
Grounded-Grid Input, Each Section	4.6	4.6	μμf
Grounded-Grid Output, Each Section	2.6	1.8	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

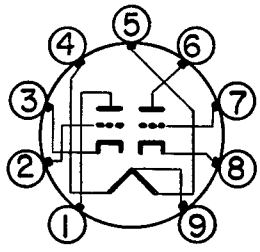
DESIGN-CENTER VALUES, EACH SECTION

Plate Voltage	300	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	2.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts

GENERAL ELECTRIC

Supersedes ET-T470A, dated 1-50

BASING DIAGRAM

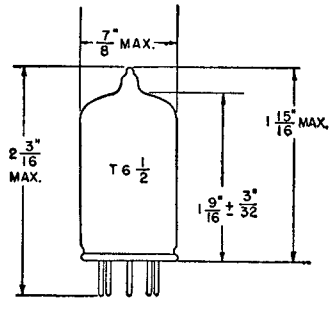


RETMA 9A

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Heater Center-Tap

PHYSICAL DIMENSIONS



RETMA 6-2

CHACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

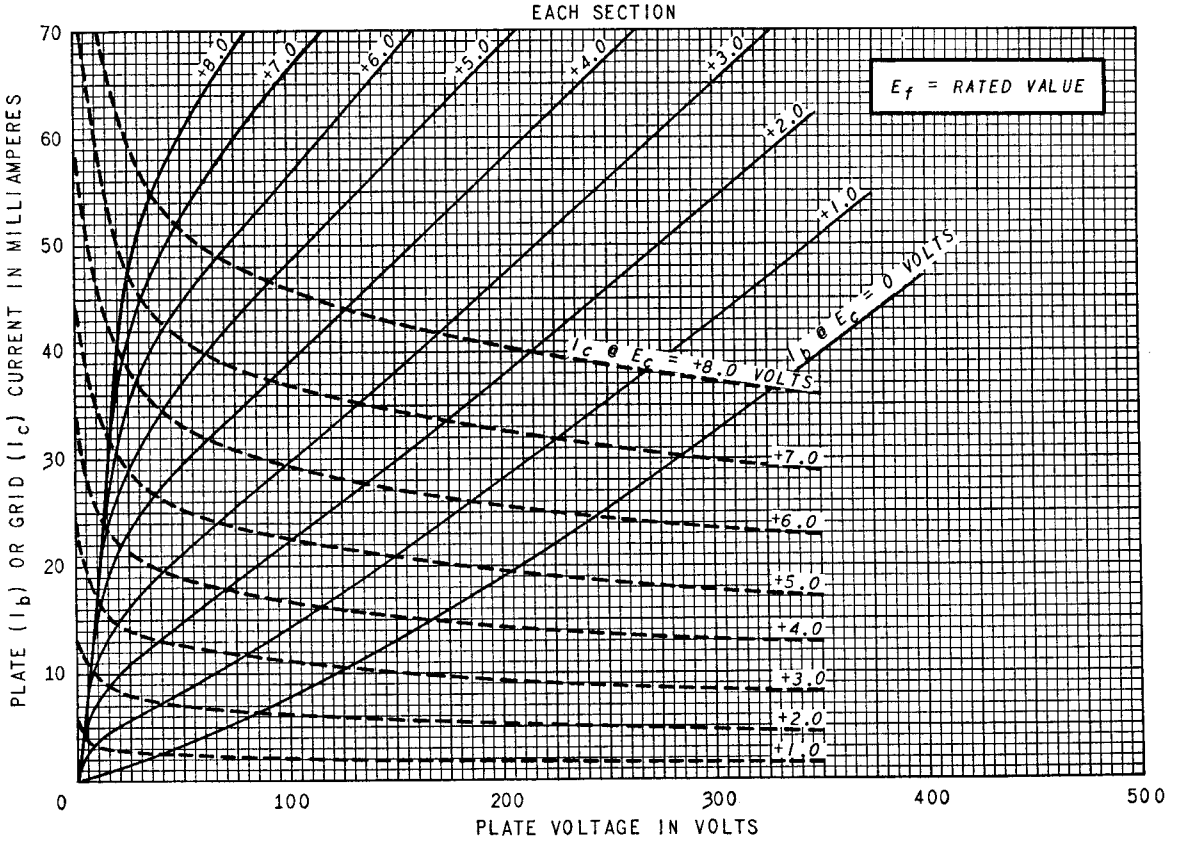
Plate Voltage	100	250	Volts
Cathode-Bias Resistor	270	200	Ohms
Amplification Factor	60	60	
Plate Resistance, approximate	15000	10900	Ohms
Transconductance	4000	5500	Micromhos
Plate Current	3.7	10	Milliamperes
Grid Voltage, approximate			
Ib = 10 Microamperes	−5	−12	Volts

* With external shield (RETMA 315) connected to cathode of section under test.

† With external shield (RETMA 315) connected to grid of section under test.

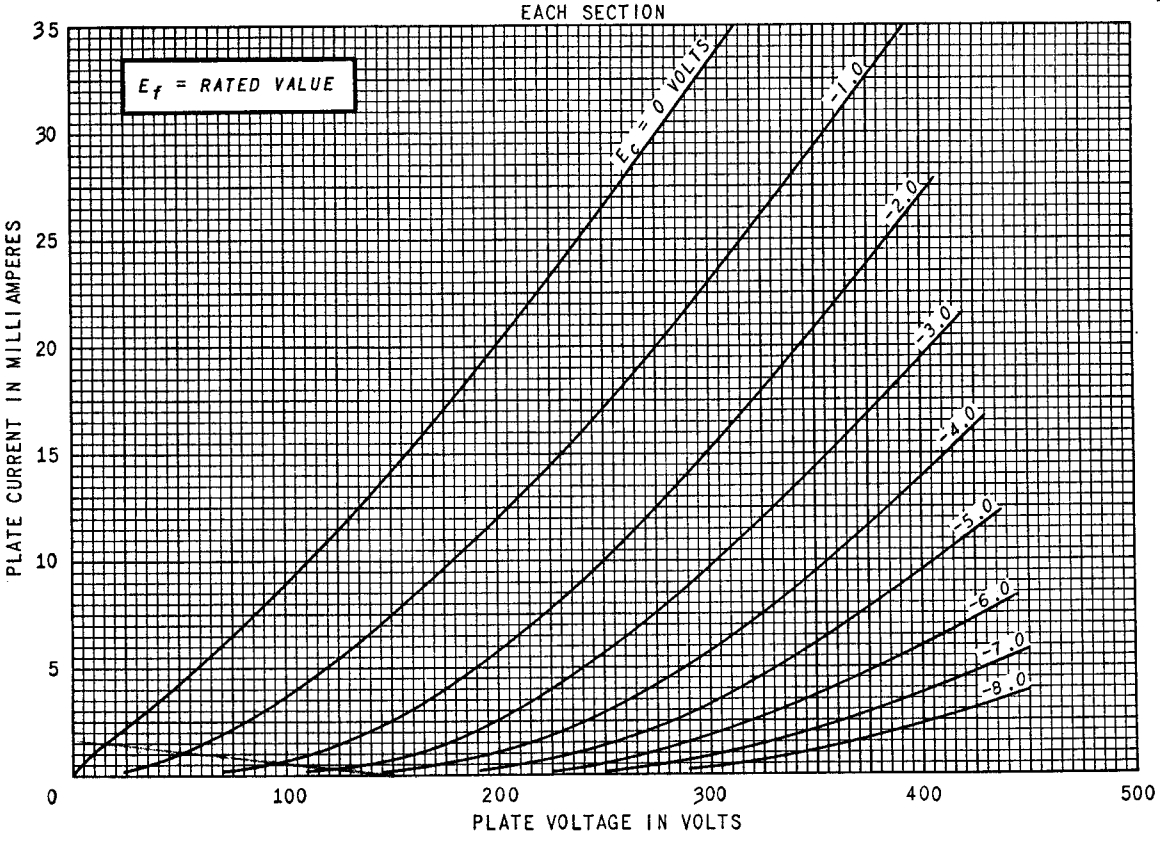
AVERAGE PLATE CHARACTERISTICS

EACH SECTION

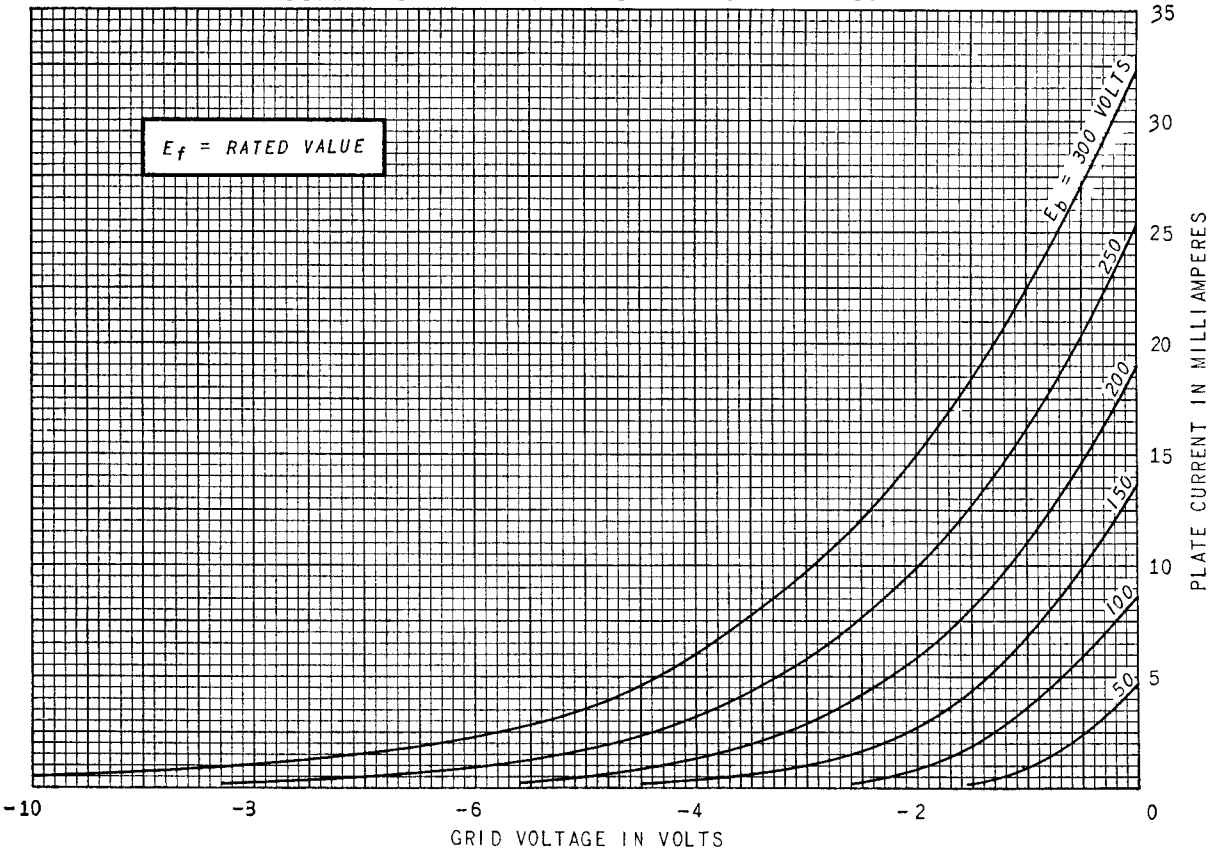


AVERAGE PLATE CHARACTERISTICS

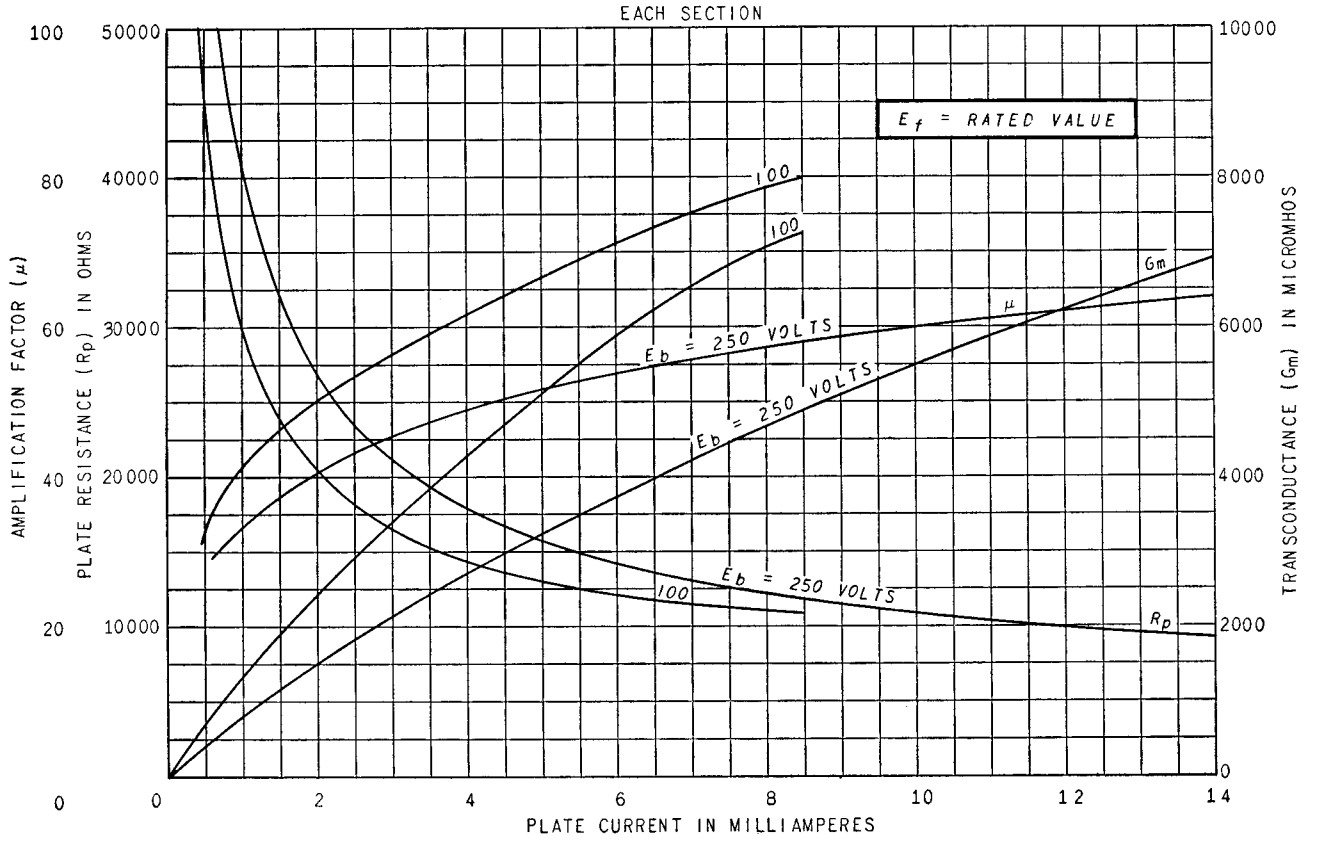
EACH SECTION



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

12AU7-A—12AU7—7AU7

TWIN TRIODE

DESCRIPTION AND RATING

The 12AU7-A is a miniature medium-mu twin triode intended for service in radio and television receivers or in audio amplifiers. The tube is suitable for use in a variety of stages, such as general-purpose amplifier, phase inverter, oscillator, or multivibrator.

The electrical characteristics of the 12AU7-A and 12AU7 are essentially equivalent. As compared to the 12AU7, the 12AU7-A exhibits a lower microphonic output.

Except for heater ratings, the 7AU7 is identical to the 12AU7-A. In addition, the 7AU7 incorporates a controlled heater warm-up characteristic and is specially suited for use in television receivers that employ 600-milliampere, series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	7AU7		12AU7-A 12AU7		
	Series	Parallel	Series	Parallel	
Heater Voltage, AC or DC	7.0	3.5	12.6	6.3	Volts
Heater Current	0.3	0.6	0.15	0.3	Amperes
Heater Warm-up Time*	....	11	....	....	Seconds

Direct Interelectrode Capacitances	With Shield†	Without Shield	
Grid to Plate, Each Section	1.5	1.5	μμf
Input, Each Section	1.8	1.6	μμf
Output, Section 1	2.0	0.4	μμf
Output, Section 2	2.0	0.32	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

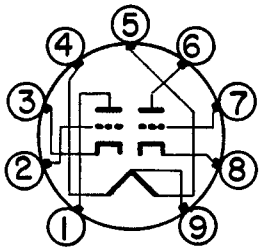
DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED, EACH SECTION

	Class A_1 Amplifier	Vertical Deflection Amplifier‡	
DC Plate Voltage	300	300	Volts
Peak Positive Pulse Plate Voltage	....	1200§	Volts
Peak Negative Grid Voltage	....	250	Volts
Plate Dissipation	2.75	2.75△	Watts
DC Cathode Current	20	20	Milliamperes
Peak Cathode Current	....	60	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance			
With Fixed Bias	0.25	....	Megohms
With Cathode Bias	1.0	2.2	Megohms

GENERAL ELECTRIC

Supersedes ET-T880, dated 9-54

BASING DIAGRAM

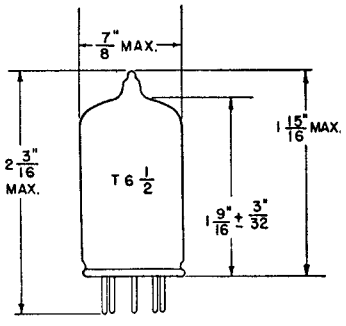


RETMA 9A

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Heater Center-Tap

PHYSICAL DIMENSIONS



RETMA 6-2

MAXIMUM RATINGS (Cont'd)

DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED, EACH SECTION

	Vertical-Oscillator Service‡	Horizontal Oscillator Service‡	
DC Plate Voltage	300	300	Volts
Peak Negative Grid Voltage	400	600	Volts
Plate Dissipation	2.75	2.75	Watts
DC Cathode Current	20	20	Milliamperes
Peak Cathode Current	60	300	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance			
With Fixed Bias	2.2	2.2	Megohms
With Cathode Bias	2.2	2.2	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	100	250	Volts
Grid Voltage	0	−8.5	Volts
Amplification Factor	20	17	
Plate Resistance, approximate	6500	7700	Ohms
Transconductance	3100	2200	Micromhos
Plate Current	11.8	10.5	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes		−24	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† With external shield (RETMA 315) connected to cathode of section under test.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

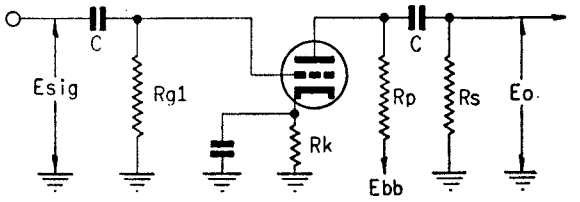
§ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

△In stages operating with grid-lead bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	0.10	0.10	3900	10	10	3600	11	20	3500	11	30
0.10	0.24	0.10	5000	11	14	4700	12	27	4400	12	41
0.24	0.24	0.10	9400	11	13	8700	11	25	8700	12	38
0.24	0.51	0.10	11000	11	17	11000	12	32	11000	12	48
0.51	0.51	0.10	19000	11	15	18000	12	29	18000	12	43
0.51	1.0	0.10	24000	11	19	23000	12	37	23000	12	54
0.24	0.24	10	0	14	12	0	16	20	0	17	28
0.24	0.51	10	0	14	16	0	16	28	0	17	40
0.51	0.51	10	0	14	15	0	15	26	0	16	38
0.51	1.0	10	0	14	19	0	16	35	0	16	52

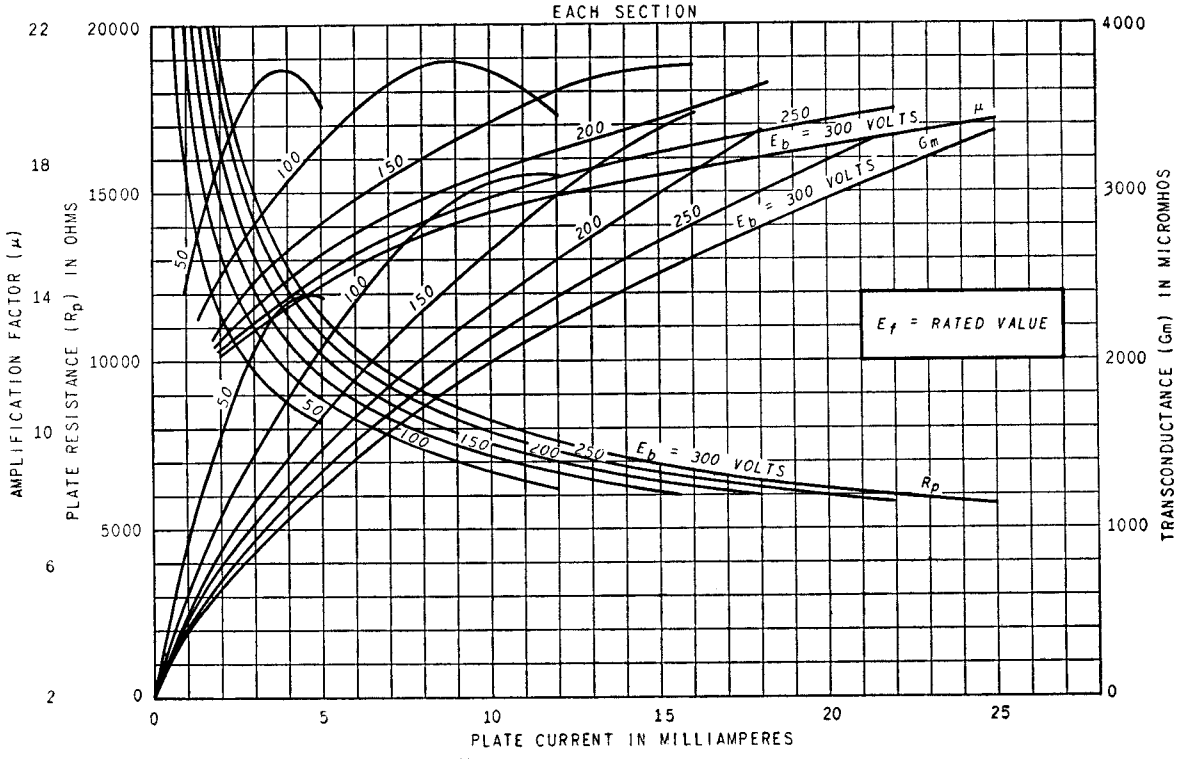


Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

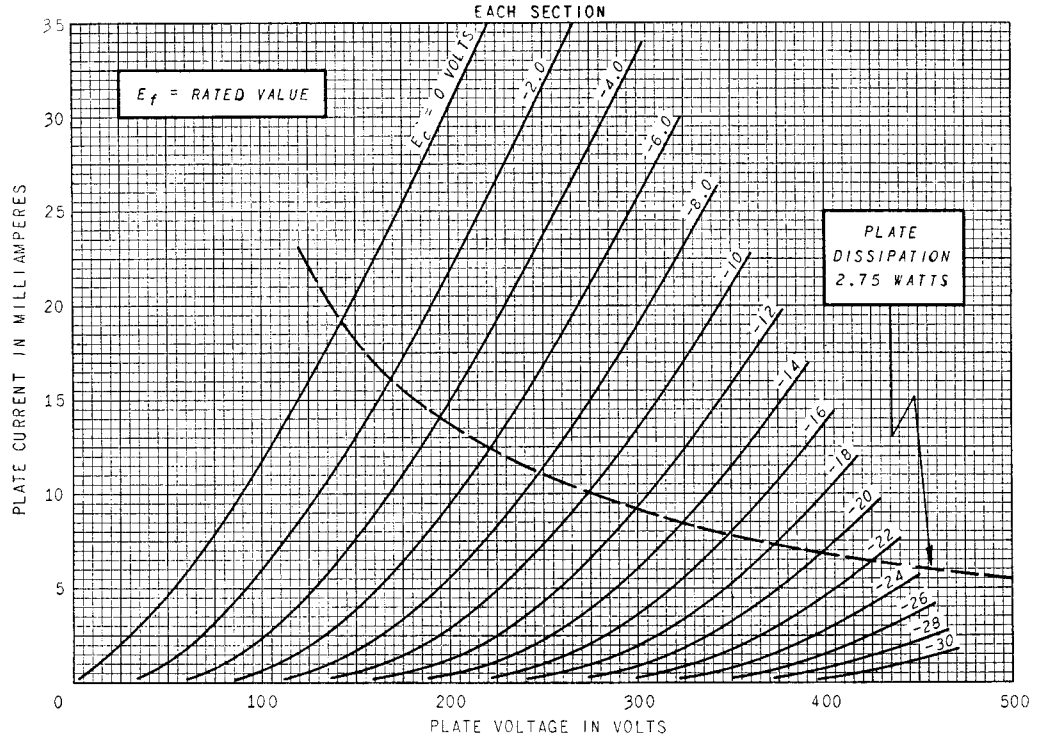
Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

AVERAGE CHARACTERISTICS

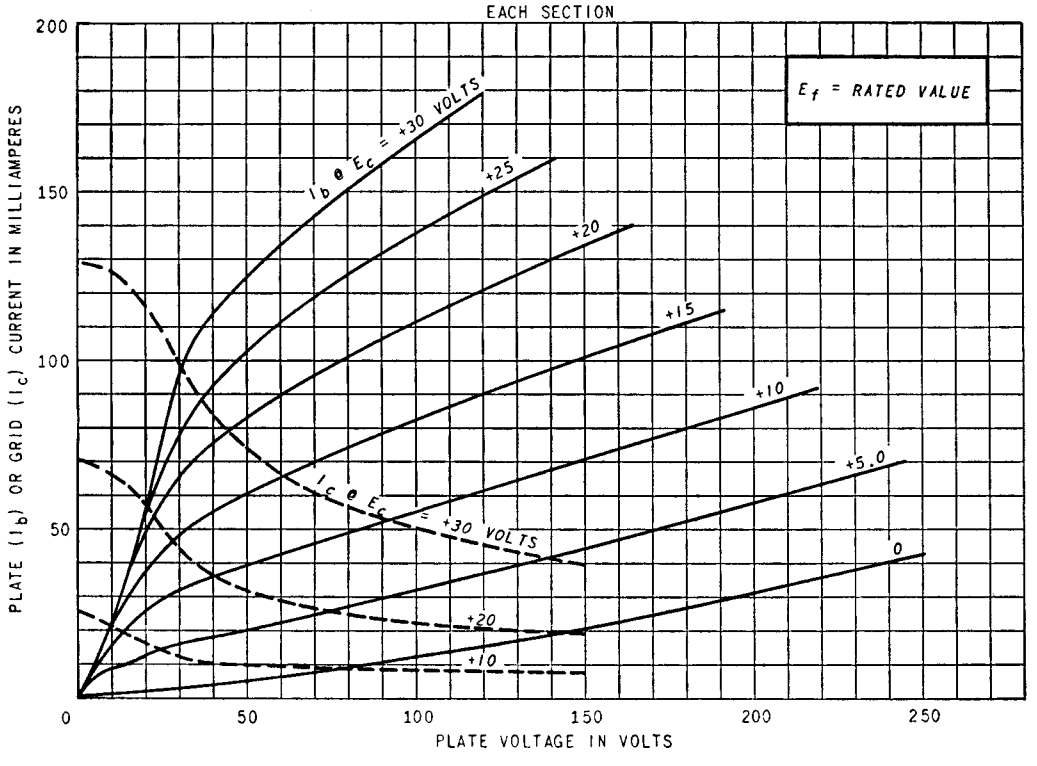
EACH SECTION



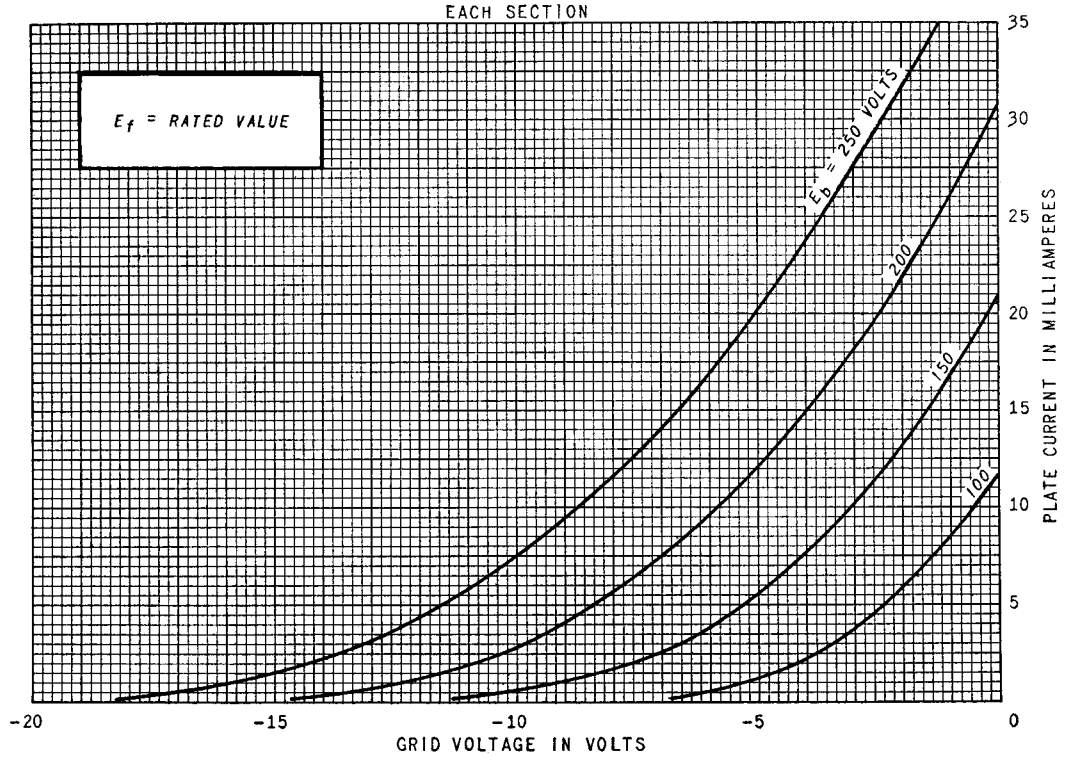
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBES

12AV7

TWIN TRIODE

DESCRIPTION AND RATING

The 12AV7 is a miniature, medium-mu twin triode for use as a radio-frequency amplifier or as a combined oscillator and mixer in VHF television receivers. It may also be used as an audio-frequency amplifier.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

	Series	Parallel	
Heater Voltage, AC or DC	12.6	6.3	Volts
Heater Current	0.225	0.45	Ampere

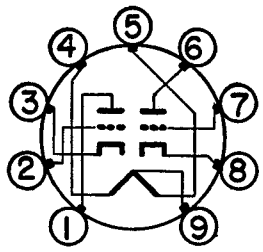
Direct Interelectrode Capacitances

	With Shield*	Without Shield	
Grid to Plate: (g to p), Each Section	1.9	1.9	μμf
Input: g to (h+k), Each Section	3.2	3.1	μμf
Output: p to (h+k), Section 1	1.3	0.5	μμf
Output: p to (h+k), Section 2	1.6	0.4	μμf
Heater to Cathode: (h to k), Each Section	4.0	3.8	μμf
Plate to Cathode: (p to k), Each Section	0.23	0.24	μμf
Grounded-Grid Input: k to (h+g), Each Section	7.0	6.9	μμf
Grounded-Grid Output: p to (h+g), Section 1	2.8	2.0	μμf
Grounded-Grid Output: p to (h+g), Section 2	3.2	2.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

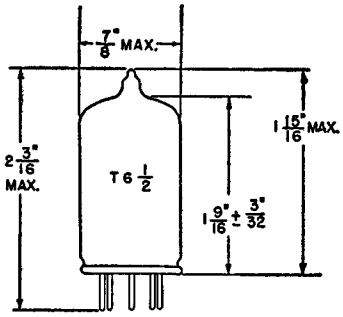


EIA 9A

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Heater Center-Tap

PHYSICAL DIMENSIONS



EIA 6-2

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GENERAL ELECTRIC

Supersedes ET-T1357 dated 1-56

MAXIMUM RATINGS

DESIGN-CENTER VALUES, EACH SECTION

Plate Voltage	300	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	2.7	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all tubes.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply-voltage.

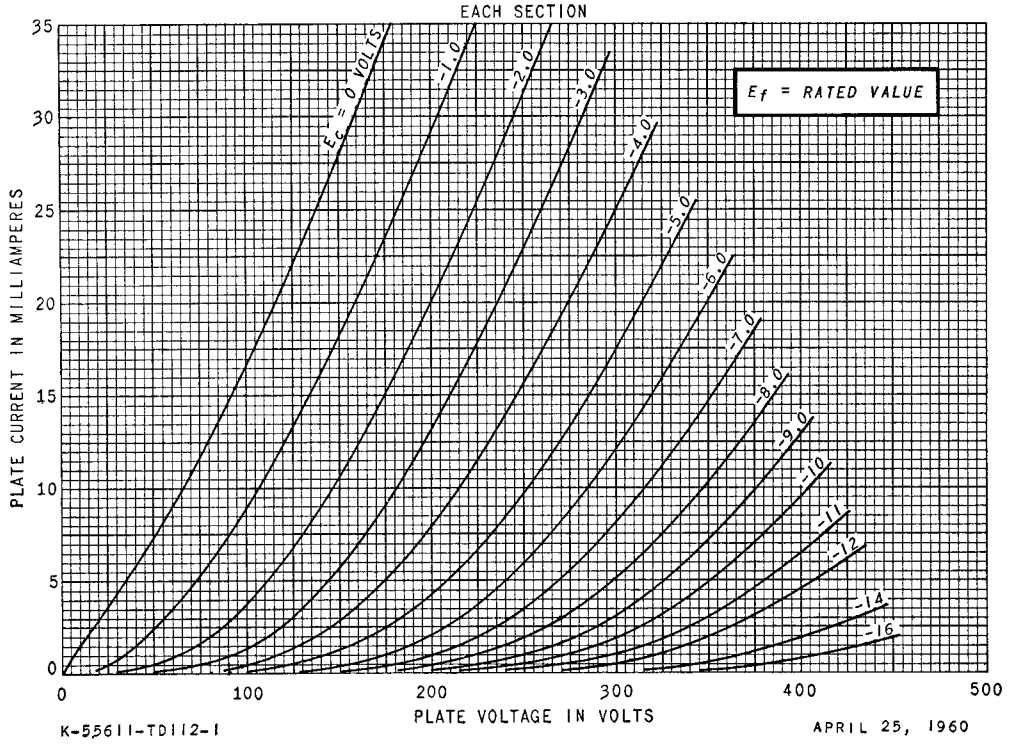
CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

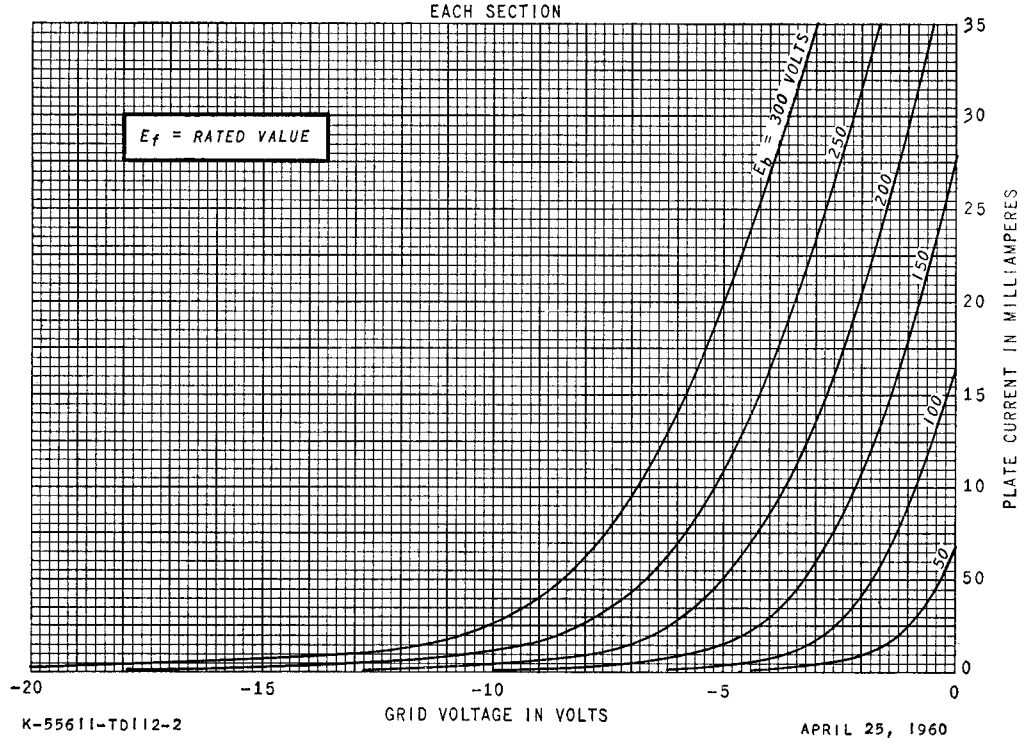
Plate Voltage	100	150	Volts
Cathode-Bias Resistor	120	56	Ohms
Amplification Factor	37	41	
Plate Resistance, approximate	6100	4800	Ohms
Transconductance	6100	8500	Micromhos
Plate Current	9.0	18	Milliamperes
Grid Voltage, approximate			
Ib = 10 Microamperes	−9	−12	Volts

* With external shield (EIA 315) connected to cathode of section under test.

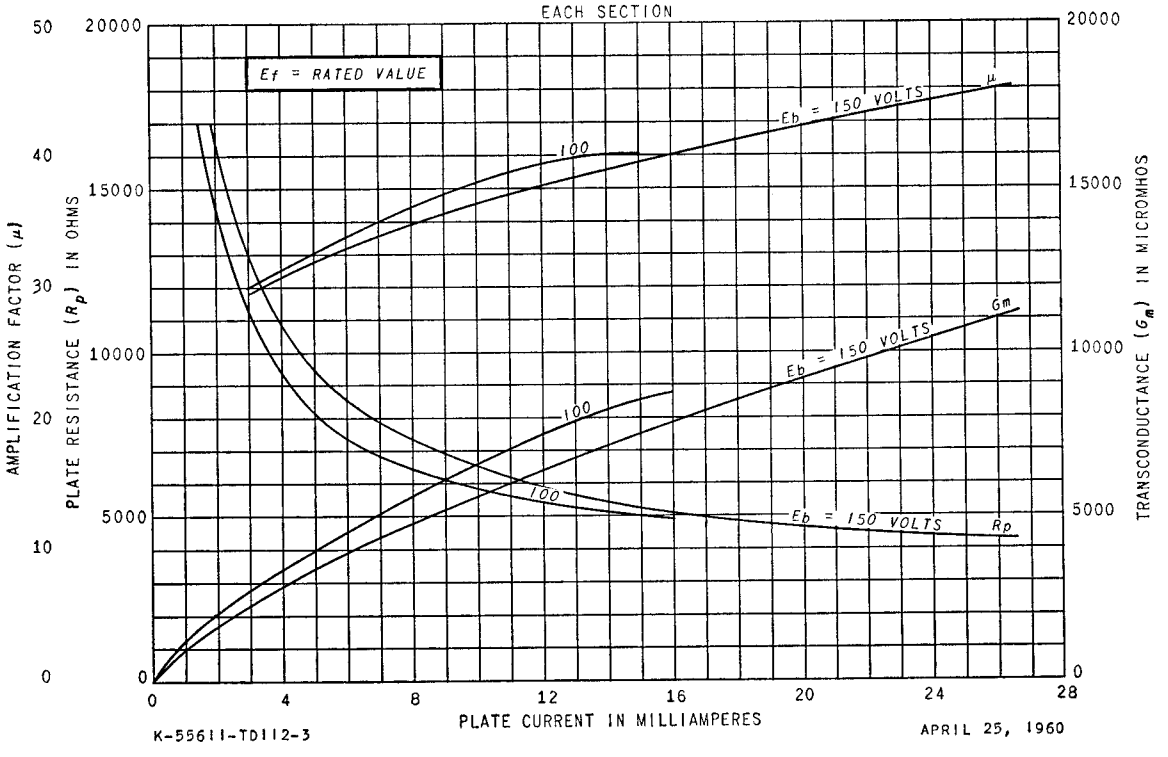
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



—PRODUCT INFORMATION—

12AX3 THROUGH 12BF11

12AX3
12BE3
12BF11

12AX3 Compactron Diode. The 12AX3 is a compactron, single heater-cathode type diode, intended for service as the damping diode in the horizontal-deflection circuit of television receivers.

Except for heater characteristics, the 12AX3 is identical to the 6AX3.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	12.6	Volts
Heater Current●	0.6±0.04	Amperes
Heater Warm-up Time, Average♦	11	Seconds

12BE3 Compactron Diode. The 12BE3 is a compactron, single heater-cathode type diode, intended for service as the damping diode in the horizontal deflection circuit of television receivers.

Except for heater characteristics, the 12BE3 is identical to the 6BE3.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	12.6	Volts
Heater Current●	0.6±0.04	Amperes
Heater Warm-up Time, Average♦	11	Seconds

12BF11 Compactron Dissimilar Double Pentode. The 12BF11 is a compactron containing a sharp-cutoff, dual-control pentode (Section 2) and a power pentode (Section 1). The dual-control pentode is intended for use as an FM detector and the power pentode as an audio-frequency output amplifier in television receivers.

Except for heater characteristics and ratings, the 12BF11 is identical to the 6BF11.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	12.6	Volts
Heater Current●	0.6 ± 0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds

Supersedes 12AL11 thru 12BF11 D and R Sheet dated 9-65

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

12AX7

TWIN TRIODE

DESCRIPTION AND RATING

The 12AX7 is a miniature high-mu twin triode each section of which has an individual cathode connection. The 12AX7 is especially suited for use in resistance-coupled voltage amplifiers, phase inverters, multivibrators, and numerous industrial-control circuits where high voltage gain is desired. A center-tapped heater permits operation of the tube from either a 6.3-volt or a 12.6-volt heater supply.

GENERAL

Cathode—Coated Unipotential

	Series	Parallel
Heater Voltage, AC or DC	12.6	6.3 Volts
Heater Current	0.15	0.3 Amperes

Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin
Mounting Position—Any

Direct Interelectrode Capacitances

	With Shield*	Without Shield
Grid to Plate, Each Section	1.7	1.7 μμf
Input, Each Section	1.8	1.6 μμf
Output, Section 1	1.9	0.46 μμf
Output, Section 2	1.9	0.34 μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES, EACH SECTION

Plate Voltage	300 Volts
Positive DC Grid Voltage	0 Volts
Negative DC Grid Voltage	50 Volts
Plate Dissipation	1.0 Watts
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	180 Volts
Heater Negative with Respect to Cathode	180 Volts

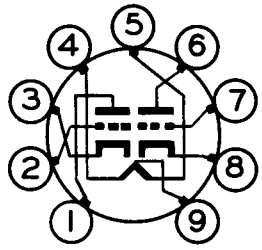
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	100	250	Volts
Grid Voltage	−1	−2	Volts
Amplification Factor	100	100	
Plate Resistance, approximate	80000	62500	Ohms
Transconductance	1250	1600	Micromhos
Plate Current	0.5	1.2	Milliamperes

* With external shield (RETMA 315) connected to cathode of section under test.

BASING DIAGRAM

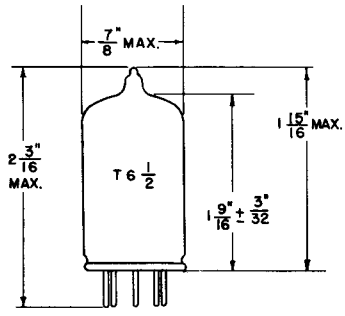


RETMA 9A
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Heater Center-Tap

PHYSICAL DIMENSIONS



RETMA 6-2

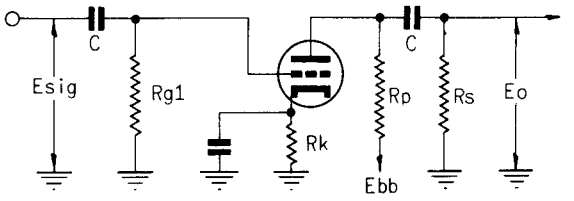
GENERAL ELECTRIC

Supersedes ET-T509A dated 2-51

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	0.10	0.1	1700	31	5.0	1000	40	15	760	43	30
0.10	0.24	0.1	2000	38	6.9	1100	46	20	900	50	40
0.24	0.24	0.1	3500	43	6.5	2000	54	18	1600	58	37
0.24	0.51	0.1	3900	49	8.6	2300	59	24	1800	64	47
0.51	0.51	0.1	7100	50	7.4	4300	62	19	3100	66	39
0.51	1.0	0.1	7800	53	9.1	4800	64	24	3600	69	46
0.24	0.24	10	0	37	3.9	0	53	15	0	62	32
0.24	0.51	10	0	44	5.4	0	60	19	0	67	41
0.51	0.51	10	0	44	5.0	0	61	17	0	69	35
0.51	1.0	10	0	49	6.4	0	66	21	0	71	41

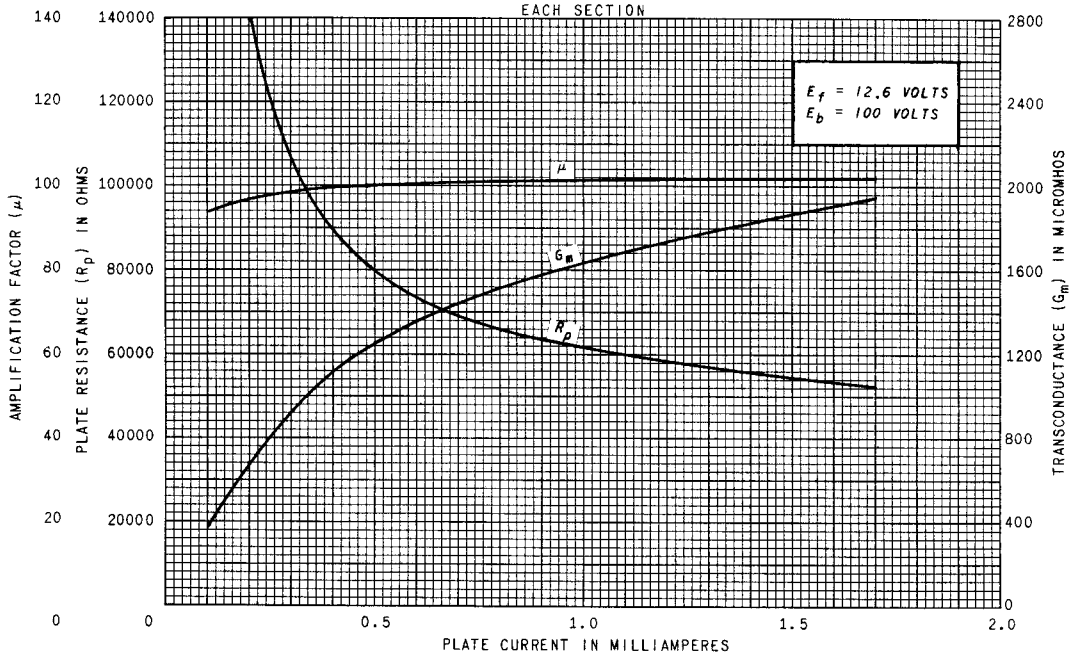


Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

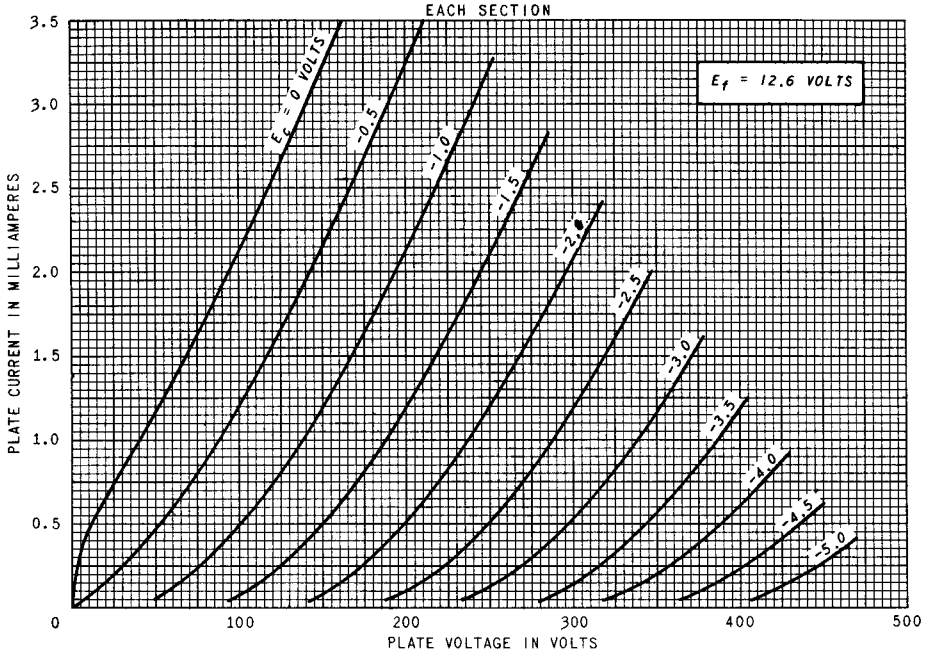
AVERAGE CHARACTERISTICS

EACH SECTION



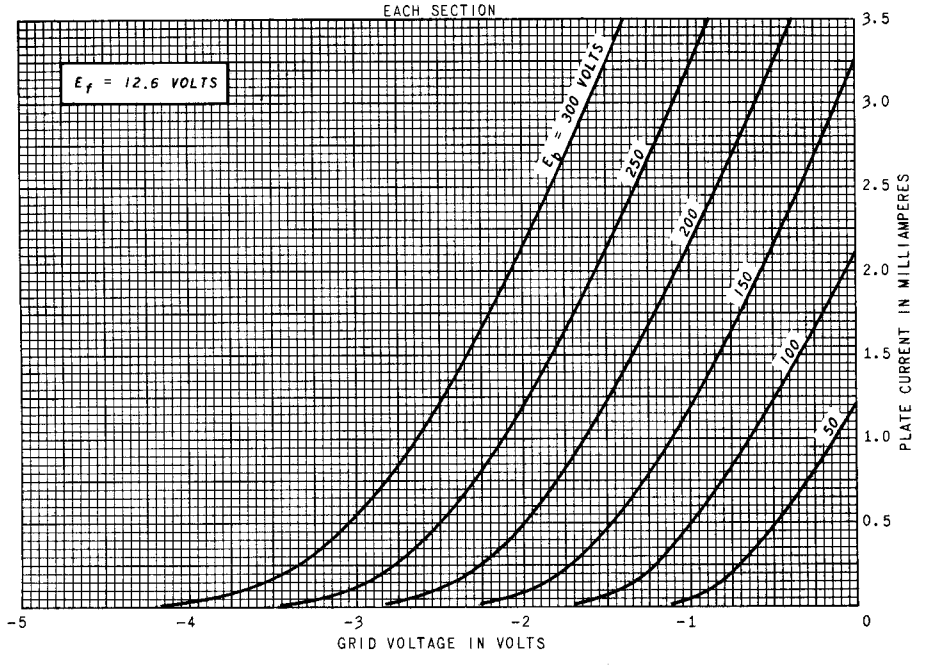
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



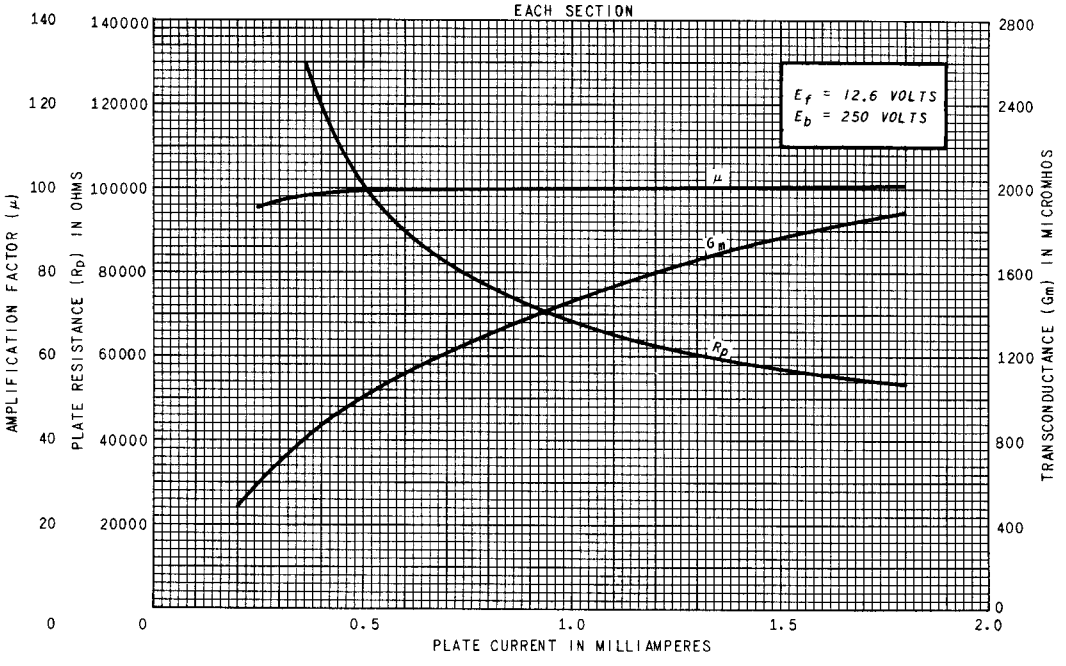
AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION



AVERAGE CHARACTERISTICS

EACH SECTION



TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

12AX7-A
TWIN TRIODE

DESCRIPTION AND RATING

The 12AX7-A is a miniature high-mu twin triode each section of which has an individual cathode connection. The 12AX7-A is especially suited for use in resistance-coupled voltage amplifiers, phase inverters, multivibrators, and numerous industrial-control circuits where high voltage gain is desired. A center-tapped heater permits operation of the tube from either a 6.3-volt or a 12.6-volt heater supply.

Use of the 12AX7-A is advantageous in applications that require low hum and microphonic output.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

	Series	Parallel	
Heater Voltage, AC or DC	12.6	6.3	Volts
Heater Current	0.15	0.3	Amperes

Direct Interelectrode Capacitances

	With Shield*	Without Shield	
Grid to Plate, Each Section	1.7	1.7	pf
Input, Each Section	1.8	1.6	pf
Output, Section 1	1.9	0.46	pf
Output, Section 2	1.9	0.34	pf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

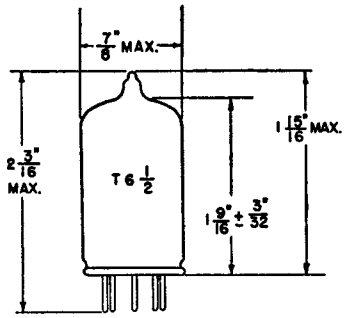
DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	55	Volts
Plate Dissipation	1.2	Watts

Heater-Cathode Voltage

Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

PHYSICAL DIMENSIONS

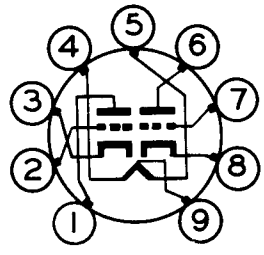


EIA 6-2

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Heater Center-Tap

BASING DIAGRAM



EIA 9A

GENERAL ELECTRIC

Supersedes ET-T509B dated 6-53

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	100	250	Volts
Grid Voltage	−1	−2	Volts
Amplification Factor	100	100	
Plate Resistance, approximate	80000	62500	Ohms
Transconductance	1250	1600	Micromhos
Plate Current	0.5	1.2	Milliamperes
Equivalent Noise and Hum Voltage, Each Section, Average, True RMS†		1.8	Microvolts

* With external shield (EIA 315) connected to cathode of section under test.

† Referred to grid and measured under the following conditions: Ef = 6.3 volts AC (parallel connection), center tap of heater transformer grounded; Ebb = 250 volts, Rb = 100,000 ohms; Rk = 2700 ohms, bypassed with 100 uf; Rg = 0 ohms; amplifier range = 25 to 10,000 cps.

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

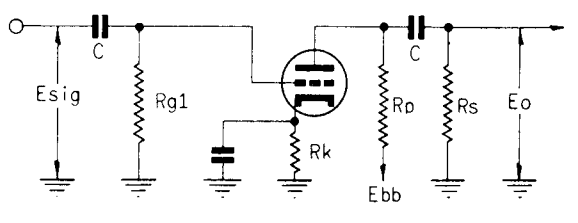
The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

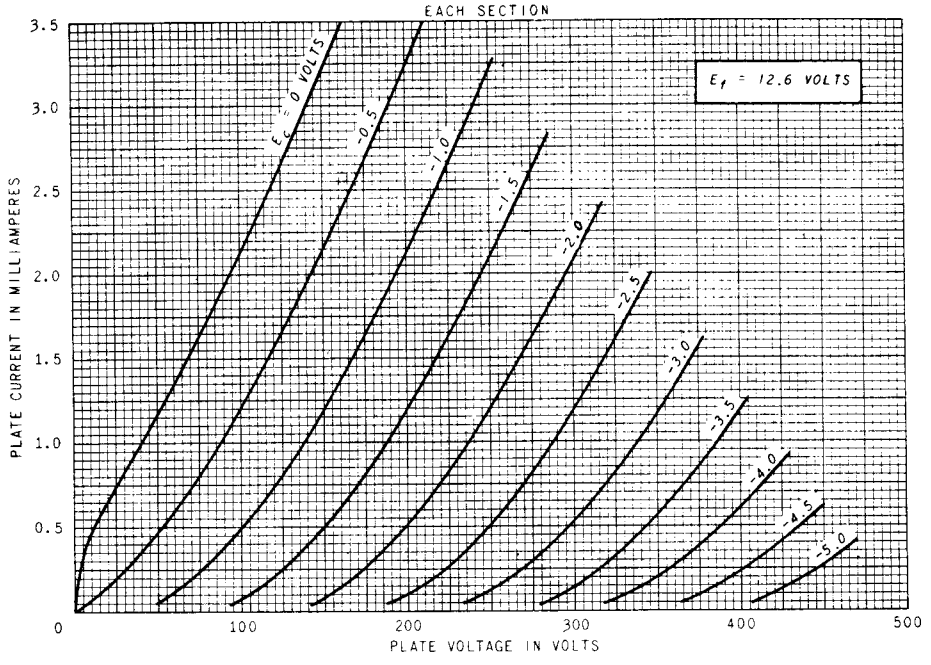
Rp Meg.	R_s Meg.	R_{g1} Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	0.10	0.1	1700	31	5.0	1000	40	15	760	43	30
0.10	0.24	0.1	2000	38	6.9	1100	46	20	900	50	40
0.24	0.24	0.1	3500	43	6.5	2000	54	18	1600	58	37
0.24	0.51	0.1	3900	49	8.6	2300	59	24	1800	64	47
0.51	0.51	0.1	7100	50	7.4	4300	62	19	3100	66	39
0.51	1.0	0.1	7800	53	9.1	4800	64	24	3600	69	46
0.24	0.24	10	0	37	3.9	0	53	15	0	62	32
0.24	0.51	10	0	44	5.4	0	60	19	0	67	41
0.51	0.51	10	0	44	5.0	0	61	17	0	69	35
0.51	1.0	10	0	49	6.4	0	66	21	0	71	41



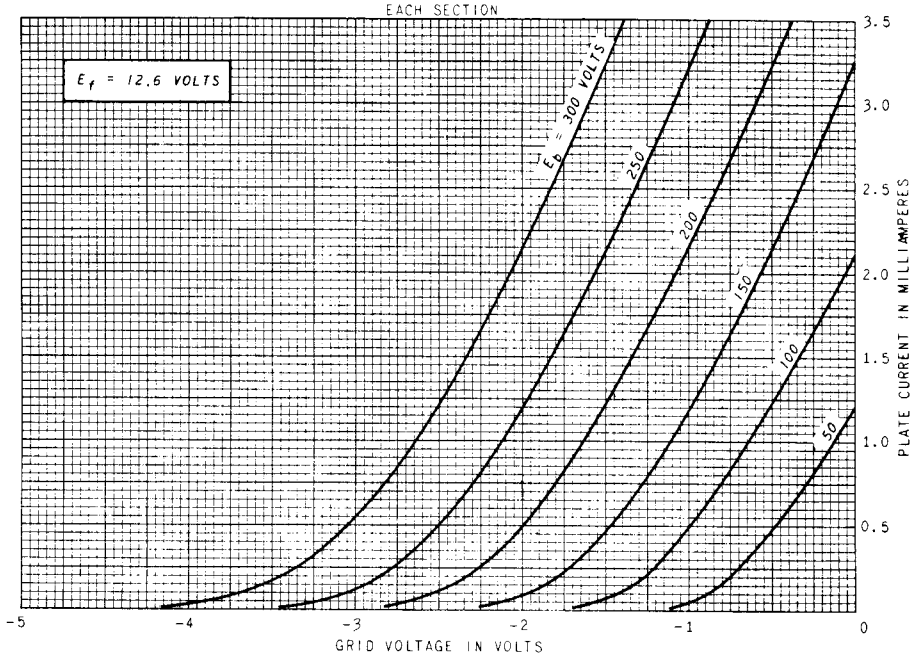
Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

AVERAGE PLATE CHARACTERISTICS

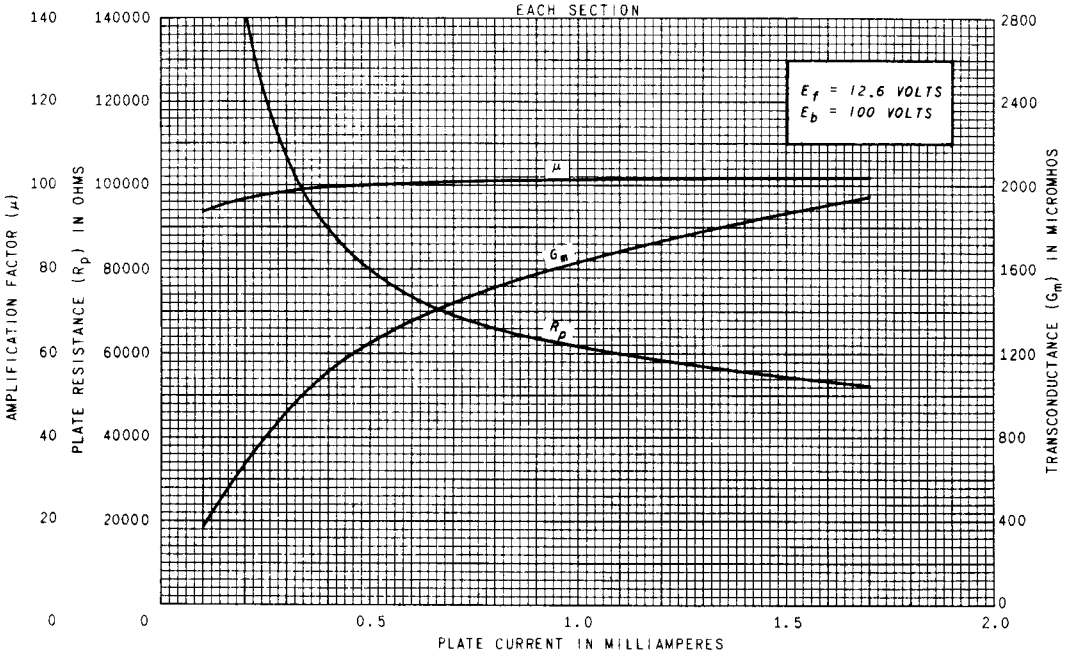


AVERAGE TRANSFER CHARACTERISTICS



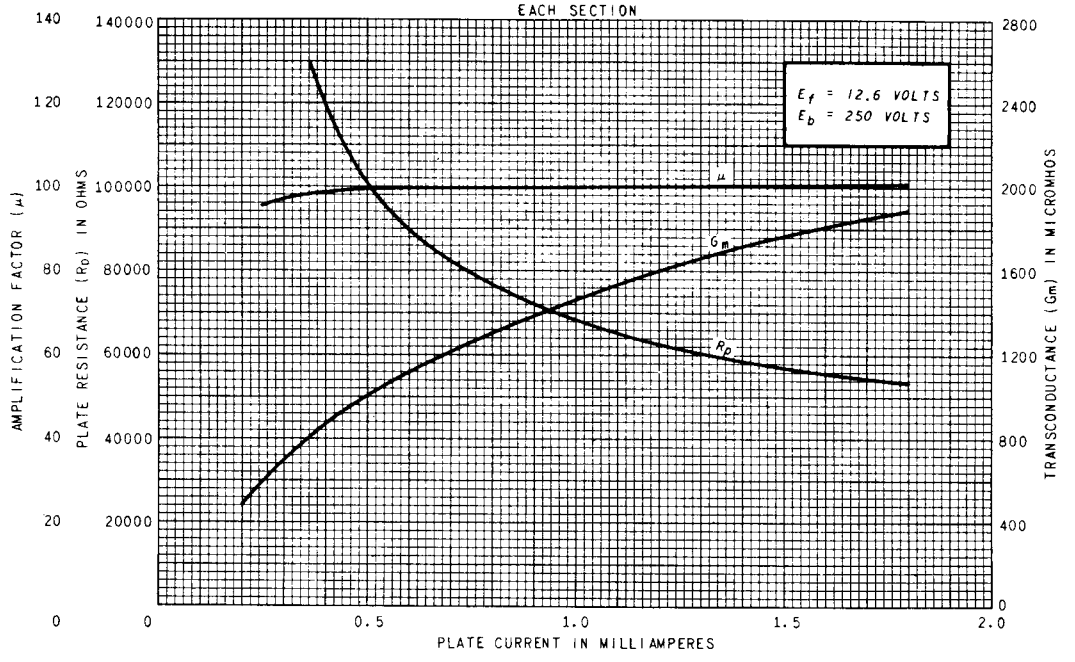
AVERAGE CHARACTERISTICS

EACH SECTION



AVERAGE CHARACTERISTICS

EACH SECTION



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

12AY7

TWIN TRIODE

FOR LOW-LEVEL AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 12AY7 is a miniature medium-mu twin triode designed primarily for use in low-level stages of high-gain audio-frequency amplifiers. The tube is specially designed to exhibit low noise and low microphonic output. In addition, hiss and hum output voltages are controlled to limits consistent with the requirements of low-level amplifier applications.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	Series	Parallel	
Heater Voltage, AC or DC	12.6	6.3	Volts
Heater Current	0.15	0.3	Amperes
Direct Interelectrode Capacitances*			
Grid to Plate: (g to p), Each Section		1.3	pf
Input: g to (h+k), Each Section		1.3	pf
Output: p to (h+k), Each Section		0.6	pf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES, Each Section

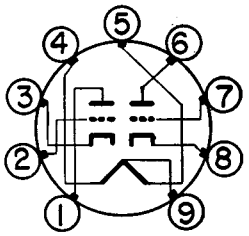
Plate Voltage	300	Volts
Plate Dissipation	1.5	Watts
DC Cathode Current	10	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under normal conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube in average applications, making allowance for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube under normal operating conditions at the stated normal supply voltage.

BASING DIAGRAM

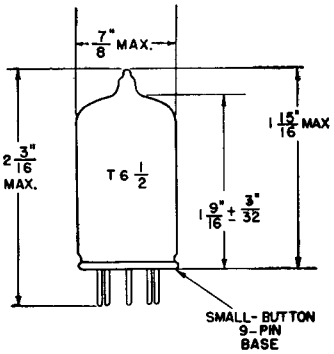


EIA 9A

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Heater Center Tap

PHYSICAL DIMENSIONS



EIA 6-2

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, Each Section

Plate Voltage	250	Volts
Grid Voltage	−4.0	Volts
Amplification Factor	44	
Plate Resistance, approximate	25,000	Ohms
Transconductance	1750	Micromhos
Plate Current	3.0	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	−8	Volts

LOW-LEVEL-AMPLIFIER SERVICE, Each Section

Heater Voltage†	6.3	Volts
Plate-Supply Voltage	150	Volts
Plate Load Resistor	20,000	Ohms
Grid Resistor	0.1	Megohms
Cathode Resistor	2700	Ohms
Cathode Capacitor	40	Microfarads
Voltage Gain	12.5	

* Without external shield.

† Pin 9 connected to negative B supply.

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

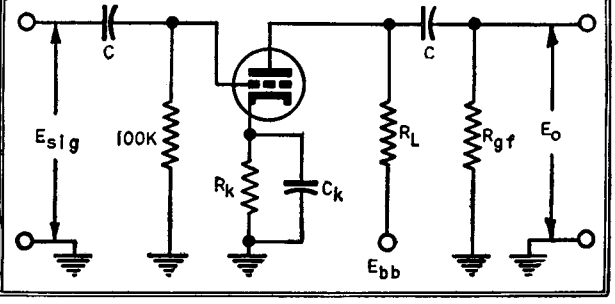
R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	1900	6.9	22	1300	18	25	1000	34	27
0.10	0.24	2100	9.6	25	1500	24	28	1300	45	29
0.24	0.24	4200	8.2	26	2700	20	28	2200	36	30
0.24	0.51	4800	11	27	3100	25	28	2700	45	31
0.51	0.51	8800	8.6	26	6000	20	29	4700	36	30
0.51	1.0	10000	11	27	7200	25	29	6000	45	31

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2600	8.8	21	1600	20	24	1300	36	26
0.10	0.24	3000	12	23	1900	27	27	1600	48	28
0.24	0.24	5500	11	24	3500	24	27	2800	41	29
0.24	0.51	6200	13	25	4100	29	28	3400	51	30
0.51	0.51	11000	11	25	6800	25	28	5500	49	30
0.51	1.0	12000	14	26	8100	31	29	6700	54	30

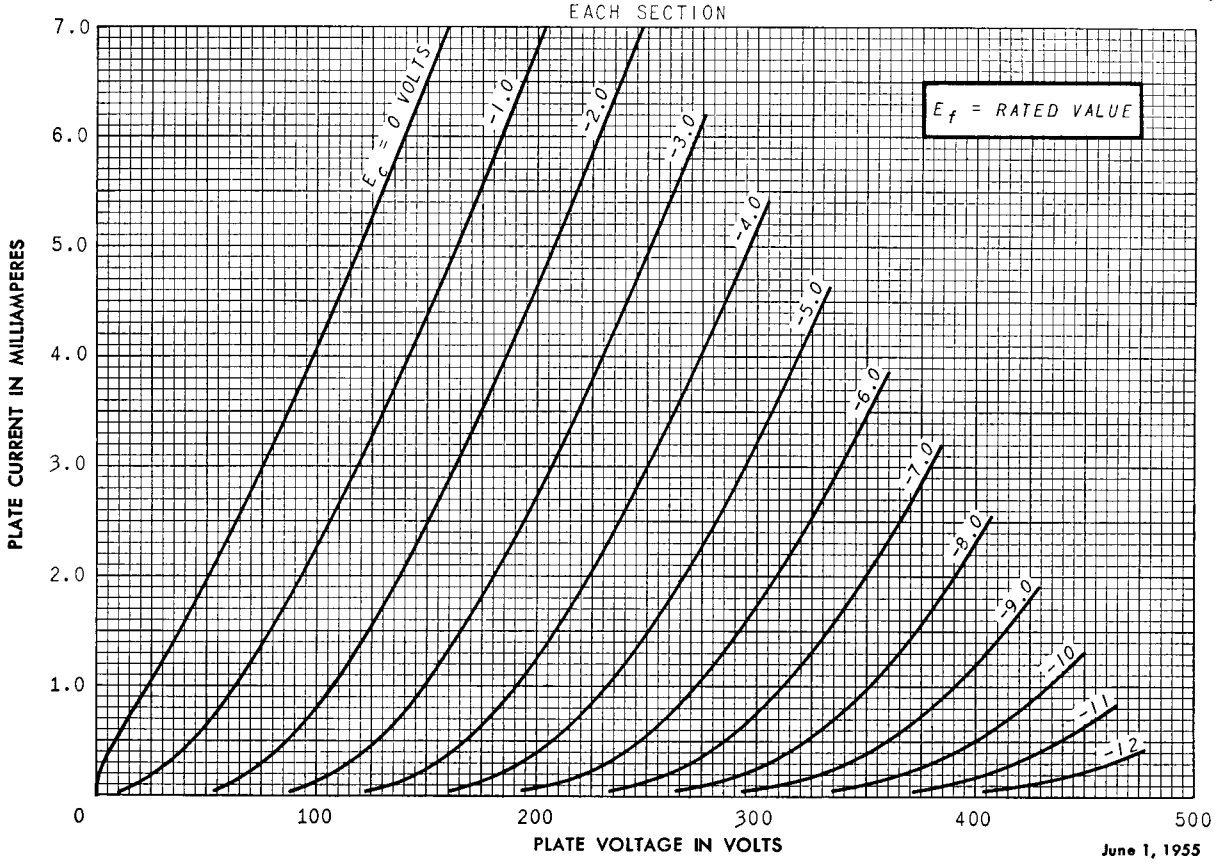
Notes:

1. E_o is maximum RMS voltage output for approximately five percent total harmonic distortion.
2. Gain is measured for an output voltage of two volts RMS.
3. R_k is in ohms; R_L and R_{gf} are in megohms.
4. Coupling capacitors (C) should be selected to give desired frequency response. R_k should be adequately by-passed.



AVERAGE PLATE CHARACTERISTICS

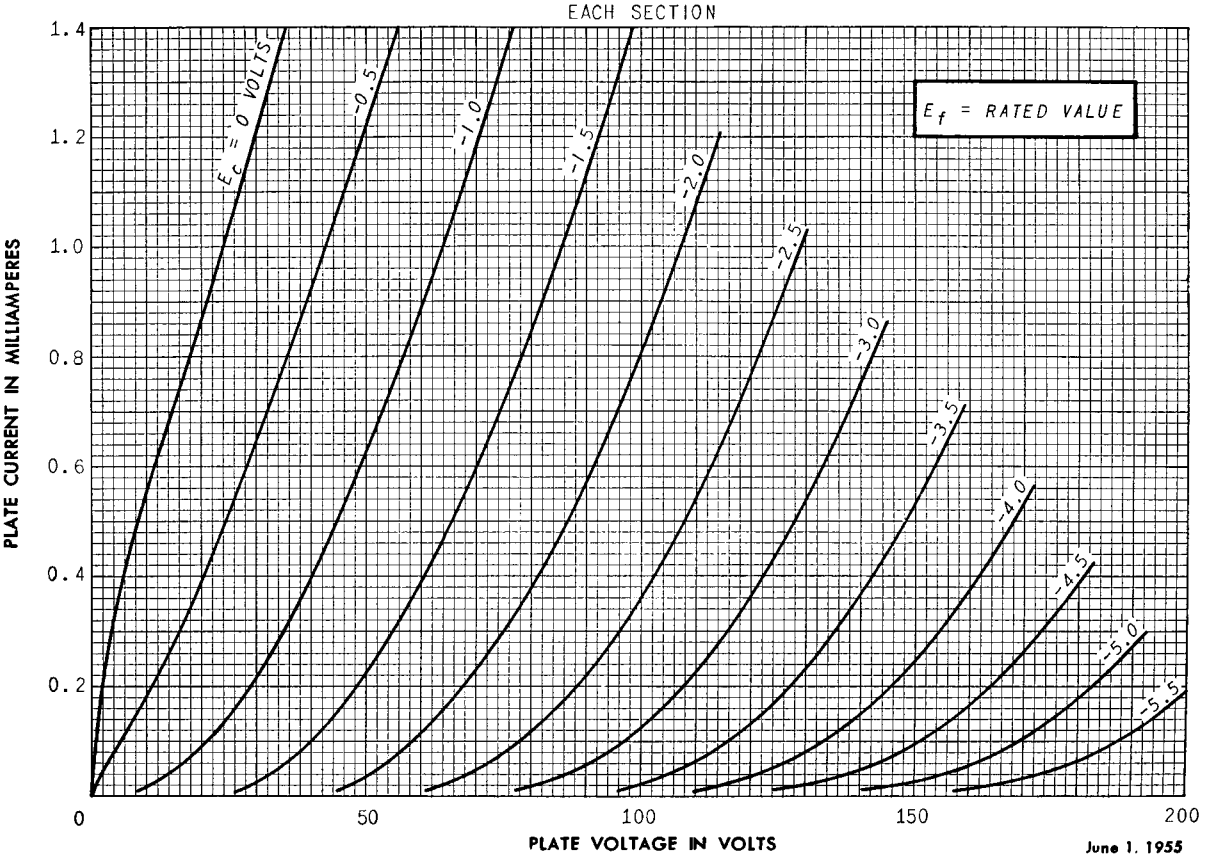
EACH SECTION



June 1, 1955

AVERAGE PLATE CHARACTERISTICS

EACH SECTION

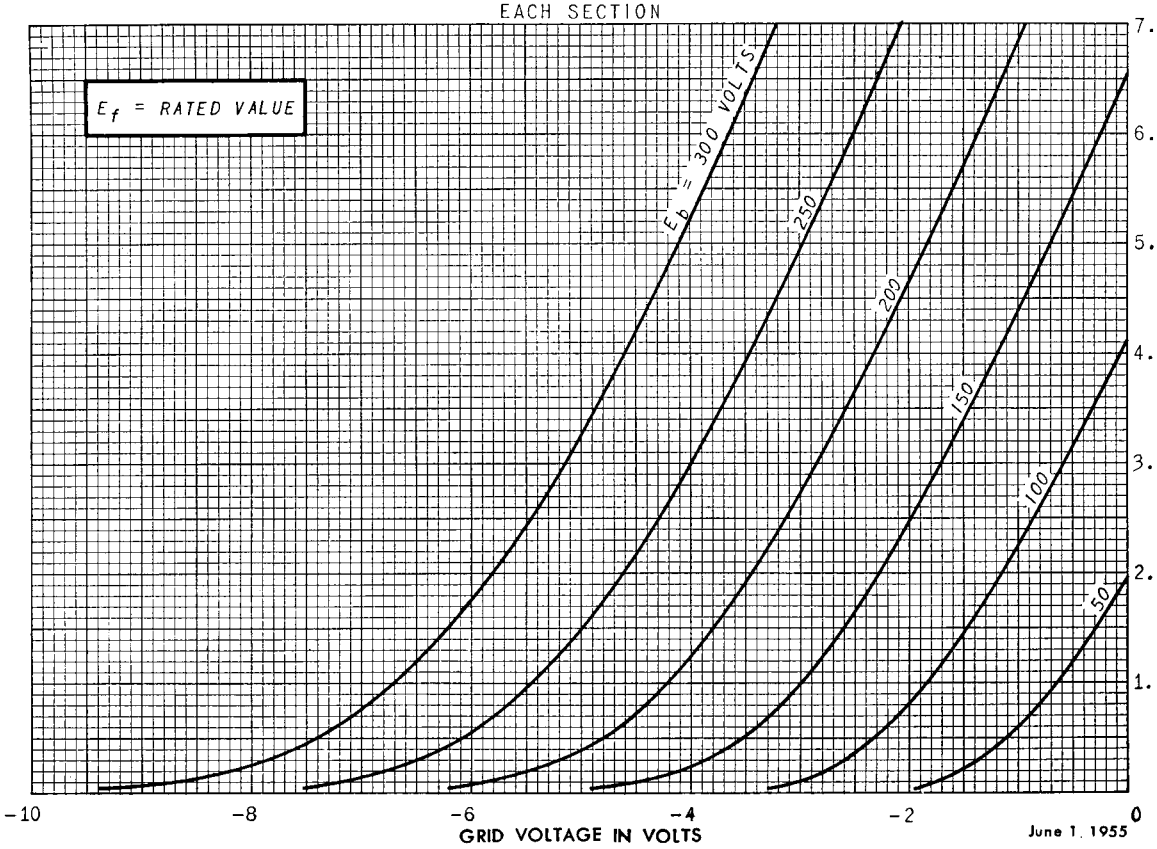


June 1, 1955

12AY7
Page 4
7-63

AVERAGE TRANSFER CHARACTERISTICS

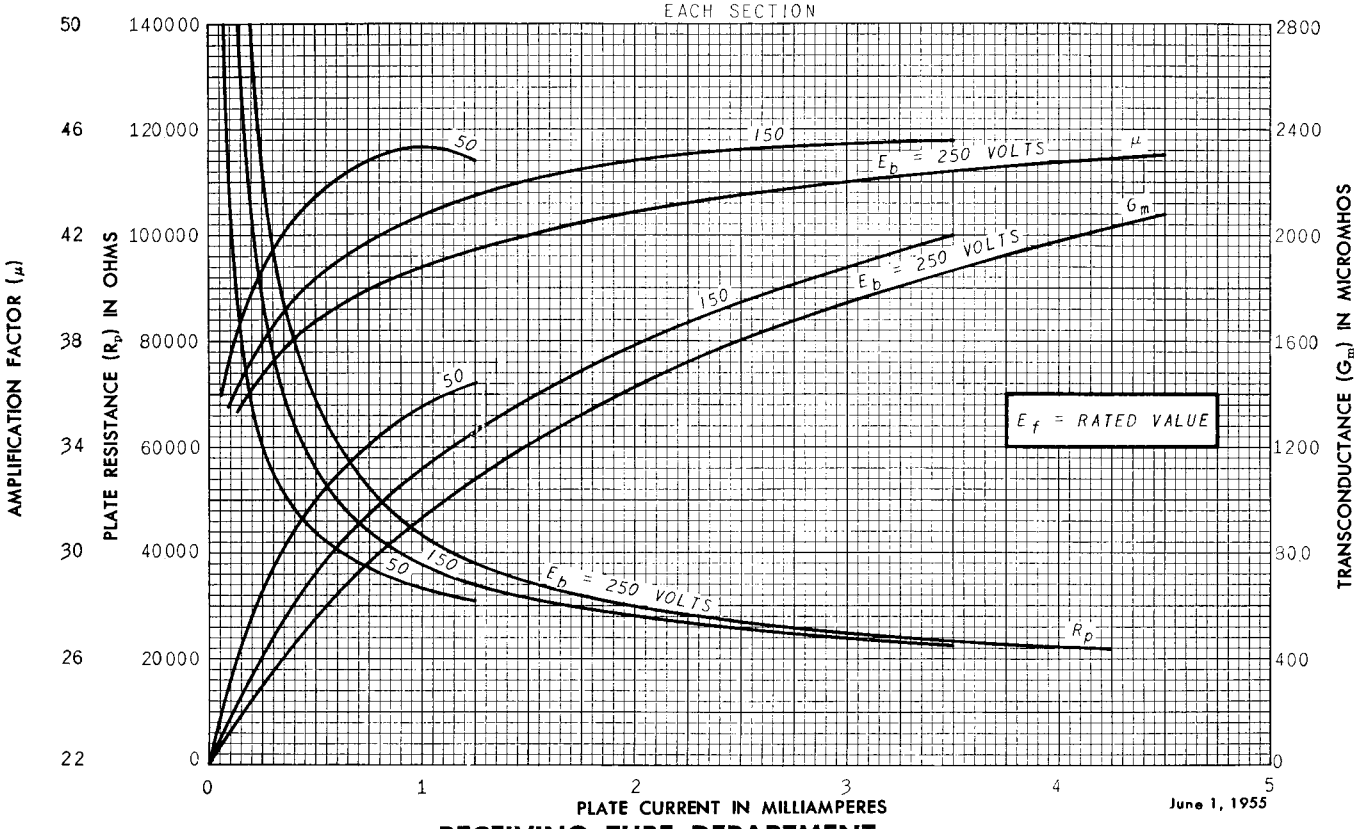
EACH SECTION



June 1, 1955

AVERAGE CHARACTERISTICS

EACH SECTION



June 1, 1955

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Electronic TUBES

12B4-A

TRIODE

FOR TV VERTICAL DEFLECTION APPLICATIONS

DESCRIPTION AND RATING

The 12B4-A is a miniature low-mu triode designed primarily for service as a vertical-deflection amplifier in television receivers. The tube features high plate current at relatively low plate voltages and is capable of withstanding the high pulse voltages normally encountered in this application.

In addition, the 12B4-A exhibits a controlled heater warm-up characteristic which makes the tube particularly suited for use in television receivers which employ series-connected heaters. When the 12B4-A is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

Except for the controlled heater warm-up time characteristic, the 12B4-A is identical to the 12B4.

GENERAL

ELECTRICAL

	Series	Parallel
Cathode—Coated Unipotential		
Heater Voltage, AC or DC	12.6	6.3 Volts
Heater Current	0.3	0.6 Amperes
Heater Warm-up Time*	—	11 Seconds
Direct Interelectrode Capacitances, approximate†		
Grid to Plate	4.8	μμf
Input	5.0	μμf
Output	1.5	μμf

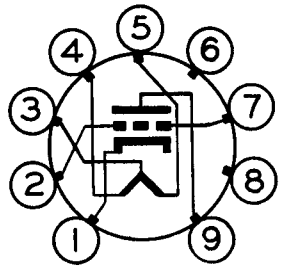
MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

	Class A_1 Amplifier	Vertical-Deflection Amplifier‡
DC Plate Voltage	550	550 Volts
Peak Positive Pulse Plate Voltage	—	1000§ Volts
Peak Negative Grid Voltage	—	250 Volts
Plate Dissipation	5.5	5.5π Watts
DC Cathode Current	—	30 Milliamperes
Peak Cathode Current	—	105 Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	100 Volts
Total DC and Peak	200	200 Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	200 Volts
Grid Circuit Resistance		
With Fixed Bias	0.47	— Megohms
With Cathode Bias	2.2	2.2 Megohms

BASING DIAGRAM

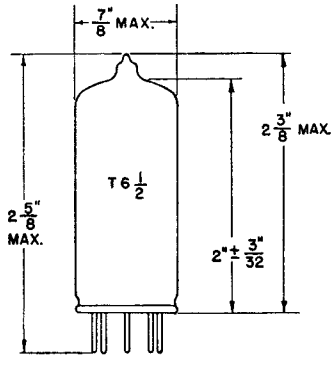


RETMA 9AG

TERMINAL CONNECTIONS

Pin 1—Cathode
Pin 2—Grid
Pin 3—Heater Center-Tap
Pin 4—Heater
Pin 5—Heater
Pin 6—No Connection
Pin 7—Grid
Pin 8—No Connection
Pin 9—Plate

PHYSICAL DIMENSIONS



RETMA 6-3

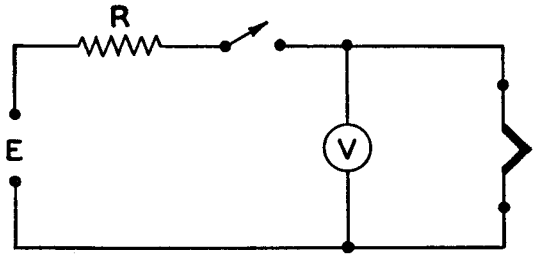
GENERAL ELECTRIC

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFER

Plate Voltage	150	150	Volts
Grid Voltage	−23	−17.5	Volts
Amplification Factor	—	6.5	
Plate Resistance, approximate	—	1030	Ohms
Transconductance	—	6300	Micromhos
Plate Current	9.6	34	Milliamperes
Grid Voltage, approximate I_b=200 Microamperes	—	−32	Volts

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E=25 volts (RMS or DC), V_b=5.0 volts (RMS or DC), and R=31.5 ohms.



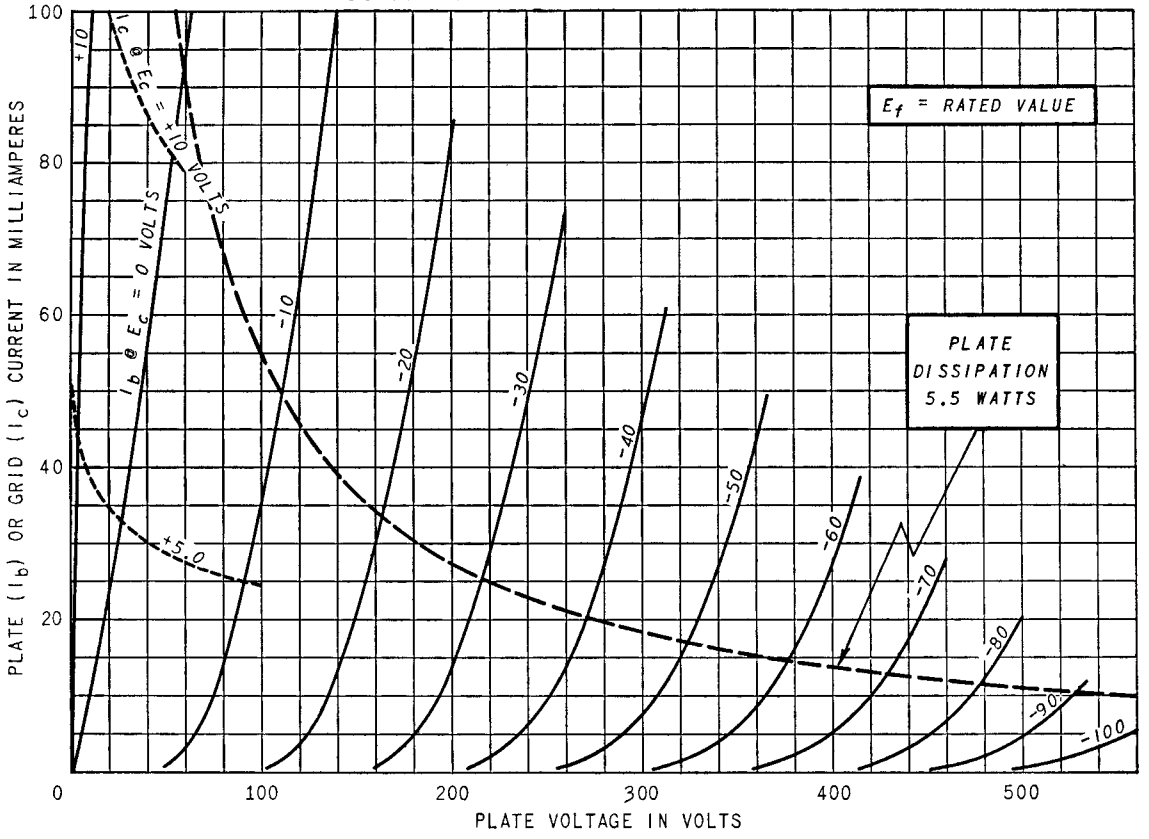
† Without external shield.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

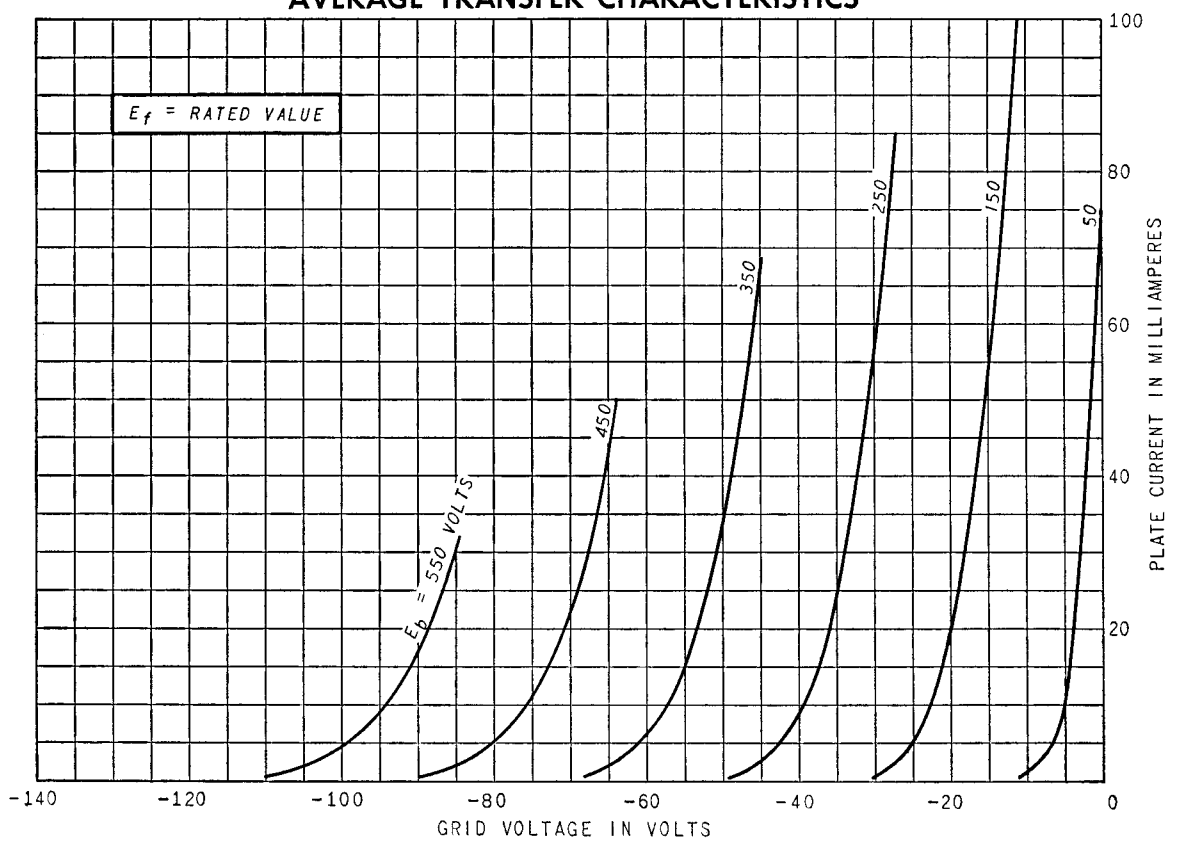
§ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

π In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



#200

E. I. A. REGISTRATION FILE

Form II
(a)

AMPLIFIER

Reservation No. 234 Date 6/26/39 Registration No. _____ Date _____

Type No. (12B7(ML)

Sponsor General Electric Co.

Type Classification: R.F. Pentode, Remote Cut-off

Physical Specifications:

Type of Cathode Heater Type

Pin Connections:

Pin 1	Heater	Pin 5	Internal Shield		
2	Plate	6	Control Grid (G_1)		
3	Screen (G_2)	7	Cathode	Basing	
4	Suppressor (G_3)	8	Heater	Designation	8 V

Type of Base: Locking 8-Pin
Type of Cap: No cap
Type of Bulb: Metal
Max. Diameter 1 3/16 inches
Max. Overall Length 2 25/32 "
Max. Seated Height 2 1/4 "

Mounting Position for Operation:

Any

Direct Interelectrode Capacitances:

Grid to plate	( )	0.005	Max. mmf
Input	(G_1 to all other electrodes except P)	5.5	mmf
Output	(P to all other electrodes except G_1)	7.0	mmf

VOLTAGE AMPLIFIER

Class A

Ratings

Heater Voltage	12.6 volts
Heater Current	0.15 amps
Maximum Plate Voltage	250 volts
Maximum Screen Voltage	100 volts

Typical Operation and Characteristics

Plate Voltage	100	250 volts
Screen Voltage	100	100 volts
Grid Voltage	-3	-3 volts
Suppressor Voltage	0	0 volts
Plate Resistance	0.25	0.8 megohm
Transconductance	1900	2000 umhos
Grid Bias (For Transconductance=10 umhos)		-35 volts
Plate Current	6.9	9.2 ma
Screen Current	2.6	2.4 ma

Electronic TUBE
KEN-RAD

12BD6
Description and Rating
RADIO-FREQUENCY AMPLIFIER PENTODE

GENERAL DESCRIPTION

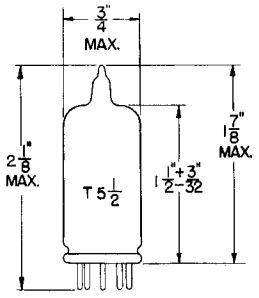
Principal Application: The 12BD6 is a miniature remote-cutoff amplifier pentode designed for use as a radio-frequency or intermediate-frequency amplifier. Electrically, the 12BD6 is similar to the 12SK7 and, except for heater ratings, is identical to the 6BD6.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	12.6 Volts
Heater Current	0.15 Ampere
Envelope	T-5½ Glass
Base	E7-1, Miniature Button 7-Pin
Mounting Position	Any

Direct Interelectrode Capacitances:

	With Shield #	Without Shield	
Grid 1 to Plate (Max)	0.005	0.004	μμf
Input	4.3	4.3	μμf
Output	5.0	5.0	μμf

PHYSICAL DIMENSIONS

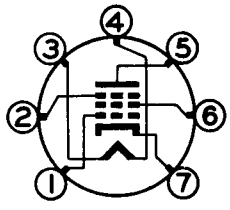


RTMA 5-2

TERMINAL CONNECTIONS

Pin 1 - Grid Number 1
Pin 2 - Grid Number 3 (Suppressor) and Internal Shield
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Cathode

BASING DIAGRAM



RTMA 7BK
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES

Plate Voltage	300	Volts
Screen Voltage	125	Volts
Plate Dissipation	3.0	Watts
Screen Dissipation	0.65	Watt
Heater-Cathode Voltage	90	Volts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	100	125	250	Volts
Suppressor Voltage	0 *	0 *	0 *	Volts
Screen Voltage	100	125	100	Volts
Grid Number 1 Voltage	-1	-3	-3	Volts
Plate Resistance	0.15	0.18	0.8	Megohm
Transconductance	2250	2350	2000	Micromhos
Plate Current	13	13	9	Milliamperes
Screen Current	5	5	3	Milliamperes
Grid Number 1 Voltage (Approx) for G_m = 10 Micromhos	-35	-45	-35	Volts

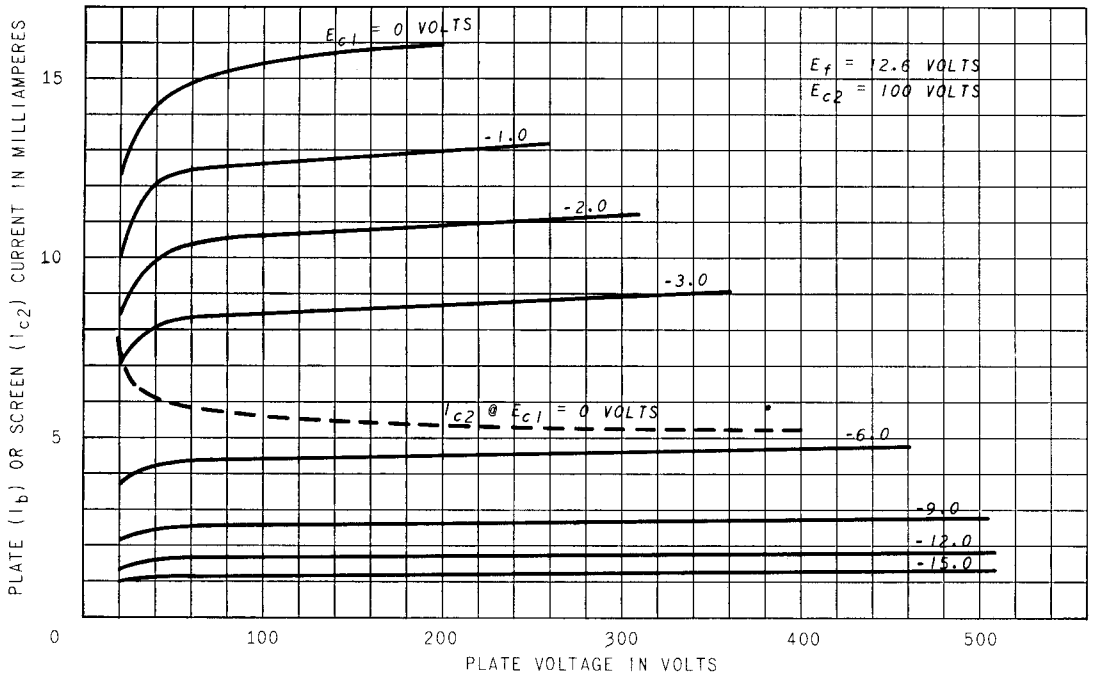
 # With external shield #316 connected to pin 7

** Pin 2 connected to pin 7 at socket*

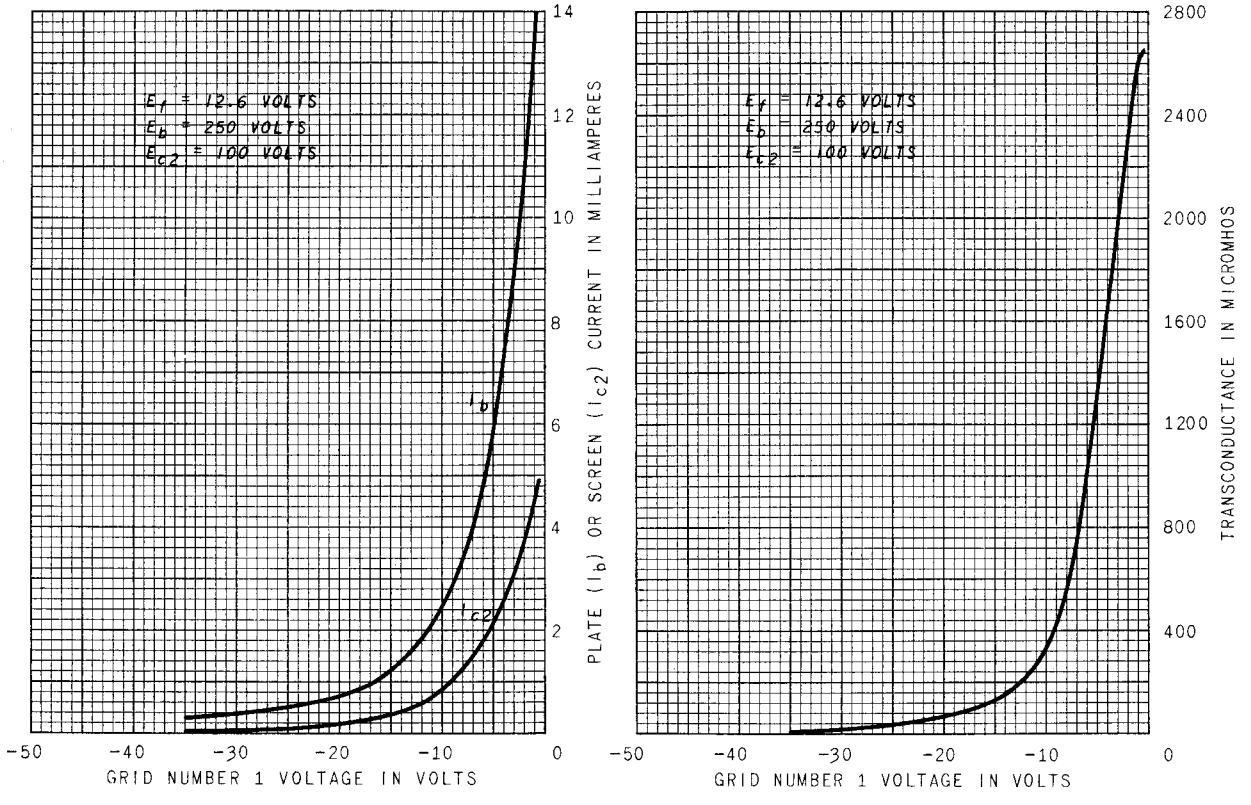
GENERAL ELECTRIC

Supersedes ET-T544 dated 5-48

AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



Tube Department, Electronics Division

GENERAL ELECTRIC

Schenectady, N. Y.

Electronic TUBES

12BH7-A

TWIN TRIODE

DESCRIPTION AND RATING

The 12BH7-A is a miniature, medium-mu twin triode designed primarily for use as a vertical-deflection amplifier in television receivers. In this application, the two sections may be employed in parallel, or they may be employed as a combined vertical-deflection amplifier and vertical oscillator. The tube is also suitable for use as the horizontal oscillator in television receivers as well as in a wide variety of general-purpose applications. Each section of the 12BH7-A features a relatively high plate current at low plate voltages and is capable of withstanding the high pulse voltages normally encountered in vertical-amplifier applications.

The 12BH7-A differs from the 12BH7 primarily by incorporating a controlled heater warm-up characteristic which makes the tube particularly suited for use in television receivers which employ 600-milliampere series-connected heaters.

GENERAL

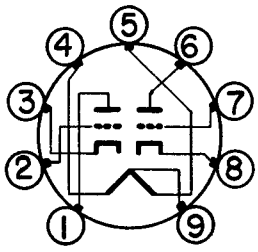
ELECTRICAL

	Series	Parallel	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	12.6	6.3	Volts
Heater Current	0.3	0.6	Amperes
Heater Warm-up Time*	....	11	Seconds
Direct Interelectrode Capacitances, approximate†			
Grid to Plate, Each Section		2.6	μμf
Input, Each Section		3.2	μμf
Output, Section 1		0.5	μμf
Output, Section 2		0.4	μμf
Plate to Plate		0.8	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

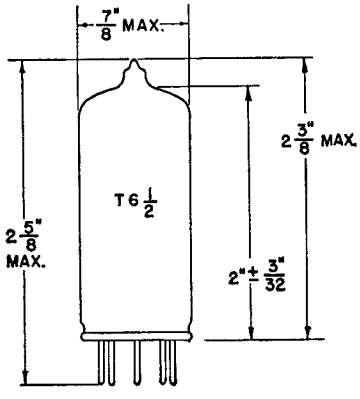


RETMA 9A

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Heater Center-Tap

PHYSICAL DIMENSIONS



RETMA 6-3

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED, EACH SECTION	Class A_1 Amplifier	Vertical-Deflection Amplifier‡	
DC Plate Voltage	300	450	Volts
Peak Positive Pulse Plate Voltage	...	1500§	Volts
Positive DC Grid Voltage	0	...	Volts
Negative DC Grid Voltage	50	...	Volts
Peak Negative Grid Voltage	...	250	Volts
Plate Dissipation	3.5	3.5π	Watts
DC Cathode Current	20	20	Milliamperes
Peak Cathode Current	...	70	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance			
With Fixed Bias	0.25	...	Megohms
With Cathode Bias	1.0	2.2	Megohms

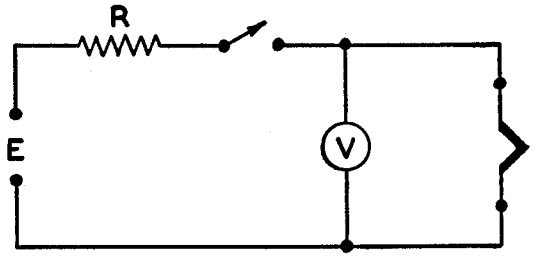
	Vertical-Oscillator Service‡	Horizontal-Oscillator Service‡	
DC Plate Voltage	450	450	Volts
Peak Negative Grid Voltage	400	600	Volts
Plate Dissipation	3.5	3.5	Watts
DC Cathode Current	20	20	Milliamperes
Peak Cathode Current	70	300	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid Circuit Resistance			
With Fixed Bias	2.2	2.2	Megohms
With Cathode Bias	2.2	2.2	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	250	250	Volts
Grid Voltage	−14	−10.5	Volts
Amplification Factor	...	16.5	
Plate Resistance, approximate	...	5300	Ohms
Transconductance	...	3100	Micromhos
Plate Current	4.0	11.5	Milliamperes
Grid Voltage, approximate			
I_b=50 Microamperes	...	−23	Volts

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals (V) to increase from zero to the heater test voltage (V_1). For this type, E=25.0 volts (RMS or DC), V_1=5.0 volts (RMS or DC) and R= 31.5 ohms.



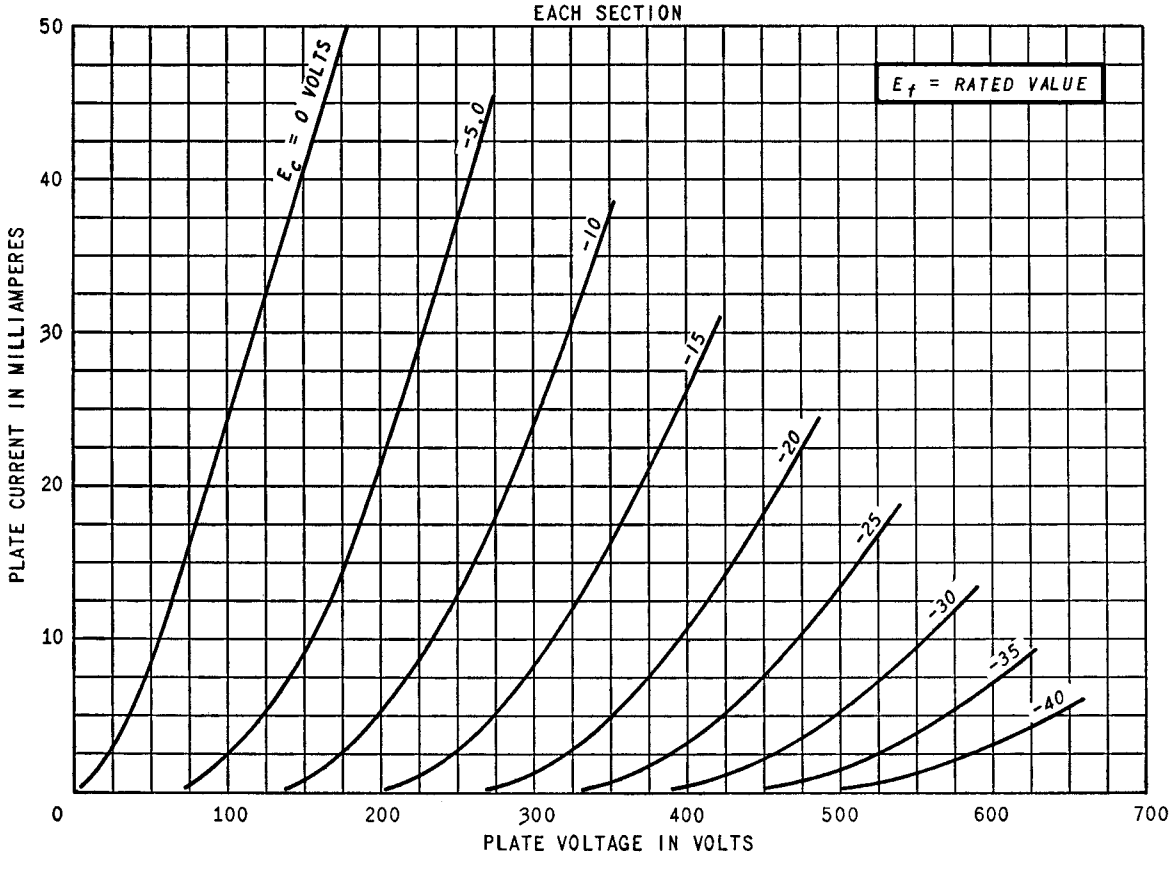
† Without external shield.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

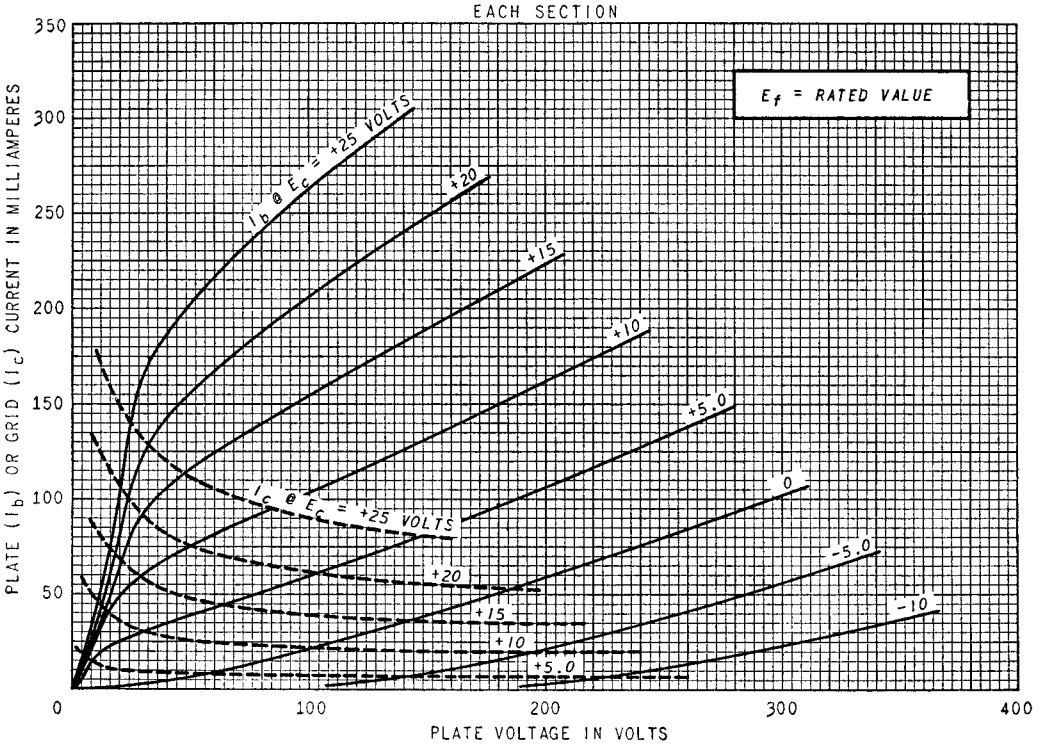
π In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

AVERAGE PLATE CHARACTERISTICS



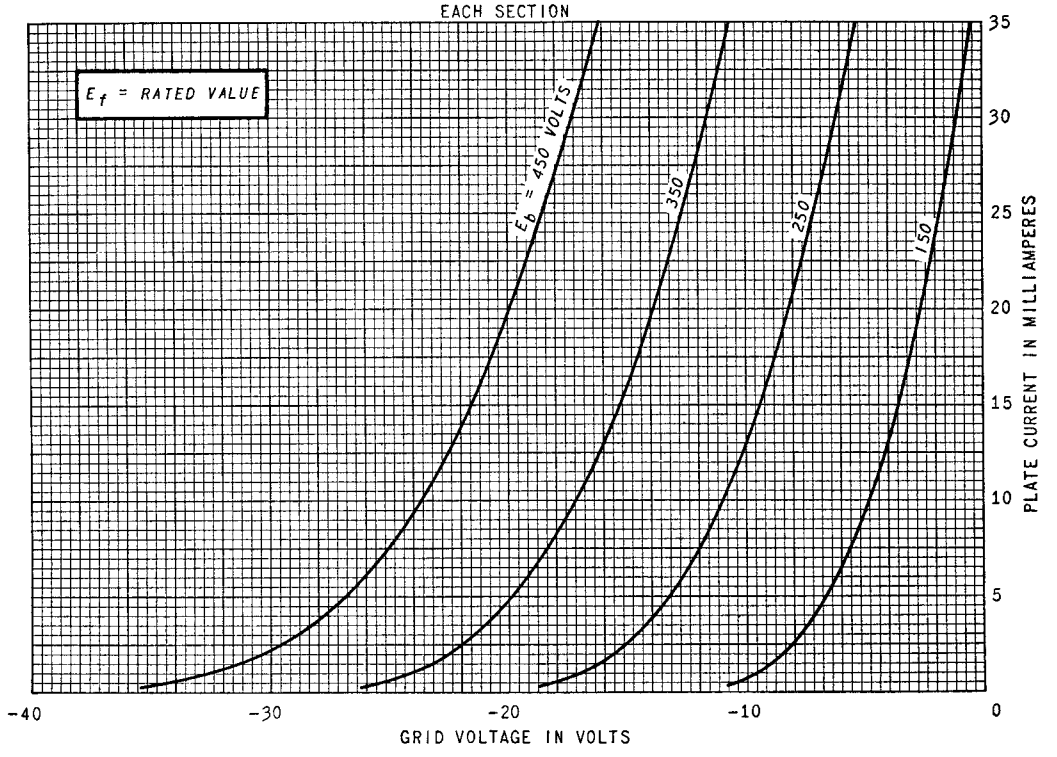
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

12BL6

PENTODE

FOR RF AND IF AMPLIFIER APPLICATIONS IN AUTOMOBILE RECEIVERS

DESCRIPTION AND RATING

The 12BL6 is a miniature remote-cutoff pentode intended for use as a radio-frequency or intermediate-frequency amplifier in automobile radio receivers. The tube is specially designed to operate with its plate and screen voltages supplied directly from a 12-volt storage battery.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	12.6*	Volts
Heater Current	0.15	Amperes
Direct Interelectrode Capacitances†		
Grid-Number 1 to Plate, maximum	0.006	μμf
Input	5.5	μμf
Output	4.8	μμf

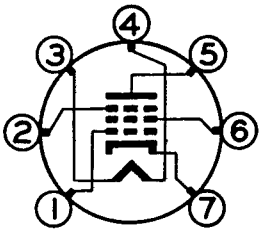
MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

* When used in automotive service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectancy at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

† With external shield (RETMA 316) connected to pin 7.

BASING DIAGRAM

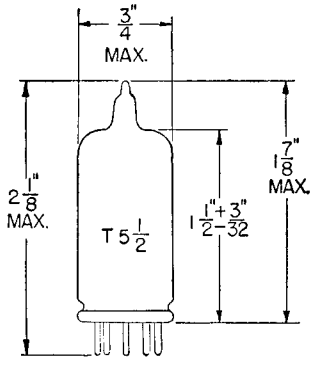


RETMA 7BK

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Grid Number 3 and Internal Shield
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Cathode

PHYSICAL DIMENSIONS



RETMA 5-2

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	30	Volts
Screen Voltage	30	Volts
DC Cathode Current	20	Milliamperes
Heater-Cathode Current		
Heater Positive with Respect to Cathode	30	Volts
Heater Negative with Respect to Cathode	30	Volts
Grid-Number 1 Circuit Resistance	10	Megohms

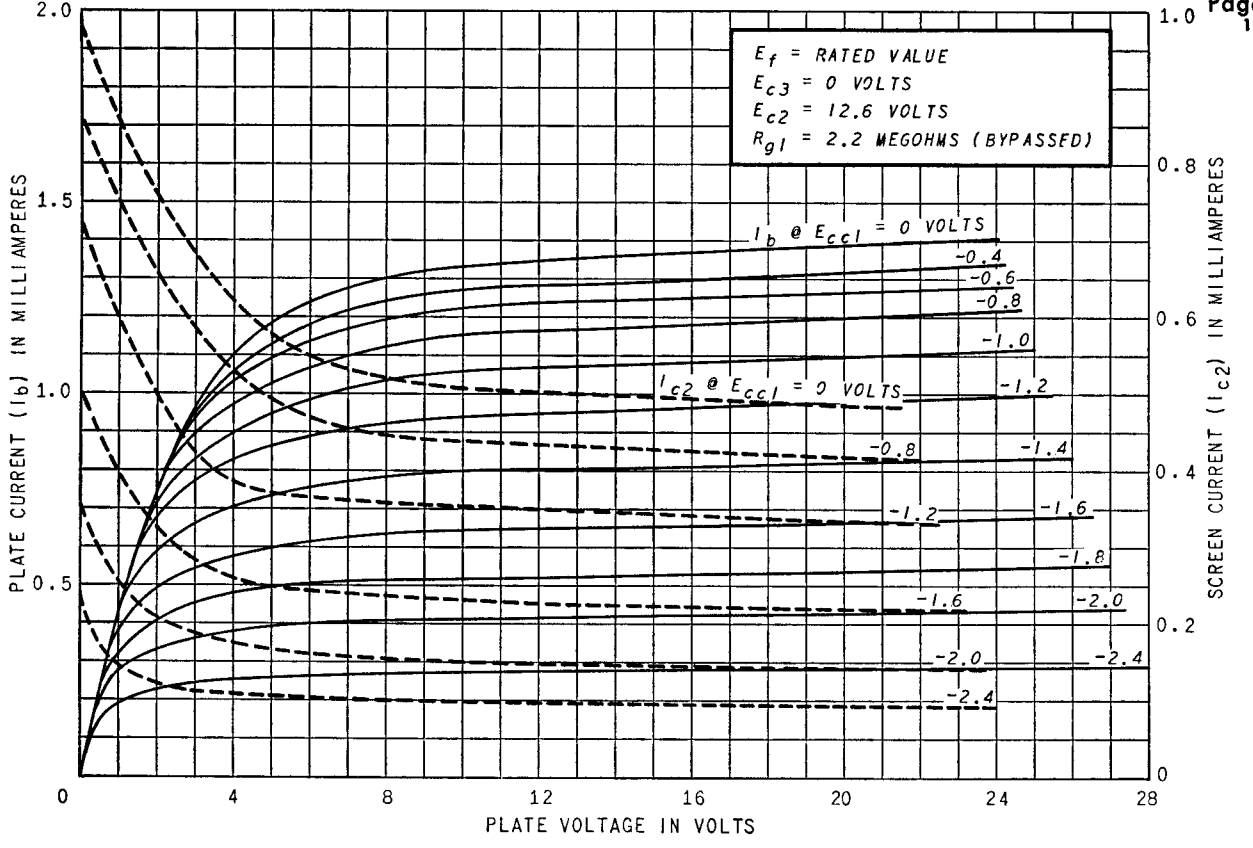
CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

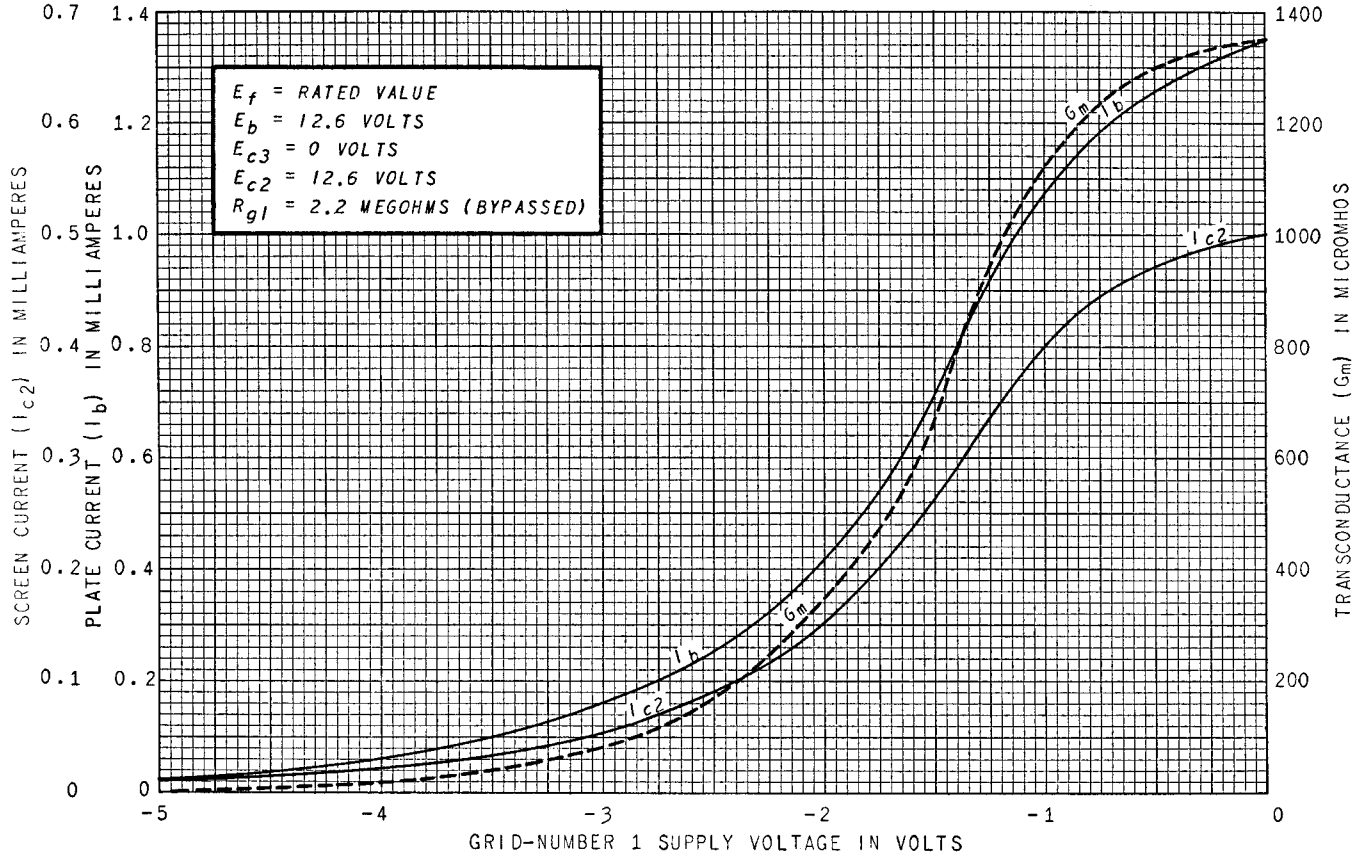
Plate Voltage	12.6	Volts
Grid-Number 3 Voltage	0	Volts
Screen Voltage	12.6	Volts
Grid-Number 1 Supply Voltage	0	Volts
Grid-Number 1 Resistor	2.2	Megohms
Grid-Number 1 Voltage	−0.65‡	Volts
Plate Resistance, approximate	0.5	Megohms
Transconductance	1350	Micromhos
Plate Current	1.35	Milliamperes
Screen Current	0.5	Milliamperes
Grid-Number 1 Voltage, Approximate		
G_m (Grid Number 1 to Plate) = 10 Micromhos	−6.0	Volts
Grid-Number 1 and Grid-Number 3 Voltage, approximate		
G_m (Grid Number 1 to Plate) = 10 Micromhos	−5.0	Volts

‡ Average contact-potential bias developed across 2.2-megohm grid resistor.

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



DESCRIPTION AND RATING

12BN6 Gated-Beam Discriminator. Identical to the 6BN6 except for heater ratings. Refer to the 6BN6 Description and Rating sheet for complete data.

12BQ6-GA Beam Pentode. Identical to the 6BQ6-GA except for heater ratings and addition of a controlled heater-warm-up characteristic. Refer to the 6BQ6-GA Description and Rating sheet for complete data.

12BQ6-GTB Beam Pentode. Identical to the 6BQ6-GTB except for the following ratings:

Heater Voltage, AC or DC	12.6	Volts
Heater Current	0.6	Amperes
Heater Warm-up Time*	11	Seconds

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

Refer to the 6BQ6-GTB Description and Rating sheet for complete data.

ELECTRONICS

12BT3

COMPACTRON DIODE

FOR TV DAMPING DIODE APPLICATIONS

DESCRIPTION AND RATING

The 12BT3 is a compactron containing a single heater-cathode type diode. It is intended for service as the damping diode in the horizontal-deflection circuit of television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	12.6	Volts
Heater Current†	0.45±0.03	Amperes
Direct Interelectrode Capacitances, approximate‡		
Cathode to Plate and Heater:		
k to (p + h)	8.5	pf
Plate to Cathode and Heater:		
p to (k + h)	7.0	pf
Heater to Cathode: (h to k)	2.7	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter	1.188	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches

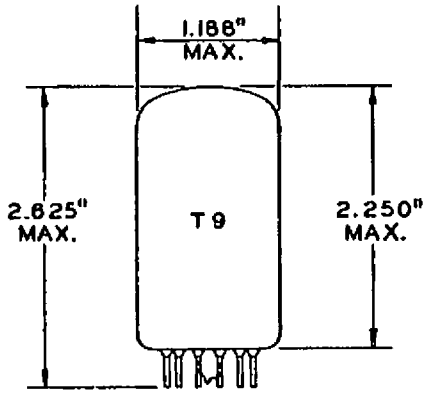
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

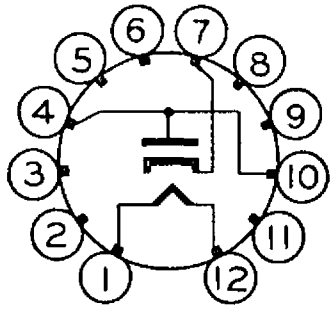


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - No Connection
Pin 3 - No Connection
Pin 4 - Plate
§Pin 5 - No Connection
§Pin 6 - No Connection
Pin 7 - Cathode
§Pin 8 - No Connection
§Pin 9 - No Connection
Pin 10 - Plate
Pin 11 - No Connection
Pin 12 - Heater

BASING DIAGRAM



EIA 12BL

GENERAL ELECTRIC

from JEDEC release #4213, April 8, 1963

MAXIMUM RATINGS (Cont'd)

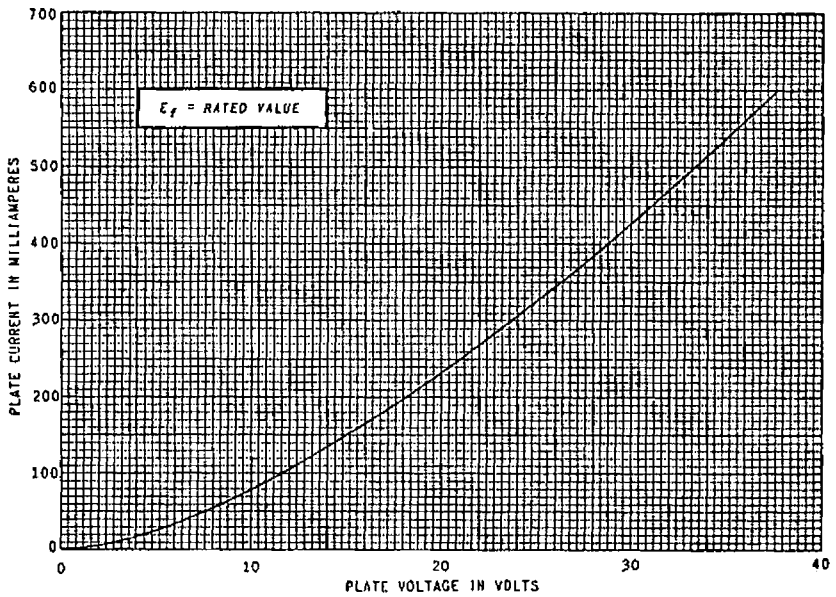
TV DAMPER SERVICE—DESIGN-MAXIMUM VALUES ¶

Peak Inverse Plate Voltage	3300	Volts
Plate Dissipation	5.3	Watts
Steady-State Peak Plate Current	1000	Milliamperes
DC Output Current	165	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	600	Volts
Total DC and Peak	3300	Volts

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 250 Milliamperes DC	21	Volts

AVERAGE PLATE CHARACTERISTICS



FOOTNOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

† The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

‡ Without external shield.

§ Socket terminals 5, 6, 8, and 9 should not be used as tie points.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

12BV7

PENTODE

FOR TV VIDEO AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 12BV7 is a miniature power pentode designed primarily for use as the video output amplifier in television receivers. In application and characteristics it is related to the 12BY7. Like the 12BY7 it features high transconductance, high power sensitivity, and low interelectrode capacitances. It can deliver relatively large output voltages with low values of plate-supply voltage and plate load resistance.

GENERAL

ELECTRICAL

	Series	Parallel	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	12.6	6.3	Volts
Heater Current	0.3	0.6	Amperes
Direct Interelectrode Capacitances*			
Grid-Number 1 to Plate		0.055	μμf
Input		11	μμf
Output		3.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

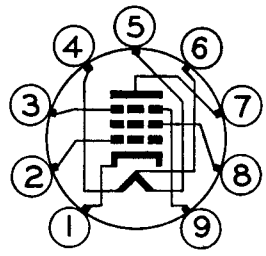
Plate Voltage	300	Volts
Screen Voltage	175	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
Plate Dissipation	6.25	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	1.0	Megohms

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GENERAL ELECTRIC

Supersedes ET-T1315, dated 4-56

BASING DIAGRAM

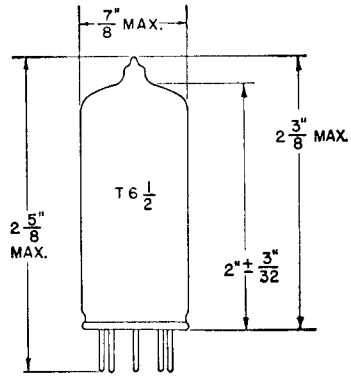


EIA 9BF

TERMINAL CONNECTIONS

Pin 1—Cathode
Pin 2—Grid Number 1
Pin 3—Internal Shield and Grid Number 3 (Suppressor)
Pin 4—Heater
Pin 5—Heater
Pin 6—Heater Center-tap
Pin 7—Plate
Pin 8—Grid Number 2 (Screen)
Pin 9—Internal Shield and Grid Number 3 (Suppressor)

PHYSICAL DIMENSIONS



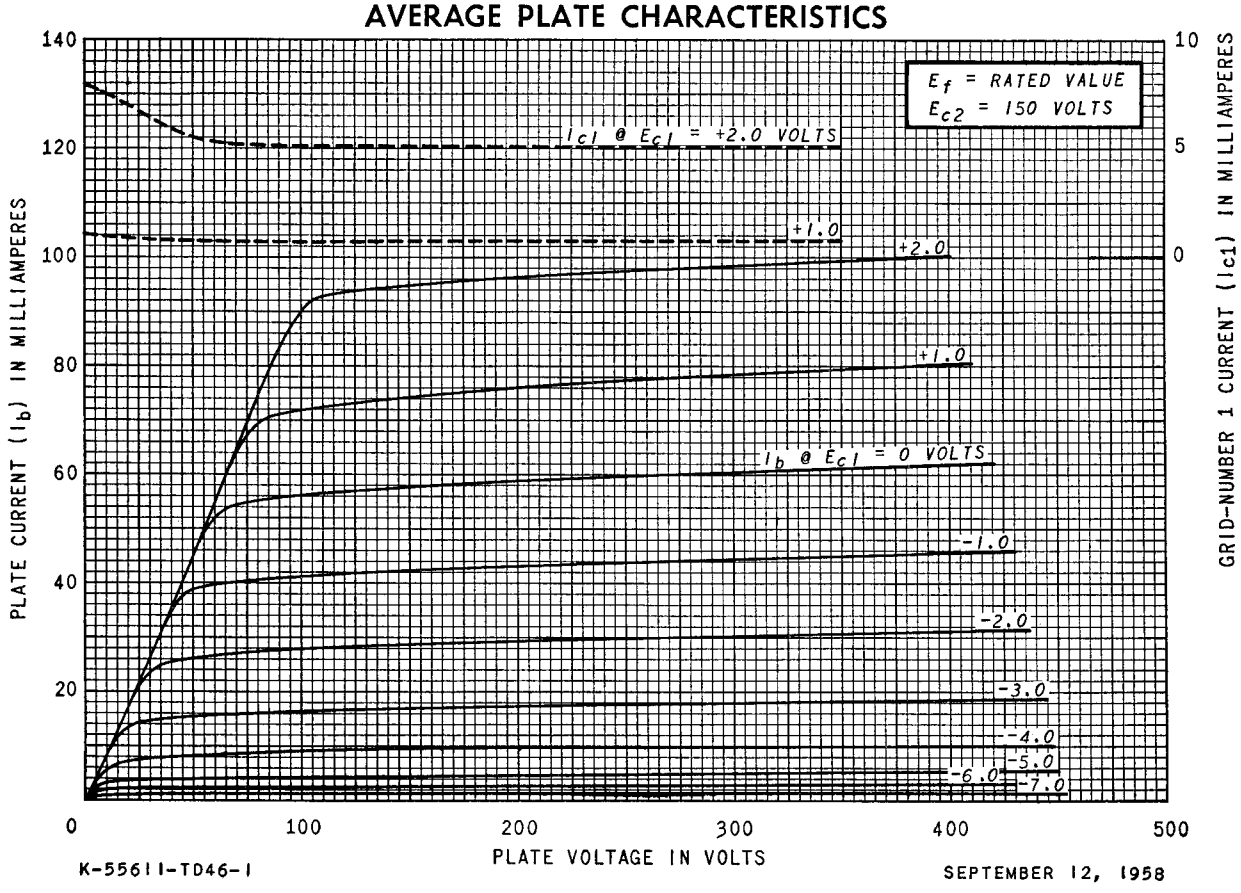
EIA 6-3

CHARACTERISTICS AND TYPICAL OPERATION

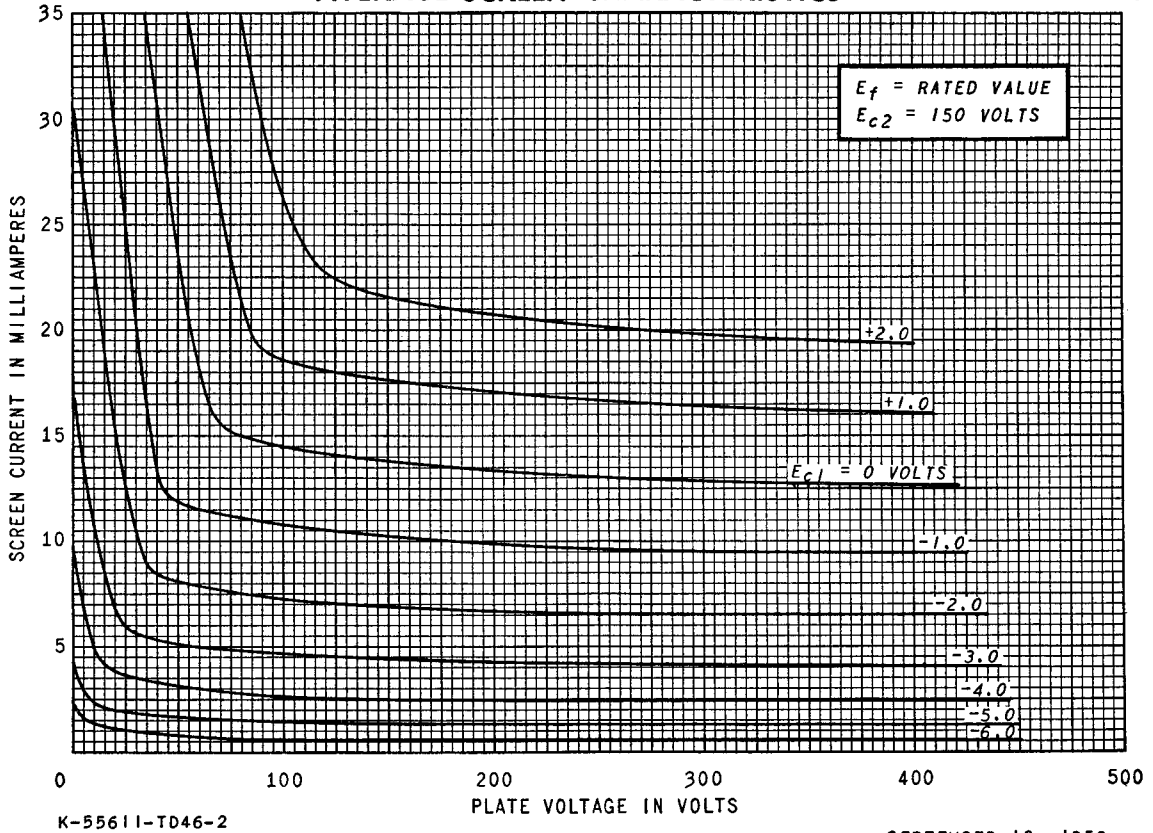
CLASS A_1 AMPLIFIER

Plate Voltage	250	250	Volts
Suppressor, Connected to Cathode at Socket			
Screen Voltage	180	150	Volts
Grid-Number 1 Voltage	−8	—	Volts
Cathode-Bias Resistor	—	68	Ohms
Plate Resistance, approximate	—	85000	Ohms
Transconductance	—	13000	Micromhos
Plate Current	0.5†	27	Milliamperes
Screen Current	—	6.0	Milliamperes
Grid-Number 1 Voltage, approximate Ib=20 Microamperes	—	−12	Volts
Triode Amplification Factor		28	

* Without external shield.
† Minimum.



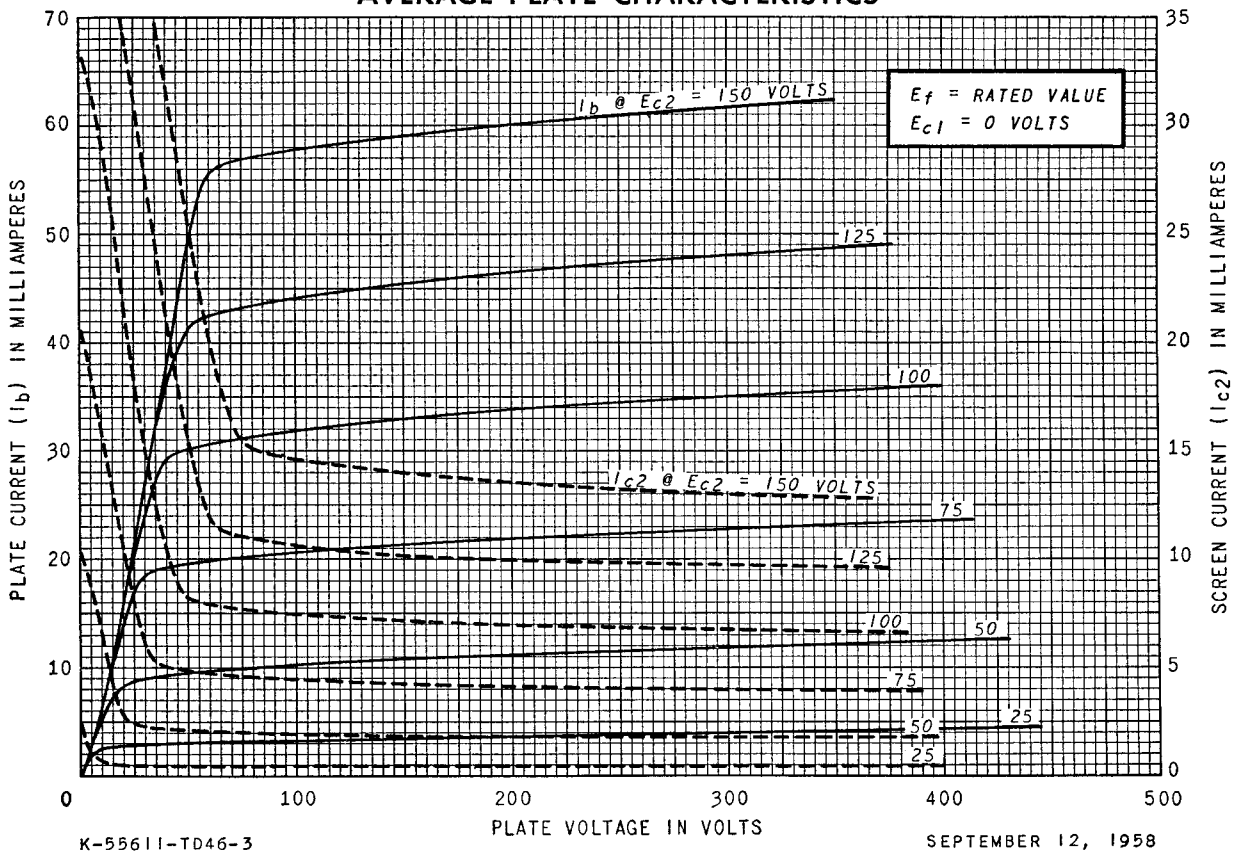
AVERAGE SCREEN CHARACTERISTICS



K-55611-TD46-2

SEPTEMBER 12, 1958

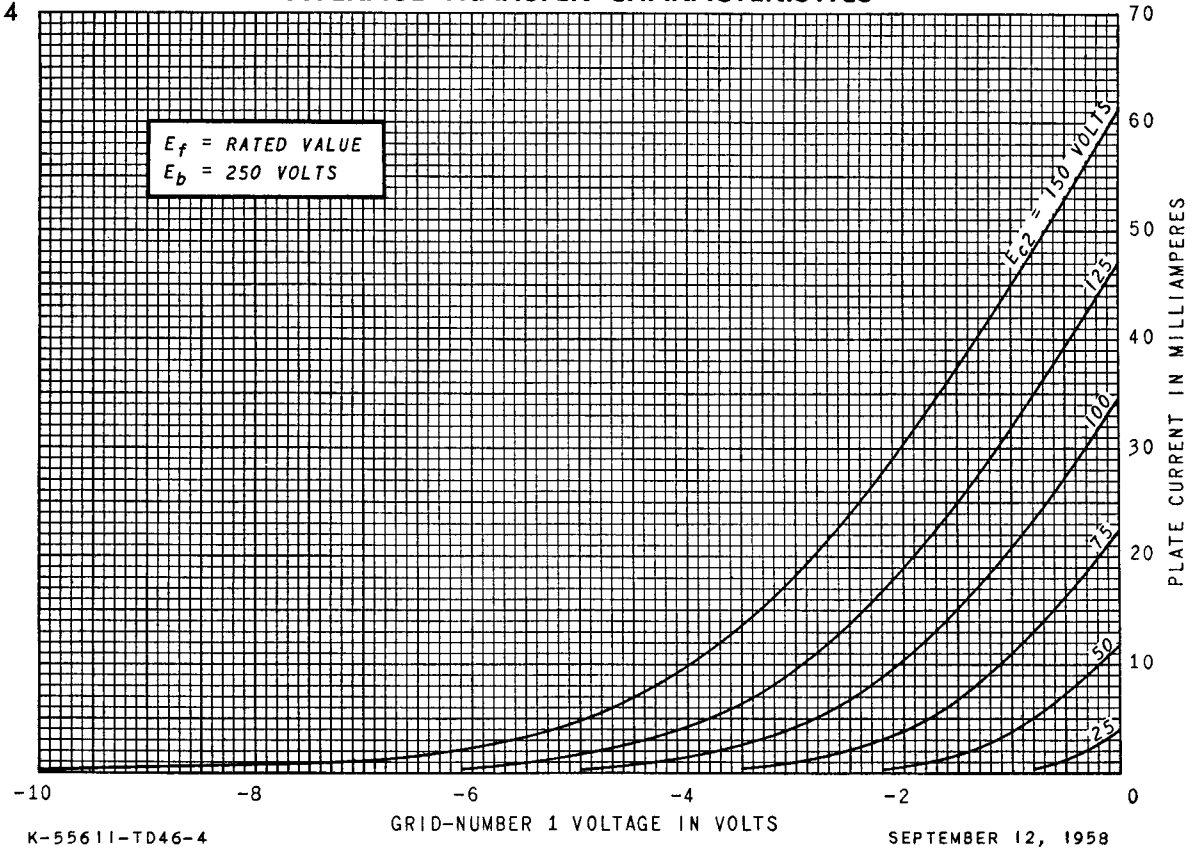
AVERAGE PLATE CHARACTERISTICS



K-55611-TD46-3

SEPTEMBER 12, 1958

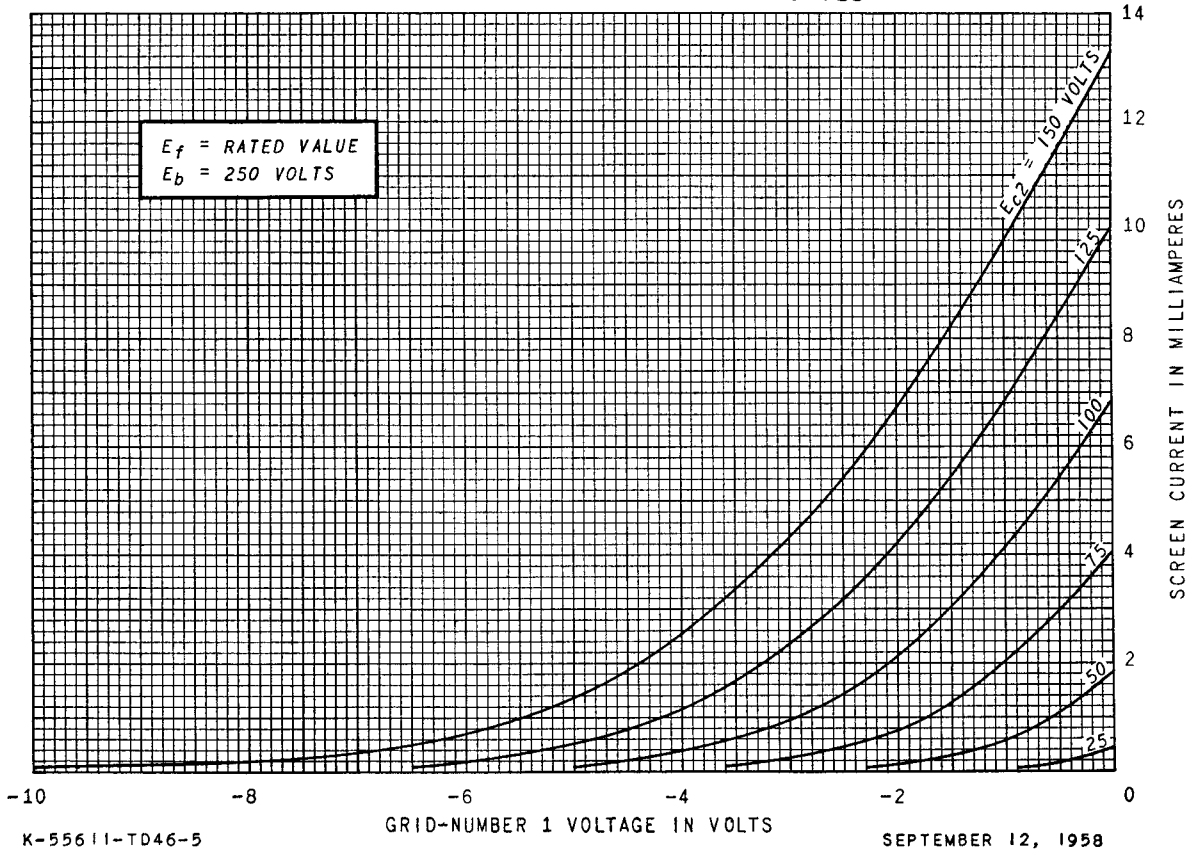
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD46-4

SEPTEMBER 12, 1958

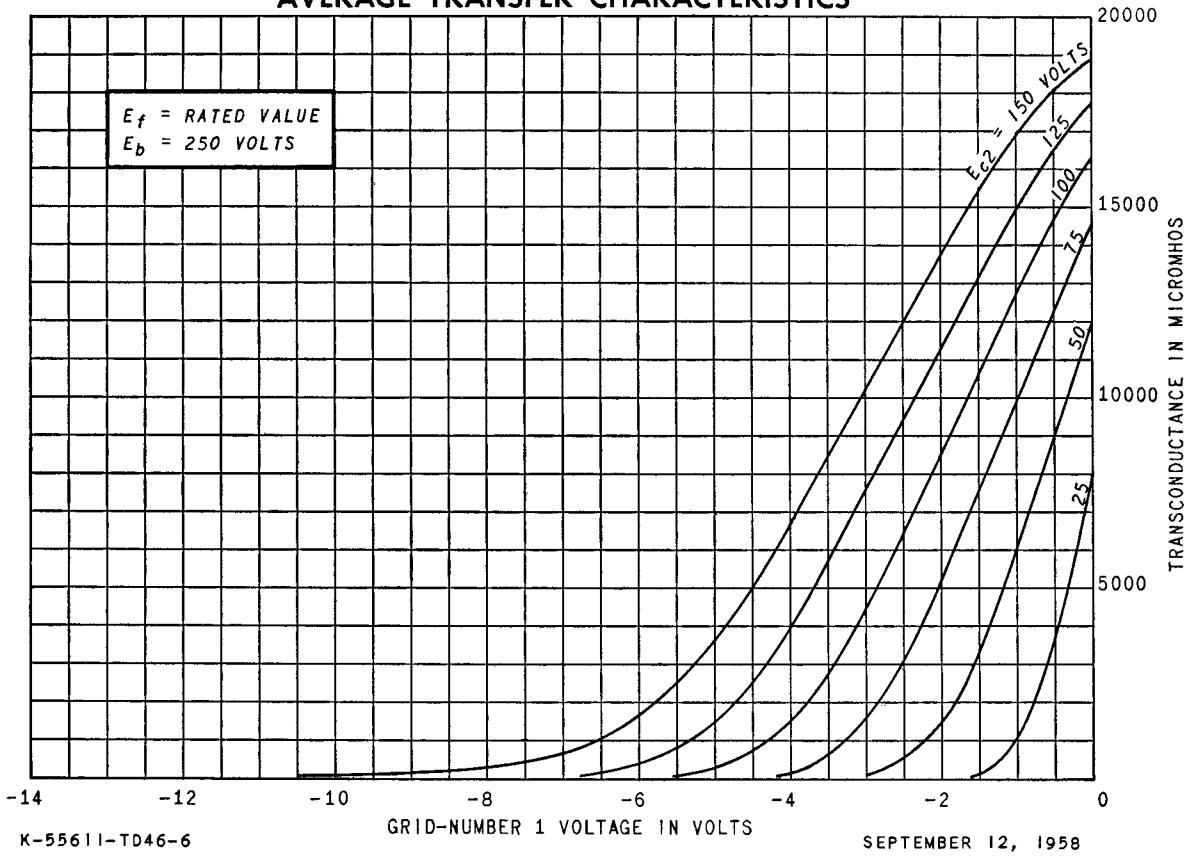
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD46-5

SEPTEMBER 12, 1958

AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD46-6

SEPTEMBER 12, 1958

Electronic TUBES

12BY7-A

PENTODE

FOR TV VIDEO AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 12BY7-A is a miniature power pentode designed primarily for use as the video output amplifier in television receivers. Features of the tube include extremely high transconductance, low interelectrode capacitances, and high power sensitivity.

Electrically and mechanically, the 12BY7-A is a replacement for the 12BY7. In addition, however, the 12BY7-A exhibits a controlled heater warm-up characteristic which makes the tube particularly suited for use in television receivers which employ series-connected heaters. When the 12BY7-A is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

GENERAL

ELECTRICAL

	Series	Parallel
Cathode—Coated Unipotential		
Heater Voltage, AC or DC	12.6	6.3 Volts
Heater Current	0.3	0.6 Amperes
Heater Warm-up Time*	..	11 Seconds
Direct Interelectrode Capacitances†		
Grid-Number 1 to Plate, maximum		0.063 μμf
Input		10.2 μμf
Output		3.5 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

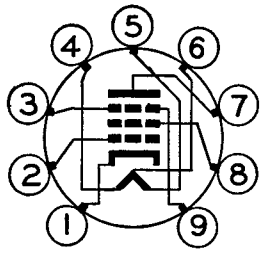
MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	300 Volts
Screen Voltage	180 Volts
Positive DC Grid-Number 1 Voltage	0 Volts
Negative DC Grid-Number 1 Voltage	50 Volts
Plate Dissipation	6.5 Watts
Screen Dissipation	1.1 Watts
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	200 Volts
Heater Negative with Respect to Cathode	200 Volts
Grid-Number 1 Circuit Resistance	
With Fixed Bias	0.25 Megohms
With Cathode Bias	1.0 Megohms

GENERAL ELECTRIC

BASING DIAGRAM

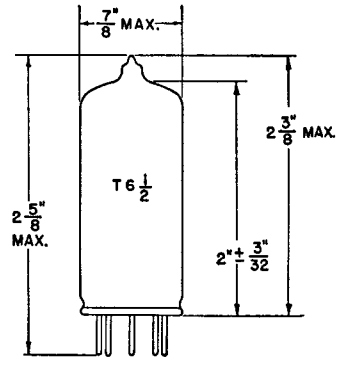


RETMA 9BF

TERMINAL CONNECTIONS

Pin 1—Cathode
Pin 2—Grid Number 1
Pin 3—Internal Shield and Grid Number 3 (Suppressor)
Pin 4—Heater
Pin 5—Heater
Pin 6—Heater Center-Tap
Pin 7—Plate
Pin 8—Grid Number 2 (Screen)
Pin 9—Internal Shield and Grid Number 3 (Suppressor)

PHYSICAL DIMENSIONS



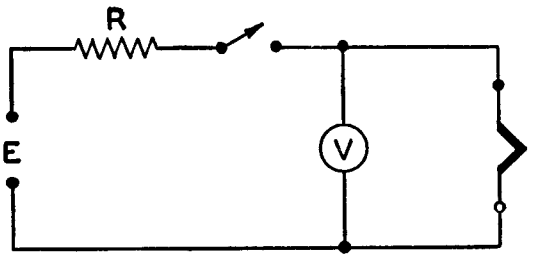
RETMA 6-3

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	250	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	180	Volts
Cathode-Bias Resistor	100	Ohms
Plate Resistance, approximate	0.093	Megohms
Transconductance	11000	Micromhos
Plate Current	26	Milliamperes
Screen Current	5.75	Milliamperes
Grid-Number 1 Voltage, approximate		
IG=20 Microamperes	−11.6	Volts
Triode Amplification Factor	28.5	

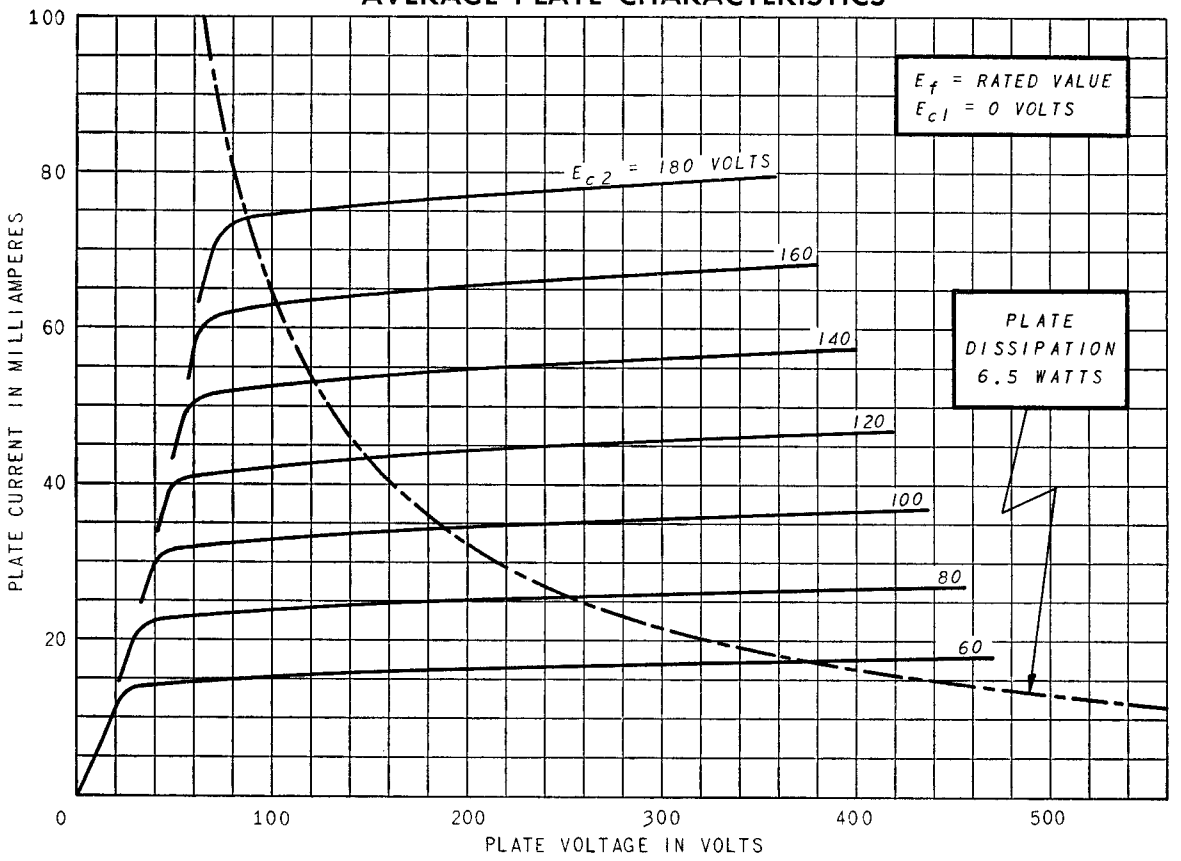
* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals (V) to increase from zero to the heater test Voltage (V_1). For this type, E=25 volts (RMS or DC), V_1=5.0 volts (RMS or DC), and R=31.5 ohms.



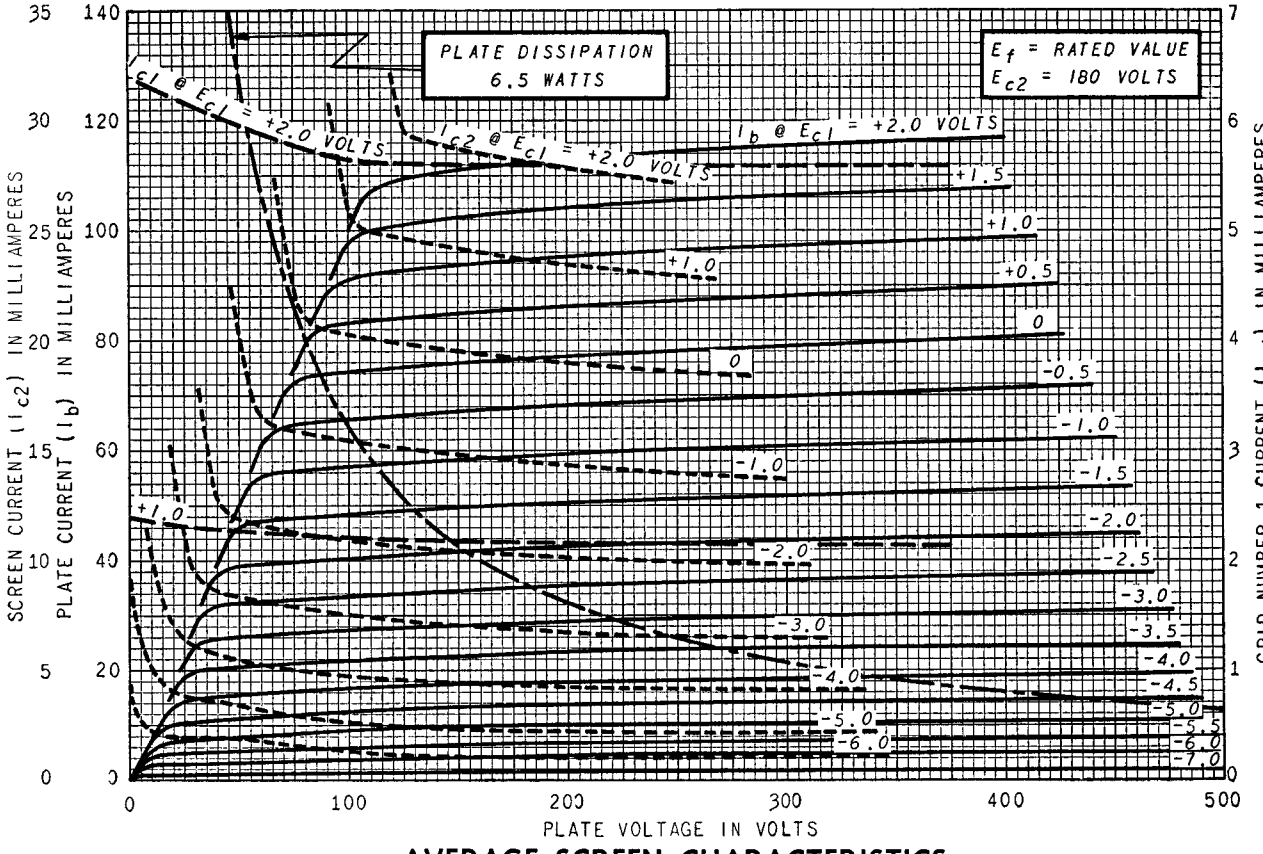
Heater of Tube under Test

† Without external shield.

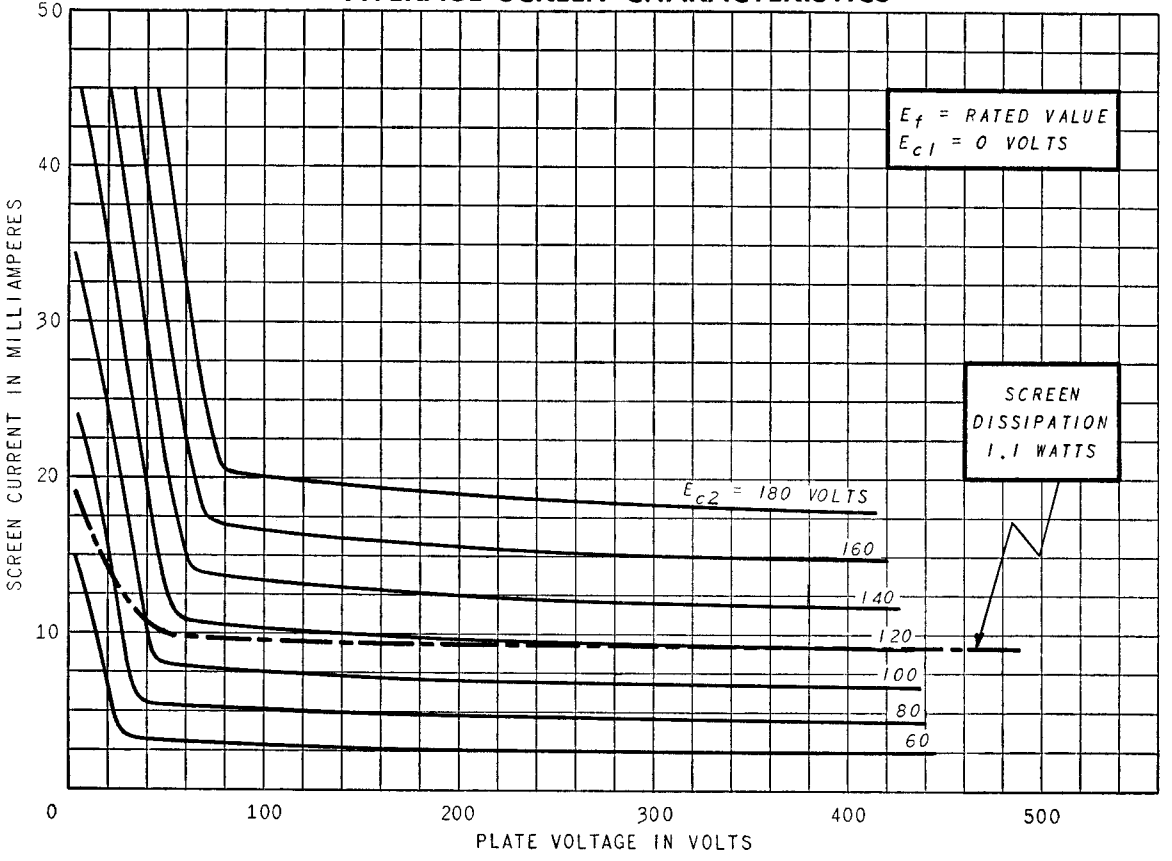
AVERAGE PLATE CHARACTERISTICS



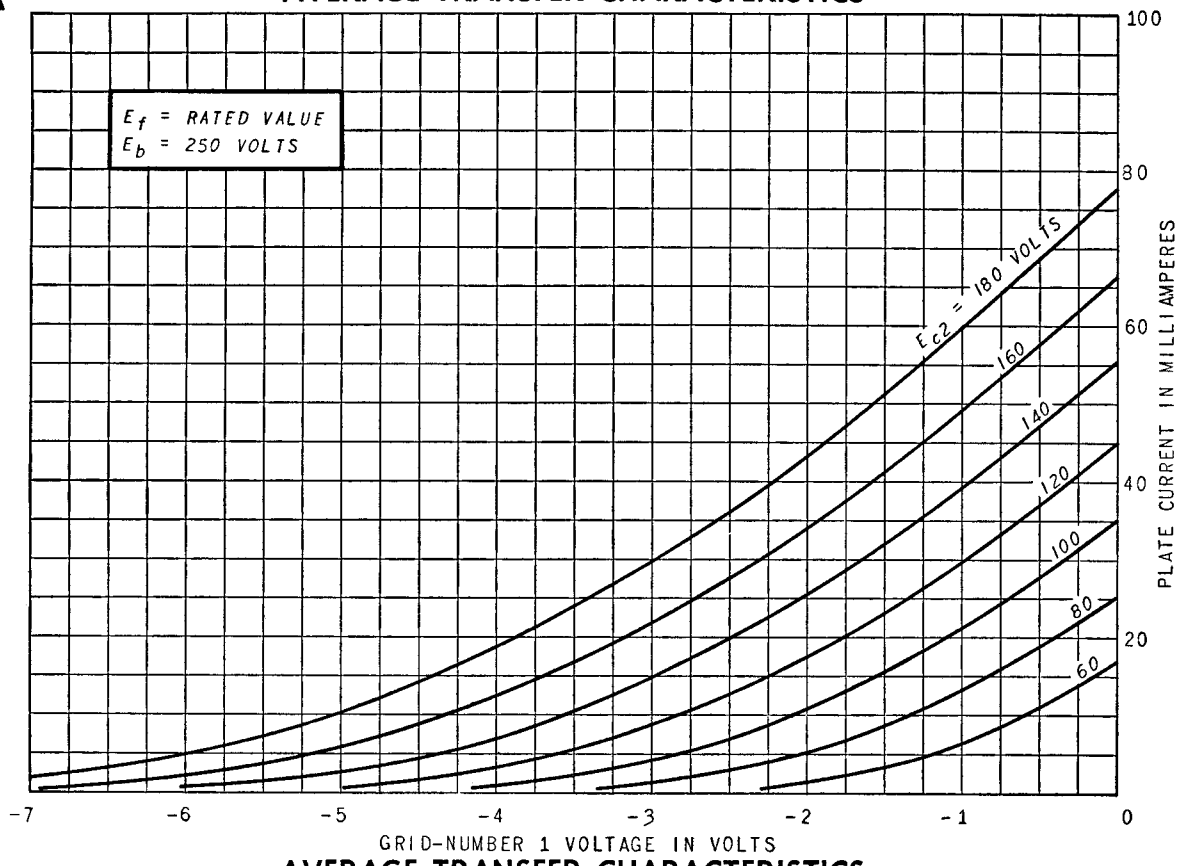
AVERAGE PLATE CHARACTERISTICS



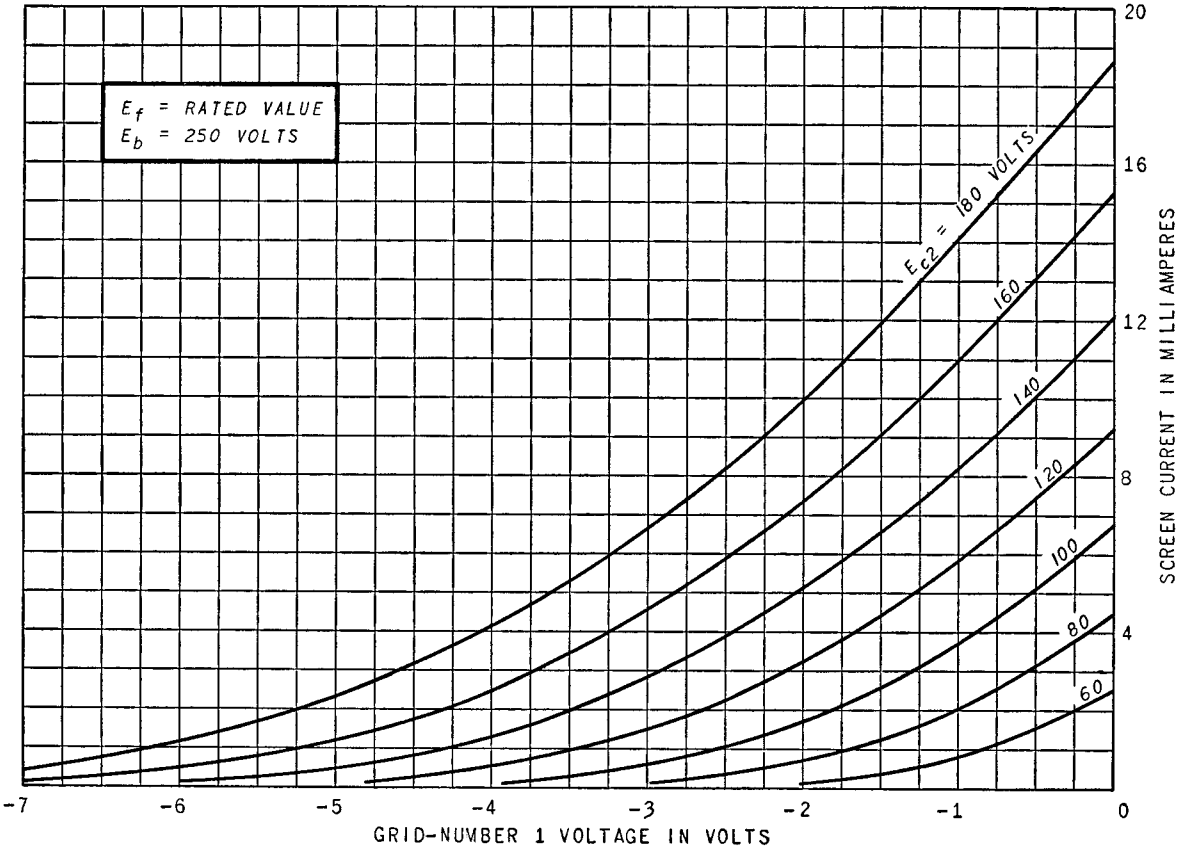
AVERAGE SCREEN CHARACTERISTICS



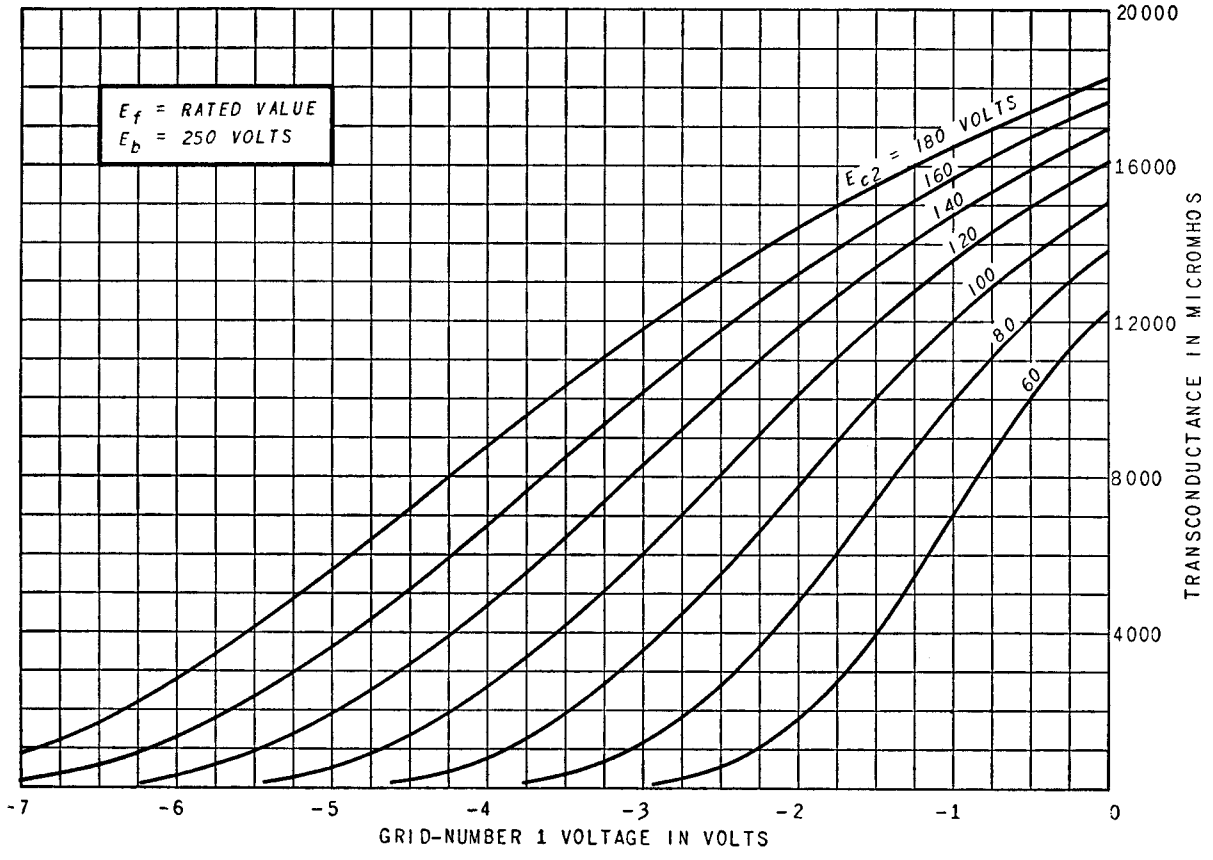
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



DESCRIPTION AND RATING

12C5

12C5 Beam Pentode. Except for heater characteristics and ratings, the 12C5 is identical to the 50C5.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	12.6	Volts
Heater Current†	0.6 ± 0.04	Amperes
Heater Warm-up Time‡	11	Seconds

12CA5

12CA5 Beam Pentode. Except for heater ratings and heater-cathode voltage ratings, the 12CA5 is identical to the 6CA5.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC	12.6	Volts
Heater Current	0.6	Amperes
Heater Warm-up Time‡	11	Seconds

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Heater-Cathode Voltage

Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
DC Component	200	Volts
Total DC and Peak	300	Volts

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under normal conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube in average applications, making allowance for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube under normal operating conditions at the stated normal supply voltage.

NOTES

ϕ Heater voltage for a bogey tube at If = 0.3 amperes.
¶ Heater voltage for a bogey tube at If = 0.45 amperes.
* Heater voltage for a bogey tube at If = 0.6 amperes.
† For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.
‡ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

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Electronic TUBES

12CT8

TRIODE-PENTODE

DESCRIPTION AND RATING

The 12CT8 is a miniature triode-pentode designed for use in compact, 300-milliampere, series-string television receivers. The pentode section is designed primarily for use as a video amplifier. The triode section is suitable for service as a sync amplifier, separator, or clipper, or as a sweep oscillator.

The 12CT8 has a controlled heater warm-up characteristic as required for use in television receivers that employ series-connected heaters. It also features high performance capabilities at the low d-c supply voltages normally available in these applications.

The 12CT8 is similar to the 6AU8, from which it differs primarily in heater ratings, basing arrangement, length of envelope, and maximum ratings.

GENERAL

ELECTRICAL

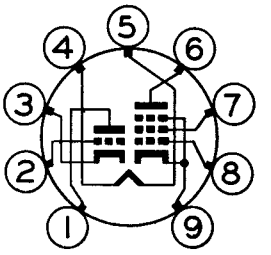
Cathode—Coated Unipotential

Heater Voltage, AC or DC	12.6	Volts
Heater Current	0.3 ± 6%	Amperes
Heater Warm-up Time*	11	Seconds
Direct Interelectrode Capacitances†		
Pentode Section		
Grid-Number 1 to Plate	0.044	μμf
Input	7.5	μμf
Output	2.4	μμf
Triode Section		
Grid to Plate	2.2	μμf
Input	2.4	μμf
Output	0.19	μμf
Pentode Grid-Number 1 to Triode Plate, maximum	0.010	μμf
Triode Grid to Pentode Plate, maximum	0.016	μμf
Pentode Plate to Triode Plate, maximum	0.16	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

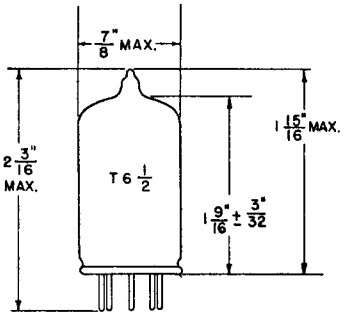


RETMA 9DA

TERMINAL CONNECTIONS

Pin 1—Triode Plate
Pin 2—Triode Grid
Pin 3—Triode Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Plate
Pin 7—Pentode Grid Number 2 (Screen)
Pin 8—Pentode Grid Number 1
Pin 9—Pentode Cathode, Grid Number 3, and Internal Shield

PHYSICAL DIMENSIONS



RETMA 6-2

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES	Pentode Section	Triode Section	
Plate Voltage	300	300	Volts
Screen-Supply Voltage	300	....	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	2.75	2.5	Watts
Screen Dissipation	0.9	....	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

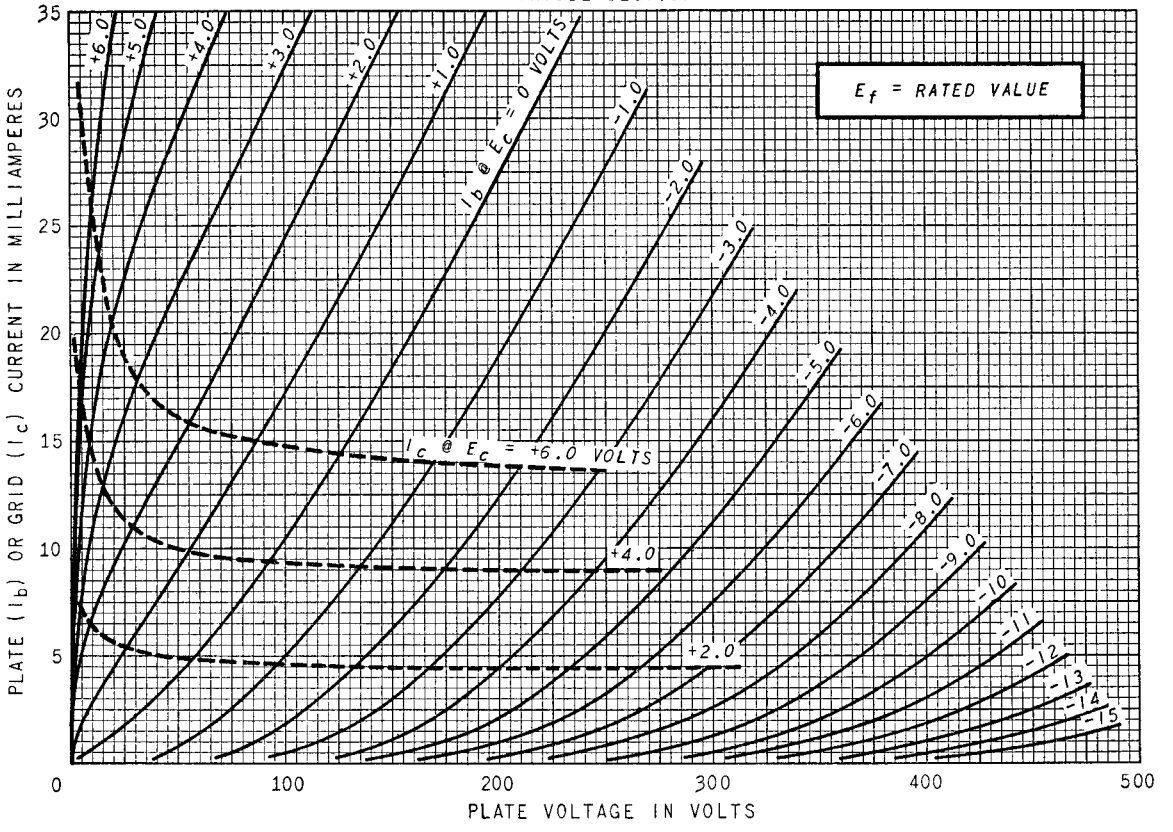
	Pentode Section	Triode Section	
Plate Voltage	200	150	Volts
Screen Voltage	125	....	Volts
Cathode-Bias Resistor	82	150	Ohms
Amplification Factor	....	40	
Plate Resistance, approximate	150000	8200	Ohms
Transconductance	7000	4900	Micromhos
Plate Current	15	9.0	Milliamperes
Screen Current	3.4	....	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 100 Microamperes	−8	−6.5	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

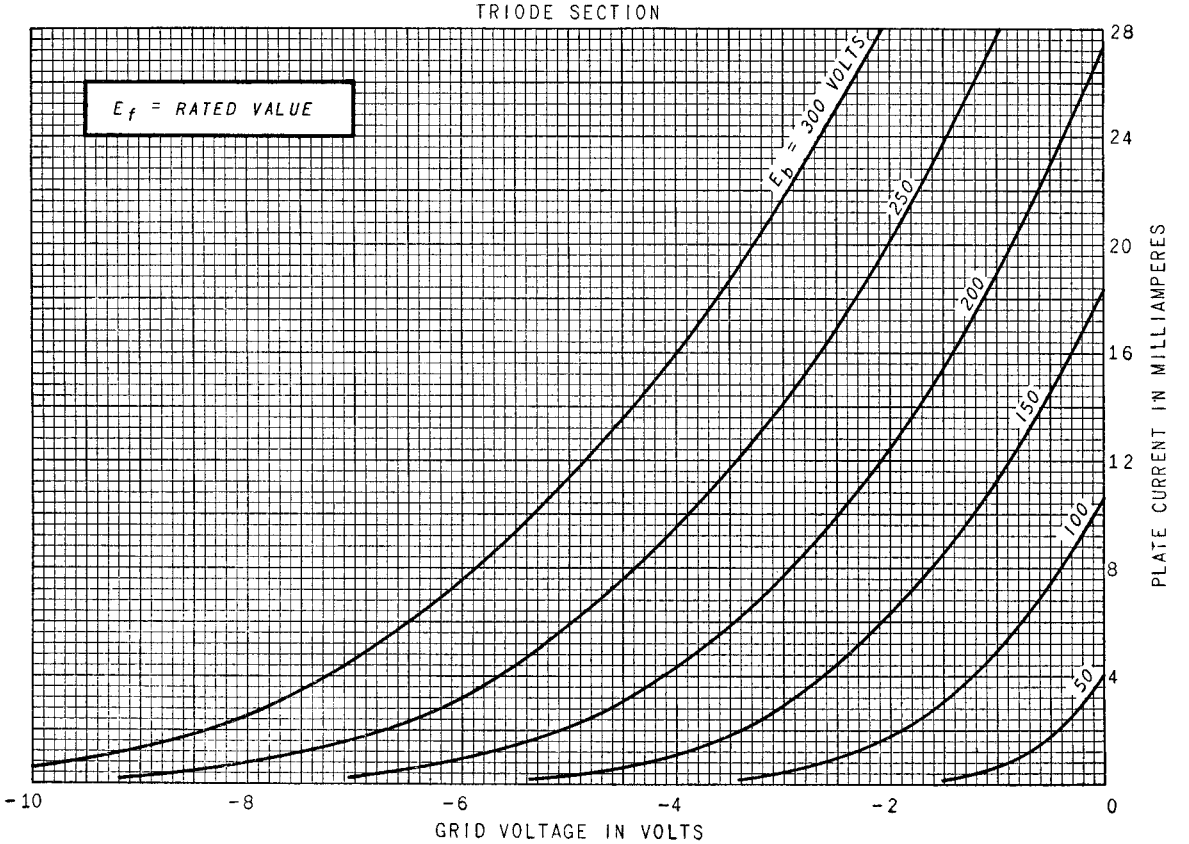
AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION



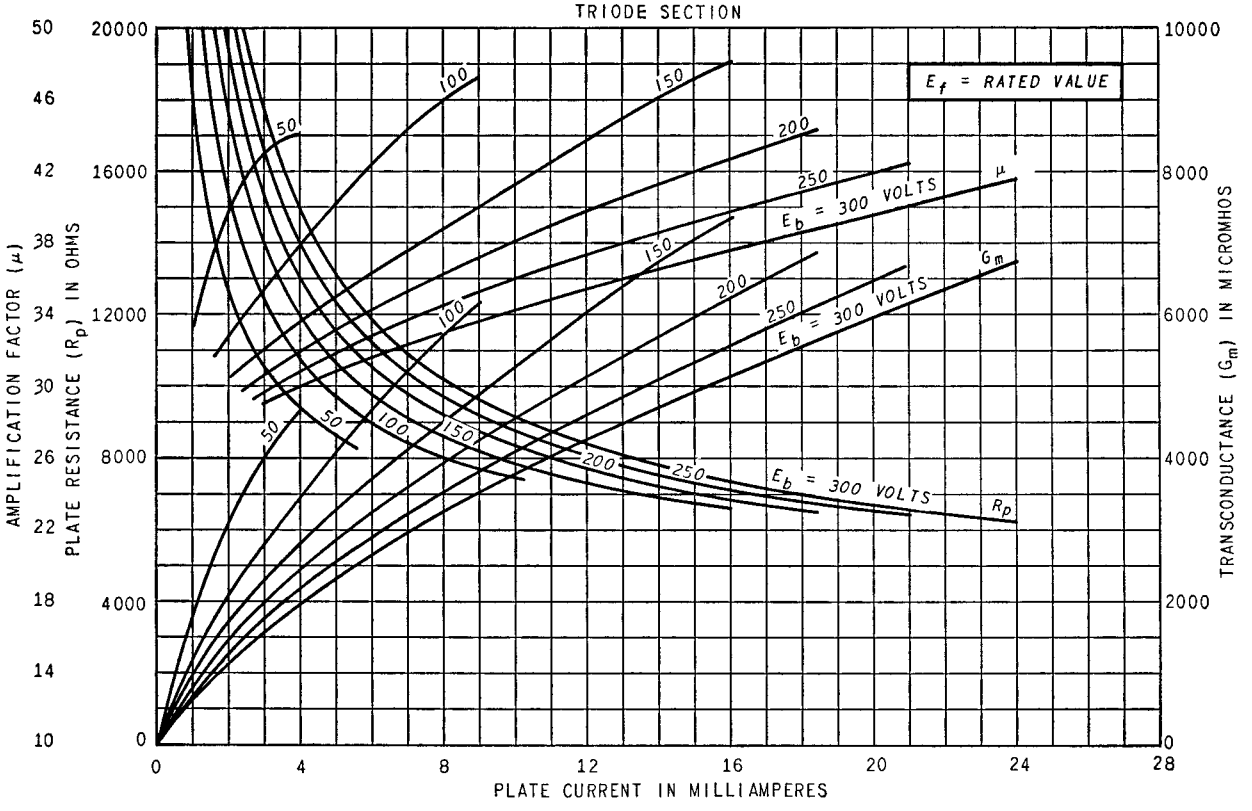
AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION



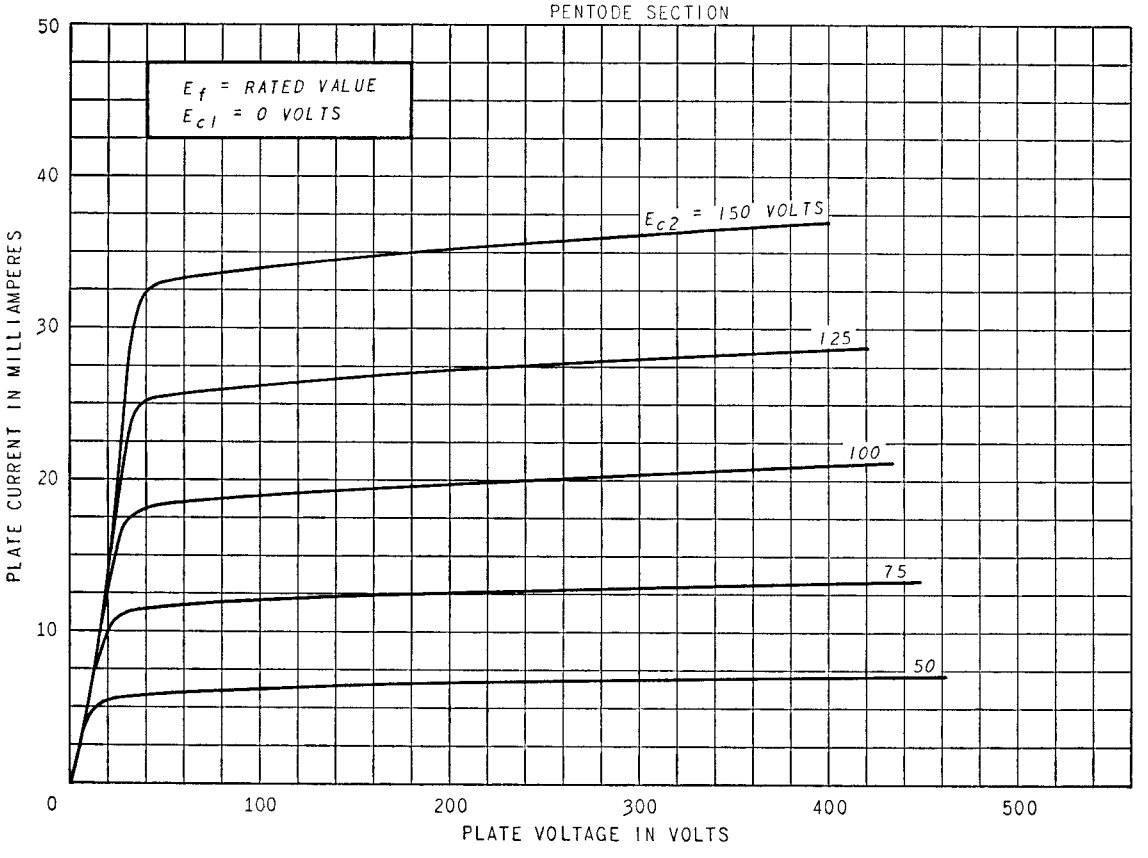
AVERAGE CHARACTERISTICS

TRIODE SECTION



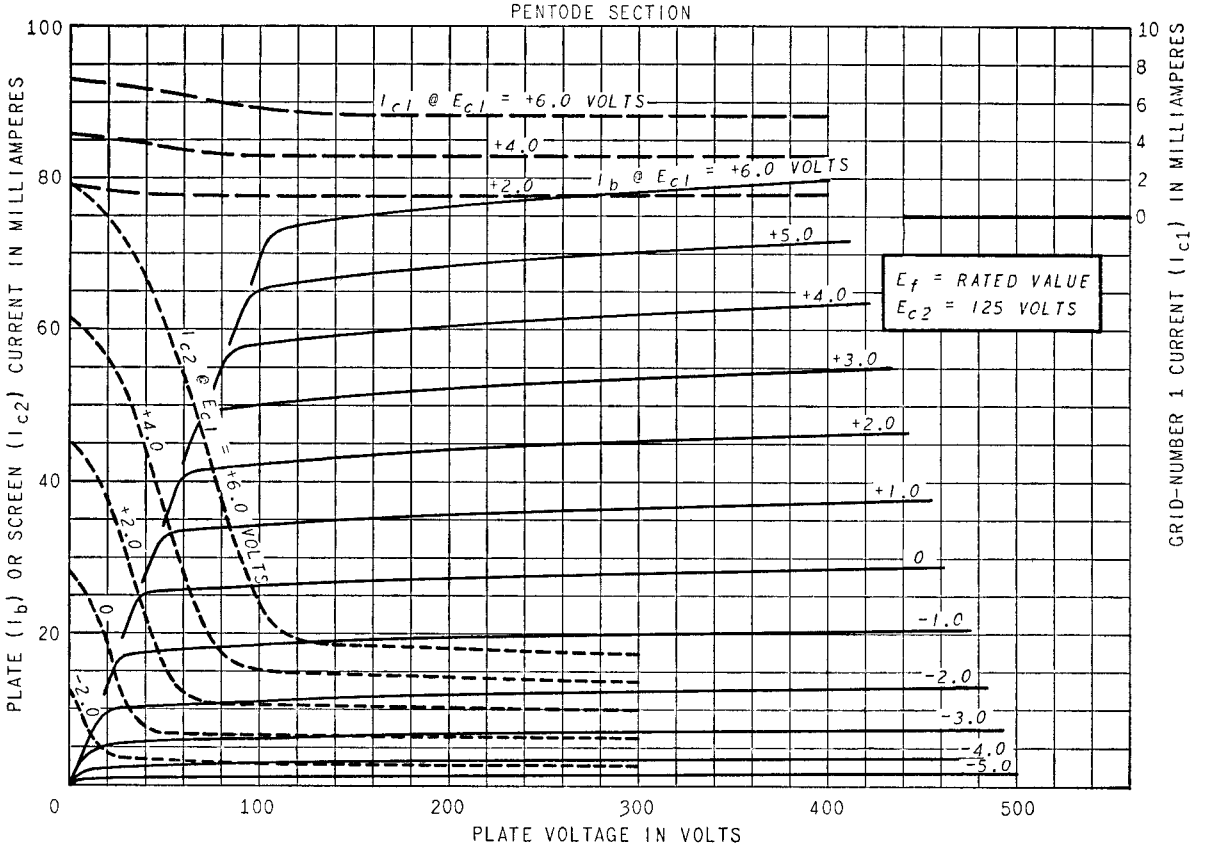
AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION



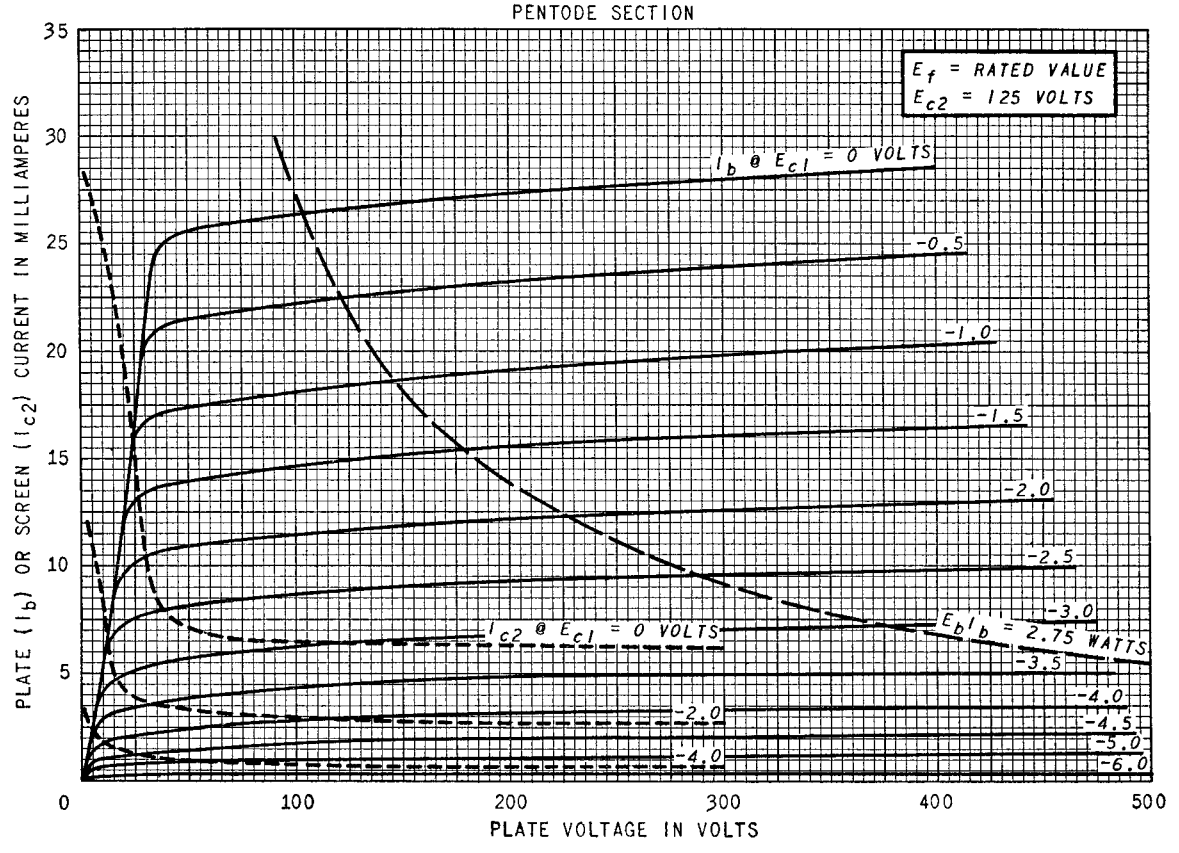
AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

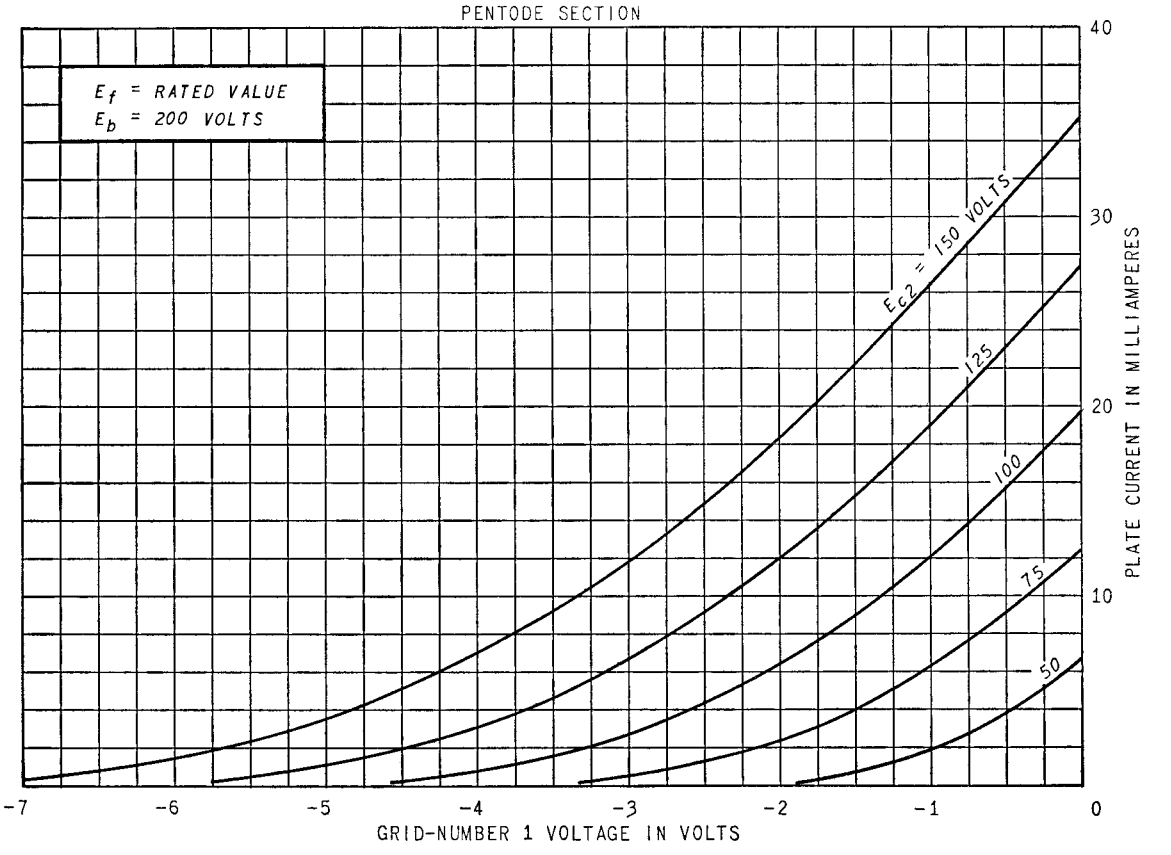


AVERAGE PLATE CHARACTERISTICS

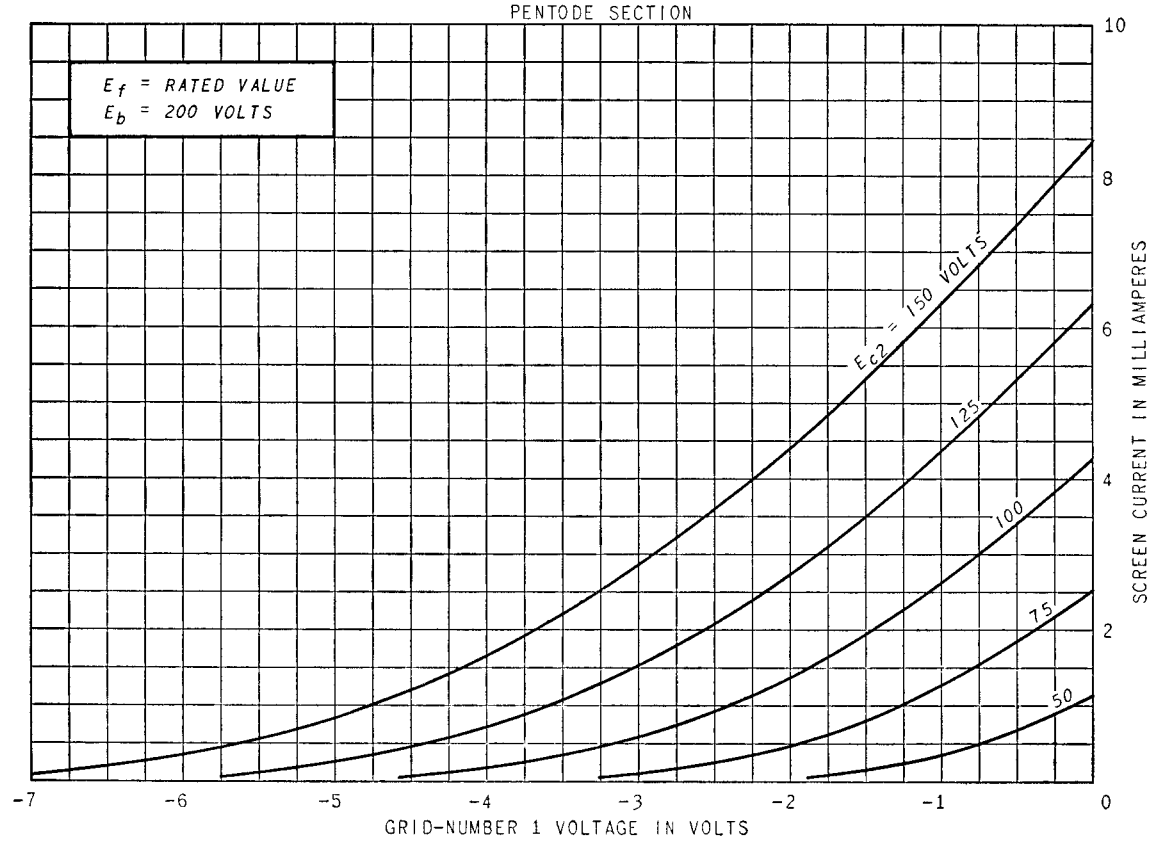
PENTODE SECTION



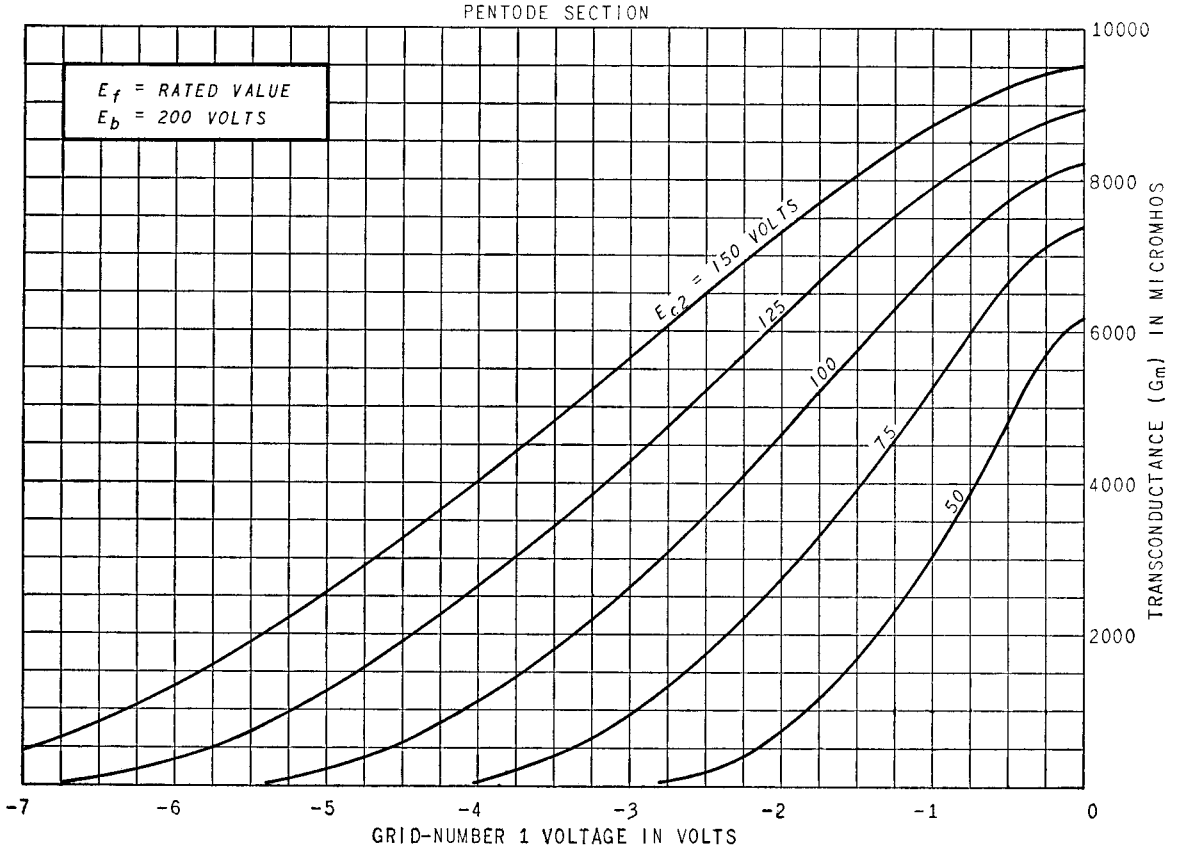
AVERAGE TRANSFER CHARACTERISTICS



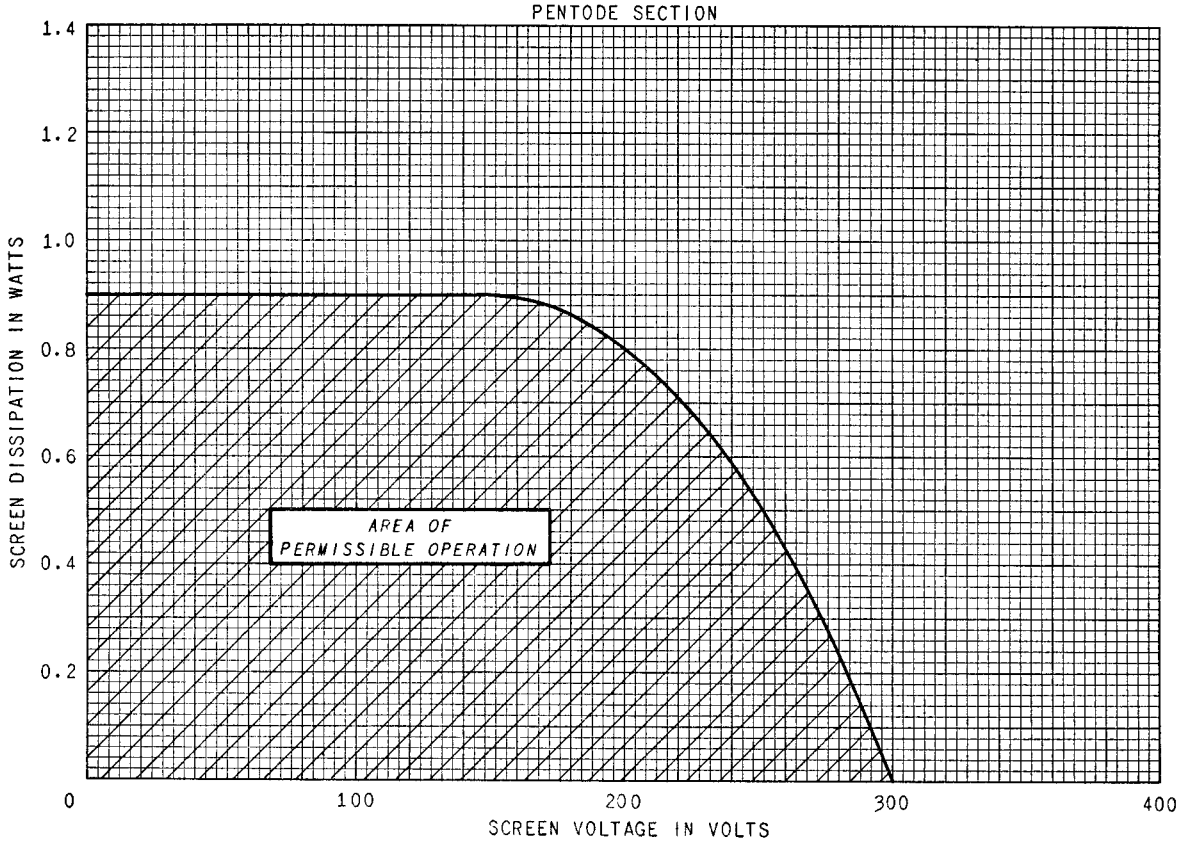
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



SCREEN RATING CHART



Electronic TUBES

12DQ7

PENTODE

FOR TV VIDEO AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 12DQ7 is a miniature power pentode primarily designed for use as the video output amplifier in television receivers. Features of the tube include high transconductance, low interelectrode capacitances, and high power sensitivity. In addition, it has a controlled heater warm-up characteristic.

GENERAL

ELECTRICAL

	Series	Parallel	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	12.6±10%	6.3	Volts
Heater Current	0.3	0.6±6%	Amperes
Heater Warm-up Time*	...	11	Seconds
Direct Interelectrode Capacitances†			
Grid-Number 1 to Plate, maximum		0.1	μμf
Input		10.0	μμf
Output		3.8	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

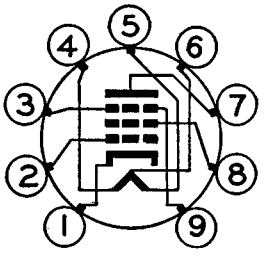
Plate Voltage	330	Volts
Screen-Supply Voltage	330	Volts
Screen Voltage—See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	6.5	Watts
Screen Dissipation	1.1	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

BASING DIAGRAM

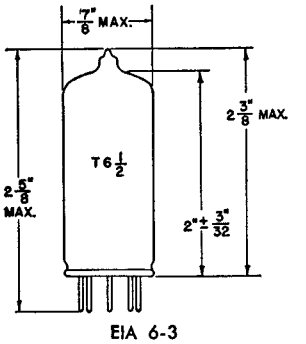


EIA 9BF

TERMINAL CONNECTIONS

Pin 1—Cathode
Pin 2—Grid Number 1
Pin 3—Internal Shield and Grid Number 3 (Suppressor)
Pin 4—Heater
Pin 5—Heater
Pin 6—Heater Center-Tap
Pin 7—Plate
Pin 8—Grid Number 2 (Screen)
Pin 9—Internal Shield and Grid Number 3 (Suppressor)

PHYSICAL DIMENSIONS



EIA 6-3

GENERAL ELECTRIC

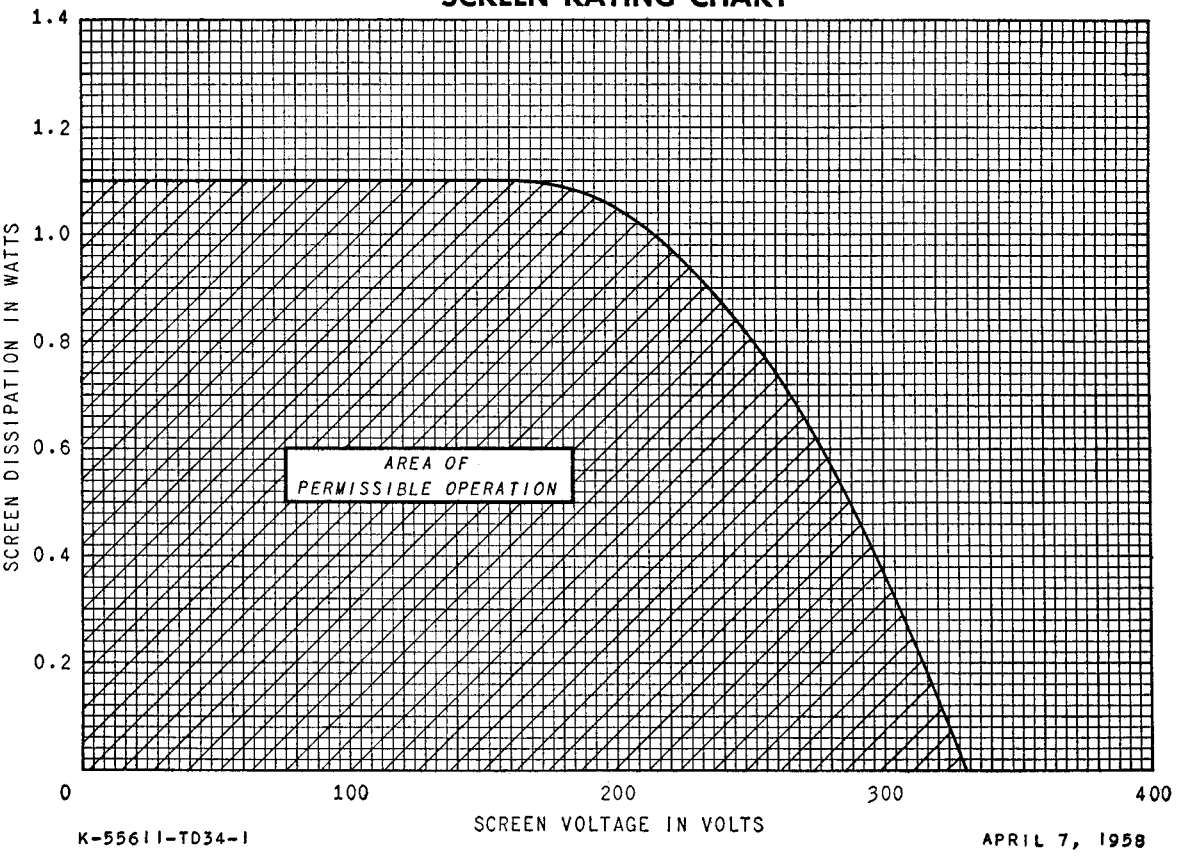
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

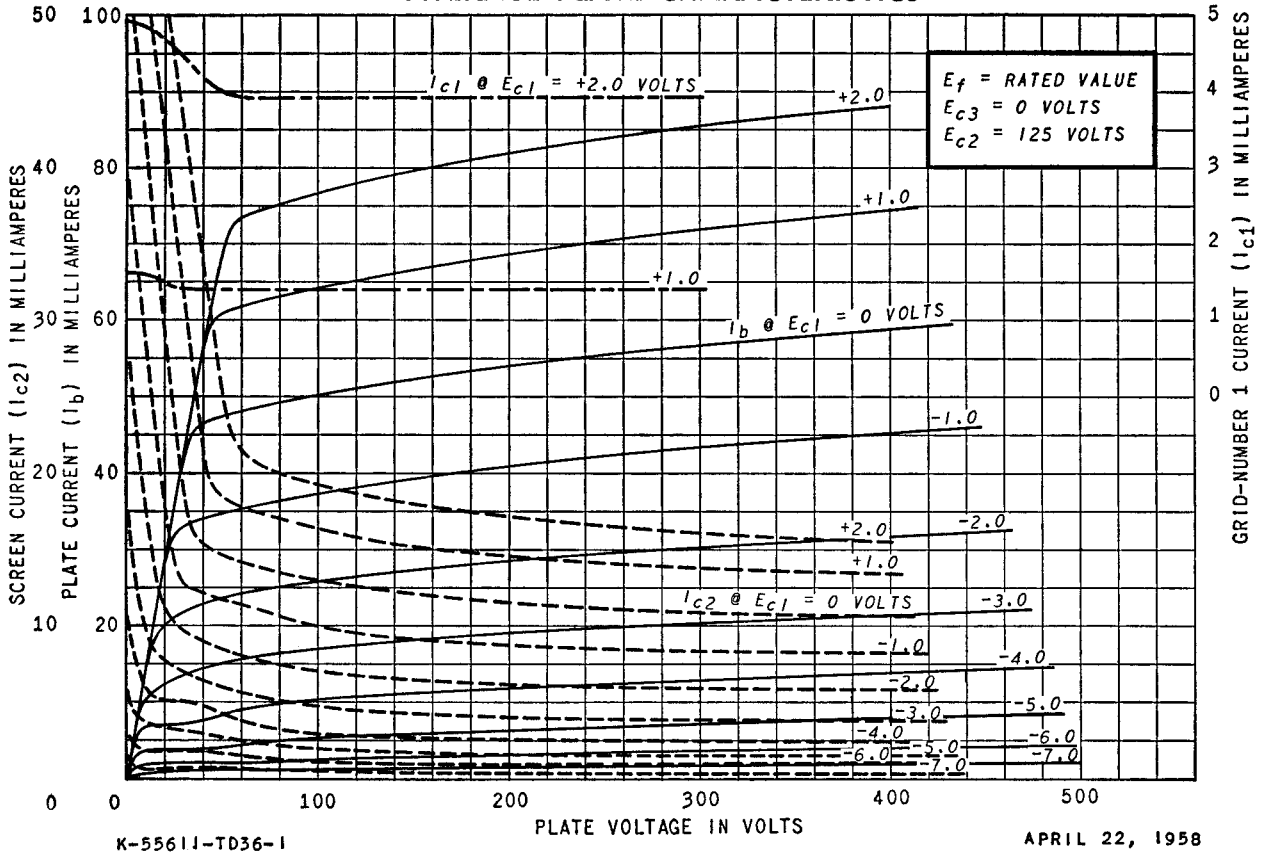
Plate Voltage	40	200	Volts
Suppressor—Connected to Cathode at Socket			
Screen Voltage	125	125	Volts
Grid-Number 1 Voltage	0‡	...	Volts
Cathode-Bias Resistor	...	68	Ohms
Plate Resistance, approximate	...	53000	Ohms
Transconductance	...	10500	Micromhos
Plate Current	45	26	Milliamperes
Screen Current	16	5.6	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	...	−9	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.
† Without external shield.
‡ Applied for short interval (two seconds maximum) so as not to damage tube.

SCREEN RATING CHART



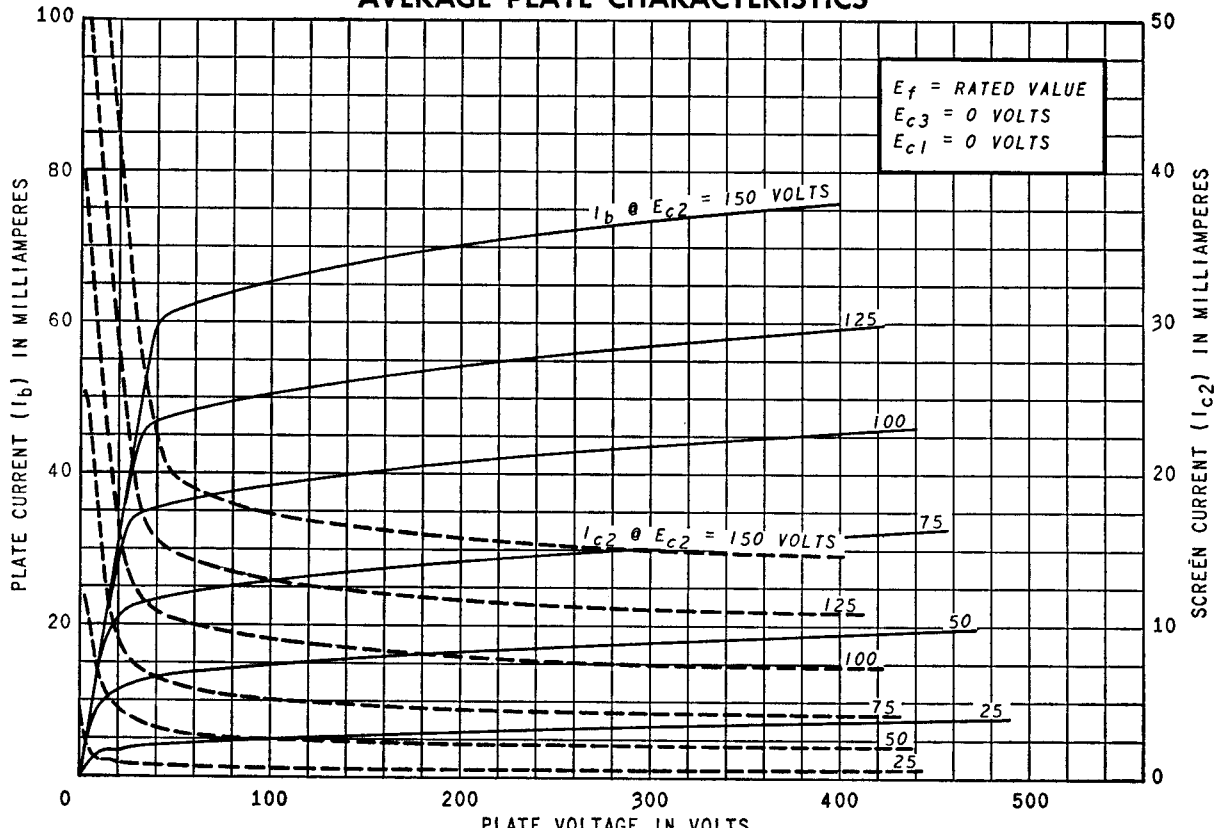
AVERAGE PLATE CHARACTERISTICS



K-55611-TD36-1

APRIL 22, 1958

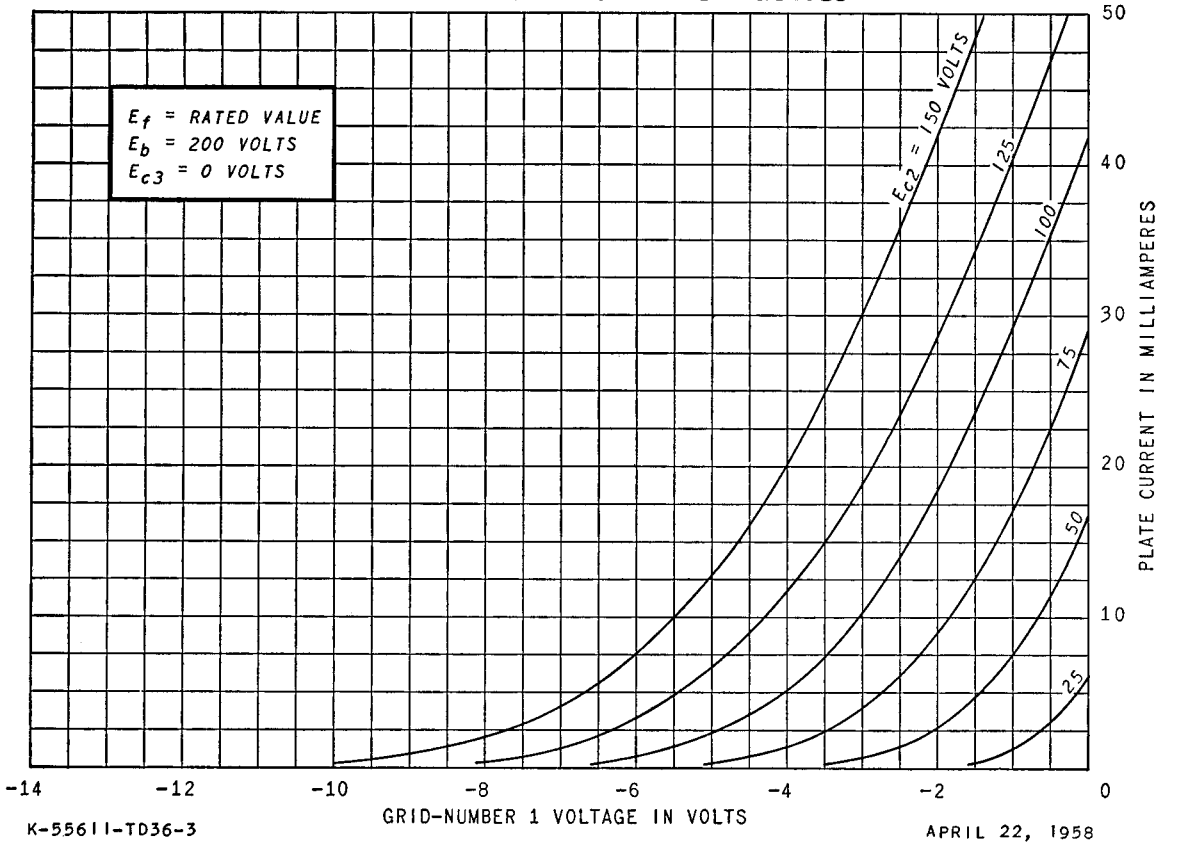
AVERAGE PLATE CHARACTERISTICS



K-55611-TD36-2

APRIL 22, 1958

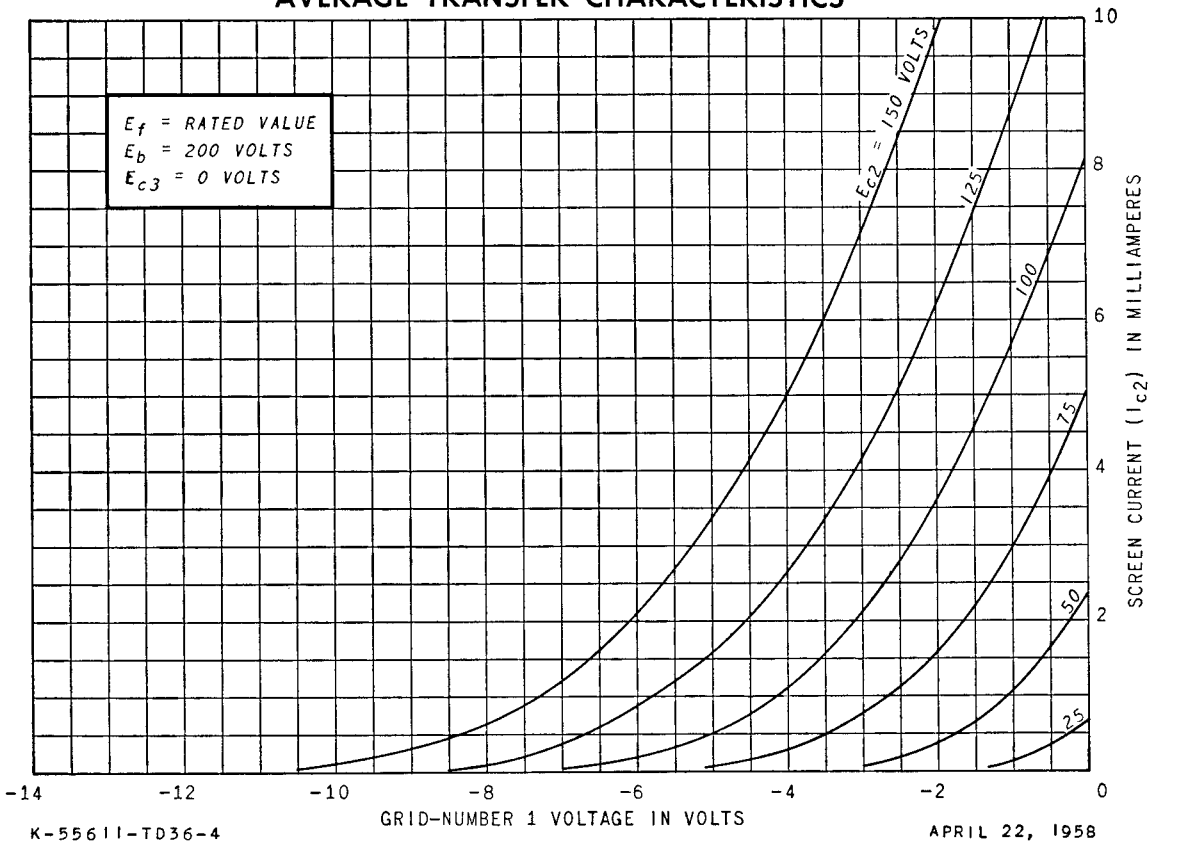
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD36-3

APRIL 22, 1958

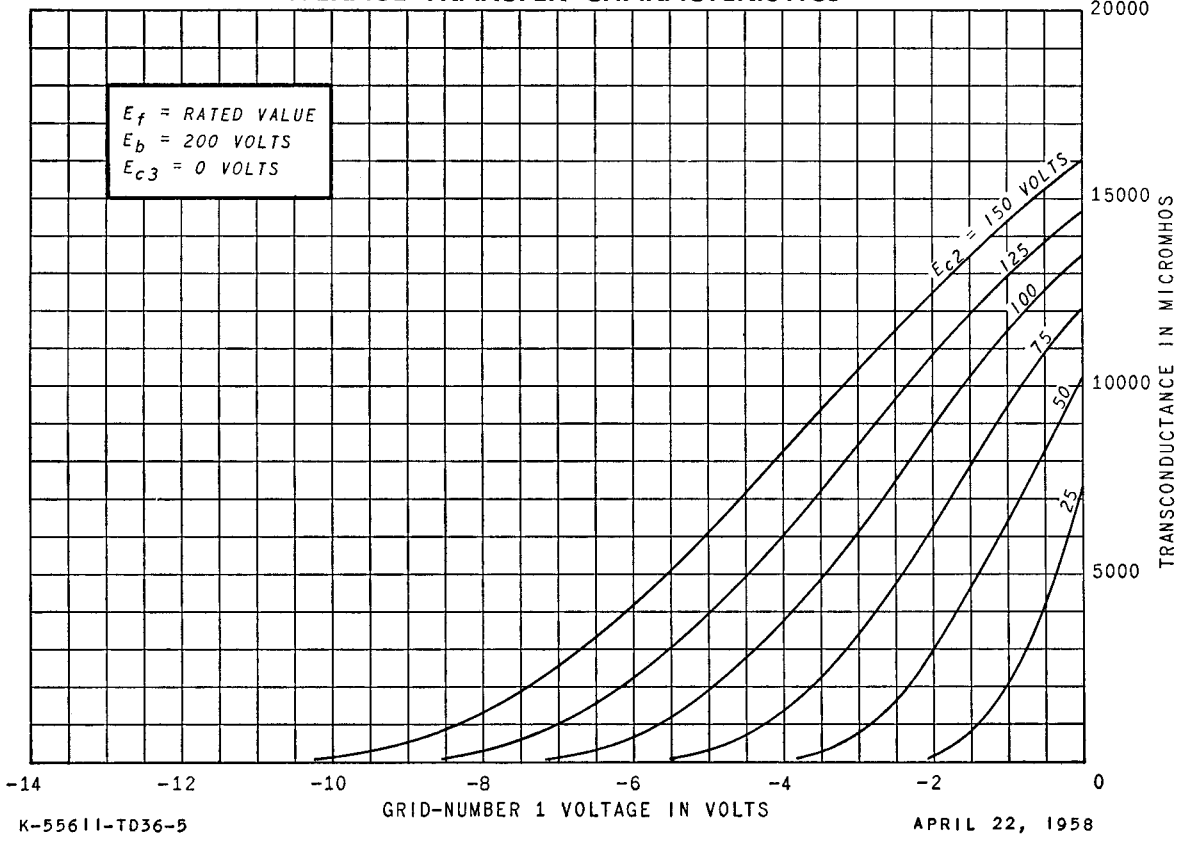
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD36-4

APRIL 22, 1958

AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD36-5

APRIL 22, 1958

Electronic TUBES

12DS7

DUPLEX-DIODE TETRODE

FOR DETECTOR AND AF DRIVER APPLICATIONS IN AUTOMOBILE RECEIVERS

DESCRIPTION AND RATINGS

The 12DS7 is a miniature duplex-diode, space-charge-grid tetrode intended for use as a combined detector, AVC rectifier, and transistor driver. The tube is specially designed to operate with its plate and space-charge-grid voltages supplied directly from a 12-volt storage battery.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	12.6*	Volts
Heater Current	0.4	Amperes
Direct Interelectrode Capacitances†		
Grid-Number 2 to Plate	12.5	μμf
Input	13	μμf
Output	2.0	μμf
Grid-Number 2 to Diode-Number 1 Plate, maximum	0.15	μμf
Grid-Number 2 to Diode-Number 2 Plate, maximum	0.15	μμf
Diode Plate to Diode Plate	0.1	μμf
Diode Plate to Cathode and Heater, Each Diode	0.5	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

Plate Voltage	16	Volts
Negative Control-Grid Voltage	16	Volts
Space-Charge-Grid Voltage	16‡	Volts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	16	Volts
Heater Negative with Respect to Cathode	16	Volts
Control-Grid Circuit Resistance	10	Megohms
Diode Current for Continuous Operation, Each Diode	5.0	Milliamperes

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

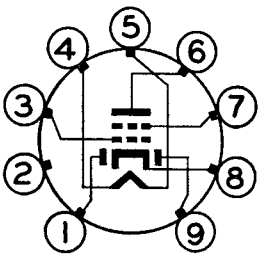
The tube manufacturer chooses these values to provide acceptable serviceability of the tube in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation (for an alternating-current power source, 117 volts plus or minus 10 percent is accepted USA practice), equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in tube characteristics.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply voltage.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM

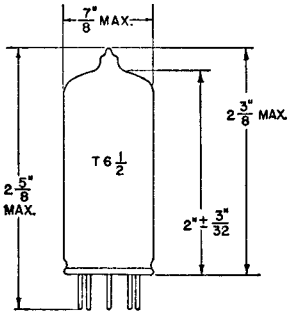


EIA 9JU

TERMINAL CONNECTIONS

Pin 1—Diode Number 2 Plate
Pin 2—No Connection
Pin 3—Tetrode Grid Number 1 (Space Charge Grid)
Pin 4—Heater
Pin 5—Heater
Pin 6—Tetrode Plate
Pin 7—Tetrode Grid Number 2 (Control Grid)
Pin 8—Cathode
Pin 9—Diode Number 1 Plate

PHYSICAL DIMENSIONS



EIA 6-3

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	12.6	Volts
Control-Grid Voltage	−0.5§	Volts
Space-Charge-Grid Voltage	12.6	Volts
Amplifications Factors¶	7.2	
Plate Resistance	480	Ohms
Transconductance¶	15000	Micromhos
Plate Current	40	Milliamperes
Space-Charge-Grid Current	75	Milliamperes
Average Diode Current, Each Diode with 10 Volts DC Applied	3.0	Milliamperes

CLASS A_1 AMPLIFIER

Plate Voltage	12.6	Volts
Control-Grid Voltage	−2.0#	Volts
Space-Charge-Grid Voltage	12.6	Volts
Peak AF Control-Grid Voltage	2.5	Volts
AF Signal Source Resistance	100000	Ohms
Maximum Signal Plate Current	8.0	Milliamperes
Space-Charge-Grid Current	75	Milliamperes
Load Resistance	800	Ohms
Total Harmonic Distortion, approximate	10	Percent
Maximum-Signal Power Output	40	Milliwatts

* When used in automobile service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectancy at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

† Without external shield.

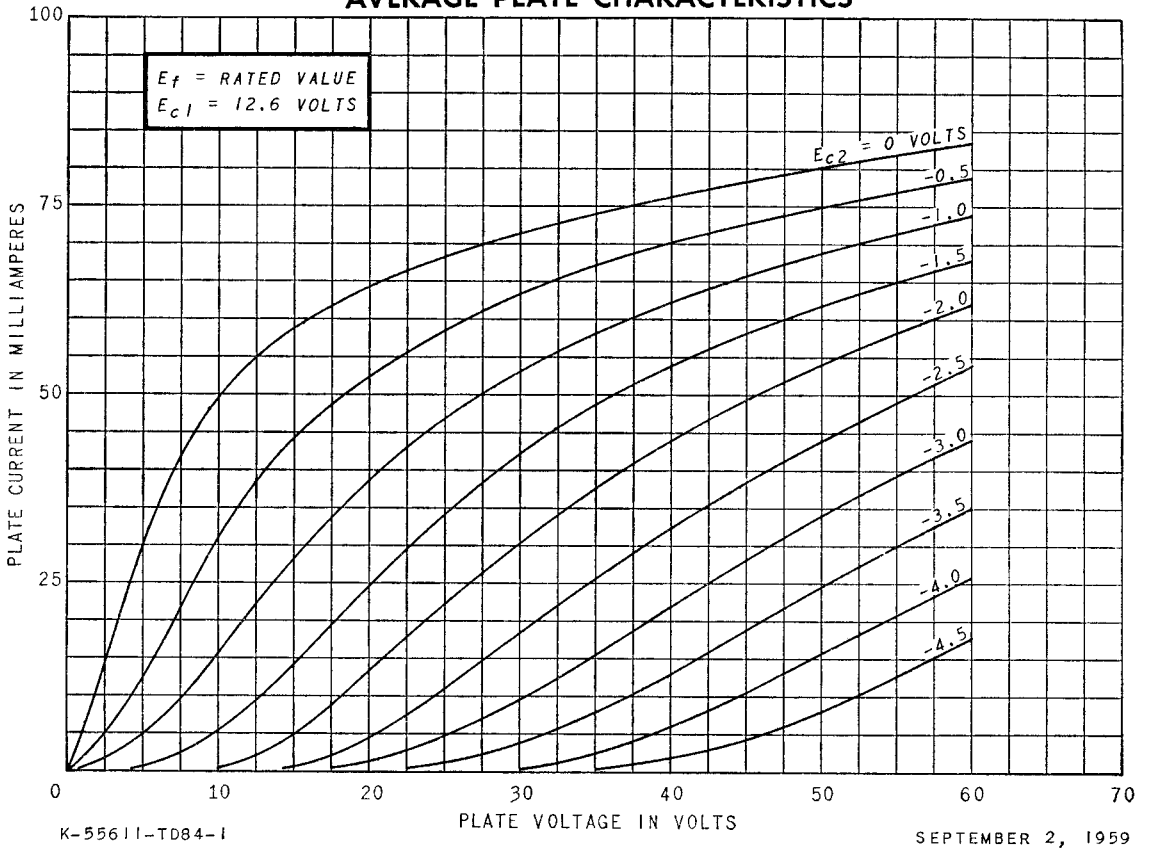
‡ Absolute Maximum Value.

§ Average bias developed across 2.2 megohm resistor.

¶ Control Grid to Plate.

Obtained by control-grid rectification (2.2-megohm grid resistor) in which case the zero-signal plate current is approximately 40 milliamperes.

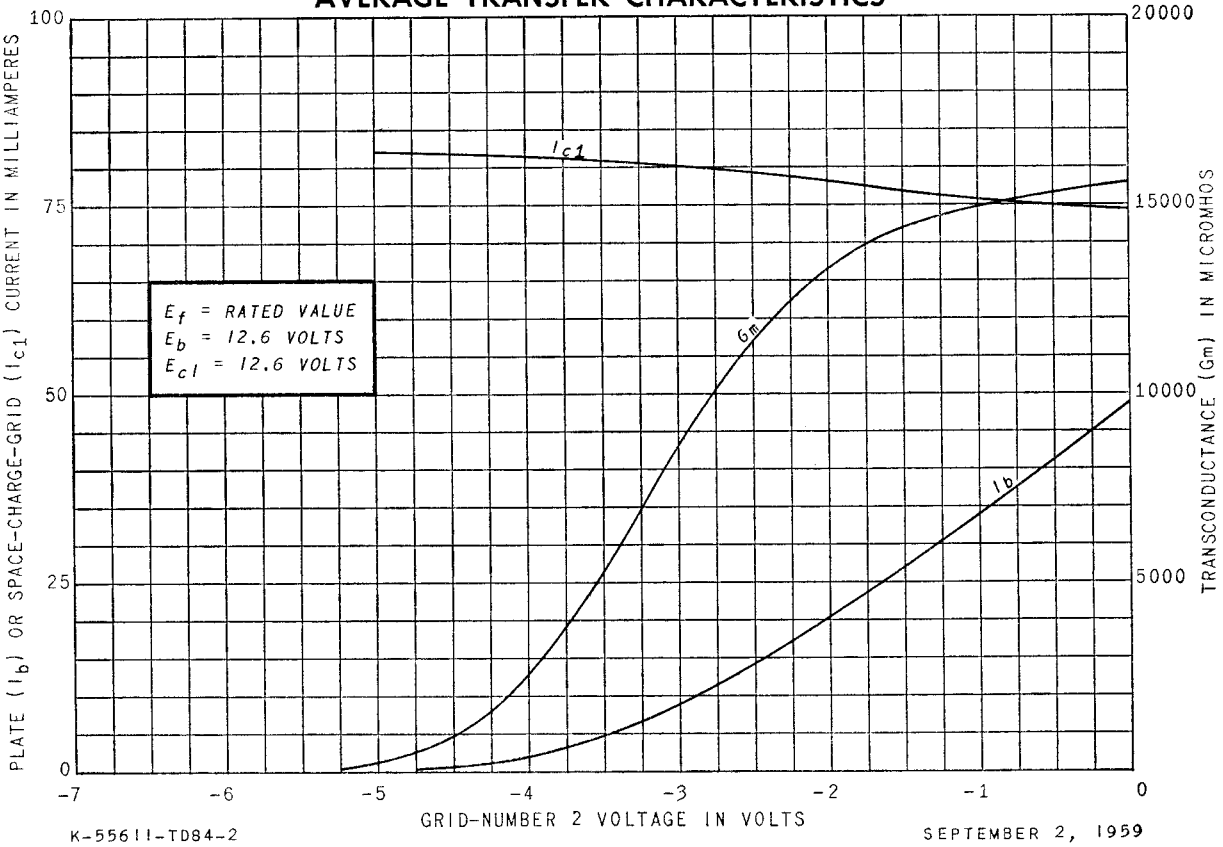
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD84-1

SEPTEMBER 2, 1959

AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD84-2

SEPTEMBER 2, 1959

Electronic TUBES

12DV8

DUPLEX-DIODE TETRODE

FOR DETECTOR AND AF DRIVER APPLICATIONS IN AUTOMOBILE RECEIVERS

DESCRIPTION AND RATING

The 12DV8 is a miniature duplex-diode, space-charge-grid tetrode intended for use as a combined detector, AVC rectifier, and transistor driver. The tetrode section of the tube is specially designed to operate with its plate and space-charge-grid voltages supplied directly from a 12-volt storage battery.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential	
Heater Voltage, AC or DC	12.6* Volts
Heater Current	0.375 Amperes
Direct Interelectrode Capacitances†	
Tetrode Grid-Number 2 to Plate	12 μμf
Tetrode Input	9.0 μμf
Tetrode Output	1.0 μμf
Tetrode Grid-Number 2 to Any Diode Plate, maximum	0.015 μμf
Diode-Number 1 Input	1.7 μμf
Diode-Number 2 Input	1.6 μμf
Diode-Number 1 Plate to Diode-Number 2 Plate, maximum	0.10 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

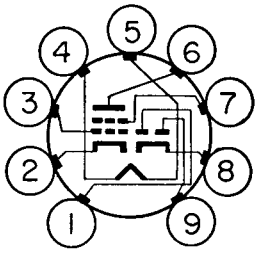
MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	16 Volts
Negative Control-Grid Voltage	16 Volts
Space-Charge-Grid Voltage	16 Volts
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	16 Volts
Heater Negative with Respect to Cathode	16 Volts
Control-Grid Circuit Resistance	10 Megohms
Diode Current for Continuous Operation, Each Diode	5.0 Milliamperes

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

BASING DIAGRAM

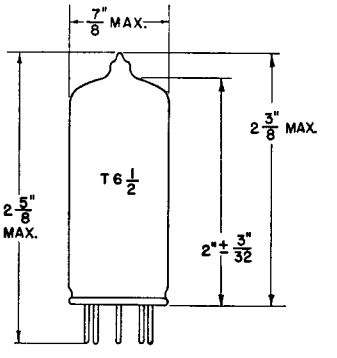


EIA 9HR

TERMINAL CONNECTIONS

Pin 1—Diode Number 2 Plate
Pin 2—Tetrode Cathode
Pin 3—Tetrode Grid Number 1 (Space-Charge Grid)
Pin 4—Heater
Pin 5—Heater
Pin 6—Tetrode Plate
Pin 7—Tetrode Grid Number 2 (Control Grid)
Pin 8—Diodes Cathode and Shield
Pin 9—Diode Number 1 Plate

PHYSICAL DIMENSIONS



EIA 6-3

GENERAL ELECTRIC

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	12.6	Volts
Cathode Resistor	18	Ohms
Control Grid Resistor	4.7	Megohms
Space-Charge-Grid Voltage	12.6	Volts
Amplification Factor§	7.6	
Plate Resistance, approximate	900	Ohms
Transconductance§	8500	Micromhos
Plate Current	9.0	Milliamperes
Space-Charge-Grid Current	53	Milliamperes
Average Diode Current, Each Diode With 10 Volts DC Applied	3.0	Milliamperes

CLASS A AMPLIFIER

Plate Voltage	12.6	Volts
Cathode Resistor	18	Ohms
Control-Grid Resistor	4.7	Megohms
Space-Charge-Grid Voltage	12.6	Volts
Peak AF Control-Grid Voltage	1.2	Volts
AF Signal Source Resistance	300,000	Ohms
Maximum Signal Plate Current	6.8	Milliamperes
Space-Charge-Grid Current	54	Milliamperes
Load Resistance	1250	Ohms
Total Harmonic Distortion, approximate	3	Percent
Power Output	5	Milliwatts

* When used in automotive service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectancy at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

† Without external shield.

§ Control Grid to Plate.

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

12DZ6

PENTODE

FOR RF AMPLIFIER APPLICATIONS IN AUTOMOBILE RECEIVERS

DESCRIPTION AND RATING

The 12DZ6 is a miniature pentode intended for use as a radio-frequency amplifier in automobile radio receivers. The tube is specially designed to operate with its plate and screen voltages supplied directly from a 12-volt storage battery.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	12.6* Volts
Heater Current	0.19 Amperes
Direct Interelectrode Capacitances†	
Grid-Number 1 to Plate, maximum	0.15 μμf
Input	9.5 μμf
Output	4.0 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	16 Volts
Screen Voltage	16 Volts
Positive DC Grid-Number 1 Voltage	0 Volts
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	16 Volts
Heater Negative with Respect to Cathode	16 Volts
Grid-Number 1 Circuit Resistance	10 Megohms
Grid-Number 3 Circuit Resistance	10 Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

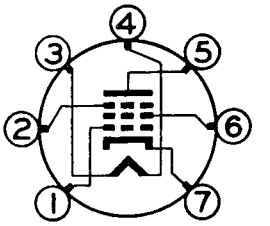
The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

Supersedes ET-T1459, dated 4-57

BASING DIAGRAM

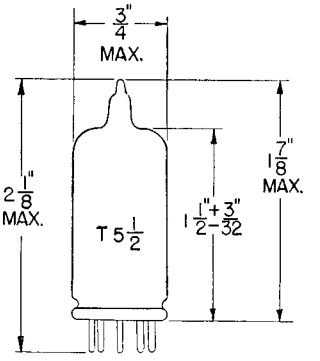


EIA 7BK

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Internal Shield and Grid Number 3 (Suppressor)
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Cathode

PHYSICAL DIMENSIONS



EIA 5-2

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	12.6	Volts
Grid-Number 3 (Suppressor) Supply Voltage	0	Volts
Grid-Number 3 Resistor (bypassed)	10	Megohms
Screen Voltage	12.6	Volts
Grid-Number 1 Supply Voltage	0	Volts
Grid-Number 1 Resistor (bypassed)	10	Megohms
Plate Resistance, approximate	25,000	Ohms
Transconductance	3800	Micromhos
Plate Current	4.5	Milliamperes
Screen Current	2.2	Milliamperes
Grid-Number 1 and 3 Supply Voltage, approximate Gm = 10 Micromhos‡	−10	Volts

* When used in automotive service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectancy at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

† Without external shield.

‡ Grid-Number 1 to Plate.

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

12EA6

PENTODE

FOR IF AMPLIFIER APPLICATIONS IN AUTOMOBILE RECEIVERS

DESCRIPTION AND RATING

The 12EA6 is a miniature pentode intended for use as an intermediate-frequency amplifier in automobile radio receivers. The tube is specially designed to operate with its plate and screen voltages supplied directly from a 12-volt storage battery.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	12.6* Volts
Heater Current	0.175 Amperes
Direct Interelectrode Capacitances†	
Grid-Number 1 to Plate, maximum	0.04 μμf
Input	11 μμf
Output	4.0 μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

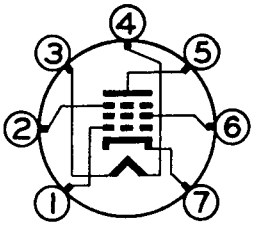
MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	16 Volts
Screen Voltage	16 Volts
Positive DC Grid-Number 1 Voltage	0 Volts
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	16 Volts
Heater Negative with Respect to Cathode	16 Volts
Grid-Number 1 Circuit Resistance	12 Megohms

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

BASING DIAGRAM

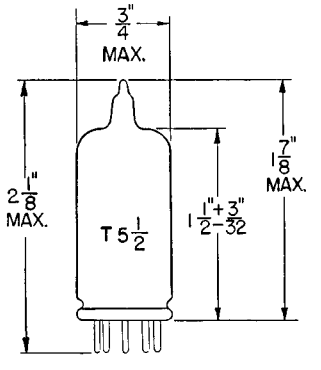


EIA 7BK

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Internal Shield and Grid Number 3 (Suppressor)
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Cathode

PHYSICAL DIMENSIONS



EIA 5-2

GENERAL ELECTRIC

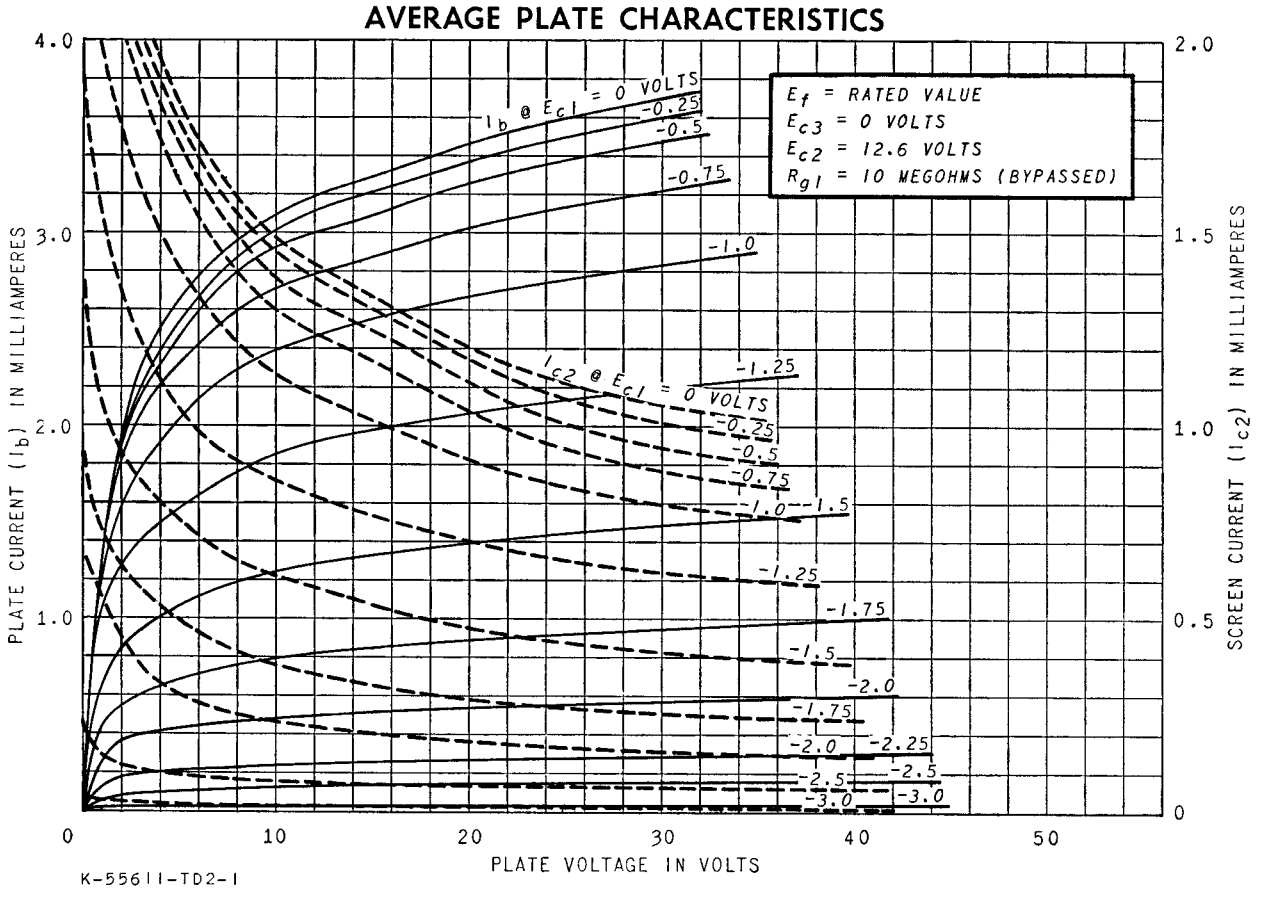
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

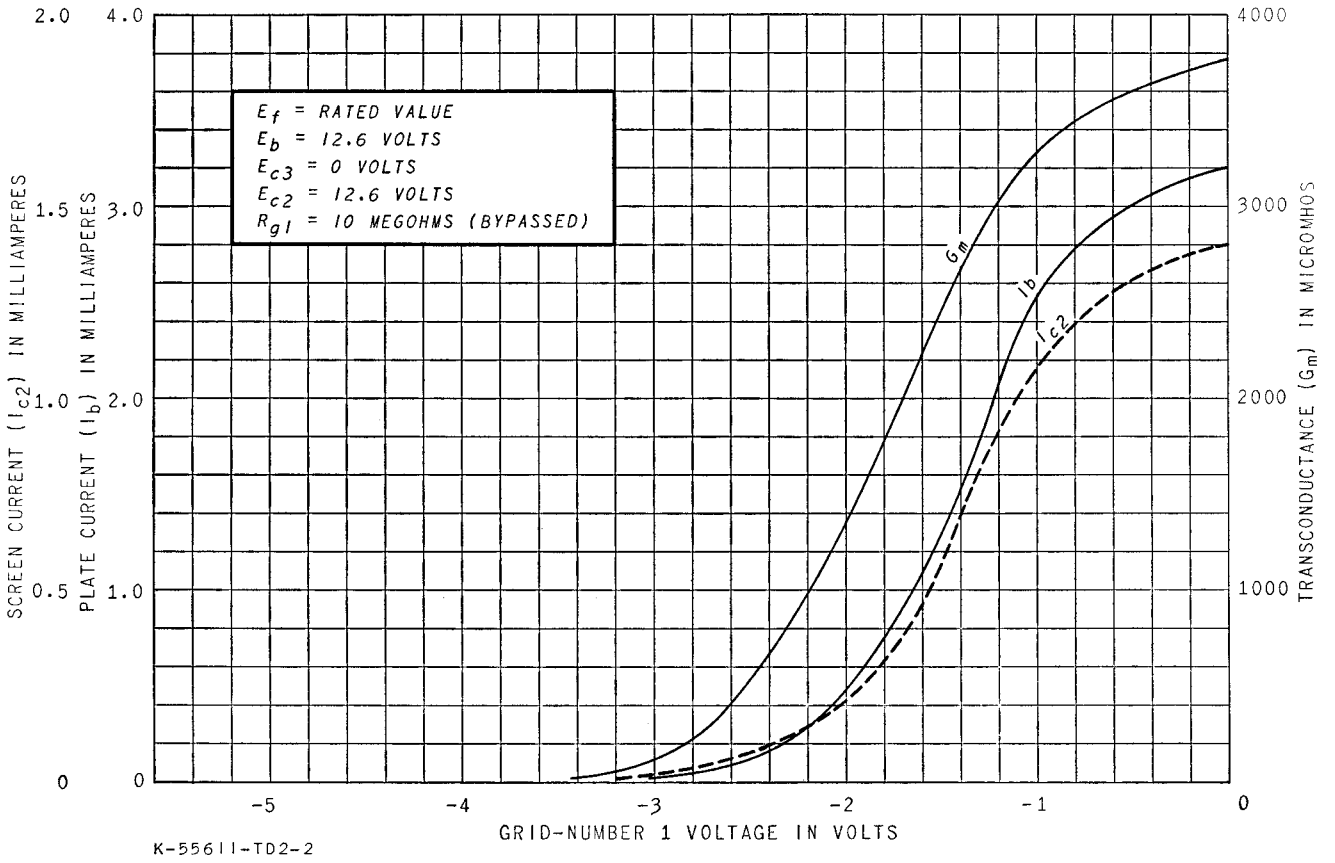
Plate Voltage	12.6	Volts
Suppressor Voltage	0	Volts
Screen Voltage	12.6	Volts
Grid-Number 1 Resistor (bypassed)	10	Megohms
Plate Resistance, approximate	32,000	Ohms
Transconductance	3800	Micromhos
Plate Current	3.2	Milliamperes
Screen Current	1.4	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	−3.4	Volts

* When used in automotive service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectancy at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

† Without external shield.



AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBES

12EG6

HEPTODE

DESCRIPTION AND RATING

The 12EG6 is a miniature heptode for radio-frequency amplifier service in automobile radio receivers. The tube is specially designed to operate with plate and screen voltages supplied directly from a 12-volt storage battery.

GENERAL

ELECTRICAL

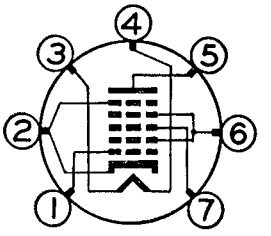
Cathode—Coated Unipotential

Heater Voltage, AC or DC	12.6*	Volts
Heater Current	0.15	Amperes
Direct Interelectrode Capacitances†		
Grid-Number 1 to Plate: (g1 to p), maximum	0.04	μμf
Grid-Number 3 to Plate: (g3 to p), maximum	0.25	μμf
Grid-Number 1 Input: g1 to (h+k+g2−4+g3+g5)	5.7	μμf
Grid-Number 3 Input: g3 to (h+k+g1+g2−4+g5+p)	6.5	μμf
Output: p to (h+k+g1+g2−4+g3+g5)	12	μμf
Grid-Number 1 to Cathode: g1 to (k+g5)	3.2	μμf
Grid-Number 3 to Grid-Number 1: (g3 to g1), maximum	0.15	μμf
Cathode to All Except Grid-Number 1: k+g5 to (h+g2−4+g3+p)	23	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

BASING DIAGRAM

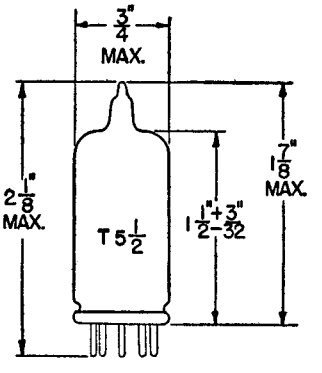


EIA 7CH

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode and Grid Number 5
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Numbers 2 and 4 (Screen)
Pin 7—Grid Number 3

PHYSICAL DIMENSIONS



EIA 5-2

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MAXIMUM RATING

DESIGN-CENTER VALUES

Plate Voltage	30	Volts
Screen Voltage	30	Volts
Positive DC Grid-Number 3 Voltage	0	Volts
Negative DC Grid-Number 3 Voltage	30	Volts
DC Cathode Current	20	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	30	Volts
Heater Negative with Respect to Cathode	30	Volts
Grid-Number 3 Circuit Resistance	10	Megohms

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all tubes.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply-voltage.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	12.6	Volts
Screen Voltage	12.6	Volts
Grid-Number 1 Voltage	0.8‡	Volts
Grid-Number 3 Voltage	0.8**	Volts
Plate Resistance, approximate	0.15	Megohm
Transconductance§	800	Micromhos
Plate Current	0.4	Milliampere
Screen Current	2.4	Milliamperes
Grid-Number 3 Voltage, approximate Gm§=10 Micromhos	−3**	Volts
Grid-Number 1 Voltage, approximate Gm§=10 Micromhos	−3	Volts

* When used in automobile service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectancy at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

† External shield (EIA 316) connected to pin 2.

‡ Average bias developed across 2.2 megohm grid-number 1 resistor.

**Provided by grid-number 1 voltage through a suitable grid-number 3 resistor.

§ From grid-number 3 to plate

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

12EK6

PENTODE

FOR RF AND IF AMPLIFIER APPLICATIONS IN AUTOMOBILE RECEIVERS

DESCRIPTION AND RATING

The 12EK6 is a miniature pentode intended for use as a radio-frequency or intermediate-frequency amplifier in automobile radio receivers. The tube is specially designed to operate with its plate and screen voltages supplied directly from a 12-volt storage battery.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	12.6*	Volts
Heater Current	0.19	Amperes
Direct Interelectrode Capacitances†		
Grid-Number 1 to Plate, maximum	0.032	μμf
Input	10	μμf
Output	5.5	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	16	Volts
Screen Voltage	16	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	16	Volts
Heater Negative with Respect to Cathode	16	Volts
Grid-Number 1 Circuit Resistance	10	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

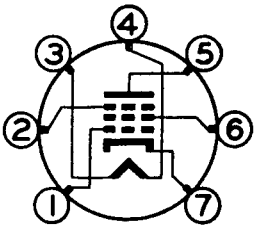
The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

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GENERAL ELECTRIC

BASING DIAGRAM

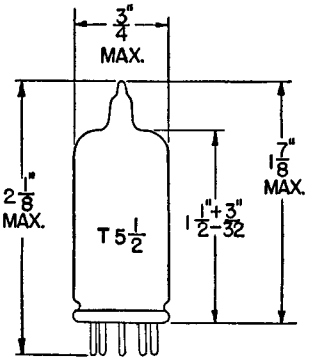


EIA 7BK

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Grid Number 3 (Suppressor)
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Cathode

PHYSICAL DIMENSIONS



EIA 5-2

CHARACTERISTICS AND TYPICAL OPERATION

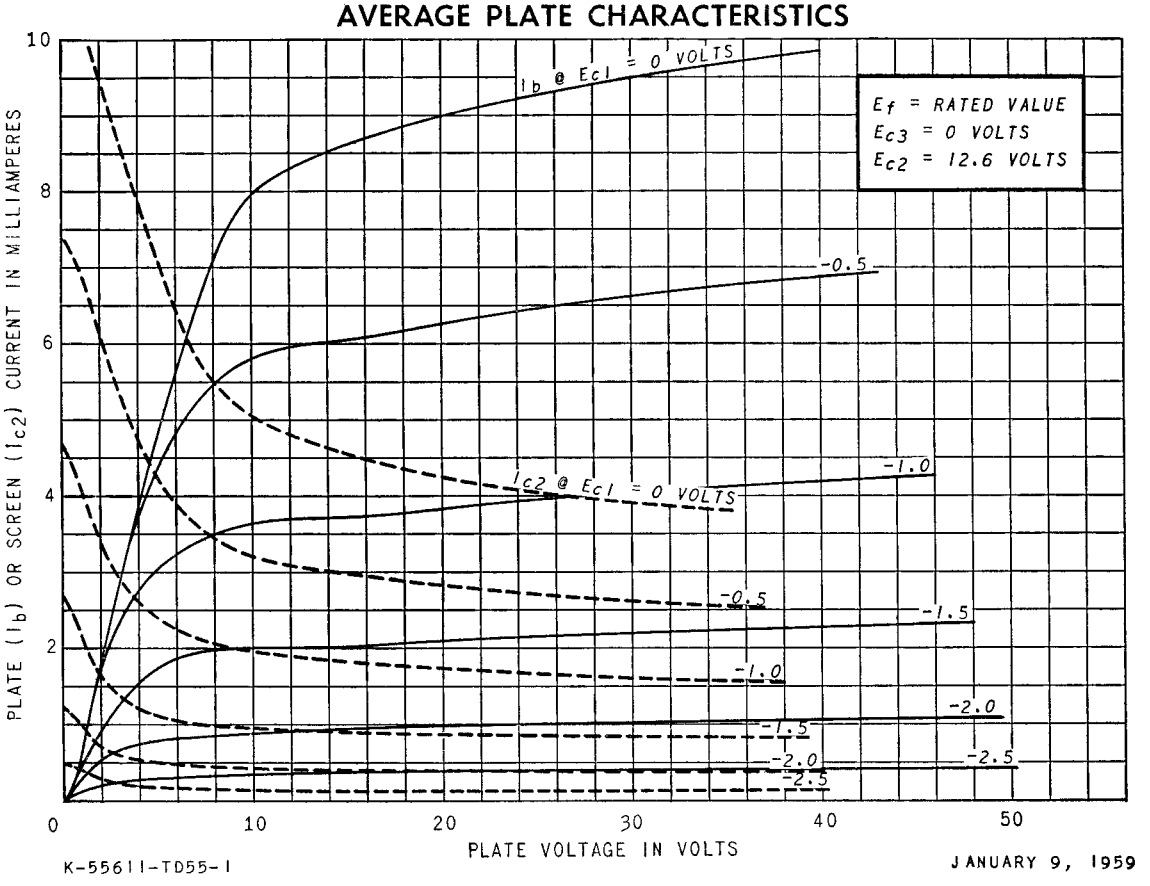
AVERAGE CHARACTERISTICS

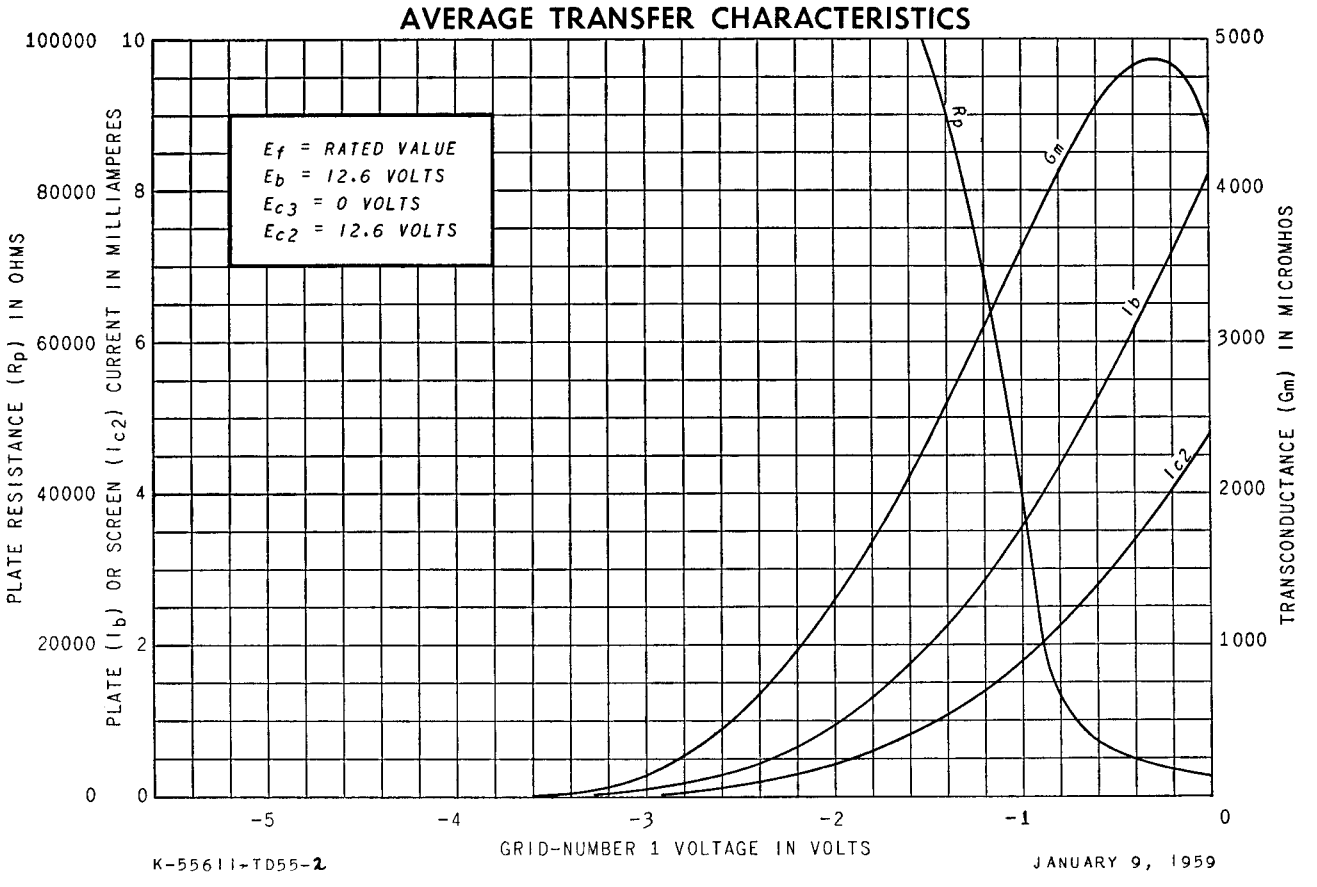
Plate Voltage	12.6	Volts
Suppressor Voltage	0	Volts
Screen Voltage	12.6	Volts
Grid-Number 1 Voltage	‡	Volts
Grid-Number 1 Resistor	2.2	Megohms
Plate Resistance, approximate	40000	Ohms
Transconductance	4200	Micromhos
Plate Current	4.4	Milliamperes
Screen Current	2.0	Milliamperes
Grid-Number 1 Voltage, approximate		
I_b = 10 Microamperes	−4	Volts

* When used in automobile service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectancy at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

† Without external shield.

‡ Average contact potential developed across 2.2-megohm grid resistor.




AVERAGE TRANSFER CHARACTERISTICS
E_f = RATED VALUE
E_b = 12.6 VOLTS
E_{c3} = 0 VOLTS
E_{c2} = 12.6 VOLTS
Rp
Gm
Ib
Ic2
PLATE RESISTANCE (Rp) IN OHMS
PLATE (I_b) OR SCREEN (I_{c2}) CURRENT IN MILLIAMPERES
TRANSCONDUCTANCE (Gm) IN MICROMHOS
100000
80000
60000
40000
20000
0
10
8
6
4
2
0
5000
4000
3000
2000
1000
0
-5
-4
-3
-2
-1
0
GRID-NUMBER 1 VOLTAGE IN VOLTS
K-5561I-TD55-2
JANUARY 9, 1959

Electronic TUBES

12FM6

DUPLEX-DIODE TRIODE

FOR DETECTOR AND AF-DRIVER APPLICATIONS IN AUTOMOBILE RECEIVERS

DESCRIPTION AND RATING

The 12FM6 is a miniature, duplex-diode triode for use as a combined detector, AVC rectifier, and transistor driver. The tube is specially designed to operate with its plate voltage supplied directly from a 12-volt storage battery.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	12.6*	Volts
Heater Current	0.15	Amperes
Direct Interelectrode Capacitances†		
Triode Grid to Plate	1.7	μμf
Triode Input	2.7	μμf
Triode Output	1.7	μμf
Diode Plate to Diode Plate	1.1	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	30	Volts
DC Cathode Current	20	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	30	Volts
Heater Negative with Respect to Cathode	30	Volts
Grid Circuit Resistance	10	Megohms
Diode Current for Continuous Operation, Each Diode	1.0	Milliamperes

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

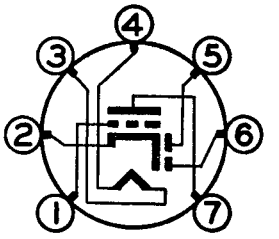
These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all tubes.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply-voltage.

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GENERAL ELECTRIC

BASING DIAGRAM

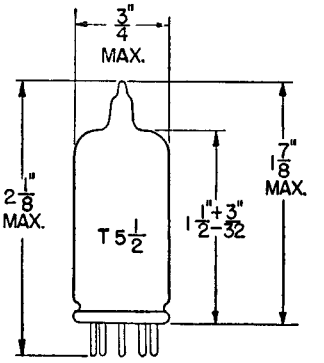


EIA 7BT

TERMINAL CONNECTIONS

Pin 1—Triode Grid
Pin 2—Cathode
Pin 3—Heater
Pin 4—Heater
Pin 5—Diode Number 2 Plate
Pin 6—Diode Number 1 Plate
Pin 7—Triode Plate

PHYSICAL DIMENSIONS



EIA 5-2

CHARACTERISTICS AND TYPICAL OPERATION

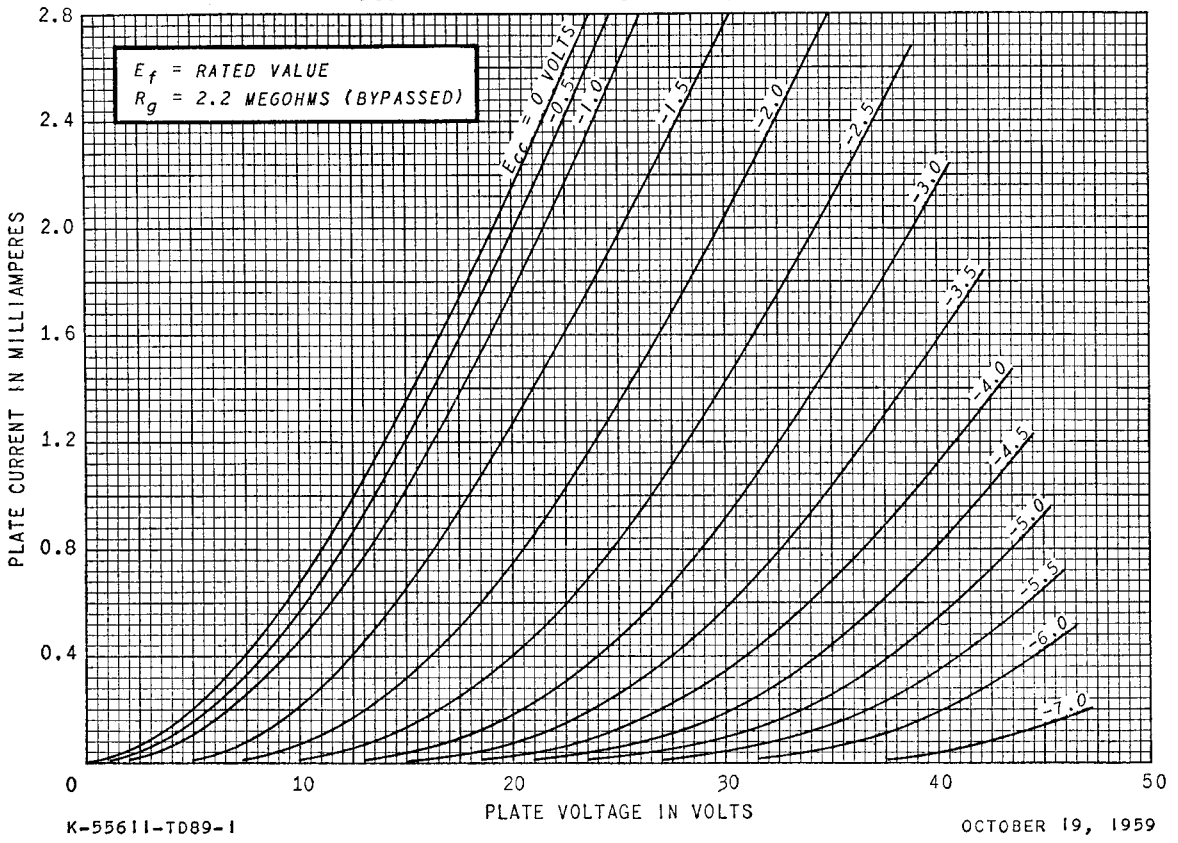
AVERAGE CHARACTERISTICS

Plate Voltage	12.6	12.6	Volts
Grid Resistor	0	2.2	Megohms
Grid Voltage	0	....	Volts
Amplification Factor	13.5	10	
Plate Resistance, approximate	5600	7700	Ohms
Transconductance	2400	1300	Micromhos
Plate Current	1.8	1.0	Milliamperes
Average Diode Current, Each Diode With 10 Volts DC Applied		2.0	Milliamperes

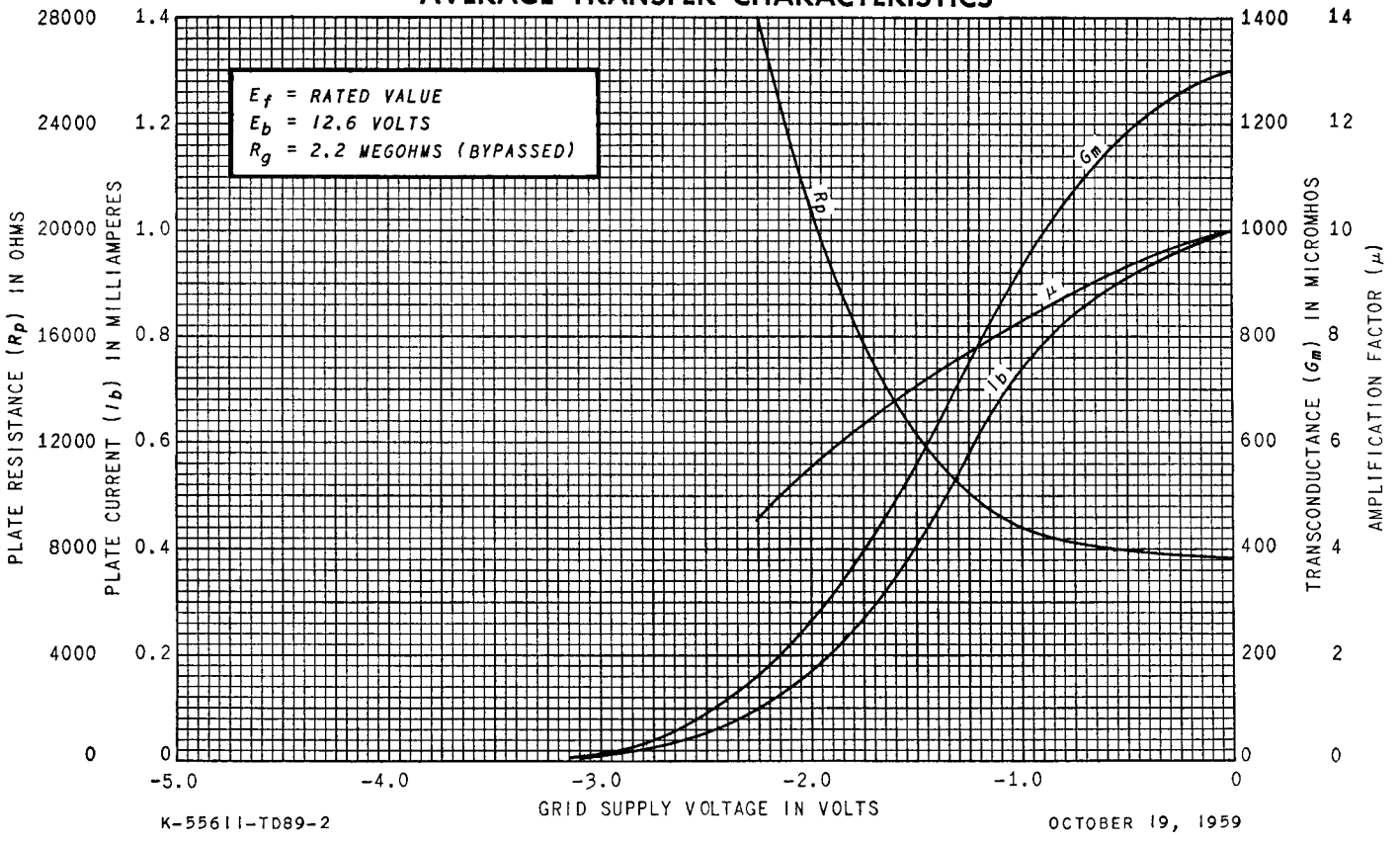
* When used in automobile service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectancy at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

† Without external shield.

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD89-2

OCTOBER 19, 1959

Electronic TUBES

12FQ8

TWIN DOUBLE-PLATE TRIODE

DESCRIPTION AND RATING

The 12FQ8 is a miniature twin double-plate triode with each section having a grid and two plates brought out to separate base pins.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	12.6	Volts
Heater Current	0.15	Amperes
Direct Interelectrode Capacitances*		
Input, Each Section	1.7	μμf
Output		
Plate A (Section 1)	0.34	μμf
Plate B (Section 1)	0.24	μμf
Plate A (Section 2)	0.30	μμf
Plate B (Section 2)	0.18	μμf
Grid to Plate		
Section 1—Grid to Plate A	0.9	μμf
Grid to Plate B	0.9	μμf
Section 2—Grid to Plate A	0.9	μμf
Grid to Plate B	0.9	μμf
Plate to Plate, Each Section	1.2	μμf
Plate A (Section 1) to Plate A (Section 2)	0.4	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION

Allowable Heater Voltage	11.3 to 13.9	Volts
Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation, Each Plate	0.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

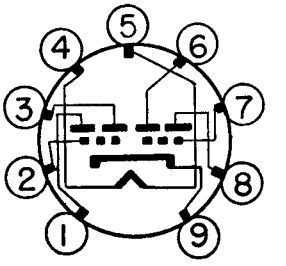
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GENERAL ELECTRIC

Supersedes ET-T1528, dated 5-59

BASING DIAGRAM

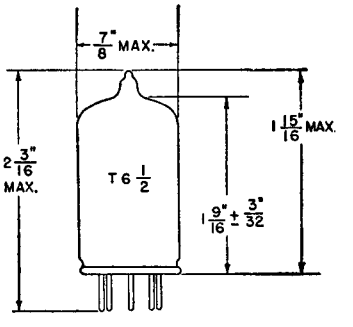


EIA 9KT

TERMINAL CONNECTIONS

Pin 1—Plate B (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Plate A (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate B (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Plate A (Section 1)
Pin 9—Cathode

PHYSICAL DIMENSIONS



EIA 6-2

CHARACTERISTICS AND TYPICAL OPERATION

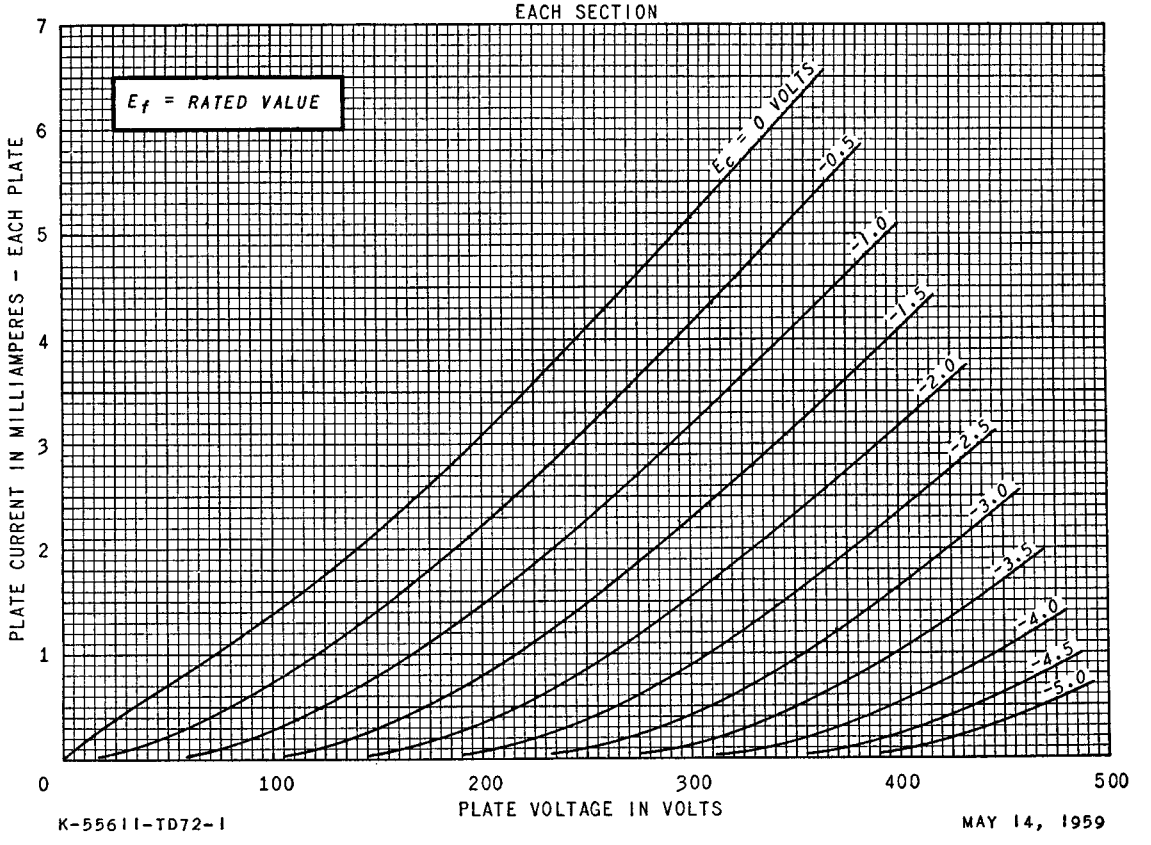
AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage	250	Volts
Grid Voltage	−1.5	Volts
Amplification Factor, Grid to Each Plate†	95	
Plate Resistance, approximate, Each Plate†	76000	Ohms
Transconductance, Grid to Each Plate†	1250	Micromhos
Plate Current, Each Plate†	1.5	Milliamperes

* Without external shield.

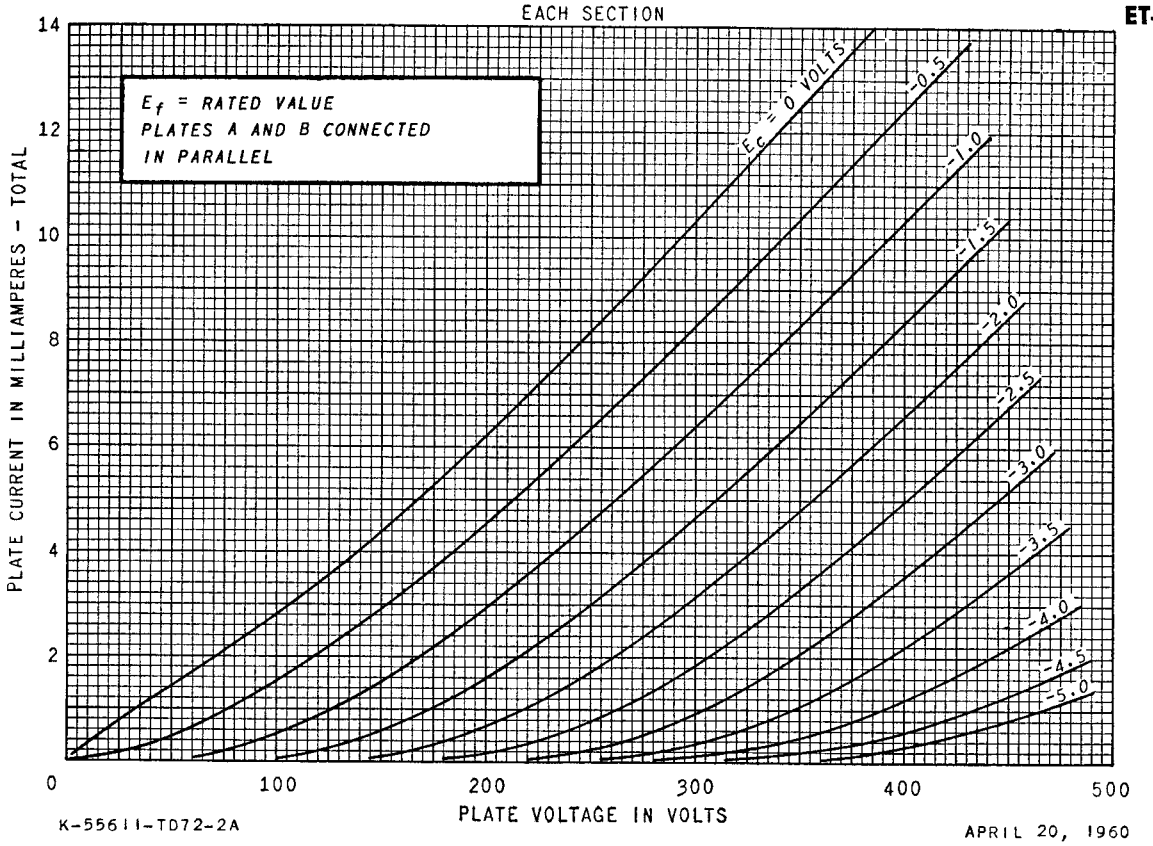
† Other plate of same section grounded.

AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

EACH SECTION

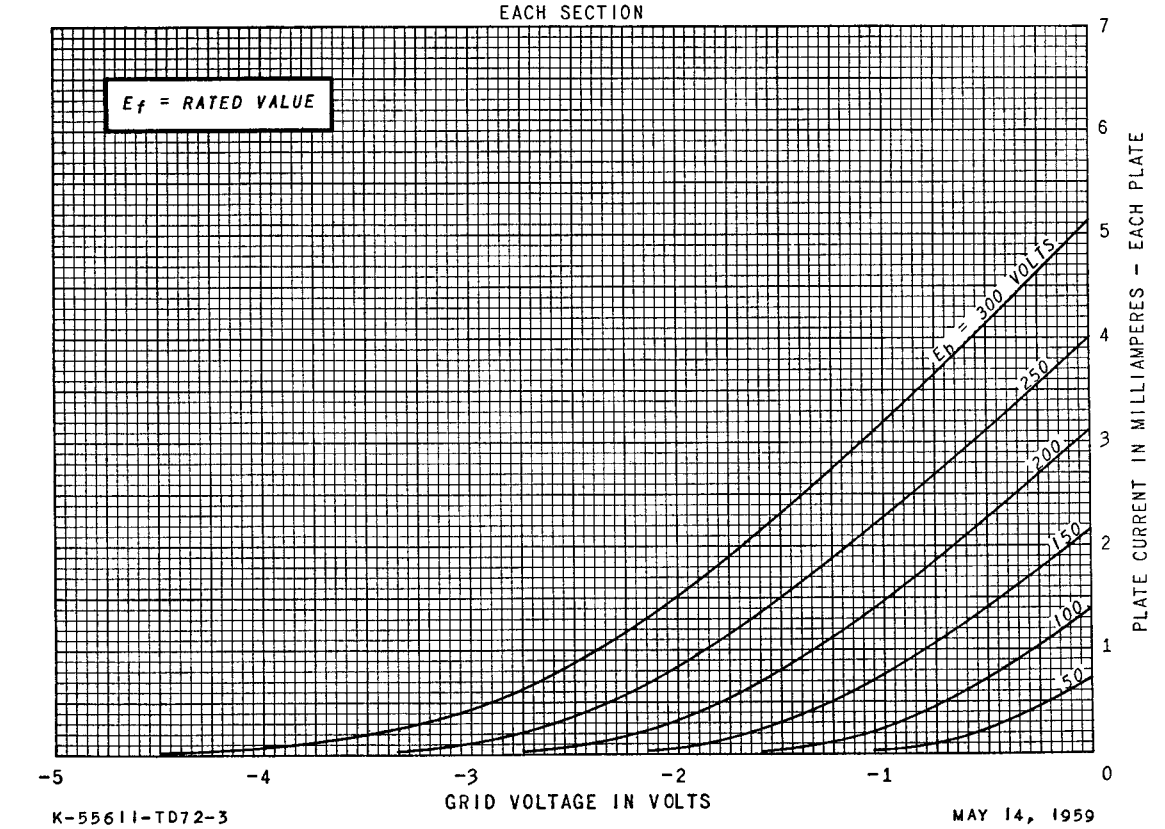


K-55611-TD72-2A

APRIL 20, 1960

AVERAGE TRANSFER CHARACTERISTICS

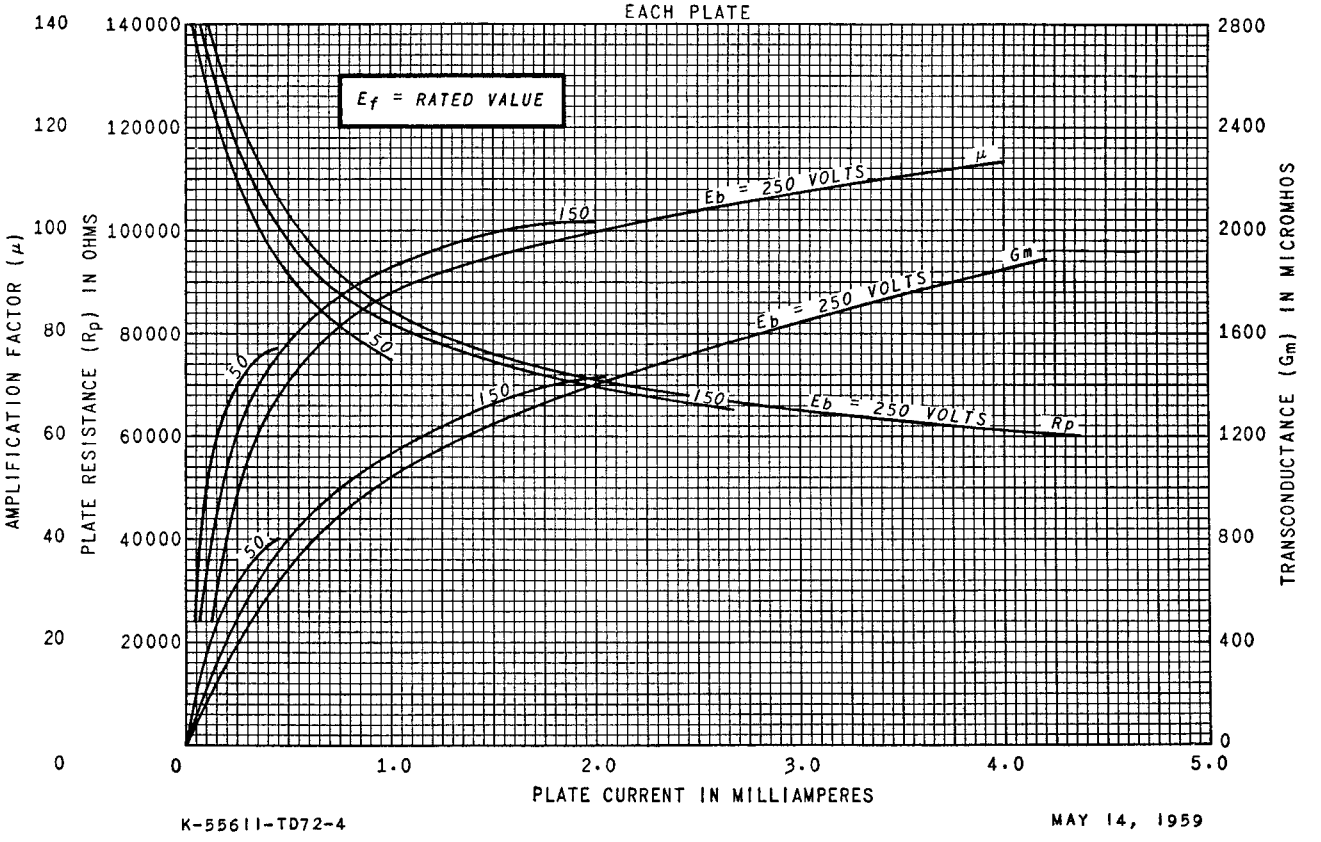
EACH SECTION



K-55611-TD72-3

MAY 14, 1959

AVERAGE CHARACTERISTICS



K-55611-TD72-4

MAY 14, 1959

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

12FR8

DIODE—TRIODE—PENTODE

DESCRIPTION AND RATING

The 12FR8 is a miniature diode-triode-pentode intended for use as a combined intermediate-frequency amplifier, detector, and audio-frequency amplifier in automobile receivers. The tube is specially designed to operate with its plate and screen voltages supplied directly from a 12-volt storage battery.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	12.6*	Volts
Heater Current	0.32	
Direct Interelectrode Capacitances†		
Pentode Section		
Grid-Number 1 to Plate: (Pg1 to Pp), maximum	0.015	μμf
Input: Pg1 to (h+Pk+Pg2+Pg3+i.s.)	8.5	μμf
Output: Pp to (h+Pk+Pg2+Pg3+i.s.)	5.5	μμf
Triode Section		
Grid to Plate: (Tg to Tp)	1.7	μμf
Input: Tg to (Tk+h+Pk+Pg3+i.s.)	2.6	μμf
Output: Tp to (Tk+h+Pk+Pg3+i.s.)	2.0	μμf
Pentode Grid-Number 1 to Triode: (Pg1 to Tg), maximum	0.012	μμf
Pentode Grid-Number 1 to Diode Plate: (Pg1 to Dp), maximum	0.004	μμf
Triode Grid to Diode Plate: (Tg to Dp), maximum	0.17	μμf
Triode Plate to Diode Plate: (Tp to Dp)	0.8	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES	Pentode Section	Triode Section	
Plate Voltage	16	16	Volts
Screen Voltage	16	—	Volts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode	16	16	Volts
Heater Negative with Respect to Cathode	16	16	Volts
Grid-Number 1 Circuit Resistance	10	10	Megohms
Diode Current for Continuous Operation	5.0		Milliamperes

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

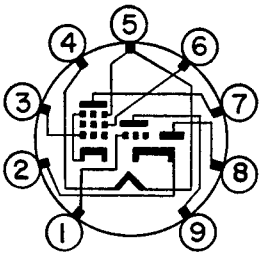
These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all tubes.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply-voltage.

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GENERAL ELECTRIC

BASING DIAGRAM

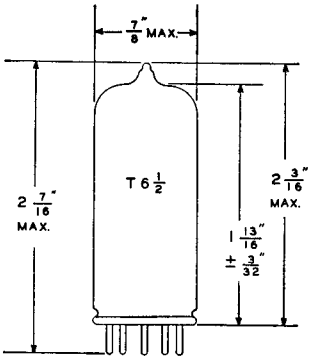


EIA 9KU

TERMINAL CONNECTIONS

Pin 1—Triode Grid
Pin 2—Triode and Diode Cathode
Pin 3—Pentode Grid Number 1
Pin 4—Heater
Pin 5—Heater, Pentode Cathode, Pentode Grid Number 3, and Internal Shield
Pin 6—Pentode Grid Number 2 (Screen)
Pin 7—Pentode Plate
Pin 8—Diode Plate
Pin 9—Triode Plate

PHYSICAL DIMENSIONS



EIA 6-10

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS	Pentode Section	Triode Section	
Plate Voltage	12.6	12.6	Volts
Screen Voltage	12.6	——	Volts
Grid-Number 1 Voltage	0.8 #	0.6 #	Volts
Amplification Factor	——	10	
Plate Resistance, approximate	400000	——	Ohms
Transconductance	2700	1200	Micromhos
Plate Current	1.9	1.0	Milliamperes
Screen Current	0.7	——	Milliamperes
Grid-Number 1 Voltage, approximate Gm = 30 Micromhos	−2.8	——	Volts
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	——	−3.5	Volts
Average Diode Current with 10 Volts, DC applied	2.0		Milliamperes

* When used in automobile service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectancy at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

† Without external shield.

Average contact potential developed across 2.2-megohm grid resistor.

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

12FX8-A

TRIODE—HEPTODE

DESCRIPTION AND RATING

The 12FX8-A is a miniature triode-heptode designed for use in automobile radio receiver service where plate and screen voltages are supplied directly from a 12-volt storage battery. The triode section is intended for RF amplifier use and the heptode section for frequency-converter use.

The 12FX8-A is unilaterally interchangeable with the 12FX8 and differs only in having an additional control on the conversion-conductance cutoff characteristic of the heptode section.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	12.6†	Volts
Heater Current	0.27	Amperes
Direct Interelectrode Capacitances‡		
Heptode		
Grid-Number 3 to Plate: (Hg3 to Hp), maximum	0.28	μμf
Grid-Number 3 to Grid-Number 1: (Hg3 to Hg1), max.	0.12	μμf
RF Input: Hg3 to (h+Tk+Hk+Hg1+Hg2, 4+Hg5+Hp+i.s.)	6.0	μμf
Oscillator Input: Hg1 to (h+Tk+Hk+Hg2, 4+Hg3+Hg5+Hp+i.s.)	5.0	μμf
Mixer Output: Hp to (h+Tk+Hk+Hg1+Hg2, 4+Hg3+Hg5+i.s.)	5.0	μμf
Grid-Number 1 to Cathode: Hg1 to (Hk+Hg5+i.s.)	3.0	μμf
Oscillator Output: Hk to (h+Tk+Hg2, 4+Hg3+Hp)	17	μμf
Grid-Number 1 to Plate: (Hg1 to Hp), maximum	0.16	μμf
Triode		
Grid to Plate: (Tg to Tp)	1.3	μμf
Input: Tg to (Tk+h)	2.2	μμf
Output: Tp to (Tk +h)	0.25	μμf
Triode Grid to Heptode Grid-Number 3: (Tg to Hg3), max.	0.01	μμf
Triode Plate to Heptode Grid-Number 3: (Tp to Hg3), max.	0.18	μμf
Triode Plate to Heptode Plate: (Tp to Hp), max.	0.20	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

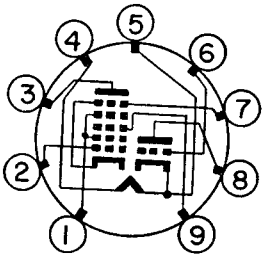
Heptode Plate Voltage	16	Volts
Heptode Screen-Supply Voltage	16	Volts
Heptode Screen Voltage	16	Volts
Heptode Positive DC Grid-Number 3 Voltage	0	Volts
Heptode Negative DC Grid-Number 3 Voltage	16	Volts
Triode Plate Voltage	16	Volts

(Continued on Page 2)

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM

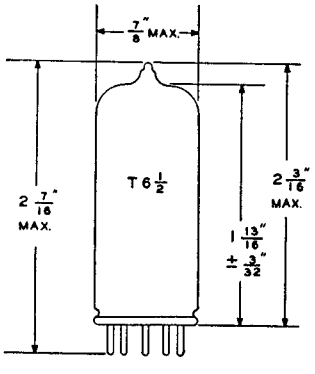


EIA 9KV

TERMINAL CONNECTIONS

Pin 1—Heptode Grid Numbers 2 and 4 (Screen)
Pin 2—Heptode Grid Number 1 (Oscillator Grid)
Pin 3—Heptode Plate
Pin 4—Heater
Pin 5—Heater and Triode Cathode
Pin 6—Triode Grid
Pin 7—Heptode Cathode, Grid Number 5, and Internal Shield
Pin 8—Triode Plate
Pin 9—Heptode Grid Number 3 (Signal Grid)

PHYSICAL DIMENSIONS



EIA 6-10

MAXIMUM RATINGS (Cont'd)

Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	16	Volts
Heater Negative with Respect to Cathode	16	Volts
Heptode Grid-Number 3 Circuit Resistance	10	Megohms
Triode Grid-Circuit Resistance	10	Megohms

Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube in average applications, taking responsibility for equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all tubes.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply-voltage.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Heptode§	Triode	
Plate Voltage	12.6	12.6	Volts
Screen Voltage	12.6	—	Volts
Grid-Number 3 Voltage	0.5¶	—	Volts
Grid-Number 3 Resistance	2.2	—	Megohms
Grid-Number 1 Voltage, RMS	1.6	—	Volts
Grid-Number 1 Resistance	0.033	2.2	Megohms
Grid Voltage	—	0.8#	Volts
Plate Resistance, approximate	0.5	—	Megohms
Conversion Transconductance	300	—	Micromhos
Transconductance	—	1400	Micromhos
Amplification Factor	—	10	
Plate Current	0.29	1.3	Milliamperes
Screen Current	1.25	—	Milliamperes
Grid-Number 3 Voltage, approximate			
Gc = 10 Micromhos	−3.0	—	Volts
Gc = 1.0 Micromho	−8.0	—	Volts
Grid Voltage, approximate			
Ib = 10 Microamperes	—	−3.2	Volts

HEPTODE OSCILLATOR CHARACTERISTICS (Not Oscillating)

Plate Voltage	12.6	Volts
Screen, Connected to Plate		
Grid-Number 3 Voltage	0	Volts
Grid-Number 1 Voltage	0	Volts
Amplification Factor§§	9	
Transconductance§§	3600	Micromhos
Cathode Current	4.4	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 10 Microamperes	−4.5	Volts

† When used in automobile service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectance at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

‡ Without external shield.

§ Self-excited converter service.

¶ Voltage developed across 2.2 megohm grid-number 3 resistor.

Voltage developed across 2.2 megohm grid resistor.

§§ Between grid-number 1 and grids number 2 and 4 connected to plate.

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

12G11

DISSIMILAR DOUBLE PENTODE

The 12G11 is a compactron containing a sharp-cutoff, dual-control pentode (Section 2) and a power pentode (Section 1). The dual-control pentode is intended for use as an FM detector and the power pentode as an audio-frequency output amplifier in television receivers.

Except for heater characteristics, the 12G11 is identical to the 6G11.

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	12.6	Volts
Heater Current+	0.6±0.04	Amperes
Heater Warm-up Time‡	11	Seconds

* Heater voltage for a bogey tube at If = 0.6 amperes.

\+ For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

‡ The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

5/23/62 (E)

frokm JEDEC release #3531B, June 11, 1962

ETR-2186

Electronic TUBES

12GA6

HEPTODE

FOR PENTAGRID CONVERTER APPLICATIONS IN AUTOMOBILE RECEIVERS

DESCRIPTION AND RATING

The 12GA6 is a miniature heptode primarily intended to perform the combined functions of mixer and oscillator in automobile radio receivers. The tube is specially designed to operate with plate and screen voltages supplied directly from a 12-volt storage battery.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	12.6*	Volts
Heater Current	0.15	Amperes

Direct Interelectrode Capacitances	With Shield†	Without Shield	
Grid-Number 3 to All	8.0	8.0	μμf
Plate to All	13	8.0	μμf
Grid-Number 1 to All	5.0	5.0	μμf
Cathode to All Except Grid-Number 1	20	15	μμf
Grid-Number 3 to Plate, maximum	0.25	0.3	μμf
Grid-Number 1 to Grid-Number 3, maximum	0.15	0.15	μμf
Grid-Number 1 to Plate, maximum	0.05	0.1	μμf
Grid-Number 1 to Cathode	2.5	2.5	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	16	Volts
Screen Voltage	16	Volts
Positive DC Grid-Number 3 Voltage	0	Volts
Negative DC Grid-Number 3 Voltage	16	Volts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	16	Volts
Heater Negative with Respect to Cathode	16	Volts
Grid-Number 3 Circuit Resistance	10	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

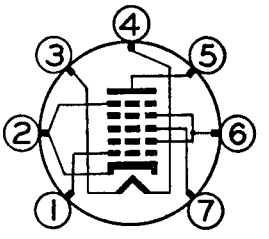
These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM

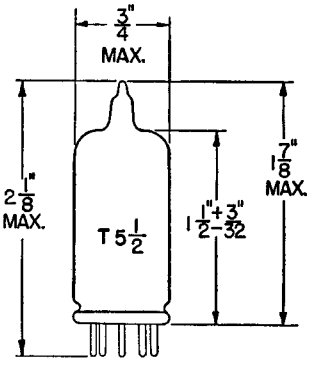


EIA 7CH

TERMINAL CONNECTIONS

Pin 1—Grid Number 1 (Oscillator Grid)
Pin 2—Cathode and Grid Number 5
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Numbers 2 and 4 (Screen)
Pin 7—Grid Number 3 (Signal Grid)

PHYSICAL DIMENSIONS



EIA 5-2

CHARACTERISTICS AND TYPICAL OPERATION

CONVERTER SERVICE

Plate Voltage	12.6	Volts
Screen Voltage	12.6	Volts
Grid-Number 3 Supply Voltage	0	Volts
Grid-Number 3 Resistor (Bypassed)	2.2	Megohms
Grid-Number 1 Voltage, RMS, approximate	1.6	Volts
Grid-Number 1 Resistor	33,000	Ohms
Plate Resistance, approximate	1.0	Megohms
Conversion Transconductance	140	Micromhos
Plate Current	0.30	Milliamperes
Screen Current	0.80	Milliamperes
Grid-Number 1 Current	0.060	Milliamperes
Grid-Number 3 Voltage, approximate Gc = 5 Micromhos	−3	Volts
Grid-Number 3 Voltage, approximate Gc = 20 Micromhos	−2.5	Volts

OSCILLATOR CHARACTERISTICS (Not Oscillating)

Plate Voltage	12.6	Volts
Screen, Connected to Plate		
Screen Voltage	0	Volts
Grid-Number 3 Voltage	0	Volts
Amplification Factor‡	9.0	
Transconductance‡	2400	Micromhos
Cathode Current	3.6	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	−3.3	Volts

* When used in automobile service from a 12-volt source, under no circumstances should the heater voltage be less than 10.0 volts or more than 15.9 volts. These extreme variations in heater voltage may be tolerated for short periods; however, operation at or near these absolute limits in heater voltage necessarily involves sacrifice in performance at low heater voltage and in life expectancy at high heater voltage. Equipment reliability can be significantly increased with improved supply-voltage regulation.

† With external shield (EIA 316) connected to pin 2.

‡ Between Grid-Number 1 and Grid-Numbers 2 and 4 connected to Plate.

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

12GC6

BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 12GC6 is a beam-power pentode primarily designed for use as the horizontal-deflection amplifier in television receivers. Its high zero-bias plate current at low plate and screen voltages makes the tube well suited for use in receivers that operate at low plate-supply voltages.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	12.6	Volts
Heater Current	0.6±6%	Amperes
Heater Warm-up Time*	11	Seconds
Direct Interelectrode Capcitances, approximate†		
Grid-Number 1 to Plate: (g1 to p)	0.55	μμf
Input: g1 to (h+k+g2+b.p.)	15	μμf
Output: p to (h+k+g2+b.p.)	7.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-12, Glass
Base—B6-122, Short Medium-Shell Octal 6-Pin
Top Cap—C1-3, Skirted Miniature

MAXIMUM RATINGS

HORIZONTAL-DEFELECTION AMPLIFIER SERVICE—DESIGN-MAXIMUM VALUES‡

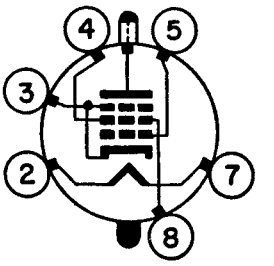
DC Plate-Supply Voltage (Boost+DC Power Supply)	770	Volts
Peak Positive Pulse Plate Voltage	6500	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Screen Voltage	220	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation§	17.5	Watts
Screen Dissipation	4.5	Watts
DC Cathode Current	175	Milliamperes
Peak Cathode Current	550	Milliamperes

(Continued on Page 2)

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GENERAL ELECTRIC

BASING DIAGRAM

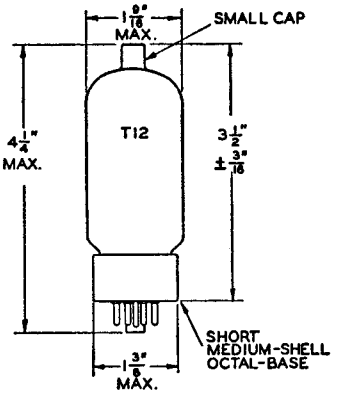


EIA 8JX

TERMINAL CONNECTIONS

Pin 2—Heater
Pin 3—Cathode and Beam Plates
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Grid Number 2 (Screen)
Cap—Plate

PHYSICAL DIMENSIONS



EIA 12-19

MAXIMUM RATINGS (Cont'd)

Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point	220	C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	60	250	Volts
Screen Voltage	150	150	150	Volts
Grid-Number 1 Voltage	——	0¶	−22.5	Volts
Plate Resistance, approximate	——	——	20,000	Ohms
Transconductance	——	——	6600	Micromhos
Plate Current	——	345	75	Milliamperes
Screen Current	——	30	2.4	Milliamperes
Grid-Number 1 Voltage, approximate I_b = 1.0 Milliampere	−100	——	−46	Volts
Triode Amplification Factor #	——	——	4.1	

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

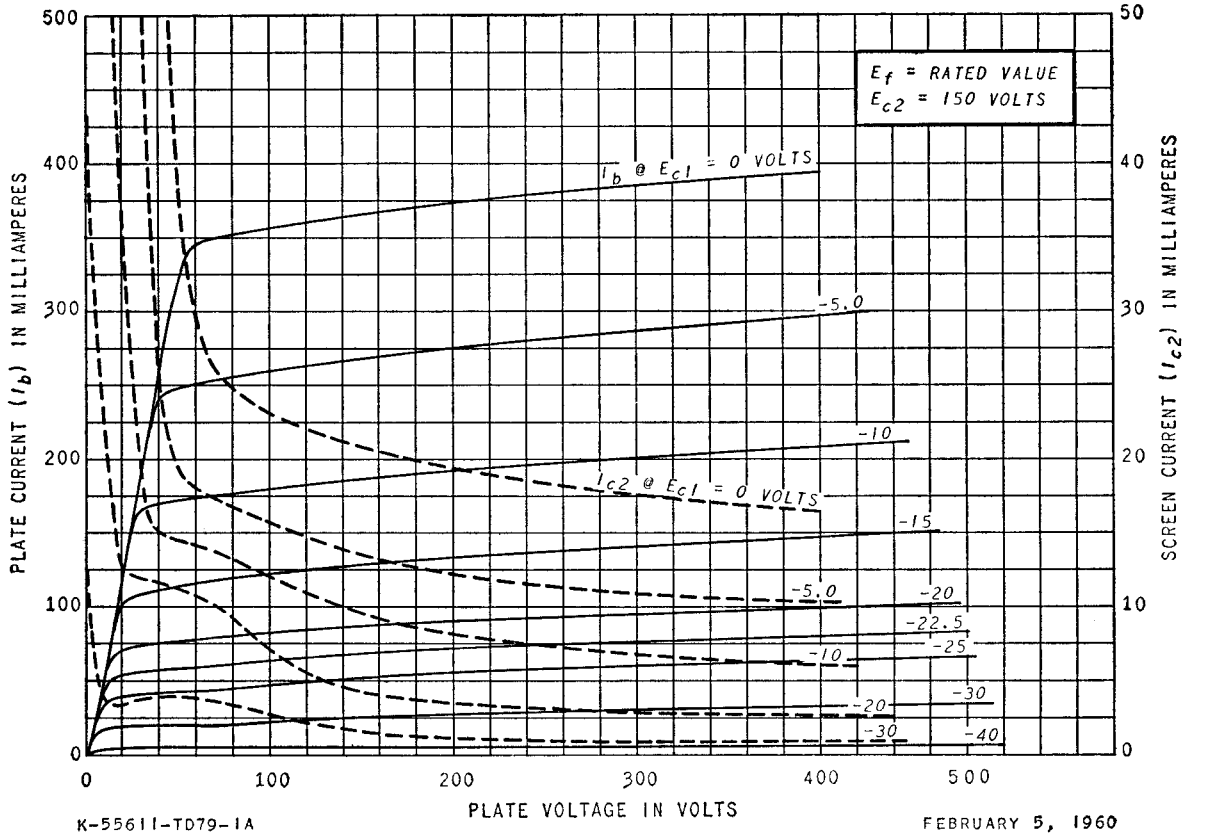
‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

¶ Applied for short interval (two seconds maximum) so as not to damage tube.

Triode Connection (screen tied to plate) with Eb = Ec2 = 150 volts, and Ec1 = −22.5 volts.

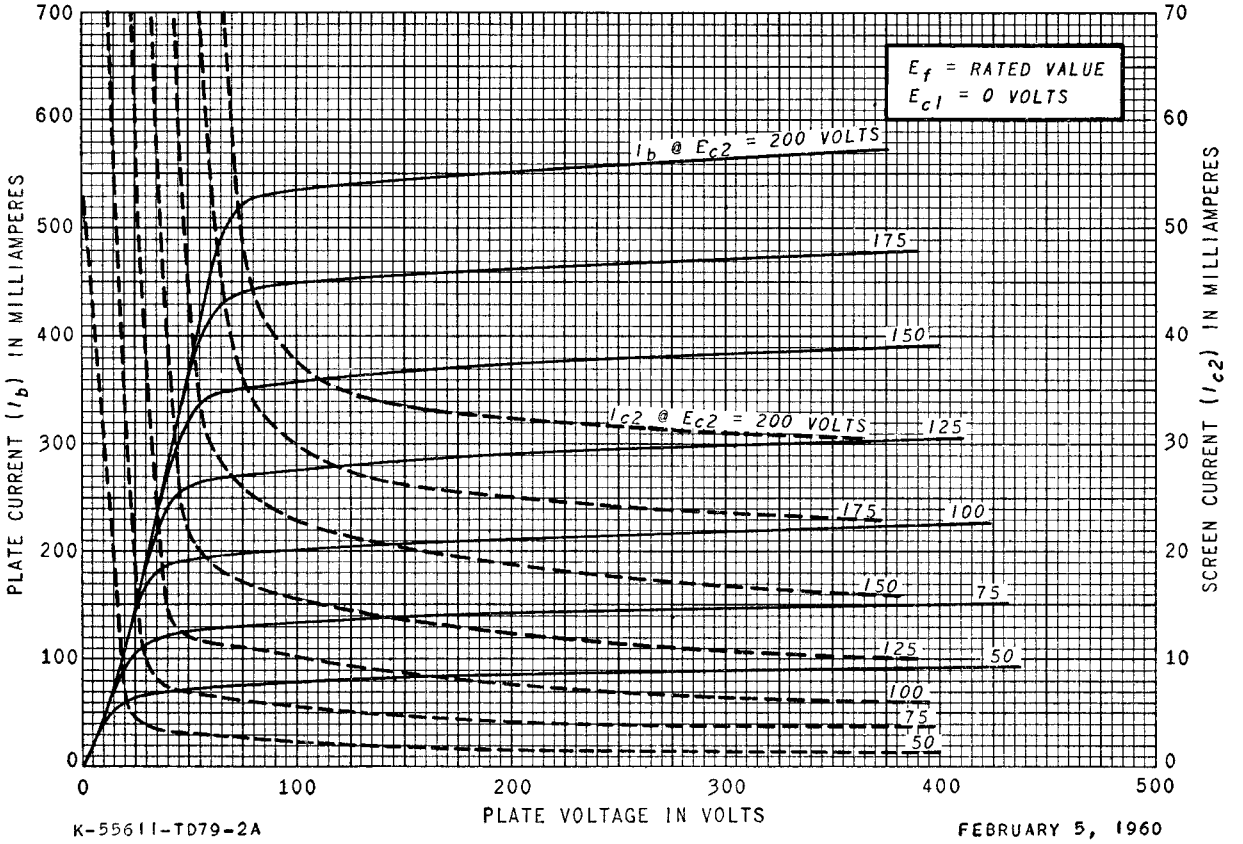
AVERAGE PLATE CHARACTERISTICS



K-55611-TD79-1A

FEBRUARY 5, 1960

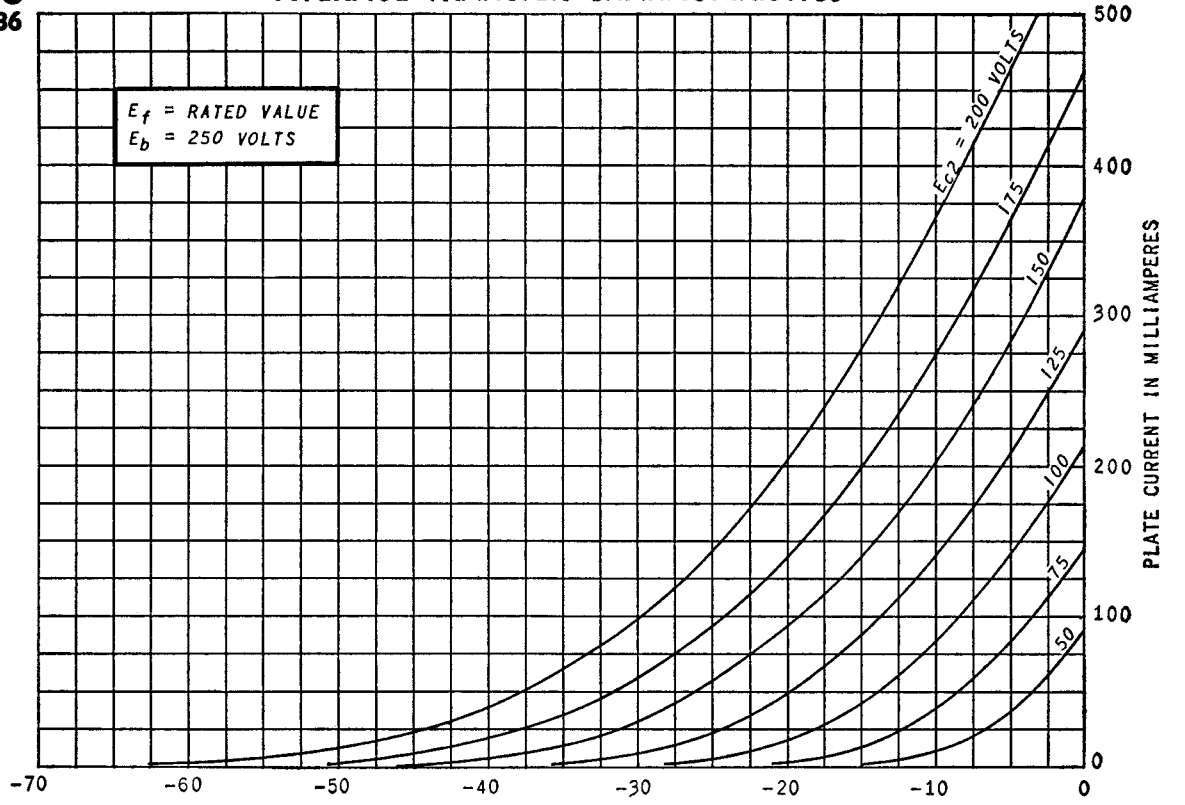
AVERAGE PLATE CHARACTERISTICS



K-55611-TD79-2A

FEBRUARY 5, 1960

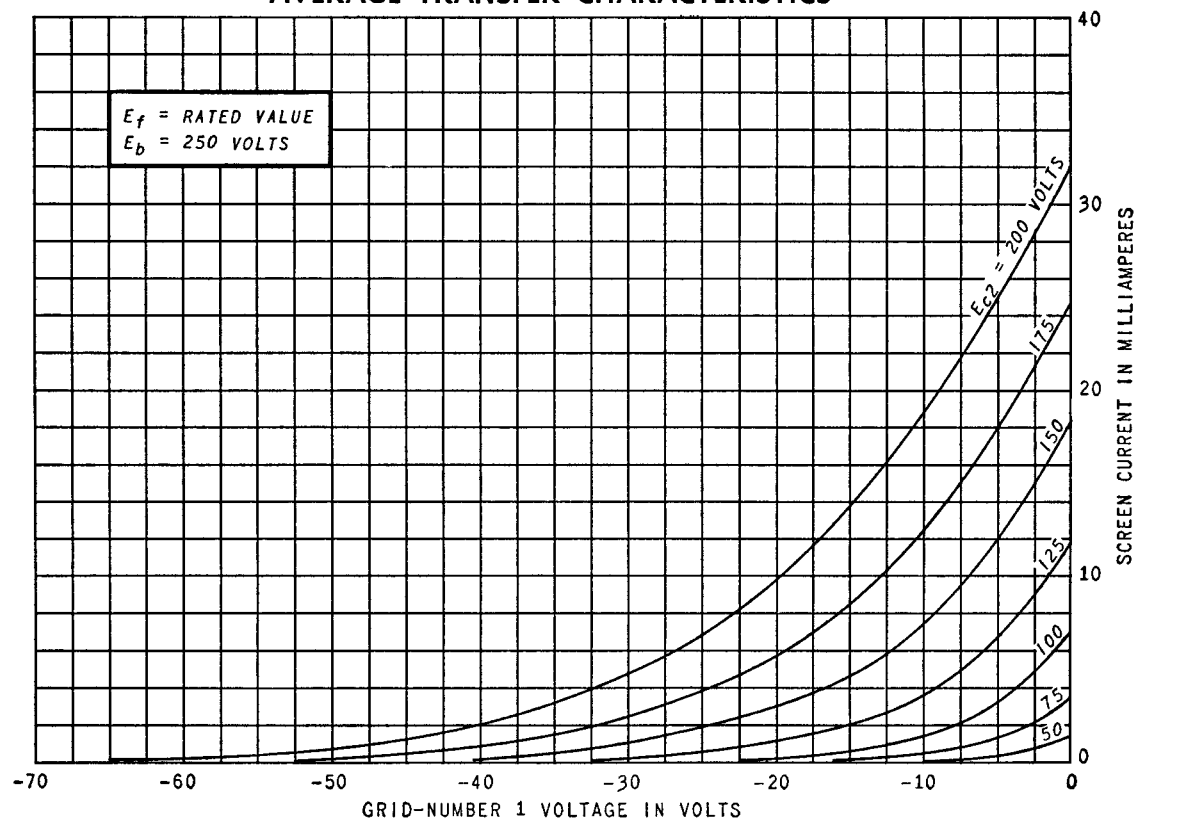
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD79-3A

FEBRUARY 5, 1960

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD79-4A

FEBRUARY 5, 1960

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady, 5, N. Y.

12GE5 – 12JN6

12GE5
12JN6

12GE5 Compactron Beam Pentode. The 12GE5 is a compactron beam-power pentode primarily designed for use as the horizontal-deflection amplifier in television receivers.

Except for heater characteristics, the 12GE5 is identical to the 6GE5.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	12.6	Volts
Heater Current●	0.6 ± 0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds

12JN6 Compactron Beam Pentode. The 12JN6 is a compactron beam-power pentode primarily designed for use as the horizontal-deflection amplifier in television receivers. A separate connection is provided for the beam plates to minimize "snivets".

Except for heater characteristics, the 12JN6 is identical to the 6JN6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	12.6	Volts
Heater Current●	0.6 ± 0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

—PRODUCT INFORMATION—

Sharp-Cutoff Pentode

12GN7-A

FOR TV VIDEO AMPLIFIER APPLICATIONS

The 12GN7-A is a miniature, sharp-cutoff pentode designed primarily for video amplifier service in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

	Parallel Sections, Series Circuit*	Parallel Sections, Parallel Circuit‡	Series Sections, Parallel Circuit§	
Heater Voltage, AC or DC	6.3¶	6.3±0.6#	12.6±1.3#	Volts
Heater Current	0.6±0.04#	0.6Δ	0.3¢	Amperes
Heater Warm-up Time, average**	11	---	---	Seconds

Direct Interelectrode Capacitances‡‡

Grid-Number 1 to Plate: (g1 to p)	0.12	pf
Input: g1 to (h + k + g2 + g3 + i.s.)	17.5	pf
Output: p to (h + k + g2 + g3 + i.s.)	4.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-3

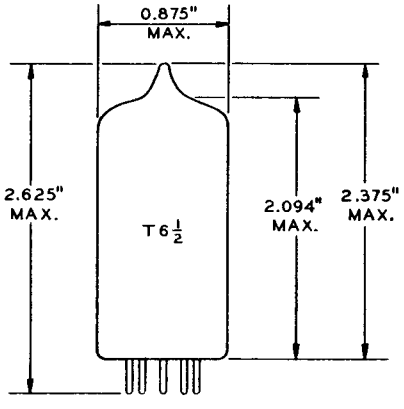
Maximum Diameter	0.875	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.375	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	400	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0§§	Volts
Plate Dissipation	11.5	Watts
Screen Dissipation	1.5	Watts
Grid-Number 1 Circuit Resistance	0.25	Megohms

PHYSICAL DIMENSIONS

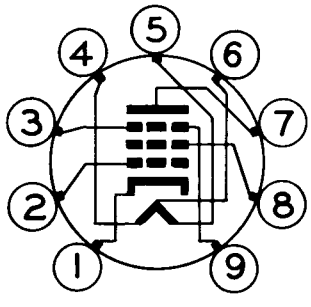


EIA 6-3

TERMINAL CONNECTIONS

Pin 1 - Cathode
Pin 2 - Grid Number 1
Pin 3 - Grid Number 3 (Suppressor) and Internal Shield
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Heater Center Tap
Pin 7 - Plate
Pin 8 - Grid Number 2 (Screen)
Pin 9 - Grid Number 3 (Suppressor) and Internal Shield

BASING DIAGRAM



EIA 9BF

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	50	250	Volts
Screen Voltage	125	150	Volts
Grid-Number 1 Voltage	0¶¶	0	Volts
Cathode-Bias Resistor	---	56	Ohms
Plate Resistance, approximate	---	50000	Ohms
Transconductance	---	36000	Micromhos
Plate Current	70	28	Milliamperes
Screen Current	24	6.5	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	---	-5.7	Volts

NOTES

* Operated with the two sections of the heater connected in parallel and the resulting combination in series with the heaters of other tubes having the same bogey heater current.

‡ Operated with the two sections of the heater connected in parallel and the resulting combination in parallel with the heaters of other tubes having the same bogey heater voltage.

§ Operated with the two sections of the heater connected in series and the resulting combination in parallel with the heaters of other tubes having the same bogey heater voltage.

¶ Heater voltage for a bogey tube at If = 0.6 amperes.

\# For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance; for series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

Δ Heater current of a bogey tube at Ef = 6.3 volts.

¢ Heater current of a bogey tube at Ef = 12.6 volts.

** The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

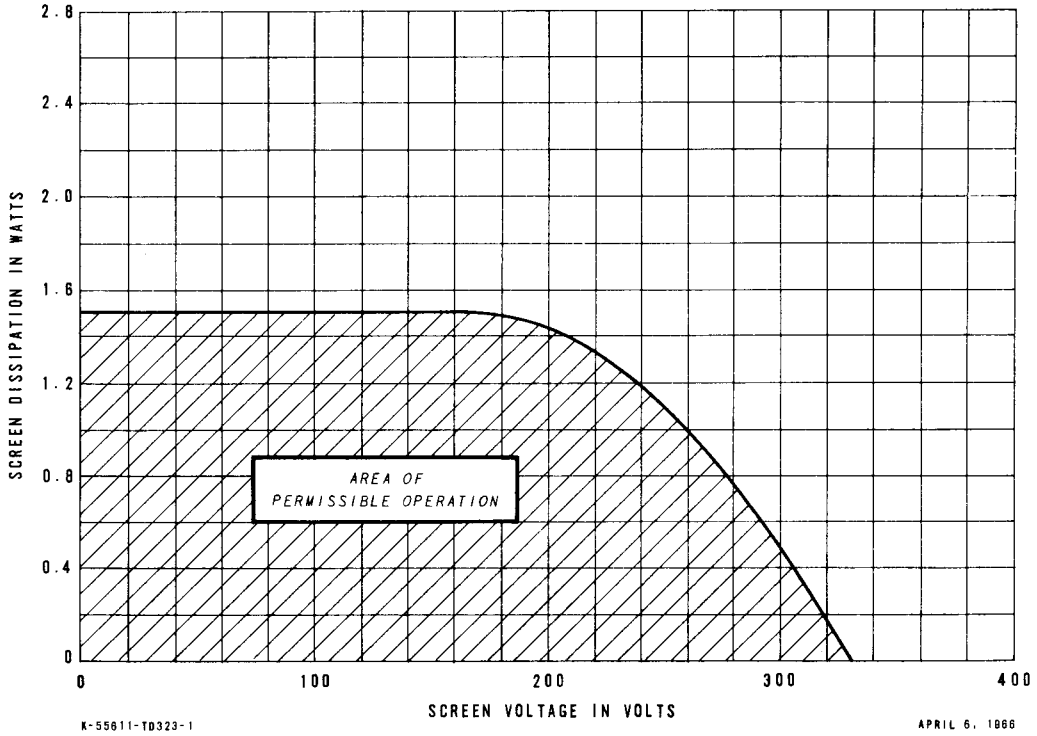
‡‡ Without external shield.

§§ Control grid to cathode spacing of this type is of such low order of magnitude as to preclude the use of voltage between these elements of more than 50 volts dc or peak ac in commercial tube checkers or shorts-indicating devices, particularly where mechanical excitation of the tube is employed.

¶¶ Applied for a short interval (two seconds maximum) so as not to damage tube.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

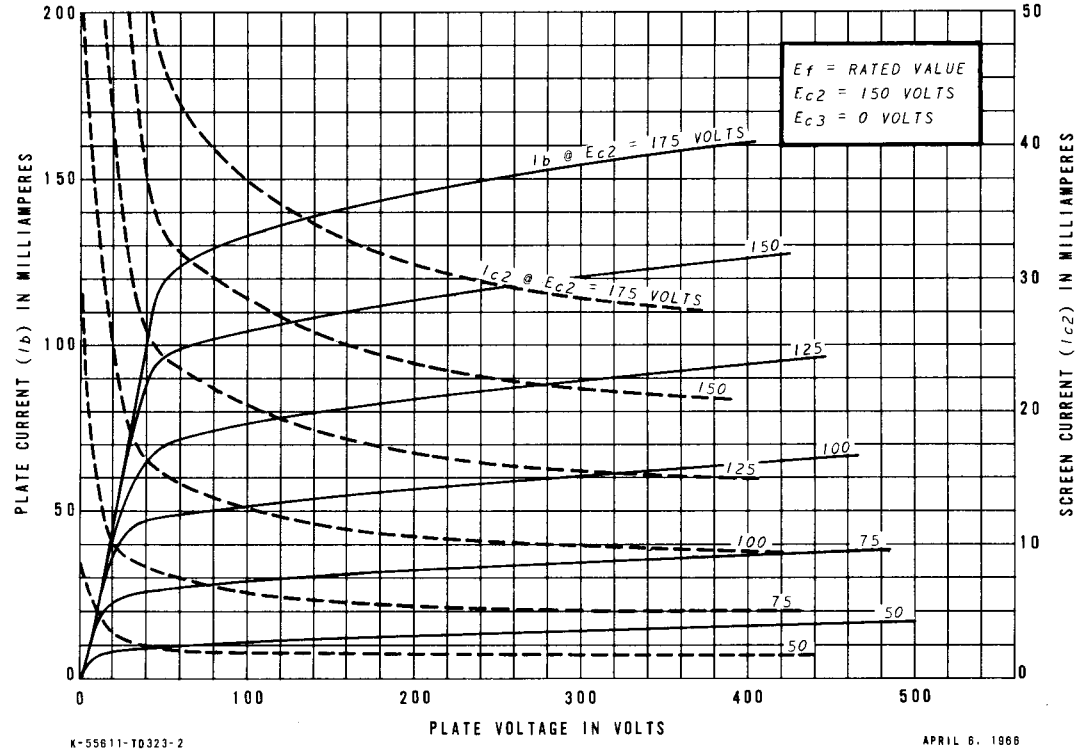
SCREEN RATING CHART



K-55611-TD323-1

APRIL 6, 1966

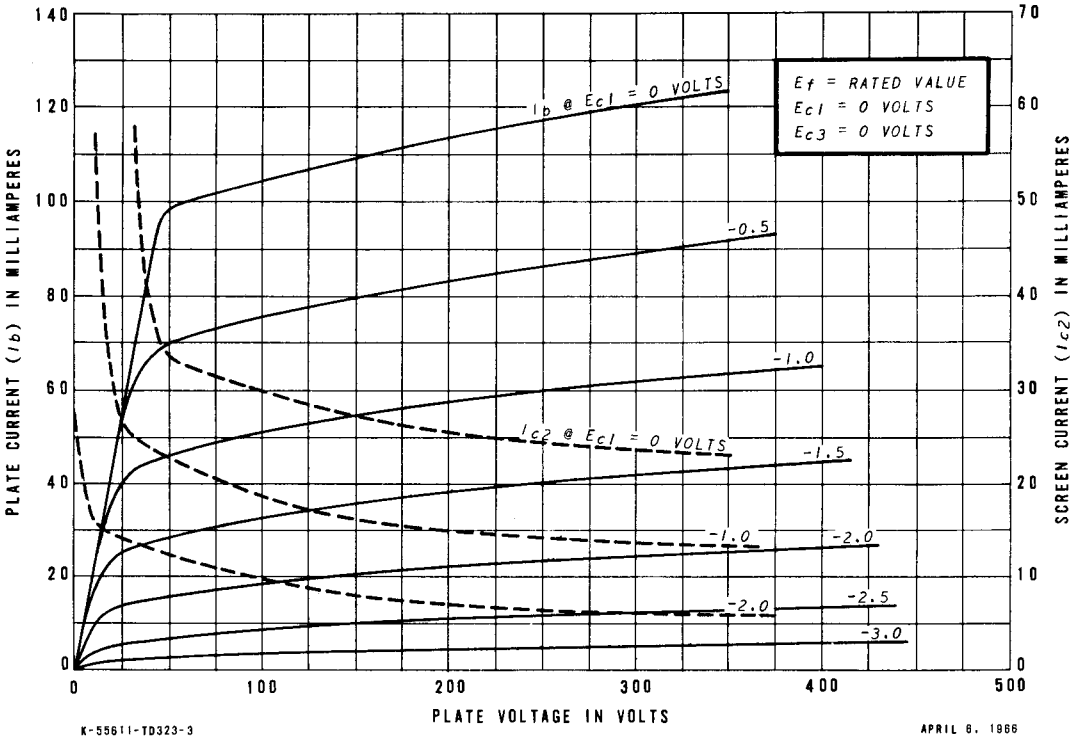
AVERAGE PLATE CHARACTERISTICS



K-55611-TD323-2

APRIL 6, 1966

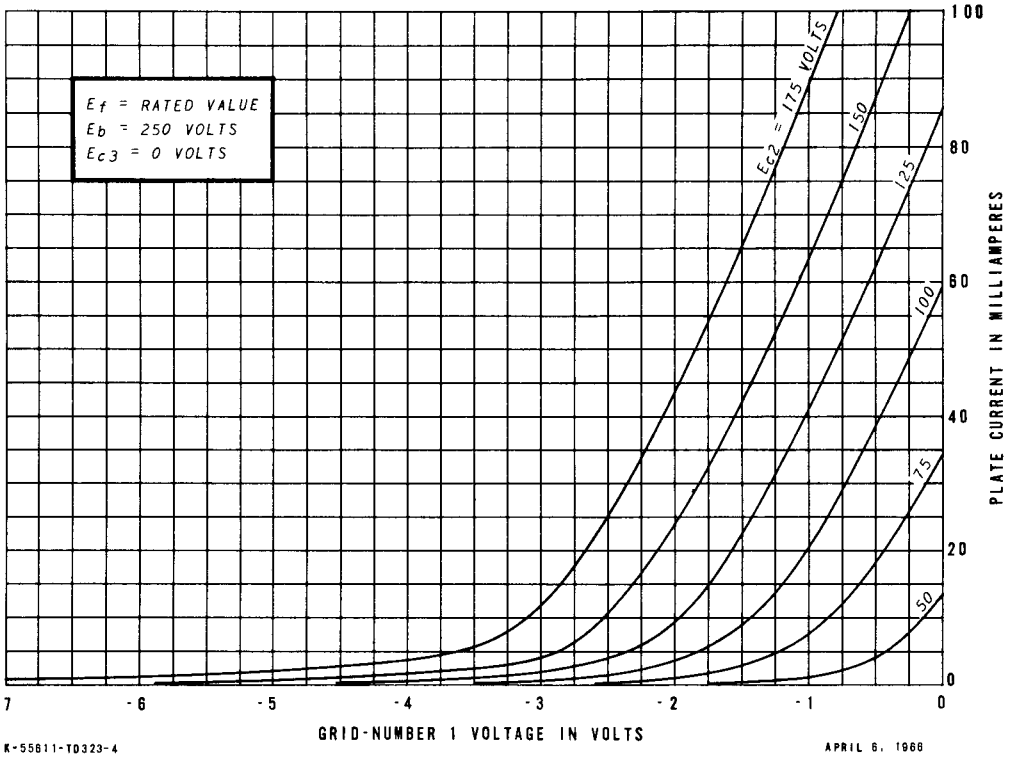
AVERAGE PLATE CHARACTERISTICS



K-55611-TD323-3

APRIL 6, 1966

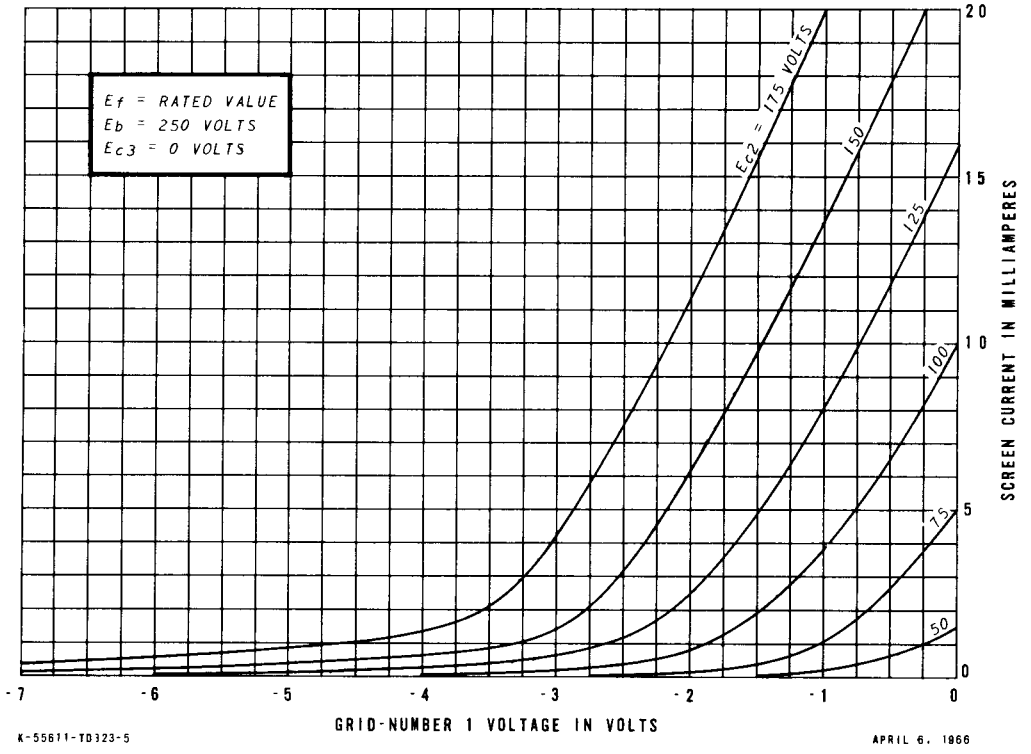
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD323-4

APRIL 6, 1966

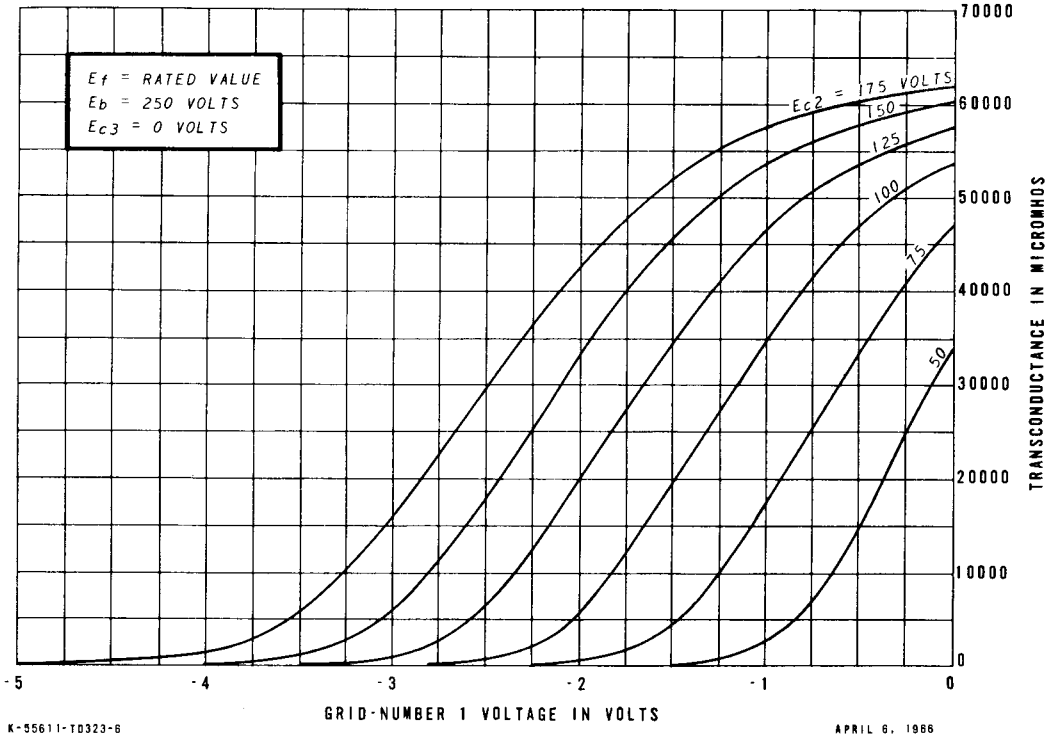
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD323-5

APRIL 6, 1966

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD323-6

APRIL 6, 1966

sponsor:
General Electric Co.

RMA Release No. 380
June 15, 1944

CATHODE-RAY TUBE

Type 12GP7

PHYSICAL CHARACTERISTICS

Focusing Method			Electrostatic
Deflecting Method			Electrostatic
Phosphor			P7
Direct Interelectrode Capacitances			
	Min	Max	
Cathode to all other electrodes	6.5	10	uuf
Grid No. 1 all other electrodes	8.5	11.5	uuf
Deflecting electrode D1 to deflecting electrode D2	1.5	5	uuf
" " D3 " " " D4	1.5	5	uuf
" " D1 " all other electrodes	5	13	uuf
" " D3 " " " "	5	13	uuf
" " D1 " " " " except D2	5	10	uuf
" " D2 " " " " " D1	5	10	uuf
" " D3 " " " " " D4	3	9	uuf
" " D4 " " " " " D3	3	9	uuf
Overall Length		22 ± 1/2	Inches
Greatest Diameter of Bulb		12 ± 3/16	Inches
Minimum Usable Screen Diameter		10	Inches
Base		Diheptal	12-Pin

Base Alignment

D1-D2 trace aligns with Pin No. 5 and tube axis ± 10 degrees

Angle between traces is 90 degrees ± 4 degrees

Positive voltage on D1 (Pin No. 11) deflects beam approximately toward Pin No. 5

Positive voltage on D3 (Pin No. 7) deflects beam approximately toward Pin No. 2

Basing RMA Designation - 14B

Bulb Contact: Medium Metal Cap

Bulb Contact Alignment

Anode No. 3 contact aligns with D1-D2 trace ± 10 degrees

Spot Center*: 35 mm Square

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

	Typical Operation	Maximum Ratings
Heater Voltage ∱	6.3	Volts
Heater Current	0.6	Amp

	Typical Operation					Maximum Ratings
Anode No. 1 (Focusing Electrode) Voltage	857 #	857 #	1143 #	1143	+25% # -30%	2200 Volts
Anode No. 2 (High Voltage Electrode) Voltage	3000	3000	4000	4000		4400 Volts
Anode No. 3 (Supplementary High Voltage Electrode) Voltage	3000	6000	4000	6000		6600 Volts
Grid No. 1 (Control Electrode) Voltage	-98 ¶	-98 ¶	-130 ¶	-130	±50% ¶	Never Positive
Peak Voltage Between Anode No. 2 and Any Deflecting Electrode ⊕						1100 Volts
D-c Heater Cathode Potential §						-250 Volts
Impedance of Any Deflecting Electrode Circuit at Heater Supply Frequency						1.0 Megohms
Grid Circuit Resistance						1.5 Megohms
Deflection Factor						
Electrodes D1 and D2	73	89	97	108	±20%	Volts D-c/in
Electrodes D3 and D4	68	83	91	101	±20%	Volts D-c/in

* The undeflected focused spot will fall within a square of the given size centered at the geometric center of the tube face and having one side parallel to the trace produced by D1 and D2.

/ Heater voltage and heater current allowable variation ±10%.

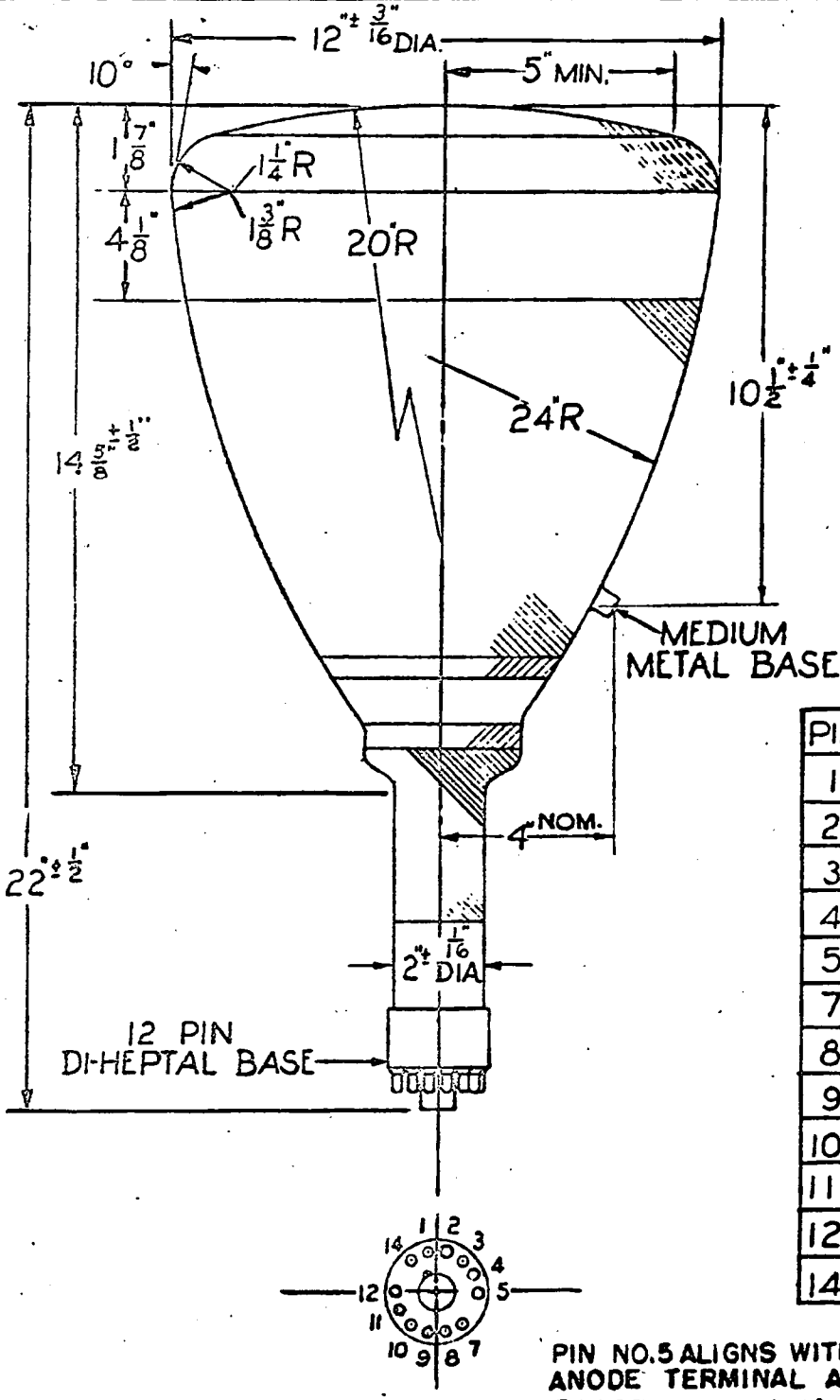
⊕ Symmetrical deflection voltage must be used.

§ With heater negative. Cathode should be tied to midtap or to one side of heater supply.

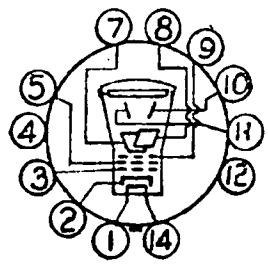
Nominal voltage taken at 75% of grid voltage for cutoff. Tolerances refer to variations of focusing voltage with grid voltage between 0 and cutoff.

¶ Cutoff voltage which is voltage necessary for visual extinction of a stationary focused spot.

Release No. 380
June 15, 1944



14B



BOTTOM VIEW OF SOCKET CONNECTION

PIN	CONNECTIONS
1	HEATER
2	CATHODE
3	GRID
4	INTERNAL CONNECTION
5	#1 ANODE
7	DEFLECTING ELECTRODE D3
8	DEFLECTING ELECTRODE D4
9	#2 ANODE
10	DEFLECTING ELECTRODE D2
11	DEFLECTING ELECTRODE D1
12	INTERNAL CONNECTION
14	HEATER

PIN NO. 5 ALIGNS WITH TRACE ID2 WITHIN ±10°
ANODE TERMINAL ALIGNS WITH ID2 TRACE WITHIN ±10°

OUTLINE
12GP7 CATHODE-RAY TUBE

—PRODUCT INFORMATION—

Sharp-Cutoff Pentode

12HL7

FOR TV VIDEO AMPLIFIER APPLICATIONS

- **COLOR TV TYPE**
- **FRAME-GRID CONSTRUCTION**
- **9-PIN MINIATURE**
- **21000 MICROMHOS**

The 12HL7 is a miniature tube containing a frame-grid, sharp-cutoff pentode designed primarily for video amplifier service in color television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

	Parallel Sections, Series Circuit*	Parallel Sections, Parallel Circuit‡	Series Sections, Parallel Circuit§	
Heater Voltage, AC or DC	6.3¶	6.3±0.6#	12.6±1.2#	Volts
Heater Current	0.6±0.04#	0.6Δ	0.3¢	Amperes
Heater Warm-up Time, average**	11	---	---	Seconds

Direct Interelectrode Capacitances‡‡

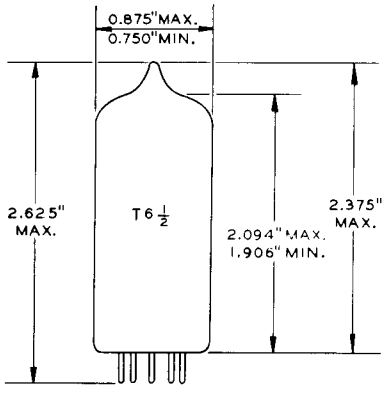
Grid-Number 1 to Plate: (g1 to p)	0.15	pf
Input: g1 to (h + k + g2 + g3 + i.s.)	15	pf
Output: p to (h + k + g2 + g3 + i.s.)	6.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-3

Maximum Diameter	0.875	Inches
Minimum Diameter	0.750	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.375	Inches

PHYSICAL DIMENSIONS

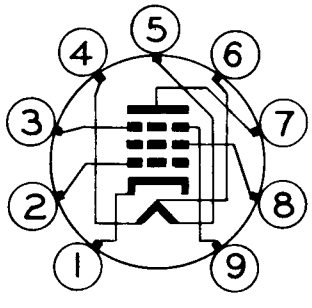


EIA 6-3

TERMINAL CONNECTIONS

Pin 1 - Cathode
Pin 2 - Grid Number 1
Pin 3 - Grid Number 3 (Suppressor) and Internal Shield
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Heater Center Tap
Pin 7 - Plate
Pin 8 - Grid Number 2 (Screen)
Pin 9 - Grid Number 3 (Suppressor) and Internal Shield

BASING DIAGRAM



EIA 9BF

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	400	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0§§	Volts
Plate Dissipation	10	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.25	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	50	250	Volts
Screen Voltage	125	150	Volts
Grid-Number 1 Voltage	0¶¶	0	Volts
Cathode Resistor (Bypassed)	---	122	Ohms
Plate Resistance, approximate	---	55000	Ohms
Transconductance	---	21000	Micromhos
Plate Current	76	25	Milliamperes
Screen Current	32	6.0	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 100 Microamperes	---	-7.2	Volts

NOTES

* Operated with the two sections of the heater connected in parallel and the resulting combination in series with the heaters of other tubes having the same bogey heater current.

‡ Operated with the two sections of the heater connected in parallel and the resulting combination in parallel with the heaters of other tubes having the same bogey heater voltage.

§ Operated with the two sections of the heater connected in series and the resulting combination in parallel with the heaters of other tubes having the same bogey heater voltage.

¶ Heater voltage for a bogey tube at If = 0.6 amperes.

\# For parallel heater operation, the equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance; for series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

Δ Heater current of a bogey tube at Ef = 6.3 volts.

¢ Heater current of a bogey tube at Ef = 12.6 volts.

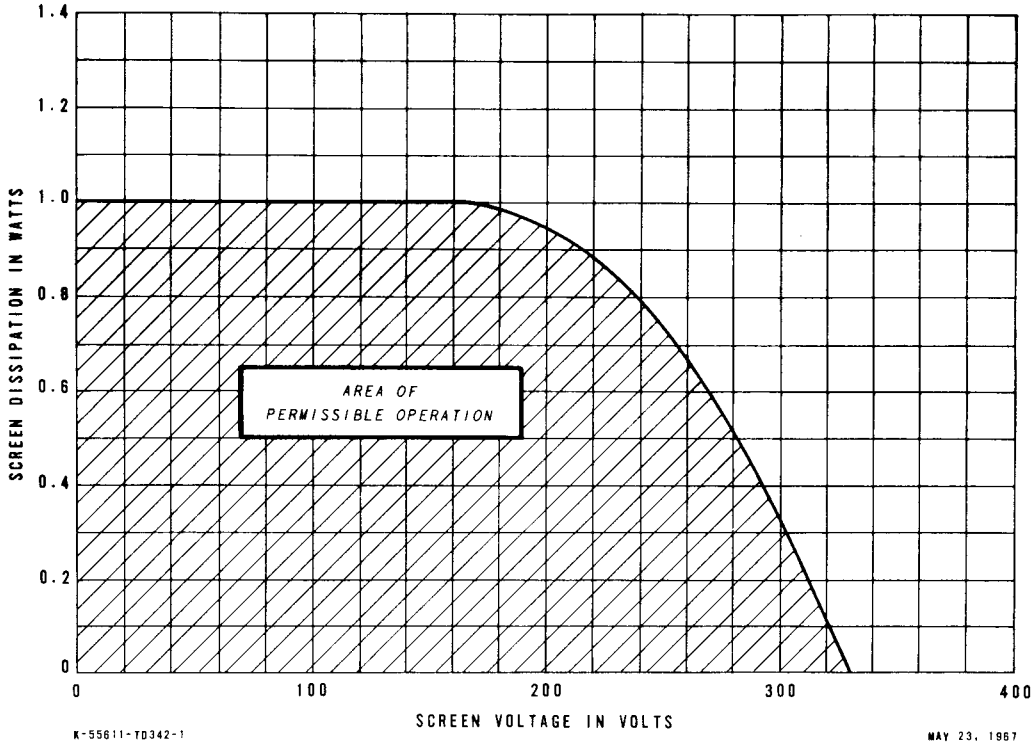
** The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

‡‡ Without external shield.

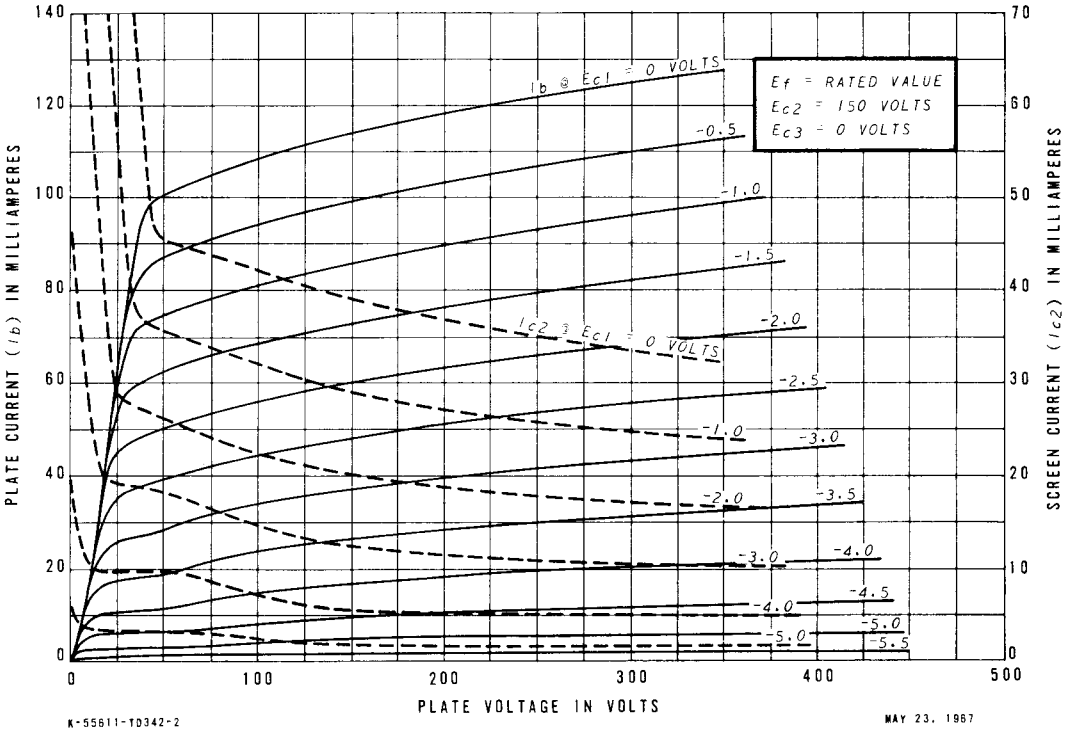
§§ Control grid to cathode spacing of this type is of such low order of magnitude as to preclude the use of voltage between these elements of more than 50 volts dc or peak ac in commercial tube checkers or shorts-indicating devices, particularly where mechanical excitation of the tube is employed.

¶¶ Applied for a short interval (two seconds maximum) so as not to damage tube.

SCREEN RATING CHART



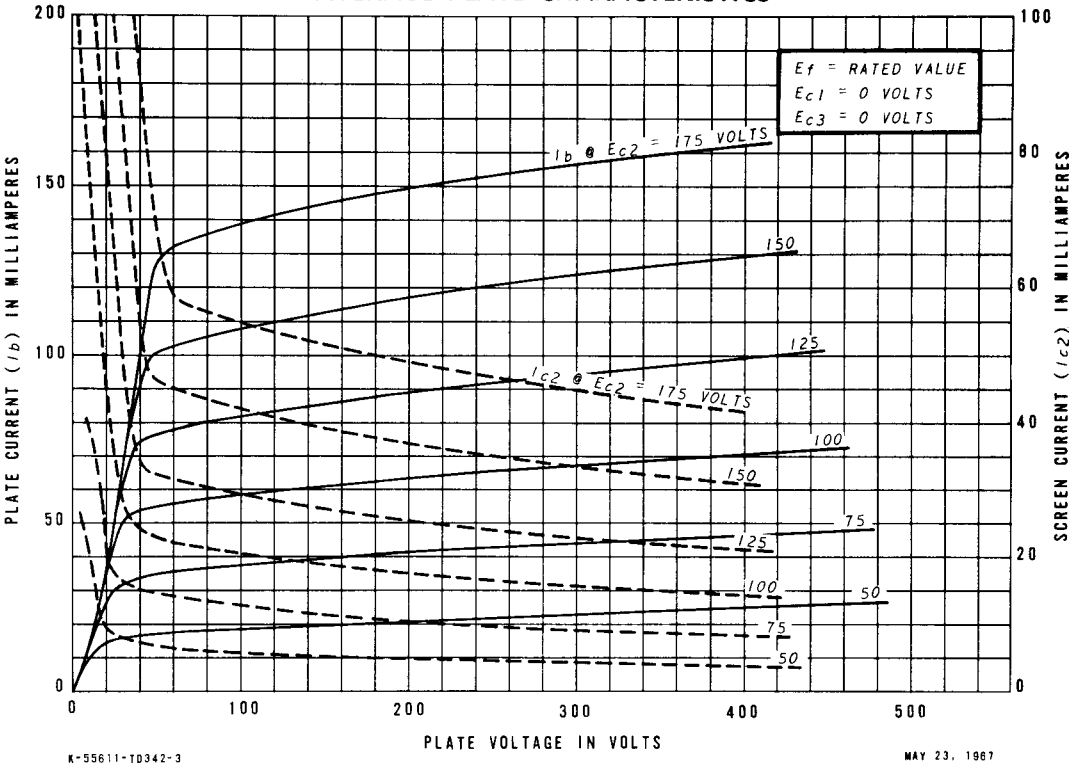
AVERAGE PLATE CHARACTERISTICS



K-55611-TD342-2

MAY 23, 1967

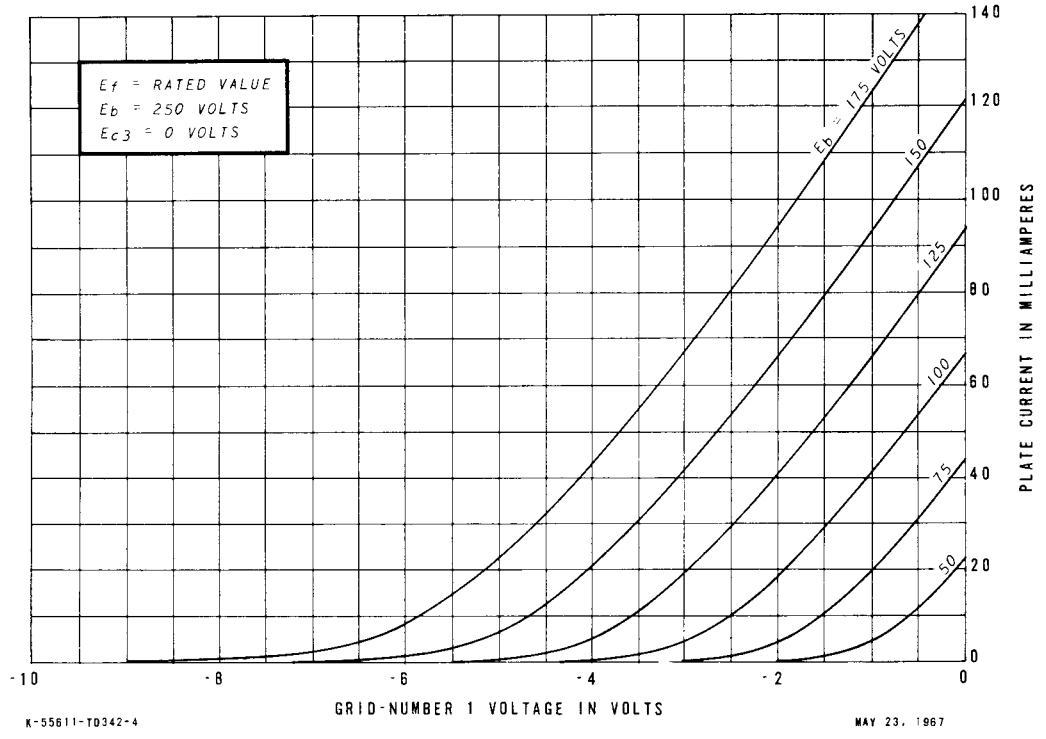
AVERAGE PLATE CHARACTERISTICS



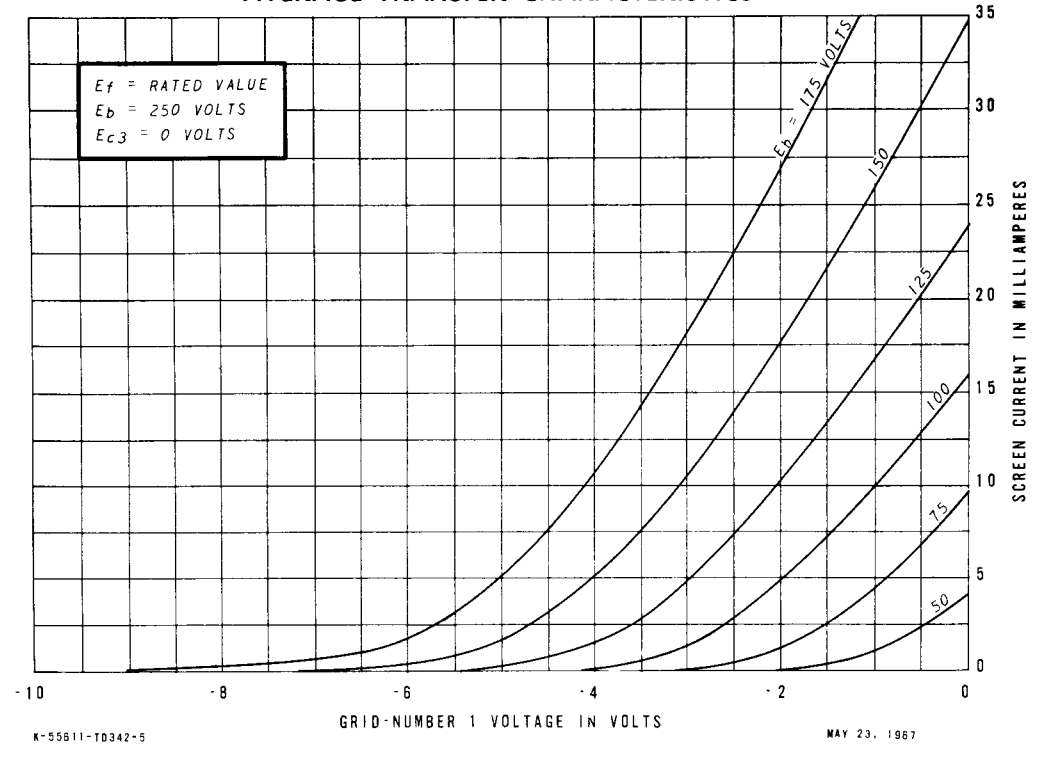
K-55611-TD342-3

MAY 23, 1967

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBE

KEN-RAD

12J5

Description and Rating

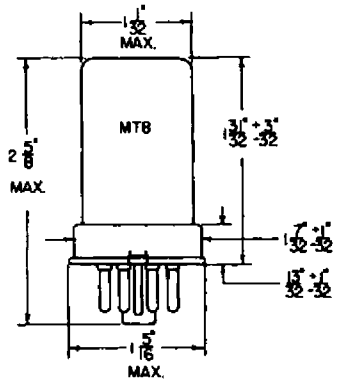
GENERAL-PURPOSE TRIODE

GENERAL DESCRIPTION

Principal Application: The 12J5 is a medium-mu general-purpose triode designed for use as an amplifier, an oscillator, or a detector. Except for heater ratings, the 12J5 is identical to the 6J5.

Cathode:	Coated Unipotential
Heater Voltage (A-C or D-C)	12.6 Volts
Heater Current	0.15 Ampere
Envelope:	MT-8, Metal Shell
Base:	B6-23, Small Wafer Octal 6-Pin
Mounting Position:	Any
Direct Interelectrode Capacitances: *	
Grid to Plate	3.4 μμf
Input	3.4 μμf
Output	3.6 μμf

PHYSICAL DIMENSIONS

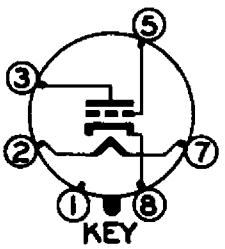


RMA 8-1

TERMINAL CONNECTIONS

Pin 1 - Shell
Pin 2 - Heater
Pin 3 - Plate
Pin 5 - Grid
Pin 7 - Heater
Pin 8 - Cathode

BASING DIAGRAM



RMA 6Q
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES:

Plate Voltage	300	Volts
Positive D-C Grid Voltage	0	Volts
Plate Dissipation	2.5	Watts
Total Cathode Current	20	Milliamperes
D-C Heater-Cathode Voltage	90	Volts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	90	250	Volts
Grid Bias Voltage **	0	-8	Volts
Amplification Factor	20	20	
Plate Resistance	6700	7700	Ohms
Transconductance	3000	2600	Micromhos
Plate Current	10	9.0	Milliamperes

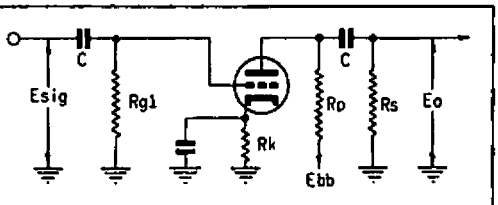
* *With shell connected to cathode*

** *The d-c resistance in the grid circuit under maximum rated conditions should not exceed 1.0 megohm.*

from RMA release #850, April 6, 1950

CLASS A RESISTANCE-COUPLED AMPLIFIER

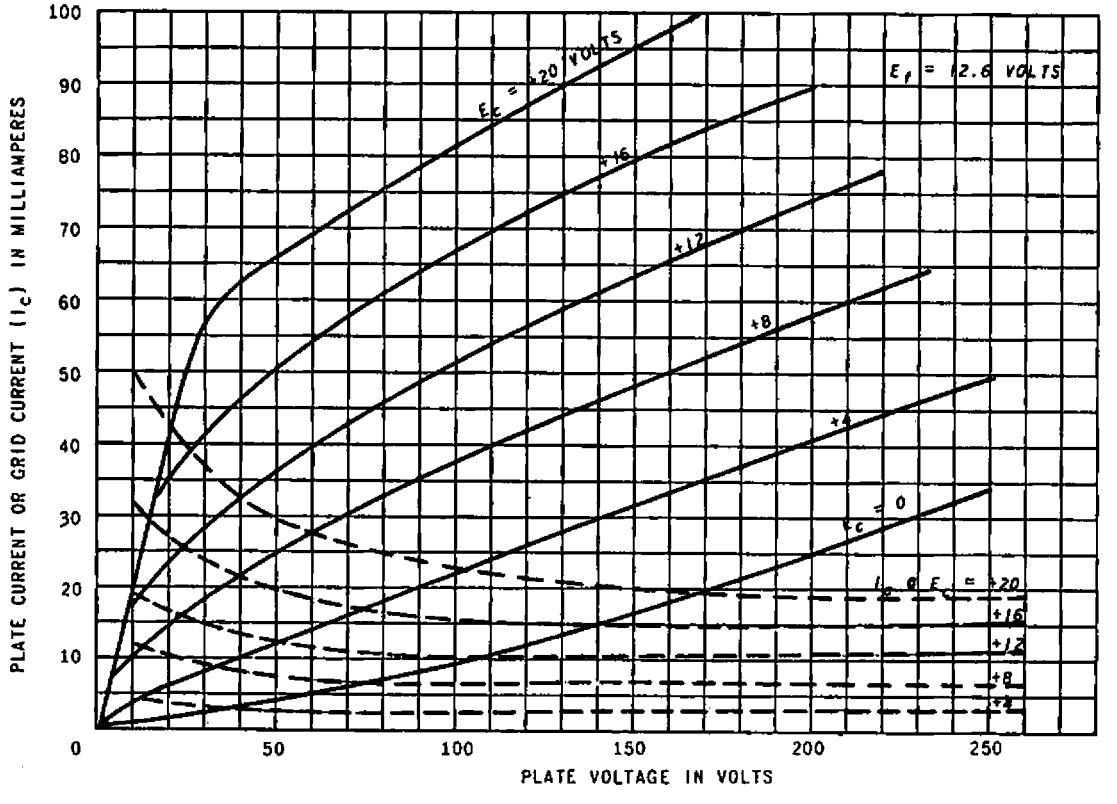
Rp Meg.	Rg1 Meg.	Rs Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	•	0.10	3300	14	13	2200	14	26	1800	14	40
0.10	•	0.24	3600	14	16	2700	15	33	2200	15	51
0.24	•	0.24	7500	14	16	5100	15	30	4300	15	44
0.24	•	0.51	9100	14	19	6800	15	39	5100	15	54
0.51	•	0.51	13000	14	16	9100	15	30	6800	16	40
0.51	•	1.0	15000	14	19	10000	16	32	7500	16	45
0.24	10	0.24	0	15	13	0	16	33	0	17	46
0.24	10	0.51	0	16	17	0	17	38	0	18	62
0.51	10	0.51	0	16	14	0	18	32	0	18	53
0.51	10	1.0	0	17	18	0	18	41	0	19	68



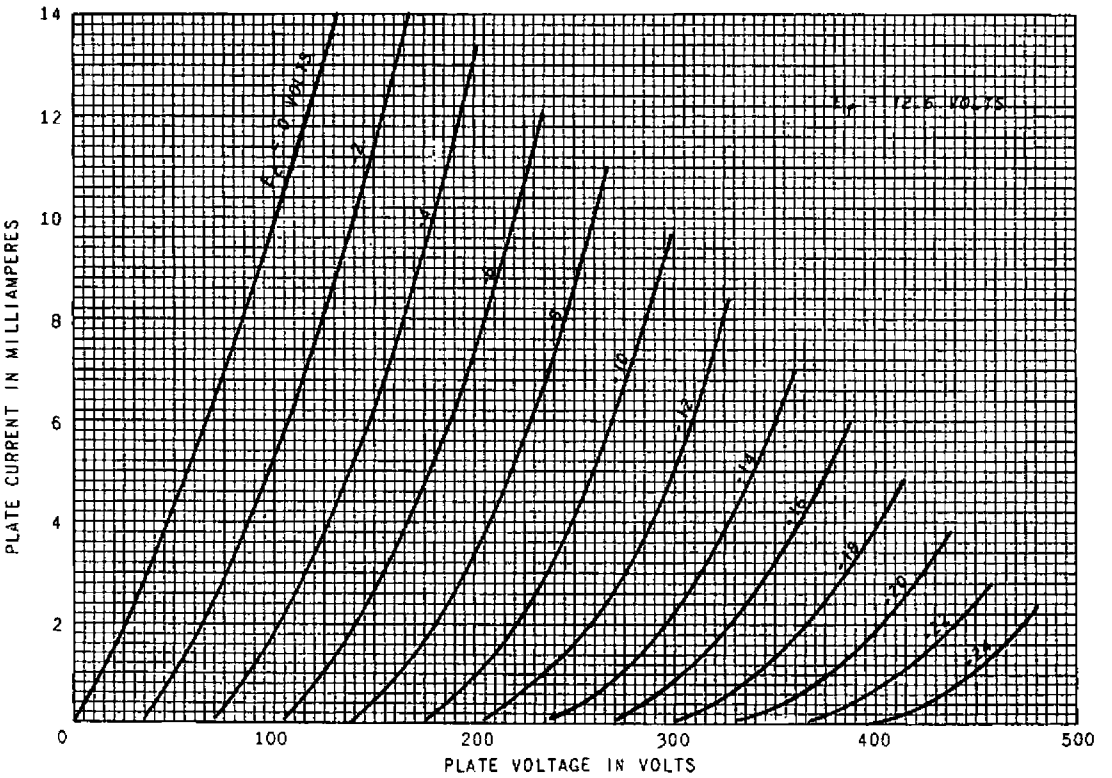
Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible. *Value of Rg1 is non-critical.

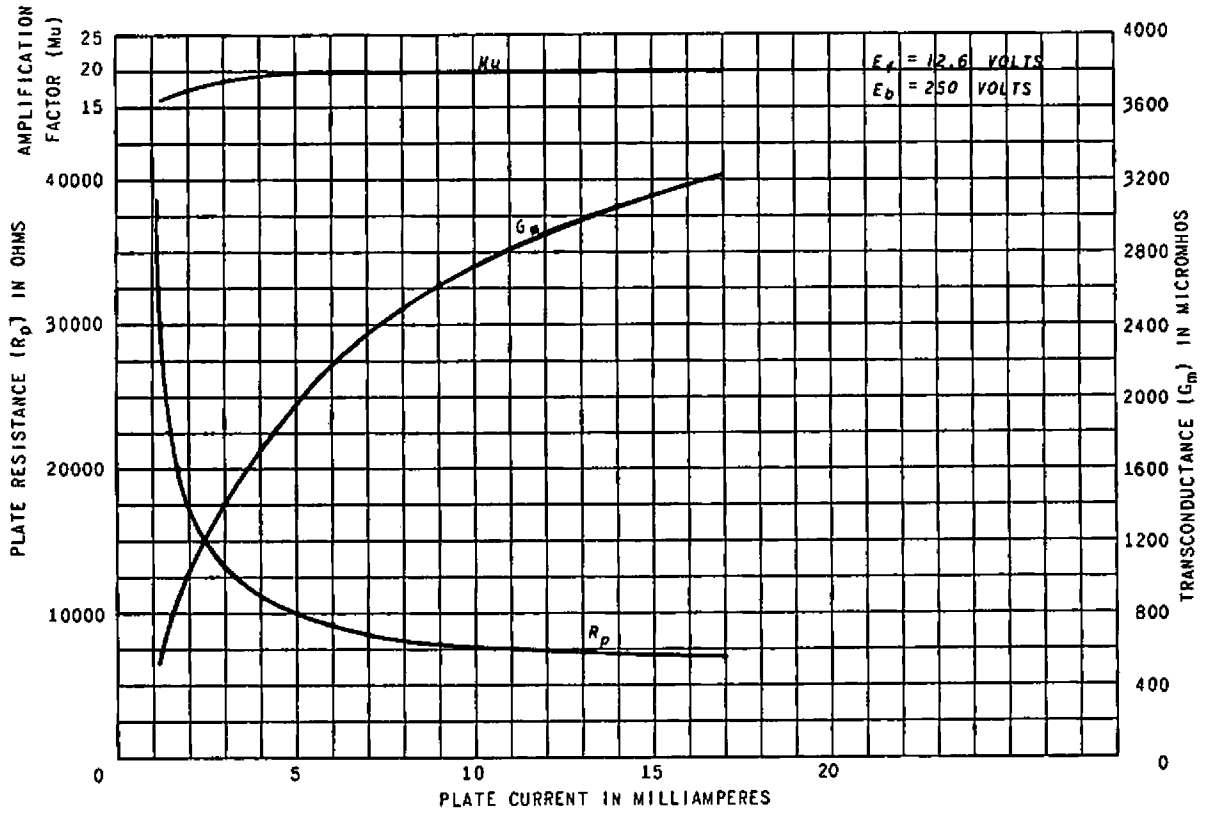
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Compactron Beam Pentode

12JF5

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

The 12JF5 is a compactron beam-power pentode primarily designed for use as the horizontal-deflection amplifier in color television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	12.6	Volts
Heater Current ●	0.6±0.04	Amperes
Heater Warm-up Time, average ▲	11	Seconds
Direct Interelectrode Capacitances, approximate ♦		
Grid-Number 1 to Plate: (g1 to p)	0.55	pf
Input: g1 to (h+k+g2+b.p.)	15.6	pf
Output: p to (h+k+g2+b.p.)	6.4	pf

MECHANICAL

Mounting Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Top Cap - C1-1, Small
Outline Drawing - EIA 12-87

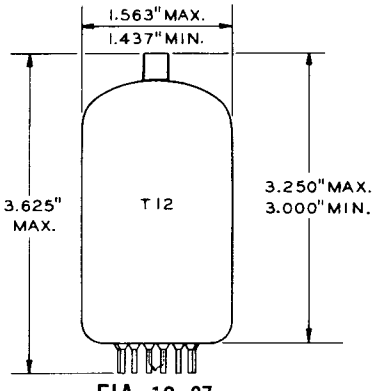
Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	3.625	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE § — DESIGN-MAXIMUM VALUES

DC Plate-Supply Voltage (Boost + DC Power Supply)	770	Volts
Peak Positive Pulse Plate Voltage	6500	Volts
Peak Negative Pulse Plate Voltage	0	Volts
Screen Voltage	220	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation ⊕	17.5	Watts
Screen Dissipation	3.5	Watts
DC Cathode Current	175	Milliamperes
Peak Cathode Current	550	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point □	220	°C

PHYSICAL DIMENSIONS

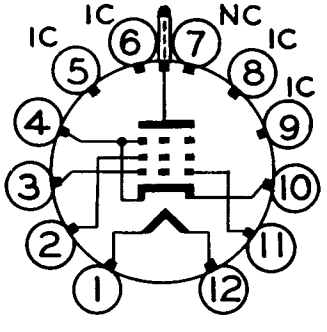


EIA 12-87

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Grid-Number 2 (Screen)
Pin 3 - Grid-Number 1
Pin 4 - Cathode and Beam Plates
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - No Connection
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Cathode and Beam Plates
Pin 11 - Grid-Number 1
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12JH

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	60	250	Volts
Screen Voltage	150	150	150	Volts
Grid-Number 1 Voltage	---	0†	-22.5	Volts
Plate Resistance, approximate	---	---	18000	Ohms
Transconductance	---	---	7300	Micromhos
Plate Current	---	345	65	Milliamperes
Screen Current	---	27	1.8	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 1.0 Milliamperes	-80	---	-42	Volts
Triode Amplification Factor‡	---	---	4.4	

MINIMUM RECOMMENDED GRID DRIVE

Peak Positive Pulse Plate Voltage	3500	5000	6000	Volts
Peak Negative Grid-Number 1 Voltage for Eg2 = 150 Volts	-100	-118	-130	Volts
Peak Negative Grid-Number 1 Voltage for Eg2 = 200 Volts	-120	-138	-150	Volts

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

▲ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

♦ Without external shield.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

⊕ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

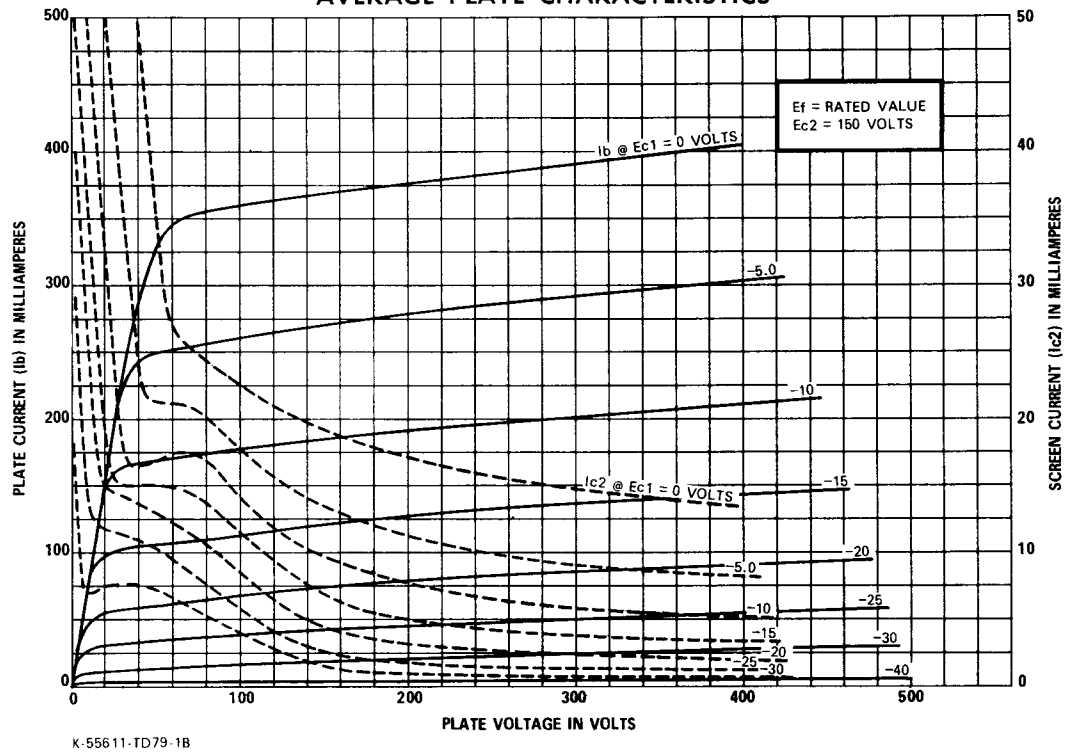
□ Measured with an infrared themometer, Ircon Model 700 BC or equivalent, at an ambient temperature of 40° C.

† Applied for short interval (two seconds maximum) so as not to damage tube.

‡ Triode connection (screen tied to plate) with Eb = Ec2 = 150 volts, and Ec1 = -22.5 volts.

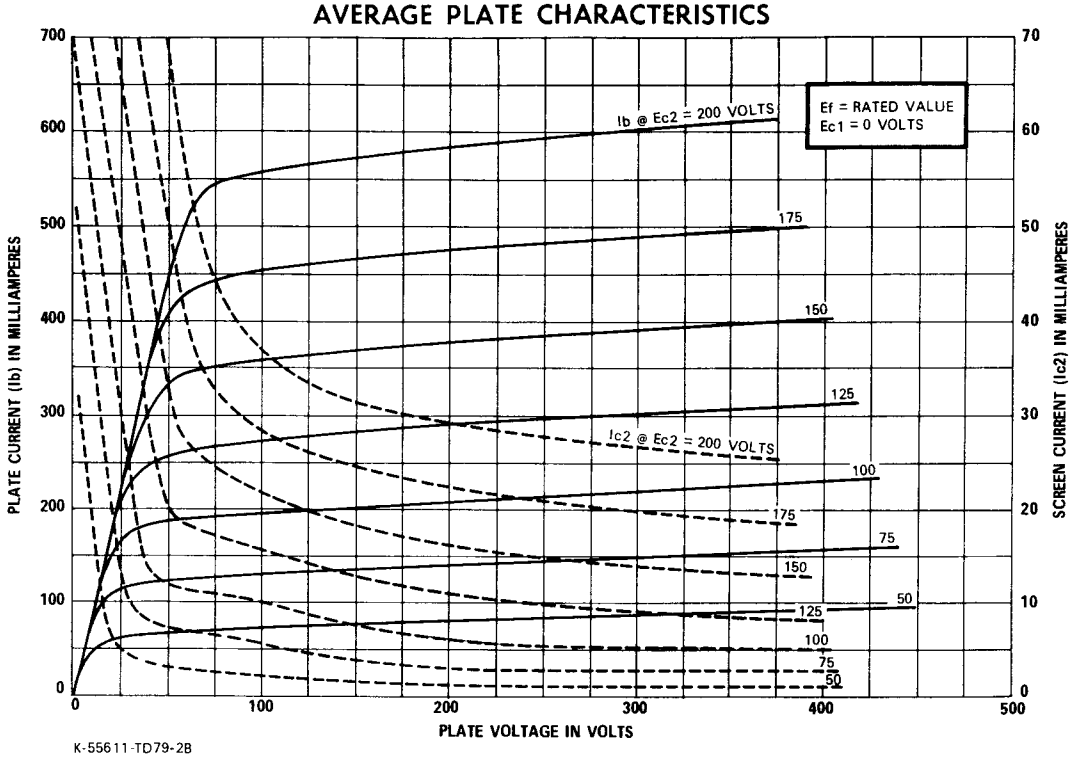
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AVERAGE PLATE CHARACTERISTICS



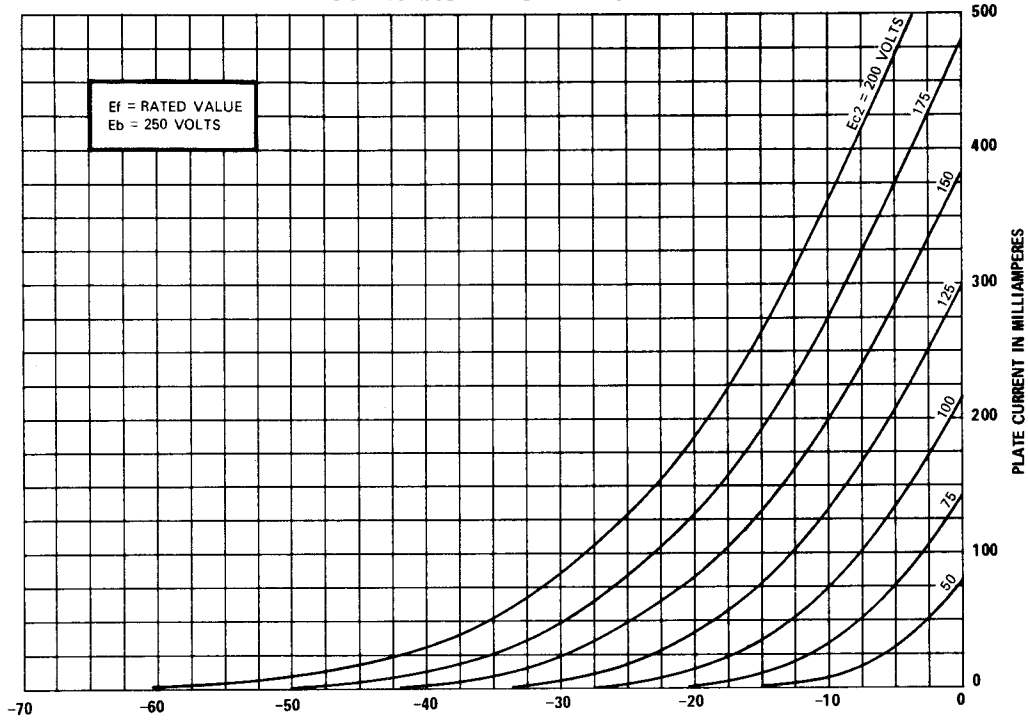
K-55611-TD79-1B

AVERAGE PLATE CHARACTERISTICS



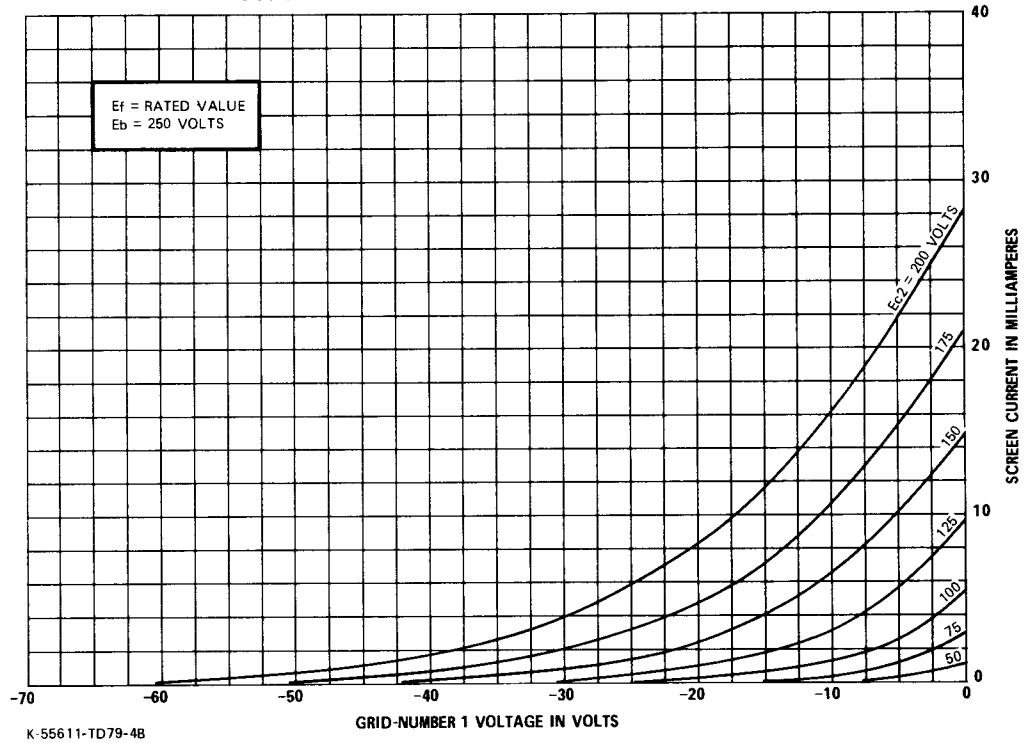
K-55611-TD79-2B

AVERAGE TRANSFER CHARACTERISTICS



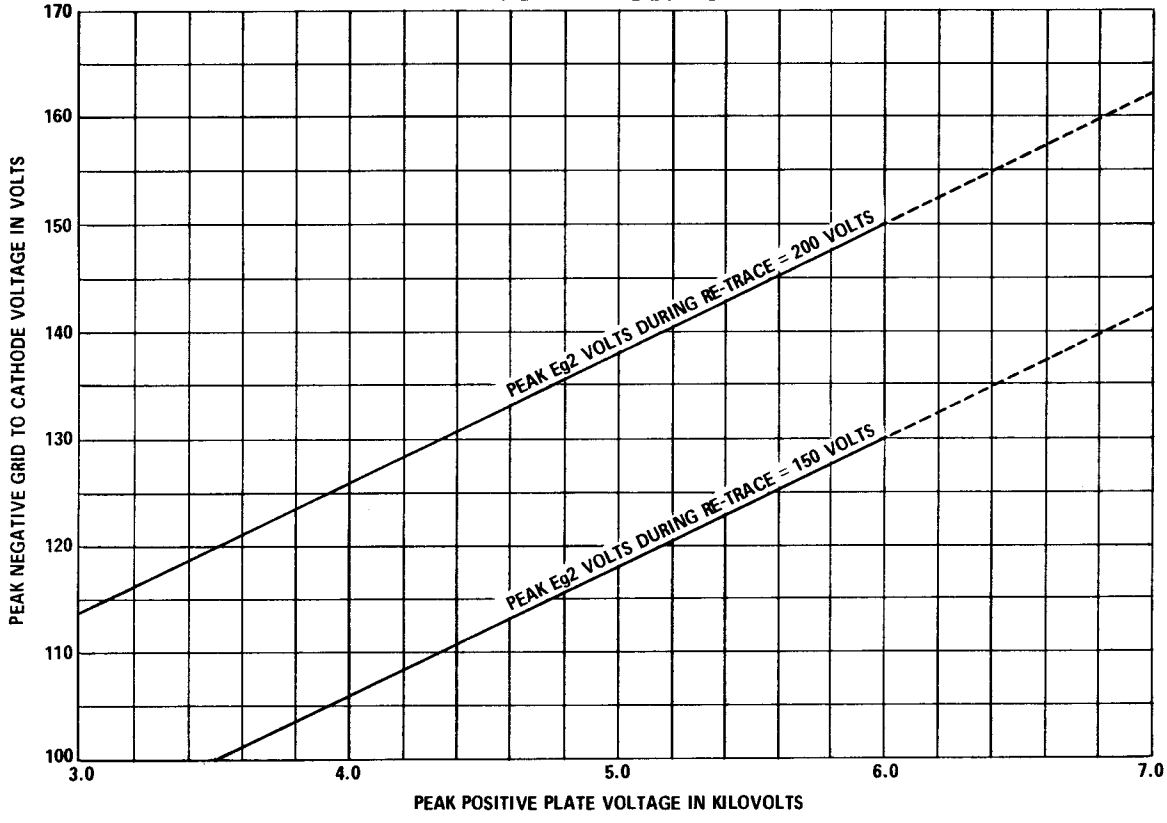
K-55611-TD79-3B

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD79-4B

RECOMMENDED MINIMUM PEAK NEGATIVE GRID VOLTAGE vs PEAK POSITIVE PULSE PLATE VOLTAGE



TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

GENERAL ELECTRIC

12JN8 THROUGH 12SN7-GTA

DESCRIPTION AND RATING

12JN8

12JN8 Triode-Pentode. The 12JN8 is a miniature tube containing a medium-mu triode and a sharp-cutoff pentode.

Except for heater characteristics and ratings, the 12JN8 is identical to the 6JN8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	12.6±1.3	Volts
Heater Current‡	0.225	Amperes

12SL7-GT

12SL7-GT Twin Triode. The 12SL7-GT is a high-mu twin triode designed for use in resistance-coupled circuits as a voltage amplifier or phase inverter.

Except for heater characteristics and ratings, the 12SL7-GT is identical to the 6SL7-GT.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC	12.6	Volts
Heater Current	0.15	Amperes

12SN7-GTA

12SN7-GTA Twin Triode. The 12SN7-GTA is a medium-mu twin triode suitable for use in a wide variety of general-purpose amplifier and phase-inverter applications.

Except for heater characteristics and ratings, the 12SN7-GTA is identical to the 6SN7-GTB.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC	12.6	Volts
Heater Current	0.3	Amperes

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 12.6 volts.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

Electronic TUBES

12K8

Description and Rating

TRIODE-HEXODE CONVERTER

GENERAL DESCRIPTION

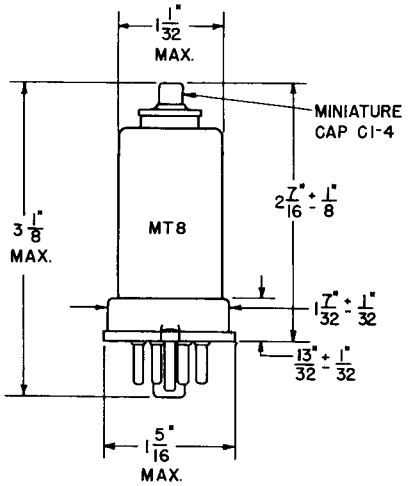
Principal Application: The 12K8 is a metal type triode-hexode converter designed to perform simultaneously the functions of mixer and oscillator in superheterodyne circuits, especially those of the all-wave type.

Cathode:	Coated Unipotential
Heater Voltage (A-C or D-C)	12.6 Volts
Heater Current	0.15 Ampere
Envelope:	Metal Shell, MT-8
Base:	B8-21 Small Wafer Octal 8-Pin
Base Material:	Phenolic
Mounting Position:	Any

Direct Interelectrode Capacitances:#

Hexode Grid Number 3 to Hexode Plate	0.03	μμf
Hexode Grid Number 3 to Triode Plate	0.02	μμf
Hexode Grid Number 3 to Triode Grid and Hexode Grid Number 1	0.2	μμf
Triode Grid and Hexode Grid Number 1 to Triode Plate	1.1	μμf
Triode Grid and Hexode Grid Number 1 to Hexode Plate	0.1	μμf
Hexode Grid Number 3 to All Other Electrodes (R-F Input)	6.6	μμf
Triode Plate to All Other Electrodes Except Triode Grid and Hexode Grid Number 1 (Oscillator Output)	3.2	μμf
Triode Grid and Hexode Grid Number 1 to All Other Electrodes Except Triode Plate (Oscillator Input)	6.0	μμf
Hexode Plate to All Other Electrode (Mixer Output)	3.5	μμf

PHYSICAL DIMENSIONS

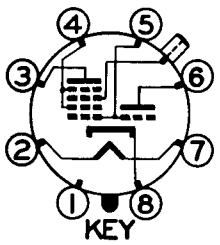


RMA 8-2

TERMINAL CONNECTIONS

Pin 1 - Shield
Pin 2 - Heater
Pin 3 - Hexode Plate
Pin 4 - Hexode Grids Number 2 and Number 4
Pin 5 - Hexode Grid Number 1 and Triode Grid
Pin 6 - Triode Plate
Pin 7 - Heater
Pin 8 - Cathode
Cap - Hexode Grid Number 3

BASING DIAGRAM



RMA 8K
BOTTOM VIEW

MAXIMUM RATINGS

	Design Center	Absolute	
Hexode Plate Voltage	300	330	Volts
Hexode Screen (Grids Number 2 and Number 4)	150	165	Volts
Hexode Screen Supply Voltage	300	330	Volts
Hexode Control-Grid (Grid Number 3) Voltage	Never Positive		
Triode Plate Voltage	125	138	Volts
Hexode Screen Dissipation	0.7	0.77	Watt
Hexode Plate Dissipation	0.75	0.83	Watt
Triode Plate Dissipation	0.75	0.83	Watt
Total Cathode Current	16	18	Milliamperes

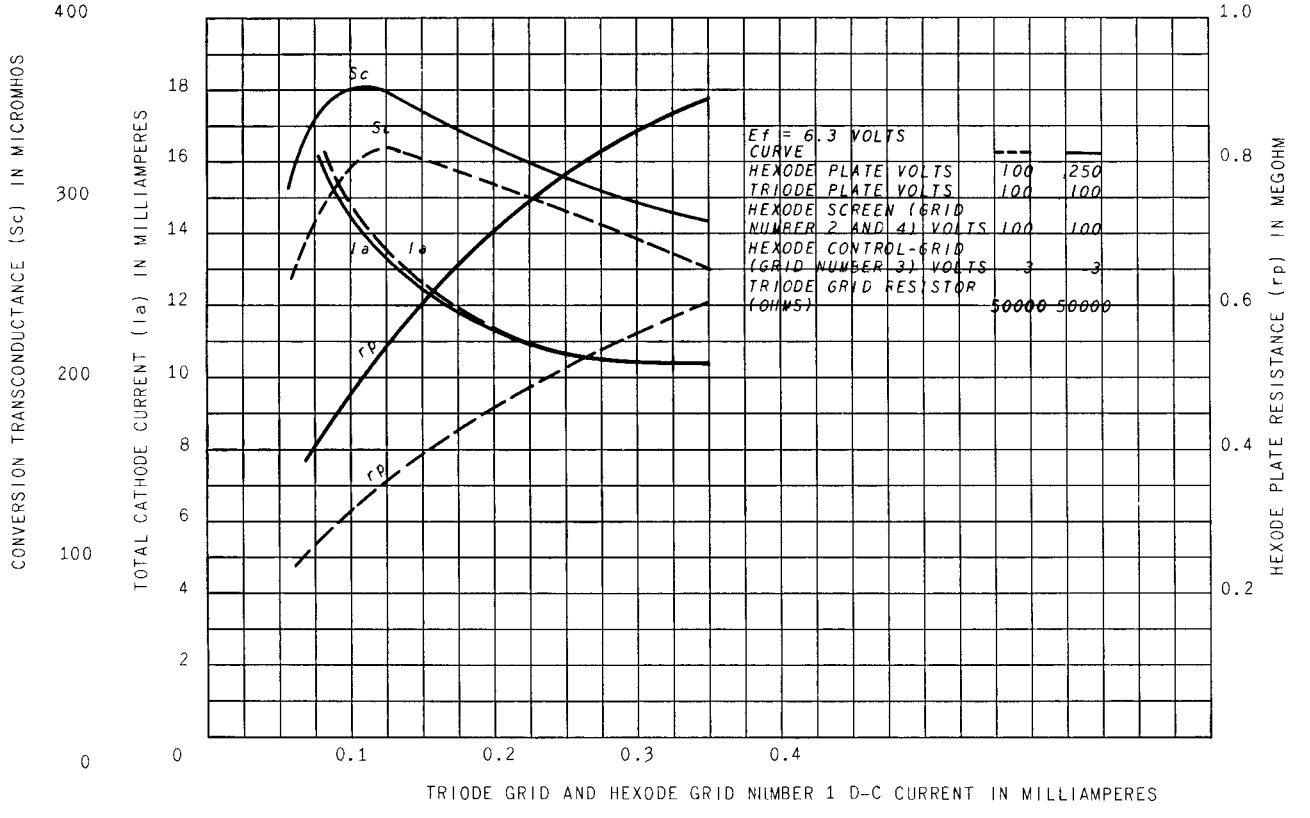
CHARACTERISTICS AND TYPICAL OPERATION

CONVERTER SERVICE

Hexode Plate Voltage	100	250	Volts
Hexode Screen Voltage	100	100	Volts
Hexode Control-Grid Voltage	-3	-3	Volts
Triode Plate Voltage	100	100	Volts
Triode Grid Resistor	50000	50000	Ohms
Hexode Plate Resistance (Approximate)	0.4	0.6	Megohm
Conversion Transconductance	325	350	Micromhos
Conversion Transconductance with Hexode Grid Number 3 Bias -30 Volts (Approximate)	2	2	Micromhos
Hexode Plate Current	2.3	2.5	Milliamperes
Hexode Screen Current	6.2	6.0	Milliamperes
Triode Plate Current	3.8	3.8	Milliamperes
Triode Grid and Hexode Grid Number 1 Current	0.15	0.15	Milliamperes
Total Cathode Current	12.5	12.5	Milliamperes

 # With shell connected to cathode.

OPERATION CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

CATHODE-RAY TUBE

12KP4

Description and Rating

TELEVISION PICTURE TUBE

The 12KP4 is a magnetic focus and deflection direct-view picture tube for television applications. It provides a 7½ x 10-inch picture. Other features of this tube are a reflective metal-backed screen which prevents ion-spot blemishes and gives improved brightness, picture contrast, and detail, and an outside conductive coating which, when grounded, serves as a filter capacitor.

GENERAL CHARACTERISTICS

ELECTRICAL:

Heater Voltage	6.3 ± 10%	Volts
Heater Current	0.6 ± 10%	Ampere
Focusing Method	Magnetic	
Deflecting Method	Magnetic	
Deflecting Angle, Approximate	54	Degrees
Phosphor - P4		
Fluorescence	White	
Persistence	Medium	
Direct Interelectrode Capacitances, Approximate		
Cathode to All Other Electrodes	5	μμf
Grid No.1 to All Other Electrodes	6.5	μμf
External Conductive Coating to Anode Capacitance	2500 Max.	μμf
	500 Min.	μμf

MECHANICAL:

Overall Length	17 5/8 ± 3/8	Inches
Greatest Diameter of Bulb	12 7/16 ± 1/8	Inches
Minimum Useful Screen Diameter	11	Inches
Bulb Contact	J1-21 Recessed Small-Cavity Cap	
Base	Small-Shell Duodecal 7-Pin	
Basing	12D	
Bulb Contact Alignment	Anode Contact Aligns with Pin No.3 ± 10 Degrees	

MAXIMUM RATINGS

DESIGN CENTER VALUES:

Anode Voltage	12000 Max	Volts D-C
Grid No.2 Voltage	410 Max	Volts D-C
Grid No.1 Voltage		
Negative-Bias Value	125 Max	Volts D-C
Positive-Bias Value	0 Max	Volts D-C
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage *		
Heater Negative with Respect to Cathode	140 Max	Volts D-C
Heater Positive with Respect to Cathode	140 Max	Volts D-C

** Cathode should be returned to one side or to the mid-tap of the heater transformer winding.*

TYPICAL OPERATING CONDITIONS

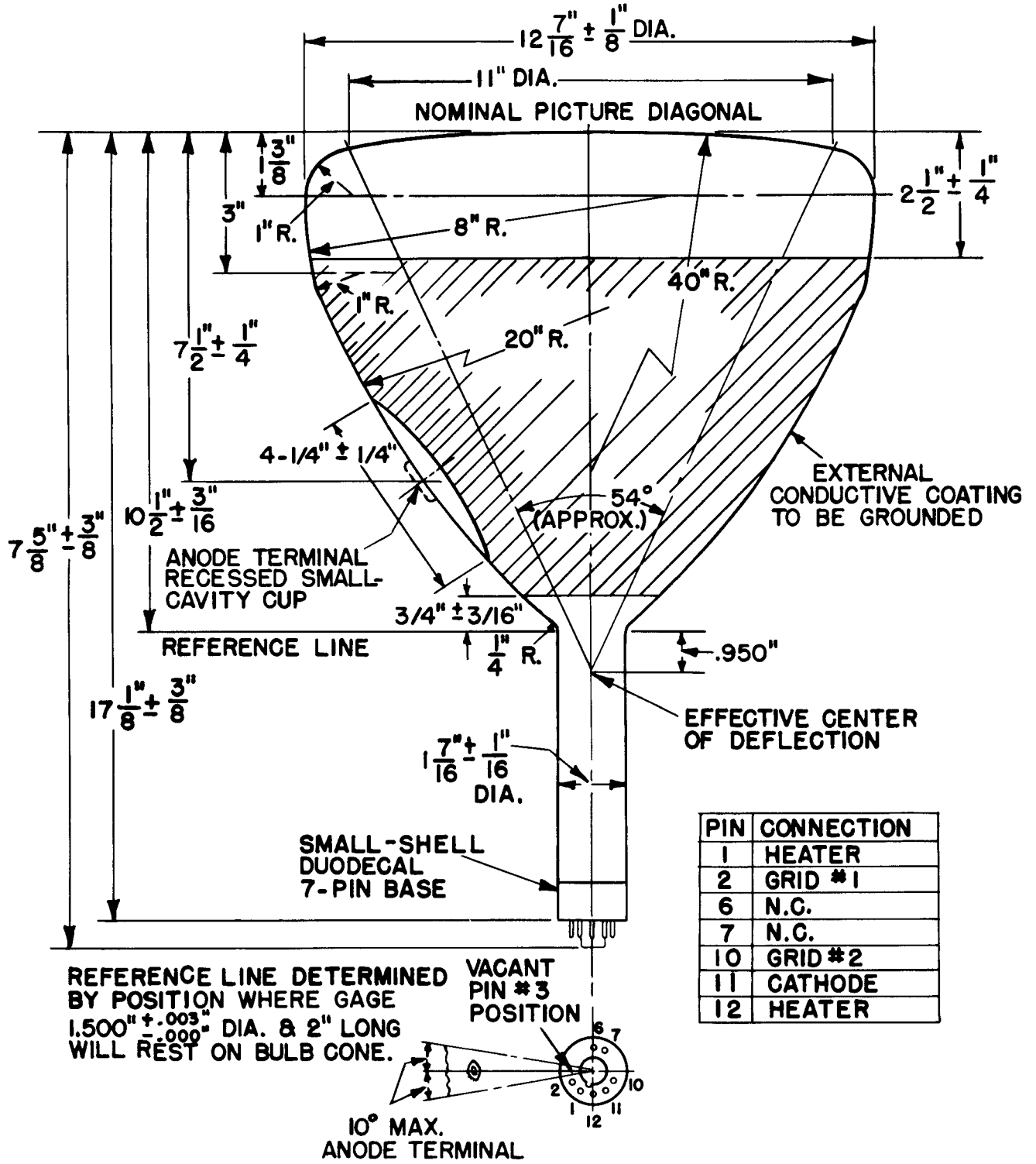
Anode Voltage	10000	Volts D-C
Grid No.2 Voltage	250	Volts D-C
Grid No.1 Voltage **	-27 to -63	Volts D-C
Focusing Coil Current #	135 Approx.	Milliamperes D-C
Spot Position (Undeflected)	20 Max	Millimeters

*** Visual extinction of undeflected focused spot.*

 # For standard focus coil or equivalent, with the combined grid No.1-bias voltage and video-signal voltage adjusted to produce a high-light brightness of 20 foot-lamberts on a 7½ x 10-inch picture area. Distance (D), reference line to center of air-gap, shall be 3 1/4 inches.

MAXIMUM CIRCUIT VALUES

Grid No.1 Circuit Resistance	1.5 Max	Megohms



PIN	CONNECTION
1	HEATER
2	GRID #1
6	N.C.
7	N.C.
10	GRID #2
11	CATHODE
12	HEATER

OUTLINE
12KP4

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

ET-T531
3-48

Electronic TUBES

12KP4-A

CATHODE-RAY TUBE

12-INCH ROUND, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
54-DEGREE DEFLECTION ANGLE

11¼- BY 8½-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ALUMINIZED SCREEN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 12KP4-A is a magnetic-focus and deflection, direct-view all-glass picture tube which provides a 11¼- by 8½-inch picture with rounded sides for television applications. The electron gun does not require an external ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions and a reflective aluminized screen to increase light output. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate	54	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	2500	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	66	Percent

GENERAL ELECTRIC

Supersedes ET-T701 dated 12-49

MECHANICAL

Over-all Length	$17\frac{5}{8} \pm \frac{3}{8}$	Inches
Greatest Bulb Diameter	$12\frac{7}{16} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Diameter	$11\frac{1}{4}$	Inches
Neck Length	$7\frac{1}{8}$	Inches

Bulb Number, ASA Designation—J99½A1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5–57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 3 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	11½	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	12,000 Max	Volts DC
Grid-No. 2 Voltage	410 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	140 Max	Volts
Heater Positive with Respect to Cathode	140 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	11,000	Volts DC
Grid-No. 2 Voltage	250	Volts DC
Grid-No. 1 Voltageπ	−22 to −58	Volts DC
Focusing Coil Current▲, approximate	135	Milliamperes DC

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

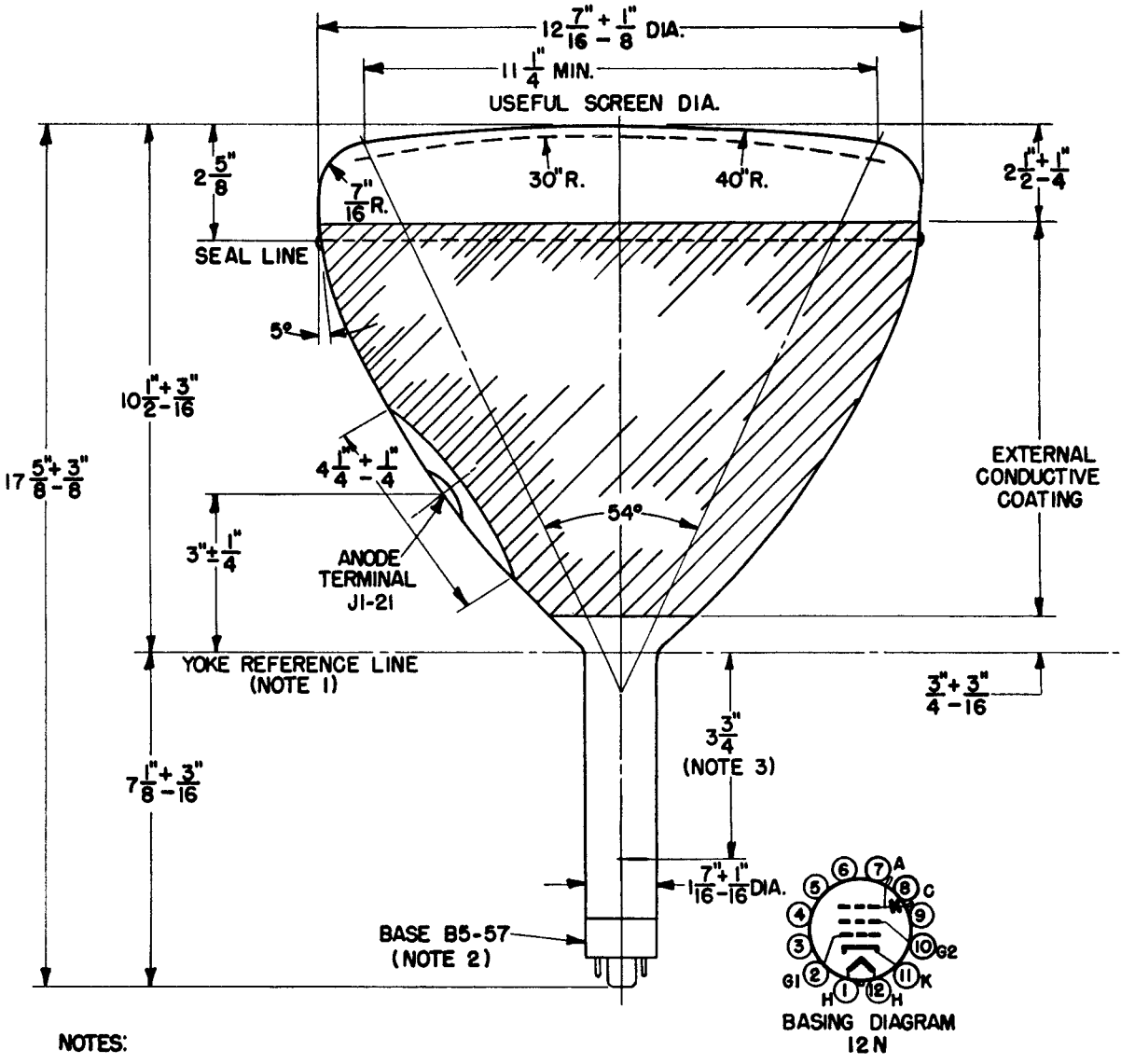
† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

‡ Cathode should be returned to one side or to the midtap of the heater transformer winding.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 9000 volts.

π For visual extinction of focused raster.

▲For JETEC focusing coil No. 106 with distance from the yoke-reference-line to center-of-air-gap equal to 3¼ inches.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 112) WHEN THE GAGE IS RESTING ON THE CONE.
2. ANODE TERMINAL ALIGNS WITH PIN-NO. 3 POSITION ±30 DEGREES.
3. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.

Electronic TUBES

12LP4-A

CATHODE-RAY TUBE

12-INCH ROUND, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
54-DEGREE DEFLECTION ANGLE
11¼- BY 8½-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 12LP4-A is a magnetic-focus and deflection, direct-view all-glass picture tube which provides a 11¼- by 8½-inch picture with rounded sides for television applications. The electron gun is used with an external double-field ion-trap magnet. Other features of this tube include a high-quality gray faceplace which increases picture contrast and detail under high-ambient-light conditions. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate	54	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	3000	μμf
Minimum	750	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	66	Percent

GENERAL ELECTRIC

Supersedes ETR-116 dated 8-51

MECHANICAL

Over-all Length	$18\frac{3}{4} \pm \frac{3}{8}$	Inches
Greatest Bulb Diameter	$12\frac{7}{16} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Diameter	$11\frac{1}{4}$	Inches
Neck Length	$8\frac{1}{4}$	Inches

Bulb Number, ASA Designation—J99½A1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 3 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	$11\frac{3}{4}$	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	12,000 Max	Volts DC
Grid-No. 2 Voltage	410 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	140 Max	Volts
Heater Positive with Respect to Cathode	140 Max	Volts

TYPICAL OPERATING CONDITIONS

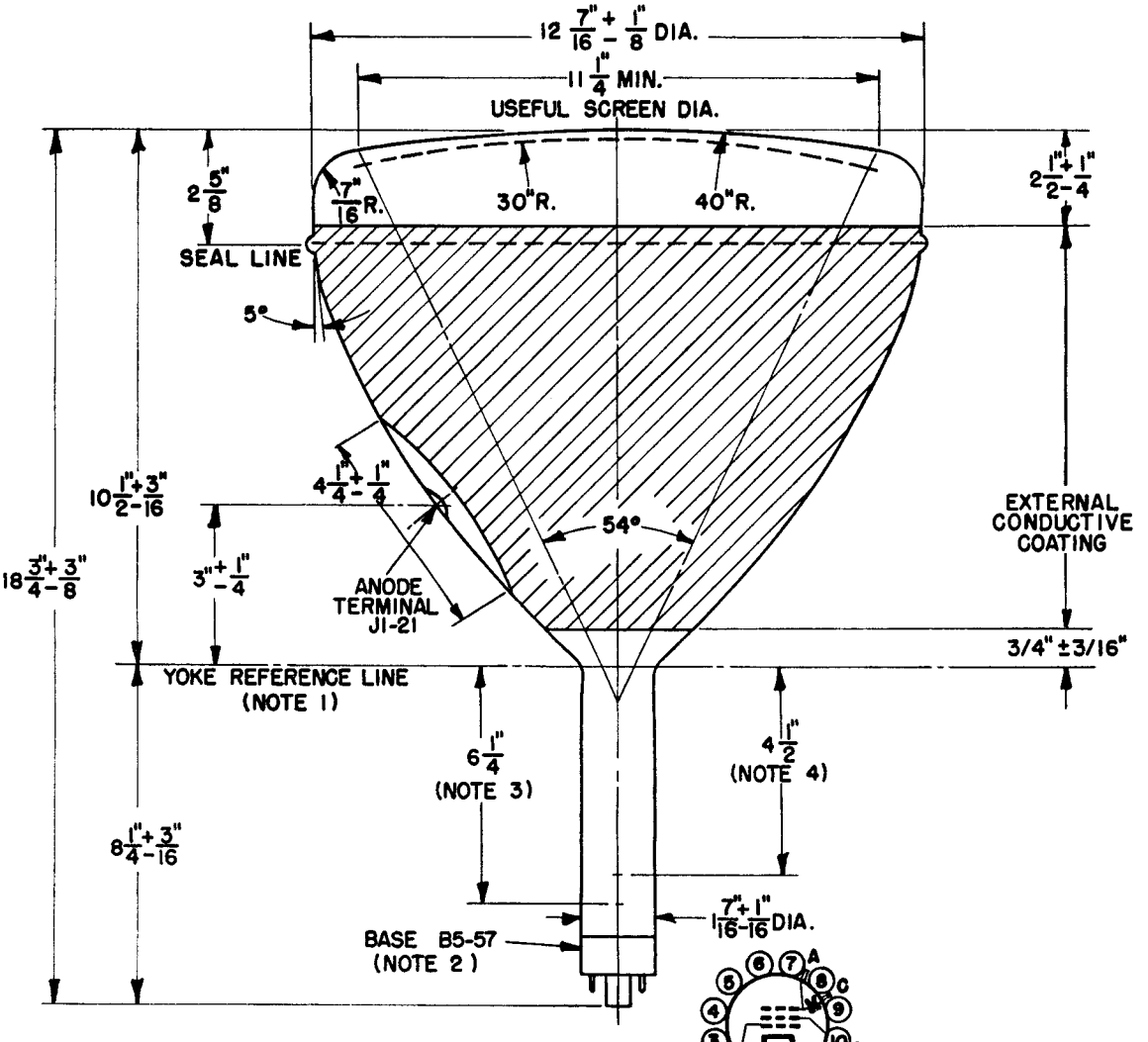
Anode Voltage§	11,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	96	Milliamperes DC
Ion-Trap Field Intensity♦, approximate	35	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.
† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.
‡ Cathode should be returned to one side or to the midtap of the heater transformer winding.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 8000 volts.
π For visual extinction of focused raster.
▲For JETEC focusing coil No. 106 with distance from the yoke-reference-line to center-of-air-gap equal to 4½ inches.
♦ Double-field ion-trap magnet adjusted to optimum position, equivalent to 120 miliamperes through JETEC ion-trap magnet No. 108.



NOTES:
1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 112) WHEN THE GAGE IS RESTING ON THE CONE.
2. ANODE TERMINAL ALIGNS WITH PIN-NO. 3 POSITION ± 30 DEGREES.
3. APPROXIMATE POSITION OF ION-TRAP MAGNET.
4. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.

Electronic TUBES

12R5

PENTODE

FOR TV VERTICAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 12R5 is a miniature beam pentode primarily designed for use as a pentode-connected vertical-deflection amplifier in television receivers. The tube features high zero-bias plate current at relatively low plate and screen voltages. In addition, a controlled heater warm-up characteristic makes it especially suited for use in television receivers with series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	12.6	Volts
Heater Current	0.6	Amperes
Heater Warm-up Time*	11	Seconds
Direct Interelectrode Capacitances†		
Grid-Number 1 to Plate	0.55	μμf
Input	13	μμf
Output	9.0	μμf

MECHANICAL

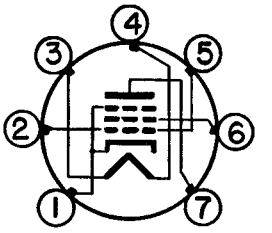
Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

VERTICAL-DEFLECTION AMPLIFIER SERVICE‡
DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

DC Plate Voltage	150	Volts
Peak Pulse Plate Voltage	1500§	Volts
Screen Voltage	150	Volts
Peak Negative Grid-Number 1 Voltage	150	Volts
Plate Dissipation△	4.5	Watts
Screen Dissipation	1.0	Watts
DC Cathode Current	45	Milliamperes
Peak Cathode Current	155	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	300	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	2.2	Megohms

BASING DIAGRAM

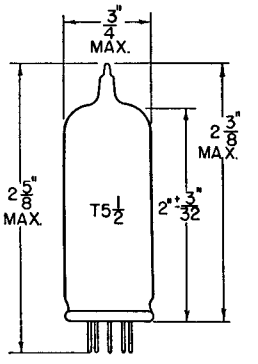


EIA 7CV

TERMINAL CONNECTIONS

Pin 1—Cathode and Beam Plates
Pin 2—Grid Number 1
Pin 3—Heater
Pin 4—Heater
Pin 5—Grid Number 1
Pin 6—Grid Number 2 (Screen)
Pin 7—Plate

PHYSICAL DIMENSIONS



EIA 5-3

GENERAL ELECTRIC

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	45	110	Volts
Suppressor, Connected to Cathode at Socket			
Screen Voltage	110	110	Volts
Grid-Number 1 Voltage	0¶	−8.5	Volts
Plate Resistance, approximate		13000	Ohms
Transconductance		7000	Micromhos
Plate Current	120	40	Milliamperes
Screen Current	17	3.3	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 0.5 Milliamperes		−22	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

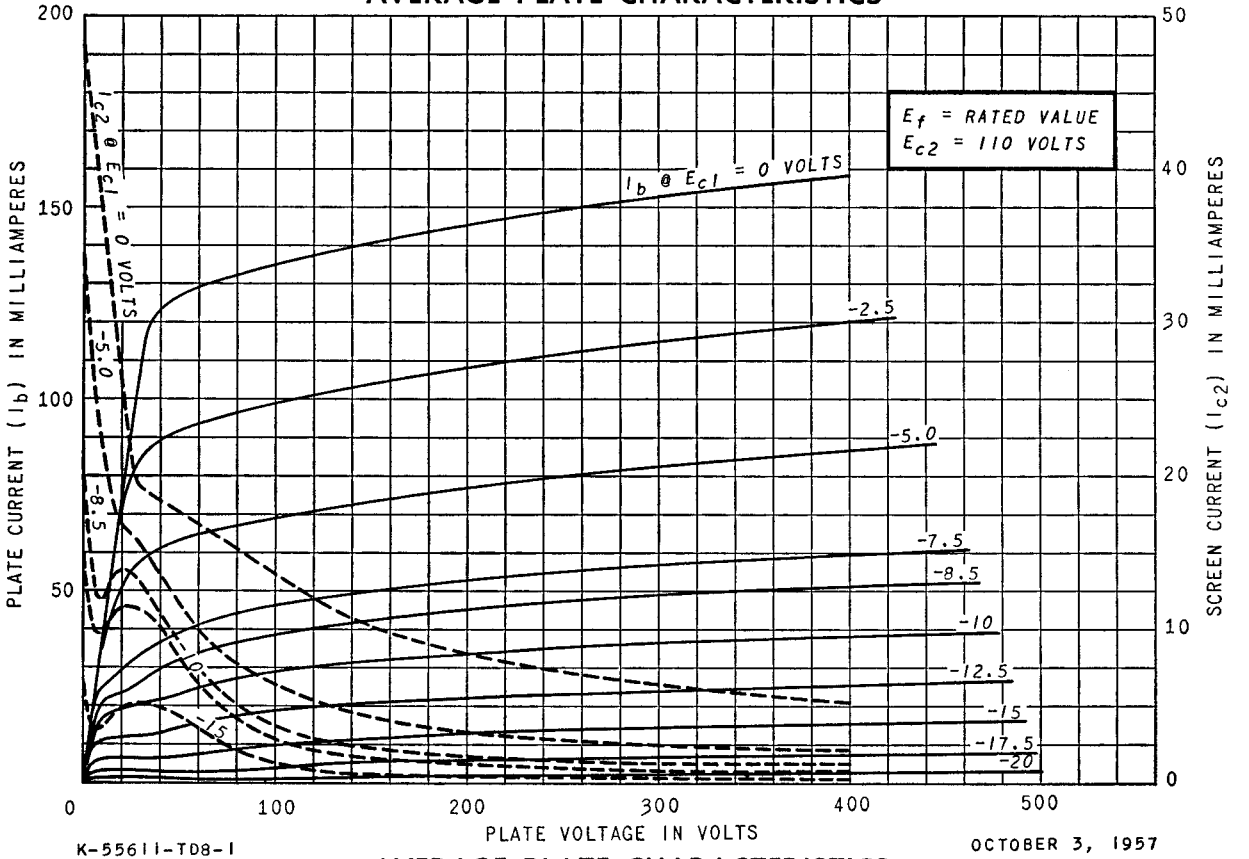
‡ For operation in 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

△In stages operating with grid-leak bias, an adequate cathode bias-resistor or other suitable means is required to protect the tube in the absence of excitation.

¶ Applied for short interval (2 seconds maximum) so as not to damage tube.

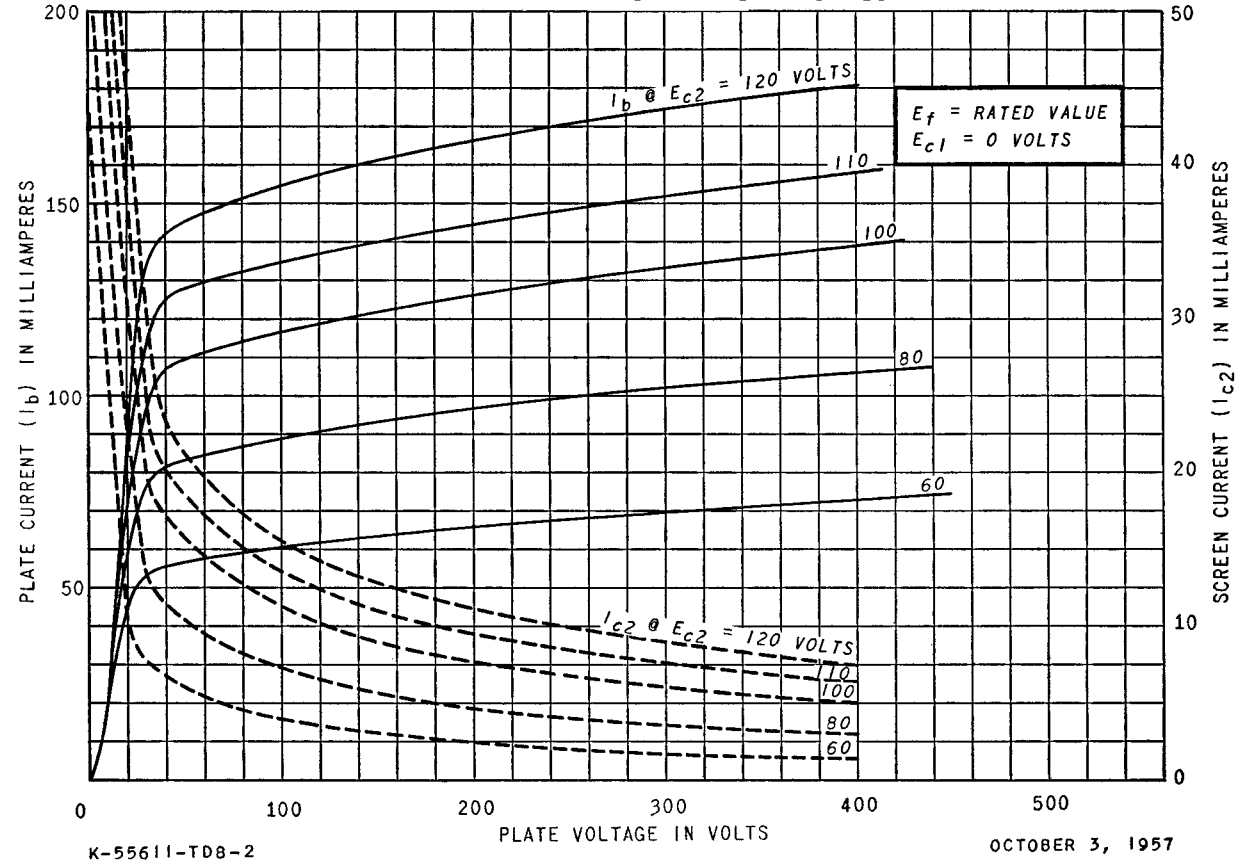
AVERAGE PLATE CHARACTERISTICS



K-55611-TD8-1

OCTOBER 3, 1957

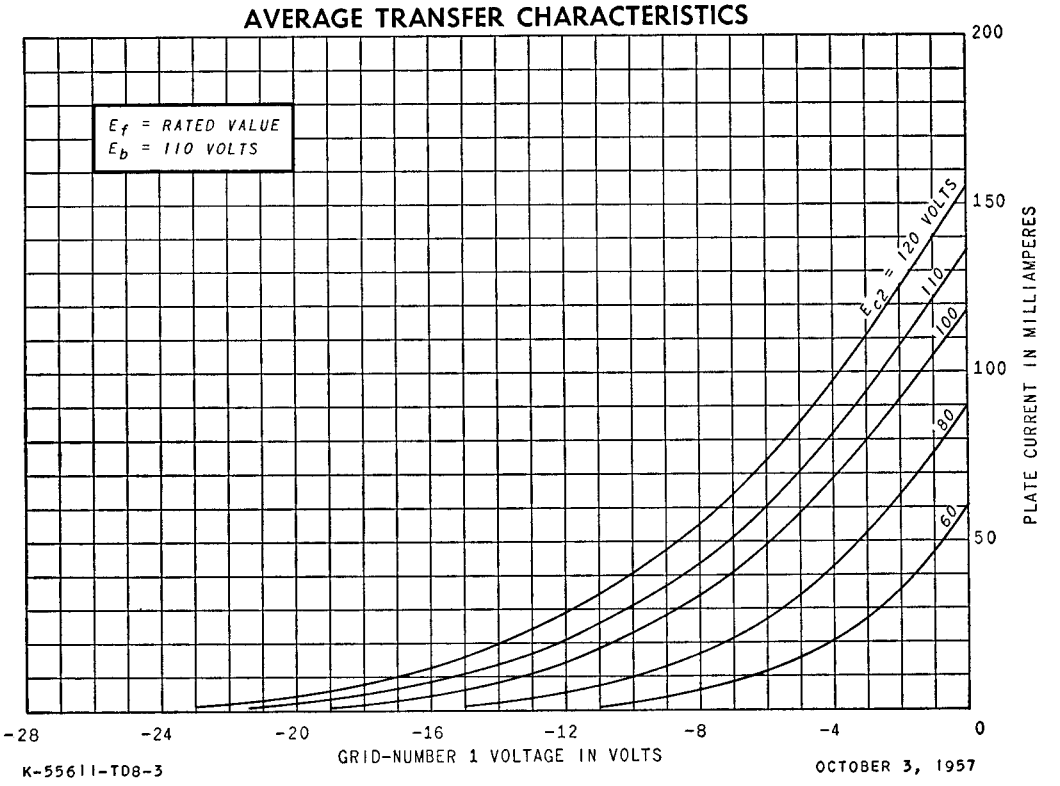
AVERAGE PLATE CHARACTERISTICS



K-55611-TD8-2

OCTOBER 3, 1957

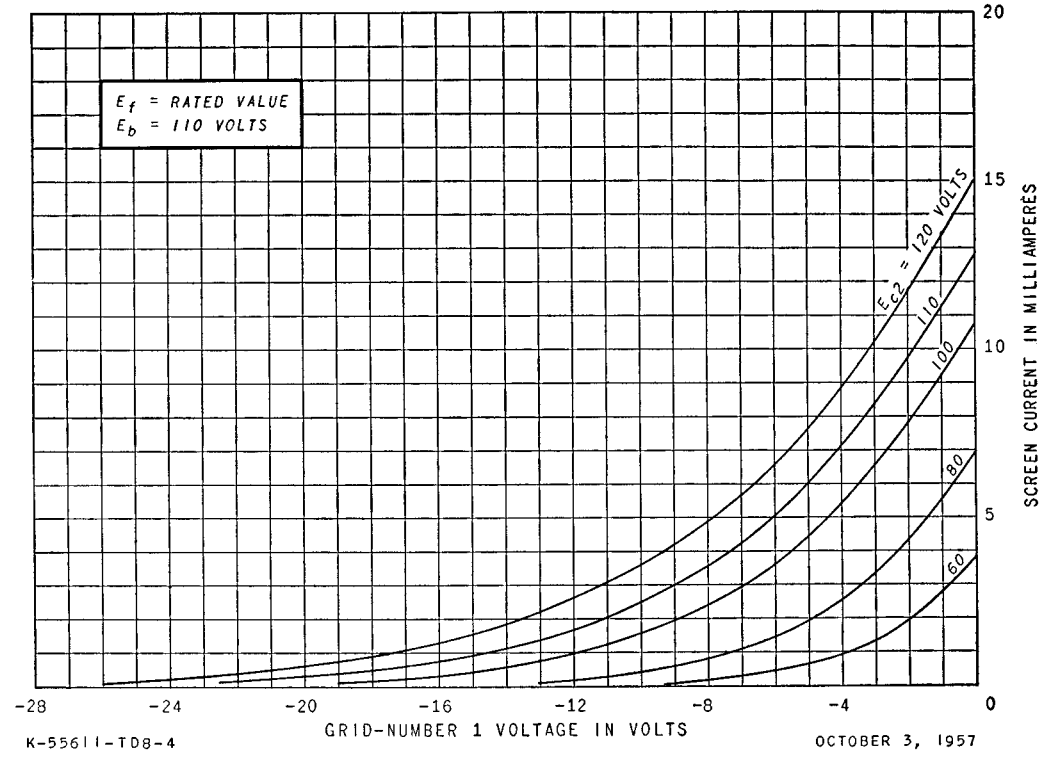
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD8-3

OCTOBER 3, 1957

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD8-4

OCTOBER 3, 1957

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBE
K KEN-RAD

12SF5

Description and Rating

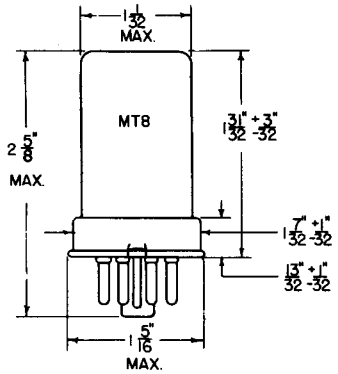
HIGH-MU TRIODE AMPLIFIER

GENERAL DESCRIPTION

Principal Application: The 12SF5 is a heater-cathode type high-mu triode designed for service as a high gain audio-frequency amplifier and is especially useful in resistance-coupled amplifier circuits in a-c/d-c or battery operated equipment. Except for heater rating the 12SF5 and 6SF5 are identical.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	12.6 Volts
Heater Current	0.15 Ampere
Envelope	MT-8 Metal Shell
Base	B6-23 Small Wafer Octal 6-Pin Phenolic
Mounting Position	Any
Direct Interelectrode Capacitances: *	
Grid to Plate	2.4 μμf
Input	4.0 μμf
Output	3.6 μμf

PHYSICAL DIMENSIONS

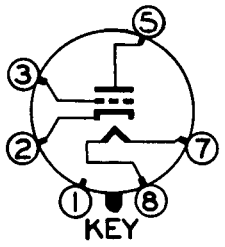


RMA 8-1

TERMINAL CONNECTIONS

Pin 1 - Metal Shell
Pin 2 - Cathode
Pin 3 - Grid
Pin 5 - Plate
Pin 7 - Heater
Pin 8 - Heater

BASING DIAGRAM



RMA 6AB
BOTTOM VIEW

MAXIMUM RATINGS

	Design Center	Absolute	
Plate Voltage	300	330	Volts
D-C Heater-Cathode Voltage	90	100	Volts

CHARACTERISTICS AND TYPICAL OPERATION

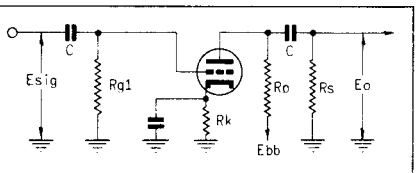
CLASS A AMPLIFIER

Heater Voltage	12.6	12.6	Volts
Plate Voltage	100	250	Volts
Grid Bias Voltage	-1	-2	Volts
Amplification Factor	100	100	
Plate Resistance	85000	66000	Ohms
Transconductance	1150	1500	Micromhos
Plate Current	0.4	0.9	Milliampere

** Approximate values with metal shell connected to cathode.*

CLASS A RESISTANCE-COUPLED AMPLIFIER

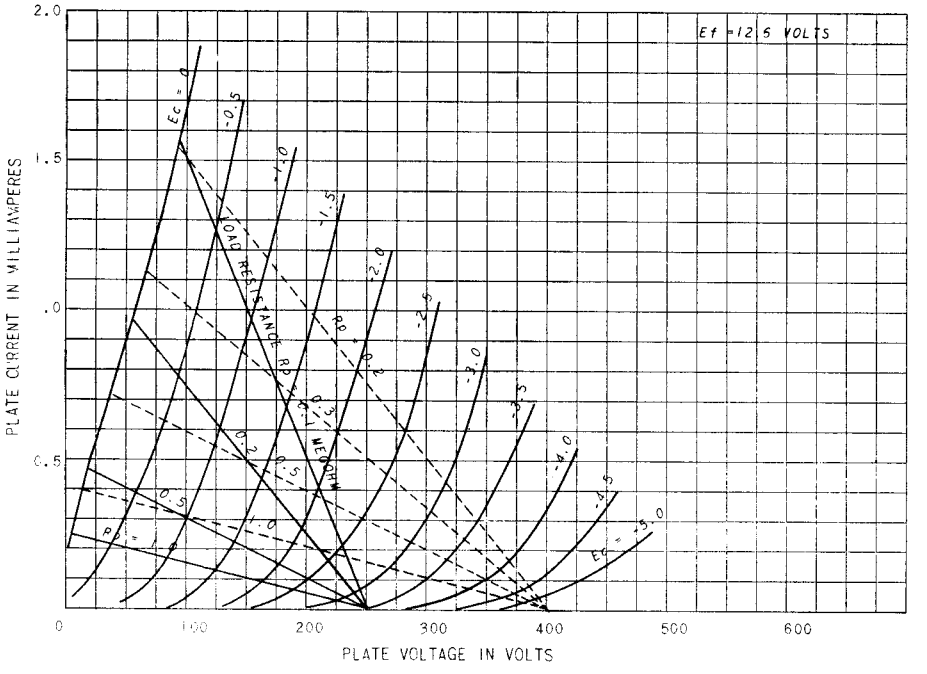
Rp Meg.	Rgl Meg.	Rs Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	*	0.10	4300	26	5	2000	36	18	1300	40	37
0.10	*	0.24	4700	33	8	2200	43	26	1500	47	48
0.24	*	0.24	8200	37	10	3900	50	24	2400	54	45
0.24	*	0.51	9100	42	11	4300	54	29	3000	62	56
0.51	*	0.51	12000	46	12	6200	59	29	4300	66	55
0.51	*	1.0	13000	50	13	6800	63	36	5100	71	66
0.24	10	0.24	---	40	4	---	53	16	---	62	34
0.24	10	0.51	---	48	6	---	62	22	---	68	44
0.51	10	0.51	---	49	6	---	64	19	---	71	41
0.51	10	1.0	---	53	9	---	68	25	---	77	50



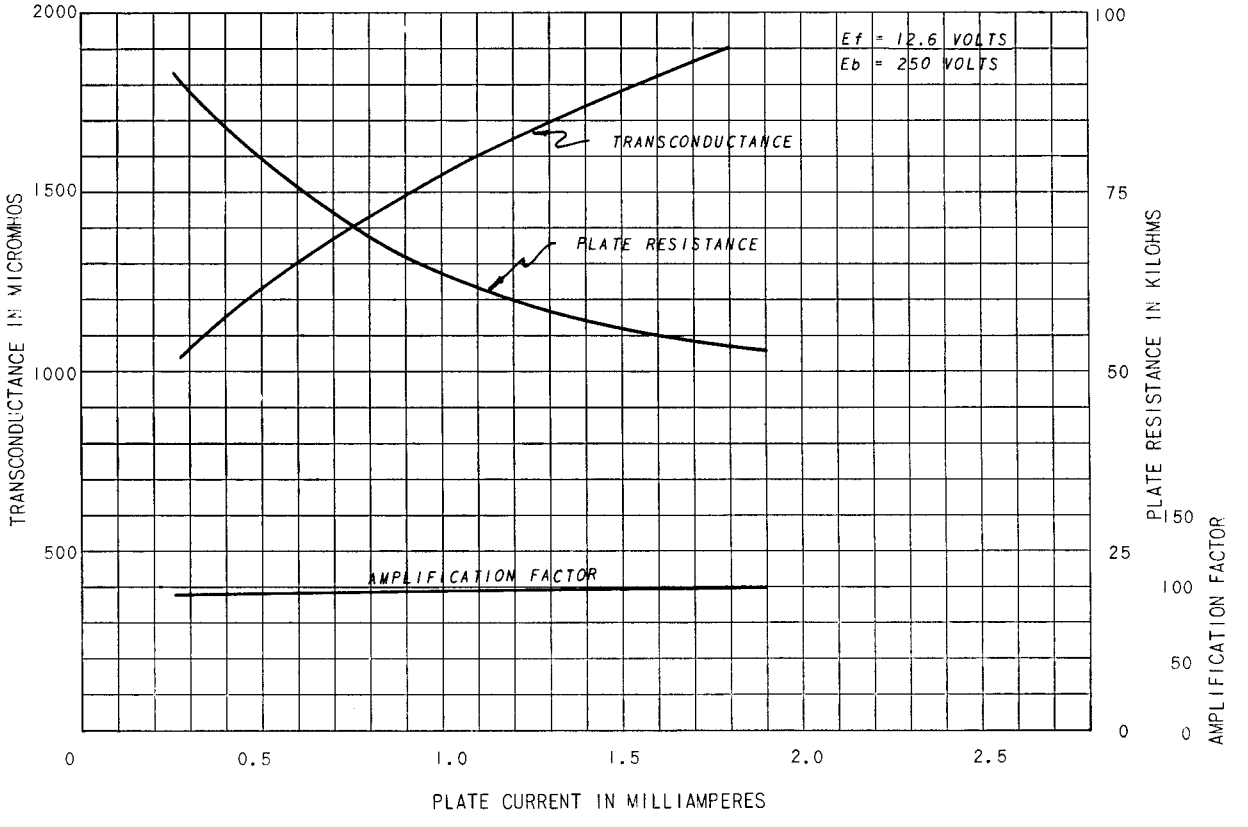
Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data generator impedence is negligible. *Value of Rgl is non-critical.

AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



Electronic TUBE
K KEN-RAD

12SG7
Description and Rating

RADIO-FREQUENCY-AMPLIFIER PENTODE

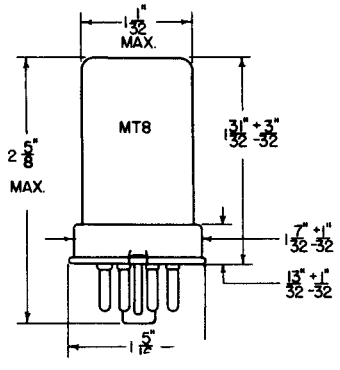
GENERAL DESCRIPTION

Principal Application: The type 12SG7 is a semi-remote cut-off amplifier pentode designed for use as a high gain radio-frequency or intermediate-frequency amplifier. The dual cathode connection provides a method for reducing undesirable coupling between cathode circuits.

Cathode:	Coated Unipotential
Heater Voltage (A-C or D-C)	12.6 Volts
Heater Current	0.15 Ampere
Envelope:	MT-8 Metal Shell
Base:	B8-21 Small Wafer Octal 8-Pin, Phenolic

Mounting Position:	Any	
Direct Interelectrode Capacitances: *		
Grid to Plate (Max)	0.003	µµf
Input	8.5	µµf
Output	7.0	µµf

PHYSICAL DIMENSIONS

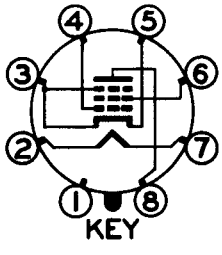


RMA 8-1

TERMINAL CONNECTIONS

Pin 1 - Shell and Internal Shield
Pin 2 - Heater
Pin 3 - Cathode and Grid Number 3
Pin 4 - Grid Number 1
Pin 5 - Cathode
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Heater
Pin 8 - Plate

BASING DIAGRAM



RMA 8BK
BOTTOM VIEW

MAXIMUM RATINGS

	Design Center	Absolute	
Plate Voltage	300	330	Volts
Screen (Grid Number 2) Voltage	200	220	Volts
Screen Supply Voltage	300	330	Volts
Control Grid Bias Voltage	Never Positive		
Plate Dissipation	3.0	3.3	Watts
Screen Dissipation	0.60	0.66	Watt
D-C Heater-Cathode Voltage	90	100	Volts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A AMPLIFIER

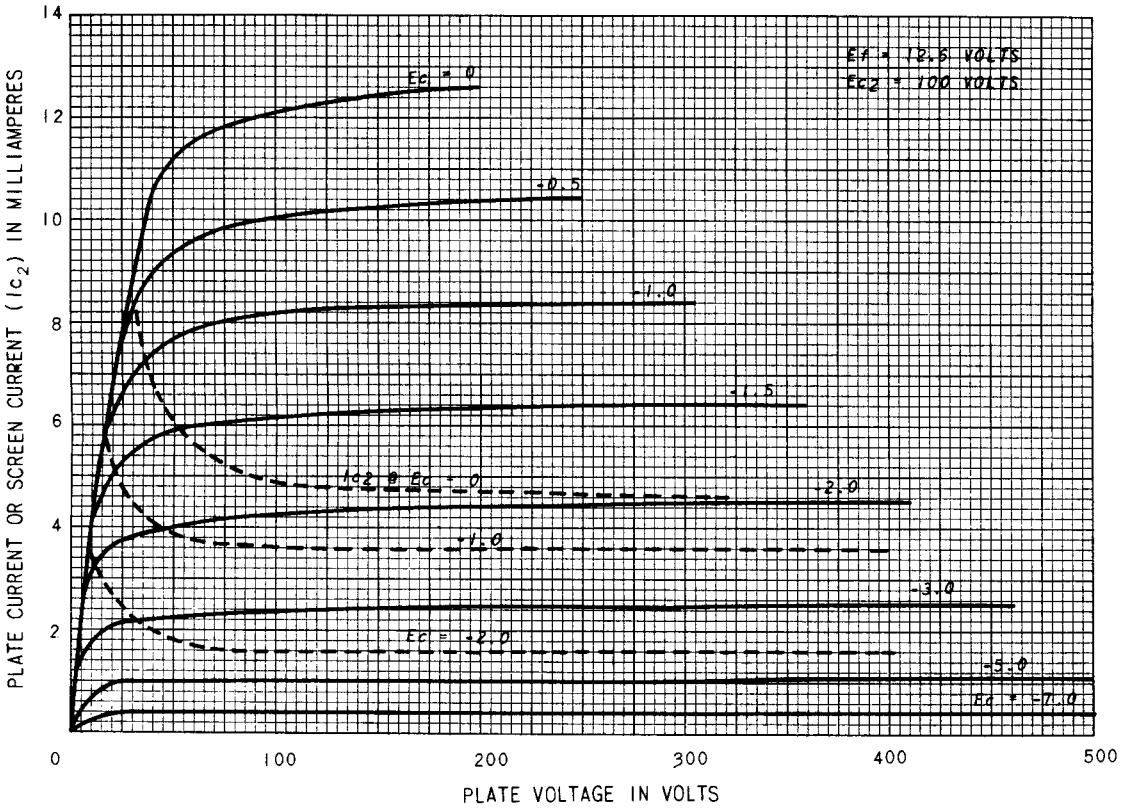
Heater Voltage	12.6	12.6	12.6	Volts
Plate Voltage	100	250	250	Volts
Screen (Grid Number 2) Voltage	100	125	250	Volts
Grid Bias Voltage	-1	-1	-2.5	Volts
Plate Resistance (Approx)	0.25	0.9	>1.0	Megohm
Transconductance	4100	4700	4000	Micromhos
Grid Bias Voltage °	-11.5	-14	-17.5	Volts
Plate Current	8.2	11.8	9.2	Milliamperes
Screen Current	3.2	4.4	3.4	Milliamperes

(For notes see page 2)

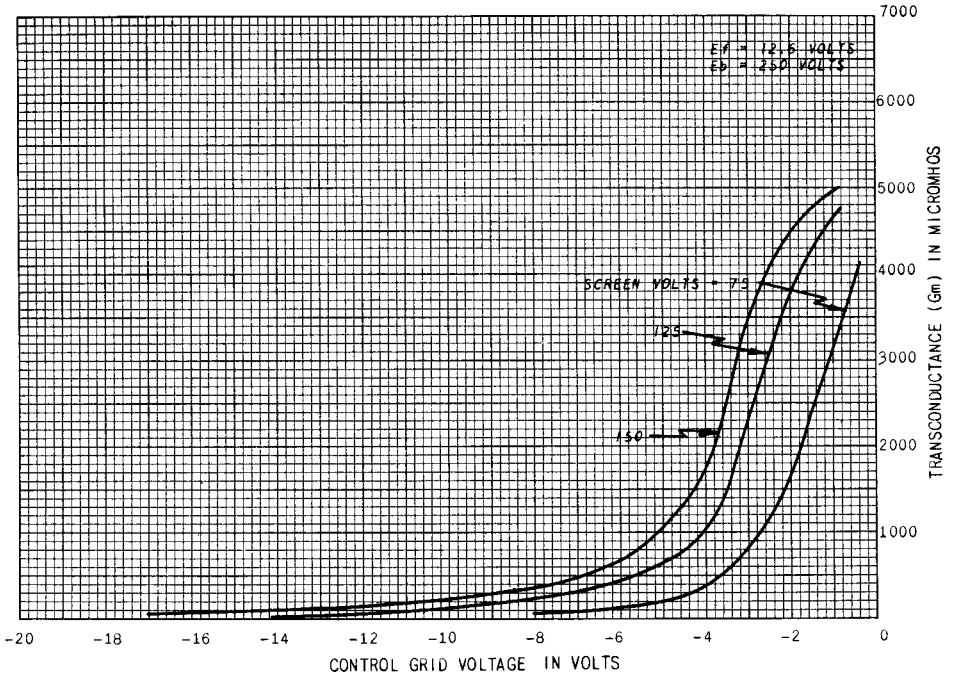
* *Measured with shell and internal shield connected.*

o *Approximate values for transconductance of 40 micromhos.*

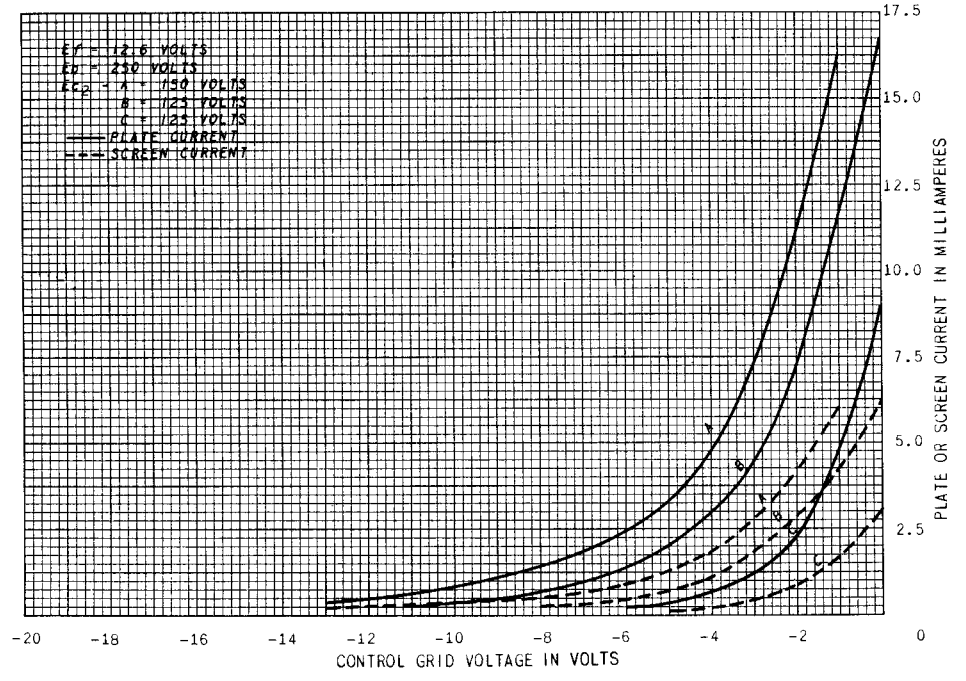
AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



AVERAGE CHARACTERISTICS



Electronic TUBES

12SJ7

Description and Rating

RADIO-FREQUENCY-AMPLIFIER PENTODE

GENERAL DESCRIPTION

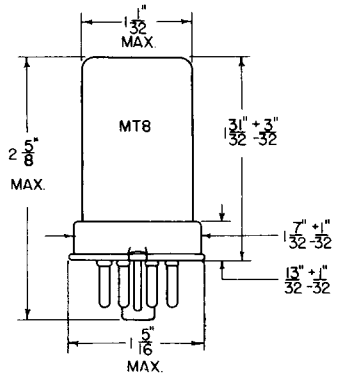
Principal Application: The type 12SJ7 is a sharp cut-off amplifier pentode designed for use as a biased detector or high-gain amplifier. As a biased detector the 12SJ7 is capable of delivering a large audio-frequency output voltage of good quality with a fairly small radio-frequency signal input.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	12.6 Volts
Heater Current	0.15 Ampere
Envelope	MT-8 Metal Shell
Base	B8-21 Small Wafer Octal 8-Pin Phenolic
Mounting Position	Any

Direct Interelectrode Capacitances: *

Pentode Connection		
Grid to Plate (Max)	0.005	µµf
Input	6.0	µµf
Output	7.0	µµf
Triode Connection §		
Grid to Plate	2.8	µµf
Grid to Cathode	3.4	µµf
Plate to Cathode	11	µµf

PHYSICAL DIMENSIONS

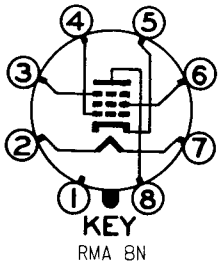


RMA 8-1

TERMINAL CONNECTIONS

Pin 1 - Shell and Internal Shield
Pin 2 - Heater
Pin 3 - Grid Number 3 (Suppressor)
Pin 4 - Grid Number 1
Pin 5 - Cathode
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Heater
Pin 8 - Plate

BASING DIAGRAM



RMA 8N
BOTTOM VIEW

MAXIMUM RATINGS

	Pentode Connection Design Center	Pentode Connection Absolute	Triode Connection § Design Center	Triode Connection § Absolute	
Plate Voltage	300	330	250	275	Volts
Screen (Grid Number 2) Voltage	125	140	---	---	Volts
Screen Supply Voltage	300	330	---	---	Volts
Grid Bias Voltage	Never Positive		Never Positive		
Plate Dissipation	2.50	2.75	2.50	2.75	Watts
Screen Dissipation	0.40	0.44	---	---	Watt
D-C Heater-Cathode Voltage #	90	100	90	100	Volts

** Measured with shell and internal shield connected to cathode.*

§ With grid number 2 and grid number 3 connected to plate.

 # Direct connection between heater and cathode is recommended.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A AMPLIFIER - PENTODE CONNECTION

Heater Voltage	12.6	12.6	Volts
Plate Voltage	100	250	Volts
Screen Grid Voltage	100	100	Volts
Suppressor Grid Voltage [o]	0	0	Volt
Control Grid Bias Voltage **	-3	-3	Volts
Plate Resistance (Approx)	0.7	1.0	Megohm
Transconductance	1575	1650	Micromhos
Grid Bias Voltage ∝	-8	-8	Volts
Plate Current	2.9	3.0	Milliamperes
Screen Current	0.9	0.8	Milliampere

CLASS A AMPLIFIER - TRIODE CONNECTION §

Heater Voltage	12.6	12.6	Volts
Plate Voltage	180	250	Volts
Grid Bias Voltage **	-6	-8.5	Volts
Amplification Factor	19	19	
Plate Resistance	8250	7600	Ohms
Transconductance	2300	2500	Micromhos
Plate Current	6.0	9.2	Milliamperes

[o] *Connected to cathode at socket terminal.*

** *The d-c resistance in the grid circuit should not exceed 1.0 megohm under rated maximum conditions.*

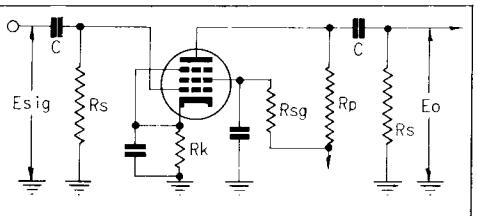
∝ *Approximate values for plate current of 10 microamperes.*

§ *With grid number 2 and grid number 3 connected to plate.*

CLASS A RESISTANCE-COUPLED AMPLIFIER

PENTODE CONNECTION

Rp Meg.	Rg1 Meg.	Rs Meg.	Ebb = 90 Volts				Ebb = 180 Volts				Ebb = 300 Volts			
			Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo
0.10	*	0.10	820	0.27	40	19	620	0.33	48	49	430	0.43	55	69
0.10	*	0.24	820	0.27	57	25	680	0.39	67	56	470	0.47	78	90
0.24	*	0.24	1600	0.68	72	20	910	0.75	95	40	750	0.91	108	82
0.24	*	0.51	1800	0.75	100	22	910	0.82	130	48	750	1.00	142	86
0.51	*	0.51	3600	1.50	95	21	1800	1.60	153	42	1200	2.00	182	70
0.51	*	1.0	3900	1.60	128	25	2000	1.80	200	50	1400	2.00	222	85
0.24	10	0.24	---	0.82	74	5.5	---	0.82	118	24	---	0.91	133	44
0.24	10	0.51	---	0.91	108	12	---	1.00	160	38	---	1.00	180	59
0.51	10	0.51	---	1.60	100	8.0	---	1.80	182	29	---	1.80	200	46
0.51	10	1.0	---	1.80	134	13	---	2.00	228	40	---	2.00	256	60

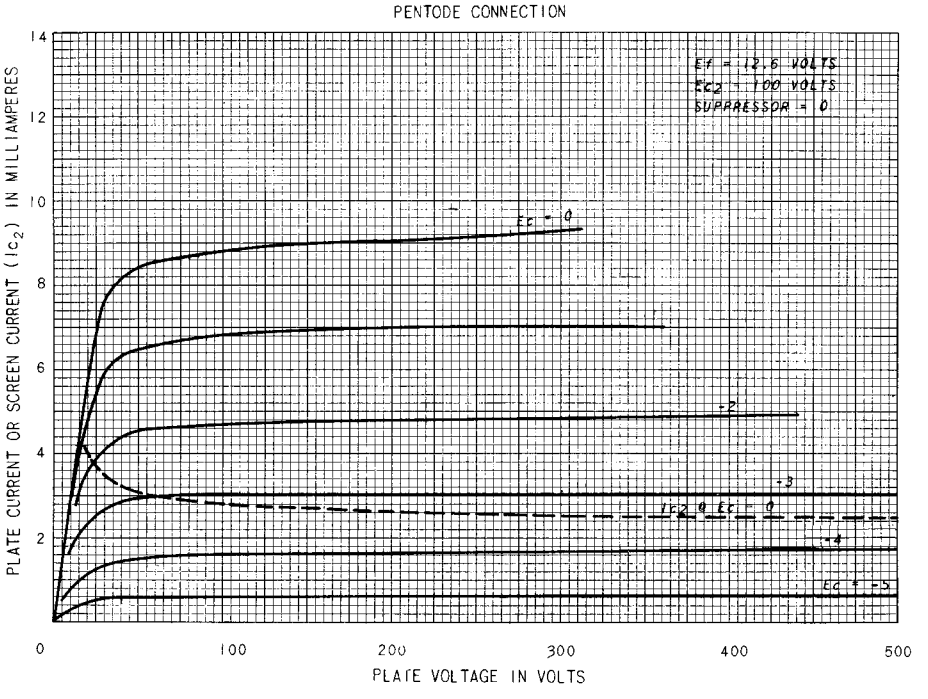


Note: Coupling capacitors (C) should be adjusted to give desired frequency response. Rk and Rsg should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data generator impedance is negligible. * Value of Rg1 is non-critical.

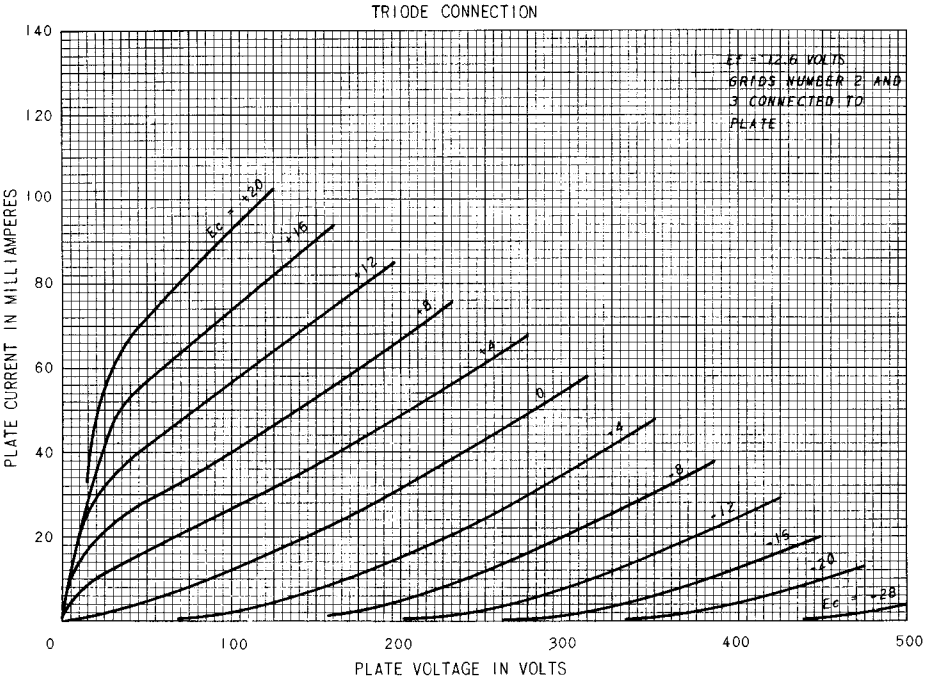
AVERAGE PLATE CHARACTERISTICS

PENTODE CONNECTION

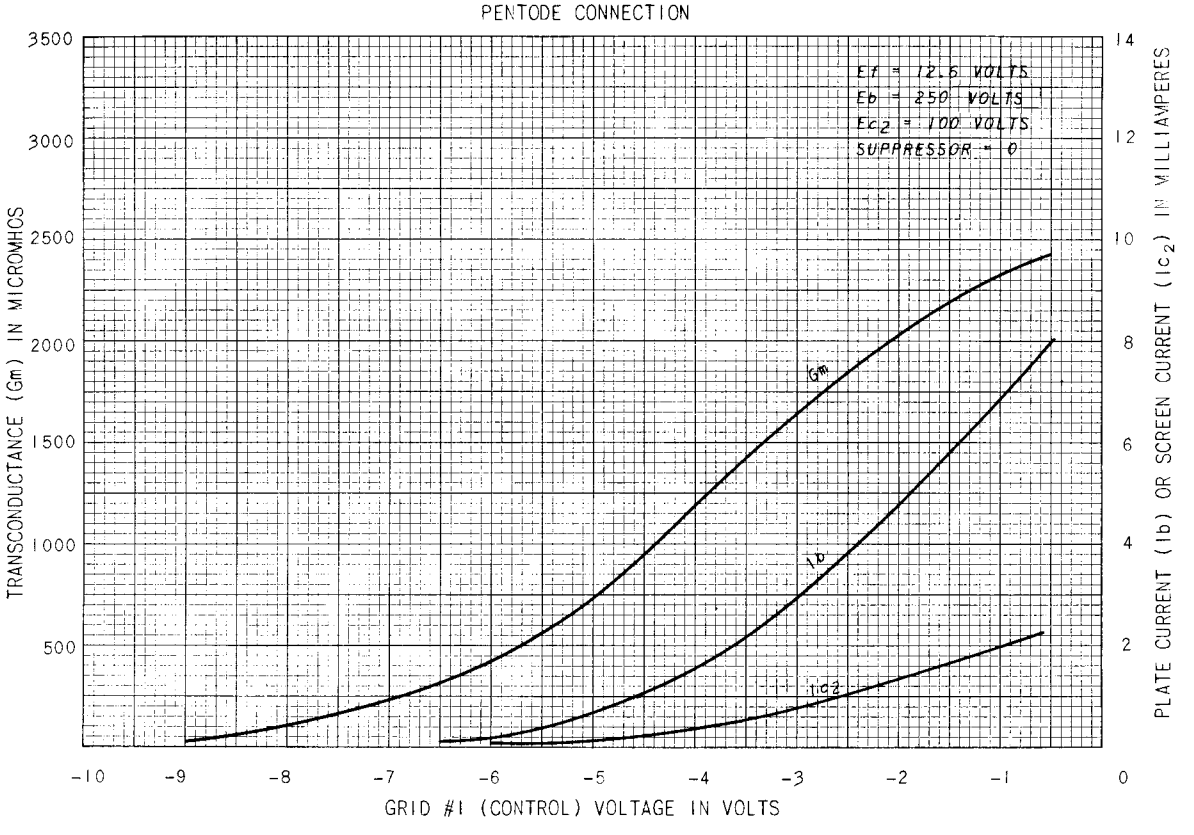


AVERAGE PLATE CHARACTERISTICS

TRIODE CONNECTION



AVERAGE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

Electronic TUBE
KEN-RAD

12SR7

Description and Rating

DUPLEX-DIODE TRIODE

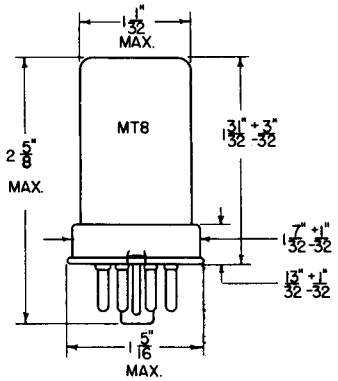
GENERAL DESCRIPTION

Principal Application: The type 12SR7 is a duplex-diode medium-mu triode amplifier designed for use as a combined detector, audio amplifier, and automatic-volume-control tube.

Cathode:	Coated Unipotential
Heater Voltage (A-C or D-C)	12.6 Volts
Heater Current	0.15 Ampere
Envelope:	MT-8 Metal Shell
Base:	B8-21 Small Wafer Octal 8-Pin Phenolic

Mounting Position:	Any	
Direct Interelectrode Capacitances: *		
Input	2.4	µµf
Output	3.6	µµf
Plate to Cathode	2.8	µµf

PHYSICAL DIMENSIONS

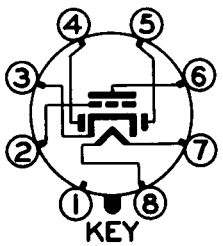


RMA 8-1

TERMINAL CONNECTIONS

Pin 1 - Shell
Pin 2 - Triode Grid
Pin 3 - Cathode and Internal Shield
Pin 4 - Diode Plate Number 2
Pin 5 - Diode Plate Number 1
Pin 6 - Triode Plate
Pin 7 - Heater
Pin 8 - Heater

BASING DIAGRAM



RMA 8Q
BOTTOM VIEW

MAXIMUM RATINGS

	Design Center	Absolute	
Plate Voltage	250	275	Volts
Plate Dissipation	2.50	2.75	Watts
Diode Operation Current per Plate	0.9	1.0	Milliampere
D-C Heater-Cathode Voltage	90	100	Volts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A AMPLIFIER

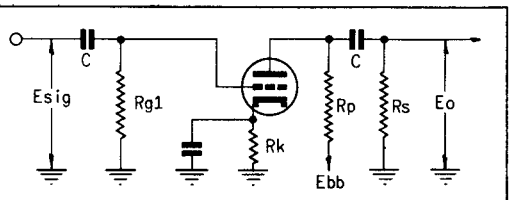
Heater Voltage	12.6	Volts
Plate Voltage	250	Volts
Grid Bias Voltage **	-9	Volts
Amplification Factor	16	
Plate Resistance	8500	Ohms
Transconductance	1900	Micromhos
Plate Current	9.5	Milliamperes
Load Resistance	10000	Ohms
Power Output	300	Milliwatts

** Approximate values with shell connected to cathode and internal shield.*

*** The d-c resistance in the grid circuit should not exceed 1.0 megohm under rated maximum conditions.*

CLASS A RESISTANCE-COUPLED AMPLIFIER

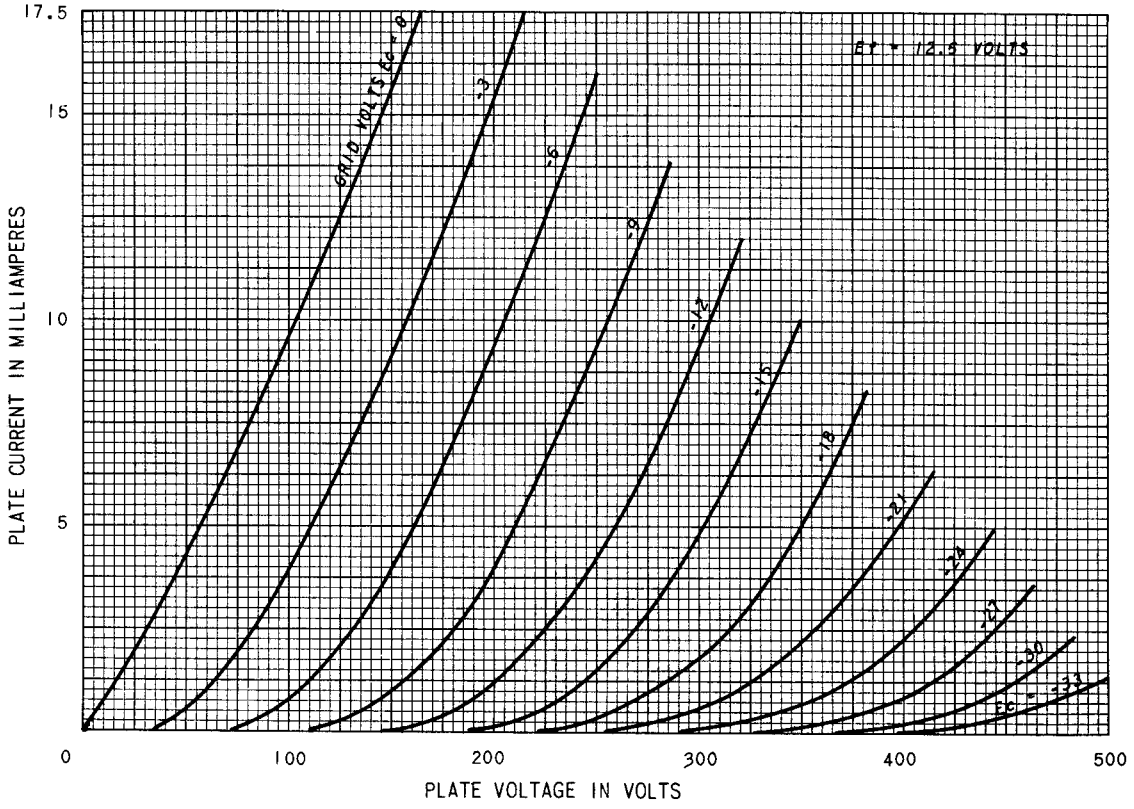
Rp Meg.	Rg1 Meg.	Rs Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	*	0.10	3300	10	15	3000	10	32	2700	10	46
0.10	*	0.24	4300	11	19	3900	11	39	3300	11	55
0.24	*	0.24	7500	11	17	6200	11	32	5600	11	49
0.24	*	0.51	8200	11	20	7500	11	36	6800	11	53
0.51	*	0.51	11000	11	17	10000	11	29	9100	11	40
0.51	*	1.0	13000	11	20	11000	11	31	10000	11	44
0.24	10	0.24	---	12	7.8	---	13	16	---	13	27
0.24	10	0.51	---	12	10	---	13	21	---	13	34
0.51	10	0.51	---	13	7.6	---	14	15	---	14	24
0.51	10	1.0	---	13	11	---	14	20	---	15	28



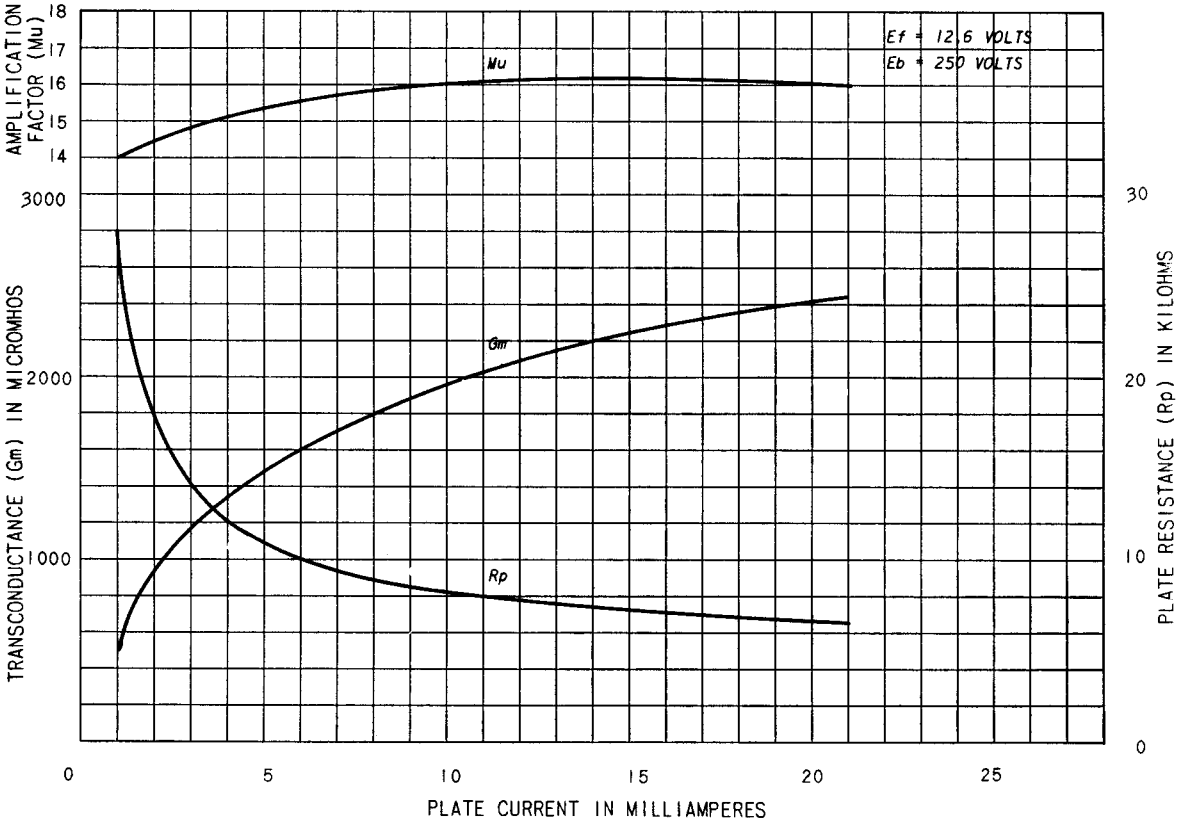
Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data generator impedence is negligible. *Value of Rg1 is non-critical.

AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

ET-T392

5-46

Electronic TUBES

12UP4-B

CATHODE-RAY TUBE

12-INCH ROUND, METAL
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC

11⅜ BY 8½-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY, FROSTED
ION-TRAP GUN

54-DEGREE DEFLECTION ANGLE

DESCRIPTION AND RATING

The 12UP4-B is a magnetic-focus and -deflection, direct-view picture tube which provides an 11⅜ by 8½-inch picture with rounded sides for television applications. Features of this tube include a lightweight metal cone envelope, a high-quality frosted gray faceplate to prevent specular reflection and increase picture contrast, and an electron gun which was designed for use with an external single-field ion-trap magnet.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate	54	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray		
Light Transmission at Center, approximate	66	Percent
Specular Reflection of Ambient Light, maximum	1.5	Percent

MECHANICAL

Over-all Length	$18\frac{3}{4} \pm \frac{3}{8}$	Inches
Greatest Bulb Diameter	$12\frac{7}{16} \pm \frac{1}{16}$	Inches
Minimum Useful Screen Diameter	$11\frac{3}{8}$	Inches
Neck Length	8	Inches

Bulb Contact—Metal Cone Lip
Base—Small-shell Duodecal 5-pin, JETEC No. B5-57
Basing, JETEC Designation—12D

Mounting Position—Any

Net Weight, approximate	8	Pounds

MAXIMUM RATINGS♦

DESIGN-CENTER VALUES*

Anode Voltage†	12,000	Max Volts DC
Grid-No. 2 Voltage	410	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	140	Max Volts
Heater Positive with Respect to Cathode	140	Max Volts

TYPICAL OPERATING CONDITIONS♦

Anode Voltage‡	11,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage§	−28 to −72	Volts DC
Focusing-Coil Currentπ, approximate	98	Milliamperes DC
Ion-Trap Field Intensity△, approximate	33	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5	Max Megohms

♦ All voltages are measured with respect to cathode.

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

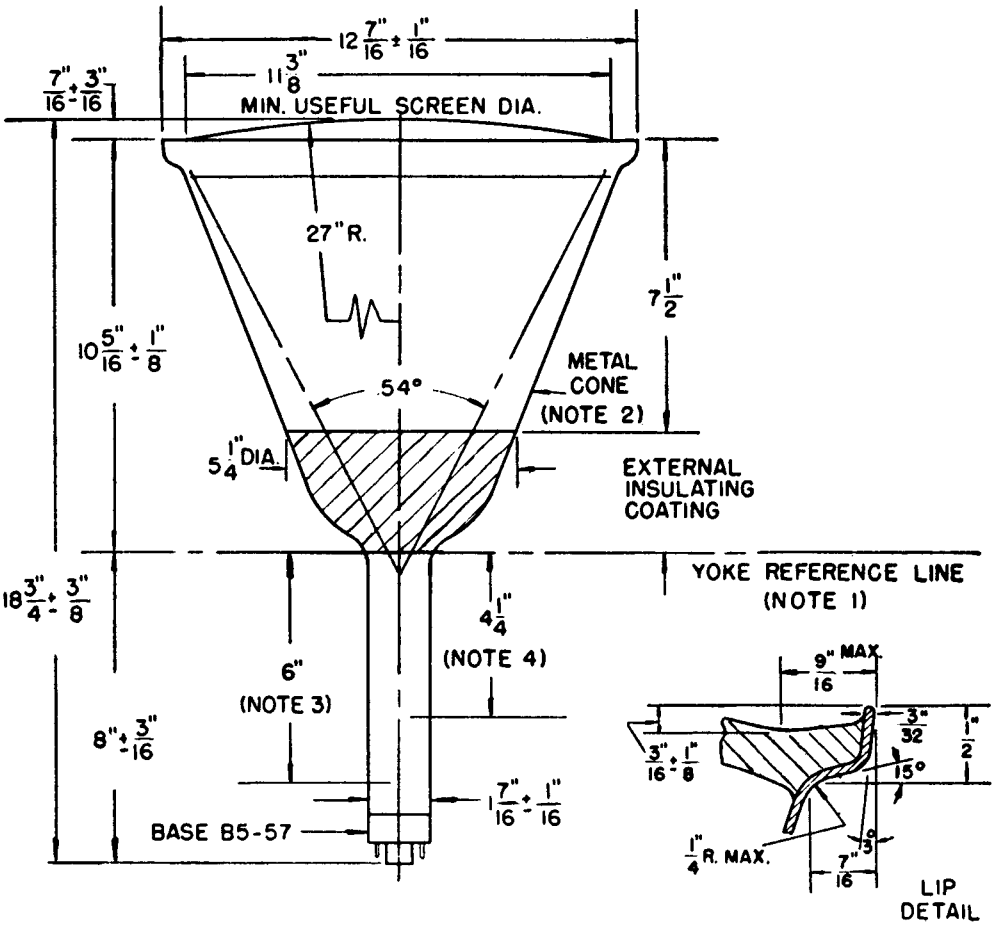
† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

‡ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 9000 volts.

§ For visual extinction of focused raster.

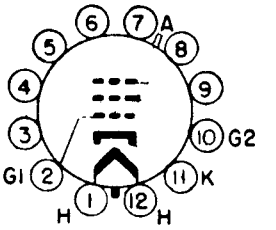
π For RETMA focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 4¼ inches.

△Single-field ion-trap magnet adjusted to optimum position, equivalent to 33 milliamperes through RETMA ion-trap magnet No. 117.



NOTES

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO 112) WHEN THE GAGE IS RESTING ON THE CONE.
2. METAL CONE OPERATES AT HIGH VOLTAGE AND MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ANODE VOLTAGE.
3. APPROXIMATE POSITION OF ION-TRAP MAGNET.
4. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.



BASING DIAGRAM
12D

Electronic TUBE

12V6-GT
Description and Rating

BEAM PENTODE

The 12V6-GT is a beam pentode designed primarily for use in the audio output stage of a-c and storage-battery-operated equipment. It is capable of supplying high power output with high sensitivity, high efficiency and low third and higher-order harmonic distortion. Except for heater ratings, the electrical characteristics of the 12V6-GT are identical to those of the 6V6-GT.

GENERAL

Cathode - Coated Unipotential		
Heater Voltage, AC or DC	12.6	Volts
Heater Current	0.225	Amperes
Envelope - T-9, Glass		
Base - B6-81 or B7-7, Intermediate Shell Octal		
or B6-84 or B7-59, Short Intermediate Shell Octal		
Mounting Position - Any		

Direct Interelectrode Capacitances, approximate *		
Grid-Number 1 to Plate	0.7	μμf
Input	9.0	μμf
Output	7.5	μμf

MAXIMUM RATINGS

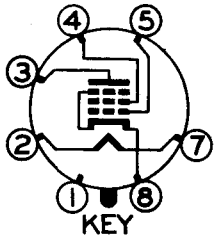
DESIGN-CENTER VALUES

Plate Voltage	315	Volts
Screen-Supply Voltage	315	Volts
Screen Voltage	285	Volts
Plate Dissipation	12	Watts
Screen Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.5	Megohms

* *Without external shield.*

+ *Pin 1 omitted on bases B6-81 and B6-84.*

BASING DIAGRAM

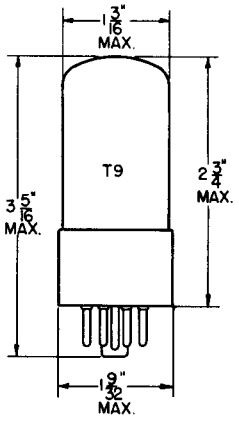


RETMA 7AC
BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 - No Connection+
Pin 2 - Heater
Pin 3 - Plate
Pin 4 - Grid Number 2 (Screen)
Pin 5 - Grid Number 1
Pin 7 - Heater
Pin 8 - Cathode and Beam Plates

PHYSICAL DIMENSIONS



RETMA 9-11 or 9-41

Supersedes ET-T809 dated 10-52

CHARACTERISTICS AND TYPICAL OPERATION

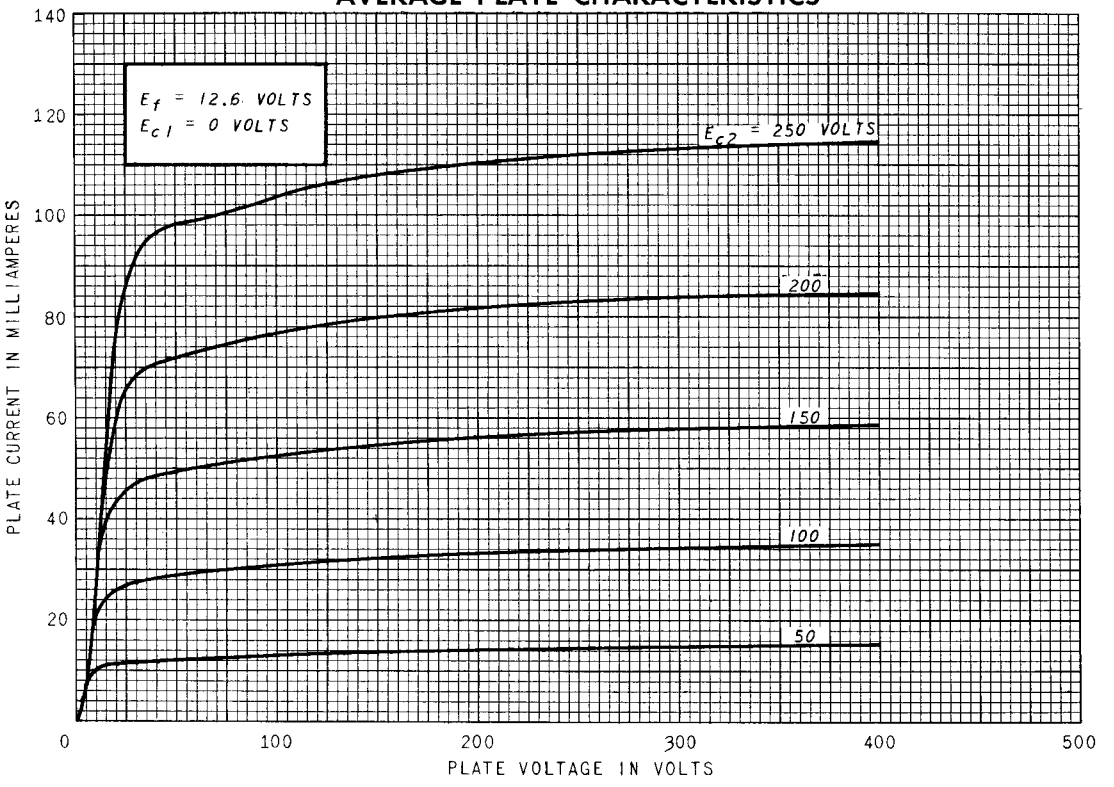
CLASS A_1 AMPLIFIER

Plate Voltage	180	250	315	Volts
Screen Voltage	180	250	225	Volts
Grid-Number 1 Voltage	-8.5	-12.5	-13.0	Volts
Peak AF Grid-Number 1 Voltage	8.5	12.5	13.0	Volts
Plate Resistance, approximate	50000	50000	80000	Ohms
Transconductance	3700	4100	3750	Micromhos
Zero-Signal Plate Current	29	45	34	Milliamperes
Maximum-Signal Plate Current	30	47	35	Milliamperes
Zero-Signal Screen Current	3.0	4.5	2.2	Milliamperes
Maximum-Signal Screen Current	4.0	7.0	6.0	Milliamperes
Load Resistance	5500	5000	8500	Ohms
Total Harmonic Distortion, approximate	8	8	12	Percent
Maximum-Signal Power Output	2.0	4.5	5.5	Watts

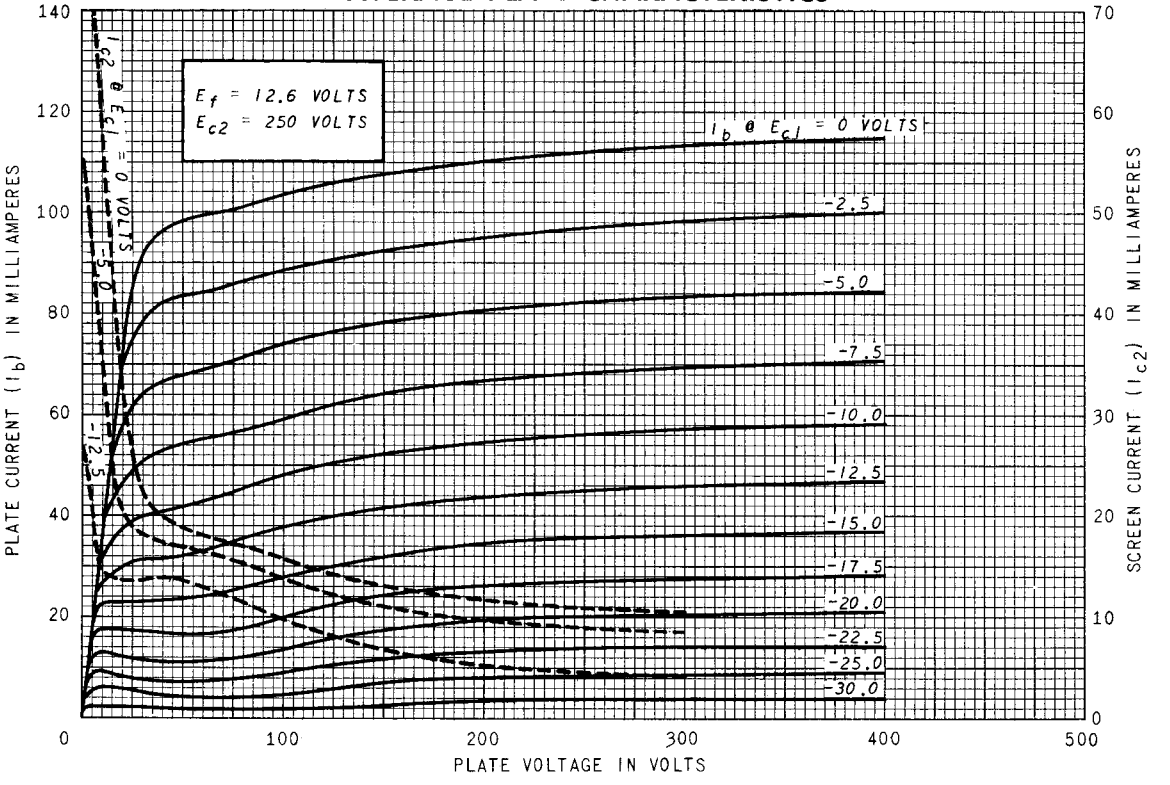
PUSH-PULL CLASS AB_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	250	285	Volts
Screen Voltage	250	285	Volts
Grid-Number 1 Voltage	-15	-19	Volts
Peak AF Grid-to-Grid Voltage	30	38	Volts
Zero-Signal Plate Current	70	70	Milliamperes
Maximum-Signal Plate Current	79	92	Milliamperes
Zero-Signal Screen Current	5.0	4.0	Milliamperes
Maximum-Signal Screen Current	13	13.5	Milliamperes
Effective Load Resistance, Plate-to-Plate	10000	8000	Ohms
Total Harmonic Distortion, approximate	5	3.5	Percent
Maximum-Signal Power Output	10	14	Watts

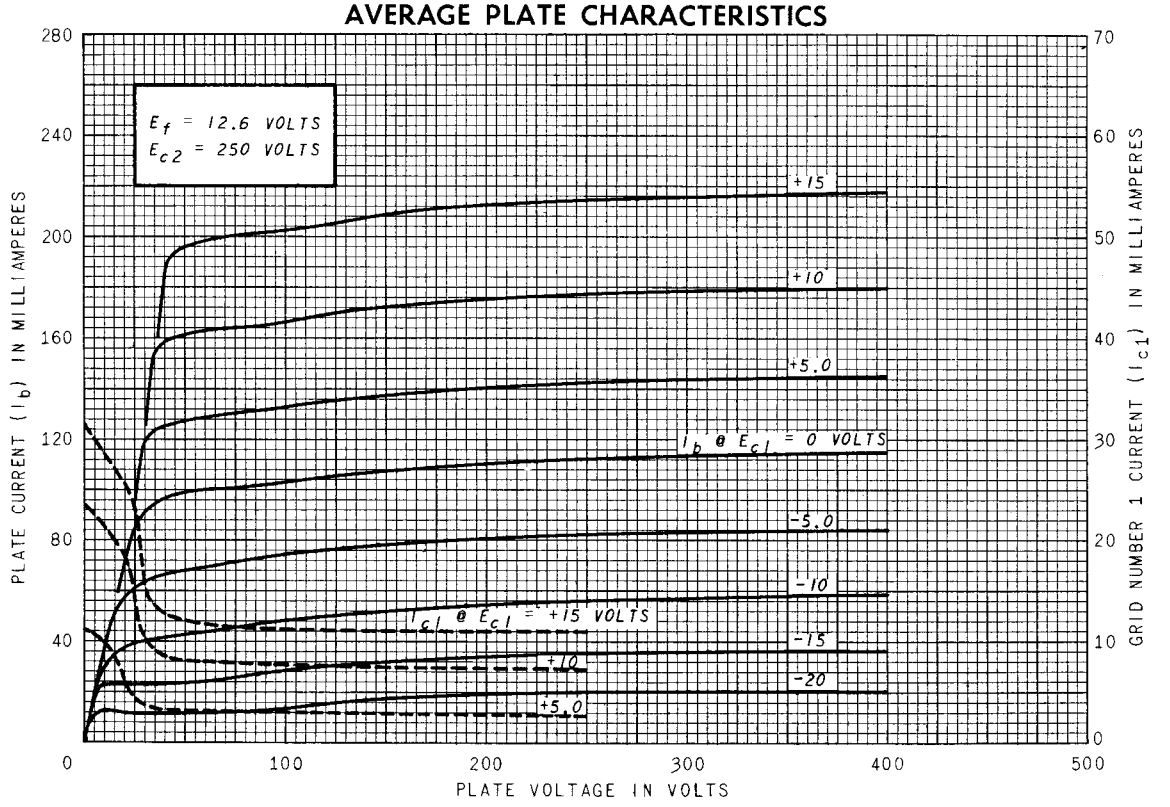
AVERAGE PLATE CHARACTERISTICS



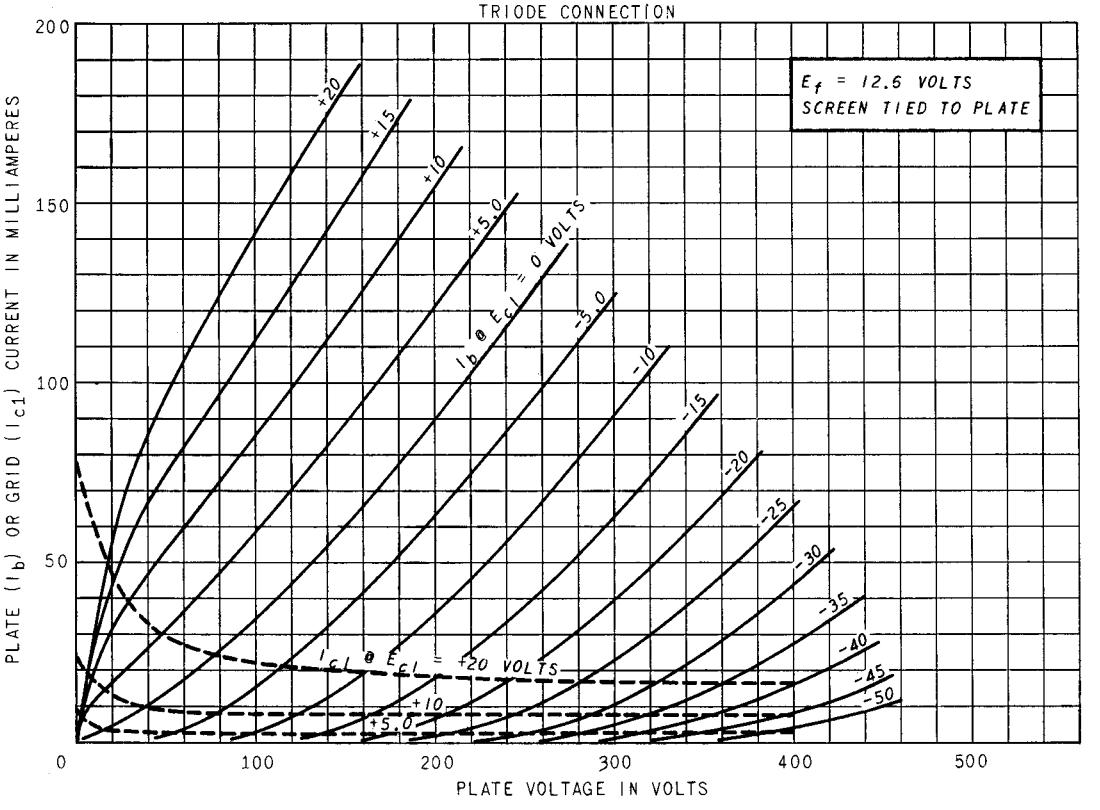
AVERAGE PLATE CHARACTERISTICS



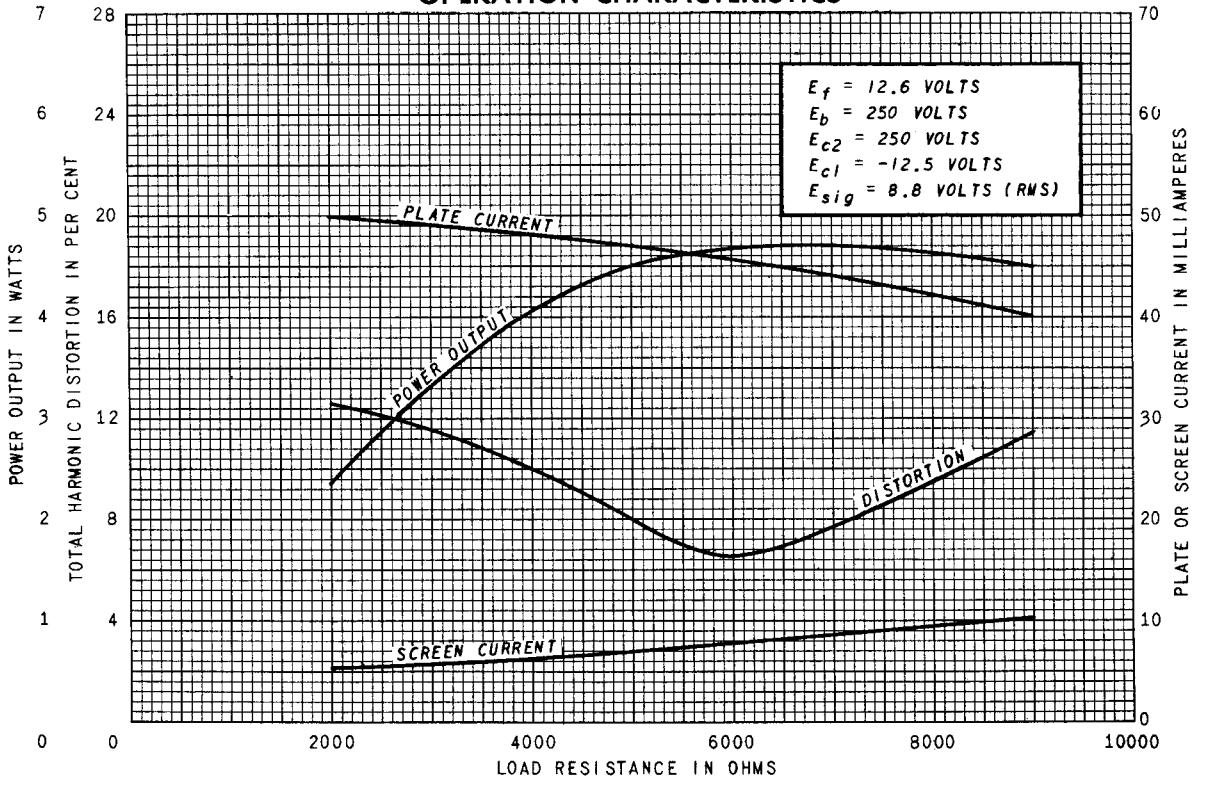
AVERAGE PLATE CHARACTERISTICS



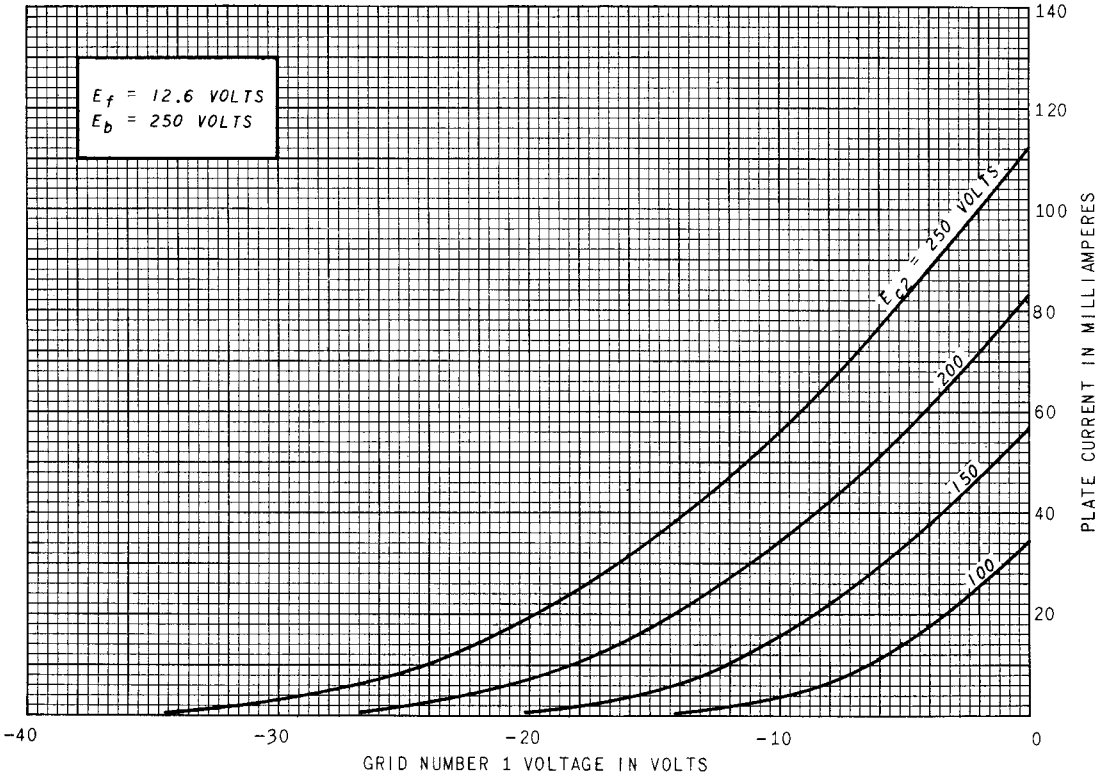
AVERAGE PLATE CHARACTERISTICS



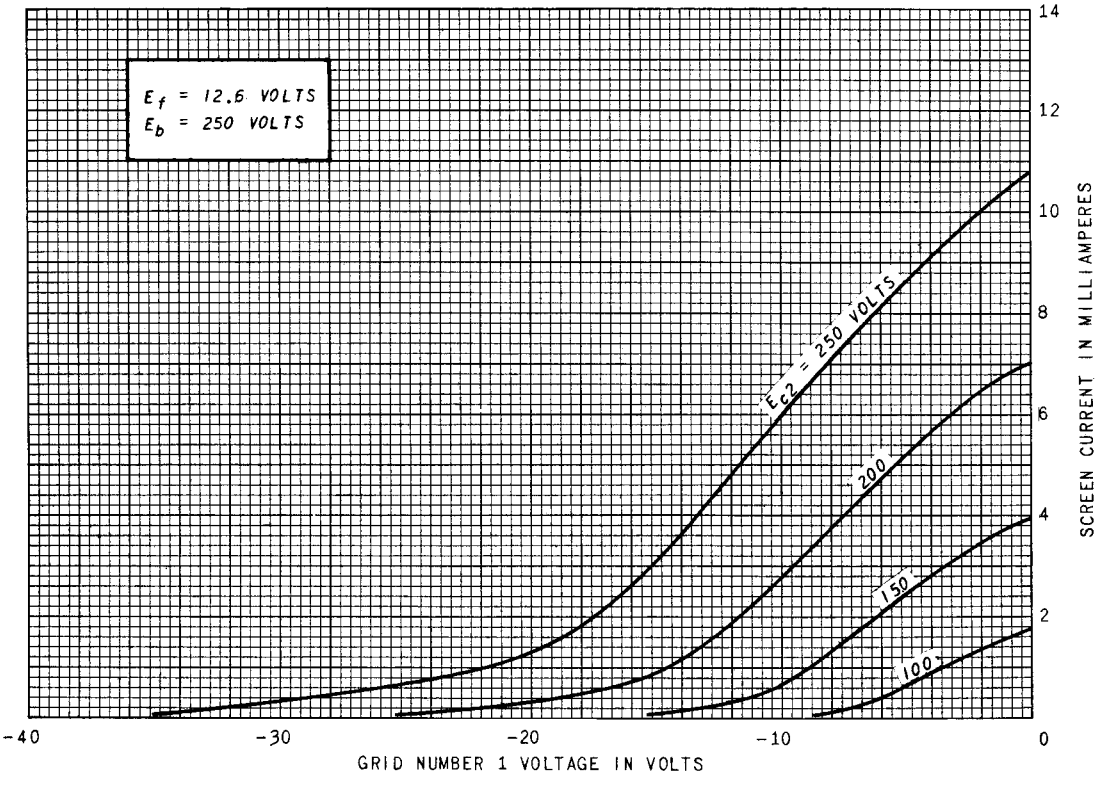
OPERATION CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



Electronic
TUBES

DESCRIPTION AND RATING

12W6-GT Beam Pentode. Identical to the 6W6-GT except for heater ratings and heater-cathode voltage ratings and addition of a controlled heater-warm-up characteristic. Refer to the 6W6-GT Description and Rating sheet for complete data.

12X4 Twin Diode. Identical to the 6X4 except for the following ratings:

Heater Voltage, AC or DC	12.6 ±10%	Volts
Heater Current	0.3	Amperes

When used in automotive service from a 12-volt battery source, the permissible range in heater voltage is from 10.0 to 15.9 volts. Refer to the 6X4 Description and Rating sheet for complete data.

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Dissimilar Double Triode

13GF7-A

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

The 13GF7-A is a dissimilar double triode designed for use as a combined vertical-deflection oscillator and amplifier in television receivers. Section one, a high-mu triode, is intended for service as an oscillator; section two, a low-mu, high-perveance triode, for service as an amplifier. The 13GF7-A utilizes a T-9 bulb and features a 9-pin glass button base with a 0.687-inch circle.

Except for heater characteristics and ratings, the 13GF7-A is identical to the 6GF7-A.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	13	Volts
Heater Current●	0.45 ± 0.03	Amperes
Heater Warm-up Time, Average♦	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.45 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

—PRODUCT INFORMATION—

Compactron Triode-Pentode

13JZ8

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

The 13JZ8 is a compactron containing a medium-mu triode and a beam pentode. The triode is designed for service as a vertical-deflection oscillator and the pentode as a vertical-deflection amplifier in television receivers.

Except for heater characteristics and ratings, the 13JZ8 is identical to the 6JZ8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	12.7	Volts
Heater Current♦	0.6 ± 0.04	Amperes
Heater Warm-up Time, average●	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

♦ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

● The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

PRODUCT INFORMATION

Compactron Dissimilar Double Pentode

13V10

The 13V10 is a compactron containing a sharp-cutoff, dual-control pentode (Section 2) and a power pentode (Section 1). The dual-control pentode is intended for use as an FM detector and the power pentode as an audio-frequency output amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	13.2	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

Direct Interelectrode Capacitances¶

Section 1

Grid-Number 1 to Plate: (1g1 to 1p)	0.20	pf
Input: 1g1 to (h + 1k + 2k + 1g2 + b.p. + i.s.)	10	pf
Output: 1p to (h + 1k + 2k + 1g2 + b.p. + i.s.)	10	pf

Section 2

Grid-Number 1 to Plate: (2g1 to 2p)	0.04	pf
Grid-Number 3 to Plate: (2g3 to 2p)	3.0	pf
Grid-Number 1 to All Except Plate: 2g1 to (h + 2k + 2g2 + 2g3 + i.s.)	6.5	pf

Section 2 (Cont'd)

Grid-Number 3 to All: 2g3 to (h + 2k + 2g1 + 2g2 + 2p + i.s.)	8.0	pf
Grid-Number 1 to Grid-Number 3: (2g1 to 2g3)	0.15	pf

Coupling

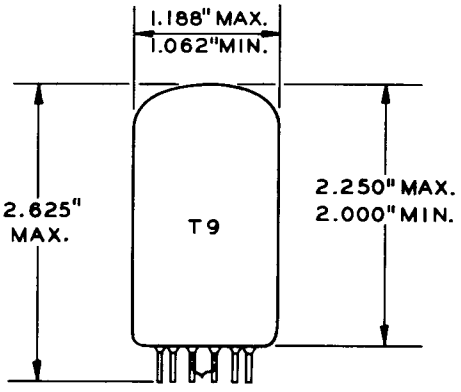
Plate (Section 1) to Plate (Section 2): (1p to 2p)	0.14	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

PHYSICAL DIMENSIONS

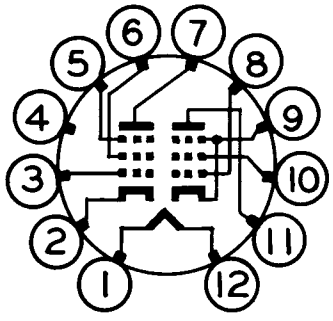


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode and Internal Shield (Section 2)
Pin 3 - Grid Number 1 (Section 2)
Pin 4 - No Connection
Pin 5 - Grid Number 3 (Suppressor) (Section 2)
Pin 6 - Grid Number 2 (Screen) (Section 2)
Pin 7 - Plate (Section 2)
Pin 8 - Grid Number 1 (Section 1)
Pin 9 - Cathode and Beam Plates (Section 1)
Pin 10 - Grid Number 2 (Screen) (Section 1)
Pin 11 - Plate (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12EZ

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Section 1

Plate Voltage	165	Volts
Screen Voltage	150	Volts
Plate Dissipation	6.5	Watts
Screen Dissipation	1.8	Watts
DC Cathode Current	65	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	0.5	Megohms

Section 2

Plate Voltage	330	Volts
Suppressor Voltage	28	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	1.7	Watts
Screen Dissipation	1.1	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER—Section 1

Plate Voltage	145	Volts
Screen Voltage	125	Volts
Grid-Number 1 Voltage	-6.0	Volts
Peak AF Grid-Number 1 Voltage	6.0	Volts
Plate Resistance, approximate	58000	Ohms
Transconductance	6400	Micromhos
Zero-Signal Plate Current	34	Milliamperes
Maximum-Signal Plate Current	36	Milliamperes
Zero-Signal Screen Current	2.2	Milliamperes
Maximum-Signal Screen Current	5.5	Milliamperes
Load Resistance	3000	Ohms
Total Harmonic Distortion, approximate	7	Percent
Maximum-Signal Power Output	1.5	Watts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

AVERAGE CHARACTERISTICS—Section 2

Plate Voltage	150	Volts
Suppressor Voltage	0	Volts
Screen Voltage	100	Volts
Cathode-Bias Resistor	560	Ohms
Plate Resistance, approximate	0.15	Megohms
Grid-Number 1 Transconductance	1000	Micromhos
Grid-Number 3 Transconductance	400	Micromhos
Plate Current	1.3	Milliamperes
Screen Current	2.0	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	-4.5	Volts
Grid-Number 3 Voltage, approximate Ib = 10 Microamperes	-4.5	Volts

NOTES

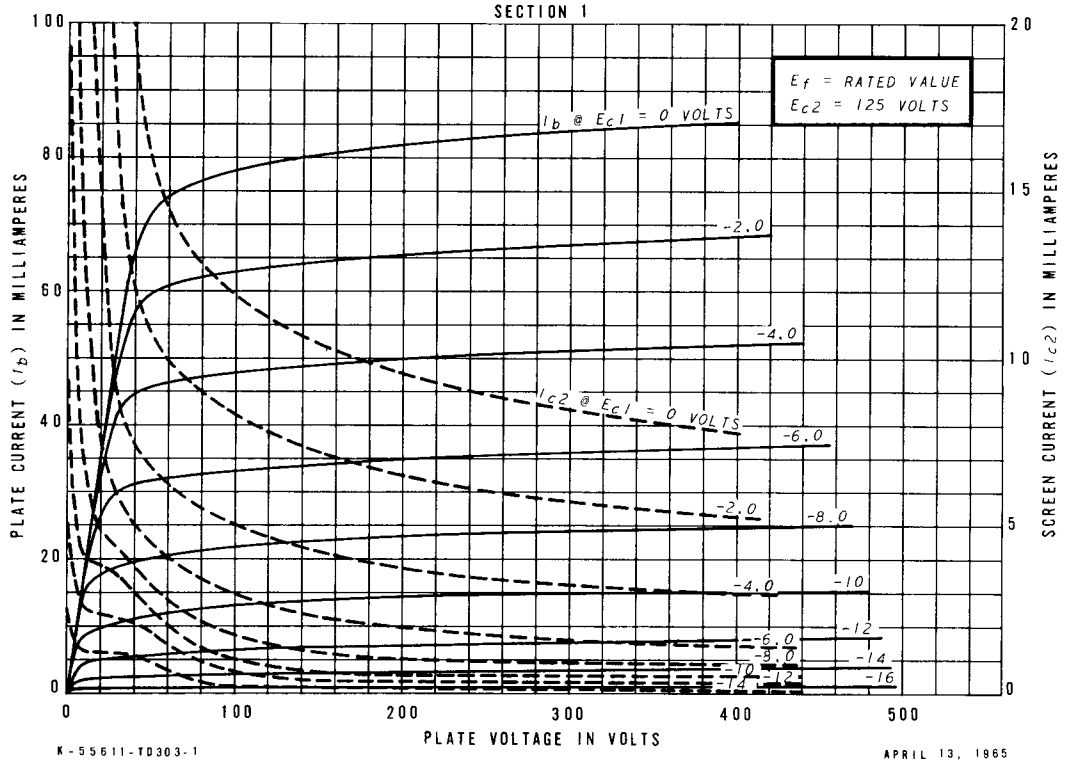
* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

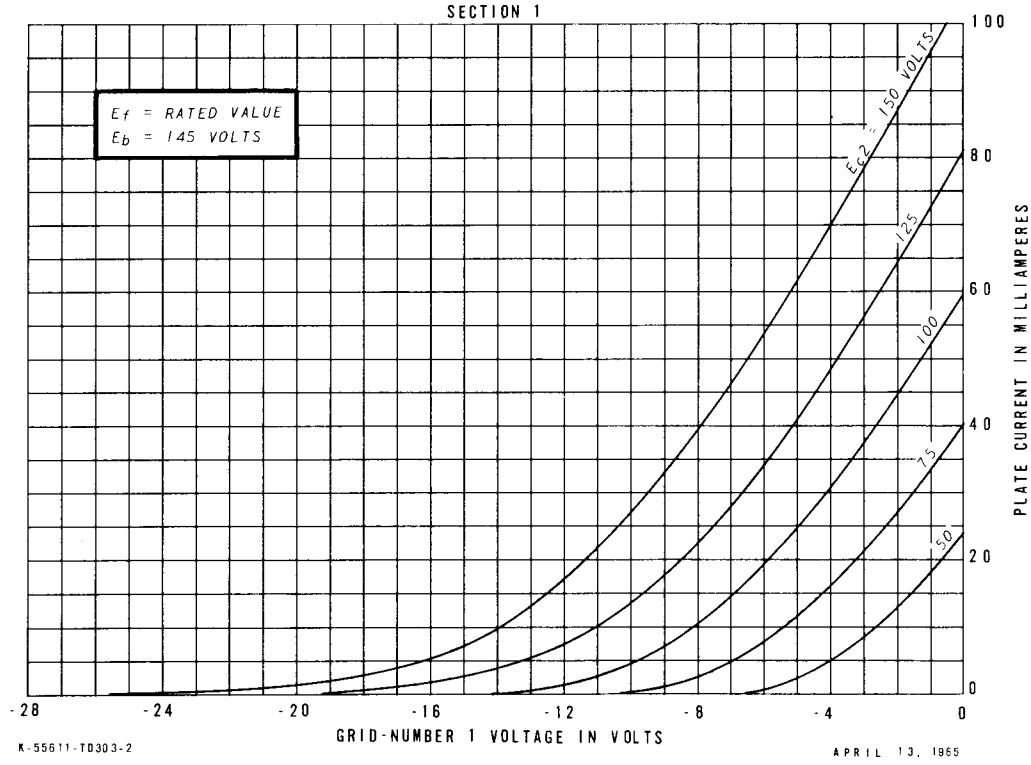
¶ Without external shield.

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

SECTION 1

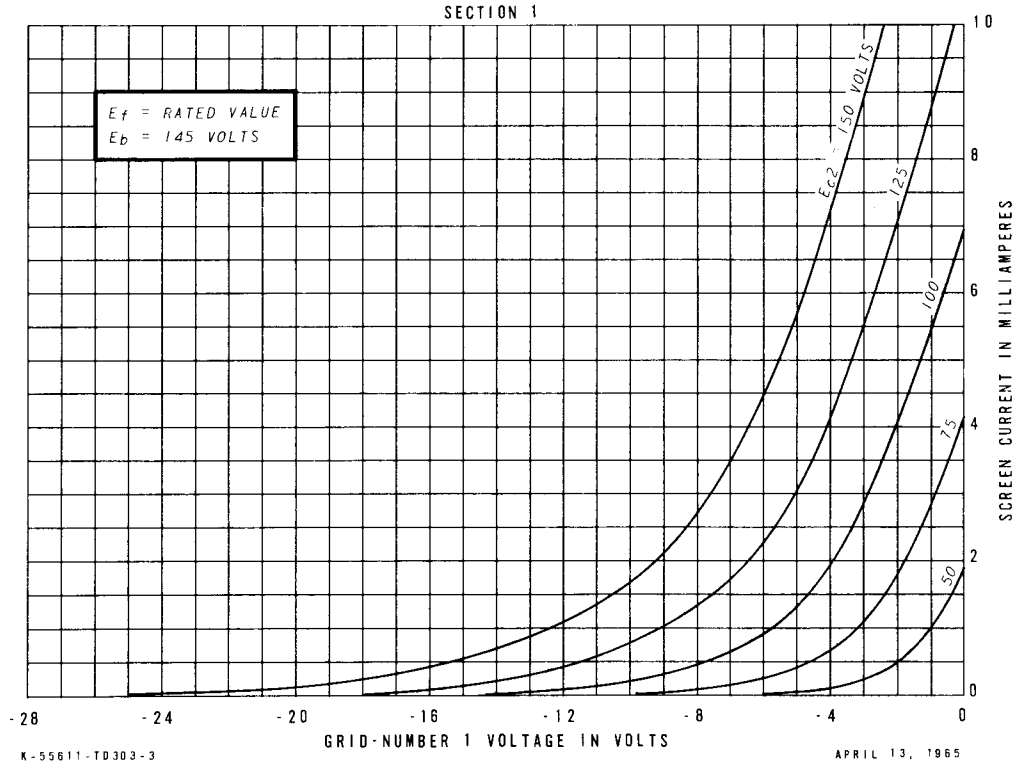


K-55611-TD303-2

APRIL 13, 1965

AVERAGE TRANSFER CHARACTERISTICS

SECTION 1

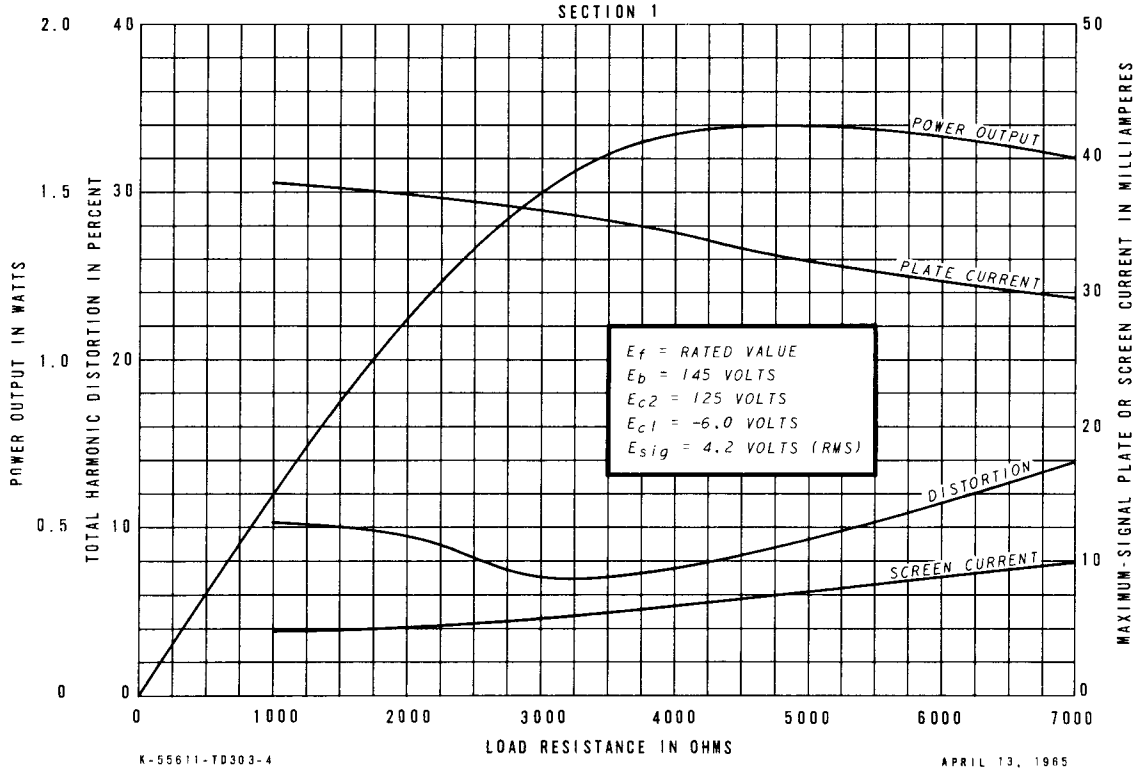


K-55611-TD303-3

APRIL 13, 1965

OPERATION CHARACTERISTICS

SECTION 1

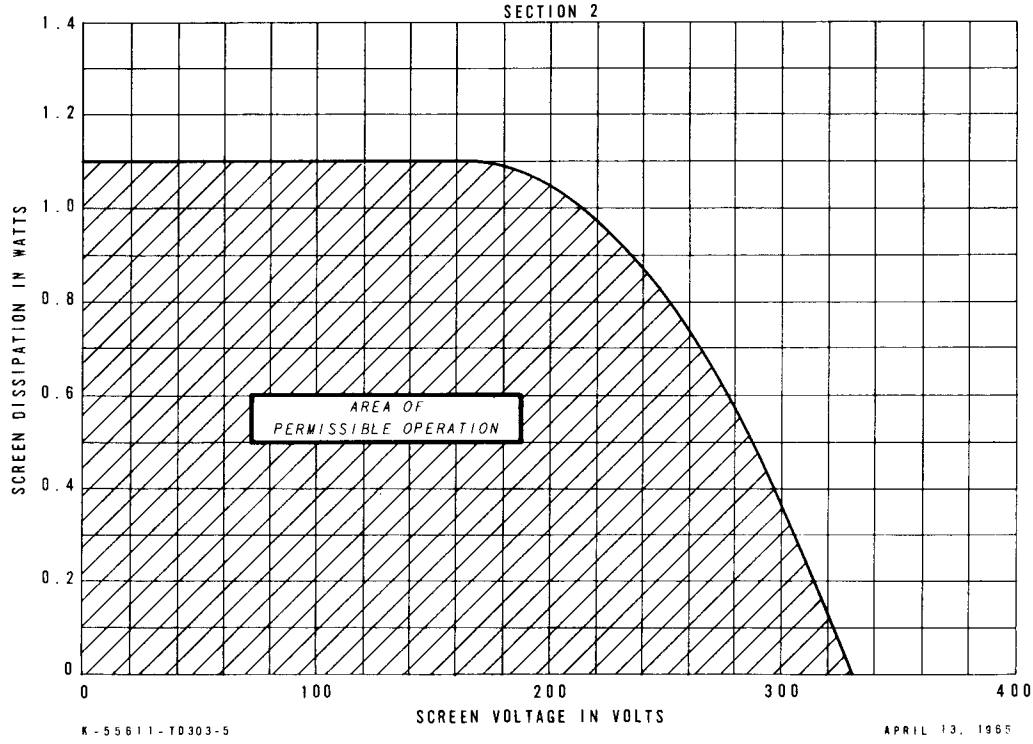


K-55611-TD303-4

APRIL 13, 1965

SCREEN RATING CHART

SECTION 2

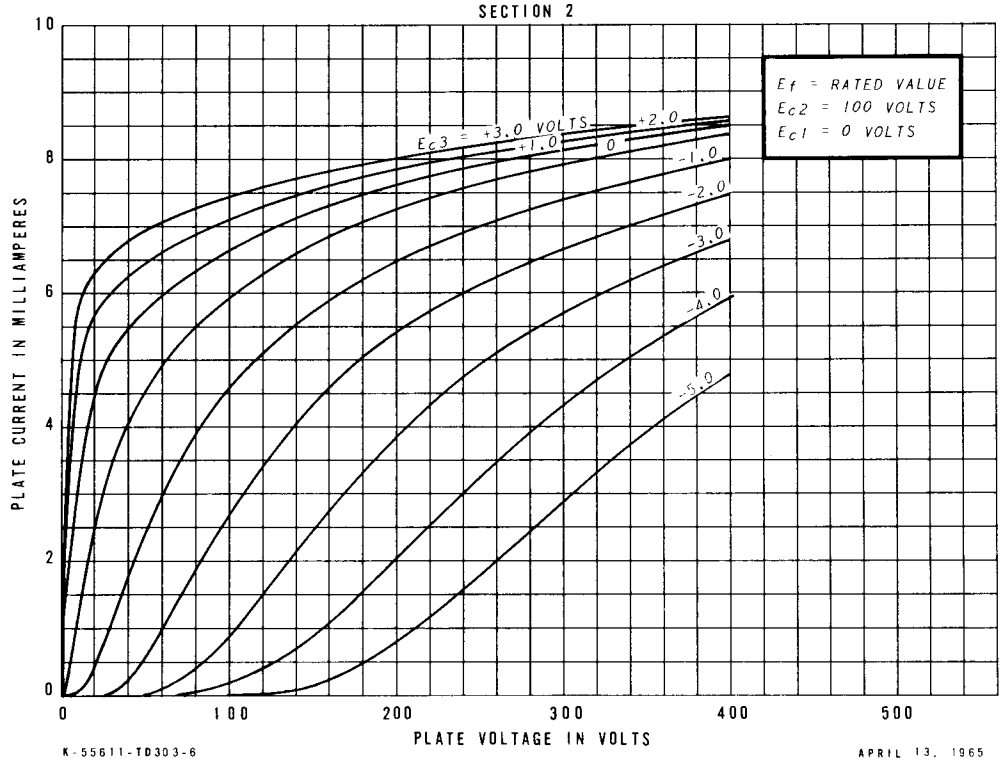


K-55611-TD303-5

APRIL 13, 1965

AVERAGE PLATE CHARACTERISTICS

SECTION 2

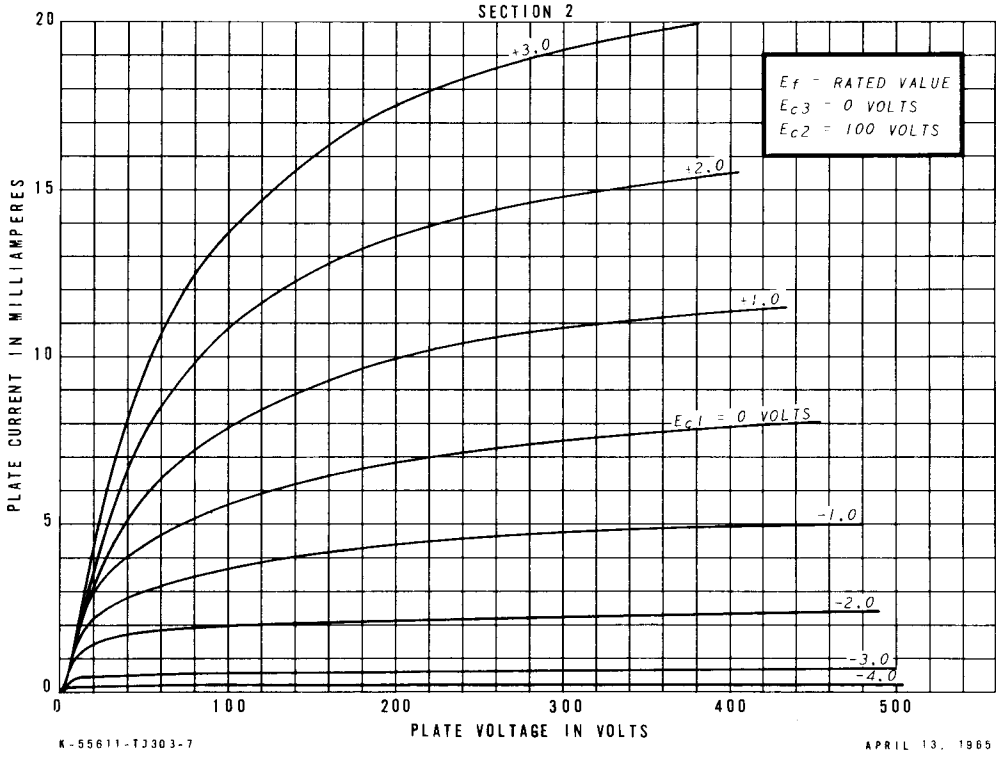


K-55611-TD303-6

APRIL 13, 1965

AVERAGE PLATE CHARACTERISTICS

SECTION 2

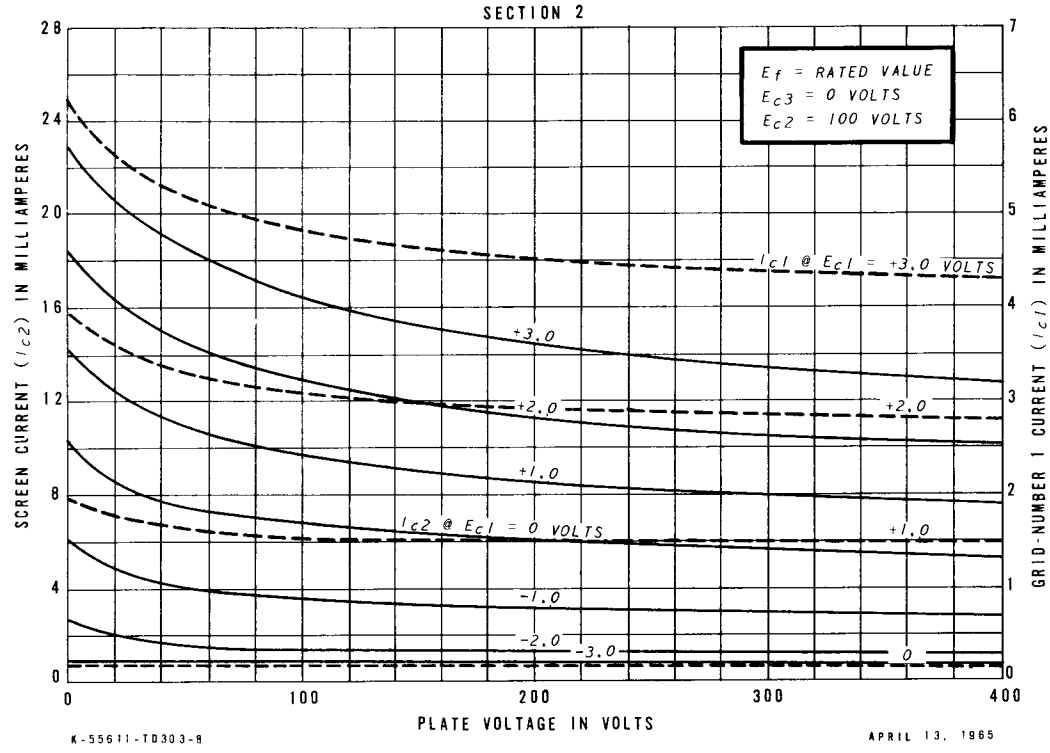


K-55611-TD303-7

APRIL 13, 1965

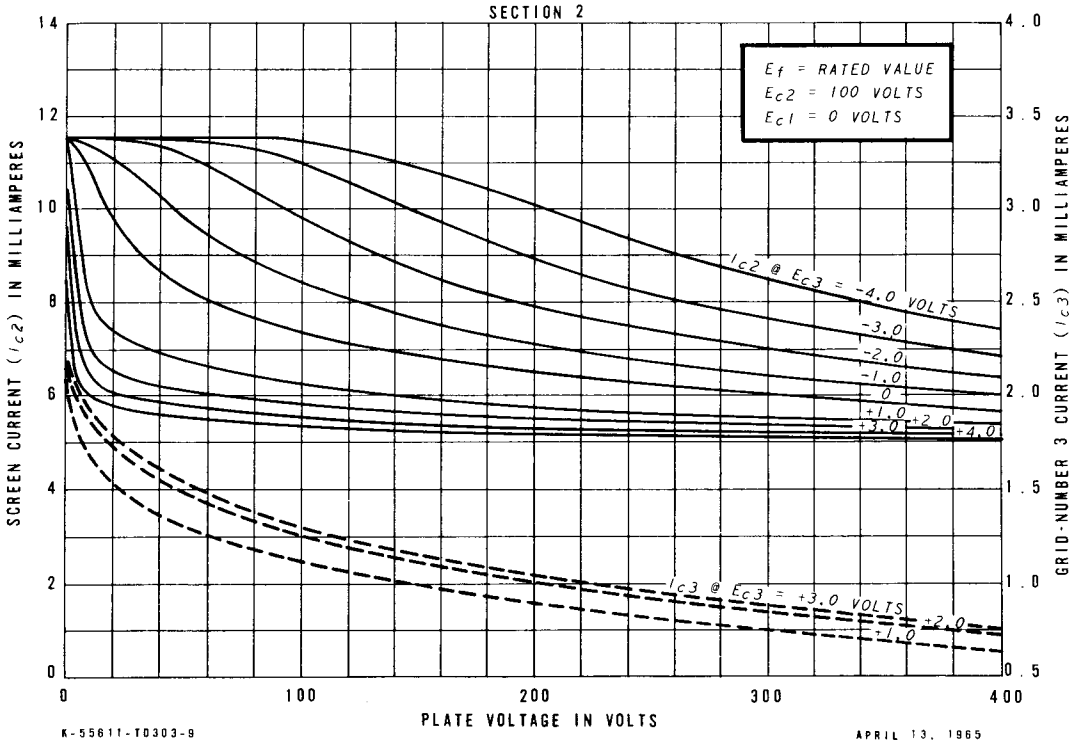
AVERAGE CHARACTERISTICS

SECTION 2



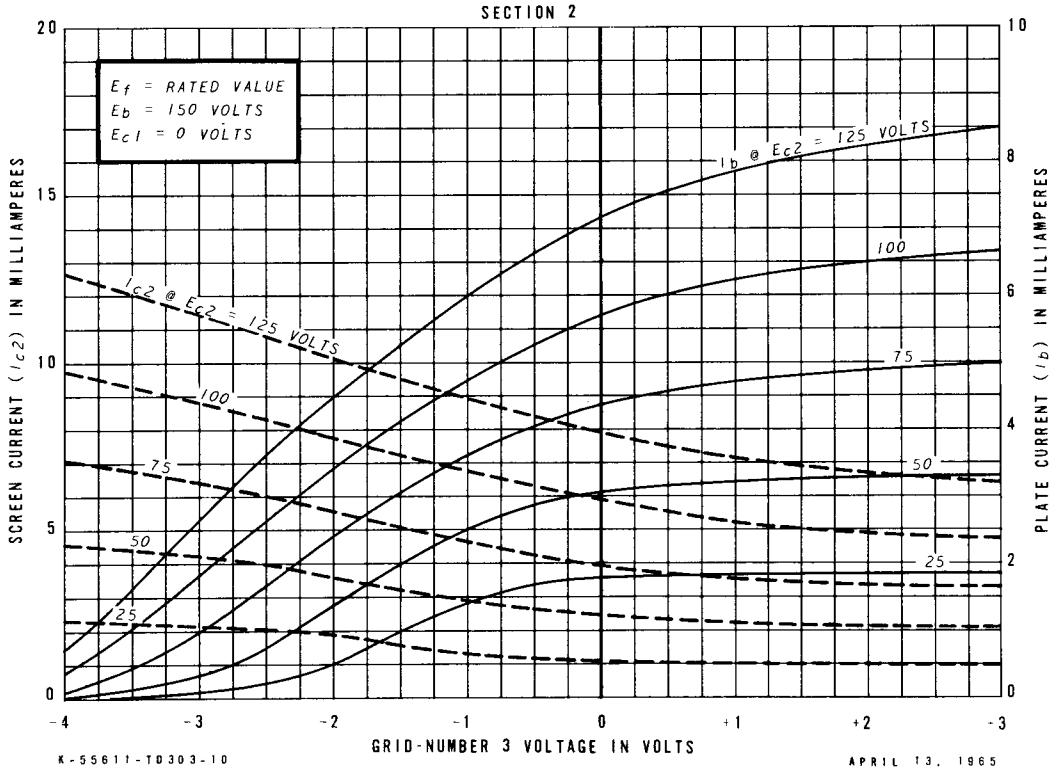
AVERAGE CHARACTERISTICS

SECTION 2



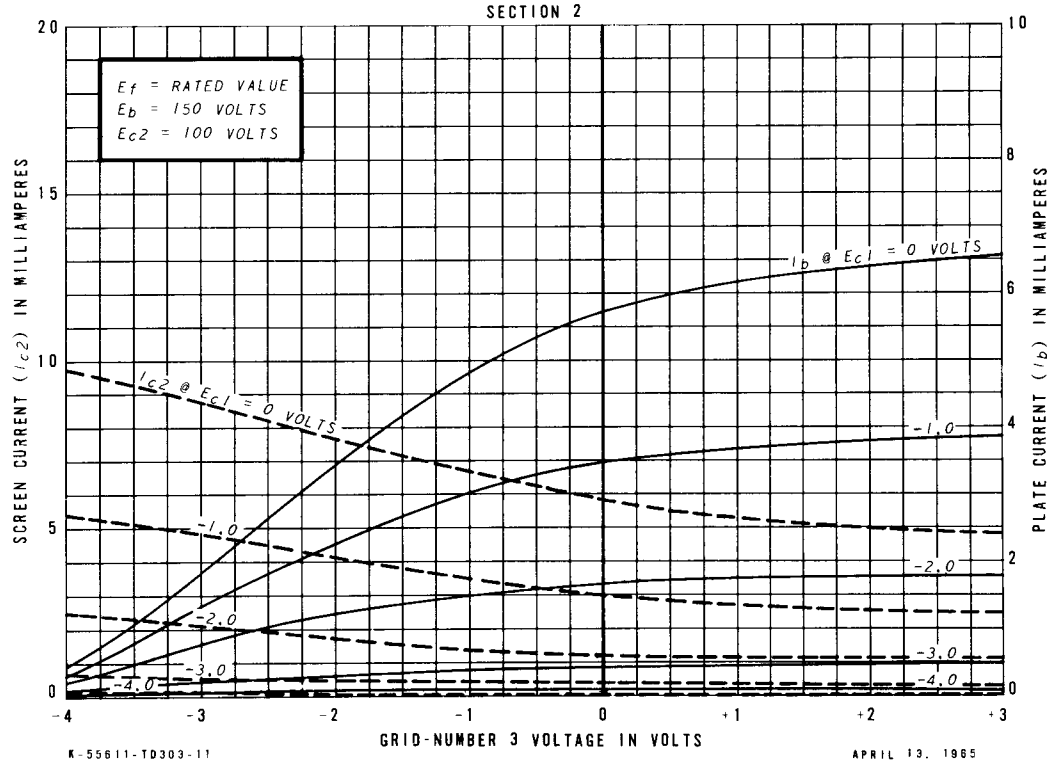
AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

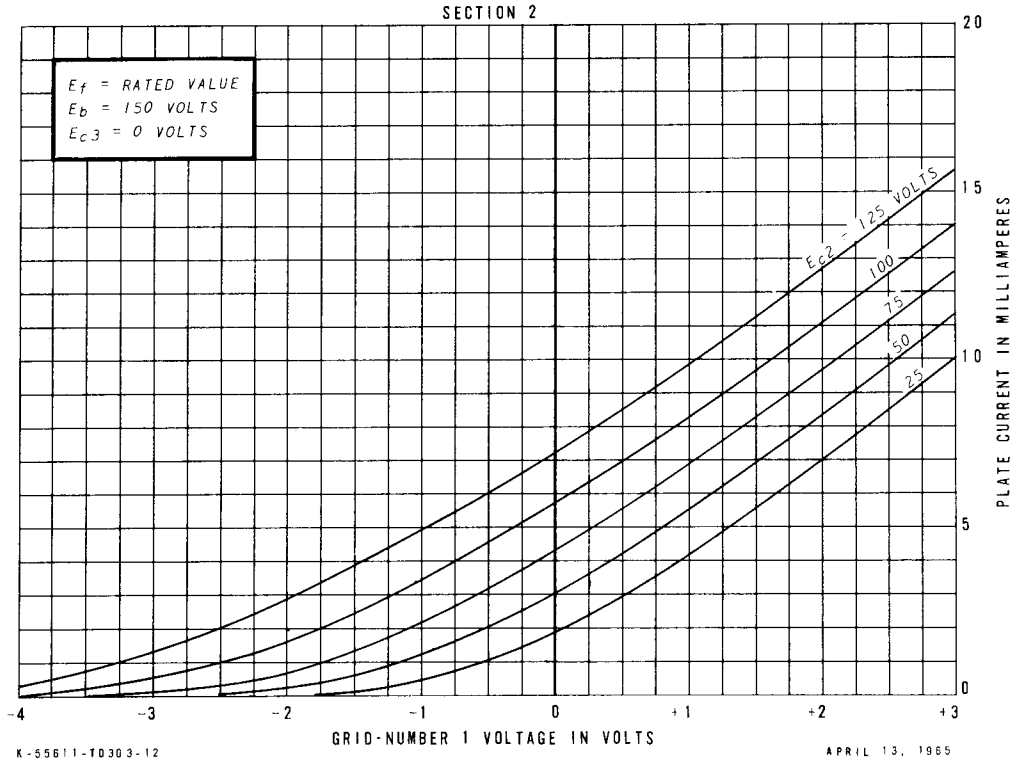


AVERAGE TRANSFER CHARACTERISTICS

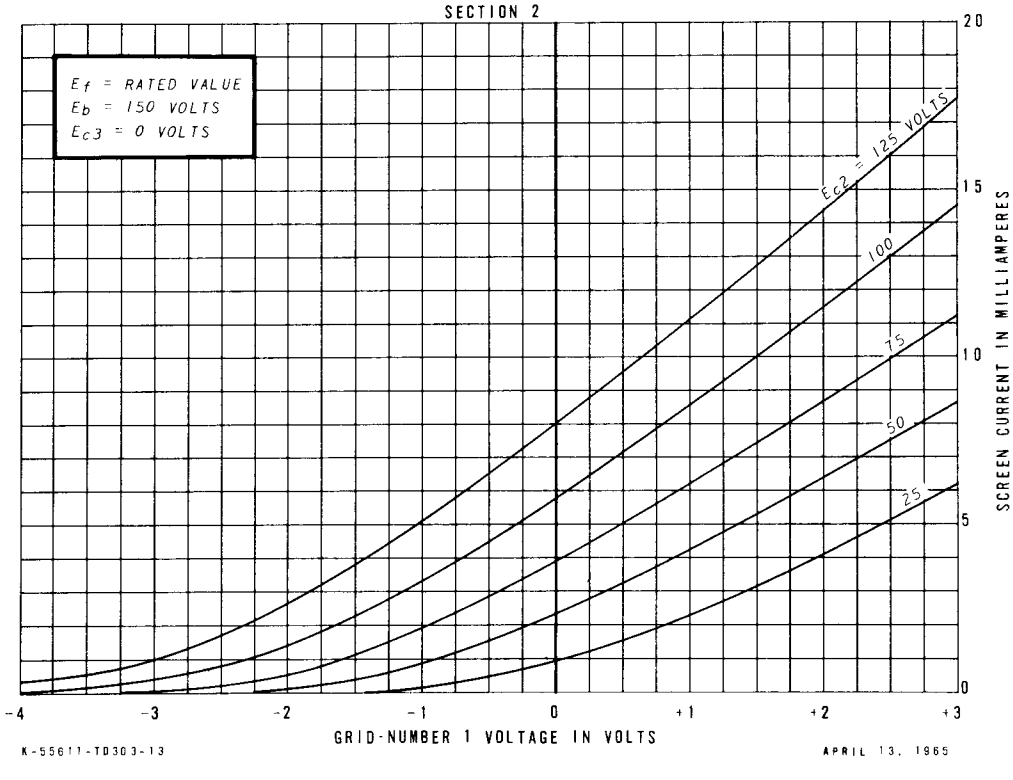
SECTION 2



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

PRODUCT INFORMATION

Compactron Pentode — Gated-Beam Discriminator

13Z10

The 13Z10 is a compactron containing a gated-beam discriminator and a beam pentode. The gated-beam discriminator is suitable for FM and TV limiter and discriminator applications, and the beam pentode for audio power output service.

Except for heater characteristics, the 13Z10 is identical to the 6Z10.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	13.2	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

14AJP4

CATHODE-RAY TUBE

14-INCH RECTANGULAR, GLASS	12-3/8 BY 9-7/8 INCH PICTURE SIZE
FOCUS - ELECTROSTATIC	FACEPLATE - SPHERICAL, GRAY
DEFLECTION - MAGNETIC	ION-TRAP GUN
110-DEGREE DEFLECTION ANGLE	EXTERNAL CONDUCTIVE COATING

ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 14AJP4 is a fourteen-inch electrostatic-focus and magnetic-deflection glass picture tube. Outstanding features include a short overall length and a small neck diameter. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Heater Warm-up Time *	11	Seconds
Focusing Method - Electrostatic		
Deflecting Method - Magnetic		
Deflection Angle, approximate		
Diagonal	110	Degrees
Horizontal	105	Degrees
Vertical	86	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	850	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number - P4, Sulfide Type
Fluorescent Color - White
Phosphorescent Color - White
Persistence - Short

Faceplate - Gray		
Light Transmission at Center, approximate	86	Percent

GENERAL ELECTRIC COMPANY

from JETEC release #1830, Jan. 28, 1957

MECHANICAL

Overall Length	11-7/16 ± 3/8	Inches
Greatest Bulb Dimensions		
Diagonal	13-7/8 ± 1/8	Inches
Width	13-3/16 ± 1/8	Inches
Height	10-7/8 ± 1/8	Inches
Minimum Useful Screen Dimensions		
Diagonal	13-1/8	Inches
Width	12-3/8	Inches
Height	9-7/8	Inches
Area	108	Square Inches
Neck Length	5-1/2 ± 3/16	Inches

Bulb Contact - Recessed Small-cavity Cap, JETEC No. J1-21
Base - Small-button Eightar, 7-Pin, JETEC No. B7-183
Basing, 8HR
Bulb Contact Alignment
Anode Contact Aligns with Pin-No. 4 ± 30 Degrees
Mounting Position - Any

Net Weight, approximate	7-1/2	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES ≠

Anode Voltage #	11,000 Max	Volts DC
Focusing-Electrode Voltage	-500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	140 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Negative-Peak Value	200 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage **	9,000	Volts DC
Focusing-Electrode Voltage for Focus	-100 to +400	Volts DC
Focusing-Electrode Current	-15 to +25	Microamperes DC
Grid-No. 2 Voltage	250	Volts DC
Grid-No. 1 Voltage ≠	-24 to -64	Volts DC
Ion-Trap Field Intensity ##, minimum	29	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

* Heater warm-up time is the time required for the voltage across the heater terminals to increase to 5.0 volts in the JETEC test circuit, with E = 25 volts and series R = 42 ohms.

/ The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

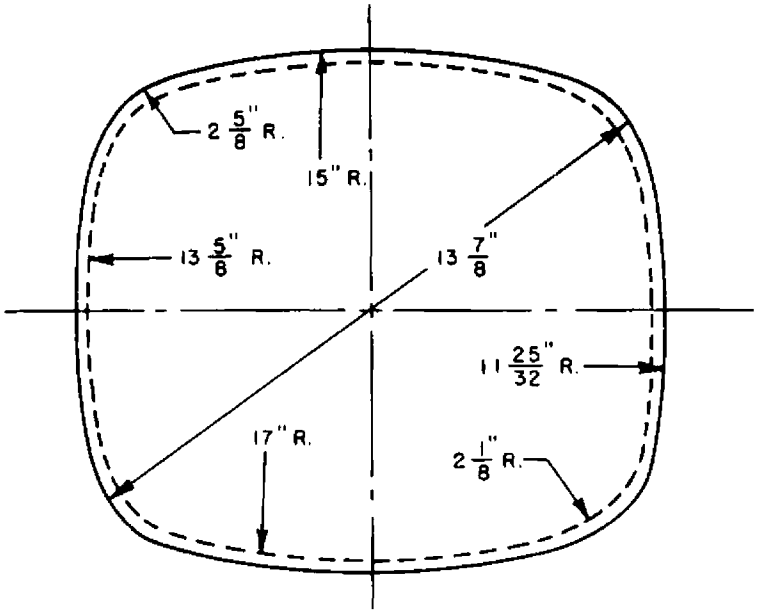
\# Anode, grid-No. 3, and grid-No. 5 which are connected together within the tube are referred to herein as anode.

** Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 8,000 volts.

$\neq$ For visual extinction of focused raster.

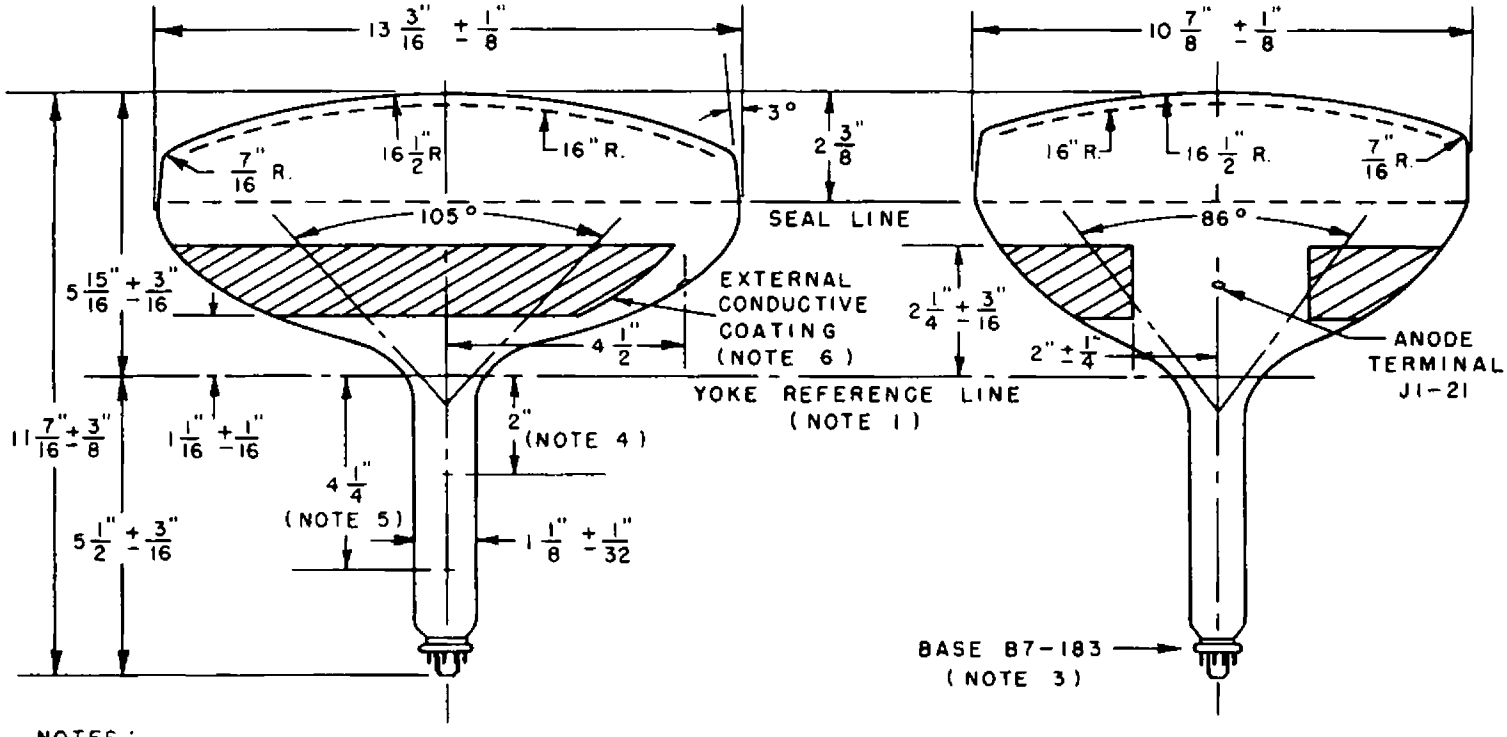
\#\# For a Heppner PM ion-trap magnet or equivalent located in optimum position and rotated to give maximum brightness.

Electronic Components Division
GENERAL ELECTRIC COMPANY
Schenectady 5, N. Y.



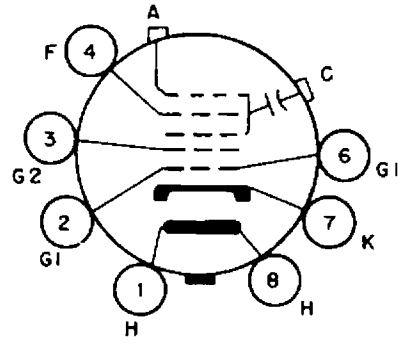
SCREEN DIMENSIONS:

DIAGONAL	13	1/8"
WIDTH	12	3/8"
HEIGHT	9	7/8"
AREA	108	SQ. IN.



NOTES:

1. REFERENCE LINE IS DETERMINED BY PLANE C-C' WHEN GAGE (RETMA) NO. 126 IS SEATED AGAINST THE BULB.
2. DEFLECTION ANGLE ON DIAGONAL IS 110°.
3. ANODE TERMINAL ALIGN WITH PIN NO. 4 ± 30 DEGREES.
4. RECOMMENDED POSITION OF CENTERING MAGNET, IF USED.
5. APPROXIMATE POSITION OF ION-TRAP MAGNET.
6. EXTERNAL CONDUCTIVE COATING.



BASING DIAGRAM
8HR

ELECTRONICS

14BL11

COMPACTRON DISSIMILAR-DOUBLE-TRIODE PENTODE

DESCRIPTION AND RATING

The 14BL11 is a compactron containing a high-mu triode, a medium-mu triode, and a sharp-cutoff frame-grid pentode. The pentode is intended for video amplifier service and the triodes for general-purpose use.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	14.2	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, average§	11	Seconds

Direct Interelectrode Capacitances¶

Triode (Section 1)

Grid to Plate: (1Tg to 1Tp)	1.9	pf
Input: 1Tg to (1Tk + Pk + Pg3 + h + i.s.)	3.0	pf
Output: 1Tp to (1Tk + Pk + Pg3 + h + i.s.)	2.4	pf

Triode (Section 2)

Grid to Plate: (2Tg to 2Tp)	2.6	pf
Input: 2Tg to (2Tk + Pk + Pg3 + h + i.s.)	4.4	pf
Output: 2Tp to (2Tk + Pk + Pg3 + h + i.s.)	4.0	pf

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.12	pf
Input: Pg1 to (Pk + Pg2 + Pg3 + h + i.s.)	12	pf
Output: P; to (Pk + Pg2 + Pg3 + h + i.s.)	4.4	pf

Coupling

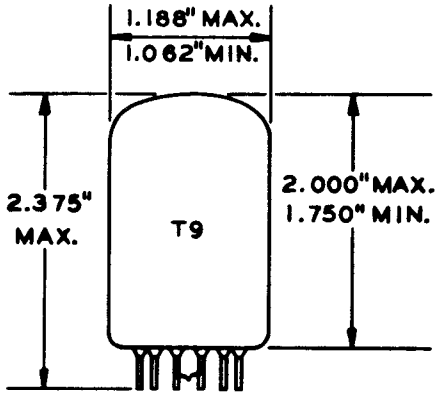
Pentode Plate to Triode Plate (Section 2): (Pp to 2Tp), maximum	0.05	pf
Triode Plate (Section 1) to Triode Plate (Section 2): (1Tp to 2Tp), maximum	0.12	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.063	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

PHYSICAL DIMENSIONS

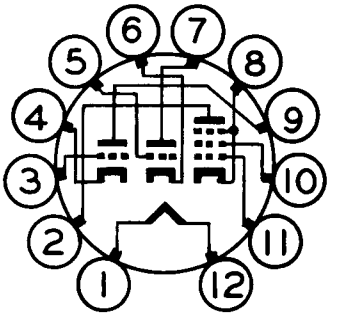


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Pentode Plate
Pin 3 - Triode Grid (Section 2)
Pin 4 - Triode Cathode (Section 2)
Pin 5 - Triode Grid (Section 1)
Pin 6 - Triode Cathode (Section 1)
Pin 7 - Triode Plate (Section 1)
Pin 8 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 9 - Triode Plate (Section 2)
Pin 10 - Pentode Grid Number 2 (Screen)
Pin 11 - Pentode Grid Number 1
Pin 12 - Heater

BASING DIAGRAM



EIA 12GC

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Pentode Section

Plate Voltage	250	Volts
Screen Voltage	125	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	2.5	Watts
Screen Dissipation	1.25	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.25	Megohms

Triode (Section 1)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.5	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Triode (Section 2)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	35	200	Volts
Screen Voltage	100	100	Volts
Grid-Number 1 Voltage	0	---	Volts
Cathode-Bias Resistor	---	82	Ohms
Plate Resistance, approximate	---	70000	Ohms
Transconductance	---	19000	Micromhos
Plate Current	40	16	Milliamperes
Screen Current	13	3.0	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	---	-5.5	Volts

Triode (Section 1)

Plate Voltage		200	Volts
Cathode-Bias Resistor		270	Ohms
Amplification Factor		69	
Plate Resistance, approximate		12500	Ohms
Transconductance		5500	Micromhos
Plate Current		7.1	Milliamperes
Grid Voltage, approximate Ib = 50 Microamperes		-5.5	Volts

Triode (Section 2)

Plate Voltage		200	Volts
Cathode-Bias Resistor		470	Ohms
Amplification Factor		40	
Plate Resistance, approximate		7600	Ohms
Transconductance		5300	Micromhos
Plate Current		7.2	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes		-8	Volts

NOTES

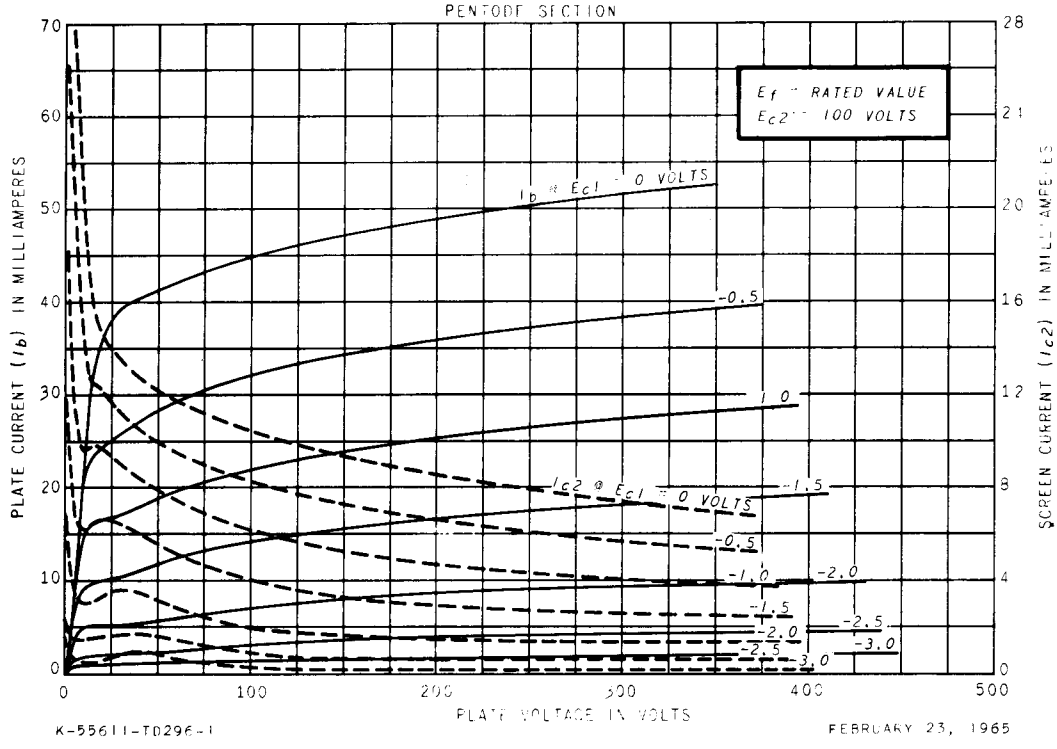
* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ Without external shield.

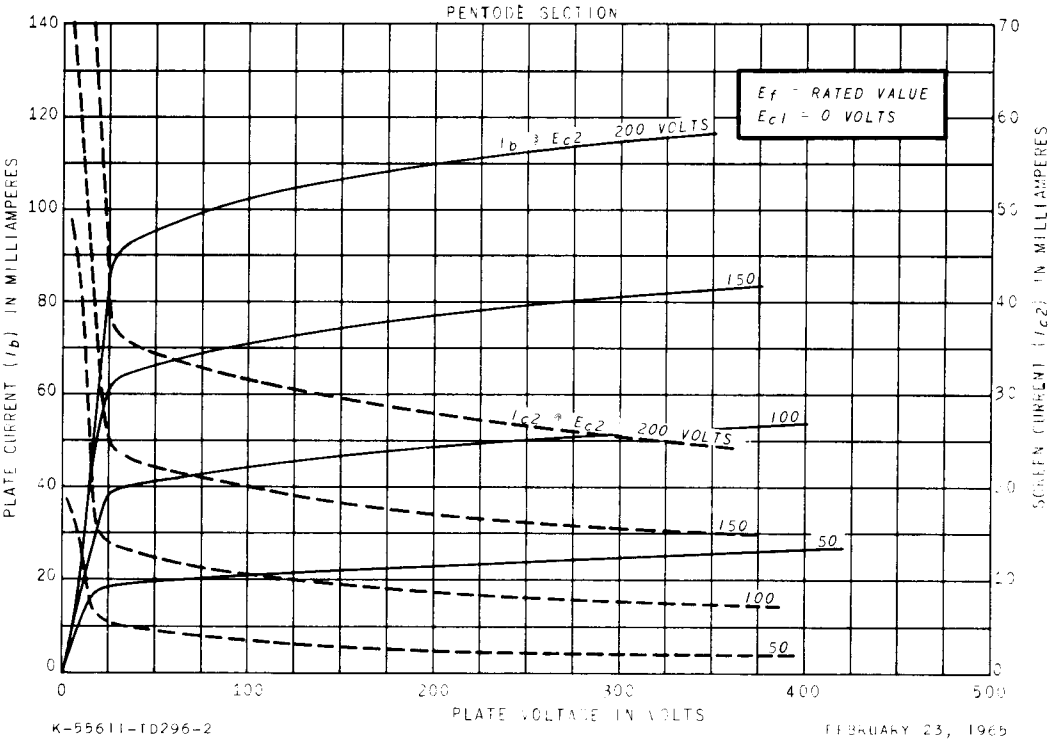
AVERAGE PLATE CHARACTERISTICS



K-55611-TD296-1

FEBRUARY 23, 1965

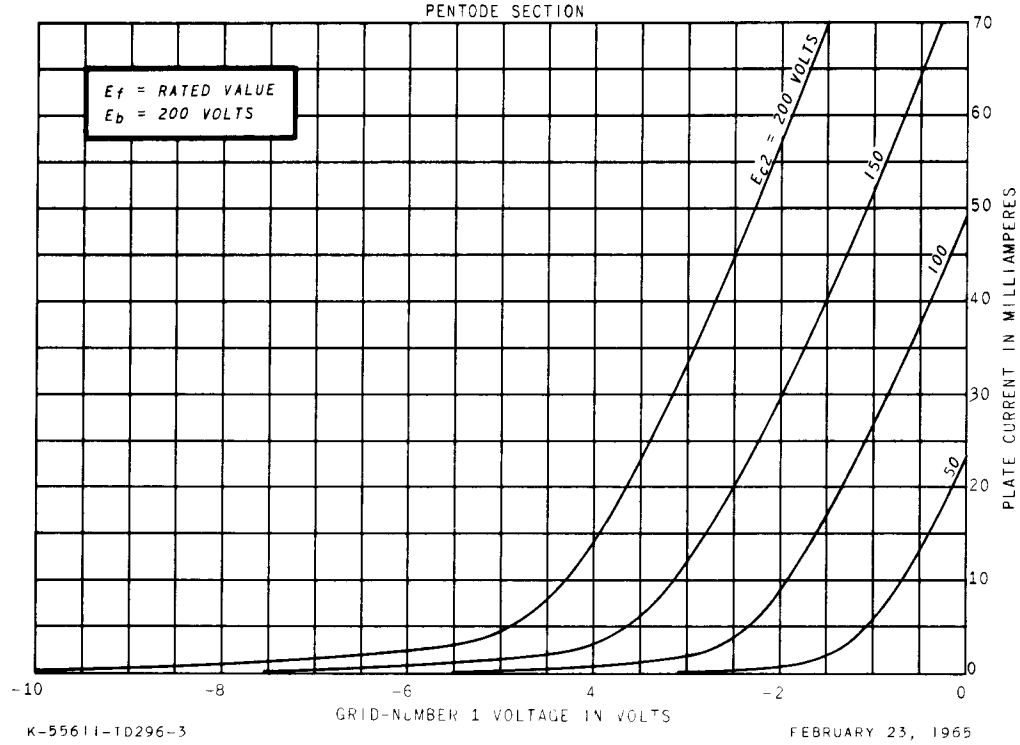
AVERAGE PLATE CHARACTERISTICS



K-55611-TD296-2

FEBRUARY 23, 1965

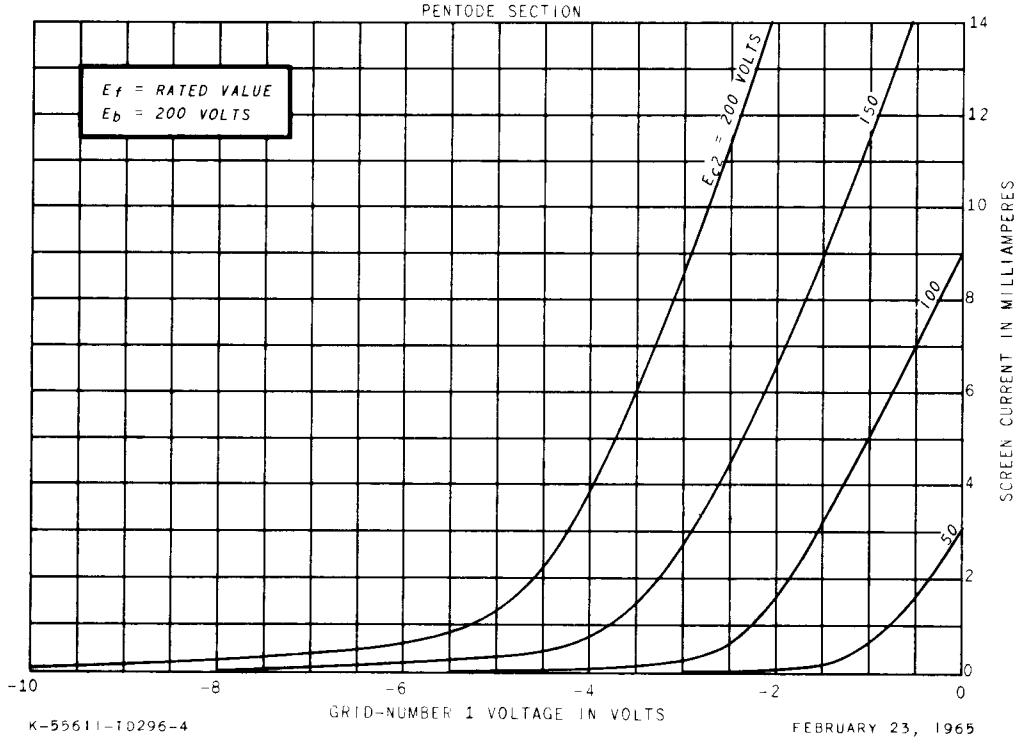
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD296-3

FEBRUARY 23, 1965

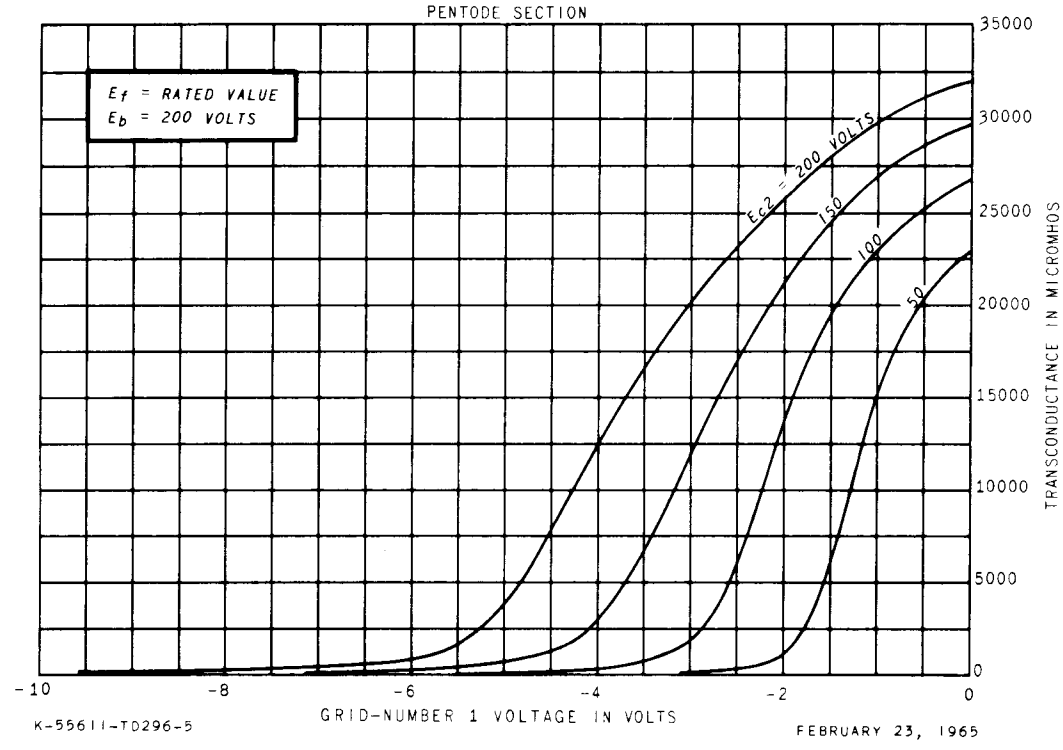
AVERAGE TRANSFER CHARACTERISTICS



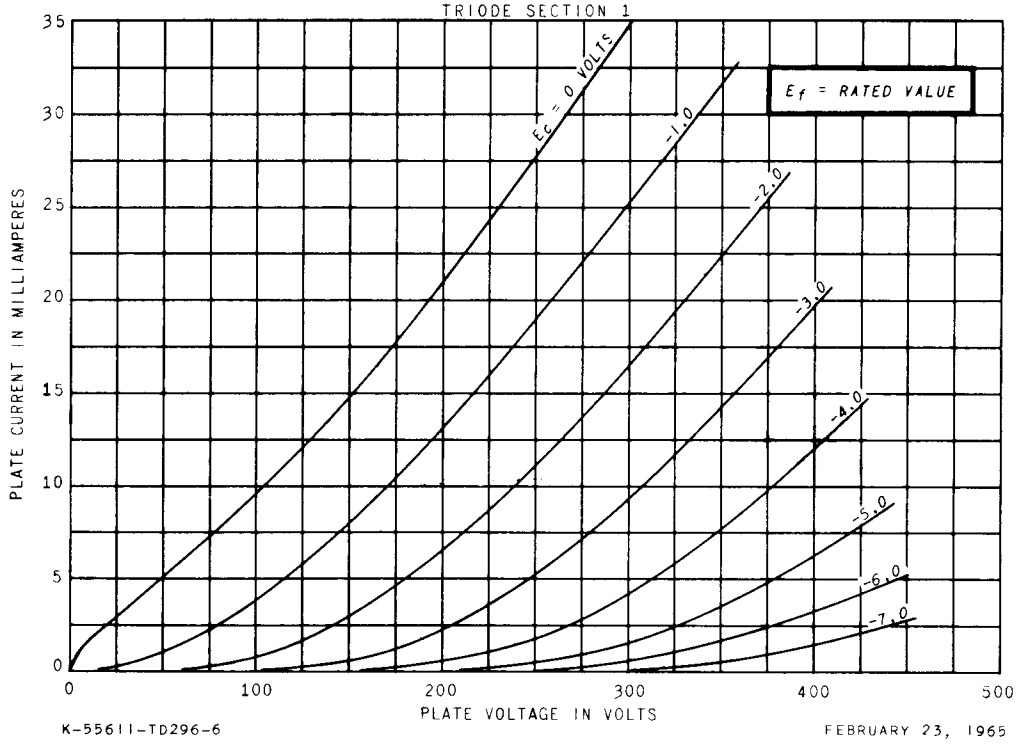
K-55611-TD296-4

FEBRUARY 23, 1965

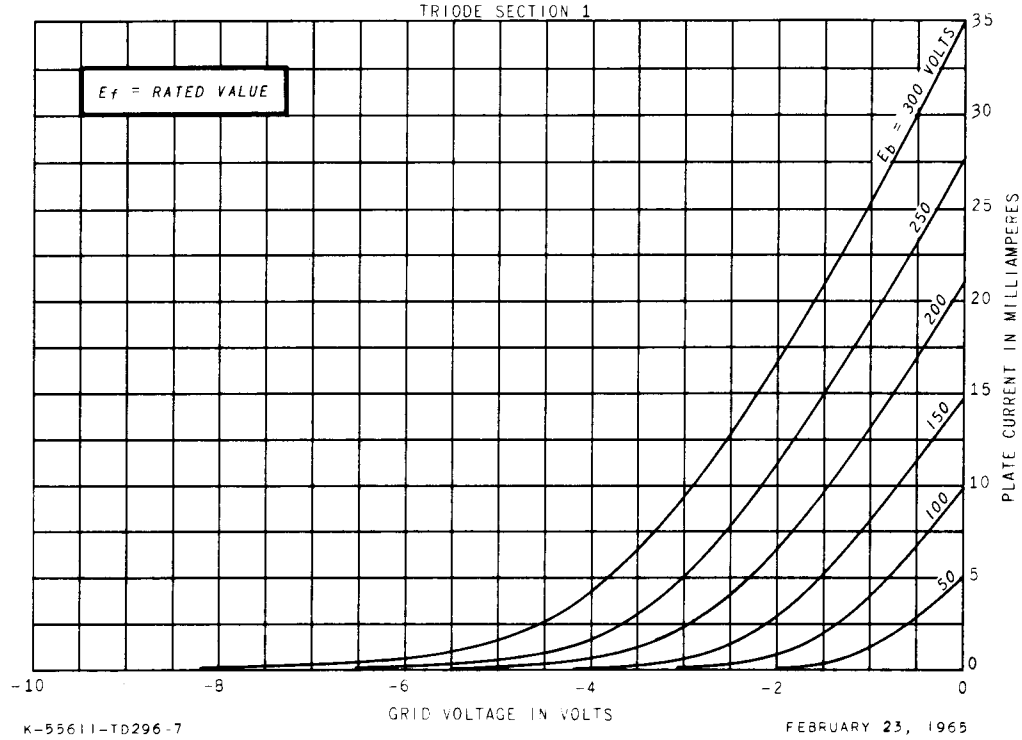
AVERAGE TRANSFER CHARACTERISTICS



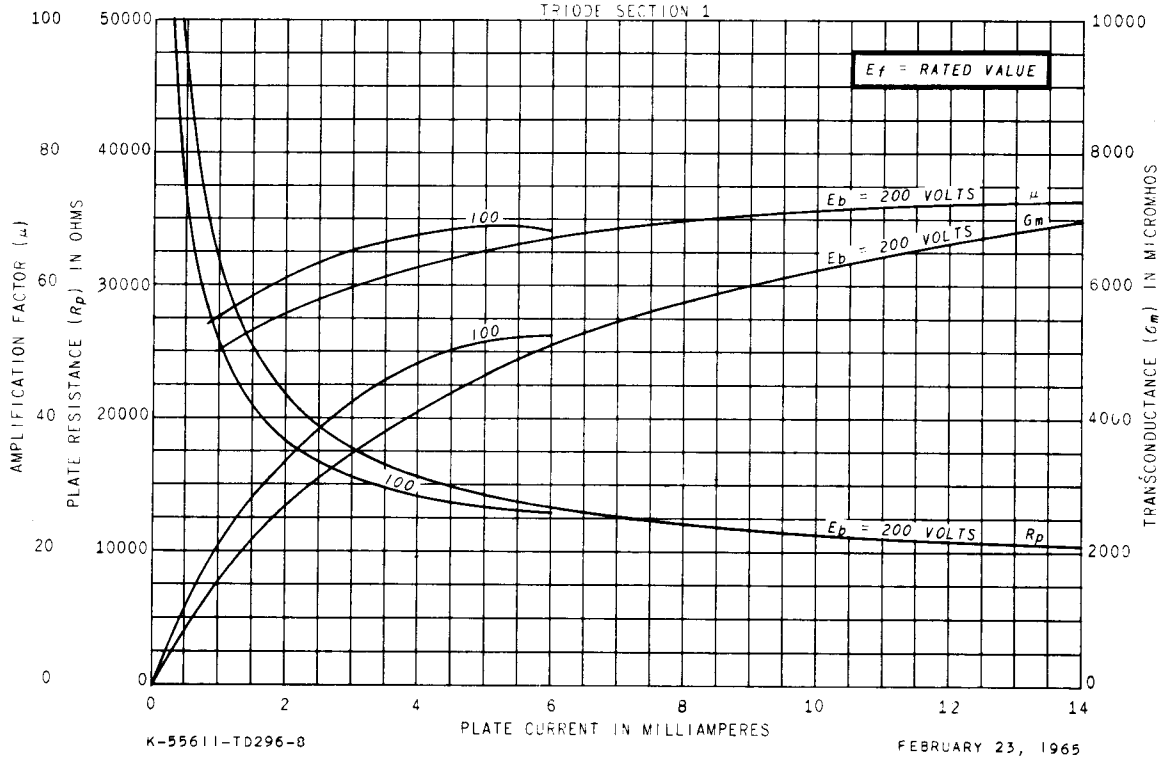
AVERAGE PLATE CHARACTERISTICS



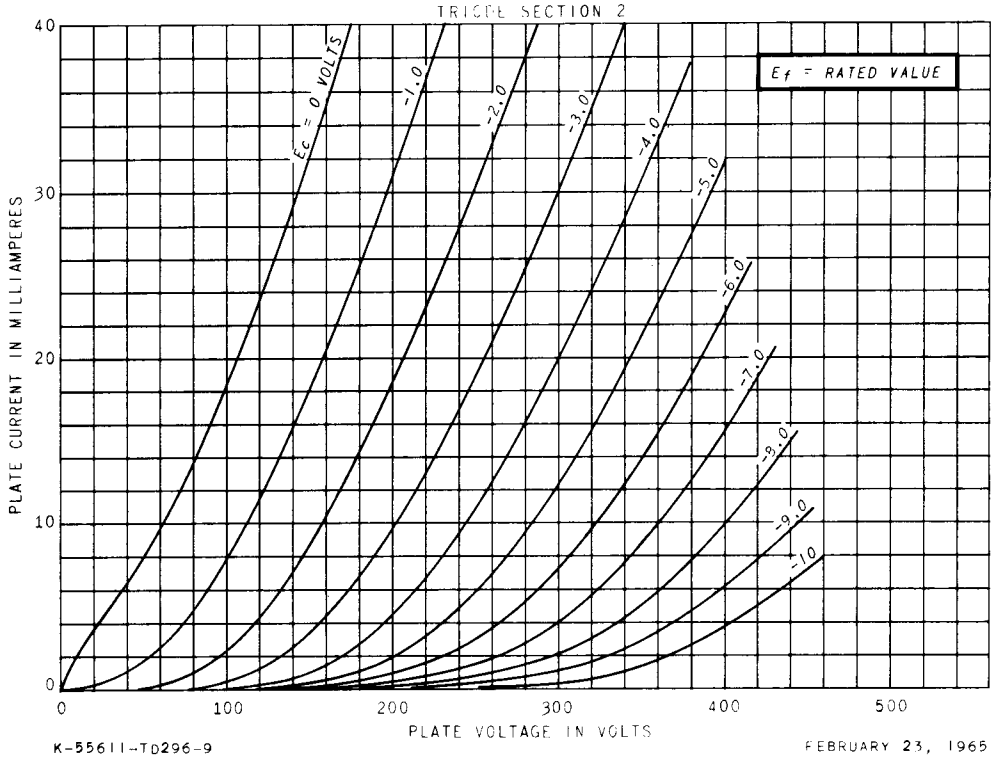
AVERAGE TRANSFER CHARACTERISTICS



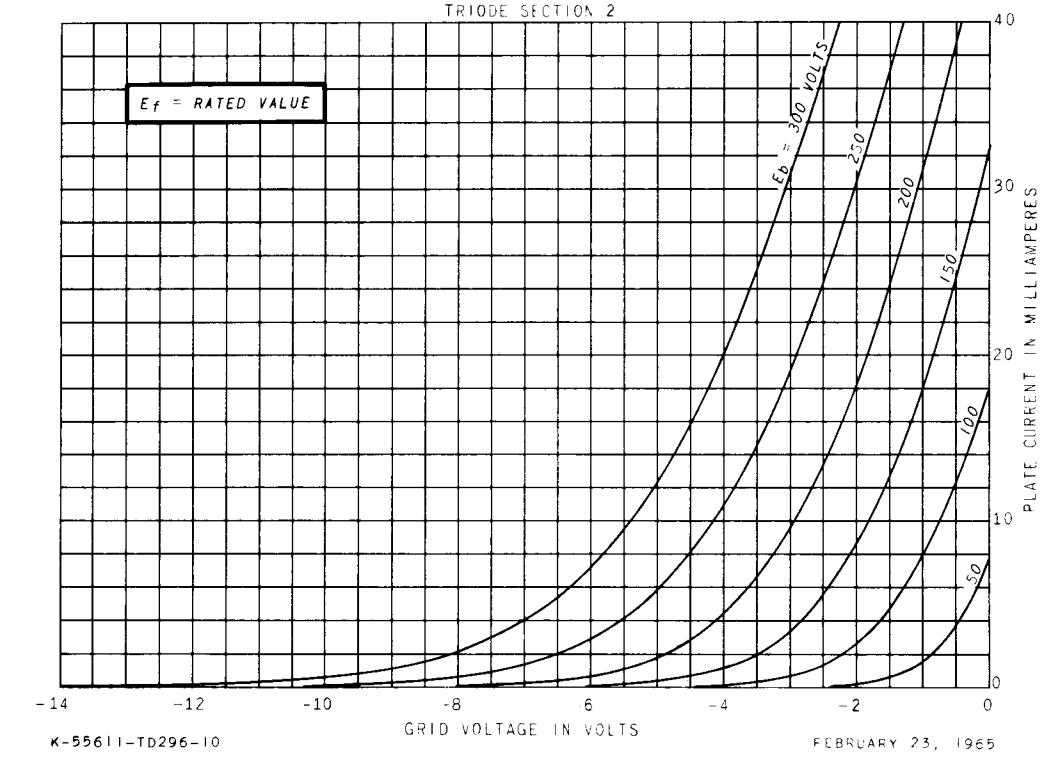
AVERAGE CHARACTERISTICS



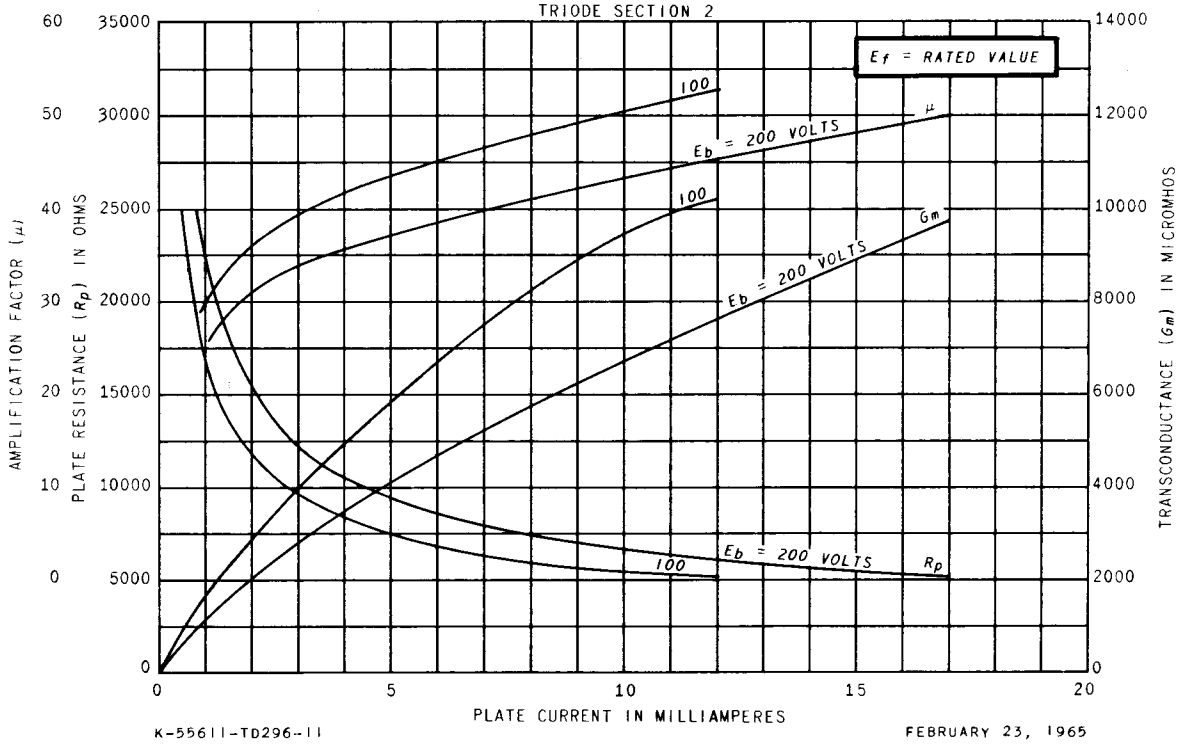
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



K-55611-TD296-11

FEBRUARY 23, 1965

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

—PRODUCT INFORMATION—

14BR11

Compactron Dissimilar-Double-Triode Pentode

- MULTIFUNCTION
- FOR LOW B+ BLACK-AND-WHITE TV
- HIGH-MU, HIGH-TRANSCONDUCTANCE TRIODE
- MEDIUM-MU TRIODE
- VIDEO AMPLIFIER PENTODE

The 14BR11 is a compactron containing a high-mu triode, a medium-mu triode, and a sharp-cutoff pentode. The high-mu triode is intended for audio i-f, AGC keyer and other general purpose uses, the medium-mu triode for sync separator service, and the pentode for video amplifier service.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	14.2	Volts
Heater Current●	0.45 ± 0.03	Amperes
Heater Warm-up Time, average♦	11	Seconds

Direct Interelectrode Capacitances, approximate▲

Triode (Section 1)

Grid to Plate: (1Tg to 1Tp)	3.8	pf
Input: 1Tg to (1Tk + Pk + Pg3 + h + i.s.)	2.4	pf
Output: 1Tp to (1Tk + Pk + Pg3 + h + i.s.)	3.8	pf

Triode (Section 2)

Grid to Plate: (2Tg to 2Tp)	1.9	pf
Input: 2Tg to (1Tk + 2Tk + Pk + Pg3 + h + i.s.)	2.8	pf
Output: 2Tp to (1Tk + 2Tk + Pk + Pg3 + h + i.s.)	2.2	pf

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.13	pf
Input: Pg1 to (2Tk + Pk + Pg2 + Pg3 + h + i.s.)	10	pf
Output: Pp to (2Tk + Pk + Pg2 + Pg3 + h + i.s.)	4.6	pf

Coupling

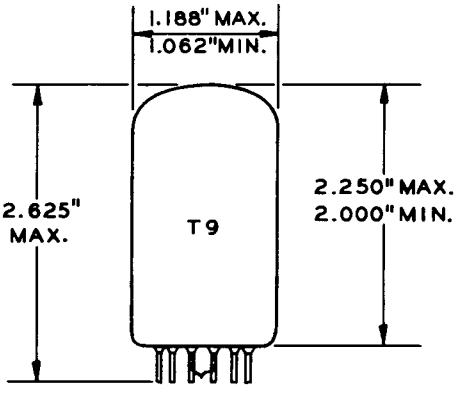
Pentode Plate to Triode Plate (Section 2): (Pp to 2Tp)	0.16	pf
Triode Plate (Section 1) to Triode Plate (Section 2): (1Tp to 2Tp), maximum	0.2	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

PHYSICAL DIMENSIONS

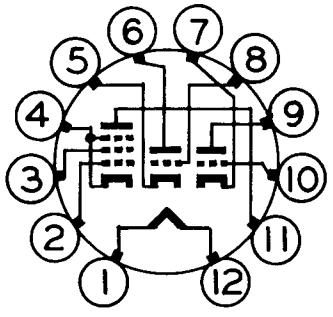


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Pentode Grid Number 1
Pin 3 - Pentode Grid Number 2 (Screen)
Pin 4 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 5 - Triode Cathode (Section 2) and Internal Shield
Pin 6 - Triode Plate (Section 2)
Pin 7 - Triode Cathode (Section 1)
Pin 8 - Triode Grid (Section 2)
Pin 9 - Triode Plate (Section 1)
Pin 10 - Triode Grid (Section 1)
Pin 11 - Pentode Plate
Pin 12 - Heater

BASING DIAGRAM



EIA 12GL

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Pentode Section		
Plate Voltage	330	Volts
Screen Supply Voltage	330	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	4.0	Watts
Screen Dissipation	1.1	Watts
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	1.0	Megohms
With Cathode Bias	1.0	Megohms
Triode (Section 1)		
Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms
Triode (Section 2)		
Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.5	Watts
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	0.5	Megohms
With Cathode Bias	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section			
Plate Voltage	35	135	Volts
Screen Voltage	135	135	Volts
Grid-Number 1 Voltage	0	---	Volts
Cathode-Bias Resistor	---	100	Ohms
Plate Resistance, approximate	---	45000	Ohms
Transconductance	---	10400	Micromhos
Plate Current	34	17	Milliamperes
Screen Current	13	4.0	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	---	-6	Volts
Triode (Section 1)			
Plate Voltage		200	Volts
Cathode-Bias Resistor		220	Ohms
Amplification Factor		41	
Plate Resistance, approximate		9400	Ohms
Transconductance		4400	Micromhos
Plate Current		9.2	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes		-6.5	Volts
Triode (Section 2)			
Plate Voltage		200	Volts
Grid Voltage		-2.0	Volts
Amplification Factor		68	
Plate Resistance, approximate		12400	Ohms
Transconductance		5500	Micromhos
Plate Current		7.0	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes		-5.5	Volts

NOTES

★ Heater voltage for a bogey tube at If = 0.45 amperes.

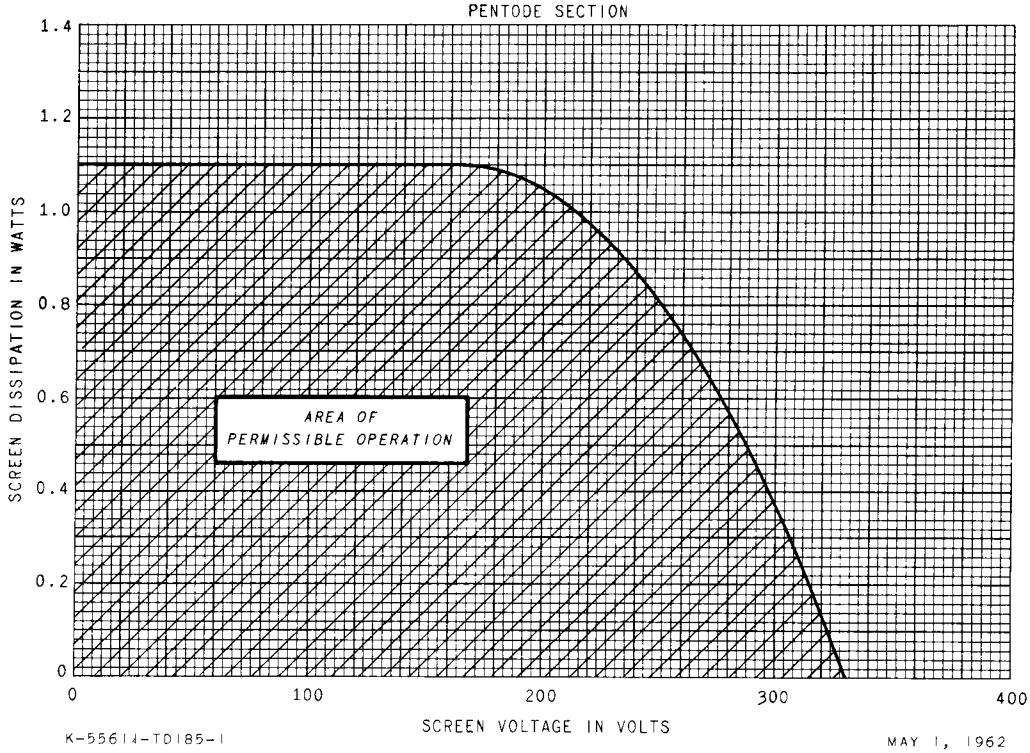
● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

▲ Without external shield.

SCREEN RATING CHART

PENTODE SECTION

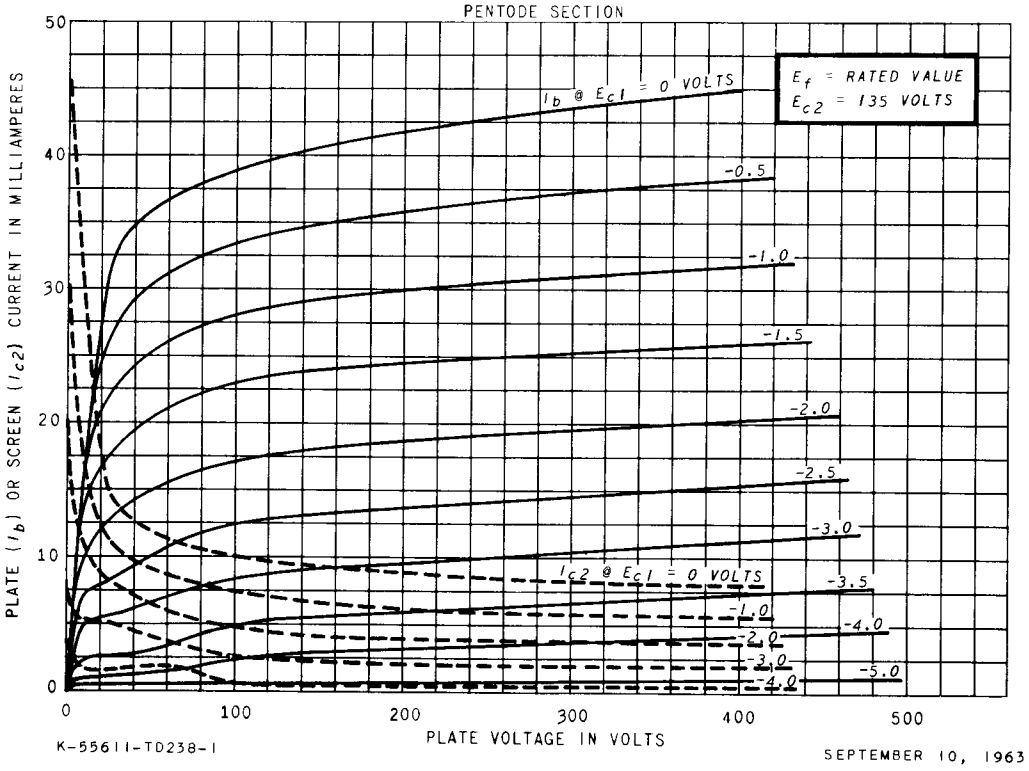


K-55614-TD185-1

MAY 1, 1962

AVERAGE PLATE CHARACTERISTICS

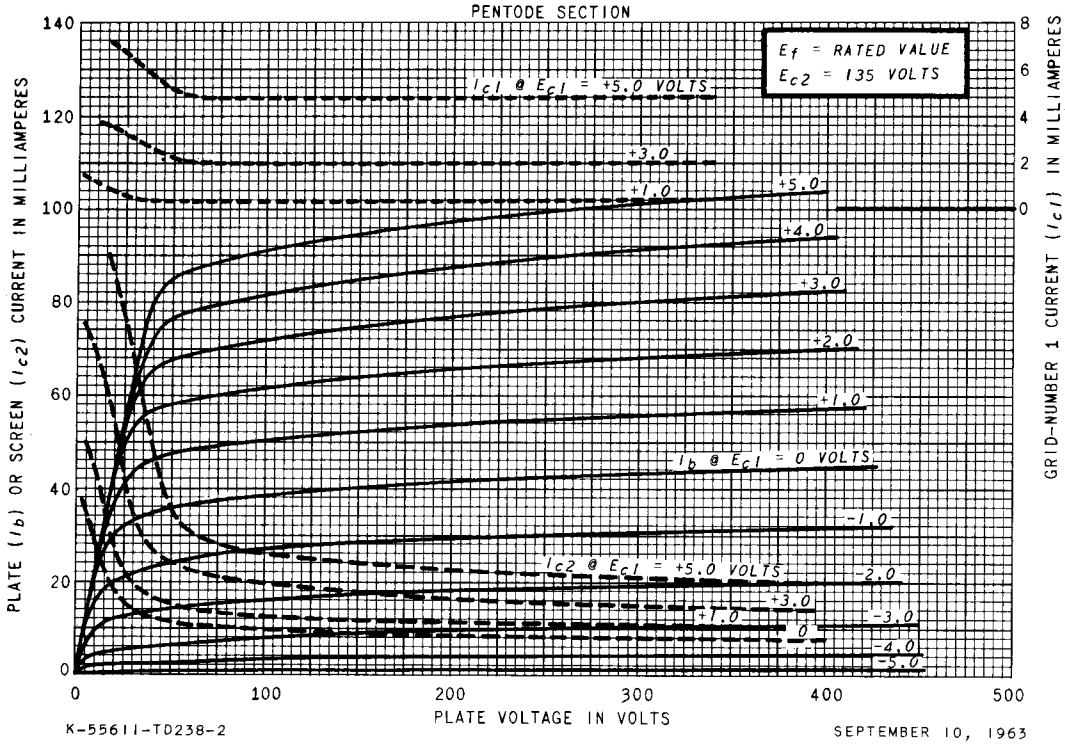
PENTODE SECTION



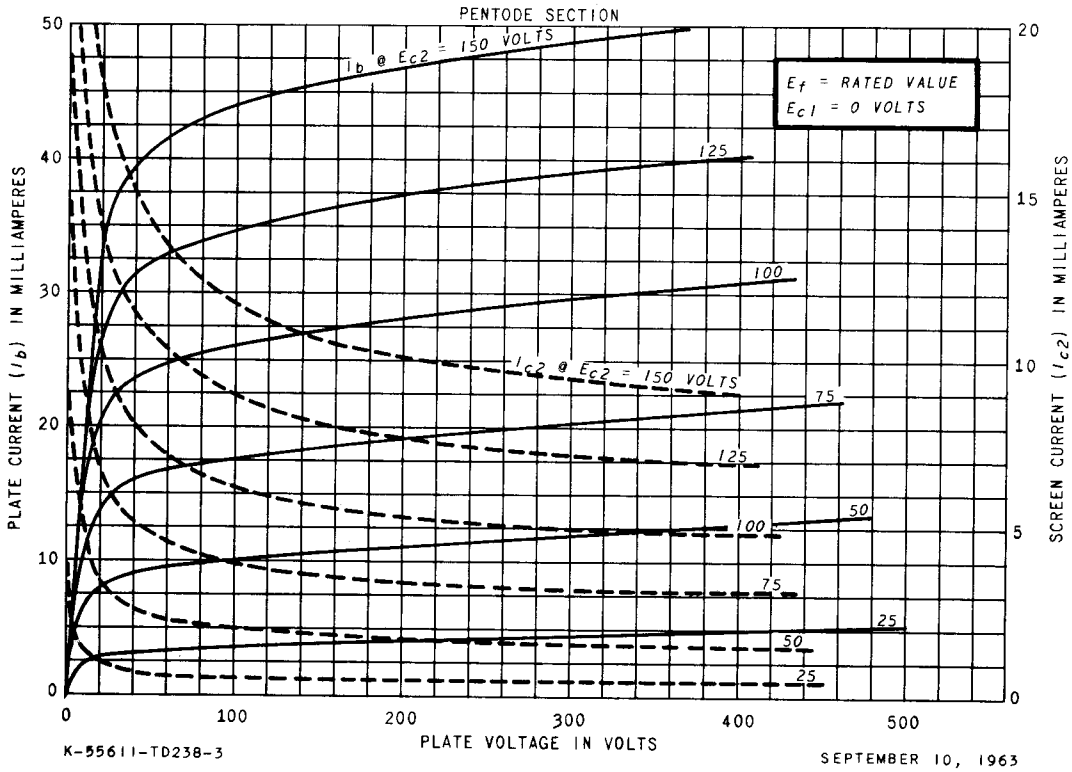
K-55611-TD238-1

SEPTEMBER 10, 1963

AVERAGE PLATE CHARACTERISTICS

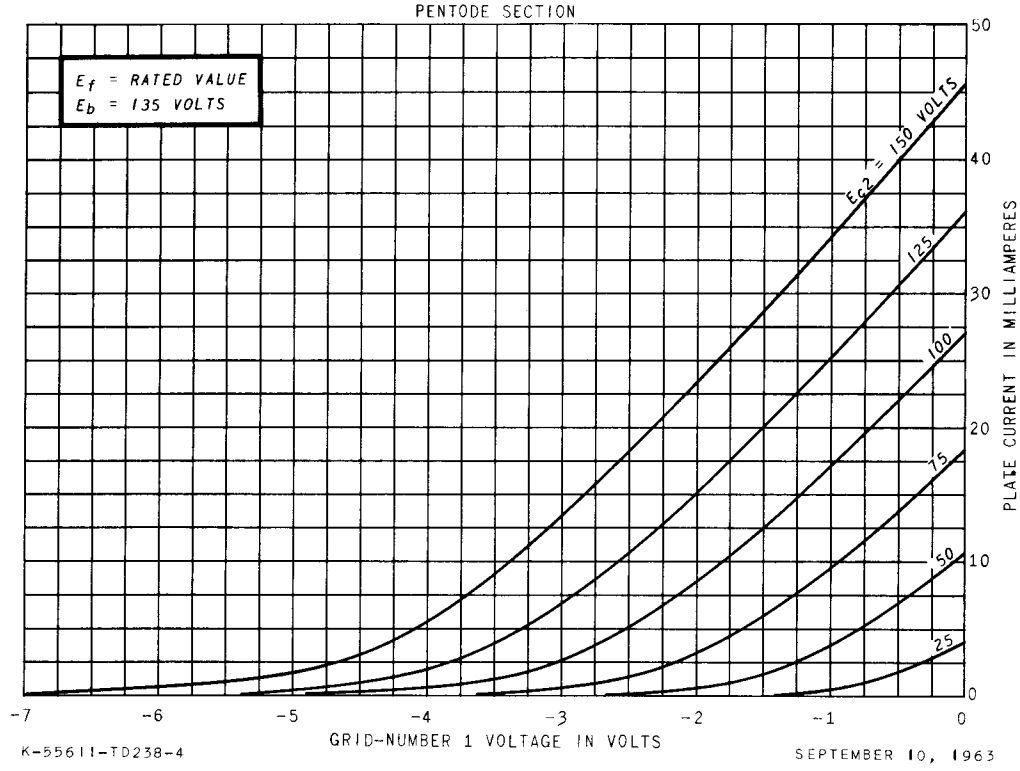


AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

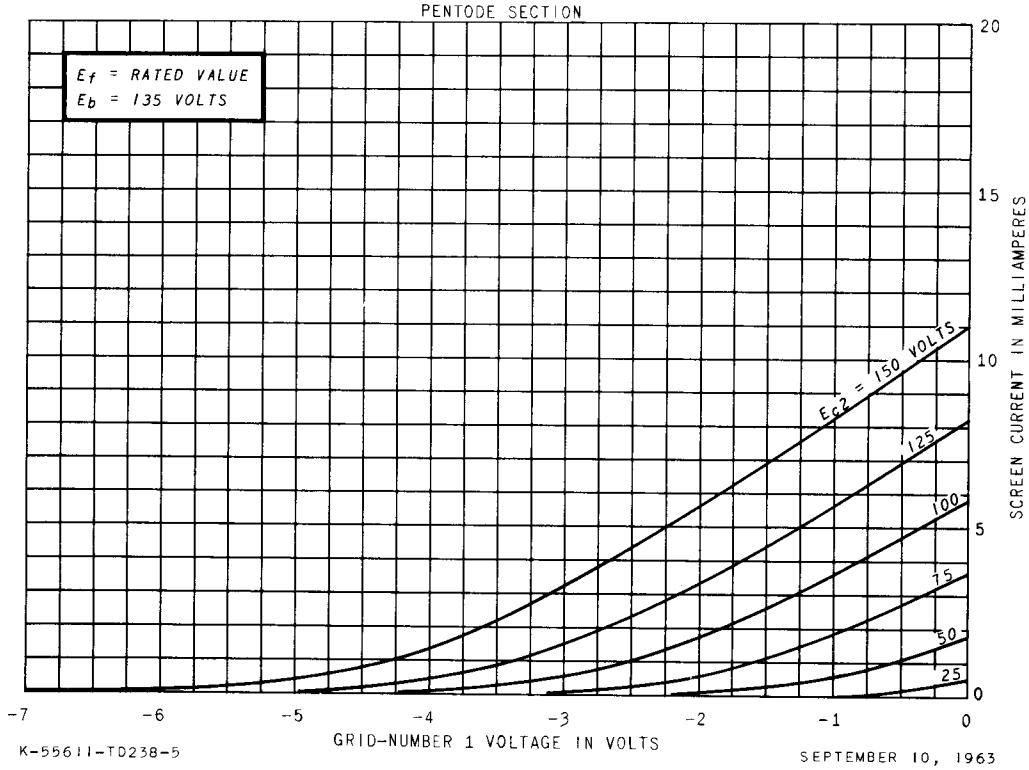


K-55611-TD238-4

SEPTEMBER 10, 1963

AVERAGE TRANSFER CHARACTERISTICS

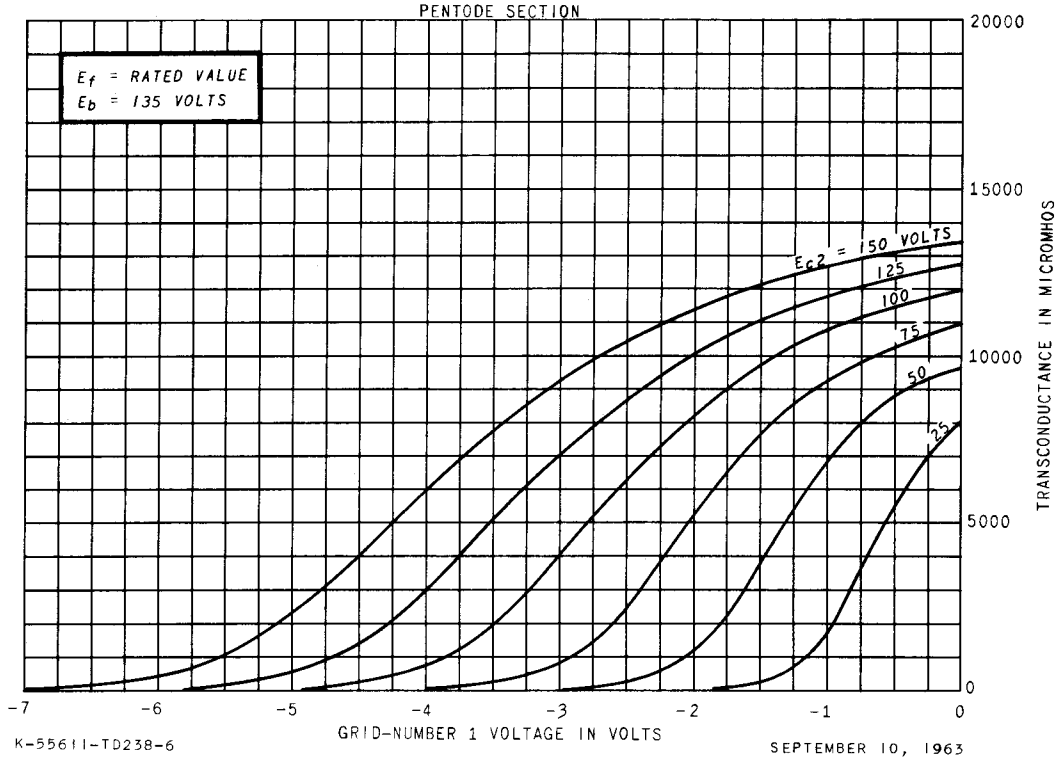
PENTODE SECTION



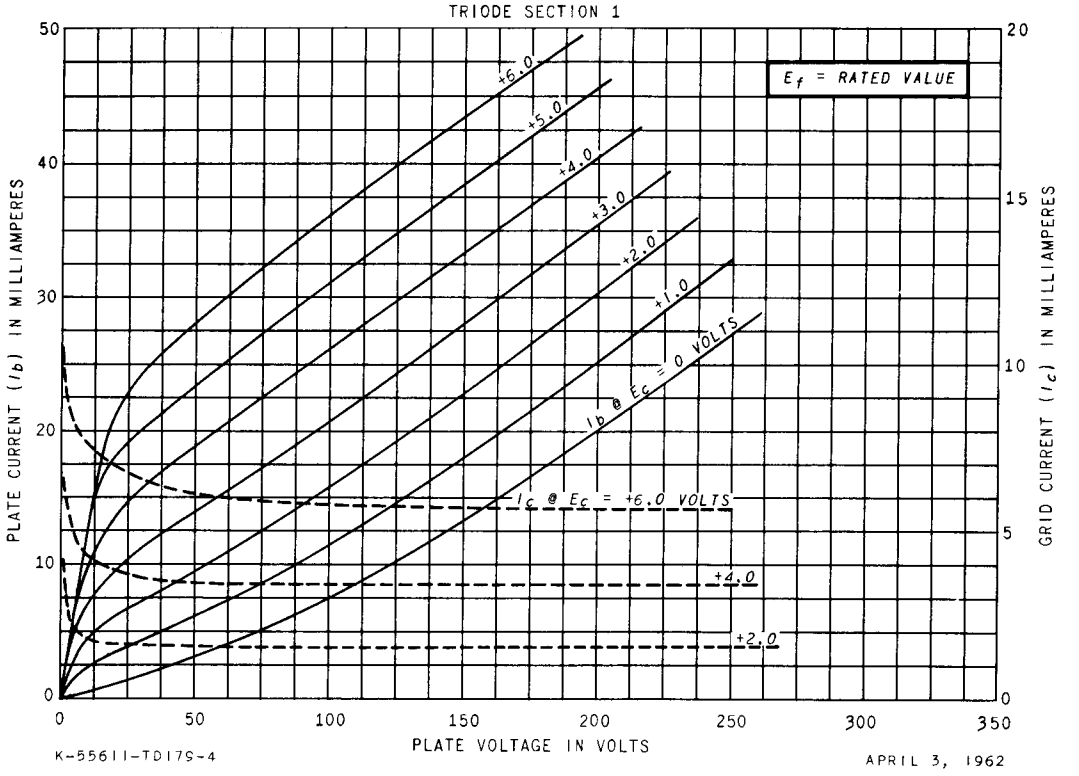
K-55611-TD238-5

SEPTEMBER 10, 1963

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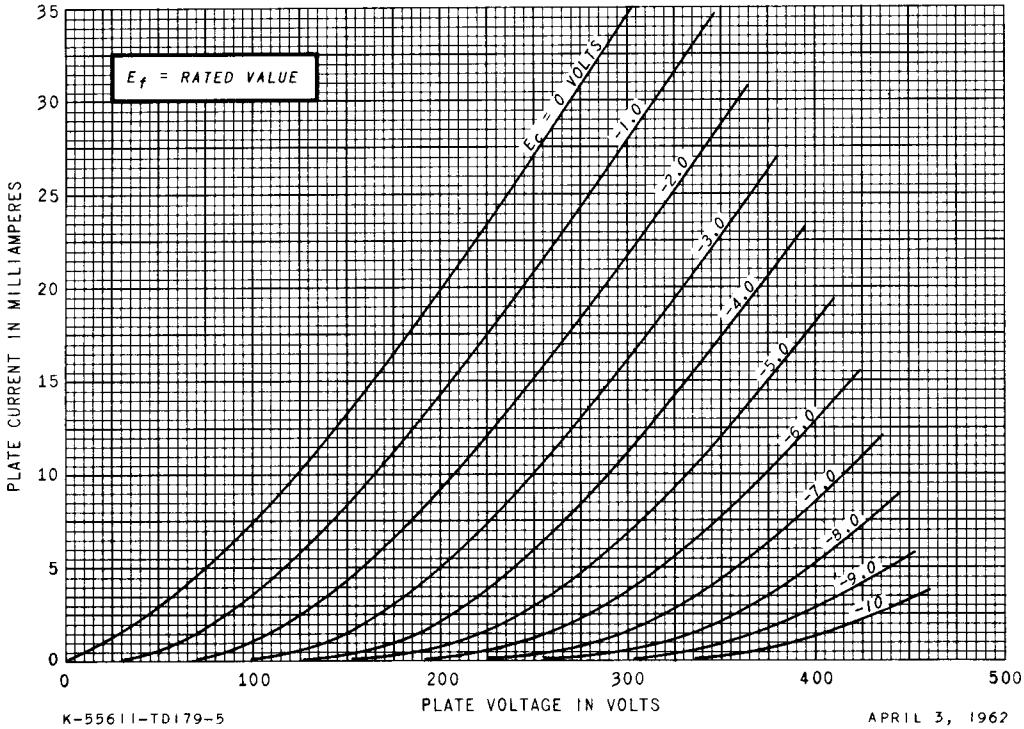


AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION 1

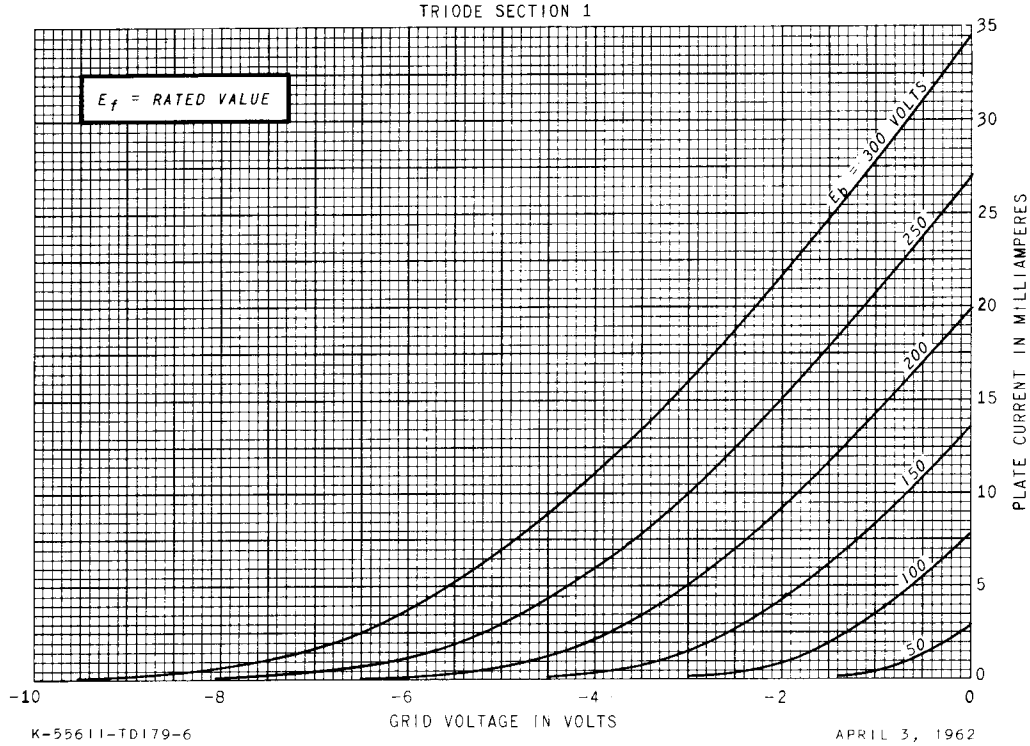


K-55611-TD179-5

APRIL 3, 1962

AVERAGE TRANSFER CHARACTERISTICS

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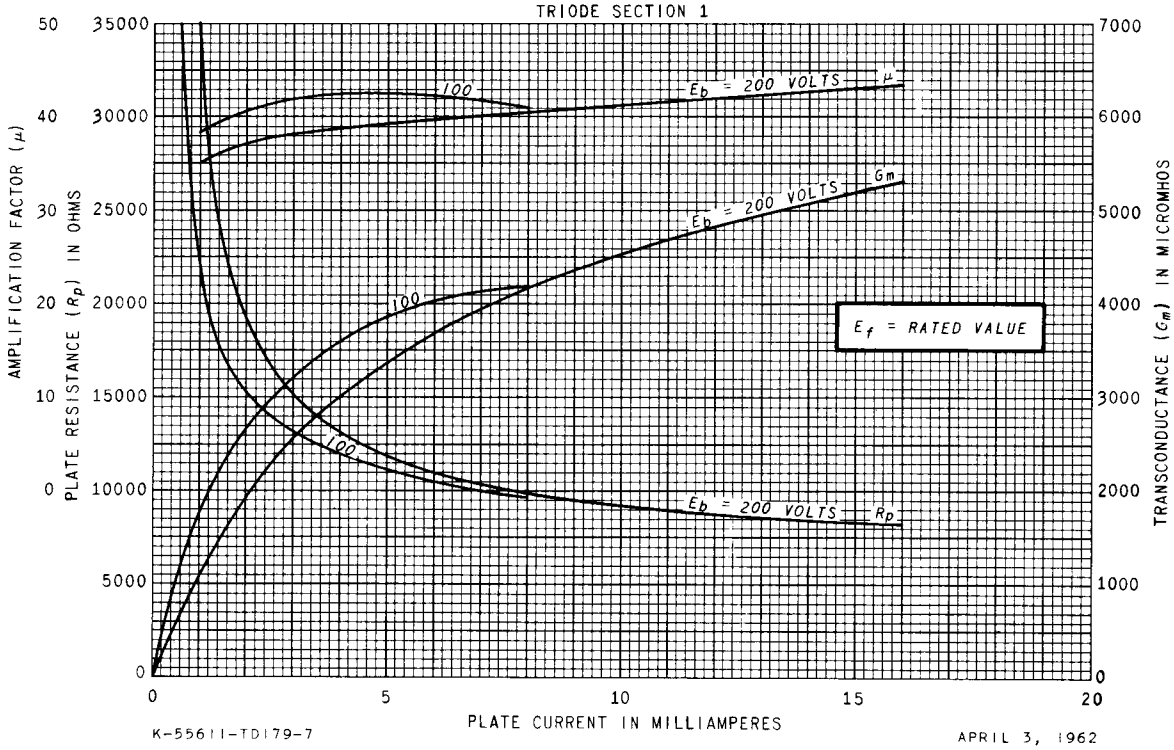


K-55611-TD179-6

APRIL 3, 1962

AVERAGE CHARACTERISTICS

TRIODE SECTION 1

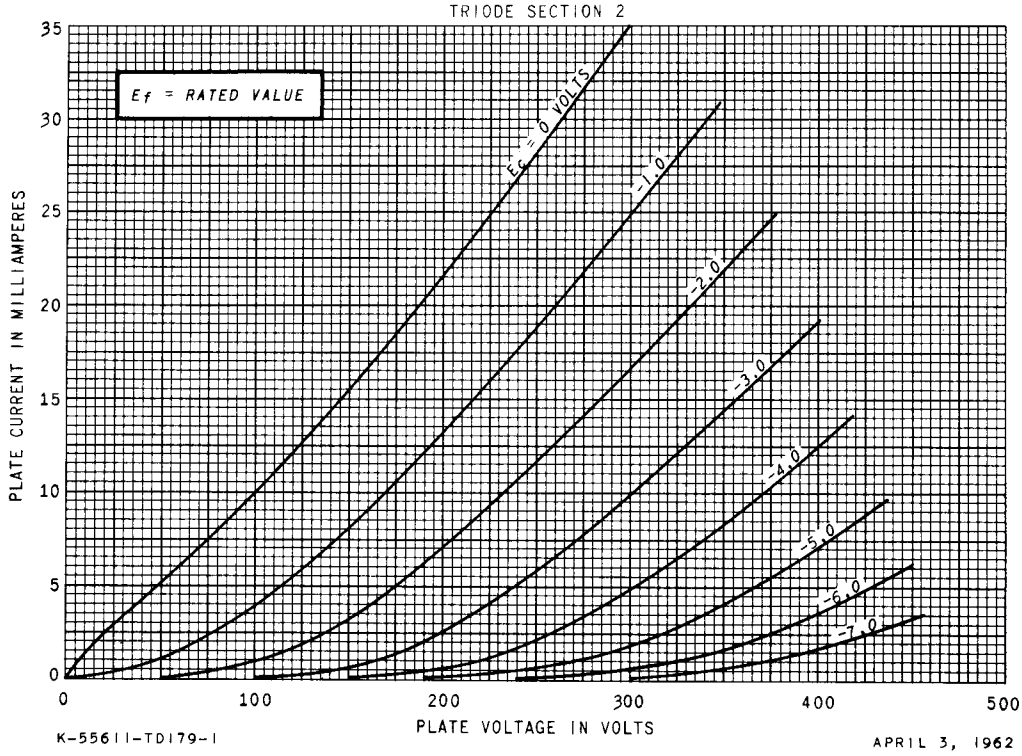


K-55611-TD179-7

APRIL 3, 1962

AVERAGE PLATE CHARACTERISTICS

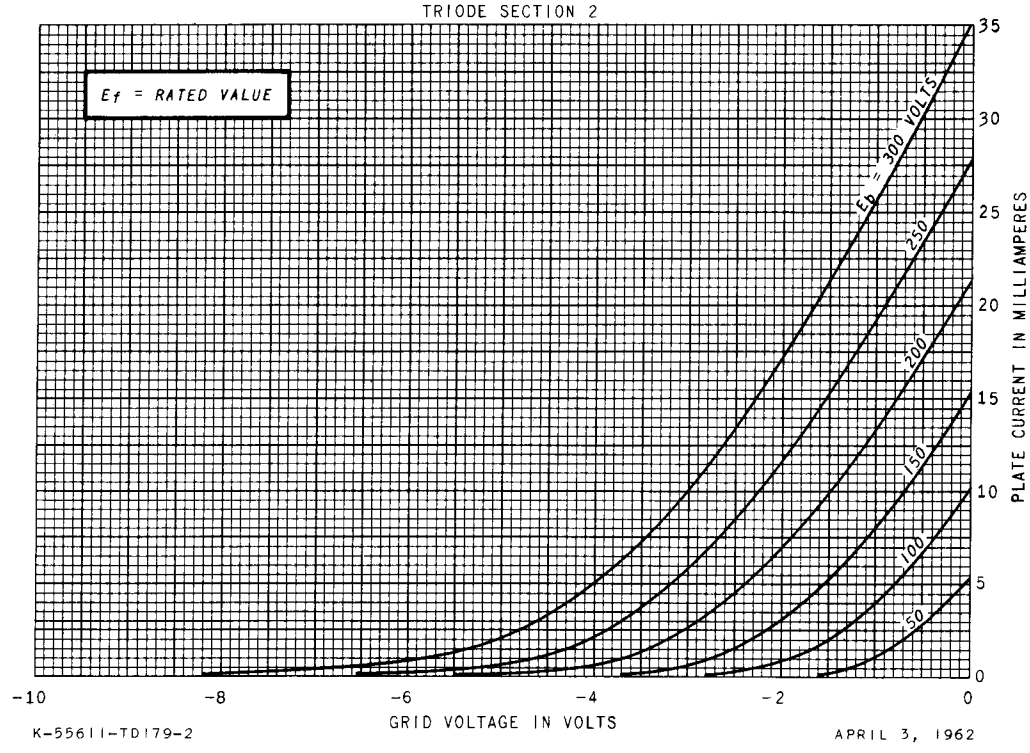
TRIODE SECTION 2



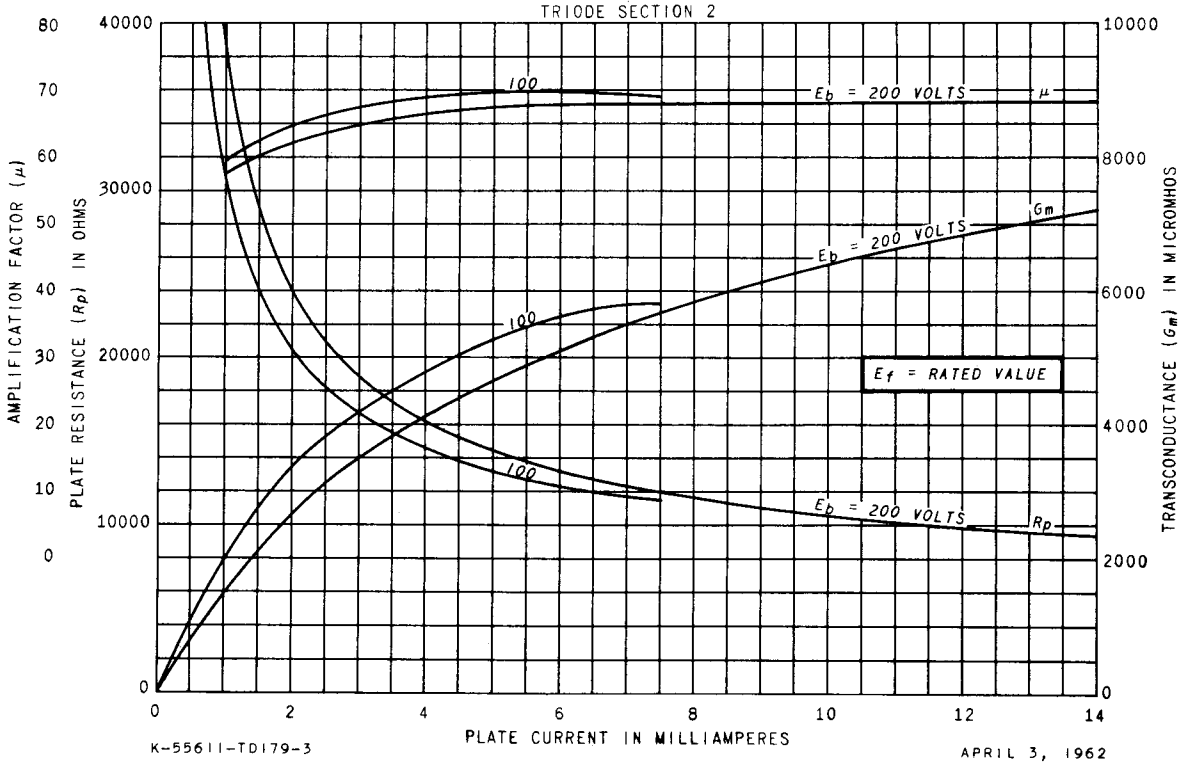
K-55611-TD179-1

APRIL 3, 1962

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

14CP4

CATHODE-RAY TUBE

14-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
11⅜- BY 8½-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 14CP4 is a magnetic-focus and deflection, direct-view all-glass picture tube which provides a 11⅜- by 8½-inch picture for television applications. The electron gun is used with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	2000	μμf
Minimum	750	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	74	Percent

Supersedes ETR-117, dated 8-51

MECHANICAL

Over-all Length	$16\frac{3}{4} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$13\frac{11}{16} \pm \frac{3}{16}$	Inches
Width	$12\frac{9}{16} \pm \frac{1}{8}$	Inches
Height	$9\frac{3}{4} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$12\frac{1}{2}$	Inches
Width	$11\frac{3}{8}$	Inches
Height	$8\frac{1}{2}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J109½-C1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	$10\frac{1}{4}$	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	14,000 Max	Volts DC
Grid-No. 2 Voltage	410 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	150 Max	Volts
Heater Positive with Respect to Cathode	150 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	12,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	105	Milliamperes DC
Ion-Trap Field Intensity♦, approximate	32	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

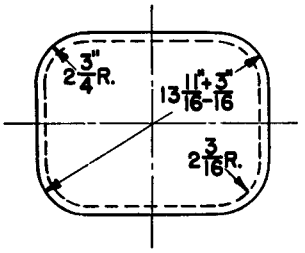
‡ Cathode should be returned to one side or to the midtap of the heater transformer winding.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 10,000 volts.

π For visual extinction of focused raster.

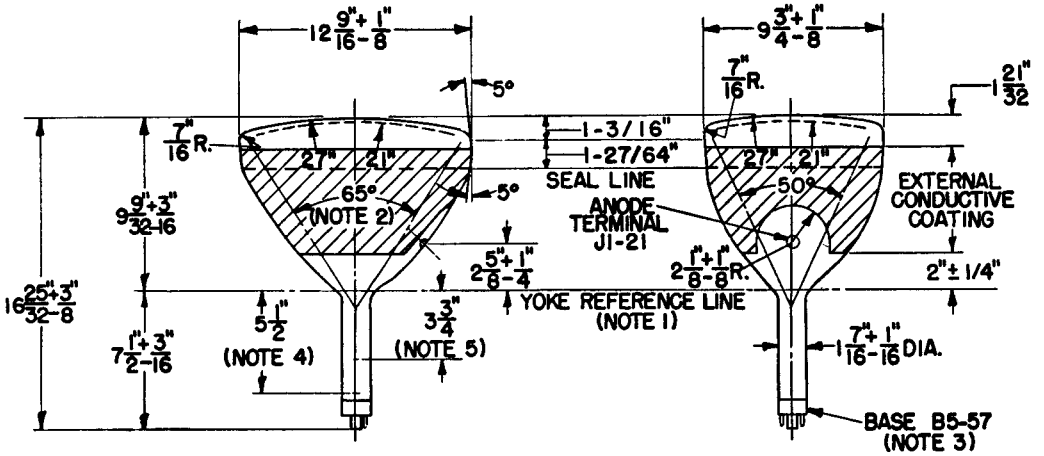
▲ For JETEC focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3¾ inches.

♦ Single-field ion-trap magnet adjusted to optimum position, equivalent to 32 milliamperes through JETEC ion-trap magnet No. 117.



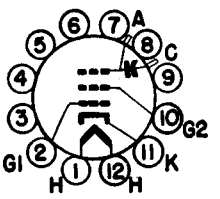
SCREEN DIMENSIONS

DIAGONAL	12-1/2"
WIDTH	11-3/8"
HEIGHT	8-1/2"



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.



BASING DIAGRAM
12 N

Electronic TUBES

14GT8

DUPLEX-DIODE TRIODE

FOR DETECTOR AND AF VOLTAGE-AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 14GT8 is a duplex-diode, high-mu triode with separate cathodes for each of the diode sections and the triode section. The tube is primarily designed for use as an FM detector and AF voltage amplifier.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	14 ± 10%	Volts
Heater Current	0.15	Amperes
Direct Interelectrode Capacitances*		
Triode Grid to Plate	1.8	μμf
Triode Input	1.6	μμf
Triode Output	0.24	μμf
Grid to Diode-Number 1 Plate, maximum	0.09	μμf
Grid to Diode-Number 2 Plate, maximum	0.07	μμf
Diode-Number 1 Input	2.4	μμf
Diode Number 2 Input	2.4	μμf
Diode-Number 1 Cathode to All	6.5	μμf
Diode-Number 2 Cathode to All	6.5	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.1	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Diode Current for Continuous Operation, Each Diode	5.0	Milliamperes

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

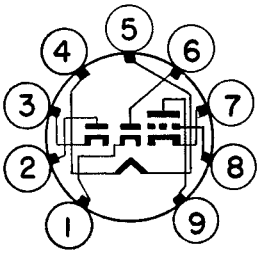
These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

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GENERAL ELECTRIC

BASING DIAGRAM

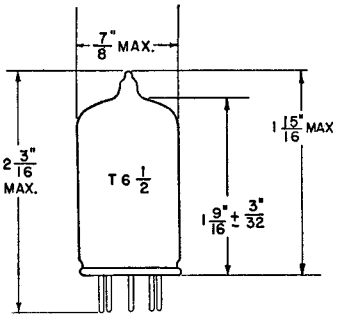


EIA 9KR

TERMINAL CONNECTIONS

Pin 1—Diode Number 2 Cathode
Pin 2—Diode Number 1 Plate
Pin 3—Diode Number 1 Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Diode Number 2 Plate
Pin 7—Triode Cathode
Pin 8—Triode Grid
Pin 9—Triode Plate

PHYSICAL DIMENSIONS



EIA 6-2

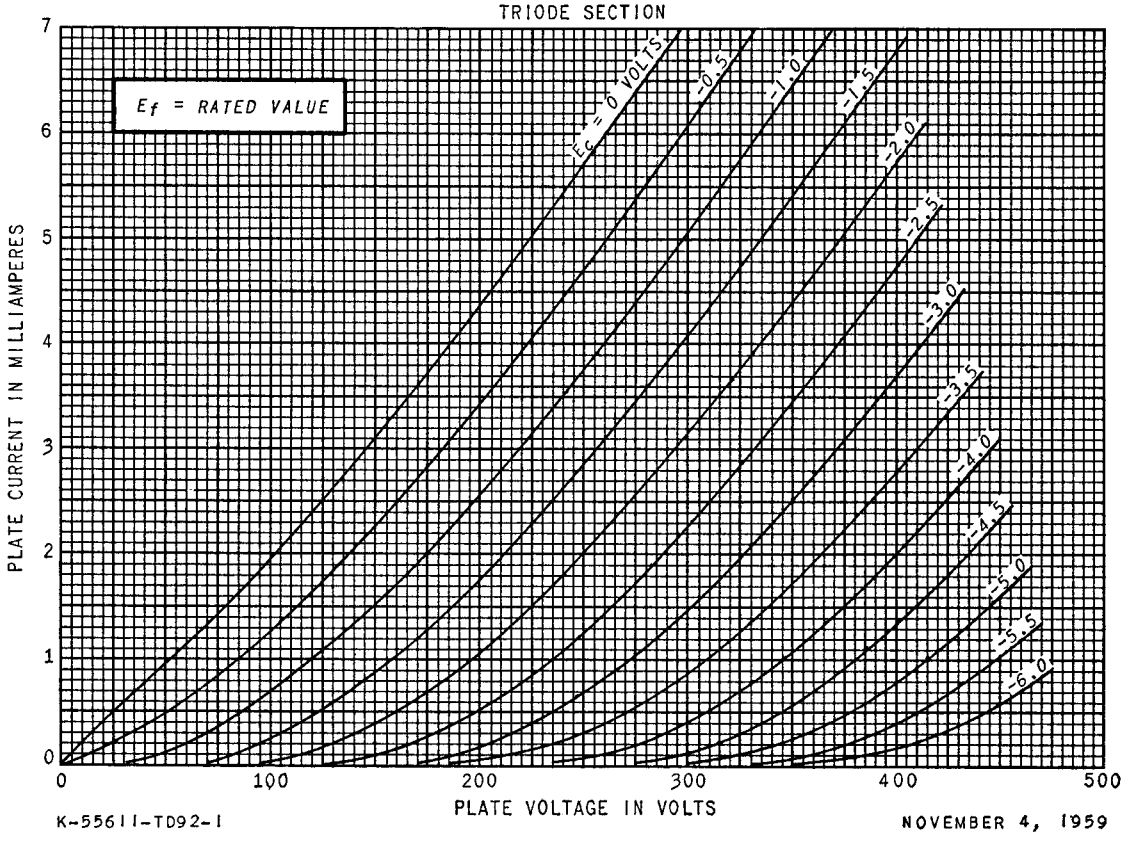
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	250	Volts
Grid Voltage	−3.0	Volts
Amplification Factor	72	
Plate Resistance, approximate	72000	Ohms
Transconductance	1000	Micromhos
Plate Current	0.7	Milliamperes
Average Diode Current, Each Diode With 5.0 Volts DC Applied	18	Milliamperes

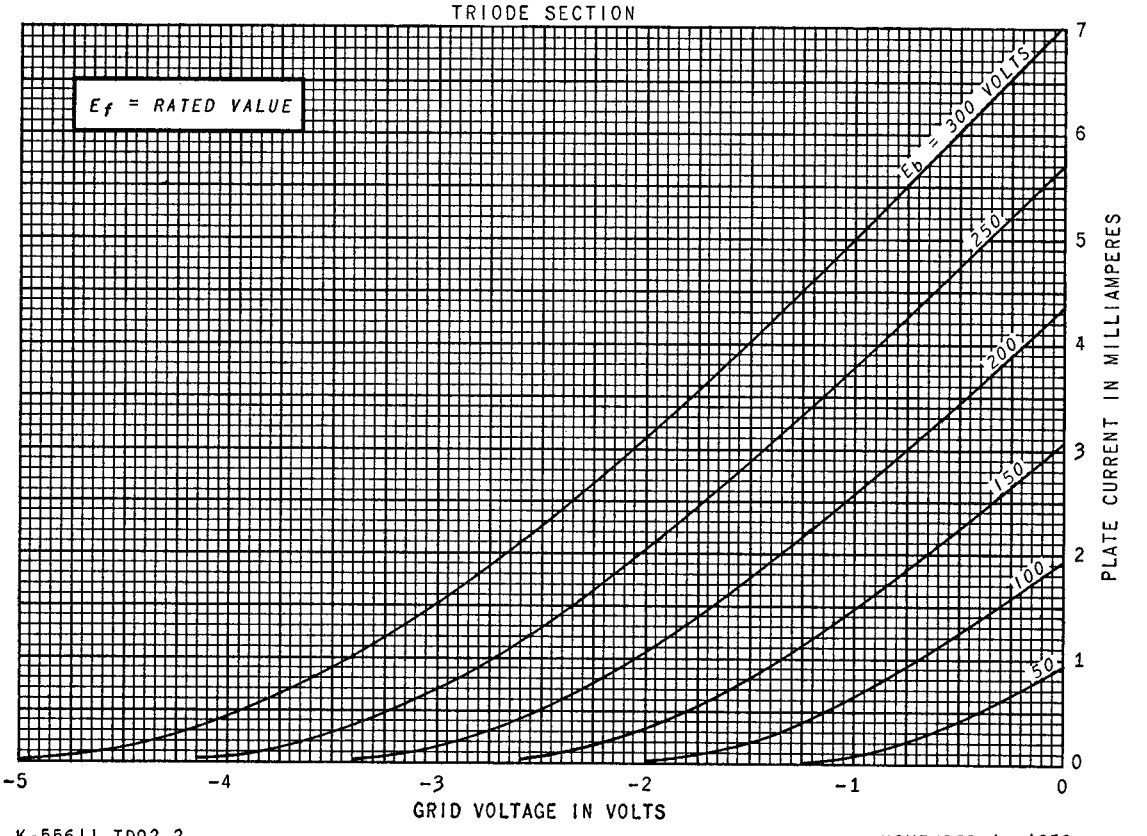
* Without external shield.

AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION

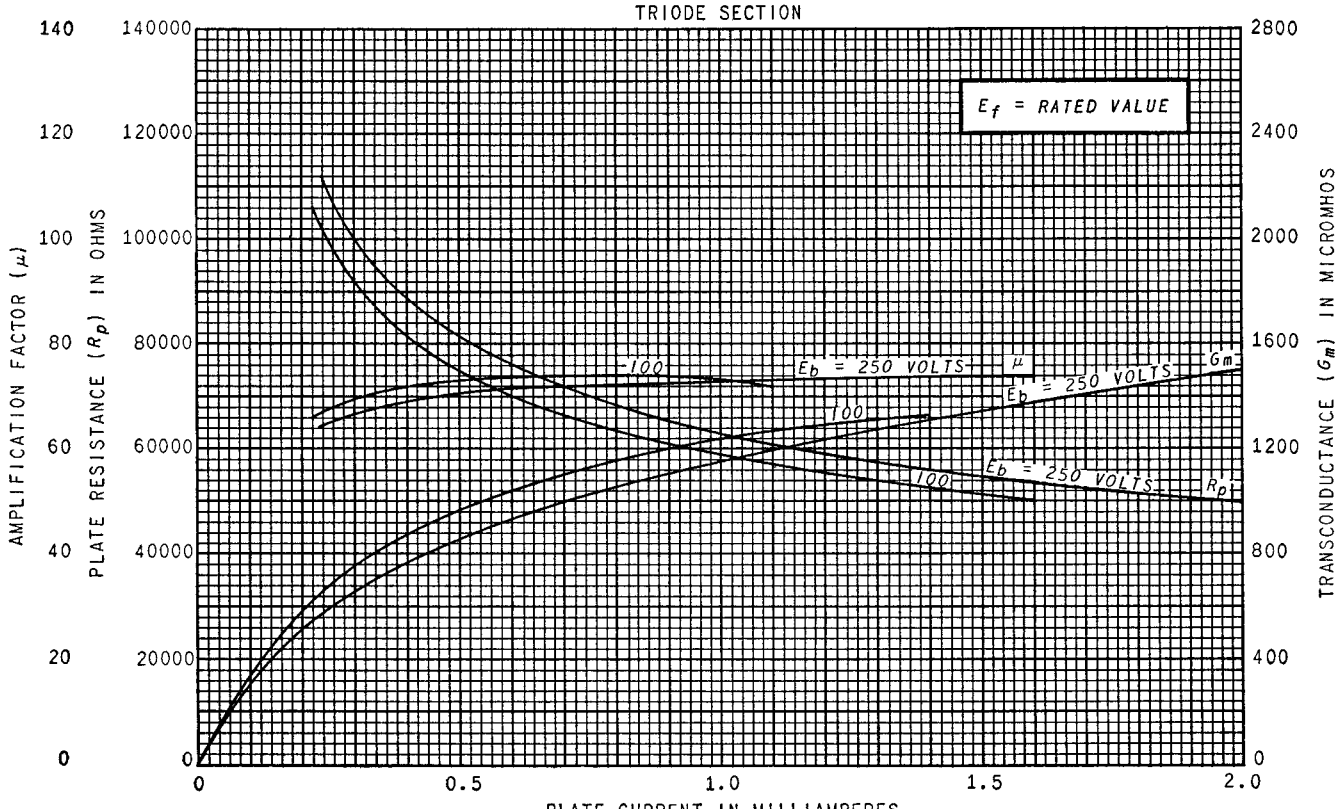


K-55611-TD92-2

NOVEMBER 4, 1959

AVERAGE CHARACTERISTICS

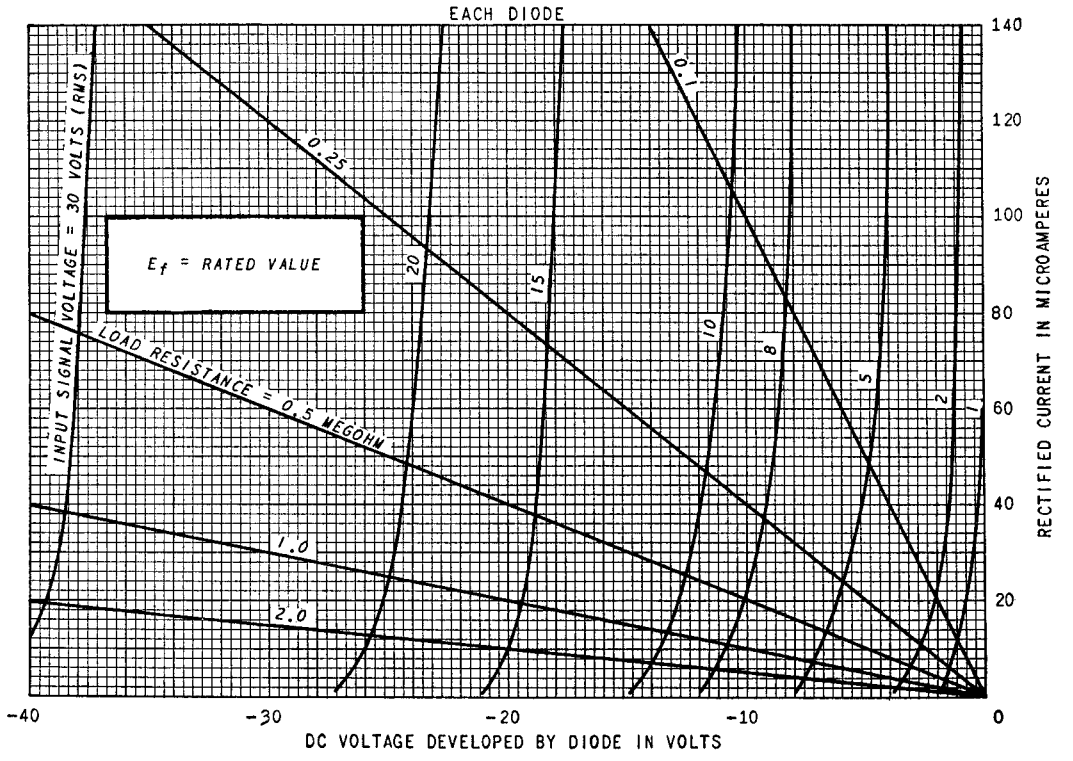
TRIODE SECTION



K-55611-TD92-3

NOVEMBER 4, 1959

OPERATION CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

14JG8

DUPLEX-DIODE TRIODE

DESCRIPTION AND RATING

FOR DETECTOR AND AF VOLTAGE-AMPLIFIER APPLICATIONS

The 14JG8 is a duplex-diode, high-mu triode with separate cathodes for each of the diode sections and the triode section. The tube is primarily designed for use as an FM detector and AF voltage amplifier.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	14	Volts
Heater Current†	0.15 ± 0.009	Amperes
Direct Interelectrode Capacitances‡		
Triode Grid to Plate	1.7	pf
Triode Input	1.8	pf
Triode Output	0.22	pf
Grid to Diode-Number 1 Plate, maximum	0.09	pf
Grid to Diode-Number 2 Plate, maximum	0.07	pf
Diode-Number 1 Input	2.4	pf
Diode-Number 2 Input	2.2	pf
Diode-Number 1 Cathode to All	6.0	pf
Diode-Number 2 Cathode to All	6.0	pf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin
Outline Drawing—EIA 6-2

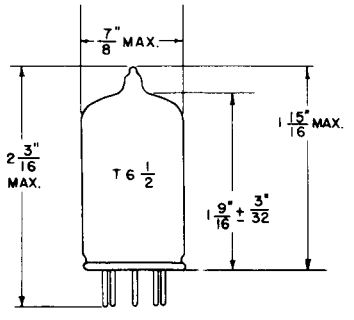
Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 3/16	Inches
Maximum Seated Height	1 15/16	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	1.1	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Diode Current for Continuous Operation, Each Diode	5.0	Milliamperes

PHYSICAL DIMENSIONS

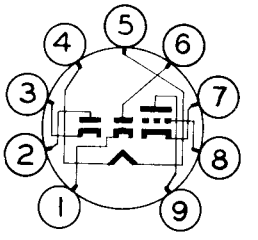


EIA 6-2

TERMINAL CONNECTIONS

Pin 1—Diode Number 2 Cathode
Pin 2—Diode Number 1 Plate
Pin 3—Diode Number 1 Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Diode Number 2 Plate
Pin 7—Triode Cathode
Pin 8—Triode Grid
Pin 9—Triode Plate

BASING DIAGRAM



EIA 9KR

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	250	Volts
Grid Voltage	−2.0	Volts
Amplification Factor	90	
Plate Resistance, approximate	41000	Ohms
Transconductance	2200	Micromhos
Plate Current	2.0	Milliamperes
Average Diode Current, Each Diode With 5.0 Volts DC Applied	20	Milliamperes

* Heater voltage for a bogey tube at If = 0.15 amperes.

† For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

‡ Without external shield.

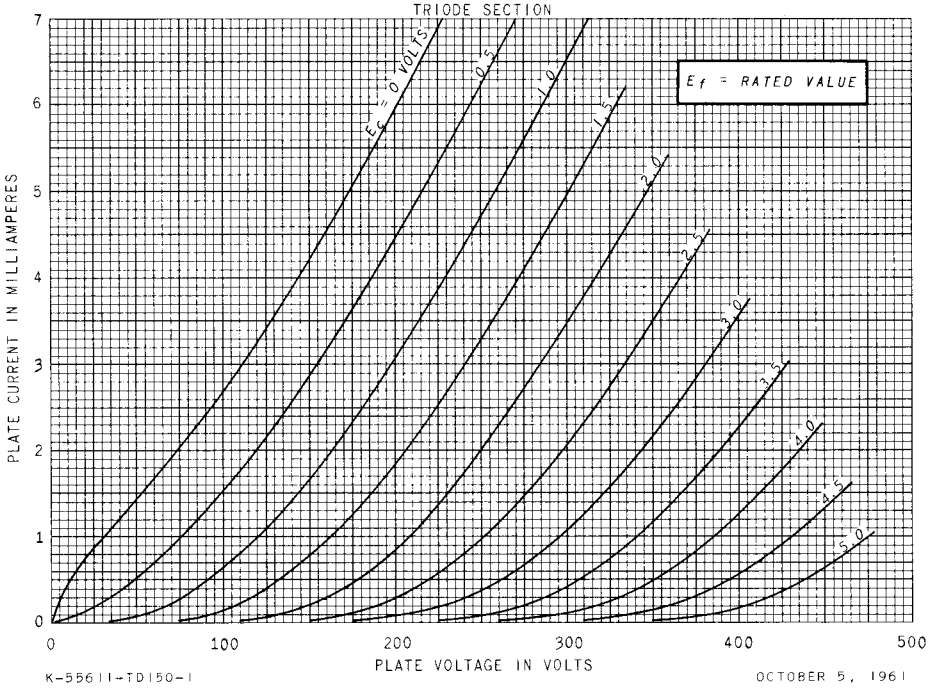
Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

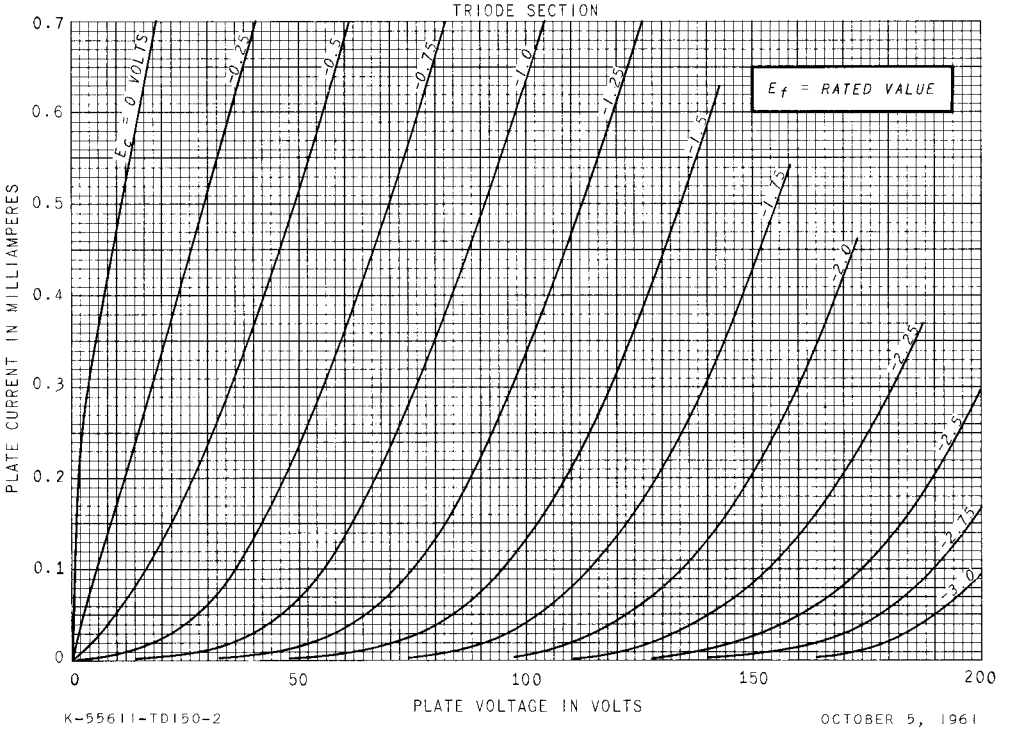
The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

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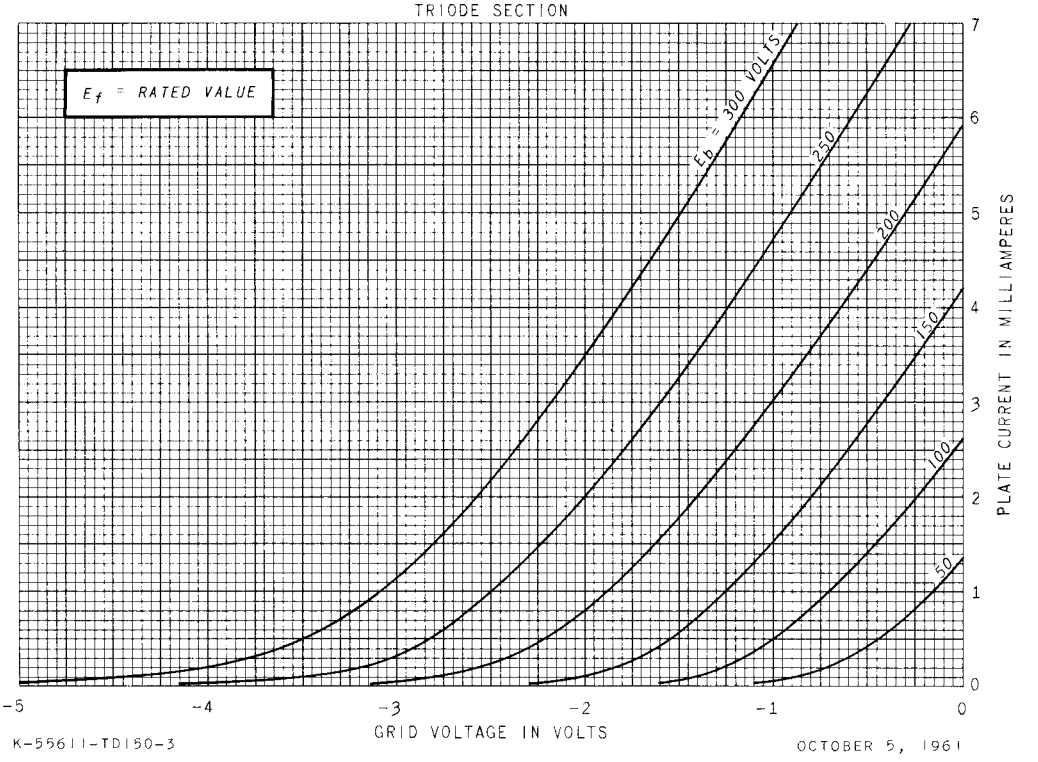
AVERAGE PLATE CHARACTERISTICS



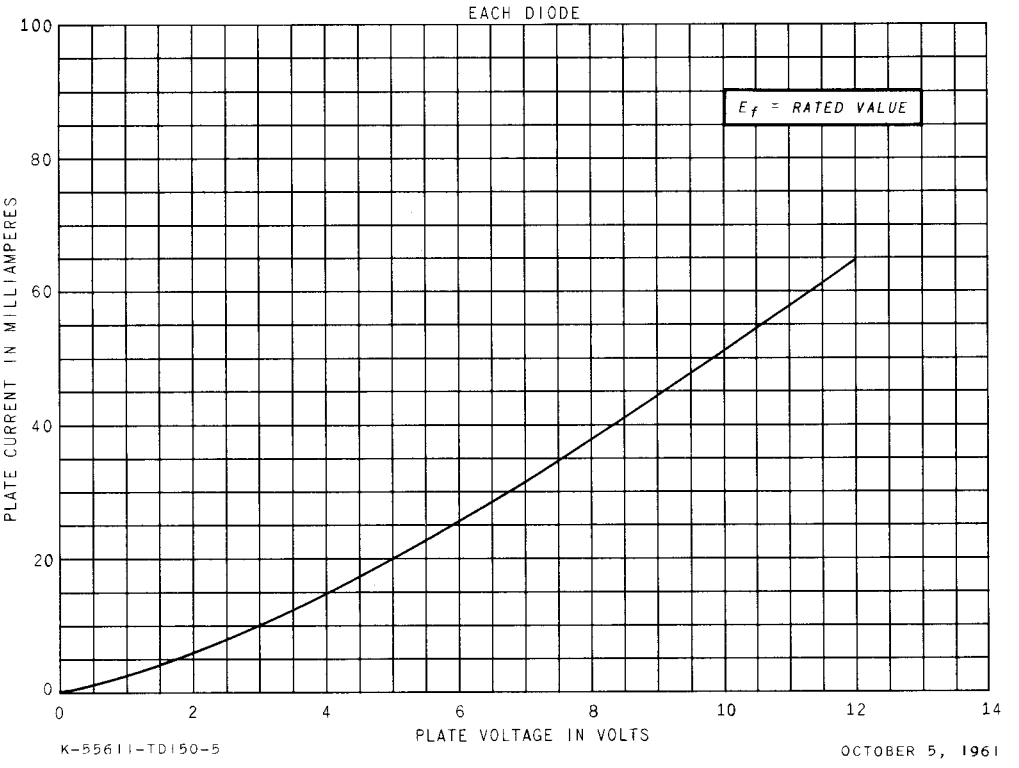
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



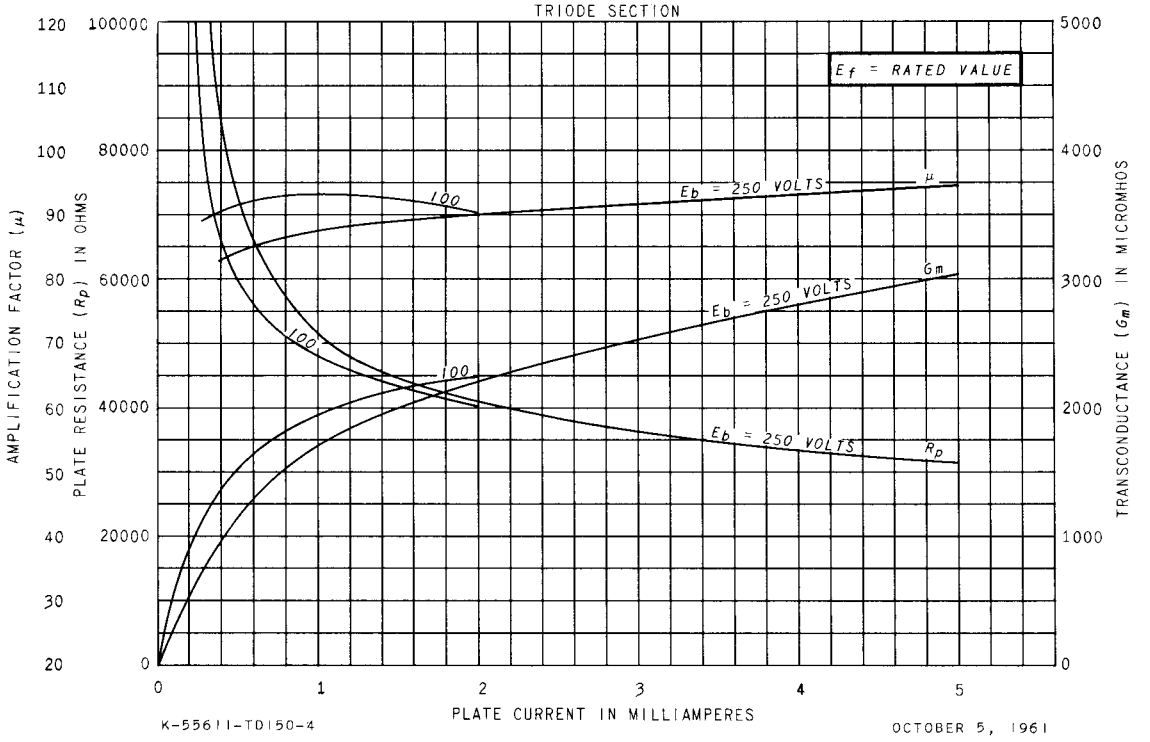
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD150-5

OCTOBER 5, 1961

AVERAGE CHARACTERISTICS



K-5561I-TD150-4

OCTOBER 5, 1961

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

14QP4-A

CATHODE-RAY TUBE

14-INCH RECTANGULAR, GLASS
FOCUS—ELECTROSTATIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
11⅜- BY 8½-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 14QP4-A is a 14-inch rectangular all-glass picture tube which provides an 11⅜- by 8½-inch picture for direct-view television applications. It employs electrostatic focusing and magnetic deflection. Features of this tube include a short neck for cabinet economy, a fluorescent screen which is aluminized to increase light output, a high-quality gray faceplate to increase picture contrast, and an external conductive coating which serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	900	μμf
Minimum	600	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	74	Percent

MECHANICAL

Over-all Length	$16\frac{5}{32} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$13\frac{11}{16} \pm \frac{1}{8}$	Inches
Width	$12\frac{9}{16} \pm \frac{1}{8}$	Inches
Height	$9\frac{3}{4} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	12½	Inches
Width	11⅜	Inches
Height	8½	Inches
Neck Length	6⅞	Inches

Bulb Number, ASA Designation—J109½C
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ± 30 Degrees

Mounting Position—Any

Net Weight, approximate	10	Pounds

MAXIMUM RATINGS*

DESIGN-CENTER VALUES†

Anode Voltage‡	11,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	180 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS*

Anode Voltage	9000	Volts DC
Focusing-Electrode Voltage for Focus	−50 to +250	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	250	Volts DC
Grid-No. 1 Voltage§	−24 to −64	Volts DC
Field Intensity of Typical PM Ion-Trap Magnetπ	27	Gausses
Ion-Trap Magnet Current▲, approximate	24	Milliamperes

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms
Grid-No. 2 Circuit Resistance	0.1 Min	Megohms
Focusing-Electrode Circuit Resistance	0.1 Min	Megohms

Protective resistance in the grid-No. 2 and focusing electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

* All voltages are measured with respect to cathode.

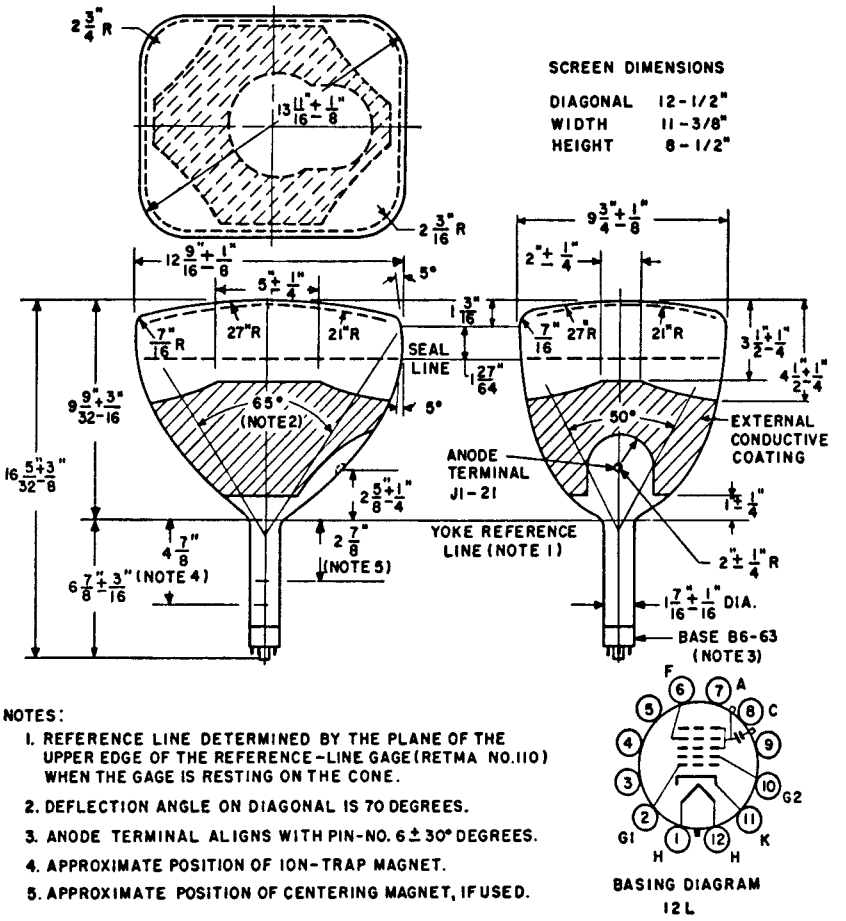
† The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

‡ Anode, grid-No. 3 and grid-No. 5 which are connected together within the tube are referred to herein as anode.

§ For visual extinction of focused raster.

π Single-field ion-trap magnet adjusted to optimum position.

▲ For RETMA ion-trap magnet No. 117.



GE Electronic TUBE — K KEN-RAD

14R7

Description and Rating

DUPLEX-DIODE PENTODE

GENERAL DESCRIPTION

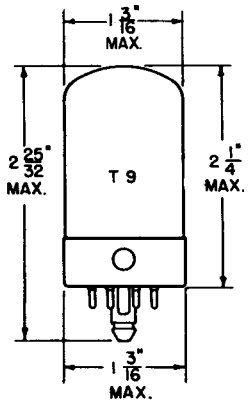
Principal Application: The 14R7 is a duplex diode, semi-remote-cutoff pentode suitable for use as a combined detector, automatic-volume-control rectifier and audio amplifier. The pentode section may also be used as a radio-frequency or intermediate-frequency amplifier. The tube features low coupling capacitance between the diode units and the pentode section.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	12.6 Volts
Heater Current	0.15 Ampere
Envelope	T-9 Glass
Base	D8-1, Locking-In 8-Pin
Mounting Position	Any

Direct Interelectrode Capacitances:*

Grid to Plate (Max)	0.004	μμf
Input	5.6	μμf
Output	5.3	μμf
Diode 1 Plate to Grid 1 (Max)	0.005	μμf
Diode 2 Plate to Grid 1 (Max)	0.002	μμf

PHYSICAL DIMENSIONS

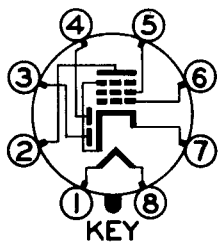


RMA 9-30

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate
Pin 3 - Diode Number 2 Plate
Pin 4 - Diode Number 1 Plate
Pin 5 - Grid Number 2 (Screen)
Pin 6 - Grid Number 1
Pin 7 - Cathode, Grid Number 3, and Internal Shield
Pin 8 - Heater

BASING DIAGRAM



RMA 8AE
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES:

Plate Voltage	250	Volts
Screen Supply Voltage	250	Volts
Screen Voltage	125	Volts
Positive D-C Grid Number 1 Voltage	0	Volts
Plate Dissipation	2.0	Watts
Screen Dissipation	0.25	Watt
Heater-Cathode Voltage	90	Volts
Diode Current for Continuous Operation (Each Diode)	1.0	Milliampere

** With external shield #308 connected to pin 7*

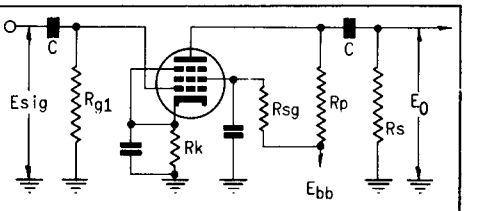
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	100	250	Volts
Screen Voltage	100	100	Volts
Grid Number 1 Voltage	-1	-1	Volt
Plate Resistance (Approx)	0.35	1.0	Megohm
Transconductance	3000	3200	Micromhos
Plate Current	5.5	5.7	Milliamperes
Screen Current	2.2	2.1	Milliamperes
Grid Number 1 Voltage (Approx) for G_m = 10 Micromhos	-20	-20	Volts
Average Diode Current: (Each Diode)			
Measured with 10 Volts D-C Applied	2.0		Milliamperes

CLASS A RESISTANCE-COUPLED AMPLIFIER

Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts				Ebb = 180 Volts				Ebb = 300 Volts			
			Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo	Rk	Rsg	Gain	Eo
0.10	0.10	*	900	0.22	39	9.2	540	0.28	59	18	360	0.38	80	31
0.10	0.24	*	970	0.24	52	12	570	0.32	84	25	400	0.44	112	42
0.24	0.24	*	2000	0.69	57	8.7	1100	0.79	85	18	760	1.00	125	28
0.24	0.51	*	2200	0.76	73	11	1200	1.00	119	21	1200	1.10	158	36
0.51	0.51	*	4200	1.60	73	7.0	2300	1.80	105	17	1600	1.90	150	28
0.51	1.0	*	4600	1.80	88	9.6	2400	2.00	141	19	1600	2.10	192	33
0.24	0.24	10	0	0.64	57	8.5	0	0.74	91	18	0	0.88	131	30
0.24	0.51	10	0	0.71	73	11	0	0.82	125	23	0	0.96	177	38
0.51	0.51	10	0	1.60	68	7.8	0	1.70	114	16	0	1.90	166	28
0.51	1.0	10	0	1.70	87	9.6	0	2.00	152	19	0	2.20	216	33

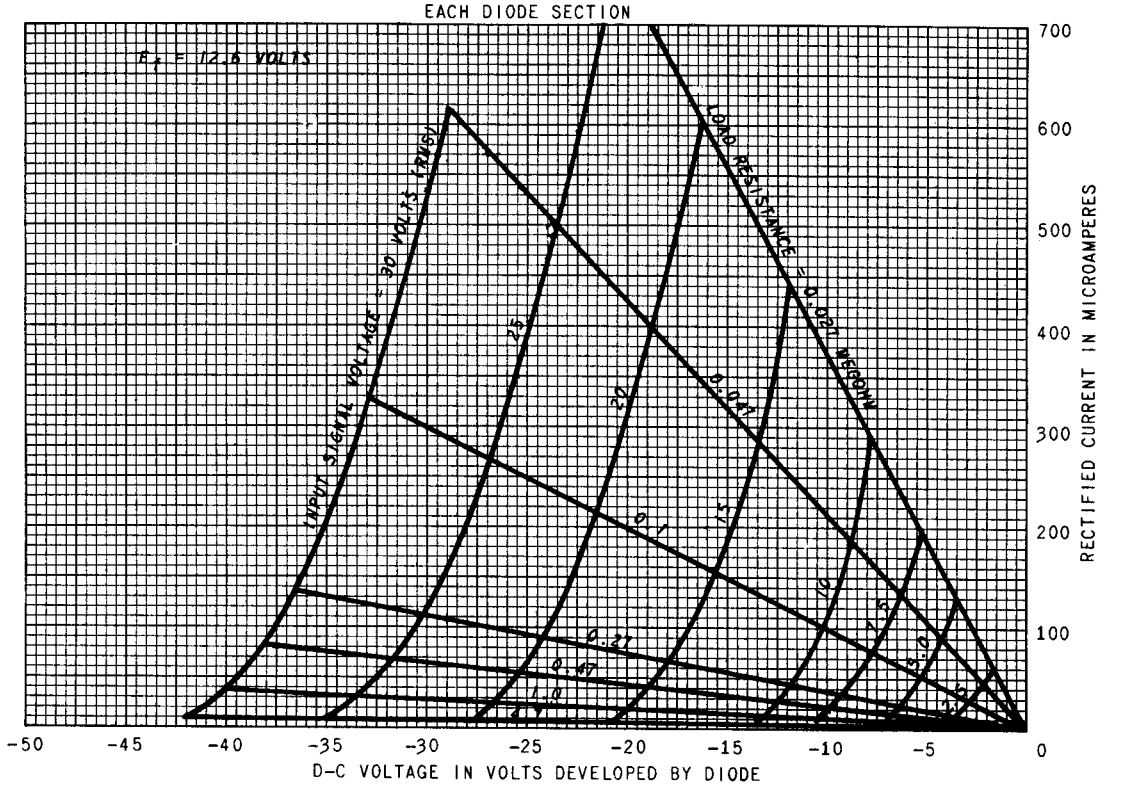


Note: Coupling capacitors (C) should be adjusted to give desired frequency response. Rk and Rsg should be adequately by-passed.

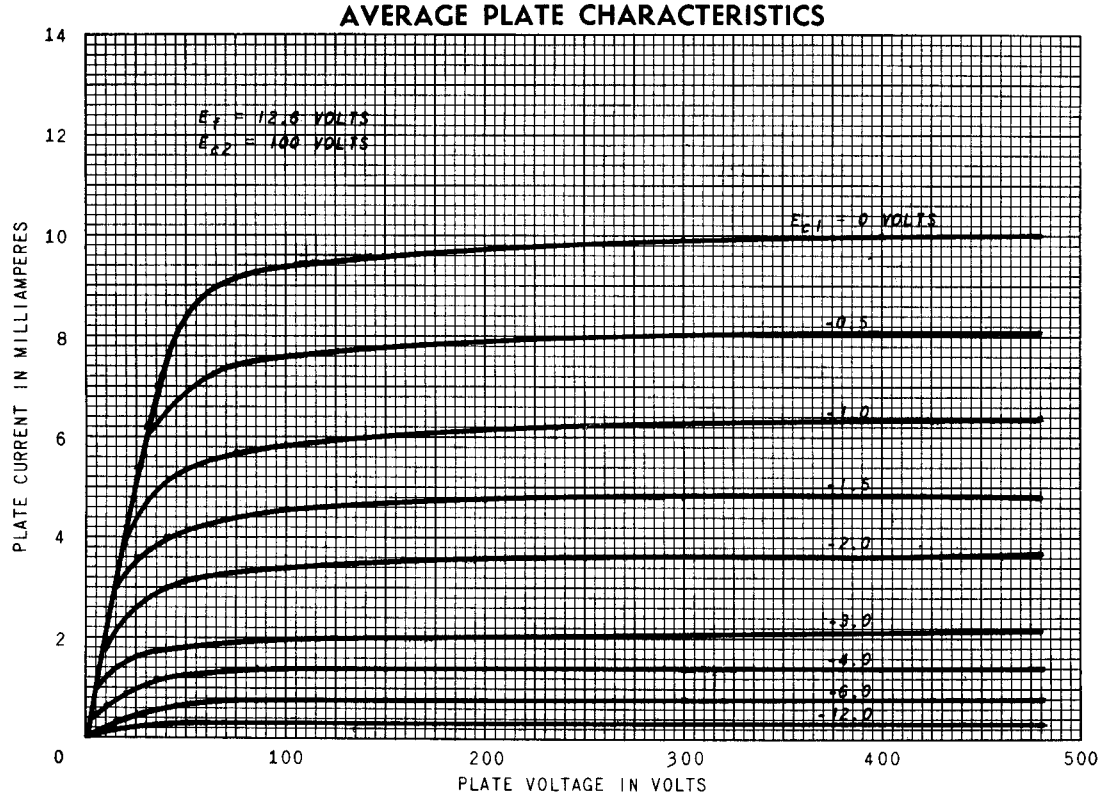
Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible. * Value of R_{g1} is non-critical.

OPERATION CHARACTERISTICS

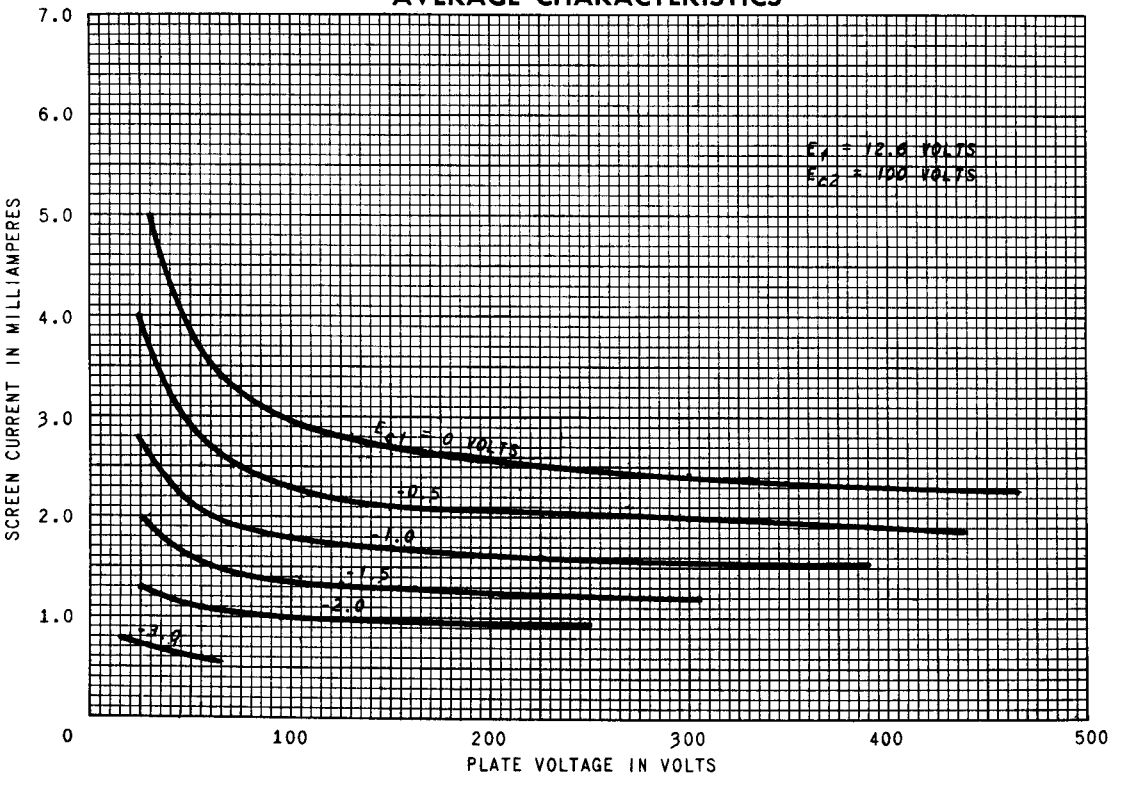
EACH DIODE SECTION



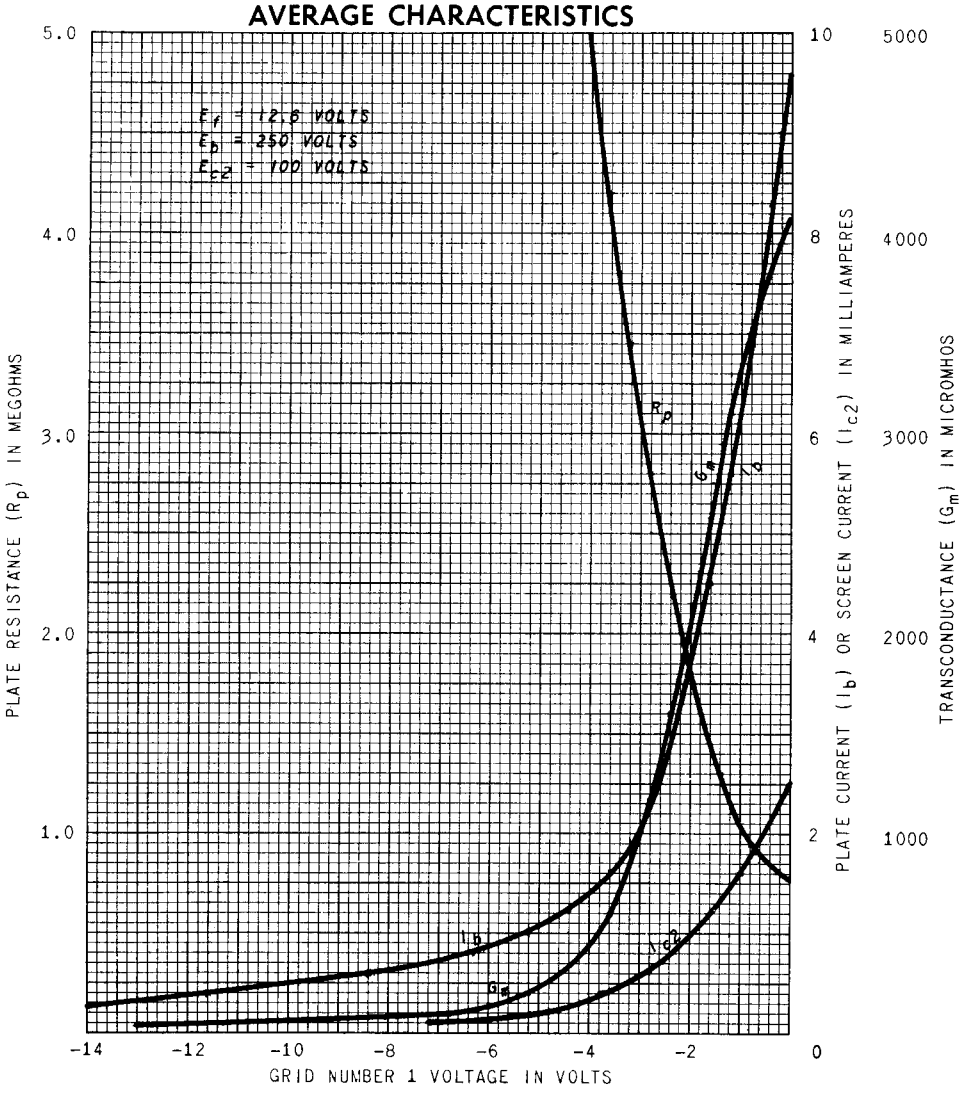
AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



AVERAGE CHARACTERISTICS



Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

Electronic TUBES

14UP4

CATHODE-RAY TUBE

14-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
11½ BY 8⅝-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
HIGH-RESOLUTION GUN
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 14UP4 is a 14-inch rectangular picture tube employing magnetic focusing and deflection. It has a high-resolution electron gun which provides a small round spot with considerable depth of focus. Other features include a high-quality fluorescent screen which is aluminized to increase light output, and a gray faceplate to improve picture contrast.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	74	Percent

MECHANICAL

Over-all Length	$16\frac{25}{32} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$13\frac{11}{16} \pm \frac{1}{8}$	Inches
Width	$12\frac{9}{16} \pm \frac{1}{8}$	Inches
Height	$9\frac{3}{4} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$12\frac{3}{4}$	Inches
Width	$11\frac{1}{2}$	Inches
Height	$8\frac{5}{8}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J109½A or J109½C
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation—12D
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	$10\frac{1}{4}$	Pounds

RATINGS*

DESIGN-CENTER VALUES†

Anode Voltage‡	14,000	Max Volts DC
Grid-No. 2 Voltage	500	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	180	Max Volts
Heater Positive with Respect to Cathode	180	Max Volts

TYPICAL OPERATING CONDITIONS*

Anode Voltage§	12,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current,♦ approximate	105	Milliamperes DC

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5	Max Megohms

* All voltages are measured with respect to cathode.

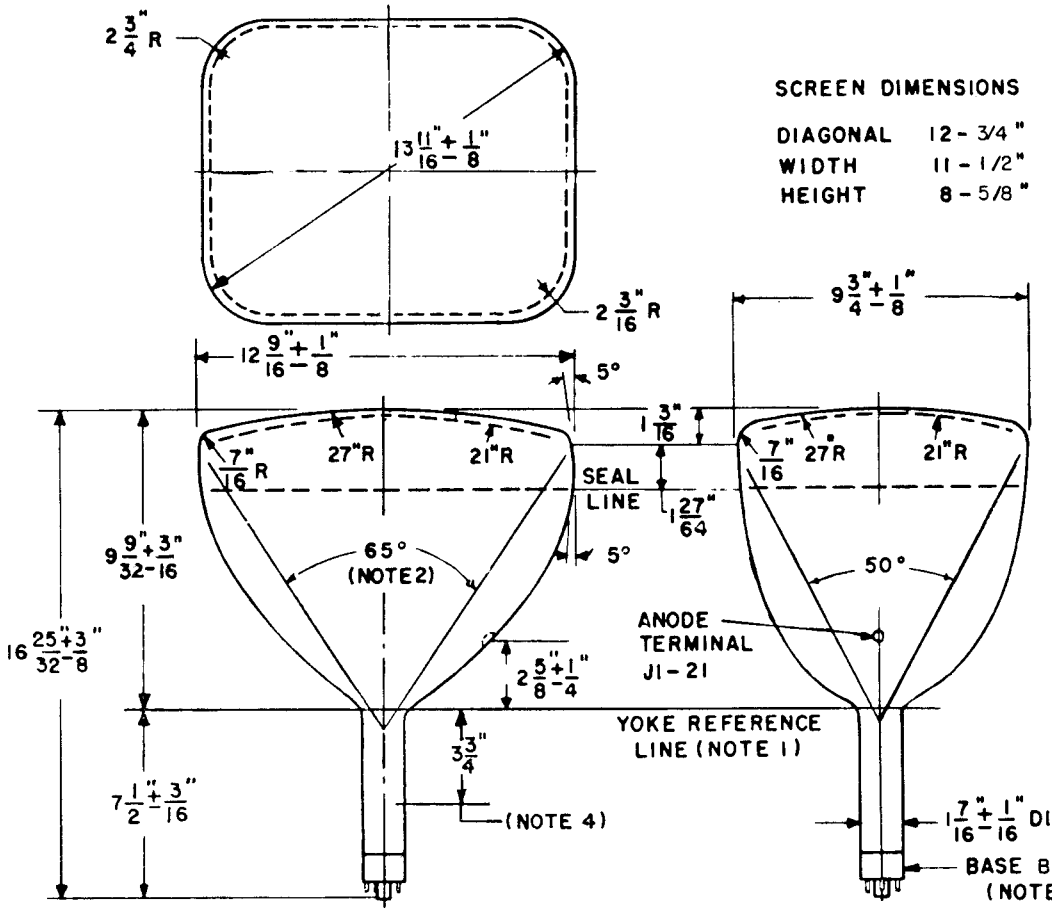
† The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

‡ Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 10,000 volts.

π For visual extinction of focused raster.

◆ For RETMA focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3¾ inches.

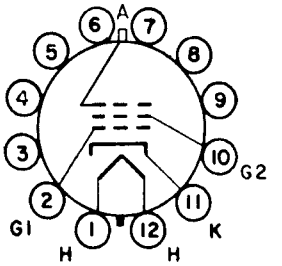


SCREEN DIMENSIONS

DIAGONAL	12 - 3/4"
WIDTH	11 - 1/2"
HEIGHT	8 - 5/8"

NOTES:

1. REFERENCE LINE DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ± 30 DEGREES.
4. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.



BASING DIAGRAM
12D

15AF11 – 15FY7

15AF11
15BD11-A
15FM7
15FY7

15AF11 Compactron Dissimilar-Double-Triode Pentode. The 15AF11 is a compactron containing a high-mu triode, a medium-mu triode, and a sharp-cutoff pentode. The high-mu triode is intended for AGC keyer service, the medium-mu triode for sync separator service, and the pentode for video amplifier service.

Except for heater characteristics and ratings, the 15AF11 is identical to the 6AF11.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC★	14.7	Volts
Heater Current●	0.45 ± 0.03	Amperes
Heater Warm-up Time, Average■	11	Seconds

15BD11-A Compactron Dissimilar-Double-Triode Pentode. The 15BD11-A is a compactron containing a high-mu triode, a medium-mu triode, and a sharp-cutoff pentode. The high-mu triode is intended for general-purpose use, the medium-mu triode for sync separator service, and the pentode for video amplifier service.

Except for heater characteristics and ratings, and a higher screen dissipation rating, the 15BD11-A is identical to the 6BD11.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC★	14.7	Volts
Heater Current●	0.45 ± 0.03	Amperes
Heater Warm-up Time, Average■	11	Seconds

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Pentode Section

Screen Dissipation	1.5	Watts

15FM7 Compactron Dissimilar Double Triode. The 15FM7 is a compactron dissimilar double triode designed for use as a combined vertical-deflection oscillator and amplifier in television receivers.

Except for heater characteristics and ratings, the 15FM7 is identical to the 6FM7.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC★	14.8	Volts
Heater Current●	0.45 ± 0.03	Amperes
Heater Warm-up Time, Average■	11	Seconds

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15FY7 Compactron Dissimilar Double Triode. The 15FY7 is a compactron dissimilar double triode designed for use as a combined vertical-deflection oscillator and amplifier in television receivers.

Except for heater characteristics and ratings, the 15FY7 is identical to the 6FY7.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	14.7	Volts
Heater Current●	0.45 ± 0.03	Amperes
Heater Warm-up Time, Average■	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.45 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

■ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

15EA7

DISSIMILAR DOUBLE TRIODE

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 15EA7 is a dissimilar double triode designed for use as a combined vertical-deflection oscillator and amplifier in television receivers. The tube is identical to the 6EA7 except for heater characteristics and ratings.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings (Design-Maximum Rating System)

Heater Voltage, AC or DC*	14.8	Volts
Heater Current†	0.45 ± 0.03	Ampere
Heater Warm-up Time #	11	Seconds

* Heater voltage at bogey heater current.

† For series heater operation, the equipment designer shall design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

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Electronic TUBES

15EW6

DESCRIPTION AND RATING

15EW6 Pentode. Identical to the 6EW6 except for the following ratings:

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	15.0 ± 10%	Volts
Heater Current	0.15	Amperes

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DESCRIPTION AND RATING

THREE-GUN TRI-COLOR PICTURE TUBE

11 1/2 by 8 5/8-INCH PICTURE SIZE

15-INCH ROUND, GLASS	FACEPLATE - SPHERICAL, CLEAR
FOCUS - ELECTROSTATIC	CONVERGENCE - ELECTROSTATIC
DEFLECTION - MAGNETIC	EXTERNAL CONDUCTIVE COATING
45-DEGREE DEFLECTION ANGLE	METAL-BACKED PHOSPHOR-DOT SCREEN

The 15GP22 is a direct-view tri-color picture tube capable of reproducing either full-color or black-and-white transmissions. It has three separate electron guns and a phosphor-dot screen on which are deposited small dots of blue, green and red phosphor arranged in triangular groups. There are approximately 195,000 such groups or a total of 585,000 dots. A perforated mask between the guns and the screen permits the beam from any one gun to strike phosphor dots of only one color. Thus, the three guns produce independent pictures, in the three different colors, which appear to be superimposed because of the close spacing of the dots. Proper registration of the three pictures is achieved through electrostatic convergence of the beams. The screen provides an 11 1/2 by 8 5/8-inch picture with rounded sides and has a metal backing to prevent ion-spot blemish and to increase light output. An external conductive coating serves as a filter capacitor when grounded.

TECHNICAL INFORMATION

GENERAL

Electrical

Heater Voltage	6.3	Volts
Heater Current	1.8 ± 10%	Amperes
Focusing Method - Electrostatic		
Convergence Method - Electrostatic		
Deflecting Method - Magnetic		
Deflection Angle, approximate		
Horizontal	45	Degrees
Vertical	35	Degrees
Direct Interelectrode Capacitances, approximate		
Cathodes (of All Three Guns Tied Together Externally)		
To All Other Electrodes	17.5	uuf
Grid-No. 1 (of Any Gun) to All Other Electrodes		
Except No. 1 Grids of Other Two Guns	7.5	uuf
Grid-No. 3 (of All Three Guns Tied Together Internally)		
To All Other Electrodes	12	uuf
Grid-No. 4 (Common to the Three Guns) to All Other Electrodes	7	uuf
External Conductive Coating to Anode		
Maximum	3000	uuf
Minimum	1500	uuf

GENERAL (CONT'D)

Optical

Phosphor - P22, Three Phosphors Collectively
Fluorescent Color of Separate Phosphors - Blue, Green, Red
Phosphorescent Color of Separate Phosphors - Blue, Green, Red
Persistence - Medium, Three Phosphors Collectively

Screen
Plate - Gray
Light Transmission, approximate — 70 Percent
Type-Metal-backed Phosphor-dot
Area — 88 1/2 Square Inches

Faceplate - Clear

Mechanical

Over-all Length	26 1/8	Max Inches
Greatest Bulb Diameter	14 5/8 ± 5/32	Inches
Screen Dimensions, with rounded sides		
Horizontal	11 1/2	Inches
Vertical	8 5/8	Inches
Greatest Metal-flange Diameter	15 3/4	Max Inches
Neck Length	10 3/8	Inches
Anode Contact - Metal Flange		
Base - Small-shell Bidecal 14-Pin, B14-103		
Basing, JETEC Designation - 20A		
Mounting Position - Any		
Net Weight, approximate	25	Pounds

MAXIMUM RATINGS - Design-Center Values ◊

Anode Voltage †	20,000	Max Volts DC
Anode Input Δ	15	Max Watts
Grid-No. 4 (Converging Electrode)	11,000	Max Volts DC
Grid-No. 3 (Focusing Electrode)	5,000	Max Volts DC
Grid-No. 2 Voltage, Each Gun	500	Max Volts DC
Grid-No. 1 Voltage, Each Gun		
Negative-bias Value	200	Max Volts DC
Positive-bias Value	0	Max Volt DC
Positive-peak Value	2	Max Volts
Peak Heater-cathode Voltage, Each Gun		
Heater Negative with Respect to Cathode		
During Equipment Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	180	Max Volts
Heater Positive with Respect to Cathode	180	Max Volts

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN
Anode Voltage 18,000 to 20,000 Volts, Anode Input 15 Watts

Grid-No. 4 (Converging Electrode) Voltage §	42.5 to 51	Percent of Anode Voltage
Grid-No. 3 (Focusing Electrode) Voltage	12 to 19	Percent of Anode Voltage
Grid-No. 2 Voltage for Visual Extinction of Focused Raster with Grid-No. 1 Voltage at a Fixed Value, Each Gun	2 to 4.5	Times Grid-No. 1 Voltage

Grid-No. 1 Voltage for Visual Extinction of Focused Raster with Grid-No. 2 Voltage at a Fixed Value, Each Gun	22.5 to 50	Percent of Grid-No. 2 Voltage
Grid-No. 4 Current	-5 to +5	Microamperes
Grid-No. 3 Current, maximum	300	Microamperes
Grid-No. 2 Current	-15 to +15	Microamperes
Beam Current Ratio to Produce Illuminant C White (6740 K)		
Red Gun to Green Gun	4:1 to 1:1	
Blue Gun to Green Gun	1.5:1 to 0.5:1	
Maximum Raster Shift in Any Direction from Screen Center ‡	1 1/4	Inches

EXAMPLES OF USE OF RANGE VALUES
Anode Voltage 20,000 Volts

Grid-No. 4 (Converging Electrode) Voltage §	8500 to 10200	Volts
Grid-No. 3 (Focusing Electrode) Voltage	2400 to 3800	Volts
Grid-No. 2 Voltage for Visual Extinction of Focused Raster with Grid-No. 1 Voltage of -70 Volts, Each Gun	140 to 315	Volts
Grid-No. 1 Voltage for Visual Extinction of Focused Raster with Grid-No. 2 Voltage of 200 Volts, Each Gun	-45 to -100	Volts

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance, Each Gun, maximum	1.5	Megohms
Dynamic Converging Voltage, approximate π	900	Volts
Dynamic Focusing Voltage, approximate π	225	Volts

◊ The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes; that is, the tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

† The aquadag coating, aperture mask, and metal screen-backing, which are connected together within the tube, are referred to herein as the anode.

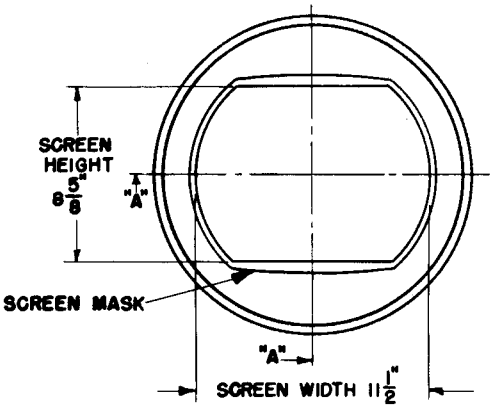
If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

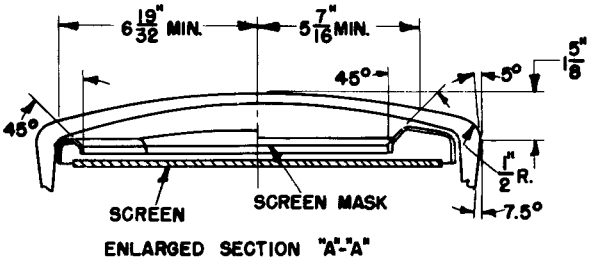
Δ Anode input equals the product of anode voltage and anode current, the latter being measured at the anode contact with a direct-current ammeter.

§ Does not include the d-c component of the dynamic coverging voltage.

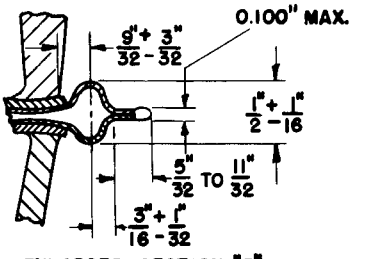
‡ Centering of the raster on the screen is accomplished by passing direct current of the required value through each pair of deflecting coils to compensate for the raster shift resulting from optimum adjustments for convergence, color purity, and concentricity.

π Peak to peak value. This a-c voltage, essentially parabolic in wave-form, is synchronized with scanning and does not include any voltage developed during the blanking time.

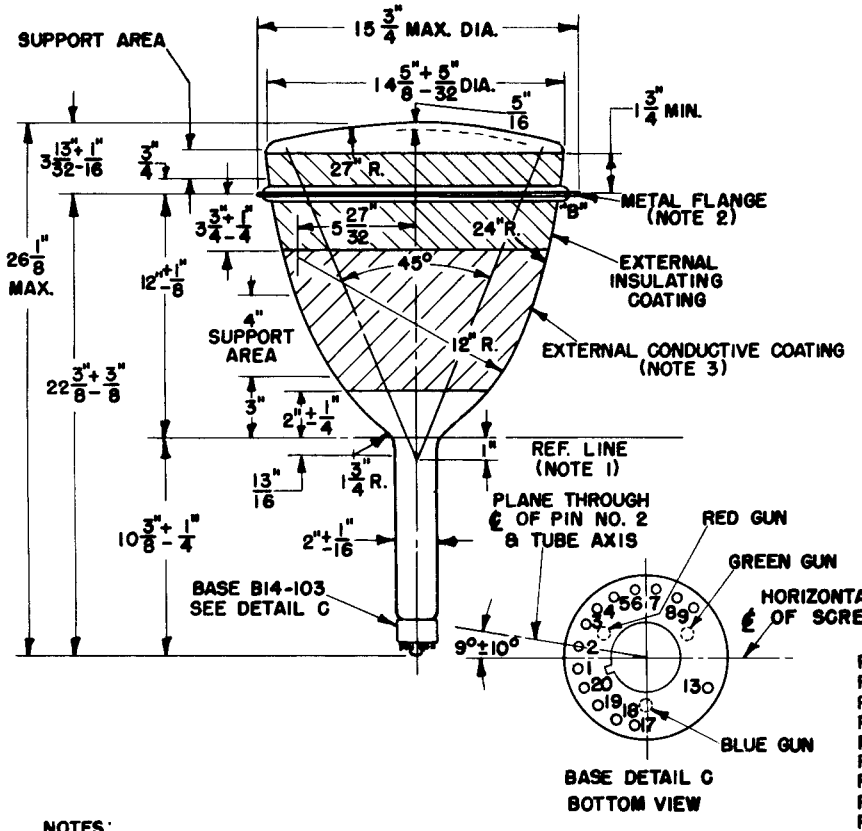




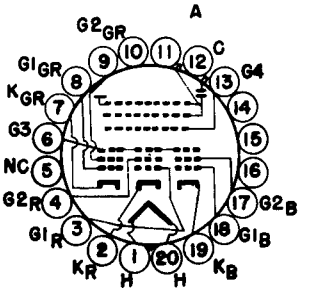
ENLARGED SECTION "A"-"A"



ENLARGED SECTION "B"



BASE DETAIL C
BOTTOM VIEW



BASING DIAGRAM
20A

PIN 1 - HEATER
PIN 2 - CATHODE } RED GUN
PIN 3 - GRID NO. 1 }
PIN 4 - GRID NO. 2 }
PIN 5 - NO CONNECTION
PIN 6 - GRIDS NO. 3
PIN 7 - CATHODE } GREEN GUN
PIN 8 - GRID NO. 1 }
PIN 9 - GRID NO. 2 }
PIN 13 - GRID NO. 4
PIN 17 - GRID NO. 2 } BLUE GUN
PIN 18 - GRID NO. 1 }
PIN 19 - CATHODE }
PIN 20 - HEATER
A - ANODE (METAL FLANGE)
C - CONDUCTIVE COATING

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE POSITION WHERE A 2.400" ±.001" DIAMETER RING GAGE WILL REST ON CONE.
2. ADEQUATE INSULATION MUST BE PROVIDED FOR METAL FLANGE WHICH IS AT ANODE POTENTIAL.
3. EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

K69087-72A637

March 10, 1954

Outline
15GP22

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

Compactron Triode-Pentode

15MF8

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

The 15MF8 is a compactron containing a medium-mu triode and a beam pentode. The triode is designed for service as a vertical-deflection oscillator and the pentode as a vertical-deflection amplifier in color television receivers. Except for heater characteristics and ratings, the 15MF8 is identical to the 6MF8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	14.7	Volts
Heater Current●	0.6 ± 0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

—PRODUCT INFORMATION—

16AK9, 16BQ11

16AK9
16BQ11

16AK9 Compactron Dissimilar-Double-Triode Pentode. The 16AK9 is a multifunction compactron containing two dissimilar triodes and a beam pentode. The pentode section is suitable for vertical-deflection amplifier service in medium-sized color television receivers. Triode Section 2 (pins 2, 3, and 7) has an amplification factor of 20 and is especially suited for vertical oscillator use. Triode Section 1 has an amplification factor of 43 and is well suited for sync-clipper applications.

Except for heater characteristics and ratings, the 16AK9 is identical to the 6AK9.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	16.4	Volts
Heater Current●	0.6 ± 0.04	Amperes
Heater Warm-up Time, Average■	11	Seconds

16BQ11 Compactron Dissimilar Double Pentode. The 16BQ11 is a compactron containing a remote-cutoff pentode (Section 1) and a sharp-cutoff pentode (Section 2). It is intended primarily for use in the intermediate-frequency amplifier stages of television receivers.

Except for heater characteristics and ratings, the 16BQ11 is identical to the 11BQ11.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC♦	16	Volts
Heater Current●	0.315 ± 0.02	Amperes
Heater Warm-up Time, Average■	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

♦ Heater voltage for a bogey tube at If = 0.315 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

■ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

Supersedes 16AK9 D and R Sheet dated 11-67 and 16BQ11 D and R Sheet dated 10-68

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

16AP4-A

CATHODE-RAY TUBE

16-INCH ROUND, METAL
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC

14⅜ BY 10¾-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN

53-DEGREE DEFLECTION ANGLE

DESCRIPTION AND RATING

The 16AP4-A is a magnetic-focus and -deflection direct-view picture tube which provides a 14⅜ by 10¾-inch picture with rounded sides for television applications. Features of this tube include a lightweight metal cone envelope, a high-quality gray faceplate to increase picture contrast and detail under high ambient light conditions, and an electron gun which was designed for use with an external double-field ion-trap magnet.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ±10%	Amperes

Focusing Method—Magnetic
Deflecting Method—Magnetic

Deflection Angle, approximate	53	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	66	Percent

GENERAL ELECTRIC

Supersedes ETR-118, dated 2-51

MECHANICAL

Over-all Length	21 7/8 ± 3/8	Inches
Greatest Bulb Diameter	15 7/8 ± 1/8	Inches
Minimum Useful Screen Diameter	14 3/8	Inches
Neck Length	7 9/16	Inches

Bulb Contact—Metal Cone Lip
Base—Small-shell Duodecal 5-pin, JETEC No. B5-57
Basing, JETEC Designation—12D

Mounting Position—Any

Net Weight, approximate	11	Pounds

MAXIMUM RATINGS♦

DESIGN-CENTER VALUES*

Anode Voltage†	14,000	Max Volts DC
Grid-No. 2 Voltage	410	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	150	Max Volts
Heater Positive with Respect to Cathode	150	Max Volts

TYPICAL OPERATING CONDITIONS♦

Anode Voltage‡	12,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage§	−28 to −72	Volts DC
Focusing-Coil Currentπ, approximate	99	Milliamperes DC
Ion-Trap Field Intensity△, approximate	35	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5	Max Megohms

♦ All voltages are measured with respect to cathode.

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

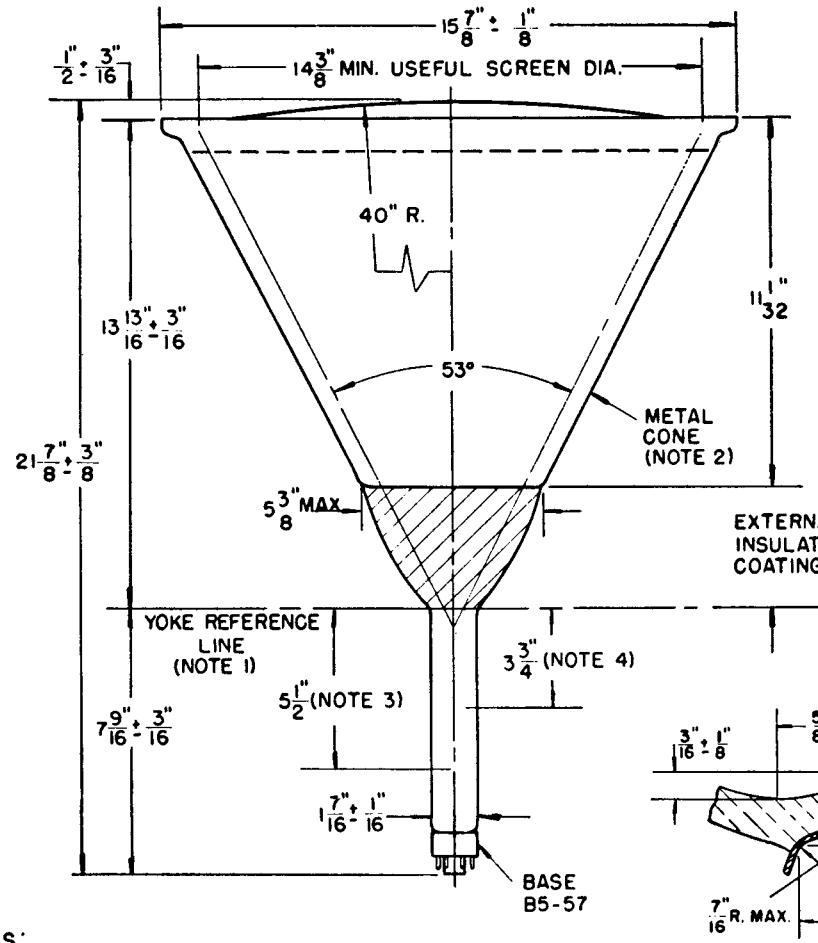
† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

‡ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 10,000 volts.

§ For visual extinction of focused raster.

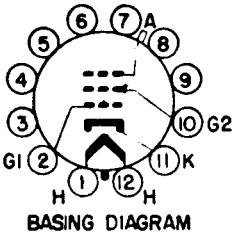
π For RETMA focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3¾ inches.

△Double-field ion-trap magnet adjusted to optimum position, equivalent to 120 milliamperes through RETMA ion-trap magnet No. 108.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO.112) WHEN THE GAGE IS RESTING ON THE CONE.
2. METAL CONE OPERATES AT HIGH VOLTAGE AND MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ANODE VOLTAGE.
3. APPROXIMATE POSITION OF ION-TRAP MAGNET.
4. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.



BASING DIAGRAM
12D

16ATP4
CATHODE RAY TUBE

16 INCH, RECTANGULAR, GLASS

FOCUS -- ELECTROSTATIC

DEFLECTION -- MAGNETIC

114 DEGREE DEFLECTION

FACE PLATE -- SPHERICAL GRAY

INTEGRAL PLASTIC IMPLOSION BARRIER

ALUMINIZED SCREEN

EXTERNAL CONDUCTIVE COATING

LOW GRID NO. 2 VOLTAGE TYPE
FOR CATHODE-DRIVE OPERATION

DESCRIPTION AND RATING

The 16ATP4 is a 16 inch electrostatic-focus and magnetic deflection glass lightweight picture tube employing an integral plastic implosion barrier. Other outstanding features include a short over-all length, a small neck diameter and a non ion trap gun designed for operation at a low Grid No. 2 voltage for use in cathode-drive circuits. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angle, Approximate	
Horizontal	102 degrees
Vertical	84 degrees
Diagonal	114 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes, approx.	5 μμf
Grid #1 to all other electrodes, approx.	6 μμf
External Conductive Coating to Anode	1500 max. μμf 1000 min. μμf
Heater Current at 6.3 volts	450 ± 23 ma.
Heater Warm-Up Time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center(Approximate)	48 Percent

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

from JEDEC release #3837, Aug. 6, 1962

MECHANICAL DATA

Overall	10 1/8 ± 1/4 inches
Greatest Dimensions of Tube	
Diagonal	15 11/16 + 5/32 - 1/8 inches
Width	13 3/4 ± 1/8 inches
Height	11 5/32 ± 1/8 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	14 7/8 inches
Horizontal Axis	12 15/16 inches
Vertical Axis	10 1/4 inches
Area	125 sq. inches
Neck Length	4 ± 1/8 inches
Bulb	J125A1
Bulb Contact	JEDEC No. J1-21
Base	JEDEC No. B7-237 or B7-208
Basing	8HR
Bulb Contact Alignment	
Anode Contact Aligns with Base Pin No. 4 ± 30 degrees	

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to Grid No. 1.

Maximum Anode Voltage	18,000 volts
Minimum Anode Voltage	11,000 volts
Maximum Grid #4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid #2 Voltage	40 volts
Maximum Grid #2 Voltage	100 volts
Cathode Voltage	
Maximum Positive Value	140 volts DC
Maximum Positive Peak Value	200 volts
Maximum Negative Value	0 volts DC
Maximum Negative Peak Value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 volts
Maximum Heater-Cathode Voltage	
Heater Negative with respect to Cathode	
During Warm-Up period not to exceed 15 sec.	410 volts
After equipment warm-up period	180 volts
Heater Positive With Respect to Cathode	180 volts

TYPICAL OPERATING CONDITIONS (Cathode-Drive Service)

Anode Voltage	15,000 volts DC
Grid #4 Voltage (Focusing Electrode, Notes 2 & 3)	250 volts DC
Grid #2 Voltage	50 volts DC
Cathode to Grid #1 Voltage for cut-off (Note 1)	31 to 49 volts

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5 max. megohm
Grid No. 2 Circuit Resistance	0.1 min. megohm
Focusing Electrode Circuit Resistance.	0.1 min. megohm

Protective resistance in Grid No. 2 and focusing electrical circuits is advisable to prevent damage to tube. If applicable, one resistor common to both circuits may be used.

NOTES:

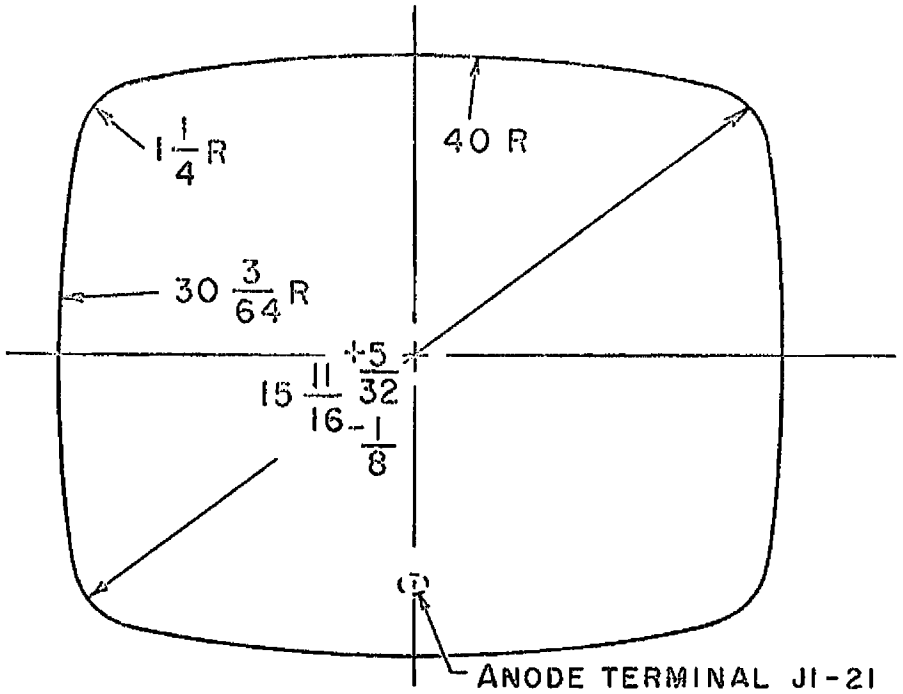
1. Visual extinction of focused raster.

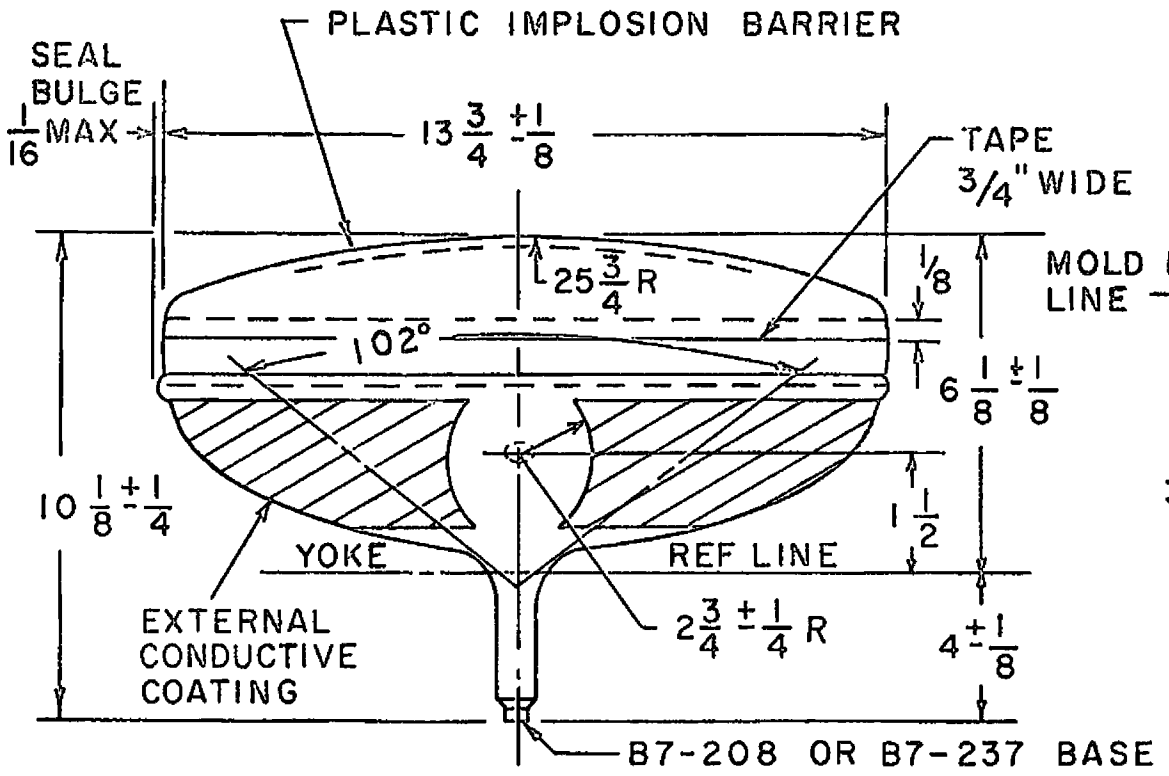
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 μa on a 12-15/16" x 10-1/4" pattern from RCA 2F21 monoscope or equivalent.

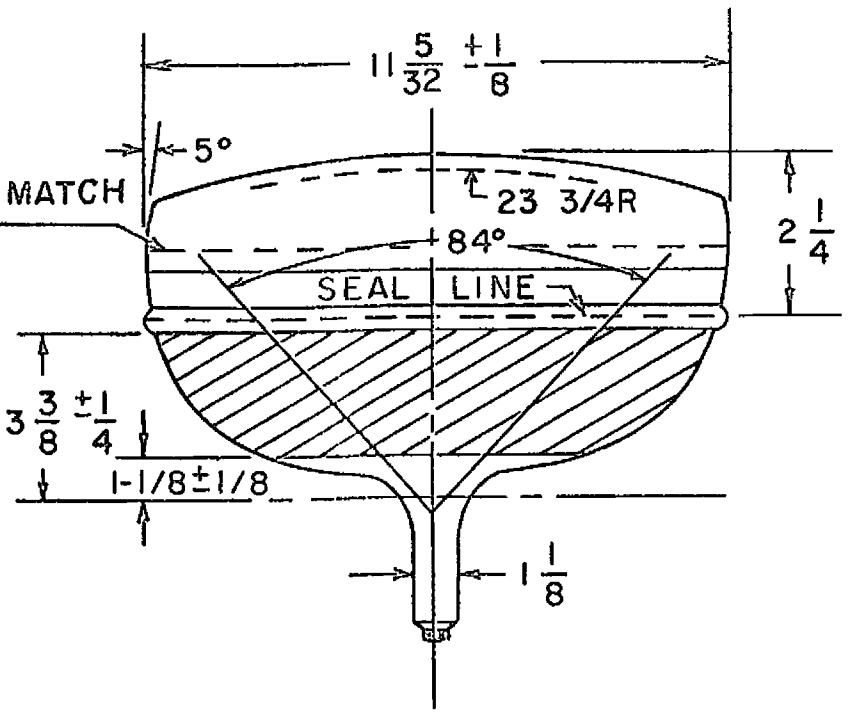
3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

16ATP4

SCREEN DIMENSIONS
DIAGONAL — 14 7/8
WIDTH — 12 15/16
HEIGHT — 10 1/4
AREA — 125 SQ. IN.







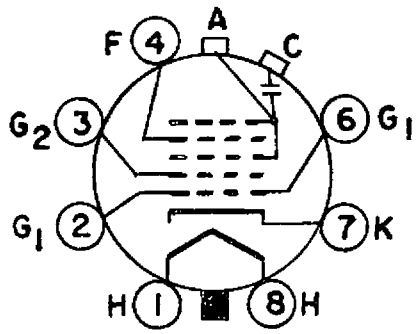
OUTLINE NOTES

1. The reference line is determined by the intersection of the plane C-C of gage (EIA No. 126) with the glass funnel.

2. Deflection angle on the diagonal is 114°.

3. Anode terminal aligns with pin no. 4 ± 30 degrees.

4. Use a non-rigidly mounted socket with flexible leads. Bottom circumference of base wafer will fall within 1-3/4 inch diameter circle concentric with the bulb axis.



BASING DIAGRAM
8 HR

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

16AWP4
CATHODE RAY TUBE

16 INCH, RECTANGULAR, GLASS

FOCUS -- ELECTROSTATIC

DEFLECTION -- MAGNETIC

114 DEGREE DEFLECTION

FACE PLATE -- SPHERICAL GRAY

INTEGRAL PLASTIC IMPLOSION BARRIER

ALUMINIZED SCREEN

EXTERNAL CONDUCTIVE COATING

MEDIUM GRID NO. 2 VOLTAGE TYPE
FOR CATHODE-DRIVE OPERATION

DESCRIPTION AND RATING

The 16AWP4 is a 16 inch electrostatic-focus and magnetic deflection glass lightweight picture tube employing an integral plastic imploston barrier. Other outstanding features include a short over-all length, a small neck diameter and a non-ion trap gun designed for operation at a medium Grid No. 2 voltage for use in cathode-drive circuits. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angle, Approximate	
Horizontal	102 degrees
Vertical	84 degrees
Diagonal	114 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes, approx.	5 uuf
Grid #1 to all other electrodes, approx.	6 uuf
External Conductive Coating to Anode	1500 max. uuf 1000 min. uuf
Heater Current at 6.3 volts	300 ± 15 ma.
Heater Warm-Up Time	18 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center(Approximate).	48 Percent

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

from JEDEC release #3991, Nov. 26, 1962

MECHANICAL DATA

Overall	10 1/8 ± 1/4 inches
Greatest Dimensions of Tube	
Diagonal	15 11/16 + 5/32 inches
Width	13 3/4 ± 1/8 inches
Height	11 5/32 ± 1/8 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	14 7/8 inches
Horizontal Axis	12 15/16 inches
Vertical Axis	10 1/4 inches
Area	125 sq. inches
Neck Length	4 ± 1/8 inches
Bulb	J125A1
Bulb Contact	JEDEC No. J1-21
Base	JEDEC No. B7-237 or B7-208
Basing	8HR
Bulb Contact Alignment	
Anode Contact Aligns with Base Pin No. 4 ± 30 degrees	

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to Grid No. 1.

Maximum Anode Voltage	18,000 volts
Minimum Anode Voltage	11,000 volts
Maximum Grid #4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid #2 Voltage	100 volts
Maximum Grid #2 Voltage	300 volts
Cathode Voltage	
Maximum Positive Value	140 volts DC
Maximum Positive Peak Value	200 volts
Maximum Negative Value	0 volts DC
Maximum Negative Peak Value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 Volts
Maximum Heater-Cathode Voltage	
Heater Negative with respect to Cathode	
During Warm-Up period not to exceed 45 sec.	410 volts
After equipment warm-up period	180 volts
Heater Positive With Respect to Cathode	180 volts

TYPICAL OPERATING CONDITIONS (Cathode-Drive Service)

Anode Voltage	15,000 volts DC
Grid #4 Voltage (Focusing Electrode, Notes 2 & 3)	250 volts DC
Grid #2 Voltage	150 volts DC
Cathode to Grid #1 Voltage for cut-off (Note 1)	31 to 49 volts

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5 max. megohm
Grid No. 2 Circuit Resistance	0.1 min. megohm
Focusing Electrode Circuit Resistance	0.1 min. megohm

Protective resistance in Grid No. 2 and focusing electrical circuits is advisable to prevent damage to tube. If applicable, one resistor common to both circuits may be used.

NOTES:

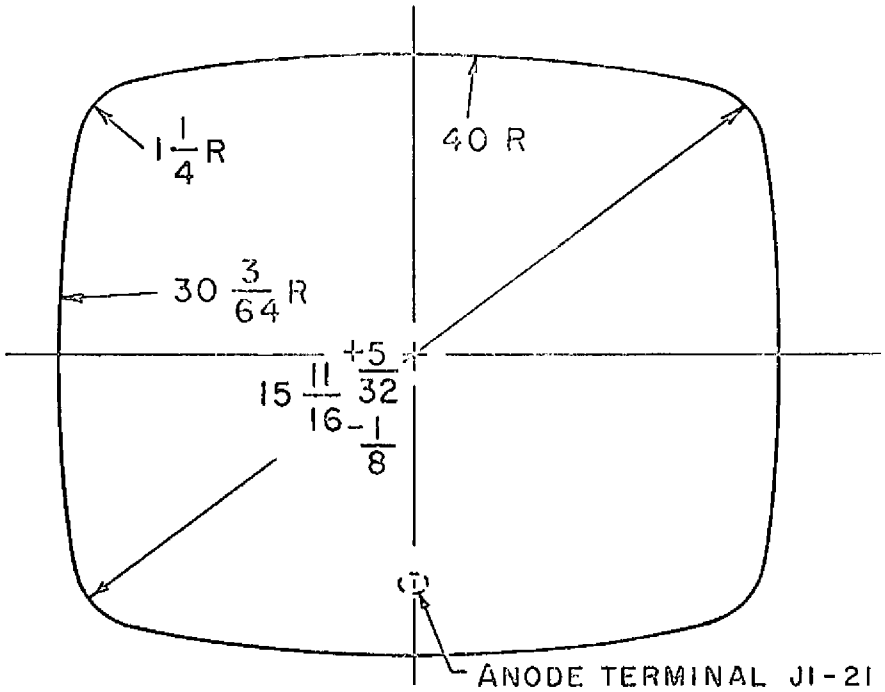
1. Visual extinction of focused raster.

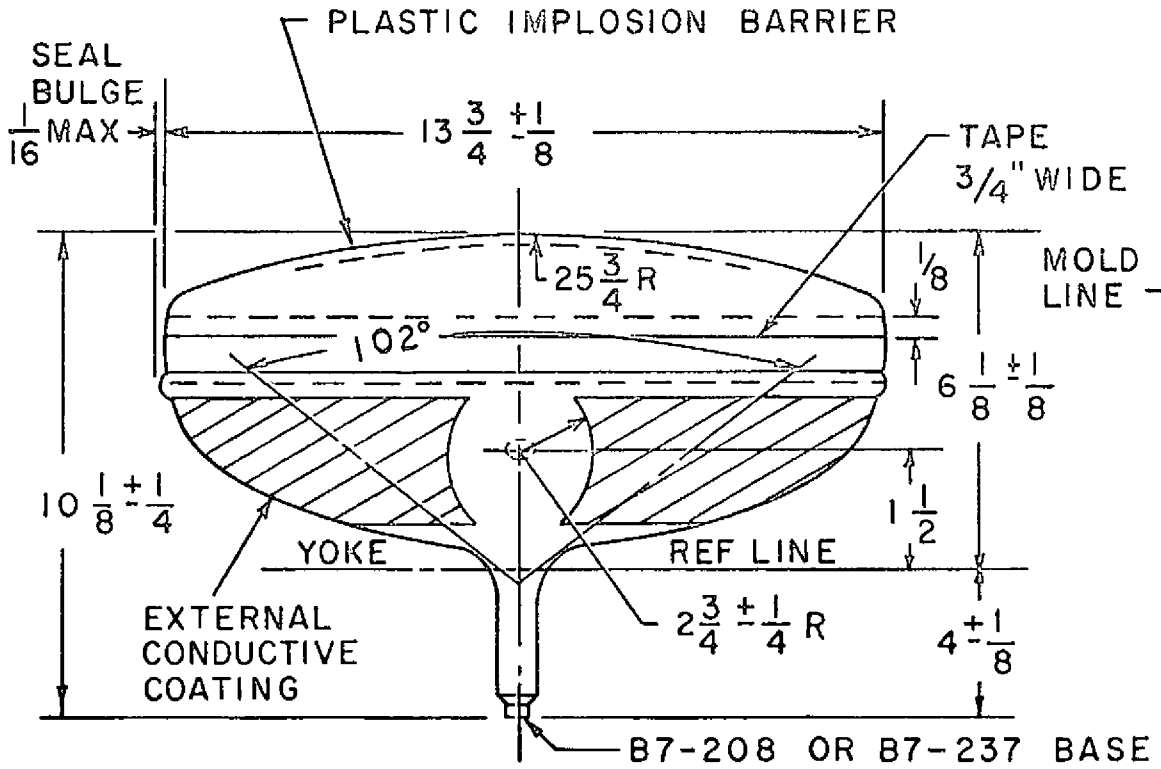
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 ua on a 12-15/16" x 10-1/4" pattern from RCA 2F21 monoscope or equivalent.

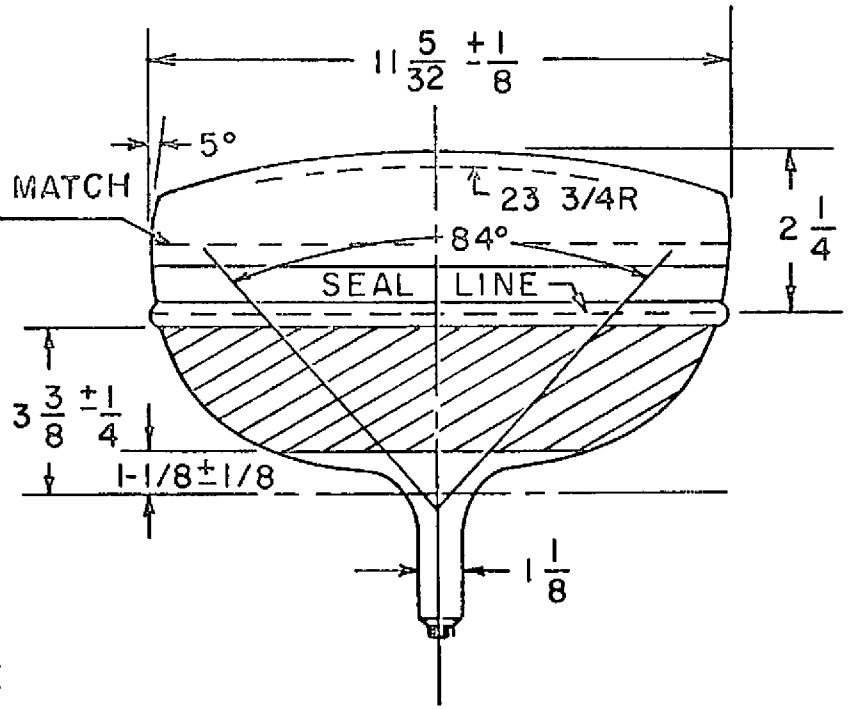
3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

16AWP4

SCREEN DIMENSIONS
DIAGONAL — 14 7/8
WIDTH —— 12 15/16
HEIGHT —— 10 1/4
AREA ——125 SQ. IN.







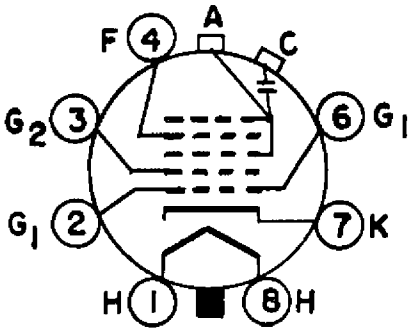
OUTLINE NOTES

1. The reference line is determined by the intersection of the plane C-C of gage (EIA No. 126) with the glass funnel.

2. Deflection angle on the diagonal is

3. Anode terminal aligns with pin no. 4 ±30 degrees.

4. Use a non-rigidly mounted socket with flexible leads. Bottom circumference of base wafer will fall within 1-3/4 inch diameter circle concentric with the bulb axis.



BASING DIAGRAM
8 HR

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC

Syracuse, N. Y.

16AZP4
CATHODE RAY TUBE

16 INCH, RECTANGULAR, GLASS

FOCUS -- ELECTROSTATIC

DEFLECTION -- MAGNETIC

114 DEGREE DEFLECTION

FACE PLATE -- SPHERICAL GRAY

INTEGRAL PLASTIC IMPLOSION BARRIER

ALUMINIZED SCREEN

EXTERNAL CONDUCTIVE COATING

----------DESCRIPTION AND RATING----------

The 16AZP4 is a 16 inch electrostatic focus and magnetic deflection glass lightweight picture tube employing an integral plastic implosion barrier. Other outstanding features include a short over-all length, a small neck diameter and a non-ion trap gun designed for operation at an intermediate Grid No. 2 voltage for use in cathode-drive circuits. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angle, Approximate	
Horizontal	102 degrees
Vertical	84 degrees
Diagonal	114 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes, approx.	5 μμf
Grid #1 to all other electrodes, approx.	6 μμf
External Conductive Coating to Anode	1500 max. μμf 1000 min. μμf
Heater Current at 6.3 volts	450 ± 23 ma.
Heater Warm-up time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light transmittance at center (Approximate)	.48 Percent

CATHODE RAY TUBE OPERATION

GENERAL ELECTRIC

Syracuse, N. Y.

from JEDEC release #4322, July 1, 1963

MECHANICAL DATA

Overall Length	10-3/8 ± 1/4 inches
Greatest Dimensions of Tube	
Diagonal	15-11/16 + 5/32 - 1/8 inches
Width	13-3/4 ± 1/8 inches
Height	11-5/32 ± 1/8 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	14-7/8 inches
Horizontal Axis	12-15/16 inches
Vertical Axis	10-1/4 inches
Area	125 sq. inches
Neck Length	4-1/4 ± 1/8 inches
Bulb	J125A1
Bulb Contact	JEDEC No. J1-21
Base	JEDEC No. B7-237 or B7-208
Basing	8HR
Bulb Contact Alignment	
Anode Contact Aligns with Base Pin No. 4	± 30 degrees

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to Grid No. 1.

Maximum Anode Voltage	18,000 volts
Minimum Anode Voltage	11,000 volts
Maximum Grid #4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid #2 Voltage	100 volts
Maximum Grid #2 Voltage	250 volts
Cathode Voltage	
Maximum Positive Value	140 volts DC
Maximum Positive Peak Value	200 volts
Maximum Negative Value	0 voltd DC
Maximum Negative Peak Value	-2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 volts
Maximum Heater-Cathode Voltage	
Heater Negative with respect to Cathode	
During Warm-up period not to exceed 15 sec.	410 volts
After equipment warm-up period	180 volts
Heater Positive with Respect to Cathode	180 volts

TYPICAL OPERATING CONDITIONS (Cathode-Drive Service)

Anode Voltage	15,000 volts DC
Grid #4 Voltage (Focusing Electrode, Notes 2 & 3)	250 volts DC
Grid #2 Voltage	150 volts DC
Cathode to Grid #1 Voltage for cut-off (Note 1)	31 to 49 volts

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance.	1.5 max. megohm
Grid #2 Circuit Resistance.	0.1 min. megohm
Focusing Electrode Circuit Resistance	0.1 min. megohm

Protective resistance in Grid No. 2 and focusing electrical circuits is advisable to prevent damage to tube. If applicable, one resistor common to both circuits may be used.

NOTES:

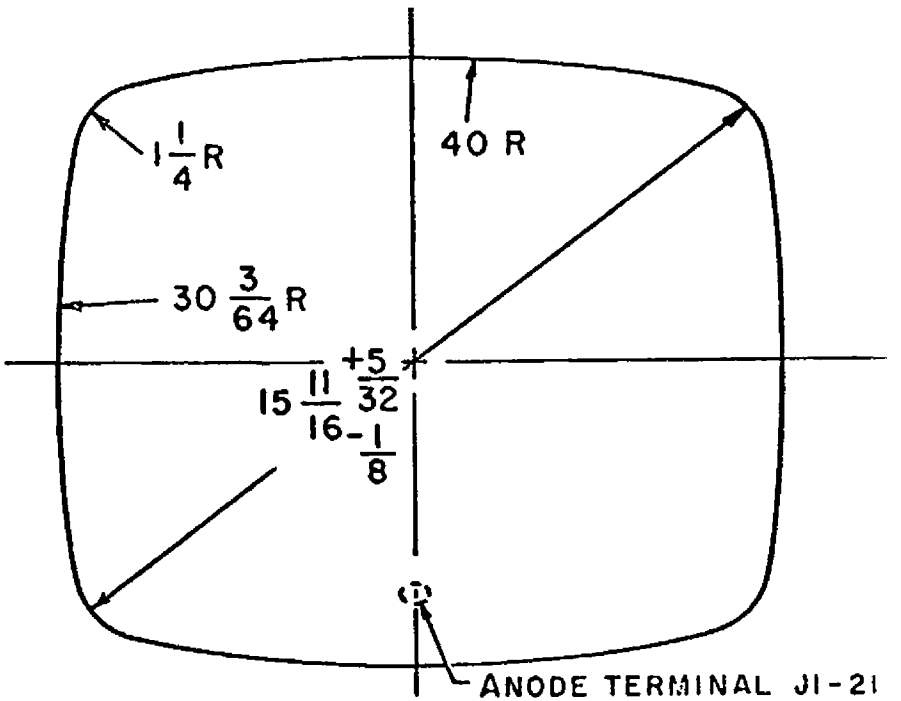
1. Visual extinction of focused raster.

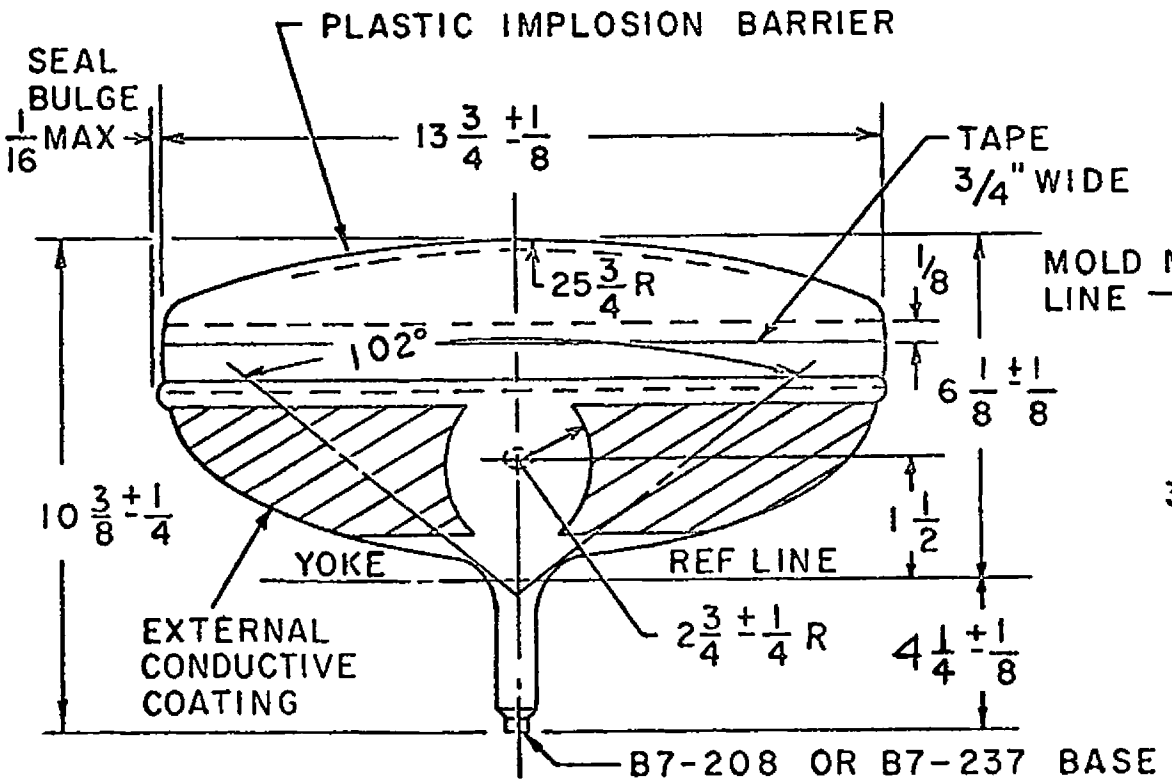
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 μa on a 12-15/16" x 10-1/4" pattern from RCA 2F21 monoscope or equivalent.

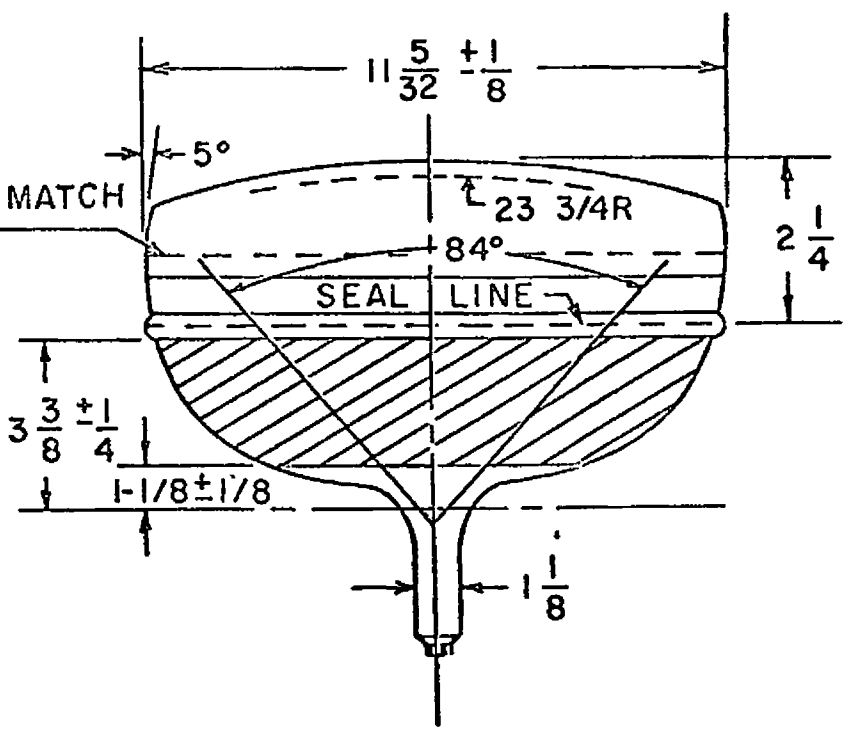
3. Individual tubes will have satisfactory focus at some value between 0 and 400 volts.

16AZP4

SCREEN DIMENSIONS
DIAGONAL — 14 7/8
WIDTH — 12 15/16
HEIGHT — 10 1/4
AREA — 125 SQ. IN.







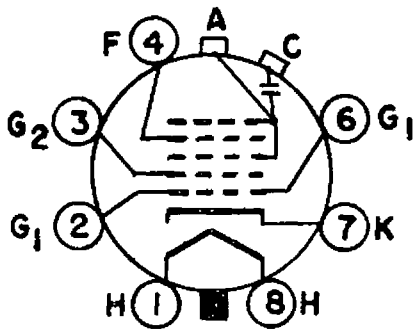
OUTLINE NOTES

1. The reference line is determined by the intersection of the plane C'-C of gage (EIA No. 126) with the glass funnel.

2. Deflection angle on the diagonal is 114°.

3. Anode terminal aligns with pin no. 4 $\pm$30 degrees.

4. Use a non-rigidly mounted socket with flexible leads. Bottom circumference of base wafer will fall within 1-3/4 inch diameter circle concentric with the bulb axis.



BASING DIAGRAM
8 HR

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

—PRODUCT INFORMATION—

16BX11

Compactron Dissimilar-Double-Triode Pentode

■ LOW HEATER POWER ■ HIGH TRANSCONDUCTANCE VIDEO AMPLIFIER PENTODE ■ GENERAL PURPOSE TRIODES

The 16BX11 is a compactron containing a high-mu triode, a medium-mu triode, and a sharp-cutoff pentode. The pentode is intended for video amplifier service and the triodes for general-purpose applications.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	16	Volts
Heater Current●	0.315 ± 0.02	Amperes
Heater Warm-up Time, average♦	11	Seconds

Direct Interelectrode Capacitances, approximate▲

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.08	pf
Input: Pg1 to (Pk + Pg2 + Pg3 + h + i.s.)	11	pf
Output: Pp to (Pk + Pg2 + Pg3 + h + i.s.)	4.0	pf

Triode (Section 1)

Grid to Plate: (T1g to T1p)	1.9	pf
Input: T1g to (T1k + Pk + Pg3 + h + i.s.)	2.6	pf
Output: T1p to (T1k + Pk + Pg3 + h + i.s.)	0.7	pf

Triode (Section 2)

Grid to Plate: (T2g to T2p)	1.9	pf
Input: T2g to (T2k + Pk + Pg3 + h + i.s.)	3.4	pf
Output: T2p to (T2k + Pk + Pg3 + h + i.s.)	0.7	pf

Coupling

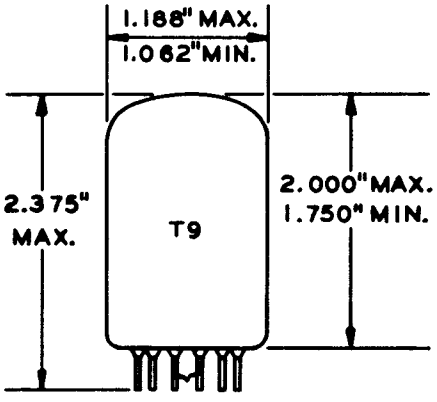
Pentode Plate to Triode Plate (Section 2): (Pp to T2p), maximum	0.02	pf
Triode Plate (Section 1) to Triode Plate (Section 2): (T1p to T2p), maximum	0.3	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

PHYSICAL DIMENSIONS

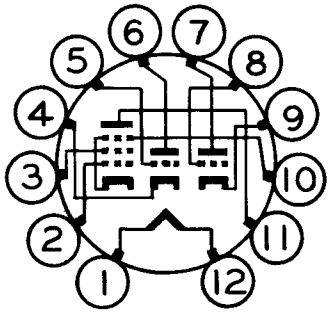


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Pentode Grid Number 1
Pin 3 - Pentode Grid Number 2 (Screen)
Pin 4 - Triode Cathode (Section 2)
Pin 5 - Triode Grid (Section 2)
Pin 6 - Triode Plate (Section 2)
Pin 7 - Triode Plate (Section 1)
Pin 8 - Triode Grid (Section 1)
Pin 9 - Triode Cathode (Section 1)
Pin 10 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 11 - Pentode Plate
Pin 12 - Heater

BASING DIAGRAM



EIA 12CA

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Pentode Section		
Plate Voltage	165	Volts
Screen Voltage	165	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	3.0	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	5000	Ohms
With Cathode Bias	10000	Ohms

Triodes	**(Section 1)**	**(Section 2)**	
Plate Voltage	330	330	Volts
Positive DC Grid Voltage	0	0	Volts
Plate Dissipation	2.0	1.5	Watts
Heater-Cathode Voltage			
Heater Positive with respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Circuit Resistance			
With Fixed Bias	0.5	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section			
Plate Voltage	35	125	Volts
Screen Voltage	125	125	Volts
Grid-Number 1 Voltage	0	---	Volts
Cathode-Bias Resistor	---	56	Ohms
Plate Resistance, approximate	---	100000	Ohms
Transconductance	---	11300	Micromhos
Plate Current	20	12	Milliamperes
Screen Current	9.2	3.8	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 100 Microamperes	---	-3	Volts

Triodes	**(Section 1)**	**(Section 2)**	
Plate Voltage	150	150	Volts
Cathode-Bias Resistor	150	220	Ohms
Amplification Factor	42	57	
Plate Resistance, approximate	6800	8400	Ohms
Transconductance	6200	6800	Micromhos
Plate Current	11	7.6	Milliamperes
Grid Voltage, approximate			
Ib = 100 Microamperes	-6	-4.5	Volts

NOTES

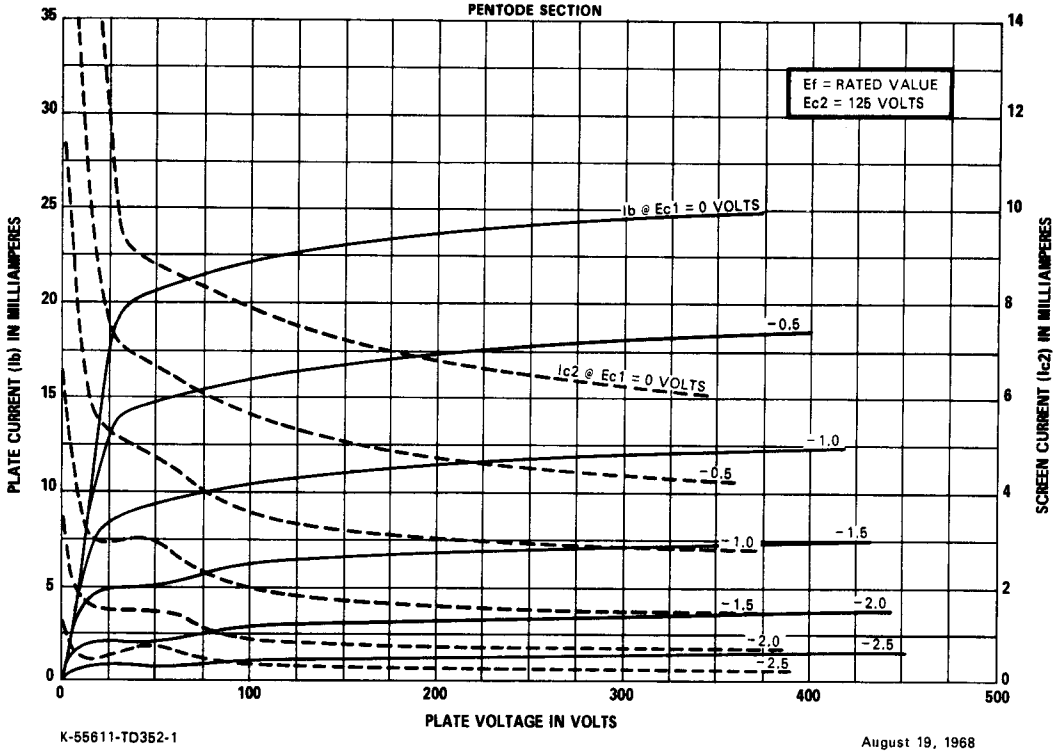
★ Heater voltage for a bogey tube at If = 0.315 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

▲ Without external shield.

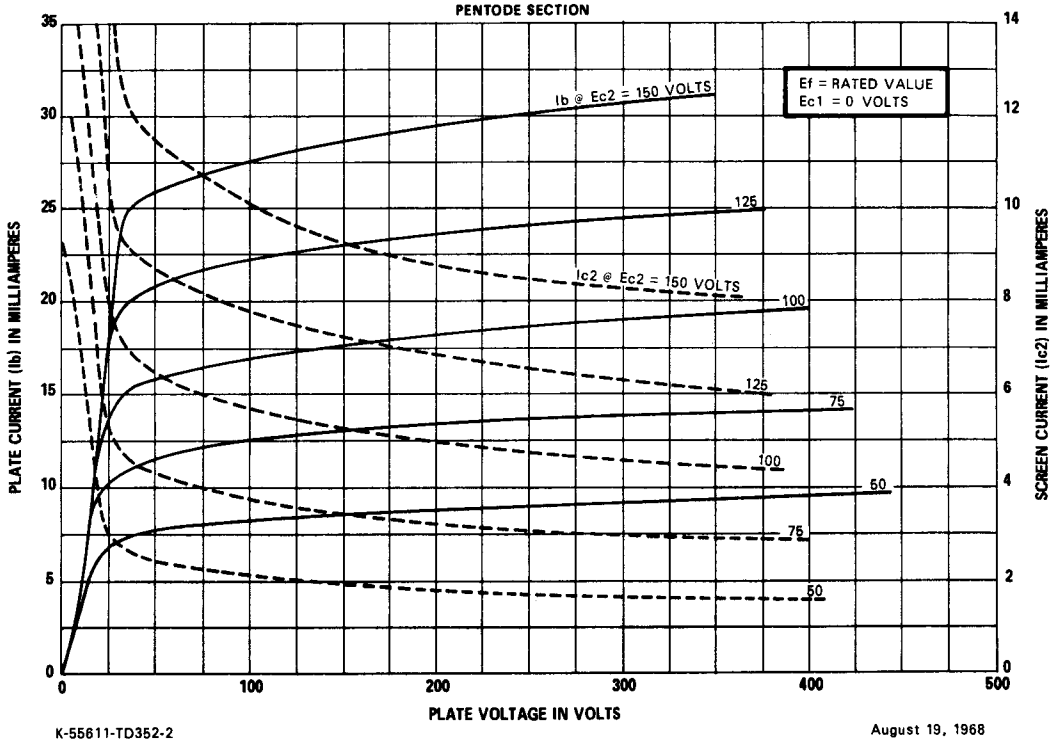
AVERAGE PLATE CHARACTERISTICS



K-55611-TD352-1

August 19, 1968

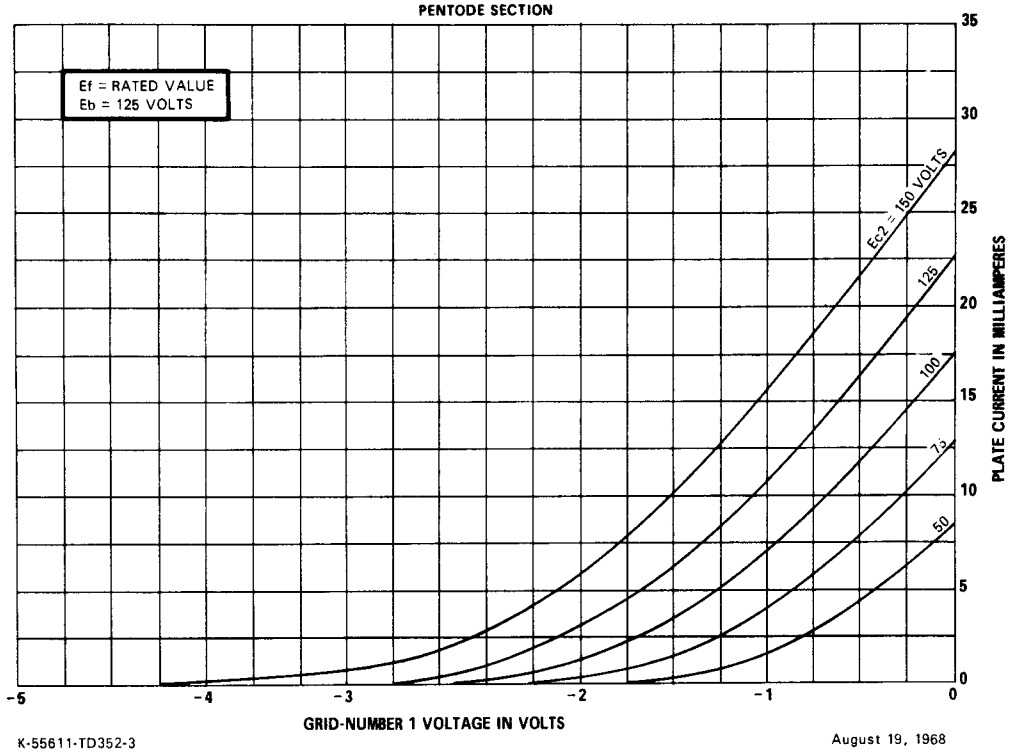
AVERAGE PLATE CHARACTERISTICS



K-55611-TD352-2

August 19, 1968

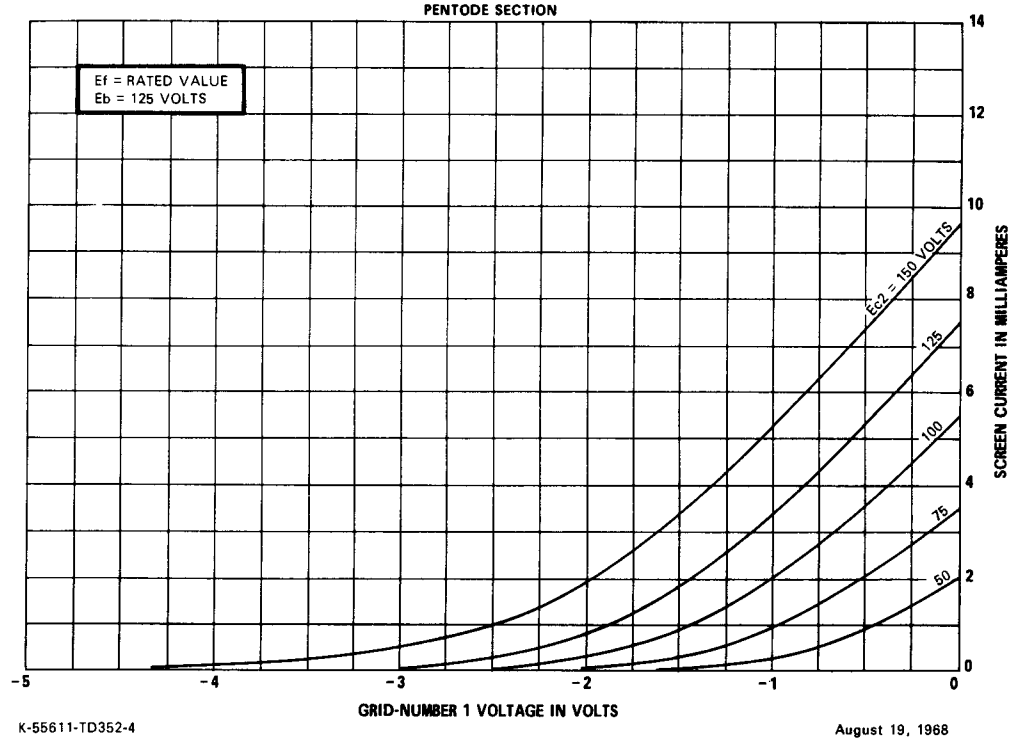
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD352-3

August 19, 1968

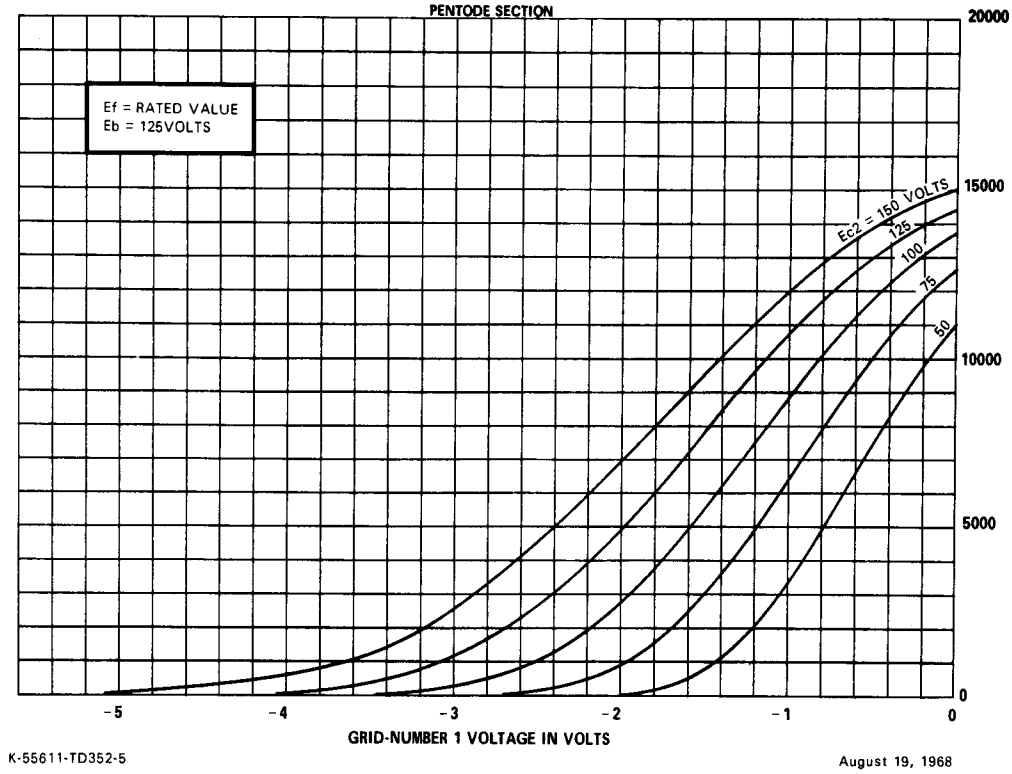
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD352-4

August 19, 1968

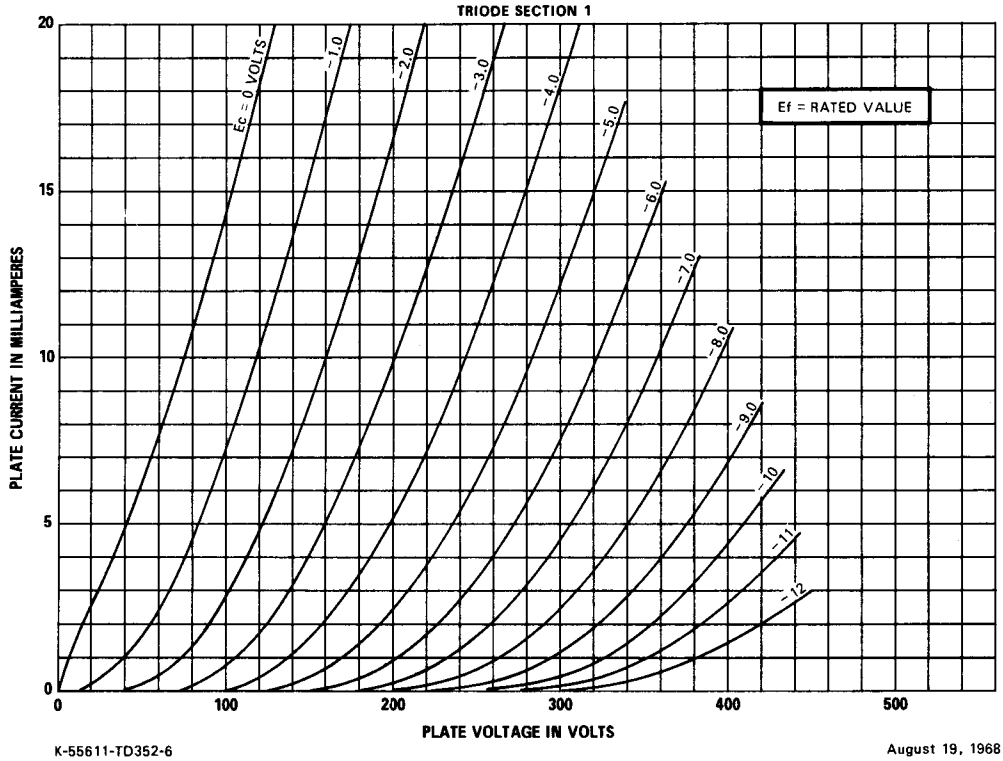
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD352-5

August 19, 1968

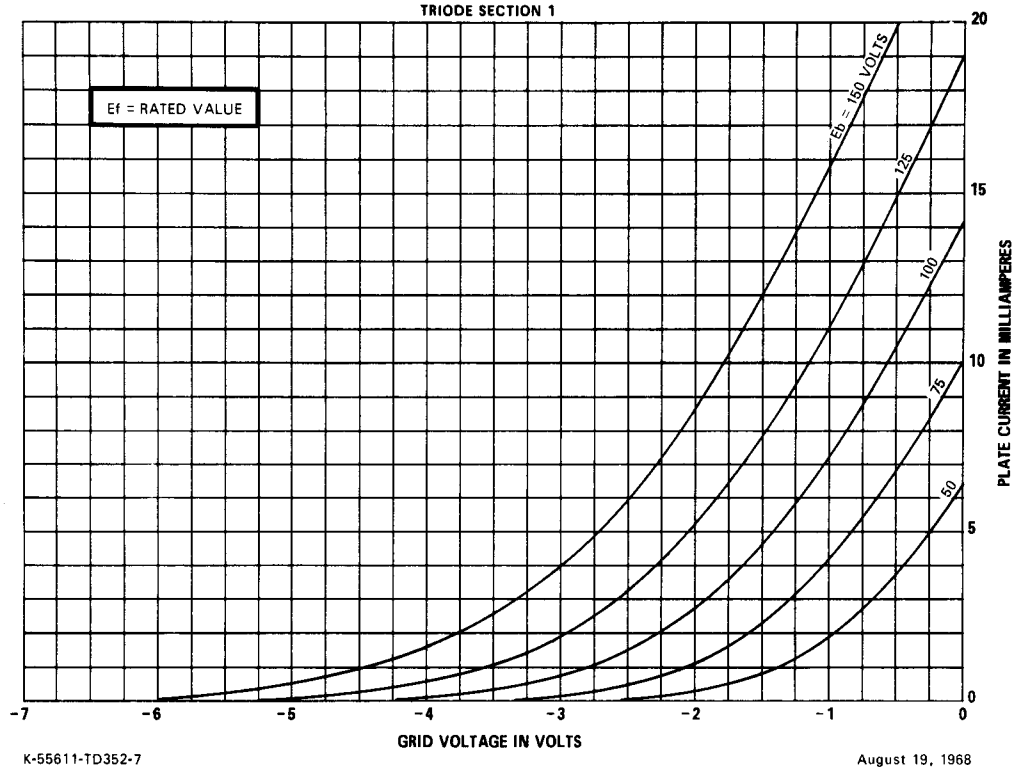
AVERAGE PLATE CHARACTERISTICS



K-55611-TD352-6

August 19, 1968

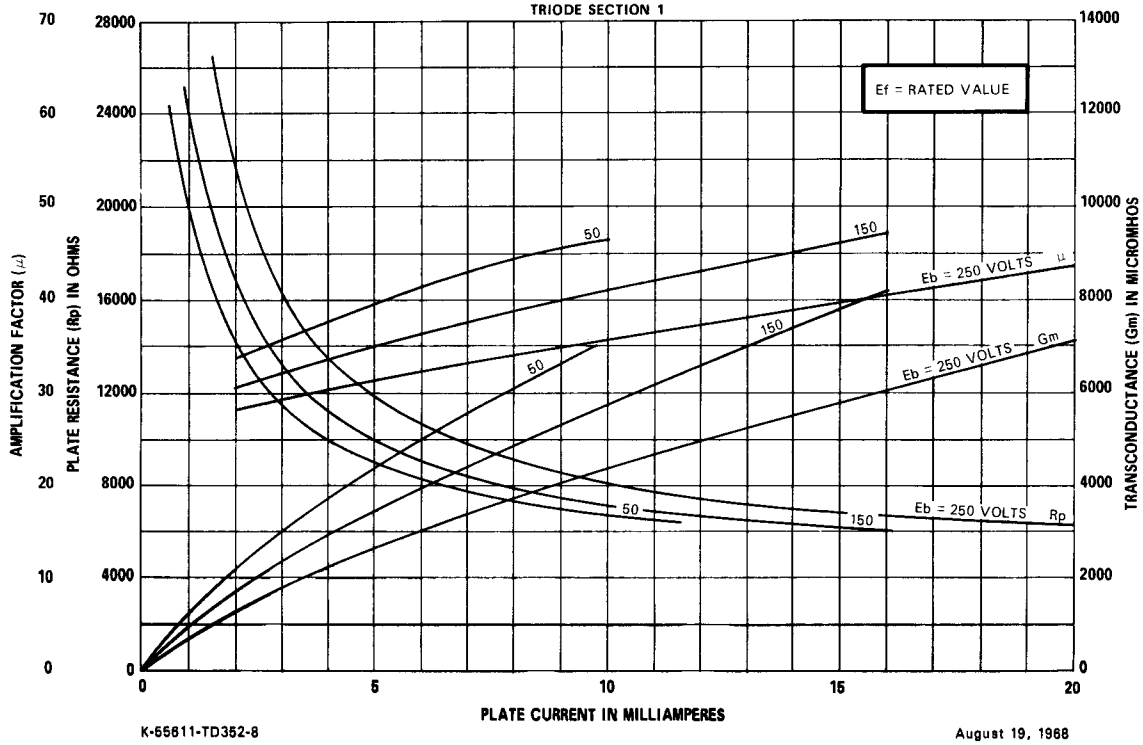
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD352-7

August 19, 1968

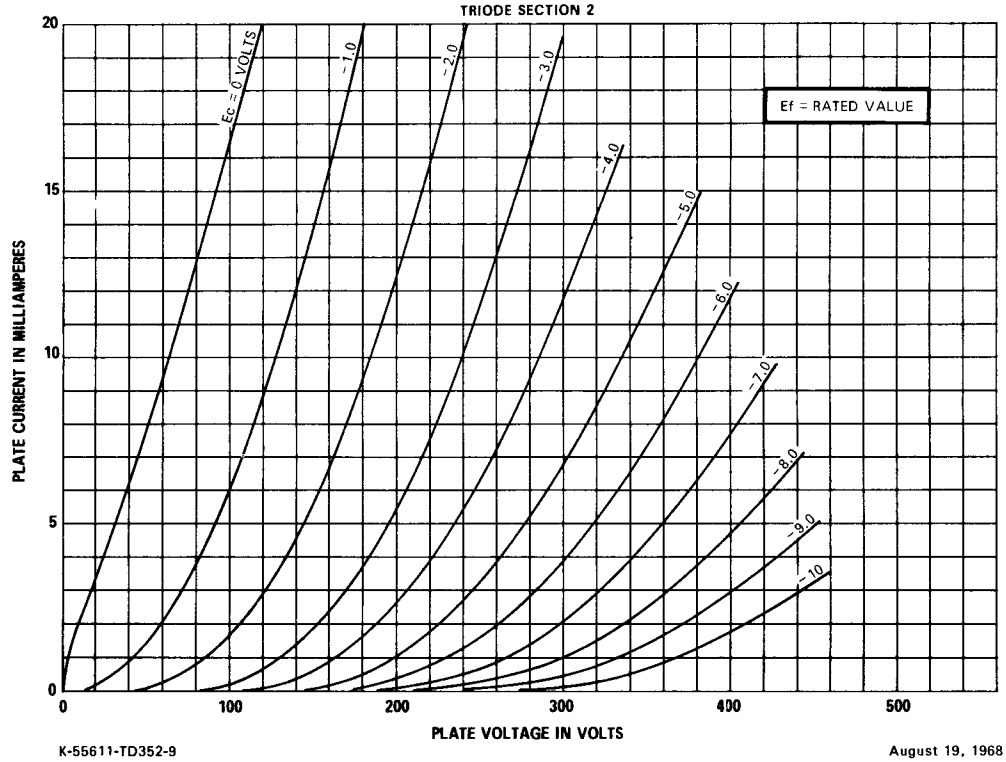
AVERAGE CHARACTERISTICS



K-55611-TD352-8

August 19, 1968

AVERAGE PLATE CHARACTERISTICS

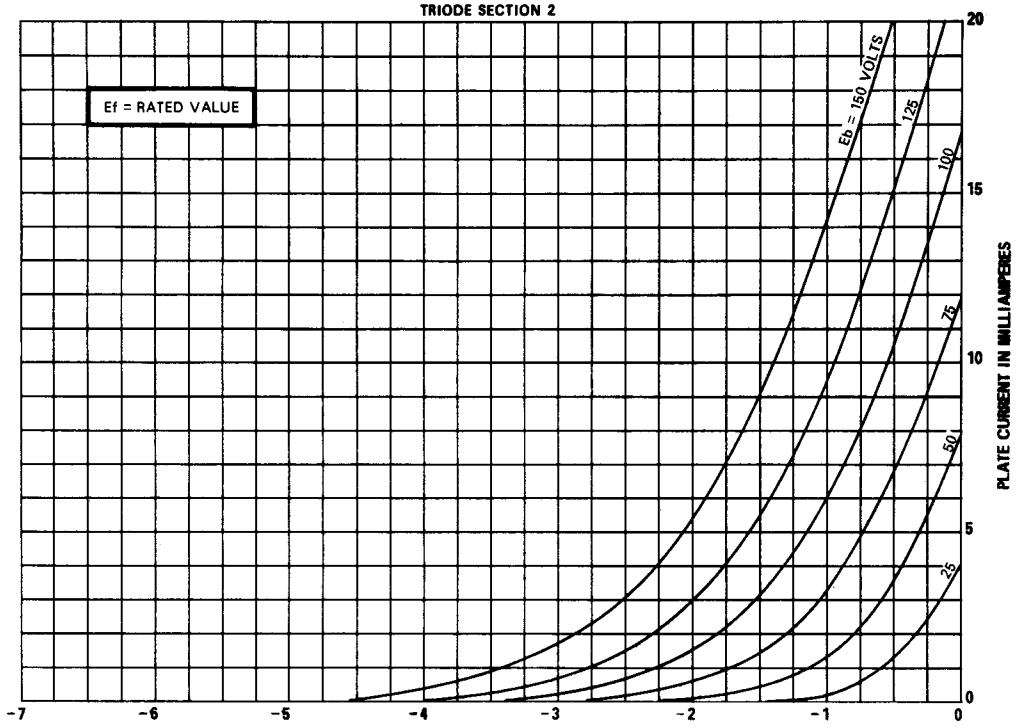


K-55611-TD352-9

August 19, 1968

AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION 2

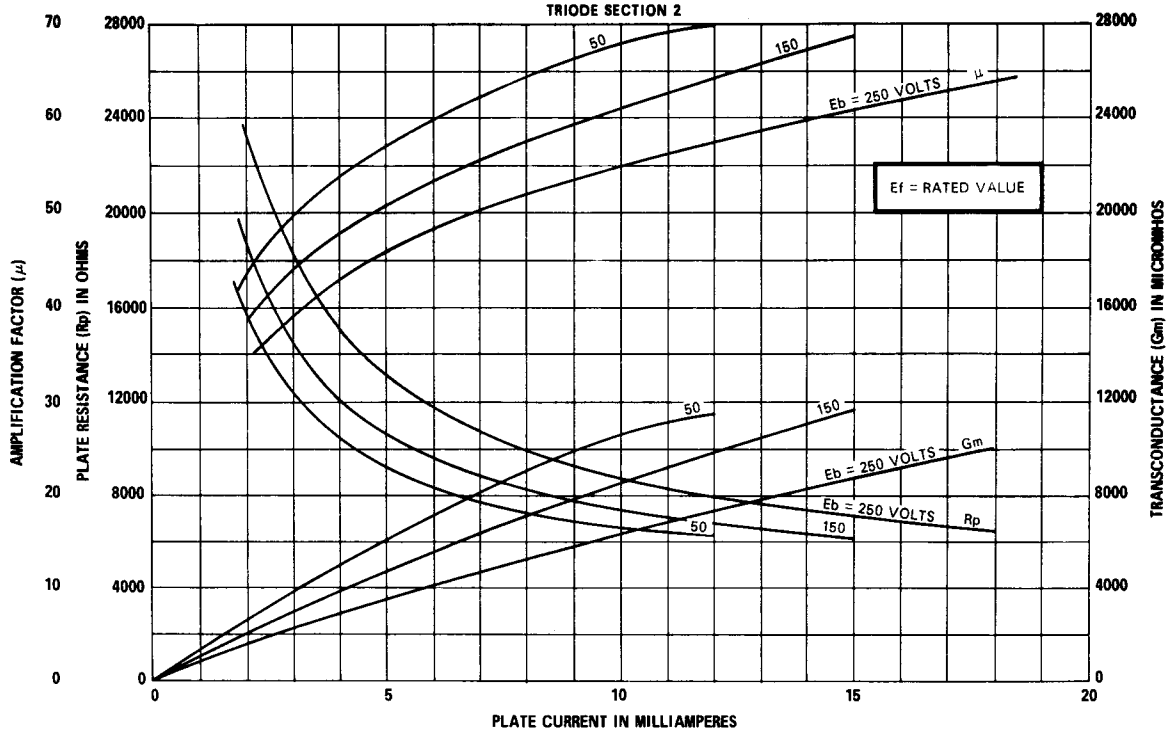


K-55611-TD352-10

August 10, 1968

AVERAGE CHARACTERISTICS

TRIODE SECTION 2



K-55611-TD352-11

August 19, 1968

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

16DP4-A

CATHODE-RAY TUBE

16-INCH ROUND, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC

14½ BY 10⅞-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN

60-DEGREE DEFLECTION ANGLE

DESCRIPTION AND RATING

The 16DP4-A is a magnetic-focus and -deflection, direct-view all-glass picture tube which provides a 14½ by 10⅞-inch picture with rounded sides for television applications. Features of this tube include a high-quality gray faceplate to increase picture contrast and detail under high ambient light conditions, and an electron gun which was designed for use with an external double-field ion-trap magnet.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ±10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate	60	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
- Fluorescent Color—White
- Phosphorescent Color—White
- Persistence—Short

Faceplate—Gray
- Light Transmission at Center, approximate . . . . . 73 Percent

MECHANICAL

Over-all Length	20¾ ± ¼	Inches
Greatest Bulb Diameter	15⅞ ± ⅛	Inches
Minimum Useful Screen Diameter	14½	Inches
Neck Length	7⅞	Inches

Bulb Number, ASA Designation—J127B
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-pin, JETEC No. B5-57
Basing, JETEC Designation—12D
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 3 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	16½	Pounds

MAXIMUM RATINGS♦

DESIGN-CENTER VALUES*

Anode Voltage†	15,000	Max Volts DC
Grid-No. 2 Voltage	410	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125	Max Volts
Heater Positive with Respect to Cathode	125	Max Volts

TYPICAL OPERATING CONDITIONS♦

Anode Voltage‡	12,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage§	−28 to −72	Volts DC
Focusing-Coil Currentπ, approximate	101	Milliamperes DC
Ion-Trap Field Intensity△, approximate	35	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

♦ All voltages are measured with respect to cathode.

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

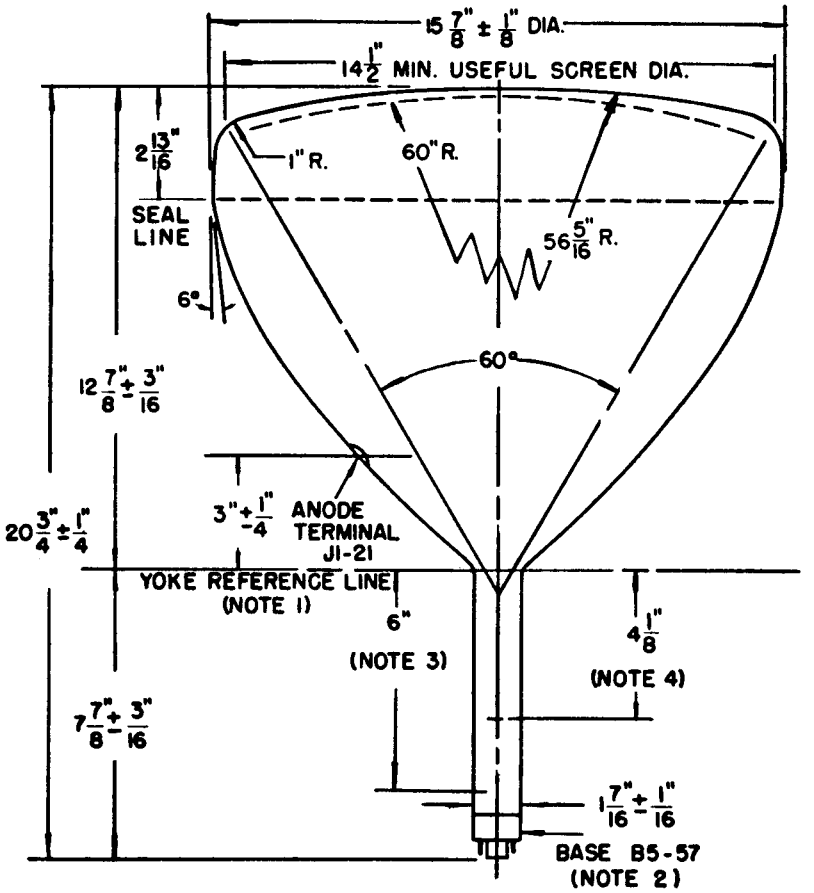
† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

‡ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 9,000 volts.

§ For visual extinction of focused raster.

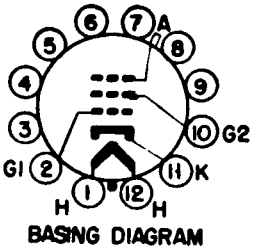
π For RETMA focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 4⅛ inches.

△Double-field ion-trap magnet adjusted to optimum position, equivalent to 120 milliamperes through RETMA ion-trap magnet No. 108.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 112) WHEN THE GAGE IS RESTING ON THE CONE.
2. ANODE TERMINAL ALIGNS WITH PIN-NO. 3 POSITION ±30 DEGREES.
3. APPROXIMATE POSITION OF ION-TRAP MAGNET.
4. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.



BASING DIAGRAM
12D

K-69087-72A693

6-20-55

Electronic TUBES

16GP4 — 16GP4-B

CATHODE-RAY TUBE

16-INCH ROUND, METAL
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE

14⅜ BY 10¾-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
16GP4-B—FROSTED FACE

DESCRIPTION AND RATING

The 16GP4 is a magnetic-focus and -deflection direct-view picture tube which provides a 14⅜ by 10¾-inch picture with rounded sides for television applications. Features of this tube include a lightweight metal cone envelope, a high-quality gray faceplate to increase picture contrast and detail under high ambient light conditions, an electron gun which is designed for use with an external single-field ion-trap magnet, and a short over-all length.

The 16GP4-B has the additional feature of a frosted faceplate to prevent specular reflection.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ±10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate	70	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

16GP4 and 16GP4-B:		
Light Transmission at Center, approximate	66	Percent
16GP4-B:		
Specular Reflection of Ambient Light, maximum	2.5	Percent

GENERAL ELECTRIC

Supersedes ETR-119, dated 2-51 and ETR-135, dated 4-52.

MECHANICAL

Over-all Length	17¼ ± ⅜	Inches
Greatest Bulb Diameter	15⅞ ± ⅛	Inches
Minimum Useful Screen Diameter	14⅜	Inches
Neck Length	6⅞	Inches

Bulb Contact—Metal Cone Lip
Base—Small-shell Duodecal 5-pin, JETEC No. B5-57
Basing, JETEC Designation—12D

Mounting Position—Any

Net Weight, approximate	10	Pounds

MAXIMUM RATINGS♦

DESIGN-CENTER VALUES*

Anode Voltage†	14,000	Max Volts DC
Grid-No. 2 Voltage	410	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	150	Max Volts
Heater Positive with Respect to Cathode	150	Max Volts

TYPICAL OPERATING CONDITIONS♦

Anode Voltage‡	12,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage§	−28 to −72	Volts DC
Focusing-Coil Currentπ, approximate	103	Milliamperes DC
Ion-Trap Field Intensity△, approximate	35	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5	Max Megohms

♦ All voltages are measured with respect to cathode.

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

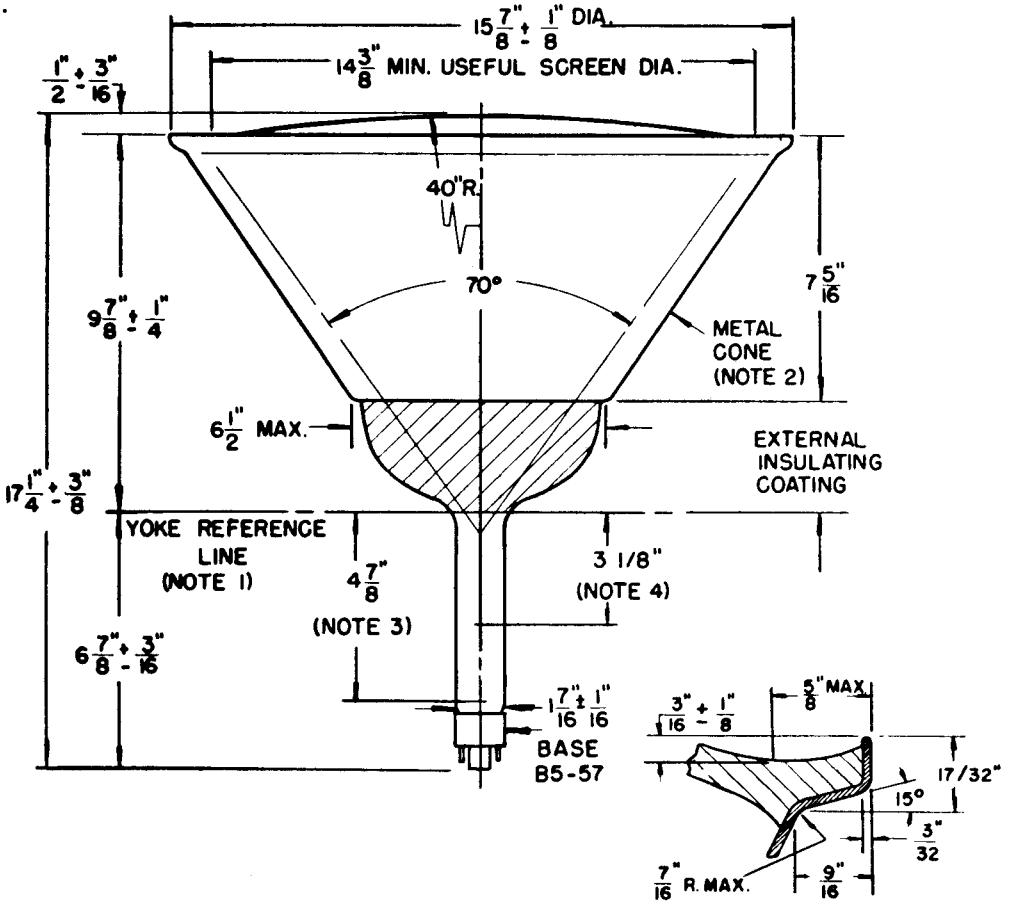
† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

‡ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 10,000 volts.

§ For visual extinction of focused raster.

π For RETMA focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3⅛ inches.

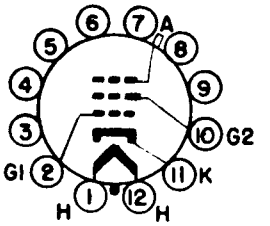
△Single-field ion-trap magnet adjusted to optimum position, equivalent to 35 milliamperes through RETMA ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO.110) WHEN THE GAGE IS RESTING ON THE CONE.
2. METAL CONE OPERATES AT HIGH VOLTAGE AND MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ANODE VOLTAGE.
3. APPROXIMATE POSITION OF ION-TRAP MAGNET.
4. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.

LIP DETAIL



BASING DIAGRAM
12D

Compactron Beam Pentode

16GY5

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

The 16GY5 is a compactron beam-power pentode designed for use as the horizontal-deflection amplifier in television receivers.

Except for heater characteristics and ratings, the 16GY5 is identical to the 6GY5.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	15.8	Volts
Heater Current■	0.6 ± 0.04	Amperes
Heater Warm-up Time, Average♦	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

■ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

16KP4-A/16RP4-A

CATHODE-RAY TUBE

16-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
13½- BY 10⅛-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 16KP4-A/16RP4-A is a magnetic-focus and deflection direct-view all-glass picture tube which provides a 13½- by 10⅛-inch picture for television applications. The electron gun is designed for use with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high ambient light conditions, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

The tube also features a reflective aluminized screen which increases light output.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	1500	μμf
Minimum	750	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	72	Percent

MECHANICAL

Over-all Length	18¾ ± ⅜	Inches
Greatest Bulb Dimensions		
Diagonal	16⅛ ± ⅛	Inches
Width	14¾ ± ⅛	Inches
Height	11½ ± ⅛	Inches
Minimum Useful Screen Dimensions		
Diagonal	14⅞	Inches
Width	13½	Inches
Height	10⅛	Inches
Neck Length	7½	Inches

Bulb Number, ASA Designation—J129B
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	16	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	16,000 Max	Volts DC
Grid-No. 2 Voltage	410 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	150 Max	Volts
Heater Positive with Respect to Cathode	150 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	14,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	108	Milliamperes DC
Ion-Trap Field Intensity ◆, approximate	35	Gausses

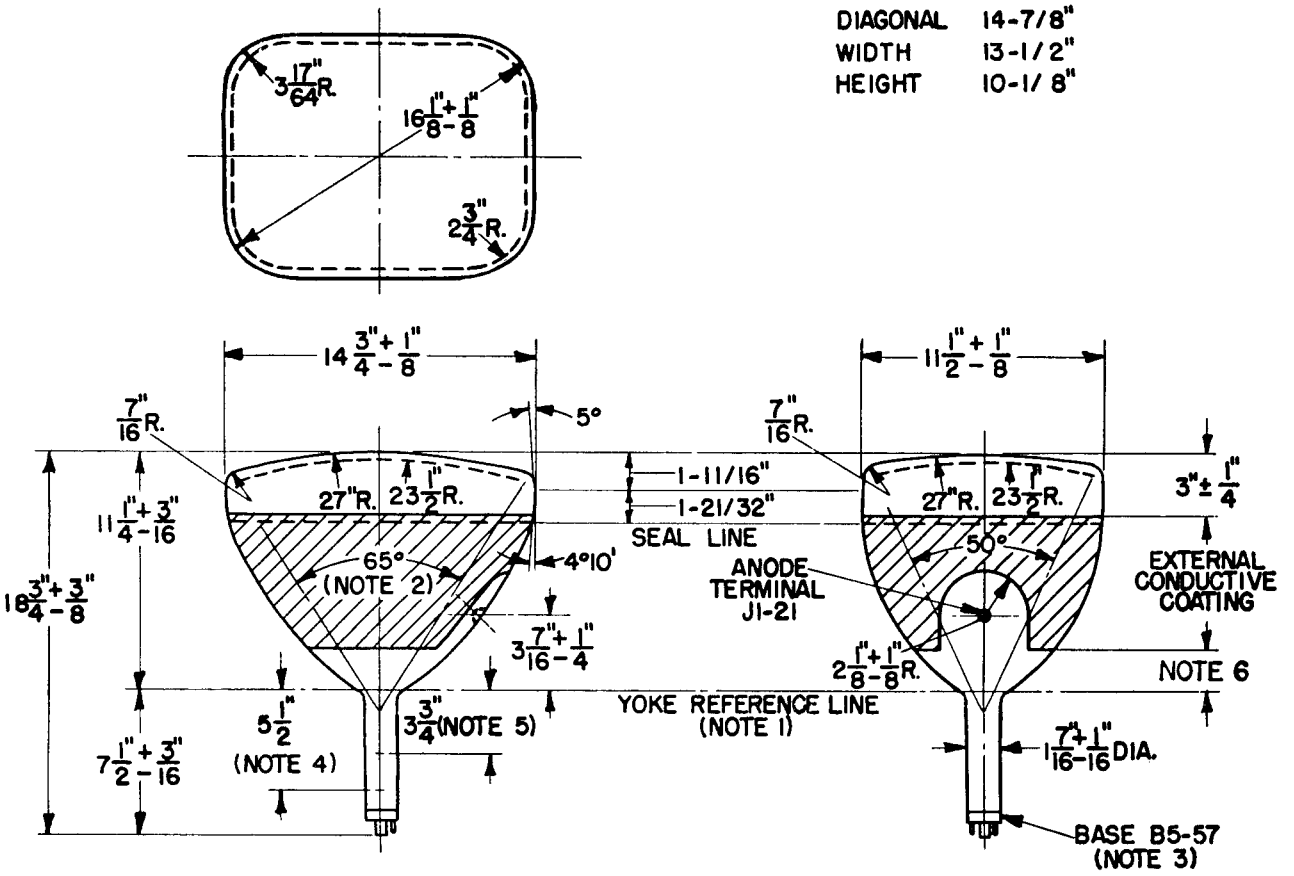
MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.
† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.
§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.
π For visual extinction of focused raster.
▲ For RETMA focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3¾ inches.
♦ Single-field ion-trap magnet adjusted to optimum position, equivalent to 35 milliamperes through RETMA ion-trap magnet No. 117.

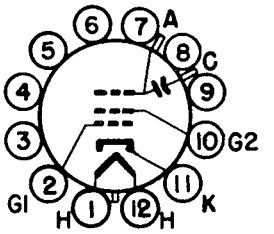
SCREEN DIMENSIONS

DIAGONAL	14-7/8"
WIDTH	13-1/2"
HEIGHT	10-1/8"



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ±30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.
6. REFERENCE LINE TO BOTTOM OF EXTERNAL CONDUCTIVE COATING - 9/16" MIN. TO 2-1/4" MAX.



BASING DIAGRAM
12N

Electronic TUBES

16LP4-A

CATHODE-RAY TUBE

16-INCH ROUND, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
52-DEGREE DEFLECTION ANGLE

14½ BY 10⅞-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 16LP4-A is a magnetic-focus and -deflection, direct-view all-glass picture tube which provides a 14½ by 10⅞-inch picture with rounded sides for television applications. Features of this tube include a high-quality gray faceplate to increase picture contrast and detail under high ambient light conditions, and an electron gun which was designed for use with an external double-field ion-trap magnet. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ±10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate	52	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	2000	μμf
Minimum	750	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray		
Light Transmission at Center, approximate	73	Percent

MECHANICAL

Over-all Length	22¼ ± ⅜	Inches
Greatest Bulb Diameter	15⅞ ± ⅛	Inches
Minimum Useful Screen Diameter	14½	Inches
Neck Length	7⅜	Inches

Bulb Number, ASA Designation—J127C
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 3 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	17½	Pounds

MAXIMUM RATINGS♦

DESIGN-CENTER VALUES*

Anode Voltage†	14,000	Max Volts DC
Grid-No. 2 Voltage	410	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125	Max Volts
Heater Positive with Respect to Cathode	125	Max Volts

TYPICAL OPERATING CONDITIONS♦

Anode Voltage‡	12,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage§	−28 to −72	Volts DC
Focusing-Coil Currentπ, approximate	97	Milliamperes DC
Ion-Trap Field Intensity△, approximate	35	Gausses

CIRCUIT VALUES

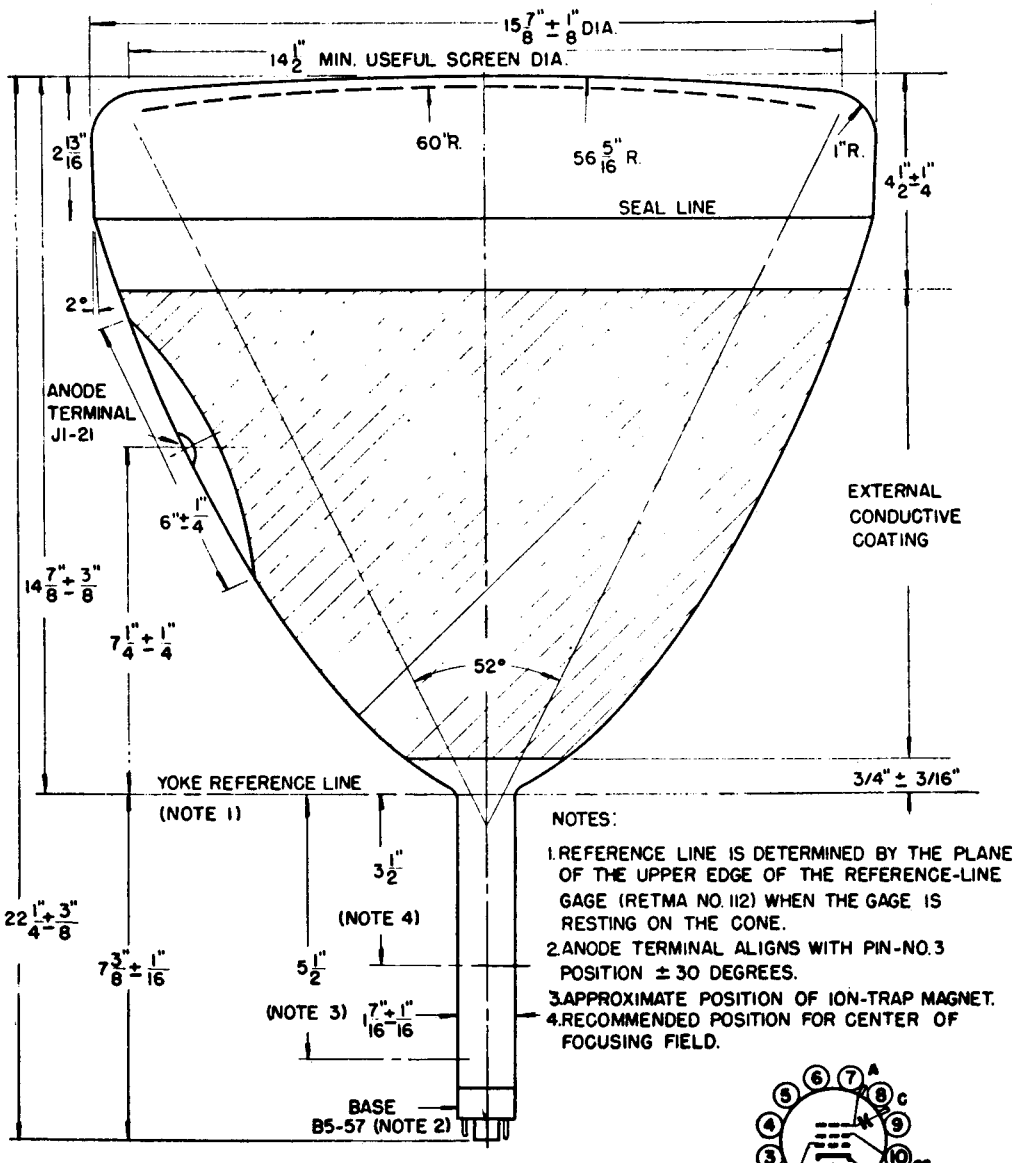
Grid-No. 1 Circuit Resistance	1.5	Max Megohms

♦ All voltages are measured with respect to cathode.

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

‡ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 10,000 volts.
§ For visual extinction of focused raster.
π For RETMA focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3½ inches.
△Double-field ion-trap magnet adjusted to optimum position, equivalent to 120 milliamperes through RETMA ion-trap magnet No. 108.



K-69087-72A695

6-20-55

—PRODUCT INFORMATION—

Compactron Triode-Pentode

16LU8-A

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

The 16LU8-A is a compactron containing a medium-mu triode and a beam pentode. The triode is designed for service as a vertical-deflection oscillator and the pentode as a vertical-deflection amplifier in television receivers. Except for heater characteristics and shorter bulb length, the 16LU8-A is identical to the 6LU8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	16	Volts
Heater Current●	0.6 ± 0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds

MECHANICAL

Outline Drawing - EIA 12-56

Maximum Diameter	1.562	Inches
Minimum Diameter	1.438	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches
Minimum Seated Height	2.250	Inches

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

16TP4

CATHODE-RAY TUBE

16-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
13½- BY 10⅛-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 16TP4 is a magnetic-focus and deflection, direct-view all-glass picture tube which provides a 13½- by 10⅛-inch picture for television applications. The electron gun is used with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	2000	μμf
Minimum	750	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	72	Percent

MECHANICAL

Over-all Length	18⅛ ± ⅜	Inches
Greatest Bulb Dimensions		
Diagonal	16⅛ ± ⅛	Inches
Width	14¾ ± ⅛	Inches
Height	11½ ± ⅛	Inches
Minimum Useful Screen Dimensions		
Diagonal	14⅞	Inches
Width	13½	Inches
Height	10⅛	Inches
Neck Length	6⅞	Inches

Bulb Number, ASA Designation—J129-B1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 15-Pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	16	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	14,000 Max	Volts DC
Grid-No. 2 Voltage	410 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	150 Max	Volts
Heater Positive with Respect to Cathode	150 Max	Volts

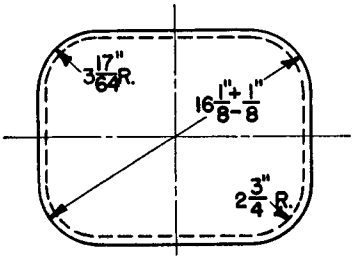
TYPICAL OPERATING CONDITIONS

Anode Voltage§	12,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	99	Milliamperes DC
Ion-Trap Field Intensity♦, approximate	35	Gausses

MAXIMUM CIRCUIT VALUES

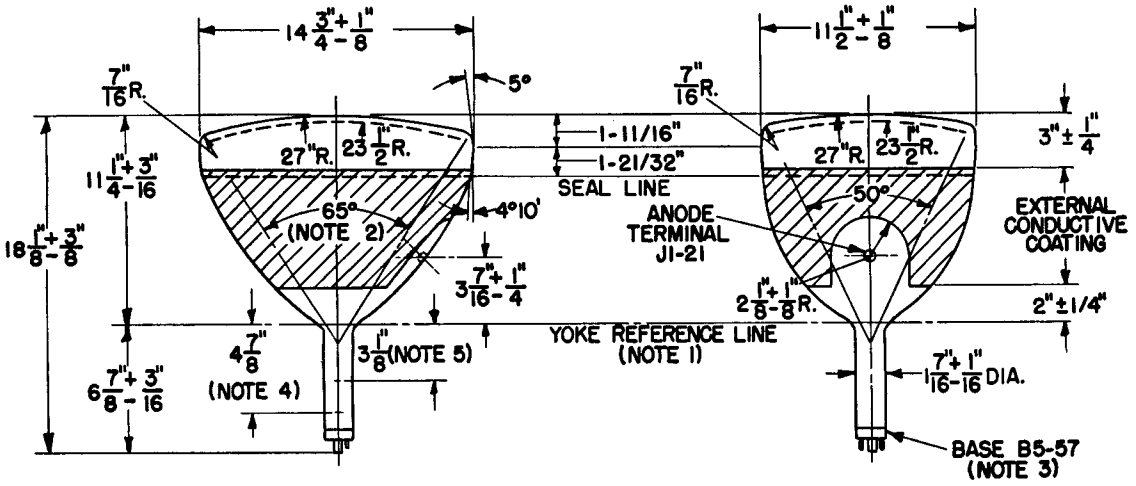
Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.
† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.
‡ Cathode should be returned to one side or to the midtap of the heater transformer winding.
§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 10,000 volts.
π For visual extinction of focused raster.
▲ For JETEC focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3⅛ inches.
♦ Single-field ion-trap magnet adjusted to optimum position, equivalent to 35 milliamperes through JETEC ion-trap magnet No. 117.



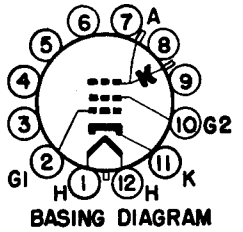
SCREEN DIMENSIONS

DIAGONAL	14-7/8"
WIDTH	13-1/2"
HEIGHT	10-1/8"



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ±30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.



BASING DIAGRAM
12N

N15170AZ

8-6-54

Electronic TUBES

16WP4-A

CATHODE-RAY TUBE

16-INCH ROUND, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE

14½ BY 10⅞-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 16WP4-A is a magnetic-focus and -deflection, direct-view all-glass picture tube which provides a 14½ by 10⅞-inch picture with rounded sides for television applications. Features of this tube include a high-quality gray faceplate to increase picture contrast and detail under high ambient light conditions, and an electron gun which was designed for use with an external double-field ion-trap magnet. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ±10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate	70	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	1500	μμf
Minimum	750	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	73	Percent

MECHANICAL

Over-all Length	17¾ ± ⅜	Inches
Greatest Bulb Diameter	15⅞ ± ⅛	Inches
Minimum Useful Screen Diameter	14½	Inches
Neck Length	$7\frac{7}{16}$	Inches

Bulb Number, ASA Designation—J127D
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 3 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	15½	Pounds

MAXIMUM RATINGS♦

DESIGN-CENTER VALUES*

Anode Voltage†	16,000	Max Volts DC
Grid-No. 2 Voltage	410	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125	Max Volts
Heater Positive with Respect to Cathode	125	Max Volts

TYPICAL OPERATING CONDITIONS♦

Anode Voltage‡	12,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage§	−28 to −72	Volts DC
Focusing-Coil Currentπ, approximate	104	Milliamperes DC
Ion-Trap Field Intensity△, approximate	35	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5	Max Megohms

♦ All voltages are measured with respect to cathode.

* The maximum ratings provide a ten percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

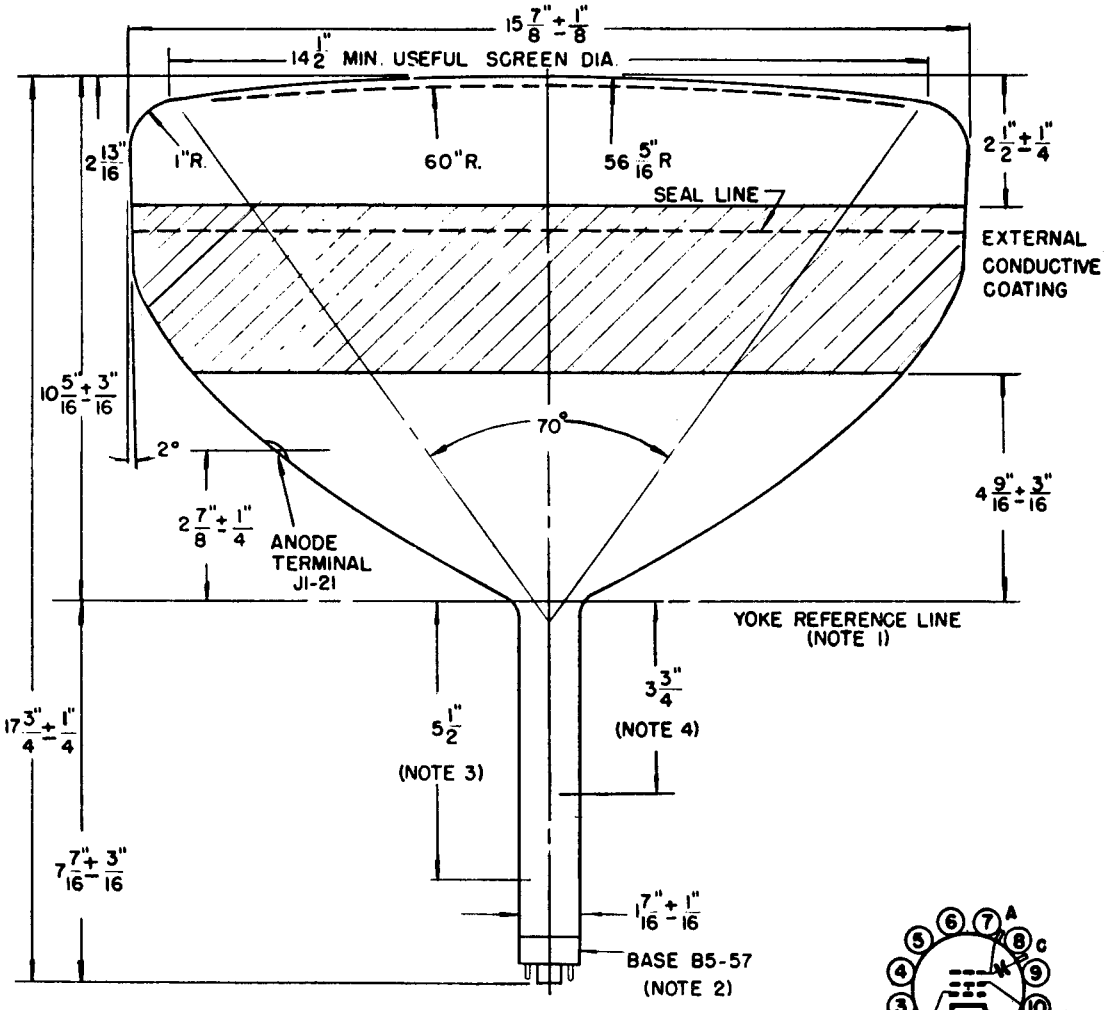
† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

‡ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 10,000 volts.

§ For visual extinction of focused raster.

π For RETMA focusing coil No. 109 with distance from the yoke reference line to center of air gap equal to 3¾ inches.

△Double-field ion-trap magnet adjusted to optimum position, equivalent to 120 milliamperes through RETMA ion-trap magnet No. 108.



BASING DIAGRAM
12N

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. ANODE TERMINAL ALIGNS WITH PIN-NO. 3 POSITION ± 30 DEGREES.
3. APPROXIMATE POSITION OF ION-TRAP MAGNET.
4. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.

K-69087-72A694

6-20-55

—PRODUCT INFORMATION—

Compactron Pentode — Gated-Beam Discriminator

17AB10

The 17AB10 is a compactron containing a gated-beam discriminator and a beam pentode. The gated-beam discriminator is suitable for FM and TV limiter and discriminator applications, and the beam pentode for audio power output service.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	16.8	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

Direct Interelectrode Capacitances¶

Gated-Beam Discriminator Section

Grid-Number 1 to Grid-Number 3	0.01	pf
Grid-Number 1 to All	4.4	pf
Grid-Number 3 to All	3.2	pf

Pentode Section

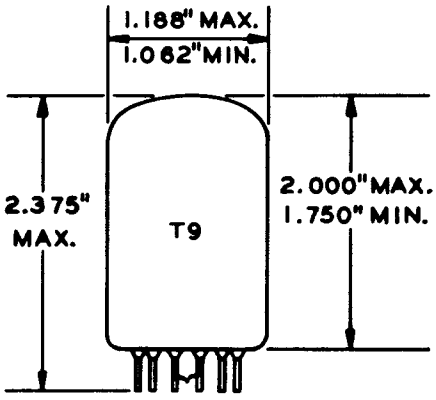
Grid-Number 1 to Plate	0.22	pf
Input	12	pf
Output	7.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

PHYSICAL DIMENSIONS

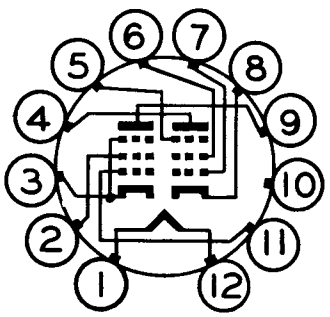


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Pentode Grid Number 2 (Screen)
Pin 3 - Pentode Cathode and Beam Plates
Pin 4 - Gated-Beam Discriminator Plate
Pin 5 - Gated-Beam Discriminator Grid Number 3 (Quadrature)
Pin 6 - Gated-Beam Discriminator Grid Number 2 (Accelerator)
Pin 7 - Gated-Beam Discriminator Grid Number 1
Pin 8 - Gated-Beam Discriminator Cathode and Internal Shields
Pin 9 - Pentode Plate
Pin 10 - No Connection
Pin 11 - Pentode Grid Number 1
Pin 12 - Heater

BASING DIAGRAM



EIA 12BT

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Gated-Beam Discriminator Section

Plate-Supply Voltage	330	Volts
Accelerator-Supply Voltage	330	Volts
Peak Positive Grid-Number 1 Voltage	60	Volts
DC Cathode Current	13	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Pentode Section

Plate Voltage	165	Volts
Screen Voltage	150	Volts
Plate Dissipation	6.5	Watts
Screen Dissipation	1.8	Watts
DC Cathode Current	65	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	0.5	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Gated-Beam Discriminator Section

Plate Voltage	135	135	135	Volts
Accelerator Voltage	75	---	---	Volts
Accelerator-Supply Voltage	---	280	280	Volts
Accelerator Resistor	---	33000	33000	Ohms
Grid-Number 1 Voltage	0	0	0	Volts
Grid-Number 3 Voltage	+4.0	+4.0	0	Volts
Plate Current	---	5.0	---	Milliamperes
Accelerator Current	4.5	---	---	Milliamperes
Grid-Number 1 Transconductance	---	---	360	Micromhos
Grid-Number 3 Transconductance	---	---	700	Micromhos
Grid-Number 1 Voltage, approximate Ib = 20 Microamperes	---	---	-4	Volts
Grid-Number 3 Voltage, approximate Ib = 20 Microamperes	---	---	-4	Volts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

CLASS A_1 AMPLIFIER

Pentode Section

Plate Voltage	145	Volts
Screen Voltage	110	Volts
Grid-Number 1 Voltage	-6.0	Volts
Peak AF Grid-Number 1 Voltage	6.0	Volts
Plate Resistance, approximate	30000	Ohms
Transconductance	8600	Micromhos
Zero-Signal Plate Current	36	Milliamperes
Maximum-Signal Plate Current	40	Milliamperes
Zero-Signal Screen Current	3.0	Milliamperes
Maximum-Signal Screen Current	9.0	Milliamperes
Load Resistance	3000	Ohms
Total Harmonic Distortion, approximate	10	Percent
Maximum-Signal Power Output	2.4	Watts

NOTES

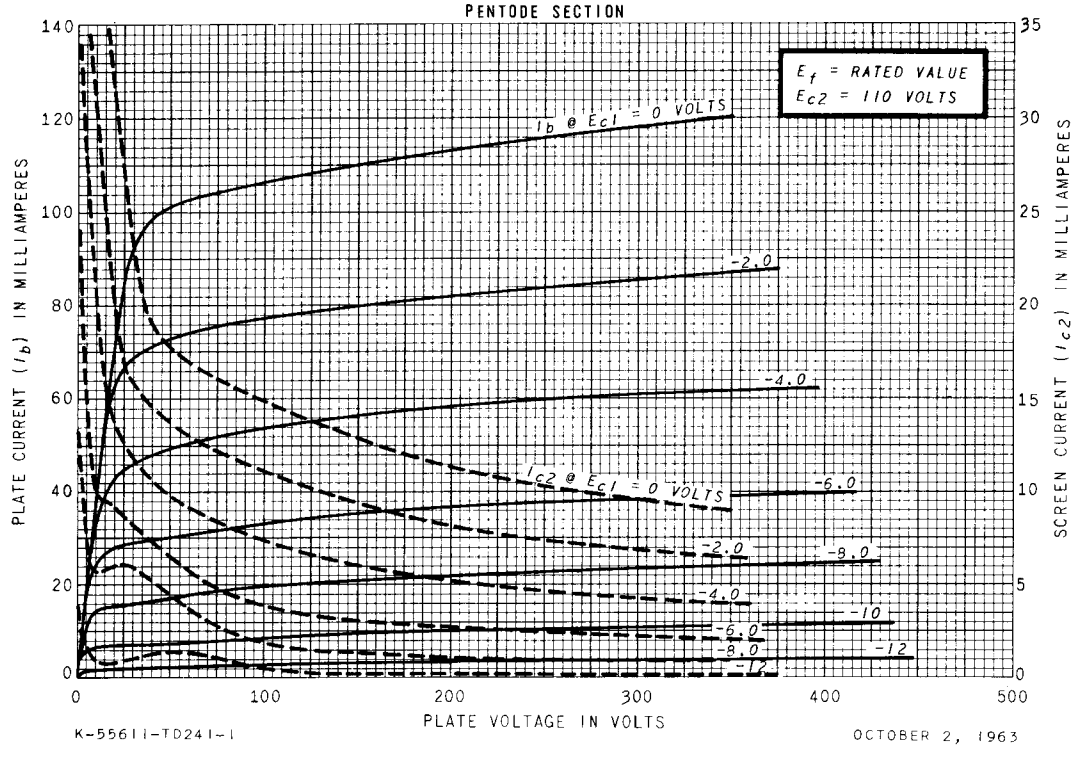
* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ Without external shield.

AVERAGE PLATE CHARACTERISTICS

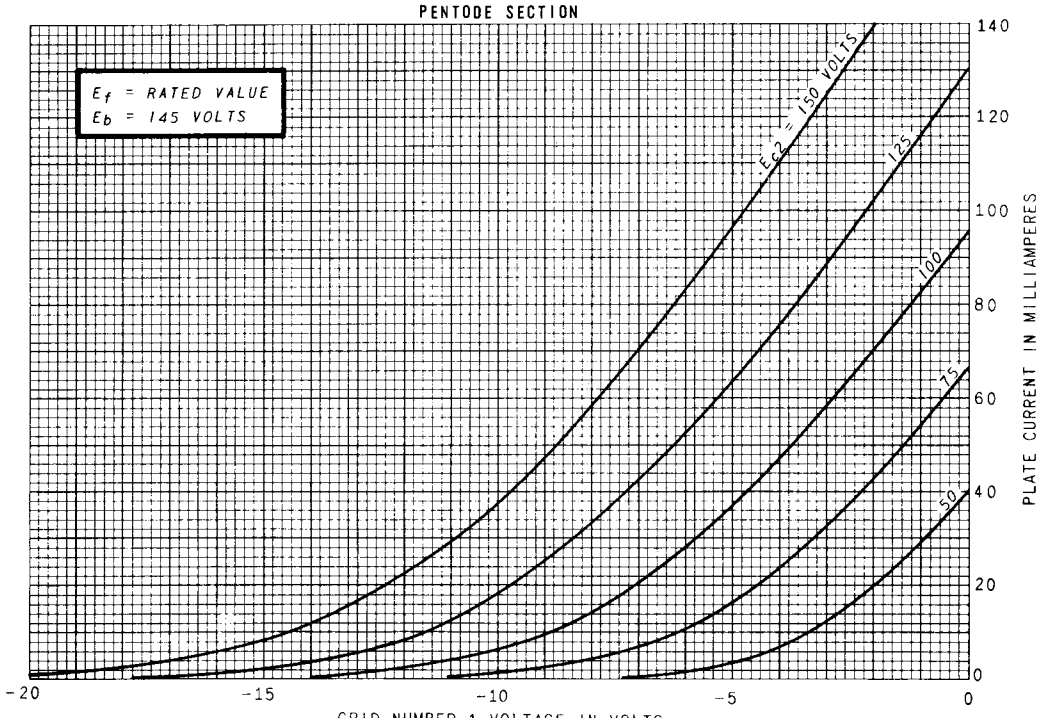


K-5561I-TD241-I

OCTOBER 2, 1963

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

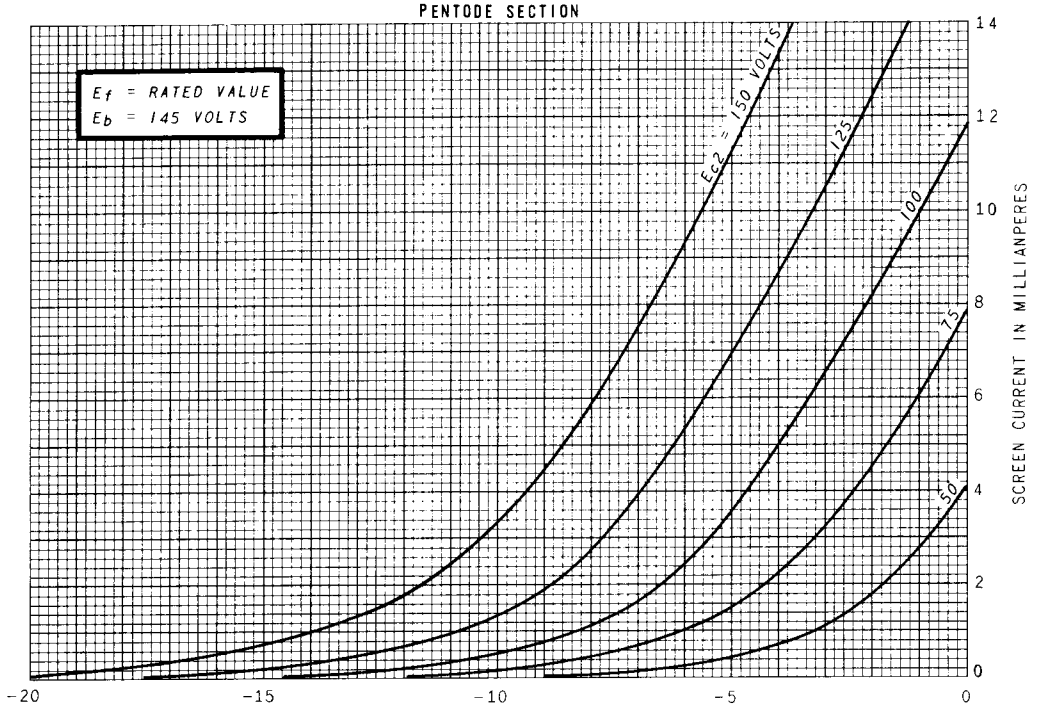


K-55611-TD241-2

OCTOBER 2, 1963

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

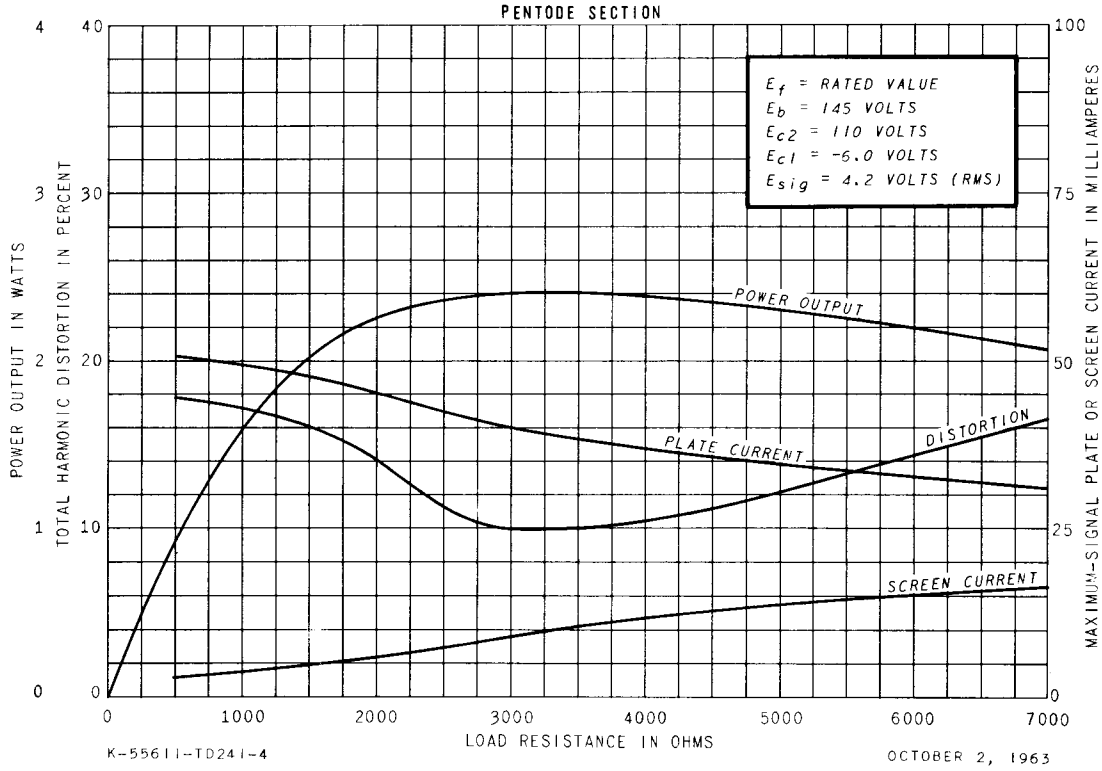


K-55611-TD241-3

OCTOBER 2, 1963

OPERATION CHARACTERISTICS

PENTODE SECTION

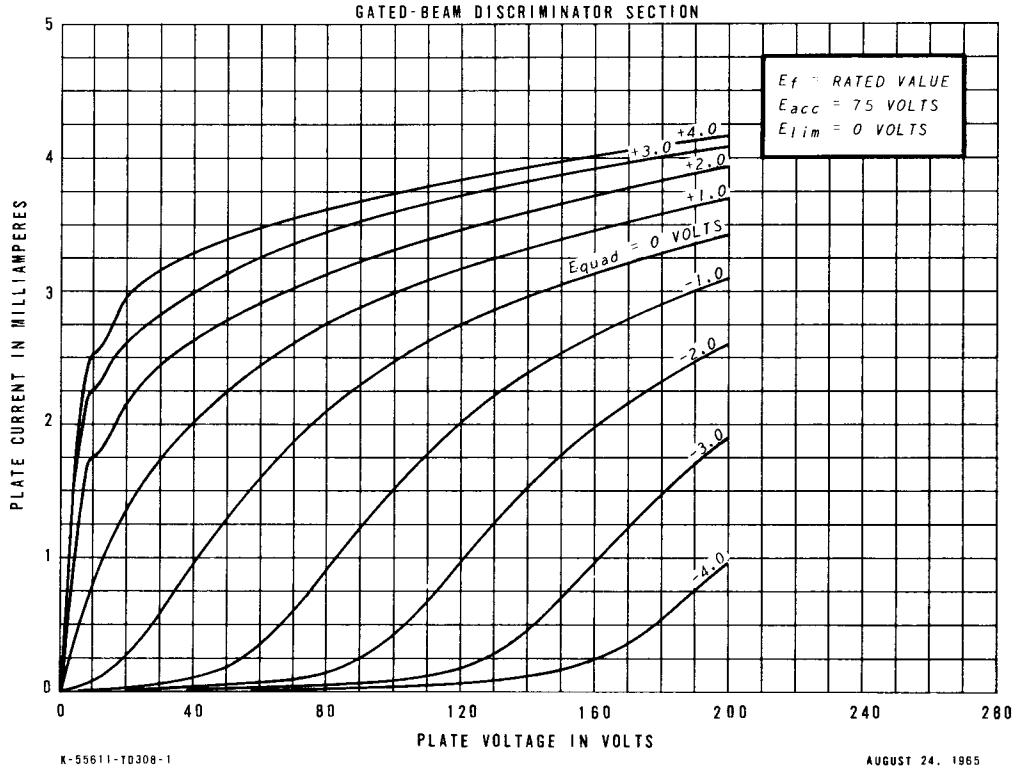


K-55611-TD241-4

OCTOBER 2, 1963

AVERAGE PLATE CHARACTERISTICS

GATED-BEAM DISCRIMINATOR SECTION

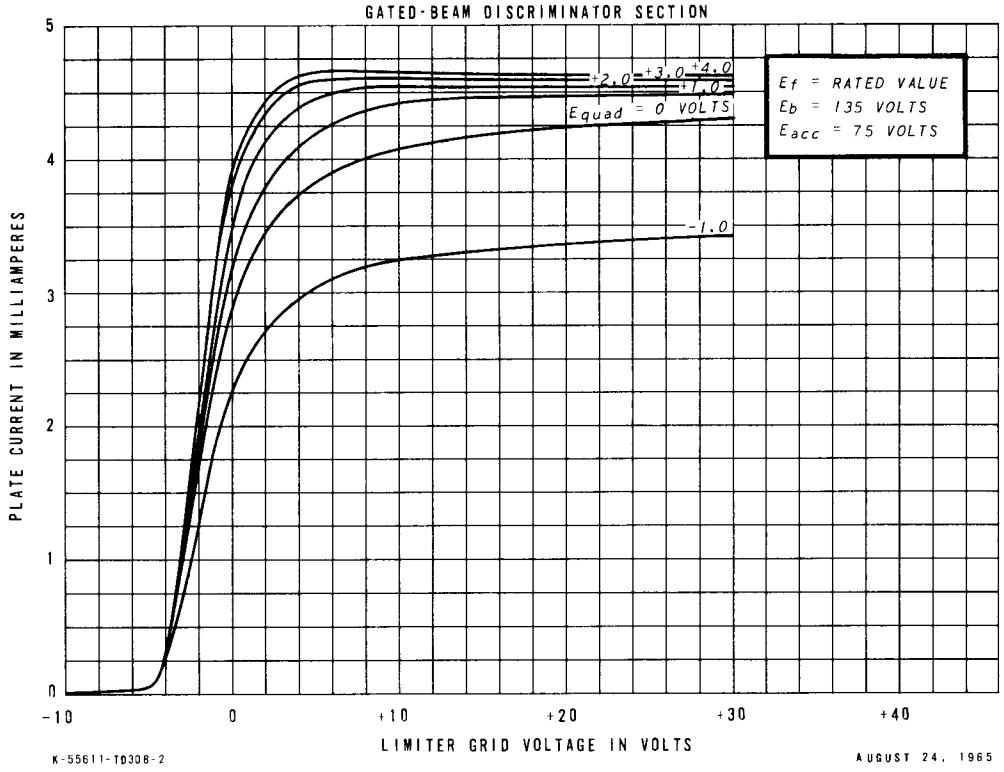


K-55611-TD308-1

AUGUST 24, 1965

AVERAGE TRANSFER CHARACTERISTICS

GATED-BEAM DISCRIMINATOR SECTION

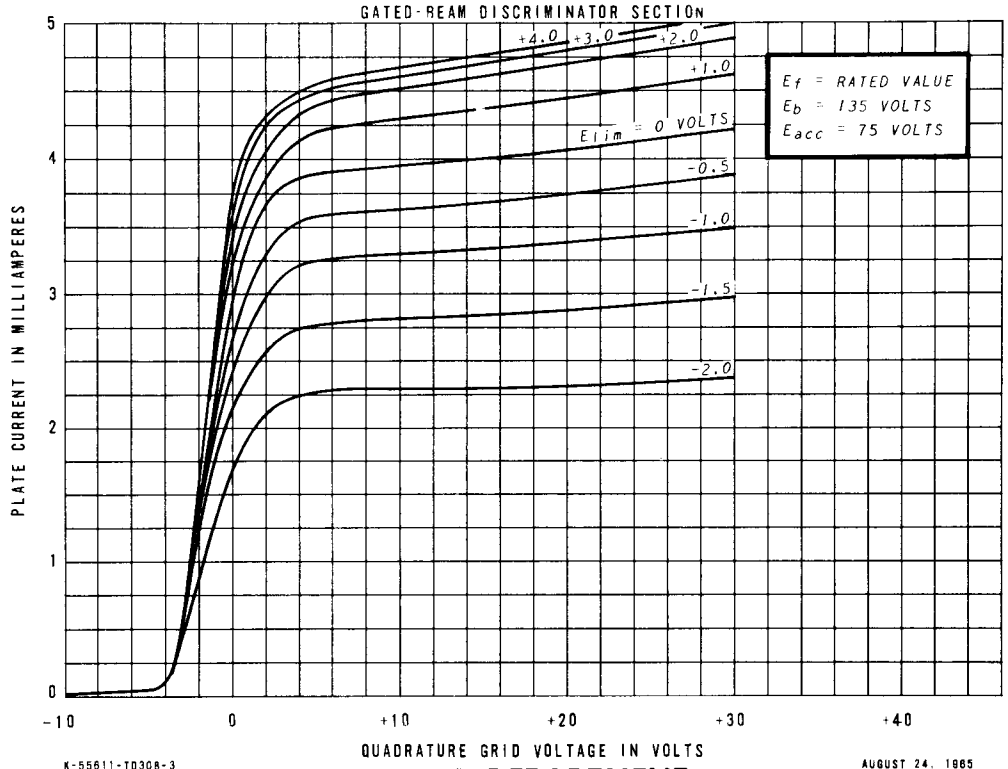


K-55611-T0308-2

AUGUST 24, 1965

AVERAGE TRANSFER CHARACTERISTICS

GATED-BEAM DISCRIMINATOR SECTION



K-55611-T0308-3

AUGUST 24, 1965

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBES

17AVP4-A

CATHODE-RAY TUBE

17-INCH RECTANGULAR, GLASS
FOCUS—ELECTROSTATIC
DEFLECTION—MAGNETIC
90-DEGREE DEFLECTION ANGLE
14¼ BY 10¾-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
ALUMINIZED SCREEN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 17AVP4-A is a rectangular all-glass picture tube employing electrostatic-focus and magnetic-deflection. It provides a 14¼ by 10¾-inch picture for direct-view television applications. The electron gun has a focusing-voltage range of −0.4 to +2.2 percent of the anode voltage and is designed for use with an external single-field ion-trap magnet. Other features of the 17AVP4-A include a high-quality fluorescent screen which is aluminized to increase light output, a gray faceplate to improve picture contrast, a 90-degree deflection angle and a short neck design both of which provide a short over-all tube length, and an external conductive coating which serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ±10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	90	Degrees
Horizontal	85	Degrees
Vertical	68	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	1500	μμf
Minimum	750	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	71	Percent

MECHANICAL

Over-all Length	$15\frac{5}{8} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$16\frac{5}{8} \pm \frac{3}{32}$	Inches
Width	$15\frac{25}{64} \pm \frac{1}{8}$	Inches
Height	$12\frac{1}{4} \pm \frac{3}{16}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$15\frac{1}{2}$	Inches
Width	$14\frac{1}{4}$	Inches
Height	$10\frac{3}{4}$	Inches
Neck Length	$6\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J133F or J133G
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees

Mounting Position—Any

Net Weight, approximate	14	Pounds

MAXIMUM RATINGS*

DESIGN-CENTER VALUES†

Anode Voltage‡	16,000	Max Volts DC
Focusing-Electrode Voltage	−500 to +1000	Max Volts DC
Grid-No. 2 Voltage	500	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	180	Max Volts
Heater Positive with Respect to Cathode	180	Max Volts

TYPICAL OPERATING CONDITIONS*

Anode Voltage§	14,000	Volts DC
Focusing-Electrode Voltage for Focus	−56 to +308	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 2 Current	−15 to +15	Microamperes DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Ion-Trap Field Intensity△, approximate	37	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5	Max Megohms
Grid-No. 2 Circuit Resistance	0.1	Min Megohms
Focusing-Electrode Circuit Resistance	0.1	Min Megohms

Protective resistance in the grid-No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

* All voltages are measured with respect to cathode.

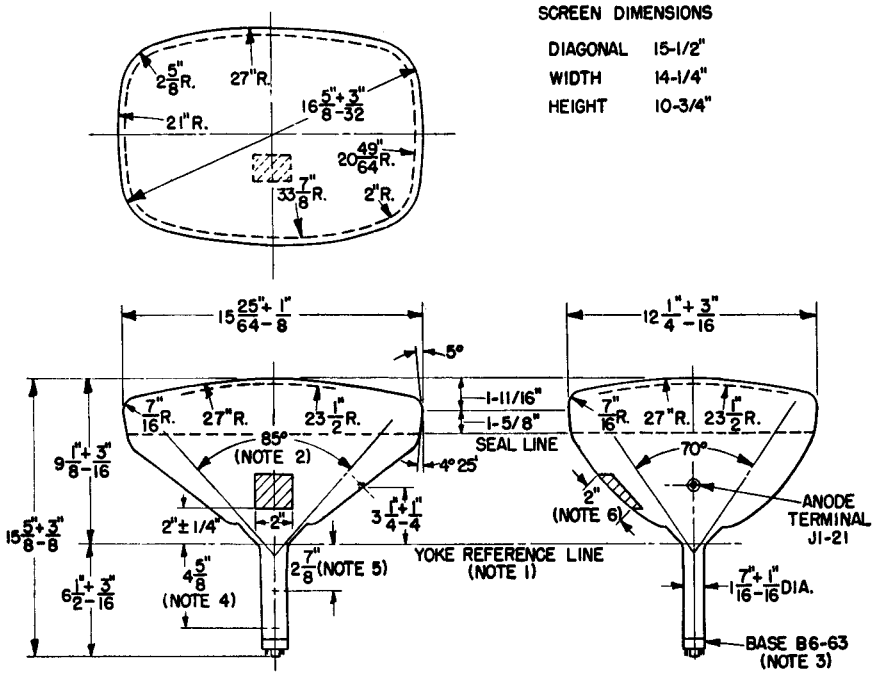
† The maximum ratings provide a ten percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

‡ Anode, grid-No. 3, and grid-No. 5 which are connected together within the tube are referred to herein as anode.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.

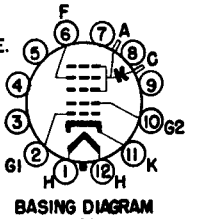
π For visual extinction of focused raster.

△Single-field ion-trap magnet adjusted to optimum position, equivalent to 37 milliamperes through RETMA ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE-LINE GAGE (RETMA NO. 116) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 90 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.
6. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



BASING DIAGRAM
12L

17AX3 through 17BZ3

17AX3
17BE3
17BF11
17BF11-A
17BW3
17BZ3

17AX3 Compactron Diode. The 17AX3 is a compactron, single heater-cathode type diode, intended for service as the damping diode in the horizontal-deflection circuit of television receivers.

Except for heater characteristics and ratings, the 17AX3 is identical to the 6AX3 and 12AX3.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	16.8	Volts
Heater Current■	0.45 ± 0.03	Amperes
Heater Warm-up Time, Average♦	11	Seconds

17BE3 Compactron Diode. The 17BE3 is a compactron, single heater-cathode type diode, intended for service as the damping diode in the horizontal-deflection circuit of television receivers.

Except for heater characteristics and ratings, the 17BE3 is identical to the 6BE3 and 12BE3.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	16.8	Volts
Heater Current■	0.45 ± 0.03	Amperes
Heater Warm-up Time, Average♦	11	Seconds

17BF11 Compactron Dissimilar Double Pentode. The 17BF11 is a compactron containing a sharp-cutoff dual-control pentode and a power pentode. The dual-control pentode is intended for use as an FM detector and the power pentode as an audio-frequency output amplifier in television receivers.

Except for heater characteristics and ratings, the 17BF11 is identical to the 6BF11.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	16.8	Volts
Heater Current■	0.45 ± 0.03	Amperes
Heater Warm-up Time, Average♦	11	Seconds

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

17BF11-A Compactron Dissimilar Double Pentode. The 17BF11-A is a compactron containing a sharp-cutoff dual-control pentode and a power pentode. The dual-control pentode is intended for use as an FM detector and the power pentode as an audio-frequency output amplifier in television receivers.

The 17BF11-A is unilaterally interchangeable with the 17BF11 and differs only in utilizing a shorter envelope.

GENERAL

MECHANICAL

Outline Drawing

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.250	Inches
Maximum Seated Height	1.875	Inches
Minimum Seated Height	1.625	Inches

17BW3 Compactron Diode. The 17BW3 is a compactron, single heater-cathode type diode intended for service as the damping diode in the horizontal-deflection circuit of television receivers.

Except for heater characteristics and ratings, the 17BW3 is identical to the 22BW3.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC●	16.8	Volts
Heater Current■	0.6 ± 0.04	Amperes
Heater Warm-up Time, Average♦	11	Seconds

17BZ3 Compactron Diode. The 17BZ3 is a compactron, single heater-cathode type diode intended for service as the damping diode in the horizontal-deflection circuit of television receivers.

Except for heater characteristics and ratings, the 17BZ3 is identical to the 6BZ3.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	16.8	Volts
Heater Current■	0.45 ± 0.03	Amperes
Heater Warm-up Time, Average♦	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.45 amperes.

● Heater voltage for a bogey tube at If = 0.6 amperes.

■ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

17AX4-GT through 17DQ6-B

DESCRIPTION AND RATING

17AX4-GT Diode. Identical to the 6AX4-GT except for heater ratings and addition of a controlled heater-warm-up characteristic. Refer to the 6AX4-GT Description and Rating sheet for complete data.

17D4 Diode. Identical to the 6DA4 except for heater ratings and addition of a controlled heater-warm-up characteristic. Refer to the 6DA4 Description and Rating sheet for complete data.

17DQ6-A Beam Pentode. Identical to the 6DQ6-A except for heater ratings and addition of a controlled heater-warm-up characteristic. Refer to the 6DQ6-A Description and Rating sheet for complete data.

17DQ6-B Beam Pentode. Identical to the 6DQ6-B except for the following ratings:

Heater Voltage AC or DC	16.8 Volts
Heater Current	0.45 ± 6% Amperes
Heater Warm-up Time*	11 Seconds

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

PRODUCT INFORMATION

17AY3-A through 17DQ6-B

17AY3-A
17CU5
17DE4
17DQ6-B

17AY3-A Diode. The 17AY3-A is a single heater-cathode type diode designed for use as the damping diode in the horizontal-deflection circuit of television receivers.

Except for heater characteristics and ratings, the 17AY3-A is identical to the 6AY3-B.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	16.8	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

17CU5 Beam Pentode. The 17CU5 is a miniature beam-power pentode designed primarily for use in the audio-frequency power-output stage of radio receivers.

Except for heater characteristics and ratings, the 17CU5 is identical to the 6CU5.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	16.8	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, average§	11	Seconds

17DE4 Diode. The 17DE4 is a single, heater-cathode type diode designed primarily for service as the damping diode in the horizontal-deflection circuit of television receivers.

Except for heater characteristics and ratings, the 17DE4 is identical to the 6DE4.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC¶	17	Volts
Heater Current‡	0.6±0.04	Amperes
Heater Warm-up Time, average§	11	Seconds

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Supersedes 17CU5 thru 17DQ6-B D and R Sheet dated 12-64

17DQ6-B Beam Pentode. The 17DQ6-B is a beam-power pentode primarily designed for service as the horizontal-deflection amplifier in television receivers.

Except for heater characteristics and ratings, the 17DQ6-B is identical to the 6DQ6-B.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	16.8	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ Heater voltage for a bogey tube at If = 0.6 amperes.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky



TELEVISION PICTURE TUBE

DESCRIPTION

The 17BP4-B is a magnetic-focus and -deflection, direct-view picture tube for television applications. It provides a $10\frac{3}{4}$ by $14\frac{1}{4}$-inch picture. Features of this tube include a high-quality, neutral-density faceplate which increases picture contrast and detail under high ambient light conditions, and a reflective, metal-backed screen which improves brightness. Other features are an electron gun designed to be used with an external ion-trap magnet and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

TECHNICAL INFORMATION

GENERAL

Electrical

Heater voltage	6.3	volts
Heater current	0.6 ± 10%	ampere
Focusing method—magnetic		
Deflecting method—magnetic		
Deflecting angle, approximate		
Horizontal	65	degrees
Diagonal	70	degrees
Phosphor—P4		
Fluorescence—white		
Persistence—medium		

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Electrical (Cont.)

Faceplate—neutral density		
Light transmission, approximate	66	per cent
Direct interelectrode capacitances, approximate		
Cathode to all other electrodes	5	uuf
Grid—No. 1 to all other electrodes	6	uuf
External conductive coating to anode capacitance, approximate	2000	uuf

Mechanical

Over-all length	$19\frac{1}{4} \pm \frac{3}{8}$	inches
Greatest bulb dimensions		
Diagonal	$16\frac{5}{8} \pm \frac{1}{8}$	inches
Width	$15\frac{3}{8} \pm \frac{1}{8}$	inches
Height	$12\frac{1}{4} \pm \frac{1}{8}$	inches
Picture dimensions (3 by 4 aspect ratio)		
Width	$14\frac{1}{4}$	inches
Height	$10\frac{3}{4}$	inches

Anode contact—recessed small-cavity cap, J1-21
Base—small-shell duodecal 5-pin, B5-57
Basing—12D
Anode contact alignment
Anode contact aligns with vacant pin position No. 6 ±30 degrees

MAXIMUM RATINGS Design Center Values

Anode voltage*	16000 max	volts d-c
Grid—No. 2 voltage	410 max	volts d-c
Grid—No. 1 voltage		
Negative—bias value	125 max	volts d-c
Positive—bias value	0 max	volts d-c
Positive—peak value	2 max	volts
Peak heater—cathode voltage**		
Heater negative with respect to cathode		
During warm-up period not to exceed 15 seconds	410 max	volts d-c
After equipment warm-up period	150 max	volts d-c
Heater positive with respect to cathode	150 max	volts d-c

JETEC COMPARATIVE CONDITIONS

Anode voltage	12000	volts
Grid—No. 2 voltage	300	volts
Grid—No. 1 voltage***	−33 to −77	volts
Focusing—coil current†	92 ±20%	milliamperes
Ion-trap current‡	75 ±50%	milliamperes

RECOMMENDED OPERATING CONDITIONS

Anode voltage (average brightness = 20 foot-lamberts)	14000	volts
Grid—No. 2 voltage	300	volts
Grid—No. 1 voltage***	−33 to −77	volts
Focusing-coil current (RTMA coil No. 109 at $3\frac{3}{4}$ inches), approximate	115	milliamperes
Ion-trap field intensity #, approximate	35	gausses

MAXIMUM CIRCUIT VALUES

Grid—No. 1 circuit resistance	1.5 max	megohms

* Anode and grid—No. 3 which are connected together within the tube, are referred to herein as anode.

** Cathode should be returned to one side or to the midtap of the heater transformer winding.

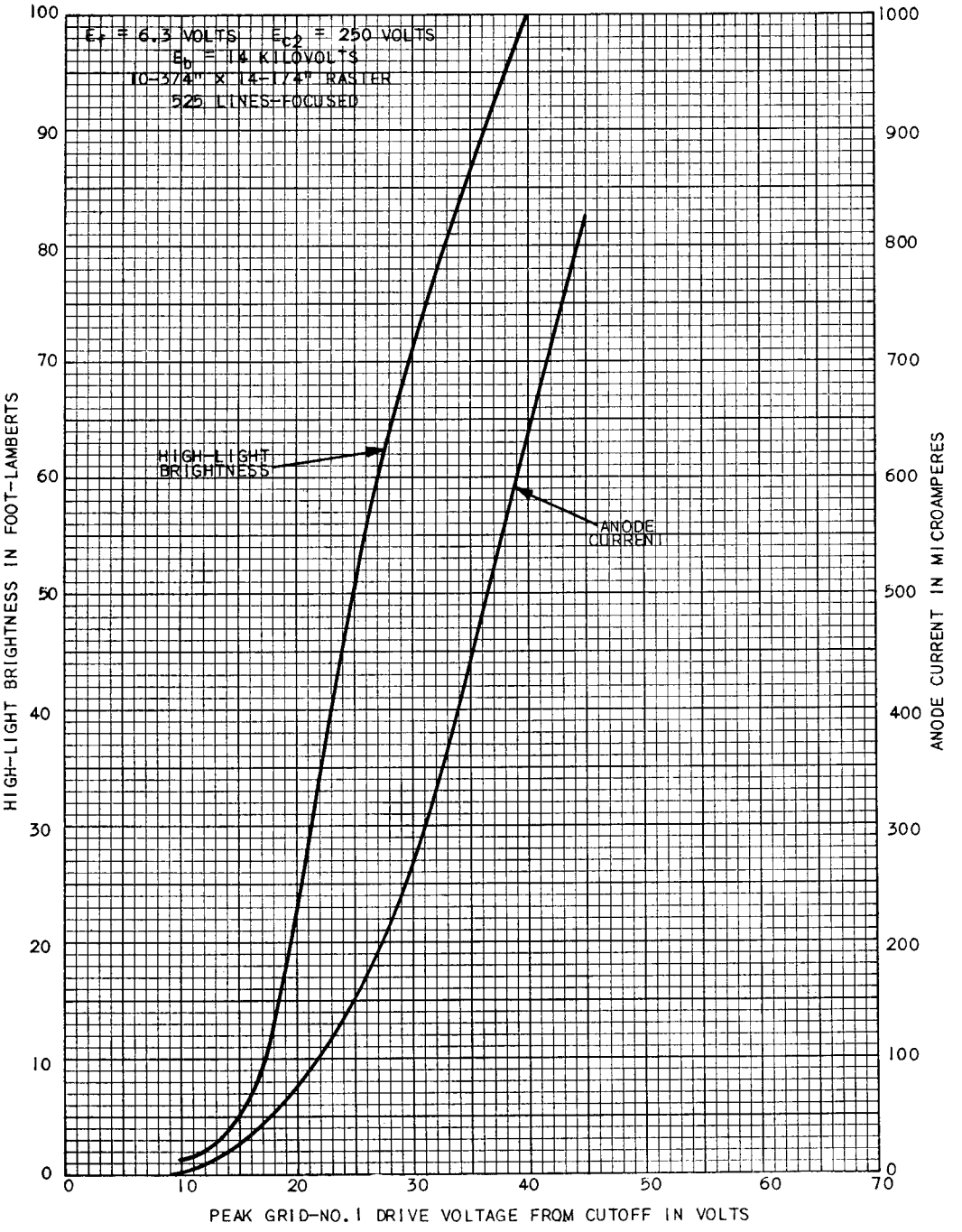
*** For visual extinction of undeflected focused spot.

† For RTMA focus coil No. 109 or equivalent with the combined grid—No. 1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 35 foot-lamberts on a $10\frac{3}{4}$ by $14\frac{1}{4}$-inch picture area and with the yoke reference line to center of air gap distance equal to 3 inches.

‡ For single-field ion-trap magnet, RTMA No. 111 or equivalent positioned $5\frac{1}{2}$ inches from the yoke reference line.

Single-field ion-trap magnet adjusted to optimum position.

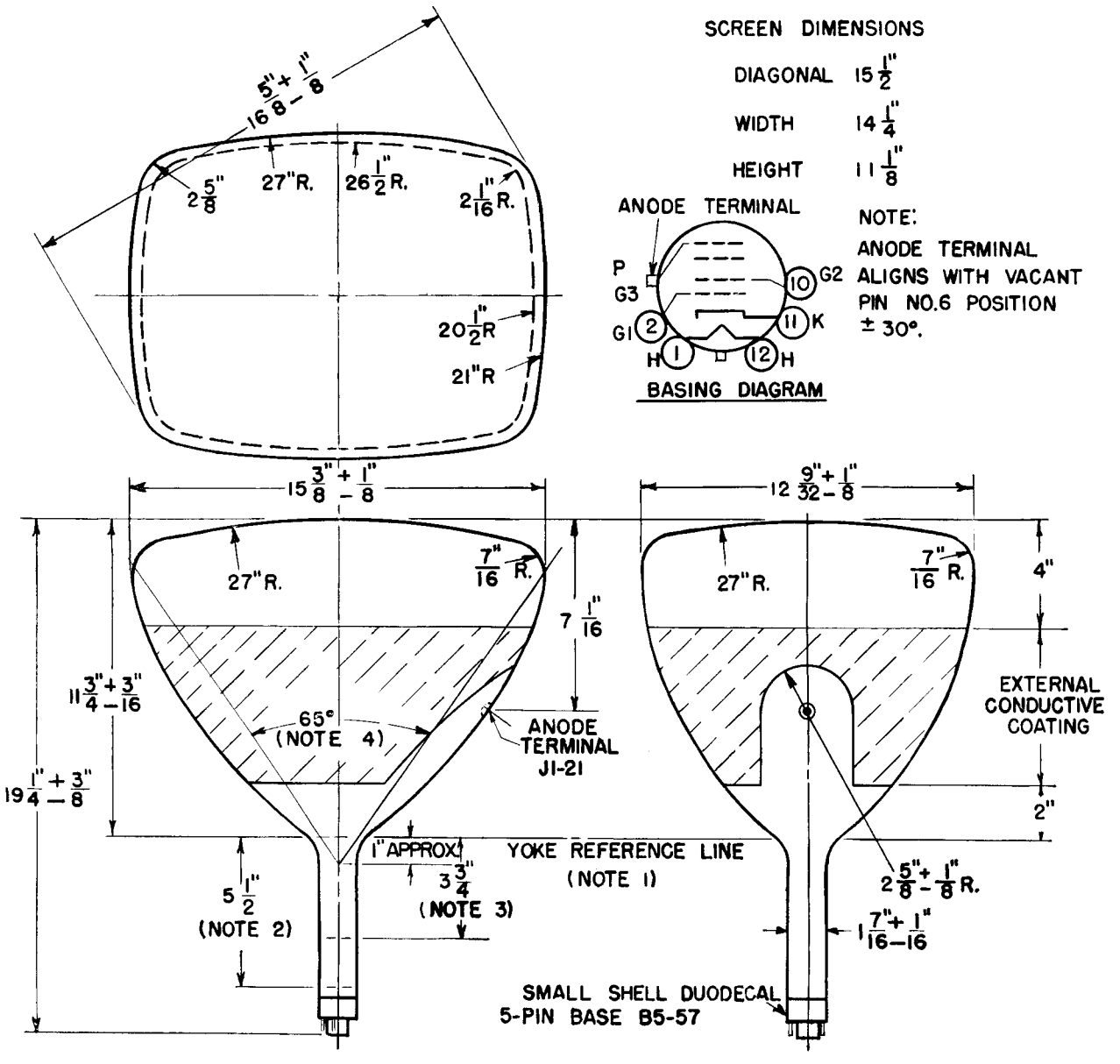
17BP4-B
AVERAGE CHARACTERISTICS



K-69087-72A414

12-7-50

OUTLINE
17BP4-B



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RTMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. NOMINAL POSITION OF ION-TRAP MAGNET.
3. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.
4. DEFLECTION ANGLE ON DIAGONAL IS 70DEGREES.

N-15180AZ

6-27-51

Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

17BRP4

CATHODE-RAY TUBE

17-INCH, RECTANGULAR, GLASS	14-3/4 BY 11-11/16-INCH PICTURE SIZE
FOCUS - ELECTROSTATIC	FACEPLACE - SPHERICAL, GRAY
DEFLECTION - MAGNETIC	ION-TRAP GUN
110-DEGREE DEFLECTION ANGLE	EXTERNAL CONDUCTIVE COATING

ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 17BRP4 is an electrostatic-focus and magnetic-deflection, direct-view picture tube. It features a short over-all length, a small neck diameter, and an aluminized fluorescent screen to increase light output and reduce undesirable screen charging. An external conductive coating serves as a filter capacitor.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Heater Warm-up Time *	11	Seconds

Focusing Method - Electrostatic
Deflecting Method - Magnetic

Deflection Angle, approximate		
Diagonal	110	Degrees
Horizontal	105	Degrees
Vertical	87	Degrees

Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	µµf
Grid-No. 1 to All Other Electrodes	6	µµf

External Conductive Coating to Anode		
Maximum	1400	µµf
Minimum	800	µµf

OPTICAL

Phosphor Number - P4, Sulfide
Fluorescent Color - White
Phosphorescent Color - White
Persistance - Short

Faceplate - Gray

Light Transmission at Center, approximate	76	Percent

MECHANICAL

Overall Length	12 9/16 ± 5/16	Inches
Greatest Bulb Dimensions		
Diagonal	16 9/16 ± 0.100	Inches
Width	15 5/8 ± 0.100	Inches
Height	12 3/4 ± 0.100	Inches
Minimum Useful Screen Dimensions		
Diagonal	15 3/4	Inches
Width	14 3/4	Inches
Height	11 11/16	Inches
Area	155	Square Inches
Neck Length	5 7/16 + 3/16 − 1/8	Inches

Bulb Contact - Recessed Small-cavity Cap, JETEC No. J1-21
Small-Button Eightar Base - 7-Pin, JETEC No. B7-183
Basing Designation - 8HR
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 4 ± 30 Degrees

Mounting Position - Any		
Net Weight, approximate	10 1/3	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES †

Anode Voltage ≠	15,000 Max	Volts DC
Focusing-Electrode Voltage	-500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	140 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Negative-Peak Value	200 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage §	14,000	Volts DC
Focusing-Electrode Voltage for Focus	0 to 500	Volts DC
Focusing-Electrode Current	-15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage ¤	-28 to -72	Volts DC
Ion-Trap Field Intensity ▲, minimum	37	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max Megohms
Grid-No. 2 Circuit Resistance	0.1 Min Megohms
Focusing-Electrode Circuit Resistance	0.1 Min Megohms

Protective resistance in the grid-No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

* Heater warm-up time is the time required for the voltage across the heater terminals to increase to 5.0 volts in the JETEC test circuit, with E = 25 volts and series R = 31.5 ohms.

† The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the design-center values are not exceeded by more than ten percent.

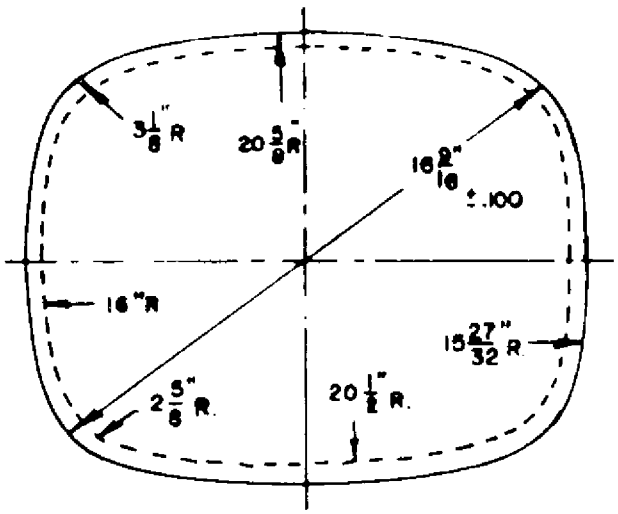
‡ Anode, grid-No. 3, and grid-No. 5 which are connected together within the tube are referred to herein as anode.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.

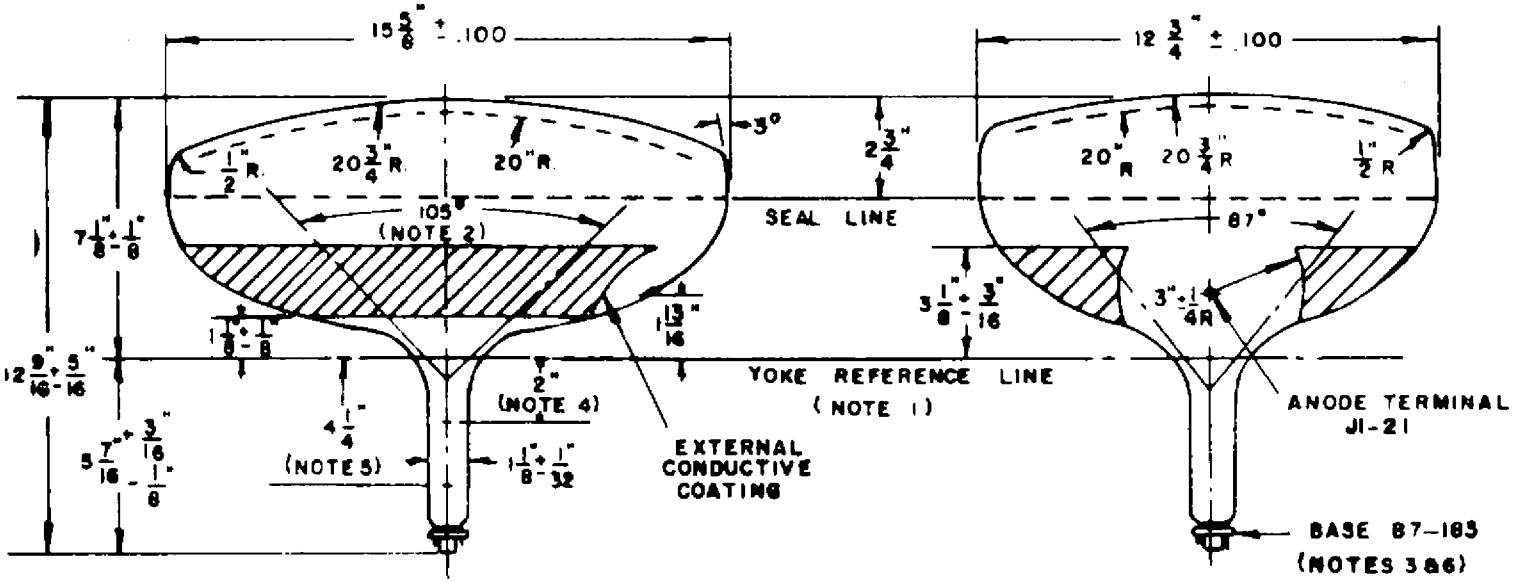
π For visual extinction of focused raster.

△ For a Heppner PM ion-trap magnet or equivalent located in optimum position and rotated to give maximum brightness.

Electronic Components Division
GENERAL ELECTRIC COMPANY
Schenectady 5, N. Y.

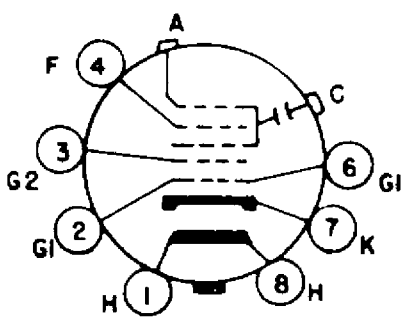


SCREEN DIMENSIONS	
DIAGONAL	15-3/4"
WIDTH	14-3/4"
HEIGHT	11-11/16"
AREA	155 SQ. IN.



NOTES:

1. REFERENCE LINE IS DETERMINED BY PLANE C-C' WHEN GAGE (RETMA) NO 126 IS SEATED AGAINST THE BULB.
2. DEFLECTION ANGLE ON DIAGONAL IS 110°.
3. ANODE TERMINAL ALIGNS WITH PIN NO. 4 ± 30 DEGREES.
4. RECOMMENDED POSITION OF CENTERING MAGNET, IF USED.
5. APPROXIMATE POSITION OF ION-TRAP MAGNET.
6. USE A NON-RIGIDLY MOUNTED SOCKET WITH FLEXIBLE LEADS. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN 1-3/4 INCHES DIA. CIRCLE CONCENTRIC WITH BULB AXIS.



BASING DIAGRAM
8HR

17CKP4

CATHODE-RAY TUBE

17-INCH RECTANGULAR, GLASS	14-3/4 BY 11-11/16-INCH PICTURE SIZE
FOCUS - ELECTROSTATIC	FACEPLATE - SPHERICAL, GRAY
DEFLECTION - MAGNETIC	EXTERNAL CONDUCTIVE COATING
110-DEGREE DEFLECTION ANGLE	ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 17CKP4 is an electrostatic-focus and magnetic-deflection, direct-view picture tube. Features of this tube include a short over-all length, a small neck diameter, and an aluminized screen to increase light output and reduce undesirable screen charging. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Heater Warm-up Time *	11	Seconds

Focusing Method - Electrostatic
Deflecting Method - Magnetic

Deflection Angle, approximate		
Diagonal	110	Degrees
Horizontal	105	Degrees
Vertical	87	Degrees

Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf

External Conductive Coating to Anode		
Maximum	1400	μμf
Minimum	800	μμf

OPTICAL

Phosphor Number - P4, Sulfide
Fluorescent Color - White
Phosphorescent Color - White
Persistence - Short

Faceplate - Gray		
Light Transmission at Center, approximate	76	Percent

from JETEC release #1972, July 8, 1957

MECHANICAL

Over-all Length	12 9/16 ± 5/16	Inches
Greatest Bulb Dimensions		
Diagonal	16 9/16 ± .100	Inches
Width	15 5/8 ± .100	Inches
Height	12 3/4 ± .100	Inches
Minimum Useful Screen Dimensions		
Diagonal	15 3/4	Inches
Width	14 3/4	Inches
Height	11 11/16	Inches
Area	155	Square Inches
Neck Length	5 7/16 $^{+3/16}_{-1/8}$	Inches

Bulb Contact - Recessed Small-cavity Cap, JETEC No. J1-21
Base - Small-Button Eightar, 7-Pin, JETEC No. B7-183
Basing Designation - 8HR
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 4 ± 30 Degrees

Mounting Position - Any		
Net Weight, approximate	10 1/3	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES †

Anode Voltage ‡	15,000 Max	Volts DC
Focusing-Electrode Voltage	-500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	140 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Negative-Peak Value	200 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage §	14,000	Volts DC
Focusing-Electrode Voltage for Focus	0 to 500	Volts DC
Focusing-Electrode Current	-15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage△	-28 to -72	Volts DC

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max Megohms
Grid-No. 2 Circuit Resistance	0.1 Min Megohms
Focusing-Electrode Circuit Resistance	0.1 Min Megohms

Protective resistance in the grid-No. 2 and focusing electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

* Heater warm-up time is the time required for the voltage across the heater terminals to increase to 5.0 volts in the JETEC test circuit, with E = 25 volts and series R = 31.5 ohms.

† The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the design-center values are not exceeded by more than ten percent.

‡ Anode, grid-No. 3 and grid-No. 5 which are connected together within the tube are referred to herein as anode.

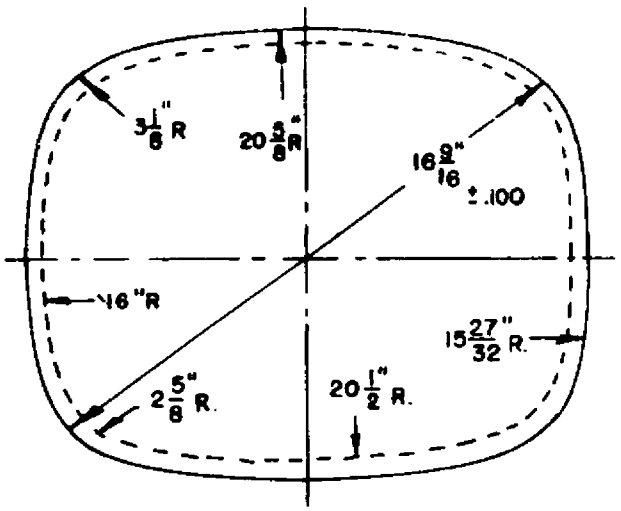
§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.

△ For visual extinction of focused raster.

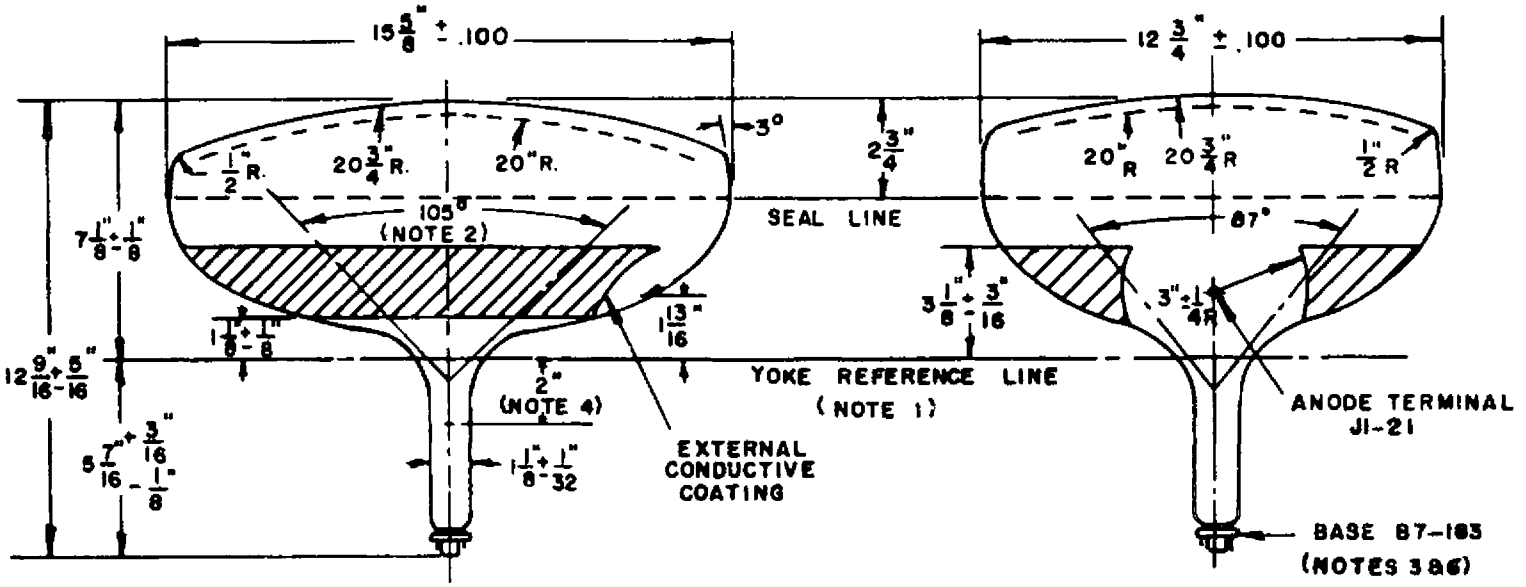
Electronic Components Division

GENERAL ELECTRIC COMPANY

Schenectady 5, N. Y.

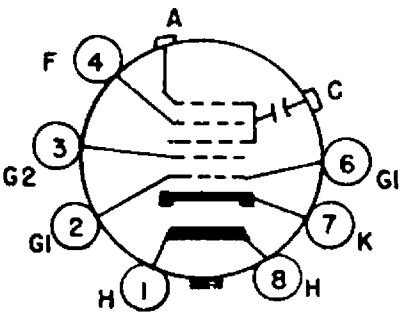


SCREEN DIMENSIONS	
DIAGONAL	15-3/4"
WIDTH	14-3/4"
HEIGHT	11-11/16"
AREA	155 SQ. IN.



NOTES:-

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE LINE GAGE (RETMA NO. 126) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 110°.
3. ANODE TERMINAL ALIGNS WITH PIN NO. 4 ± 30 DEGREES.
4. RECOMMENDED POSITION OF CENTERING MAGNET, IF USED.
5. USE A NON-RIGIDLY MOUNTED SOCKET WITH FLEXIBLE LEADS BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN 1-3/4 INCHES DIA. CIRCLE CONCENTRIC WITH BULB AXIS.



BASING DIAGRAM

8HR

Electronic TUBES

17CP4

CATHODE-RAY TUBE

17-INCH, RECTANGULAR, METAL
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
14⅜ BY 10$\frac{11}{16}$-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY, FROSTED
ION-TRAP GUN
70-DEGREE DEFLECTION ANGLE

DESCRIPTION AND RATING

The 17CP4 is a magnetic-focus and -deflection, direct-view picture tube which provides a 14⅜ by 10$\frac{11}{16}$-inch picture for television applications. Features of this tube include a lightweight metal-cone envelope, a high-quality frosted gray faceplate to prevent specular reflection and increase picture contrast, a space-saving rectangular face shape, and an electron gun designed for use with an external single-field ion-trap magnet.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ±10%	Amperes

Focusing Method—Magnetic
Deflecting Method—Magnetic
Deflection Angle, approximate

Diagonal	70	Degrees
Horizontal	66	Degrees
Vertical	50	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	66	Percent
Specular Reflection of Ambient Light, Maximum	1.5	Percent

MECHANICAL

Over-all Length	18½ ± ½	Inches
Greatest Bulb Dimensions		
Diagonal	16 13/16 ± 3/16	Inches
Width	15 15/16 ± ⅛	Inches
Height	12¼ ± ⅛	Inches
Minimum Useful Screen Dimensions		
Diagonal	15¼	Inches
Width	14⅜	Inches
Height	10 11/16	Inches
Neck Length	7 3/16	Inches

Bulb Contact—Metal Cone Lip
Base—Small-shell Duodecal 5-pin, JETEC No. B5-57
Basing, JETEC Designation—12D
Base Alignment
Pin-No. 3 Position Aligns with Horizontal Picture Axis ±30 Degrees

Mounting Position—Any

Net Weight, approximate . . . . . 10 Pounds

MAXIMUM RATINGS♦

DESIGN-CENTER VALUES*

Anode Voltage†	16,000	Max Volts DC
Grid-No. 2 Voltage	410	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	180	Max Volts
Heater Positive with Respect to Cathode	180	Max Volts

TYPICAL OPERATING CONDITIONS♦

Anode Voltage‡	14,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage§	−28 to −72	Volts DC
Focusing-Coil Currentπ, approximate	112	Milliamperes DC
Ion-Trap Field Intensity△, approximate	37	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance . . . . . 1.5 Max Megohms

♦ All voltages are measured with respect to cathode.

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

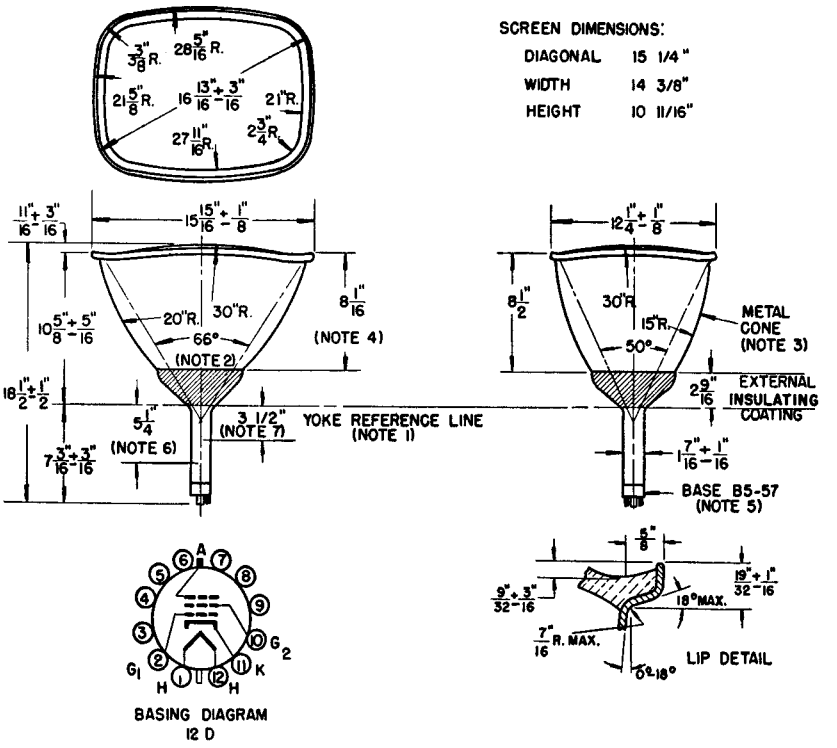
† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

‡ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.

§ For visual extinction of focused raster.

π For RETMA focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3½ inches.

△Single-field ion-trap magnet adjusted to optimum position, equivalent to 37 milliamperes through RETMA ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. METAL CONE OPERATES AT HIGH VOLTAGE AND MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ANODE VOLTAGE.
4. CONE HEIGHT AT DIAGONAL IS 8 INCHES.
5. PIN-NO. 3 POSITION ALIGNS WITH HORIZONTAL PICTURE AXIS ±30 DEGREES.
6. APPROXIMATE POSITION OF ION-TRAP MAGNET.
7. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.

K-69087-72A697 6-20-55

17DLP4
CATHODE RAY TUBE

17 INCH, RECTANGULAR, GLASS	14-3/4 BY 11-11/16 INCH PICTURE SIZE
FOCUS -- ELECTROSTATIC	FACEPLATE -- SPHERICAL, GRAY
DEFLECTION -- MAGNETIC	NON ION-TRAP GUN
110 DEGREE DEFLECTION ANGLE	ALUMINIZED SCREEN
LIGHTWEIGHT BULB	EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 17DLP4 is a 17 inch electrostatic-focus and magnetic-deflection glass, lightweight picture tube. Outstanding features include a short over-all length, a small neck diameter and a non ion-trap gun. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Heater Warm-Up Time*	11	Seconds

Focusing Method - Electrostatic
Deflecting Method - Magnetic

Deflection Angle, Approximate		
Diagonal	110	Degrees
Horizontal	105	Degrees
Vertical	87	Degrees

Direct Interelectrode Capacitances, Approximate		
Cathode to All Other Electrodes	5	uuf
Grid No. 1 to All Other Electrodes	6	uuf

External Conductive Coating to Anode		
Maximum	1500	uuf
Minimum	1000	uuf

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

from JEDEC release #2378, March 9, 1959

OPTICAL

Phosphor Number - P4, Sulfide
Fluorescent Color - White
Phosphorescent Color - White
Persistence - Short
Faceplate - Gray
Light Transmission at Center, Approximate..... 76 Percent

MECHANICAL

Over-all Length	11-1/16 ± 5/16	Inches
Neck Length	3-15/16 + 3/16 - 1/8	Inches
Greatest Bulb Dimensions		
Diagonal	16-9/16 ± 1/8	Inches
Width	15-5/8 ± 1/8	Inches
Height	12-3/4 ± 1/8	Inches
Minimum Useful Screen Dimensions		
Diagonal	15-3/4	Inches
Width	14-3/4	Inches
Height	11-11/16	Inches
Area	155	Square Inches

Bulb Designation - J132-1/2A1
Bulb Contact - Recessed small-cavity Cap, JETEC No. J1-21
Base-Small-button Eightar, 6 pin, JEDEC No. B6-212
Basing Designation - 8JS
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 4 ± 30 Degrees

Mounting Position - Any
Net Weight, Approximate..... 10-1/3 Pounds

MAXIMUM RATINGS

DESIGN - CENTER VALUES*

Anode Voltage*	18000	Max Volts DC
Focusing-Electrode Voltage	- 500 to + 1000	Max Volts DC
Grid No.2 Voltage	700	Max Volts DC
Grid No. 1 Voltage		
Negative-Bias Value	140	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Negative-Peak Value	200	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with respect to Cathode		
During Warm-up Period not to exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	180	Max Volts
Heater Positive with respect to Cathode	180	Max Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage $\mathcal{S}$	17000	Volts DC
Focusing-Electrode Voltage for Focus	0 to 500	Volts DC
Focusing-Electrode Current	- 15 to +25	Microamperes DC
Grid No. 2 Voltage	450	Volts DC
Grid No. 1 Voltage π	- 28 to - 72	Volts DC

MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5	Max Megohms
Grid No. 2 Circuit Resistance	0.1	Min. Megohms
Focusing-Electrode Circuit Resistance	0.1	Min. Megohms

Protective resistance in Grid No. 2 and focusing-electrode circuits is advisable to prevent damage to tube. If applicable, one resistor, common to both circuits may be used.

* Heater warm-up time is the time required for the voltage across the heater terminals to increase to 5.0 volts in the JETEC test circuit, with E = 25 volts and R = 31.5 ohms.

$\neq$ The maximum ratings provide a ten percent safety factor in accordance with the standard design center system of rating cathode ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design center values are not exceeded by more than ten percent.

$\neq$ Anode, Grid No. 3 and Grid No. 5 which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltages in excess of 16,000 volts, X-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

$\mathcal{S}$ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 15,000 volts.

π For visual extinction of focused raster.

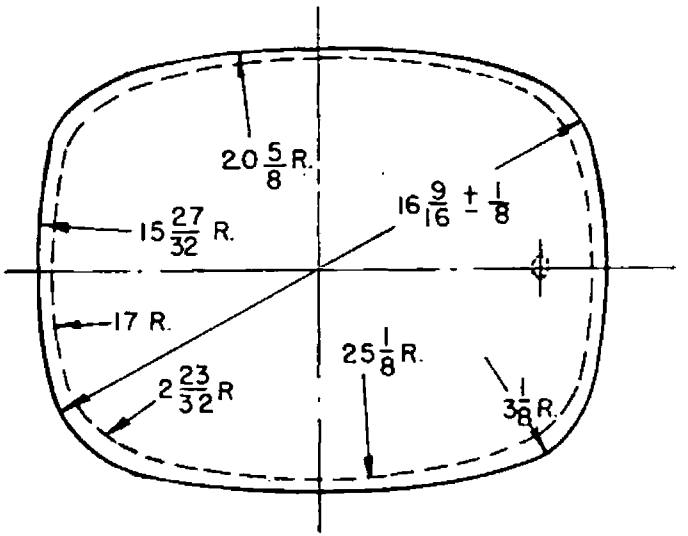
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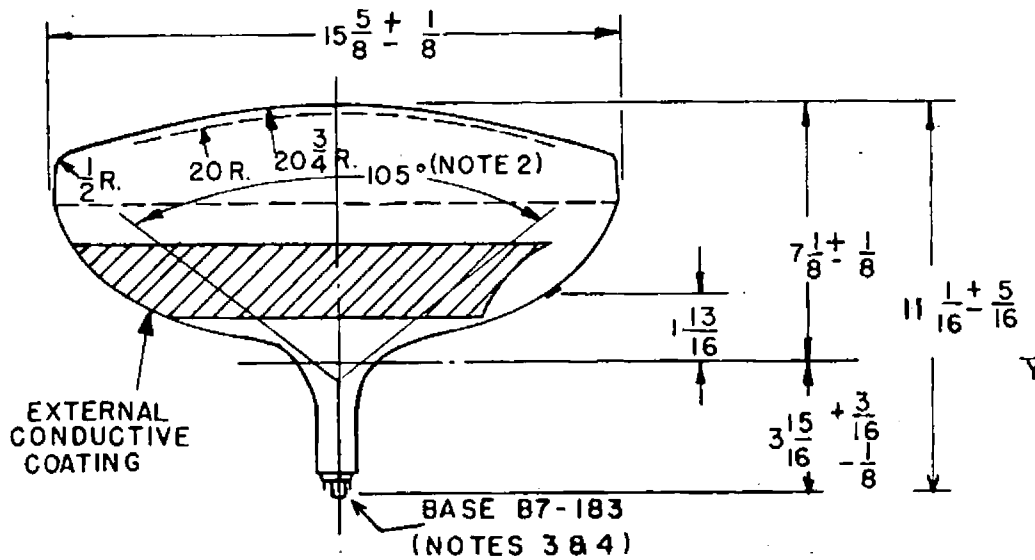
GENERAL ELECTRIC COMPANY

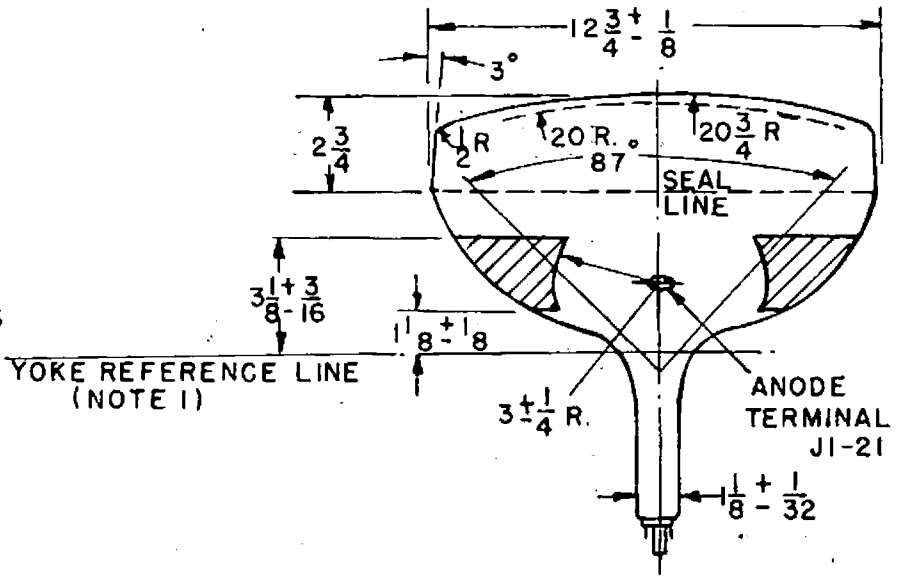
Syracuse, New York

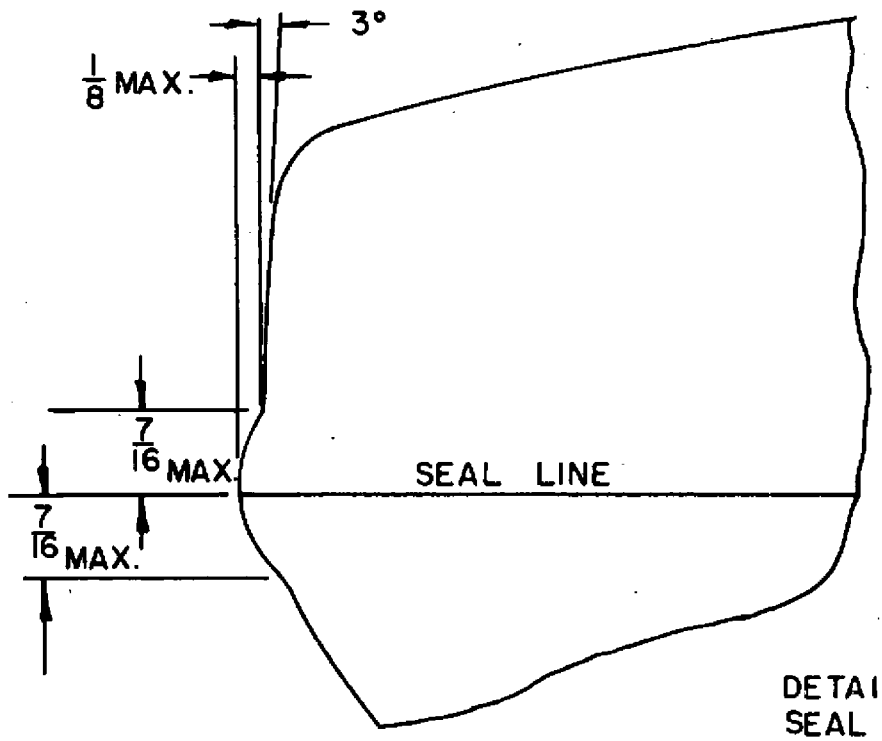
SCREEN DIMENSIONS

DIAGONAL	$15\frac{3}{4}$
WIDTH	$14\frac{3}{4}$
HEIGHT	$11\frac{11}{16}$
AREA	155 SQ. IN.





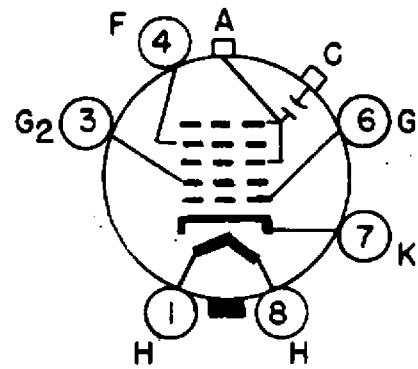




DETAIL AT
SEAL LINE

NOTES:

1. THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE C-C' OF GAGE (E.I.A. NO. 126) WITH THE GLASS FUNNEL.
2. DEFLECTION ANGLE ON THE DIAGONAL IS 110°
3. ANODE TERMINAL ALIGNS WITH PIN NO. 4 ±30 DEGREES.
4. USE A NON-RIGIDLY MOUNTED SOCKET WITH FLEXIBLE LEADS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN 1-3/4 INCH DIAMETER CIRCLE CONCENTRIC WITH THE BULB AXIS.



BASING DIAGRAM
8 J S

Electronic TUBES

17FP4-A

CATHODE-RAY TUBE

17-INCH RECTANGULAR GLASS
FOCUS—HIGH VOLTAGE, ELECTROSTATIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
14¼- BY 10¾-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 17FP4-A is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 14¼- by 10¾-inch picture for television applications. The electron gun has a focusing voltage range of 19.1 to 25.9 percent of the anode voltage and is used with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	2000	uuf
Minimum	750	uuf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	72	Percent

MECHANICAL

Over-all Length	$19\frac{3}{16} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$16\frac{5}{8} \pm \frac{3}{32}$	Inches
Width	$15\frac{25}{64} \pm \frac{1}{8}$	Inches
Height	$12\frac{1}{4} \pm \frac{3}{16}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$15\frac{1}{2}$	Inches
Width	$14\frac{1}{4}$	Inches
Height	$10\frac{3}{4}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J133-A1 or -B1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees

Mounting Position—Any

Net Weight, approximate	16	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	18,000 Max	Volts DC
Focusing-Electrode Voltage	5000 Max	Volts DC
Focusing-Electrode Current‡	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage§		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltageπ	14,000	Volts DC
Focusing-Electrode Voltage for Focus▲	2650 to 3650	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage♦	−28 to −72	Volts DC
Ion-Trap Field Intensityϕ, approximate	35	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Meghoms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode, grid-No. 3 and grid-No. 5 which are connected together within the tube are referred to herein as anode. If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

‡At design-center maximum anode voltage plus ten percent.

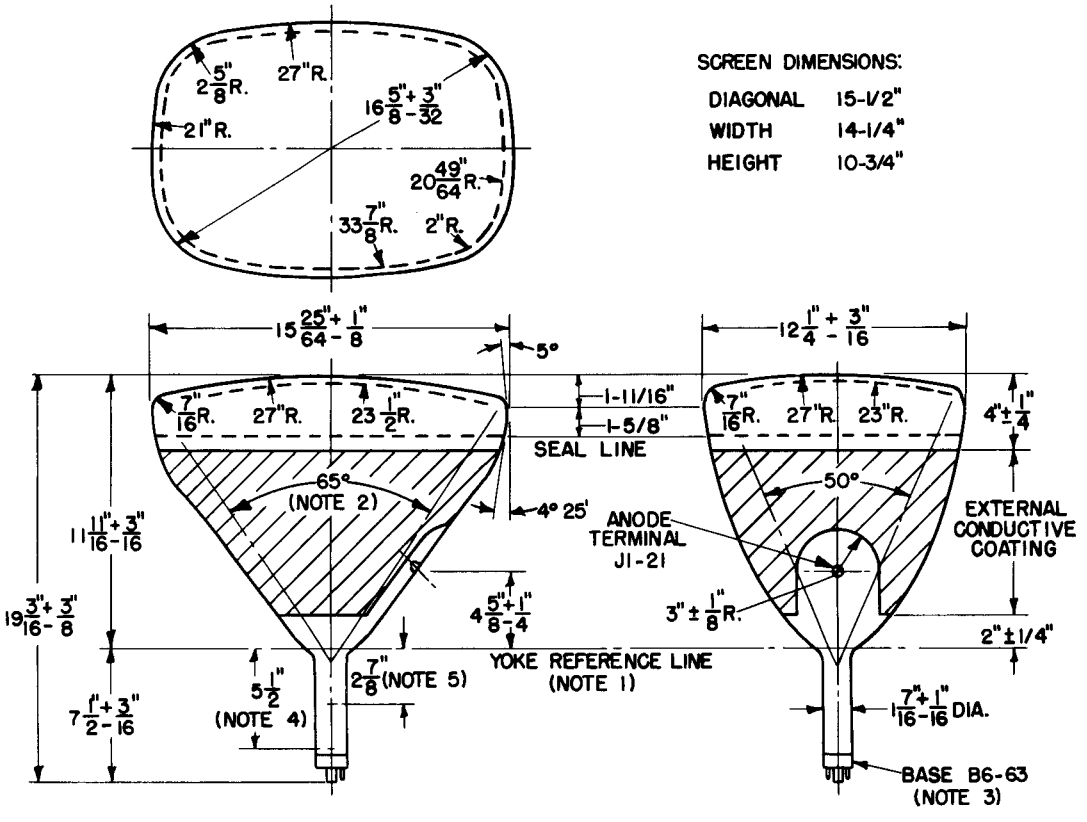
§Cathode should be returned to one side or to the midtap of the heater transformer winding.

πBrightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.

▲The focusing electrode may be modulated within the stipulated maximum range without damage to the tube.

♦For visual extinction of focused raster.

φSingle-field ion-trap magnet adjusted to optimum position, equivalent to 35 milliamperes through JETEC ion-trap magnet No. 117.

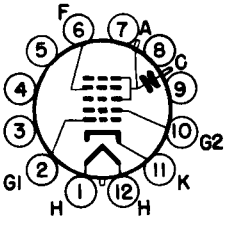


SCREEN DIMENSIONS:

DIAGONAL	15-1/2"
WIDTH	14-1/4"
HEIGHT	10-3/4"

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.



BASING DIAGRAM
12L

17GE5 thru 17JZ8

17GE5
17GV5
17JM6
17JN6
17JZ8

17GE5 Compactron Beam Pentode. The 17GE5 is a compactron beam-power pentode, primarily designed for use as the horizontal-deflection amplifier in television receivers.

Except for heater characteristics and ratings, the 17GE5 is identical to the 6GE5 and 12GE5.

17GV5 Compactron Beam Pentode. The 17GV5 is a compactron beam-power pentode, primarily designed for use as the horizontal-deflection amplifier in television receivers.

Except for heater characteristics and ratings, the 17GV5 is identical to the 6GV5.

17JM6 Compactron Beam Pentode. The 17JM6 is a compactron beam-power pentode, primarily designed for use as the horizontal-deflection amplifier in television receivers. A separate connection is provided for the beam plates to minimize "snivets".

Except for heater characteristics and ratings, the 17JM6 is identical to the 6JM6.

17JN6 Compactron Beam Pentode. The 17JN6 is a compactron beam-power pentode, primarily designed for use as the horizontal-deflection amplifier in television receivers. A separate connection is provided for the beam plates to minimize "snivets".

Except for heater characteristics and ratings, the 17JN6 is identical to the 6JN6.

17JZ8 Compactron Triode-Pentode. The 17JZ8 is a compactron containing a medium-mu triode and a beam pentode. The triode is designed for service as a vertical-deflection oscillator and the pentode as a vertical-deflection amplifier in television receivers.

Except for heater characteristics and ratings, the 17JZ8 is identical to the 6JZ8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	16.8	Volts
Heater Current■	0.45 ± 0.03	Amperes
Heater Warm-up Time, Average♦	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.45 amperes.

■ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

17GP4

CATHODE-RAY TUBE

17-INCH, RECTANGULAR, METAL
FOCUS—ELECTROSTATIC
DEFLECTION—MAGNETIC
14⅜ BY 10$\frac{11}{16}$-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY, FROSTED
ION-TRAP GUN
70-DEGREE DEFLECTION ANGLE

DESCRIPTION AND RATING

The 17GP4 is an electrostatic-focus, magnetic-deflection, direct-view picture tube which provides a 14⅜ by 10$\frac{11}{16}$-inch picture for television applications. The electron gun has a focusing-voltage range of 19.1 to 25.9 percent of the anode voltage and is designed for use with an external single-field ion-trap magnet. Other features of the 17GP4 include a lightweight metal-cone envelope, a high-quality frosted gray faceplate to prevent specular reflection and increase picture contrast, and a space-saving rectangular face shape.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ±10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	66	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	66	Percent
Specular Reflection of Ambient Light, maximum	1.5	Percent

MECHANICAL

Over-all Length	$18\frac{13}{16} \pm \frac{1}{2}$	Inches
Greatest Bulb Dimensions		
Diagonal	$16\frac{13}{16} \pm \frac{3}{16}$	Inches
Width	$15\frac{15}{16} \pm \frac{1}{8}$	Inches
Height	$12\frac{1}{4} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$15\frac{1}{4}$	Inches
Width	$14\frac{3}{8}$	Inches
Height	$10\frac{11}{16}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Contact—Metal Cone Lip
Base—Small-shell Duodecal 6-pin, JETEC No. B6-63
Basing, JETEC Designation—12M
Base Alignment
Pin-No. 3 Position Aligns with Horizontal Picture Axis ±30 Degrees

Mounting Position—Any

Net Weight, approximate . . . . . 10 Pounds

MAXIMUM RATINGS♦

DESIGN-CENTER VALUES*

Anode Voltage†	16,000	Max Volts DC
Focusing-Electrode Voltage	5000	Max Volts DC
Grid-No. 2 Voltage	500	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	180	Max Volts
Heater Positive with Respect to Cathode	180	Max Volts

TYPICAL OPERATING CONDITIONS♦

Anode Voltage‡	14,000	Volts DC
Focusing-Electrode Voltage for Focus	2670 to 3620	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage§	−28 to −72	Volts DC
Ion-Trap Field Intensityπ, approximate	37	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance . . . . . 1.5 Max Megohms

♦ All voltages are measured with respect to cathode.

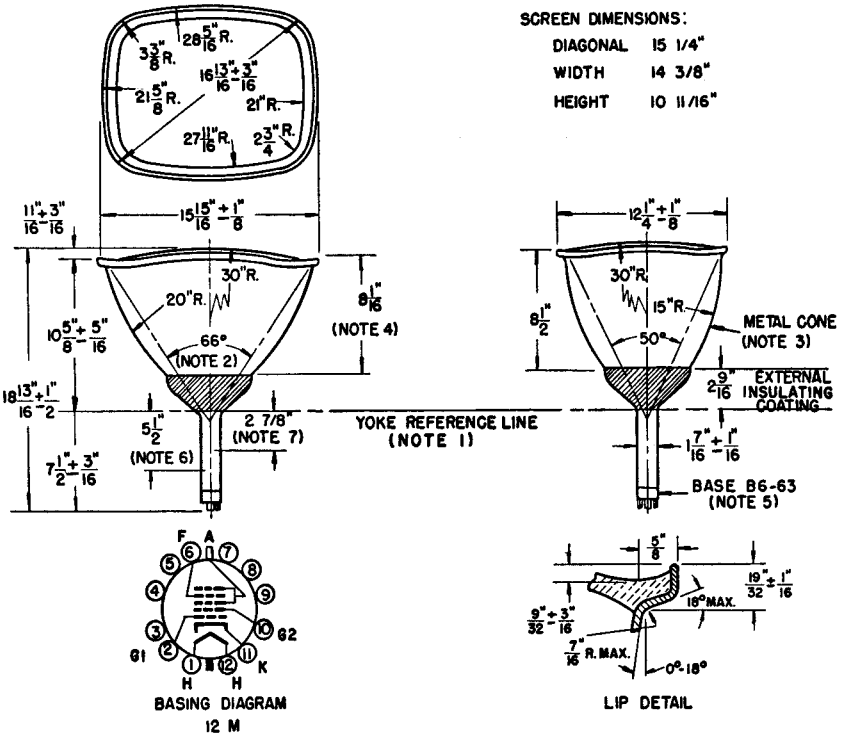
* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode, grid-No. 3, and grid-No. 5 which are connected together within the tube are referred to herein as anode.

‡ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.

§ For visual extinction of focused raster.

π Single-field ion-trap magnet adjusted to optimum position, equivalent to 37 milliamperes through RETMA ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. METAL CONE OPERATES AT A HIGH VOLTAGE AND MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ANODE VOLTAGE.
4. CONE HEIGHT AT DIAGONAL IS 8 INCHES.
5. PIN-NO. 3 POSITION ALIGNS WITH HORIZONTAL PICTURE AXIS ±30 DEGREES.
6. APPROXIMATE POSITION OF ION-TRAP MAGNET.
7. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.

Electronic TUBES

17H3

DIODE

FOR TV DAMPING DIODE APPLICATIONS

DESCRIPTION AND RATING

The 17H3 is a miniature heater-cathode type diode intended for service as the damping diode in the horizontal-deflection circuit of compact, 300-milliampere series-string television receivers. The tube features relatively small size and low power requirements. It also has a controlled heater warm-up characteristic as required for use in television receivers that employ series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	17.5	Volts
Heater Current	0.3 ± 6%	Amperes
Heater Warm-up Time*	11	Seconds
Direct Interelectrode Capacitances, approximate†		
Cathode to Plate and Heater	5.5	μμf
Plate to Cathode and Heater	4.0	μμf
Heater to Cathode	2.0	μμf

MECHANICAL

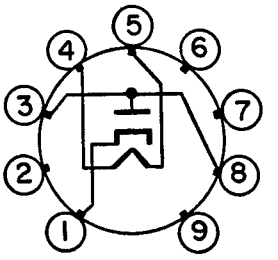
Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

TV DAMPER SERVICE‡—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	2000	Volts
Plate Dissipation	3.0	Watts
Steady-State Peak Plate Current	450	Milliamperes
DC Output Current	75	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
DC Component	500	Volts
Total DC and Peak	2000	Volts

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

BASING DIAGRAM

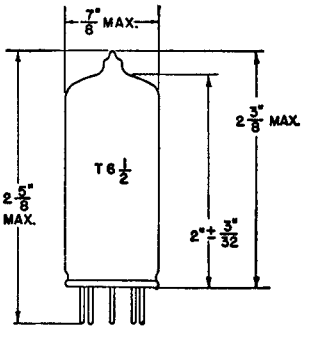


RETMA 9FK

TERMINAL CONNECTIONS

Pin 1—Cathode
Pin 2—No Connection—Do Not Use
Pin 3—Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—No Connection—Do Not Use
Pin 7—No Connection—Do Not Use
Pin 8—Plate
Pin 9—No Connection—Do Not Use

PHYSICAL DIMENSIONS



RETMA 6–3

GENERAL ELECTRIC

AVERAGE CHARACTERISTICS

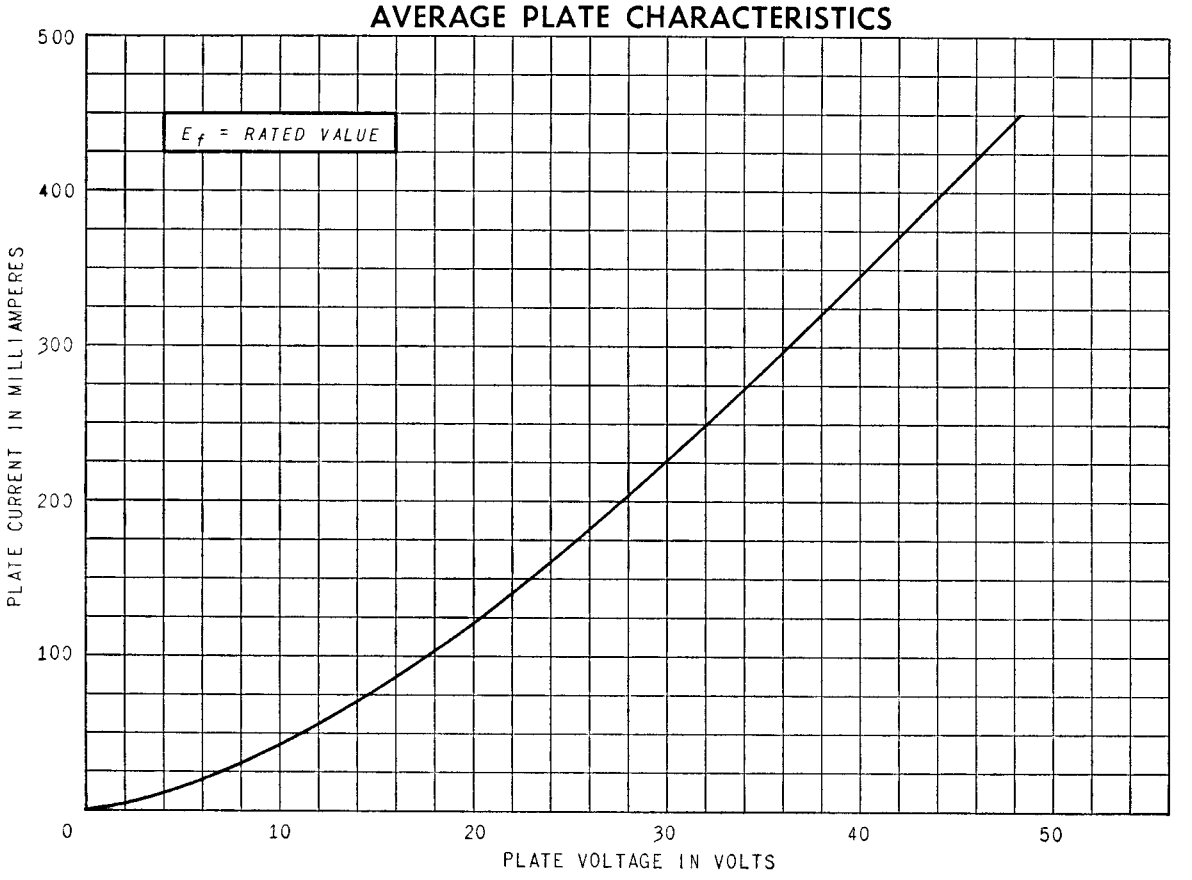
Tube Voltage Drop
Ib = 140 Milliamperes DC ..... 22 Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

Note: Operation of this tube as a power rectifier is not recommended.



TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

17HP4-B

CATHODE-RAY TUBE

17-INCH RECTANGULAR, GLASS
FOCUS—LOW VOLTAGE ELECTROSTATIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
14¼- BY 10¾-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 17HP4-B is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 14¼- by 10¾-inch picture for television applications. The electron gun has a focusing voltage range of −0.4 to +2.2 percent of the anode voltage and is designed for use with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, a reflective aluminized screen to increase light output, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	1500	μμf
Minimum	750	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	72	Percent

MECHANICAL

Over-all Length . . . . . $19\frac{3}{16} \pm \frac{3}{8}$ Inches
Greatest Bulb Dimensions
Diagonal . . . . . $16\frac{5}{8} \pm \frac{3}{32}$ Inches
Width . . . . . $15\frac{25}{64} \pm \frac{1}{8}$ Inches
Height . . . . . $12\frac{1}{4} \pm \frac{3}{16}$ Inches

Minimum Useful Screen Dimensions
Diagonal . . . . . 15½ Inches
Width . . . . . 14¼ Inches
Height . . . . . 10¾ Inches
Neck Length . . . . . 7½ Inches

Bulb Number, ASA Designation—J133-A1 or -B1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees

Mounting Position—Any
Net Weight, approximate . . . . . 16 Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage† . . . . . 16,000 Max Volts DC
Focusing-Electrode Voltage . . . . . −500 to +1000 Max Volts DC
Grid-No. 2 Voltage . . . . . 500 Max Volts DC
Grid-No. 1 Voltage
Negative-Bias Value . . . . . 125 Max Volts DC
Positive-Bias Value . . . . . 0 Max Volts DC
Positive-Peak Value . . . . . 2 Max Volts

Peak Heater-Cathode Voltage§
Heater Negative with Respect to Cathode
During Warm-up Period not to Exceed 15 Seconds . . . . . 410 Max Volts
After Equipment Warm-up Period . . . . . 180 Max Volts
Heater Positive with Respect to Cathode . . . . . 180 Max Volts

TYPICAL OPERATING CONDITIONS

Anode Voltageπ . . . . . 14,000 Volts DC
Focusing-Electrode Voltage for Focus▲ . . . . . −56 to +308 Volts DC
Focusing-Electrode Current . . . . . −15 to +25 Microamperes DC
Grid-No. 2 Voltage . . . . . 300 Volts DC
Grid-No. 1 Voltage♦ . . . . . −28 to −72 Volts DC
Ion-Trap Field Intensityϕ, approximate . . . . . 37 Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance . . . . . 1.5 Max Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode, grid-No. 3, and grid-No. 5 which are connected together within the tube are referred to herein as anode.

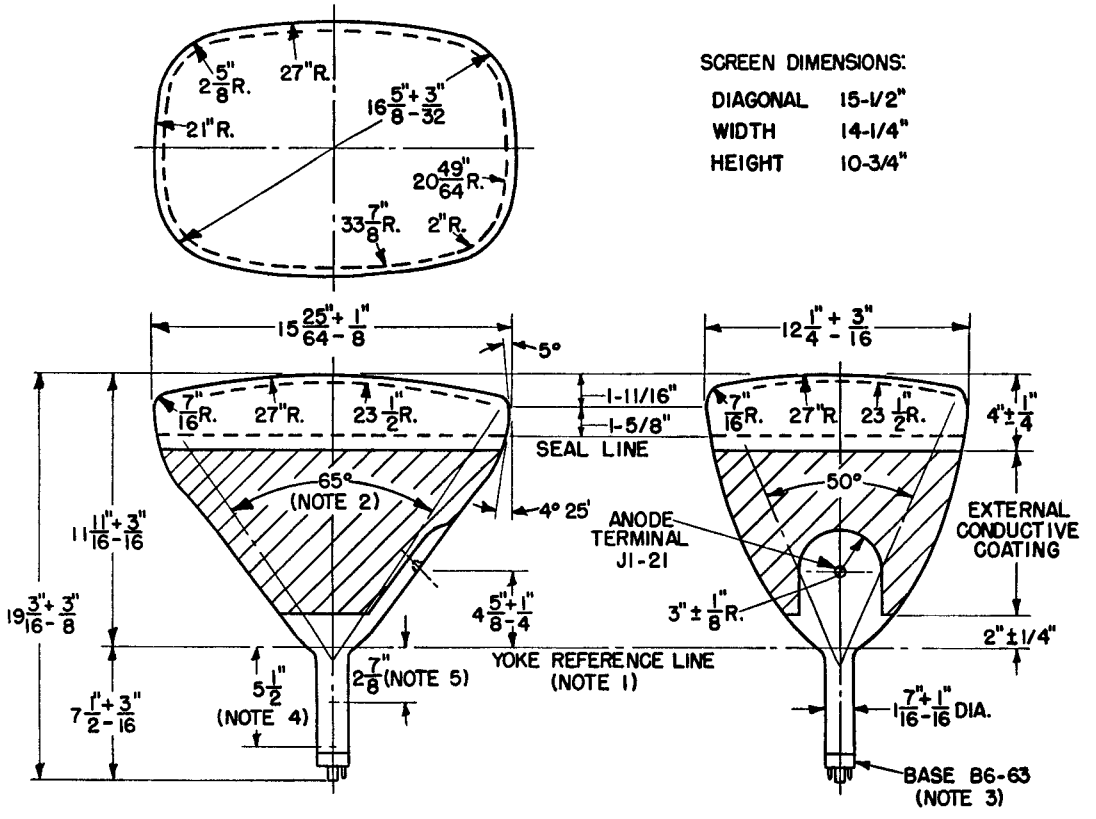
§Cathode should be returned to one side or to the midtap of the heater transformer winding.

πBrightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.

▲The focusing electrode may be modulated within the stipulated maximum range without damage to the tube.

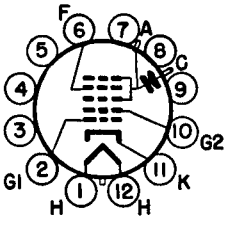
♦For visual extinction of focused raster.

ϕSingle-field ion-trap magnet adjusted to optimum position, equivalent to 37 milliamperes through JETEC ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.



BASING DIAGRAM
12L

Electronic TUBES

17QP4

CATHODE-RAY TUBE

17-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE

14¼- BY 10¾-INCH PICTURE SIZE
FACEPLATE—CYLINDRICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 17QP4 is a magnetic-focus and deflection, direct-view all-glass picture tube which provides a 14¼- by 10¾-inch picture for television applications. The electron gun is designed for use with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, a space-saving rectangular face shape, and a cylindrical front surface which materially reduces the effects of specular reflection. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	1500	uuf
Minimum	750	uuf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	72	Percent

MECHANICAL

Over-all Length	$19\frac{3}{16} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$16\frac{5}{8} \pm \frac{3}{32}$	Inches
Width	$15\frac{25}{64} \pm \frac{1}{8}$	Inches
Height	$12\frac{1}{4} \pm \frac{3}{16}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$15\frac{1}{2}$	Inches
Width	$14\frac{1}{4}$	Inches
Height	$10\frac{3}{4}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J133-C1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	18	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	16,000 Max	Volts DC
Grid-No. 2 Voltage	410 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	150 Max	Volts
Heater Positive with Respect to Cathode	150 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	14,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	110	Milliamperes DC
Ion-Trap Field Intensity♦, approximate	37	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1-Circuit Resistance	1.5 Max	Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

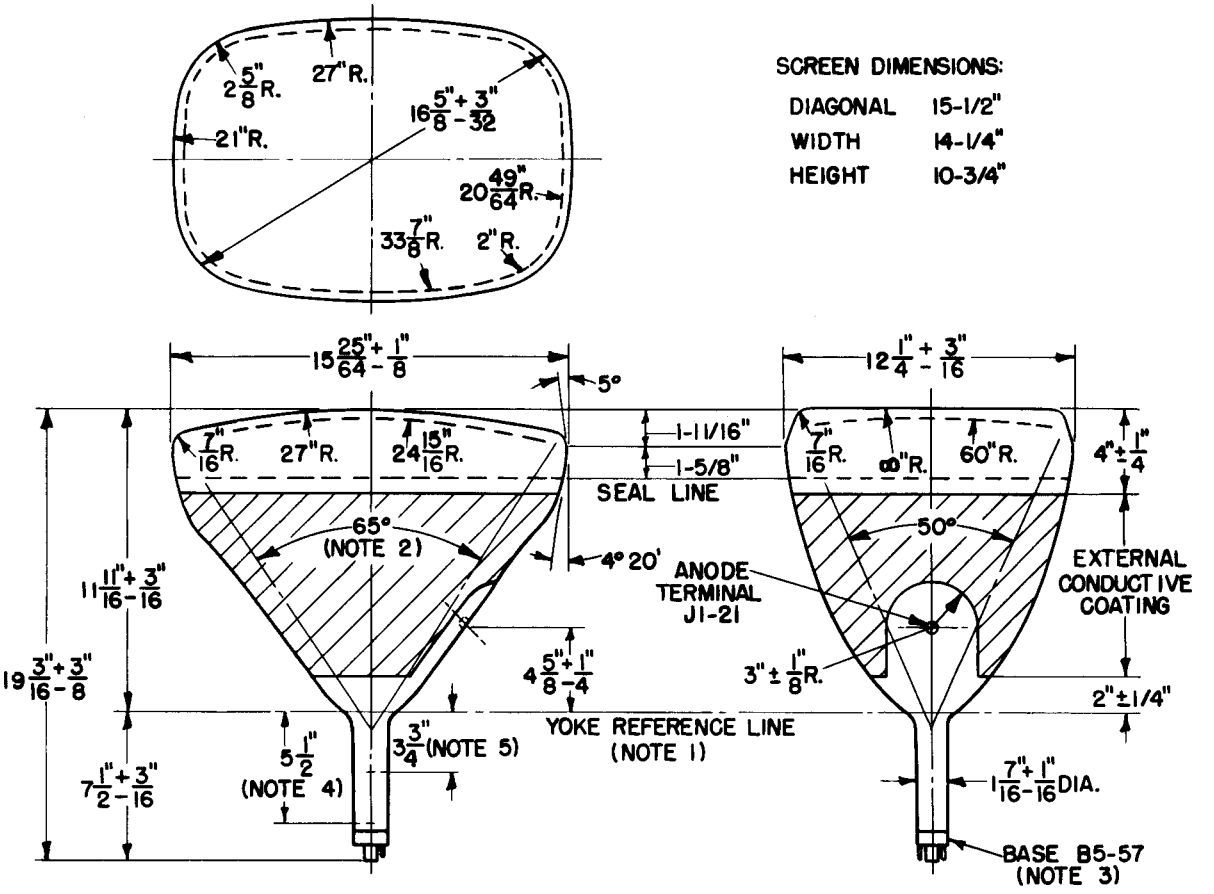
‡Cathode should be returned to one side or to the midtap of the heater transformer winding.

§Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.

πFor visual extinction of focused raster.

▲For JETEC focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3¾ inches

♦Single-field ion-trap magnet adjusted to optimum position, equivalent to 37 milliamperes through JETEC ion-trap No. 117.

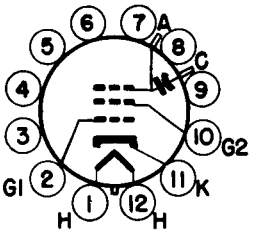


SCREEN DIMENSIONS:

DIAGONAL	15-1/2"
WIDTH	14-1/4"
HEIGHT	10-3/4"

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.



BASING DIAGRAM
12N

Electronic TUBES

17RP4/17HP4

CATHODE-RAY TUBE

17-INCH RECTANGULAR, GLASS
FOCUS—LOW VOLTAGE ELECTROSTATIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE

14¼- BY 10¾-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 17RP4/17HP4 is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 14¼- by 10¾-inch picture for television applications. The electron gun has a focusing voltage range of −0.4 to +2.2 percent of the anode voltage and is designed for use with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	1500	uuf
Minimum	750	uuf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	72	Percent

MECHANICAL

Over-all Length	$19\frac{3}{16} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$16\frac{5}{8} \pm \frac{3}{32}$	Inches
Width	$15\frac{25}{64} \pm \frac{1}{8}$	Inches
Height	$12\frac{1}{4} \pm \frac{3}{16}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$15\frac{1}{2}$	Inches
Width	$14\frac{1}{4}$	Inches
Height	$10\frac{3}{4}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J133-A1 or -B1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees

Mounting Position—Any

Net Weight, approximate	16	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	16,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Focusing-Electrode Current‡	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage§		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltageπ	14,000	Volts DC
Focusing-Electrode Voltage for Focus▲	−56 to +308	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage♦	−28 to −72	Volts DC
Ion-Trap Field Intensityϕ, approximate	37	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode, grid-No. 3, and grid-No. 5 which are connected together within the tube are referred to herein as anode.

‡At design-center maximum anode voltage plus ten percent.

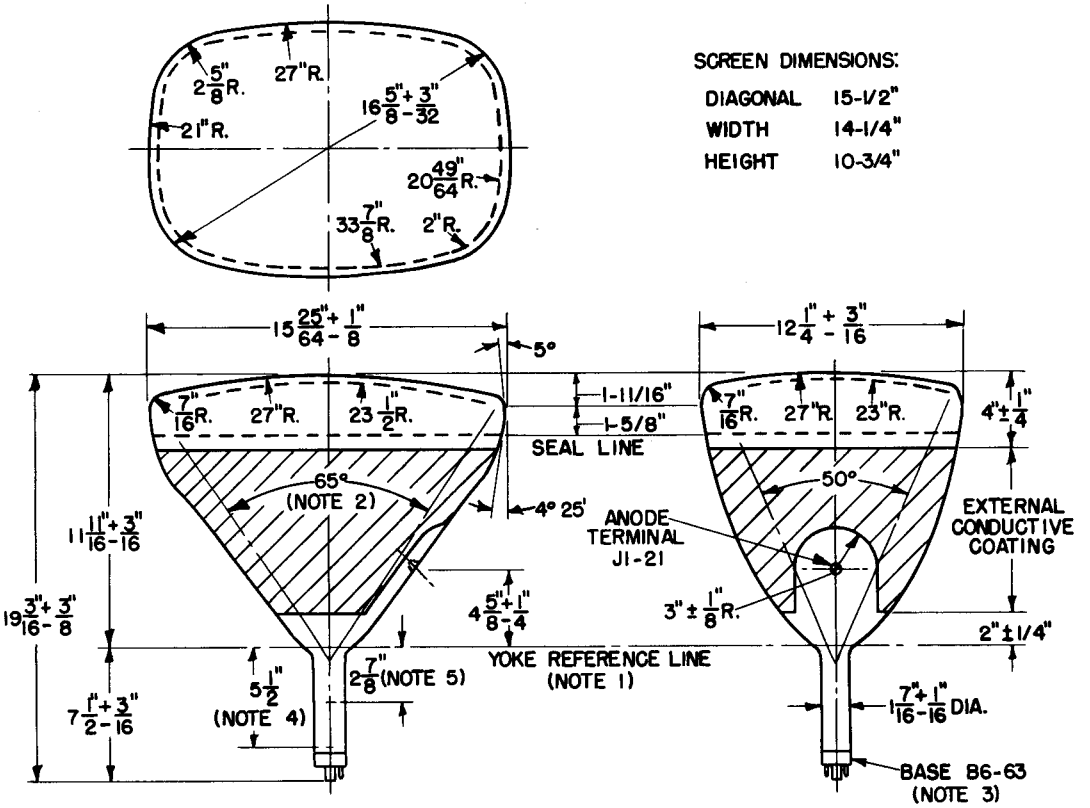
§Cathode should be returned to one side or to the midtap of the heater transformer winding.

πBrightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.

▲The focusing electrode may be modulated within the stipulated maximum range without damage to the tube.

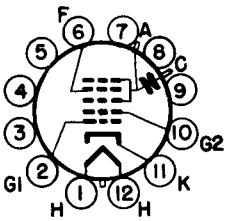
♦For visual extinction of focused raster.

φSingle-field ion-trap magnet adjusted to optimum position, equivalent to 37 milliamperes through JETEC ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.



BASING DIAGRAM
12L

Electronic TUBES

17VP4/17LP4

CATHODE-RAY TUBE

17-INCH RECTANGULAR, GLASS
FOCUS—LOW VOLTAGE ELECTROSTATIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
14¼- BY 10¾-INCH PICTURE SIZE
FACEPLATE—CYLINDRICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 17VP4/17LP4 is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 14¼- by 10¾-inch picture for television applications. The electron gun has a focusing voltage range of −0.4 to +2.2 percent of the anode voltage and is used with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, a space-saving rectangular face shape, and a cylindrical front surface which materially reduces the effects of specular reflection. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	1500	uuf
Minimum	750	uuf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	72	Percent

MECHANICAL

Over-all Length	$19\frac{3}{16} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$16\frac{5}{8} \pm \frac{3}{32}$	Inches
Width	$15\frac{25}{64} \pm \frac{1}{8}$	Inches
Height	$12\frac{1}{4} \pm \frac{3}{16}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	15½	Inches
Width	14¼	Inches
Height	10¾	Inches
Neck Length	7½	Inches

Bulb Number, ASA Designation—J133-C1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. J1-21
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees

Mounting Position—Any

Net Weight, approximate	18	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	16,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Focusing-Electrode Current‡	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage§		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltageπ	14,000	Volts DC
Focusing-Electrode Voltage for Focus▲	−56 to +308	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage♦	−28 to −72	Volts DC
Ion-Trap Field Intensityϕ, approximate	37	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

‡At design-center maximum anode voltage plus ten percent.

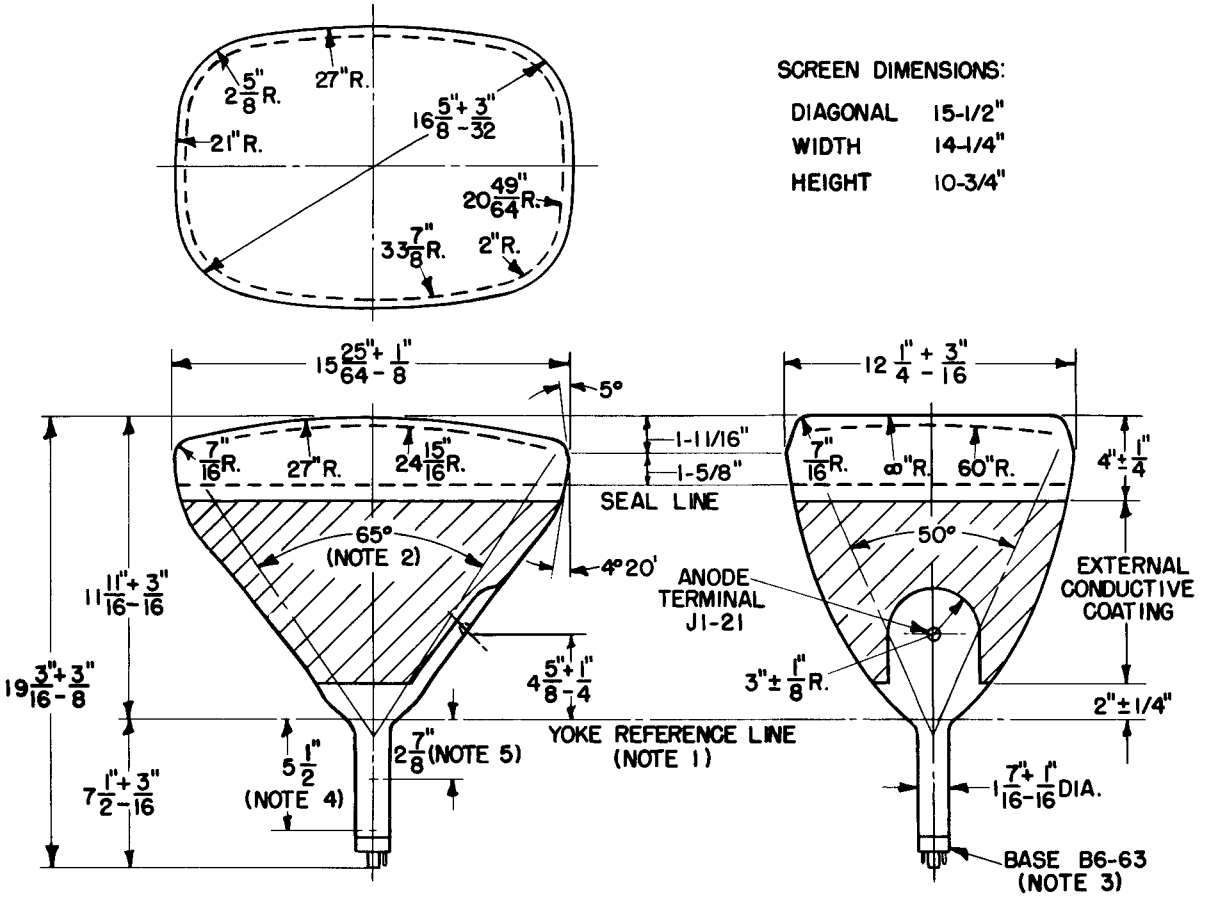
§Cathode should be returned to one side or to the midtap of the heater transformer winding.

πBrightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.

▲The focusing electrode may be modulated within the stipulated maximum range without damage to the tube.

♦For visual extinction of focused raster.

φSingle-field ion-trap magnet adjusted to optimum position, equivalent to 37 milliamperes through JETEC ion-trap magnet No. 117.

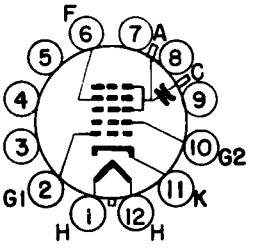


SCREEN DIMENSIONS:

DIAGONAL	15-1/2"
WIDTH	14-1/4"
HEIGHT	10-3/4"

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.



BASING DIAGRAM
12L

Electronic TUBES

18A5

BEAM PENTODE

DESCRIPTION AND RATING

The 18A5 is a beam-power pentode designed for use as the horizontal-deflection amplifier in compact, 300-milliampere, series-string television receivers. The tube features relatively small size, low power requirements, and high performance capabilities at the low d-c supply voltages normally available in this application. The tube also has a controlled heater warm-up characteristic as required for use in television receivers that employ series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	18.5	Volts
Heater Current	0.3 ± 6%	Amperes
Heater Warm-up Time*	11	Seconds
Direct Interelectrode Capacitances, approximate†		
Grid-Number 1 to Plate	0.7	μμf
Input	13	μμf
Output	7.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B6-8, Intermediate Shell Octal 6-Pin
or B6-60, Short Intermediate Shell Octal 6-Pin

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE‡

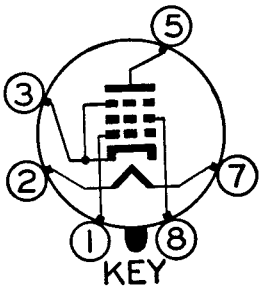
DESIGN-MAXIMUM VALUES

DC Plate-Supply Voltage (Boost† DC Power Supply)	350	Volts
Peak Positive Pulse Plate Voltage	3000	Volts
Peak Negative Pulse Plate Voltage	600	Volts
Screen Voltage	160	Volts
Peak Negative Grid-Number 1 Voltage	250	Volts
Plate Dissipation§	9.0	Watts
Screen Dissipation	2.5	Watts
DC Cathode Current	90	Milliamperes
Peak Cathode Current	310	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point	190	C

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

GENERAL ELECTRIC

BASING DIAGRAM

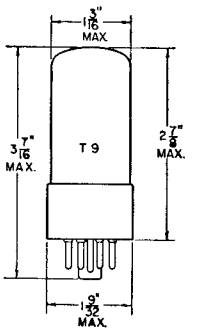


RETMA 6CK

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Heater
Pin 3—Cathode and Beam Plates
Pin 5—Plate
Pin 7—Heater
Pin 8—Grid Number 2 (Screen)

PHYSICAL DIMENSIONS



RETMA 9-15
OR 9-43

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	60	200 Volts
Screen Voltage	125	125 Volts
Grid-Number 1 Voltage	0♦	−17 Volts
Plate Resistance, approximate	....	27000 Ohms
Transconductance	....	4800 Micromhos
Plate Current	165	40 Milliamperes
Screen Current	15	1.1 Milliamperes
Grid-Number 1 Voltage, approximate Ib = 1.0 Milliampere	....	−36 Volts
Triode Amplification Factor¶	....	4.6

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

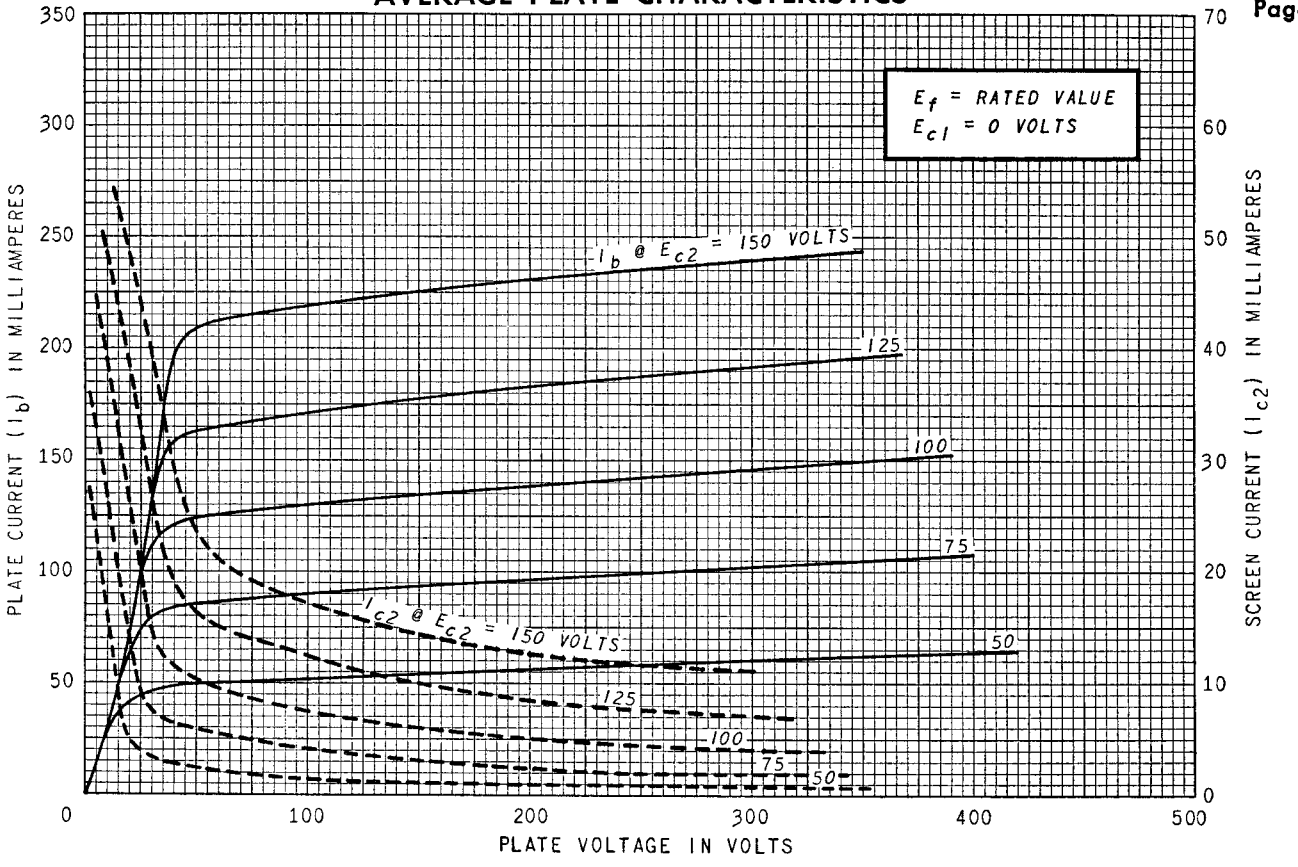
‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

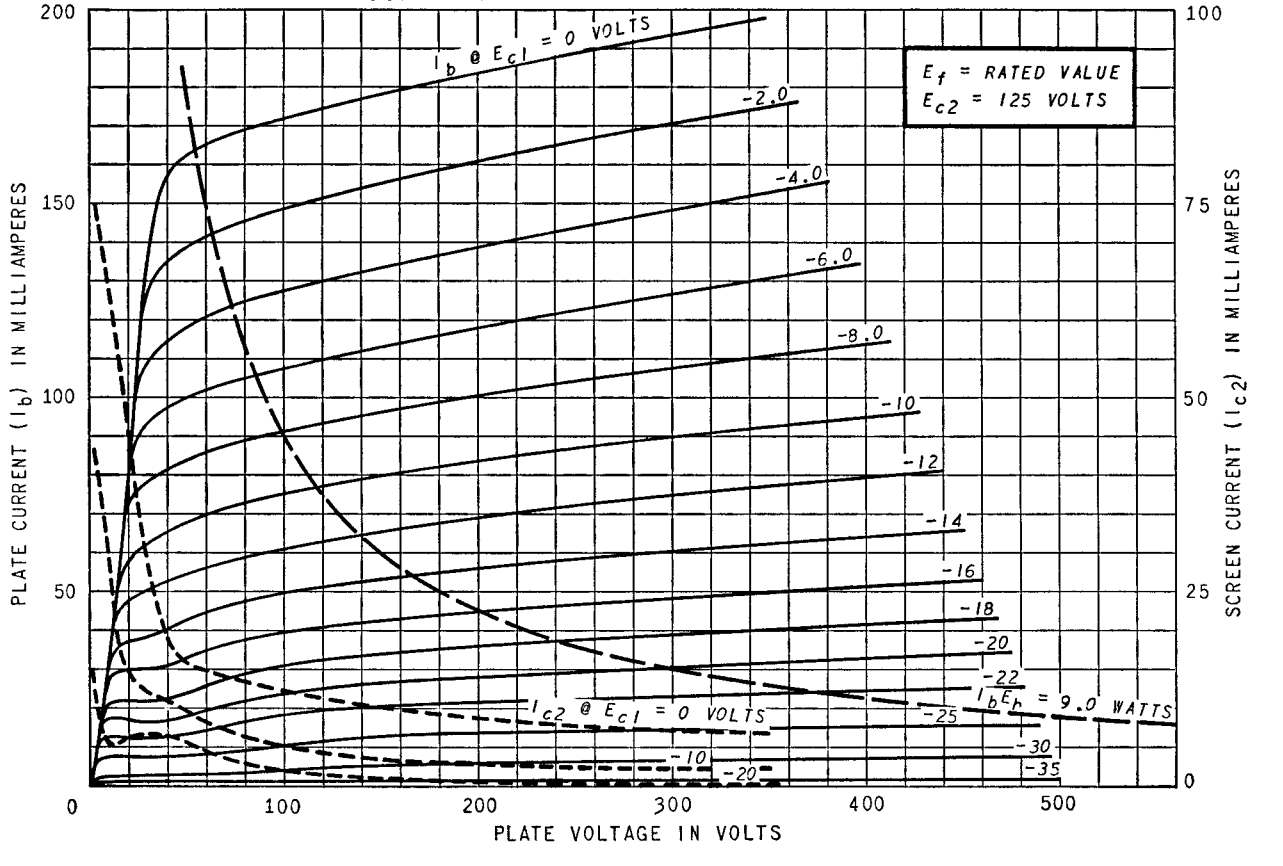
♦ Applied for short interval (two seconds maximum) so as not to damage tube.

¶ Triode connection (screen tied to plate) with Eb = Ec2 = 125 volts and Ec1 = −17 volts.

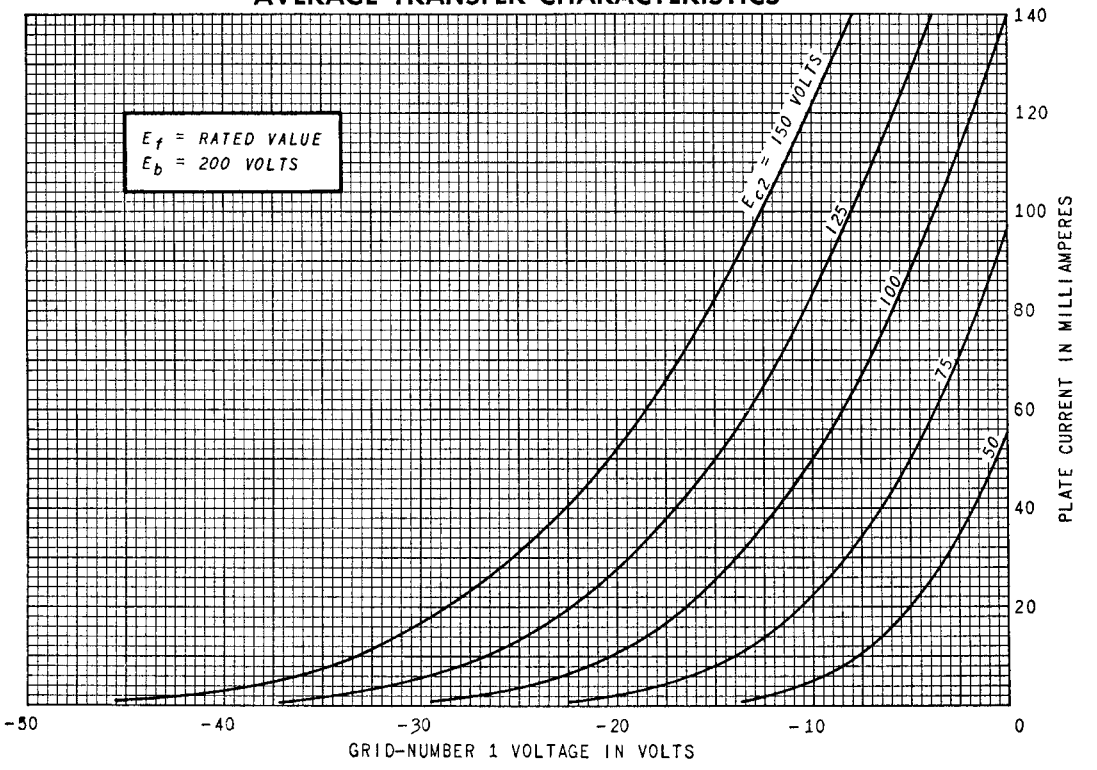
AVERAGE PLATE CHARACTERISTICS



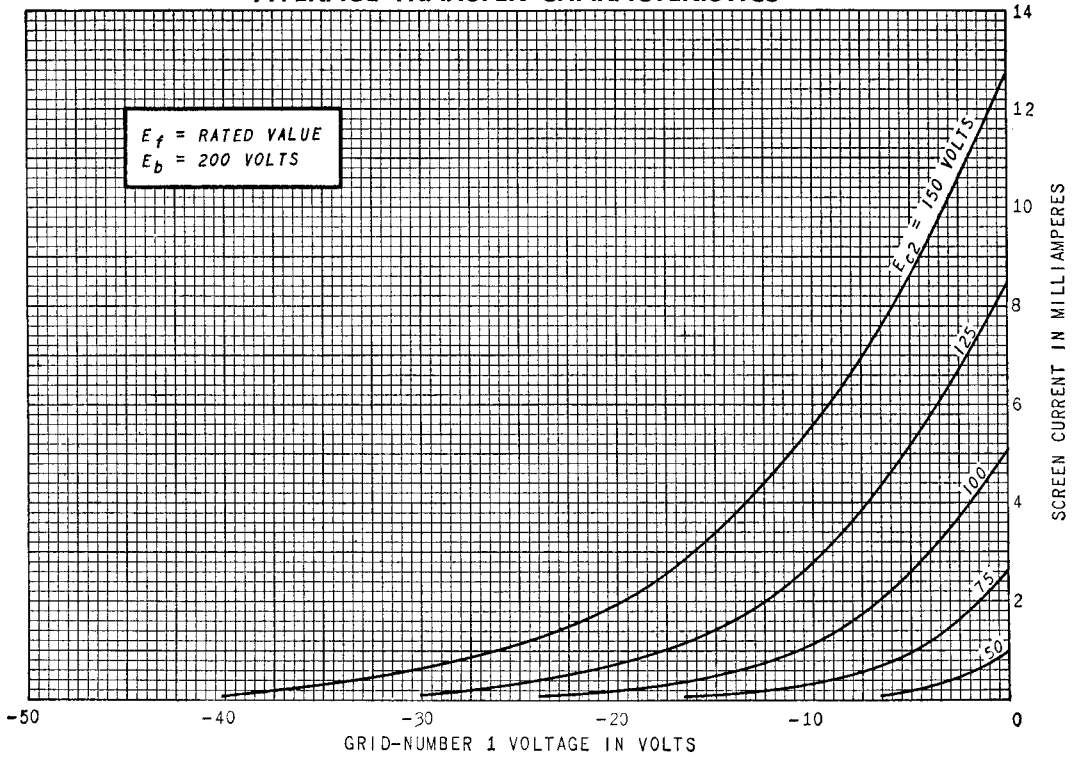
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

—PRODUCT INFORMATION—

Compactron
Dissimilar Double Pentode

18AJ10

- **LOW HEATER POWER**
- **140 VOLTS B+**
- **HIGH SENSITIVITY SOUND DETECTOR**

The 18AJ10 is a compactron containing a sharp-cutoff, dual-control pentode (Section 2) and a power pentode (Section 1). The dual-control pentode is intended for use as an FM detector and the power pentode as an audio-frequency output amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	18	Volts
Heater Current†	0.315 ±0.02	Amperes
Heater Warm-up Time, average‡	11	Seconds

Direct Interelectrode Capacitances, approximate§

Section 1

Grid-Number 1 to Plate: (1g1 to 1p)	0.24	pf
Input: 1g1 to (h + 1k + 1g2 + b.p. + 2k + i.s.)	9.5	pf
Output: 1p to (h + 1k + 1g2 + b.p. + 2k + i.s.)	10	pf

Section 2

Grid-Number 1 to Plate: (2g1 to 2p)	0.036	pf
Grid-Number 3 to Plate: (2g3 to 2p)	3.0	pf
Grid-Number 1 to All Except Plate: 2g1 to (h + 2k + 2g2 + 2g3 + i.s.)	7.0	pf
Grid-Number 3 to All: 2g3 to (h + 2k + 2g1 + 2g2 + 2p + i.s.)	7.8	pf
Grid-Number 1 to Grid-Number 3: (2g1 to 2g3)	0.14	pf

Coupling

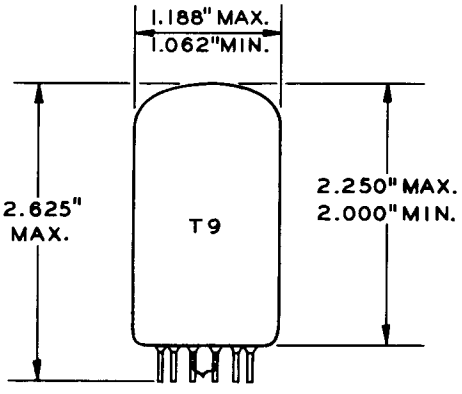
Plate, Section 1 to Plate, Section 2: (1p to 2p) . . . 0.17 pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

PHYSICAL DIMENSIONS

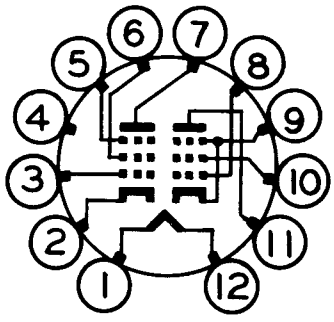


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode (Section 2) and Internal Shield
Pin 3 - Grid Number 1 (Section 2)
Pin 4 - No Connection
Pin 5 - Grid Number 3 (Suppressor)(Section 2)
Pin 6 - Grid Number 2 (Screen)(Section 2)
Pin 7 - Plate (Section 2)
Pin 8 - Grid Number 1 (Section 1)
Pin 9 - Cathode and Beam Plates (Section 1)
Pin 10 - Grid Number 2 (Screen)(Section 1)
Pin 11 - Plate (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12EZ

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Section 1

Plate Voltage	165	Volts
Screen Voltage	150	Volts
Plate Dissipation	6.0	Watts
Screen Dissipation	1.25	Watts
DC Cathode Current	60	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Cathode Bias	1.0	Megohms

Section 2

Plate Voltage	300	Volts
Suppressor Voltage		
Positive (DC + Peak)	25	Volts
Negative (DC + Peak)	100	Volts
Screen Supply Voltage	300	Volts
Screen Voltage - See Screen Rating Chart		
Positive DC Grid-Number 1 Voltage	0	Volts
Negative DC Grid-Number 1 Voltage	50	Volts
Plate Dissipation	1.7	Watts
Suppressor Dissipation	0.1	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Suppressor Circuit Resistance	0.5	Megohms
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	0.5	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS—CLASS A_1 AMPLIFIER

Section 1

Plate Voltage	145	Volts
Screen Voltage	110	Volts
Grid-Number 1 Voltage	-7.0	Volts
Peak AF Grid-Number 1 Voltage	7.0	Volts
Plate Resistance, approximate	33000	Ohms
Transconductance	5600	Micromhos
Zero-Signal Plate Current	34	Milliamperes
Maximum-Signal Plate Current	39	Milliamperes
Zero-Signal Screen Current	6.5	Milliamperes
Maximum-Signal Screen Current	9.3	Milliamperes
Load Resistance	2500	Ohms
Total Harmonic Distortion, approximate	12	Percent
Maximum-Signal Power Output	1.45	Watts

AVERAGE CHARACTERISTICS

Section 2

Plate Voltage	150	Volts
Suppressor Voltage	0	Volts
Screen Voltage	100	Volts
Cathode-Bias Resistor	180	Ohms
Plate Resistance, approximate	0.18	Megohms
Grid-Number 1 Transconductance	2400	Micromhos
Grid-Number 3 Transconductance	750	Micromhos
Plate Current	2.8	Milliamperes
Screen Current	3.5	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 20 Microamperes	-4	Volts
Grid-Number 3 Voltage, approximate Ib = 50 Microamperes	-3.5	Volts

NOTES

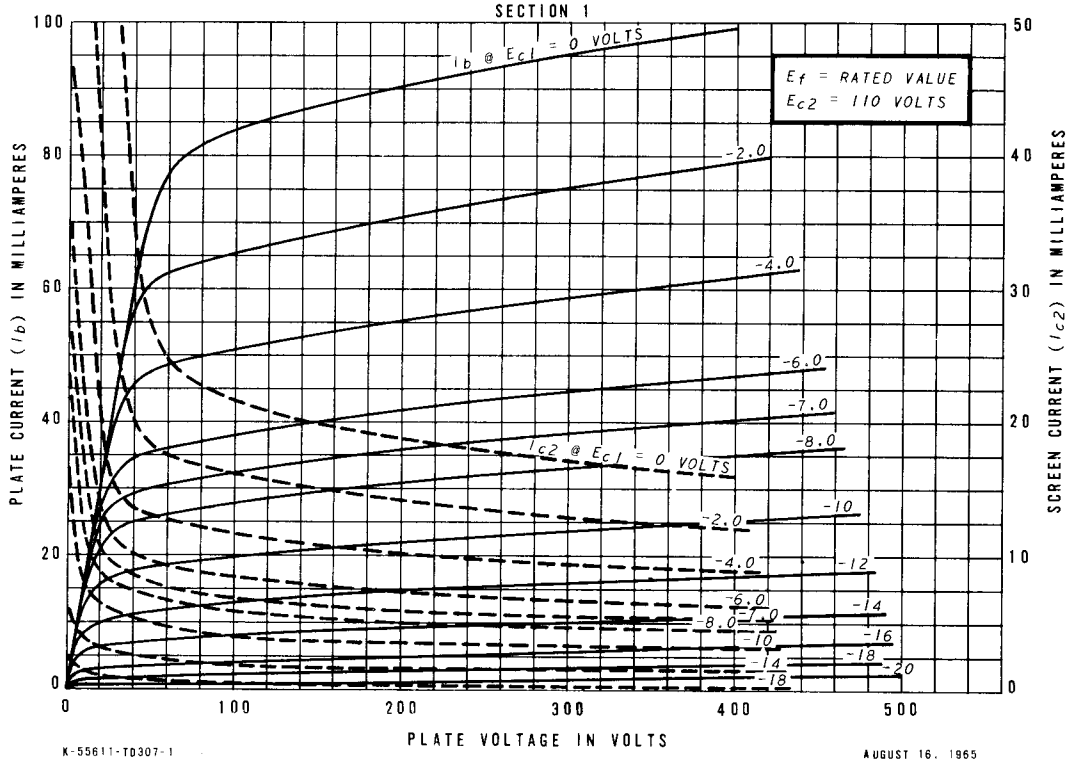
* Heater voltage for a bogey tube at If = 0.315 amperes.

† The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

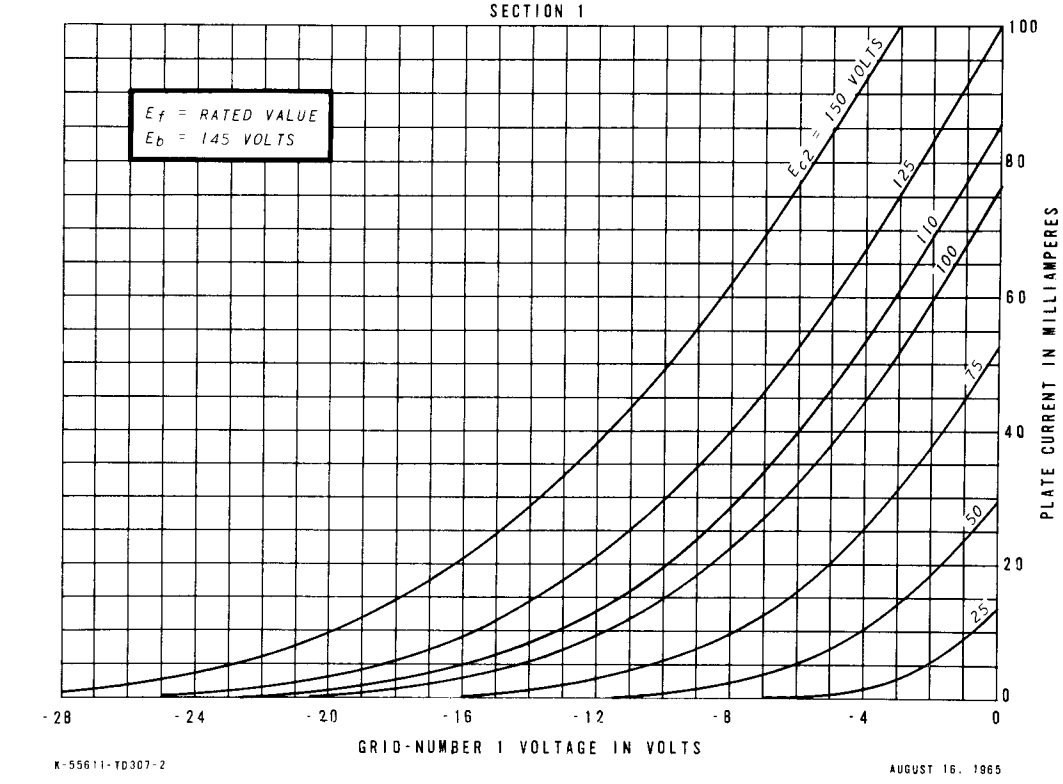
‡ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

§ Without external shield.

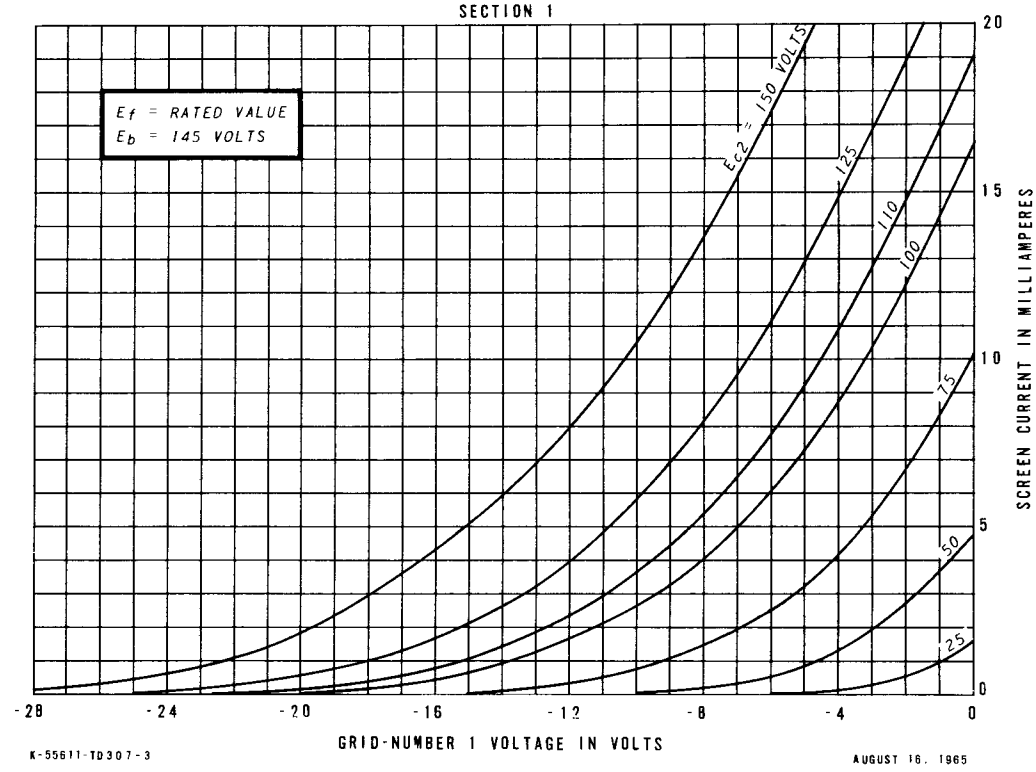
AVERAGE PLATE CHARACTERISTICS



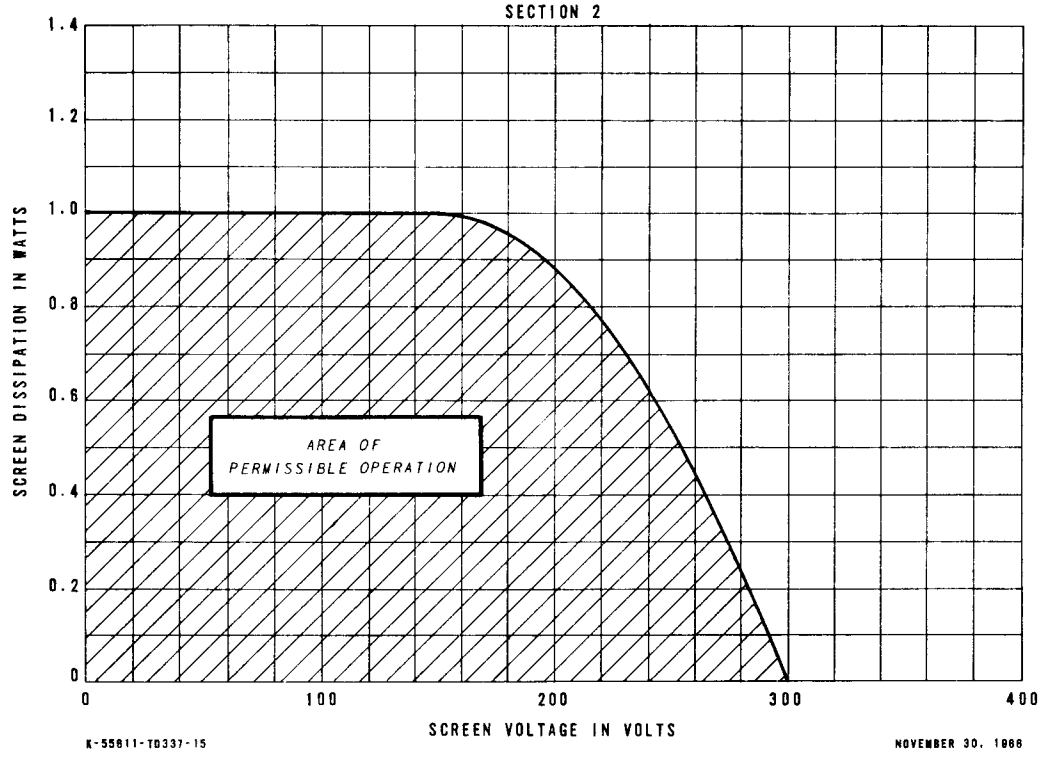
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

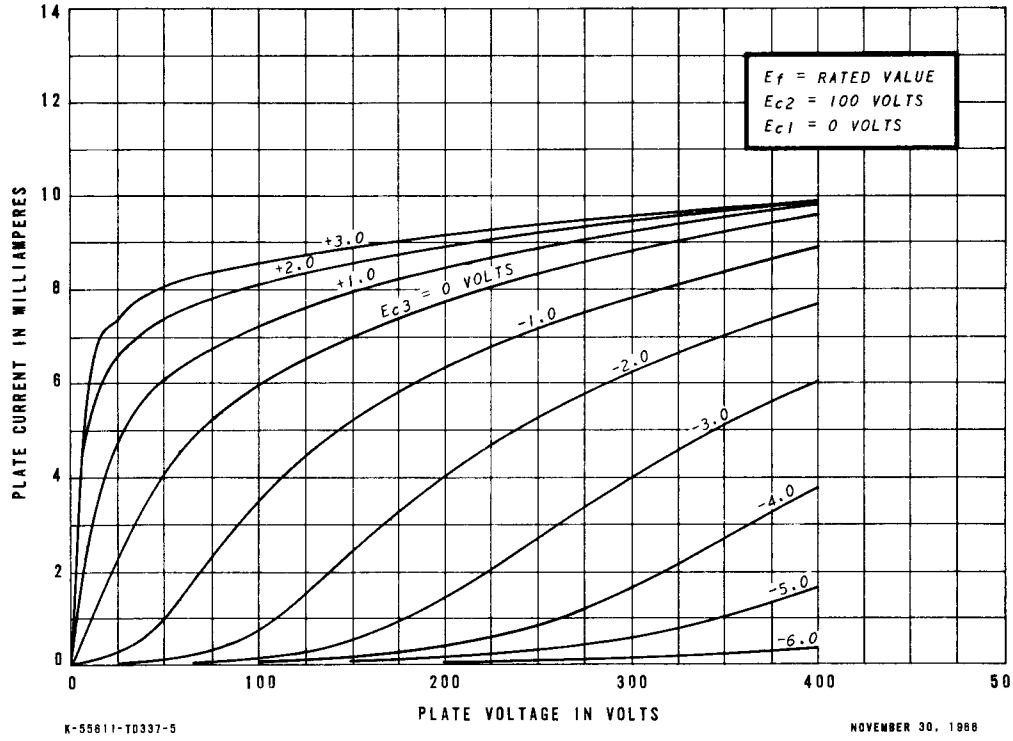


SCREEN RATING CHART



AVERAGE PLATE CHARACTERISTICS

SECTION 2

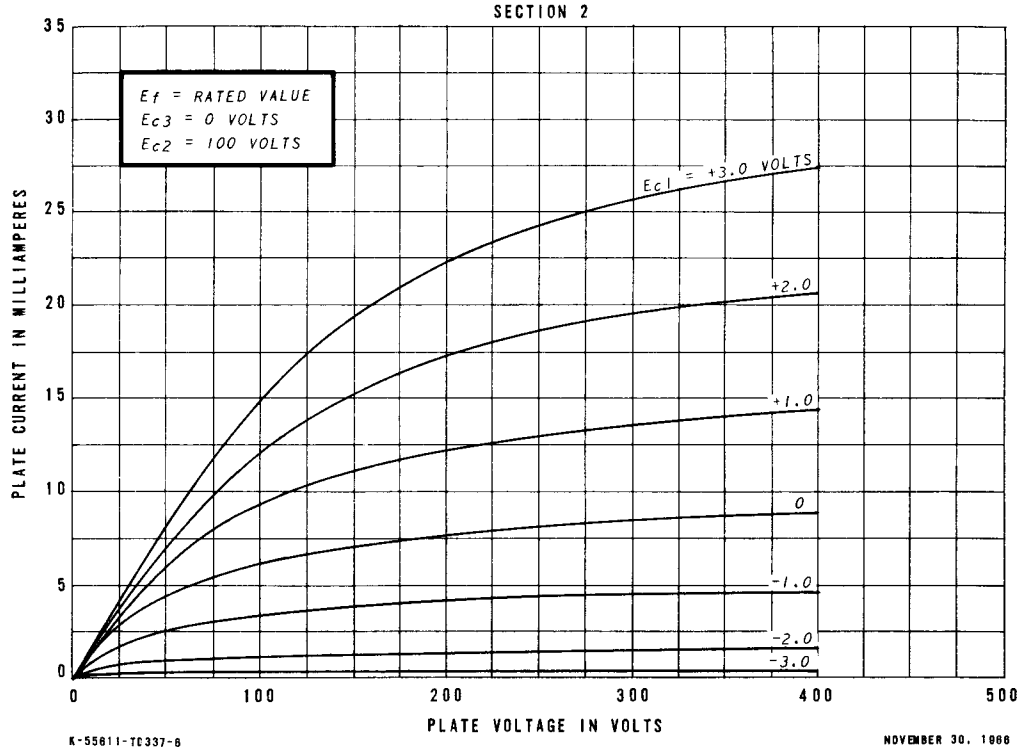


K-55611-TD337-5

NOVEMBER 30, 1966

AVERAGE PLATE CHARACTERISTICS

SECTION 2

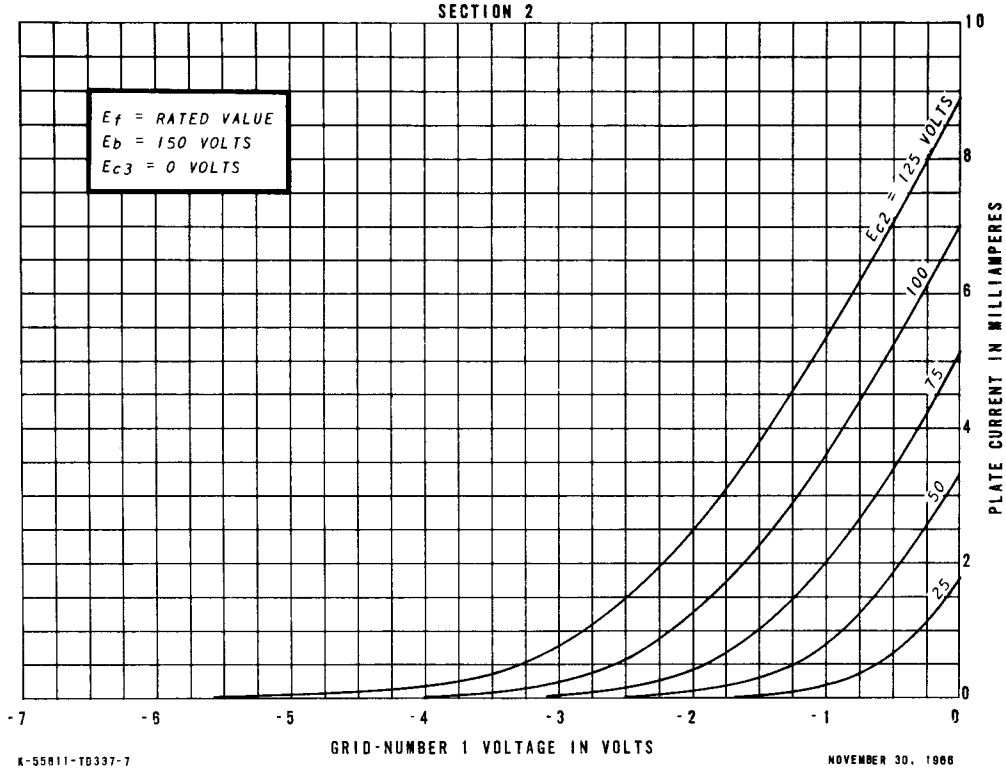


K-55611-TD337-6

NOVEMBER 30, 1966

AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

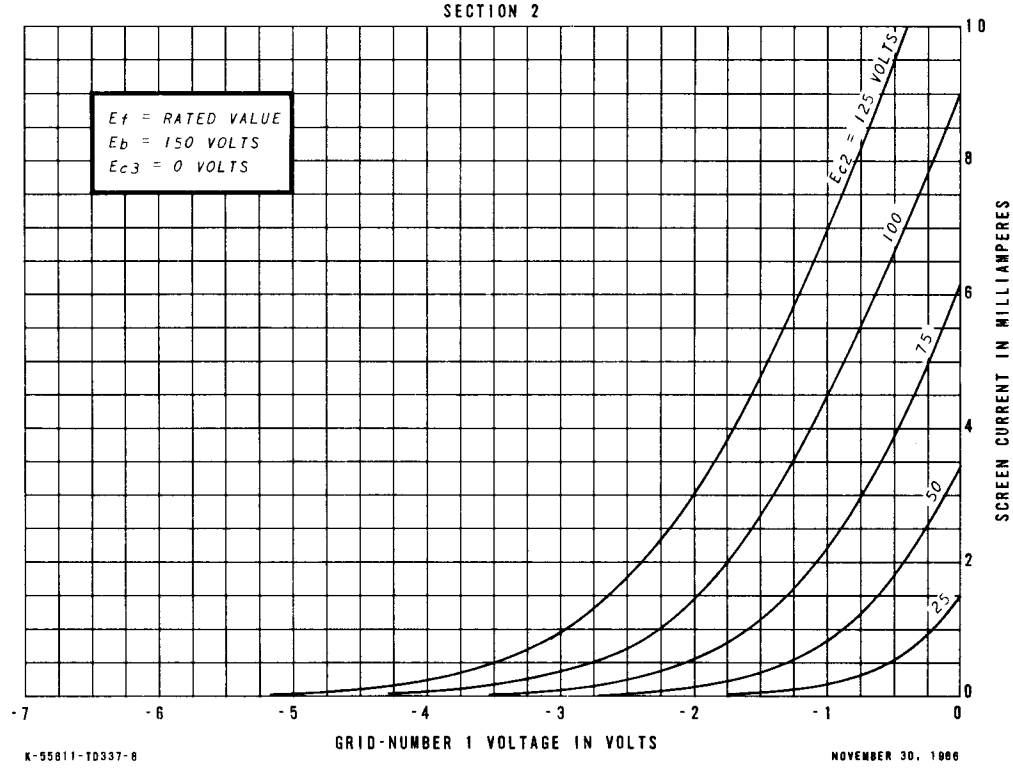


K-55811-TD337-7

NOVEMBER 30, 1966

AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

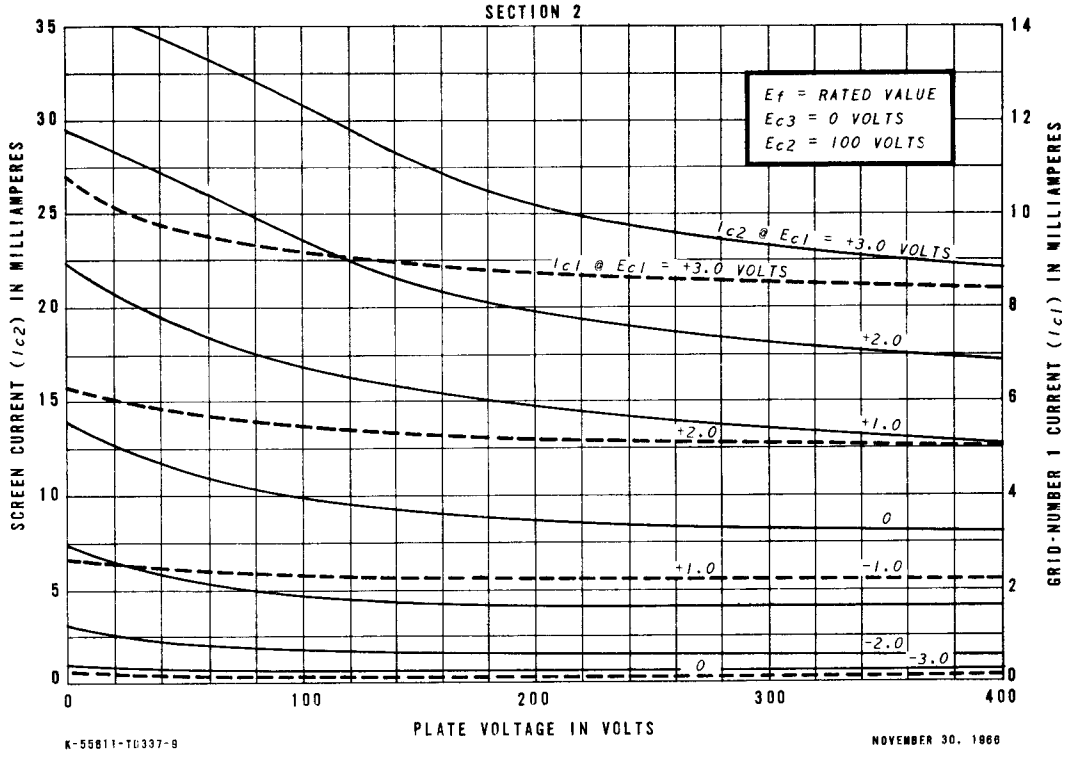


K-55811-TD337-8

NOVEMBER 30, 1966

AVERAGE CHARACTERISTICS

SECTION 2

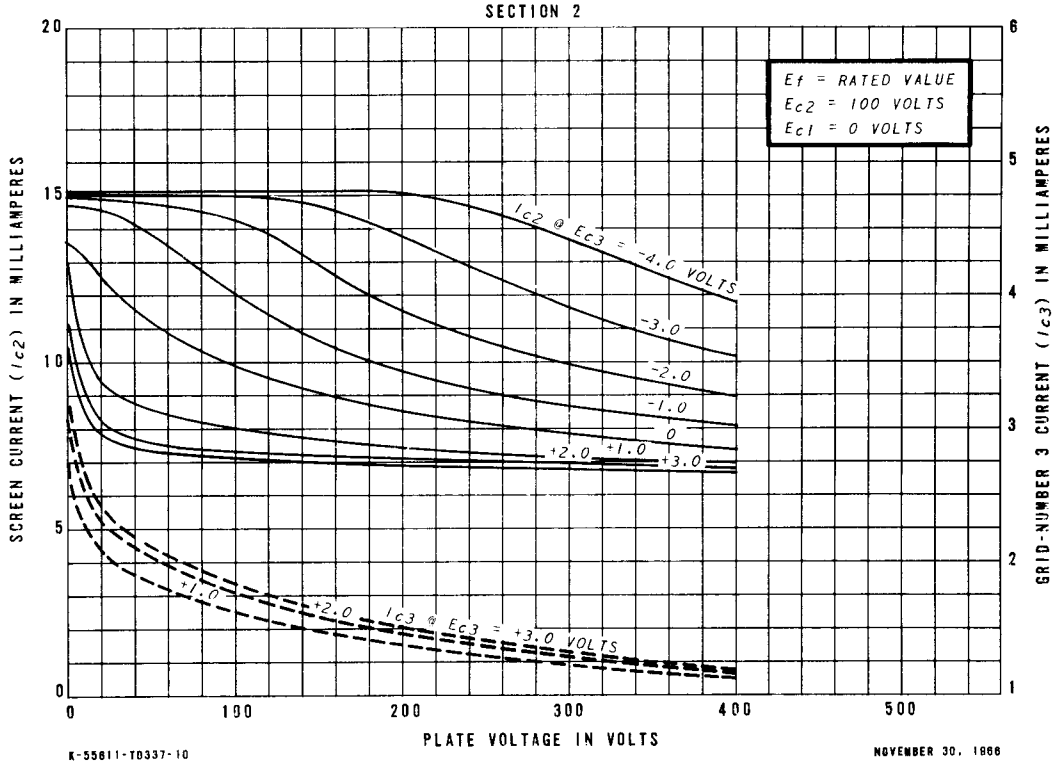


K-55811-TD337-9

NOVEMBER 30, 1966

AVERAGE CHARACTERISTICS

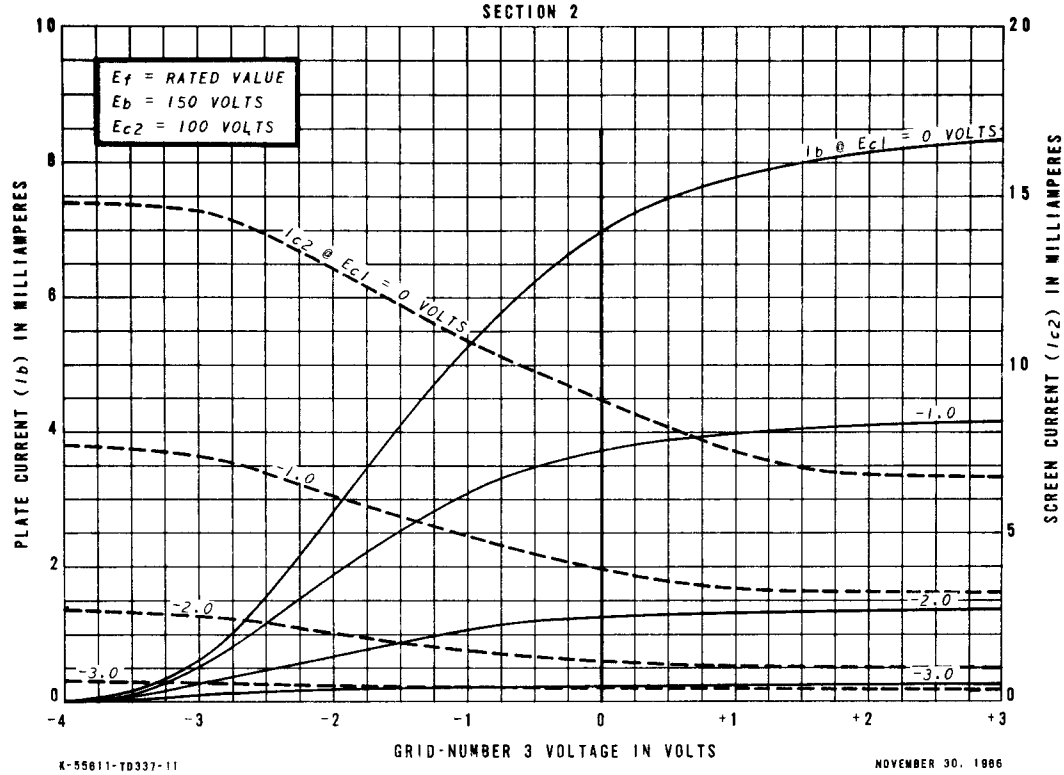
SECTION 2



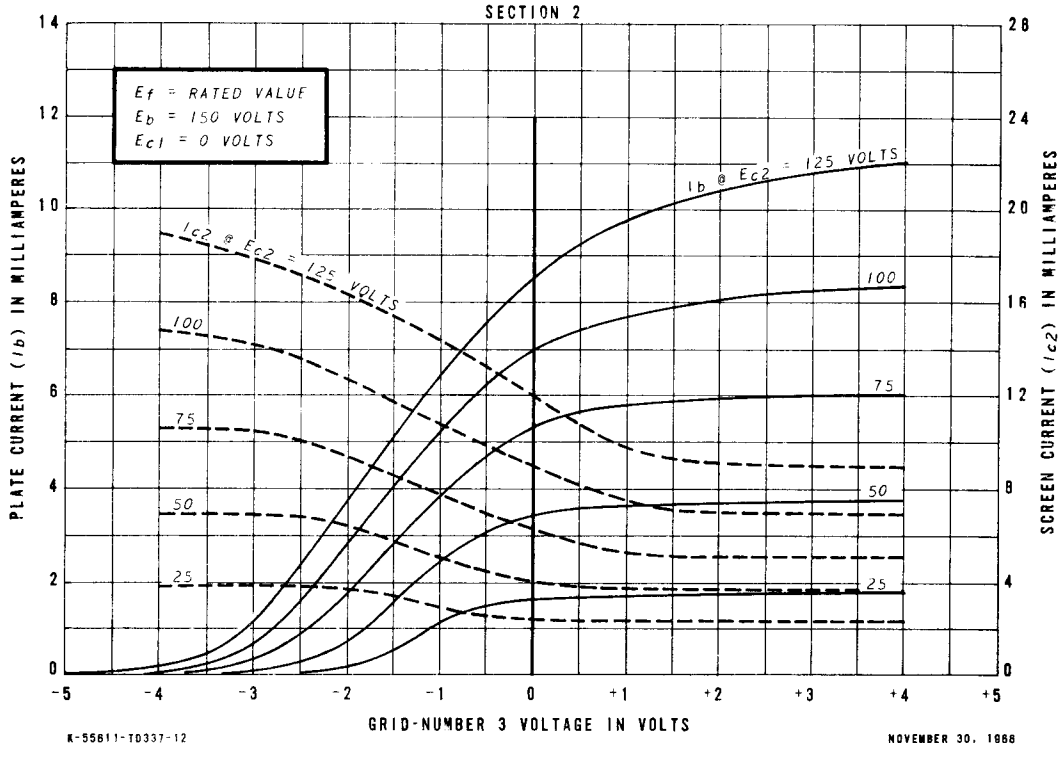
K-55811-TD337-10

NOVEMBER 30, 1966

AVERAGE TRANSFER CHARACTERISTICS

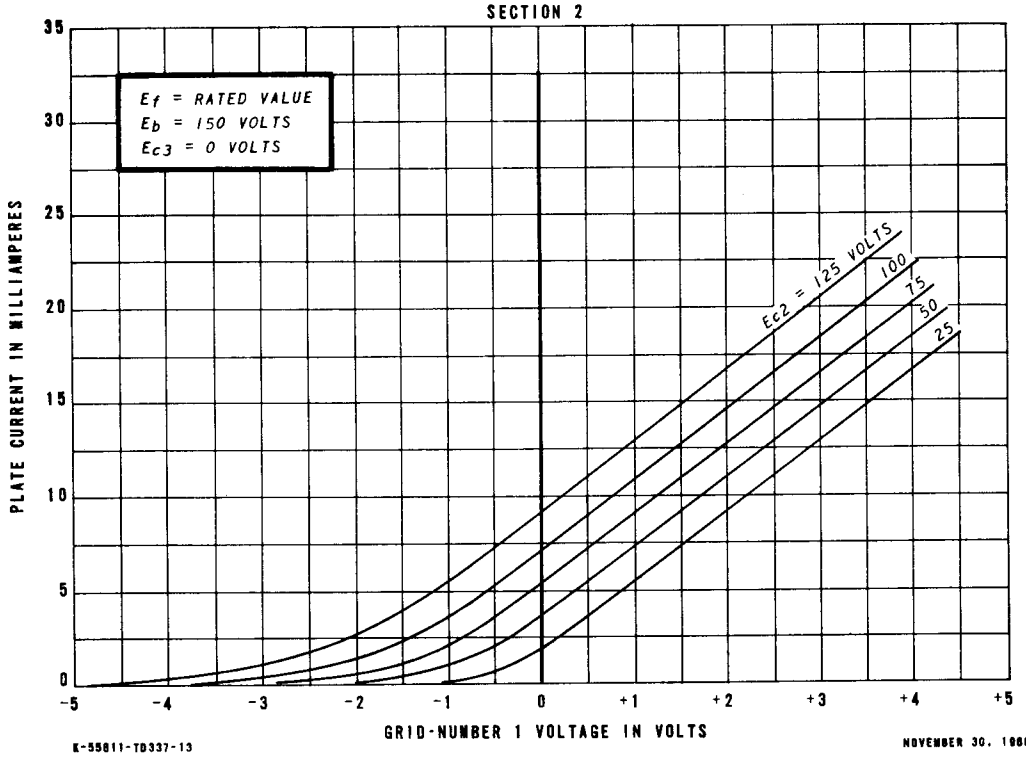


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

SECTION 2

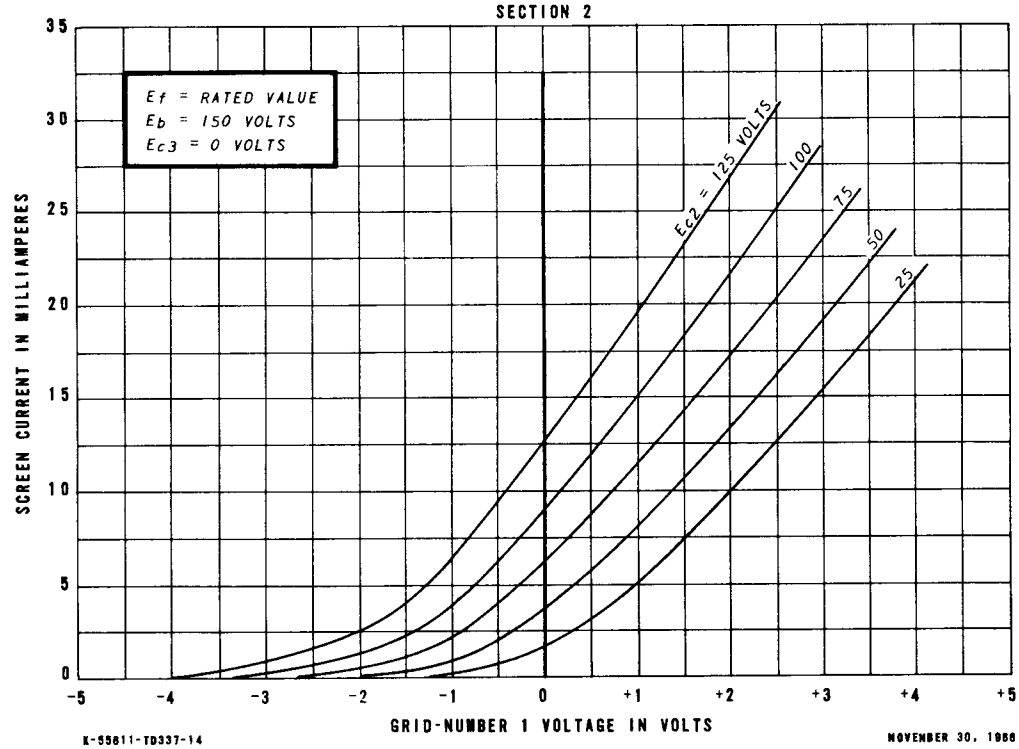


K-55611-TD337-13

NOVEMBER 30, 1966

AVERAGE TRANSFER CHARACTERISTICS

SECTION 2



K-55611-TD337-14

NOVEMBER 30, 1966

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

18FW6

PENTODE

DESCRIPTION AND RATING

The 18FW6 is a miniature, semi-remote-cutoff pentode designed for RF and IF amplifier service in line-operated radio receivers having 100-milliampere, series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	18 ± 10%	Volts
Heater Current	0.1	Amperes
Direct Interelectrode Capacitances*		
Grid-Number 1 to Plate: (g1 to p)	0.0035	μμf
Input: G1 to (H+K+G2+G3)	5.5	μμf
Output: P to (H+K+G2+G3)	5.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	150	Volts
Screen-Supply Voltage	150	Volts
Screen Voltage—See Screen Rating Chart		
Plate Dissipation	2.5	Watts
Screen Dissipation	0.6	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	100	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

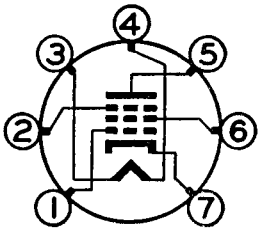
These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

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GENERAL ELECTRIC

BASING DIAGRAM

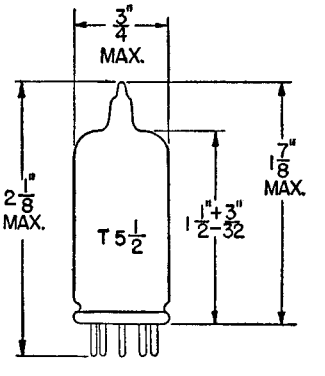


EIA 7CC

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Grid Number 3 (Suppressor)
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Cathode

PHYSICAL DIMENSIONS



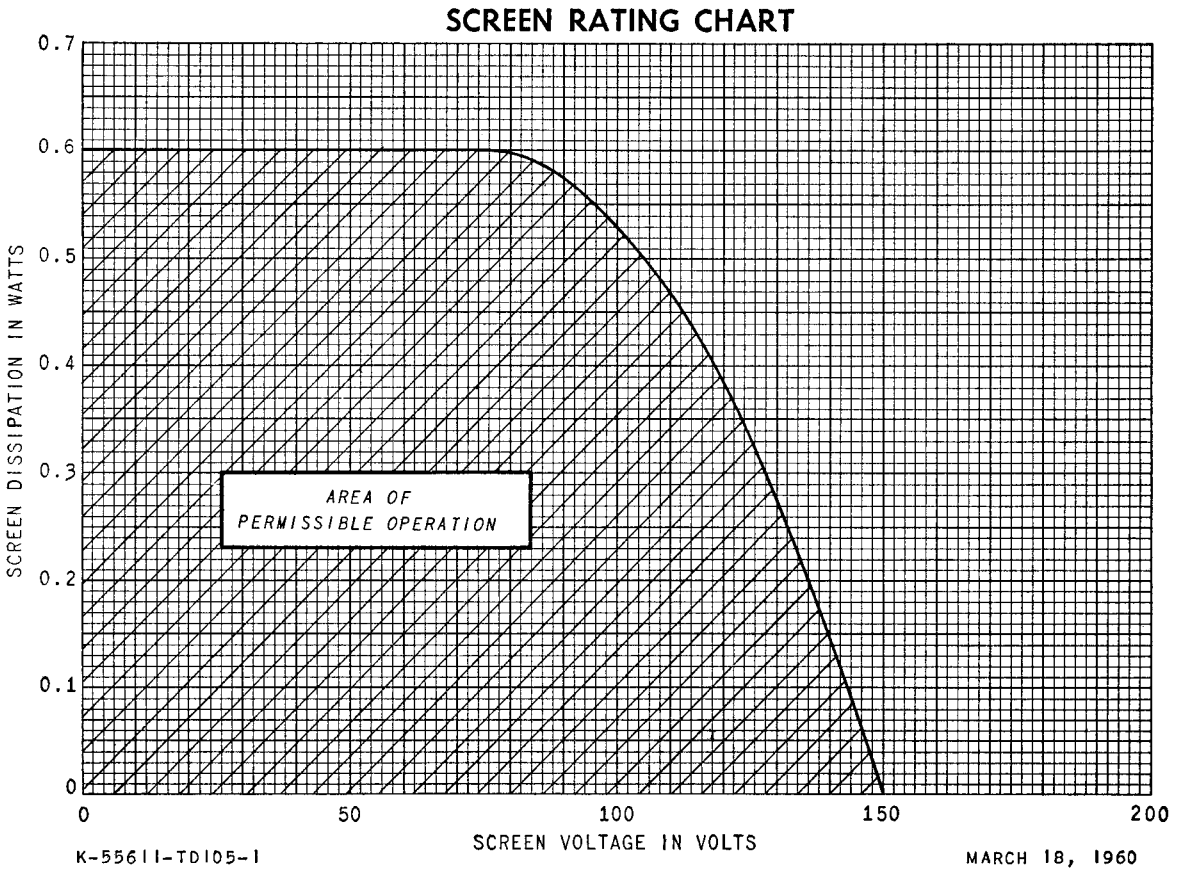
EIA, 5-2

CHARACTERISTICS AND TYPICAL OPERATION

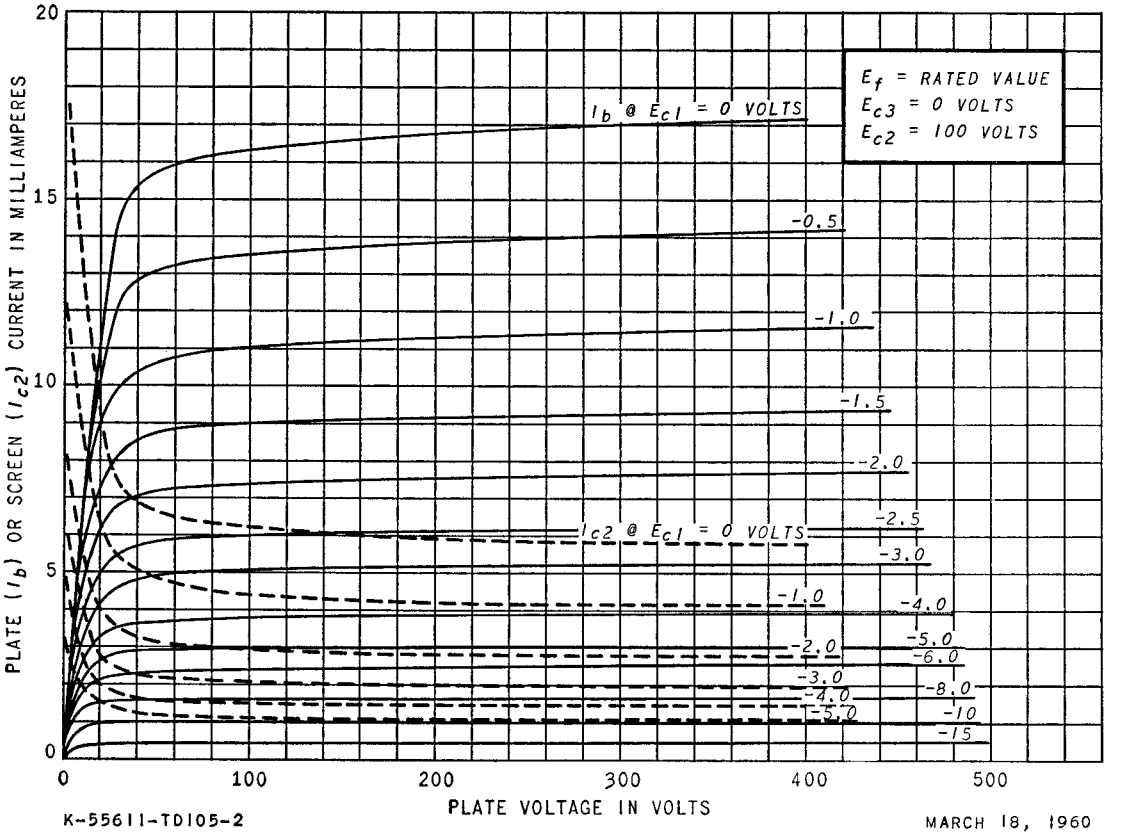
AVERAGE CHARACTERISTICS

Plate Voltage	100	Volts
Suppressor, Connected to Cathode at socket		
Screen Voltage	100	Volts
Cathode-Bias Resistor	68	Ohms
Plate Resistance, approximate	0.25	Megohms
Transconductance	4100	Micromhos
Plate Current	9.0	Milliamperes
Screen Current	3.9	Milliamperes
Grid-Number 1 Voltage, approximate		
Gm = 25 Micromhos	−20	Volts

* With external shield (EIA 316) connected to cathode.



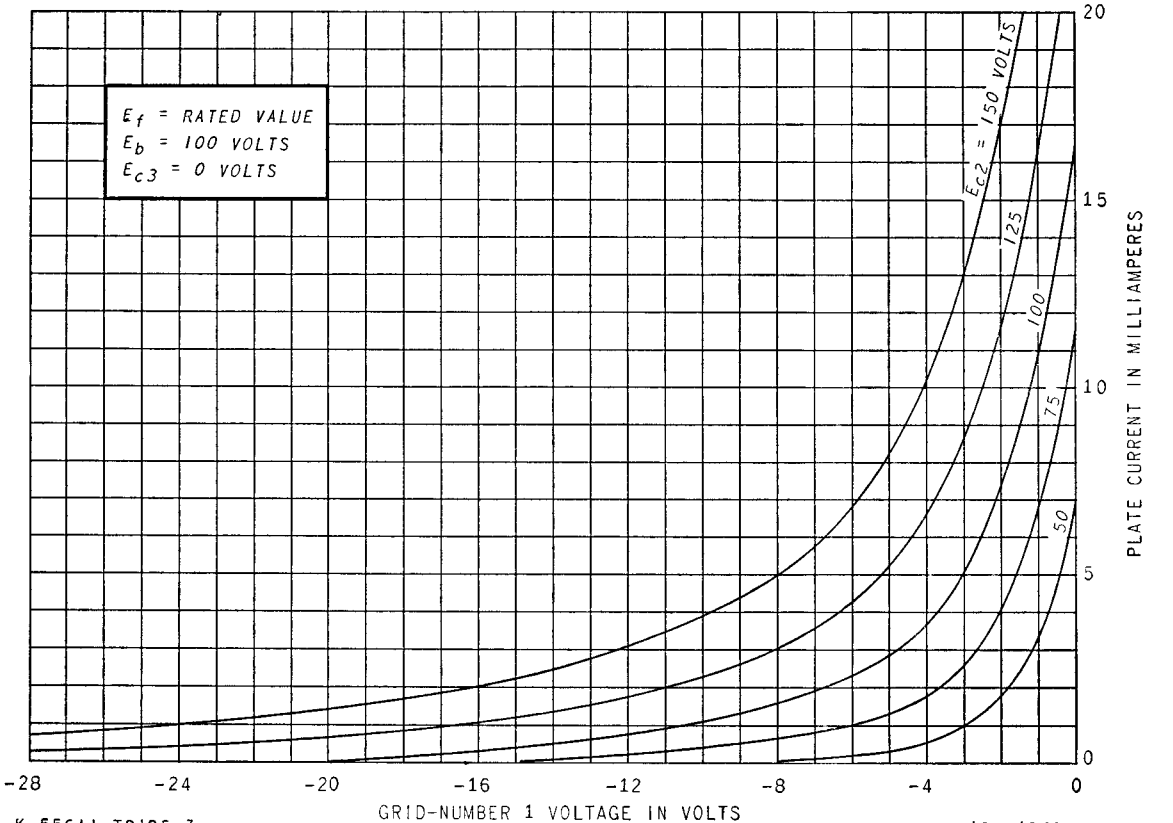
AVERAGE PLATE CHARACTERISTICS



K-55611-TD105-2

MARCH 18, 1960

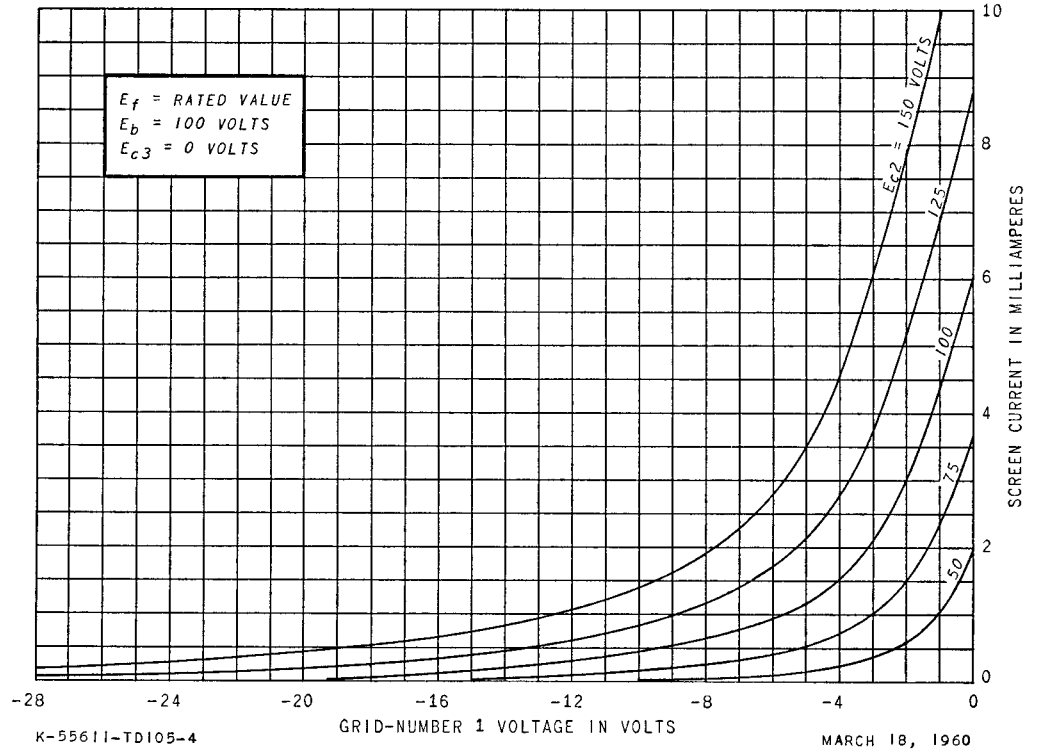
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD105-3

MARCH 18, 1960

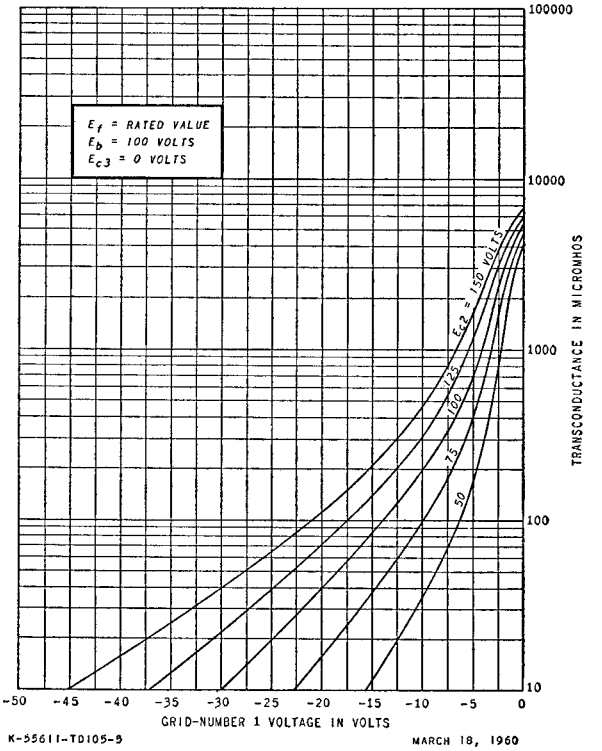
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD105-4

MARCH 18, 1960

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD105-5

MARCH 18, 1960

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

18FX6

HEPTODE

FOR PENTAGRID CONVERTER APPLICATIONS

DESCRIPTION AND RATING

The 18FX6 is a miniature heptode designed to perform the combined functions of the mixer and oscillator in line-operated superheterodyne radio receivers having 100-milliampere, series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	18 ± 10%		Volts
Heater Current		0.1	Amperes

Direct Interelectrode Capacitances	With Shield*	Without Shield	
Grid-Number 3 to Plate: (g3 to p)	0.25	0.30	μμf
Grid-Number 3 to Grid-Number 1: (g3 to g1)	0.15	0.15	μμf
RF Input: g3 to (h+k+g1+g2, 4+g5+p)	7.0	7.0	μμf
Oscillator Input: g1 to (h+k+g2, 4+g3+g5+p)	5.5	5.5	μμf
Mixer Output: p to (h+k+g1+g2, 4+g3+g5)	13	8.0	μμf
Grid-Number 1 to Cathode: (g1 to k)	3.0	3.0	μμf
Oscillator Output: k to (h+g2, 4+g3+g5+p)	20	15	μμf
Grid-Number 1 to Plate: (g1 to p)	0.05	0.10	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	150	Volts
Screen-Supply Voltage	150	Volts
Screen Voltage	110	Volts
Plate Dissipation	1.0	Watts
Screen Dissipation	1.2	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	100	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

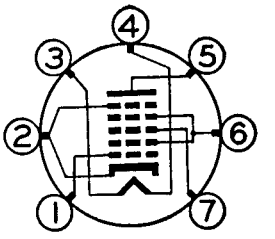
These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

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GENERAL ELECTRIC

BASING DIAGRAM

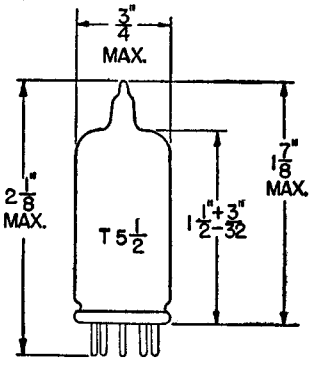


EIA 7CH

TERMINAL CONNECTIONS

Pin 1—Grid Number 1 (Oscillator Grid)
Pin 2—Cathode and Grid Number 5
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grids Number 2 and 4 (Screen)
Pin 7—Grid Number 3 (Mixer Grid)

PHYSICAL DIMENSIONS



EIA 5-2

CHARACTERISTICS AND TYPICAL OPERATION

CONVERTER SERVICE†

Plate Voltage	100	Volts
Screen Voltage	100	Volts
Grid-Number 3 Voltage	−1.5	Volts
Grid-Number 1 Resistance	20000	Ohms
Plate Resistance, approximate	0.4	Megohms
Conversion Transconductance	480	Micromhos
Plate Current	2.3	Milliamperes
Screen Current	6.2	Milliamperes
Grid-Number 1 Current	0.5	Milliamperes
Cathode Current	9.0	Milliamperes
Grid-Number 3 Voltage, approximate Gc = 10 Micromhos	−21	

OSCILLATOR CHARACTERISTICS (Not Oscillating)

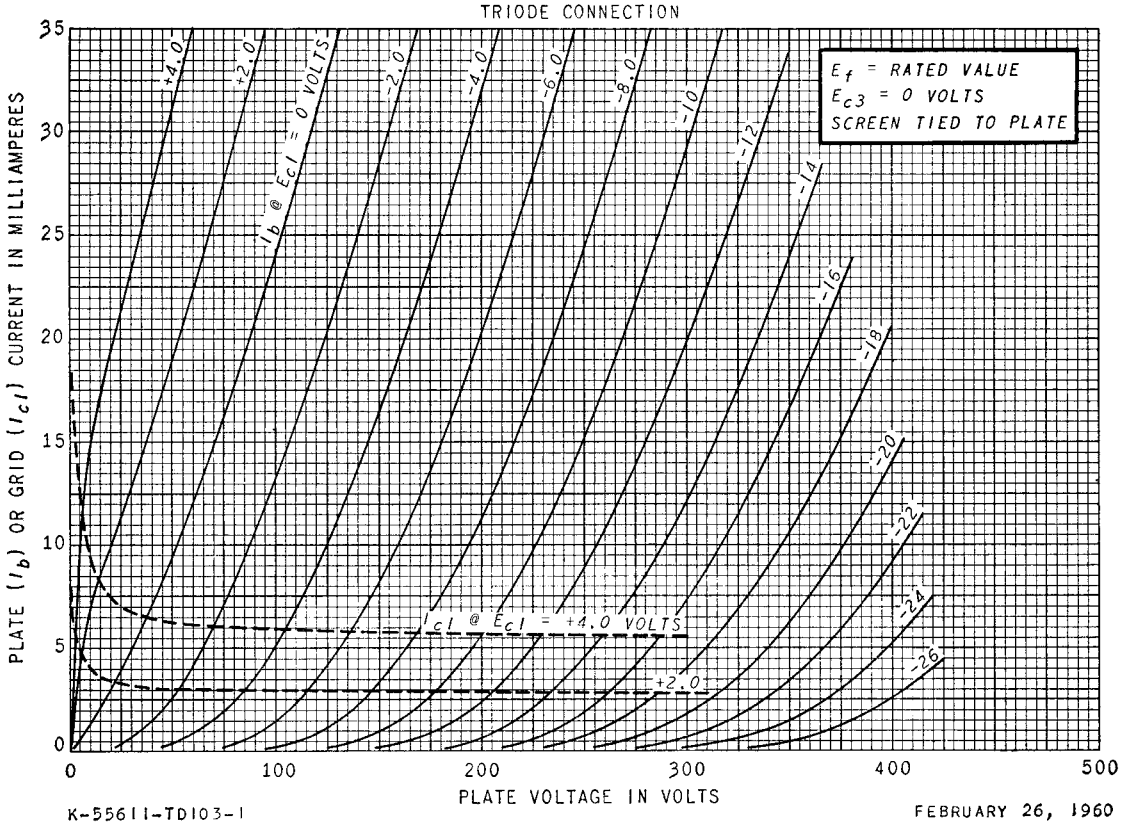
Plate Voltage	100	Volts
Screen, Connected to Plate		
Grid-Number 3 Voltage	0	Volts
Grid-Number 1 Voltage	0	Volts
Amplification Factor #	22	
Transconductance #	7000	Micromhos
Cathode Current	24	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 20 Microamperes	−9.2	Volts

* With external shield (EIA 316) connected to pin 2.

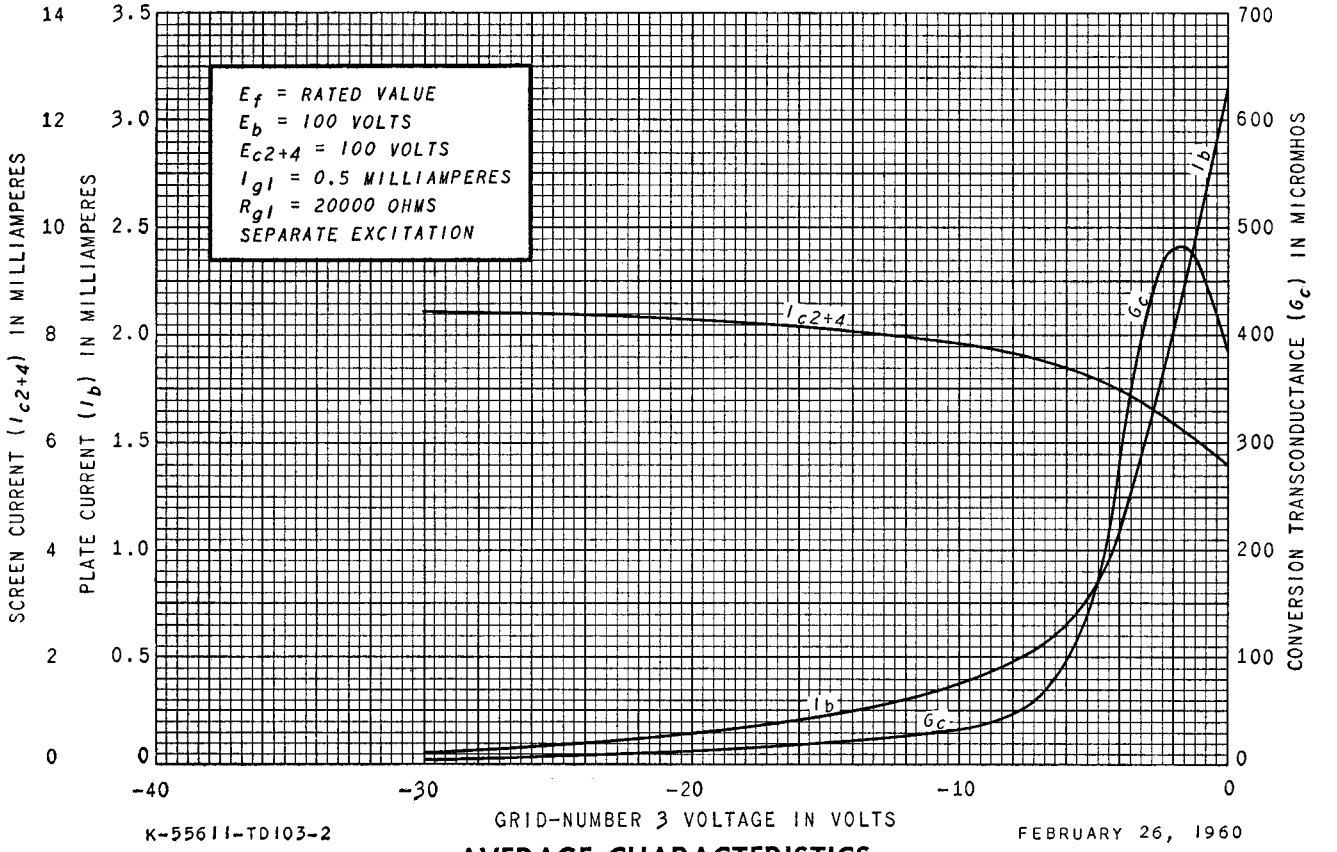
† Characteristics shown are obtained in the standard EIA conversion conductance test set which uses separable excitation. The characteristics under these conditions correspond very closely with those obtained in a self-excited oscillatory circuit operating with zero bias.

Between grid number 1 and grids number 2 and 4 connected to plate.

AVERAGE PLATE CHARACTERISTICS



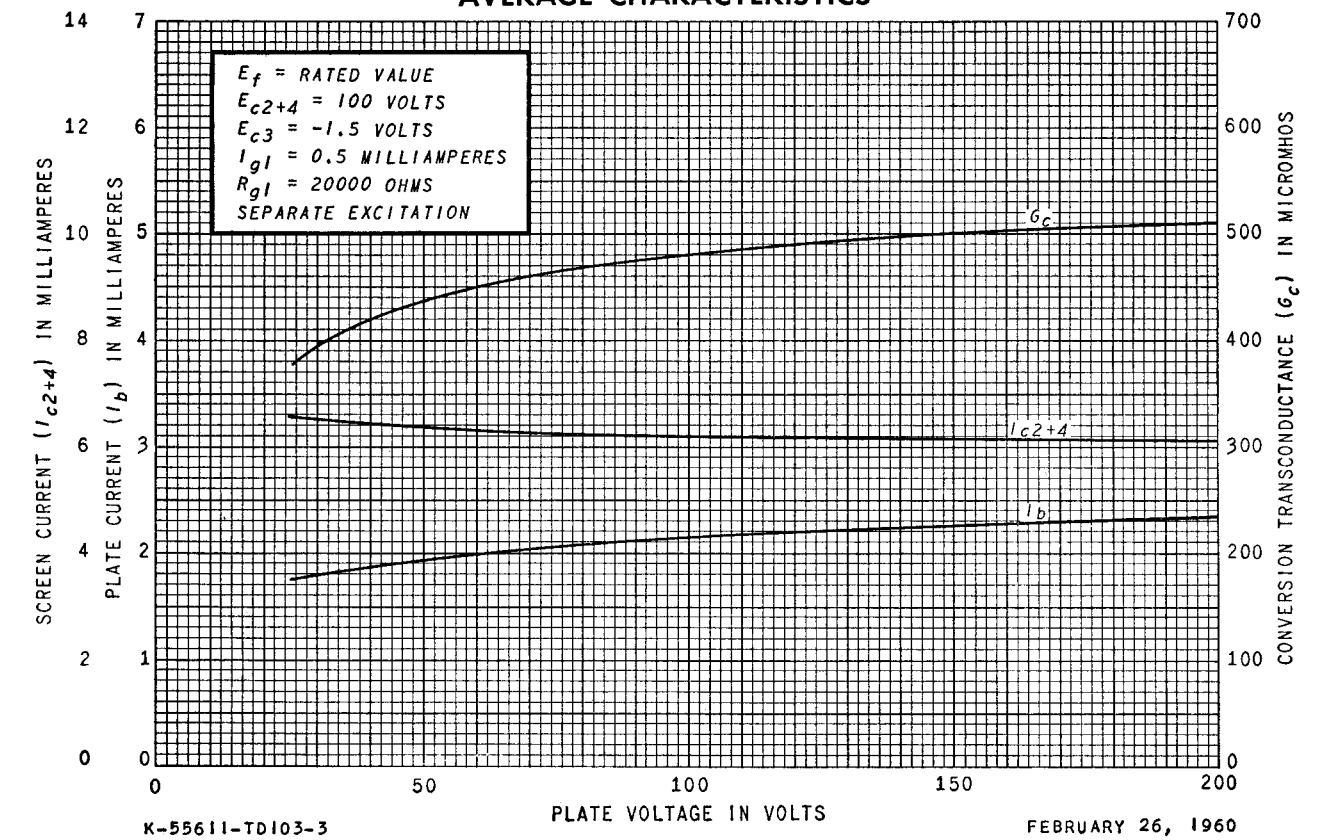
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD103-2

FEBRUARY 26, 1960

AVERAGE CHARACTERISTICS



K-55611-TD103-3

FEBRUARY 26, 1960

Electronic TUBES

19AP4-A — 19AP4-B

CATHODE-RAY TUBE

19-INCH ROUND, METAL
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
66-DEGREE DEFLECTION ANGLE

17⅜ BY 13-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
19AP4-B—FROSTED FACE

DESCRIPTION AND RATING

The 19AP4-A is a magnetic-focus and -deflection direct-view picture tube which provides a 17⅜ by 13-inch picture for television applications. Features of this tube include a lightweight metal cone envelope, a high-quality gray faceplate to increase picture contrast and detail under high ambient light conditions, and an electron gun which is designed for use with an external single-field ion-trap magnet.

The 19AP4-B has the additional feature of a frosted faceplate to prevent specular reflection.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ±10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate	66	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

19AP4-A and 19AP4-B:		
Light Transmission at Center, approximate	66	Percent
19AP4B:		
Specular Reflection of Ambient Light, Maximum	1.5	Percent

GENERAL ELECTRIC

Supersedes ETR-123, dated 2-51 and ETR-141, dated 4-52

MECHANICAL

Over-all Length	21½ ± ½	Inches
Greatest Bulb Diameter	18⅝ ± ⅛	Inches
Minimum Useful Screen Diameter	17⅜	Inches
Neck Length	7⅛	Inches

Bulb Contact—Metal Cone Lip
Base—Small-shell Duodecal 5-pin, JETEC No. B5-57
Basing, JETEC Designation—12D

Mounting Position—Any

Net Weight, approximate	16	Pounds

MAXIMUM RATINGS♦

DESIGN-CENTER VALUES*

Anode Voltage†	16,000	Max Volts DC
Grid-No. 2 Voltage	410	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	150	Max Volts
Heater Positive with Respect to Cathode	150	Max Volts

TYPICAL OPERATING CONDITIONS♦

Anode Voltage‡	14,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage§	−28 to −72	Volts DC
Focusing-Coil Currentπ, approximate	107	Milliamperes DC
Ion-Trap Field Intensity△, approximate	37	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5	Max Megohms

♦ All voltages are measured with respect to cathode.

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

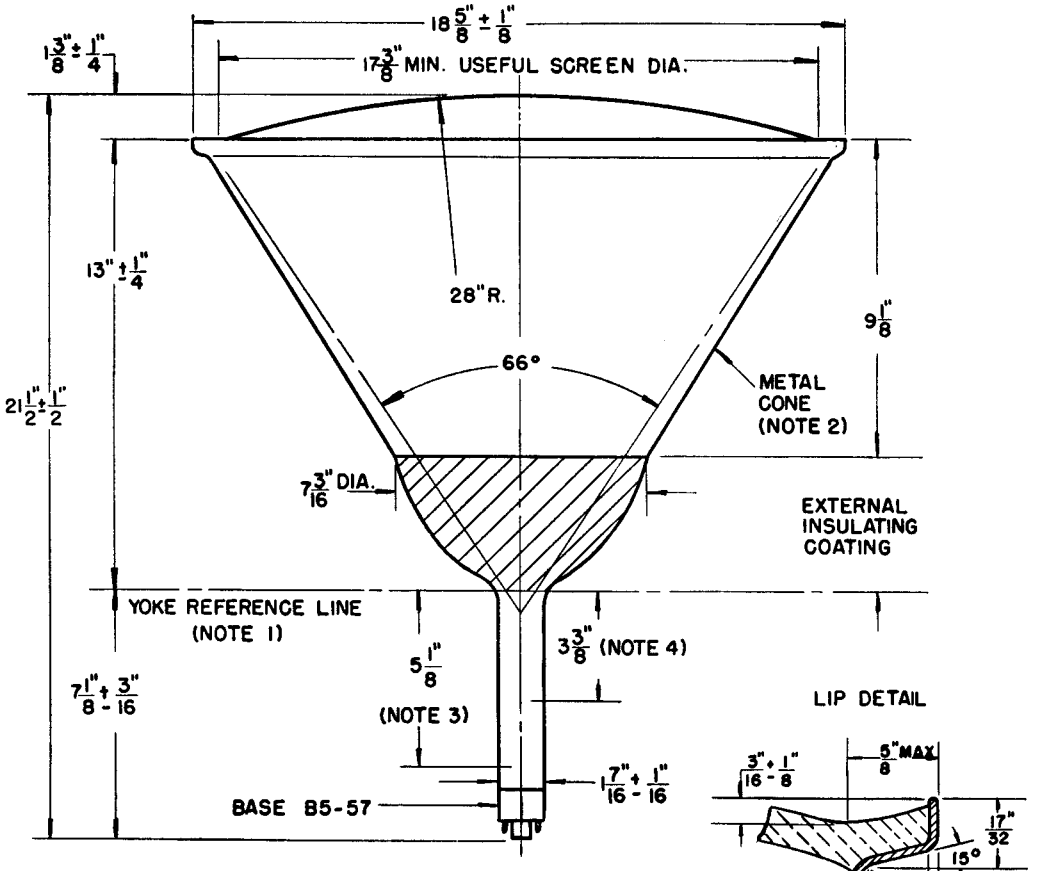
† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

‡ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.

§ For visual extinction of focused raster.

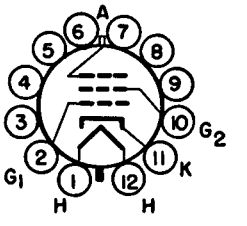
π For RETMA focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3⅜-inches.

△Single-field ion-trap magnet adjusted to optimum position, equivalent to 37 milliamperes through RETMA ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 112) WHEN THE GAGE IS RESTING ON THE CONE.
2. METAL CONE OPERATES AT HIGH VOLTAGE AND MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ANODE VOLTAGE.
3. APPROXIMATE POSITION OF ION-TRAP MAGNET.
4. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.



BASING DIAGRAM
12 D

DESCRIPTION AND RATING

19AU4-GTA Diode. Identical to the 6AU4-GTA except for heater ratings and addition of a controlled heater-warm-up characteristic. Refer to the 6AU4-GTA Description and Rating sheet for complete data.

19BG6-GA Beam Pentode. Identical to the 6BG6-GA except for heater ratings. Refer to the 6BG6-GA Description and Rating for complete data.

19CL8-A Triode-Tetrode. Identical to the 6CL8-A except for the following ratings:

Heater Voltage, AC or DC	18.9	Volts
Heater Current	0.15	Amperes
Allowable Heater Current	0.14 to 0.16	Amperes

19EA8 Triode-Pentode. Identical to the 6EA8 except for the following ratings:

Heater Voltage, AC or DC	18.9	Volts
Heater Current	0.15	Amperes
Allowable Heater Current	0.14 to 0.16	Amperes

19EZ8 Triple-Triode. Identical to the 6EZ8 except for the following ratings:

Cathode—Coated Unipotential

Heater Voltage, AC or DC	18.9 ± 10%	Volts
Heater Current	0.15	Amperes

19J6 Twin Triode. Identical to the 6J6 except for heater ratings. Refer to the 6J6 Description and Rating sheet for complete data.

19T8 Triple-Diode Triode. Identical to the 6T8 except for heater ratings. Refer to the 6T8 Description and Rating sheet for complete data.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

19BHP4
CATHODE RAY TUBE

19 INCH, RECTANGULAR, GLASS

FACE PLATE -- SPHERICAL GRAY

FOCUS -- ELECTROSTATIC

NON ION TRAP GUN

DEFLECTION -- MAGNETIC

ALUMINIZED SCREEN

114 DEGREE DEFLECTION ANGLE

EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 19BHP4 is a 19 inch electrostatic-focus and magnetic deflection glass picture tube. Outstanding features include a short over-all length, a small neck diameter and a non ion trap gun. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angle, Approximate	
Horizontal	102 degrees
Vertical	87 degrees
Diagonal	114 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes, approximate	5 uuf
Grid #1 to all other electrodes, approximate	6 uuf
External Conductor Coating to Anode	1500 max. uuf 1000 min. uuf
Heater Current at 6.3 volts	600 ± 10% ma.
Heater Warm Up Time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center Approx.	76 Percent

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC

Syracuse, N. Y.

from JEDEC release #3177, March 6, 1961

MECHANICAL DATA

Overall Length	11 3/4 ± 5/16 inches
Greatest Dimensions of Tube	
Diagonal	18 5/8 ± 1/8 inches
Width	16 13/32 ± 1/8 inches
Height	13 11/32 ± 1/8 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	17 9/16 inches
Horizontal Axis	15 1/8 inches
Vertical Axis	12 inches
Area	172 sq. inches
Neck Length	4 1/2 ± 3/16 inches
Bulb	J149-A1
Bulb Contact	JETEC No. J1-21
Base	JETEC No. B7-237 or B7-208
Basing	8HR
Bulb Contact Alignment	
Anode Contact Aligns with Rev. No. 4 ± 30 degrees	

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	22,000 volts
Minimum Anode Voltage	15,000 volts
Maximum Grid 4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid 2 Voltage	400 volts
Maximum Grid 2 Voltage	700 volts
Grid 1 Voltage	
Maximum Negative Value	140 volts DC
Maximum Negative Peak Value	200 volts
Maximum Positive Value	0 volts DC
Maximum Positive Peak Value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm up period not to exceed 15 sec.	410 volts
After equipment warm-up period	180 volts
Heater positive with respect to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode Voltage	18,500 volts DC
Grid #4 Voltage (Focusing Electrode (Notes 2 & 3)	250 volts DC
Grid #2 Voltage	450 volts DC
Grid #1 Voltage (Note 1)	-28 to -61 volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5 max. megohm
Grid No. 2 Circuit Resistance	0.1 min. megohm
Focusing Electrode Circuit Resistance	0.1 min. megohm

Protective resistance in Grid No. 2 and focusing electrical circuits is advisable to prevent damage to tube. If applicable, one resistor common to both circuits may be used.

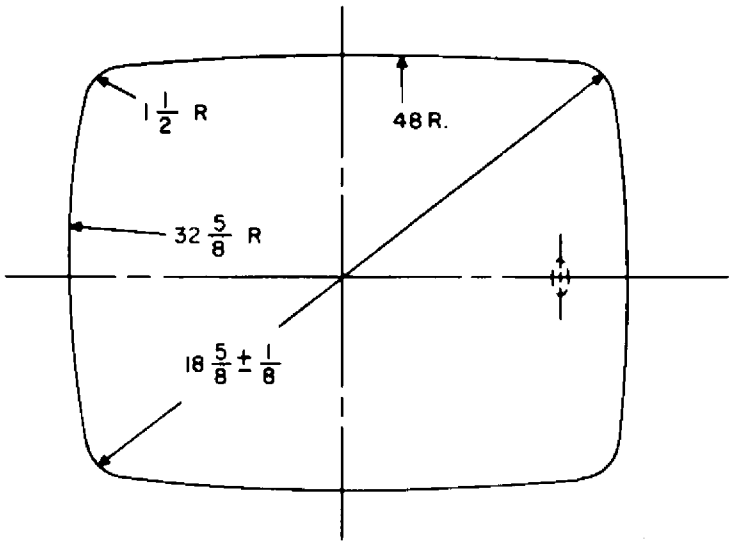
NOTES:

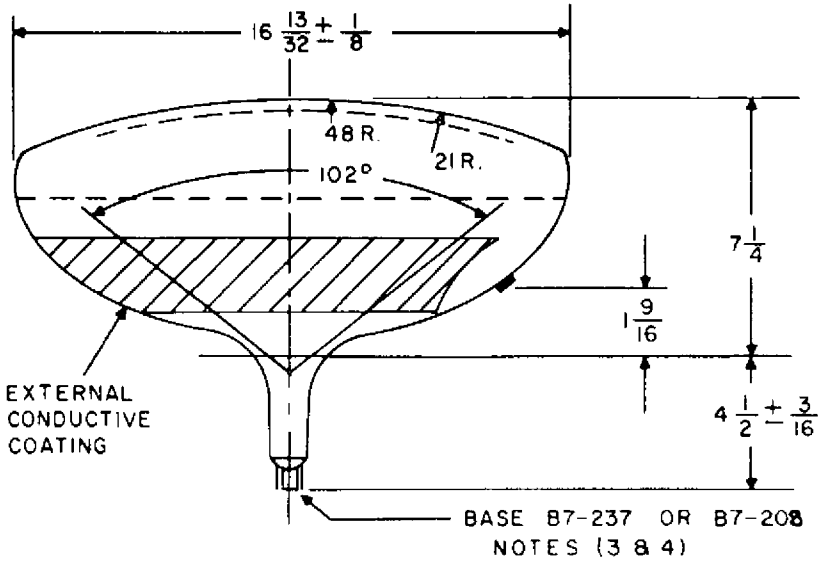
1. Visual extinction of focused raster.

2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 microamperes on a 15 1/8 x 11 15/16" pattern from RCA 2F21 monoscope or equivalent.

3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

SCREEN DIMENSIONS
DIAGONAL — 17 9/16
WIDTH — 15 1/8
HEIGHT — 12
AREA — 172 SQ. IN.







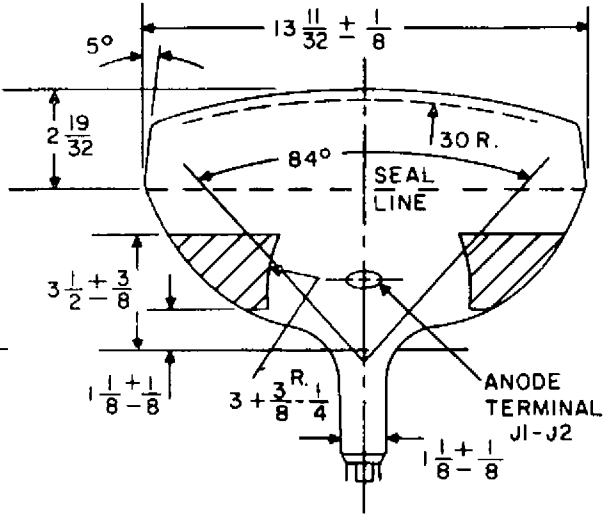


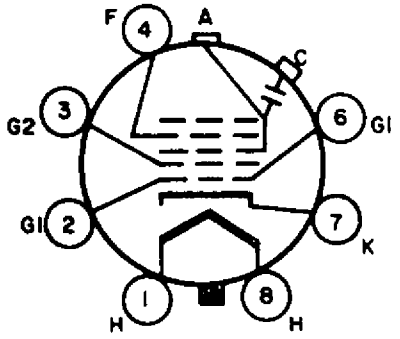
Diagram Notes

1. The reference line is determined by the intersection of the plane C-C of gage (EIA No. 126) with the glass funnel.

2. Deflection angle on the diagonal is 114°.

3. Anode terminal aligns with pin No. 4 ± 30 degrees.

4. Use a non-rigidly mounted socket with flexible leads. Bottom circumference of base wafer will fall within 1-3/4 inch diameter circle concentric with the bulb axis.



BASING DIAGRAM

8HR

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

SYRACUSE, NEW YORK

19CFP4
CATHODE RAY TUBE

19 INCH, RECTANGULAR, GLASS

FACE PLATE -- SPHERICAL GRAY

FOCUS -- ELECTROSTATIC

NON ION TRAP GUN

DEFLECTION -- MAGNETIC

ALUMINIZED SCREEN

114 DEGREE DEFLECTION ANGLE

EXTERNAL CONDUCTIVE COATING

LOW GRID NO. 2 VOLTAGE TYPE
FOR CATHODE DRIVE OPERATION

DESCRIPTION AND RATING

The 19CFP4 is a 19 inch electrostatic-focus and magnetic deflection glass picture tube, Outstanding features include a short over-all length, a small neck diameter and a non ion trap gun designed to be operated at a low Grid No. 2 voltage for cathode drive. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angle, Approximate	
Horizontal	102 degrees
Vertical	87 degrees
Diagonal	114 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes, approximate	5 μμf
Grid #1 to all other electrodes, approximate	6 μμf
External Conductive Coating to Anode	1500 max. μμf 1000 min. μμf
Heater Current at 6.3 volts	600 ± 30 ma.
Heater Warm Up Time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center Approx.	76 percent

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

from JEDEC release #3594, Feb. 12, 1962

MECHANICAL DATA

Overall Length	11 1/2 ± 1/4 inches
Greatest Dimensions of Tube	
Diagonal	18 5/8 ± 1/8 inches
Width	16 13/32 ± 1/8 inches
Height	13 11/32 ± 1/8 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	17 9/16 inches
Horizontal Axis	15 1/8 inches
Vertical Axis	12 inches
Area	172 sq. inches
Neck Length	4 1/4 ± 1/4 inches
Bulb	J149-A1
Bulb Contact	JETEC No. J1-21
Base	JETEC No. B7-237 or B7-208
Basing	8HR
Bulb Contact Alignment	
Anode Contact Aligns with Pin No. 4 ± 30 degrees	

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	17,500 volts
Minimum Anode Voltage	10,000 volts
Maximum Grid 4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid 2 Voltage	40 volts
Maximum Grid 2 Voltage	100 volts
Grid 1 Voltage	
Maximum Negative Value	140 volts DC
Maximum Negative Peak Value	200 volts
Maximum Positive Value	0 volts DC
Maximum Positive Peak Value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 sec.	410 volts
After equipment warm-up period	180 volts
Heater positive with respect to cathode	180 volts

TYPICAL OPERATING CONDITIONS (Cathode Drive Service)

Anode Voltage	13,000 volts DC
Grid #4 Voltage (Focusing Electrode, Notes 2 & 3)	250 volts DC
Grid #2 Voltage	50 volts DC
Cathode to Grid #1 Voltage (Note 1)	31 to 49 volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5 max. megohm
Grid #2 Circuit Resistance	0.1 min. megohm
Focusing Electrode Circuit Resistance	0.1 min. megohm

Protective resistance in Grid No. 2 and focusing electrical circuits is advisable to prevent damage to tube. If applicable, one resistor common to both circuits may be used.

NOTES:

1. Visual extinction of focused raster.

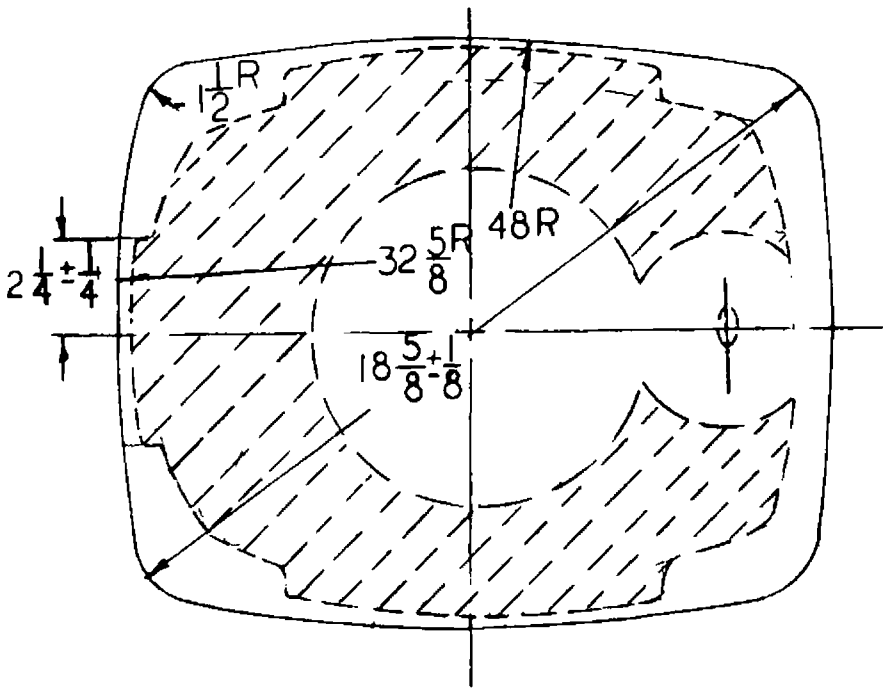
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 microamperes on a 15 1/8 x 11 15/16" pattern from RCA 2F21 monoscope or equivalent.

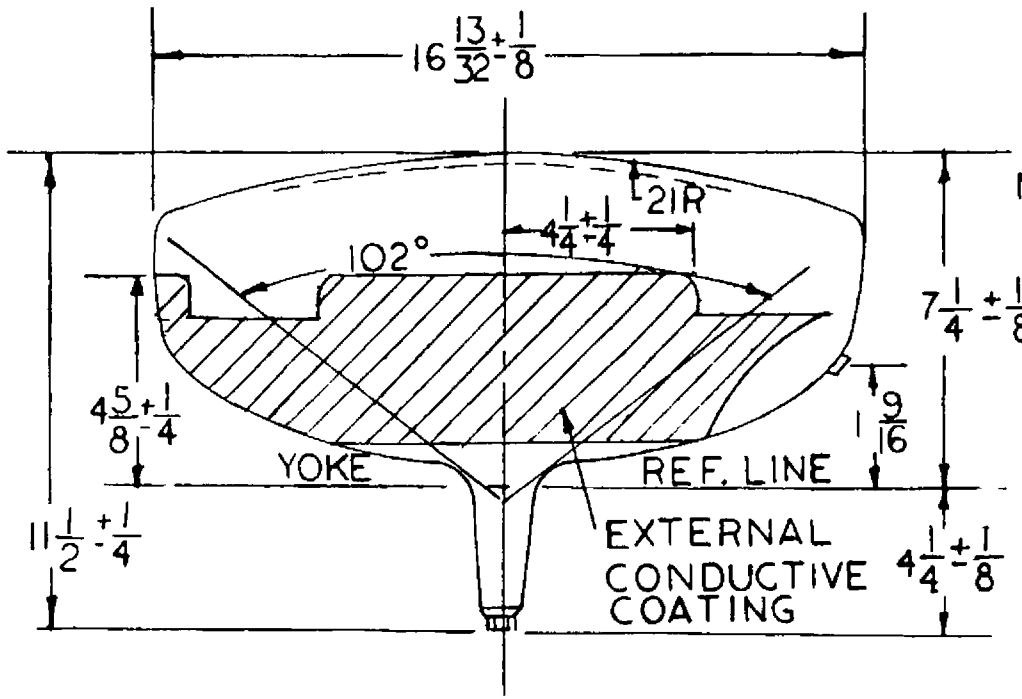
3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

19CFP4

SCREEN DIMENSIONS

DIAGONAL	17 9/16
WIDTH	15 1/8
HEIGHT	12
AREA	172 SQ.IN.





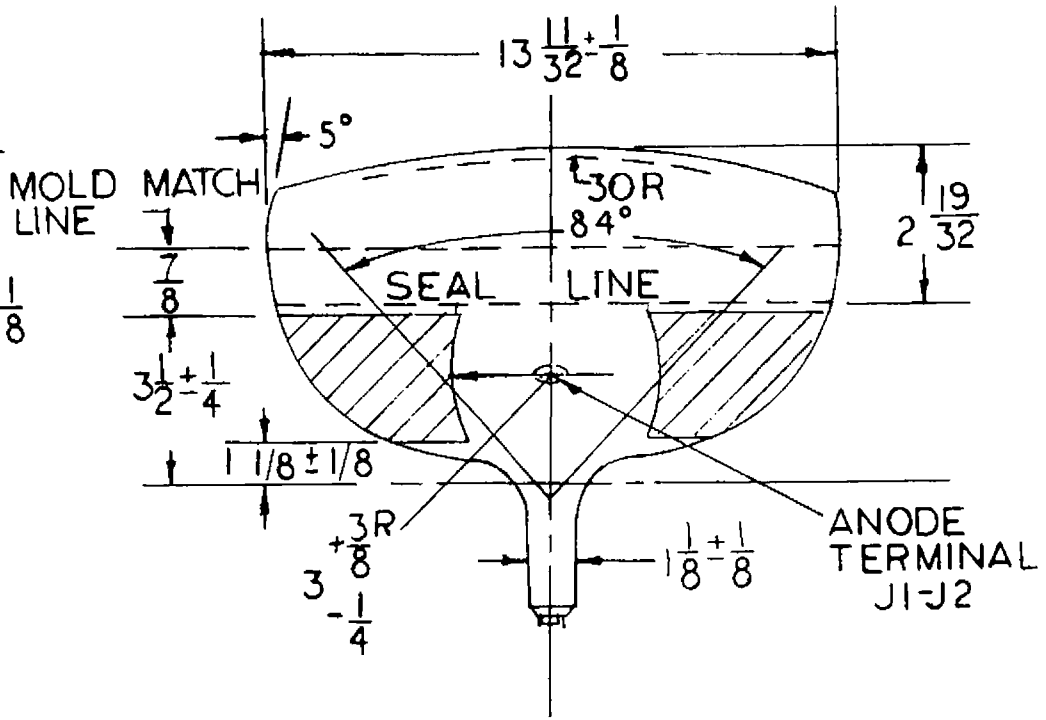


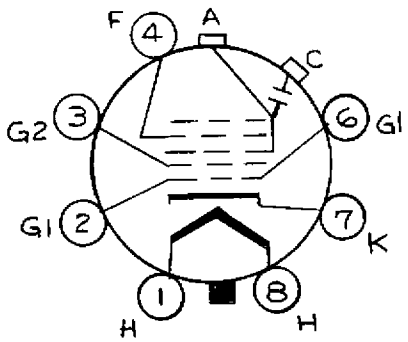
Diagram Notes

1. The reference line is determined by the intersection of the plane C-C of gage (EIA No. 126) with the glass funnel.

2. Deflection angle on the diagonal is 114°.

3. Anode terminal aligns with pin No. 4 ± 30 degrees.

4. Use a non-rigidly mounted socket with flexible leads. Bottom circumference of base wafer will fall within 1-3/4 inch diameter circle concentric with the bulb axis.



BASING DIAGRAM
8HR

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC

Syracuse, N. Y.

—PRODUCT INFORMATION—

Compactron Diode

19CG3

FOR TV DAMPING DIODE APPLICATIONS

The 19CG3 is a compactron containing a single heater-cathode type diode. It is intended for service as the damping diode in the horizontal-deflection circuit of color television receivers.

Except for heater characteristics and ratings, the 19CG3 is identical to the 6CG3.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	19	Volts
Heater Current‡	0.6±0.04	Amperes
Heater Warm-up Time, average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.6 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

19CKP4
CATHODE RAY TUBE

19 INCH, RECTANGULAR, GLASS

FACE PLATE -- SPHERICAL GRAY

FOCUS -- ELECTROSTATIC

NON ION TRAP GUN

DEFLECTION -- MAGNETIC

ALUMINIZED SCREEN

114 DEGREE DEFLECTION

EXTERNAL CONDUCTIVE COATING

LOW GRID NO. 2 VOLTAGE TYPE
FOR CATHODE-DRIVE OPERATION

DESCRIPTION AND RATING

The 19CKP4 is a 19 inch electrostatic-focus and magnetic deflection glass picture tube. Outstanding features include a short over-all length, a small neck diameter and a non ion trap gun designed for operation at a low Grid No. 2 voltage for use in cathode-drive circuits. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angle, Approximate	
Horizontal	102 degrees
Vertical	87 degrees
Diagonal	114 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes, approximate	5 μμf
Grid #1 to all other electrodes, approximate	6 μμf
External Conductive Coating to Anode	1500 max. μμf 1000 min. μμf
Heater Current at 6.3 volts	600 ± 30 ma.
Heater Warm Up Time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center (Approx.)	78 Percent

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

February 14, 1962

from JEDEC release #3653, March 26, 1962

MECHANICAL DATA

Overall Length	11 3/4 ± 1/4 inches
Greatest Dimensions of Tube	
Diagonal	18 5/8 ± 1/8 inches
Width	16 13/32 ± 1/8 inches
Height	13 11/32 ± 1/8 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	17 9/16 inches
Horizontal Axis	15 1/8 inches
Vertical Axis	12 inches
Area	172 sq. inches
Neck Length	4 1/2 ± 1/8 inches
Bulb	J149-A1
Bulb Contact	JEDEC No. J1-21
Base	JEDEC No. B7-237 or B7-208
Basing	8HR
Bulb Contact Alignment	
Anode Contact Aligns with Pin No. 4 ± 30 degrees	

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	22,000 volts
Minimum Anode Voltage	15,000 volts
Maximum Grid 4 (Focusing Electrode) voltage	-500 to +1000 volts
Minimum Grid 2 Voltage	40 volts
Maximum Grid 2 Voltage	100 volts
Grid 1 Voltage	
Maximum Negative Value	140 volts DC
Maximum Negative Peak Value	200 volts
Maximum Positive Value	0 volts DC
Maximum Positive Peak Value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 sec.	410 volts
After equipment warm-up period	300 volts
Heater positive with respect to cathode	180 volts

TYPICAL OPERATING CONDITIONS (Cathode Drive Service)

Anode Voltage	18,000 volts DC
Grid #4 Voltage (Focusing Electrode, Notes 2 & 3)	250 volts DC
Grid #2 Voltage	50 volts DC
Cathode to Grid #1 Voltage (Note 1)	31 to 49 volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5 max.	megohm
Grid #2 Circuit Resistance	0.1 min.	megohm
Focusing Electrode Circuit Resistance	0.1 min.	megohm

Protective resistance in Grid No. 2 and focusing electrical circuits is advisable to prevent damage to tube. If applicable, one resistor common to both circuits may be used.

NOTES:

1. Visual extinction of focused raster.

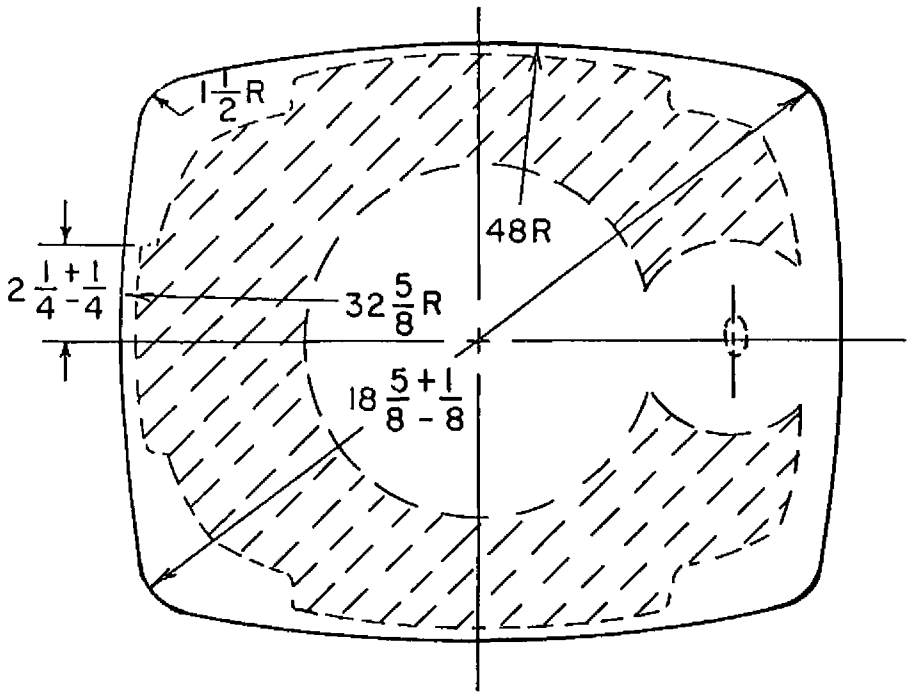
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 microamperes on a 15 1/8 x 11 15/16" pattern from RCA 2F21 monoscope or equivalent.

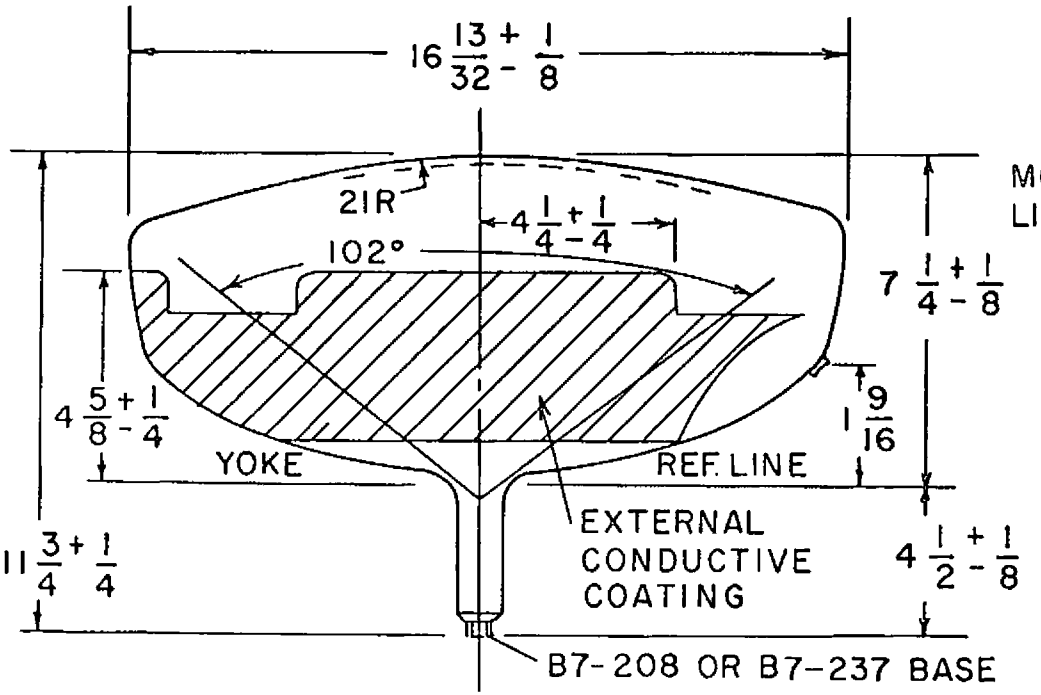
3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

19CKP4

SCREEN DIMENSIONS

DIAGONAL — 17 9/16
WIDTH — 15 1/8
HEIGHT — 12
AREA — 172 SQ.IN.





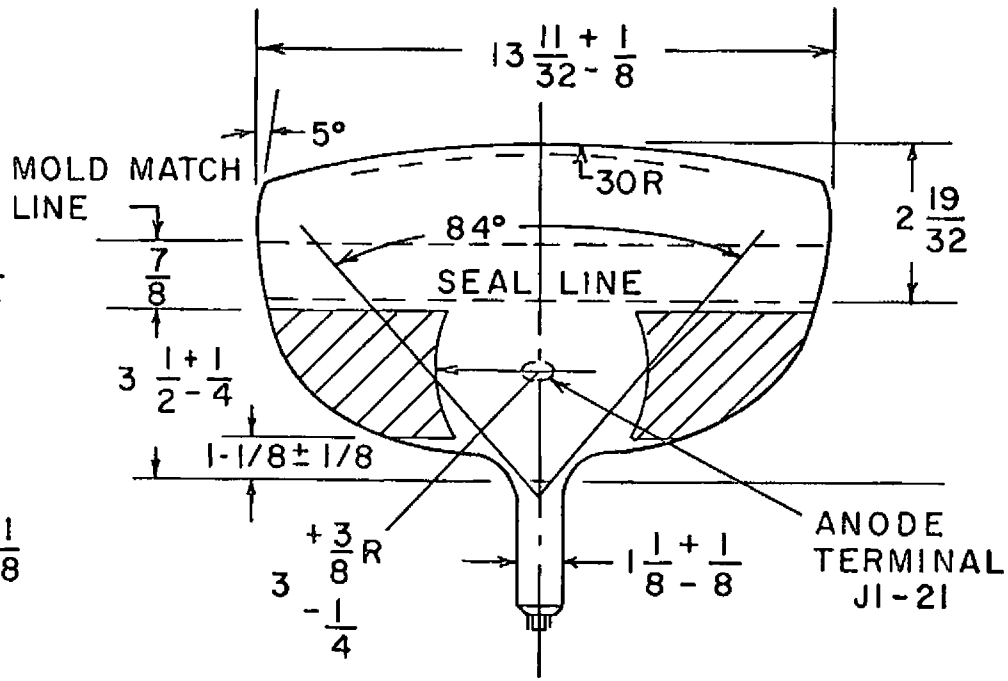


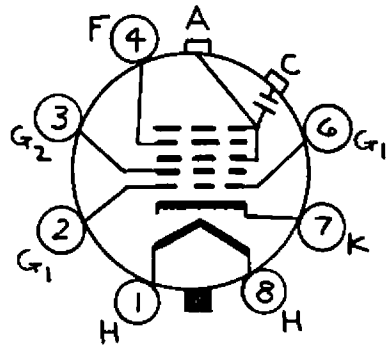
Diagram Notes

1. The reference line is determined by the intersection of the plane C-C of gage (EIA No. 126) with the glass funnel.

2. Deflection angle on the diagonal is 114°.

3. Anode terminal aligns with pin No. 4 ± 30 degrees.

4. Use a non-rigidly mounted socket with flexible leads. Bottom circumference of base wafer will fall within 1-3/4 inch diameter circle concentric with the bulb axis.



BASING DIAGRAM
8HR

—PRODUCT INFORMATION—

Compactron Diode

19DE3

FOR TV DAMPING DIODE APPLICATIONS

- COLOR TV TYPE
- LOW TUBE DROP
- DIFFUSION BONDED CATHODE
- 5000 VOLTS DC
- 350 MILLIAMPERES DC

The 19DE3 is a compactron containing a single heater-cathode type diode. It is intended for service as the damping diode in the horizontal deflection circuit of color television receivers.

The diffusion bonded cathode practically eliminates one of the major failure mechanisms in damping diodes, which is plate-to-cathode arcing caused by emissive particles being pulled from the cathode by the high electrostatic field.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	19	Volts
Heater Current■	0.6 ± 0.04	Amperes
Heater Warm-up Time, average♦	11	Seconds
Direct Interelectrode Capacitances, approximate▲		
Cathode to Plate and Heater: k to (p + h)	21	pf
Plate to Cathode and Heater: p to (k + h)	13	pf
Heater to Cathode: (h to k)	1.7	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Top Cap - C1-1, Small
Outline Drawing - EIA 9-101

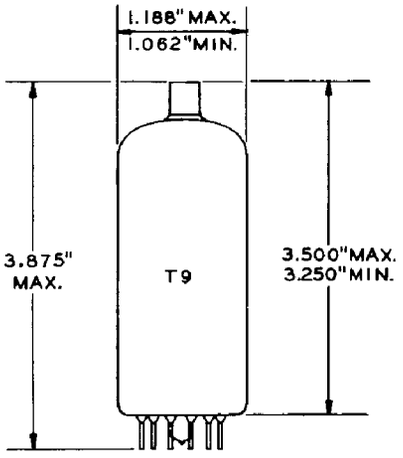
Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.875	Inches
Maximum Seated Height	3.500	Inches
Minimum Seated Height	3.250	Inches

MAXIMUM RATINGS

TV DAMPER SERVICE□—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	5000	Volts
Plate Dissipation	9.0	Watts
Steady-State Peak Plate Current	1050	Milliamperes
DC Output Current	350	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with respect to Cathode		
DC Component	900	Volts
Total DC and Peak	5000	Volts

PHYSICAL DIMENSIONS

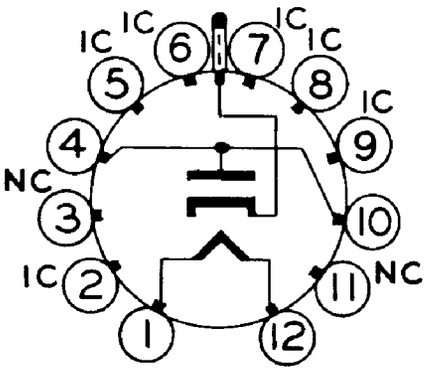


EIA 9-101

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Internal Connection - Do Not Use
Pin 3 - No Connection
Pin 4 - Plate
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Internal Connection - Do Not Use
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Plate
Pin 11 - No Connection
Pin 12 - Heater
Cap - Cathode

BASING DIAGRAM



EIA 12HX

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop, approximate
Ib = 700 Milliamperes DC.....25 Volts

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

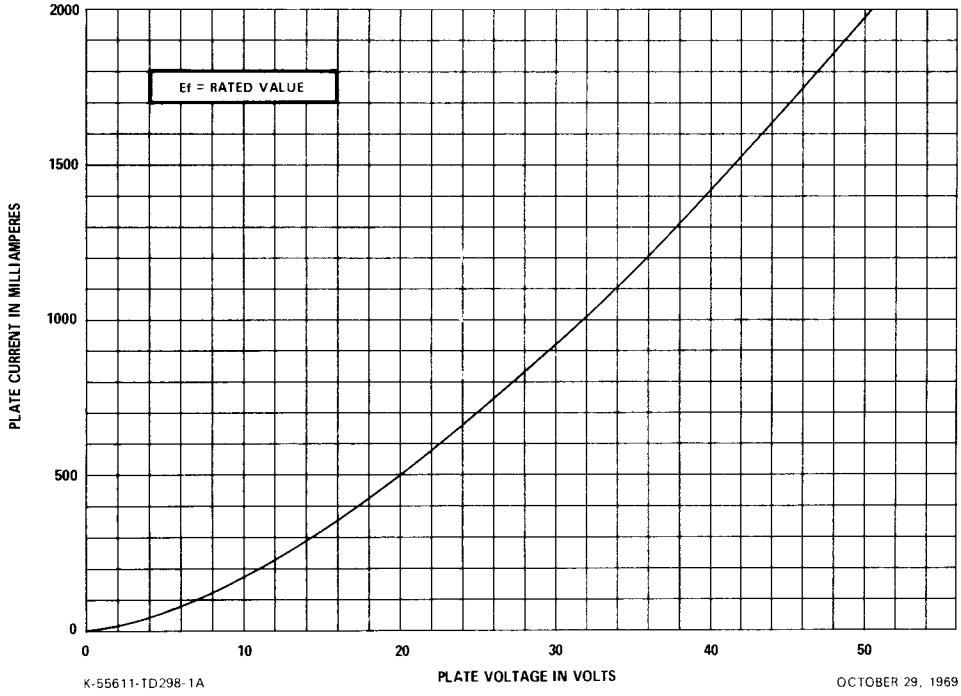
■ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

▲ Without external shield.

□ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

19DEP4

CATHODE RAY TUBE

19 INCH, RECTANGULAR, GLASS	FACE PLATE -- SPHERICAL GRAY
FOCUS -- ELECTROSTATIC	NON ION TRAP GUN
DEFLECTION -- MAGNETIC	ALUMINIZED SCREEN
114 DEGREE DEFLECTION	EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 19DEP4 is a 19 inch electrostatic-focus and magnetic deflection glass picture tube. Outstanding features include a short over-all length, a small neck diameter and a non ion trap gun. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded. Except for higher grid no. 2 and cut-off voltages the 19DEP4 is identical to the 19CKP4.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angle, Approximate	
Horizontal	102 degrees
Vertical	87 degrees
Diagonal	114 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes, approximate	5 uuf
Grid #1 to all other electrodes, approximate	6 uuf
External Conductive Coating to Anode	1500 max. uuf 1000 min. uuf
Heater Current at 6.3 volts	600 ± 30 ma.
Heater Warm Up Time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center (Approx.)	78 Percent

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC

Syracuse, N. Y.

from JEDEC release #4302, June 17, 1963

MECHANICAL DATA

Overall Length	11 7/8 ± 1/4 inches
Greatest Dimensions of Tube	
Diagonal	18 5/8 ± 1/8 inches
Width	16 13/32 ± 1/8 inches
Height	13 11/32 ± 1/8 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	17 9/16 inches
Horizontal Axis	15 1/8 inches
Vertical Axis	12 inches
Area	172 sq. inches
Neck Length	4 5/8 ± 1/8 inches
Bulb	J149-A1
Bulb Contact	JEDEC No. J1-21
Base	JEDEC No. B7-237 or B7-208
Basing	8HR
Bulb Contact Alignment	
Anode Contact Aligns with Pin No. 4 ± 30 degrees	

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	22,000 volts
Minimum Anode Voltage	15,000 volts
Maximum Grid 4 (Focusing Electrode) voltage	-500 to +1000 volts
Minimum Grid 2 Voltage	100 volts
Maximum Grid 2 Voltage	500 volts
Grid 1 Voltage	
Maximum Negative Value	140 volts DC
Maximum Negative Peak Value	200 volts
Maximum Positive Value	0 volts DC
Maximum Positive Peak Value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 sec.	410 volts
After equipment warm-up period	300 volts
Heater positive with respect to cathode	180 volts

TYPICAL OPERATING CONDITIONS (Cathode Drive Service)

Anode Voltage	18,000 volts DC
Grid #4 Voltage (Focusing Electrode, Notes 2 & 3)	250 volts DC
Grid #2 Voltage	300 volts DC
Cathode to Grid #1 Voltage (Note 1)	36 to 54 volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5 max.	megohm
Grid #2 Circuit Resistance	0.1 min.	megohm
Focusing Electrode Circuit Resistance	0.1 min.	megohm

Protective resistance in Grid No. 2 and focusing electrical circuits is advisable to prevent damage to tube. If applicable, one resistor common to both circuits may be used.

NOTES:

1. Visual extinction of focused raster.

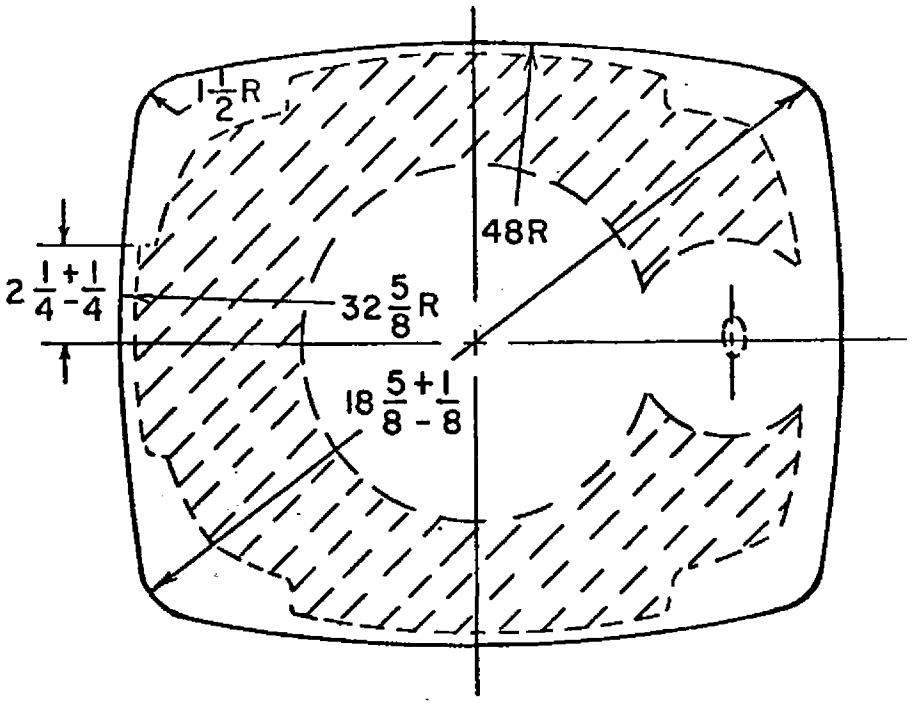
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 microamperes on a 15 1/8 x 11 15/16" pattern from RCA 2F21 monoscope or equivalent.

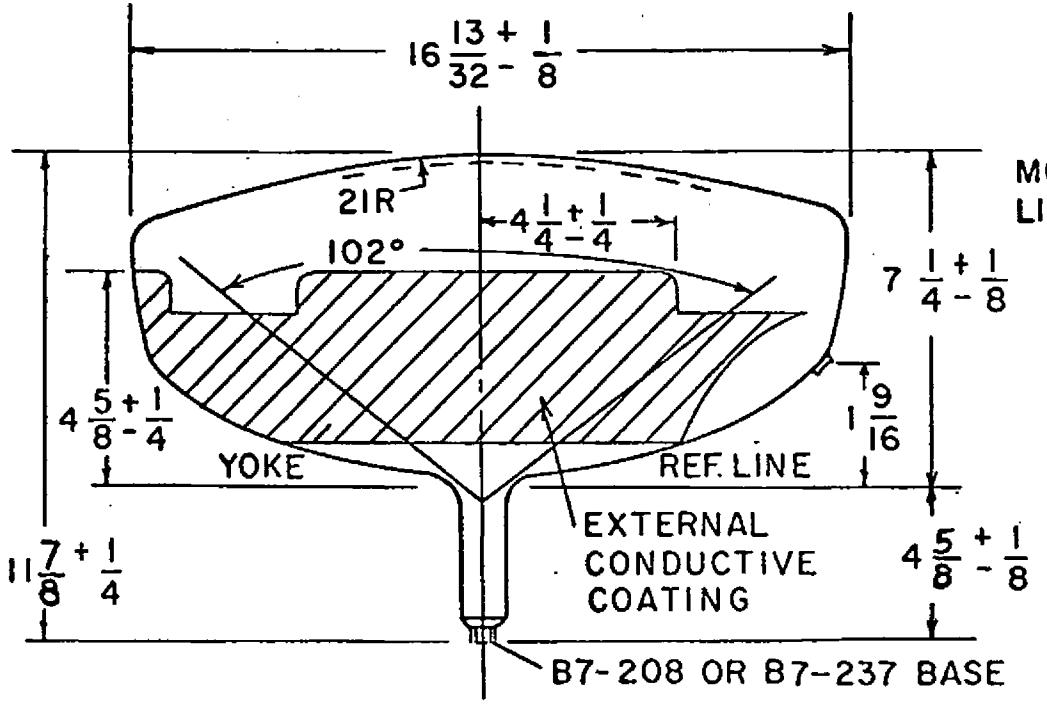
3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

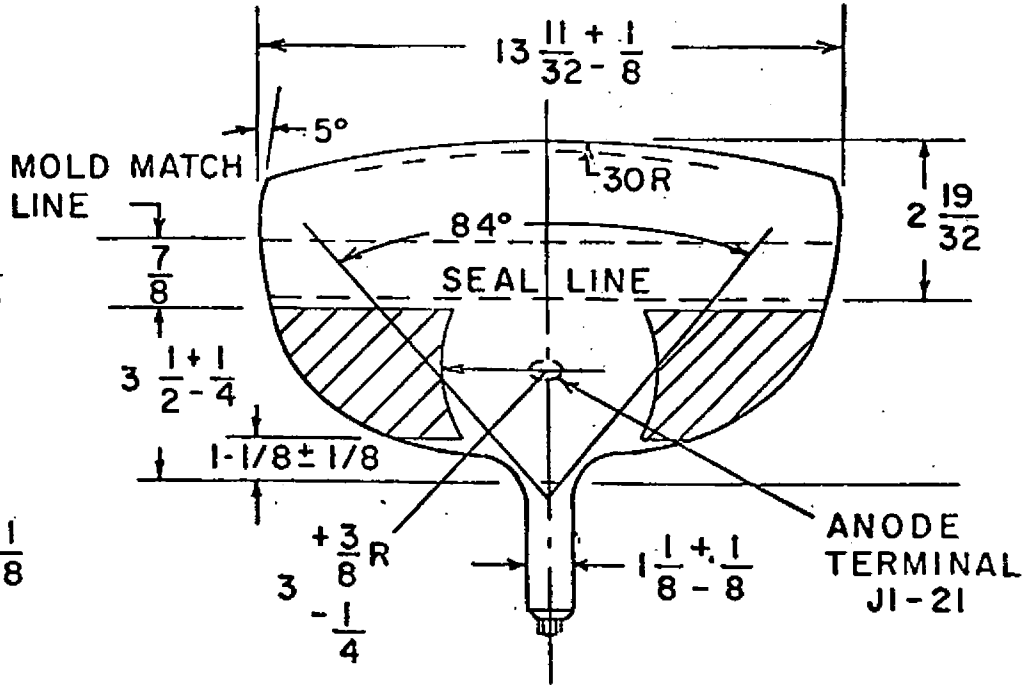
19DEP4

SCREEN DIMENSIONS

DIAGONAL — 17 9/16
WIDTH — 15 1/8
HEIGHT — 12
AREA — 172 SQ.IN.







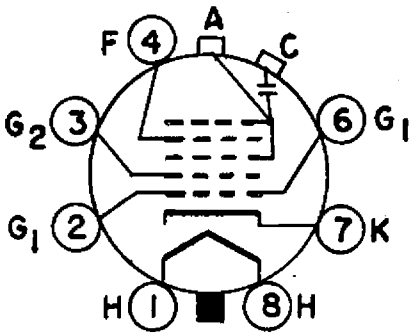
OUTLINE NOTES

1. The reference line is determined by the intersection of the plane C-C of gage (EIA No. 126) with the glass funnel.

2. Deflection angle on the diagonal is 114°.

3. Anode terminal aligns with pin no. 4 ±30 degrees.

4. Use a non-rigidly mounted socket with flexible leads. Bottom circumference of base wafer will fall within 1-3/4 inch diameter circle concentric with the bulb axis.



BASING DIAGRAM
8 HR

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Diode

19DK3

FOR TV DAMPING DIODE APPLICATIONS

- COLOR TV TYPE
- LOW TUBE DROP
- 6,500 VOLTS DC AND PEAK
- 400 MILLIAMPERES DC

The 19DK3 is a heater–cathode type diode intended for service as the damping diode in the horizontal–deflection circuit of color television receivers. It utilizes a unique heater–cathode insulating system making possible a rating of 6,500 volts peak. The 19DK3 also features a top cap connection to the cathode, a T–9 bulb and a 9–pin glass button base with a 0.687–inch pin circle.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	19	Volts
Heater Current ●	0.6±0.04	Amperes
Heater Warm-up Time, average ▲	11	Seconds
Direct Interelectrode Capacitances, approximate ♦		
Cathode to Plate and Heater: k to (p+h)	22	pf
Plate to Cathode and Heater: p to (k+h)	13.6	pf
Heater to Cathode: (h to k)	1.10	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E9-89, Button 9-Pin
Top Cap - C1-2, Skirted Miniature
Outline Drawing - EIA 9-117

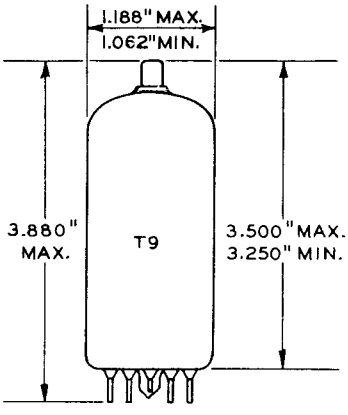
Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.880	Inches
Maximum Seated Height	3.500	Inches
Minimum Seated Height	3.250	Inches

MAXIMUM RATINGS

TV DAMPER SERVICE § —DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	6,500	Volts
Plate Dissipation	9.0	Watts
Steady-State Peak Plate Current	1,200	Milliamperes
DC Output Current	400	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	900	Volts
Total DC and Peak	6,500	Volts
Bulb Temperature □	220	°C

PHYSICAL DIMENSIONS

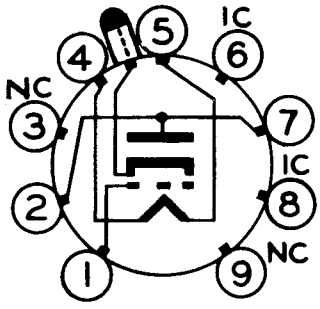


EIA 9-117

TERMINAL CONNECTIONS ⊕

Pin 1 - Heater Insulation Coil
Pin 2 - Plate
Pin 3 - No Connection
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Plate
Pin 8 - Internal Connection - Do Not Use
⊕ Pin 9 - No Connection
Cap - Cathode

BASING DIAGRAM



EIA 9SG

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 400 Milliamperes	16	Volts
Ib = 800 Milliamperes	25	Volts

NOTES

★ Heater voltage for a bogey tube at If = 0.6 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

▲ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

♦ Without external shield.

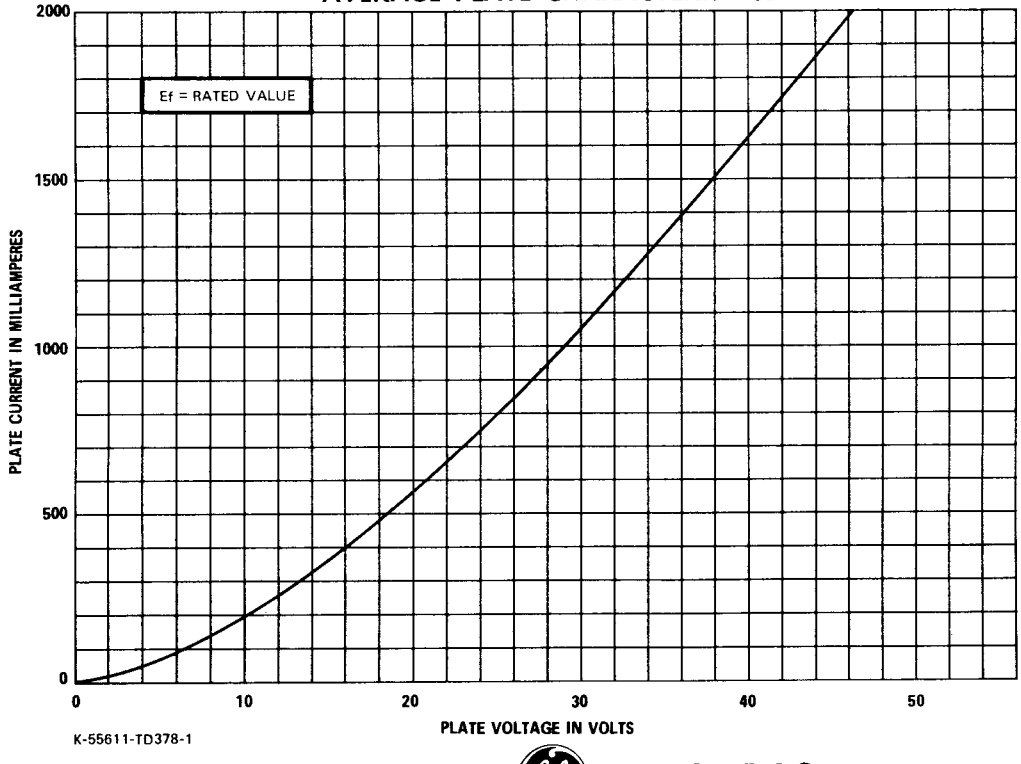
§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

□ Measured with an infrared thermometer, Ircon Model 700 BC or equivalent

⊕ May be used as tie point for components at or near heater potential

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



K-55611-TD378-1

GENERAL ELECTRIC

TUBE PRODUCTS DEPARTMENT
OWENSBORO, KENTUCKY 42301

from JEDEC release #3172, March 6, 1961

19HV8

TRIODE—PENTODE

The 19HV8 is a miniature triode-pentode designed for use in radio receivers employing 150-milliampere, series-connected heaters. The pentode section is intended to serve as an intermediate-frequency amplifier and the triode as an audio-frequency voltage amplifier.

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings (Design-Maximum Rating System)			
Heater Voltage, AC or DC*		18.9	Volts
Heater Current+		0.15±0.009	Amperes
	With Shield‡	Without Shield	
→ Pentode Section			
Grid-Number 1 to Plate: (Pg1 to Pp)	0.007	0.019	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.)	5.5	5.5	pf
Output: Pp to (h + Pk + Pg2 + Pg3 + i.s.)	3.4	2.4	pf
Heater to Cathode: (Pk to h)	2.8§	2.8	pf
→ Triode Section			
Grid to Plate: (Tg to Tp)	0.09	0.09	pf
Input: Tg to (Tk + h + Pk + Pg3 + i.s.)	1.9	1.7	pf
Output: Tp to (Tk + h + Pk + Pg3 + i.s.)	1.4	0.38	pf
Heater to Cathode: (Tk to h)	2.8§	2.8	pf

Mechanical

Mounting Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

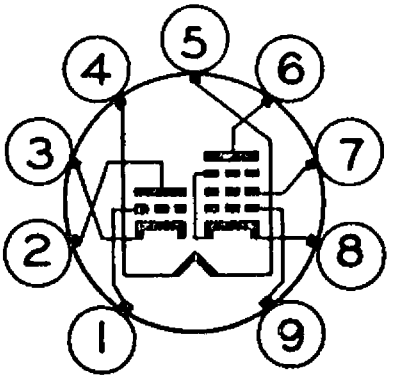
Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 3/16	Inches
Maximum Seated Height	1 15/16	Inches

ETR-2186

TERMINAL CONNECTIONS

Pin 1 - Triode Grid
Pin 2 - Triode Plate
Pin 3 - Triode Cathode
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Plate
Pin 7 - Pentode Grid Number 2 (Screen)
Pin 8 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 9 - Pentode Grid Number 1

BASING DIAGRAM



EIA 9FA

MAXIMUM RATINGS

Design-Maximum Values

	Pentode Section	Triode Section	
Plate Voltage	330	330	Volts
Screen Supply Voltage	330	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.0	0.55	Watts
Screen Dissipation	0.55	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
→ Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.25	0.5	Megohms
With Cathode Bias	1.0	1.0	Megohms

Design-maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions. The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics	Pentode Section	Triode Section	
Plate Voltage	125	100	Volts
Screen Voltage	125	---	Volts
Grid-Number 1 Voltage	-1.0	-1.0	Volts
Amplification Factor	---	70	
Plate Resistance, approximate	200000	54000	Ohms
Transconductance	6500	1300	Micromhos
Plate Current	12	0.8	Milliamperes
Screen Current	4.0	---	Milliamperes
→ Grid-Number 1 Voltage, approximate Ib = 50 Microamperes	---	-1.5	Volts
Grid-Number 1 Voltage, approximate Ib = 20 Microamperes	-9	---	Volts

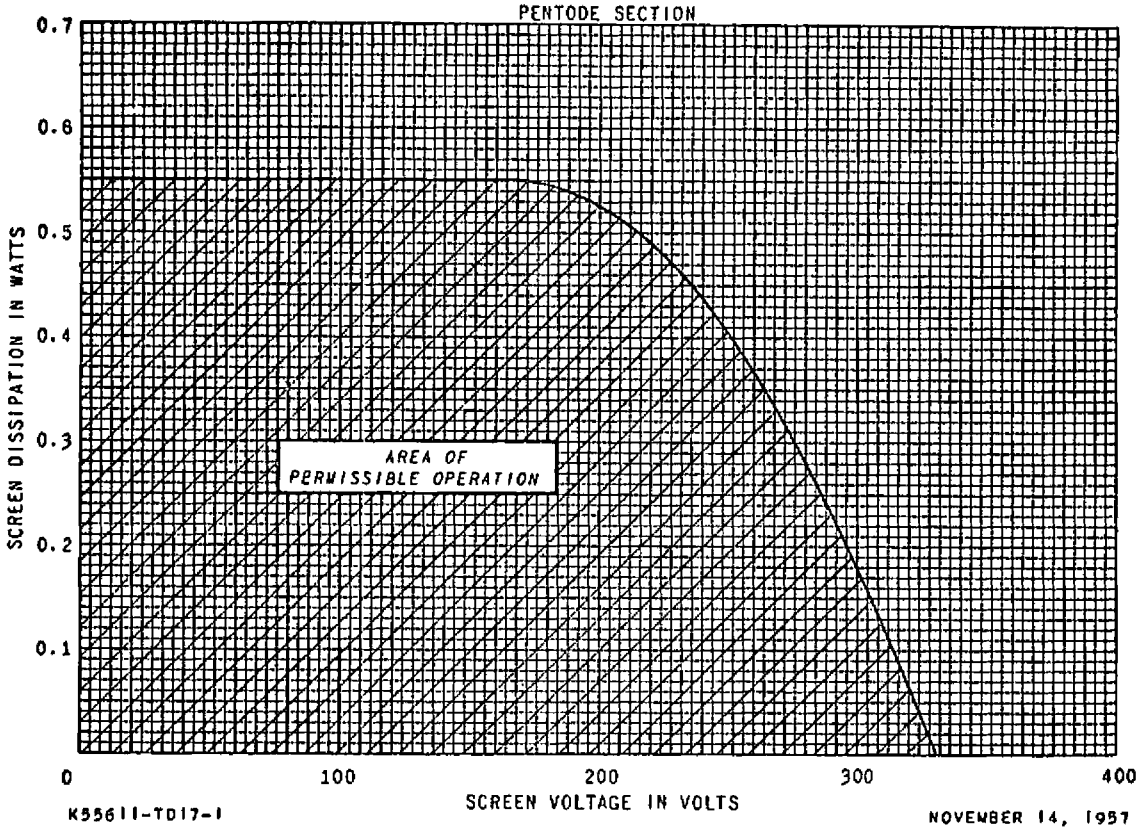
* Heater voltage at bogey heater current.

\+ For series heater operation, the equipment designer shall design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

‡ With external shield (EIA 315) connected to cathode of section under test unless otherwise indicated.

§ With external shield (EIA 315) connected to ground.

SCREEN RATING CHART



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19JN8

TRIODE-PENTODE

DESCRIPTION AND RATING

The 19JN8 is a miniature tube containing a sharp-cutoff pentode and a medium-mu triode.

GENERAL

ELECTRICAL

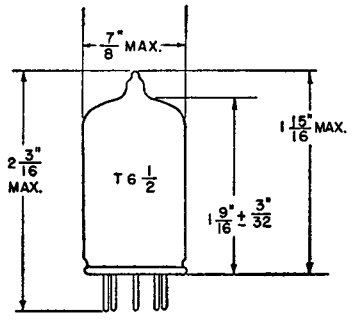
Cathode—Coated Unipotential		
Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	18.9	Volts
Heater Current†	0.15 ± 0.01	Amperes
Direct Interelectrode Capacitances‡		
Pentode Section		
Grid-Number 1 to Plate, maximum:		
(g1 to p)	0.01	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.)	5.5	pf
Output: Pp to (h + Pk + Pg2 + Pg3 + i.s.)	3.4	pf
Triode Section		
Grid to Plate: (g to p)	1.7	pf
Input: g to (h + Tk + Pk + Pg3 + i.s.)	3.2	pf
Output: p to (h + Tk + Pk + Pg3 + i.s.)	2.2	pf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin
Outline Drawing—EIA 6-2

Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 3/16	Inches
Maximum Seated Height	1 15/16	Inches

PHYSICAL DIMENSIONS

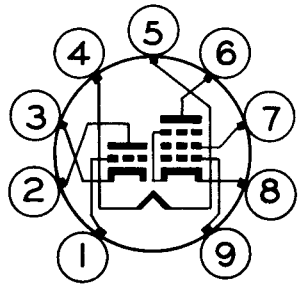


EIA 6-2

TERMINAL CONNECTIONS

Pin 1—Triode Grid
Pin 2—Triode Plate
Pin 3—Triode Cathode
Pin 4—Heater
Pin 5—Heater
Pin 6—Pentode Plate
Pin 7—Pentode Grid Number 2 (Screen)
Pin 8—Pentode Cathode, Grid Number 3, and Internal Shield
Pin 9—Pentode Grid Number 1

BASING DIAGRAM



EIA 9FA

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Section	Triode Section	
Plate Voltage	300	300	Volts
Screen Supply Voltage	300	...	Volts
Screen Voltage—See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	2.5	2.5	Watts
Screen Dissipation	0.55	...	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	2.2	2.2	Megohms
With Cathode Bias	2.2	2.2	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section	Triode Section	
Plate Voltage	125	125	Volts
Screen Voltage	125	...	Volts
Grid-Number 1 Voltage	−1.0	−1.0	Volts
Amplification Factor	...	46	
Plate Resistance, approximate	200000	5400	Ohms
Transconductance	7500	8500	Micromhos
Plate Current	12	13.5	Milliamperes
Screen Current	4.0	...	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 10 Microamperes	−8	−8	Volts

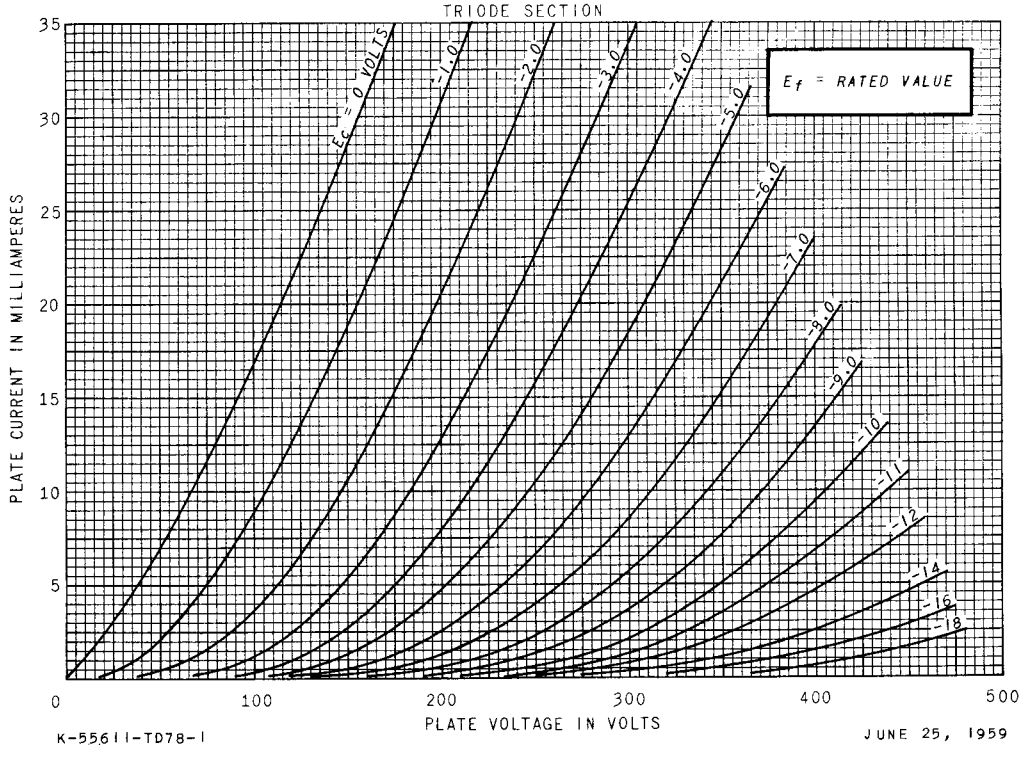
* Heater voltage for a bogey tube at If = 0.15 amperes.

† For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

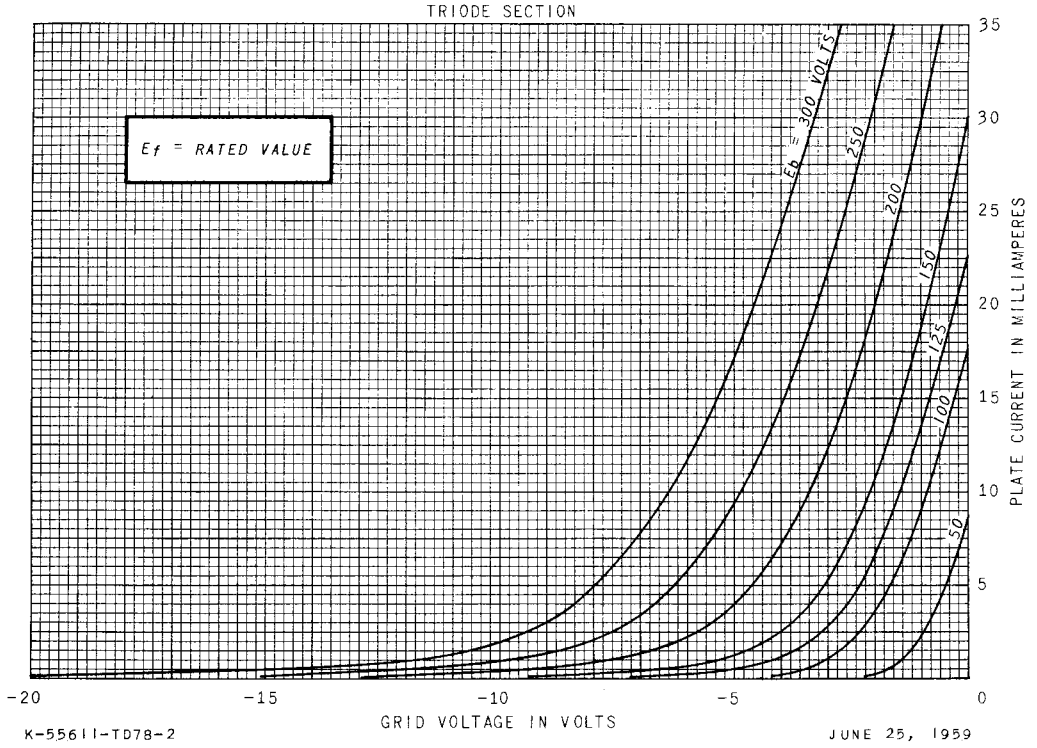
‡ With external shield (EIA 315) connected to cathode of section under test.

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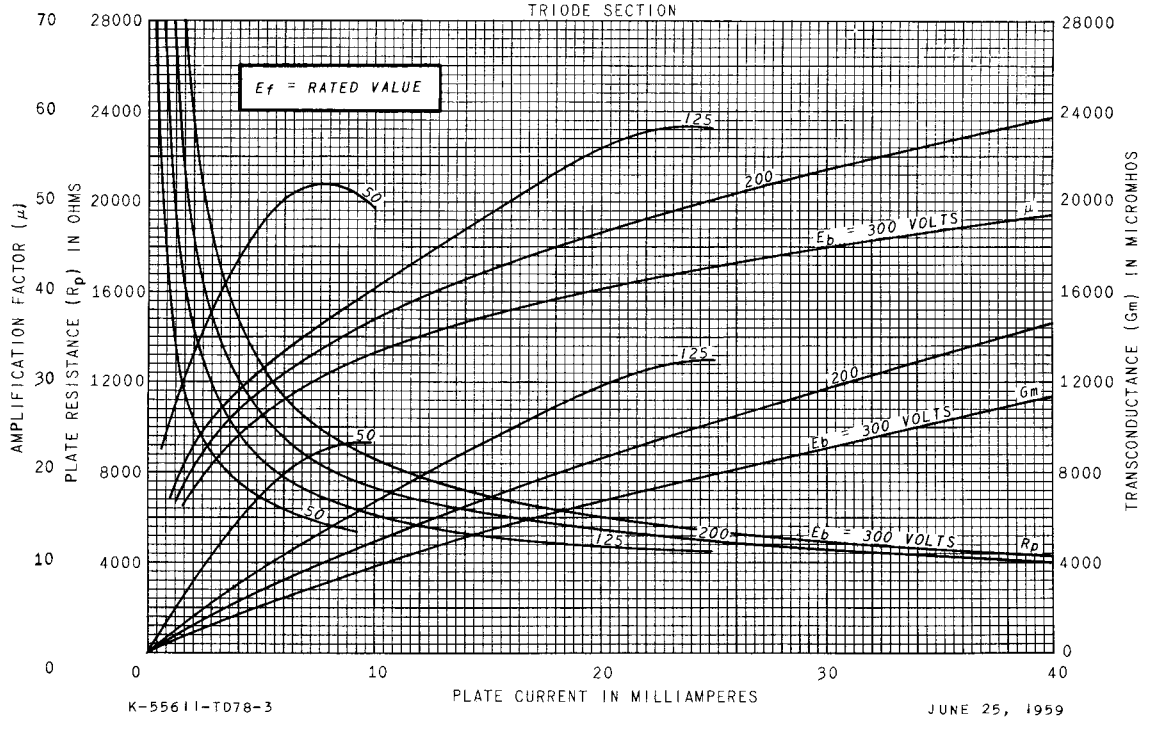
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

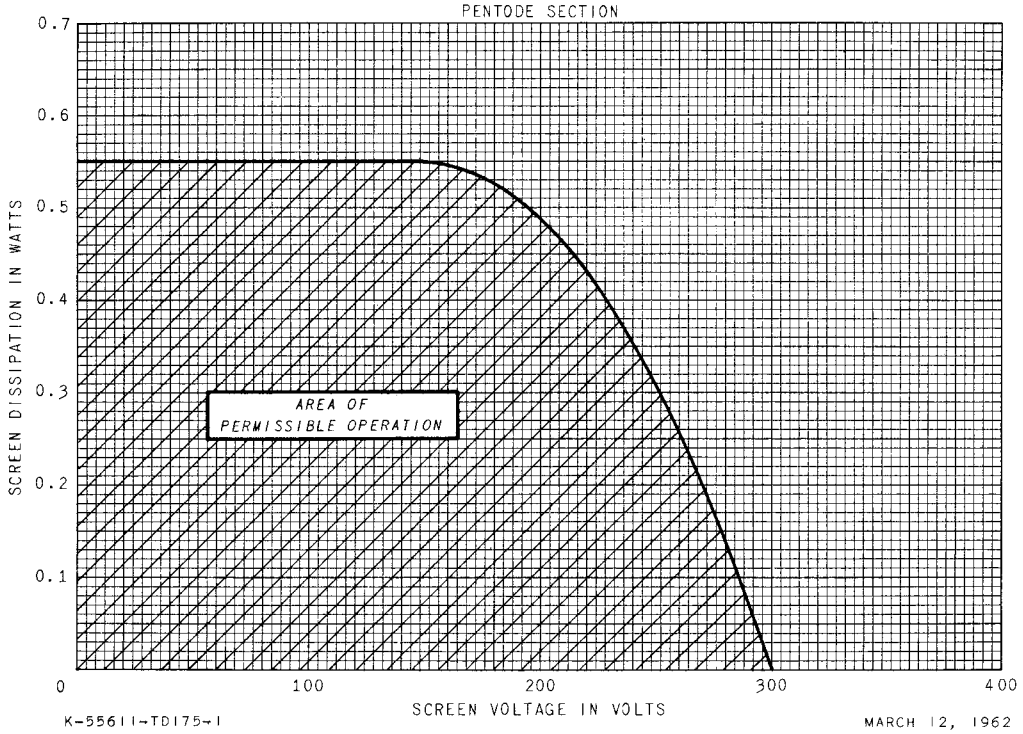


AVERAGE CHARACTERISTICS



SCREEN RATING CHART

PENTODE SECTION

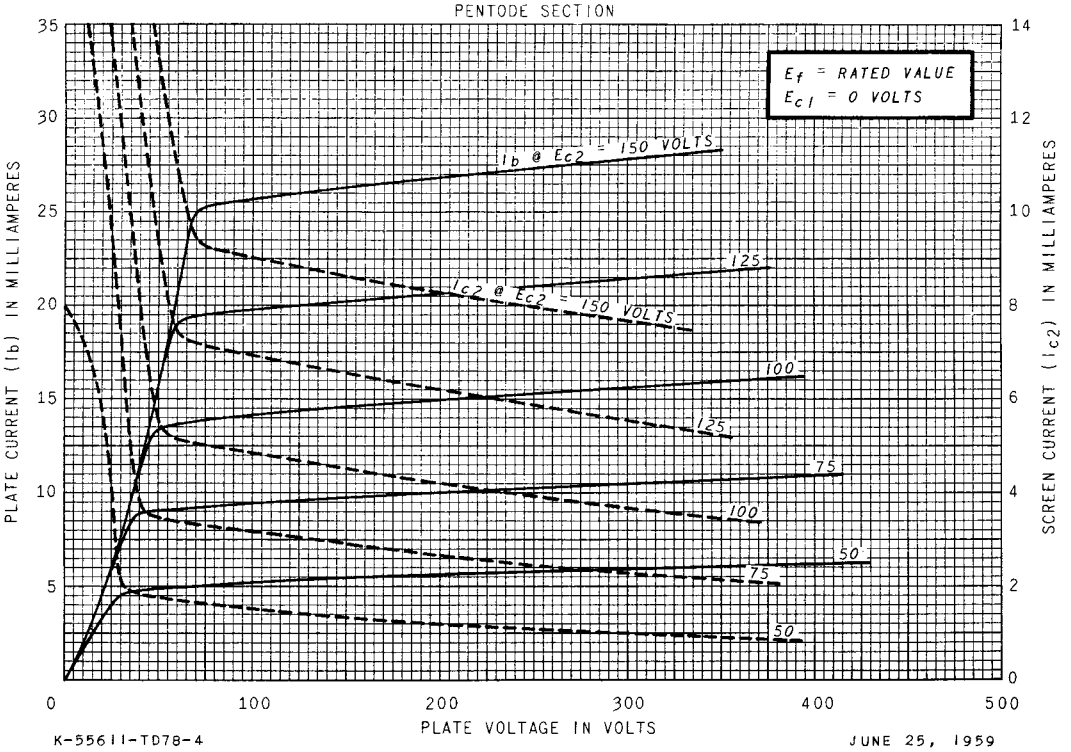


K-55611-TD175-1

MARCH 12, 1962

AVERAGE PLATE CHARACTERISTICS

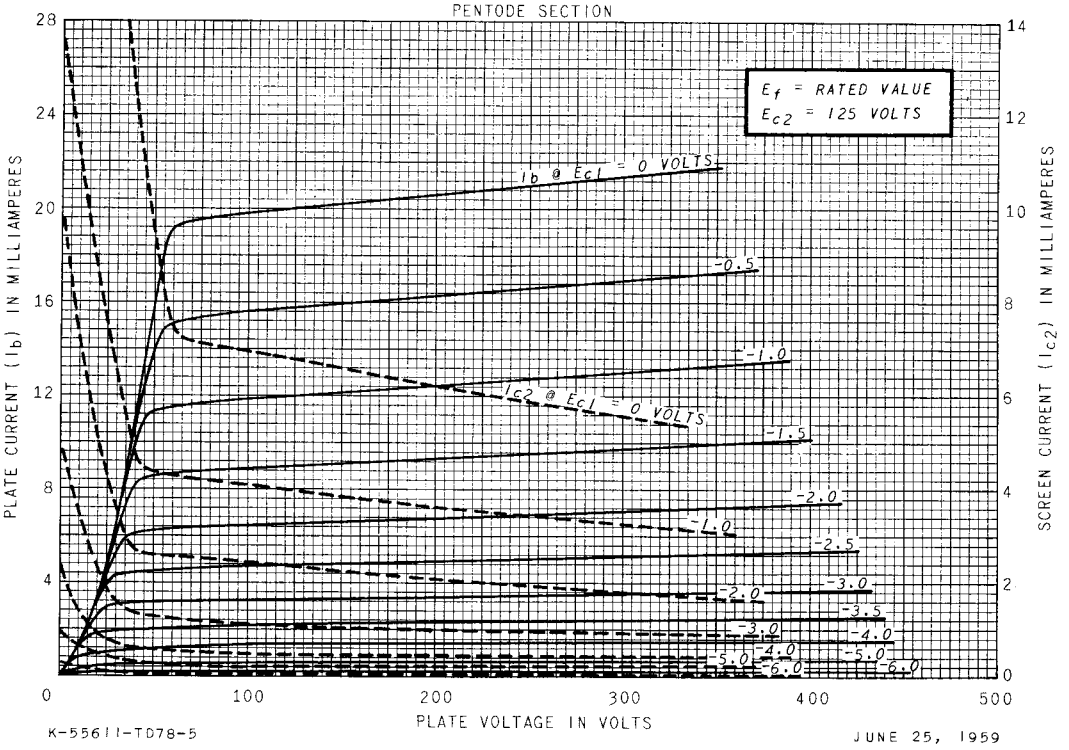
PENTODE SECTION



K-55611-TD78-4

JUNE 25, 1959

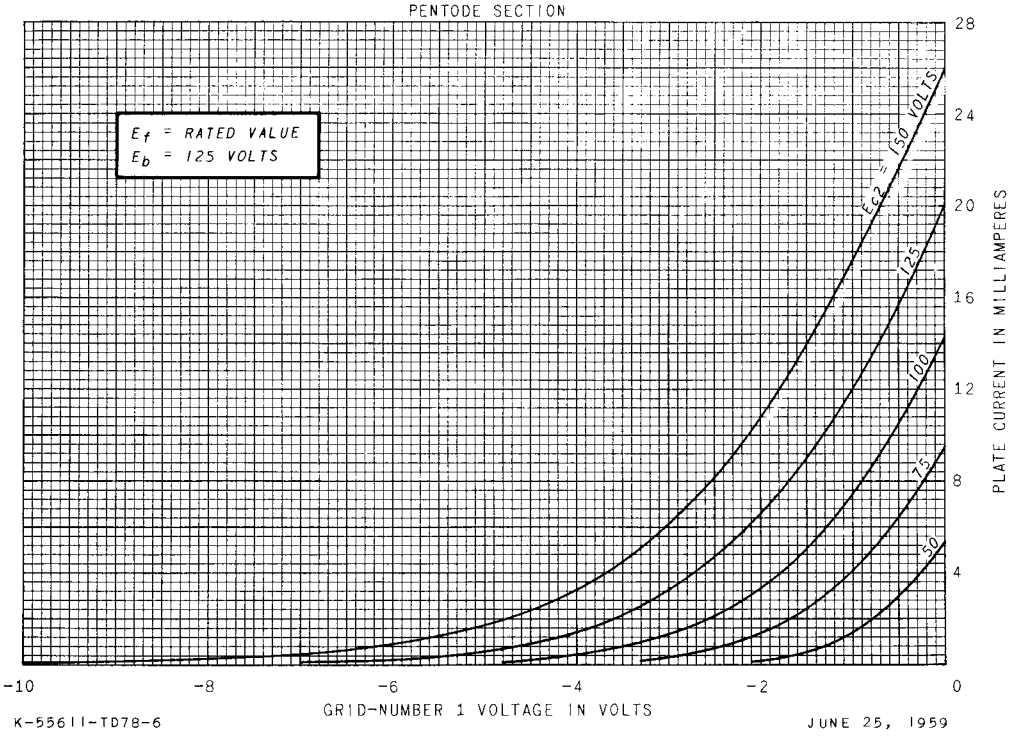
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD78-5

JUNE 25, 1959

AVERAGE TRANSFER CHARACTERISTICS

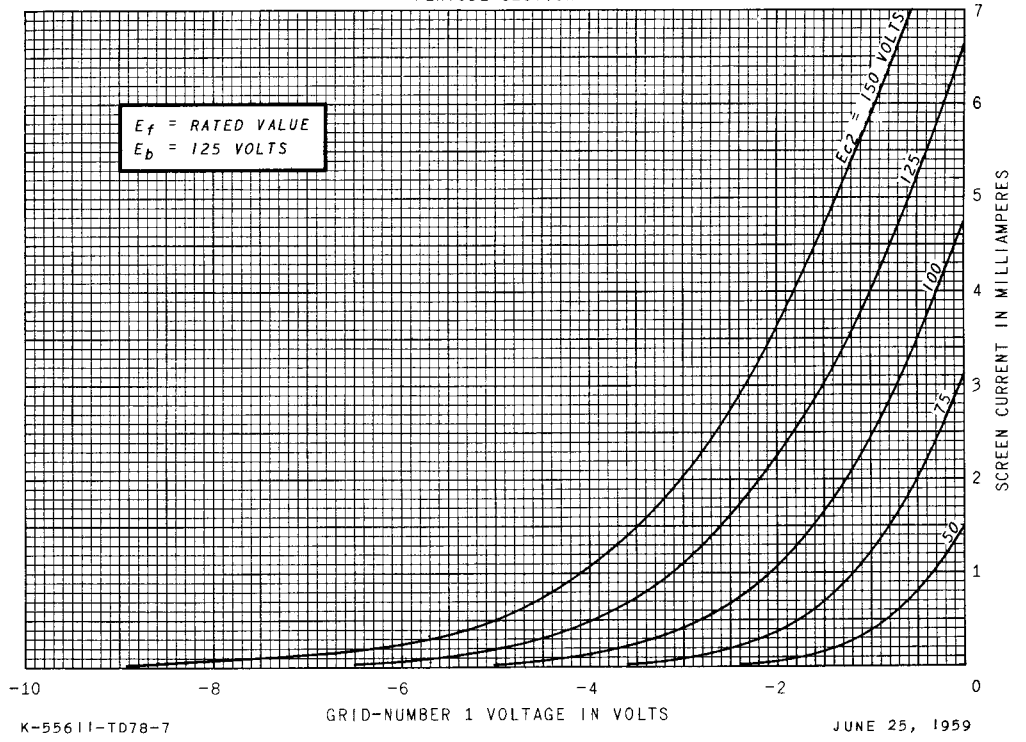


K-5561I-TD78-6

JUNE 25, 1959

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

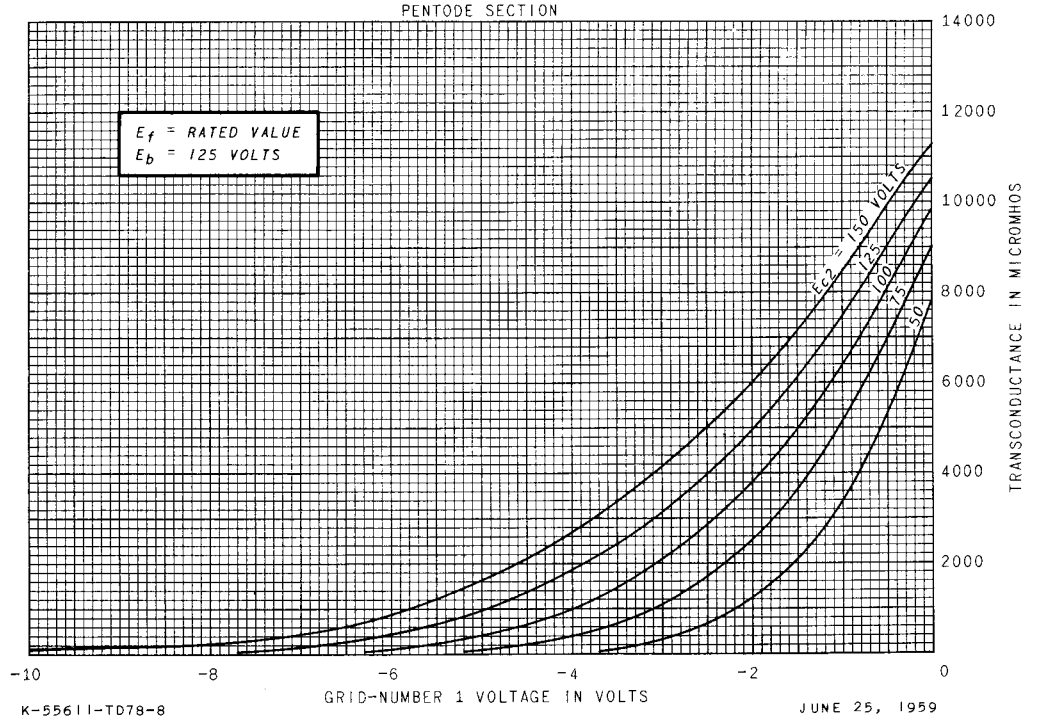


K-55611-TD78-7

JUNE 25, 1959

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION



K-55611-TD78-8

JUNE 25, 1959

19KG8

TRIODE-PENTODE

The 19KG8 is a miniature tube containing a sharp-cutoff pentode and a medium-mu triode. The tube is intended primarily for service as a combined triode oscillator and pentode mixer.

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	18.9	Volts
Heater Current+	0.15±0.01	Amperes
Direct Interelectrode Capacitances‡		
Pentode Section		
Grid-Number 1 to Plate, maximum: (g1 to p)	0.01	pf
Input: Pg1 to (h + Pk + Pg2 + Pg3 + i.s.)	5.5	pf
Output: Pp to (h + Pk + Pg2 + Pg3 + i.s.)	3.4	pf
Triode Section		
Grid to Plate: (g to p)	1.7	pf
Input: g to (h + Tk + Pk + Pg3 + i.s.)	3.2	pf
Output: p to (h + Tk + Pk + Pg3 + i.s.)	2.2	pf

Mechanical

Mounting Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 3/16	Inches
Maximum Seated Height	1 15/16	Inches

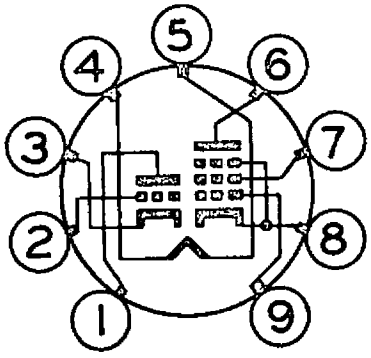
ETR-2186

from JEDEC release #3899, Sept. 24, 1962

TERMINAL CONNECTIONS

Pin 1 - Triode Plate
Pin 2 - Triode Grid
Pin 3 - Triode Cathode
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode Plate
Pin 7 - Pentode Grid Number 2 (Screen)
Pin 8 - Pentode Cathode, Grid Number 3, and Internal Shield
Pin 9 - Pentode Grid Number 1

BASING DIAGRAM



EIA 9LY

MAXIMUM RATINGS

Design-Maximum Values	Pentode Section	Triode Section	
Plate Voltage	300	300	Volts
Screen Supply Voltage	300	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	2.5	2.5	Watts
Screen Dissipation	0.55	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	2.2	2.2	Megohms
With Cathode Bias	2.2	2.2	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics

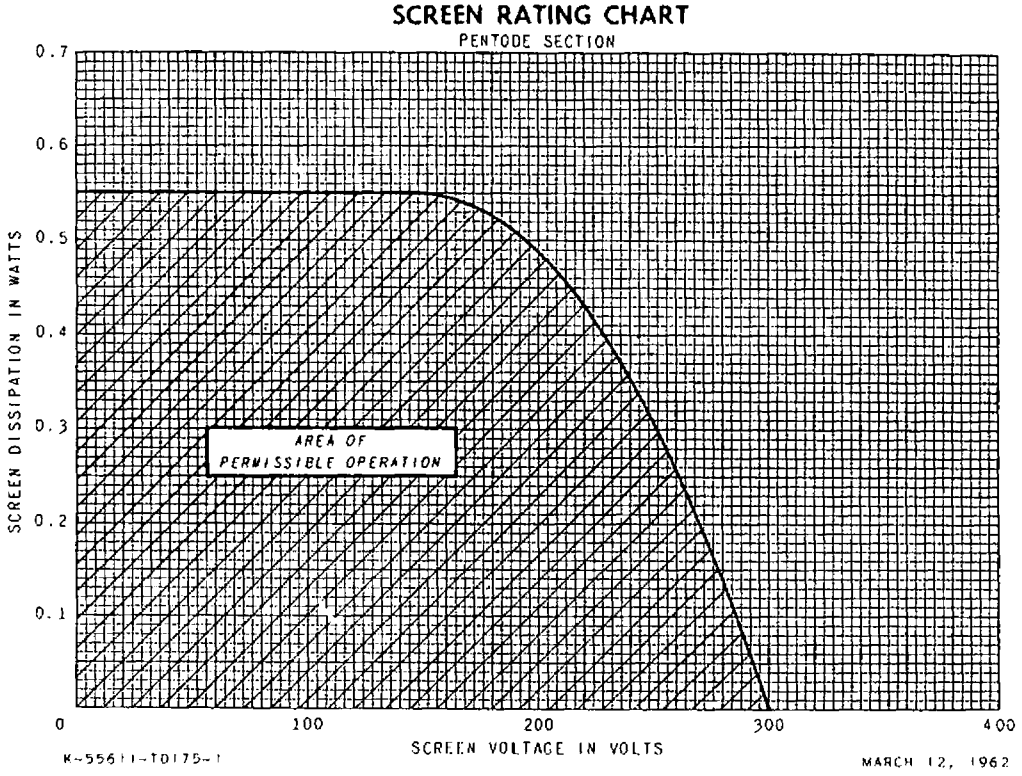
	Pentode Section	Triode Section	
Plate Voltage	125	125	Volts
Screen Voltage	125	---	Volts
Grid-Number 1 Voltage	-1.0	-1.0	Volts
Amplification Factor	---	46	
Plate Resistance, approximate	200000	5400	Ohms
Transconductance	7500	8500	Micromhos
Plate Current	12	13.5	Milliamperes
Screen Current	4.0	---	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 10 Microamperes	-8	-8	Volts

* Heater voltage for a bogey tube at If = 0.15 amperes.

\+ For series heater operation, the equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

‡ With external shield (EIA 315) connected to cathode of section under test.

9/4/62 (E)



The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

Electronic TUBE
K KEN-RAD

19T8

Description and Rating

TRIPLE-DIODE TRIODE

PRELIMINARY DATA

GENERAL DESCRIPTION

Principal Application: The 19T8 is a miniature tube containing three high-perveance diodes and a high-mu triode in the same envelope. One of the diodes has a separate cathode connection.

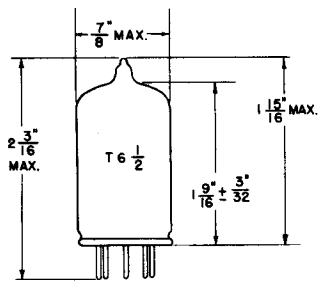
Cathode:	Coated Unipotential
Heater Voltage (A-C or D-C)	18.9 Volts
Heater Current	0.15 Ampere
Envelope:	T-6½ Glass
Base:	E9-1 Small Glass Button 9-Pin
Mounting Position:	Any

The tube is designed for use as a combined AM and FM detector and audio-frequency amplifier. Except for heater rating, the 19T8 and the 6T8 are identical.

Direct Interelectrode Capacitances:*

Triode Grid to Plate	2.4	μμf
Triode Input	1.5	μμf
Triode Output	1.1	μμf
Grid to Each Diode Plate (Max)	0.03	μμf
Number 1 And Number 3 Diode Input (Each)	3.8	μμf
Number 2 Diode Input	2.2	μμf

PHYSICAL DIMENSIONS

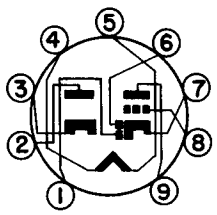


RMA 6-2

TERMINAL CONNECTIONS

Pin 1 - Number 3 Diode Plate
Pin 2 - Number 2 Diode Plate
Pin 3 - Number 2 Diode Cathode and Shield
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Number 1 Diode Plate
Pin 7 - Triode Cathode and Shield
Pin 8 - Triode Grid
Pin 9 - Triode Plate

BASING DIAGRAM



RMA 9E
BOTTOM VIEW

MAXIMUM RATINGS

	Design Center	Absolute	
Plate Voltage	300	330	Volts
Plate Dissipation	1.0	1.1	Watts
Diode Operation Current per Plate	5.0	5.5	Milliamperes
Peak Heater-Cathode Voltage	90	100	Volts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A AMPLIFIER: TRIODE UNIT

Plate Voltage	100	250	Volts
Grid Bias Voltage	-1	-3.0	Volts
Plate Current	0.8	1.0	Ampere
Amplification Factor	70	70	
Transconductance	1300	1200	Micromhos

DIODE UNIT: EACH UNIT

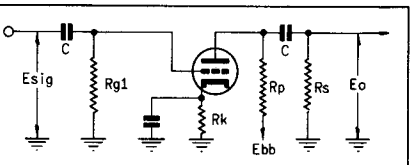
Average Diode Current with 5 Volts D-C Applied	20	Milliamperes

Note: In a ratio-detector circuit for FM, it is recommended that diodes number 2 and number 3 be used.

* *Approximate values without external shield.*

CLASS A RESISTANCE COUPLED AMPLIFIER:

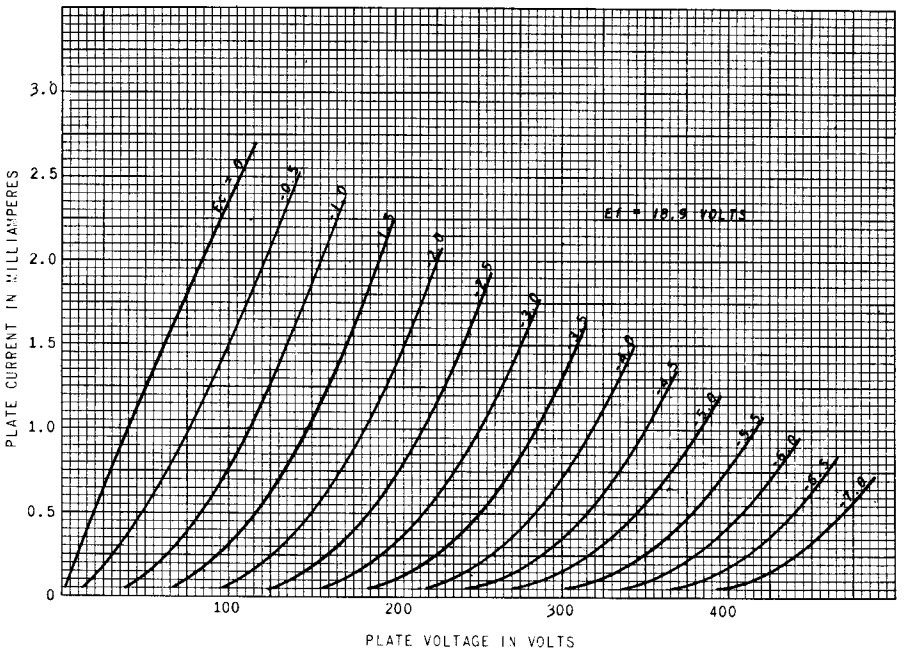
Rp Meg.	Rg1 Meg.	Rs Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	*	0.10	5700	21	7.0	2400	29	18	1800	33	35
0.10	*	0.24	6100	26	9.0	2700	34	23	2000	38	42
0.24	*	0.24	9100	30	10	4300	40	24	3000	44	43
0.24	*	0.51	10000	34	13	4700	45	31	3300	49	52
0.51	*	0.51	15000	37	14	7500	47	28	5600	51	50
0.51	*	1.0	16000	40	16	8200	50	35	6200	55	60
0.24	10	0.24	---	31	5.0	---	44	19	---	48	40
0.24	10	0.51	---	37	7.0	---	49	25	---	52	52
0.51	10	0.51	---	39	7.5	---	51	22	---	54	44
0.51	10	1.0	---	42	10	---	54	28	---	58	56



Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data generator impedance is negligible. *Value of Rg1 is non-critical.

AVERAGE PLATE CHARACTERISTICS



Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

19ZP4
CATHODE RAY TUBE

19 INCH, RECTANGULAR, GLASS	FACE PLATE -- SPHERICAL GRAY
FOCUS -- ELECTROSTATIC	NON ION TRAP GUN
DEFLECTION -- MAGNETIC	ALUMINIZED SCREEN
114 DEGREE DEFLECTION ANGLE	EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 19ZP4 is a 19 inch electrostatic-focus and magnetic deflection glass picture tube. Outstanding features include a short over-all length, a small neck diameter and a non ion trap gun. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angle, Approximate	
Horizontal	102 degrees
Vertical	87 degrees
Diagonal	114 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes, approximate	5 uuf
Grid #1 to all other electrodes, approximate	6 uuf
External Conductor Coating to Anode	1500 max. uuf 1000 min. uuf
Heater Current at 6.3 volts	600 ± 10% ma.
Heater Warm Up Time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center Approx.	76 Percent

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

from JEDEC release #2804, May 9, 1960

MECHANICAL DATA

Overall Length	11 1/2 ± 5/16 inches
Greatest Dimensions of Tube	
Diagonal	18 5/8 ± 1/8 inches
Width	16 13/32 ± 1/8 inches
Height	13 11/32 ± 1/8 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	17 9/16 inches
Horizontal Axis	15 1/8 inches
Vertical Axis	12 inches
Area	172 sq. inches
Neck Length	4 1/4 ± 3/16 inches
Bulb	J149-A1
Bulb Contact	JETEC No. J1-21
Base	JETEC No. B6-226
Basing	8JS
Bulb Contact Alignment	
Anode Contact Aligns with Rev. No. 4 ± 30 degrees	

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	20,000 volts
Minimum Anode Voltage	15,000 volts
Maximum Grid 4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid 2 Voltage	400 volts
Maximum Grid 2 Voltage	700 volts
Grid 1 Voltage	
Maximum Negative Value	140 volts DC
Maximum Negative Peak Value	200 volts
Maximum Positive Value	0 volts DC
Maximum Positive Peak Value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm up period not to exceed 15 sec.	410 volts
After equipment warm-up period	180 volts
Heater positive with respect to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode Voltage	16,500 volts DC
Grid #4 Voltage (Focusing Electrode(Notes 2 & 3)	250 volts DC
Grid #2 Voltage	450 volts DC
Grid #1 Voltage (Note 1)	-28 to -72 volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5 max. megohm
Grid No. 2 Circuit Resistance	0.1 min. megohm
Focusing Electrode Circuit Resistance	0.1 min. megohm

Protective resistance in Grid No. 2 and focusing electrical circuits is advisable to prevent damage to tube. If applicable, one resistor common to both circuits may be used.

NOTES:

1. Visual extinction of focused raster.

2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 microamperes on a 15 1/8 x 11 15/16" pattern from RCA 2F21 monoscope or equivalent.

3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

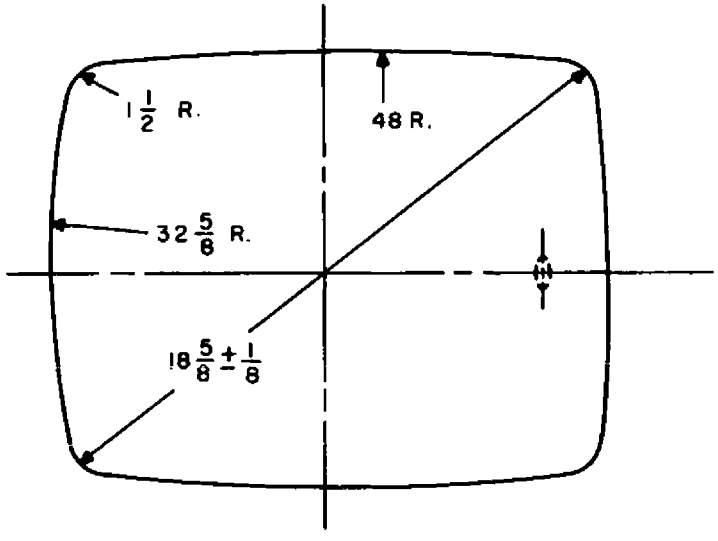
4/14/60

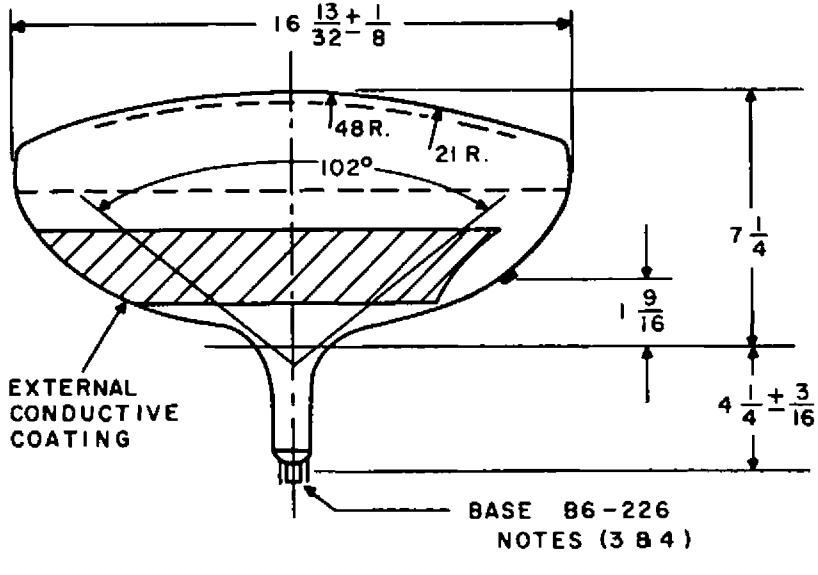
CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

19ZP4

PAGE 4

SCREEN DIMENSIONS
DIAGONAL — 17 9/16
WIDTH — 15 1/8
HEIGHT — 12
AREA — 172 SQ. IN.





YOKE REFERENCE LINE

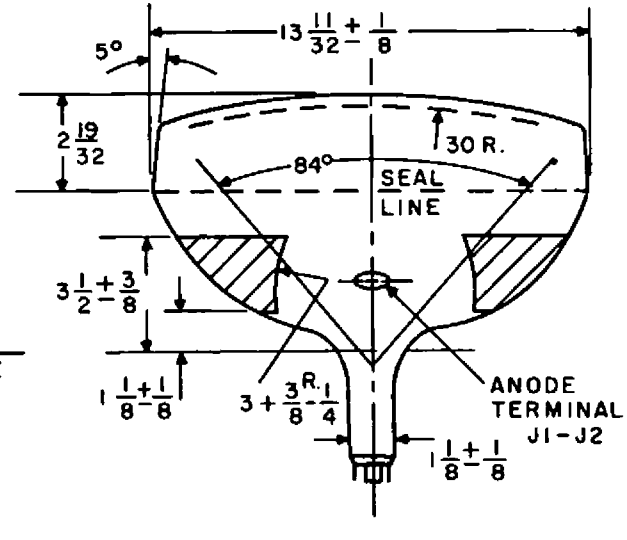


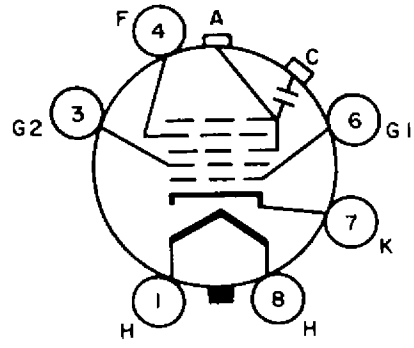
DIAGRAM NOTES

1. THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE C-C' OF GAGE (EIA NO. 126) WITH THE GLASS FUNNEL.

2. DEFLECTION ANGLE ON THE DIAGONAL IS 114°.

3. ANODE TERMINAL ALIGNS WITH PIN NO. 4 ±30 DEGREES.

4 USE A NON-RIGIDLY MOUNTED SOCKET WITH FLEXIBLE LEADS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN 1-3/4 INCH DIAMETER CIRCLE CONCENTRIC WITH THE BULB AXIS.



BASING DIAGRAM

8JS

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

SYRACUSE, NEW YORK

Electronic TUBES

20CP4 and 20CP4-A

CATHODE-RAY TUBE

20-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
17- BY 12¾-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
20CP4-A—EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 20CP4 is a magnetic-focus and deflection, direct-view all-glass picture tube which provides a 17- by 12¾-inch picture for television applications. The electron gun is used with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, and a space-saving rectangular face shape.

The 20CP4-A has the additional feature of an external conductive coating which serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
20CP4 and 20CP4-A		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
20CP4-A		
External Conductive Coating to Anode		
Maximum	750	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	66	Percent

GENERAL ELECTRIC

Supersedes ETR-138 and ETR-139, dated 4-52

MECHANICAL

Over-all Length	$21\frac{7}{16} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$20\frac{3}{32} \pm \frac{1}{8}$	Inches
Width	$18\frac{11}{16} \pm \frac{1}{8}$	Inches
Height	$14\frac{15}{16} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$18\frac{5}{8}$	Inches
Width	17	Inches
Height	$12\frac{3}{4}$	Inches
Neck Length	$7\frac{3}{16}$	Inches

Bulb Number, ASA Designation—J161-C1
Bulb Contact—Recessed Small-cavity Cap, JETEC, No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation
20CP4—12D
20CP4-A—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin-No. 6 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	22½	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	18,000 Max	Volts DC
Grid-No. 2 Voltage	410 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	150 Max	Volts
Heater Positive with Respect to Cathode	150 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	16,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	106	Milliamperes DC
Ion-Trap Field Intensity♦, approximate	40	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode. If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

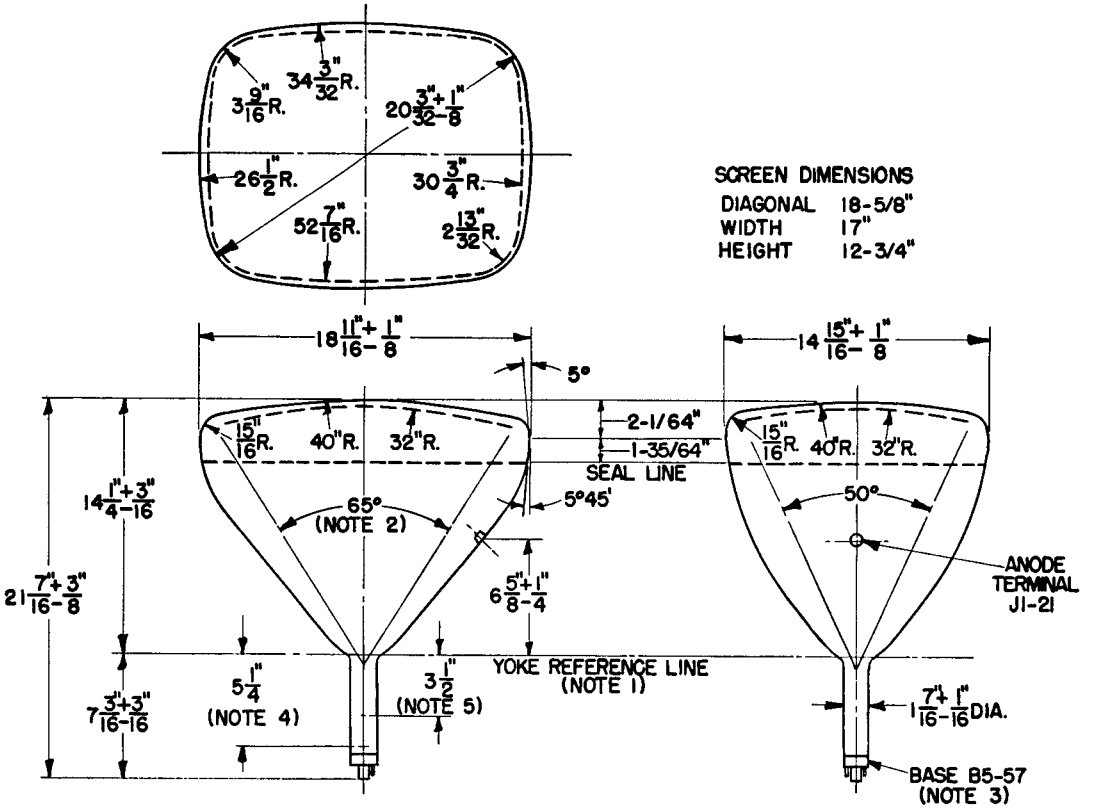
‡ Cathode should be returned to one side or to the midtap of the heater transformer winding.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

π For visual extinction of focused raster.

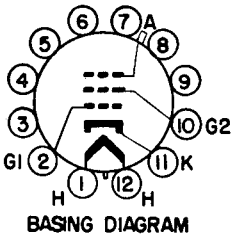
▲ For JETEC focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3½ inches.

♦ Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through JETEC ion-trap magnet No. 117.

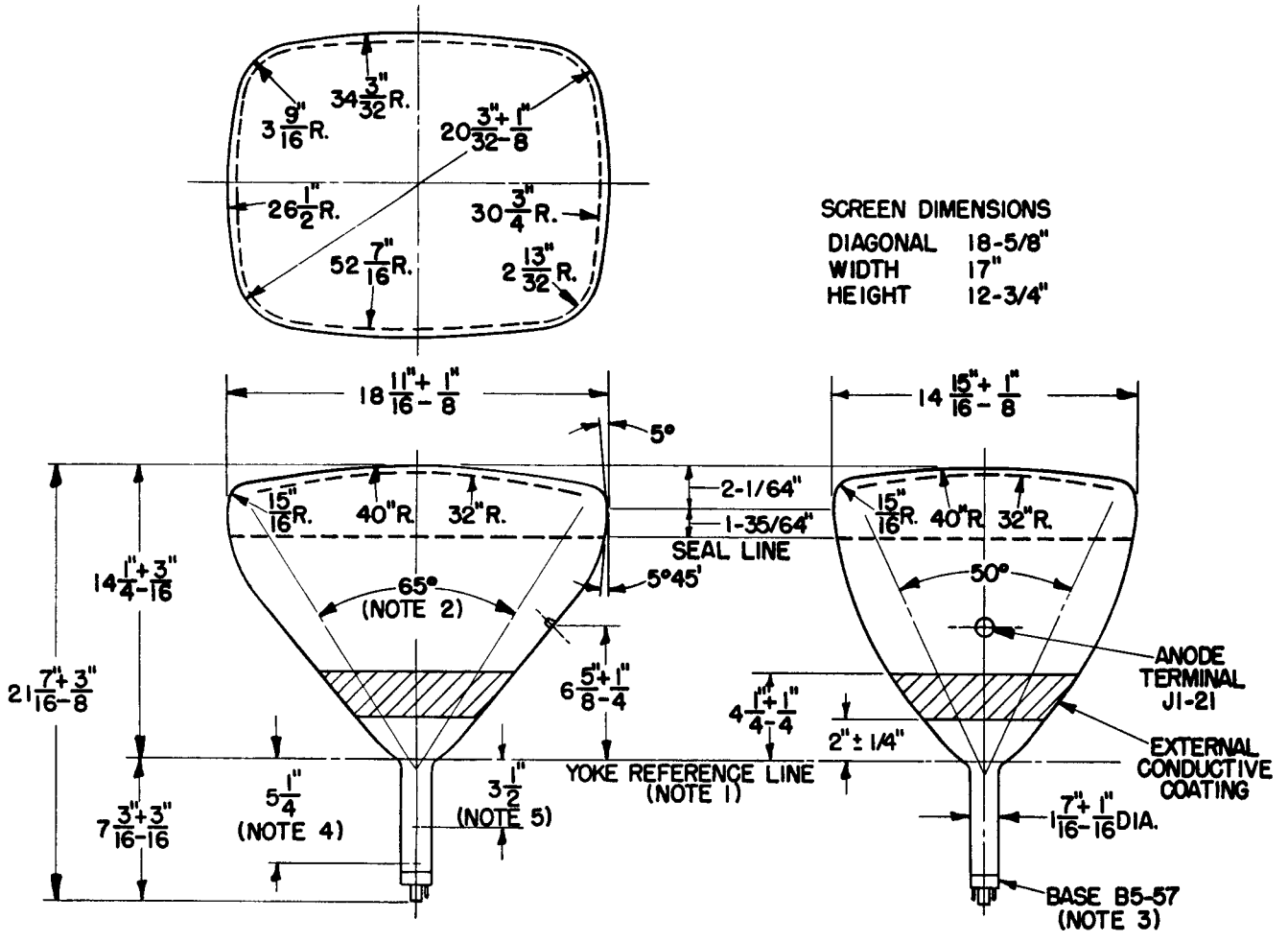


NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.

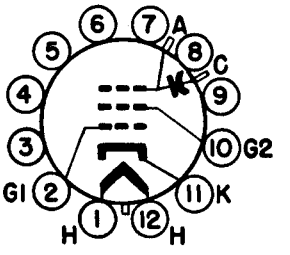


BASING DIAGRAM
12D



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.



BASING DIAGRAM
12N

N15195AZ

7-7-54

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

Electronic TUBES

20DP4-A

CATHODE-RAY TUBE

20-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
17- BY 12¾-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 20DP4-A is a magnetic-focus and deflection, direct-view all-glass picture tube which provides a 17- by 12¾-inch picture for television applications. The electron gun is designed for use with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high ambient light conditions, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	750	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	73	Percent

MECHANICAL

Over-all Length	$21\frac{3}{4} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$20\frac{3}{32} \pm \frac{1}{8}$	Inches
Width	$18\frac{11}{16} \pm \frac{1}{8}$	Inches
Height	$14\frac{15}{16} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$18\frac{5}{8}$	Inches
Width	17	Inches
Height	$12\frac{3}{4}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J161C
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ±30 Degrees

Mounting Position—Any
Net Weight, approximate . . . . . 23 Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	18,000 Max	Volts DC
Grid-No. 2 Voltage	410 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	150 Max	Volts
Heater Positive with Respect to Cathode	150 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	16,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	117	Milliamperes DC
Ion-Trap Field Intensity◆, approximate	40	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

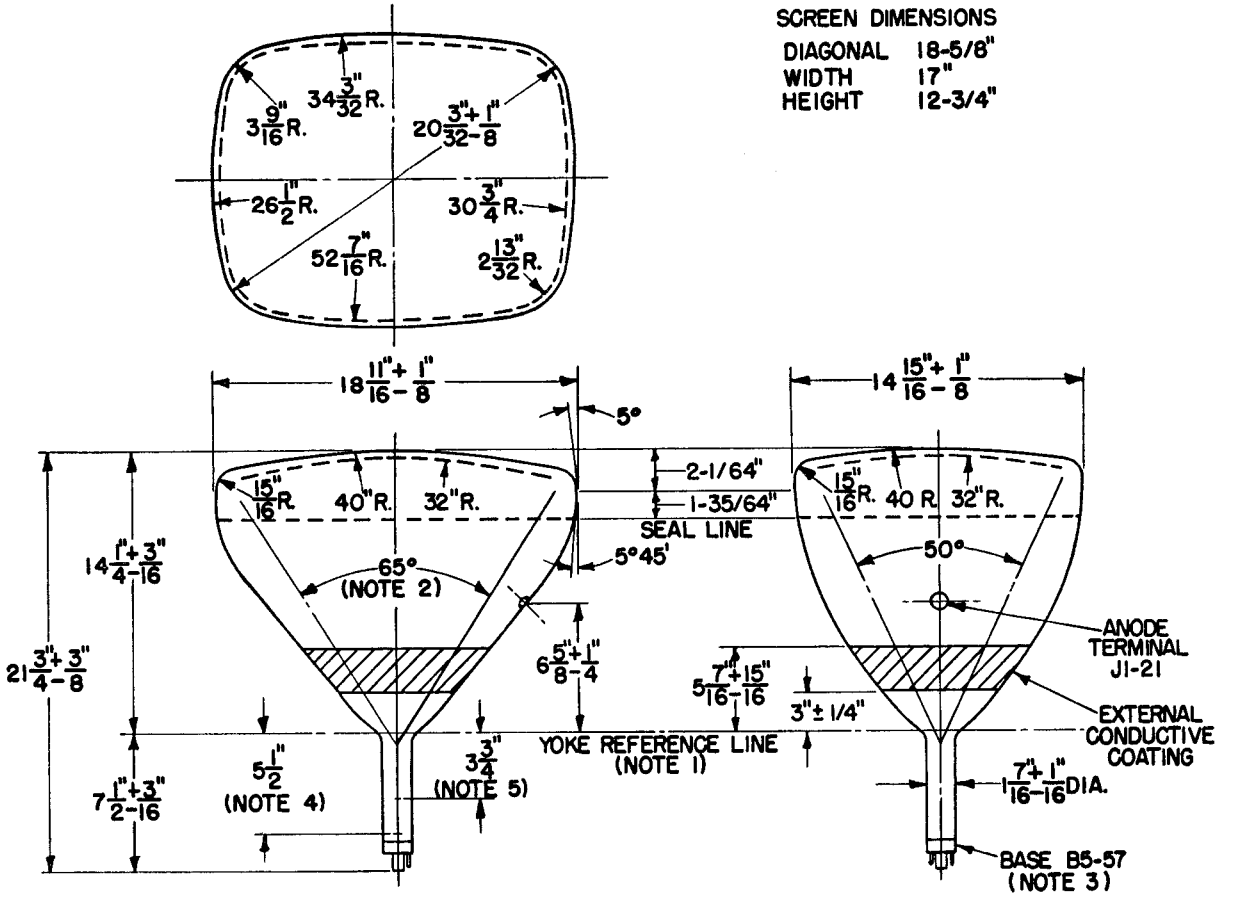
‡ Cathode should be returned to one side or to the midtap of the heater transformer winding.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

π For visual extinction of focused raster.

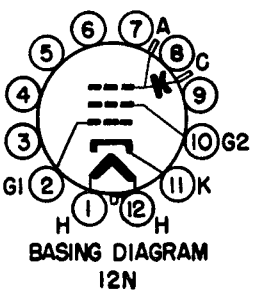
▲ For RETMA focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3¾-inches.

♦ Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through JETEC ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.



BASING DIAGRAM
12N

Electronic TUBES

20HP4-A/20LP4

CATHODE-RAY TUBE

20-INCH RECTANGULAR, GLASS
FOCUS—LOW VOLTAGE ELECTROSTATIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
17- BY 12¾-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 20HP4-A/20LP4 is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 17- by 12¾-inch picture for television applications. The electron gun has a focusing voltage range of −0.4 to +2.2 percent of the anode voltage and is used with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	1500	μμf
Minimum	750	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	73	Percent

Supersedes ETR-143, dated 4-52

MECHANICAL

Over-all Length	21¾ ± ⅜	Inches
Greatest Bulb Dimensions		
Diagonal	20 3/32 ± ⅛	Inches
Width	18 11/16 ± ⅛	Inches
Height	14 15/16 ± ⅛	Inches
Minimum Useful Screen Dimensions		
Diagonal	18⅝	Inches
Width	17	Inches
Height	12¾	Inches
Neck Length	7½	Inches

Bulb Number, ASA Designation—J161-C1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing—JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees

Mounting Position—Any

Net Weight, approximate	22½	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	16,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage§		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltageπ	14,000	Volts DC
Focusing-Electrode Voltage for Focus▲	−56 to +308	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage♦	−28 to −72	Volts DC
Ion-Trap Field Intensityϕ, approximate	35	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode, grid-No. 3 and grid-No. 5 which are connected together within the tube are referred to herein as anode. If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

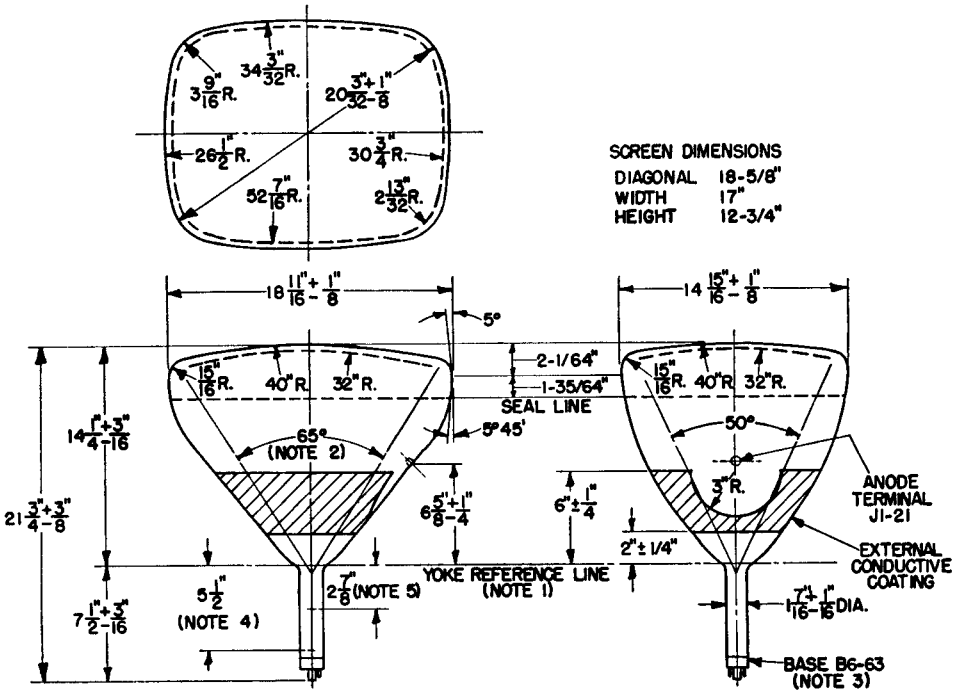
§ Cathode should be returned to one side or to the midtap of the heater transformer winding.

π Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.

▲ The focusing electrode may be modulated within the stipulated maximum range without damage to the tube.

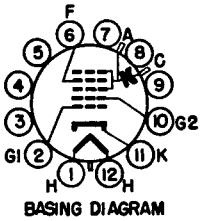
♦ For visual extinction of focused raster.

ϕ Single-field ion-trap magnet adjusted to optimum position, equivalent to 35 milliamperes through JETEC ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.



BASING DIAGRAM
12L

K-69087-72A492

8-11-54

ELECTRONIC INNOVATIONS IN ACTION

TUBES

20LF6

Pentode

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

The 20LF6 is a beam power pentode designed for use in horizontal deflection circuits of color television receivers.

GENERAL

ELECTRICAL

HEATER CHARACTERISTICS AND RATINGS

Heating	A.C. or D.C. parallel supply	
Heater Voltage	20.0	volts
Heater Current	0.6	amps

Direct Interelectrode Capacitances (unshielded)

Plate to Grid–Number 1 (p to g1)	2.5 pF
Input	37.0 pF
Output	18.5 pF

MECHANICAL

Additional support of the tube at the top is required.

Envelope – T–12, Glass

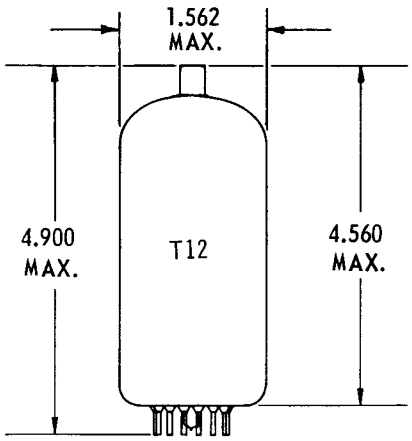
Base – E12–74, Button 12 Pin

Top Cap – C1–1

Outline Drawing

Maximum Diameter	1.562	Inches
Maximum Over–all Length	4.900	Inches
Maximum Seated Height	4.560	Inches

PHYSICAL DIMENSIONS

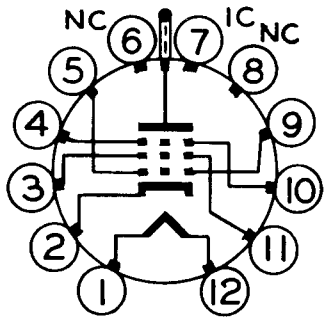


E12–74

TERMINAL CONNECTIONS

Pin 1 – Heater
Pin 2 – Cathode
Pin 3 – Grid–Number 2
Pin 4 – Beam Plates
Pin 5 – Grid–Number 1
Pin 6 – No Connection
Pin 7 – Internal Connection (Do not use)
Pin 8 – No Connection
Pin 9 – Grid–Number 1
Pin 10 – Beam Plates
Pin 11 – Grid–Number 2
Pin 12 – Heater
P – Plate (Top Cap)

BASING DIAGRAM



EIA 12GW

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MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE
DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

Plate Voltage at Zero Current	990	volts
Peak Positive Plate Voltage •	8000	volts
Plate Dissipation	40	watts
Temporary Overload Plate Dissipation ♦	200	watts
Beam Plate Voltage	50	volts
Grid No. 2 Voltage at Zero Current	770	volts
Screen Voltage	275	volts
Screen Dissipation ▲	9	watts
Cathode to Heater Voltage		
D.C. ⊣ Peak, k positive	200	volts
k negative ⊕	200	volts
Beam Plates Circuit Resistor †	10000	ohms
Peak Negative Grid No. 1 Voltage ★	550	volts
Bulb Temperature (hotspot)	300	°C
Grid No. 1 Circuit Resistance (Design Center) ‡	0.5	Megohm
Cathode Current (avg) (Design Center)	500	Milliamperes
(peak) (Design Center)	1200	Milliamperes

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	160	50	volts
Grid No. 1 Voltage	0	−10	volts
Grid No. 3 Voltage	0	0	volts
Screen Voltage	160	175	volts
Plate Current	1400	800	Milliamperes
Screen Current	45	70	Milliamperes

OPERATING CONDITIONS

Stabilized Circuits (D.C. Feedback)

Cut-Off Voltage

The minimum required cut-off voltage (−Ec1) during flyback at Eb=7000 volts and Zc1=1 kΩ at line frequency is:

Ec2 = 150 V: Ec1 = −175 V
Ec2 = 175 V: Ec1 = −185 V
Ec2 = 200 V: Ec1 = −195 V
Ec2 = 250 V: Ec1 = −215 V

OPERATING CONDITIONS (Cont'd)

Supply Voltage: Refer to Figures 2, 3 and 4

Minimum Required Plate Voltage (Eb min)

Barkenhausen interference and loss of stability can be prevented by ensuring the plate voltage is above the specified minimum Eb, during the scanning period.

If low values of Eb min. are required, the Eb min. 1–line can be shifted over 10 volts to Eb min. 2 provided a D.C. voltage of at least $\pm$ 20 volts is applied to the beam plate (G3). To compensate for the influence of line voltage variations, the specified values of Eb min. have to be increased with 10% of the plate supply voltage.

Minimum Required Values of the Screen Grid Voltage (Ec2 min.)

The graph refers to nominal line voltage. The specified values of peak plate current will be available throughout life of the tube at supply voltages 10% below nominal.

Maximum Permissible Screen Grid Series Resistance Rc2 max. see Figures 2, 3 and 4

Rc2: To optimize the high tension properties of the tube, it is recommended to apply an unbypassed resistor of 100 ohms at the screen grid of the tube

Rc3: Application of an undecoupled srries resistance of 1000 ohms is recommended.

At Zc1 =200 kΩ (f=50 Hz), Vk/h=220 VRMS and without wiring and socket capacitances the equivalent grid hum voltage is less than 5 mV.

NOTES

- • Maximum pulse duration is 22% of a cycle, but maximum 18 microseconds.
- ♦ Total continuous or accumulated time not to exceed 40 seconds.
- ▲ To prevent an excessive value of Pc2 the minimum Rc2 values are given in Figure 1.
- ⊕ D.C. component maximum 100 volts.
- † With Rc3>10 000 ohms, capacitance decoupling of C3 is not required.
- ⋆ Absolute maximum value.
- ‡ The circuit design has to be such that negative control grid currents up to 5 microamperes do not have detri – mental effect upon tube adjustment or circuit performance. Care should be taken, that with 5 micro–amperes grid current the limiting values for Ik, Pp and Pc2 are not ex–ceeded.

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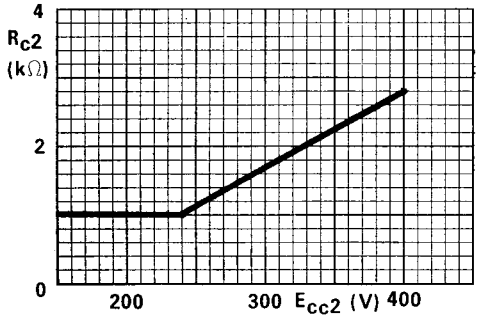


Figure 1

Minimum required plate voltage.
Rc2 maximum: maximum permissible screen grid series resistance for 400 V screen grid supply. The specified values of Ib peak are available at supply voltage 10% below nominal and throughout the tube life.
Note: Rc2 minimum for 400 V screen grid supply is 2.9 kΩ (see Figure 1).

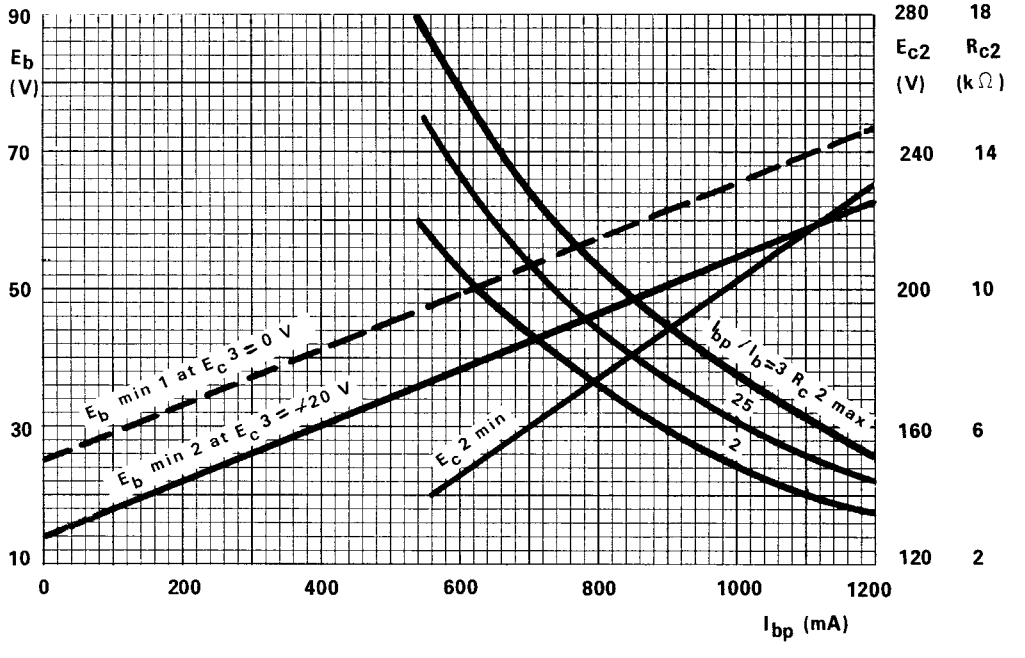


Figure 2

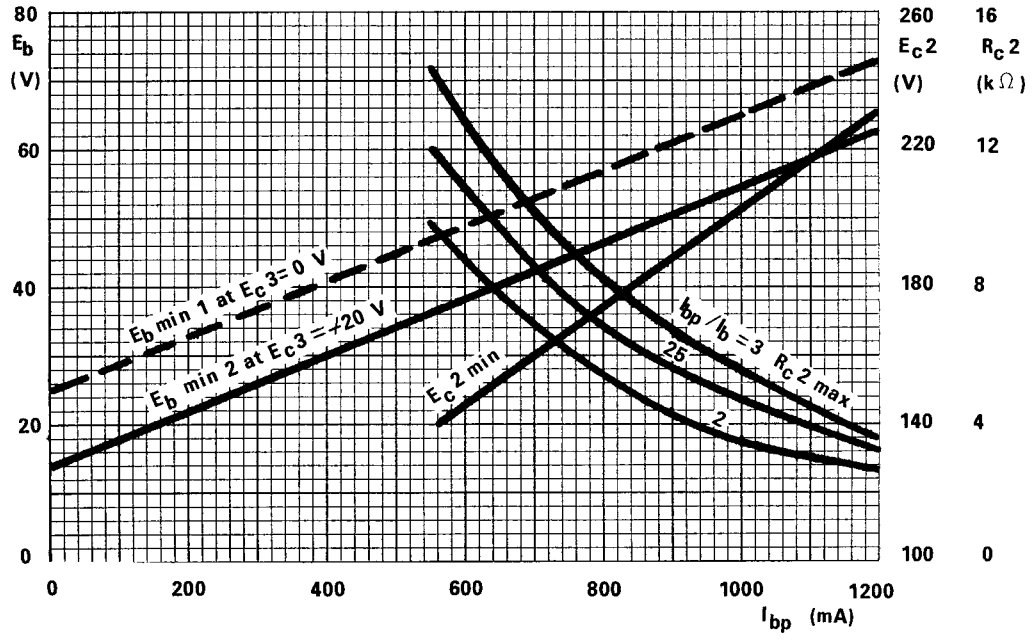
Minimum required plate voltage.

R_c 2 maximum: maximum permissible screen grid series resistance for 350 V screen grid supply.

The specified values of I_b peak are available at supply voltages 10% below nominal and throughout the tube life

Note: R_c 2 minimum for 350 V screen grid supply is 2.2 k Ω (see Figure 1)

Figure 3



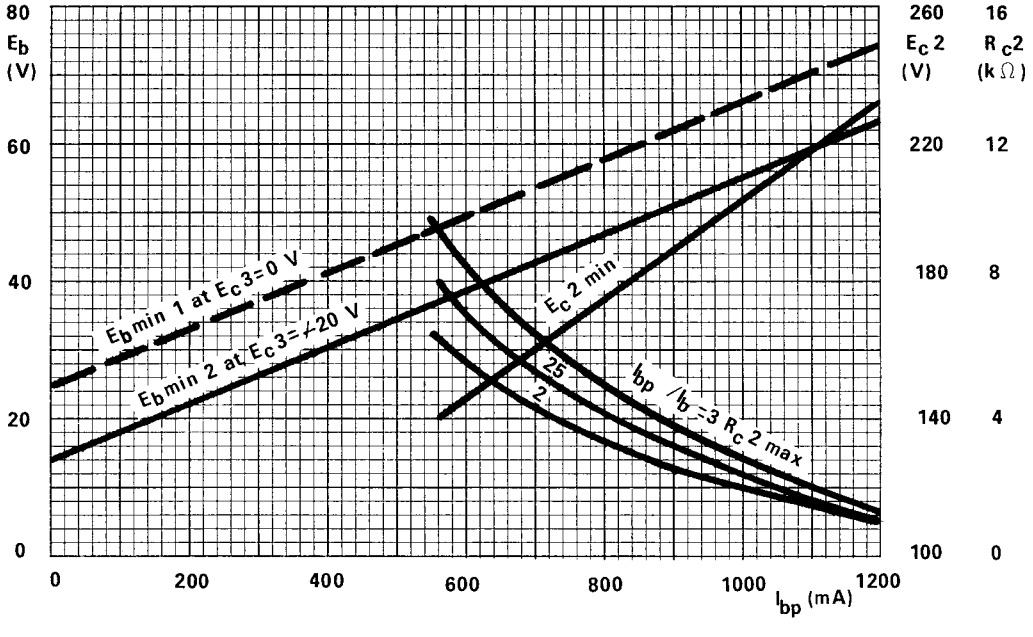
Minimum required plate voltage.

R_c 2 maximum: maximum permissible screen grid series resistance for 280 V screen grid supply.

The specified values of I_b peak are available at supply voltages 10% below nominal and throughout the tube life.

Note: R_c 2 minimum for 280 V screen grid supply is 1.4kΩ(see Figure 1)

Figure 4



TRANSFER CHARACTERISTICS

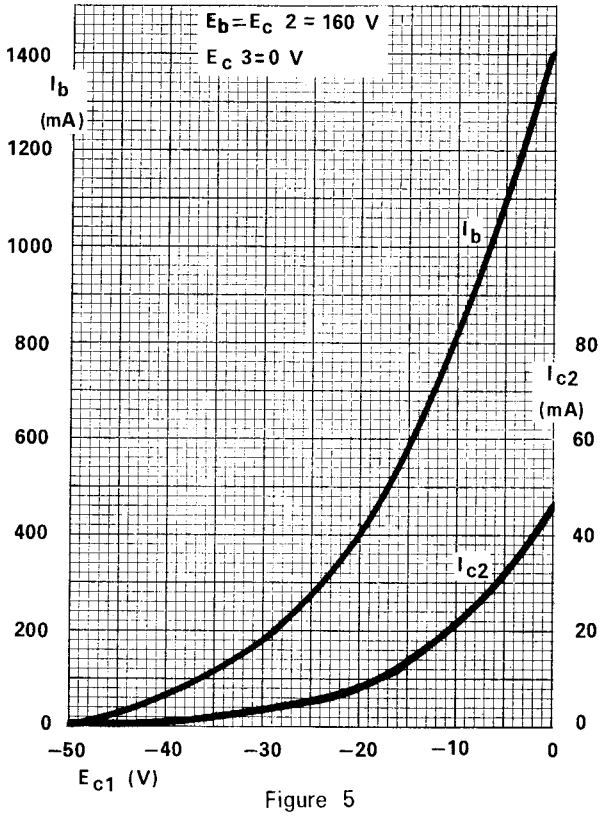


Figure 5

PLATE CHARCATERISTICS

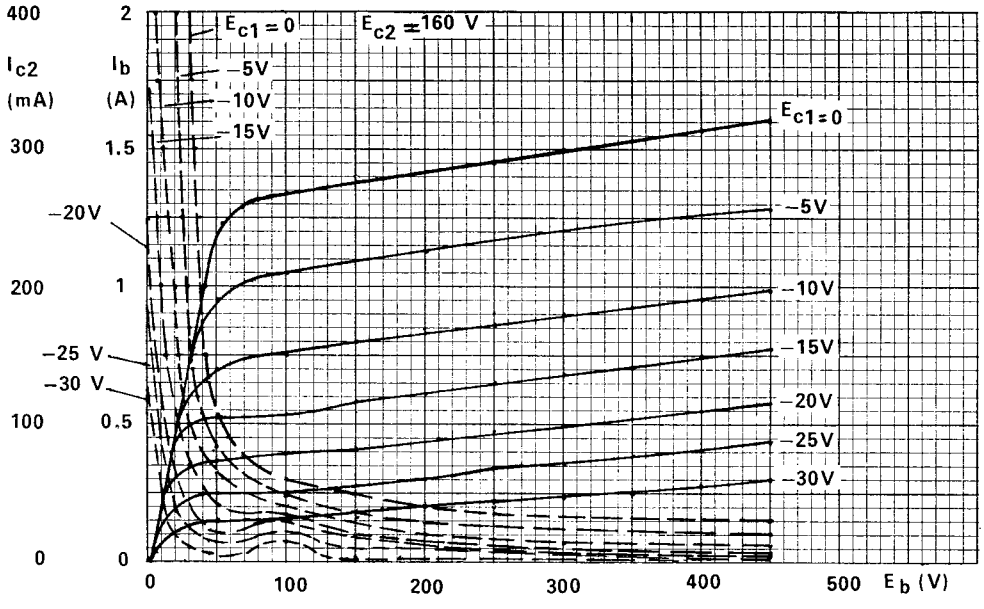


FIGURE 6

PLATE CHARACTERISTICS

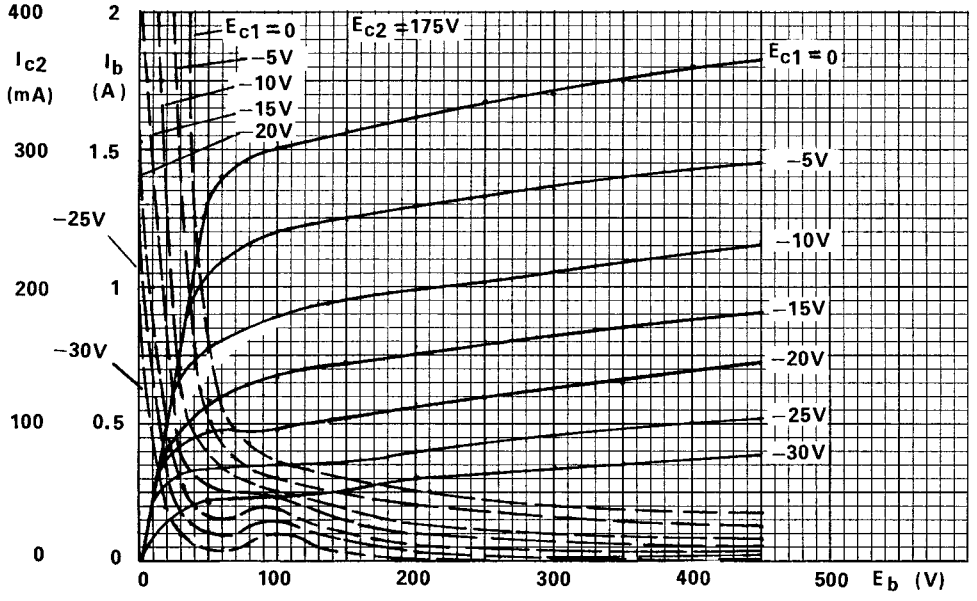


Figure 7

PLATE CHARACTERISTICS

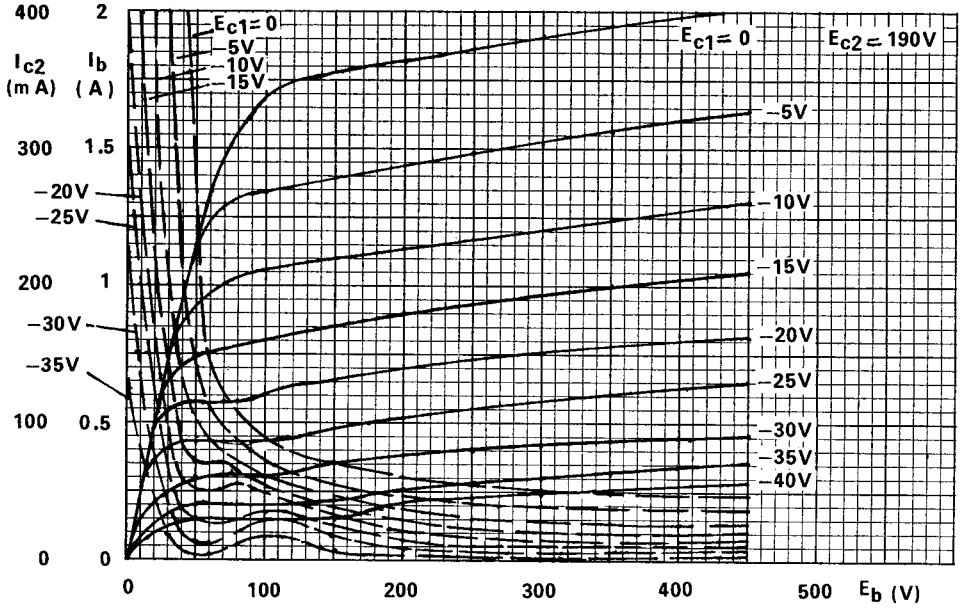


Figure 8

Electronic TUBES

21ACP4 AND 21ACP4-A

CATHODE-RAY TUBE

21-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
90-DEGREE DEFLECTION ANGLE
19⅛ BY 15-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
EXTERNAL CONDUCTIVE COATING
ION-TRAP GUN
21ACP4-A—ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 21ACP4 is a magnetic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 19⅛ by 15-inch picture for television applications. It has an electron gun which is used with an external single-field ion-trap magnet. The ninety-degree deflection angle allows a reduction in tube length and an increase of approximately 4.5 percent in screen area over tubes with narrower angles. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high ambient light conditions, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

The 21ACP4-A has the additional feature of a reflective aluminized screen which increases light output.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	90	Degrees
Horizontal	85	Degrees
Vertical	68	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	750	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	71	Percent

GENERAL ELECTRIC

Supersedes ET-T1045 and ET-T1046, dated 11-53

MECHANICAL

Over-all Length	20 ± 3/8	Inches
Greatest Bulb Dimensions		
Diagonal	21 3/8 ± 1/8	Inches
Width	20 1/4 ± 1/8	Inches
Height	16 3/8 ± 1/8	Inches
Minimum Useful Screen Dimensions		
Diagonal	20 1/4	Inches
Width	19 1/8	Inches
Height	15	Inches
Neck Length	7 1/2	Inches

Bulb Number, ASA Designation—C171 Exp. 2
Bulb Contact—Recessed Small-Cavity Cap, JETEC No. J1-21
Base—Small-Shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ± 30 Degrees

Mounting Position—Any

Net Weight, approximate	25	Pounds

MAXIMUM RATINGS*

DESIGN-CENTER VALUES

Anode Voltage†	20,000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	16,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current△, approximate	117	Milliamperes DC
Ion-Trap Field Intensity,♦ approximate	40	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

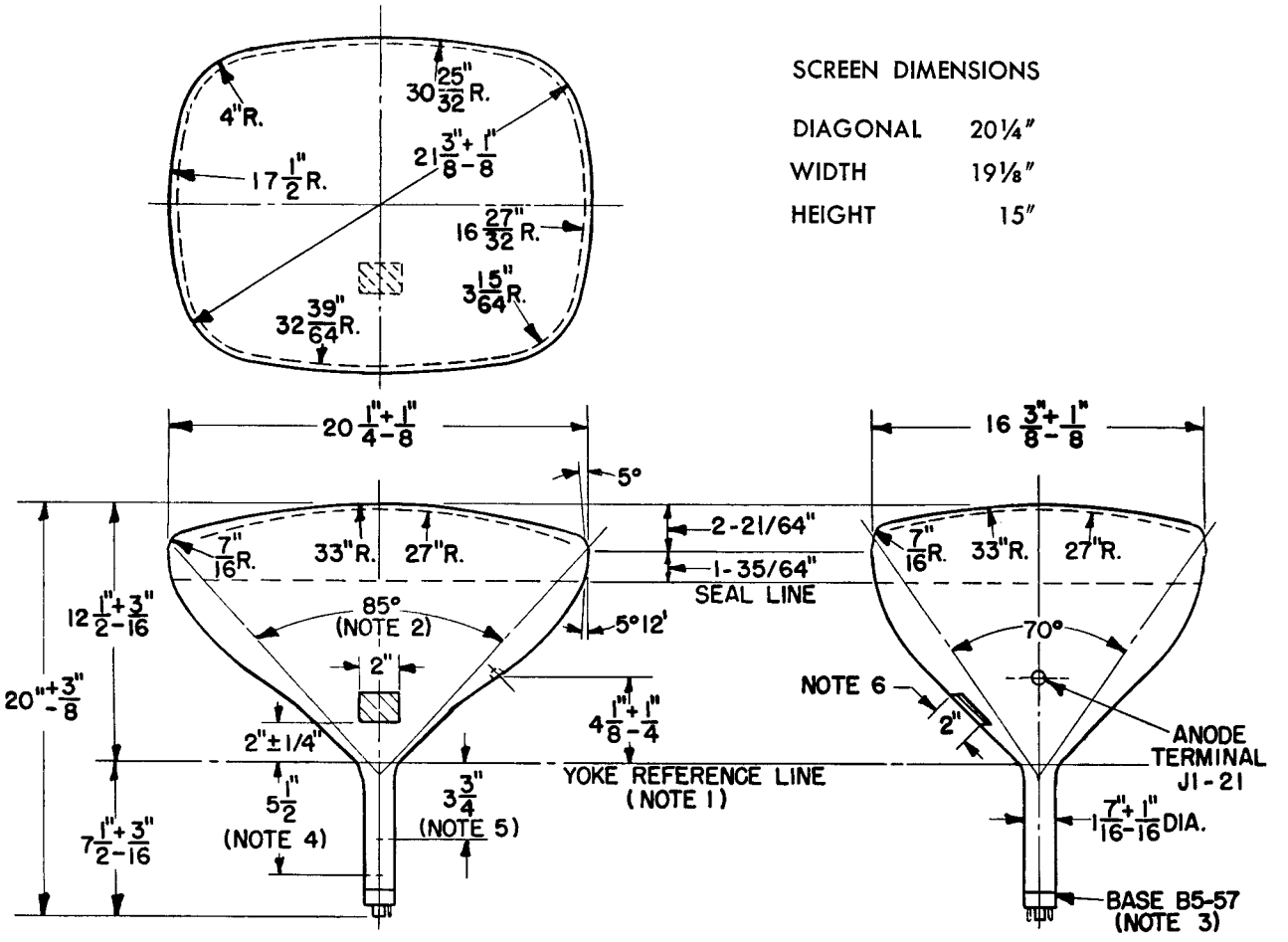
‡ Cathode should be returned to one side or to the midtap of the heater transformer winding.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

π For visual extinction of focused raster.

△For RETMA focusing coil No. 109 with the yoke-reference-line to center-of-air-gap distance equal to 3¾ inches.

♦ Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through RETMA ion-trap magnet No. 117.

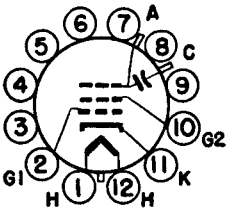


SCREEN DIMENSIONS

DIAGONAL	20¼"
WIDTH	19⅛"
HEIGHT	15"

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE-LINE GAGE (RETMA NO. 116) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 90 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.
6. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



BASING DIAGRAM
12N

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

21ALP4

CATHODE-RAY TUBE

21-INCH RECTANGULAR, GLASS
FOCUS—LOW-VOLTAGE ELECTROSTATIC
DEFLECTION—MAGNETIC
90-DEGREE DEFLECTION ANGLE

19⅛- BY 15-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 21ALP4 is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 19⅛- by 15-inch picture for television applications. The electron gun has a focusing voltage range of −0.4 to +2.2 percent of the final anode voltage and is used with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high ambient light conditions, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	90	Degrees
Horizontal	85	Degrees
Vertical	68	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	750	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
- Fluorescent Color—White
- Phosphorescent Color—White
- Persistence—Short

Faceplate—Gray
- Light Transmission at Center, approximate ..... 71 Percent

GENERAL ELECTRIC

Supersedes ET-T1140, dated 8-54

MECHANICAL

Over-all Length . . . . . 20 ± 3/8 Inches
Greatest Bulb Dimensions
  Diagonal . . . . . 21 3/8 ± 1/8 Inches
  Width . . . . . 20 1/4 ± 1/8 Inches
  Height . . . . . 16 3/8 ± 1/8 Inches
Minimum Useful Screen Dimensions
  Diagonal . . . . . 20 1/4 Inches
  Width . . . . . 19 1/8 Inches
  Height . . . . . 15 Inches
Neck Length . . . . . 7 1/2 Inches
Bulb Number, ASA Designation—C171 Exp. 2
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
  Anode Contact Aligns with Pin No. 6 ± 30 Degrees
Mounting Position—Any
Net Weight, approximate . . . . . 25 Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage† . . . . . 18,000 Max Volts DC
Focusing-Electrode Voltage . . . . . −500 to +1000 Max Volts DC
Grid-No. 2 Voltage . . . . . 500 Max Volts DC
Grid-No. 1 Voltage
  Negative-Bias Value . . . . . 125 Max Volts DC
  Positive-Bias Value . . . . . 0 Max Volts DC
  Positive-Peak Value . . . . . 2 Max Volts
Peak Heater-Cathode Voltage‡
  Heater Negative with Respect to Cathode
    During Warm-up Period not to Exceed 15 Seconds . . . . . 410 Max Volts
    After Equipment Warm-up Period . . . . . 180 Max Volts
  Heater Positive with Respect to Cathode . . . . . 180 Max Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§ . . . . . 16,000 Volts DC
Focusing-Electrode Voltage for Focusπ . . . . . −64 to +352 Volts DC
Focusing-Electrode Current . . . . . −15 to +25 Microamperes DC
Grid-No. 2 Voltage . . . . . 300 Volts DC
Grid-No. 1 Voltage△ . . . . . −28 to −72 Volts DC
Ion-Trap Field Intensity◆, approximate . . . . . 40 Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance . . . . . 1.5 Max Megohms

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode, grid-No. 3 and grid-No. 5 which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

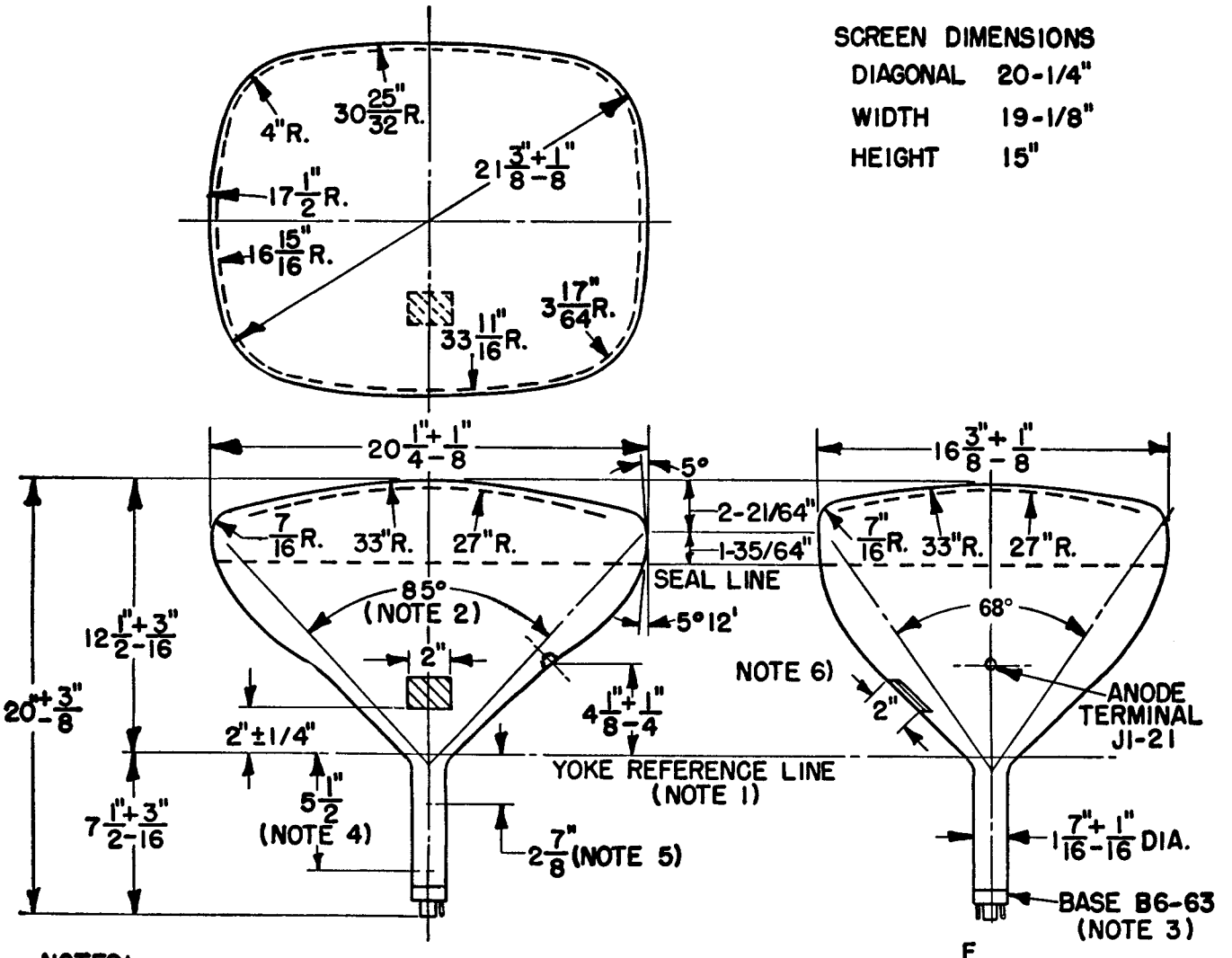
‡ Cathode should be returned to one side or to the midtap of the heater transformer winding.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

π The focusing electrode may be modulated within the stipulated maximum range without damage to the tube.

△For visual extinction of focused raster.

◆ Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through JETEC ion-trap magnet No. 117.

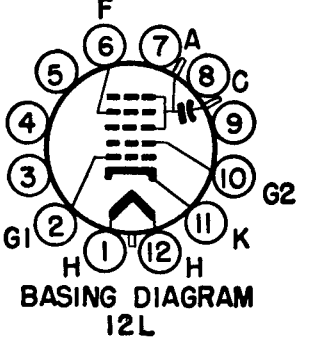


SCREEN DIMENSIONS

DIAGONAL	20-1/4"
WIDTH	19-1/8"
HEIGHT	15"

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE-LINE GAGE (RETMA NO. 116) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 90 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.
6. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



BASING DIAGRAM
12L

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

DESCRIPTION AND RATING

CATHODE-RAY TUBE 21ARP4

19-1/8 by 14-3/16-INCH PICTURE SIZE

21-INCH RECTANGULAR, GLASS	FACEPLATE — SPHERICAL, GRAY
BUILT-IN FOCUSING UNIT	BUILT-IN ION-TRAP MAGNET
DEFLECTION — MAGNETIC	EXTERNAL CONDUCTIVE COATING
70-DEGREE DEFLECTION ANGLE	OPERATING RANGE — 14 to 18 KILOVOLTS

The 21ARP4 is a magnetic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 19-1/8 by 14-3/16-inch picture for television applications. In this tube, an ion-trap magnet and a magnetic focusing unit are integral parts of the electron gun. The ion-trap magnet assures proper alignment of the electron beam and eliminates the adjustable external magnet usually required. The focusing unit permits a sharp over-all focus adjustable through a wide range of anode voltage by a magnetic shunt sleeve around the tube neck. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high ambient light conditions, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

TECHNICAL INFORMATION

GENERAL

Electrical

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method - Magnetic		
Deflecting Method - Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	750	uuf
Minimum	500	uuf

Optical

Phosphor Number - P4, Sulfide Type		
Fluorescent Color - White		
Phosphorescent Color - White		
Persistence - Short		
Faceplate - Gray		
Light Transmission at Center, approximate	71	Percent

GENERAL ELECTRIC

from RETMA release #1267, Jan. 22, 1954

GENERAL (CONT'D)

Mechanical

Over-all Length	23-1/32 ± 3/8	Inches
Greatest Bulb Dimensions		
Diagonal	21-7/32 ± 1/8	Inches
Width	20-1/4 ± 1/8	Inches
Height	15-9/16 ± 1/8	Inches
Minimum Useful Screen Dimensions		
Diagonal	20-1/8	Inches
Width	19-1/8	Inches
Height	14-3/16	Inches
Neck Length	7-1/2	Inches

Bulb Number, ASA Designation - C170 Exp. 13
Bulb Contact - Recessed Small-Cavity Cap, JETEC No. J1-21
Base - Small-Shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation - 12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ± 30 Degrees
Mounting Position - Any
Net Weight, approximate 25 Pounds

MAXIMUM RATINGS * Design-Center Values

Anode Voltage †	20,000 Max	Volts DC
Anode Input ‡	6 Max	Watts
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage §		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

Typical Operating Conditions

Anode Voltage Δ	16,000 ± 2000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage π	-28 to -72	Volts DC

Maximum Circuit Values

Grid-No. 1-Circuit Resistance	1.5 Max	Megohms

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

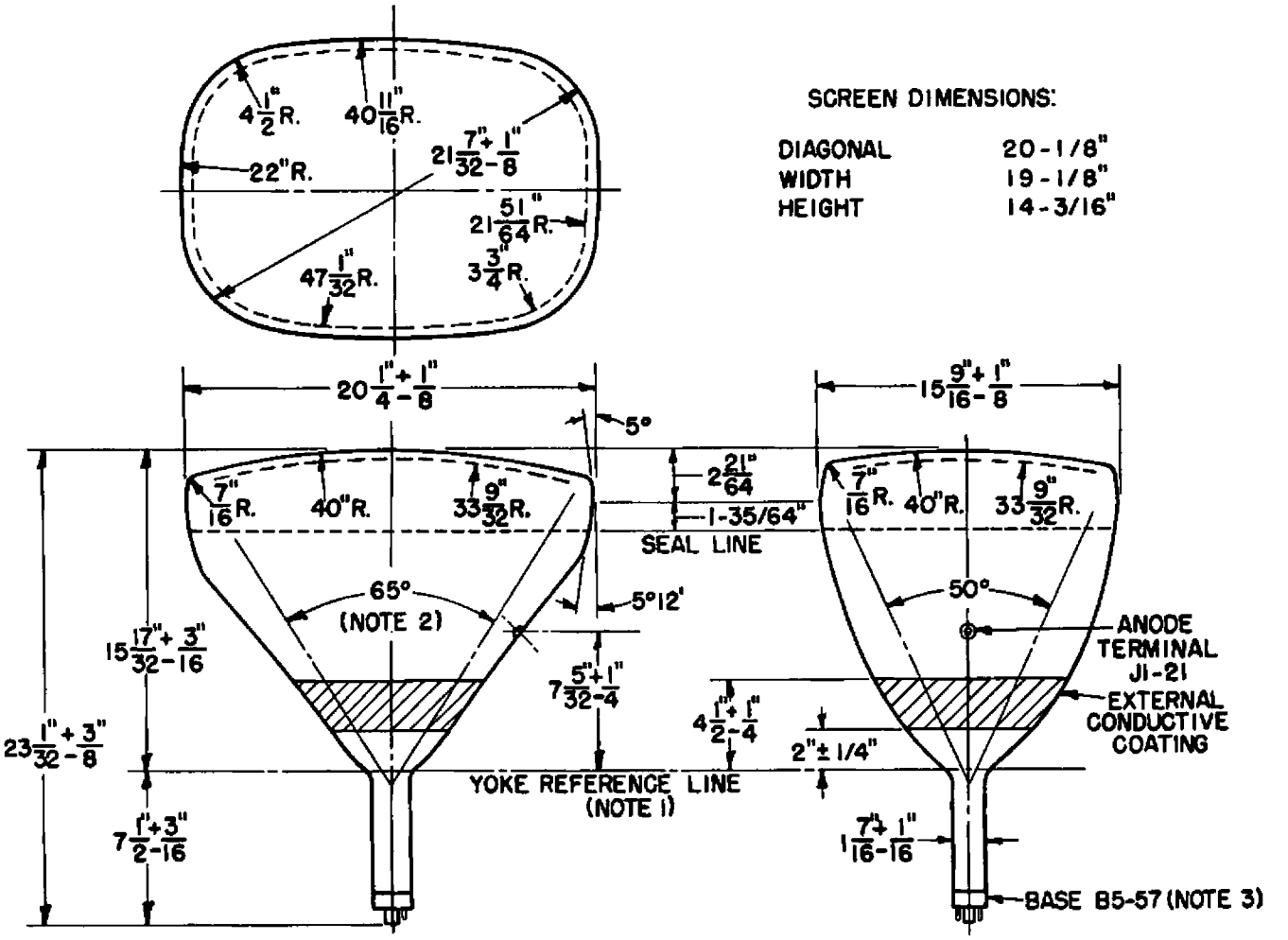
If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

‡ Anode input equals the product of anode voltage and anode current, the latter being measured at the anode contact with a direct-current ammeter.

§ Cathode should be returned to one side or to the midtap of the heater transformer winding.

Δ Optimum focusing conditions require that the tube be operated within the specified voltage range. The tube, however, will safely withstand the rated maximum anode voltage.

π For visual extinction of focused raster.

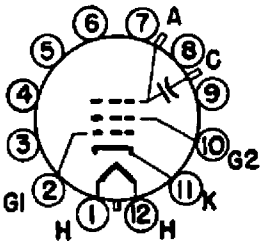


SCREEN DIMENSIONS:

DIAGONAL	20-1/8"
WIDTH	19-1/8"
HEIGHT	14-3/16"

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ±30 DEGREES.



BASING DIAGRAM
12N

K69087-72A632

November 10, 1953

Outline
21ARP4

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

DESCRIPTION AND RATING

PICTURE TUBE

19-1/8 BY 14-3/16-INCH PICTURE SIZE

21-INCH RECTANGULAR, GLASS	FACEPLATE - SPHERICAL, GRAY
BUILT-IN FOCUSING UNIT	METAL-BACKED SCREEN
DEFLECTION - MAGNETIC	EXTERNAL CONDUCTIVE COATING
70-DEGREE DEFLECTION ANGLE	OPERATING RANGE - 13 to 19 KILOVOLTS

The 21ARP4-A is a magnetic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 19-1/8 by 14-3/16-inch picture for television applications. In this tube, a magnetic focusing unit which is an integral part of the electron gun permits a sharp over-all focus adjustable through a wide range of anode voltage by a shunt sleeve around the tube neck. An external ion-trap magnet is not required and should not be used. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high ambient light conditions, a reflective aluminized screen to increase light output, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

TECHNICAL INFORMATION

GENERAL

Electrical

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method - Magnetic		
Deflecting Method - Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	750	uuf
Minimum	500	uuf

Optical

Phosphor Number - P4, Sulfide Type		
Fluorescent Color - White		
Phosphorescent Color - White		
Persistence - Short		
Faceplate - Gray		
Light Transmission at Center, approximate	71	Percent

Mechanical

Over-all Length	23-1/32 ± 3/8	Inches
Greatest Bulb Dimensions		
Diagonal	21-7/32 ± 1/8	Inches
Width	20-1/4 ± 1/8	Inches
Height	15-9/16 ± 1/8	Inches
Minimum Useful Screen Dimensions		
Diagonal	20-1/8	Inches
Width	19-1/8	Inches
Height	14-3/16	Inches
Neck Length	7-1/2	Inches

Bulb Number, ASA Designation - J170-B1
Bulb Contact - Recessed Small-cavity Cap, JETEC No. J1-21
Base - Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation - 12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ± 30 Degrees

Mounting Position - Any

Net Weight, approximate	25	Pounds

MAXIMUM RATINGS ◊ Design-Center Values

Anode Voltage †	20,000	Max Volts DC
Anode Input ‡	6	Max Watts
Grid-No. 2 Voltage	500	Max Volts DC
Grid-No. 1 Voltage		
Negative-bias Value	125	Max Volts DC
Positive-bias Value	0	Max Volt DC
Positive-peak Value	2	Max Volts
Peak Heater-cathode Voltage §		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	180	Max Volts
Heater Positive with Respect to Cathode	180	Max Volts

Typical Operating Conditions

Anode Voltage Δ	16,000 ± 3000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage π	-28 to -72	Volts DC

Maximum Circuit Values

Grid-No. 1 Circuit Resistance	1.5	Max Megohms

◊ The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

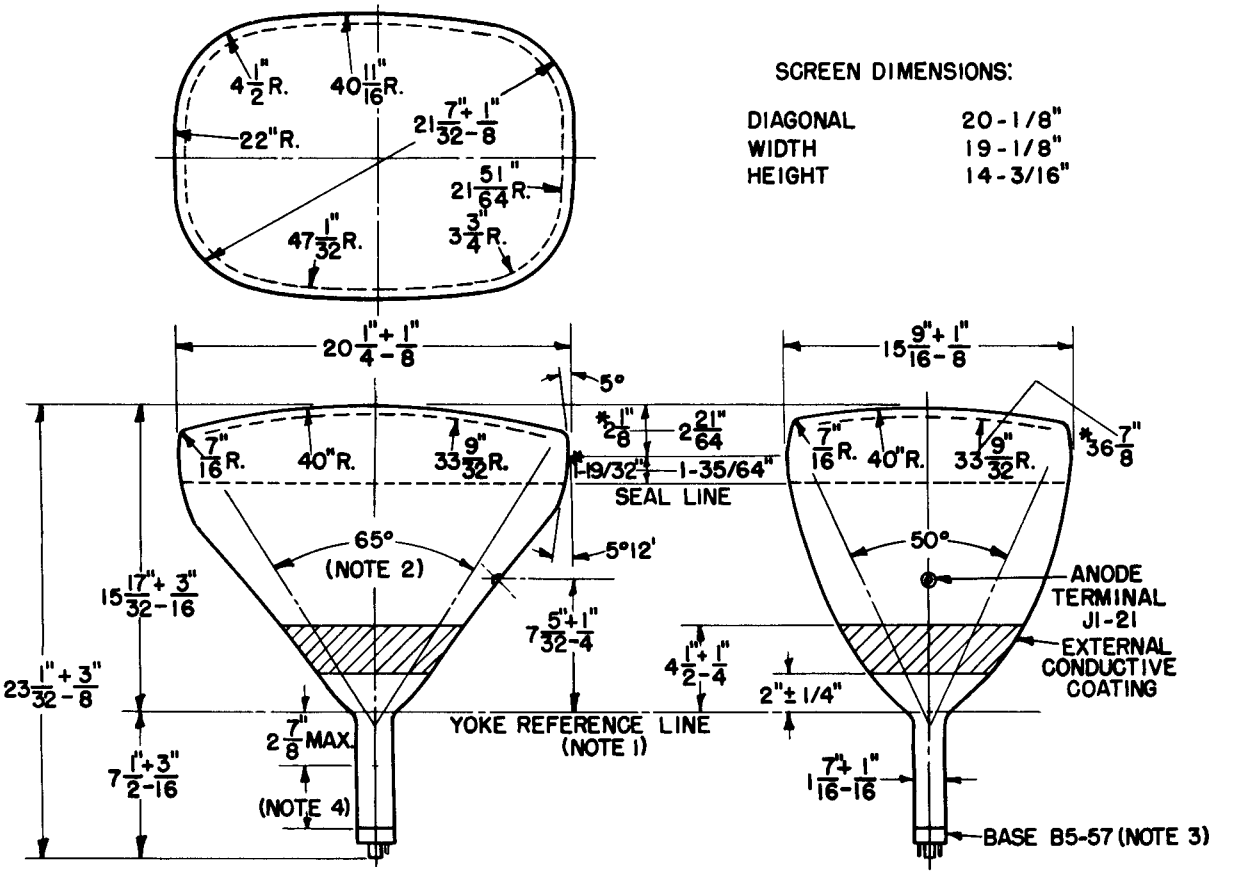
If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

‡ Anode input equals the product of anode voltage and anode current, the latter being measured at the anode contact with a direct-current ammeter.

§ Cathode should be returned to one side or to the midtap of the heater transformer winding.

Δ Optimum focusing conditions require that the tube be operated within the specified voltage range. The tube, however, will safely withstand the rated maximum anode voltage.

π For visual extinction of focused raster.



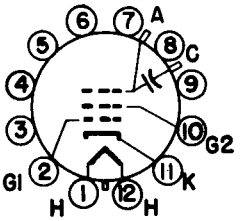
SCREEN DIMENSIONS:

DIAGONAL	20-1/8"
WIDTH	19-1/8"
HEIGHT	14-3/16"

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ±30 DEGREES.
4. KEEP THIS SPACE CLEAR FOR FOCUSING-UNIT SHUNT SLEEVE.

* THIS SET OF VALUES ALSO POSSIBLE.



BASING DIAGRAM
12N

Electronic TUBES

21ATP4

CATHODE-RAY TUBE

21-INCH RECTANGULAR, GLASS
FOCUS—LOW-VOLTAGE ELECTROSTATIC
DEFLECTION—MAGNETIC
90-DEGREE DEFLECTION ANGLE
19⅛- BY 15-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 21ATP4 is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 19⅛- by 15-inch picture for television applications. The electron gun has a focusing voltage range of −0.4 to +2.2 percent of the anode voltage and is used with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high ambient light conditions, a reflective aluminized screen to increase light output, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded. Except for the capacitance of this coating, the 21ATP4 is identical to the 21ALP4-A.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	90	Degrees
Horizontal	85	Degrees
Vertical	70	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	1500	μμf
Minimum	1200	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	71	Percent

MECHANICAL

Over-all Length	20 ± ⅜	Inches
Greatest Bulb Dimensions		
Diagonal	21⅜ ± ⅛	Inches
Width	20¼ ± ⅛	Inches
Height	16⅜ ± ⅛	Inches
Minimum Useful Screen Dimensions		
Diagonal	20¼	Inches
Width	19⅛	Inches
Height	15	Inches
Neck Length	7½	Inches

Bulb Number, ASA Designation—C171 Exp. 2
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ± 30 Degrees

Mounting Position—Any

Net Weight, approximate	25	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	18,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	16,000	Volts DC
Focusing-Electrode Voltage for Focusπ	−64 to +352	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage△	−28 to −72	Volts DC
Ion-Trap Field Intensity♦, approximate	40	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode, grid-No. 3 and grid-No. 5, which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

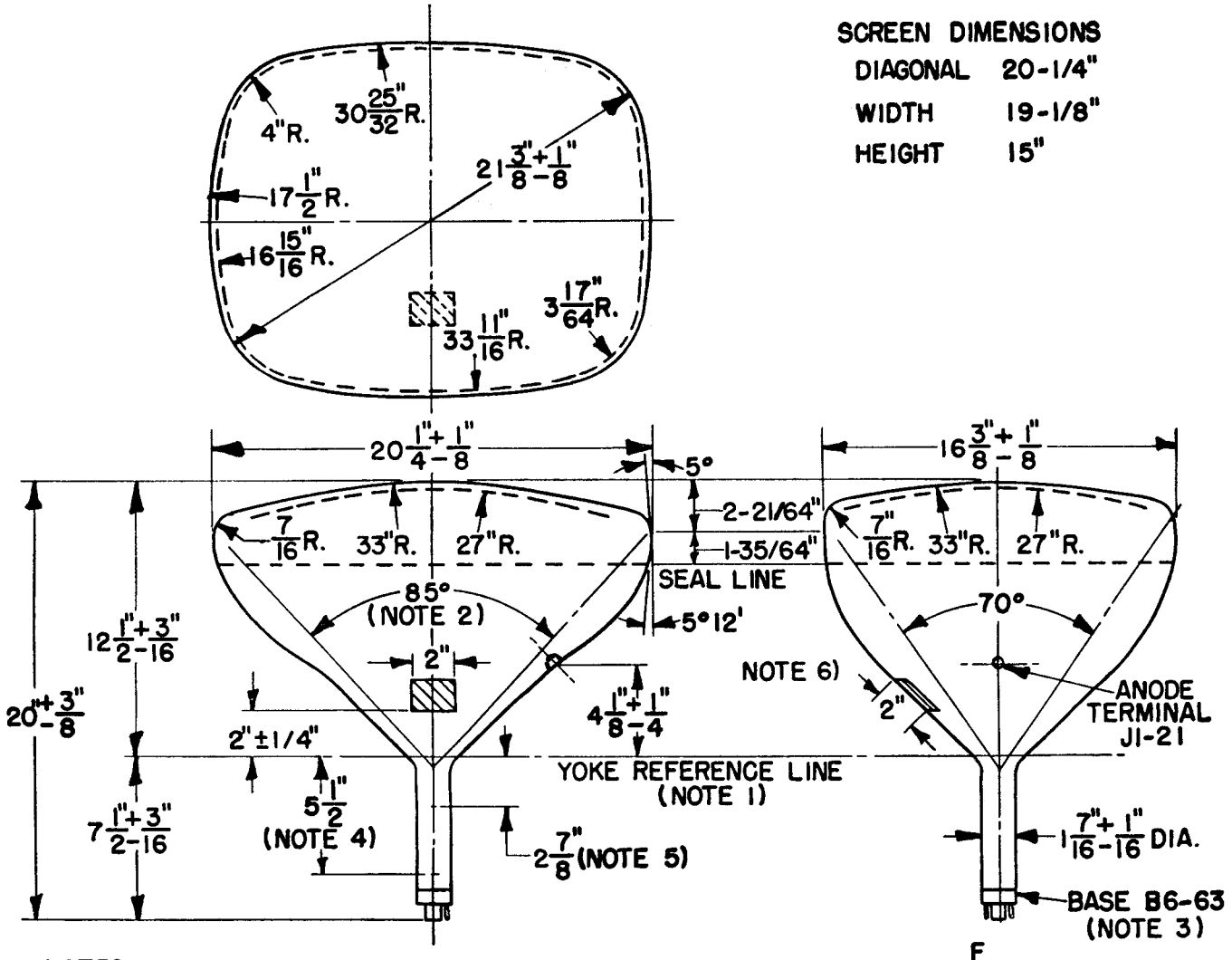
‡ Cathode should be returned to one side or to the midtap of the heater transformer winding.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

π The focusing electrode may be modulated within the stipulated maximum range without damage to the tube.

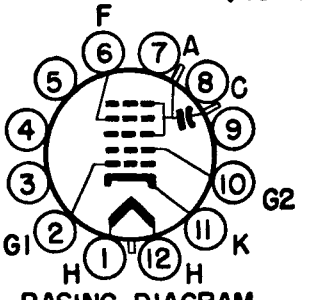
△For visual extinction of focused raster.

◆ Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through JETEC ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE-LINE GAGE (RETMA NO. 116) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 90 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.
6. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



BASING DIAGRAM
12L

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

21AUP4-B/21AUP4-A

CATHODE-RAY TUBE

21-INCH RECTANGULAR GLASS
FOCUS—ELECTROSTATIC
DEFLECTION—MAGNETIC
72-DEGREE DEFLECTION ANGLE
19⅛- BY 15-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 21AUP4-B/21AUP4-A is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube for television applications. This tube provides the same large 19⅛- by 15-inch picture area as do 21-inch, 90-degree-deflection tubes. The electron gun has a focusing voltage range of −0.4 to +2.2 percent of the anode voltage and is designed for use with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high ambient light conditions, a reflective aluminized screen to increase light output, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	72	Degrees
Horizontal	67	Degrees
Vertical	53	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	750	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray		
Light Transmission at Center, approximate	71	Percent

MECHANICAL

Over-all Length	$23\frac{1}{32} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$21\frac{3}{8} \pm \frac{1}{8}$	Inches
Width	$20\frac{1}{4} \pm \frac{1}{8}$	Inches
Height	$16\frac{3}{8} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$20\frac{1}{4}$	Inches
Width	$19\frac{1}{8}$	Inches
Height	15	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J171F
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing—JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees

Mounting Position—Any

Net Weight, approximate	25	Pounds

RATINGS*

DESIGN-CENTER VALUES†

Anode Voltage‡	20,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS*

Anode Voltage§	16,000	Volts DC
Focusing-Electrode Voltage	−64 to +352	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Ion-Trap Field Intensity▲, approximate	40	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms
Grid-No. 2 Circuit Resistance	0.1 Min	Megohms
Focusing-Electrode Resistance	0.1 Min	Megohms

Protective resistance in the grid-No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

* All voltages are measured with respect to cathode.

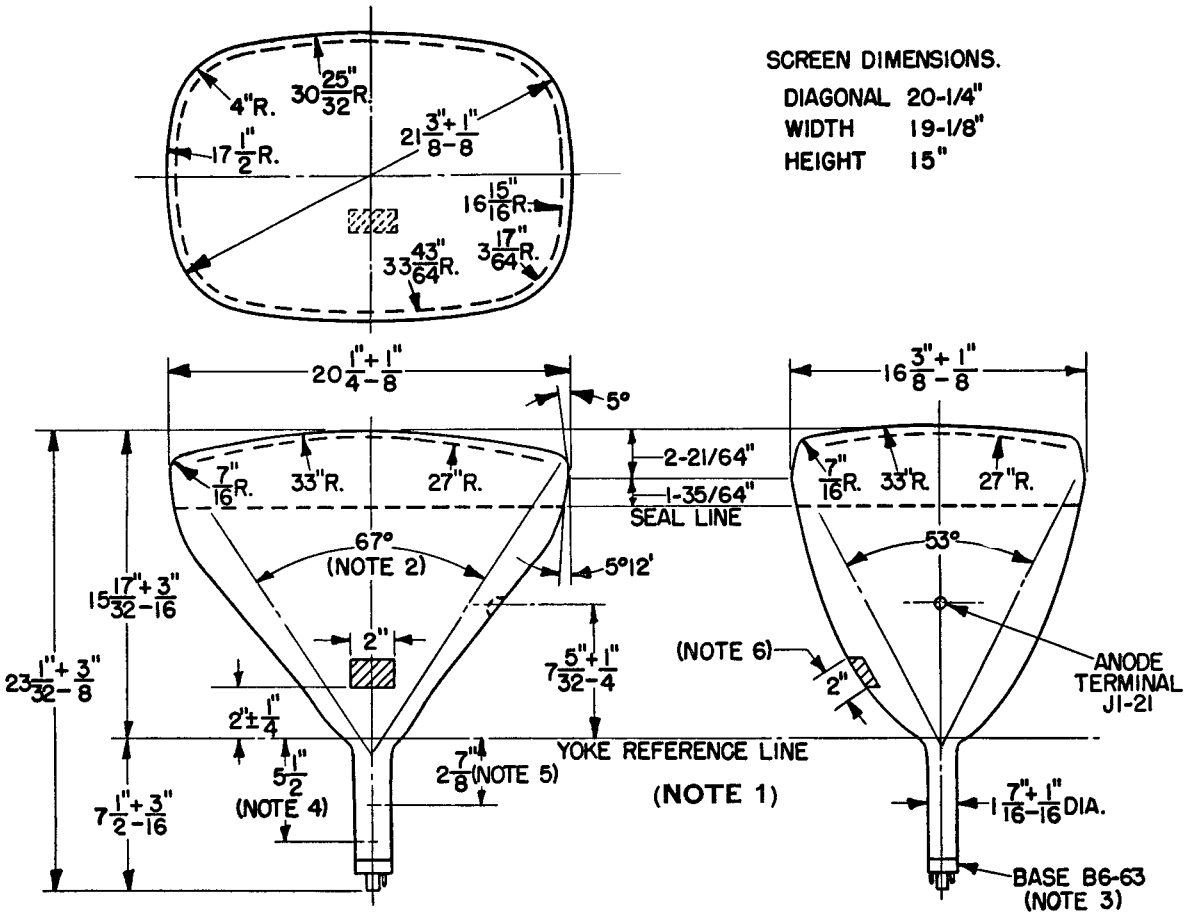
† The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

‡ Anode, grid-No. 3 and grid-No. 5 which are connected together within the tube are referred to herein as anode. If this tube is operated at voltage in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

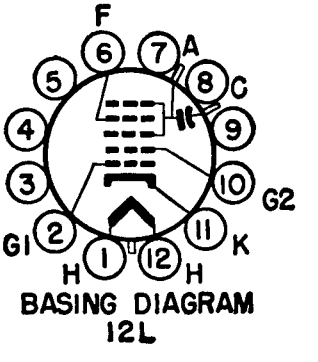
π For visual extinction of focused raster.

▲ Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through JETEC ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 72 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.
6. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



BASING DIAGRAM
12L

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

21AVP4-B/21AVP4-A

CATHODE-RAY TUBE

19⅛ BY 15-INCH PICTURE SIZE

21-INCH, RECTANGULAR, GLASS
FOCUS—ELECTROSTATIC
DEFLECTION—MAGNETIC
72-DEGREE DEFLECTION ANGLE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
ALUMINIZED SCREEN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 21AVP4-B/21AVP4-A is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube for television applications. It provides the same large 19⅛ by 15-inch picture area as do 21-inch 90-degree deflection tubes. The electron gun has a focusing voltage range of −0.4 to +2.2 percent of the anode voltage and is designed for use with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high ambient light conditions, a reflective aluminized screen to increase light output, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ±10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	72	Degrees
Horizontal	67	Degrees
Vertical	53	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	1500	μμf
Minimum	1200	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray		
Light Transmission at Center, approximate	71	Percent

GENERAL ELECTRIC

Supersedes ET-T1199, dated 6-55

MECHANICAL

Over-all Length	$23\frac{1}{32} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$21\frac{3}{8} \pm \frac{1}{8}$	Inches
Width	$20\frac{1}{4} \pm \frac{1}{8}$	Inches
Height	$16\frac{3}{8} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$20\frac{1}{4}$	Inches
Width	$19\frac{1}{8}$	Inches
Height	15	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J171F
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees

Mounting Position—Any

Net Weight, approximate . . . . . 25 Pounds

MAXIMUM RATINGS◆

DESIGN-CENTER VALUES*

Anode Voltage†	20,000	Max Volts DC
Focusing-Electrode Voltage	−500 to +1000	Max Volts DC
Grid-No. 2 Voltage	500	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	180	Max Volts
Heater Positive with Respect to Cathode	180	Max Volts

TYPICAL OPERATING CONDITIONS◆

Anode Voltage‡	16,000	Volts DC
Focusing-Electrode Voltage for Focus	−64 to +352	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage§	−28 to −72	Volts DC
Ion-Trap Field Intensityπ, approximate	40	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5	Max Megohms
Grid-No. 2 Circuit Resistance	0.1	Min Megohms
Focusing-Electrode Circuit Resistance	0.1	Min Megohms

Protective resistance in the grid-No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

♦ All voltages are measured with respect to cathode.

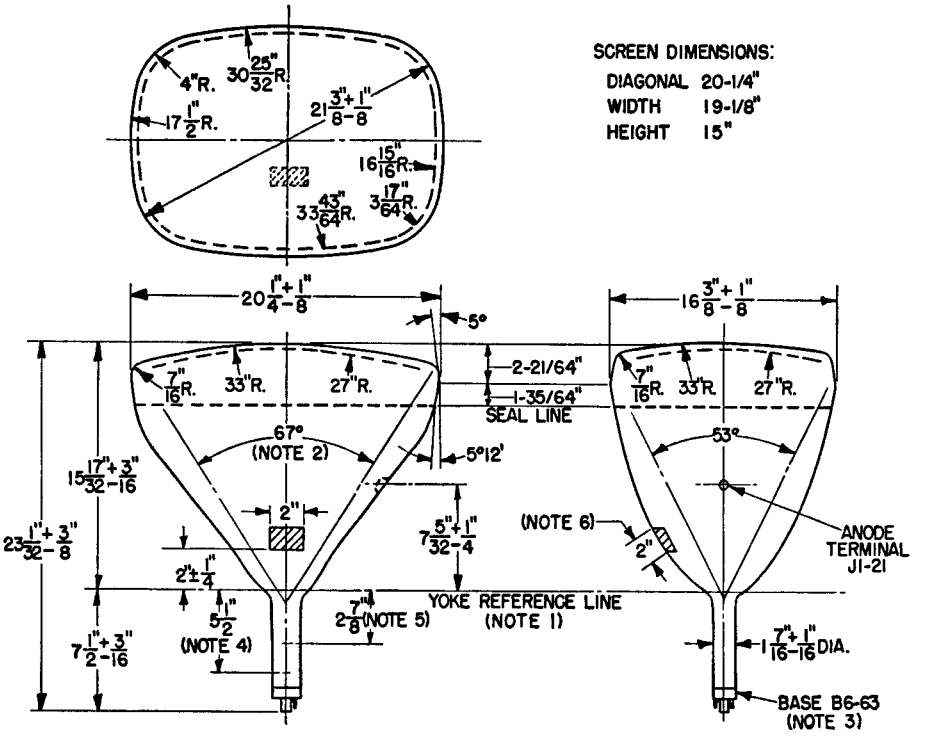
* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode, grid-No. 3, and grid-No. 5 which are connected together within the tube are referred to herein as anode. If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

‡ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

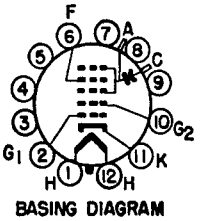
§ For visual extinction of focused raster.

π Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through RETMA ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 72 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.
6. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



BASING DIAGRAM
12L

Electronic TUBES

21AWP4

CATHODE-RAY TUBE

21-INCH RECTANGULAR GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
72-DEGREE DEFLECTION ANGLE
19⅛- BY 15-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 21AWP4 is a magnetic-focus and magnetic-deflection, direct-view all-glass picture tube for television applications. This tube provides the same large 19⅛- by 15-inch picture area as do 21-inch, 90-degree-deflection tubes. Other features of the 21AWP4 include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, a reflective aluminized screen to increase light output, a space-saving rectangular face shape, and an electron gun designed for use with an external single-field ion-trap magnet. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	72	Degrees
Horizontal	67	Degrees
Vertical	53	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	1500	μμf
Minimum	1200	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	71	Percent

MECHANICAL

Over-all Length	$23\frac{1}{32} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$21\frac{3}{8} \pm \frac{1}{8}$	Inches
Width	$20\frac{1}{4} \pm \frac{1}{8}$	Inches
Height	$16\frac{3}{8} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$20\frac{1}{4}$	Inches
Width	$19\frac{1}{8}$	Inches
Height	15	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—C171 Exp. 6
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing—JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	25	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	18,000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	16,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	116	Milliamperes DC
Ion-Trap Field Intensity♦, approximate	40	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

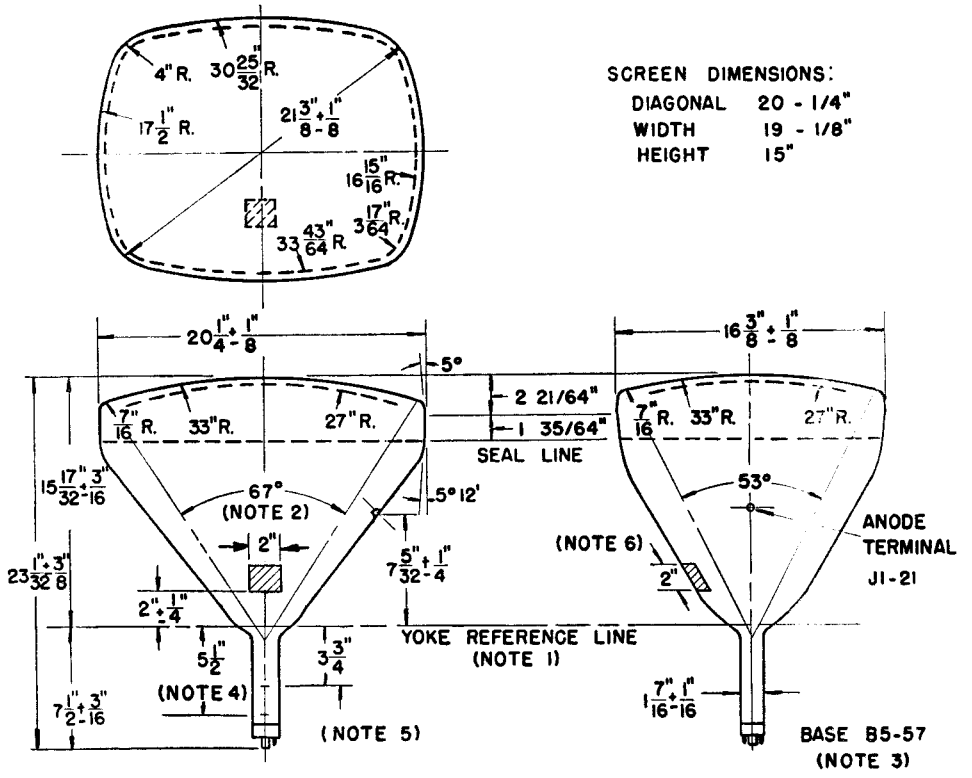
‡Cathode should be returned to one side or to the midtap of the heater transformer winding.

§Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

πFor visual extinction of focused raster.

▲For RETMA focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3¾-inches.

◆ Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through RETMA ion-trap magnet No. 117.

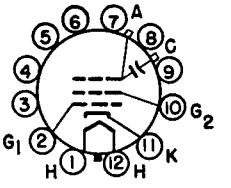


SCREEN DIMENSIONS:

DIAGONAL	20 - 1/4"
WIDTH	19 - 1/8"
HEIGHT	15"

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 72 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.
6. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



BASING DIAGRAM
12 N

Electronic TUBES

21BAP4

CATHODE-RAY TUBE

21-INCH, RECTANGULAR GLASS
FOCUS—ELECTROSTATIC
DEFLECTION—MAGNETIC
90-DEGREE DEFLECTION ANGLE

19⅛- BY 15-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
EXTERNAL CONDUCTIVE COATING
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 21BAP4 is a rectangular all-glass picture tube which provides a 19⅛- by 15-inch picture for direct-view television reception. It employs electrostatic focusing and magnetic deflection. The outstanding feature of this tube is the fact that it does not require an ion-trap magnet; thus better resolution at all times is assured. Other features of the 21BAP4 include a high-quality fluorescent screen which is aluminized to increase light output, a gray faceplate which improves picture contrast, and an external conductive coating which serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	90	Degrees
Horizontal	85	Degrees
Vertical	70	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	750	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	71	Percent

MECHANICAL

Over-all Length	20 ± 3/8	Inches
Greatest Bulb Dimensions		
Diagonal	21 3/8 ± 1/8	Inches
Width	20 1/4 ± 1/8	Inches
Height	16 3/8 ± 1/8	Inches
Minimum Useful Screen Dimensions		
Diagonal	20 1/4	Inches
Width	19 1/8	Inches
Height	15	Inches
Neck Length	7 1/2	Inches

Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees

Mounting Position—Any

Net Weight, approximate	25	Pounds

MAXIMUM RATINGS*

DESIGN-CENTER VALUES†

Anode Voltage‡	18,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage§		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS*

Anode Voltageπ	16,000	Volts DC
Focusing-Electrode Voltage for Focus	0 to 500	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage▲	−28 to −72	Volts DC

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms
Grid-No. 2 Circuit Resistance	0.1 Min	Megohms
Focusing-Electrode Circuit Resistance	0.1 Min	Megohms

Protective resistance in the grid-No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

* All voltages are measured with respect to cathode.

† The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

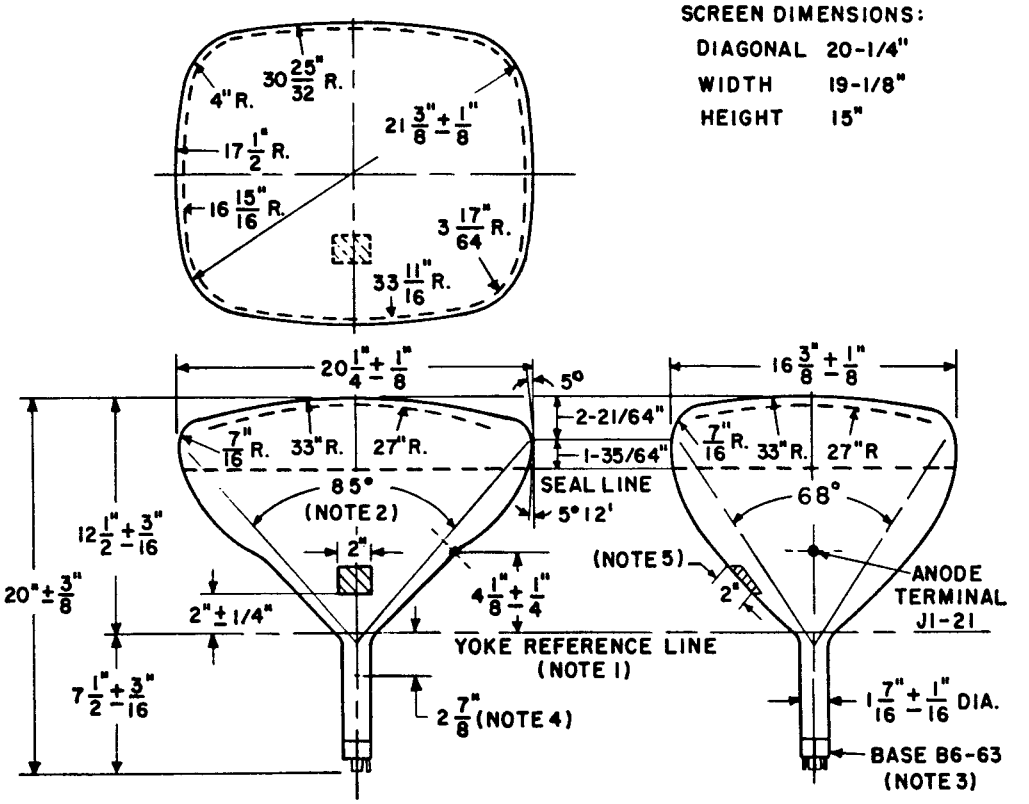
‡ Anode, grid-No. 3 and grid-No. 5 which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltage in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

§ Cathode should be returned to one side or to the midtap of the heater transformer winding.

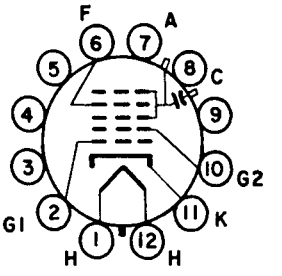
π Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

▲For visual extinction of focused raster.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE-LINE GAGE (RETMA NO. 116) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 90 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.
5. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



BASING DIAGRAM
12 L

Electronic TUBES

21BCP4

CATHODE-RAY TUBE

21-INCH, RECTANGULAR GLASS
FOCUS—ELECTROSTATIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE

19⅛- BY 14$\frac{3}{16}$-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
EXTERNAL CONDUCTIVE COATING
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 21BCP4 is a rectangular all-glass picture tube which provides a 19⅛ by 14$\frac{3}{16}$-inch picture for direct-view television reception. It employs electrostatic focusing and magnetic deflection. The outstanding feature of this tube is the fact that it does not require an ion-trap magnet; thus better resolution at all times is assured. Other features of the 21BCP4 include a high-quality fluorescent screen which is aluminized to increase light output, a gray faceplate which improves picture contrast, and an external conductive coating which serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	750	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	71	Percent

MECHANICAL

Over-all Length	$23\frac{1}{32} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$21\frac{7}{32} \pm \frac{1}{8}$	Inches
Width	$20\frac{1}{4} \pm \frac{1}{8}$	Inches
Height	$15\frac{9}{16} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$20\frac{1}{8}$	Inches
Width	$19\frac{1}{8}$	Inches
Height	$14\frac{3}{16}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J170B
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees

Mounting Position—Any
Net Weight, approximate . . . . . 25 Pounds

MAXIMUM RATINGS*

DESIGN-CENTER VALUES†

Anode Voltage‡	18,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage§		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS*

Anode Voltageπ	16,000	Volts DC
Focusing-Electrode Voltage for Focus	+50 to +550	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage▲	−28 to −72	Volts DC

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms
Grid-No. 2 Circuit Resistance	0.1 Min	Megohms
Focusing-Electrode Circuit Resistance	0.1 Min	Megohms

Protective resistance in the grid-No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

* All voltages are measured with respect to cathode.

† The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

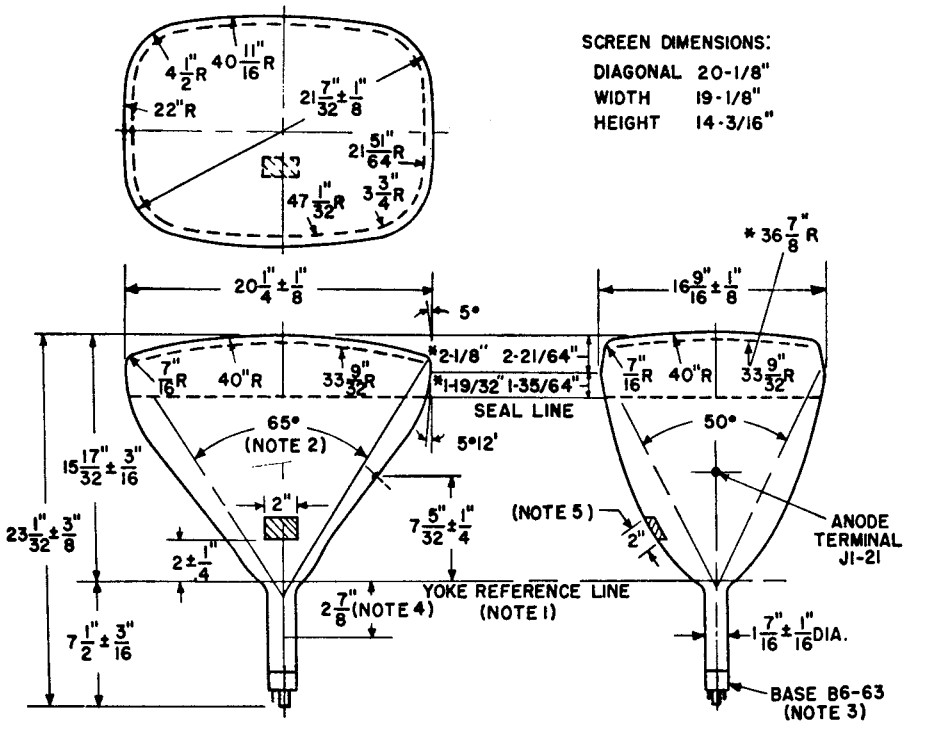
‡ Anode, grid-No. 3 and grid-No. 5 which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

§ Cathode should be returned to one side or to the midtap of the heater transformer winding.

π Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

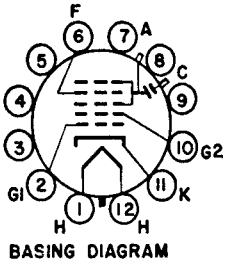
▲ For visual extinction of focused raster.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70°.
3. ANODE TERMINAL ALIGNS WITH PIN-NO.6 ±30DEGREES.
4. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.
5. EXTERNAL CONDUCTIVE COATING CONTACT AREA.

* THIS SET OF VALUES ALSO POSSIBLE.



BASING DIAGRAM
12L

Electronic TUBES

21BDP4

CATHODE-RAY TUBE

21-INCH, RECTANGULAR GLASS
FOCUS—ELECTROSTATIC
DEFLECTION—MAGNETIC
72-DEGREE DEFLECTION ANGLE

19⅛- BY 15-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
EXTERNAL CONDUCTIVE COATING
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 21BDP4 is a rectangular all-glass picture tube which provides a 19⅛- by 15-inch picture for direct-view television reception. It employs electrostatic focusing and magnetic deflection. The outstanding feature of this tube is the fact that it does not require an ion-trap magnet; thus better resolution at all times is assured. Other features of the 21BDP4 include a high-quality fluorescent screen which is aluminized to increase light output, a gray faceplate which improves picture contrast, and an external conductive coating which serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	72	Degrees
Horizontal	67	Degrees
Vertical	53	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	750	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray		
Light Transmission at Center, approximate	71	Percent

MECHANICAL

Over-all Length	$23\frac{1}{32} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$21\frac{3}{8} \pm \frac{1}{8}$	Inches
Width	$20\frac{1}{4} \pm \frac{1}{8}$	Inches
Height	$16\frac{3}{8} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$20\frac{1}{4}$	Inches
Width	$19\frac{1}{8}$	Inches
Height	15	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin. No. 6 ±30 Degrees

Mounting Position—Any

Net Weight, approximate	27	Pounds

MAXIMUM RATINGS*

DESIGN-CENTER VALUES†

Anode Voltage‡	18,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage§		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS*

Anode Voltageπ	16,000	Volts DC
Focusing-Electrode Voltage for Focus	+50 to +550	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage▲	−28 to −72	Volts DC

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms
Grid-No. 2 Circuit Resistance	0.1 Min	Megohms
Focusing-Electrode Circuit Resistance	0.1 Min	Megohms

Protective resistance in the grid-No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

* All voltages are measured with respect to cathode.

† The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

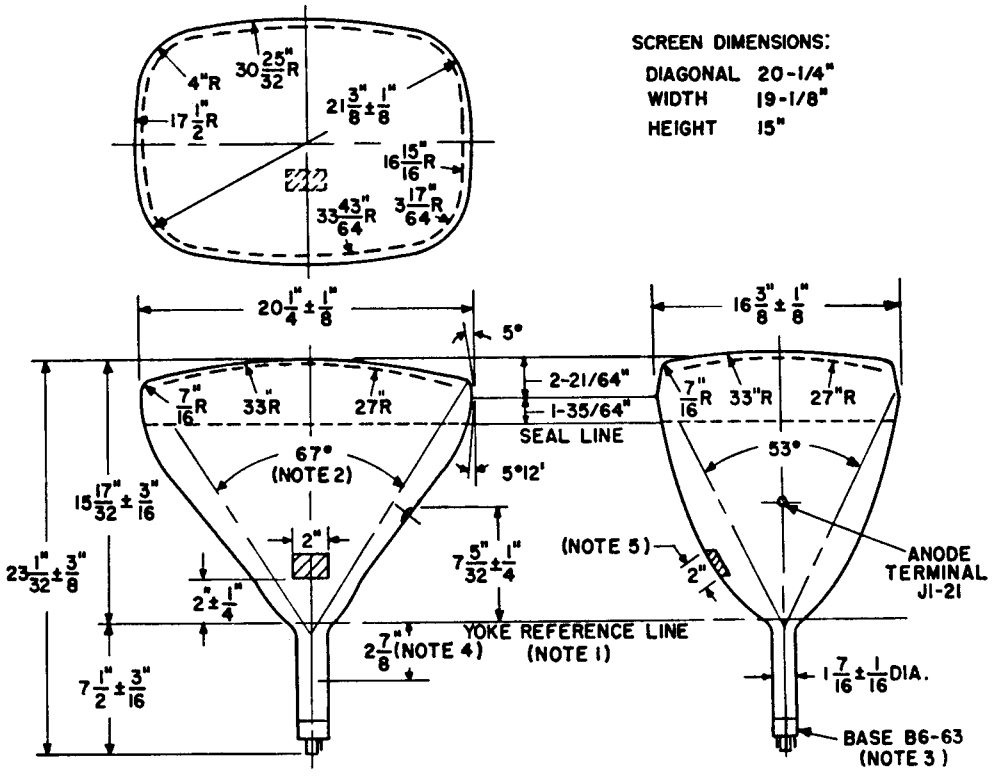
‡ Anode, grid-No. 3 and grid-No. 5 which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

§ Cathode should be returned to one side or to the midtap of the heater transformer winding.

π Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

▲ For visual extinction of focused raster.

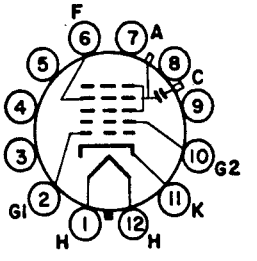


SCREEN DIMENSIONS:

DIAGONAL	20-1/4"
WIDTH	19-1/8"
HEIGHT	15"

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 72°.
3. ANODE TERMINAL ALIGNS WITH PIN-NO.6 ±30 DEGREES.
4. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.
5. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



BASING DIAGRAM
12 L

Electronic TUBES

21BNP4

CATHODE-RAY TUBE

21-INCH, RECTANGULAR, GLASS
FOCUS—ELECTROSTATIC
DEFLECTION—MAGNETIC
90-DEGREE DEFLECTION ANGLE

19⅛- BY 15-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ALUMINIZED SCREEN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 21BNP4 is a 21-inch rectangular, all-glass picture tube which provides a 19⅛- by 15-inch picture for direct-view television reception. It employs electrostatic focusing and magnetic deflection with the center of the focusing range designed to fall at or near the value of B+ voltage normally encountered in television receivers. The outstanding feature of this tube is that it requires no ion-trap magnet. This not only eliminates an external component but also avoids the aberrations inherent in ion-trap guns. Better focus and resolution are thus achieved at lower cost. In addition, the possibility of ion-trap magnet misalignment, which often causes reduced tube life, has been removed. Other features of the 21BNP4 include a high-quality fluorescent screen which is aluminized to increase light output and preclude ion-spot blemish, a gray faceplate which improves picture contrast, and a high-capacitance external conductive coating which serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	90	Degrees
Horizontal	85	Degrees
Vertical	68	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	1500	μμf
Minimum	1200	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	71	Percent

MECHANICAL

Over-all Length	20 ± 3/8	Inches
Greatest Bulb Dimensions		
Diagonal	21 3/8 ± 1/8	Inches
Width	20 1/4 ± 1/8	Inches
Height	16 3/8 ± 1/8	Inches
Minimum Useful Screen Dimensions		
Diagonal	20 1/4	Inches
Width	19 1/8	Inches
Height	15	Inches
Neck Length	7 1/2	Inches

Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ± 30 Degrees

Mounting Position—Any

Net Weight, approximate	25	Pounds

MAXIMUM RATINGS△

DESIGN-CENTER VALUES*

Anode Voltage†	18,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS△

Anode Voltage π	16,000	Volts DC
Focusing-Electrode Voltage for Focus§	0 to 500	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage ♦	−28 to −72	Volts DC

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms
Grid-No. 2 Circuit Resistance	0.1 Min	Megohms
Focusing-Electrode Resistance	0.1 Min	Megohms

Protective resistance in the grid-No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

△All voltages are measured with respect to cathode.

* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode, grid-No. 3, and grid-No. 5 which are connected together within the tube are referred to herein as anode. If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

‡ Cathode should be returned to one side or to the midtap of the heater transformer winding.

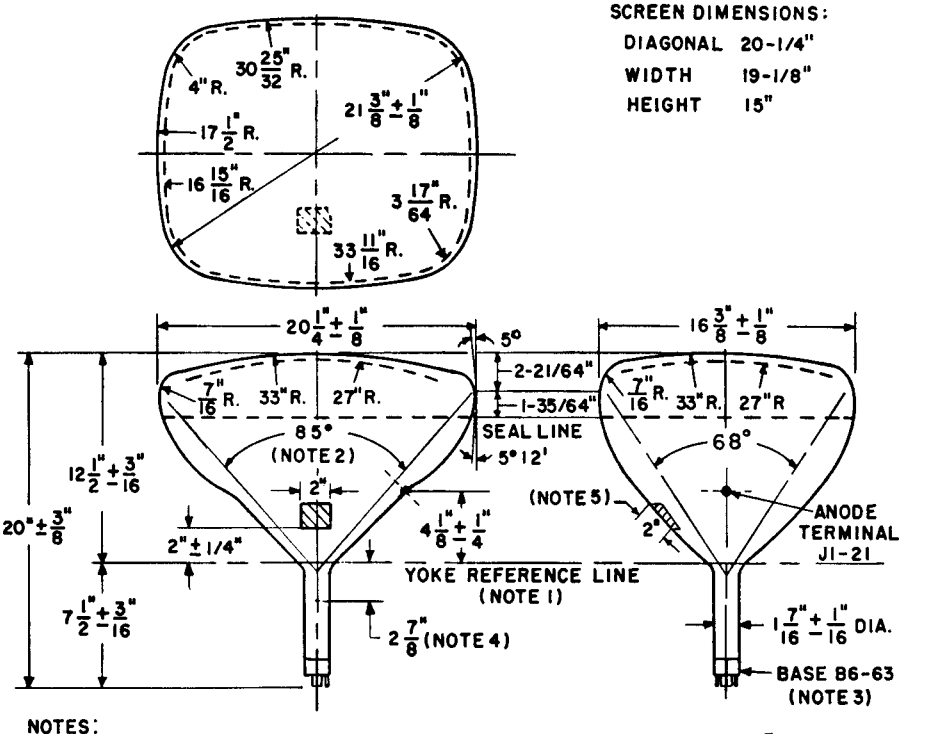
π Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

§ The focusing electrode may be modulated within the stipulated maximum range to improve over-all focus.

◆ For visual extinction of focused raster.

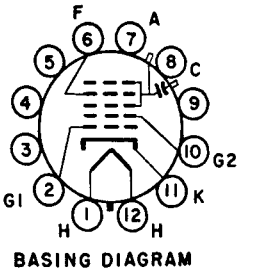
SCREEN DIMENSIONS:

DIAGONAL	20-1/4"
WIDTH	19-1/8"
HEIGHT	15"



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE-LINE GAGE (RETMA NO. 116) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 90 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.
5. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



BASING DIAGRAM
12 L

K-69982-13A26

4-21-55

21CZP4

CATHODE-RAY TUBE

21-INCH, RECTANGULAR, GLASS — 19-1/16 BY 15-1/16-INCH PICTURE SIZE

FOCUS - ELECTROSTATIC — FACEPLATE - SPHERICAL, GRAY

DEFLECTION - MAGNETIC — ION-TRAP GUN

110-DEGREE DEFLECTION ANGLE — EXTERNAL CONDUCTIVE COATING

ALUMINIZED SCREEN

DESCRIPITION AND RATING

The 21CZP4 is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube. Features of this tube include a short over-all length, a small neck diameter, and an aluminized screen to increase light output. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.60 ± 10%	Amperes
Heater Warm-up Time *	11	Seconds
Focusing Method - Electrostatic		
Deflecting Method - Magnetic		
Deflection Angle, approximate		
Diagonal	110	Degrees
Horizontal	105	Degrees
Vertical	87	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	µµf
Grid-No. 1 to All Other Electrodes	6	µµf
External Conductive Coating to Anode		
Maximum	2500	µµf
Minimum	2000	µµf

OPTICAL

Phosphor Number - P4, Sulfide
Fluorescent Color - White
Phosphorescent Color - White
Persistence - Short

Faceplate - Gray

Light Transmission at Center, approximate	76	Percent

MECHANICAL

Overall Length	14 11/16 ± 5/16	Inches
Greatest Bulb Dimensions		
Diagonal	21 3/8 ± 1/8	Inches
Width	20 1/4 ± 1/8	Inches
Height	16 3/8 ± 1/8	Inches
Minimum Useful Screen Dimensions		
Diagonal	20 1/4	Inches
Width	19 1/16	Inches
Height	15 1/16	Inches
Area	262	Square Inches
Neck Length	5 7/16 + 3/16 − 1/8	Inches

Bulb Contact - Recessed Small-cavity Cap, JETEC No. J1-21
Base - Small-button Eightar, 7-Pin, JETEC No. B7-183
Basing Designation - 8HR
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 4 Position ± 30 Degrees

Mounting Position - Any		
Net Weight, approximate	22	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES †

Anode Voltage ‡	18,000 Max	Volts DC
Focusing-Electrode Voltage	-500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	140 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Negative-Peak Value	200 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage §	17,000	Volts DC
Focusing-Electrode Voltage for Focus	0 to 500	Volts DC
Focusing-Electrode Current	-15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage π	-28 to -72	Volts DC
Ion-Trap Field Intensity △, minimum	37	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max Megohms
Grid-No. 2 Circuit Resistance	0.1 Min Megohms
Focusing-Electrode Circuit Resistance	0.1 Min Megohms

Protective resistance in the grid-No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

* Heater warm-up time is the time required for the voltage across the heater terminals to increase to 5.0 volts in the JETEC test circuit, with E = 25 volts and R = 31.5 ohms.

† The maximum ratings provide a ten-percent safety factor in accordance with the standard design center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design center values are not exceeded by more than ten percent.

‡ Anode, grid-No. 3, and grid-No. 5 which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 15,000 volts.

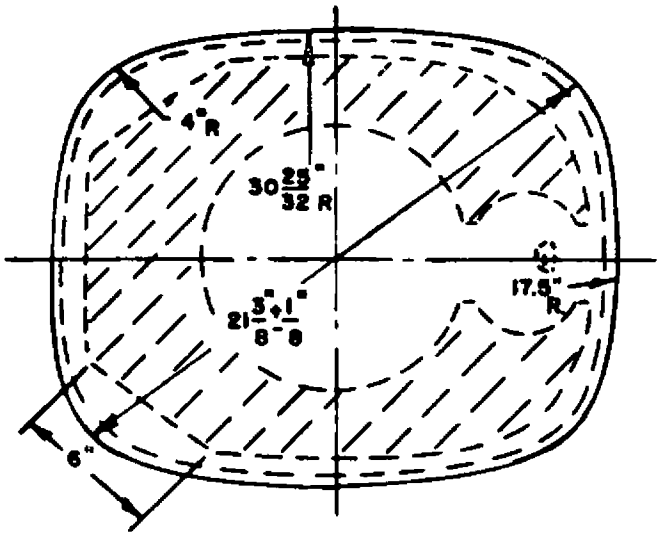
π For visual extinction of focused raster.

Δ For a Heppner PM ion-trap magnet or equivalent located in optimum position and rotated to give maximum brightness.

Electronic Components Division

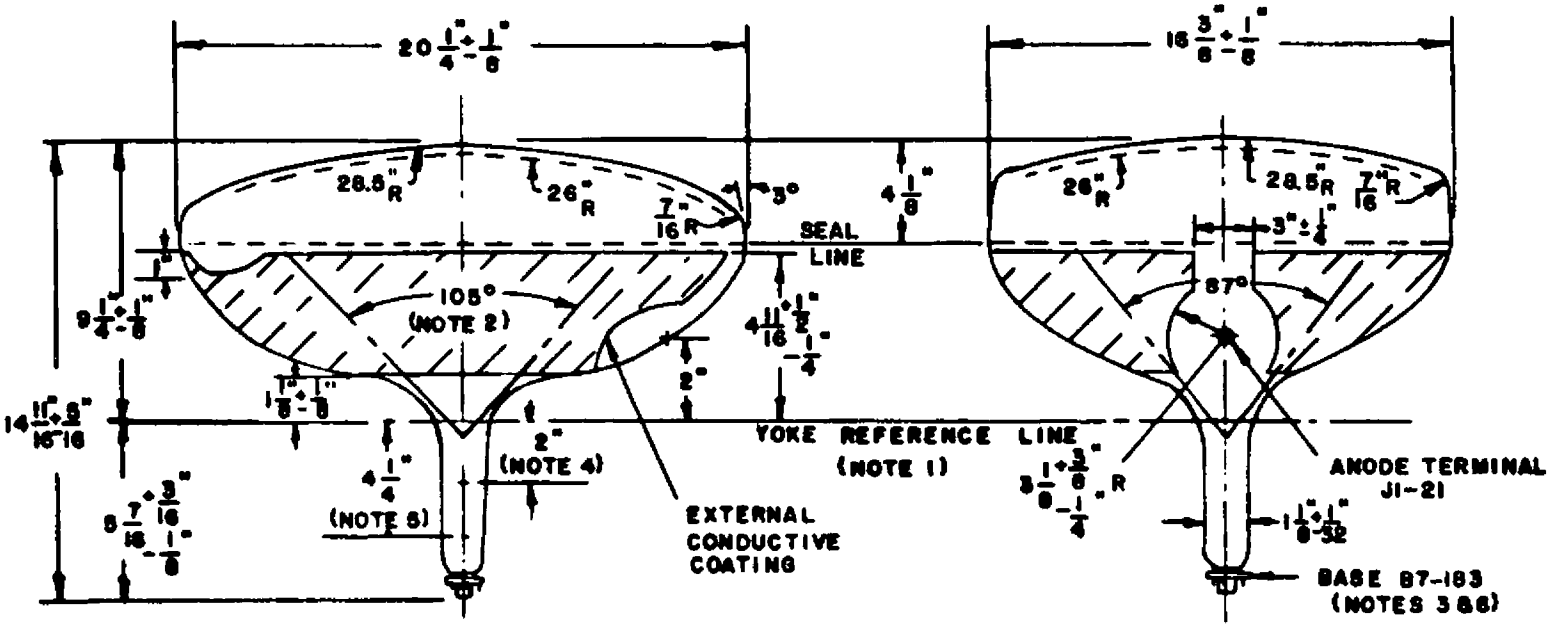
GENERAL ELECTRIC COMPANY

Schenectady 5, N. Y.



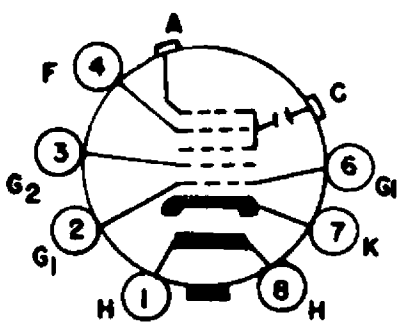
SCREEN DIMENSIONS

DIAGONAL	20-1/4"
WIDTH	19-1/16"
HEIGHT	15-1/16"
AREA	262 SQ. IN.



NOTES:-

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE LINE GAGE (RETMA NO. 126) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 110°.
3. ANODE TERMINAL ALIGNS WITH PIN NO. 4 ± 30 DEGREES.
4. RECOMMENDED POSITION OF CENTERING MAGNET, IF USED.
5. APPROXIMATE POSITION OF ION-TRAP MAGNET.
6. USE A NON-RIGIDLY MOUNTED SOCKET WITH FLEXIBLE LEADS. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN 1-3/4 INCHES DIA. CIRCLE CONCENTRIC WITH BULB AXIS.



BASING DIAGRAM
8HR

Electronic TUBES

21EP4-A AND 21EP4-B

CATHODE-RAY TUBE

21-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
19⅛- BY 13⅞-INCH PICTURE SIZE
FACEPLATE—CYLINDRICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING
21EP4-B—ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 21EP4-A is a magnetic-focus and deflection, direct-view all-glass picture tube which provides a 19⅛- by 13⅞-inch picture for television applications. The electron gun is designed for use with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, a space-saving rectangular face shape, and a cylindrical front surface which materially reduces the effects of specular reflection. An external conductive coating serves as a filter capacitor when grounded.

The 21EP4-B has the additional feature of a reflective aluminized screen which increases light output.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	750	uuf
Minimum	500	uuf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	71	Percent

Supersedes ETR-144 and ETR-145, dated 4-52

MECHANICAL

Over-all Length	$23\frac{1}{32} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$21\frac{7}{32} \pm \frac{3}{16}$	Inches
Width	$20\frac{1}{4} \pm \frac{3}{16}$	Inches
Height	$15\frac{9}{16} \pm \frac{3}{16}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$20\frac{1}{8}$	Inches
Width	$19\frac{1}{8}$	Inches
Height	$13\frac{7}{8}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J170-A1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	27	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	18,000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	16,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage#	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	116	Milliamperes DC
Ion-Trap Field Intensity♦, approximate	40	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.
If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

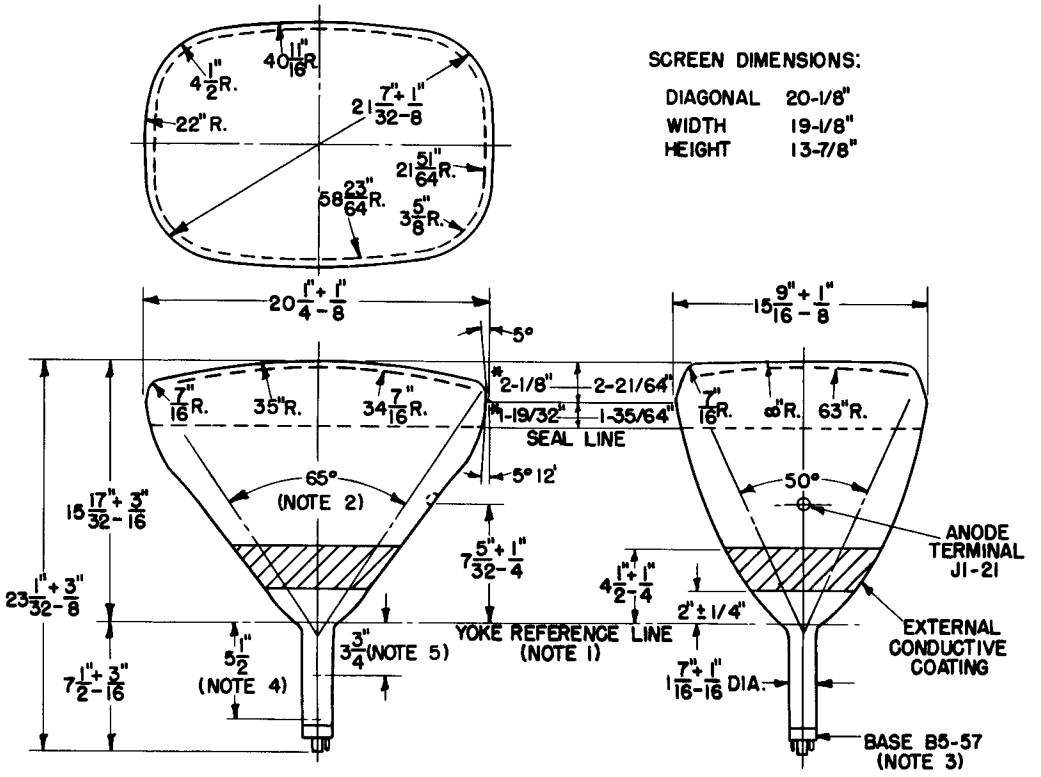
‡Cathode should be returned to one side or to the midtap of the heater transformer winding.

§Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

πFor visual extinction of focused raster.

▲For JETEC focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3¾ inches.

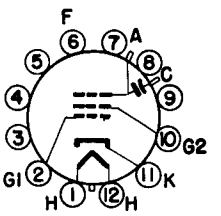
♦Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through JETEC ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ±30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.

* THIS SET OF VALUES ALSO POSSIBLE.



BASING DIAGRAM
12N

21ESP4

CATHODE RAY TUBE

21 INCH, RECTANGULAR, GLASS	19-1/16 BY 15-1/16 INCH PICTURE SIZE
FOCUS ---------ELECTROSTATIC	FACEPLATE-----SPHERICAL, GRAY
DEFLECTION -----MAGNETIC	NON ION-TRAP GUN
110 DEGREE DEFLECTION ANGLE	ALUMINIZED SCREEN
LIGHTWEIGHT BULB	EXTERNAL CONDUCTIVE COATING

==========DESCRIPTION AND RATING==========

The 21ESP4 is a 21 inch electrostatic-focus and magnetic deflection glass lightweight picture tube. Outstanding features include a short over-all length, a small neck diameter and a non ion-trap gun. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.60 ± 10%	Amperes
Heater Warm-up Time*	11	Seconds
Focusing Method - Electrostatic		
Deflecting Method - Magnetic		
Deflection Angle, Approximate		
Diagonal	110	Degrees
Horizontal	105	Degrees
Vertical	87	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode To All Other Electrodes	5	uuf
Grid No. 1 to All Other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	2500	uuf
Minimum	2000	uuf

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC

Syracuse, N. Y.

from JEDEC release #2378, March 9, 1959

OPTICAL

Phosphor Number - P4, Sulfide
Fluorescent Color - White
Phosphorescent Color - White
Persistence - Short
Faceplate - Gray

Light Transmission at Center, Approximate	76	Percent

MECHANICAL

Over-all Length	13-3/16 ± 5/16	Inches
Neck Length	3-15/16 + 3/16 -1/8	Inches
Greatest Bulb Dimensions		
Diagonal	21-3/8 ± 1/8	Inches
Width	20-1/4 ± 1/8	Inches
Height	16-3/8 ± 1/8	Inches
Minimum Useful Screen Dimensions		
Diagonal	20-1/4	Inches
Width	19-1/16	Inches
Height	15-1/16	Inches
Area	262	Square Inches

Bulb Designation J171G1
Bulb Contact - Recessed Small-cavity Cap, JEDEC No. J1-21
Base - Small button Eightar, 6 pin, JEDEC No. B6-212
Basing Designation - 8JS
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 4 ± 30 Degrees.

Mounting Position - Any

Net Weight, Approximate	20	Pounds

MAXIMUM RATINGS

DESIGN - CENTER VALUES /

Anode Voltage#	18,000	Max. Volts D.C.
Focusing-Electrode Voltage	-500 to +1000	Max. Volts D.C.
Grid No. 2 Voltage	750	Max. Volts D.C.
Grid No. 1 Voltage		
Negative-Bias Value	140	Max. Volts D.C.
Positive-Bias Value	0	Max. Volts D.C.
Positive-Peak Value	2	Max. Volts
Negative-Peak Value	200	Max. Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period Not to Exceed 15 seconds	410	Max. Volts
After Equipment Warm-up Period	180	Max. Volts
Heater Positive with Respect to Cathode	180	Max. Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage SS	17,000	Volts D.C.
Focusing-Electrode Voltage for Focus	0 to 500	Volts D.C.
Focusing-Electrode Current	-15 to +25	Microamperes D.C.
Grid No. 2 Voltage	450	Volts D.C.
Grid No. 1 Voltage TT	-28 to -72	Volts D.C.

MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5	Max. Megohms
Grid No. 2 Circuit Resistance	0.1	Min. Megohms
Focusing-Electrode Circuit Resistance	0.1	Min. Megohms

Protective resistance in the grid - No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

*Heater warm-up time is the time required for the voltage across the heater terminals to increase to 5.0 volts in the JETEC test circuit, with E = 25 volts and R = 31.5 ohms.

/The maximum ratings provide a ten-percent safety factor in accordance with the standard design center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design center values are not exceeded by more than ten percent.

≠Anode, grid No. 3, and grid No. 5 which are connected together within the tube are referred to herein as anode.

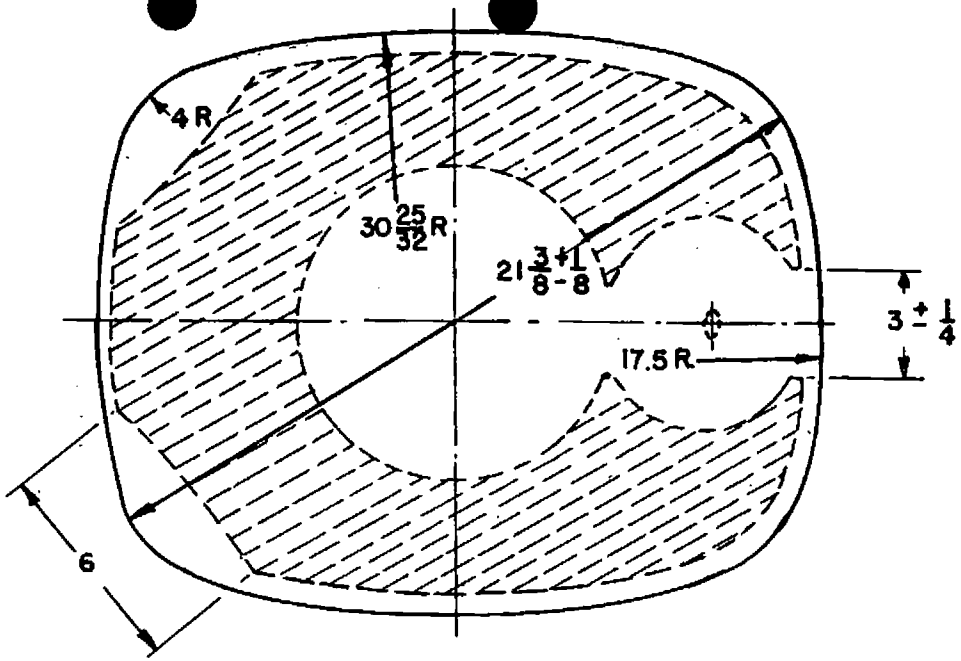
If this tube is operated at voltages in excess of 16,000 volts, X-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

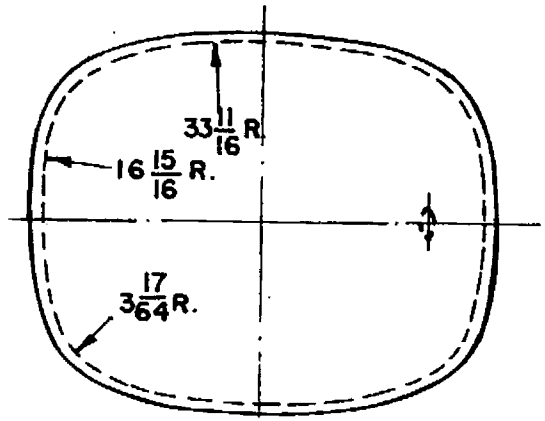
SS Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 15,000 volts.

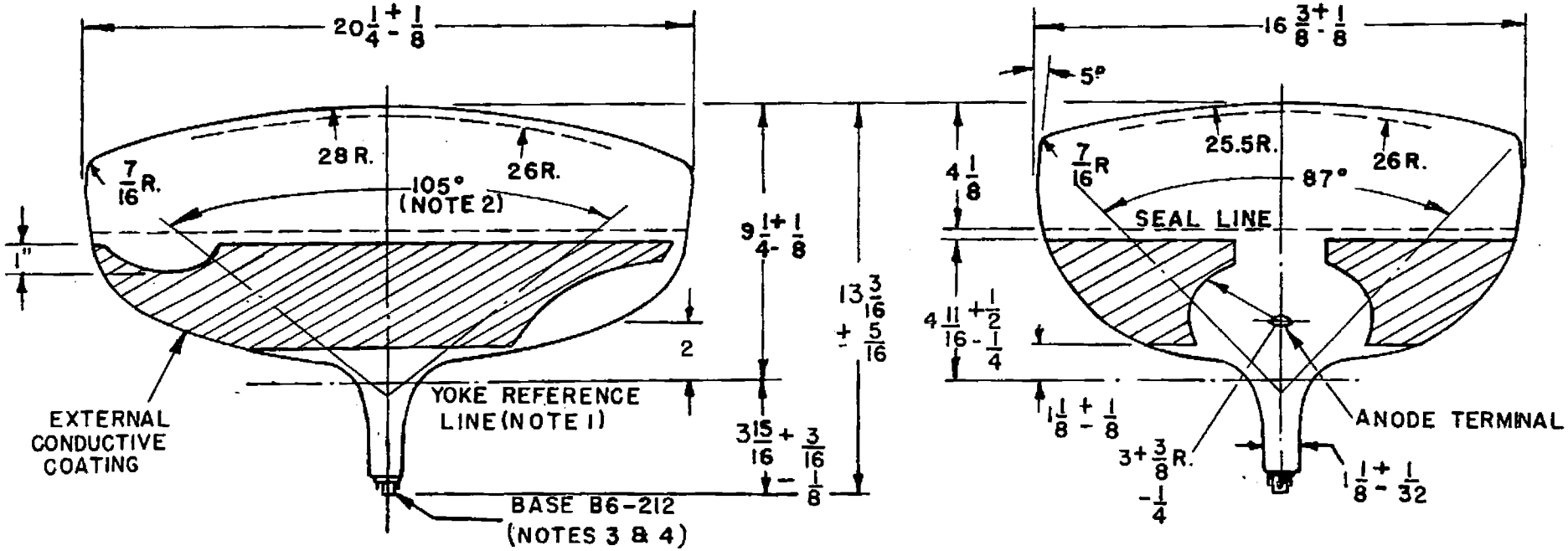
TT For visual extinction of focused raster.

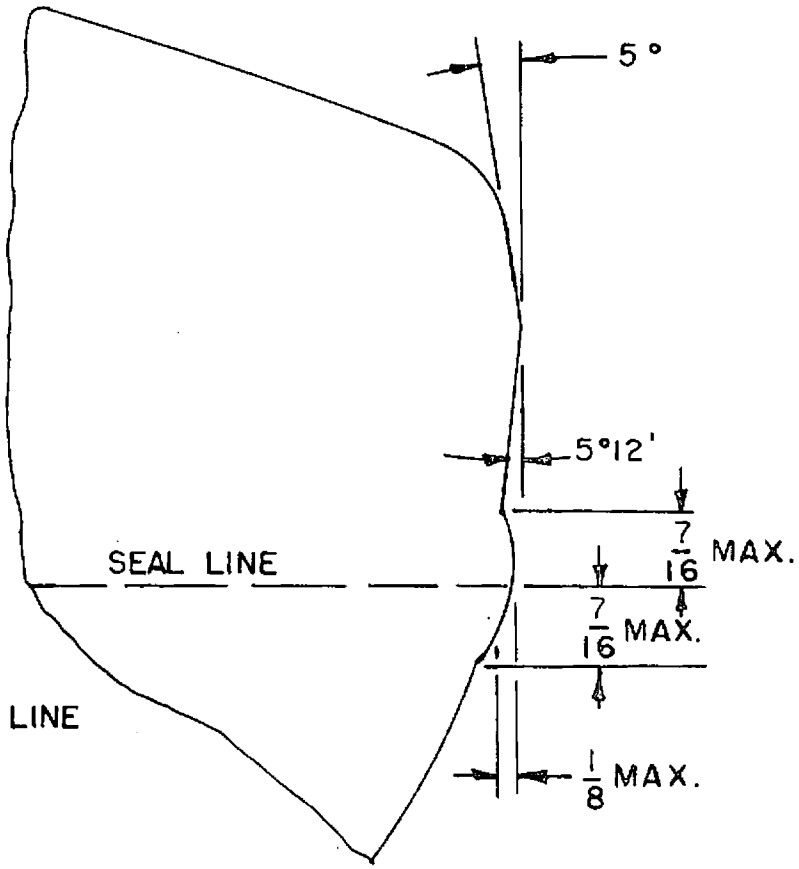
SCREEN DIMENSIONS

DIAGONAL	20 1/4
WIDTH	19 1/16
HEIGHT	15 1/16
AREA	262 SQ.IN.





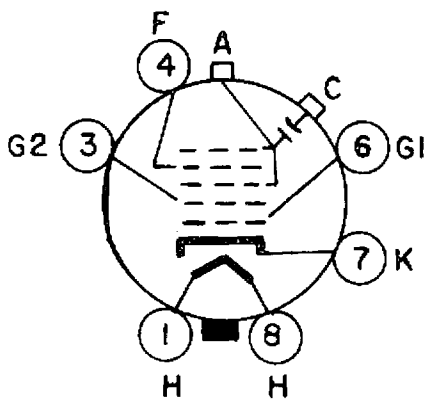




DETAIL AT SEAL LINE

NOTES:

1. THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE C-C' OF GAGE (EIA NO. 126) WITH THE GLASS FUNNEL.
2. DEFLECTION ANGLE ON THE DIAGONAL IS 110°
3. ANODE TERMINAL ALIGNS WITH PIN NO. 4 ±30 DEGREES.
4. USE A NON-RIGIDLY MOUNTED SOCKET WITH FLEXIBLE LEADS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN 1-3/4 INCH DIAMETER CIRCLE CONCENTRIC WITH THE BULB AXIS.



BASING DIAGRAM

8JS

21FMP4
CATHODE RAY TUBE

21 INCH, RECTANGULAR, GLASS	19-1/16 BY 15-1/16 INCH PICTURE SIZE
FOCUS-------ELECTROSTATIC	FACEPLATE------SPHERICAL, GRAY
DEFLECTION-------MAGNETIC	NON ION-TRAP GUN
110 DEGREE DEFLECTION ANGLE	ALUMINIZED SCREEN
LOW GRID NO. 2 VOLTAGE TYPE FOR CATHODE DRIVE OPERATION	EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 21FMP4 is a 21 inch electrostatic-focus and magnetic deflection glass picture tube. Outstanding features include a short over-all length, a small neck diameter and a non ion-trap gun designed to be operated at a low Grid No. 2 voltage for cathode drive. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angles, Approximate	
Horizontal	105 degrees
Vertical	87 degrees
Diagonal	110 degrees
Direct Interelectrode Capacitances	
Cathode to all other electrodes, approximate	5 μμf
Grid #1 to all other electrodes, approximate	6 μμf
External Conductive Coating to Anode	2500 max. μμf 2000 min. μμf
Heater Current at 6.3 volts	600 ± 30 ma
Heater Warm-up Time	11 seconds

OPTICAL DATA

Phosphor Number	P4 aluminized
Light Transmittance at Center, approx.	76 percent

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC

Syracuse, N. Y.

from JEDEC release #3594, Feb. 12, 1962

MECHANICAL DATA

Overall Length	14 3/8 ± 5/16 inches
Greatest Dimensions of Tube	
Diagonal	21 3/8 ± 1/8 inches
Width	20 1/4 ± 1/8 inches
Height	16 3/8 ± 1/8 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	20 1/4 inches
Horizontal Axis	19 1/16 inches
Vertical Axis	15 1/16 inches
Area	262 sq. inches
Neck Length	5 1/8 ± 3/16 inches
Bulb	J171G1
Bulb Contact	J1-21
Basing	B7-237 or B7-208
Bulb Contact Alignment	8HR
Anode Contact aligns with pin position No. 4	

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	22,000 volts
Minimum Anode Voltage	15,000 volts
Maximum Grid #4 (Focusing Electrode) Voltage	-500 to +1000 volts
Maximum Grid #2 Voltage	100 volts
Minimum Grid #2 Voltage	40 volts
Grid #1 Voltage	
Maximum Negative Value	140 volts DC
Maximum Negative Peak Value	200 volts
Maximum Positive Value	0 volts DC
Maximum Positive Peak Value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 sec.	410 volts
After equipment warm-up period	180 volts
Heater positive with respect to cathode	180 volts

TYPICAL OPERATING CONDITIONS (Cathode Drive Service)

Unless otherwise specified, all voltage values are positive with respect to Grid #1.

Anode Voltage	18,000 volts
Grid #4 Voltage (Focusing Electrode, Notes 2 & 3)	250 volts DC
Grid #2 Voltage	50 volts DC
Cathode Voltage (Note 1)	31 to 49 volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5 max. megohm
Grid #2 Circuit Resistance	0.1 min. megohm
Focusing Electrode Circuit Resistance	0.1 min. megohm

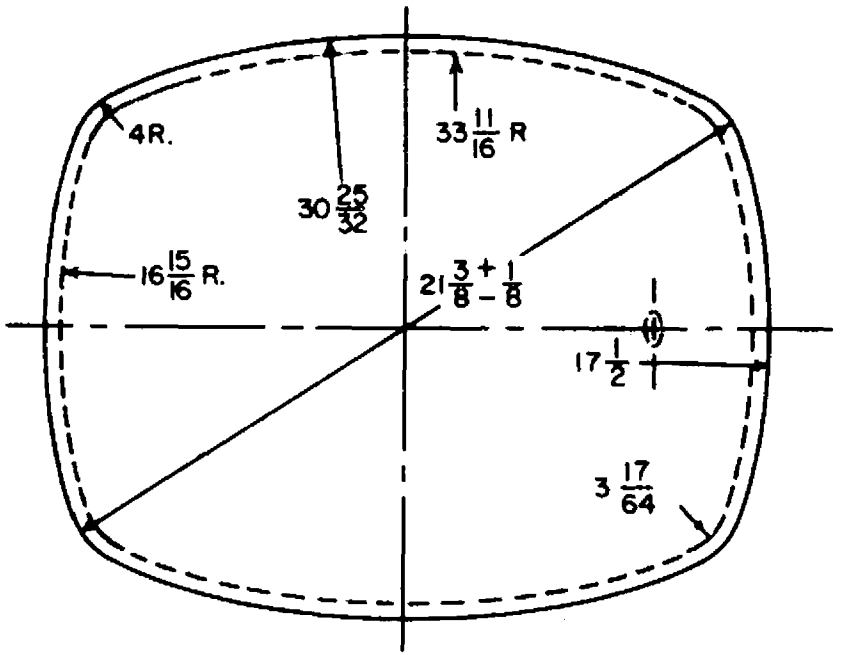
NOTES:

1. Visual extinction of focused raster.

2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 microamperes on a 19 1/4 X 15 1/4" pattern from RCA 2F21 Monoscope or equivalent.

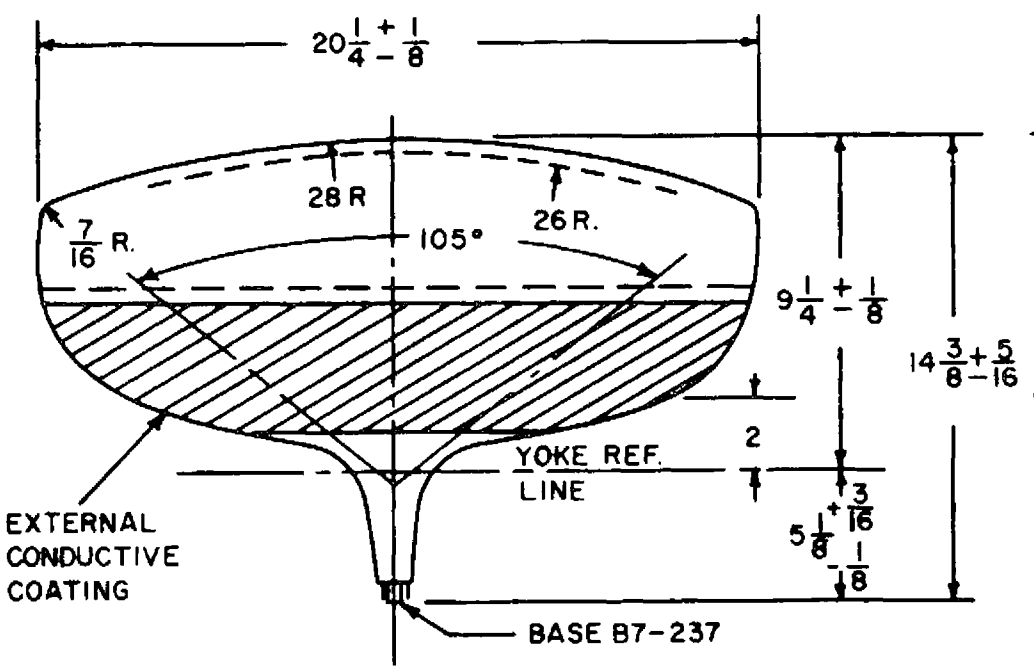
3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

21FMP4



SCREEN DIMENSIONS

DIAGONAL	20 1/4
WIDTH	19 1/16
HEIGHT	15 1/16
AREA	262 SQ. IN



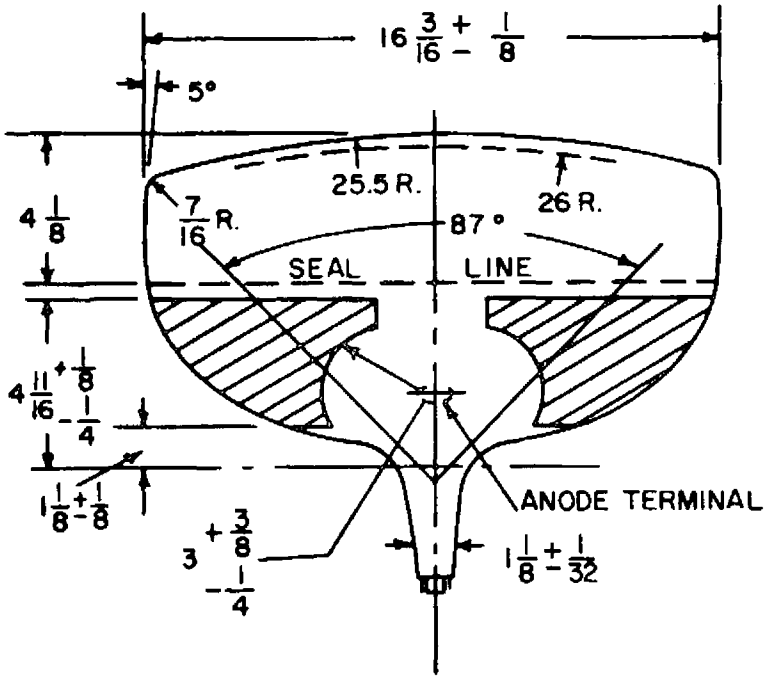


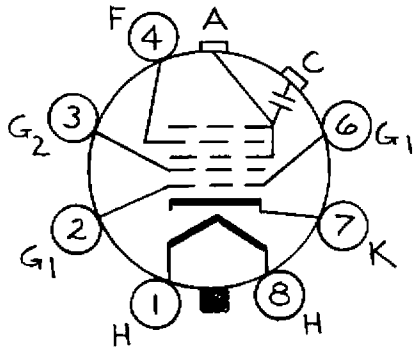
Diagram Notes

1. The reference line is determined by the intersection of the plane C-C of gage (EIA No. 126) with the glass funnel.

2. Deflection angle on the diagonal is 110^{o}.

3. Anode terminal aligns with pin No. 4 $\pm$ 30 degrees.

4. Use a non-rigidly mounted socket with flexible leads. Bottom circumference of base wafer will fall within 1-3/4 inch diameter circle concentric with the bulb axis.



BASING DIAGRAM
8HR

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

SYRACUSE, NEW YORK

Electronic TUBES

21FP4-A — 21FP4-C

CATHODE-RAY TUBE

21-INCH RECTANGULAR, GLASS
FOCUS—ELECTROSTATIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
19⅛- BY 13⅞-INCH PICTURE SIZE
FACEPLATE—CYLINDRICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING
21FP4-C—ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 21FP4-A is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 19⅛- by 13⅞-inch picture for television applications. The electron gun has a focusing voltage range of −0.4 to +2.2 percent of the anode voltage and is used with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, a space-saving rectangular face shape, and a cylindrical front surface which materially reduces the effects of specular reflection. An external conductive coating serves as a filter capacitor when grounded.

The 21FP4-C has the additional feature of a reflective aluminized screen which increases light output.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	750	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray		
Light Transmission at Center, approximate	71	Percent

Supersedes ET-T1076, dated 5-54

MECHANICAL

Over-all Length	$23\frac{1}{32} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$21\frac{7}{32} \pm \frac{1}{8}$	Inches
Width	$20\frac{1}{4} \pm \frac{1}{8}$	Inches
Height	$15\frac{9}{16} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$20\frac{1}{8}$	Inches
Width	$19\frac{1}{8}$	Inches
Height	$13\frac{7}{8}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J170A or J170C
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees

Mounting Position—Any

Net Weight, approximate	27	Pounds

MAXIMUM RATINGS△

DESIGN-CENTER VALUES*

Anode Voltage†	18,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS△

Anode Voltageπ	16,000	Volts DC
Focusing-Electrode Voltage for Focus	−64 to +352	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage♦	−28 to −72	Volts DC
Ion-Trap Field Intensityϕ, approximate	40	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms
Grid-No. 2 Circuit Resistance	0.1 Min	Megohms
Focusing-Electrode Circuit Resistance	0.1 Min	Megohms

Protective resistance in the grid-No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

△ All voltages are measured with respect to cathode.

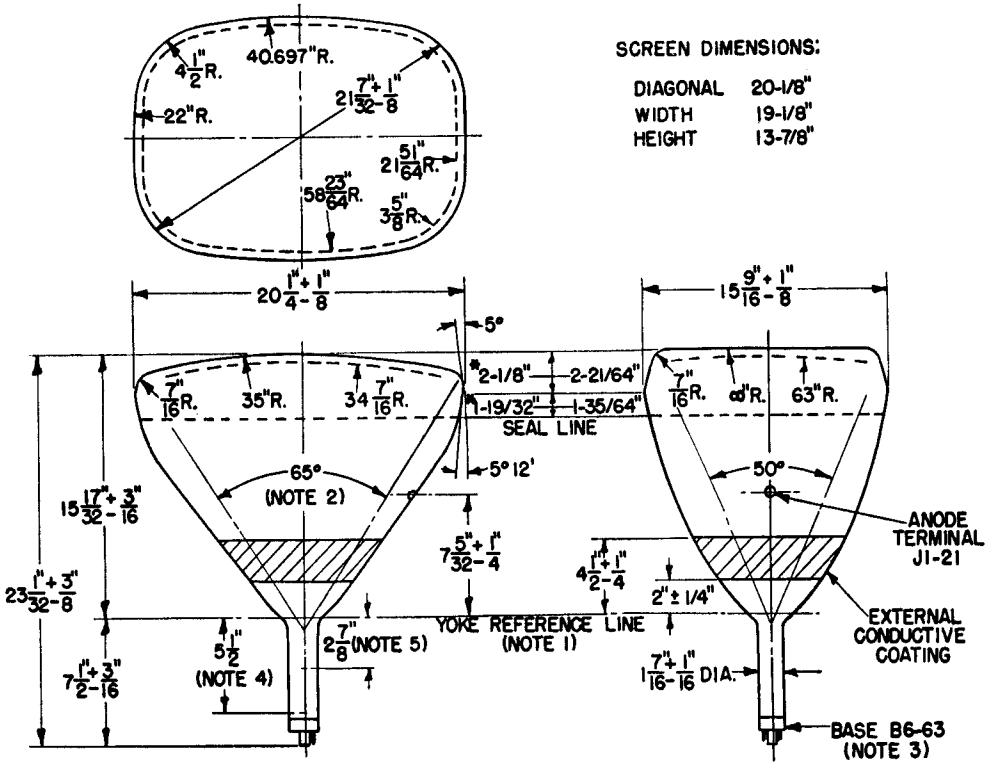
*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode, grid-No. 3, and grid-No. 5, which are connected together within the tube are referred to herein as anode. If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

πBrightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

♦For visual extinction of focused raster.

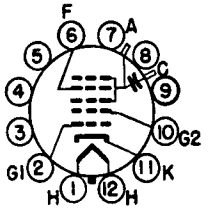
φSingle-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through RETMA ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.

* THIS SET OF VALUES ALSO POSSIBLE.



BASING DIAGRAM
12L

—PRODUCT INFORMATION—

Compactron Beam Pentode

21GY5

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

The 21GY5 is a compactron beam-power pentode designed for use as the horizontal-deflection amplifier in television receivers.

Except for heater characteristics, the 21GY5 is identical to the 6GY5.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	21	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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Supersedes 21GY5-21HB5 D and R Sheet dated 12-63

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

21HB5-A

COMPACTRON BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 21HB5-A is a compactron beam-power pentode designed for use as the horizontal-deflection amplifier in television receivers. It is unilaterally interchangeable with the 21HB5.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	21	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds
Direct Interelectrode Capacitances, approximate¶		
Grid-Number 1 to Plate: (g1 to p)	0.4	pf
Input: g1 to (h + k + g2 + b.p.)	24	pf
Output: p to (h + k + g2 + b.p.)	9.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing - EIA 12-58

Maximum Diameter	1.563	Inches
Maximum Over-all Length	3.375	Inches
Maximum Seated Height	3.000	Inches

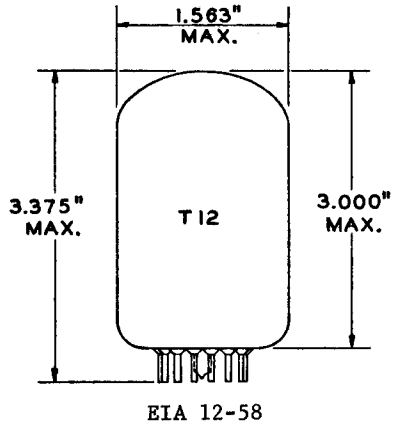
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

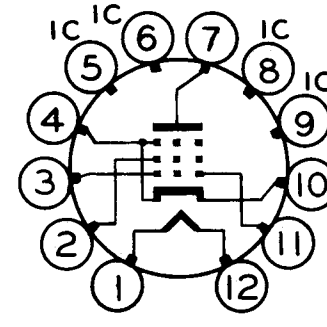


EIA 12-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Grid Number 2 (Screen)
Pin 3 - Grid Number 1
Pin 4 - Cathode and Beam Plates
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Plate
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Cathode and Beam Plates
Pin 11 - Grid Number 1
Pin 12 - Heater

BASING DIAGRAM



EIA 12BJ

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MAXIMUM RATINGS (Cont'd)

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE△—DESIGN-MAXIMUM VALUES

DC Plate-Supply Voltage (Boost + DC Power Supply)	770	Volts
Peak Positive Pulse Plate Voltage	6000	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Screen Voltage	220	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation§§	18	Watts
Screen Dissipation	3.5	Watts
DC Cathode Current	230	Milliamperes
Peak Cathode Current	800	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point	220	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	50	130	Volts
Screen Voltage	130	130	130	Volts
Grid-Number 1 Voltage	---	0**	-20	Volts
Plate Resistance, approximate	---	---	9900	Ohms
Transconductance	---	---	9000	Micromhos
Plate Current	---	450	46	Milliamperes
Screen Current	---	29	1.8	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 1.0 Milliamperes	-64	---	-32	Volts
Triode Amplification Factor‡‡	---	---	4.8	

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designers should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ Without external shield.

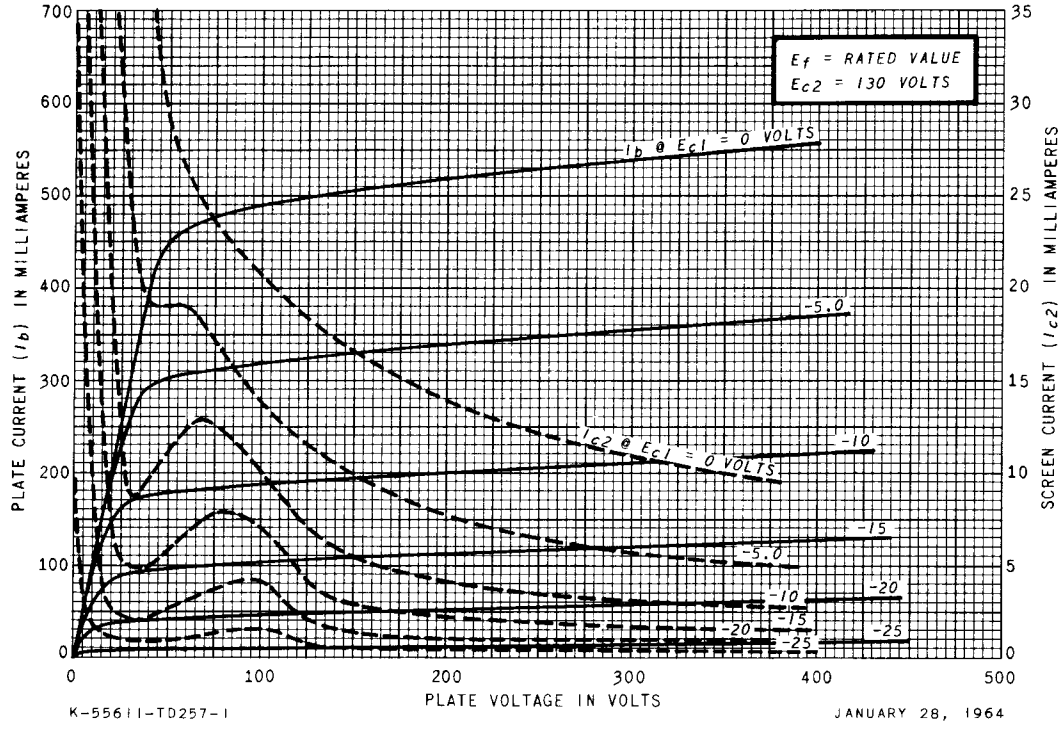
△ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§§ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

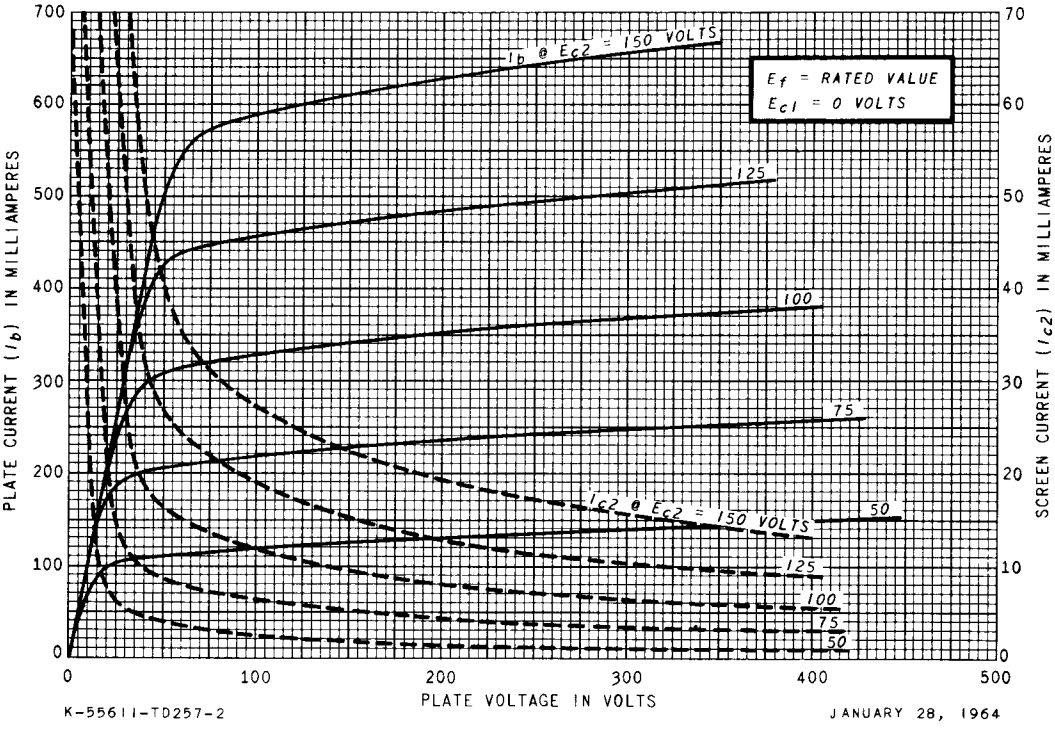
** Applied for short interval (two seconds maximum) so as not to damage tube.

‡‡ Triode connection (screen tied to plate) with Eb = Ec2 = 130 volts and Ec1 = -20 volts.

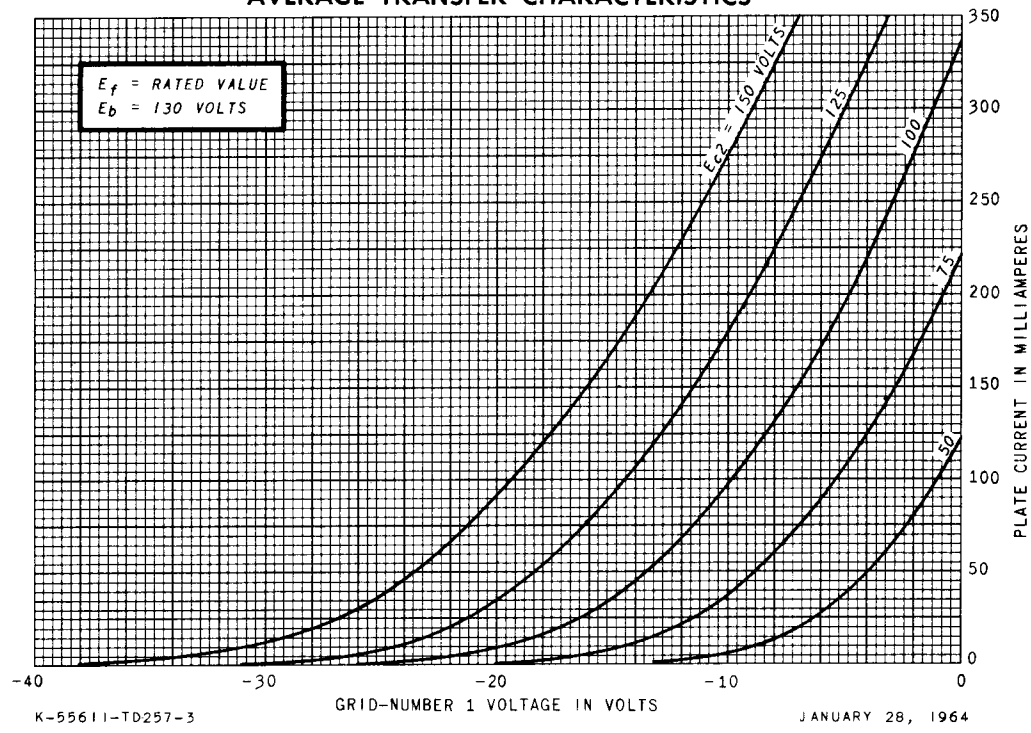
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



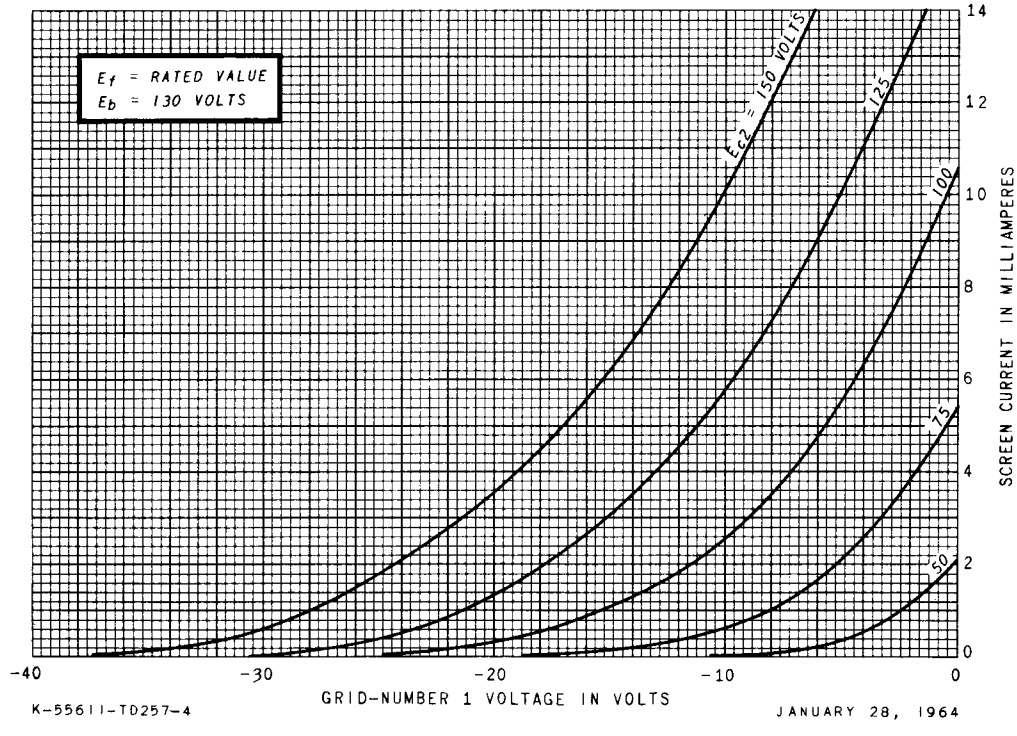
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD257-3

JANUARY 28, 1964

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD257-4

JANUARY 28, 1964

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONICS

21JZ6

COMPACTRON BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 21JZ6 is a compactron beam-power pentode designed for use as the horizontal-deflection amplifier in television receivers. A separate connection is provided for the beam plates to minimize "snivets".

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	21	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, average§	11	Seconds

Direct Interelectrode Capacitances, approximate¶

Grid-Number 1 to Plate: (g1 to p)	0.34	pf
Input: g1 to (h + k + g2 + b.p.)	. 24	pf
Output: p to (h + k + g2 + b.p.)	8.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Top Cap - C1-3, Skirted Miniature
Outline Drawing - EIA 12-79

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	3.625	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches

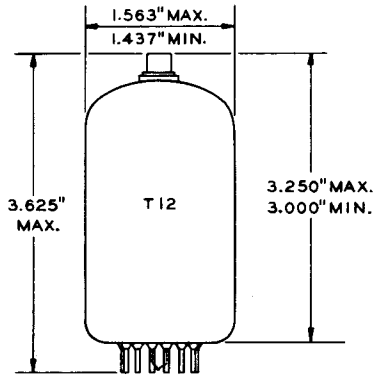
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

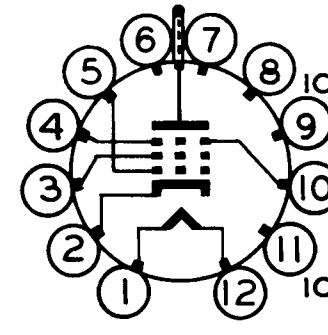


EIA 12-79

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid Number 2 (Screen)
Pin 4 - Beam Plates
Pin 5 - Grid Number 1
Pin 6 - No Connection
Pin 7 - No Connection
Pin 8 - No Connection
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Beam Plates
Pin 11 - Internal Connection - Do Not Use
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12GD

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MAXIMUM RATINGS (Cont'd)

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE#—DESIGN-MAXIMUM VALUES

DC Plate-Supply Voltage (Boost + DC Power Supply)	770	Volts
Peak Positive Pulse Plate Voltage	6500	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Positive DC Beam Plate Voltage	70	Volts
Screen Voltage	220	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate DissipationΔ	18	Watts
Screen Dissipation	3.5	Watts
DC Cathode Current	230	Milliamperes
Peak Cathode Current	800	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms
Bulb Temperature at Hottest Point	220	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	50	130	Volts
Beam Plates, Connected to Cathode at Socket				
Screen Voltage	130	130	130	Volts
Grid-Number 1 Voltage	---	0**	-20	Volts
Plate Resistance, approximate	---	---	9900	Ohms
Transconductance	---	---	9000	Micromhos
Plate Current	---	450	46	Milliamperes
Screen Current	---	29	1.8	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 1.0 Milliamperes	-64	---	-32	Volts
Triode Amplification Factor‡‡	---	---	4.8	

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ Without external shield.

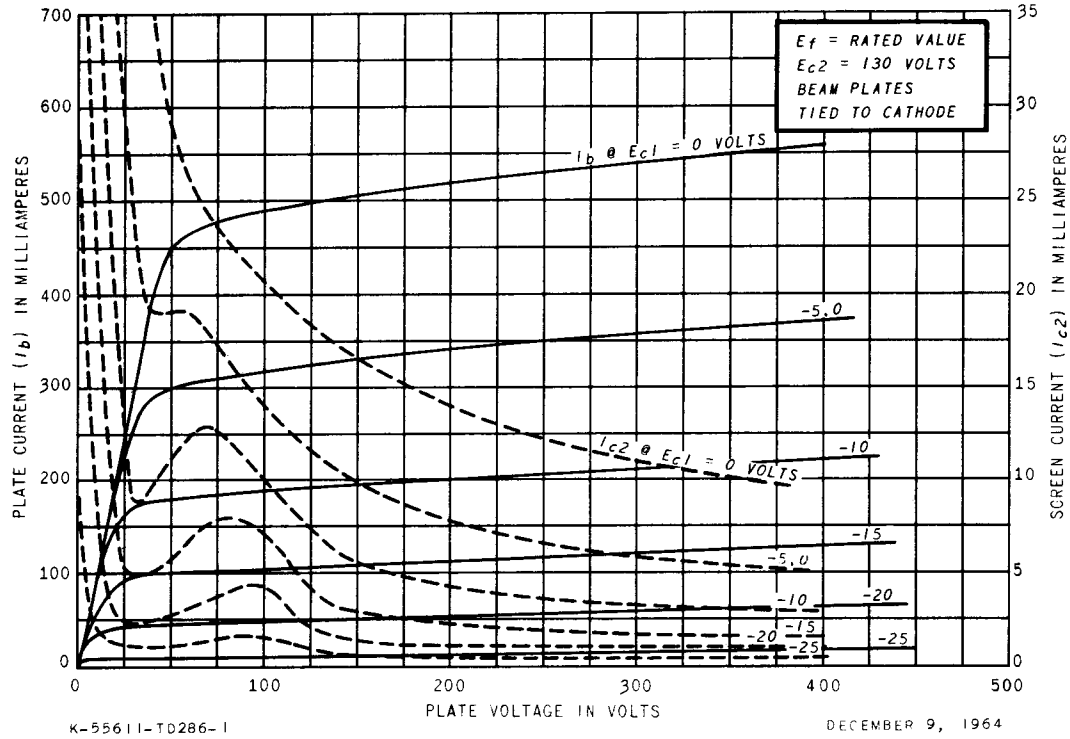
\# For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

Δ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

** Applied for short interval (two seconds maximum) so as not to damage tube.

‡‡ Triode connection (screen tied to plate) with Eb = Ec2 = 130 volts and Ec1 = -20 volts.

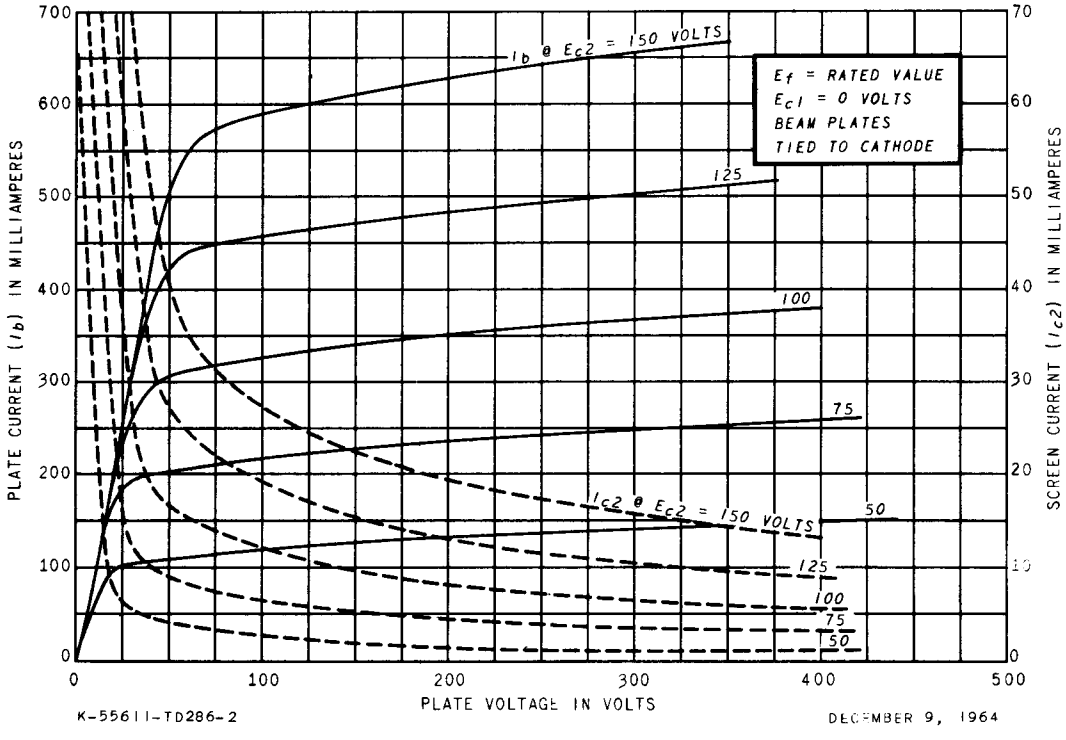
AVERAGE PLATE CHARACTERISTICS



K-55611-TD286-1

DECEMBER 9, 1964

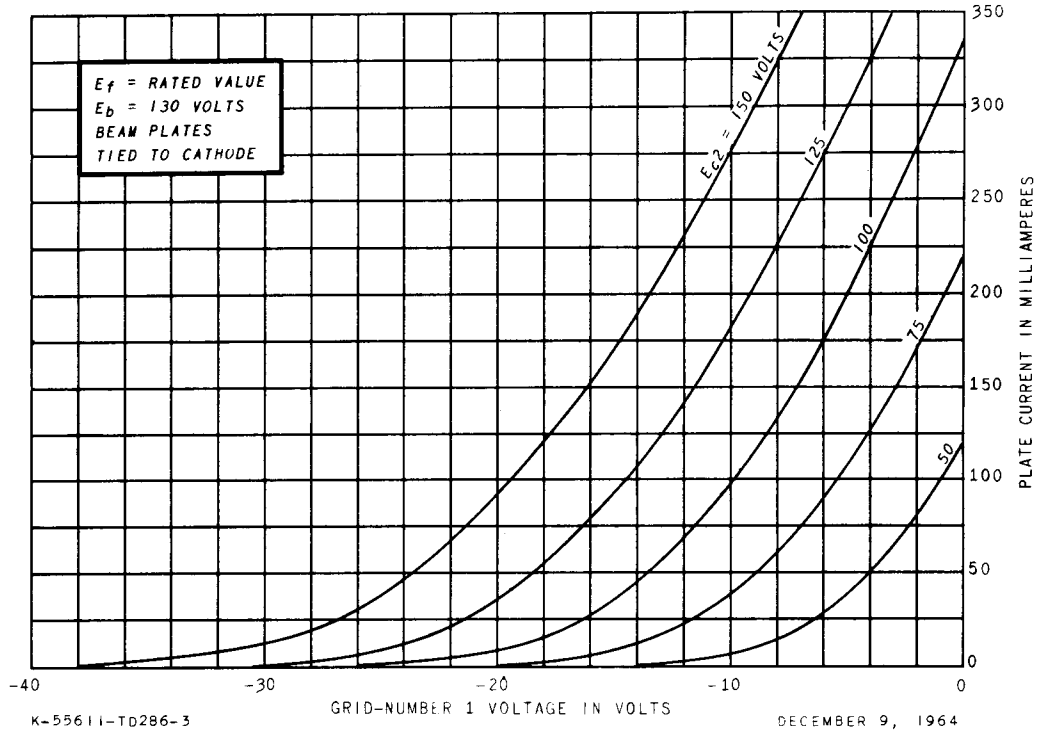
AVERAGE PLATE CHARACTERISTICS



K-55611-TD286-2

DECEMBER 9, 1964

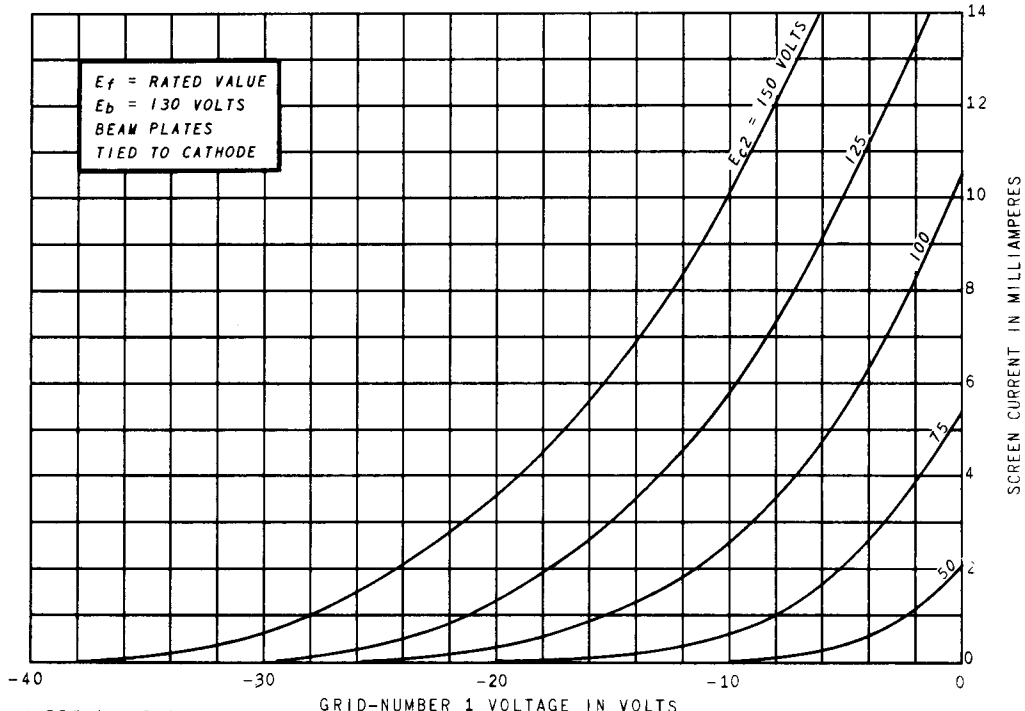
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD286-3

DECEMBER 9, 1964

AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD286-4

DECEMBER 9, 1964

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

—PRODUCT INFORMATION—

Triode-Pentode

21LR8

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

The 21LR8 is a triode-pentode containing a high-mu triode and a beam pentode. The triode is designed for service as a vertical-deflection oscillator, and the pentode as a vertical-deflection amplifier in television receivers. The 21LR8 utilizes a T-12 bulb and features a 9-pin glass button base with a 0.687-inch pin circle.

Except for heater characteristics, the 21LR8 is identical to the 6LR8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	21	Volts
Heater Current●	0.45±0.03	Amperes
Heater Warm-up Time, Average▲	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.45 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

▲ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

—PRODUCT INFORMATION—

Compactron Triode-Pentode

21LU8

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

21LU8 Compactron Triode-Pentode. The 21LU8 is a compactron containing a medium-mu triode and a beam pentode. The triode is designed for service as a vertical-deflection oscillator and the pentode as a vertical-deflection amplifier in television receivers.

Except for heater characteristics and ratings, the 21LU8 is identical to the 6LU8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	21	Volts
Heater Current♦	0.45 ± 0.03	Amperes
Heater Warm-up Time, average▲	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.45 amperes.

♦ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

▲ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

21MP4

CATHODE-RAY TUBE

21-INCH RECTANGULAR, METAL
FOCUS—ELECTROSTATIC
DEFELECTION—MAGNETIC

18⅛ BY 13$\frac{11}{16}$-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY, FROSTED
ION-TRAP GUN

70-DEGREE DEFLECTION ANGLE

DESCRIPTION AND RATING

The 21MP4 is an electrostatic-focus, magnetic-deflection, direct-view picture tube which provides an 18⅛ by 13$\frac{11}{16}$-inch picture for television applications. The electron gun has a focusing-voltage range of −0.4 to +2.2 percent of the anode voltage and is designed for use with an external single-field ion-trap magnet. Other features of the 21MP4 include a lightweight metal-cone envelope, a high-quality frosted gray faceplate to prevent specular reflection and increase picture contrast, and a space-saving rectangular face shape.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ±10%	Amperes

Focusing Method—Electrostatic
Deflecting Method—Magnetic
Deflection Angle, approximate

Diagonal	70	Degrees
Horizontal	66	Degrees
Vertical	50	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	66	Percent
Specular Reflection of Ambient Light, maximum	1.5	Percent

MECHANICAL

Over-all Length	$22\frac{1}{8} \pm \frac{1}{2}$	Inches
Greatest Bulb Dimensions		
Diagonal	$20\frac{3}{4} \pm \frac{1}{4}$	Inches
Width	$19\frac{23}{32} \pm \frac{1}{8}$	Inches
Height	$15\frac{5}{16} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$19\frac{1}{8}$	Inches
Width	$18\frac{1}{8}$	Inches
Height	$13\frac{11}{16}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Contact—Metal Cone Lip
Base—Small-shell Duodecal 6-pin, JETEC No. B6-63
Basing, JETEC Designation—12M
Base Alignment
Pin-No. 6 Aligns with Horizontal Picture Axis ±30 Degrees

Mounting Position—Any

Net Weight, approximate . . . . . 18 Pounds

MAXIMUM RATINGS♦

DESIGN-CENTER VALUES*

Anode Voltage†	16,000	Max Volts DC
Focusing-Electrode Voltage	−500 to +1000	Max Volts DC
Grid-No. 2 Voltage	500	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	180	Max Volts
Heater Positive with Respect to Cathode	180	Max Volts

TYPICAL OPERATING CONDITIONS♦

Anode Voltage‡	14,000	Volts DC
Focusing-Electrode Voltage for Focus	−56 to +308	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage§	−28 to −72	Volts DC
Ion-Trap Field Intensityπ, approximate	37	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5	Max Megohms
Grid-No. 2 Circuit Resistance	0.1	Min Megohms
Focusing-Electrode Circuit Resistance	0.1	Min Megohms

Protective resistance in the grid-No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

♦ All voltages are measured with respect to cathode.

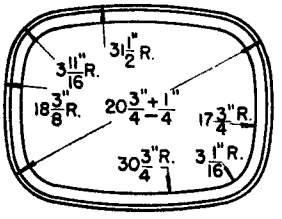
* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

† Anode, grid-No. 3, and grid-No. 5 which are connected together within the tube are referred to herein as anode.

‡ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.

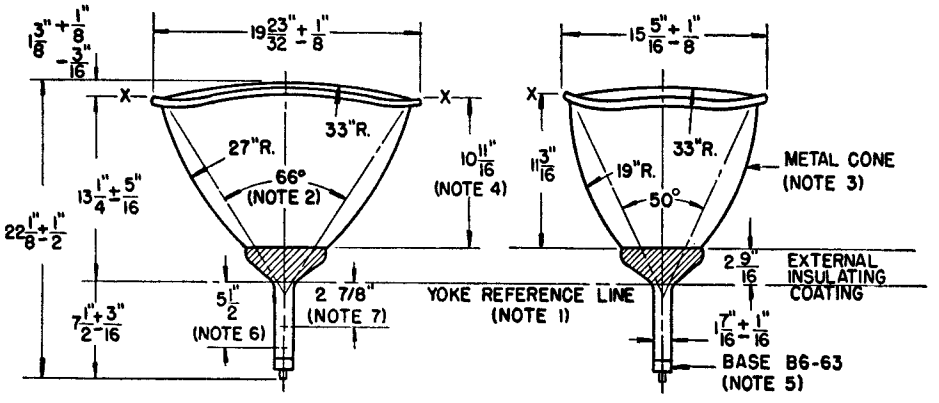
§ For visual extinction of focused raster.

π Single-field ion-trap magnet adjusted to optimum position, equivalent to 37 milliamperes through RETMA ion-trap magnet No. 117.



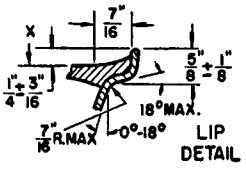
SCREEN DIMENSIONS:

DIAGONAL	19 1/8"
WIDTH	18 1/8"
HEIGHT	13 11/16"



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO.110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. METAL CONE OPERATES AT HIGH VOLTAGE AND MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ANODE VOLTAGE.
4. CONE HEIGHT AT DIAGONAL IS 10-9/16".
5. PIN-NO. 6 POSITION ALIGNS WITH HORIZONTAL PICTURE AXIS ±30 DEGREES.
6. APPROXIMATE POSITION OF ION-TRAP MAGNET.
7. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.





BASING DIAGRAM
12 M

Electronic TUBES

21WP4-A

CATHODE-RAY TUBE

21-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
17 BY 12¾-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
ALUMINIZED SCREEN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 21WP4-A is a rectangular all-glass picture tube employing magnetic focusing and deflection. It provides a 17 by 12¾-inch picture for direct-view television applications. Features of this tube include a high-quality fluorescent screen which is aluminized to increase light output, a gray faceplate to increase picture contrast, an electron gun designed for use with an external single-field ion-trap magnet, and an external conductive coating which serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ±10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	750	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	72	Percent

MECHANICAL

Over-all Length	$22\frac{7}{16}$	$\pm\frac{3}{8}$	Inches
Greatest Bulb Dimensions			
Diagonal	$20\frac{5}{8}$	$\pm\frac{1}{8}$	Inches
Width	$18\frac{11}{16}$	$\pm\frac{1}{8}$	Inches
Height	$14\frac{15}{16}$	$\pm\frac{1}{8}$	Inches
Minimum Useful Screen Dimensions			
Diagonal	$19\frac{1}{8}$		Inches
Width	17		Inches
Height	$12\frac{3}{4}$		Inches
Neck Length	$7\frac{1}{2}$		Inches

Bulb Number, ASA Designation—J171F
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ±30 Degrees
Mounting Position—Any

Net Weight, approximate	23	Pounds

MAXIMUM RATINGS*

DESIGN-CENTER VALUES†

Anode Voltage‡	18,000	Max Volts DC
Grid-No. 2 Voltage	500	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	180	Max Volts
Heater Positive with Respect to Cathode	180	Max Volts

TYPICAL OPERATING CONDITIONS*

Anode Voltage§	16,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current△, approximate	116	Milliamperes DC
Ion-Trap Field Intensity♦, approximate	40	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance . . . . . 1.5 Max Megohms

* All voltages are measured with respect to cathode.

† The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

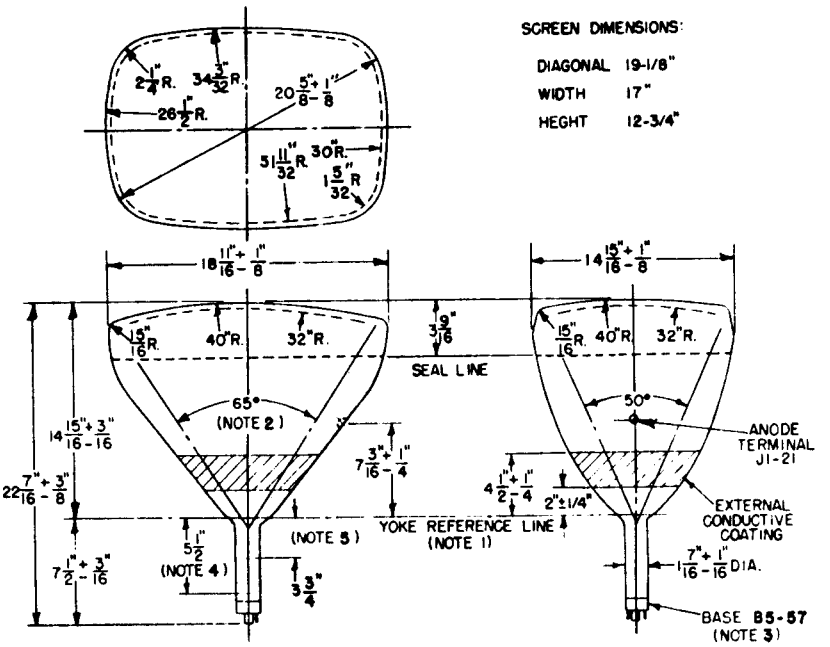
‡ Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.
If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

π For visual extinction of focused raster.

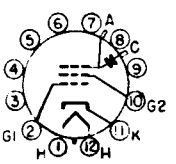
△For RETMA focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3¾-inches.

♦ Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through RETMA ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO 110) WHEN THE GAGE IS RESTING ON THE CONE
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ±30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD



BASING DIAGRAM
12N

K-69982-13A31

6-22-55

Electronic TUBES

21XP4-A

CATHODE-RAY TUBE

17- BY 12¾-INCH PICTURE SIZE

21-INCH RECTANGULAR, GLASS
FOCUS—LOW VOLTAGE, ELECTROSTATIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 21XP4-A is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 17- by 12¾-inch picture for television applications. The electron gun has a focusing voltage range of −0.4 to +2.2 percent of the anode voltage and is used with an external single-field ion-trap magnet. Other features of this tube include a high quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, a reflective aluminized screen to increase light output, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	750	uuf
Minimum	500	uuf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	72	Percent

MECHANICAL

Over-all Length	$22\frac{7}{16} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$20\frac{5}{8} \pm \frac{3}{16}$	Inches
Width	$18\frac{11}{16} \pm \frac{1}{8}$	Inches
Height	$14\frac{15}{16} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$19\frac{1}{8}$	Inches
Width	17	Inches
Height	$12\frac{3}{4}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number—C165 Exp. 5
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees

Mounting Position—Any

Net Weight, approximate	23	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	18,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Focusing-Electrode Current‡	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage§		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltageπ	16,000	Volts DC
Focusing-Electrode Voltage for Focus▲	−64 to +352	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage♦	−28 to −72	Volts DC
Ion-Trap Field Intensityϕ, approximate	40	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

*The maximum ratings provide a ten percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode, grid-No. 3 and grid-No. 5 which are connected together within the tube are referred to herein as anode. If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

‡At design-center maximum anode voltage plus ten percent.

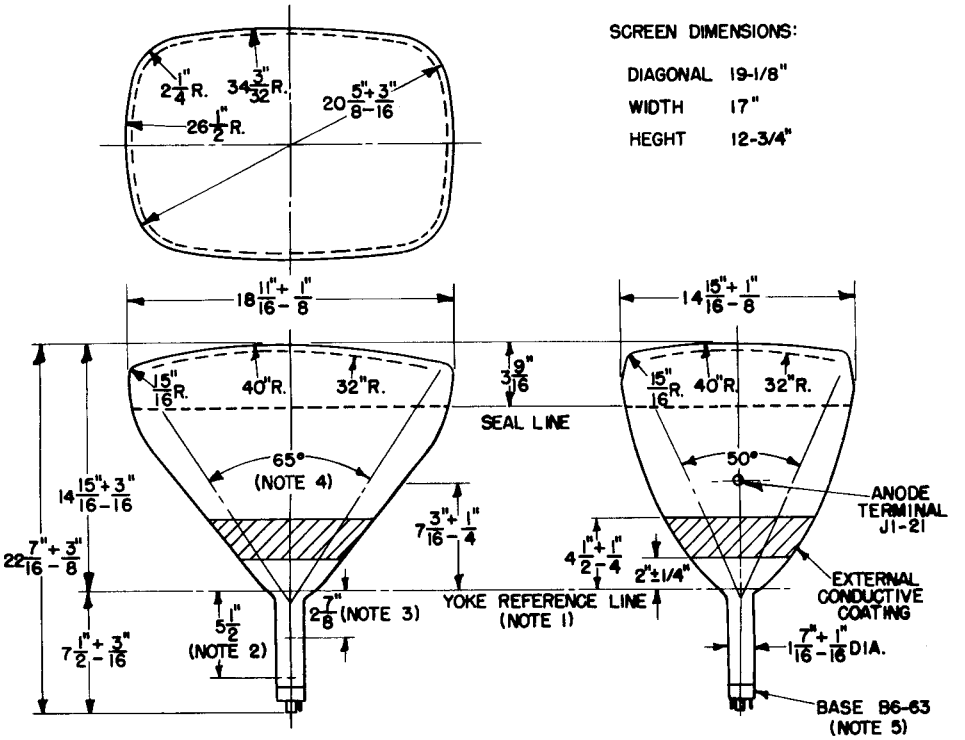
§Cathode should be returned to one side or to the midtap of the heater transformer winding.

πBrightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

▲The focusing electrode may be modulated within the stipulated maximum range without damage to the tube.

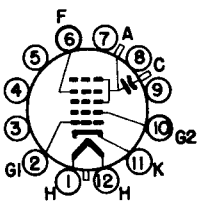
♦For visual extinction of focused raster.

φSingle-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through JETEC ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. APPROXIMATE POSITION OF ION TRAP MAGNET.
3. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.
4. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
5. ANODE TERMINAL ALIGNS WITH PIN NO. 6 ± 30 DEGREES.



BASING DIAGRAM
12L

Electronic TUBES

21YP4 AND 21YP4-A

CATHODE-RAY TUBE

21-INCH RECTANGULAR, GLASS
FOCUS—LOW VOLTAGE ELECTROSTATIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
19⅛- BY 14$\frac{3}{16}$-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING
21YP4-A—ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 21YP4 is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 19⅛- by 14$\frac{3}{16}$-inch picture for television applications. The electron gun has a focusing voltage range of −0.4 to +2.2 percent of the anode voltage and is designed for use with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

The 21YP4-A has the additional feature of a reflective aluminized screen which increases light output.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	750	uuf
Minimum	500	uuf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	71	Percent

MECHANICAL

Over-all Length	$23\frac{1}{32} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$21\frac{7}{32} \pm \frac{3}{16}$	Inches
Width	$20\frac{1}{4} \pm \frac{3}{16}$	Inches
Height	$15\frac{9}{16} \pm \frac{3}{16}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$20\frac{1}{8}$	Inches
Width	$19\frac{1}{8}$	Inches
Height	$14\frac{3}{16}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J170-B1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees

Mounting Position—Any

Net Weight, approximate	25	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	18,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Focusing-Electrode Current‡	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage§		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltageπ	16,000	Volts DC
Focusing-Electrode Voltage for Focus▲	−64 to +352	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage♦	−28 to −72	Volts DC
Ion-Trap Field Intensityϕ, approximate	40	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.
If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

‡At design-center maximum anode voltage plus ten percent.

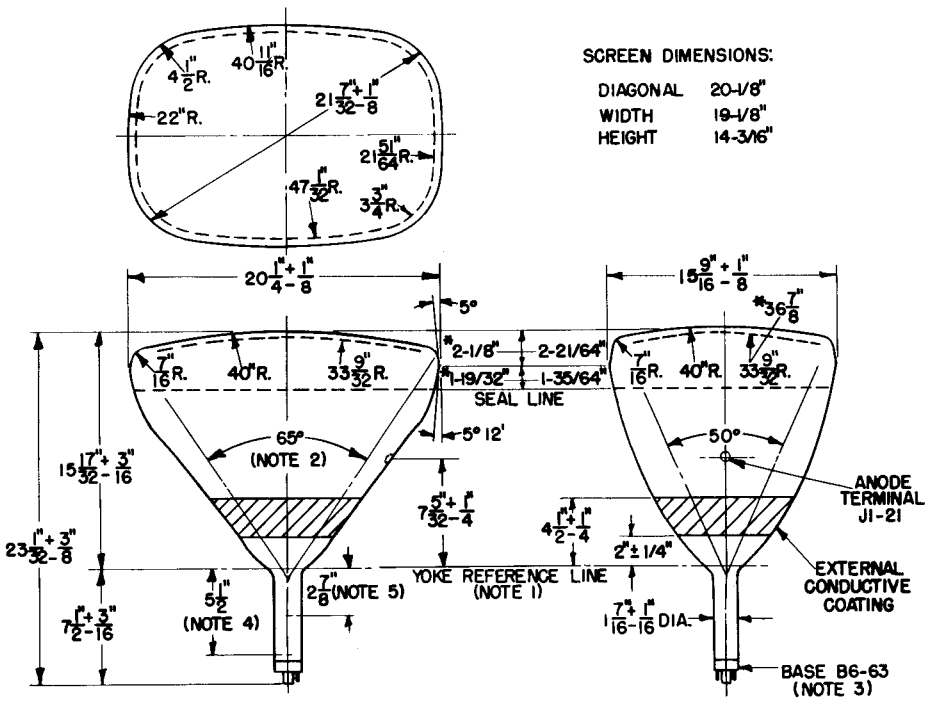
§Cathode should be returned to one side or to the midtap of the heater transformer winding.

πBrightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

▲The focusing electrode may be modulated within the stipulated maximum range without damage to the tube.

♦For visual extinction of focused raster.

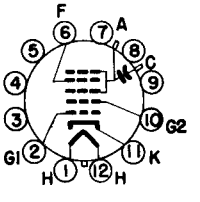
φSingle-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through JETEC ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ±30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED

* THIS SET OF VALUES ALSO POSSIBLE.



BASING DIAGRAM
12L

Electronic TUBES

21ZP4-A AND 21ZP4-B

CATHODE-RAY TUBE

21-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
70-DEGREE DEFLECTION ANGLE
19⅛- BY 14$\frac{3}{16}$-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING
21ZP4-B—ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 21ZP4-A is a magnetic-focus and deflection, direct-view all-glass picture tube which provides a 19⅛- by 14$\frac{3}{16}$-inch picture for television applications. The electron gun is designed for use with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

The 21ZP4-B has the additional feature of a reflective aluminized screen which increases light output.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	70	Degrees
Horizontal	65	Degrees
Vertical	50	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	750	uuf
Minimum	500	uuf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	71	Percent

MECHANICAL

Over-all Length	$23\frac{1}{32} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$21\frac{7}{32} \pm \frac{3}{16}$	Inches
Width	$20\frac{1}{4} \pm \frac{3}{16}$	Inches
Height	$15\frac{9}{16} \pm \frac{3}{16}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$20\frac{1}{8}$	Inches
Width	$19\frac{1}{8}$	Inches
Height	$14\frac{3}{16}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J170-B1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	25	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	18,000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	16,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage#	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	116	Milliamperes DC
Ion-Trap Field Intensity♦, approximate	40	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

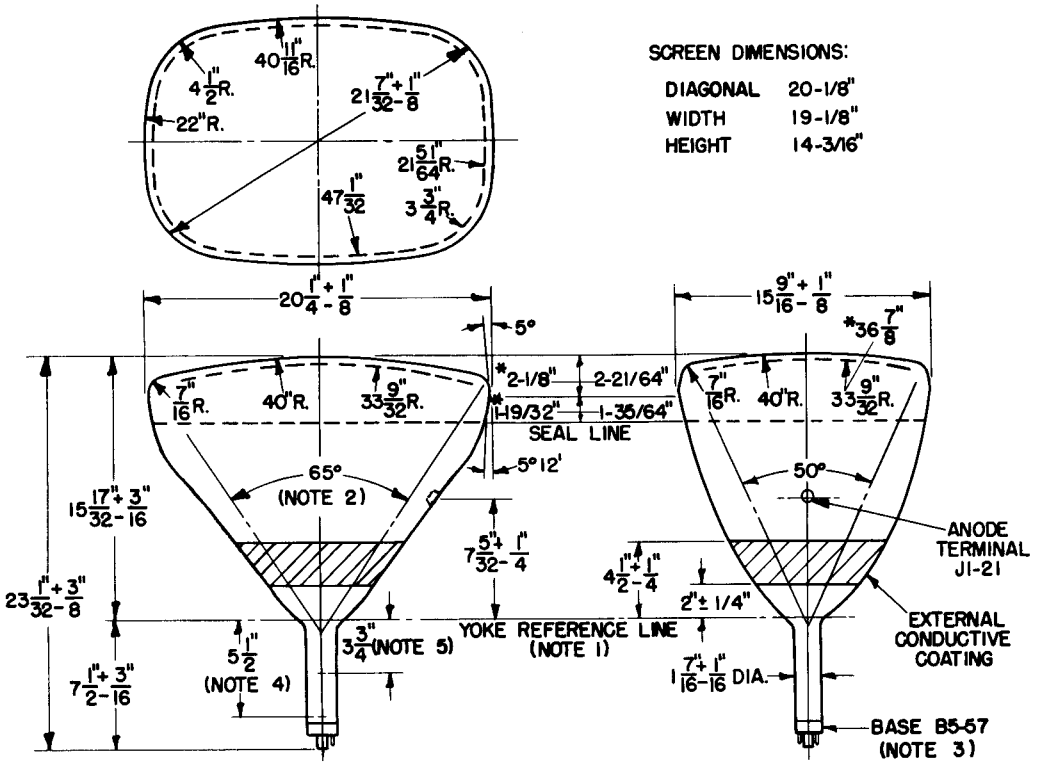
‡Cathode should be returned to one side or to the midtap of the heater transformer winding.

§Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

πFor visual extinction of focused raster.

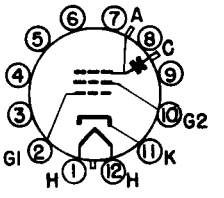
▲For JETEC focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3¾ inches.

♦Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through JETEC ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE-LINE GAGE (RETMA NO. 110) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 70 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ±30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.



BASING DIAGRAM
12N

Compactron Diode

22BW3

FOR TV DAMPING DIODE APPLICATIONS

- DIFFUSION BONDED CATHODE
- 5000 VOLTS DC
- 175 MILLIAMPERES DC

The 22BW3 is a compactron, single heater-cathode type diode intended for service as the damping diode in the horizontal deflection circuit of television receivers.

The diffusion bonded cathode practically eliminates one of the major failure mechanisms in damping diodes, which is plate-to-cathode arcing caused by emissive particles being pulled from the cathode by the high electrostatic field.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	22.4	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

Direct Interelectrode Capacitances, approximate¶

Cathode to Plate and Heater:		
k to (p + h)	8.5	pf
Plate to Cathode and Heater:		
p to (k + h)	6.0	pf
Heater to Cathode: (h to k)	3.8	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-60

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches
Minimum Seated Height	2.250	Inches

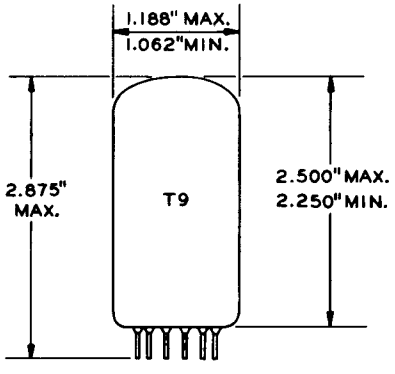
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

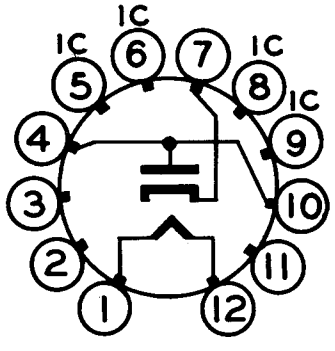


EIA 9-60

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - No Connection
Pin 3 - No Connection
Pin 4 - Plate
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Cathode
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Plate
Pin 11 - No Connection
Pin 12 - Heater

BASING DIAGRAM



EIA 12FX

GENERAL ELECTRIC

Supersedes 22BW3 D and R Sheet dated 12-63

MAXIMUM RATINGS (Cont'd)

TV DAMPER SERVICE#—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	5000	Volts
Plate Dissipation	6.5	Watts
Steady-State Peak Plate Current	1100	Milliamperes
DC Output Current	175	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	900	Volts
Total DC and Peak	5000	Volts

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 350 Milliamperes DC	32	Volts

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

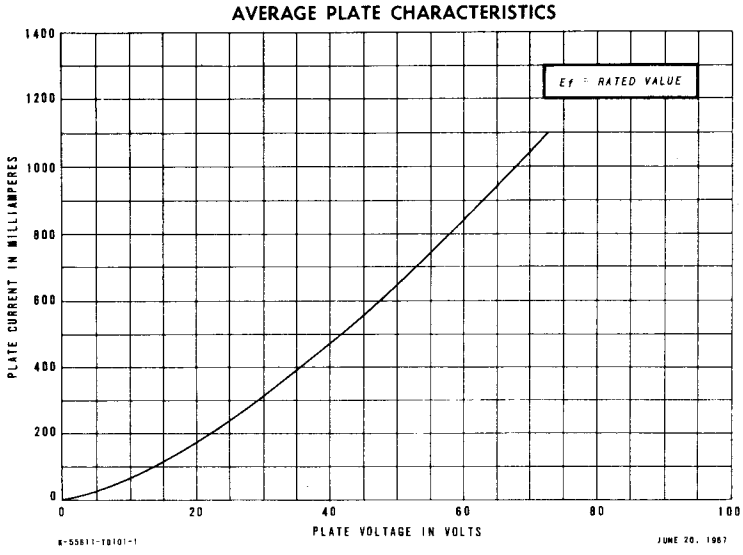
§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ Without external shield.

\# For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky

23DLP4

CATHODE RAY TUBE

23 INCH, RECTANGULAR, GLASS	FACE PLATE -- SPHERICAL GRAY
FOCUS -- ELECTROSTATIC	NON ION TRAP GUN
92 DEGREE MAGNETIC DEFLECTION	ALUMINIZED SCREEN
INTEGRAL IMPLOSION PROTECTION	EXTERNAL CONDUCTIVE COATING

LOW GRID NO. 2 VOLTAGE TYPE
FOR CATHODE-DRIVE OPERATION

DESCRIPTION AND RATING

The 23DLP4 is a 23 inch rectangular glass picture tube employing integral implosion protection consisting of a face rim band, tension strap and bulb funnel coating. An outstanding feature is a non-ion trap gun designed for operation at a low Grid #2 voltage for use in cathode-drive circuits. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating serves as a filter capacitor when grounded and contributes to the reduction of sweep induced radiation. Overall length is 18±3/8 inches and screen area is 282 square inches.

The 23DLP4 is equivalent to the 23AWP4 electrically and mechanically except for the addition of integral implosion protection hardware and reduced transmission of the face glass to provide equivalent transmission of conventional face glass plus separate protective shield.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angle, Approximate	
Horizontal	80 degrees
Vertical	65 degrees
Diagonal	92 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes, approx.	5 μμf
Grid #1 to all other electrodes, approx.	6 μμf
External Conductive Coating to Anode	2500 max. μμf
(including implosion protection hardware)	1700 min. μμf
Heater Current at 6.3 volts	600 ± 30 ma.
Heater Warm-Up Time	11 sec.

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

from JEDEC release #3895, Sept. 24, 1962

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center (Approximate)	42 1/2 Percent

MECHANICAL DATA

Overall	18 ± 3/8 inches
Greatest Dimensions of Tube	
Diagonal	23 1/2 ± 1/8 inches
Width	20 5/8 ± 1/8 inches
Height	16 5/8 ± 1/8 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	22 5/16 inches
Horizontal Axis	19 1/4 inches
Vertical Axis	15 1/8 inches
Area	282 sq. inches
Neck Length	5 1/2 ± 3/16 inches
Bulb Contact	JEDEC No. J1-21
Base	JEDEC No. B6-203
Basing Designation	12L
Bulb Contact Alignment	
Anode Contact Aligns with Base Pin No. 6 ± 30 degrees	
Bulb Designation	JEDEC No. J187J1
Weight (Approximately)	30 Pounds

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to Grid No. 1

Maximum Anode Voltage	22,000 volts
Minimum Anode Voltage	11,000 volts
Maximum Grid #4 (Focusing Electrode) Voltage	-450 to +1250 volts
Minimum Grid #2 Voltage	40 volts
Maximum Grid #2 Voltage	225 volts
Cathode Voltage	
Maximum Positive Bias Value	154 volts DC
Maximum Positive Peak Value	220 volts
Maximum Negative Bias Value	0 volts DC
Maximum Negative Peak Value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 volts
Maximum Heater-Cathode	
Heater Negative with respect to Cathode	
During Warm-Up period not to exceed 15 sec.	450 volts
After equipment warm-up period	200 volts
Heater Positive With Respect to Cathode	200 volts

TYPICAL OPERATING CONDITIONS (Cathode-Drive Service)

Anode Voltage	20,000 volts DC
Grid #4 Voltage (Focusing Electrode, Notes 2 & 3)	250 volts DC
Grid #2 Voltage	50 volts DC
Cathode to Grid #1 Voltage for cut-off (Note 1)	36 to 54 volts

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5 max. megohm
Grid No. 2 Circuit Resistance	0.1 min. megohm
Focusing Electrode Circuit Resistance	0.1 min. megohm

Protective resistance in Grid No. 2 and focusing electrical circuits is advisable to prevent damage to tube. If applicable, one resistor common to both circuits may be used.

NOTES:

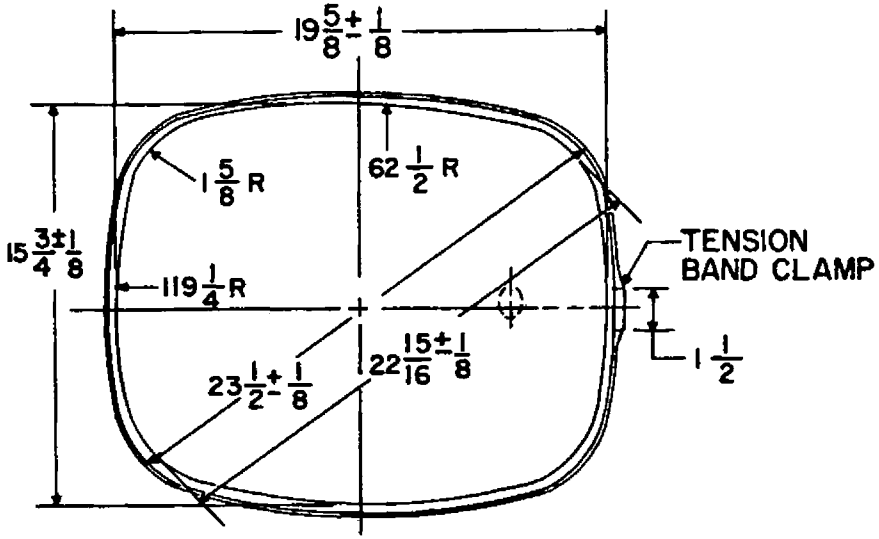
1. Visual extinction of focused raster

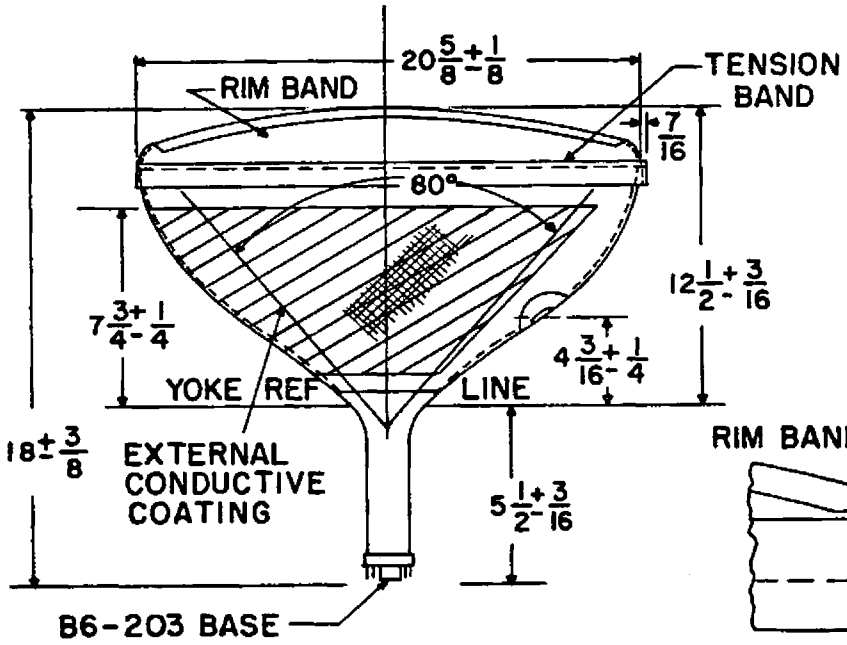
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 μa on a 19-1/4" x 15-1/4" pattern from RCA 2F21 monoscope or equivalent.

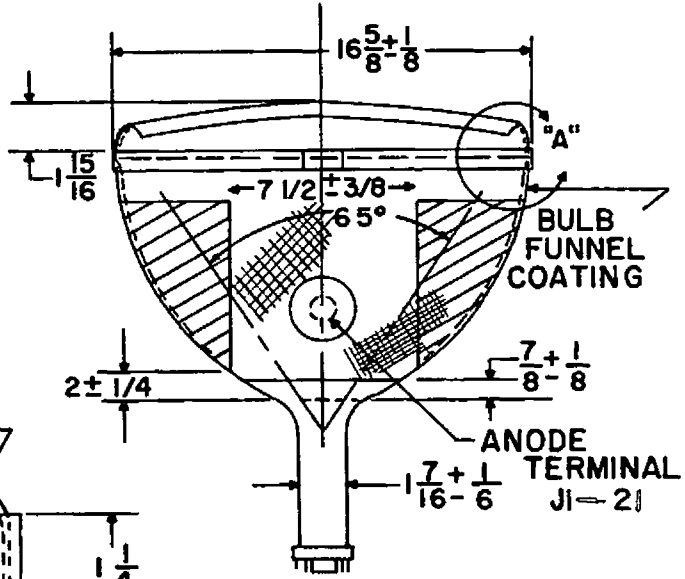
3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

23 DLP4

SCREEN DIMENSIONS
DIAGONAL — 22 5/16
WIDTH — 19 1/4
HEIGHT — 15 1/8
AREA — 282 SQ.IN.







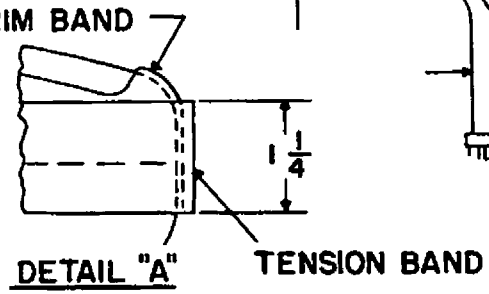
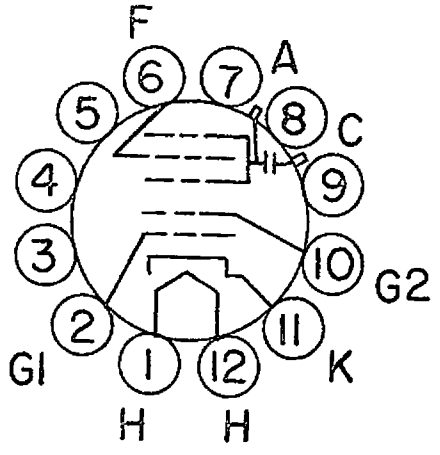


DIAGRAM NOTES

1. The reference line is determined by the intersection of the plane C-C' of gage (EIA No. 116) with the glass funnel.
2. Deflection angle on the diagonal is 92°.
3. Anode terminal aligns with pin No. 6 ± 30 degrees.
4. Use a non-rigidly mounted socket with flexible leads. Bottom circumference of base wafer will fall within 2-3/4 inch diameter circle concentric with the bulb axis.



BASING DIAGRAM

12L

23DWP4

CATHODE RAY TUBE

23 INCH, RECTANGULAR, GLASS

FACEPLATE--SPHERICAL GRAY

FOCUS--ELECTROSTATIC

NON ION TRAP GUN

DEFLECTION--MAGNETIC

ALUMINIZED SCREEN

94 DEGREE DEFLECTION ANGLE

EXTERNAL CONDUCTIVE COATING

INTEGRAL IMPLOSION PROTECTION

----------DESCRIPTION AND RATING----------

The 23DWP4 is a 23 inch electrostatic-focus and magnetic deflection glass lightweight picture tube equipped with banded tube - coated funnel type integral implosion protection. Outstanding features include a small neck diameter and a non ion trap gun. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angle, Approximate	
Horizontal	82 degrees
Vertical	68 degrees
Diagonal	94 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes, approx.	5 μμf
Grid #1 to all other electrodes, approx.	6 μμf
External Conductive Coating to Anode	2500 max. μμf
(including implosion protection hardware)	2000 min. μμf
Heater Current at 6.3 volts	600 ± 30 ma.
Heater Warm-Up Time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center, approx.	42 Percent

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC

Syracuse, N. Y.

from JEDEC release #4302, June 17, 1963

MECHANICAL DATA

Overall Length	17 3/16 ± 5/16 inches
Greatest Dimensions of Tube	
Diagonal	23 1/2 ± 1/8 inches
Width	20 5/8 ± 1/8 inches
Height	16 5/8 ± 1/8 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	22 5/16 inches
Horizontal Axis	19 1/4 inches
Vertical Axis	15 1/8 inches
Area	282 square inches
Neck Length	5 1/8 ± 1/8 inches
Bulb	J187 M1
Bulb Contact	JEDEC No. J1-21
Base	JEDEC No. B7-208
Basing	8HR
Bulb Contact Alignment	
Anode Contact Aligns with base pin No. 4 ± 30 degrees	

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	22,000 volts
Minimum Anode Voltage	15,000 volts
Maximum Grid #4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid #2 Voltage	100 volts
Maximum Grid #2 Voltage	400 volts
Grid #1 Voltage	
Maximum Negative Value	140 volts DC
Maximum Negative Peak Value	200 volts
Maximum Positive Value	0 volts DC
Maximum Positive Peak Value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 volts

Maximum Heater-Cathode Voltage
Heater negative with respect to cathode
During warm-up period not to exceed 15 sec . . . . 410 volts
After equipment warm-up period . . . . . 300 volts
Heater positive with respect to cathode. . . . . 180 volts

TYPICAL OPERATING CONDITIONS (Cathode Drive Service)

Anode Voltage	18,000 volts DC
Grid #4 Voltage (Focusing Electrode-Notes 2 & 3) . . .	250 volts DC
Grid #2 Voltage.	200 volts DC
Cathode to Grid #1 Voltage (Note 1).	31 to 49 volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5 max. megohm
Grid #2 Circuit Resistance	0.1 min. megohm
Focusing Electrode Circuit Resistance.	0.1 min. megohm

Protective resistance in Grid #2 and focusing electrical circuits is advisable to prevent damage to tube. If applicable, one resistor common to both circuits may be used.

NOTES:

1. Visual extinction of focused raster.

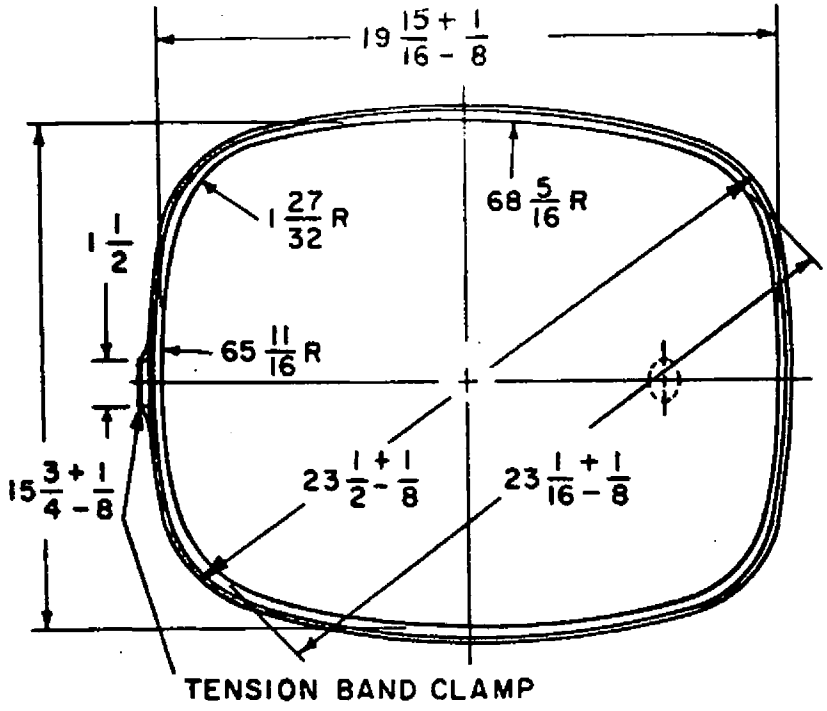
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 μa on a 19 1/4" x 15 1/8" pattern from RCA 2F21 monoscope or equivalent.

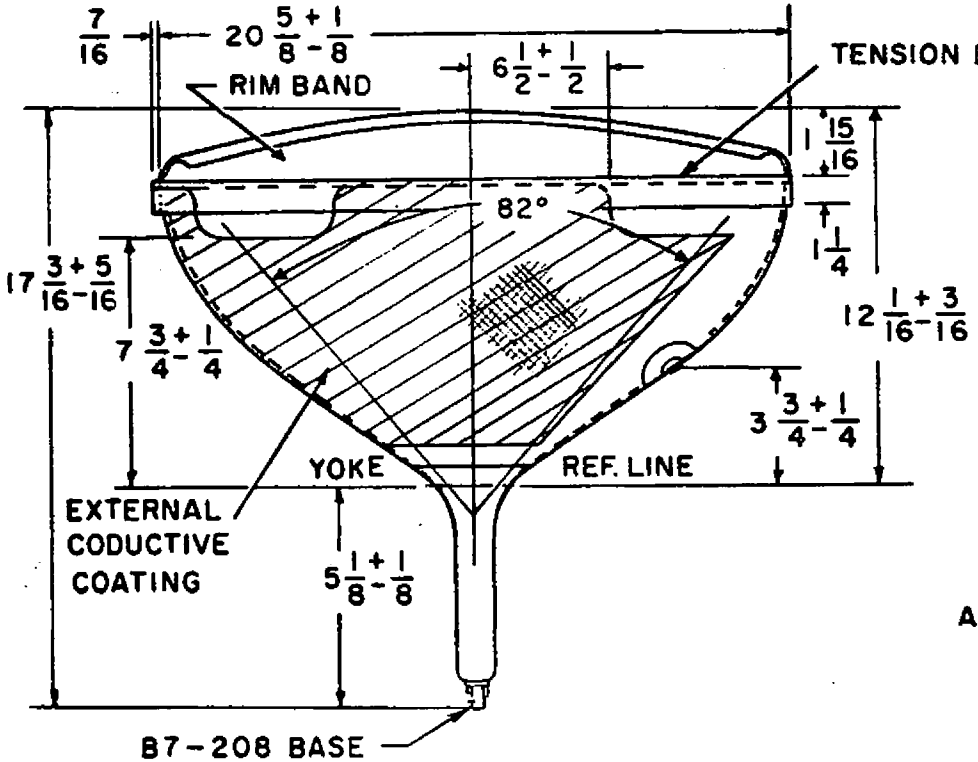
3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

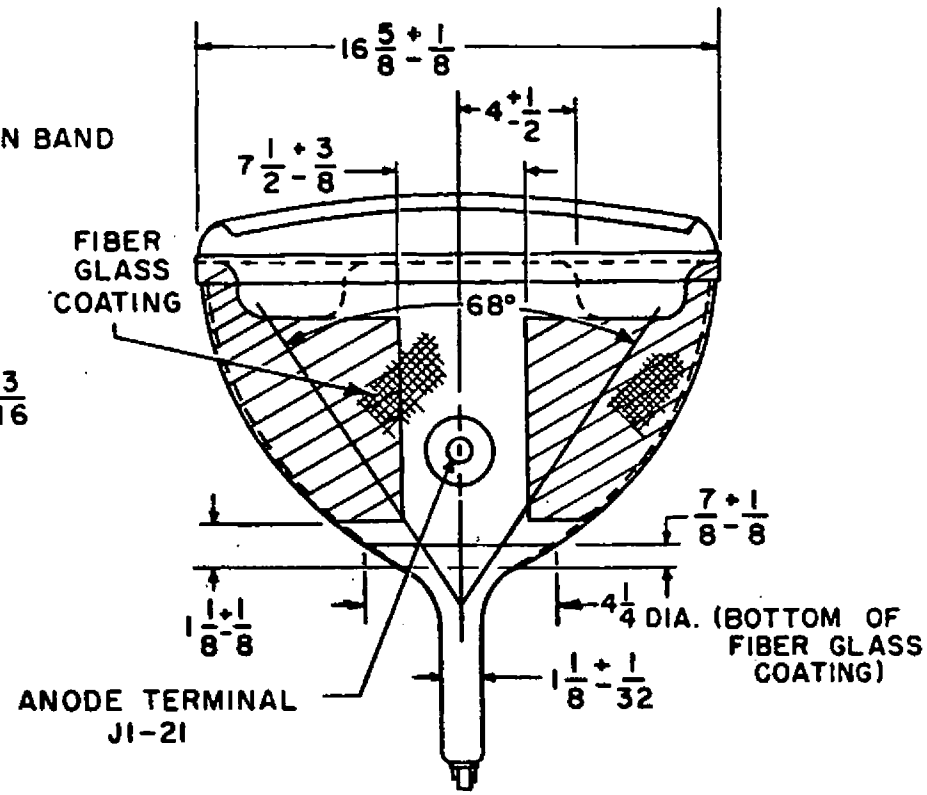
23 DWP4

SCREEN DIMENSIONS

DIAGONAL — 22 5/16
WIDTH — 19 1/4
HEIGHT — 15 1/8
AREA — 282 SQ. IN.







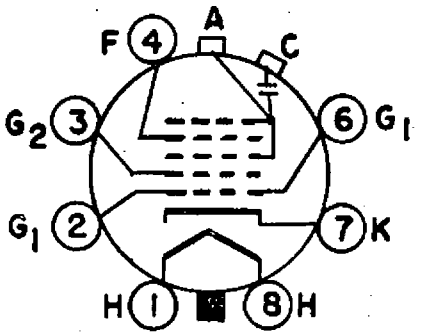
OUTLINE NOTES

1. The reference line is determined by the intersection of the plane C-C of gage (EIA No. 126) with the glass funnel.

2. Deflection angle on the diagonal is 94°.

3. Anode terminal aligns with pin no. 4 ±30 degrees.

4. Use a non-rigidly mounted socket with flexible leads. Bottom circumference of base wafer will fall within 1-3/4 inch diameter circle concentric with the bulb axis.



BASING DIAGRAM
8 HR

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

23DYP4
CATHODE RAY TUBE

23 INCH, RECTANGULAR, GLASS
FOCUS--ELECTROSTATIC
DEFLECTION--MAGNETIC
110-DEGREE DEFLECTION ANGLE
FACEPLATE--SPHERICAL GRAY
NON ION TRAP GUN
ALUMINIZED SCREEN
EXTERNAL CONDUCTIVE COATING

INTEGRAL IMPLOSION PROTECTION

DESCRIPTION AND RATING

The 23DYP4 is a 23 inch electrostatic-focus and magnetic deflection glass light-weight picture tube equipped with banded tube - coated funnel type integral implosion protection. Outstanding features include a short over-all length, a small neck diameter and a non ion trap gun. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angle, Approximate	
Horizontal	99 Degrees
Vertical	82 Degrees
Diagonal	110 Degrees
Direct Interelectrode Capacitance	
Cathode to all other electrodes, approx.	5 μμf
Grid #1 to all other electrodes, approx.	6 μμf
External Conductive Coating to Anode	2500 max. μμf
(including implosion protection hardware)	2000 min. μμf
Heater Current at 6.3 volts	600 ± 30 ma.
Heater Warm-Up Time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center, approx.	42 Percent

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

from JEDEC release #4302, June 17, 1963

MECHANICAL DATA

Overall Length	14-7/8 ± 5/16 inches
Greatest Dimensions of Tube	
Diagonal	23-1/2 ± 1/8 inches
Width	20-5/8 ± 1/8 inches
Height	16-5/8 ± 1/8 inches
Minimum Useful Screen Dimensions (Projected)	
Diagonal	22-5/16 inches
Horizontal Axis	19-1/4 inches
Vertical Axis	15-1/8 inches
Area	282 square inches
Neck Length	5-1/8 ± 1/8 inches
Bulb	J187K1
Bulb Contact	JEDEC No. J1-21
Base	JEDEC No. B7-208
Basing	8HR
Bulb Contact Alignment	
Anode Contact Aligns with base pin No. 4 ± 30 degrees	

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	22,000 volts
Minimum Anode Voltage	15,000 volts
Maximum Grid #4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid #2 Voltage	100 volts
Maximum Grid #2 Voltage	550 volts
Grid #1 Voltage	
Maximum Negative Value	140 volts DC
Maximum Negative Peak Value	200 volts
Maximum Positive Value	0 volts DC
Maximum Positive Peak Value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 volts

Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm-up period not to exceed 15 sec	410 volts
After equipment warm-up period	300 volts
Heater positive with respect to cathode	180 volts

TYPICAL OPERATING CONDITIONS (Cathode Drive Service)

Anode Voltage	18,000 volts DC
Grid #4 Voltage (Focusing Electrode-Notes 2 & 3)	250 volts DC
Grid #2 Voltage	300 volts DC
Cathode to Grid #1 Voltage (Note 1)	36 to 54 volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5 max. megohm
Grid #2 Circuit Resistance	0.1 min. megohm
Focusing Electrode Circuit Resistance	0.1 min. megohm

Protective resistance in Grid #2 and focusing electrical circuits is advisable to prevent damage to tube. If applicable, one resistor common to both circuits may be used.

NOTES:

1. Visual extinction of focused raster.

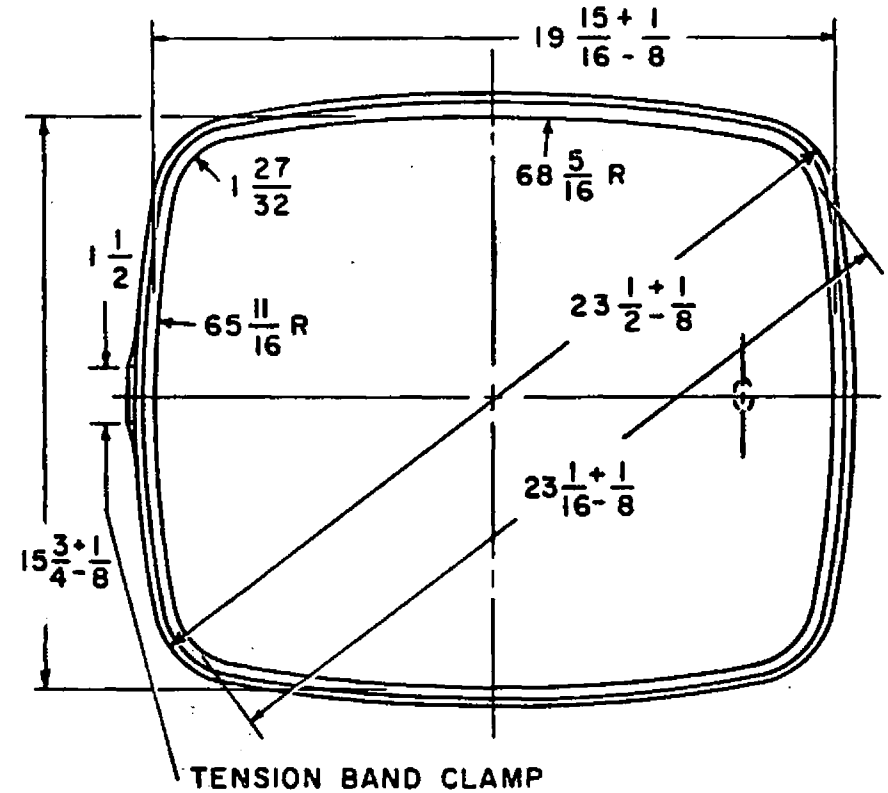
2. With the combined Grid #1 bias voltage and video-signal voltage adjusted to give an anode current of 150 μa on a 19-1/4" x 15-1/8" pattern from RCA 2F21 monoscope or equivalent.

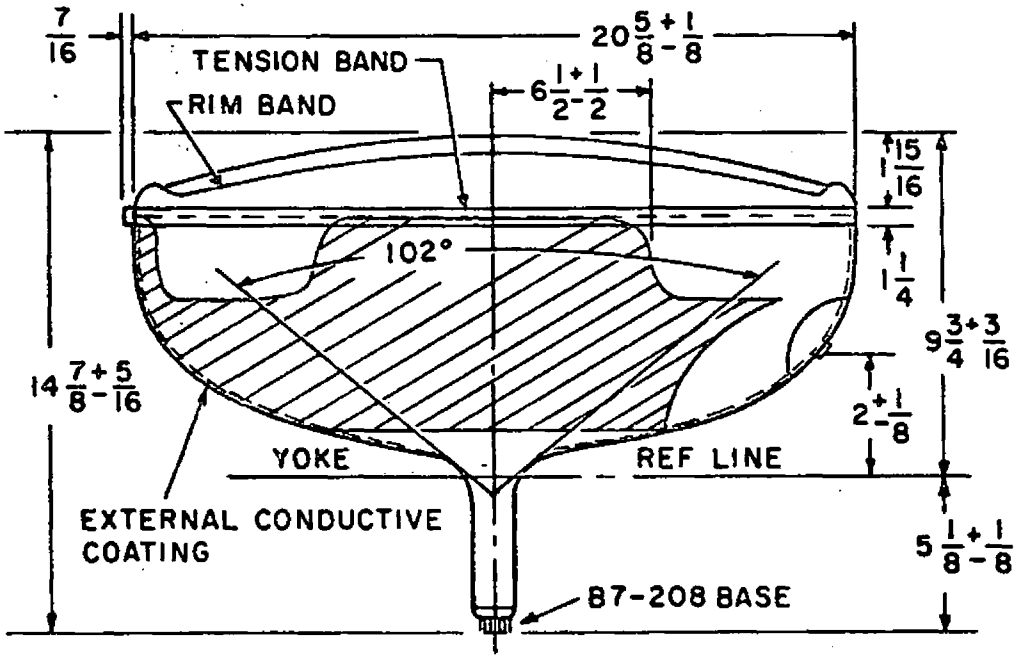
3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

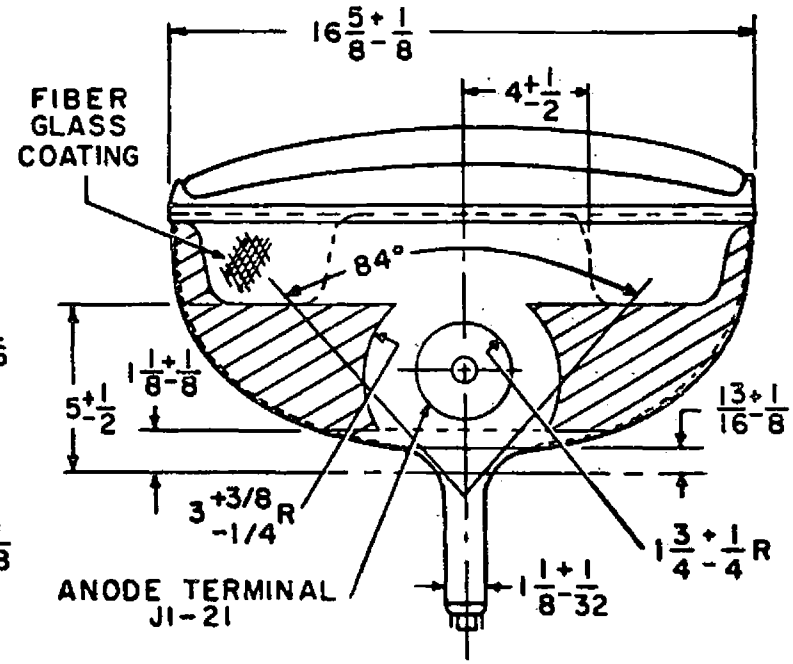
23DYP4

SCREEN DIMENSIONS

DIAGONAL	22 5/16
WIDTH	19 1/4
HEIGHT	15 1/8
AREA	282 SQ IN.







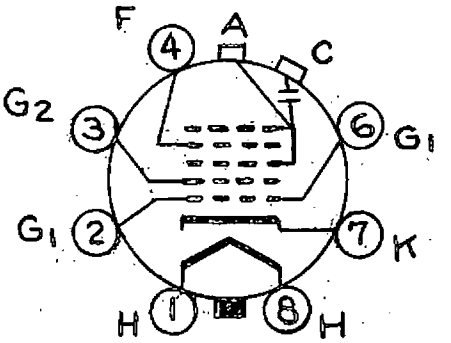
OUTLINE NOTES

1. The reference line is determined by the intersection of the plane C-C of gage (EIA No. 126) with the glass funnel.

2. Deflection angle on the diagonal is 110°.

3. Anode terminal aligns with pin no. 4 $\pm$ 30 degrees.

4. Use a non-rigidly mounted socket with flexible leads. Bottom circumference of base wafer will fall within 1 3/4 inch diameter circle concentric with the bulb axis.



BASING DIAGRAM
8 HR

CATHODE RAY TUBE DEPARTMENT
GENERAL ELECTRIC
Syracuse, N. Y.

23KP4
CATHODE RAY TUBE

23 INCH, RECTANGULAR, GLASS	FACE PLATE -- SPHERICAL GRAY
FOCUS -- ELECTROSTATIC	NON ION TRAP GUN
DEFLECTION -- MAGNETIC	ALUMINIZED SCREEN
114 DEGREE DEFLECTION ANGLE	EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 23KP4 is a 23 inch electrostatic-focus and magnetic deflection glass lightweight picture tube. Outstanding features include a short over-all length, a small neck diameter and a non ion-trap gun. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor when grounded.

ELECTRICAL DATA

Focusing Method	Electrostatic
Deflection Angle, Approximate	
Horizontal	102 degrees
Vertical	84 degrees
Diagonal	114 degrees
Direct Interelectrode Capacitance	
Cathode to all other electrode, approximate	5 uuf
Grid #1 to all other electrodes, approximate	6 uuf
External Conductor Coating to Anode	2500 max. uuf 2000 min. uuf
Heater Current at 6.3 volts	600 ± 10% ma.
Heater Warm Up Time	11 sec.

OPTICAL DATA

Phosphor Number	P4 Aluminized
Light Transmittance at Center Approx.	76 Percent

MECHANICAL DATA

Overall Length	13 5/16 ± 5/16 inches
Greatest Dimensions of Tube	
Diagonal	23 7/16 ± 1/8 inches
Width	20 1/2 ± 1/8 inches
Height	16 1/2 ± 1/8 inches

from JEDEC release #2608, Oct. 19, 1959

MECHANICAL DATA (con't)

Minimum Useful Screen Dimensions (Projected)	
Diagonal	22 1/16 inches
Horizontal axis	19 1/4 inches
Vertical axis	15 1/4 inches
Area	278 sq. inches
Neck Length	4 1/16 ± 3/16 inches
Bulb Contact	JETEC No. J1-21
Base	JETEC No. B6-226
Basing	8JS
Bulb Contact Alignment	
Anode Contact Aligns with Rev. No. 4 ± 30 degrees	

RATINGS (Design Maximum System)

Unless otherwise specified, voltage values are positive and measured with respect to cathode.

Maximum Anode Voltage	20,000 volts
Minimum Anode Voltage	15,000 volts
Maximum Grid 4 (Focusing Electrode) Voltage	-500 to +1000 volts
Minimum Grid 2 Voltage	400 volts
Maximum Grid 2 Voltage	700 volts
Grid #1 Voltage	
Maximum Negative Value	140 volts DC
Maximum Negative Peak Value	200 volts
Maximum Positive Value	0 volts DC
Maximum Positive Peak Value	2 volts
Maximum Heater Voltage	6.9 volts
Minimum Heater Voltage	5.7 volts
Maximum Heater-Cathode Voltage	
Heater negative with respect to cathode	
During warm up period not to exceed 15 sec.	410 volts
After equipment warm-up period	180 volts
Heater positive with respect to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode Voltage	16,500 volts DC
Grid #4 Voltage (Focusing Electrode (Notes 2 & 3)	250 volts DC
Grid #2 Voltage	450 volts DC
Grid #1 Voltage (Note 1)	-28 to -72 volts DC

MAXIMUM CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5 max. megohm
Grid No. 2 Circuit Resistance	0.1 min. megohm
Focusing Electrode Circuit Resistance	0.1 min. megohm

Protective resistance in Grid No. 2 and focusing electrical circuits is advisable to prevent damage to tube. If applicable, one resistor common to both circuits may be used.

NOTES:

1. Visual extinction of focused raster.

2. With the combined Grid#1 bias voltage and video-signal voltage adjusted to give an anode current of 150 microamperes on a 19 1/4" x 15 1/4" pattern from RCA 2F21 monoscope or equivalent.

3. Individual tubes will have satisfactory focus at some value between 0 and 500 volts.

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

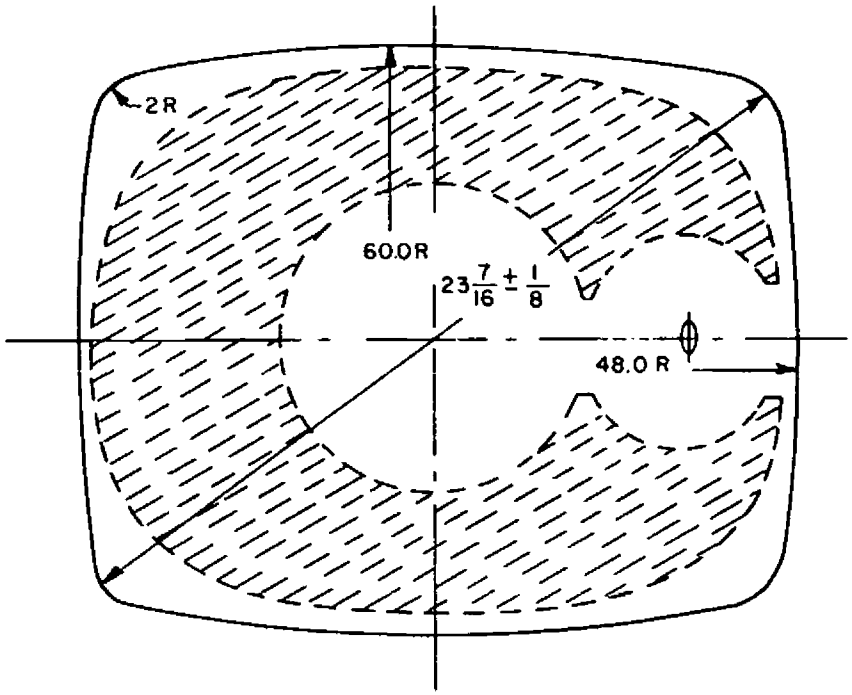
SYRACUSE, NEW YORK

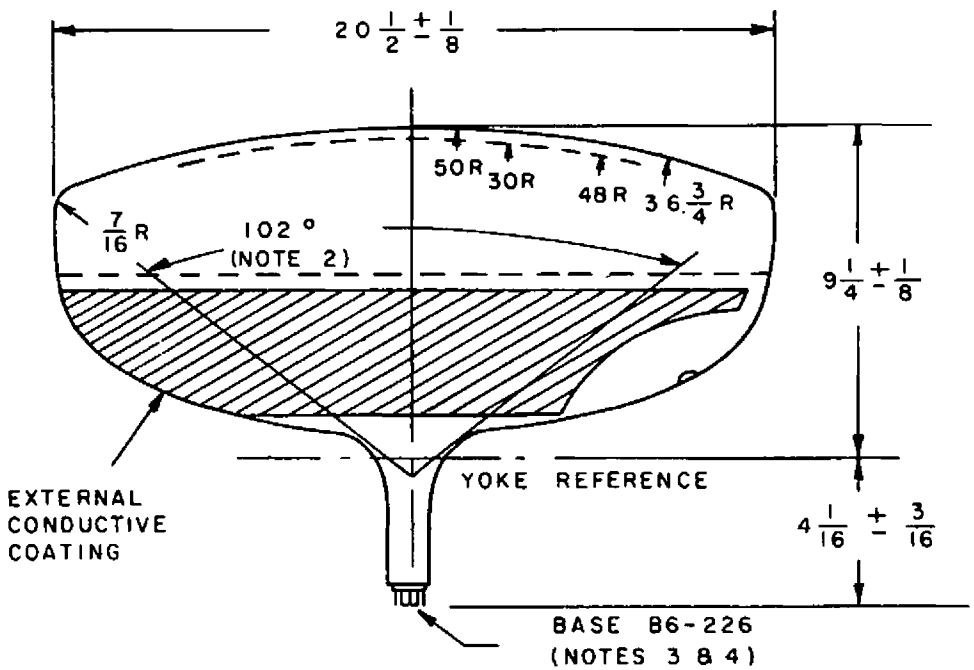
23KP4

PAGE 4

SCREEN DIMENSIONS

DIAGONAL	$22\frac{1}{16}$
WIDTH	$19\frac{1}{4}$
HEIGHT	$15\frac{1}{4}$
AREA	278 SQ. IN.





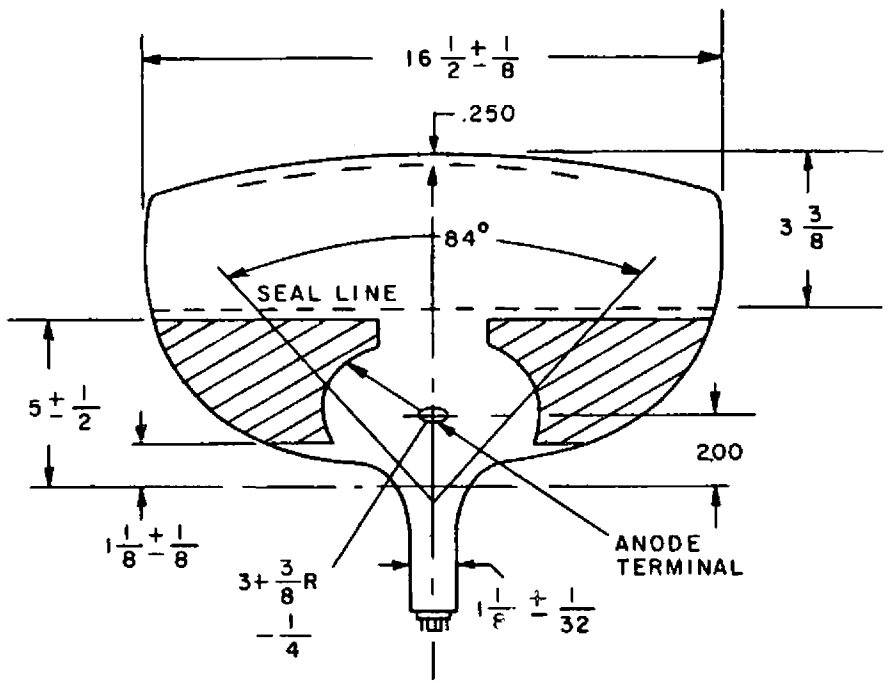


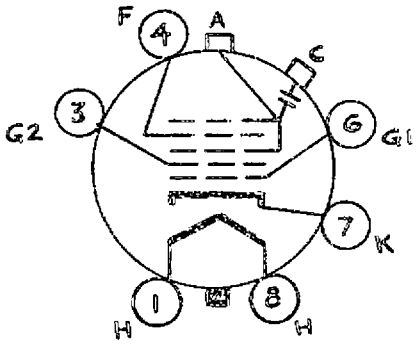
DIAGRAM NOTES

1. THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE C-C' OF GAGE (EIA NO. 126) WITH THE GLASS FUNNEL.

2. DEFLECTION ANGLE ON THE DIAGONAL IS 114°.

3. ANODE TERMINAL ALIGNS WITH PIN NO. 4 ±30 DEGREES.

4. USE A NON-RIGIDLY MOUNTED SOCKET WITH FLEXIBLE LEADS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN 1-3/4 INCH DIAMETER CIRCLE CONCENTRIC WITH THE BULB AXIS.



CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

SYRACUSE, NEW YORK

Compactron Dissimilar-Double-Triode Pentode

23Z9

- VERTICAL OUTPUT PENTODE
- 140 VOLTS B+
- VERTICAL OSCILLATOR
- SYNC CLIPPER

The 23Z9 is a compactron containing a medium-mu triode, a high-mu triode, and a high-perveance beam pentode. The pentode is intended for vertical output service in monochrome television receivers operating from 140 volts B+. The two triodes are intended for vertical oscillator and sync clipper functions.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	23	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

Direct Interelectrode Capacitances¶

Triode (Section 1)

Grid to Plate: (T1g to T1p)	3.0	pf
Input: T1g to (h + k + Pb.p.)	3.0	pf
Output: Tp to (h + k + Pb.p.)	0.4	pf

Triode (Section 2)

Grid to Plate: (T2g to T2p)	3.8	pf
Input: T2g to (h + k + Pb.p.)	2.0	pf
Output: T2p to (h + k + Pb.p.)	0.44	pf

Pentode Section

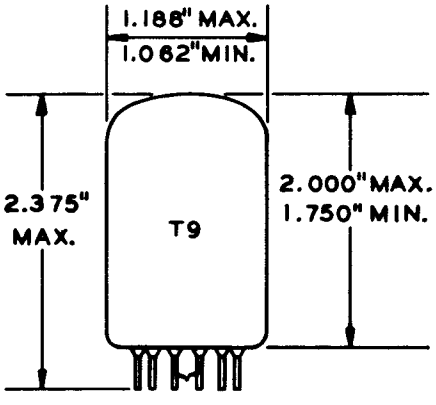
Grid-Number 1 to Plate: (Pg1 to Pp)	0.24	pf
Input: Pg1 to (h + k + Pg2 + Pb.p.)	12	pf
Output: Pp to (h + k + Pg2 + Pb.p.)	7.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-58

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches
Minimum Seated Height	1.750	Inches

PHYSICAL DIMENSIONS

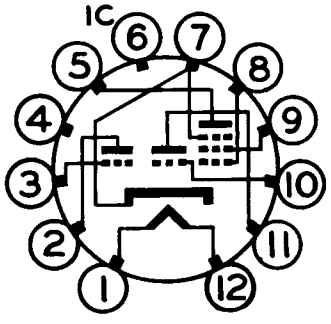


EIA 9-58

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Triode Plate (Section 2)
Pin 3 - Triode Grid (Section 2)
Pin 4 - No Connection
Pin 5 - Pentode Plate
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Cathode and Pentode Beam Plates
Pin 8 - Pentode Grid Number 1
Pin 9 - Pentode Grid Number 2 (Screen)
Pin 10 - Triode Grid (Section 1)
Pin 11 - Triode Plate (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12GZ

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

Supersedes 23Z9 D and R Sheet dated 9-64

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

PENTODE SECTION—VERTICAL-DEFLECTION AMPLIFIER SERVICE△

DC Plate Voltage	250	Volts
Peak Pulse Plate Voltage	2000	Volts
Screen Voltage	200	Volts
Peak Negative Grid-Number 1 Voltage	150	Volts
Plate Dissipation	7.0	Watts
Screen Dissipation	1.8	Watts
Total DC Plate and Screen Current	70	Milliamperes
Total Peak Plate and Screen Current	245	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	1.0	Megohms

TRIODE SECTION 1

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.25	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.5	Megohms

TRIODE SECTION 2—VERTICAL OSCILLATOR SERVICE△

DC Plate Voltage	250	Volts
Peak Negative Grid Voltage	400	Volts
Plate Dissipation	1.0	Watts
DC Plate Current	20	Milliamperes
Peak Plate Current	70	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	1.0	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

PENTODE SECTION

Plate Voltage	45	120	Volts
Screen Voltage	110	110	Volts
Grid-Number 1 Voltage	0#	-8.0	Volts
Plate Resistance, approximate	---	11700	Ohms
Transconductance	---	7100	Micromhos
Plate Current	122	46	Milliamperes
Screen Current	16.5	3.5	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 100 Microamperes	---	-25	Volts

TRIODE SECTION 1

Plate Voltage		150	Volts
Grid Voltage		-2.0	Volts
Amplification Factor		43	
Plate Resistance, approximate		11000	Ohms
Transconductance		.3900	Micromhos
Plate Current		5.4	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes		-5.7	Volts

TRIODE SECTION 2

Plate Voltage		150	Volts
Grid Voltage		-5.0	Volts
Amplification Factor		20	
Plate Resistance, approximate		.8500	Ohms
Transconductance		.2350	Micromhos
Plate Current		5.5	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes		-11	Volts

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

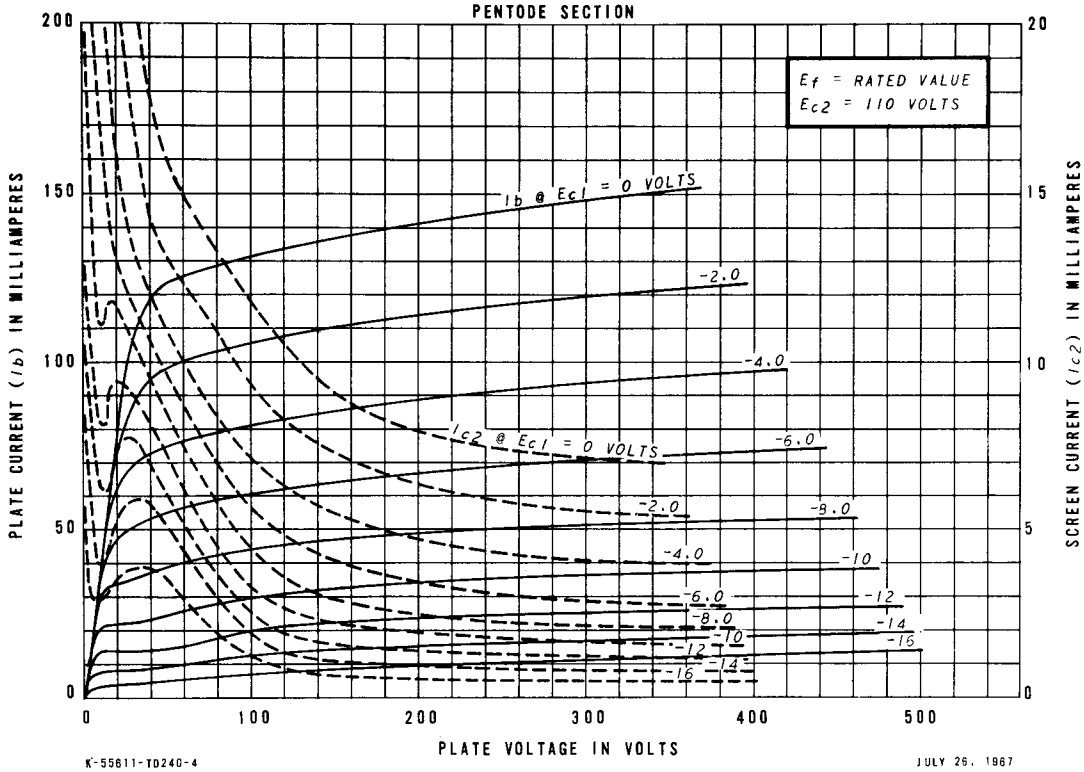
¶ Without external shield.

Δ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

Applied for short interval (two seconds maximum) so as not to damage tube.

AVERAGE PLATE CHARACTERISTICS

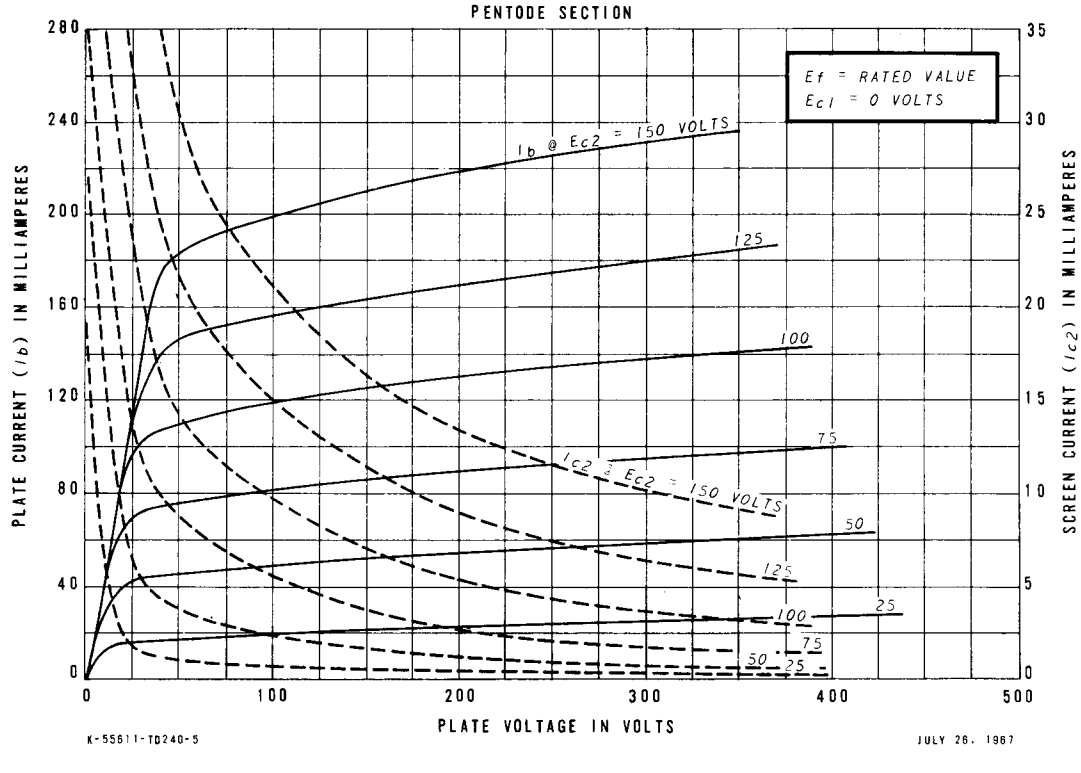
PENTODE SECTION



K-55611-TD240-4 JULY 26, 1967

AVERAGE PLATE CHARACTERISTICS

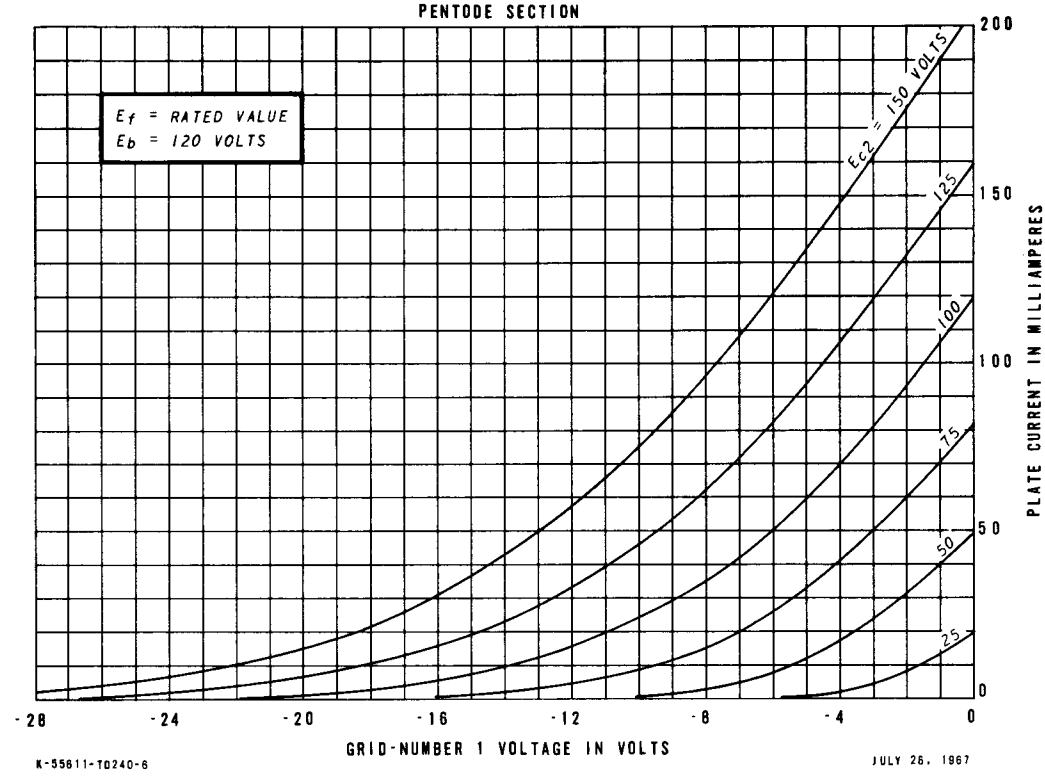
PENTODE SECTION



K-55611-TD240-5 JULY 26, 1967

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

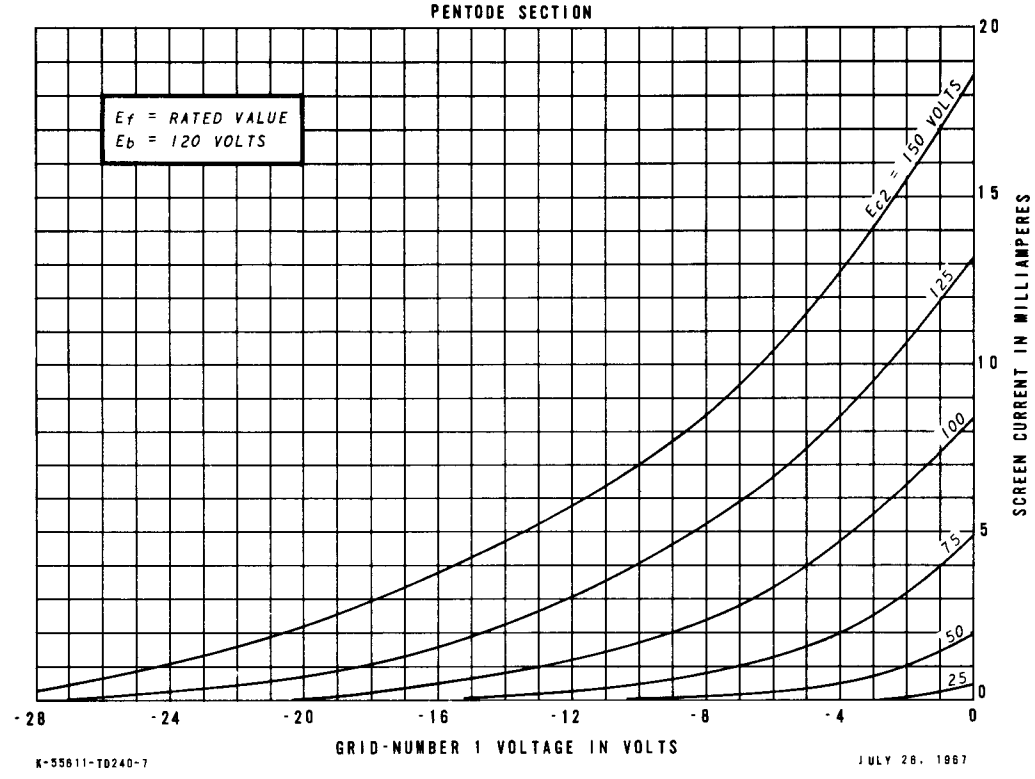


K-55611-TD240-6

JULY 26, 1967

AVERAGE TRANSFER CHARACTERISTICS

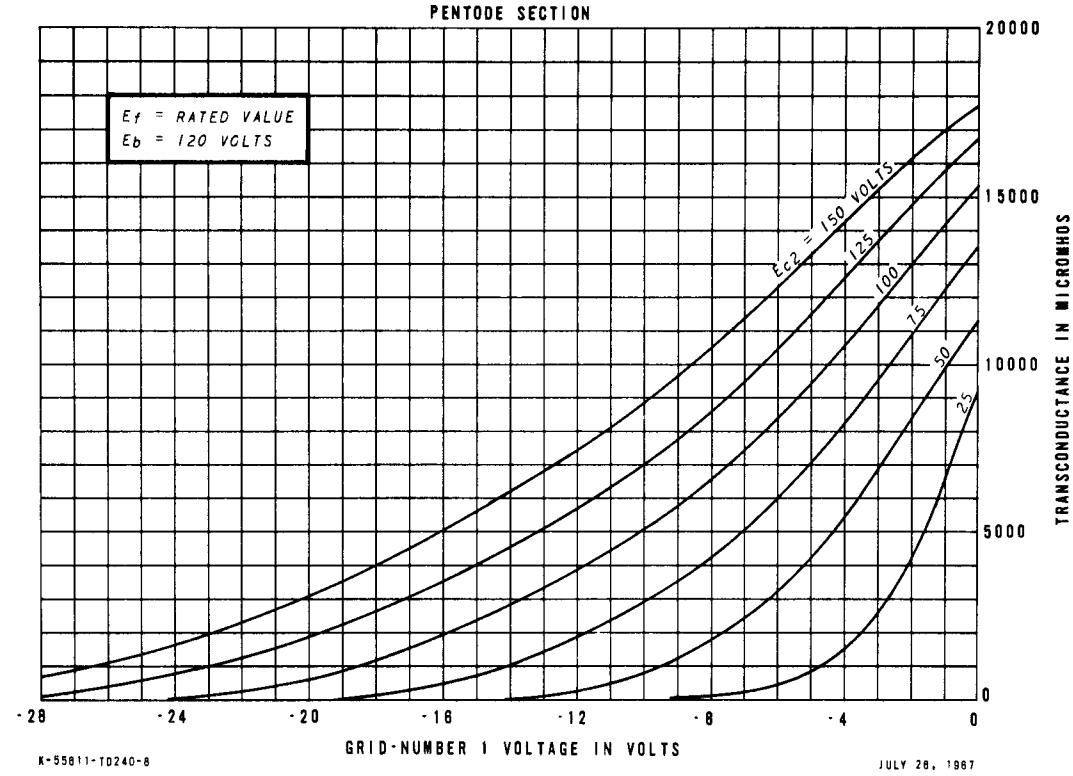
PENTODE SECTION



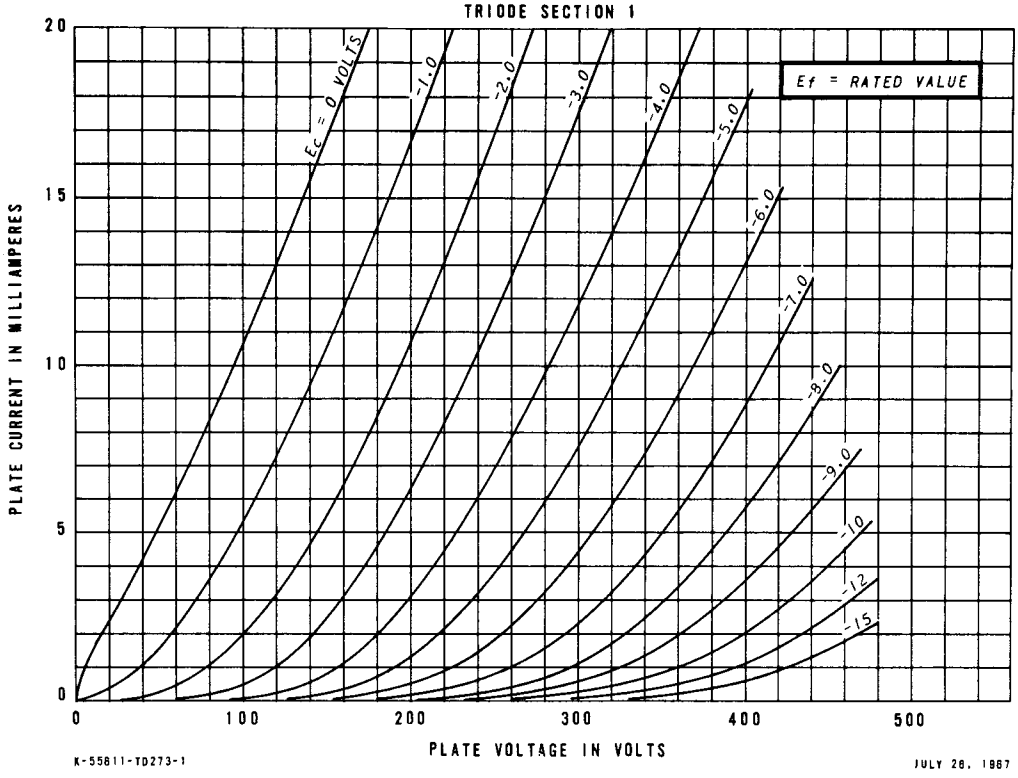
K-55611-TD240-7

JULY 26, 1967

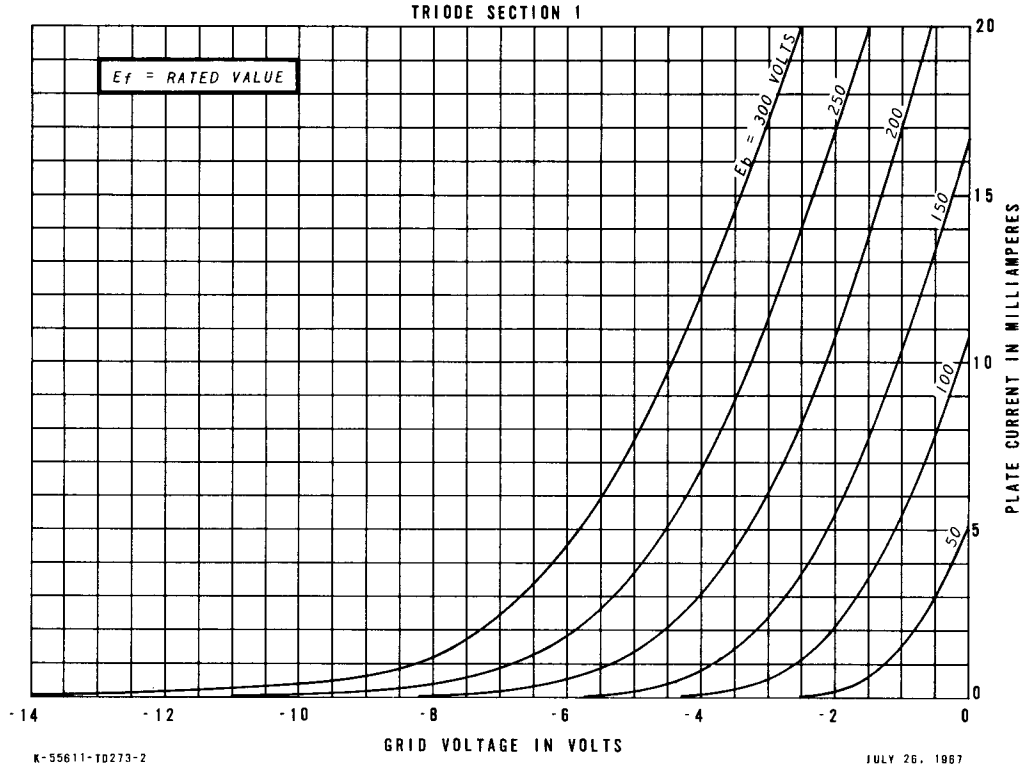
AVERAGE TRANSFER CHARACTERISTICS



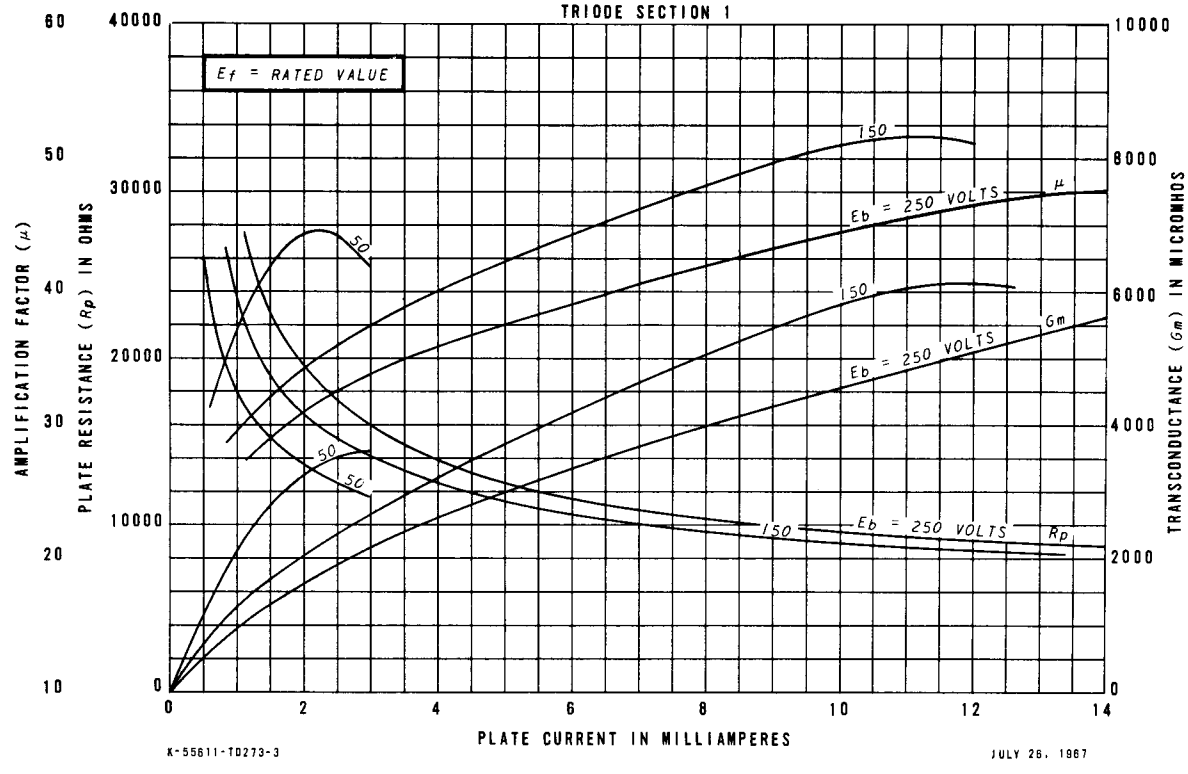
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

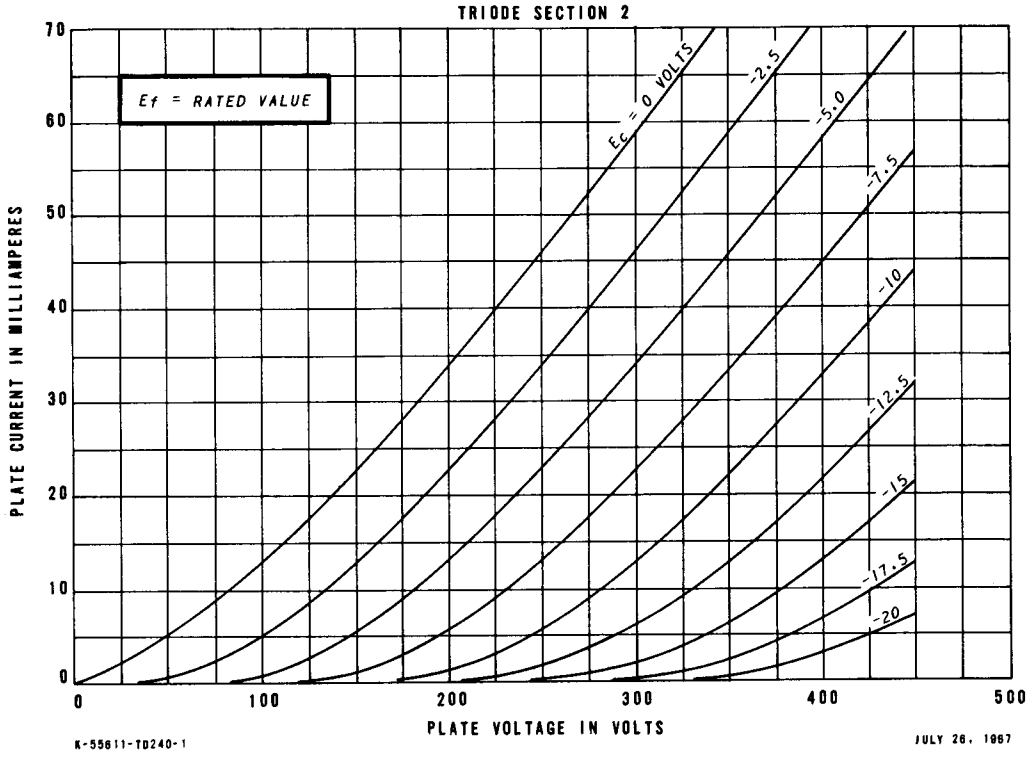


AVERAGE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION 2

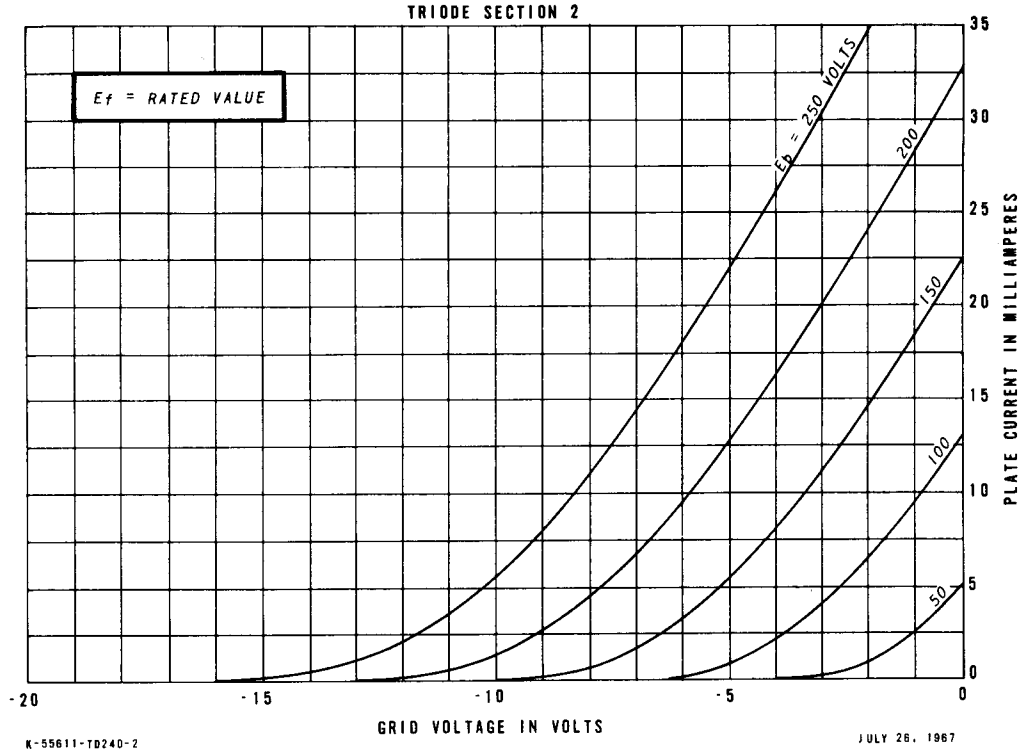


K-55611-TD240-1

JULY 26, 1967

AVERAGE TRANSFER CHARACTERISTICS

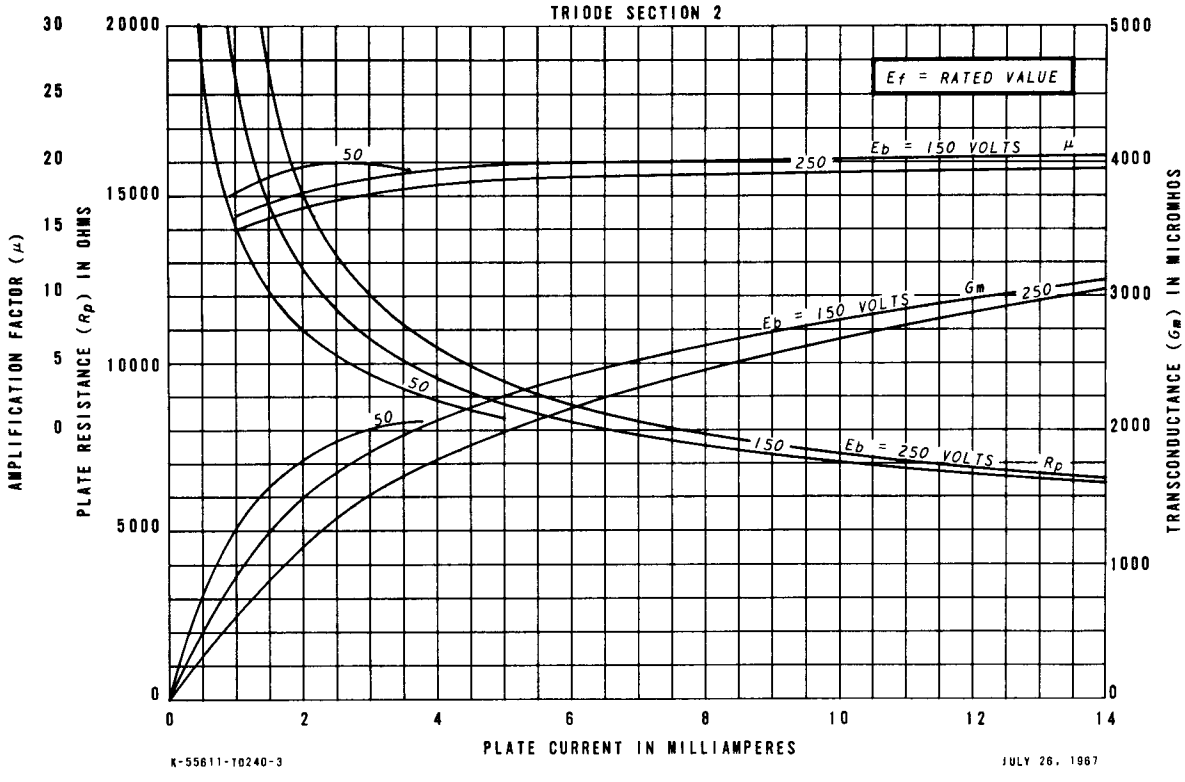
TRIODE SECTION 2



K-55611-TD240-2

JULY 26, 1967

AVERAGE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

24ALP4

CATHODE-RAY TUBE

24-INCH RECTANGULAR GLASS	21-7/16 BY 16-7/8 INCH PICTURE SIZE
FOCUS - ELECTROSTATIC	FACEPLATE - SPHERICAL, GRAY
DEFLECTION - MAGNETIC	EXTERNAL CONDUCTIVE COATING
110-DEGREE DEFLECTION ANGLE	NON-ION-TRAP GUN

ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 24ALP4 is a 24-inch electrostatic-focus and magnetic-deflection glass picture tube. Outstanding features include a short over-all length, a small neck diameter and a non-ion-trap gun. The fluorescent screen is aluminized to increase light output and reduce undesirable screen charging. An external conductive coating is provided to serve as a filter capacitor, when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Heater Warm-up Time *	11	Seconds
Focusing Method - Electrostatic		
Deflecting Method - Magnetic		
Deflection Angle, approximate		
Diagonal	110	Degrees
Horizontal	105	Degrees
Vertical	87	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode Capacitance		
Maximum	2500	μμf
Minimum	2000	μμf

OPTICAL

Phosphor Number - P4, Sulfide
Fluorescent Color - White
Phosphorescent Color - White
Persistance - Short

Faceplate - Gray

Light Transmission at Center, approximate	76	Percent

GENERAL ELECTRIC COMPANY

from JETEC release #2001, Aug. 23, 1957

MECHANICAL

Overall Length	15 7/8 ± 5/16	Inches
Neck Length	5 7/16 +3/16 − 1/8	Inches
Greatest Bulb Dimensions		
Diagonal	24 ± 1/8	Inches
Width	22 11/16 ± 1/8	Inches
Height	18 1/2 ± 1/8	Inches
Minimum Useful Screen Dimensions		
Diagonal	22 13/16	Inches
Width	21 7/16	Inches
Height	16 7/8	Inches
Area	332	Square Inches

Bulb Contact - Recessed Small-cavity Cap, JETEC No. J1-21
Base - Small-button Eightar, 7-Pin, JETEC No. B7-183
Basing Designation - 8HR
Bulb Contact Alignment
Anode Contact Aligns with Pin-No. 4 Position ± 30 Degrees

Mounting Position - Any
Net Weight, approximate . . . . . 27 Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES †

Anode Voltage ‡	20,000 Max	Volts DC
Focusing-Electrode Voltage	-500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	140 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Negative-Peak Value	200 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period Not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage §	17,000	Volts DC
Focusing-Electrode Voltage for Focus	0 to 500	Volts DC
Focusing-Electrode Current	-15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage △	-28 to -72	Volts DC

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms
Grid-No. 2 Circuit Resistance	0.1 Min	Megohms
Focusing-Electrode Circuit Resistance	0.1 Min	Megohms

Protective resistance in the grid-No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

* Heater warm-up time required for the voltage across the heater terminals to increase to 5.0-volts in the JETEC test circuit, with E = 25-volts and R = 31.5-ohms.

† The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the design-center values are not exceeded by more than ten percent.

‡ Anode, grid-No. 3, and grid-No. 5, which are connected together within the tube, are referred to herein as anode.

If this tube is operated at voltage in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

§ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 15,000 volts.

△ For visual extinction of focused raster.

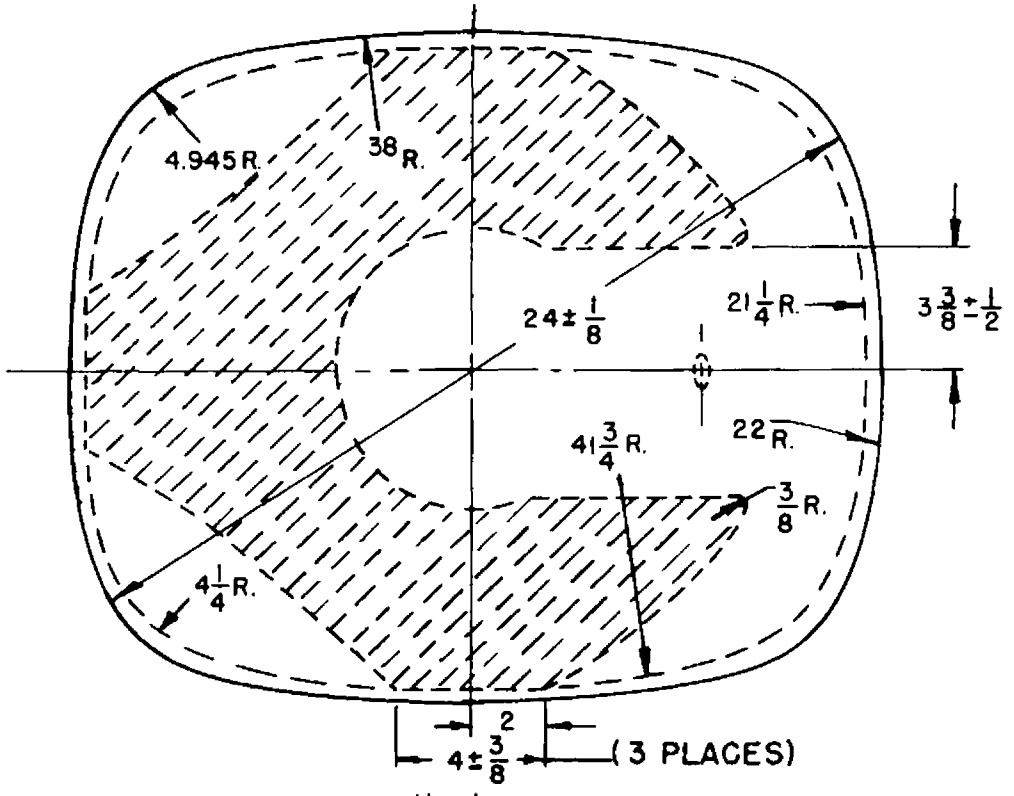
Electronic Components Division

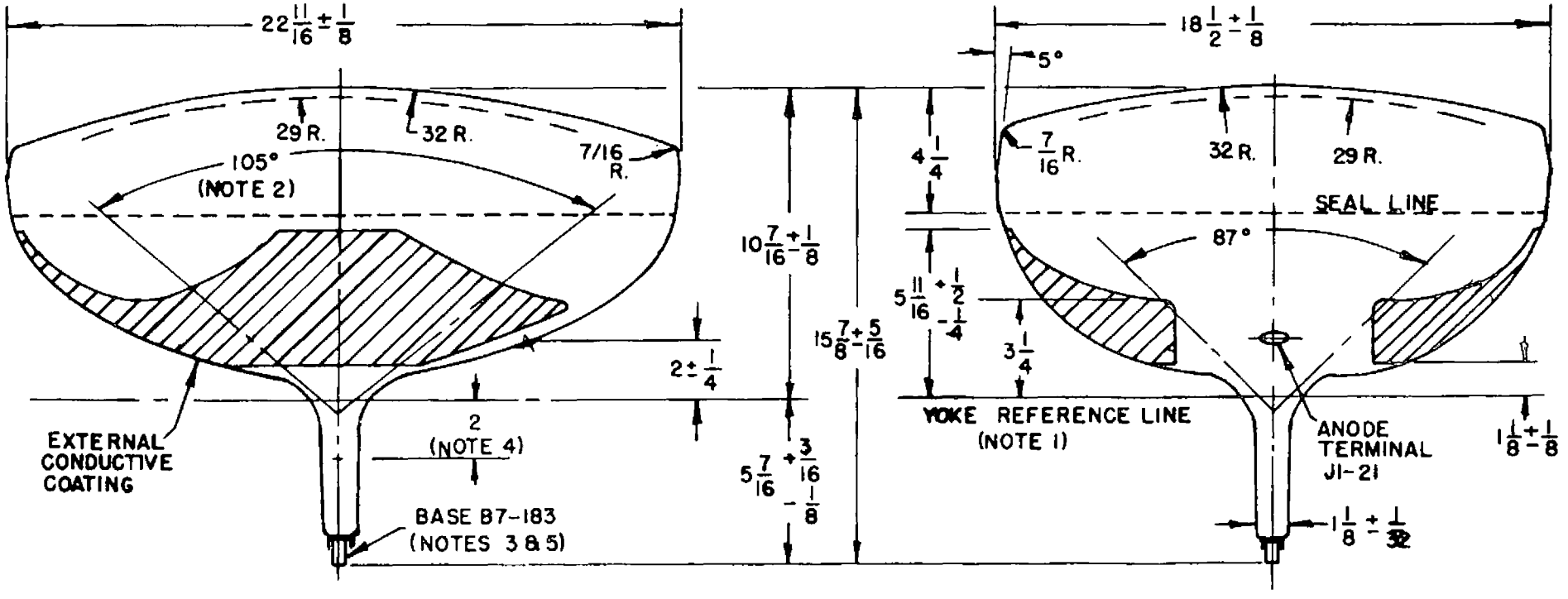
GENERAL ELECTRIC COMPANY

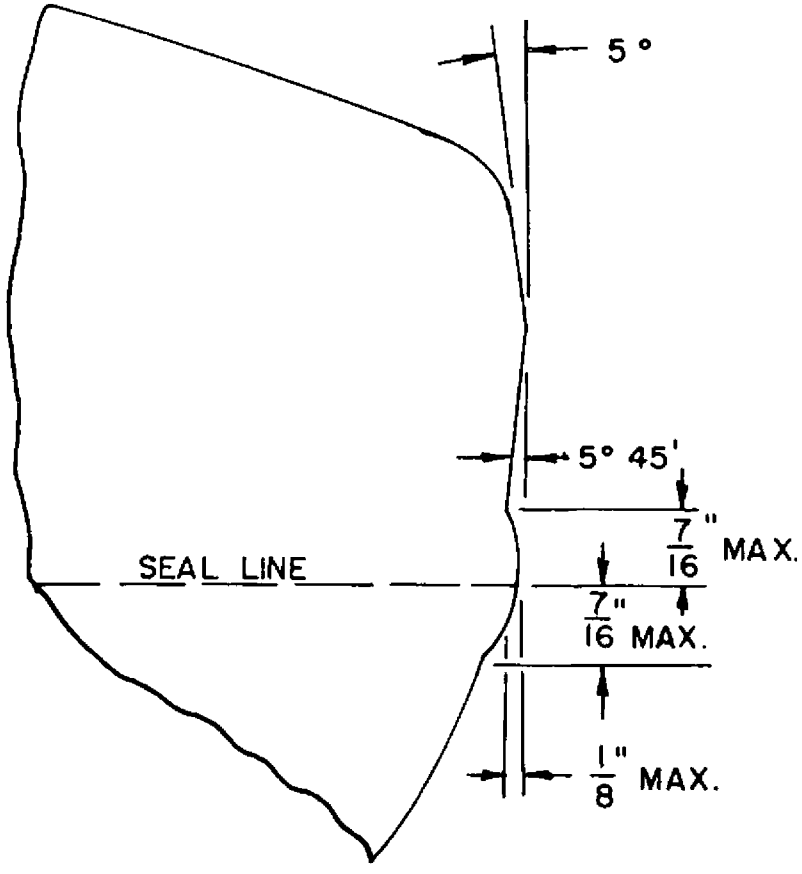
Schenectady 5, N. Y.

SCREEN DIMENSIONS

DIAGONAL	22 - 13/16
WIDTH	21 - 7/16
HEIGHT	16 - 7/8
AREA	332 SQ. IN.



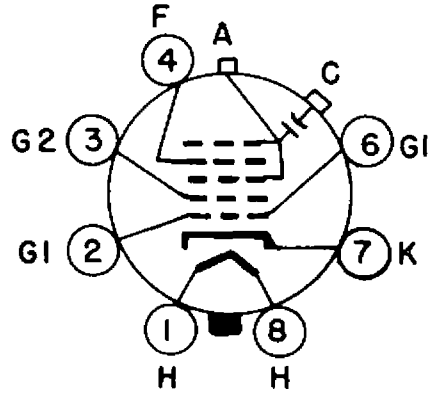




DETAIL AT
SEAL LINE

NOTES:

1. THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE C-C' OF GAGE (RETMA NO.126) WITH THE GLASS FUNNEL.
2. DEFLECTION ANGLE ON THE DIAGONAL IS 110°.
3. ANODE TERMINAL ALIGNS WITH PIN NO.4 ± 30 DEGREES.
4. RECOMMENDED POSITION OF CENTERING MAGNET, IF USED.
5. USE A NON-RIGIDLY MOUNTED SOCKET WITH FLEXIBLE LEADS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN 1-3/4 INCH DIAMETER CIRCLE CONCENTRIC WITH THE BULB AXIS.



BASING DIAGRAM
8 HR

Electronic TUBES

24AP4

CATHODE-RAY TUBE

24-INCH ROUND, METAL
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
22⅛- BY 16$\frac{9}{16}$-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
70-DEGREE DEFLECTION ANGLE

DESCRIPTION AND RATING

The 24AP4 is a magnetic-focus and -deflection direct-view picture tube which provides a 22⅛- by 16$\frac{9}{16}$-inch picture with rounded sides for television applications. Features of this tube include a lightweight metal cone envelope, a high-quality gray faceplate to increase picture contrast and detail under high ambient light conditions, and an electron gun which is designed for use with an external single-field ion-trap magnet.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate	70	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	62	Percent

GENERAL ELECTRIC

Supersedes ETR-127, dated 3-51

MECHANICAL

Over-all Length	$23\frac{15}{16} \pm \frac{1}{2}$	Inches
Greatest Bulb Diameter	$24 \pm \frac{1}{4}$	Inches
Minimum Useful Screen Diameter	$22\frac{1}{8}$	Inches
Neck Length	$7\frac{5}{32}$	Inches

Bulb Contact—Metal Cone Lip
Base—Small-shell Duodecal 5-pin, JETEC No. B5-57
Basing, JETEC Designation—12D

Mounting Position—Any		
Net Weight, approximate	$27\frac{1}{2}$	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	16,000 Max	Volts DC
Grid-No. 2 Voltage	410 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	150 Max	Volts
Heater Positive with Respect to Cathode	150 Max	Volts

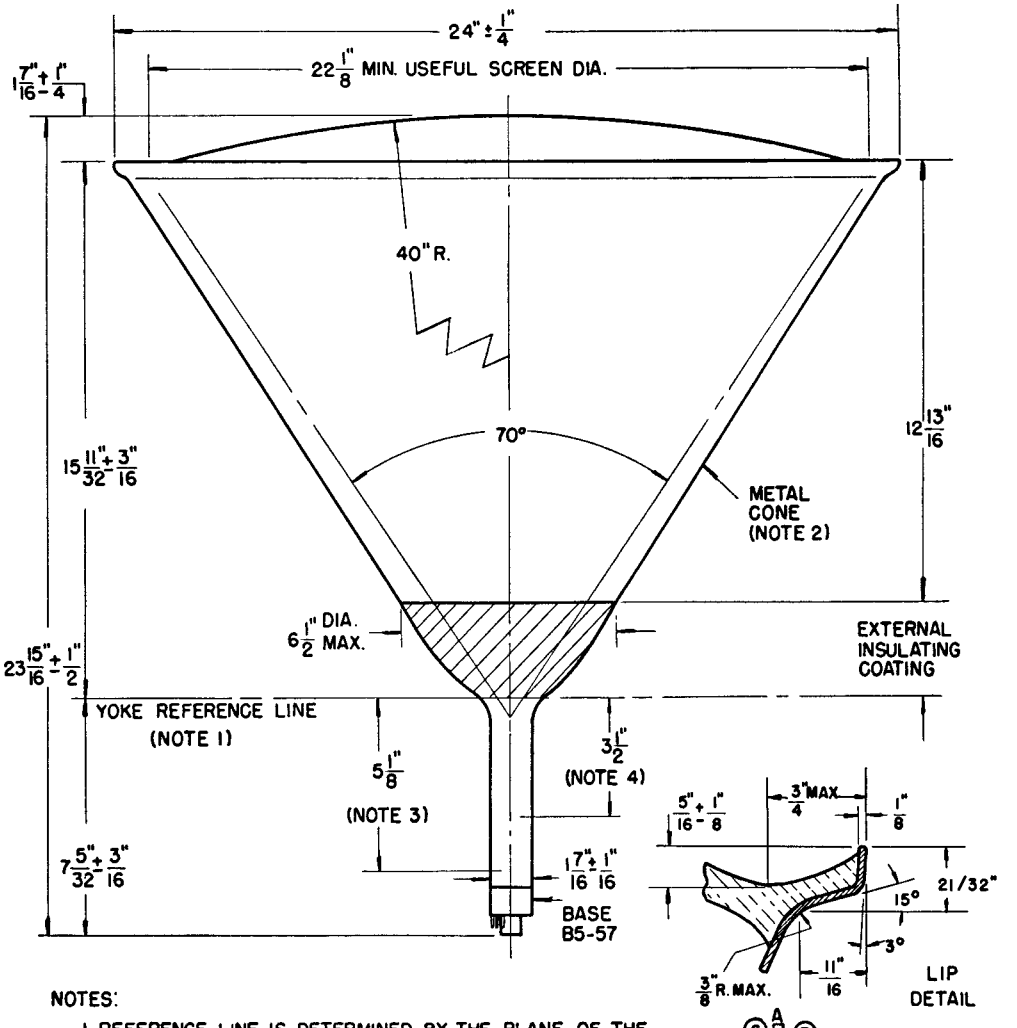
TYPICAL OPERATING CONDITIONS

Anode Voltage‡	14,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage§	−28 to −72	Volts DC
Focusing-Coil Currentπ, approximate	111	Milliamperes DC
Ion-Trap Field Intensity△, approximate	37	Gausses

MAXIMUM CIRCUIT VALUES

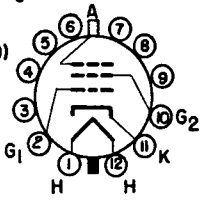
Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

All voltages are measured with respect to cathode.
* The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.
† Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.
‡ Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 12,000 volts.
§ For visual extinction of focused raster.
π For RETMA focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3½ inches.
△Single-field ion-trap magnet adjusted to optimum position, equivalent to 37 milliamperes through RETMA ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE REFERENCE LINE GAGE (RETMA NO.110) WHEN THE GAGE IS RESTING ON THE CONE.
2. METAL CONE OPERATES AT HIGH VOLTAGE AND MUST BE INSULATED TO WITHSTAND THE MAX. APPLIED ANODE VOLTAGE.
3. APPROXIMATE POSITION OF ION-TRAP MAGNET.
4. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.



BASING DIAGRAM
12D

Compactron Dissimilar Double Pentode

24BF11

The 24BF11 is a compactron containing a sharp-cutoff, dual-control pentode (Section 2) and a power pentode (Section 1). The dual-control pentode is intended for use as an FM detector and the power pentode as an audio-frequency output amplifier in television receivers.

Except for heater characteristics and ratings, the 24BF11 is identical to the 6BF11.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	24.2	Volts
Heater Current‡	0.315±0.02	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.315 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

24CP4-A

CATHODE-RAY TUBE

21⅜- BY 16⅞-INCH PICTURE SIZE

24-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
90-DEGREE DEFLECTION ANGLE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 24CP4-A is a magnetic-focus and deflection, direct-view all-glass picture tube which provides a 21⅜- by 16⅞-inch picture for television applications. The electron gun is designed for use with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, a reflective aluminized screen to increase light output, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	90	Degrees
Horizontal	85	Degrees
Vertical	70	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	750	uuf
Minimum	500	uuf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	68	Percent

MECHANICAL

Over-all Length	$21\frac{1}{8} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$24 \pm \frac{1}{8}$	Inches
Width	$22\frac{43}{64} \pm \frac{1}{8}$	Inches
Height	$18\frac{7}{16} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$22\frac{3}{4}$	Inches
Width	$21\frac{3}{8}$	Inches
Height	$16\frac{7}{8}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J192-A1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	32	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	20,000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	16,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	117	Milliamperes DC
Ion-Trap Field Intensity♦, approximate	40	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

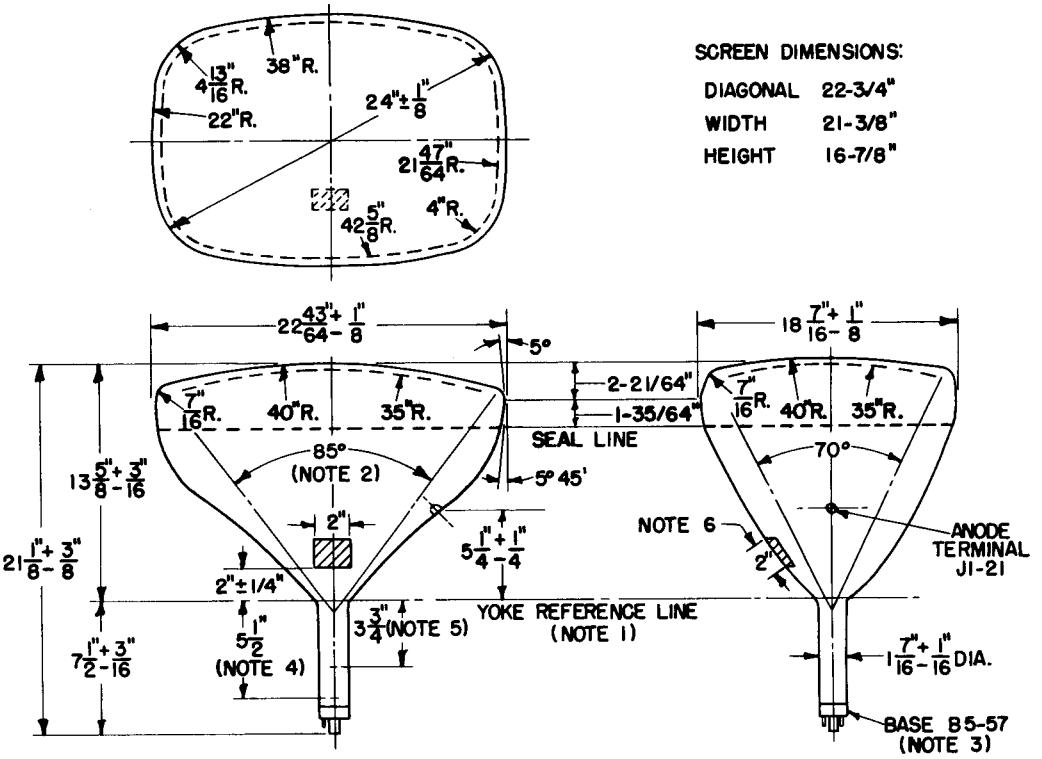
‡Cathode should be returned to one side or to the midtap of the heater transformer winding.

§Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

πFor visual extinction of focused raster.

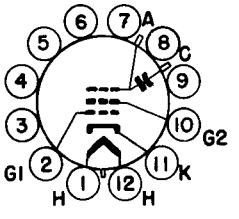
▲For JETEC focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap distance equal to 3¾ inches.

♦Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through JETEC ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE-LINE GAGE (RETMA NO 116) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 90 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.
6. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



BASING DIAGRAM
12 N

Electronic TUBES

24DP4-A

CATHODE-RAY TUBE

24-INCH RECTANGULAR, GLASS
FOCUS—LOW-VOLTAGE ELECTROSTATIC
DEFLECTION—MAGNETIC
90-DEGREE DEFLECTION ANGLE

21¼- BY 16¾-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
EXTERNAL CONDUCTIVE COATING
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 24DP4-A is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 21¼- by 16¾-inch picture for television applications. The electron gun has a focusing-voltage range of −0.4 to +2.2 percent of the anode voltage and was designed for use with an external single-field ion-trap magnet. Other features of the 24DP4-A include a high-quality gray faceplate to increase picture contrast and detail under high ambient light conditions, a space-saving rectangular face shape, and a fluorescent screen which is aluminized to increase light output. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes

Focusing Method—Electrostatic
Deflecting Method—Magnetic
Deflection Angle, approximate

Diagonal	90	Degrees
Horizontal	85	Degrees
Vertical	70	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	750	μμf
Minimum	500	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	68	Percent

MECHANICAL

Over-all Length	$21\frac{1}{8} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$24 \pm \frac{1}{8}$	Inches
Width	$22\frac{43}{64} \pm \frac{1}{8}$	Inches
Height	$18\frac{7}{16} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	$22\frac{9}{16}$	Inches
Width	$21\frac{1}{4}$	Inches
Height	$16\frac{3}{4}$	Inches
Neck Length	$7\frac{1}{2}$	Inches

Bulb Number, ASA Designation—J192A
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-Pin JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ± 30 Degrees

Mounting Position—Any

Net Weight, approximate	32	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	20,000 Max	Volts DC
Focusing-Electrode Voltage	−500 to +1000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage§	16,000	Volts DC
Focusing-Electrode Voltage for Focusπ	−64 to +352	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage△	−28 to −72	Volts DC
Ion-Trap Field Intensity♦, approximate	40	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode, grid-No. 3, and grid-No. 5 which are connected together within the tube are referred to herein as anode.

If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

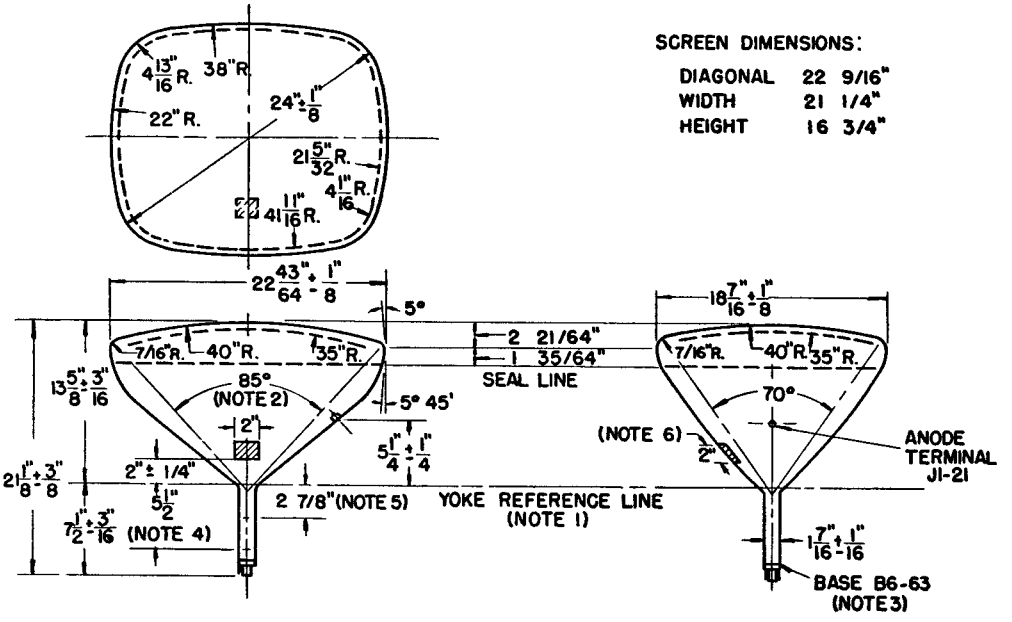
‡Cathode should be returned to one side or to the midtap of the heater transformer winding.

§Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

πThe focusing electrode may be modulated within the stipulated maximum range without damage to the tube.

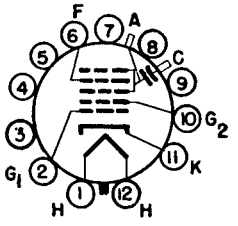
△For visual extinction of focused raster.

♦Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through RETMA ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE-LINE GAGE (RETMA NO. 116) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 90 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.
6. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



BASING DIAGRAM
12L

—PRODUCT INFORMATION—

Compactron Triode-Pentode

24JZ8

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

The 24JZ8 is a compactron containing a medium-mu triode and a beam pentode. The triode is designed for service as a vertical-deflection oscillator and the pentode as a vertical-deflection amplifier in television receivers.

Except for heater characteristics and ratings, the 24JZ8 is identical to the 6JZ8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	24.2	Volts
Heater Current‡	0.315±0.02	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.315 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

—PRODUCT INFORMATION—

Beam Pentode

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

24LQ6

DARK HEATER | PLATE CURRENT 30 WATTS | NOVAR TYPE | OVERLOAD Pb 200 WATTS

The 24LQ6 is a beam–power pentode primarily designed for use as the horizontal–deflection amplifier in color television receivers. Control testing gives the assurance the 24LQ6 is capable of withstanding a 200 watt plate dissipation for 40 seconds, sufficient time to permit conventional receiver protective devices to function.

The 24LQ6 has a maximum plate dissipation rating of 30 watts, a maximum grid–No. 2 input rating of 5 watts and a 0.600 ampere/24.0 volt heater having a controlled 11 second warm–up time for use in series heater–string arrangement .

GENERAL

ELECTRICAL

Cathode – Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC	24.0	Volts
Heater Current	0.6	Ampere
Heater Warm Up Time	11	Seconds

Direct Interelectrode Capacitances, approximate •

Grid–Number 1 to Plate (g1 to p)	0.56	pf
Input: G1 to (K,G3,G2,H)	22	pf
Output: P to (K,G3,G2,H)	11	pf

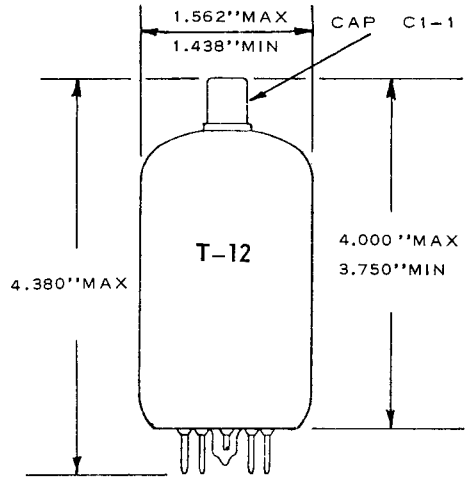
MECHANICAL

Operating Position ..... Any
Envelope T–12
Base ....E9–88, Large Button Novar 9 Pin With Exhaust Tip
Outline Drawing 12–117

Maximum Diameter	1.562 "
Minimum Diameter	1.438 " *
Maximum Overall Length	4.380 "
Maximum Seated Height	4.000 "
Minimum Seated Height	3.750 "

* Applies to the minimum diameter except in the area of the seal.

PHYSICAL DIMENSIONS

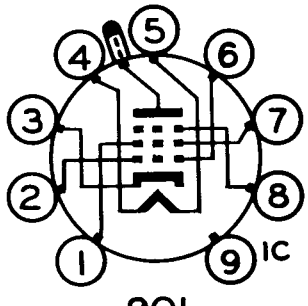


12–117

TERMINAL CONNECTIONS

Pin 1 – Grid No. 2
Pin 2 – Grid No. 1
Pin 3 – Cathode
Pin 4 – Heater
Pin 5 – Heater
Pin 6 – Grid No. 1
Pin 7 – Grid No. 2
Pin 8 – Grid No. 3
Pin 9 – Internal Connection (Do Not Use)
Top Cap – Plate

BASING DIAGRAM



9QL

MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE — DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

DC Plate-Supply Voltage	990	Volts
Peak Positive Pulse Plate Voltage †	7500	Volts
Peak Negative Pulse Plate Voltage	1100	Volts
DC Grid Number 3 Voltage #	75	Volts
Screen Voltage	220	Volts
Peak Negative Pulse Grid Number 1 Voltage	330	Volts
Plate Dissipation ▲	30	Watts
Grid Number 2 Input	5.0	Watts
Average Cathode Current	350	Milliamperes
Peak Cathode Current	1200	Milliamperes
Heater Cathode Voltage		
Peak	≠200	Volts
Average	100	Volts
Temporary Overload Plate Dissipation ‡	200	Watts
Bulb Temperature (at hottest point)	250°	C
Heater Current	560 to 640	mA

MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance		
For grid-No. 1- resistor bias operation	0.47	MΩ
For plate-pulsed operation (horizontal-deflection circuits only)	10	MΩ

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

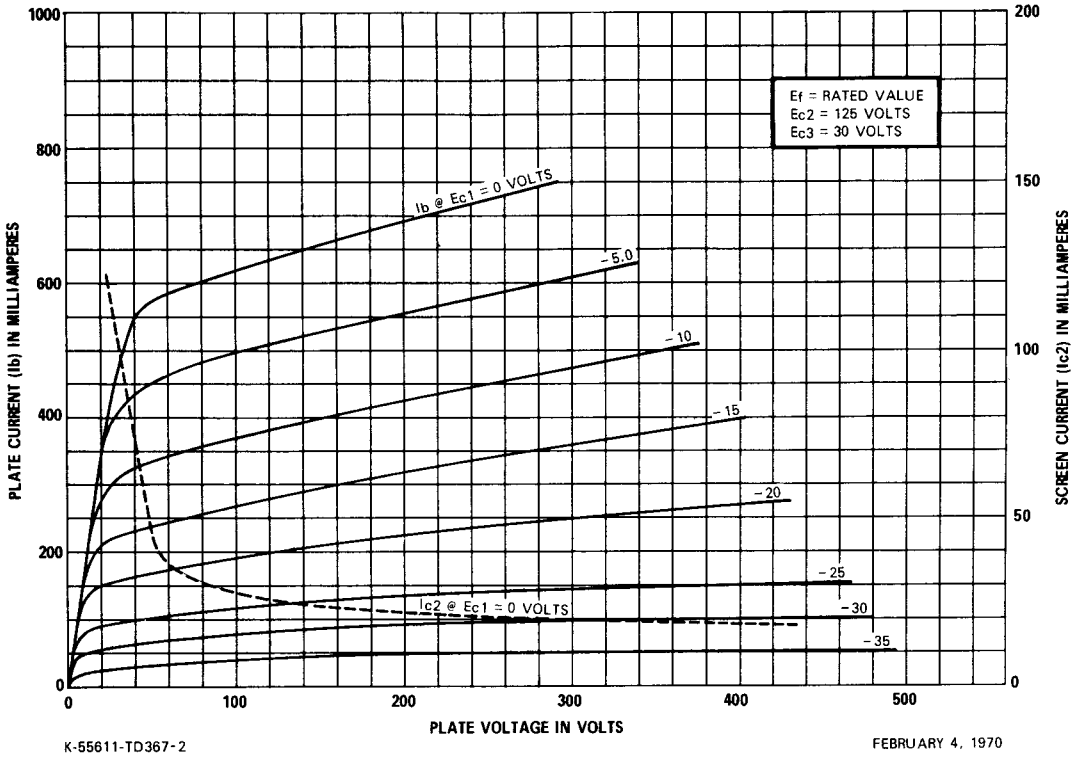
The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

			BOGEY VALUE			
Heater Voltage	←				→	Volts
Peak Positive Pulse Plate Voltage §	5000	– –	– –	5000	– – –	– – –	Volts
Grid Number 1 Voltage	– –	0	–25	– –	0	–35	Volts
Screen Voltage	125	125	125	145	145	145	Volts
DC Grid Number 3 Voltage	30	30	30	30	30	30	Volts
Transconductance	– –	– –	9600	– –	– –	7500	μmho
Plate Current	– –	580 ♦	130	– –	710 ♦	95	Milliampere
Screen Current	– –	40 ♦	2.8	– –	55 ♦	2.4	Milliampere
Cutoff DC Grid No. 1 Voltage							
Ib=1 mA	–120	– –	–54	–125	– –	–60	Volts
Triode Amplification Factor *	– –	– –	3 ♦	– –	– –	2.8 ⊕	
Plate Resistance (Approximate)	– –	– –	5800	–	– –	7000	Ω
DC Plate Voltage	– –	55	175	– –	60	175	Volts

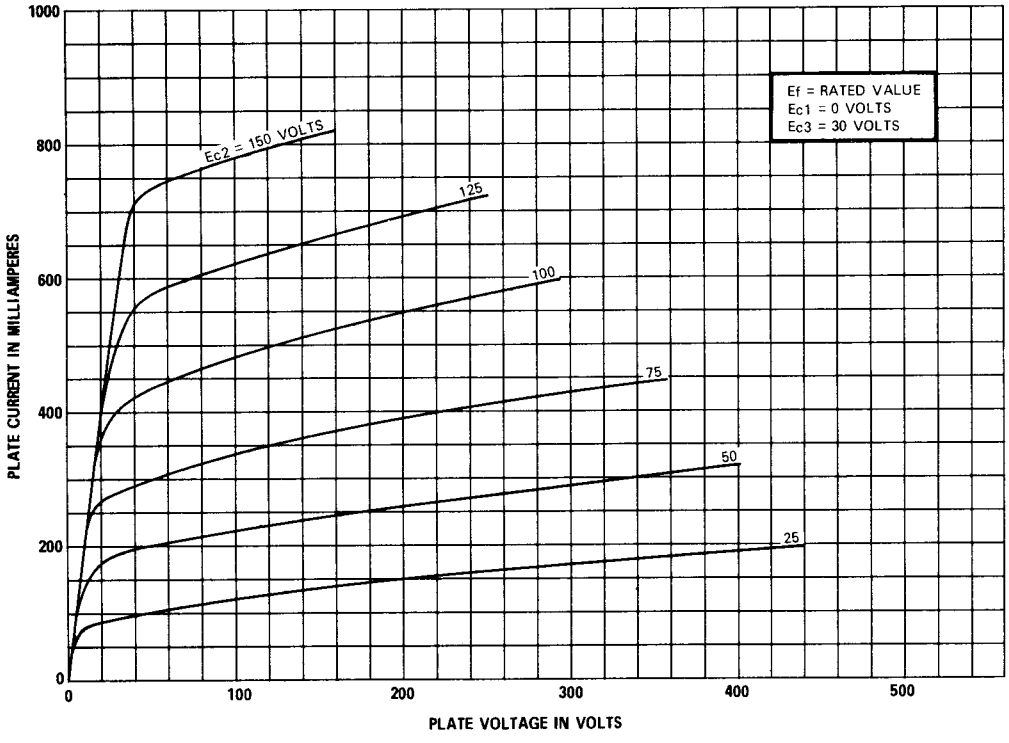
AVERAGE PLATE CHARACTERISTICS



K-55611-TD367-2

FEBRUARY 4, 1970

AVERAGE PLATE CHARACTERISTICS



NOTES

• Measured without external shield in accordance with the current issue of EIA Standard RS–191.

* With grid No. 3 and grid No. 2 connected, respectively to cathode and plate at socket.

⊕ Conditions: $E_b = E_{c2} = 145$ V, $E_{c1} = -35$ V.

• Conditions: $E_b = E_{c2} = 125$ V, $E_{c1} = -25$ V.

♦ This value can be measured by a method involving a recurrent waveform such that the Maximum Ratings of the tube will not be exceeded.

‡ Total continuous or accumulated time not to exceed 40 seconds.

† This rating is applicable when the duratoin of the vol–tage pulse does not exceed 15% of one horizontal scann –ing cycle. In a 525–line, 30–frame system, 15% of one scanning cycle is 10 μ s.

In horizontal–delecftion–amplifier service, a positive voltage should be applied to grid No. 3 to reduce in–terference from "snivets", which may occur in both vhf and uhf television receivers, and to increase power putput. A typical value is 30 V.

▲ An adequate bias resistor or other means is required to protect the tube in the absence of excitation.

§ Under pulse–duration condition specified in Footnote †.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

Electronic TUBES

24YP4

CATHODE-RAY TUBE

24-INCH, RECTANGULAR, GLASS
FOCUS—ELECTROSTATIC
DEFLECTION—MAGNETIC
90-DEGREE DEFLECTION ANGLE
21¼ BY 16¾-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
ALUMINIZED SCREEN
EXTERNAL CONDUCTIVE COATING

DESCRIPTION AND RATING

The 24YP4 is an electrostatic-focus and magnetic-deflection, direct-view all-glass picture tube which provides a 21¼ by 16¾-inch picture for television applications. The electron gun has a focusing-voltage range of −0.4 to +2.2 percent of the anode voltage and was designed for use with an external single-field ion-trap magnet. Other features of the 24YP4 include a high-quality gray faceplate to increase picture contrast and detail under high ambient light conditions, a space-saving rectangular face shape, and a fluorescent screen which is aluminized to increase light output. A high-capacitance external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Electrostatic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	90	Degrees
Horizontal	85	Degrees
Vertical	70	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf
External Conductive Coating to Anode		
Maximum	1500	μμf
Minimum	1200	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	68	Percent

MECHANICAL

Over-all Length	21⅛ ±⅜	Inches
Greatest Bulb Dimensions		
Diagonal	24 ±⅛	Inches
Width	22 43/64 ±⅛	Inches
Height	18 7/16 ±⅛	Inches
Minimum Useful Screen Dimensions		
Diagonal	22 9/16	Inches
Width	21¼	Inches
Height	16¾	Inches
Neck Length	7½	Inches

Bulb Number, ASA Designation—J192A
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 6-pin, JETEC No. B6-63
Basing, JETEC Designation—12L
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 ±30 Degrees
Mounting Position—Any

Net Weight, approximate	32	Pounds

MAXIMUM RATINGS*

DESIGN-CENTER VALUES†

Anode Voltage‡	20,000	Max Volts DC
Focusing-Electrode Voltage	−500 to +1000	Max Volts DC
Grid-No. 2 Voltage	500	Max Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125	Max Volts DC
Positive-Bias Value	0	Max Volts DC
Positive-Peak Value	2	Max Volts
Peak Heater-Cathode Voltage§		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410	Max Volts
After Equipment Warm-up Period	180	Max Volts
Heater Positive with Respect to Cathode	180	Max Volts

TYPICAL OPERATING CONDITIONS*

Anode Voltageπ	16000	Volts DC
Focusing-Electrode Voltage for Focus	−64 to +352	Volts DC
Focusing-Electrode Current	−15 to +25	Microamperes DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage△	−28 to −72	Volts DC
Ion-Trap Field Intensity♦, approximate	40	Gausses

CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5	Max Megohms
Grid-No. 2 Circuit Resistance	0.1	Min Megohms
Focusing-Electrode Circuit Resistance	0.1	Min Megohms

Protective resistance in the grid-No. 2 and focusing-electrode circuits is advisable to prevent damage to the tube. If applicable, one resistor common to both circuits may be used.

* All voltages are measured with respect to cathode.

† The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten percent.

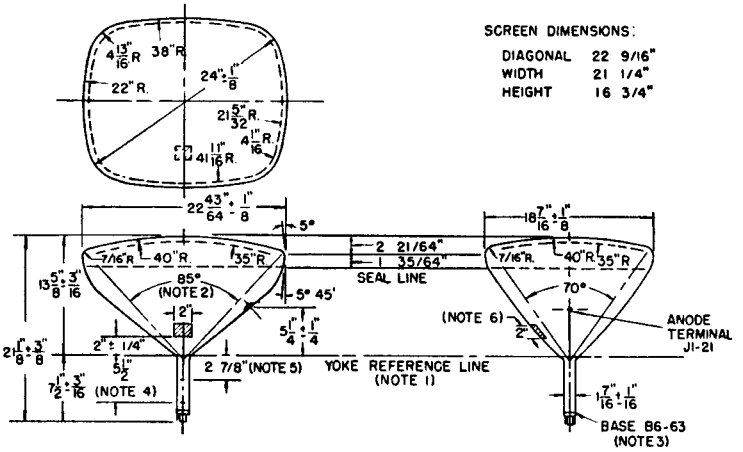
‡ Anode, grid-No. 3, and grid-No. 5 which are connected together within the tube are referred to herein as anode. If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.

§ Cathode should be returned to one side or to the midtap of the heater transformer winding.

π Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

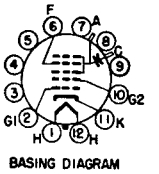
△For visual extinction of focused raster.

♦ Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through RETMA ion-trap magnet No. 117.



NOTES

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE-LINE GAGE (RETMA NO 116) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 90 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO.6 ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. APPROXIMATE POSITION OF CENTERING MAGNET, IF USED.
6. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



BASING DIAGRAM
12L

OUTLINE
24YP4, 24DP4-A

K-69087-72A691

6-20-55

DESCRIPTION AND RATING

25AV5-GA Beam Pentode. Identical to the 6AV5-GA except for heater ratings. Refer to the 6AV5-GA Description and Rating sheet for complete data.

25AX4-GT Diode. Identical to the 6AX4-GT except for heater ratings. Refer to the 6AX4-GT Description and Rating sheet for complete data.

25BQ6-GA Beam Pentode. Identical to the 6BQ6-GA except for heater ratings. Refer to the 6BQ6-GA Description and Rating sheet for complete data.

25BQ6-GTB Beam Pentode. Identical to the 6BQ6-GTB except for heater ratings listed below. Refer to the 6BQ6-GTB Description and Rating sheet for complete data.

Heater Voltage, AC or DC	25.0	Volts
Heater Current	0.3	Amperes

25C5 Beam Pentode. Identical to the 50C5 except for heater ratings and addition of a controlled heater-warm-up characteristic. Refer to the 50C5 Description and Rating sheet for complete data.

25CA5 Beam Pentode. Identical to the 6CA5 except for heater ratings. Refer to the 6CA5 Description and Rating sheet for complete data.

25CD6-GB Beam Pentode. Identical to the 6CD6-GA except for heater ratings and addition of a controlled heater-warm-up characteristic. Refer to the 6CD6-GA Description and Rating sheet for complete data.

25CU6 Beam Pentode. Identical to the 6CU6 except for heater ratings. Refer to the 6CU6 Description and Rating sheet for complete data.

—PRODUCT INFORMATION—

Compactron Diode

25CG3

FOR TV DAMPING DIODE APPLICATIONS

The 25CG3 is a compactron containing a single heater-cathode type diode. It is intended for service as the damping diode in the horizontal-deflection circuit of color television receivers.

Except for heater characteristics, the 25CG3 is identical to the 6CG3.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	25	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Diode

25DK3

FOR TV DAMPING DIODE APPLICATIONS

- COLOR TV TYPE
- LOW TUBE DROP
- 6,500 VOLTS DC AND PEAK
- 400 MILLIAMPERES DC

The 25DK3 is a heater-cathode type diode intended for service as the damping diode in the horizontal-deflection circuit of color television receivers. It utilizes a unique heater-cathode insulating system making possible a rating of 6,500 volts peak. The 25DK3 also features a top cap connector to the cathode, a T-9 bulb and a 9-pin glass button base with a 0.687-inch pin circle.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	25	Volts
Heater Current●	0.45±0.03	Amperes
Heater Warm-up Time, average▲	11	Seconds

Direct Interelectrode Capacitances, approximate♦

Cathode to Plate and Heater: k to (p+h)	22	pf
Plate to Cathode and Heater: p to (k+h)	13.6	pf
Heater to Cathode: (h to k)	1.10	pf

MECHANICAL

Operating Position - Any

Envelope - T-9, Glass

Base - E9-89, Button 9-Pin

Top Cap - C1-2, Skirted Miniature

Outline Drawing - EIA 9-117

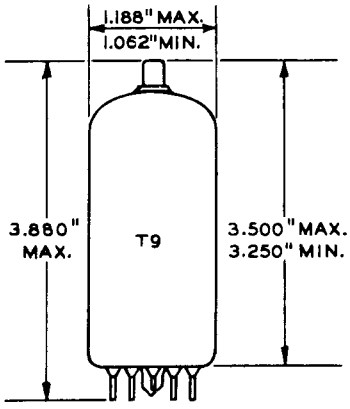
Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.880	Inches
Maximum Seated Height	3.500	Inches
Minimum Seated Height	3.250	Inches

MAXIMUM RATINGS

TV DAMPER SERVICE§—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	6,500	Volts
Plate Dissipation	9.0	Watts
Steady-State Peak Plate Current	1,200	Milliamperes
DC Output Current	400	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	900	Volts
Total DC and Peak	6,500	Volts
Bulb Temperature□	220	°C

PHYSICAL DIMENSIONS

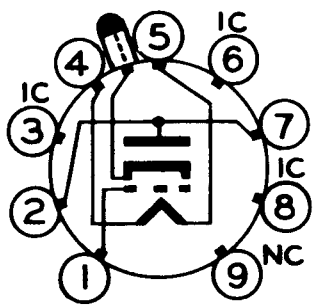


EIA 9-117

TERMINAL CONNECTIONS⊕

Pin 1 - Heater Insulation Coil
Pin 2 - Plate
Pin 3 - No Connection
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Plate
Pin 8 - Internal Connection - Do Not Use
⊕ Pin 9 - No Connection
Cap - Cathode

BASING DIAGRAM



EIA 9SG

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 400 Milliamperes	16	Volts
Ib = 800 Milliamperes	25	Volts

NOTES

★ Heater voltage for a bogey tube at If = 0.45 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

▲ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

♦ Without external shield.

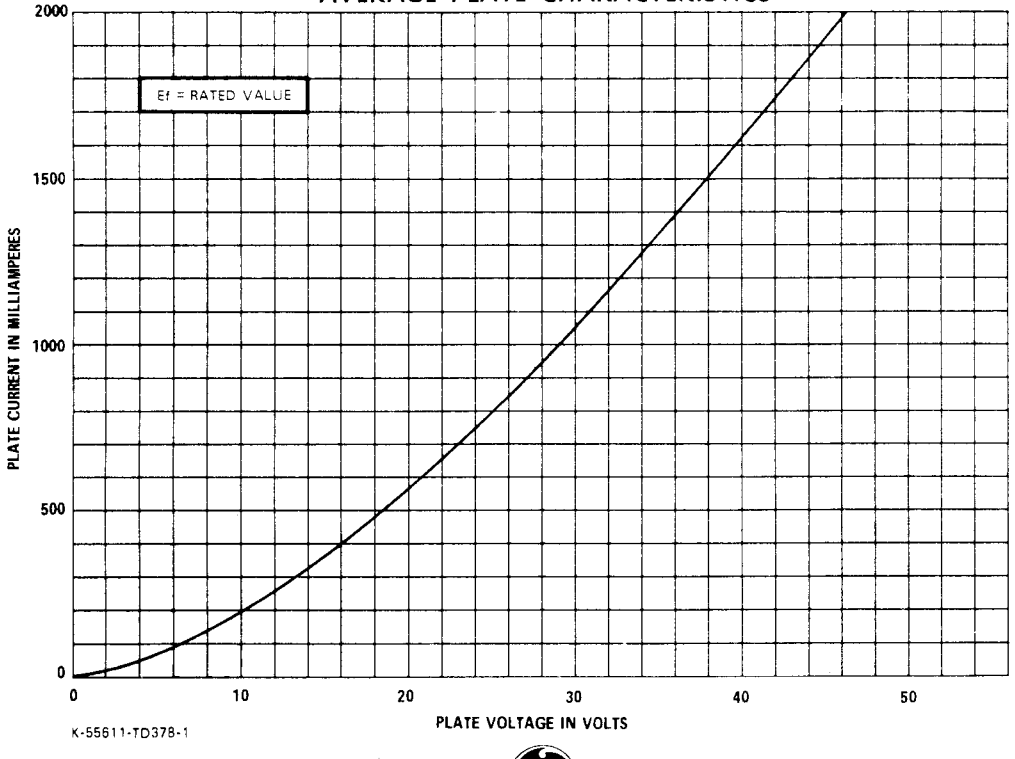
§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

□ Measured with an infrared thermometer, Ircon Model 700 BC or equivalent.

⊕ May be used as tie point for components at or near heater potential

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AVERAGE PLATE CHARACTERISTICS



K-55611-TD378-1

GENERAL ELECTRIC

TUBE PRODUCTS DEPARTMENT
OWENSBORO, KENTUCKY 42301

from JEDEC release #3172, March 6, 1961

25DK4

DIODE

FOR HALF-WAVE POWER RECTIFIER APPLICATIONS

The 25DK4 is a miniature half-wave rectifier designed for use in line-operated equipment having series-connected, 150-milliampere heaters. The heater is tapped to allow a portion of it to be used as a current-limiting resistor.

GENERAL

Electrical

Cathode - Coated Unipotential		
Heater Characteristics and Ratings (Design-Maximum Rating System)		
Heater Voltage, AC or DC*		
Between Pins 3 and 4	25	Volts
Between Pins 3 and 6	22.25	Volts
Heater Current+	0.15±0.01	Amperes

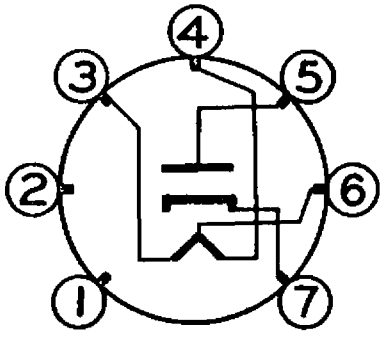
Mechanical

Mounting Position - Any		
Envelope - T-5 1/2, Glass		
Base E7-1, Miniature Button 7-Pin		
Outline Drawing - EIA 5-3		
Maximum Diameter	3/4	Inches
Maximum Over-all Length	2 5/8	Inches
Maximum Seated Height	2 3/8	Inches

TERMINAL CONNECTIONS

Pin 1 - No Connection
Pin 2 - No Connection
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Heater Tap
Pin 7 - Cathode

BASING DIAGRAM



EIA 5BQ

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MAXIMUM RATINGS

Rectifier Service - Design-Maximum Values

Peak Inverse Plate Voltage	330	Volts
Steady-State Peak Plate Current	600	Milliamperes
DC Output Current	100	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	330	Volts
Heater Negative with Respect to Cathode	330	Volts

Design-maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions. The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

Half-Wave Rectifier with Capacitor-Input Filter

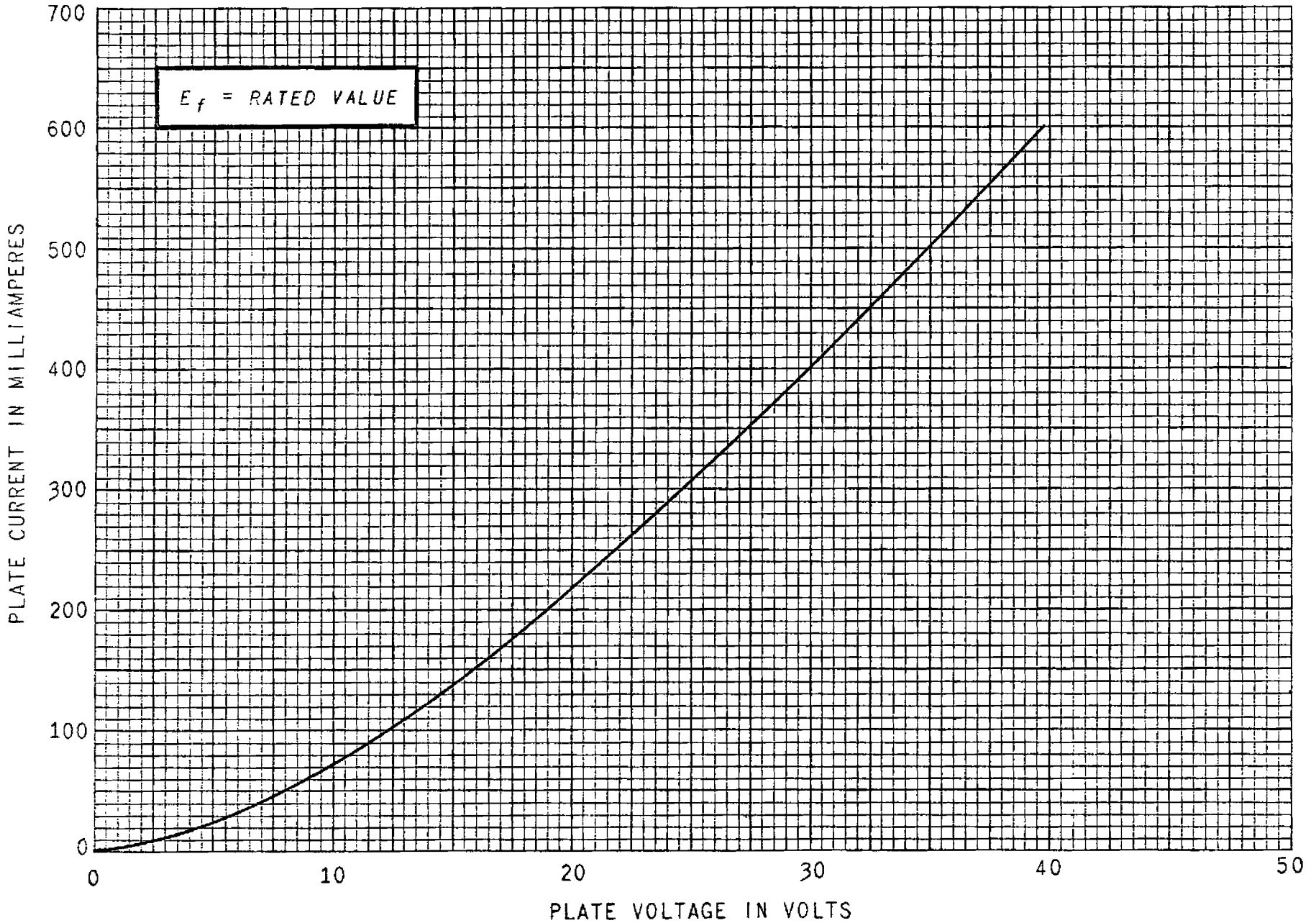
AC Plate-Supply Voltage, RMS	117	Volts
Filter Input Capacitor	40	Microfarads
Total Plate-Supply Resistance‡		
DC Output Current	90	Milliamperes
DC Output Voltage at Filter Input	113	Volts
Tube Voltage Drop		
Ib = 200 Milliamperes DC	19	Volts

* Heater voltage at bogey heater current. The heater tap is provided to allow a portion of the heater to be used as a current-limiting resistor (see schematic). It is not intended for panel-lamp operation.

\+ For series heater operation, the equipment designer shall design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

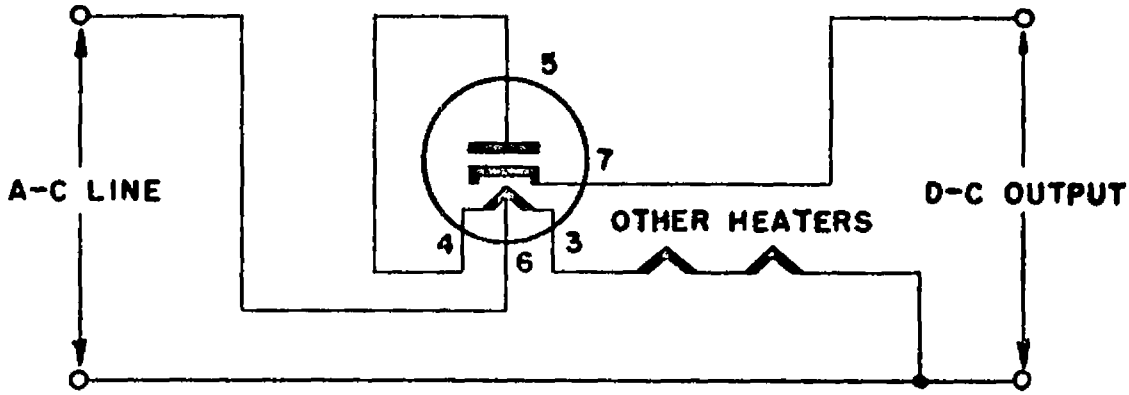
‡ The portion of the heater between pins 4 and 6 has an approximate resistance of 19 ohms when the output current of the rectifier is 100 milliamperes.

AVERAGE PLATE CHARACTERISTICS



K-5561 I-TD135-I

JANUARY 5, 1961


A-C LINE
5
7
4
6
3
OTHER HEATERS
D-C OUTPUT

Electronic TUBES

25DN6

BEAM PENTODE

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 25DN6 is a beam-power pentode designed primarily for use as the horizontal-deflection amplifier in television receivers which incorporate large-deflection-angle picture tubes. Features of the tube include high perveance, high plate current at low plate and screen voltages, and a high ratio of plate to screen current. As a result of its controlled heater warm-up characteristic, the 25DN6 is especially suited for use in television receivers that employ 600-milliampere, series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	25.0	Volts
Heater Current	0.6	Amperes
Heater Warm-up Time*	11	Seconds
Direct Interelectrode Capacitances, approximate†		
Grid-Number 1 to Plate	0.8	μμf
Input	22	μμf
Output	11.5	μμf

MECHANICAL

Mounting Position—Vertical‡
Envelope—T-12, Glass
Base—B8-118, Short Medium-Shell Octal 8-Pin
Top Cap—C1-1, Small

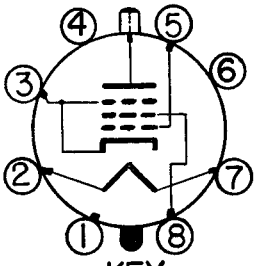
MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE§
DESIGN-CENTER VALUES UNLESS OTHERWISE INDICATED

DC Plate-Supply Voltage (Boost+DC Power Supply)	700	Volts
Peak Positive Pulse Plate Voltage	6600△	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Screen Voltage	175	Volts
Peak Negative Grid-Number 1 Voltage	200	Volts
Plate Dissipation♦	15	Watts
Screen Dissipation	3.0	Watts
DC Cathode Current	200	Milliamperes
Peak Cathode Current	700	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	0.47	Megohms
Bulb Temperature at Hottest Point	225	C

GENERAL ELECTRIC

BASING DIAGRAM

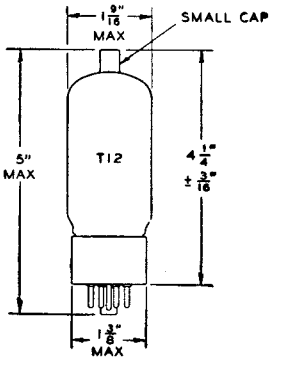


RETMA 5BT

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Heater
Pin 3—Cathode and Beam Plates
Pin 4—No Connection
Pin 5—Grid Number 1
Pin 6—No Connection
Pin 7—Heater
Pin 8—Grid-Number 2 (Screen)
Cap—Plate

PHYSICAL DIMENSIONS



CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	50	125	Volts
Screen Voltage	100	125	Volts
Grid-Number 1 Voltage	0ϕ	−18	Volts
Plate Resistance, approximate		4000	Ohms
Transconductance		9000	Micromhos
Plate Current	240	70	Milliamperes
Screen Current	30	6.3	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 0.5 Milliampere		−36	Volts
Triode Amplification Factor**		4.35	

* The time required for the voltage across the heater to reach 80 per cent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

‡ Horizontal operation is permitted if pins 2 and 7 are in a vertical plane.

§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

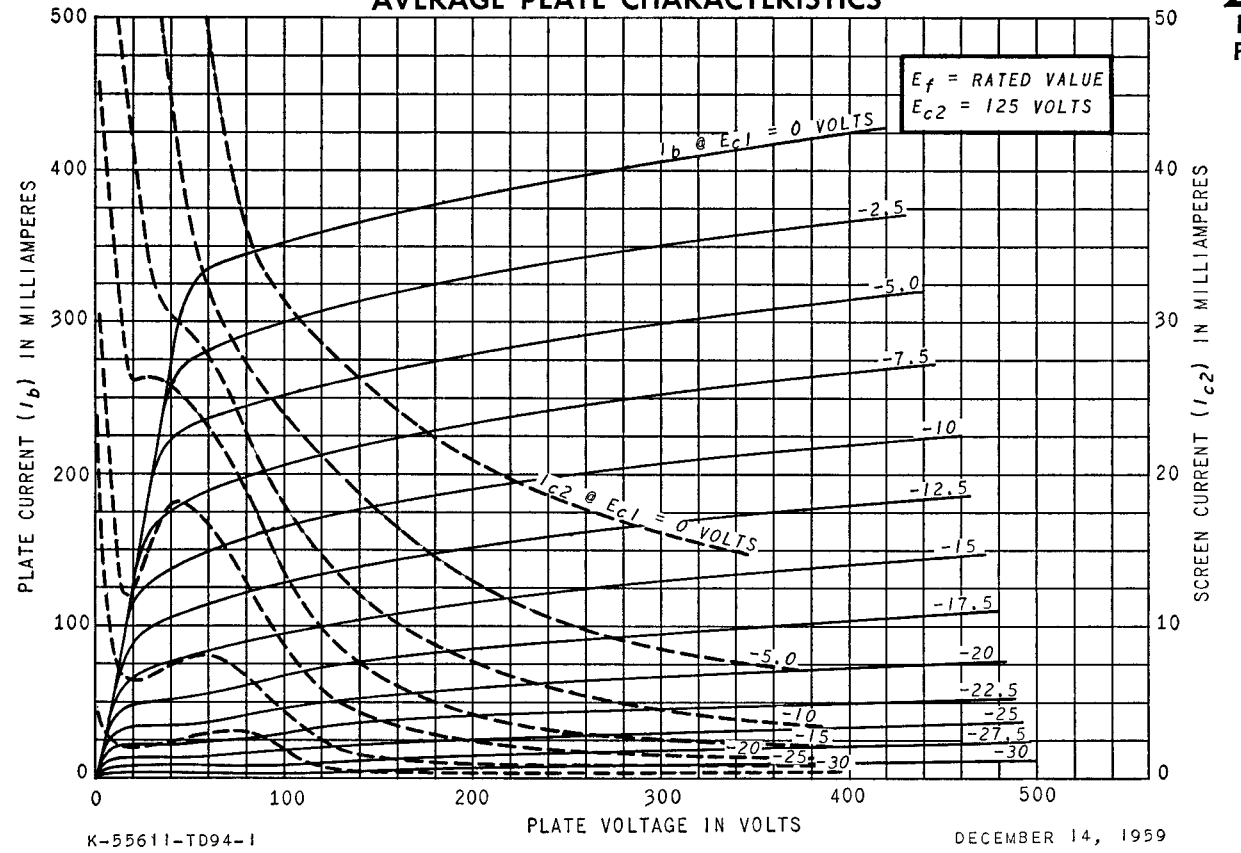
△Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

♦ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

ϕ Applied for short interval (2 seconds maximum) so as not to damage tube.

**Triode connection (screen tied to plate) with Eb = Ec2 = 125 volts and Ec1 = −18 volts.

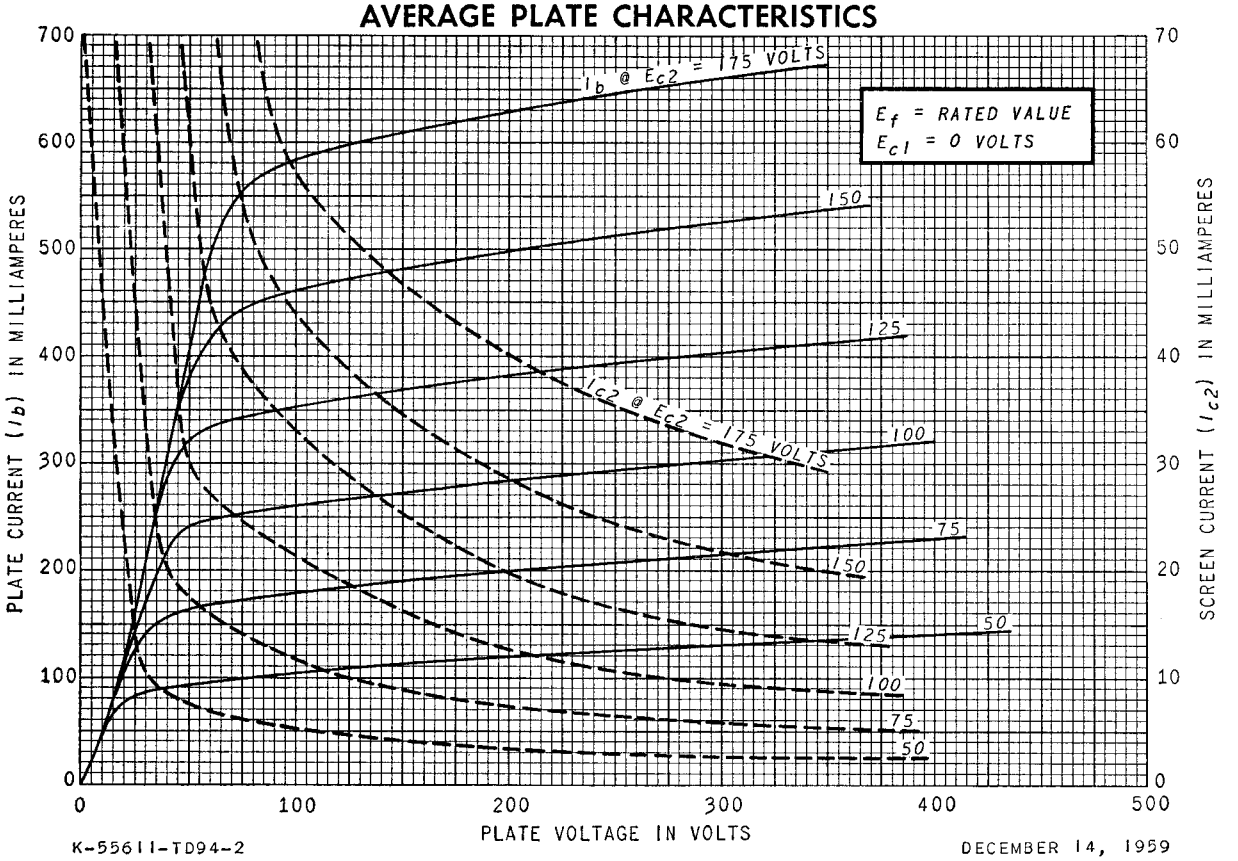
AVERAGE PLATE CHARACTERISTICS



K-55611-TD94-1

DECEMBER 14, 1959

AVERAGE PLATE CHARACTERISTICS

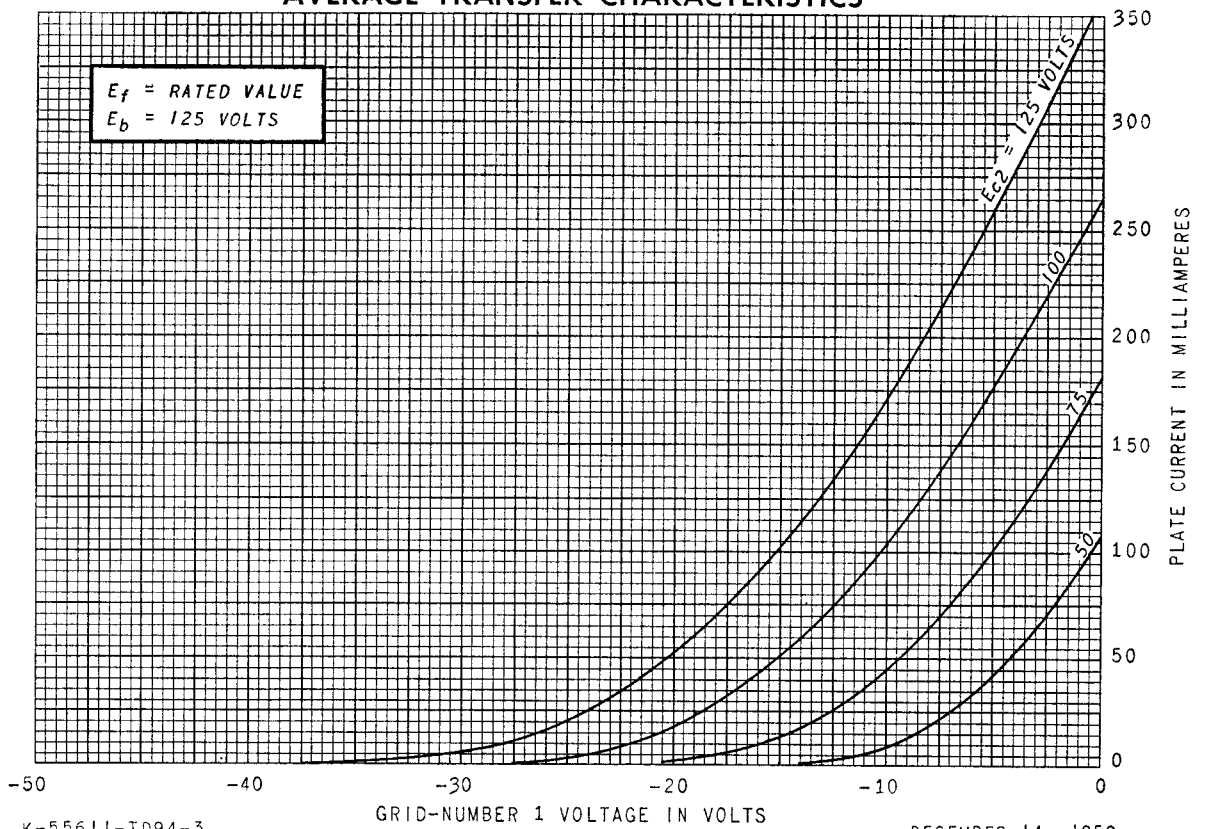


K-55611-TD94-2

DECEMBER 14, 1959

▲*Supersedes pages 3 and 4 dated 9-56.*

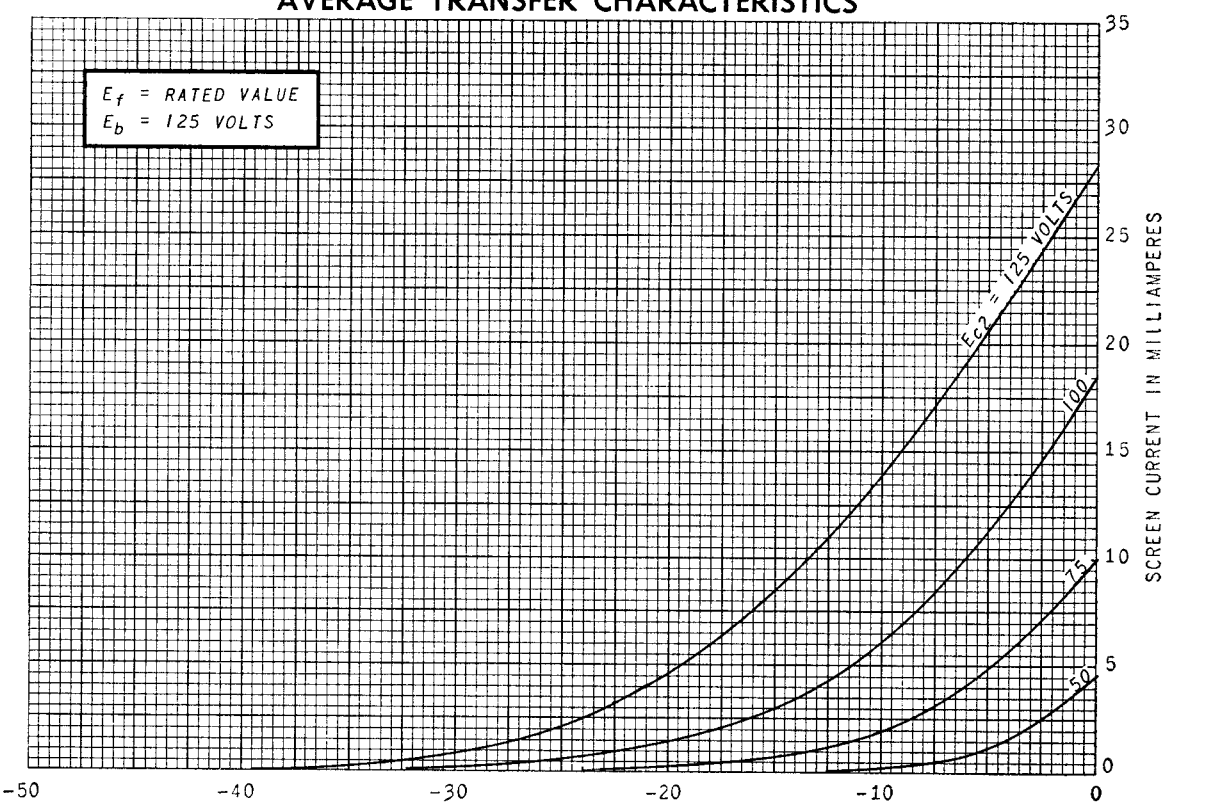
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD94-3

DECEMBER 14, 1959

AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD94-4

DECEMBER 14, 1959

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

▲*Supersedes pages 3 and 4 dated 9-56.*

PRINTED IN U.S.A.

Electronic TUBES

25EC6

BEAM PENTODE

DESCRIPTION AND RATING

The 25EC6 is a beam-power pentode designed for use as the horizontal-deflection amplifier in television receivers that employ 110-degree-deflection picture tubes. Designed especially for use in receivers that operate from off-the-line rectifiers, the tube features high performance capabilities at relatively low supply voltages. It has electrical characteristics similar to those of the 25CD6-GB. In addition, the 25EC6 features a controlled heater warm-up characteristic to make it especially suited for use in television receivers that employ 600-milliampere series-connected heaters.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	25	Volts
Heater Current	0.6±6%	Amperes
Heater Warm-up Time*	11	Seconds
Direct Interelectrode Capacitances, approximate†		
Grid-Number 1 to Plate	0.6	μμf
Input	24	μμf
Output	10	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-12, Glass
Base—B8-110, Short Medium-Shell Octal 8-Pin
Top Cap—C1-1, Small

MAXIMUM RATINGS

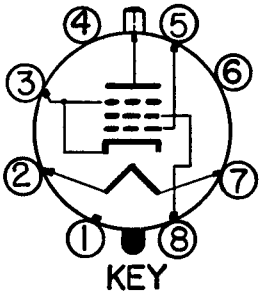
HORIZONTAL-DEFLECTION AMPLIFIER SERVICE‡

DESIGN-MAXIMUM VALUES

DC Plate-Supply Voltage (Boost+DC Power Supply)	700	Volts
Peak Positive Pulse Plate Voltage	7000	Volts
Peak Negative Pulse Plate Voltage	1500	Volts
Screen Voltage	175	Volts
Peak Negative Grid-Number 1 Voltage	300	Volts
Plate Dissipation§	10	Watts
Screen Dissipation	4.0	Watts
DC Cathode Current	200	Milliamperes
Peak Cathode Current	700	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Grid-Leak Bias	1.5	Megohms
Bulb Temperature at Hottest Point	225	C

Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

BASING DIAGRAM

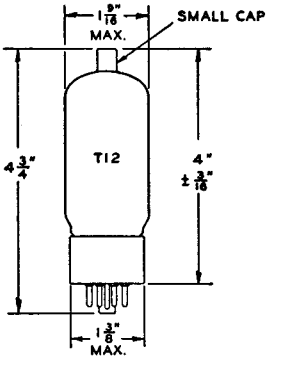


RETMA 5BT

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Heater
Pin 3—Cathode and Beam Plates
Pin 4—No Connection
Pin 5—Grid Number 1
Pin 6—No Connection
Pin 7—Heater
Pin 8—Grid Number 2 (Screen)
Cap —Plate

PHYSICAL DIMENSIONS



GENERAL ELECTRIC

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	60	135	Volts
Screen Voltage	135	135	Volts
Grid-Number 1 Voltage	0‖	−22.5	Volts
Plate Resistance, approximate		4700	Ohms
Transconductance		7500	Micromhos
Plate Current	350	70	Milliamperes
Screen Current	40	4.5	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 1.0 Milliampere		−42	Volts
Triode Amplification Factor¶		3.8	

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times ratep heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

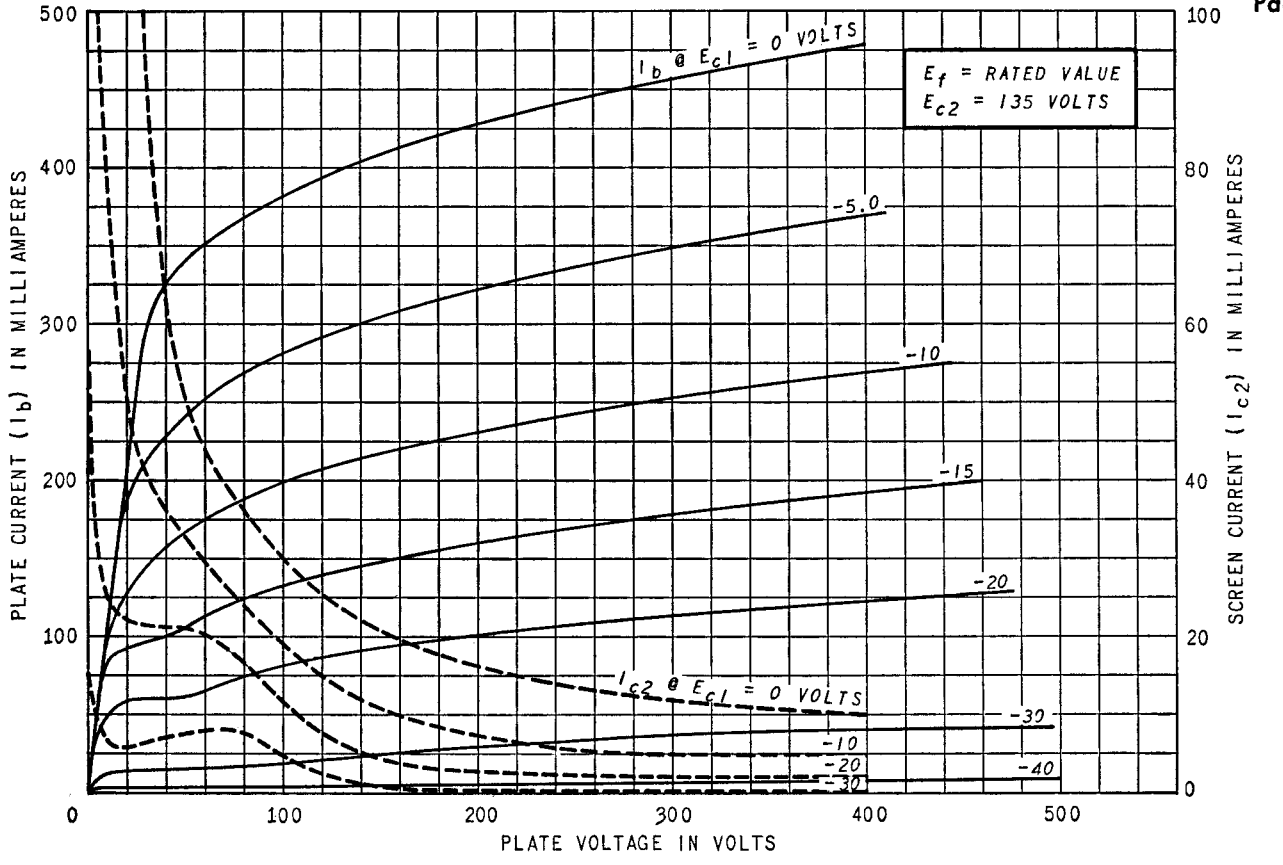
‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

§ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

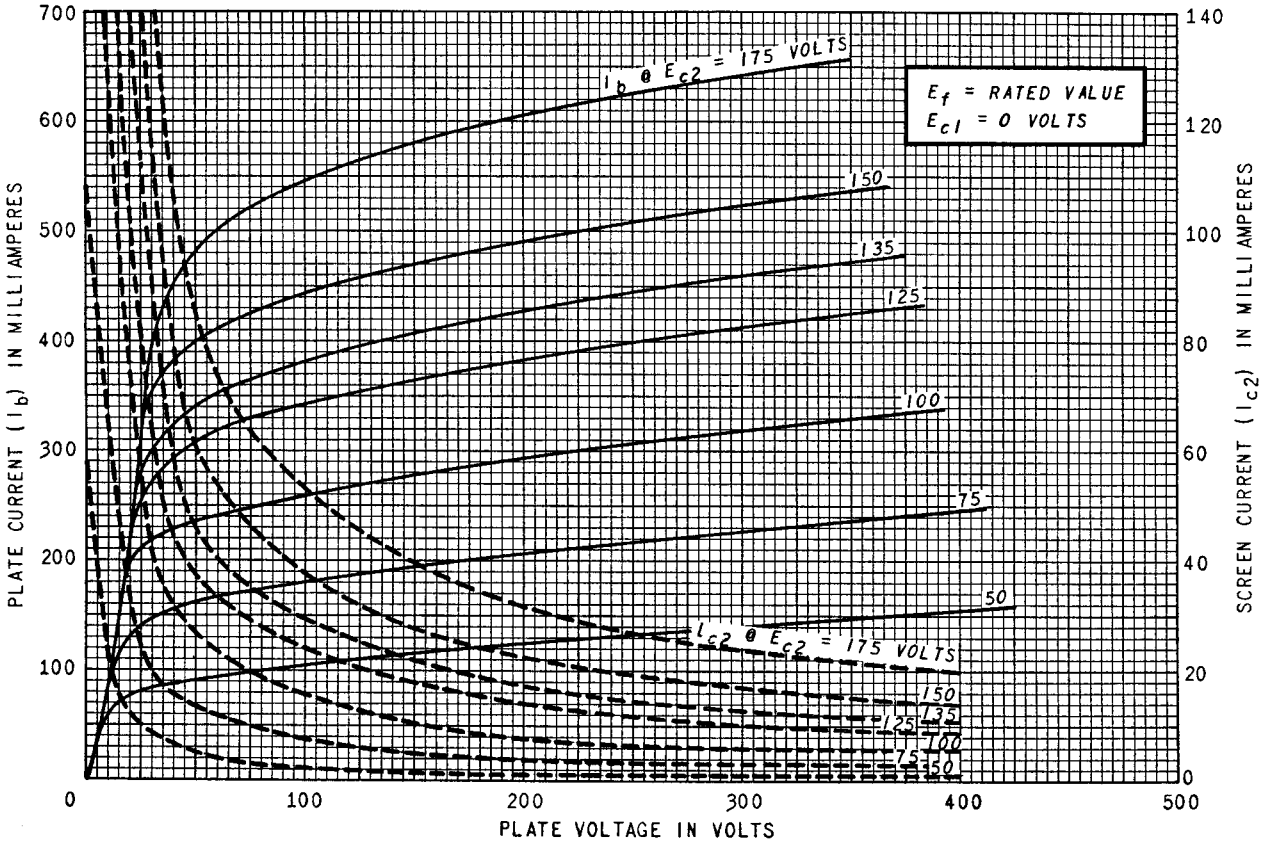
‖ Applied for short interval (two seconds maximum) so as not to damage tube.

¶ Triode connection (screen tied to plate) with Eb = Ec2 = 135 volts and Ec1 = −22.5 volts.

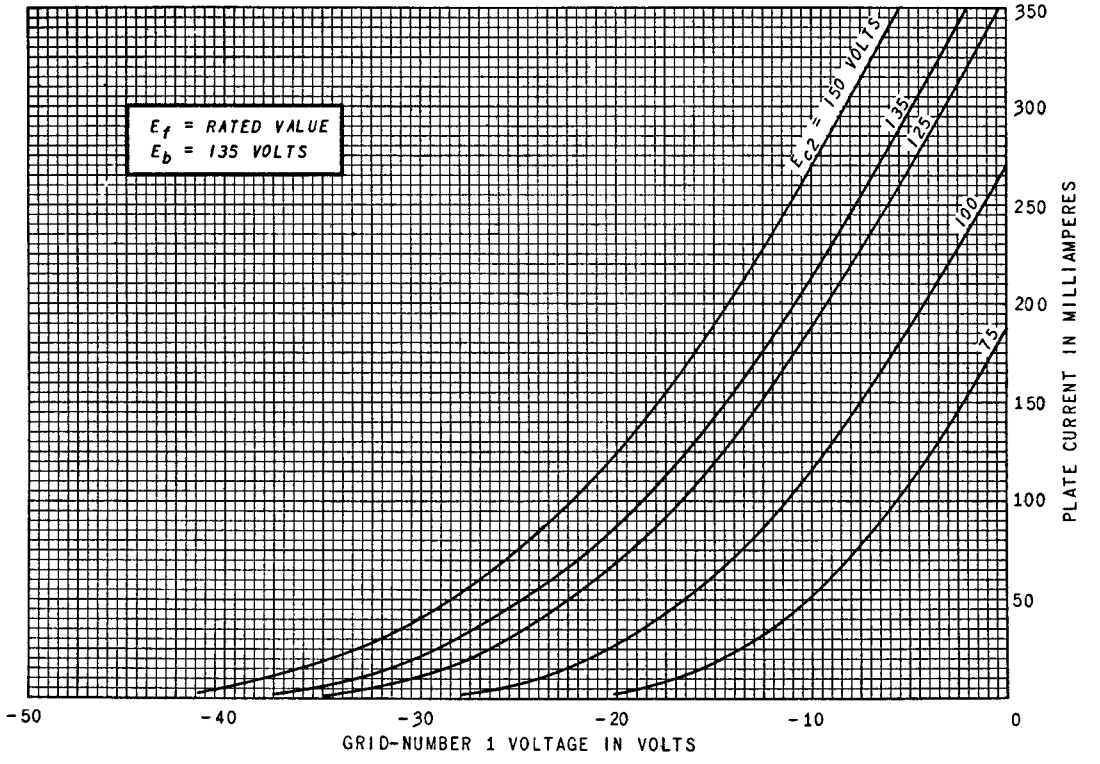
AVERAGE PLATE CHARACTERISTICS



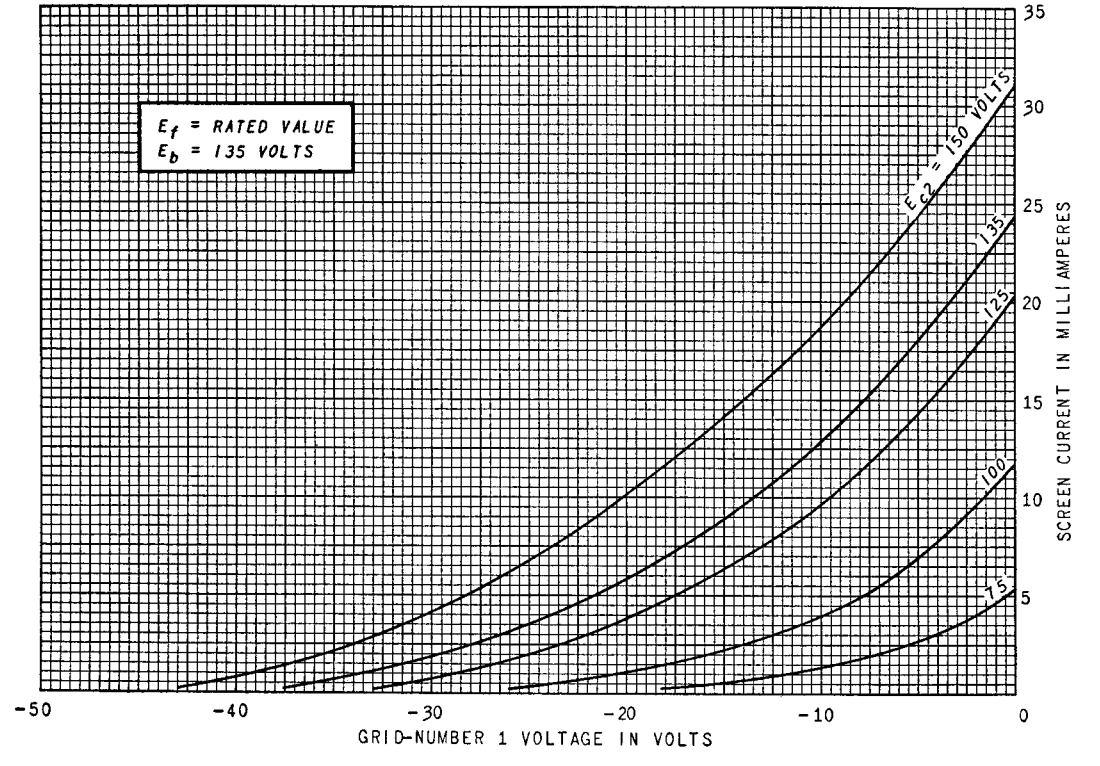
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

ELECTRONICS

25EH5

PENTODE

FOR AF POWER AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 25EH5 is a miniature power pentode designed primarily for use in the audio-frequency power output stage of radio receivers and phonographs. The tube features high power sensitivity at low plate and screen voltages.

Except for heater characteristics, the 25EH5 is identical to the 50EH5.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	25±2.5	Volts
Heater Current†	0.3	Amperes

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 25 volts.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

—PRODUCT INFORMATION—

Compactron Triode-Pentode

25JZ8

FOR TV VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER APPLICATIONS

The 25JZ8 is a compactron containing a medium-mu triode and a beam pentode. The triode is designed for service as a vertical-deflection oscillator and the pentode as a vertical-deflection amplifier in television receivers.

Except for heater characteristics and ratings, the 25JZ8 is identical to the 6JZ8.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	25.2	Volts
Heater Current♦	0.3 ± 0.02	Amperes
Heater Warm-up Time, average●	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.3 amperes.

♦ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

● The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

25L6-GT—12L6-GT—50L6-GT

BEAM PENTODE

For AF Power Amplifier Applications

DESCRIPTION AND RATING

The 25L6-GT is a beam pentode designed for use in the audio-frequency power output stage of radio and television receivers. Features include high power sensitivity and high efficiency at relatively low plate and screen voltages.

The 12L6-GT, 25L6-GT, and 50L6-GT are alike except for heater ratings and heater-cathode voltage ratings. The 50L6-GT is particularly suited for use in a-c/d-c receivers; while the 12L6-GT, as a result of its controlled heater warm-up characteristic, is especially suited for use in television receivers which employ series-connected heaters. When the 12L6-GT is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during the warm-up period.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

	12L6-GT	25L6-GT	50L6-GT	
Heater Voltage, AC or DC	12.6	25.0	50.0	Volts
Heater Current	0.6	0.3	0.15	Amperes
Heater Warm-up Time*	10.5	——	——	Seconds

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
□ Base—B6-81 or B7-7, Intermediate Shell Octal
or B6-84 or B7-59, Short Intermediate Shell Octal

MAXIMUM RATINGS

DESIGN-CENTER VALUES

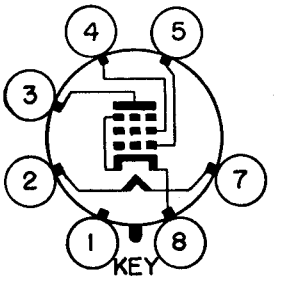
Plate Voltage	200	Volts
Screen Voltage	125	Volts
Plate Dissipation	10	Watts
Screen Dissipation	1.25	Watts

	12L6-GT	25L6-GT	50L6-GT
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	——	Volts
Total DC and Peak	200	90	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	300	90	Volts
Grid Circuit Resistance			
With Fixed Bias	0.1	0.1	Megohms
With Cathode Bias	0.5	0.5	Megohms

GENERAL ELECTRIC

Supersedes ET-T400A dated 6-50 and ET-T413A dated 1-50

BASING DIAGRAM

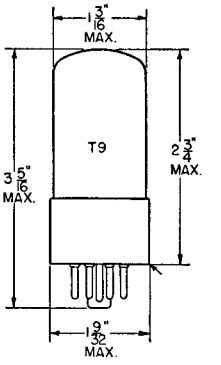


RETMA 7AC

TERMINAL CONNECTIONS

Pin 1—No Connection†
Pin 2—Heater
Pin 3—Plate
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates

PHYSICAL DIMENSIONS



RETMA 9-11 or 9-41

CHARACTERISTICS AND TYPICAL OPERATION

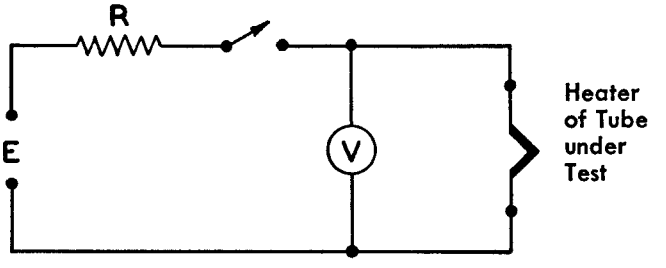
CLASS A_1 AMPLIFIER

Plate Voltage	110	200	Volts
Screen Voltage	110	125	Volts
Grid-Number 1 Voltage	−7.5	—	Volts
Cathode-Bias Resistor	—	180	Ohms
Peak AF Grid-Number 1 Voltage	7.5	8.5	Volts
Plate Resistance, approximate	13000	28000	Ohms
Transconductance	8000	8000	Micromhos
Zero-Signal Plate Current	49	46	Milliamperes
Maximum-Signal Plate Current	50	47	Milliamperes
Zero-Signal Screen Current	4.0	2.2	Milliamperes
Maximum-Signal Screen Current	10	8.5	Milliamperes
Load Resistance	2000	4000	Ohms
Total Harmonic Distortion, approximate	10	10	Percent
Maximum-Signal Power Output	2.1	3.8	Watts

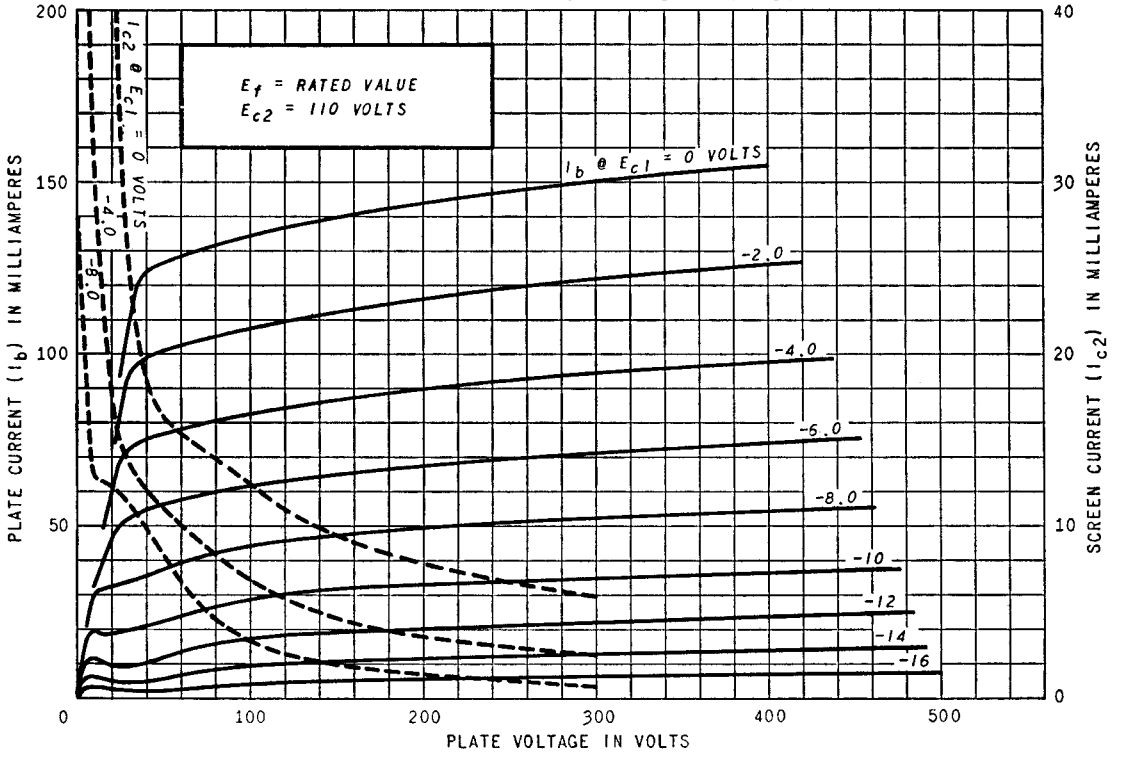
* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E=50 volts (RMS or DC), V_1=10.0 volts (RMS or DC), and R=63 ohms.

□ † Pin 1 omitted on bases B6=81 and B6=84.

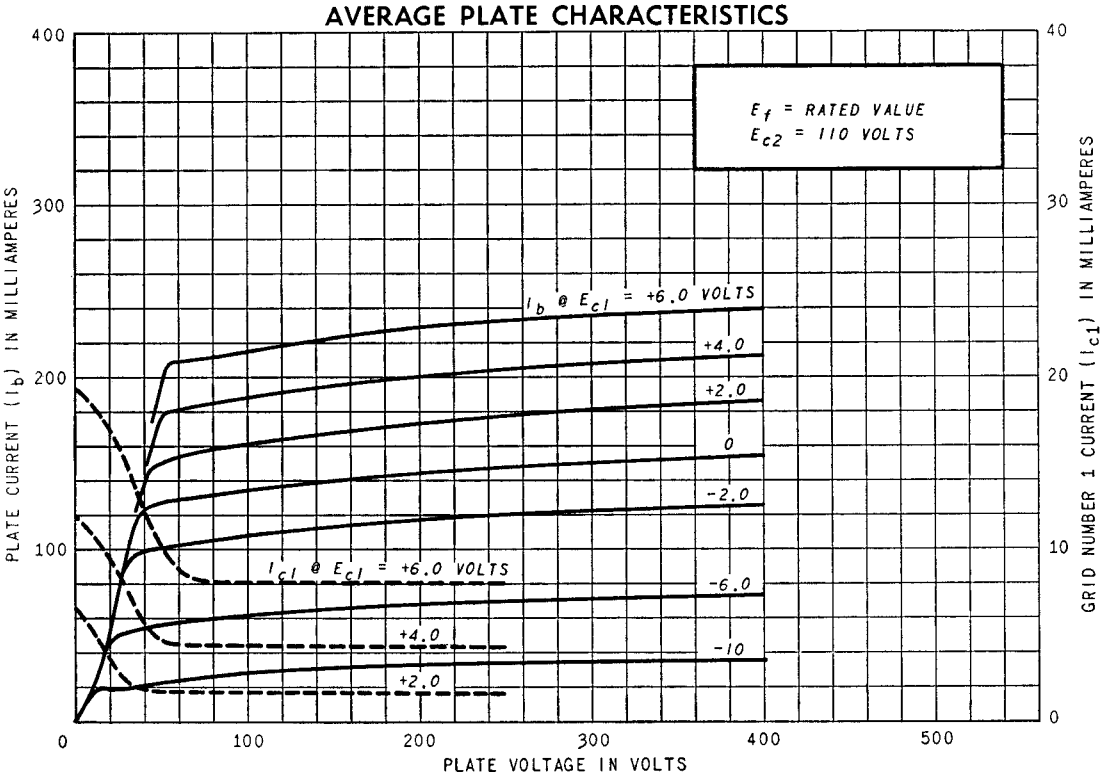
□ Indicates an additional rating.



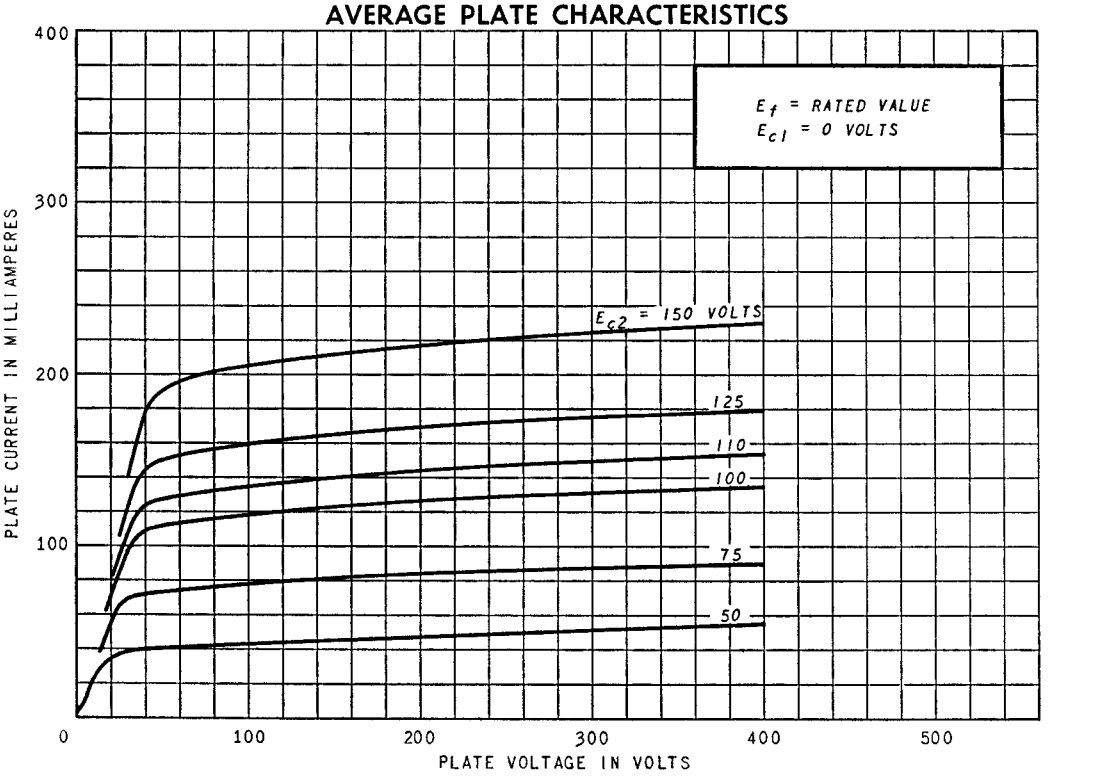
AVERAGE PLATE CHARACTERISTICS



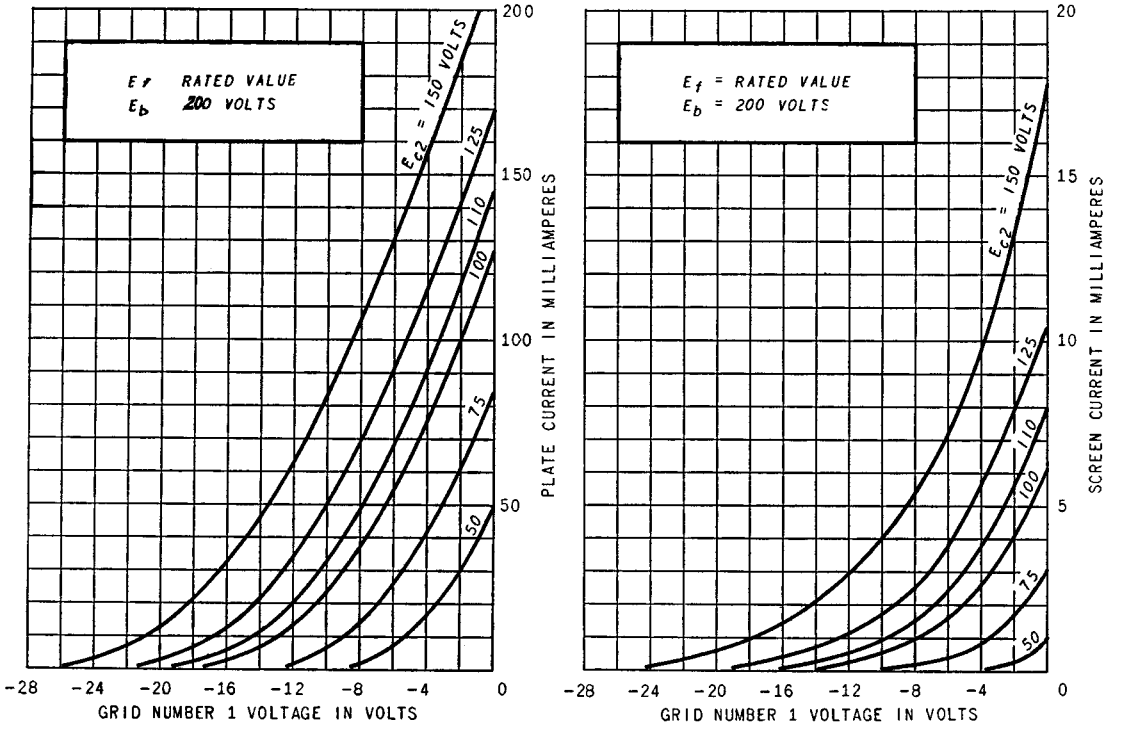
AVERAGE PLATE CHARACTERISTICS



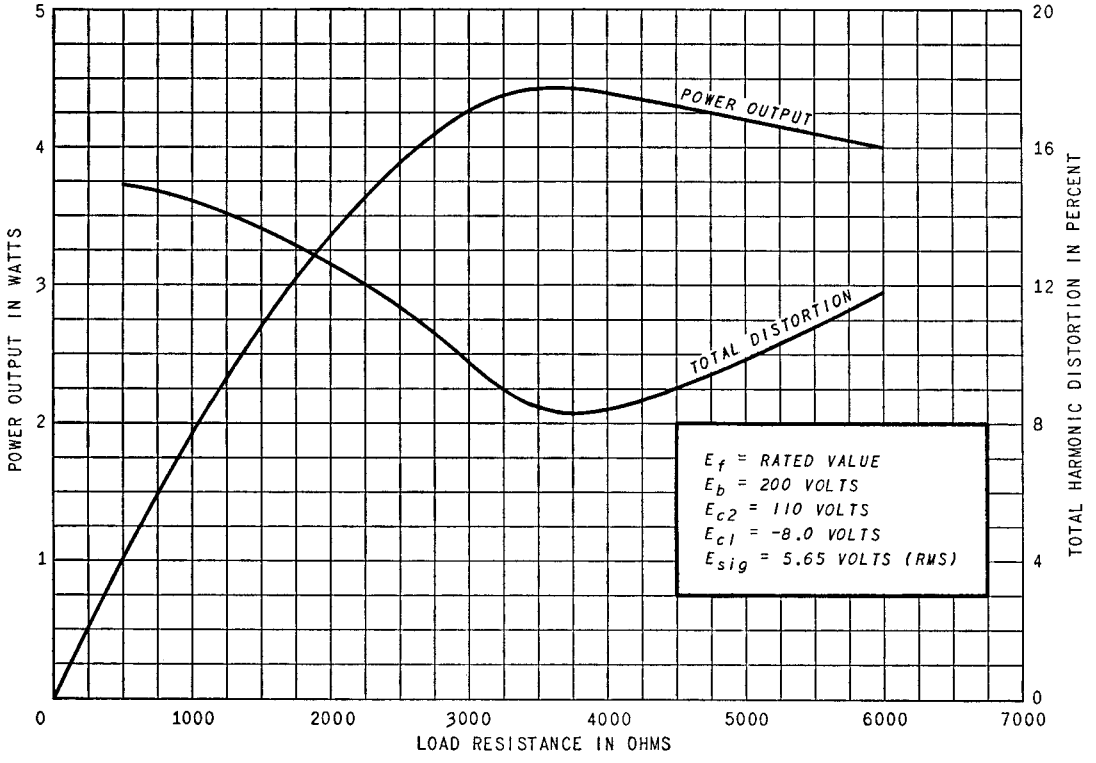
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



OPERATION CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBE
KEN-RAD

25Z6-GT

Description and Rating

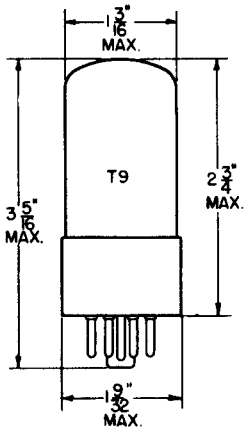
HIGH-VACUUM RECTIFIER DOUBLER

GENERAL DESCRIPTION

Principal Application: The 25Z6-GT is a heater-cathode type full-wave high-vacuum rectifier-doubler tube designed for use in the power supply of a-c or a-c/d-c receivers. Electrically the 25Z5, 25Z6 and 25Z6-GT are identical.

Cathode:	Coated Unipotential
Heater Voltage (A-C or D-C)	25.0 Volts
Heater Current	0.3 Ampere
Envelope:	T-9 Glass
Base:	B7-7 Intermed Shell Octal 7-Pin Phenolic
Mounting Position:	Any

PHYSICAL DIMENSIONS

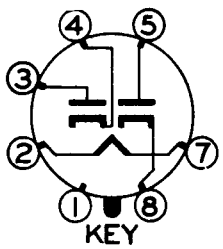


RMA 9-11

TERMINAL CONNECTIONS

Pin 1 - No Connection
Pin 2 - Heater
Pin 3 - Plate Number 2
Pin 4 - Cathode Number 2
Pin 5 - Plate Number 1
Pin 7 - Heater
Pin 8 - Cathode Number 1

BASING DIAGRAM



RMA 7Q
BOTTOM VIEW

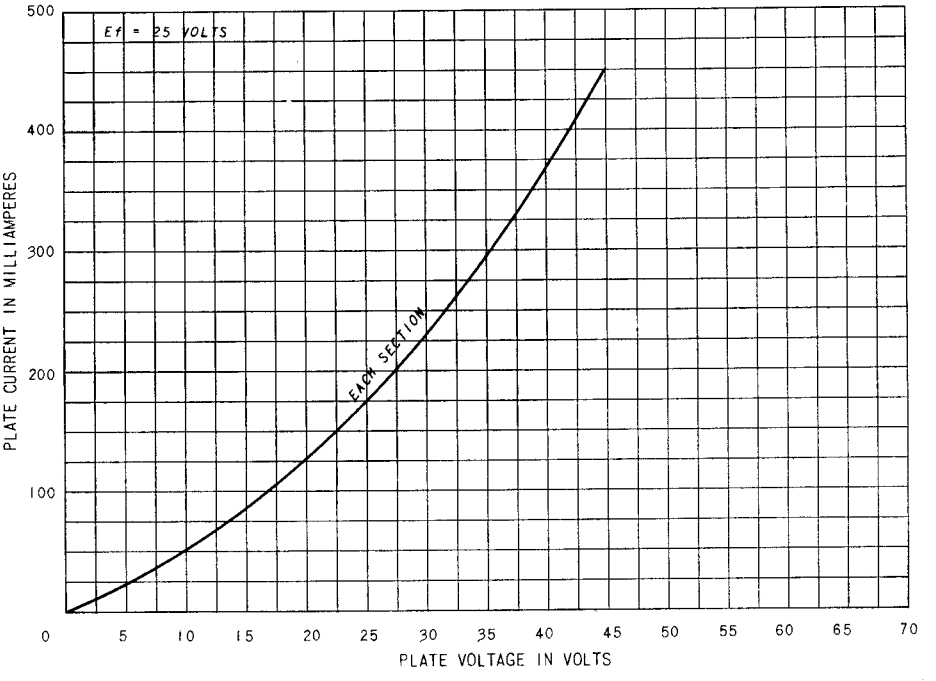
MAXIMUM RATINGS

	Design Center	Absolute	
Peak Inverse Plate Voltage	700	770	Volts
A-C Plate Voltage per Plate (RMS)	235	260	Volts
Peak Plate Current per Plate	450	495	Milliamperes
D-C Output Current per Plate	75	83	Milliamperes
D-C Heater-Cathode Voltage	350	385	Volts

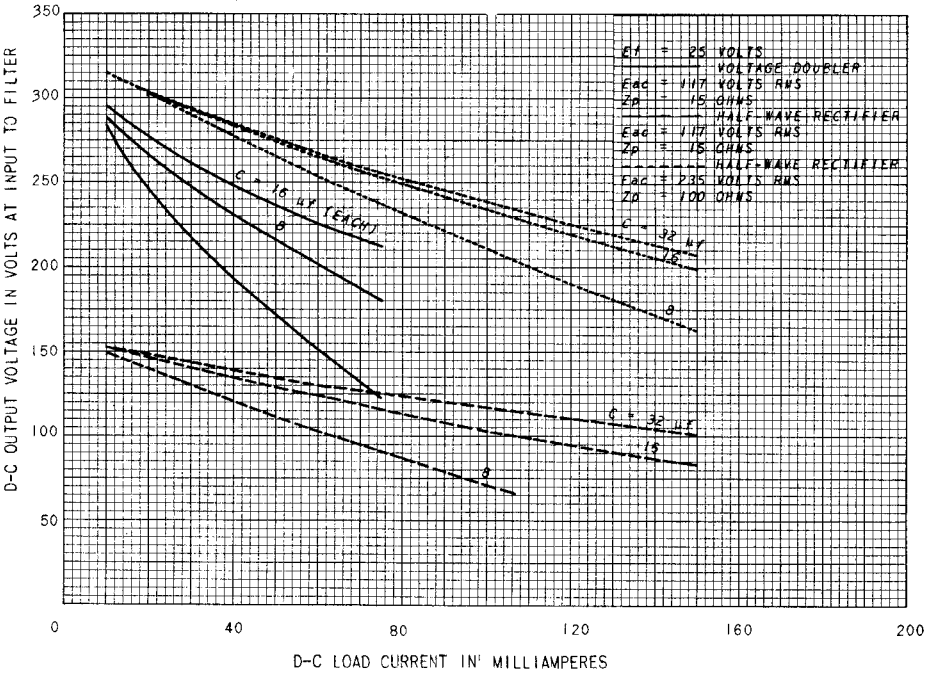
CHARACTERISTICS AND TYPICAL OPERATION

	Half-Wave Rectifier			Voltage Doubler		
				Half-Wave	Full-Wave	
Heater Voltage	25	25	25	25	25	Volts
A-C Plate Voltage per Plate (RMS)	117	150	235	117	117	Volts
Minimum Total Plate-Supply Impedance per Plate	15	40	100	30	15	Ohms
D-C Output Current per Plate	75	75	75	75	75	Milliamperes
D-C Output Voltage at Input to Filter (Approx):						
At Half-Load Current	115	---	255	---	250	Volts
At Full-Load Current	80	---	200	---	205	Volts
Difference (Voltage Regulation)	35	---	55	---	45	Volts
Percentage Regulation	30	---	22	---	18	Per Cent
Filter Input Capacitor	16	16	16	16	16	Microfarads
Tube Voltage Drop: Applied D-C at 150 Milliamperes per Plate	22					Volts

AVERAGE PLATE CHARACTERISTICS



OPERATION CHARACTERISTICS



Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

ELECTRONIC INNOVATIONS IN ACTION

TUBES

Compactron Beam Pentode

26LX6

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

- COLOR TV TYPE
- 33 WATTS PLATE DISSIPATION
- 280 VOLTS B+
- 400 MILLIAMPERES DC CATHODE CURRENT
- OVER 1 AMPERE PEAK CURRENT

The 26LX6 is a compactron beam-power pentode primarily designed for use as the horizontal-deflection amplifier in color television receivers. It is characterized by having a very low knee with a very high peak current of over an ampere. This results in a basic capability to scan 90-degree large screen color picture tubes at 25 KV from 280-volt power supplies. Its low knee minimizes "snivets" without the necessity of supplying special voltages to the beam plates.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	26	Volts
Heater Current‡	0.6±0.04	Amperes
Heater Warm-up Time, Average§	11	Seconds

Direct Interelectrode Capacitances, Approximate¶

Grid-Number 1 to Plate: (g1 to p)	1.0	pf
Input: g1 to (h + k + g2 + b.p.)	40	pf
Output: p to (h + k + g2 + b.p.)	17	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Top Cap - C1-1, Small
Outline Drawing - EIA 12-118

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	4.625	Inches
Maximum Seated Height	4.250	Inches
Minimum Seated Height	4.000	Inches

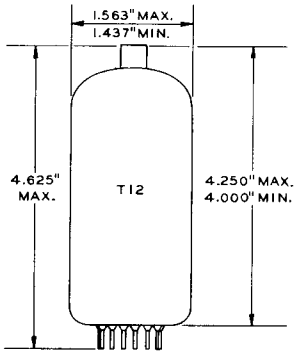
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

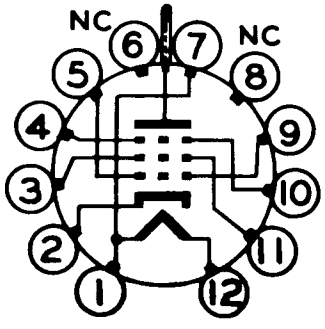


EIA 12-118

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid Number 2 (Screen)
Pin 4 - Beam Plates
Pin 5 - Grid Number 1
Pin 6 - No Connection
Pin 7 - Heater
Pin 8 - No Connection
Pin 9 - Grid Number 1
Pin 10 - Beam Plates
Pin 11 - Grid Number 2 (Screen)
Pin 12 - Heater
Cap - Plate

BASING DIAGRAM



EIA 12JA

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE #— DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

DC Plate-Supply Voltage (Boost + DC Power Supply)	990	Volts
Peak Positive Pulse Plate Voltage	7000	Volts
Positive DC Beam Plate Voltage	0	Volts
Screen Voltage	250	Volts
Peak Negative Grid-Number 1 Voltage	250	Volts
Plate Dissipation△ (Absolute-Maximum Value)	33	Watts
Screen Dissipation	5.0	Watts
DC Cathode Current	400	Milliamperes
Peak Cathode Current	1400	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance ¢		
With Feedback-Type High Voltage Regulation	1.2	Megohms
With Shunt-Type High Voltage Regulation (Switching Mode)	2.2	Megohms
Beam Plate Circuit Resistance	0	Ohms
Bulb Temperature at Hottest Point**	240	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	45	60	175	Volts
Beam Plates Connected to Cathode at Socket					
Screen Voltage	110	160	110	110	Volts
Grid-Number 1 Voltage	---	0	0	-21	Volts
Plate Resistance, Approximate	---	---	---	6000	Ohms
Transconductance	---	---	---	14000	Micromhos
Plate Current	---	1100‡‡	750‡	125	Milliamperes
Screen Current	---	110‡‡	42‡	3.3	Milliamperes
Grid-Number 1 Voltage, Approximate					
Ib = 1.0 Milliamperes	-125	---	---	-40	Volts
Triode Amplification Factor§§	---	---	---	4.0	

MINIMUM RECOMMENDED GRID DRIVE

Peak Positive Pulse Plate Voltage	5000	6000	Volts
Peak Negative Grid-Number 1 Voltage for Eg2 = 150 Volts	-190	-210	Volts
Peak Negative Grid-Number 1 Voltage for Eg2 = 200 Volts	-210	-235	Volts

NOTES

* Heater voltage for a bogey tube at If = 0.6 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ Without external shield.

\# For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

Δ In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

¢ The circuit design has to be such that negative control grid currents up to 5 microamperes do not have any detrimental effect upon tube adjustment or circuit performance. Care should be taken so that the limiting values for plate dissipation, screen dissipation and cathode current are not exceeded with 5 microamperes grid current.

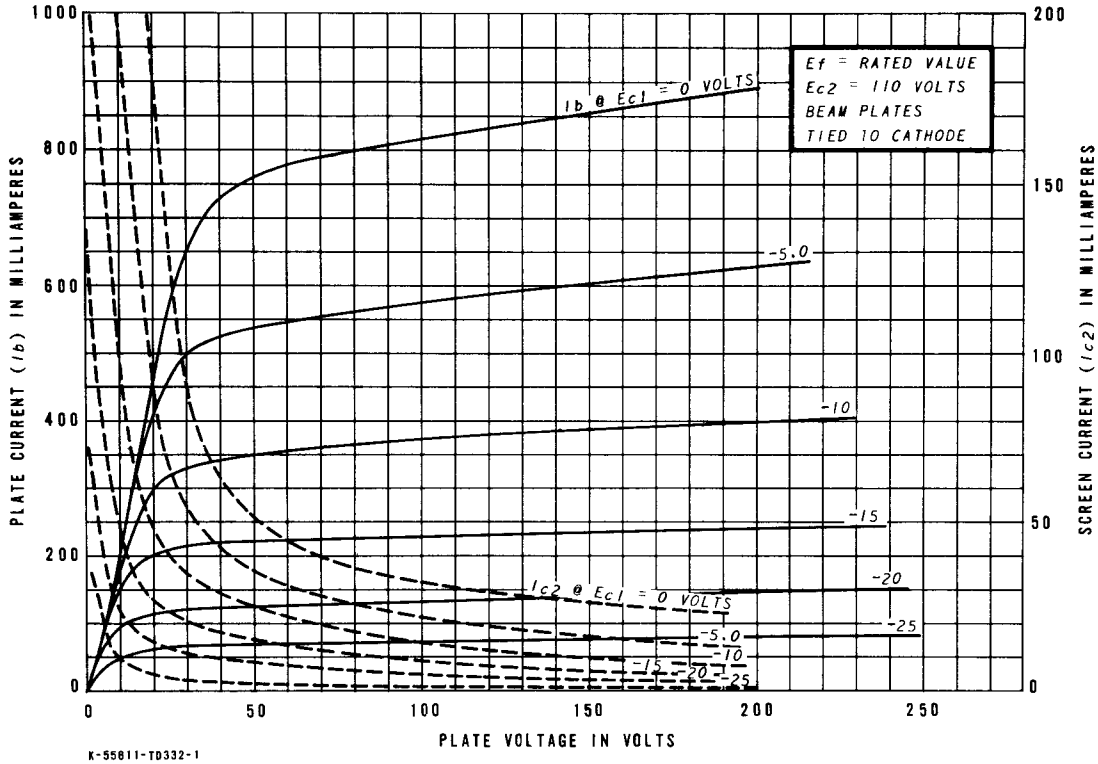
** Measured with an infrared thermometer, Ircon Model 700 BC or equivalent, at an ambient temperature of 40° C.

‡‡ Values measured by a method involving a recurrent waveform such that the plate and screen dissipations will be kept within ratings in order to prevent damage to the tube.

§§ Triode connection (screen tied to plate) with Eb = Ec2 = 175 volts, and Ec1 = -21 volts.

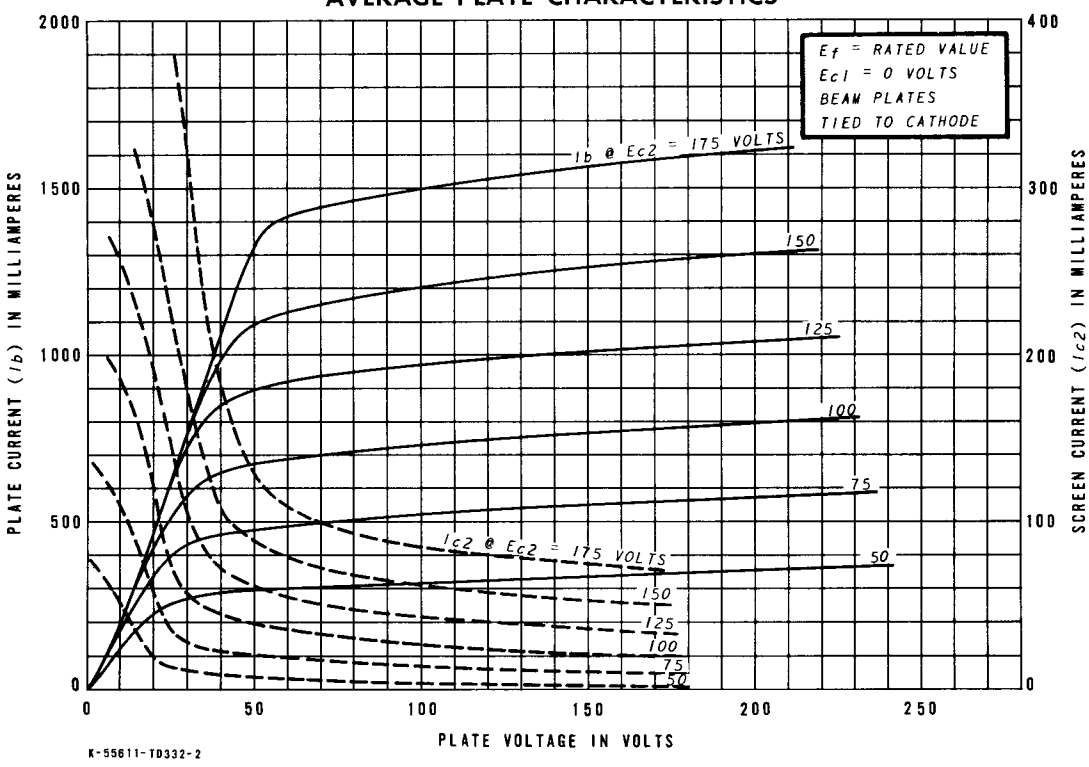
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AVERAGE PLATE CHARACTERISTICS



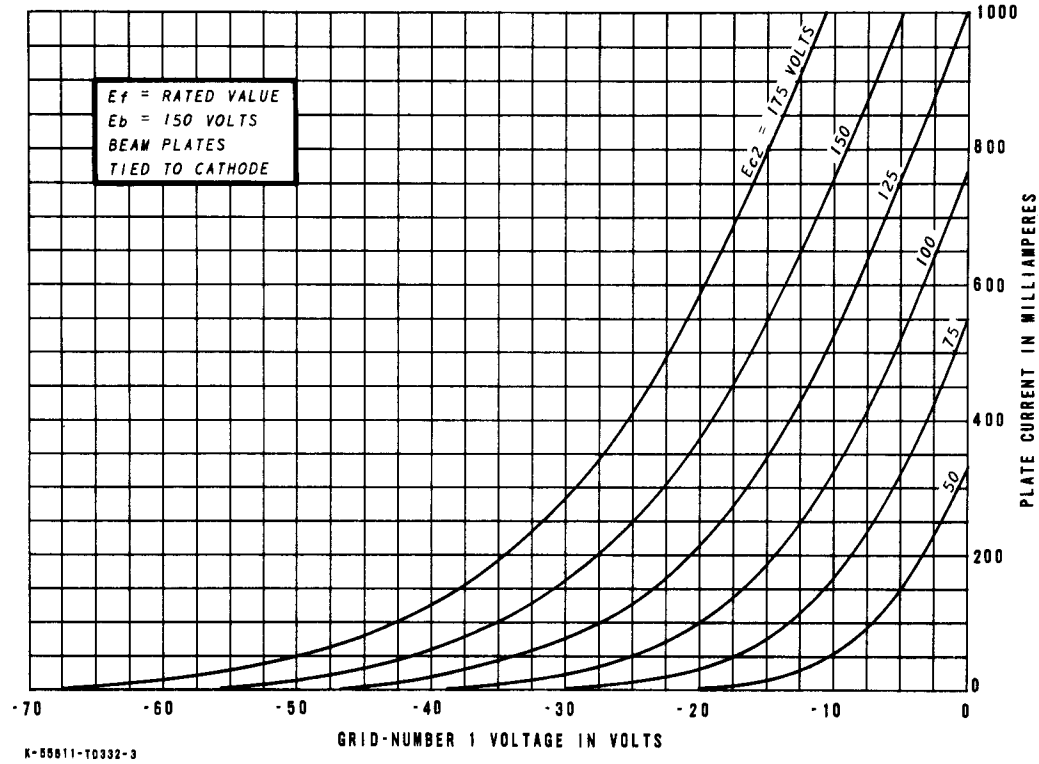
K-55611-TD332-1

AVERAGE PLATE CHARACTERISTICS



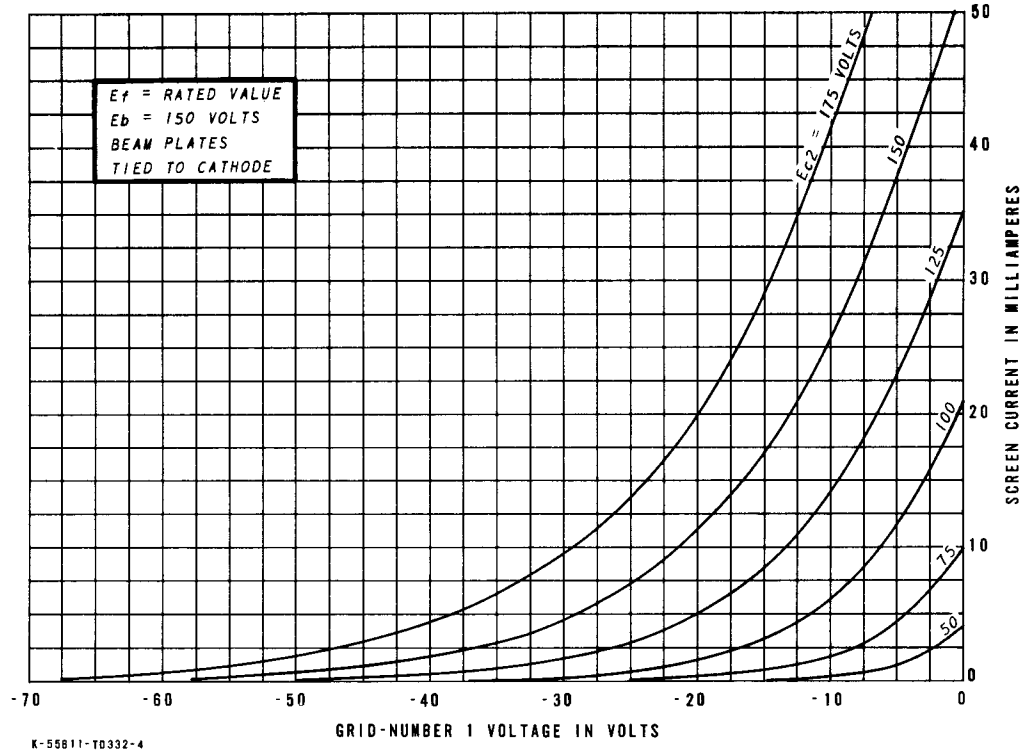
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AVERAGE TRANSFER CHARACTERISTICS



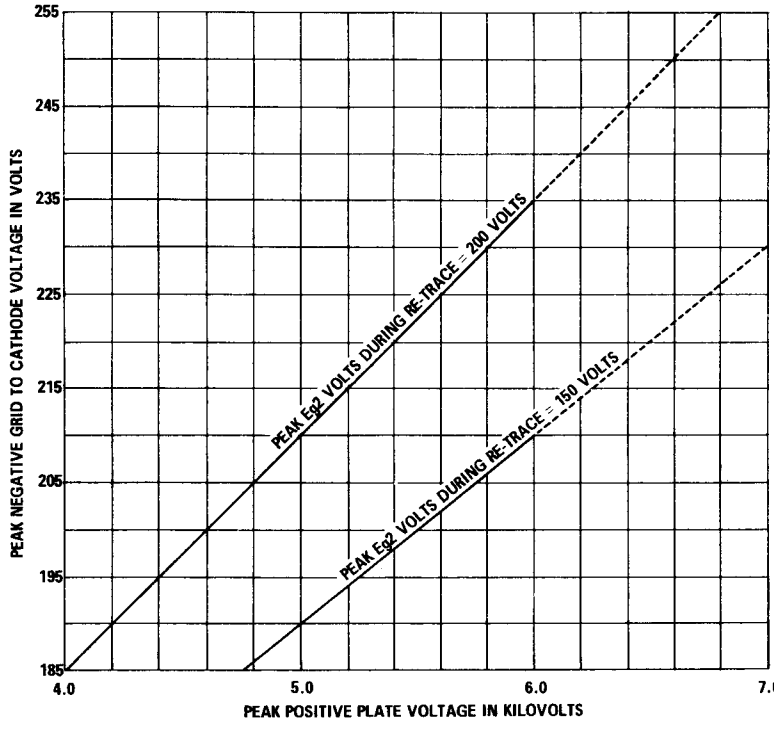
K-55811-T0332-3

AVERAGE TRANSFER CHARACTERISTICS



K-55811-T0332-4

RECOMMENDED MINIMUM PEAK NEGATIVE GRID VOLTAGE vs PEAK POSITIVE PULSE PLATE VOLTAGE



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBES

27EP4

CATHODE-RAY TUBE

27-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
90-DEGREE DEFLECTION ANGLE

24- BY 18½-INCH PICTURE SIZE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 27EP4 is a magnetic-focus and deflection, direct-view all-glass picture tube which provides a 24- by 18½-inch picture for television applications. The electron gun is designed for use with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, a reflective aluminized screen to increase light output, and a space-saving rectangular face shape.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes

Focusing Method—Magnetic
Deflecting Method—Magnetic
Deflection Angle, approximate

Diagonal	90	Degrees
Horizontal	85	Degrees
Vertical	70	Degrees

Direct Interelectrode Capacitances, approximate

Cathode to All Other Electrodes	5	μμf
Grid-No. 1 to All Other Electrodes	6	μμf

OPTICAL

Phosphor Number—P4, Sulfide Type
Fluorescent Color—White
Phosphorescent Color—White
Persistence—Short

Faceplate—Gray

Light Transmission at Center, approximate	68	Percent

MECHANICAL

Over-all Length	$23\frac{1}{16} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$26\frac{13}{16} \pm \frac{1}{8}$	Inches
Width	$25\frac{9}{32} \pm \frac{1}{8}$	Inches
Height	$20\frac{7}{32} \pm \frac{1}{8}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	25¾	Inches
Width	24	Inches
Height	18½	Inches
Neck Length	7½	Inches

Bulb Number, ASA Designation—J214-½-A1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation—12D
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	44	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	20,000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

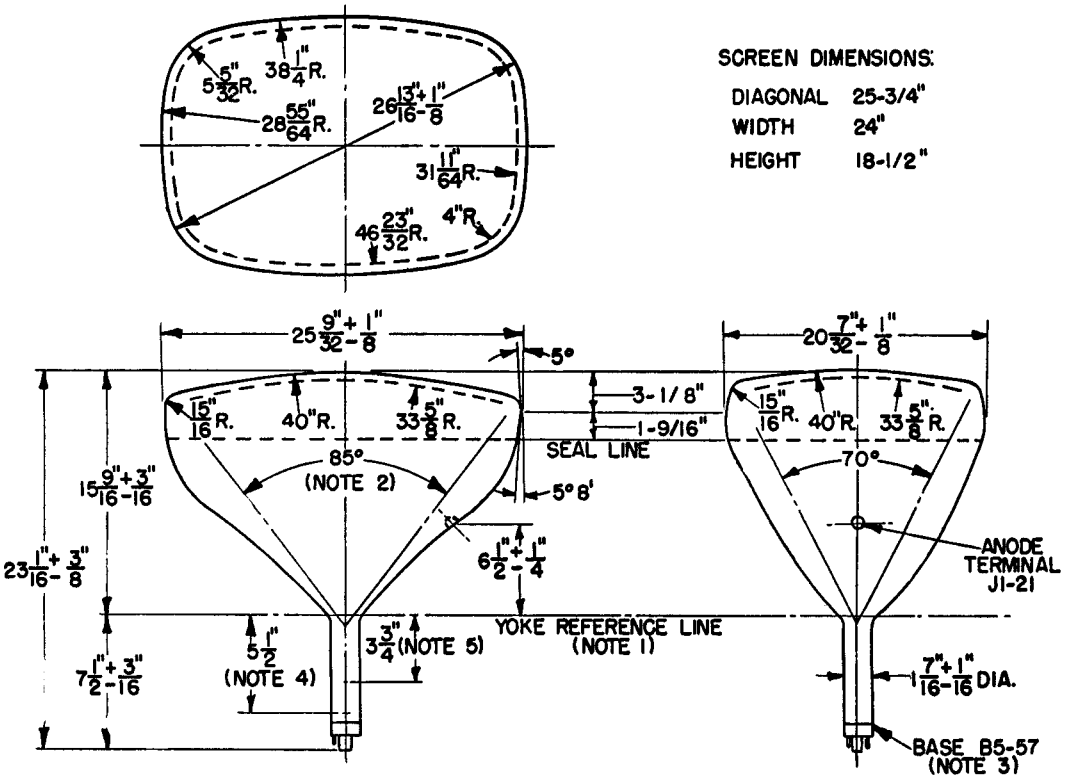
Anode Voltage§	16,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltage π	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	116	Milliamperes DC
Ion-Tap Field Intensity♦, approximate	40	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.
If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.
‡Cathode should be returned to one side or to the midtap of the heater transformer winding.
§Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.
πFor visual extinction of focused raster.
▲For JETEC focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3¾ inches.
♦Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through JETEC ion-trap magnet No. 117.

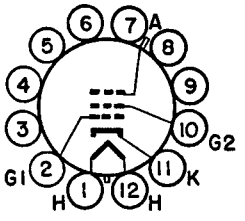


SCREEN DIMENSIONS:

DIAGONAL	25-3/4"
WIDTH	24"
HEIGHT	18-1/2"

NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE-LINE GAGE (RETMA NO. 116) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 90 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.



BASING DIAGRAM
12D

Electronic TUBES

27RP4

CATHODE-RAY TUBE

24- BY 18½-INCH PICTURE SIZE

27-INCH RECTANGULAR, GLASS
FOCUS—MAGNETIC
DEFLECTION—MAGNETIC
90-DEGREE DEFLECTION ANGLE
FACEPLATE—SPHERICAL, GRAY
ION-TRAP GUN
EXTERNAL CONDUCTIVE COATING
ALUMINIZED SCREEN

DESCRIPTION AND RATING

The 27RP4 is a magnetic-focus and deflection, direct-view all-glass picture tube which provides a 24- by 18½-inch picture for television applications. The electron gun is designed for use with an external single-field ion-trap magnet. Other features of this tube include a high-quality gray faceplate which increases picture contrast and detail under high-ambient-light conditions, a reflective aluminized screen to increase light output, and a space-saving rectangular face shape. An external conductive coating serves as a filter capacitor when grounded.

GENERAL

ELECTRICAL

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Amperes
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Deflection Angle, approximate		
Diagonal	90	Degrees
Horizontal	85	Degrees
Vertical	70	Degrees
Direct Interelectrode Capacitances, approximate		
Cathode to All Other Electrodes	5	uuf
Grid-No. 1 to All Other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	750	uuf
Minimum	500	uuf

OPTICAL

Phosphor Number—P4, Sulfide Type		
Fluorescent Color—White		
Phosphorescent Color—White		
Persistence—Short		
Faceplate—Gray		
Light Transmission at Center, approximate	68	Percent

MECHANICAL

Over-all Length	$23\frac{1}{16} \pm \frac{3}{8}$	Inches
Greatest Bulb Dimensions		
Diagonal	$26\frac{13}{16} \pm \frac{3}{16}$	Inches
Width	$25\frac{9}{32} \pm \frac{3}{16}$	Inches
Height	$20\frac{7}{32} \pm \frac{3}{16}$	Inches
Minimum Useful Screen Dimensions		
Diagonal	25¾	Inches
Width	24	Inches
Height	18½	Inches
Neck Length	7½	Inches

Bulb Number, ASA Designation—J214-½-A1
Bulb Contact—Recessed Small-cavity Cap, JETEC No. J1-21
Base—Small-shell Duodecal 5-Pin, JETEC No. B5-57
Basing, JETEC Designation—12N
Bulb Contact Alignment
Anode Contact Aligns with Pin No. 6 Position ±30 Degrees

Mounting Position—Any

Net Weight, approximate	44	Pounds

MAXIMUM RATINGS

DESIGN-CENTER VALUES*

Anode Voltage†	20,000 Max	Volts DC
Grid-No. 2 Voltage	500 Max	Volts DC
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts DC
Positive-Bias Value	0 Max	Volts DC
Positive-Peak Value	2 Max	Volts
Peak Heater-Cathode Voltage‡		
Heater Negative with Respect to Cathode		
During Warm-up Period not to Exceed 15 Seconds	410 Max	Volts
After Equipment Warm-up Period	180 Max	Volts
Heater Positive with Respect to Cathode	180 Max	Volts

TYPICAL OPERATING CONDITIONS

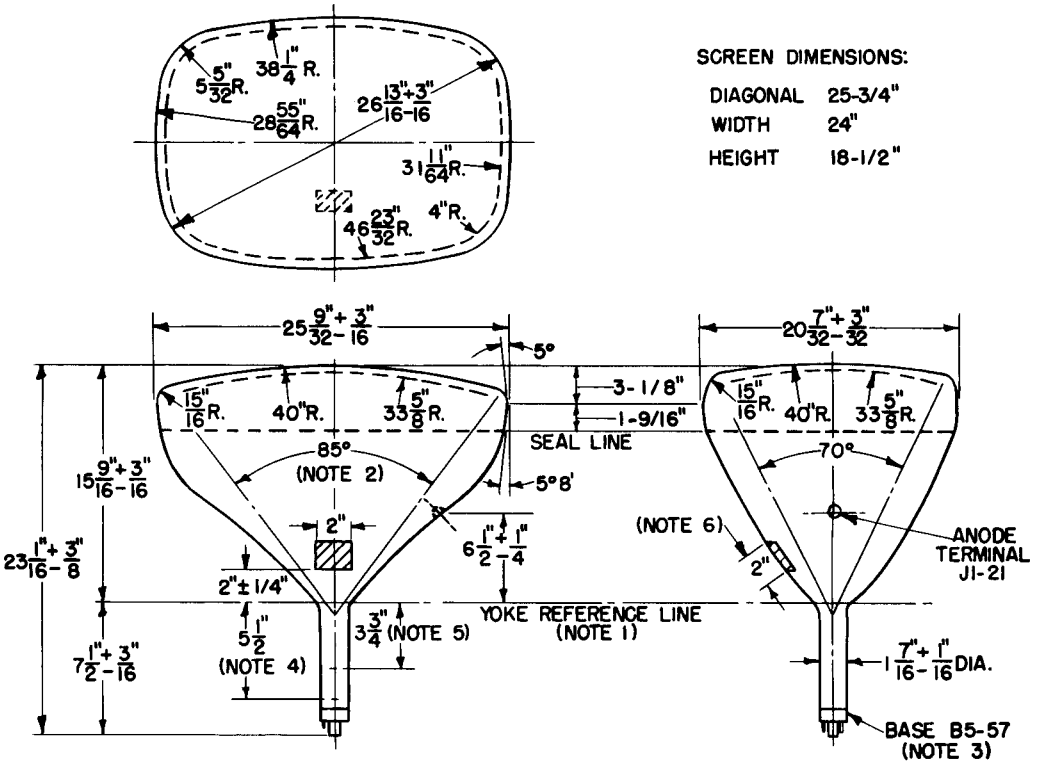
Anode Voltage§	16,000	Volts DC
Grid-No. 2 Voltage	300	Volts DC
Grid-No. 1 Voltageπ	−28 to −72	Volts DC
Focusing-Coil Current▲, approximate	116	Milliamperes DC
Ion-Trap Field Intensity♦, approximate	40	Gausses

MAXIMUM CIRCUIT VALUES

Grid-No. 1 Circuit Resistance	1.5 Max	Megohms

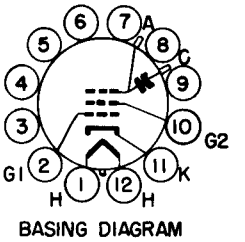
*The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltages and components provided the maximum design-center values are not exceeded by more than ten percent.

†Anode and grid-No. 3 which are connected together within the tube are referred to herein as anode.
If this tube is operated at voltages in excess of 16,000 volts, x-ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour, the window will normally provide adequate protection.
‡Cathode should be returned to one side or to the midtap of the heater transformer winding.
§Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.
πFor visual extinction of focused raster.
▲For JETEC focusing coil No. 109 with distance from the yoke-reference-line to center-of-air-gap equal to 3¾ inches.
♦Single-field ion-trap magnet adjusted to optimum position, equivalent to 40 milliamperes through JETEC ion-trap magnet No. 117.



NOTES:

1. REFERENCE LINE IS DETERMINED BY THE PLANE OF THE UPPER EDGE OF THE SHOULDER OF THE REFERENCE-LINE GAGE (RETMA NO. 116) WHEN THE GAGE IS RESTING ON THE CONE.
2. DEFLECTION ANGLE ON DIAGONAL IS 90 DEGREES.
3. ANODE TERMINAL ALIGNS WITH PIN-NO. 6 POSITION ± 30 DEGREES.
4. APPROXIMATE POSITION OF ION-TRAP MAGNET.
5. RECOMMENDED POSITION FOR CENTER OF FOCUSING FIELD.
6. EXTERNAL CONDUCTIVE COATING CONTACT AREA.



30JZ6

Compactron Beam Pentode

30JZ6 Compactron Beam Pentode. The 30JZ6 is a compactron beam power pentode designed for use as the horizontal-deflection amplifier in television receivers. A separate connection is provided for the beam plates to minimize "snivets".

Except for heater characteristics, the 30JZ6 is identical to the 6JZ6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC●	30	Volts
Heater Current▲	0.3±0.02	Amperes
Heater Warm-up Time, Average♦	11	Seconds

NOTES

- ● Heater voltage for a bogey tube at If = 0.3 amperes.
- ▲ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.
- ♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Compactron Dissimilar-Double-Triode Pentode

31AL10

- VERTICAL OUTPUT PENTODE
- VERTICAL OSCILLATOR
- SYNC CLIPPER
- LOW HEATER POWER
- 140 VOLTS B+

The 31AL10 is a compactron containing a medium-mu triode, a high-mu triode, and a high-perveance beam pentode. The pentode is intended for vertical output service in monochrome television receivers operating from 140 volts B+. The two triodes are intended for vertical oscillator and sync clipper functions.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	31.5	Volts
Heater Current●	0.315 ± 0.02	Amperes
Heater Warm-up Time, average♦	11	Seconds

Direct Interelectrode Capacitances, approximate▲

Triode (Section 1)

Grid to Plate: (T1g to T1p)	3.0	pf
Input: T1g to (h + k + Pb.p.)	3.2	pf
Output: T1p to (h + k + Pb.p.)	0.4	pf

Triode (Section 2)

Grid to Plate: T2g to T2p)	3.7	pf
Input: T2g to (h + k + Pb.p.)	2.0	pf
Output: T2p to (h + k + Pb.p.)	0.6	pf

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.24	pf
Input: Pg1 to (h + k + Pg2 + Pb.p.)	12	pf
Output: Pp to (h + k + Pg2 + Pb.p.)	8.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-59

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	2.625	Inches
Maximum Seated Height	2.250	Inches
Minimum Seated Height	2.000	Inches

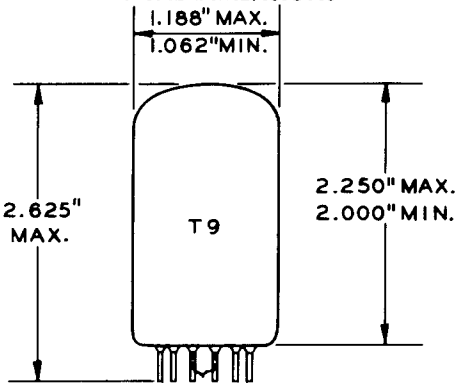
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

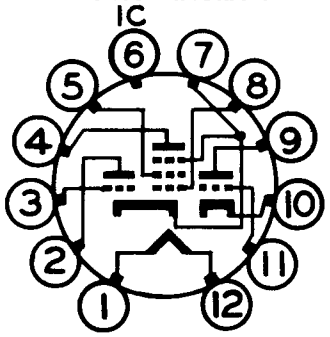


EIA 9-59

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Triode Plate (Section 2)
Pin 3 - Triode Grid (Section 2)
Pin 4 - Pentode Plate
Pin 5 - Pentode Grid Number 2 (Screen)
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Triode Cathode (Section 2), Pentode Cathode, and Pentode Beam Plates
Pin 8 - Pentode Grid Number 1
Pin 9 - Triode Plate (Section 1)
Pin 10 - Triode Cathode (Section 1)
Pin 11 - Triode Grid (Section 1)
Pin 12 - Heater

BASING DIAGRAM



EIA 12HR

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

Pentode Section - Vertical-Deflection Amplifier Service□

DC Plate Voltage	250	Volts
Peak Pulse Plate Voltage	2000	Volts
Screen Voltage	200	Volts
Peak Negative Grid-Number 1 Voltage	150	Volts
Plate Dissipation	7.0	Watts
Screen Dissipation	1.8	Watts
Total DC Plate and Screen Current	70	Milliamperes
Total Peak Plate and Screen Current	245	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	1.0	Megohms

Triode (Section 1)

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Plate Dissipation	1.25	Watts
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.5	Megohms

Triode (Section 2) - Vertical Oscillator Service□

DC Plate Voltage	250	Volts
Peak Negative Grid Voltage	400	Volts
Plate Dissipation	1.0	Watts
DC Plate Current	20	Milliamperes
Peak Plate Current	70	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Circuit Resistance		
With Fixed Bias	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	45	120	Volts
Screen Voltage	110	110	Volts
Grid-Number 1 Voltage	0⊕	−8.0	Volts
Plate Resistance, approximate	---	11700	Ohms
Transconductance	---	7100	Micromhos
Plate Current	122	46	Milliamperes
Screen Current	16.5	3.5	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 100 Microamperes	---	−25	Volts

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CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

Triode (Section 1)		
Plate Voltage	150	Volts
Grid Voltage	-2.0	Volts
Amplification Factor	43	
Plate Resistance, approximate	11000	Ohms
Transconductance	3900	Micromhos
Plate Current	5.4	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	-5.7	Volts
Triode (Section 2)		
Plate Voltage	150	Volts
Grid Voltage	-5.0	Volts
Amplification Factor	20	
Plate Resistance, approximate	8500	Ohms
Transconductance	2350	Micromhos
Plate Current	5.5	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	-11	Volts

NOTES

★ Heater voltage for a bogey tube at If = 0.315 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

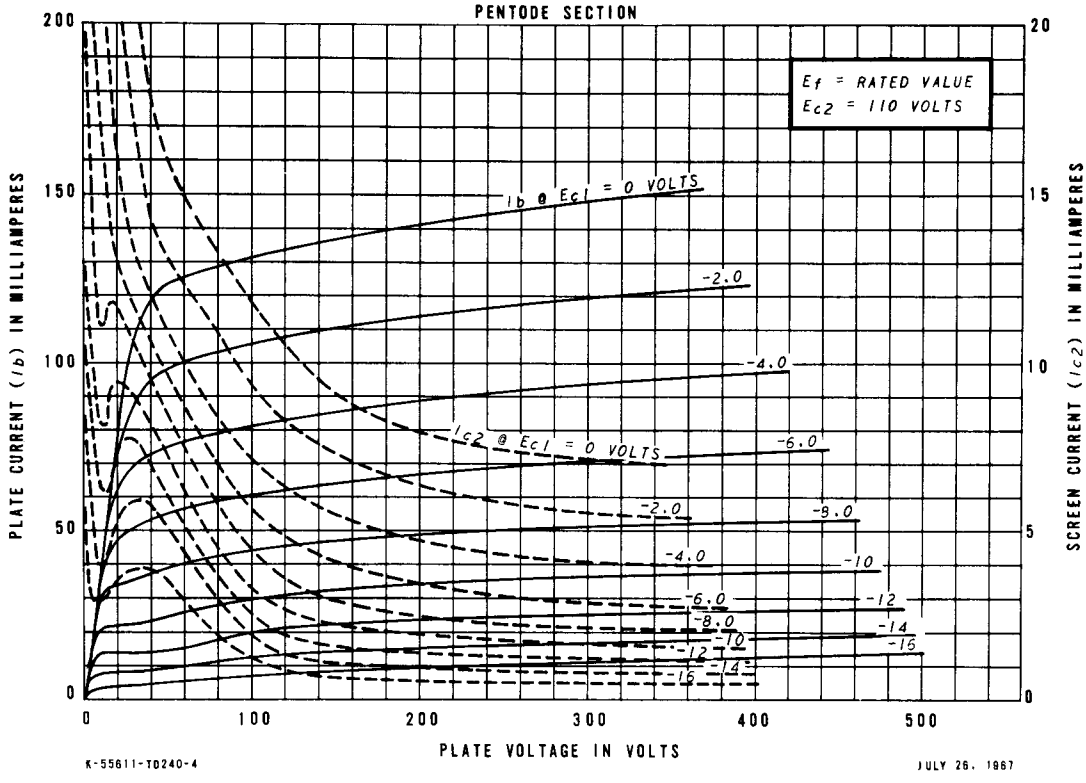
♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

▲ Without external shield.

□ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

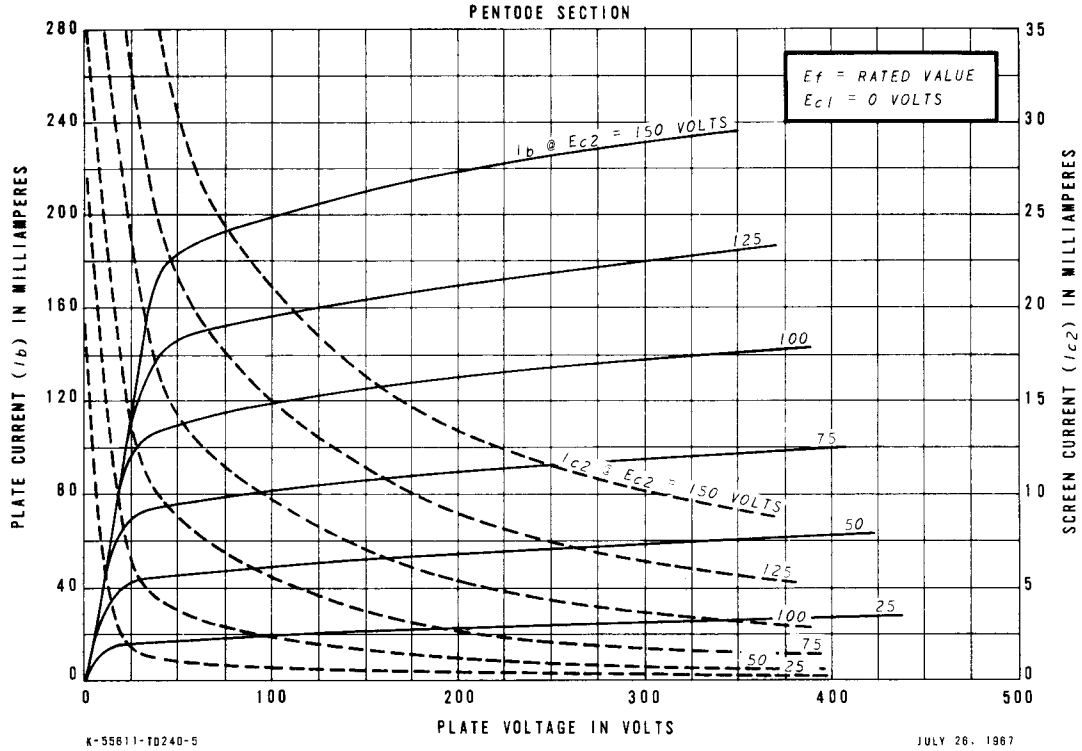
⊕ Applied for short interval (two seconds maximum) so as not to damage tube.

AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

PENTODE SECTION

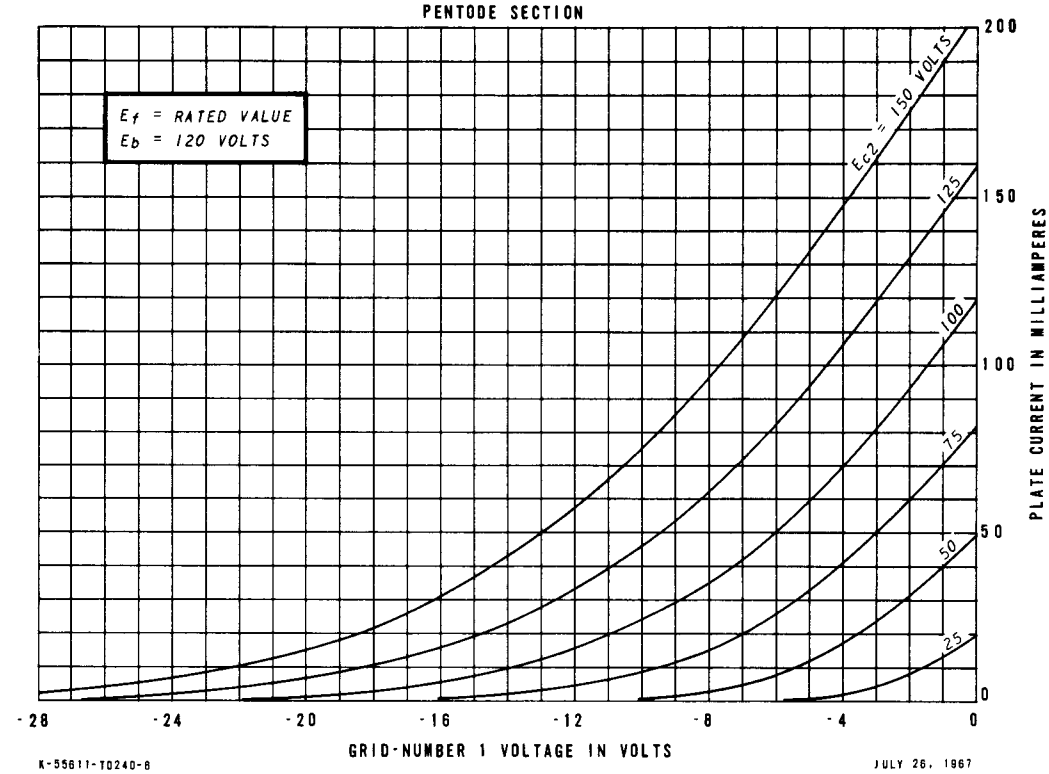


K-55611-T0240-5

JULY 26, 1967

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

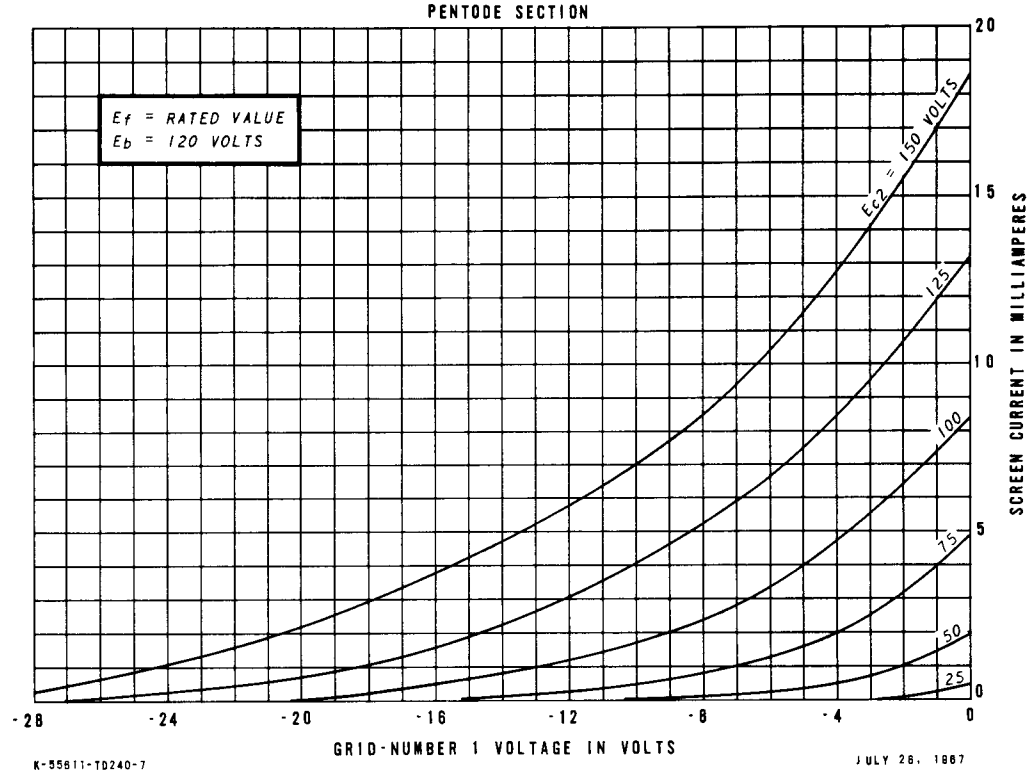


K-55611-T0240-6

JULY 26, 1967

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

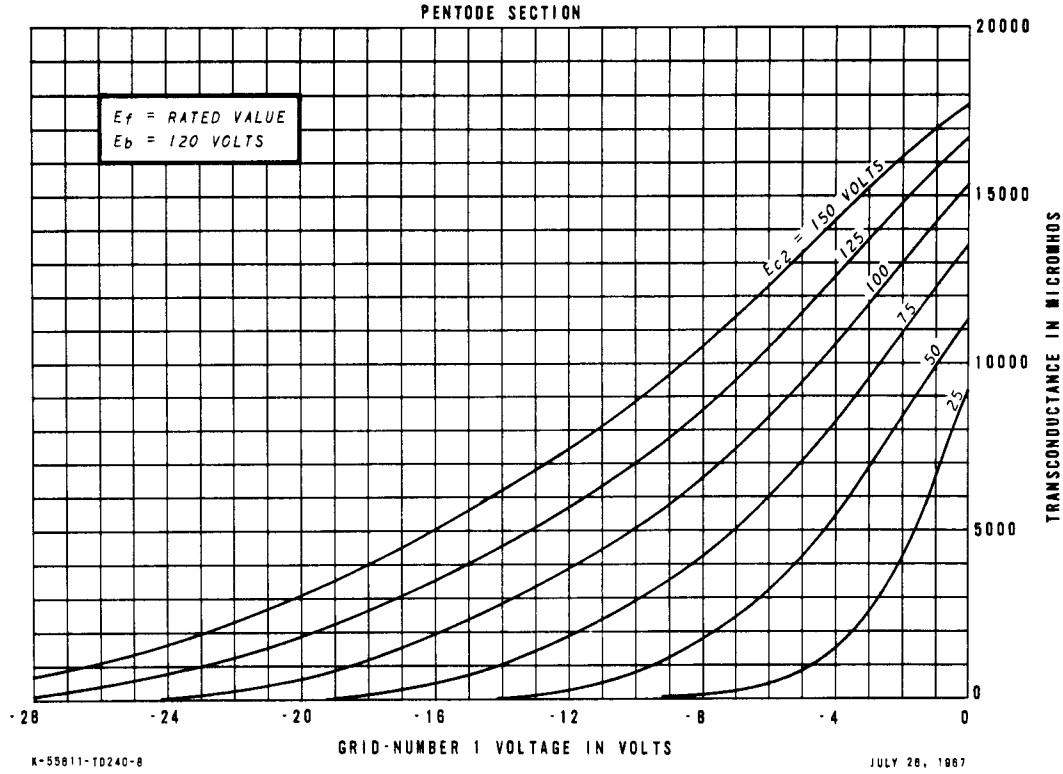


K-55811-TD240-7

JULY 28, 1967

AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

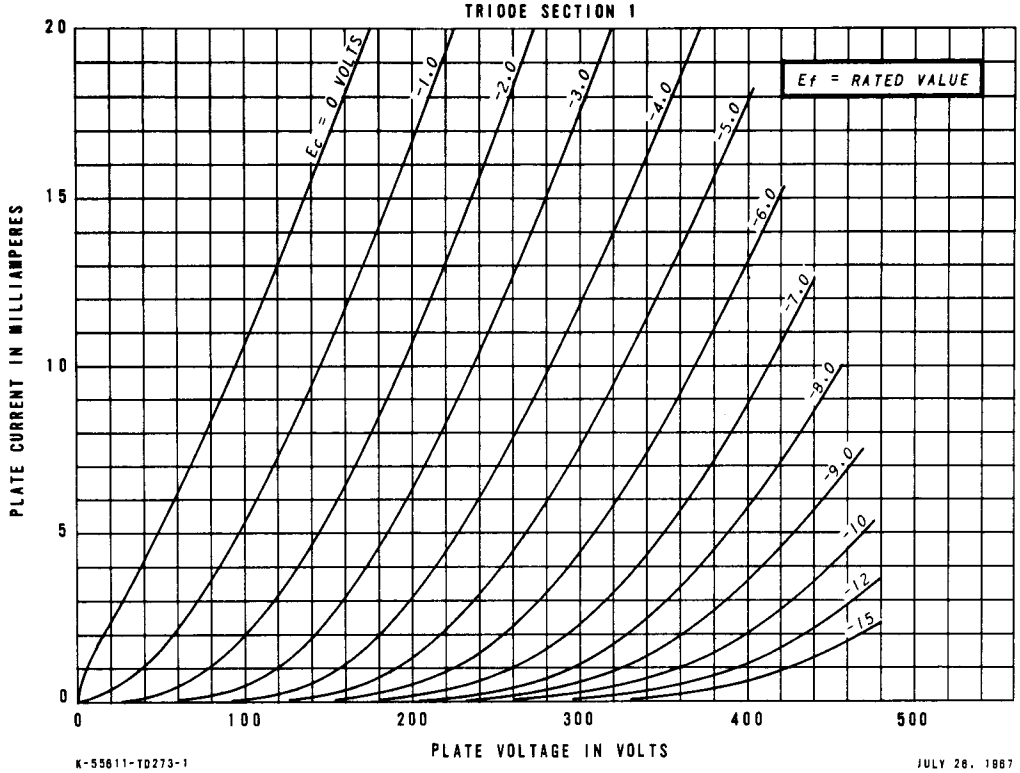


K-55811-TD240-8

JULY 28, 1967

AVERAGE PLATE CHARACTERISTICS

TRIODE SECTION 1

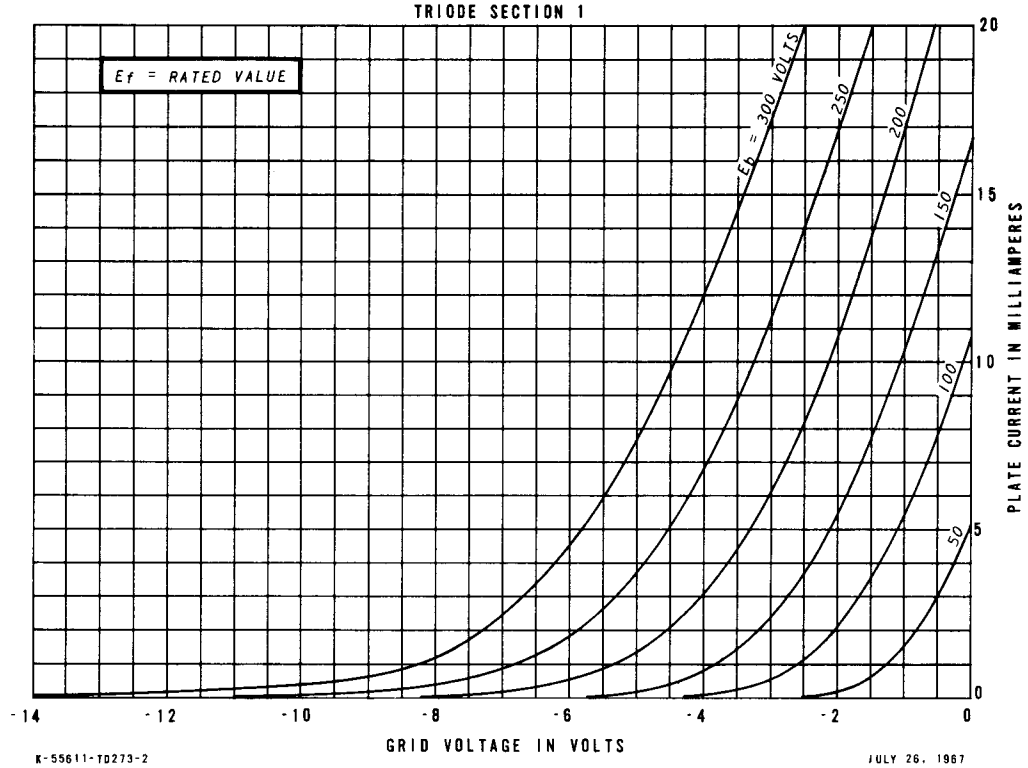


K-55611-TD273-1

JULY 26, 1967

AVERAGE TRANSFER CHARACTERISTICS

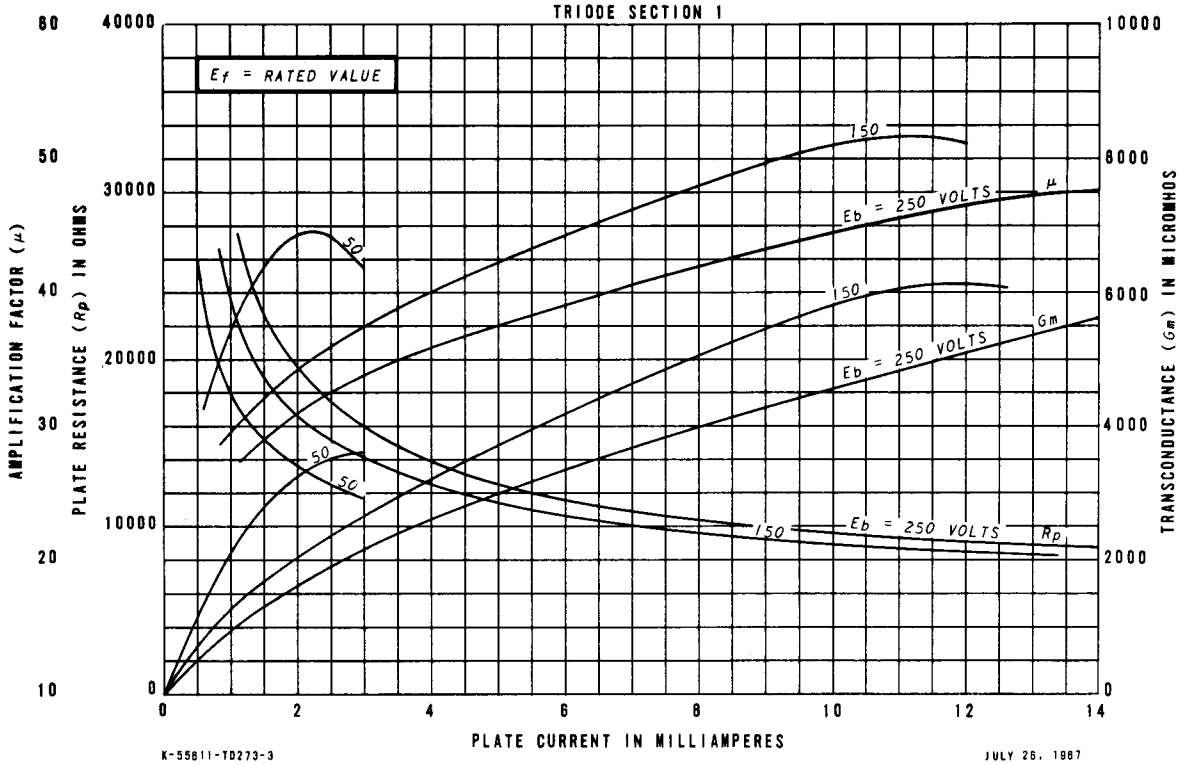
TRIODE SECTION 1



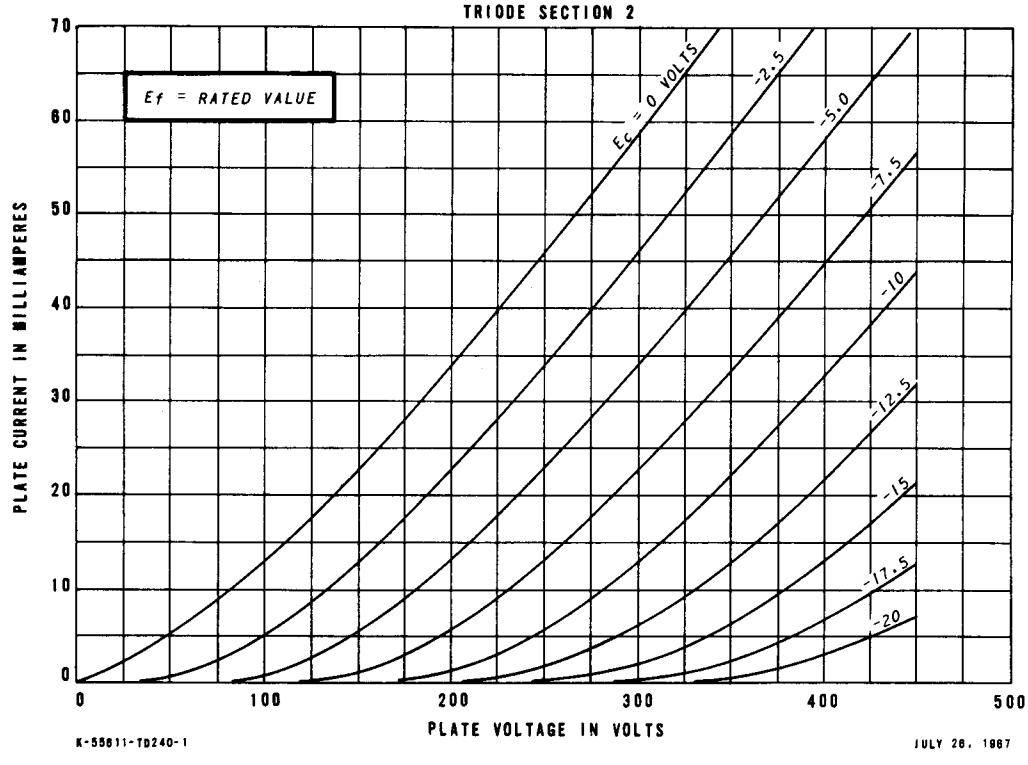
K-55611-TD273-2

JULY 26, 1967

AVERAGE CHARACTERISTICS

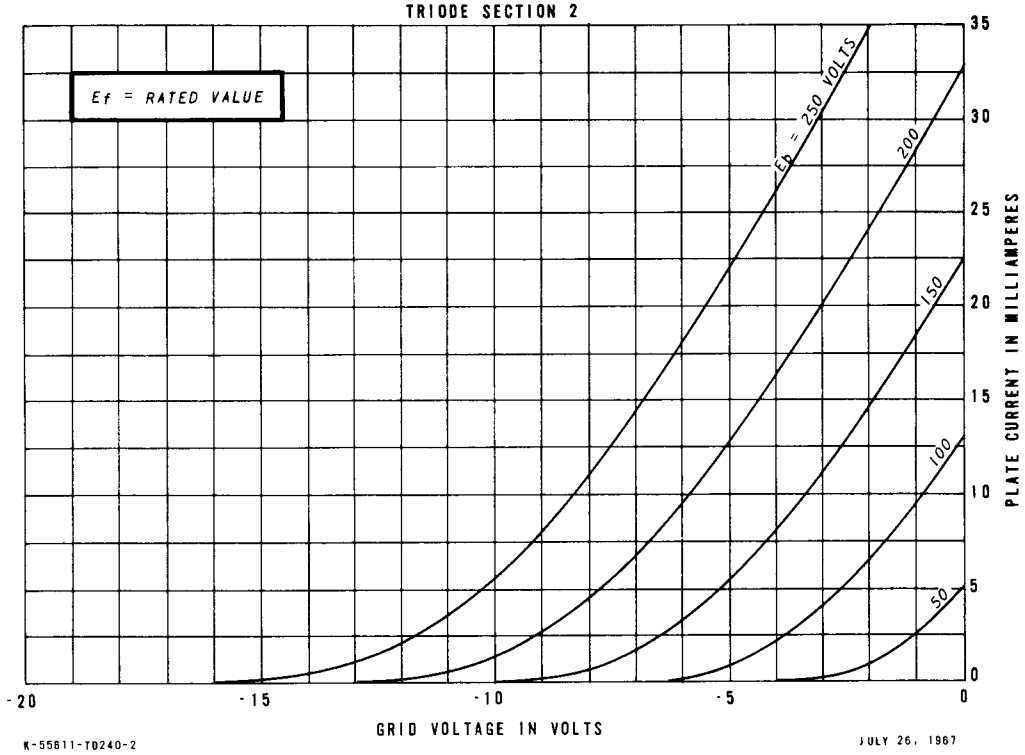


AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

TRIODE SECTION 2

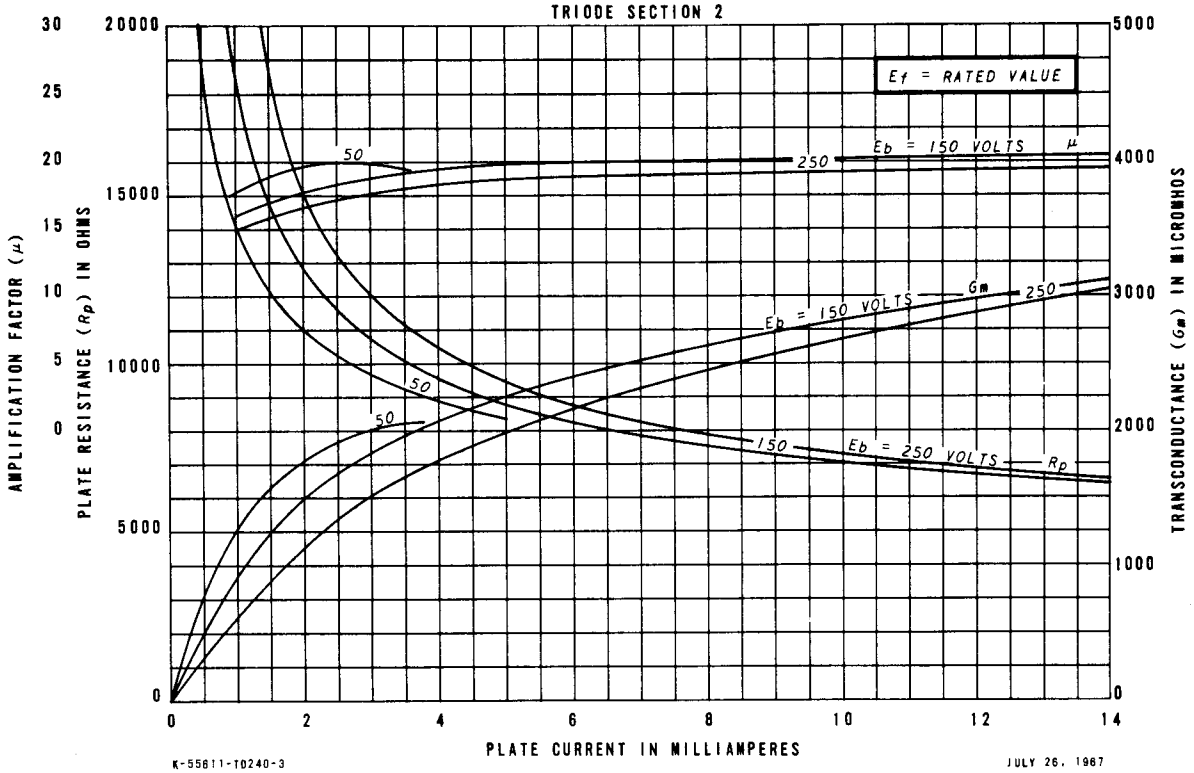


K-55611-T0240-2

JULY 26, 1967

AVERAGE CHARACTERISTICS

TRIODE SECTION 2



K-55611-T0240-3

JULY 26, 1967

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

32HQ7

Compactron Diode-Pentode

■ MULTIFUNCTION ■ LOW HEATER POWER ■ DIFFUSION BONDED DIODE CATHODE

The 32HQ7 is a multifunction compactron containing a high-perveance diode and a beam power pentode. The diode is intended for service as the damping diode and the pentode as the horizontal-deflection amplifier in television receivers.

The diode of the 32HQ7 features a diffusion bonded cathode coating. This coating practically eliminates one of the failure mechanisms in damper diodes, which is back-emission from the anode due to emissive particles being pulled from the cathode by the high electrostatic field.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	32.6	Volts
Heater Current●	0.315 ± 0.02	Amperes
Heater Warm-up Time, average♦	11	Seconds

Direct Interelectrode Capacitances, approximate▲

Pentode Section

Grid-Number 1 to Plate: (Pg1 to Pp)	0.3	pf
Input: Pg1 to (h + Pk + Pg2 + Pb.p.)	14	pf
Output: Pp to (h + Pk + Pg2 + Pb.p.)	6.9	pf

Diode Section

Cathode to Plate and Heater: Dk to (h + Dp)	8.2	pf
Plate to Cathode and Heater: Dp to (h + Dk)	6.1	pf
Heater to Cathode: (h to Dk)	2.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing - EIA 12-56

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches
Minimum Seated Height	2.250	Inches

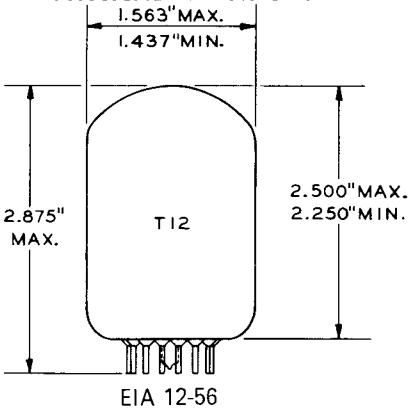
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

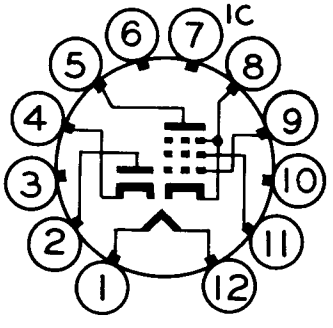


EIA 12-56

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Diode Plate
⊕Pin 3 - No Connection
Pin 4 - Diode Cathode
Pin 5 - Pentode Plate
⊕Pin 6 - No Connection
⊕Pin 7 - Internal Connection - Do Not Use
Pin 8 - Pentode Cathode and Beam Plates
Pin 9 - Pentode Grid Number 1
⊕Pin 10 - No Connection
Pin 11 - Pentode Grid Number 2 (Screen)
Pin 12 - Heater

BASING DIAGRAM



EIA 12HT

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

Horizontal-Deflection Amplifier Service □ — Pentode Section

DC Plate-Supply Voltage (Boost + DC Power Supply)	400	Volts
Peak Positive Pulse Plate Voltage	4000	Volts
Peak Negative Pulse Plate Voltage	0	Volts
Screen Voltage	150	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation†	7.0	Watts
Screen Dissipation	3.0	Watts
DC Cathode Current	125	Milliamperes
Peak Cathode Current	440	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms

TV Damper Service □ — Diode Section

Peak Inverse Plate Voltage	3300	Volts
Plate Dissipation	3.8	Watts
Steady-State Peak Plate Current	600	Milliamperes
DC Output Current	120	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with respect to Cathode		
DC Component	400	Volts
Total DC and Peak	3300	Volts
Bulb Temperature at Hottest Point	200	°C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section				
Plate Voltage	3500	50	110	Volts
Screen Voltage	110	110	110	Volts
Grid-Number 1 Voltage	---	0‡	−22.5	Volts
Plate Resistance, approximate	---	---	8400	Ohms
Transconductance	---	---	4500	Micromhos
Plate Current	---	240	42	Milliamperes
Screen Current	---	19	2.4	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 1.0 Milliamperes	−90	---	−40	Volts
Triode Amplification Factor§	---	---	3.2	

Diode Section

Tube Voltage Drop, approximate		
Ib = 200 Milliamperes DC	16	Volts

NOTES

★ Heater voltage for a bogey tube at If = 0.315 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

♦ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

▲ Without external shield.

⊕ Socket terminals 3, 6, 7, and 10 should not be used as tie points.

□ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

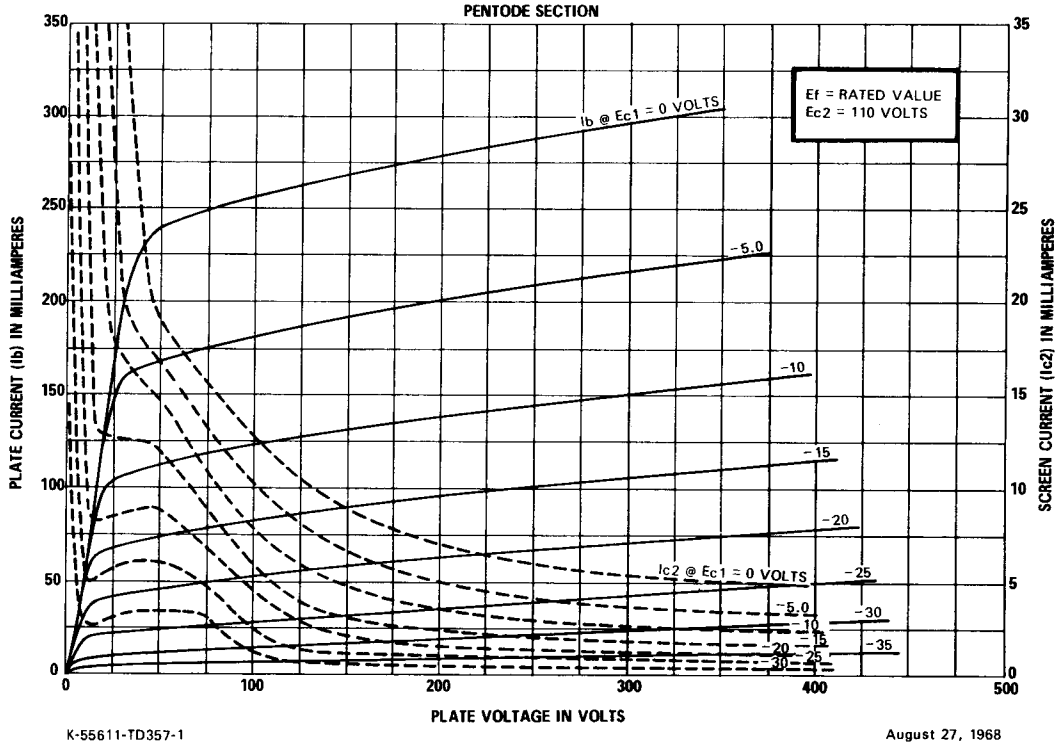
† In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

‡ Applied for short interval (two seconds maximum) so as not to damage tube.

§ Triode connection (screen tied to plate) with Eb = Ec2 = 130 volts and Ec1 = −22.5 volts.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

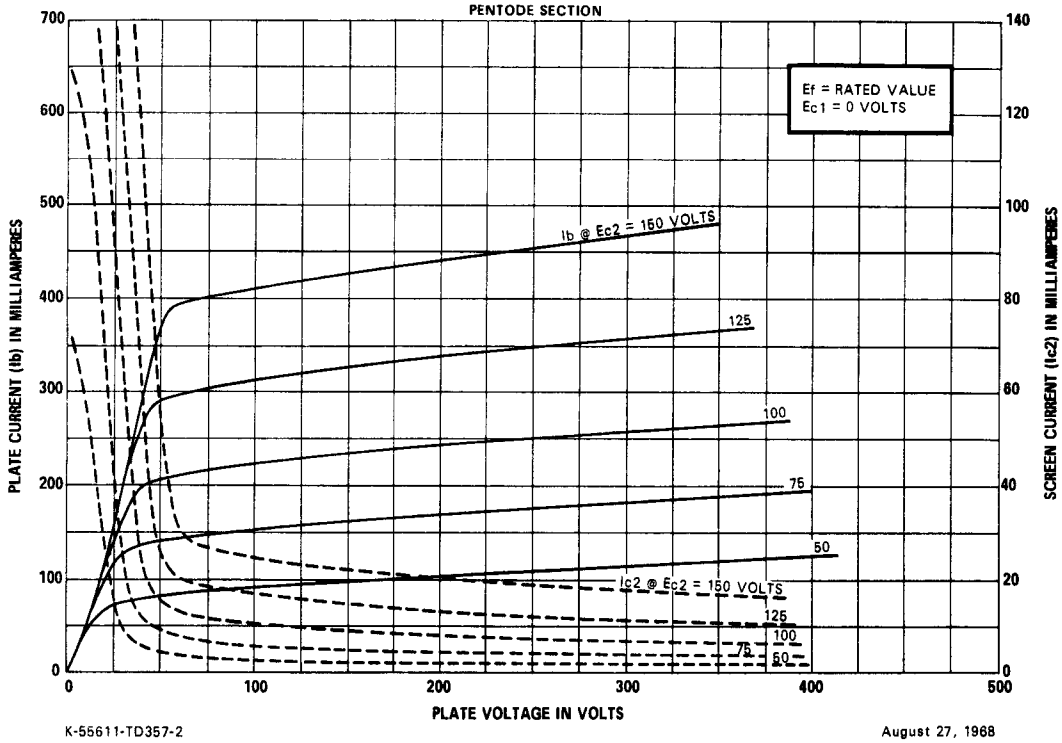
AVERAGE PLATE CHARACTERISTICS



K-55611-TD357-1

August 27, 1968

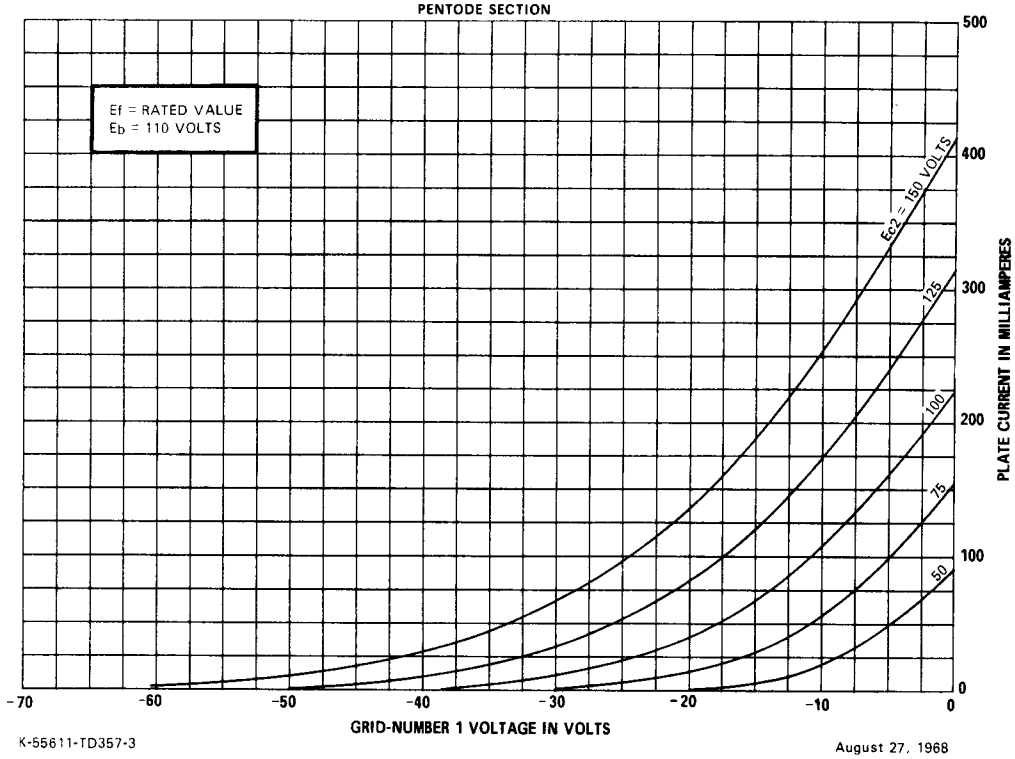
AVERAGE PLATE CHARACTERISTICS



K-55611-TD357-2

August 27, 1968

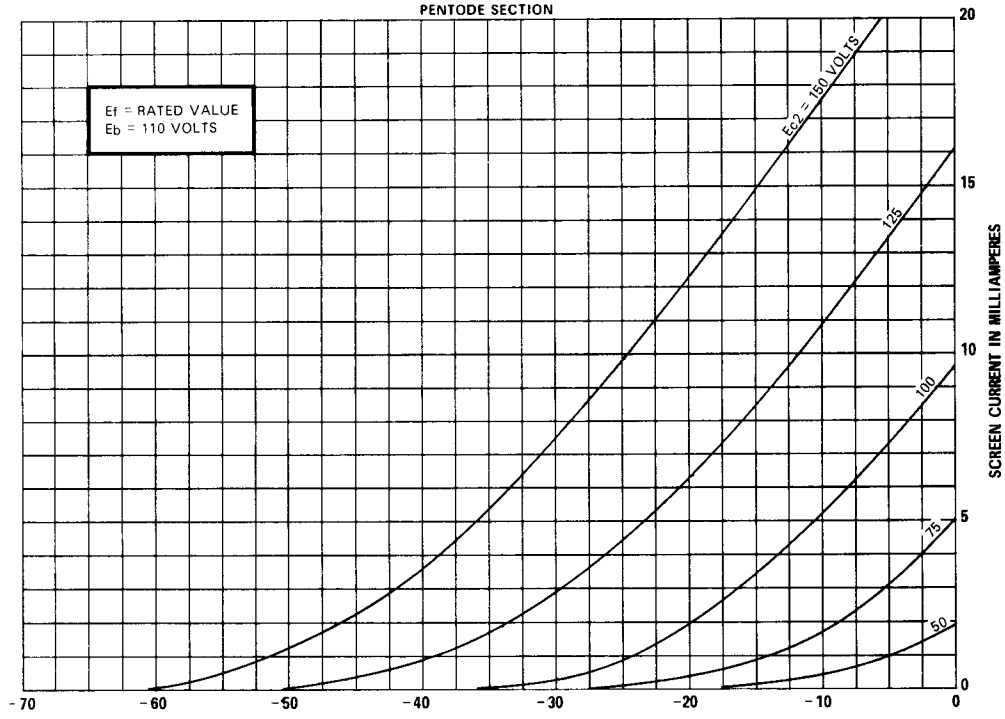
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD357-3

August 27, 1968

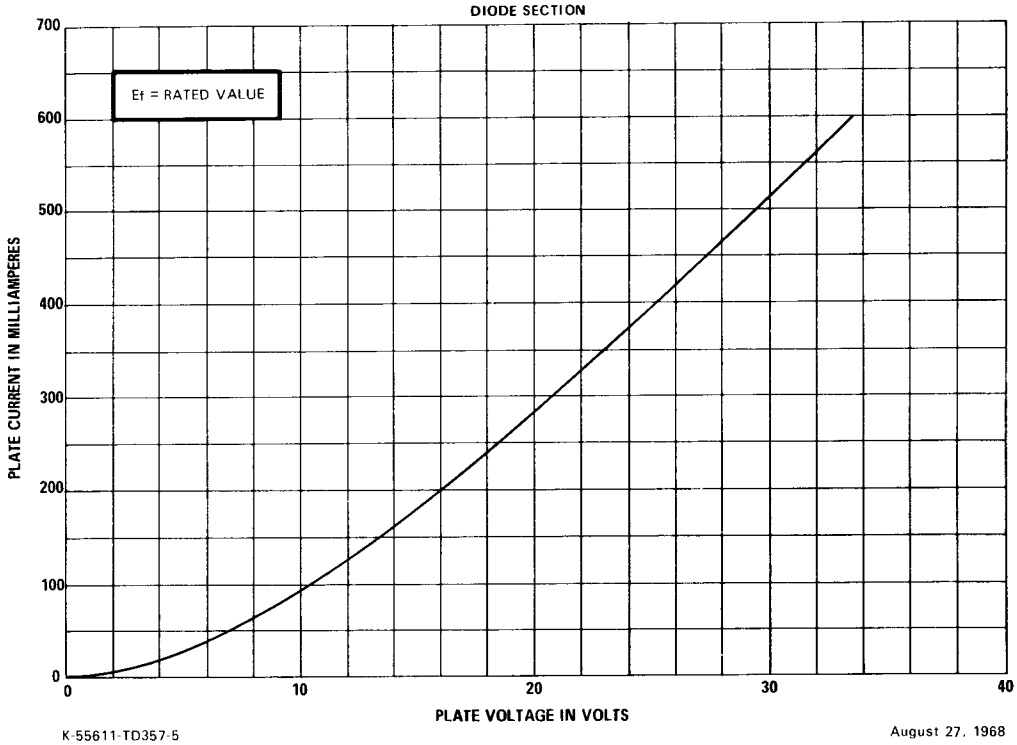
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD357-4

August 27, 1968

AVERAGE PLATE CHARACTERISTICS



K-55611-TD357-5

August 27, 1968

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Electronic TUBE
KEN-RAD

32L7-GT

Description and Rating

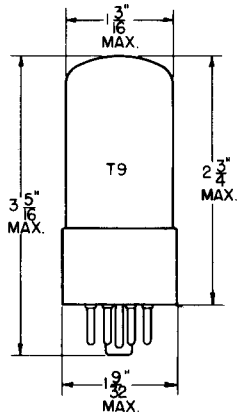
RECTIFIER-BEAM POWER AMPLIFIER

GENERAL DESCRIPTION

Principal Application: The 32L7-GT is a multipurpose tube, consisting of a beam power amplifier and half-wave rectifier. The tube is designed for use as the combined power rectifier and power amplifier in a-c/d-c receivers.

Cathodes	Coated Unipotential	Envelope	T-9, Glass
Heater Voltage (A-C or D-C)	32.5 Volts	Base	B8-6, Intermediate Shell Octal 8-Pin
Heater Current	0.3 Ampere	Mounting Position	Any

PHYSICAL DIMENSIONS

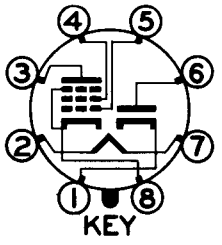


RMA 9-11

TERMINAL CONNECTIONS

Pin 1 - Rectifier Cathode
Pin 2 - Heater
Pin 3 - Amplifier Plate
Pin 4 - Amplifier Grid Number 2 (Screen)
Pin 5 - Amplifier Grid Number 1
Pin 6 - Rectifier Plate
Pin 7 - Heater
Pin 8 - Amplifier Cathode and Beam Plates

BASING DIAGRAM



RMA 8Z
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES:

RECTIFIER SECTION

A-C Plate Supply Voltage (RMS)	125	Volts
D-C Output Current	60	Milliamperes

CHARACTERISTICS AND TYPICAL OPERATION

AMPLIFIER SECTION (CLASS A_1 AMPLIFIER)

Plate Voltage	90	90	Volts
Screen Voltage	90	90	Volts
Grid Number 1 Voltage*	-5	-7	Volts
Plate Resistance	15000	17000	Ohms
Transconductance	6000	4800	Micromhos
Plate Current	38	27	Milliamperes
Screen Current	3.0	2.0	Milliamperes
Load Resistance	2600	2600	Ohms
Total Harmonic Distortion	5.3	9.0	Per Cent
Second Harmonic Component	2.2	6.5	Per Cent
Third Harmonic Component	4.6	5.5	Per Cent
Maximum-Signal Power Output	0.8	1.0	Watt

** The d-c resistance in the grid circuit should not exceed 0.5 megohm.*

Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

ELECTRONICS 33GT7

COMPACTRON DIODE-PENTODE

DESCRIPTION AND RATING

The 33GT7 is a compactron containing a high-perveance diode and a beam-power pentode. The diode is intended for service as the damping diode and the pentode as the horizontal-deflection amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	33.6	Volts
Heater Current†	0.45±0.03	Amperes
Heater Warm-up Time, Average‡	11	Seconds

Direct Interelectrode Capacitances, approximate§

Diode Section

Cathode to Plate and Heater:		
k to (p + h)	8.5	pf
Plate to Cathode and Heater:		
p to (k + h)	5.5	pf
Heater to Cathode: (h to k)	3.2	pf

Pentode Section

Grid-Number 1 to Plate: (g1 to p)	0.2	pf
Input: g1 to (h + k + g2 + b.p.)	17	pf
Output: p to (h + k + g2 + b.p.)	7.0	pf

MECHANICAL

Operating Position - Any

Envelope - T-12, Glass

Base - E12-74, Button 12-Pin

Outline Drawing - EIA 12-56

Maximum Diameter	1.563	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches

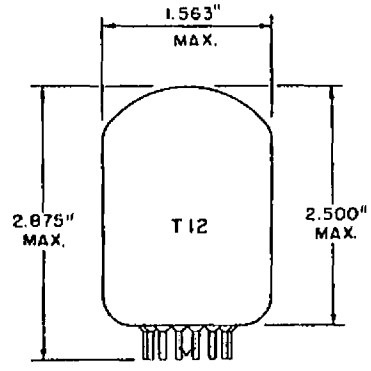
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

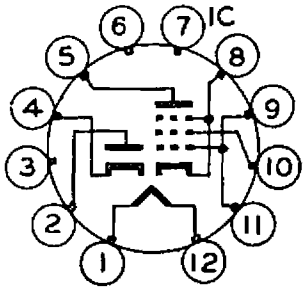


EIA 12-56

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Diode Plate
Pin 3 - No Connection
Pin 4 - Diode Cathode
Pin 5 - Pentode Plate
Pin 6 - No Connection
Pin 7 - Internal Connection - Do Not Use
Pin 8 - Pentode Cathode and Beam Plates
Pin 9 - Pentode Grid Number 1
Pin 10 - Pentode Grid Number 2 (Screen)
Pin 11 - Pentode Grid Number 1
Pin 12 - Heater

BASING DIAGRAM



EIA 12FC

GENERAL ELECTRIC

from JEDEC release #4213, April 8, 1963

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

PENTODE SECTION—HORIZONTAL-DEFLECTION AMPLIFIER SERVICE¶

DC Plate-Supply Voltage (Boost + DC Power Supply)	400	Volts
Peak Positive Pulse Plate Voltage	3500	Volts
Peak Negative Pulse Plate Voltage	0	Volts
Screen Voltage	150	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation#	9.0	Watts
Screen Dissipation	2.5	Watts
DC Cathode Current	140	Milliamperes
Peak Cathode Current	490	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms

DIODE SECTION—TV DAMPER SERVICE¶

Peak Inverse Plate Voltage	2500	Volts
Plate Dissipation	3.5	Watts
Steady-State Peak Plate Current	750	Milliamperes
DC Output Current	125	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
DC Component	400	Volts
Total DC and Peak	2500	Volts
Bulb Temperature at Hottest Point	220	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

PENTODE SECTION

Plate Voltage	3500	60	130	Volts
Screen Voltage	130	130	130	Volts
Grid-Number 1 Voltage	---	0Δ	-22.5	Volts
Plate Resistance, approximate	---	---	10000	Ohms
Transconductance	---	---	6500	Micromhos
Plate Current	---	320	48	Milliamperes
Screen Current	---	22	2.9	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 1.0 Milliamperes	-60	---	-40	Volts
Triode Amplification Factor**	---	---	4.0	

DIODE SECTION

Tube Voltage Drop		
Ib = 250 Milliamperes DC	21	Volts

FOOTNOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

† The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

‡ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

§ Without external shield.

¶ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cyle of the voltage pulse must not exceed 15 percent of one scanning cycle.

\# In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Δ Applied for short interval (two seconds maximum) so as not to damage tube.

** Triode connection (screen tied to plate) with Eb = Ec2 = 130 volts and Ec1 = -22.5 volts.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

—PRODUCT INFORMATION—

Compactron Diode-Pentode

33GY7-A

The 33GY7-A is a compactron containing a high-perveance diode and a beam-power pentode. The diode is intended for service as the damping diode and the pentode as the horizontal-deflection amplifier in television receivers.

The 33GY7-A is unilaterally interchangeable with the 33GY7 and differs only in utilizing a dimple anode construction to minimize snivets.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	33.6	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

Direct Interelectrode Capacitances, approximate¶

Diode Section

Cathode to Plate and Heater:		
k to (p + h)	8.5	pf
Plate to Cathode and Heater:		
p to (k + h)	5.2	pf
Heater to Cathode: (h to k)	3.2	pf

Pentode Section

Grid-Number 1 to Plate: (g1 to p)	0.2	pf
Input: g1 to (h + k + g2 + b.p.)	17	pf
Output: p to (h + k + g2 + b.p.)	7.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing - EIA 12-56

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches
Minimum Seated Height	2.250	Inches

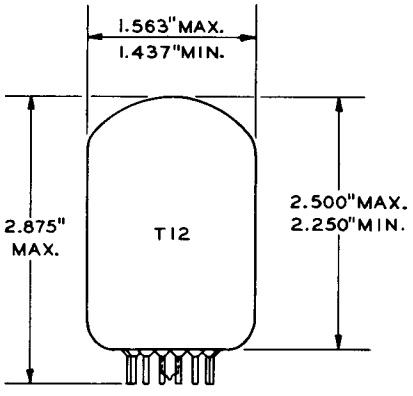
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

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PHYSICAL DIMENSIONS

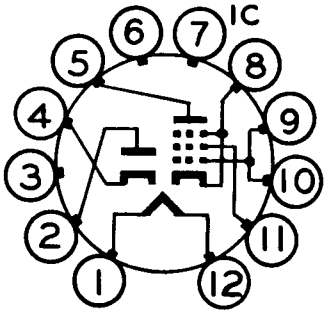


EIA 12-56

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Diode Plate
#Pin 3 - No Connection
Pin 4 - Diode Cathode
Pin 5 - Pentode Plate
#Pin 6 - No Connection
#Pin 7 - Internal Connection
Pin 8 - Pentode Cathode and Beam Plates
Pin 9 - Pentode Grid Number 1
Pin 10 - Pentode Grid Number 1
Pin 11 - Pentode Grid Number 2 (Screen)
Pin 12 - Heater

BASING DIAGRAM



EIA 12FN

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE△—Pentode Section

DC Plate-Supply Voltage (Boost + DC Power Supply)	400	Volts
Peak Positive Pulse Plate Voltage	5000	Volts
Peak Negative Pulse Plate Voltage	0	Volts
Screen Voltage	150	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation**	9.0	Watts
Screen Dissipation	3.0	Watts
DC Cathode Current	155	Milliamperes
Peak Cathode Current	540	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms

TV DAMPER SERVICE△—Diode Section

Peak Inverse Plate Voltage	4200	Volts
Plate Dissipation	3.8	Watts
Steady-State Peak Plate Current	810	Milliamperes
DC Output Current	135	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
DC Component	400	Volts
Total DC and Peak	4200	Volts
Bulb Temperature at Hottest Point	200	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	5000	50	60	130	Volts
Screen Voltage	130	130	130	130	Volts
Grid-Number 1 Voltage	---	0‡‡	0‡‡	-22.5	Volts
Plate Resistance, approximate	---	---	---	10000	Ohms
Transconductance	---	---	---	6500	Micromhos
Plate Current	---	315	320	48	Milliamperes
Screen Current	---	20	22	2.9	Milliamperes
Grid-Number 1 Voltage, approximate Ib = 1.0 Milliamperes	-80	---	---	-40	Volts
Triode Amplification Factor§§	---	---	---	4.0	

Diode Section

Tube Voltage Drop Ib = 250 Milliamperes DC	21	Volts

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

NOTES

* Heater Voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ Without external shield.

\# Socket terminals 3, 6, and 7 should not be used as tie points.

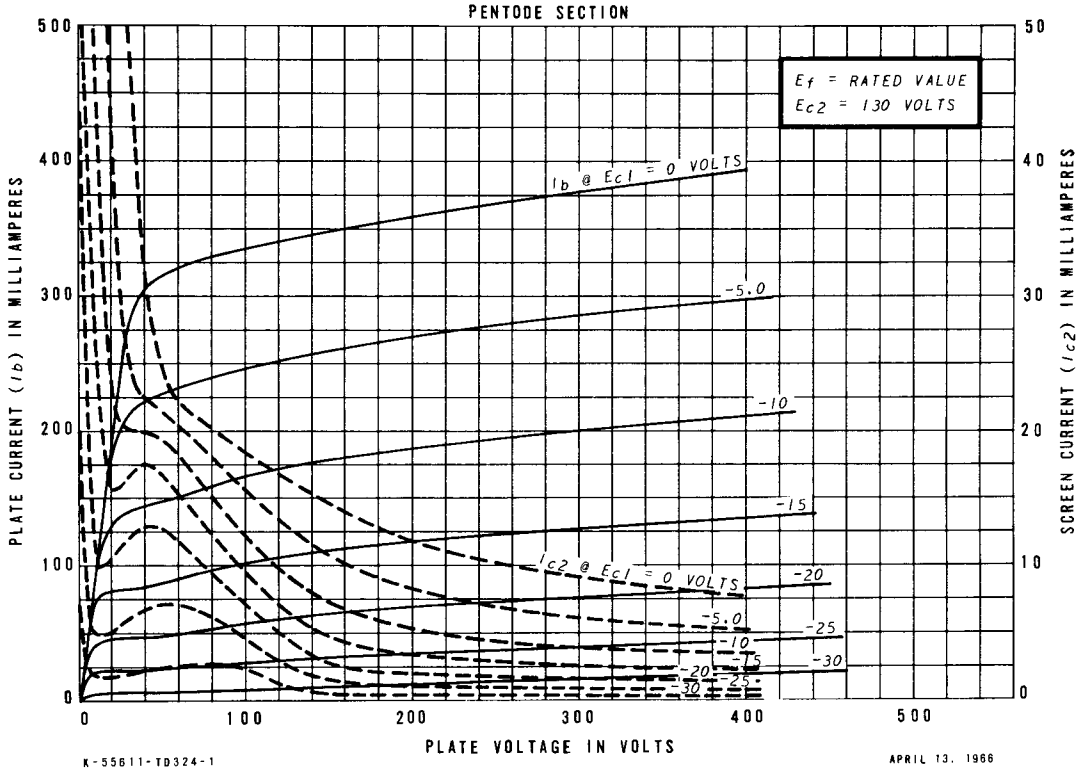
Δ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

** In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

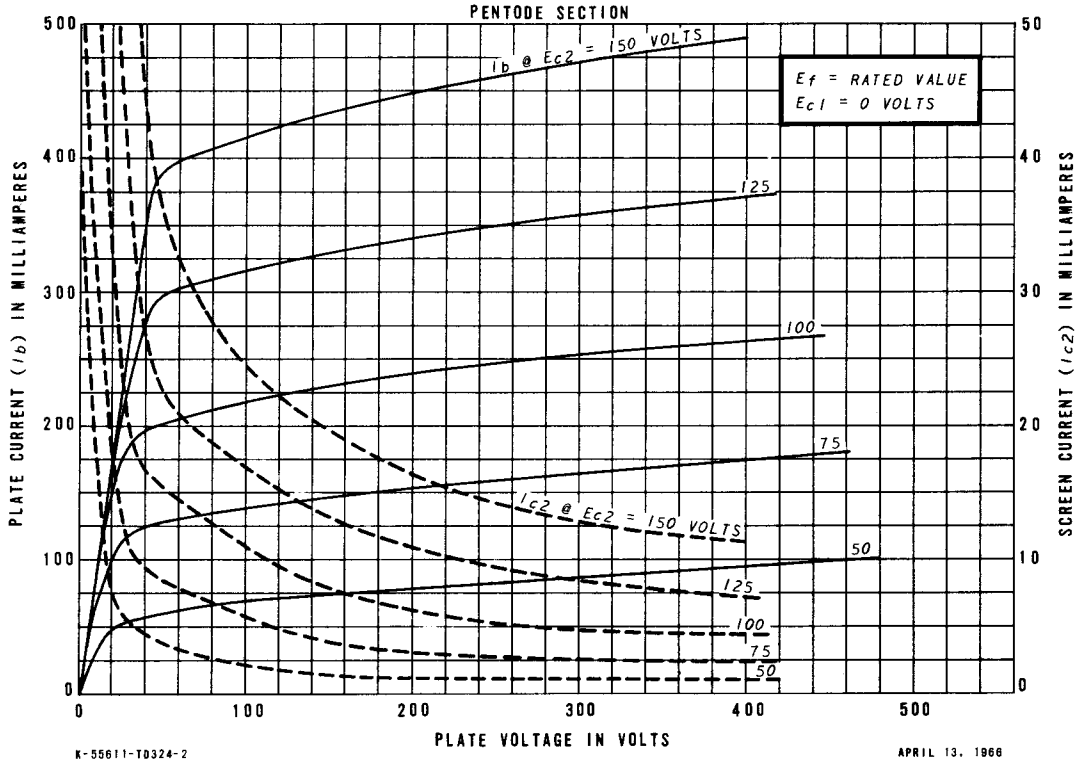
‡‡ Applied for short interval (two seconds maximum) so as not to damage tube.

§§ Triode connection (screen tied to plate) with Eb = Ec2 = 130 volts and Ec1 = -22.5 volts.

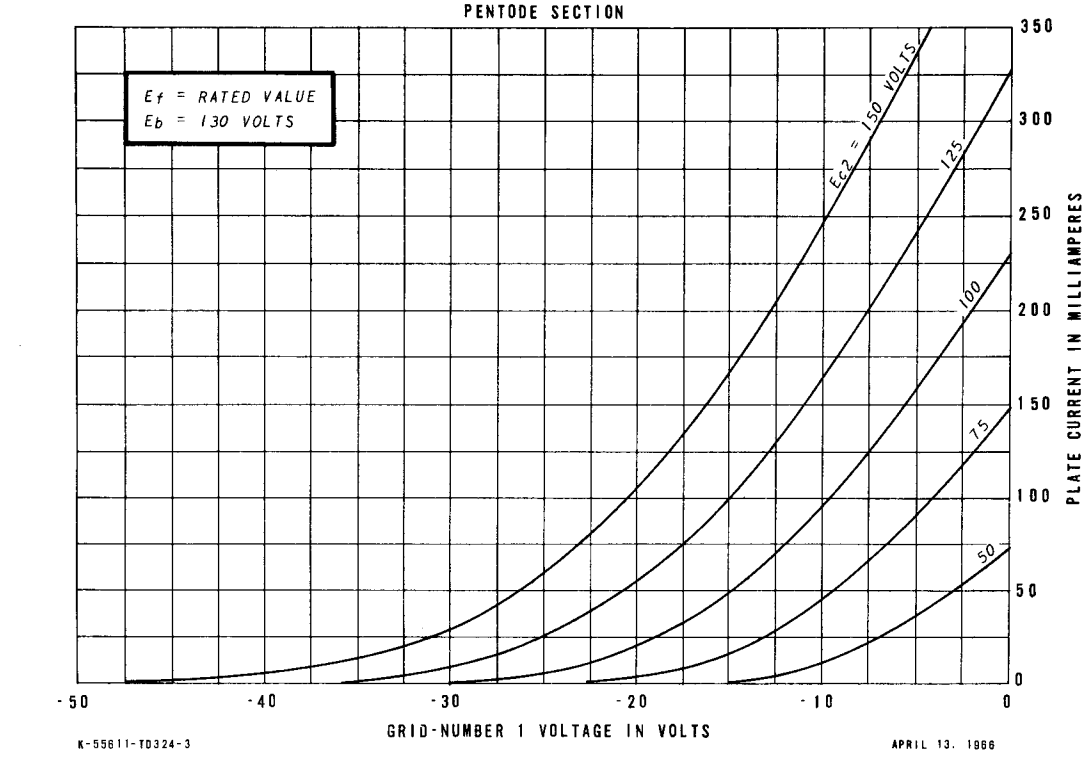
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

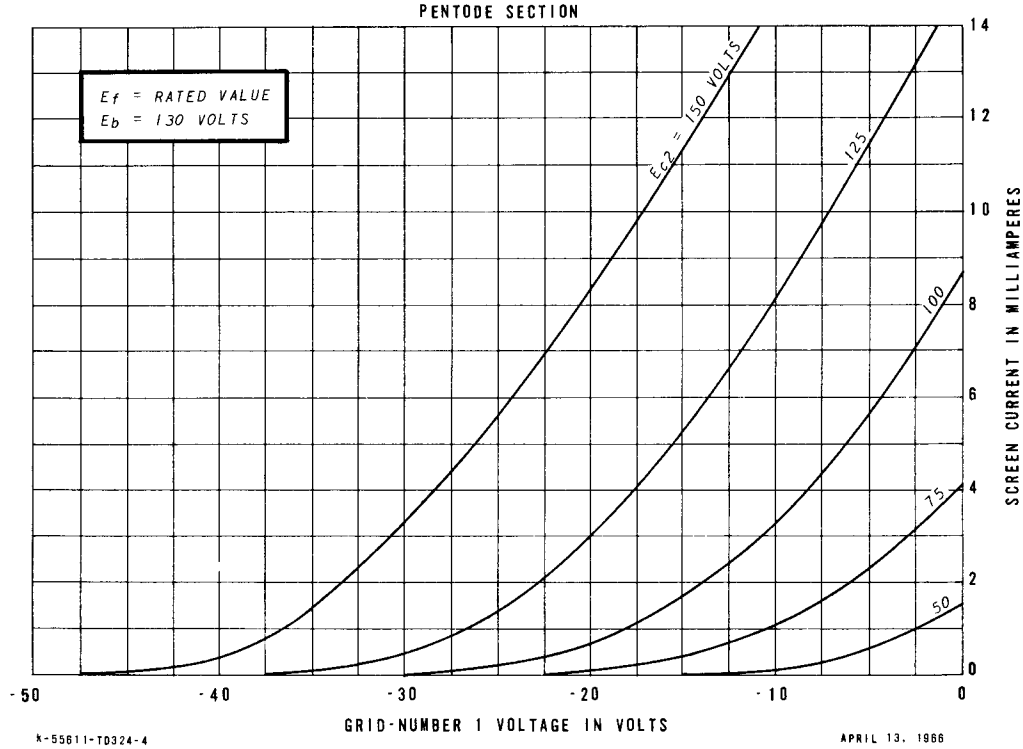


AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

PENTODE SECTION

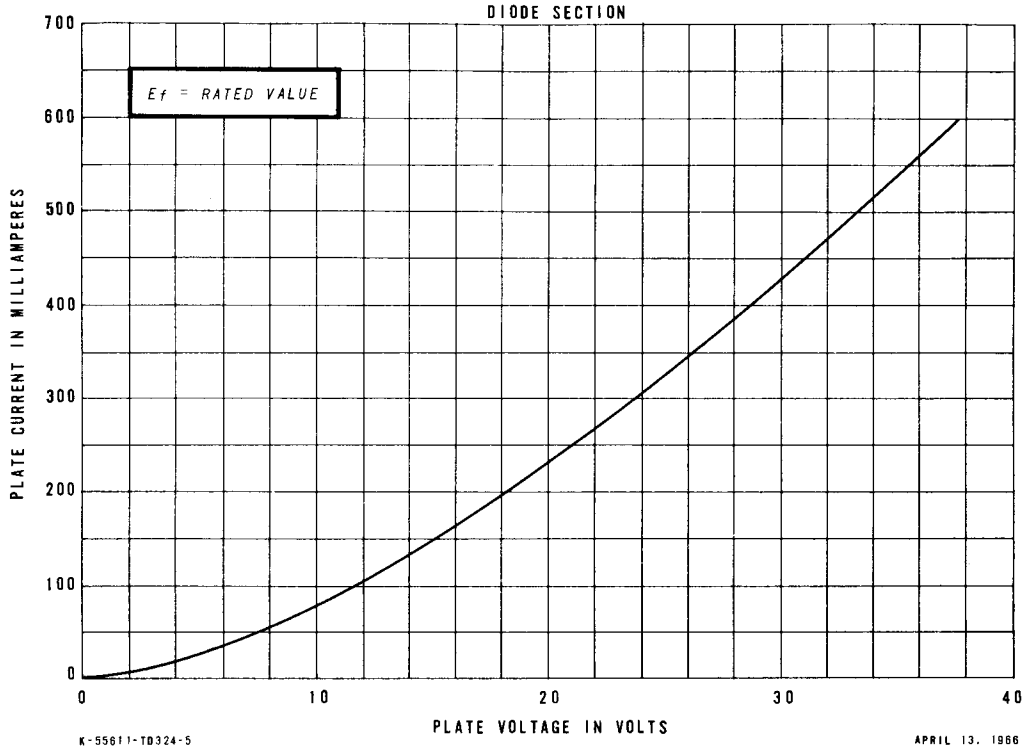


K-55611-TD324-4

APRIL 13, 1966

AVERAGE PLATE CHARACTERISTICS

DIODE SECTION



K-55611-TD324-5

APRIL 13, 1966

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

—PRODUCT INFORMATION—

Compactron Diode

34CE3

FOR TV DAMPING DIODE APPLICATIONS

- COLOR TV TYPE
- LOW TUBE DROP
- DIFFUSION BONDED CATHODE
- 5000 VOLTS DC
- 350 MILLIAMPERES DC

The 34CE3 is a compactron containing a single heater-cathode type diode. It is intended for service as the damping diode in the horizontal deflection circuit of color television receivers.

The diffusion bonded cathode practically eliminates one of the major failure mechanisms in damping diodes, which is plate-to-cathode arcing caused by emissive particles being pulled from the cathode by the high electrostatic field.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	34.5	Volts
Heater Current♦	0.45 ± 0.03	Amperes
Heater Warm-up Time, average●	11	Seconds

Direct Interelectrode Capacitances, approximate♦

Cathode to Plate and Heater: k to (p + h)	18	pf
Plate to Cathode and Heater: p to (k + h)	13	pf
Heater to Cathode: (h to k)	5.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing - EIA 9-62

Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.375	Inches
Maximum Seated Height	3.000	Inches
Minimum Seated Height	2.750	Inches

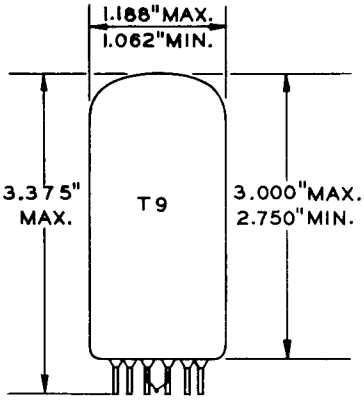
MAXIMUM RATINGS

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PHYSICAL DIMENSIONS

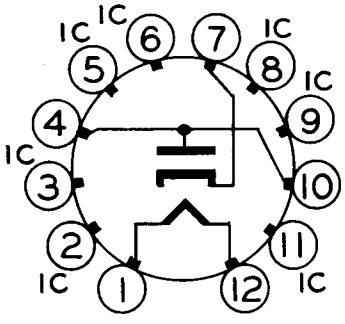


EIA 9-62

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Internal Connection - Do Not Use
Pin 3 - Internal Connection - Do Not Use
Pin 4 - Plate
Pin 5 - Internal Connection - Do Not Use
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Cathode
Pin 8 - Internal Connection - Do Not Use
Pin 9 - Internal Connection - Do Not Use
Pin 10 - Plate
Pin 11 - Internal Connection - Do Not Use
Pin 12 - Heater

BASING DIAGRAM



EIA 12GK

MAXIMUM RATINGS (Cont'd)

TV DAMPER SERVICE▲—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	5000	Volts
Plate Dissipation	11	Watts
Steady-State Peak Plate Current	1500	Milliamperes
DC Output Current	350	Milliamperes
Heater-Cathode Voltage		
Heater Positive with respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with respect to Cathode		
DC Component	900	Volts
Total DC and Peak	5000	Volts

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 680 Milliamperes DC	20	Volts

NOTES

★ Heater voltage for a bogey tube at If = 0.45 amperes.

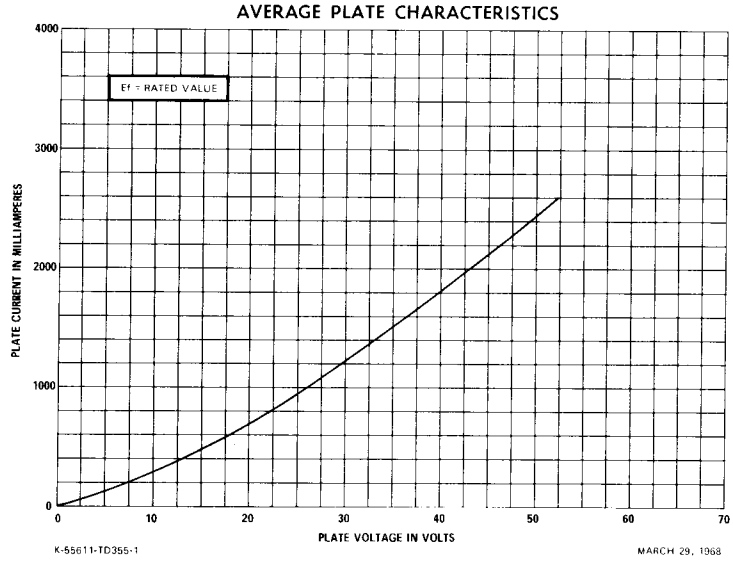
♦ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

● The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

♦ Without external shield.

▲ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

AVERAGE PLATE CHARACTERISTICS



K-55611-TD355-1 MARCH 29, 1968

TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Diode

34DK3

FOR TV DAMPING DIODE APPLICATIONS

- COLOR TV TYPE
- LOW TUBE DROP
- 6,500 VOLTS DC AND PEAK
- 400 MILLIAMPERES DC

The 34DK3 is a heater–cathode type diode intended for service as the damping diode in the horizontal–deflection circuit of color television receivers. It utilizes a unique heater – cathode insulating system making possible a rating of 6,500 volts peak. The 34DK3 also features a top cap connection to the cathode, a T – 9 bulb and a 9 – pin glass button base with a 0.687 – inch pin circle.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	34.5	Volts
Heater Current●	0.45±0.03	Amperes
Heater Warm-up Time, average▲	11	Seconds

Direct Interelectrode Capacitances, approximate♦

Cathode to Plate and Heater: k to (p+h)	.22	pf
Plate to Cathode and Heater: p to (k+h)	.13.6	pf
Heater to Cathode: (h to k)	.1.10	pf

MECHANICAL

Operating Position - Any

Envelope - T-9, Glass

Base - E9-89, Button 9-Pin

Top Cap - C1-2, Skirted Miniature

Outline Drawing - EIA 9-117

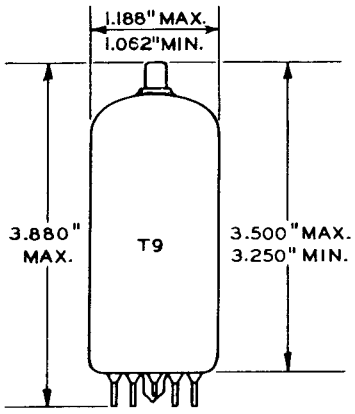
Maximum Diameter	1.188	Inches
Minimum Diameter	1.062	Inches
Maximum Over-all Length	3.880	Inches
Maximum Seated Height	3.500	Inches
Minimum Seated Height	3.250	Inches

MAXIMUM RATINGS

TV DAMPER SERVICE§—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	6,500	Volts
Plate Dissipation	9.0	Watts
Steady-State Peak Plate Current	1,200	Milliamperes
DC Output Current	400	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	300	Volts
Heater Negative with Respect to Cathode		
DC Component	900	Volts
Total DC and Peak	6,500	Volts
Bulb Temperature□	220	°C

PHYSICAL DIMENSIONS

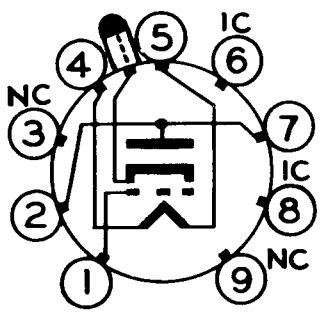


EIA 9-117

TERMINAL CONNECTIONS⊕

Pin 1 - Heater Insulation Coil
Pin 2 - Plate
Pin 3 - No Connection
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Internal Connection - Do Not Use
Pin 7 - Plate
Pin 8 - Internal Connection - Do Not Use
⊕ Pin 9 - No Connection
Cap - Cathode

BASING DIAGRAM



EIA 9SG

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

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AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 400 Milliamperes	16	Volts
Ib = 800 Milliamperes	25	Volts

NOTES

★ Heater voltage for a bogey tube at If = 0.45 amperes.

● The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

▲ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

♦ Without external shield.

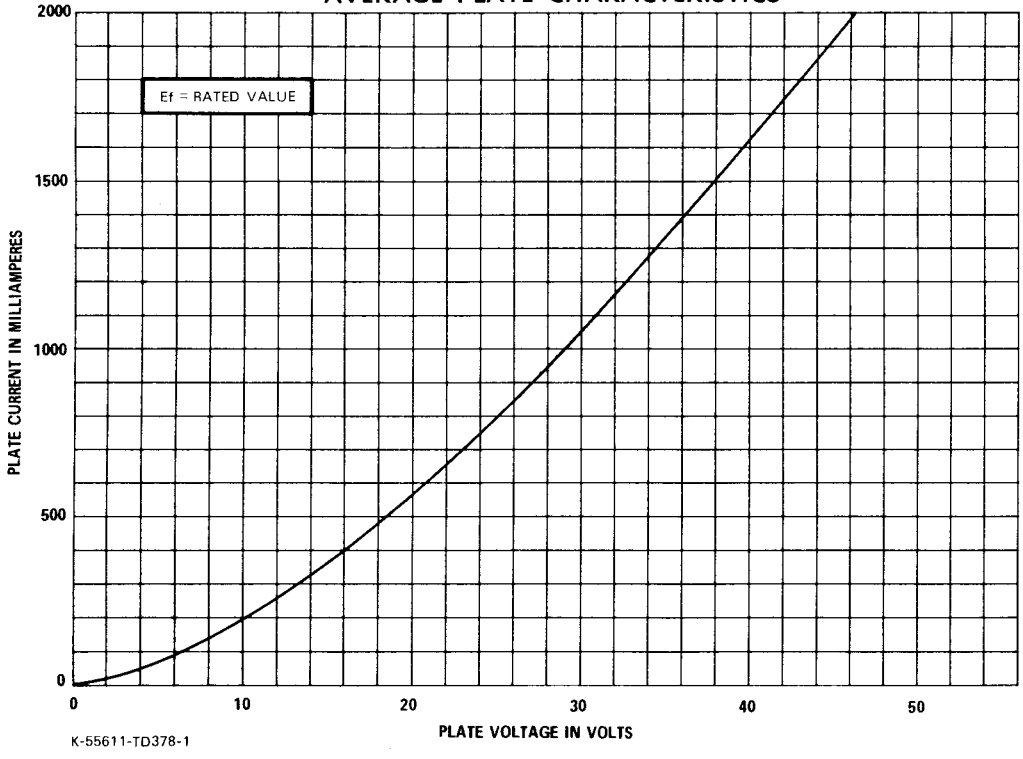
§ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

□ Measured with an infrared thermometer, Ircon Model 700 BC or equivalent

⊕ May be used as tie point for components at or near heater potential

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AVERAGE PLATE CHARACTERISTICS



Electronic TUBES

35C5

BEAM PENTODE

DESCRIPTION AND RATING

The 35C5 is a miniature beam pentode primarily designed for use in the audio-frequency power output stage of radio receivers. Features include high power sensitivity and high efficiency at relatively low plate and screen voltages.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC	35.0	Volts
Heater Current	0.15	Amperes
Direct Interelectrode Capacitances, approximate*		
Grid-Number 1 to Plate	0.6	μμf
Input	12	μμf
Output	9.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	135	Volts
Screen Voltage	117	Volts
Plate Dissipation	4.5	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	180	Volts
Heater Negative with Respect to Cathode	180	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.5	Megohms
Bulb Temperature at Hottest Point	250	C

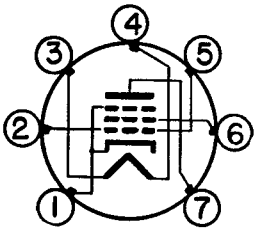
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	110	Volts
Screen Voltage	110	Volts
Grid-Number 1 Voltage	−7.5	Volts
Peak AF Grid-Number 1 Voltage	7.5	Volts
Plate Resistance, approximate	13000	Ohms
Transconductance	5800	Micromhos
Zero-Signal Plate Current	40	Milliamperes
Maximum-Signal Plate Current	41	Milliamperes
Zero-Signal Screen Current	3.0	Milliamperes
Maximum-Signal Screen Current	7.0	Milliamperes
Load Resistance	2500	Ohms
Total Harmonic Distortion, approximate	10	Percent
Maximum-Signal Power Output	1.5	Watts

* Without external shield.

BASING DIAGRAM

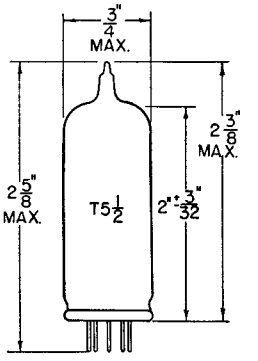


RETMA 7CV

TERMINAL CONNECTIONS

Pin 1—Cathode and Beam Plates
Pin 2—Grid Number 1
Pin 3—Heater
Pin 4—Heater
Pin 5—Grid Number 1
Pin 6—Grid Number 2 (Screen)
Pin 7—Plate

PHYSICAL DIMENSIONS

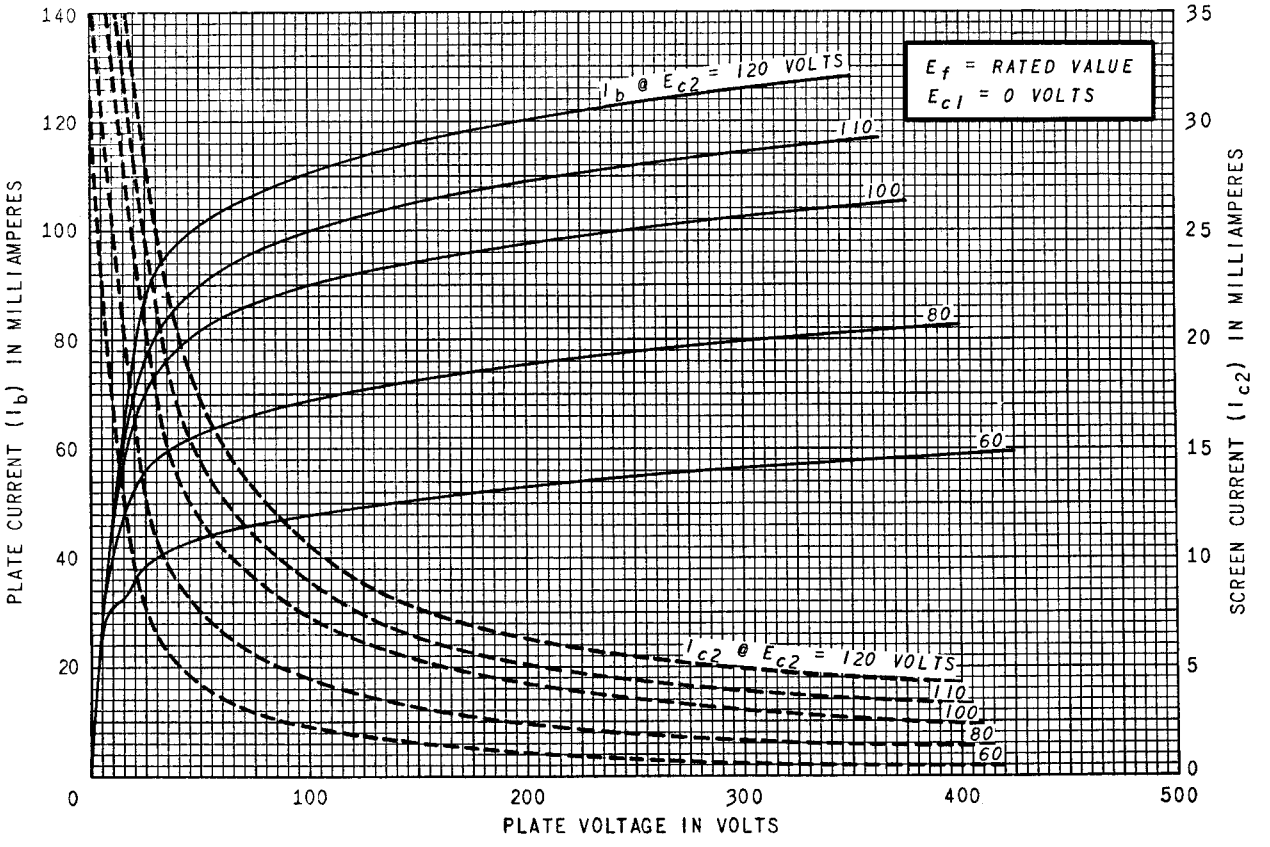


RETMA 5-3

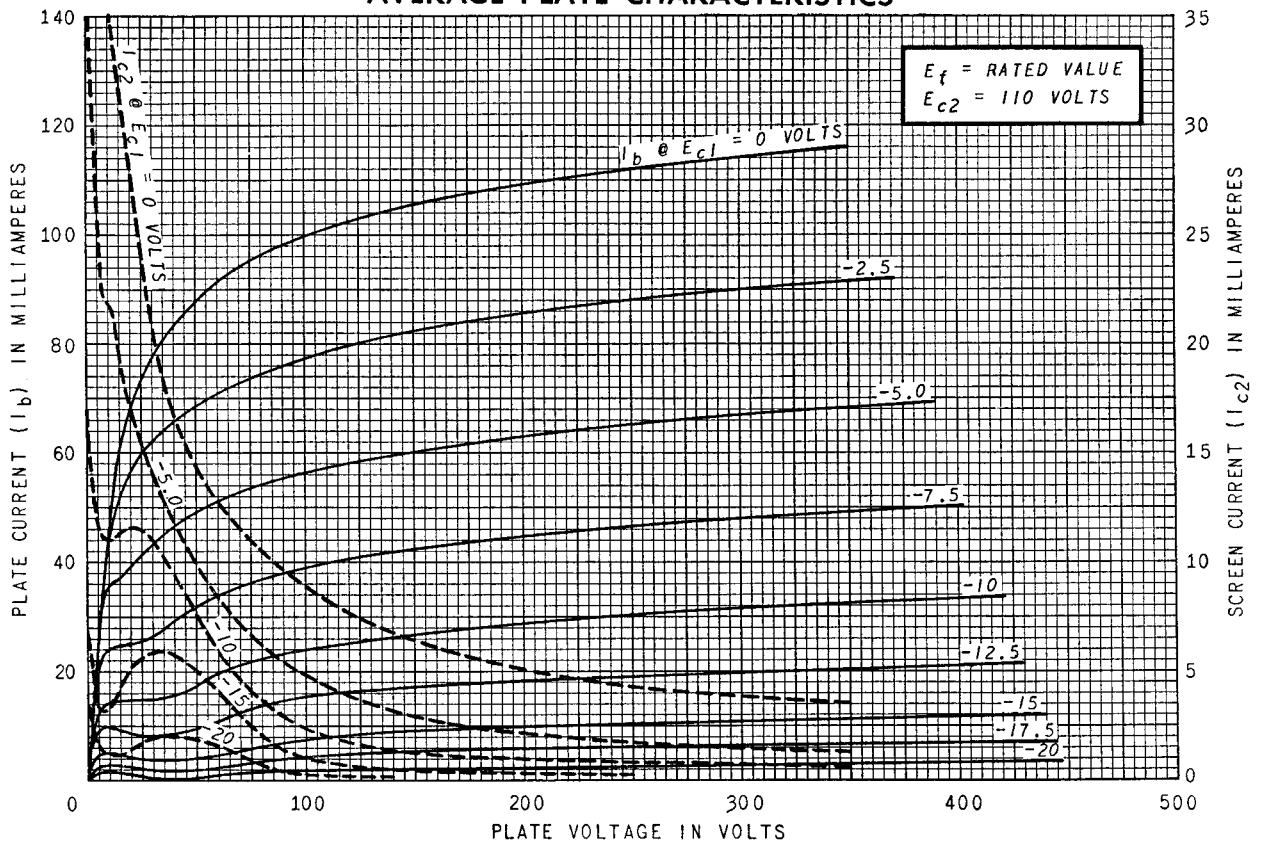
GENERAL ELECTRIC

Supersedes ET-T524A, dated 3-50

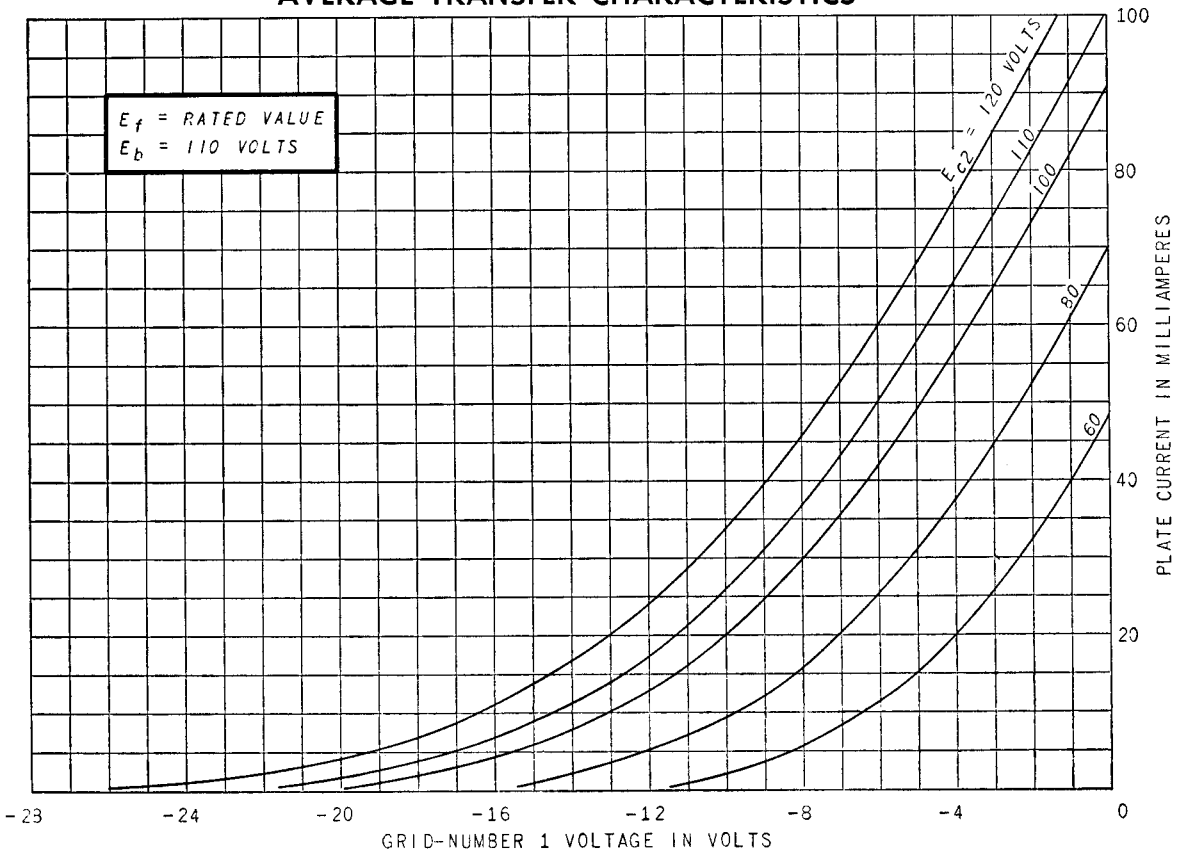
AVERAGE PLATE CHARACTERISTICS



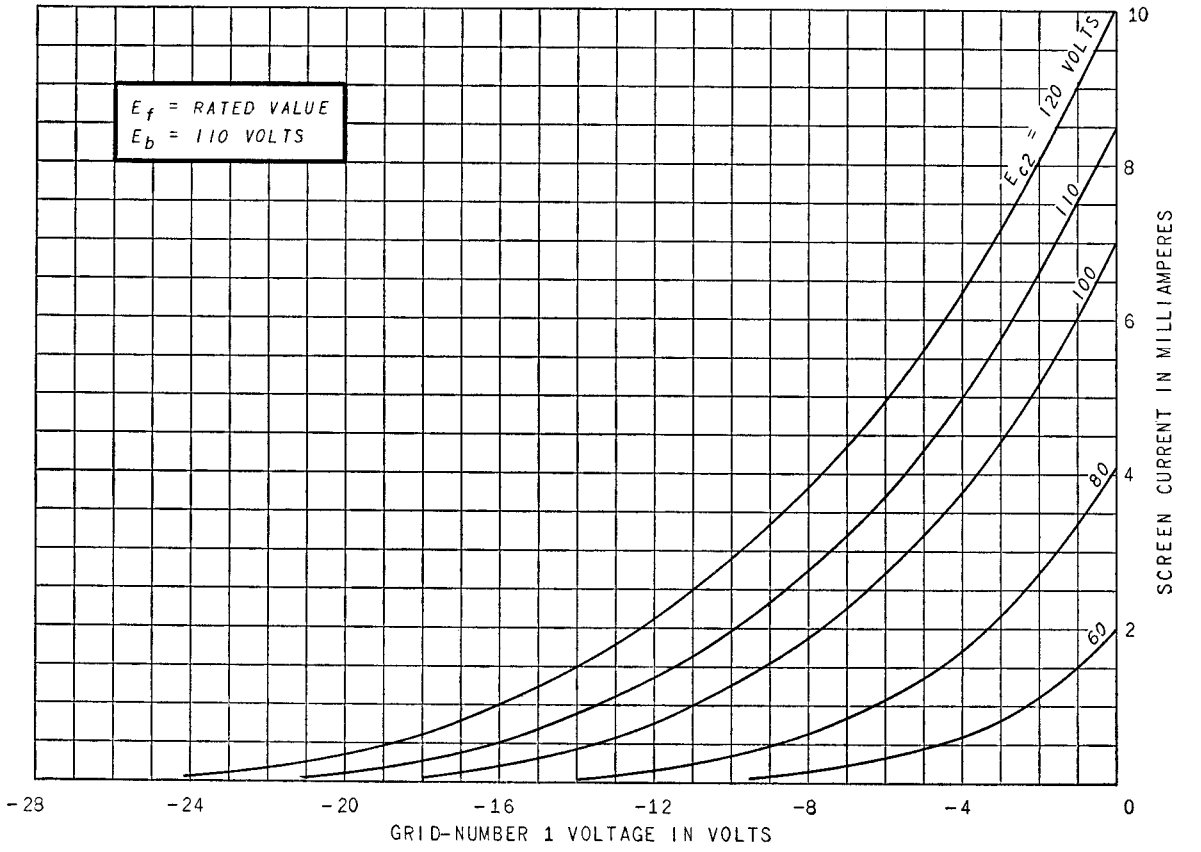
AVERAGE PLATE CHARACTERISTICS



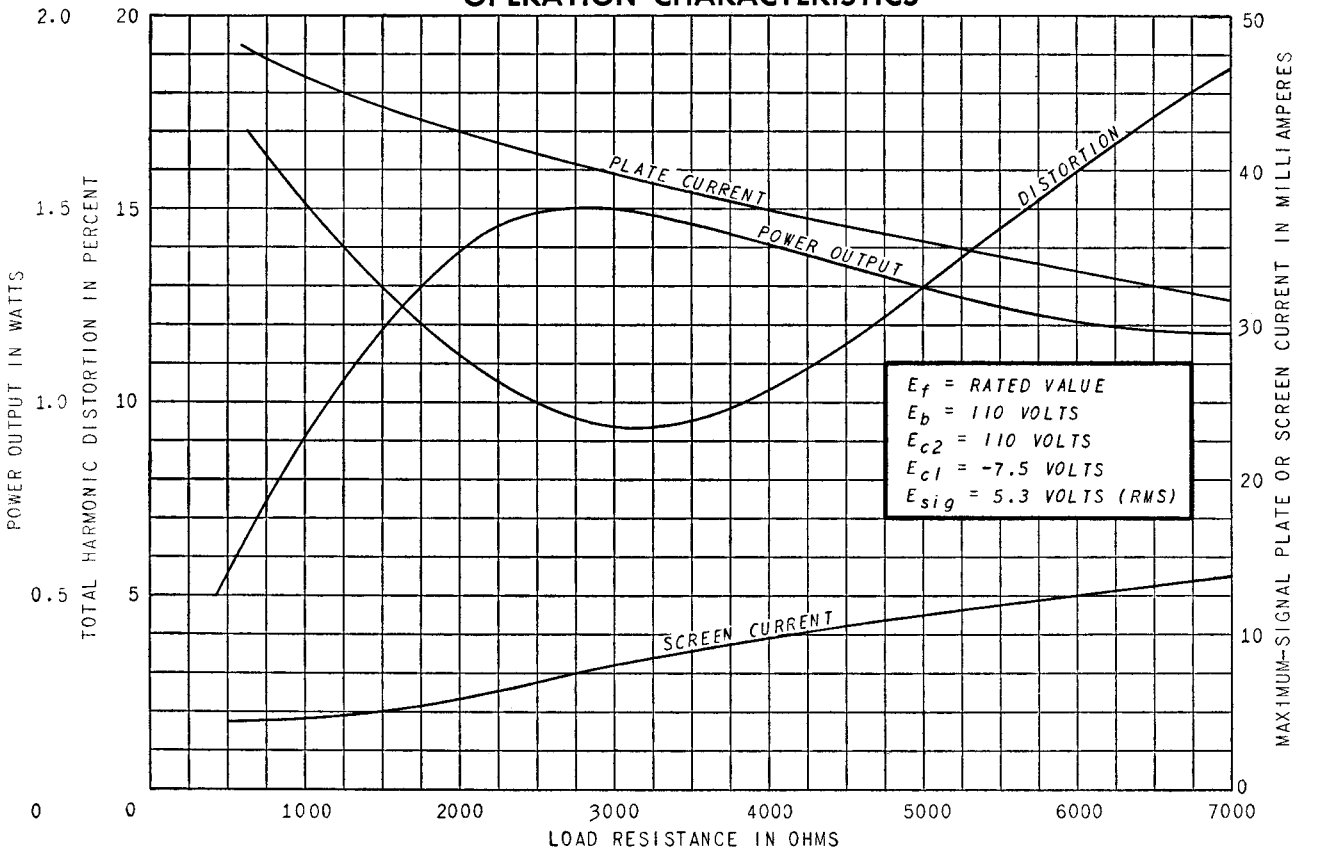
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



OPERATION CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

35GL6

BEAM PENTODE

DESCRIPTION AND RATING

The 35GL6 is a miniature beam pentode primarily designed for use in the audio-frequency power output stage of radio receivers. Features include high power sensitivity and high efficiency at relatively low plate and screen voltages. The heater of the 35GL6 is tapped to permit operation of a panel lamp.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC*	35 ± 10%	Volts
Heater-Tap Voltage*	7.0	Volts
Heater Current*	0.15	Amperes
Direct Interelectrode Capacitances, approximate†		
Grid-Number 1 to Plate	0.5	μμf
Input	14	μμf
Output	9.5	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Heater-Tap Voltage when Panel Lamp Fails, RMS	14	Volts
Plate Voltage	150	Volts
Screen Voltage	130	Volts
Plate Dissipation	5.5	Watts
Screen Dissipation	1.1	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	200	Volts
Heater Negative with Respect to Cathode	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.5	Megohms
Bulb Temperature at Hottest Point	225	C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

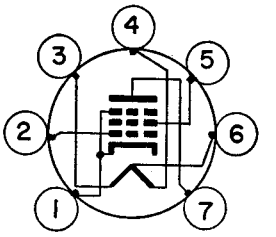
These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

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GENERAL ELECTRIC

BASING DIAGRAM

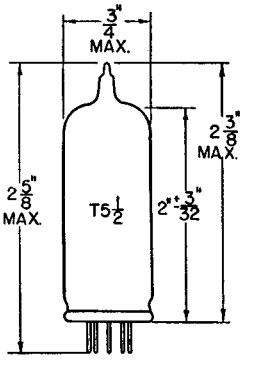


EIA 7FZ

TERMINAL CONNECTIONS

Pin 1—Cathode and Beam Plates
Pin 2—Grid Number 1
Pin 3—Heater
Pin 4—Heater
Pin 5—Grid Number 2 (Screen)
Pin 6—Heater Tap
Pin 7—Plate

PHYSICAL DIMENSIONS



EIA 5-3

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	110	Volts
Screen Voltage	110	Volts
Grid-Number 1 Voltage	−7.5	Volts
Peak AF Grid-Number 1 Voltage	7.5	Volts
Plate Resistance, approximate	12000	Ohms
Transconductance	7500	Micromhos
Zero-Signal Plate Current	45	Milliamperes
Maximum-Signal Plate Current	47	Milliamperes
Zero-Signal Screen Current	3.0	Milliamperes
Maximum-Signal Screen Current	9.0	Milliamperes
Load Resistance	2500	Ohms
Total Harmonic Distortion, approximate	8	Percent
Maximum-Signal Power Output	1.8	Watts

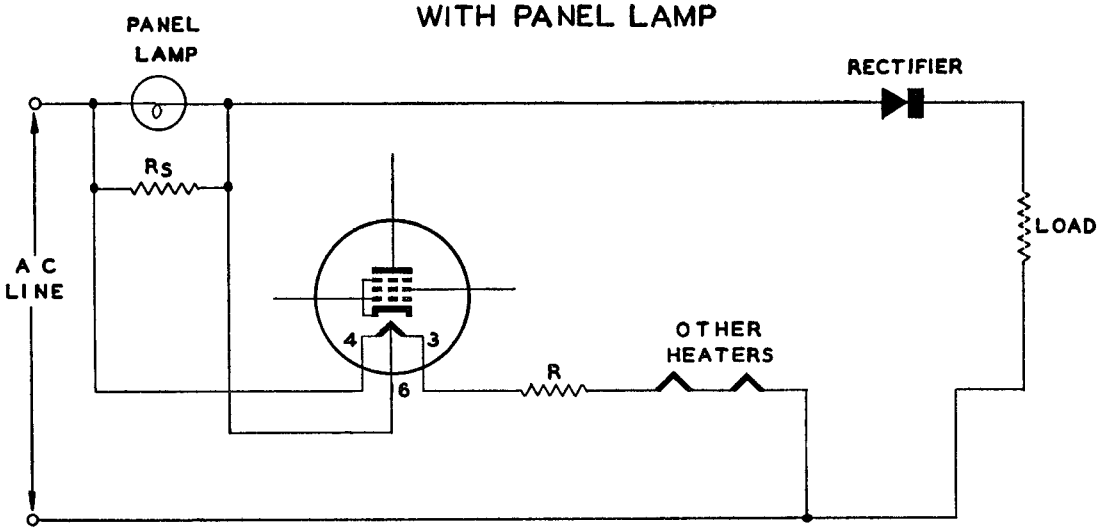
* Operation without panel lamp.
† Without external shield.

The 35GL6 has a heater tap, which may be used for operating a 6.3-volt, 150-milliampere panel lamp in equipment employing semiconductor rectifiers. The table below gives the required values of panel-lamp shunting resistor for various rectifier load currents.

SHUNTING RESISTOR REQUIRED WITH PANEL LAMP NUMBER 40 OR NUMBER 47 (See Typical Circuit)

Heater Voltage (Pin 3 to Pin 4)	32	32	32	32	32	32	32	Volts
Heater-Tap Voltage (Pin 4 to Pin 6)	5.0	5.4	5.5	5.5	5.5	5.5	5.5	Volts
Heater Current (Between Pins 3 and 6)	150	150	150	150	150	150	150	Milliamperes
Panel-Lamp Shunting Resistor	—	—	370	175	120	88	73	Ohms
Rectifier Load Current‡	60	70	80	90	100	110	120	Milliamperes

TYPICAL CIRCUIT FOR OPERATION WITH PANEL LAMP

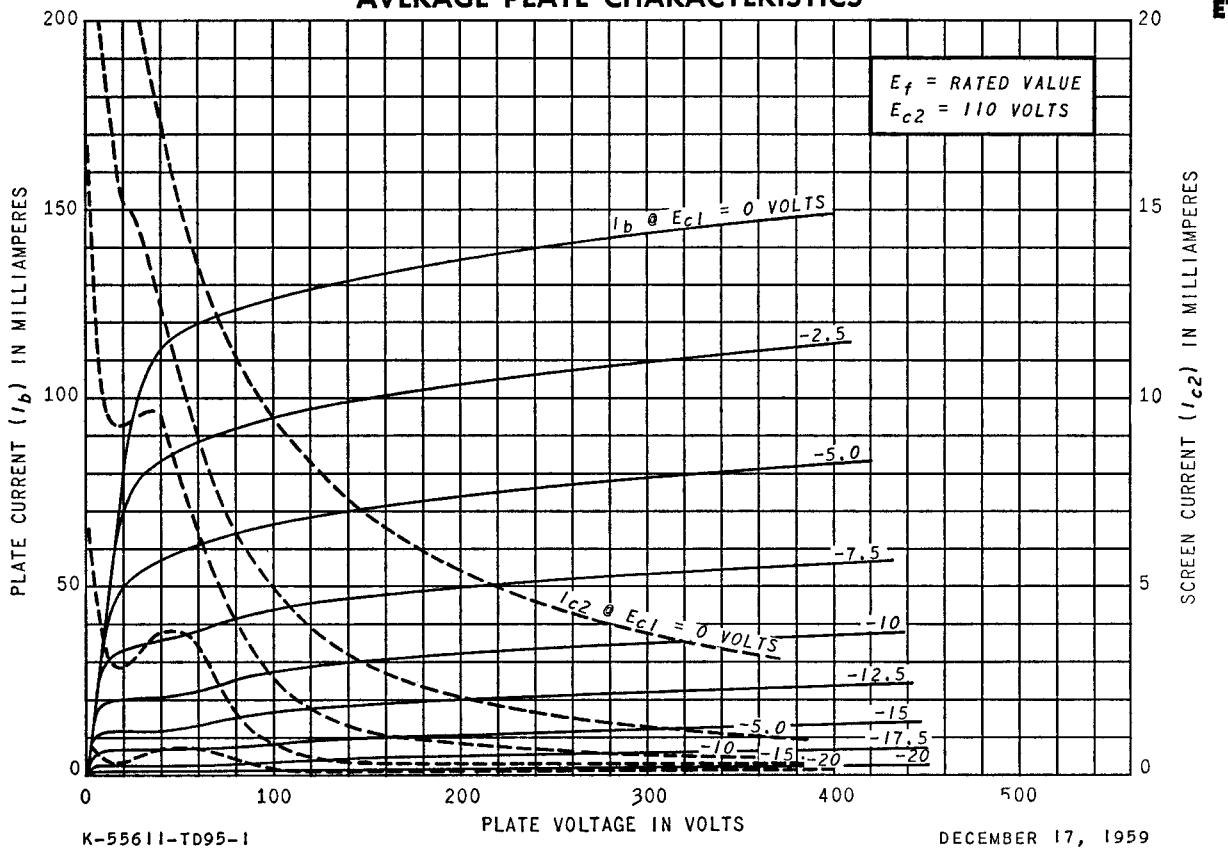


Rs = PANEL-LAMP SHUNTING RESISTOR

DROP ACROSS R AT 0.15 AMPERE SHOULD EQUAL DIFFERENCE BETWEEN LINE VOLTAGE AND TOTAL OF ALL RATED HEATER VOLTAGES

‡ Higher load currents will require smaller values of panel-lamp shunting resistor. For maximum panel-lamp life, the shunting resistor should be selected to allow a panel-lamp voltage of 5.5 volts with full rectifier load current.

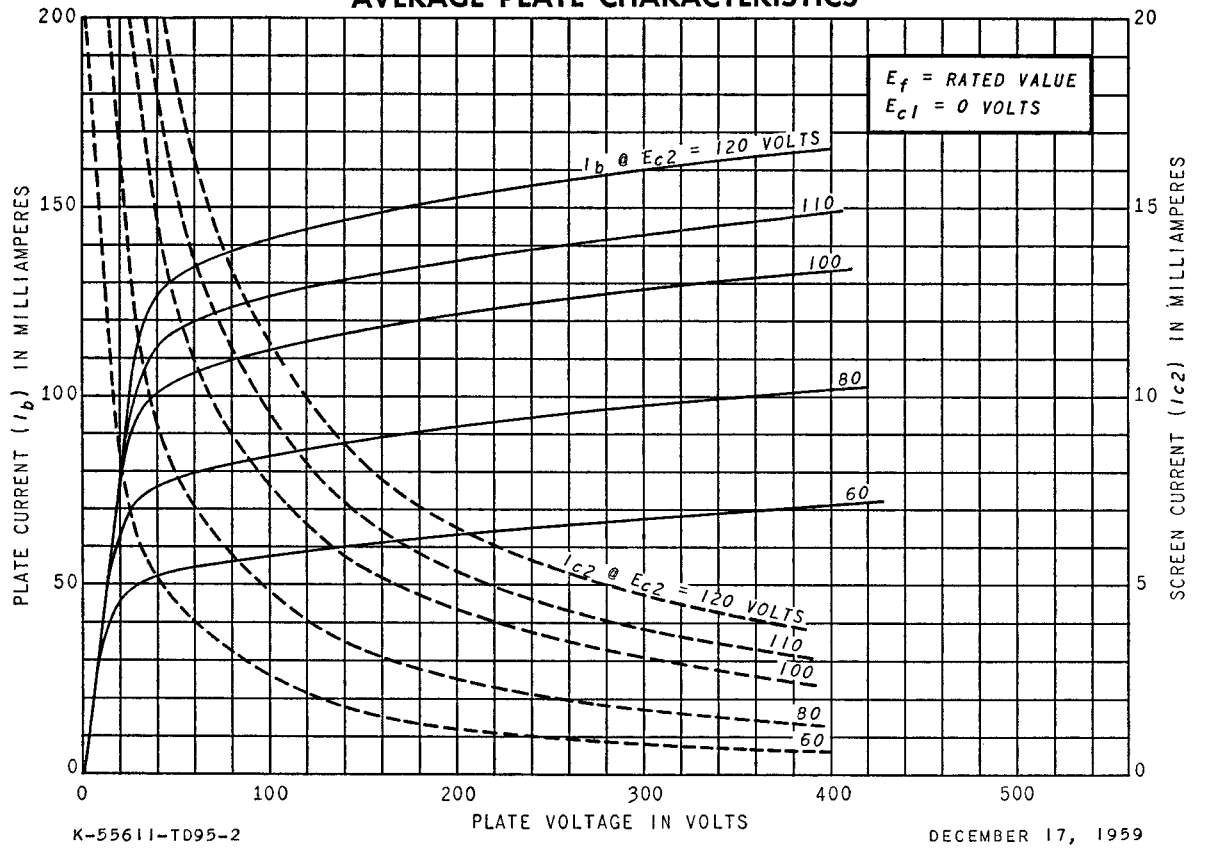
AVERAGE PLATE CHARACTERISTICS



K-55611-TD95-1

DECEMBER 17, 1959

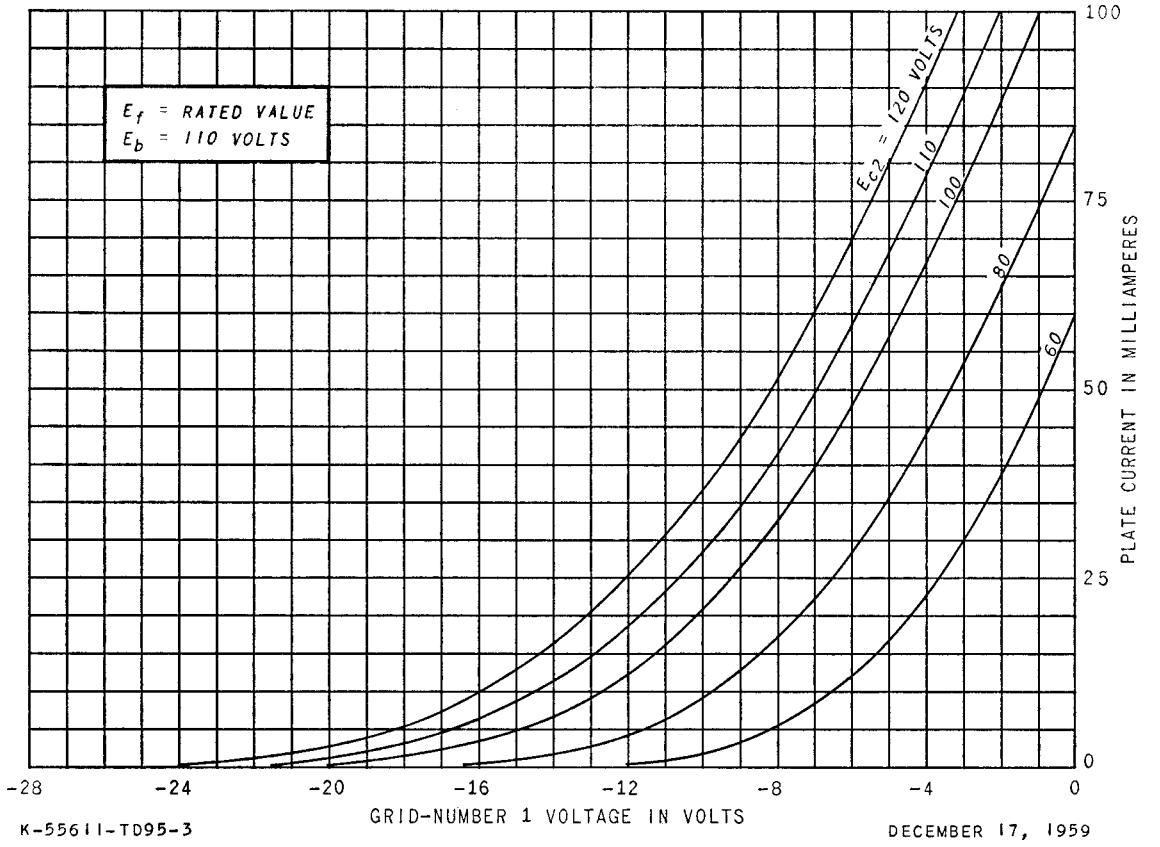
AVERAGE PLATE CHARACTERISTICS



K-55611-TD95-2

DECEMBER 17, 1959

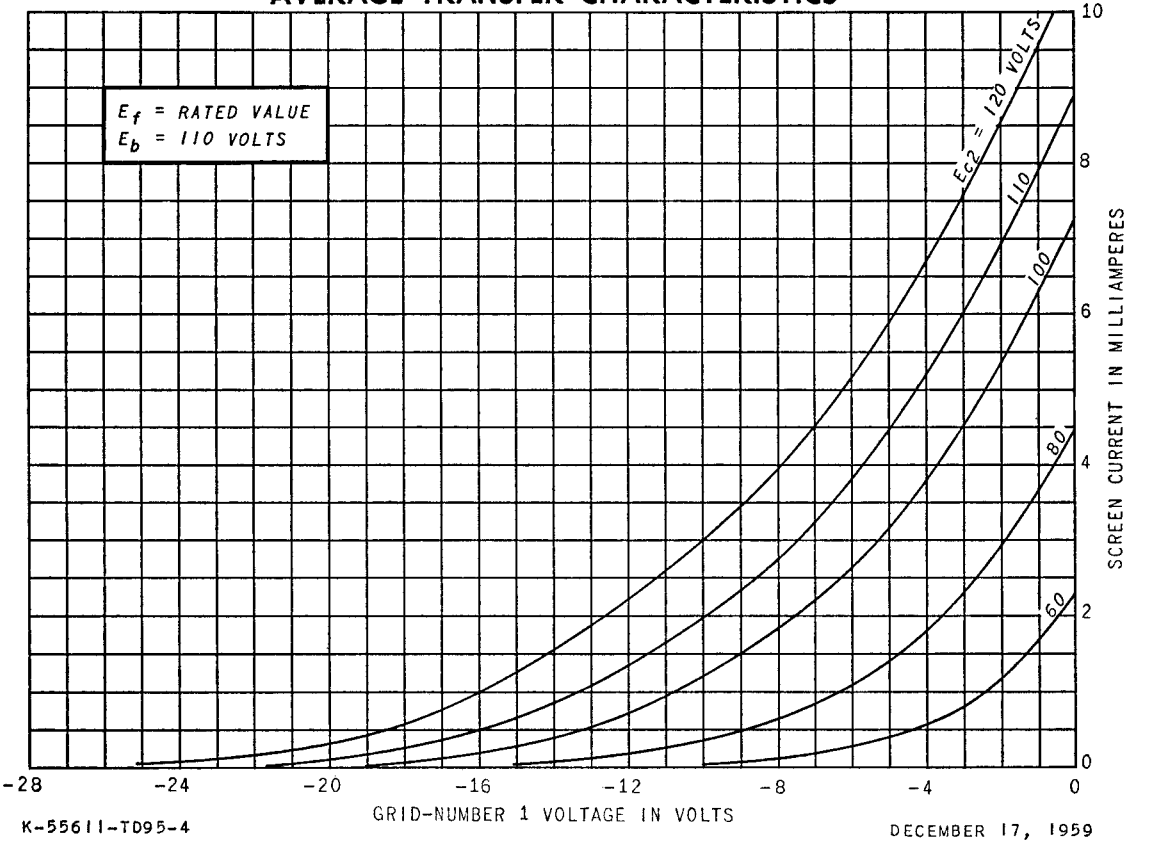
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD95-3

DECEMBER 17, 1959

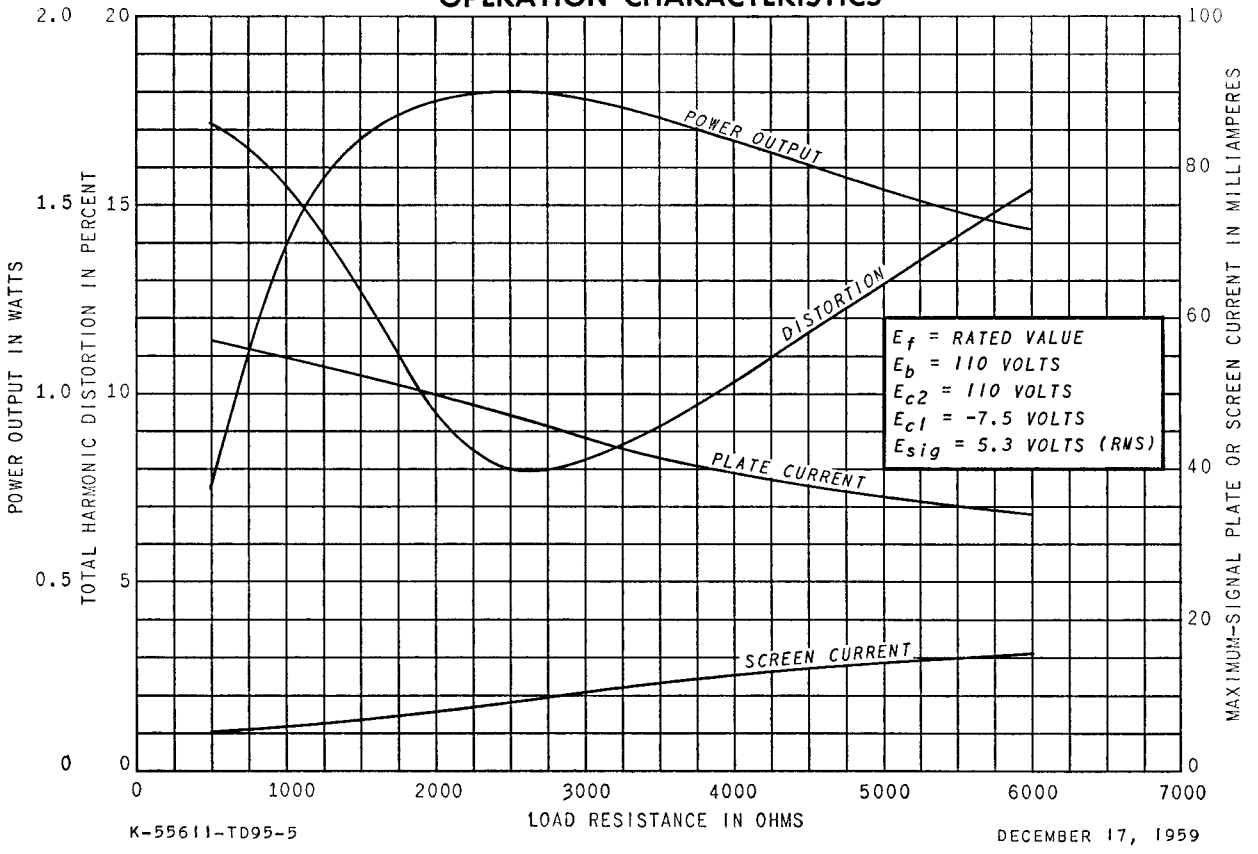
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD95-4

DECEMBER 17, 1959

OPERATION CHARACTERISTICS



Electronic TUBES

35L6-GT

BEAM PENTODE

DESCRIPTION AND RATING

The 35L6-GT is a beam pentode primarily designed for use in the audio frequency power output stage of radio receivers. Features include high power sensitivity and high efficiency at relatively low plate and screen voltages.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	35.0	Volts
Heater Current	0.15	Amperes

MECHANICAL

Mounting Position—Any

Envelope—T-9, Glass

Base—B6-81 or B7-7, Intermediate-Shell Octal 6- or 7-Pin
or B6-84 or B7-47, Short Intermediate-Shell Octal 6- or 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	200	Volts
Screen Voltage	125	Volts
Plate Dissipation	8.5	Watts
Screen Dissipation	1.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.5	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

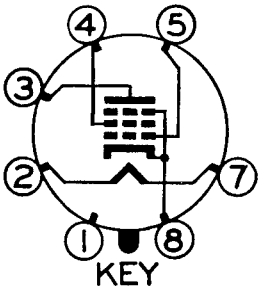
CLASS A_1 AMPLIFIER

Plate Voltage	110	200	Volts
Screen Voltage	110	125	Volts
Grid-Number 1 Voltage	−7.5	.....	Volts
Cathode-Bias Resistor	.....	180	Ohms
Peak AF Grid-Number 1 Voltage	7.5	8.0	Volts
Plate Resistance, approximate	14000	34000	Ohms
Transconductance	5800	6100	Micromhos
Zero-Signal Plate Current	40	43	Milliamperes
Maximum-Signal Plate Current	41	43	Milliamperes
Zero-Signal Screen Current	3.0	2.0	Milliamperes
Maximum-Signal Screen Current	7.0	5.5	Milliamperes
Load Resistance	2500	5000	Ohms
Total Harmonic Distortion, approximate	10	10	Percent
Maximum-Signal Power Output	1.5	3.0	Watts

GENERAL ELECTRIC

Supersedes ET-T406A, dated 1-52

BASING DIAGRAM



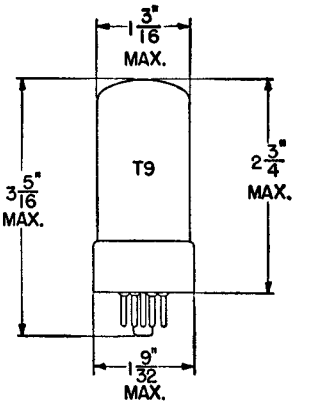
EIA 7AC

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Heater
Pin 3—Plate
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates

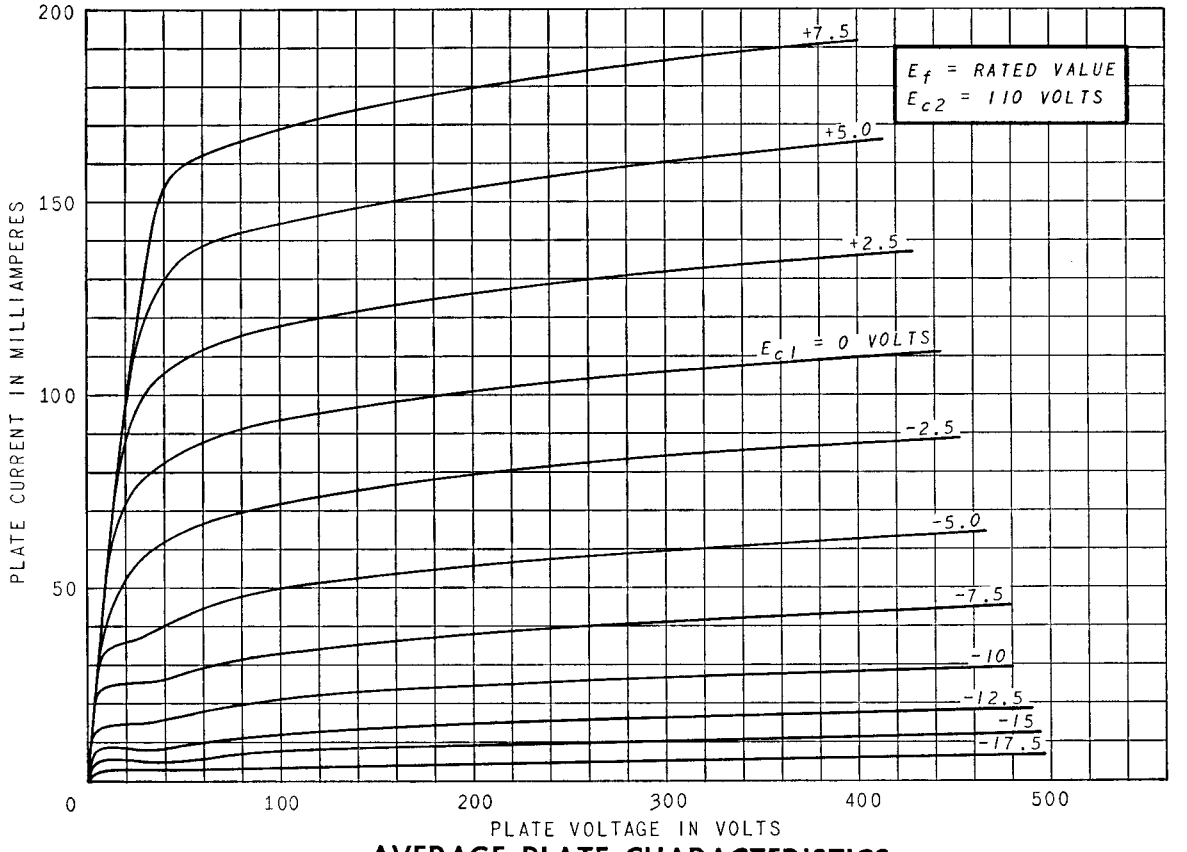
Note: Pin 1 omitted on bases B6-81 and B6-84

PHYSICAL DIMENSIONS

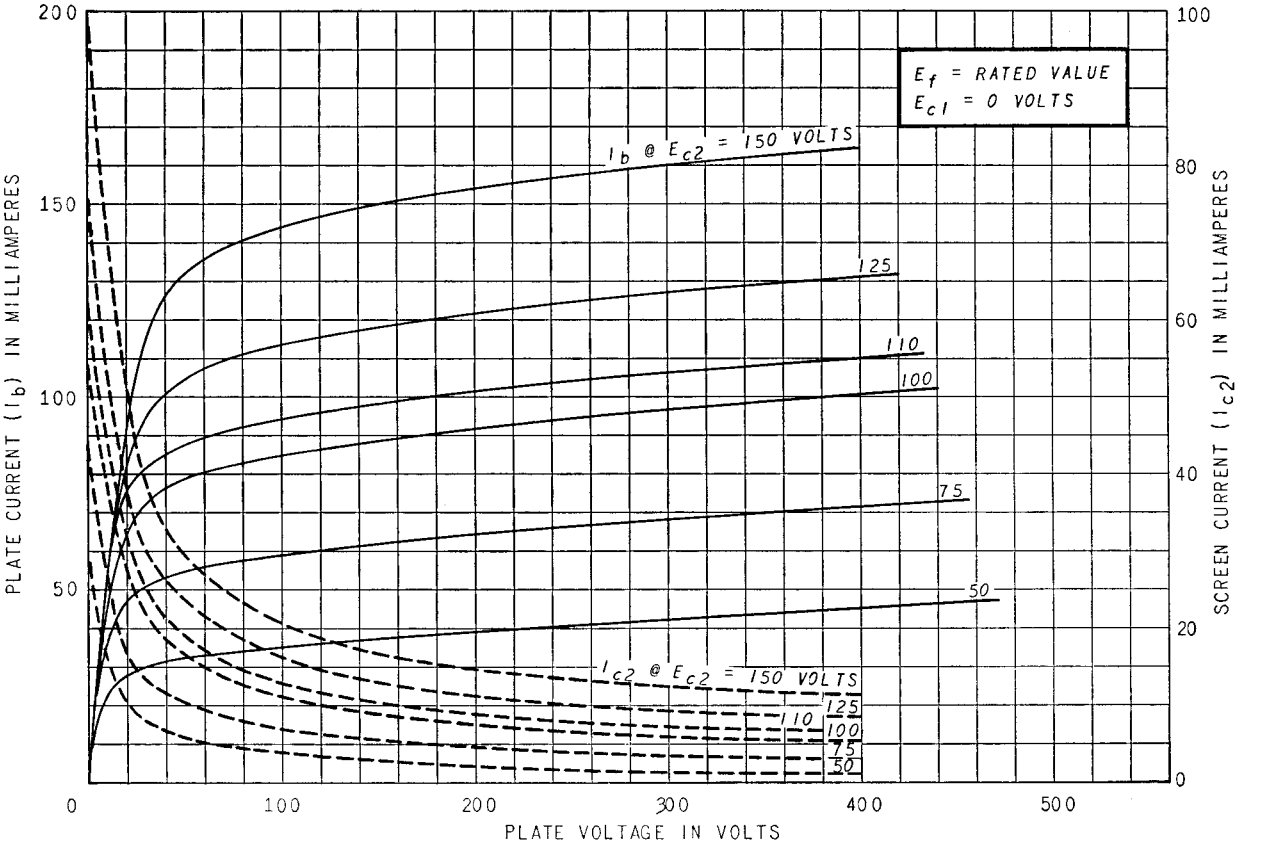


EIA 9-11
OR 9-41

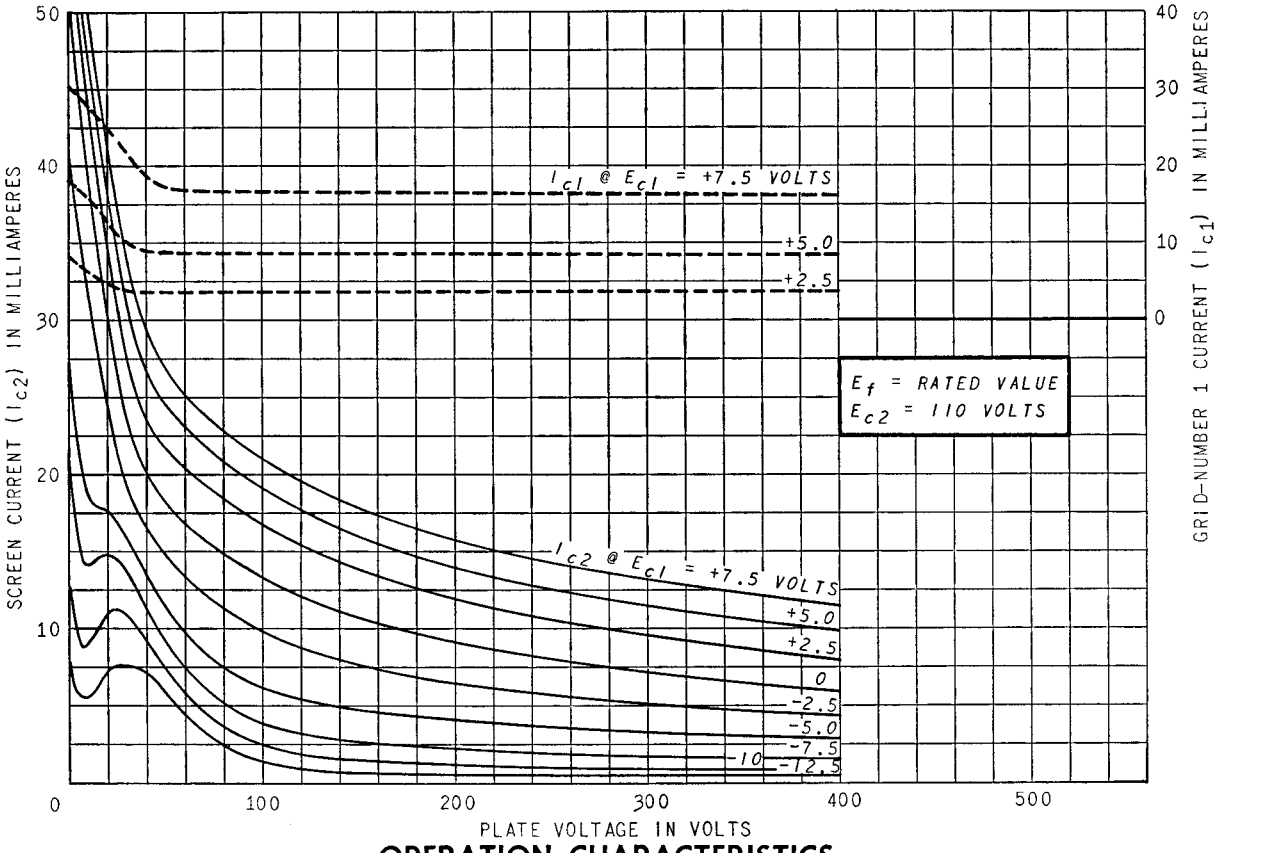
AVERAGE PLATE CHARACTERISTICS



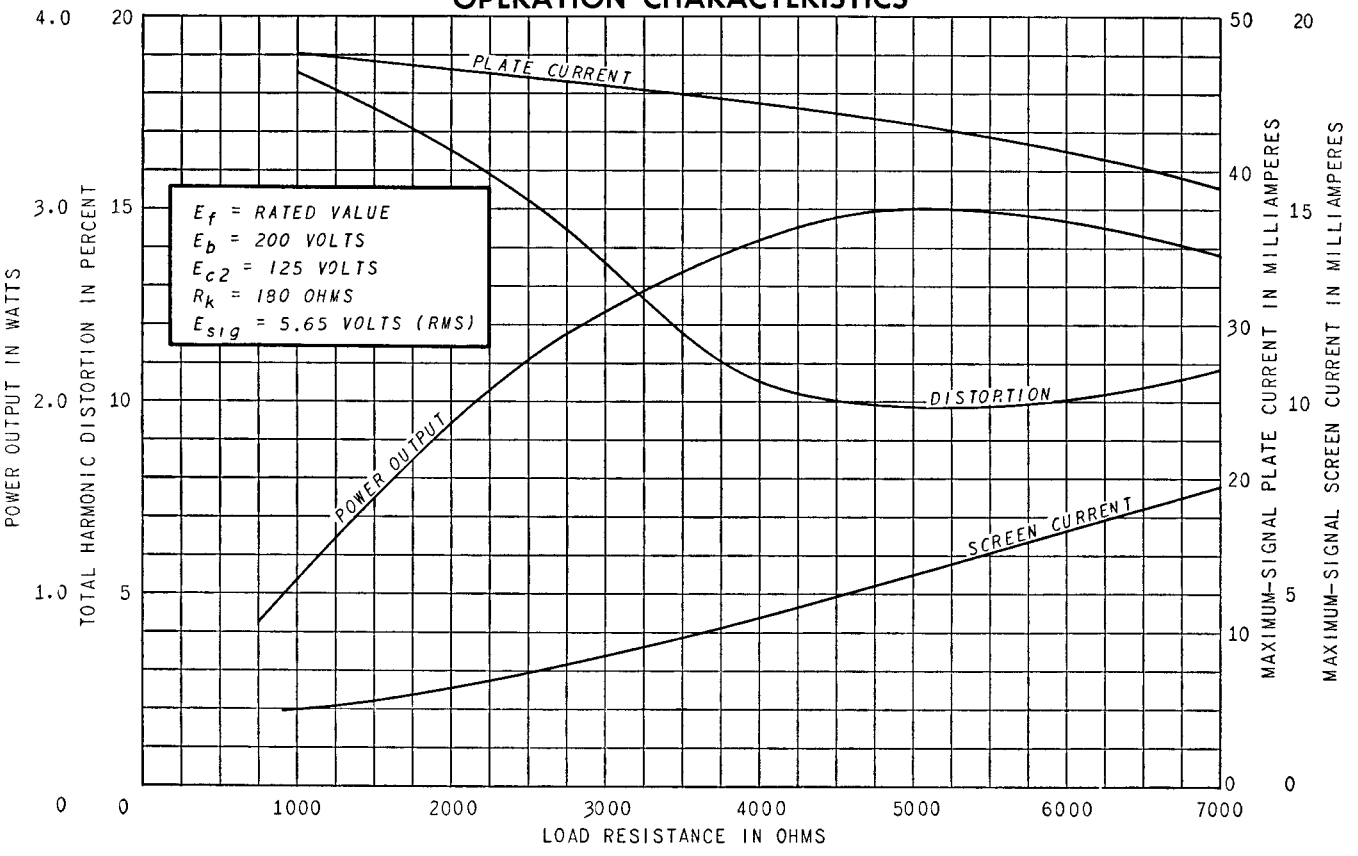
AVERAGE PLATE CHARACTERISTICS



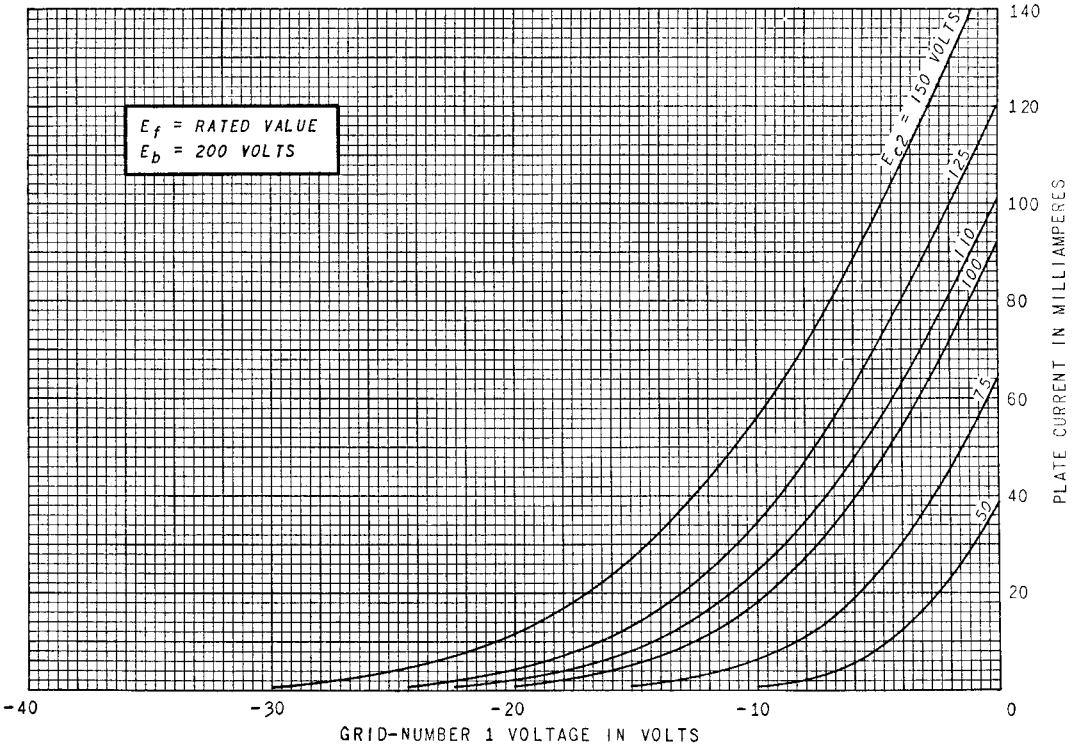
AVERAGE CHARACTERISTICS



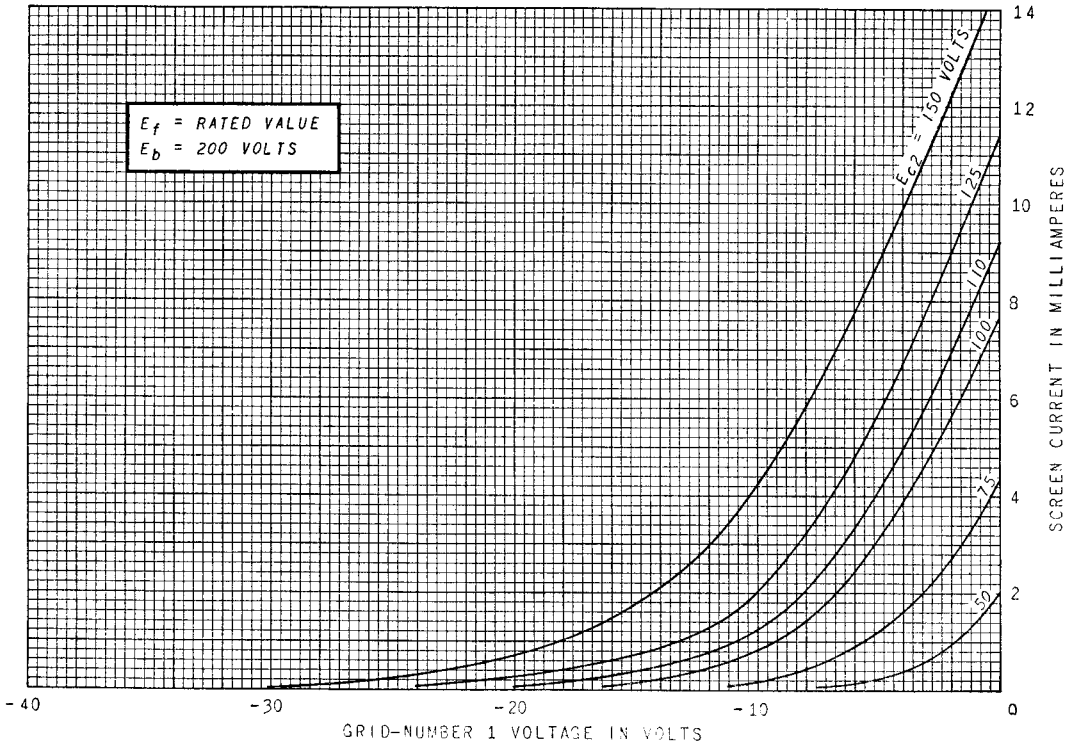
OPERATION CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

35W4

DIODE

FOR HALF-WAVE POWER-RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 35W4 is a miniature half-wave rectifier for use in line-operated equipment having series-connected heaters. The heater is tapped to permit operation of a panel lamp.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	35 ± 10%*	32 ± 10%†	Volts
Heater-Tap Voltage	7.5*	5.5†	Volts
Heater Current	0.15	0.15	Ampere

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

RECTIFIER SERVICE—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	360	Volts
Steady-State Peak Plate Current	660	Milliamperes
DC Output Current		
Without Panel Lamp	110	Milliamperes
With Panel Lamp and Shunting Resistor	100	Milliamperes
With Panel Lamp and No Shunting Resistor	66	Milliamperes
Heater-Tap Voltage When Panel Lamp Fails, RMS	17	Volts
Panel Lamp Shunting Resistor		
For DC Output Current of 70 Milliamperes	800	Ohms
For DC Output Current of 80 Milliamperes	400	Ohms
For D-C Output Current of 90 Milliamperes	250	Ohms
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	360	Volts
Heater Negative with Respect to Cathode	360	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

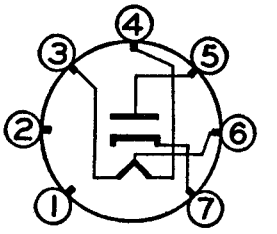
The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

Supersedes ET-T407B dated 3-50

BASING DIAGRAM

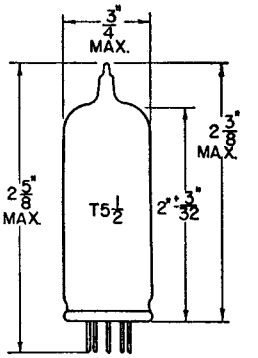


EIA 5BQ

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—No Connection
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Heater Tap
Pin 7—Cathode

PHYSICAL DIMENSIONS



EIA 5-3

CHARACTERISTICS AND TYPICAL OPERATION

HALF-WAVE RECTIFIER WITH PANEL LAMP NUMBER 40 OR NUMBER 47

Heater Voltage (Pin 3 to Pin 4)	32	32	32	32	Volts
Heater-Tap Voltage (Pin 4 to Pin 6)	5.5	5.5	5.5	5.5	Volts
Heater Current (Between Pins 3 and 6)	150	150	150	150	Milliamperes
AC Plate-Supply Voltage, RMS	117	117	117	117	Volts
Filter Input Capacitor	40	40	40	40	Microfarads
Total Effective Plate-Supply Impedance	15	15	15	15	Ohms
Panel-Lamp Shunting Resistor	——	300	150	100	Ohms
DC Output Current	60	70	80	90	Milliamperes

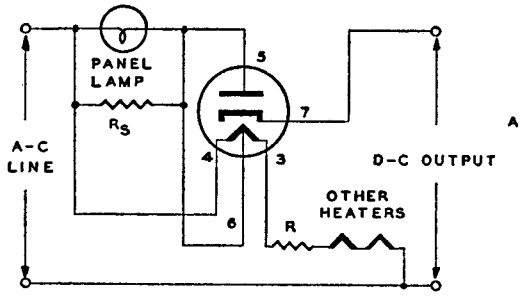
HALF-WAVE RECTIFIER WITHOUT PANEL LAMP

Heater Voltage (Pin 3 to Pin 4)	35	Volts
Heater-Tap Voltage (Pin 4 to Pin 6)	7.5	Volts
Heater Current (Between Pins 3 and 4)	150	Milliamperes
AC Plate-Supply Voltage, RMS	117	Volts
Filter Input Capacitor	40	Microfarads
Total Effective Plate-Supply Impedance	15	Ohms
DC Output Current	100	Milliamperes
DC Output Voltage at Filter Input		
For DC Output Current of 50 Milliamperes	135	Volts
For DC Output Current of 100 Milliamperes	120	Volts

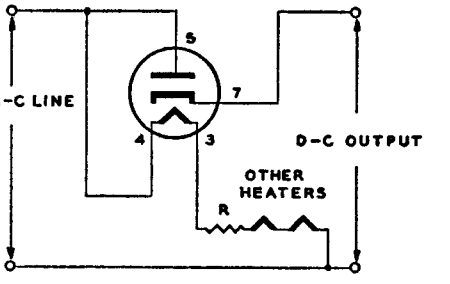
Tube Voltage Drop
Ib = 200 Milliamperes DC ..... 18 Volts

* Operation without a panel lamp.
† Operation with Number 40 or Number 47 panel lamp connected between pins 4 and 6.

TYPICAL CIRCUIT FOR OPERATION WITH PANEL LAMP



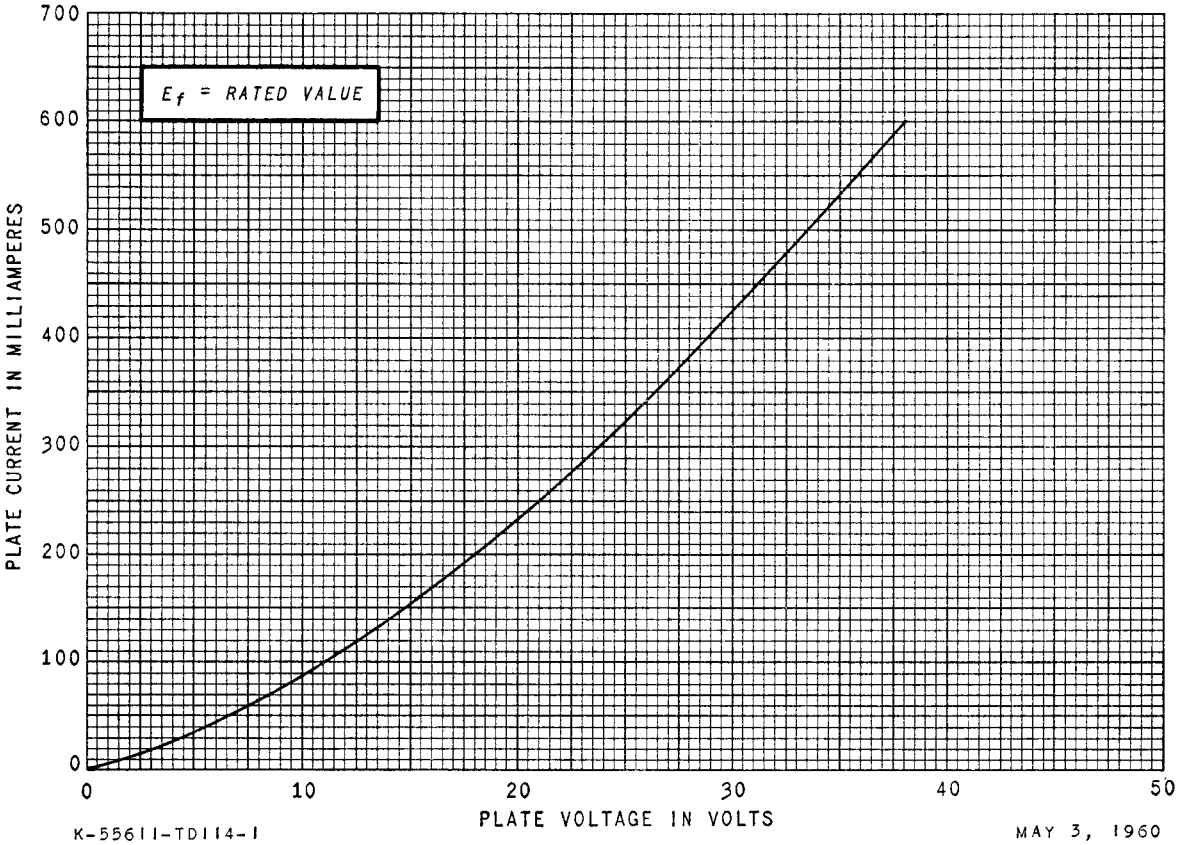
TYPICAL CIRCUIT FOR OPERATION WITHOUT PANEL LAMP



R_S = PANEL-LAMP SHUNTING RESISTOR

DROP ACROSS R AT 0.15 AMPERE SHOULD EQUAL DIFFERENCE BETWEEN LINE VOLTAGE AND TOTAL OF ALL RATED HEATER VOLTAGES

AVERAGE PLATE CHARACTERISTICS

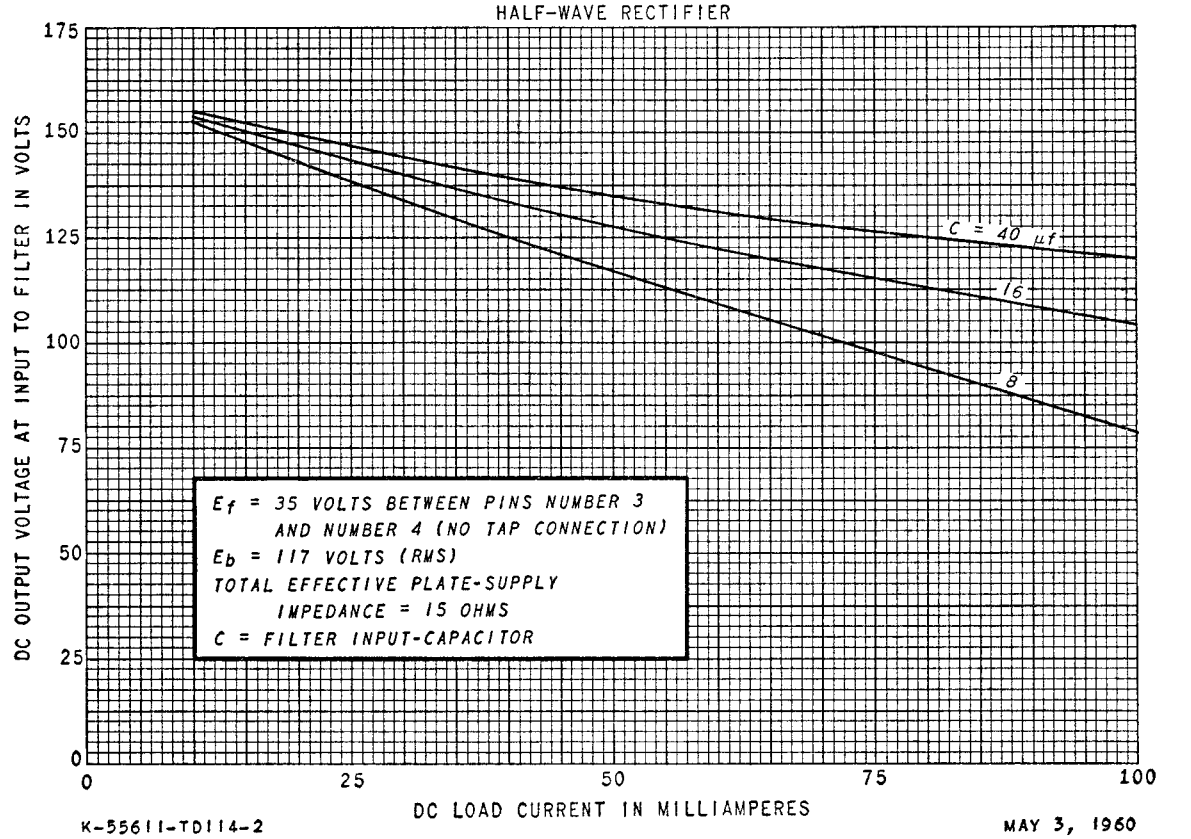


K-55611-TD114-1

MAY 3, 1960

OPERATION CHARACTERISTICS

HALF-WAVE RECTIFIER



K-55611-TD114-2

MAY 3, 1960

Electronic TUBE
KEN-RAD

35Z5-GT

Description and Rating

HALF-WAVE HIGH-VACUUM RECTIFIER

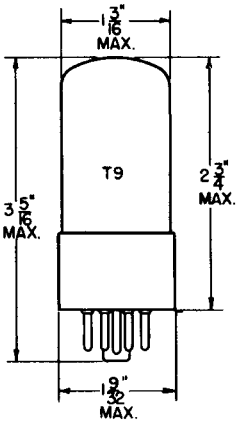
GENERAL DESCRIPTION

Principal Application: The 35Z5-GT is a half-wave high-vacuum rectifier designed for use in a-c/d-c receivers. The heater is tapped to permit operation of a panel lamp. It is recommended that the plate be connected to the heater tap so that the plate current will pass through the panel lamp and the tapped section of the heater.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)*	35.0 Volts
Heater Tap Voltage*	7.5 Volts
Heater Current*	0.15 Ampere

Envelope	T-9 Glass
Base	B6-8, Intermediate Shell Octal 6-Pin
Mounting Position	Any

PHYSICAL DIMENSIONS

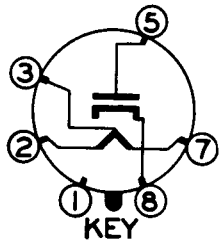


RMA 9-11

TERMINAL CONNECTIONS

Pin 1 - No Connection
Pin 2 - Heater
Pin 3 - Heater Tap
Pin 5 - Plate
Pin 7 - Heater
Pin 8 - Cathode

BASING DIAGRAM



RMA 6AD
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES:

Peak Inverse Plate Voltage	700	Volts
A-C Plate Supply Voltage (RMS)	235	Volts
Steady-State Peak Plate Current	600	Milliamperes
Steady-State D-C Output Current:		
Without Panel Lamp	100	Milliamperes
With Panel Lamp and Shunting Resistor	90	Milliamperes
With Panel Lamp and No Shunting Resistor	60	Milliamperes
Panel Lamp Shunting Resistor:		
For D-C Output Current of 70 Milliamperes	800	Ohms
For D-C Output Current of 80 Milliamperes	400	Ohms
For D-C Output Current of 90 Milliamperes	250	Ohms
Heater Tap Voltage (RMS) When Panel Lamp Fails	15	Volts
D-C Heater Cathode Voltage	350	Volts

** Values are for operation without panel lamp. For heater voltage and current ratings with panel lamp, refer to Characteristics and Typical Operation given on page 2. The heater tap voltage is measured between pins 2 and 3 with 0.15 ampere flowing between pins 2 and 7.*

Supersedes ET-T409A dated 10-47

CHARACTERISTICS AND TYPICAL OPERATION

HALF-WAVE RECTIFIER - WITH PANEL LAMP NUMBER 40 OR NUMBER 47

Heater Voltage (Pin 2 to Pin 7)	32	32	32	32	32	. . . .	Volts
Heater Tap Voltage (Pin 2 to Pin 3)	5.5	5.5	5.5	5.5	5.5	. . . .	Volts
Heater Current (Between Pins 3 and 7)	0.15	0.15	0.15	0.15	0.15	. . . .	Ampere
A-C Plate Supply Voltage (RMS)	117	117	117	117	235	. . . .	Volts
Filter Input Capacitor	40	40	40	40	40	. . . .	Microfarads
Minimum Total Effective Plate Supply Impedance	15	15	15	15	100	. . . .	Ohms
Panel Lamp Shunting Resistor #	---	300	150	100	---	. . . .	Ohms
D-C Output Current	60	70	80	90	60	. . . .	Milliamperes

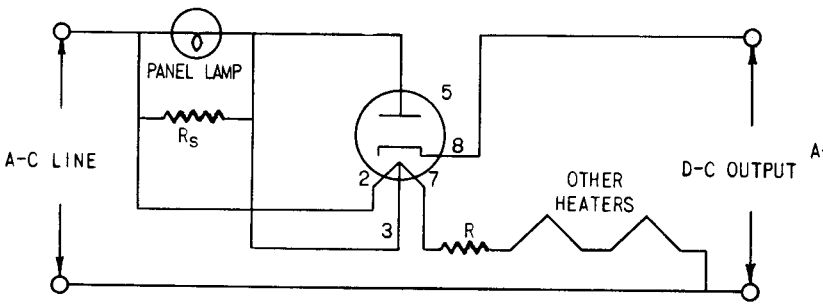
HALF-WAVE RECTIFIER - WITHOUT PANEL LAMP

Heater Voltage (Pin 2 to Pin 7)	35	35	. . . . .	Volts
Heater Tap Voltage (Pin 2 to Pin 3)	7.5	7.5	. . . . .	Volts
Heater Current (Between Pins 3 and 7)	0.15	0.15	. . . . .	Ampere
A-C Plate Supply Voltage (RMS)	117	235	. . . . .	Volts
Filter Input Capacitor	40	40	. . . . .	Microfarads
Minimum Total Effective Plate Supply Impedance	15	100	. . . . .	Ohms
D-C Output Current	100	100	. . . . .	Milliamperes
D-C Output Voltage at Input to Filter: (Approx)				
At 50 Milliamperes Load Current	140	280	. . . . .	Volts
At 100 Milliamperes Load Current	120	235	. . . . .	Volts

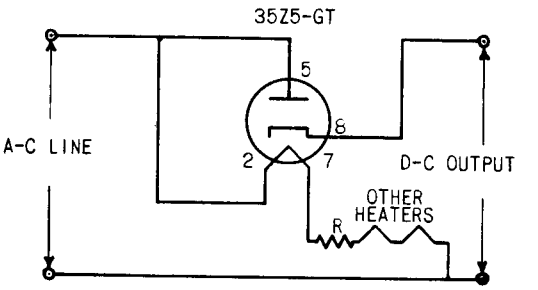
Tube Voltage Drop:
Measured with Applied D-C at 200 Milliamperes . . . . . 18 . . . . . Volts

 # Shunting resistor required if d-c output current is greater than 60 milliamperes.

TYPICAL CIRCUIT FOR OPERATION WITH PANEL LAMP



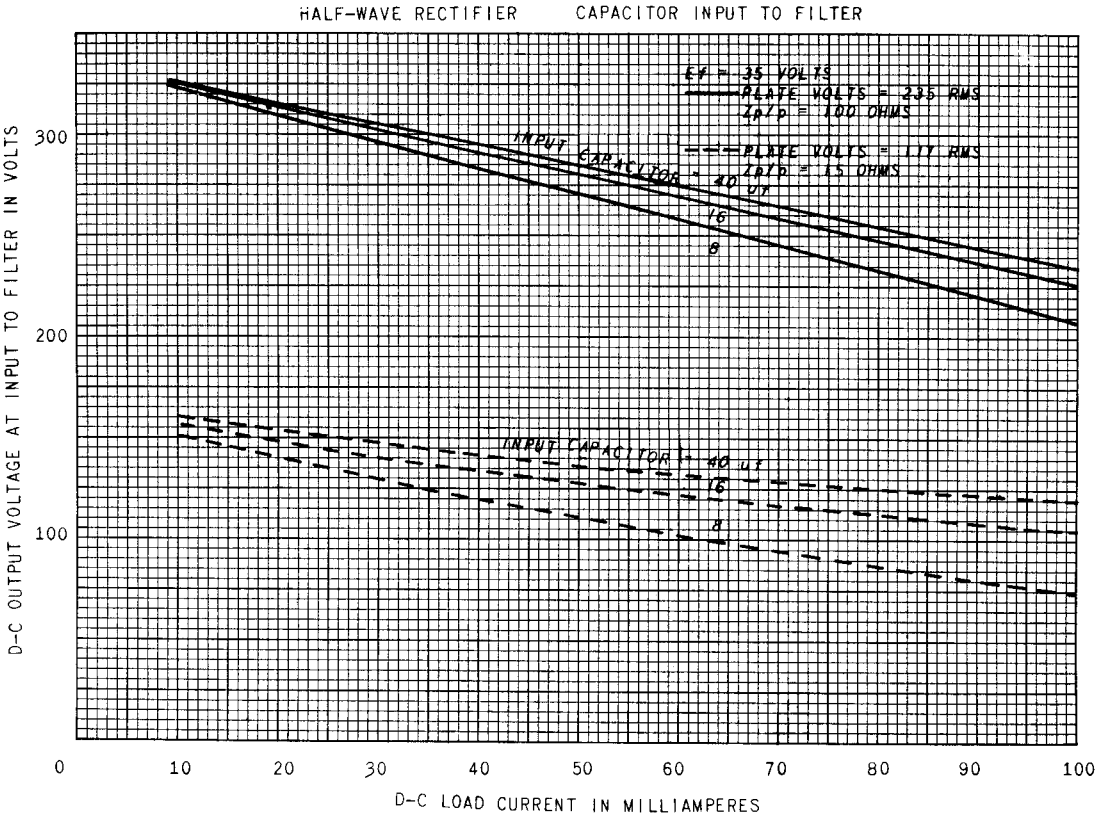
TYPICAL CIRCUIT FOR OPERATION WITHOUT PANEL LAMP



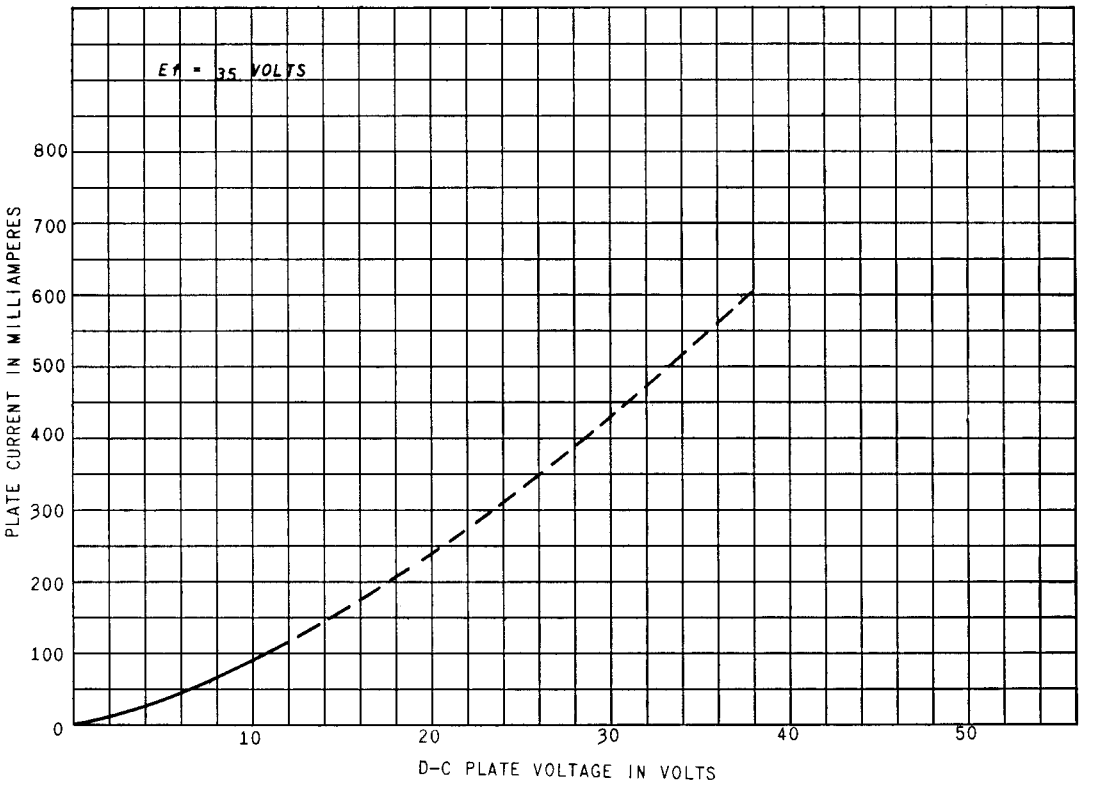
Rs = Panel-lamp shunting resistor

Drop across R at 0.15 ampere should equal difference between line voltage and total of all rated heater voltages.

OPERATION CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



Tube Divisions, Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

Electronic TUBES

36AM3

DIODE

FOR HALF-WAVE POWER-RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 36AM3 is a miniature half-wave rectifier designed for use in line-operated equipment having series-connected, 100-milliampere heaters. The heater is tapped to allow a portion of it to be used as a current-limiting resistor.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage*

Between Pins 3 and 4	36 ± 10%	Volts
Between Pins 3 and 6	32 ± 10%	Volts
Heater Current	0.1	Amperes

MECHANICAL

Mounting Position—Any

Envelope—T-5½, Glass

Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

RECTIFIER SERVICE—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage	365	Volts
Steady-State Peak Plate Current	530	Milliamperes
DC Output Current	82	Milliamperes
Heater Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
DC Component	350	Volts
Total DC and Peak	350	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

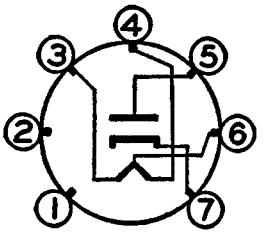
These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

BASING DIAGRAM

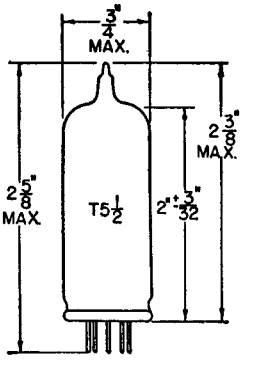


EIA 5BQ

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—No Connection
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Heater Tap
Pin 7—Cathode

PHYSICAL DIMENSIONS



EIA 5-3

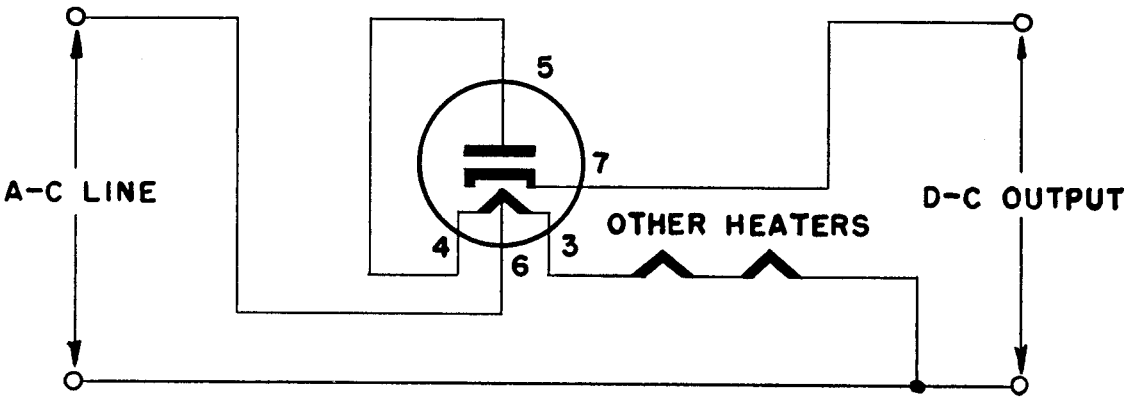
CHARACTERISTICS AND TYPICAL OPERATION

HALF-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

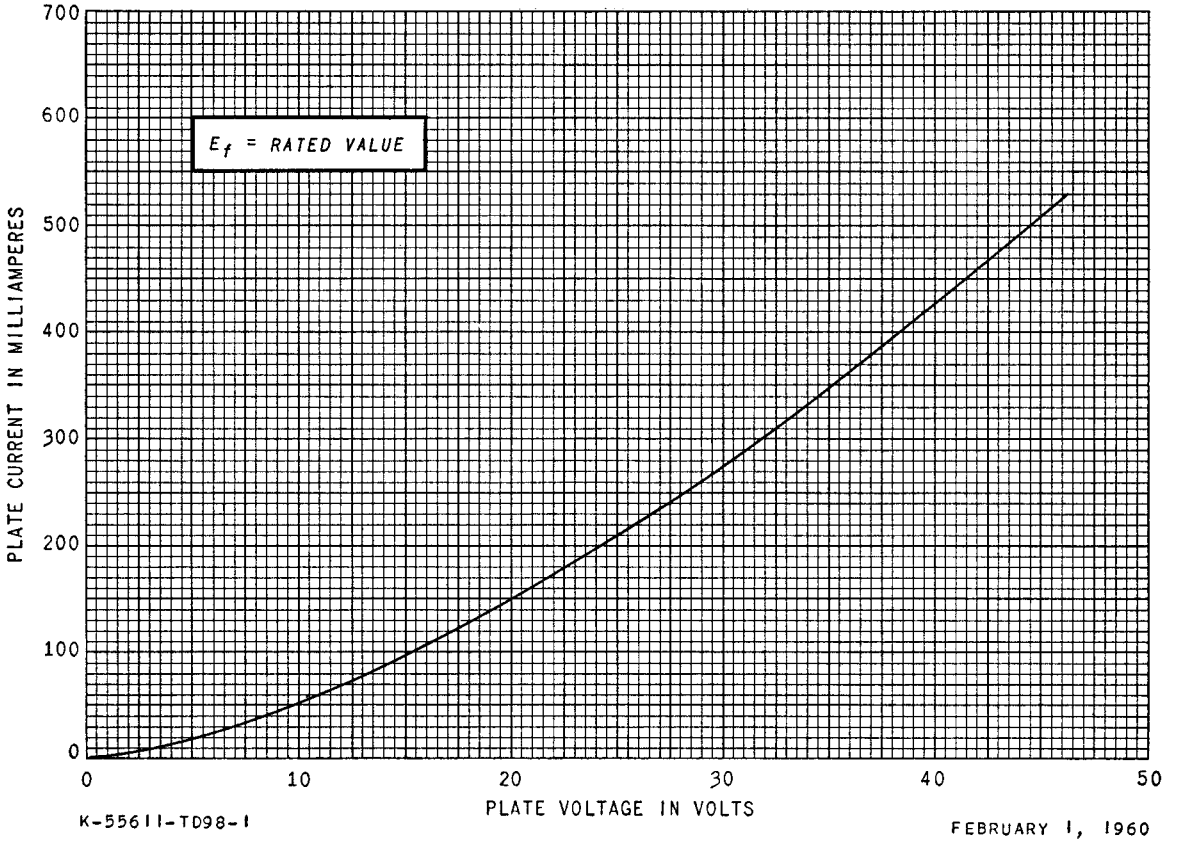
AC Plate-Supply Voltage, RMS	117	Volts
Filter Input Capacitor	40	Microfarads
Total Plate-Supply Resistance†		
DC Output Current	75	Milliamperes
DC Output Voltage at Filter Input	105	Volts
Tube Voltage Drop		
Ib = 150 Milliamperes DC	20	Volts

* The heater tap is provided to allow a portion of the heater to be used as a current-limiting resistor (See schematic). It is not intended for panel-lamp operation.

† The portion of the heater between pins 4 and 6 has an approximate resistance 45 ohms when the output current of the rectifier is 82 milliamperes.



AVERAGE PLATE CHARACTERISTICS



K-55611-TD98-1

FEBRUARY 1, 1960

—PRODUCT INFORMATION—

Compactron Beam Pentode

36KD6

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

The 36KD6 is a compactron beam-power pentode primarily designed for use as the horizontal-deflection amplifier in color television receivers. It is characterized by having a very low knee with a very high peak current of over an ampere. This results in a basic capability to scan 90-degree large screen color picture tubes at 25 KV from 280-volt power supplies. Its low knee minimizes "snivets" without the necessity of supplying special voltages to the beam plates.

Except for heater characteristics and ratings, the 36KD6 is identical to the 6KD6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	36	Volts
Heater Current♦	0.45 ± 0.03	Amperes
Heater Warm-up Time, average●	11	Seconds

NOTES

★ Heater voltage for a bogey tube at If = 0.45 amperes.

♦ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

● The time required for the voltage across the heater to reach 80 percent of the bogey value after supplying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

TUBES

Beam Pentode

36LW6

FOR TV HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS

The 36LW6 beam power pentode is designed for horizontal–deflection of 90° and 110° color picture tubes from power supplies of 280 to over 400 volts. It is particularly well suited for feedback scan regulation systems since it provides high peak plate current with high screen voltage and relatively high negative end–of–scan grid drive voltage for great control latitude. The great power handling capability of the 36LW6 results from a new integral fin and radiator anode design that achieves very uniform heat distribution over the entire surface of its larger T–14 bulb. In addition, its low knee voltage minimizes snivets without the necessity of supplying special voltages to the beam plates.

Except for heater characteristics and ratings, the 36LW6 is identical to the 6LW6.

GENERAL

ELECTRICAL

Cathode – Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC *	36.0	Volts
Heater Current •	0.45	Amperes
Heater Warm-up Time, average ▲	11	Seconds

NOTES

* Heater voltage for a bogey tube at If= 0.45 Amperes

• The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

▲ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

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ELECTRONICS

38HE7

COMPACTRON DIODE-PENTODE

DESCRIPTION AND RATING

The 38HE7 is a compactron containing a high-perveance diode and a beam-power pentode. The diode is intended for service as the damping diode and the pentode as the horizontal-deflection amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	37.8	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

Direct Interelectrode Capacitances, approximate¶

Diode Section

Cathode to Plate and Heater: k to (p + h)	8.0	pf
Plate to Cathode and Heater: p to (k + h)	7.0	pf
Heater to Cathode: (h to k)	1.6	pf

Pentode Section

Grid-Number 1 to Plate: (g1 to p)	0.38	pf
Input: g1 to (h + k + g2 + b.p.)	19	pf
Output: p to (h + k + g2 + b.p.)	8.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing - EIA 12-57

Maximum Diameter	1.563	Inches
Maximum Over-all Length	3.125	Inches
Maximum Seated Height	2.750	Inches

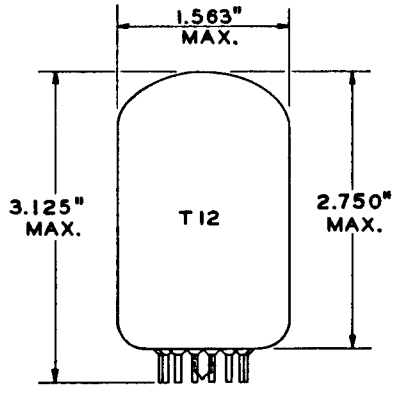
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

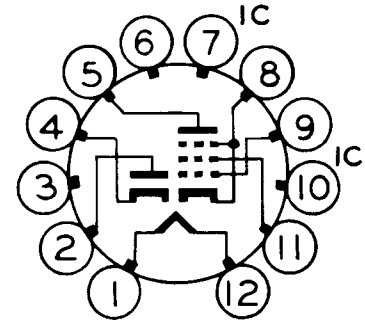


EIA 12-57

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Diode Plate
#Pin 3 - No Connection
Pin 4 - Diode Cathode
Pin 5 - Pentode Plate
#Pin 6 - No Connection
#Pin 7 - Internal Connection
Pin 8 - Pentode Cathode and Beam Plates
Pin 9 - Pentode Grid Number 1
#Pin 10 - Internal Connection
Pin 11 - Pentode Grid Number 2 (Screen)
Pin 12 - Heater

BASING DIAGRAM



EIA 12FS

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE△—Pentode Section

DC Plate-Supply Voltage (Boost + DC Power Supply)	500	Volts
Peak Positive Pulse Plate Voltage	5000	Volts
Peak Negative Pulse Plate Voltage	0	Volts
Screen Voltage	150	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation**	10	Watts
Screen Dissipation	3.5	Watts
Screen Dissipation (With Plate Dissipation Limited to 9 Watts or less)	4.0	Watts
DC Cathode Current	230	Milliamperes
Peak Cathode Current	800	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms

TV DAMPER SERVICE△—Diode Section

Peak Inverse Plate Voltage	4200	Volts
Steady-State Peak Plate Current	1200	Milliamperes
DC Output Current	200	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
DC Component	500	Volts
Total DC and Peak	4200	Volts
Bulb Temperature at Hottest Point	200	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	5000	50	130	Volts
Screen Voltage	130	130	130	Volts
Grid-Number 1 Voltage	---	0§§	-22	Volts
Plate Resistance, approximate	---	---	6200	Ohms
Transconductance	---	---	8800	Micromhos
Plate Current	---	450	60	Milliamperes
Screen Current	---	40	2.8	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 1.0 Milliamperes	-80	---	-39	Volts
Triode Amplification Factor¶¶	---	---	4.2	

Diode Section

Tube Voltage Drop		
Ib = 350 Milliamperes DC	21	Volts

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NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ Without external shield.

\# Socket terminals 3, 6, 7, and 10 should not be used as tie points.

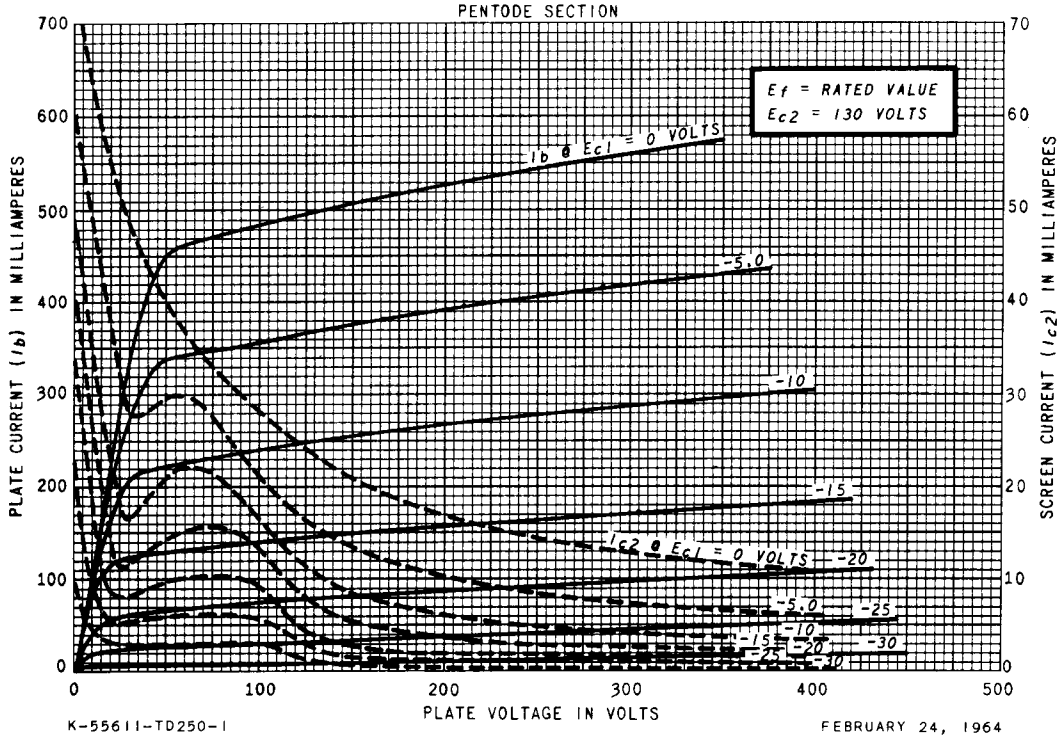
Δ For operation a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

** In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

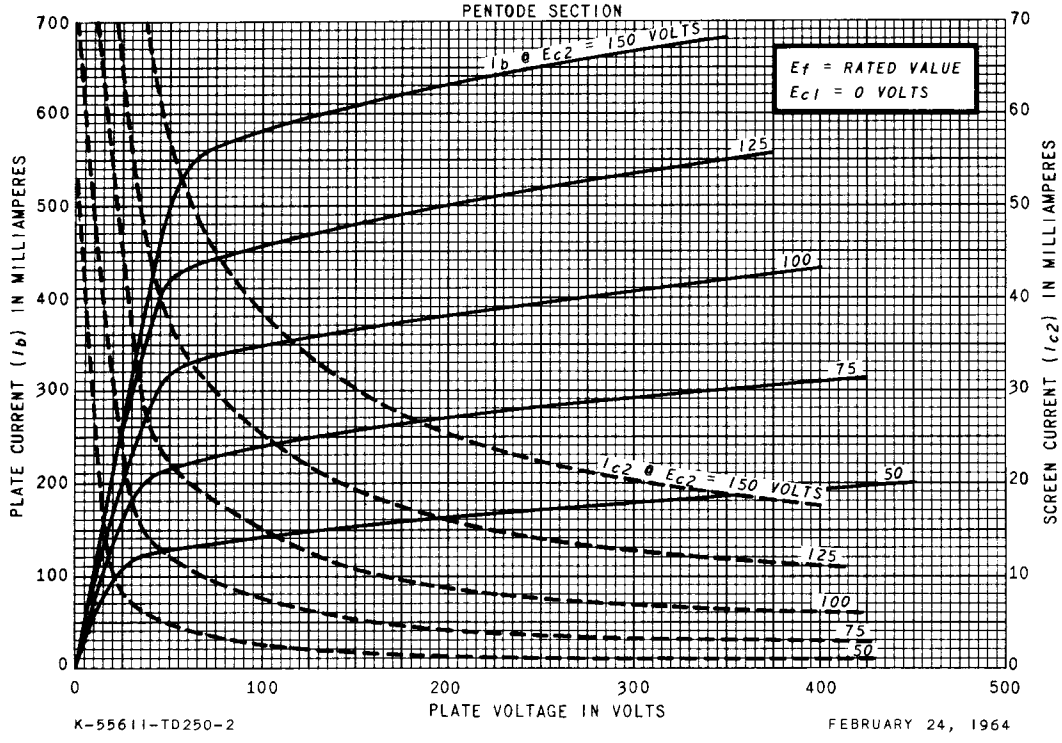
§§ Applied for short interval (two seconds maximum) so as not to damage tube.

¶¶ Triode connection (screen tied to plate) with Eb = Ec2 = 130 volts and Ec1 = -22 volts.

AVERAGE PLATE CHARACTERISTICS

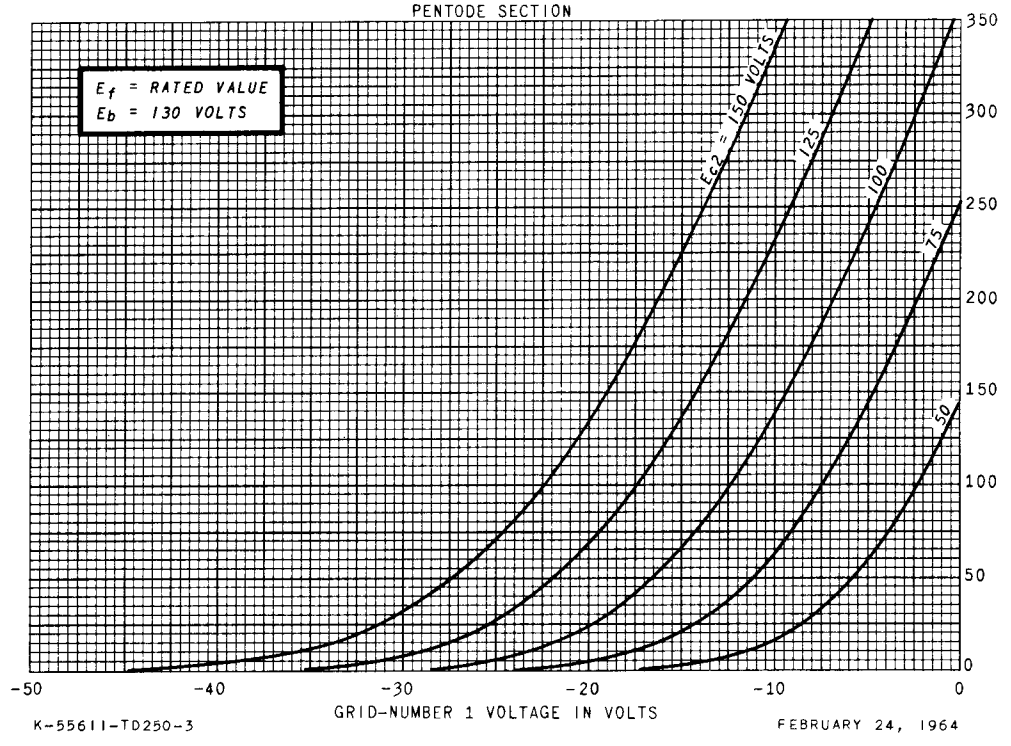


AVERAGE PLATE CHARACTERISTICS



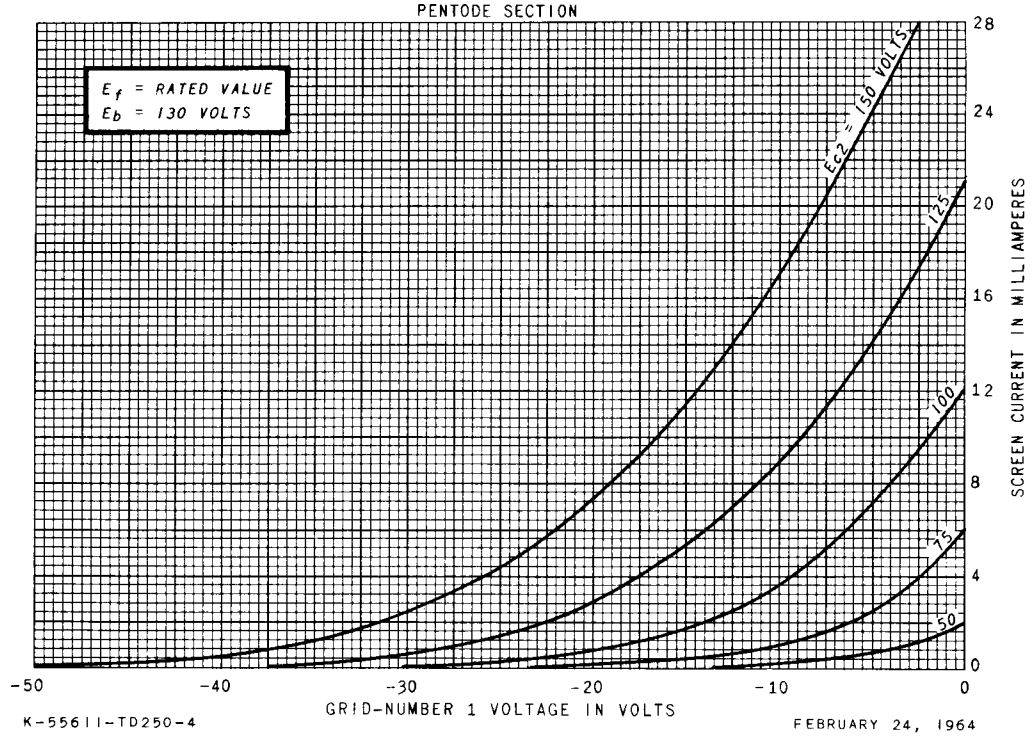
K-55611-TD250-2 FEBRUARY 24, 1964

AVERAGE TRANSFER CHARACTERISTICS

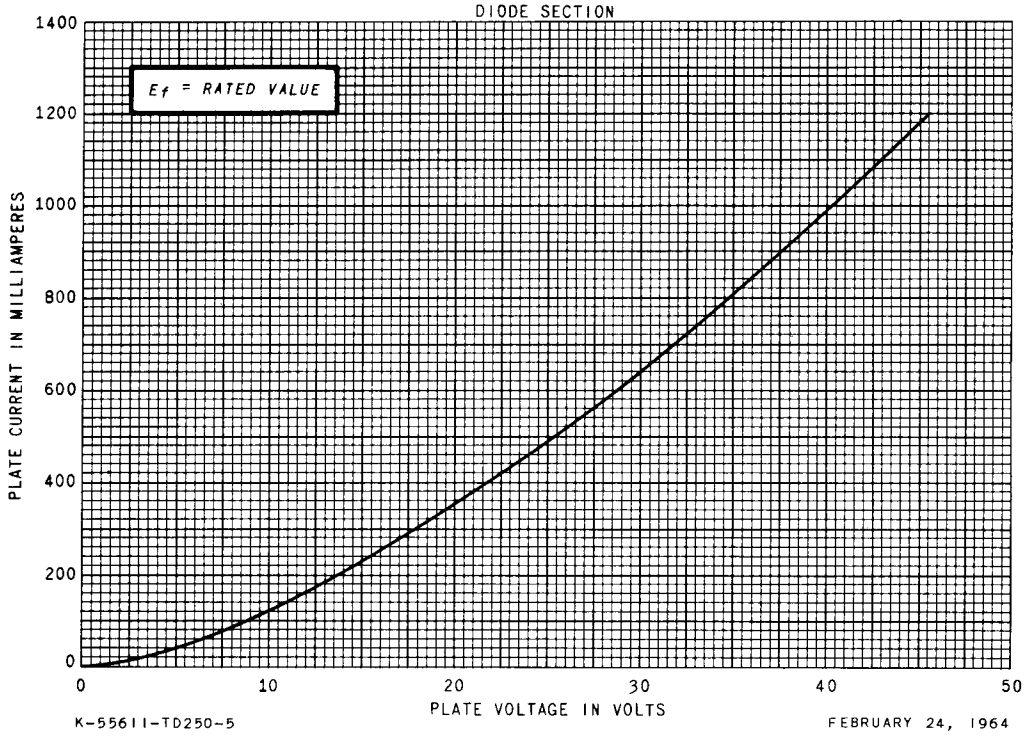


K-55611-TD250-3 FEBRUARY 24, 1964

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

PRODUCT INFORMATION

38HK7

Compactron Diode-Pentode

The 38HK7 is a compactron containing a high-perveance diode and a beam-power pentode. The diode is intended for service as the damping diode and the pentode as the horizontal-deflection amplifier in television receivers.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	37.8	Volts
Heater Current‡	0.45±0.03	Amperes
Heater Warm-up Time, Average§	11	Seconds

Direct Interelectrode Capacitances, approximate¶

Diode Section

Cathode to Plate and Heater:		
k to (p + h)	10	pf
Plate to Cathode and Heater:		
p to (k + h)	9.0	pf
Heater to Cathode: (h to k)	2.0	pf

Pentode Section

Grid-Number 1 to Plate:		
(g1 to p)	0.38	pf
Input: g1 to (h + k + g2 + b.p.)	19	pf
Output: p to (h + k + g2 + b.p.)	8.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing - EIA 12-57

Maximum Diameter	1.563	Inches
Minimum Diameter	1.437	Inches
Maximum Over-all Length	3.125	Inches
Maximum Seated Height	2.750	Inches
Minimum Seated Height	2.500	Inches

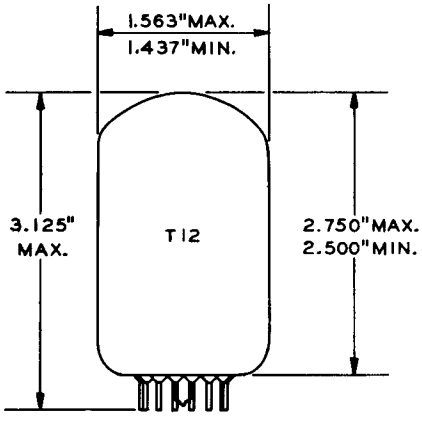
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

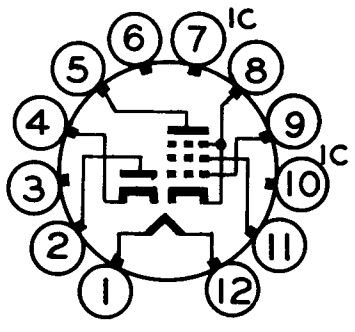


EIA 12-57

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Diode Plate
#Pin 3 - No Connection
Pin 4 - Diode Cathode
Pin 5 - Pentode Plate
#Pin 6 - No Connection
#Pin 7 - Internal Connection
Pin 8 - Pentode Cathode and Beam Plates
Pin 9 - Pentode Grid Number 1
#Pin 10 - Internal Connection
Pin 11 - Pentode Grid Number 2 (Screen)
Pin 12 - Heater

BASING DIAGRAM



EIA 12FS

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE△—Pentode Section

DC Plate-Supply Voltage (Boost + DC Power Supply)	500	Volts
Peak Positive Pulse Plate Voltage	5000	Volts
Peak Negative Pulse Plate Voltage	0	Volts
Screen Voltage	150	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Peak Negative Grid-Number 1 Voltage	330	Volts
Plate Dissipation**	10	Watts
Screen Dissipation	3.5	Watts
Screen Dissipation (With Plate Dissipation Limited to 9 Watts or Less)	4.0	Watts
DC Cathode Current	230	Milliamperes
Peak Cathode Current	800	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance	1.0	Megohms

TV DAMPER SERVICE△—Diode Section

Peak Inverse Plate Voltage	3700	Volts
Steady-State Peak Plate Current	1200	Milliamperes
DC Output Current	200	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
DC Component	500	Volts
Total DC and Peak	3700	Volts
Bulb Temperature at Hottest Point	200	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Pentode Section

Plate Voltage	3500	50	130	Volts
Screen Voltage	130	130	130	Volts
Grid-Number 1 Voltage	---	0‡‡	-22	Volts
Plate Resistance, approximate	---	---	6200	Ohms
Transconductance	---	---	8800	Micromhos
Plate Current	---	450	60	Milliamperes
Screen Current	---	40	2.8	Milliamperes
Grid-Number 1 Voltage, approximate				
Ib = 1.0 Milliamperes	-66	---	-39	Volts
Triode Amplification Factor§§	---	---	4.2	

Diode Section

Tube Voltage Drop		
Ib = 350 Milliamperes	16	Volts

NOTES

* Heater voltage for a bogey tube at If = 0.45 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

¶ Without external shield.

\# Socket terminals 3, 6, 7, and 10 should not be used as tie points.

Δ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations", Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

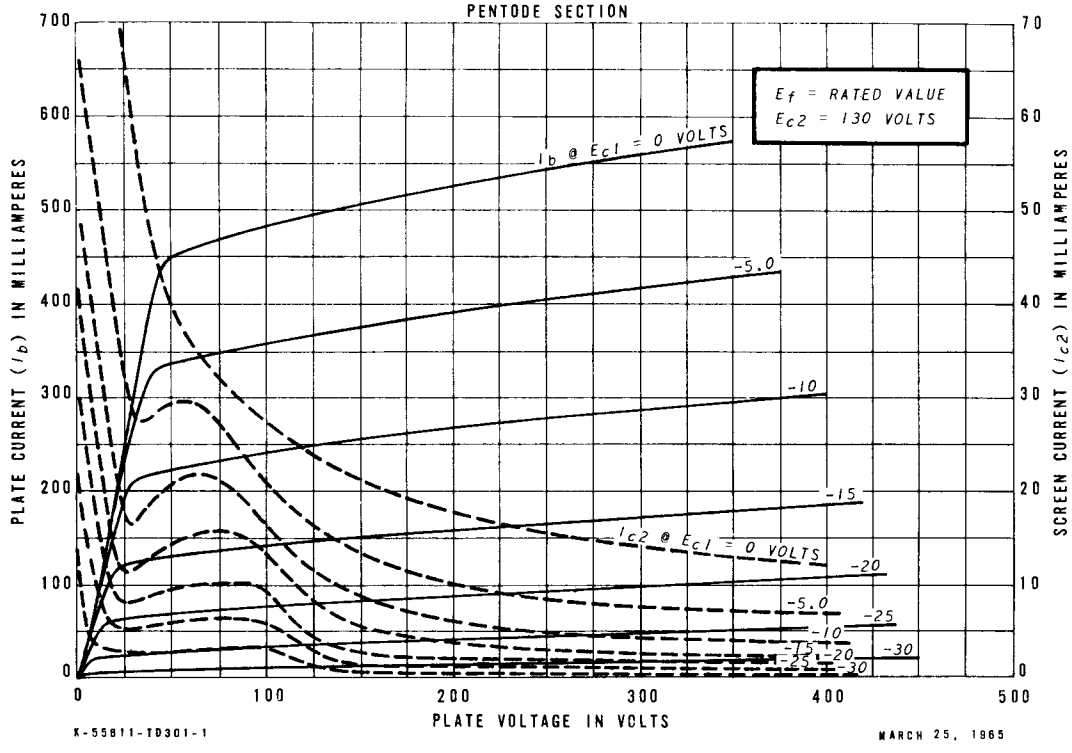
** In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

‡‡ Applied for short interval (two seconds maximum) so as not to damage tube.

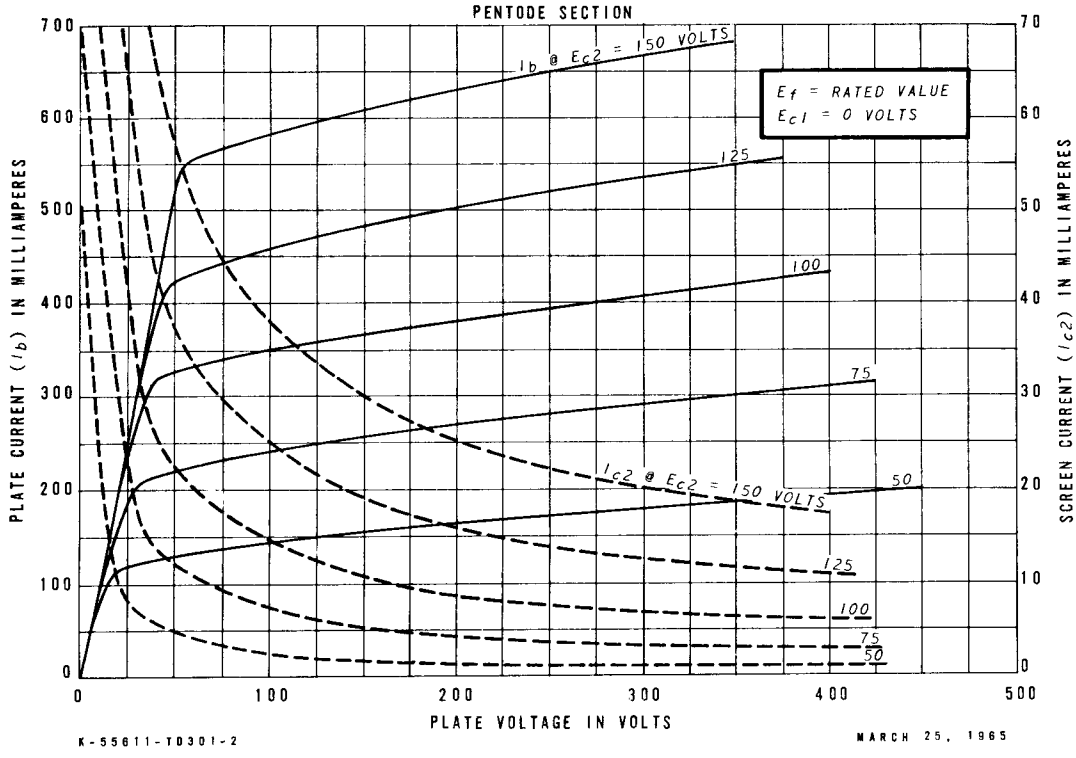
§§ Triode connection (screen tied to plate) with Eb = Ec2 = 130 volts and Ec1 = -22 volts.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

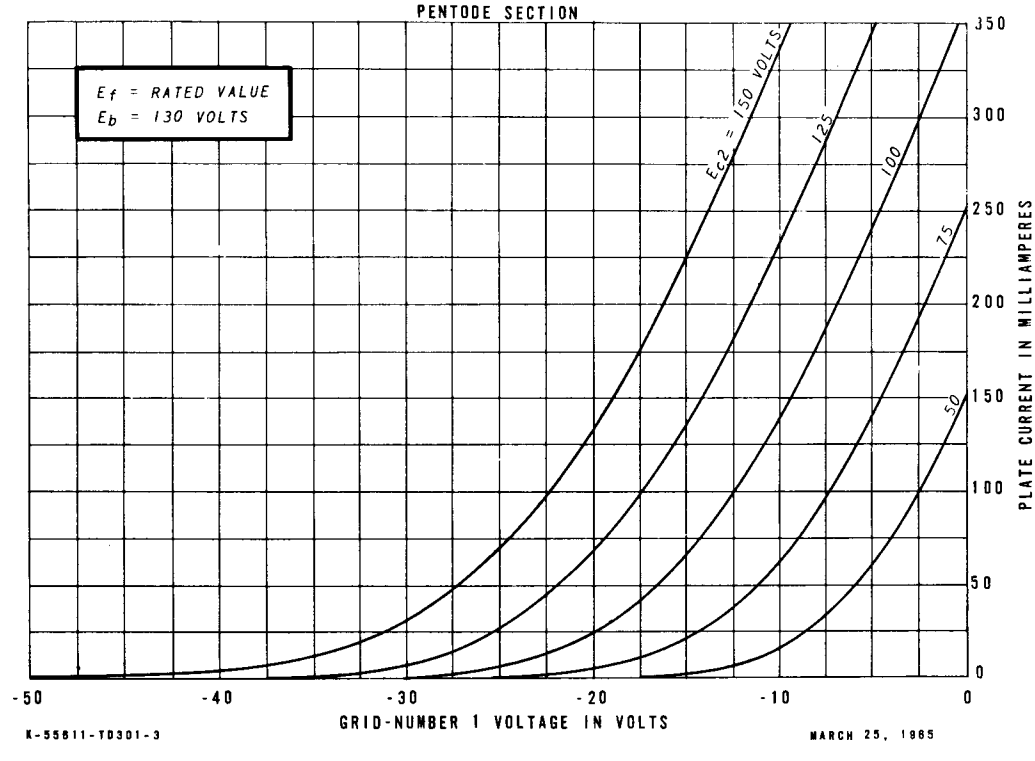
AVERAGE PLATE CHARACTERISTICS



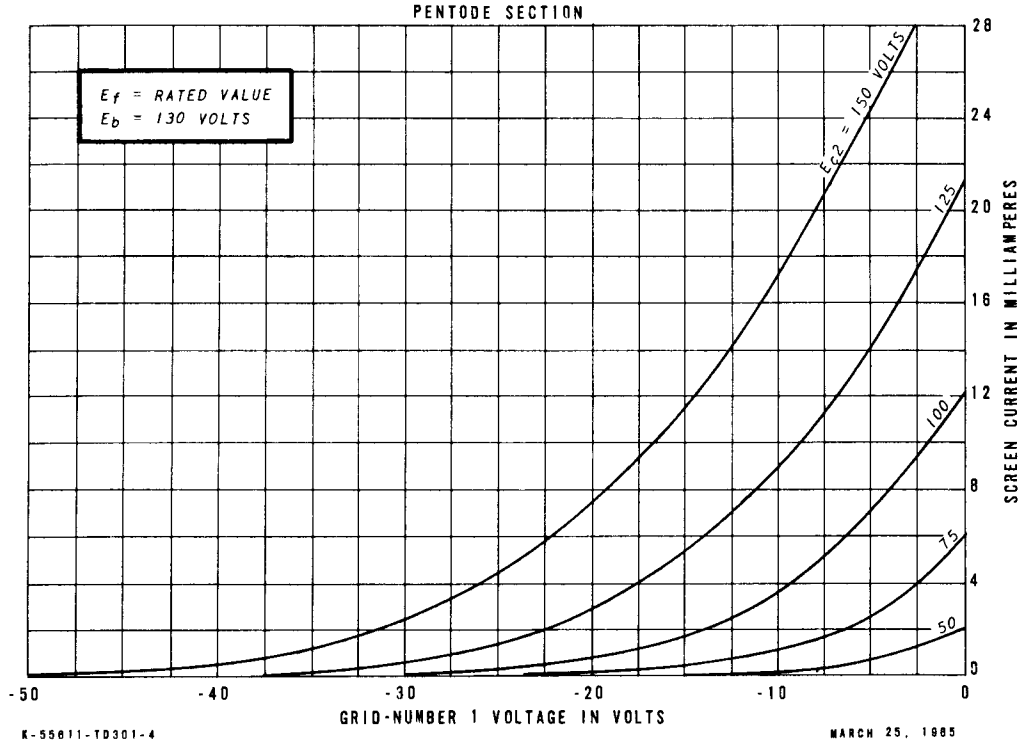
AVERAGE PLATE CHARACTERISTICS



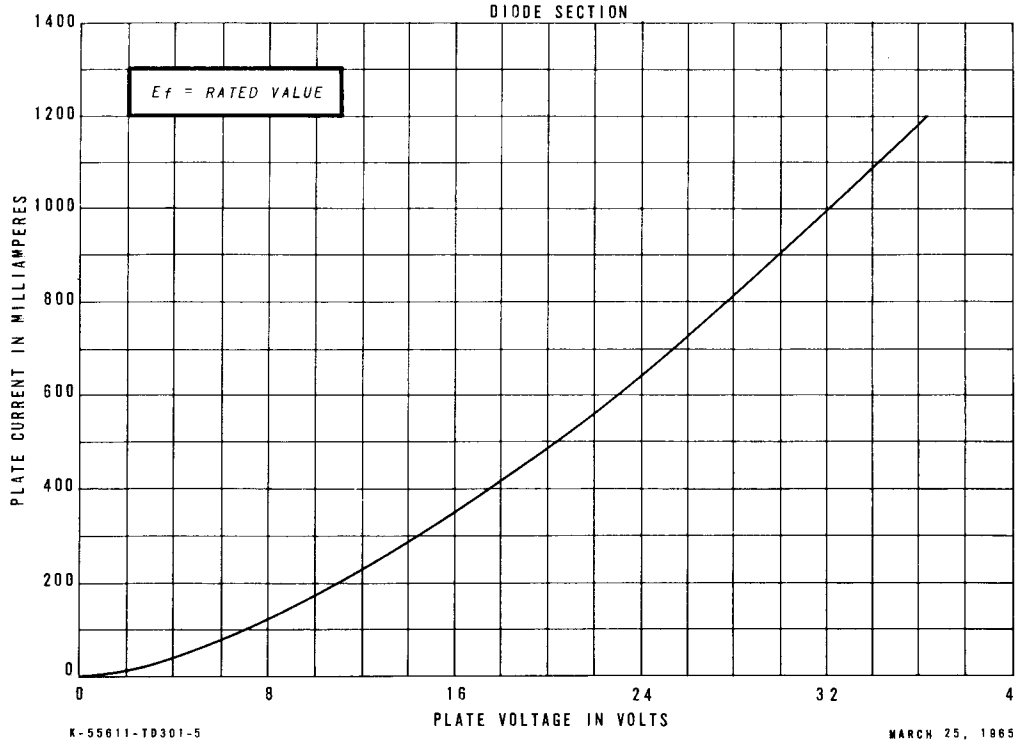
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Electronic TUBE
KEN-RAD

41

Description and Rating

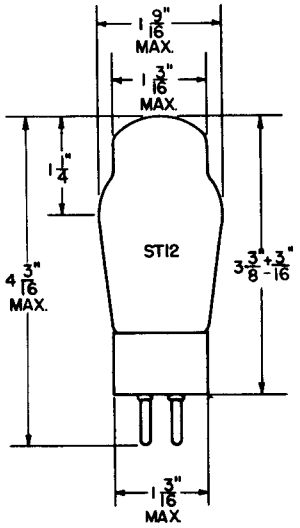
POWER-AMPLIFIER PENTODE

GENERAL DESCRIPTION

Principal Application: The 41 is a heater-cathode type power-amplifier pentode tube designed for service in the output stage of a-c or battery-operated receivers. More than one audio stage preceding the 41 is not recommended because of the possibility of microphonic disturbances resulting from the high level of amplification. Electrically the 41 and 6K6-GT are identical.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.4 Ampere
Envelope	ST-12 Glass
Base	A6-7 Small 6-Pin Phenolic
Mounting Position	Any
Direct Interelectrode Capacitances: *	
Grid Number 1 to Plate	0.5 μμf
Input	5.5 μμf
Output	6.0 μμf

PHYSICAL DIMENSIONS

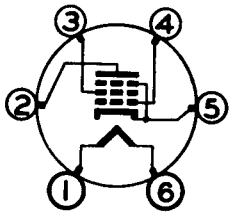


RMA 12-5

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate
Pin 3 - Grid No. 2 (Screen)
Pin 4 - Grid Number 1
Pin 5 - Cathode and Grid No. 3
Pin 6 - Heater

BASING DIAGRAM



RMA 6B
BOTTOM VIEW

MAXIMUM RATINGS

	Design Center	Absolute	
Plate Voltage	315	345	Volts
Screen (Grid Number 2) Voltage	285	315	Volts
Screen Supply Voltage	315	345	Volts
Plate Dissipation	8.5	9.4	Watts
Screen Dissipation	2.8	3.1	Watts
D-C heater-Cathode Voltage	90	100	Volts

** Approximate values without external shield.*

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A AMPLIFIER

Heater Voltage (A-C or D-C)	6.3	6.3	6.3	Volts
Plate Voltage	100	250	315	Volts
Screen (Grid No. 2) Voltage	100	250	285	Volts
Grid Bias Voltage **	-7	-18	-21	Volts
Peak A-F Grid Voltage	7	18	21	Volts
Zero-Signal Plate Current	9	32	25.5	Milliamperes
Zero-Signal Screen Current	1.6	5.5	4.0	Milliamperes
Maximum-Signal Plate Current	9.5	33	28	Milliamperes
Maximum-Signal Screen Current	3	10	9	Milliamperes
Plate Resistance	104000	88000	75000	Ohms
Transconductance	1500	2300	2100	Micromhos
Load Resistance	12000	7600	9000	Ohms
Total Harmonic Distortion	11	11	15	Per Cent
Maximum-Signal Power Output	0.35	3.4	4.5	Watts

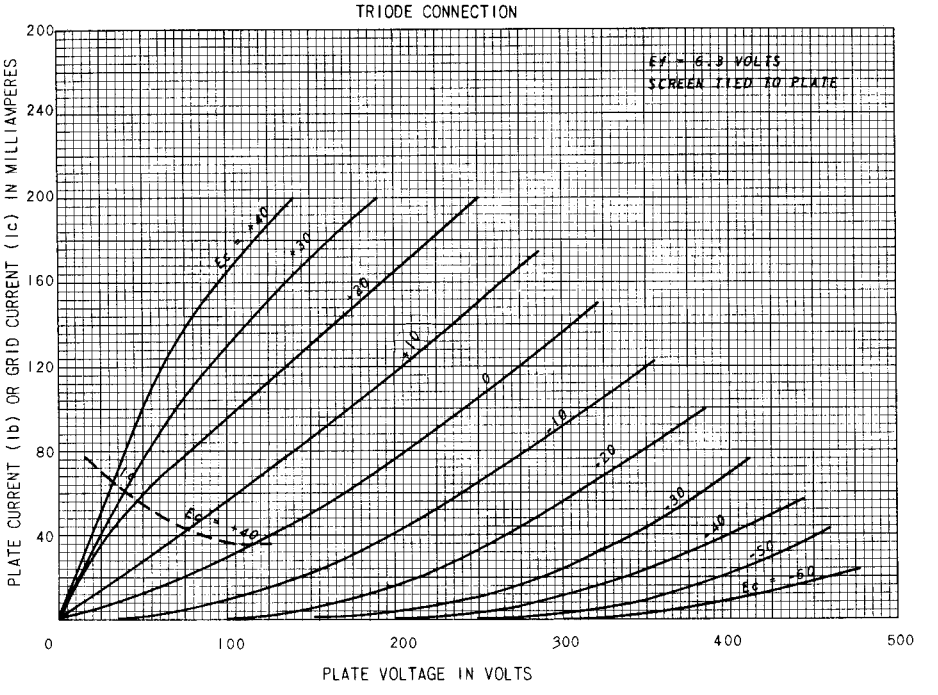
PUSH-PULL CLASS A AMPLIFIER °

	Fixed Bias	Self Bias	
Heater Voltage (A-C or D-C)	6.3	6.3	Volts
Plate Voltage	285	285	Volts
Screen (Grid Number 2) Voltage	285	285	Volts
Grid Bias Voltage **	-25.5	---	Volts
Self Bias Cathode Resistor	---	400	Ohms
Peak A-F Grid to Grid Voltage	51	51	Volts
Zero-Signal Plate Current	55	55	Milliamperes
Zero-Signal Screen Current	9	9	Milliamperes
Maximum-Signal Plate Current	72	61	Milliamperes
Maximum-Signal Screen Current	17	13	Milliamperes
Load Resistance (Plate to Plate)	12000	12000	Ohms
Total Harmonic Distortion	6	4	Per Cent
Maximum-Signal Power Output	10.5	9.8	Watts

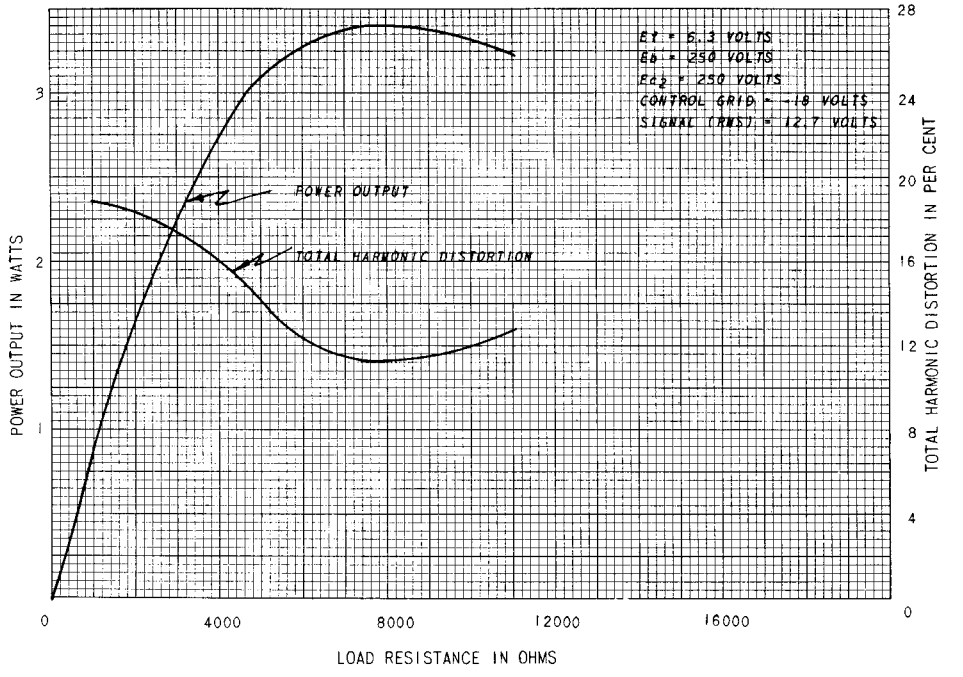
** *Transformer- or impedance-type input coupling devices are recommended to minimize resistance in the grid circuit. The d-c resistance, in the grid circuit, under rated maximum conditions, should not exceed 0.1 megohm with fixed bias or 0.5 megohm with cathode bias.*

° *Values are for two tubes unless otherwise stated.*

AVERAGE PLATE CHARACTERISTICS

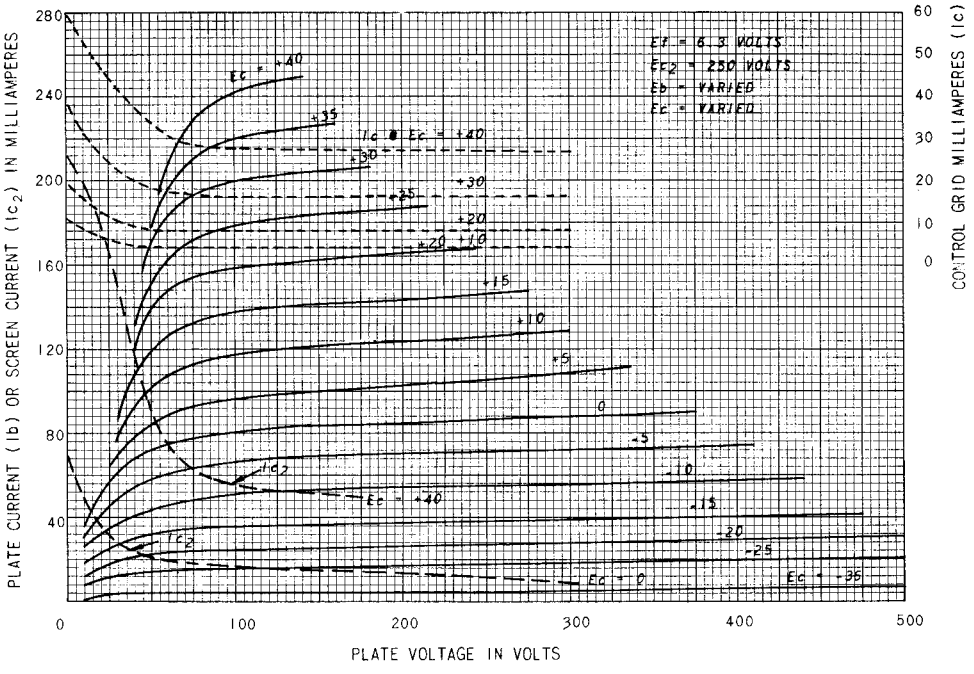


OPERATION CHARACTERISTICS



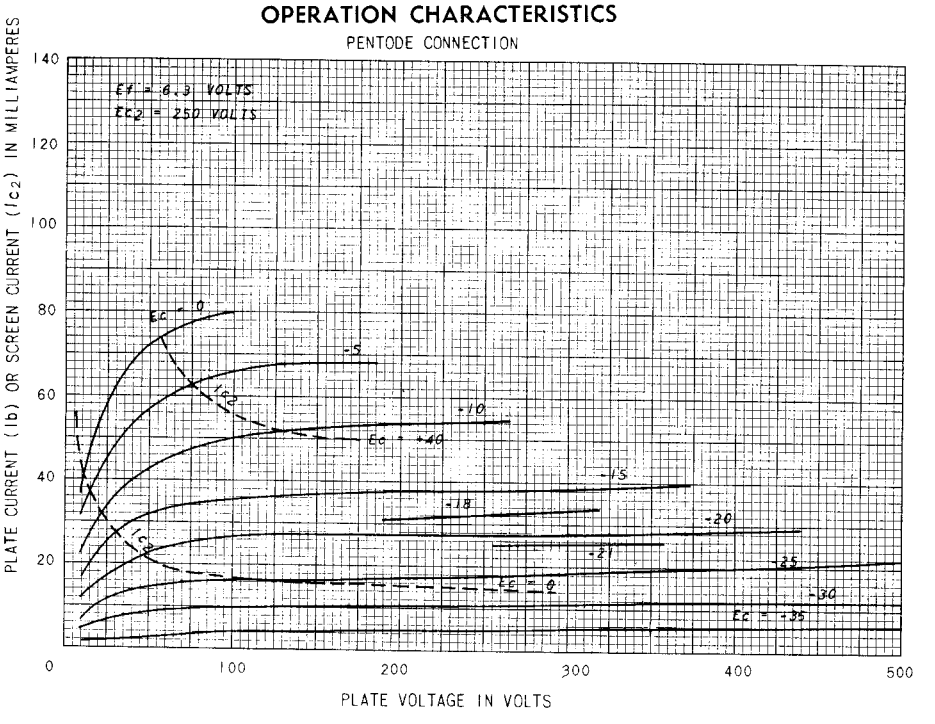
AVERAGE CHARACTERISTICS

PENTODE CONNECTION



OPERATION CHARACTERISTICS

PENTODE CONNECTION



Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

Electronic TUBE
KEN-RAD

42

Description and Rating

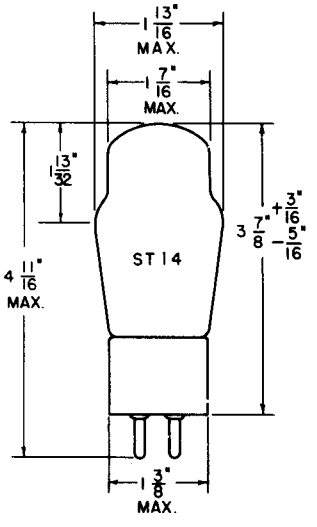
POWER-AMPLIFIER PENTODE

GENERAL DESCRIPTION

Principal Application: The 42 is a heater-cathode type pentode amplifier tube designed for use as a power-amplifier in the audio-output stage of a-c or battery-operated equipment. Electrically the 42, 6F6 and 6F6-GT are identical and the 42 and 2A5 are the same except for heater rating.

Cathode	Coated Unipotential	Envelope	ST-14 Glass
Heater Voltage (A-C or D-C)	6.3 Volts	Base	A6-12 Medium 6-Pin Phenolic
Heater Current	0.7 Ampere	Mounting Position	Any

PHYSICAL DIMENSIONS

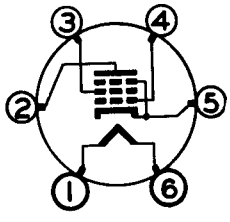


RMA 14-1

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate
Pin 3 - Grid No. 2 (Screen)
Pin 4 - Grid Number 1
Pin 5 - Cathode and Grid No. 3
Pin 6 - Heater

BASING DIAGRAM



RMA 6B
BOTTOM VIEW

MAXIMUM RATINGS

	Pentode Design Center	Pentode Absolute	Triode § Design Center	Triode § Absolute	
Plate Voltage	375	415	350	385	Volts
Screen (Grid No. 2) Voltage	285	315	---	---	Volts
Screen Supply Voltage	375	415	---	---	Volts
Plate Dissipation	11.0	12.1	10	11	Watts
Screen Dissipation	3.75	4.13	---	---	Watts
D-C Heater-Cathode Voltage	90	100	90	100	Volts

§ *With grid number 2 (screen) connected to plate.*

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A AMPLIFIER - PENTODE CONNECTION

	Fixed Bias		Cathode Bias		
Heater Voltage	6.3	6.3	6.3	6.3	Volts
Plate Voltage	250	285	250	285	Volts
Screen Voltage	250	285	250	285	Volts
Grid Bias Voltage **	-16.5	-20	---	---	Volts
Cathode Bias Resistor	---	---	410	440	Ohms
Peak A-F Grid Voltage	16.5	20	16.5	20	Volts
Plate Resistance (Approx)	80000	78000	---	---	Ohms
Transconductance	2500	2550	---	---	Micromhos
Zero-Signal Plate Current	34	38	34	38	Milliamperes
Zero-Signal Screen Current	6.5	7.0	6.5	7.0	Milliamperes
Maximum-Signal Plate Current	36	40	35	38	Milliamperes
Maximum-Signal Screen Current	10.5	13	9.7	12	Milliamperes
Load Resistance	7000	7000	7000	7000	Ohms
Total Harmonic Distortion	8	9	8.5	9	Per Cent
Maximum-Signal Power Output	3.2	4.8	3.1	4.5	Watts

CLASS A AMPLIFIER - TRIODE CONNECTION §

	Fixed Bias	Cathode Bias	
Heater Voltage	6.3	6.3	Volts
Plate Voltage	250	250	Volts
Grid Bias Voltage **	-20	---	Volts
Cathode Bias Resistor	---	650	Ohms
Peak A-F Grid Voltage	20	20	Volts
Plate Resistance (Approx)	2600	---	Ohms
Transconductance	2600	---	Micromhos
Zero-Signal Plate Current	31	31	Milliamperes
Maximum-Signal Plate Current	34	32	Milliamperes
Load Resistance	4000	4000	Ohms
Total Harmonic Distortion	6.5	6.5	Per Cent
Maximum-Signal Power Output	0.85	0.80	Watt

PUSH-PULL CLASS A AMPLIFIER - PENTODE CONNECTION ##

	Fixed Bias	Cathode Bias	
Heater Voltage	6.3	6.3	Volts
Plate Voltage	315	315	Volts
Screen Voltage	285	285	Volts
Grid Bias Voltage **	-24	---	Volts
Cathode Bias Resistor	---	320	Ohms
Peak A-F Grid to Grid Voltage	48	58	Volts
Zero-Signal Plate Current	62	62	Milliamperes
Zero-Signal Screen Current	12	12	Milliamperes
Maximum-Signal Plate Current	80	73	Milliamperes
Maximum-Signal Screen Current	19.5	18	Milliamperes
Effective Load Resistance (Plate to Plate)	10000	10000	Ohms
Total Harmonic Distortion	4	3	Per Cent
Maximum-Signal Power Output	11	10.5	Watts

§ *With grid number 2 (screen) connected to plate.*

** *The d-c resistance in the grid circuit, under maximum rated conditions, should not exceed 0.1 megohm for fixed bias operation and 0.5 megohm for cathode bias operation.*

Unless otherwise specified the values given are for two tubes.

PUSH-PULL CLASS AB_2 AMPLIFIER ##

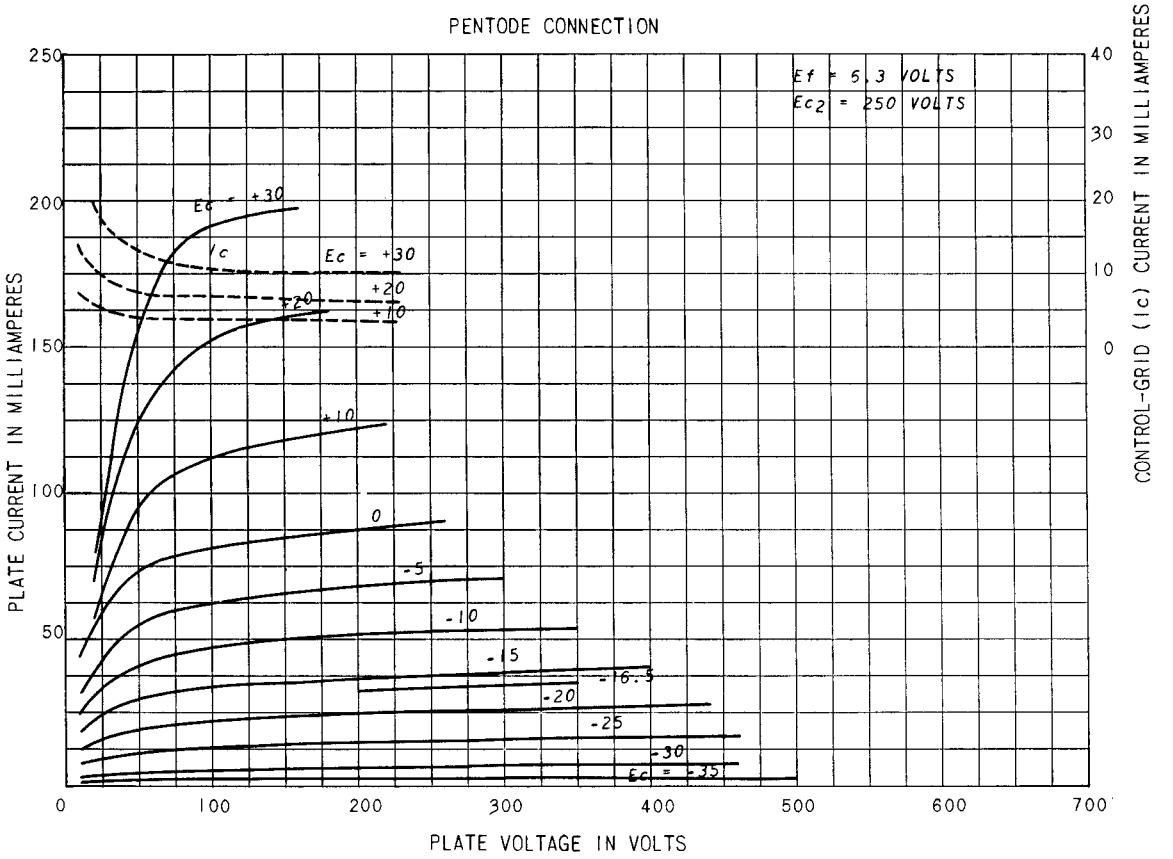
	Pentode Connection		Triode Connection §		
	Fixed Bias	Cathode Bias	Fixed Bias	Cathode Bias	
Heater Voltage	6.3	6.3	6.3	6.3	Volts
Plate Voltage	375	375	350	350	Volts
Screen Voltage	250	250	---	---	Volts
Grid Bias Voltage **	-26	---	-38	---	Volts
Cathode Bias Resistor	---	340	---	730	Ohms
Peak A-F Grid to Grid Voltage	82	94	123	132	Volts
Zero-Signal Plate Current	34	54	48	50	Milliamperes
Zero-Signal Screen Current	5	8	---	---	Milliamperes
Maximum-Signal Plate Current	82	77	92	60	Milliamperes
Maximum-Signal Screen Current	19.5	18	---	---	Milliamperes
Effective Load Resistance (Plate to Plate)	10000	10000	6000	10000	Ohms
Total Harmonic Distortion	3.5	5	2	3	Per Cent
Maximum-Signal Power Output	18.5	19	13	9	Watts

§ *With grid number 2 (screen) connected to plate.*

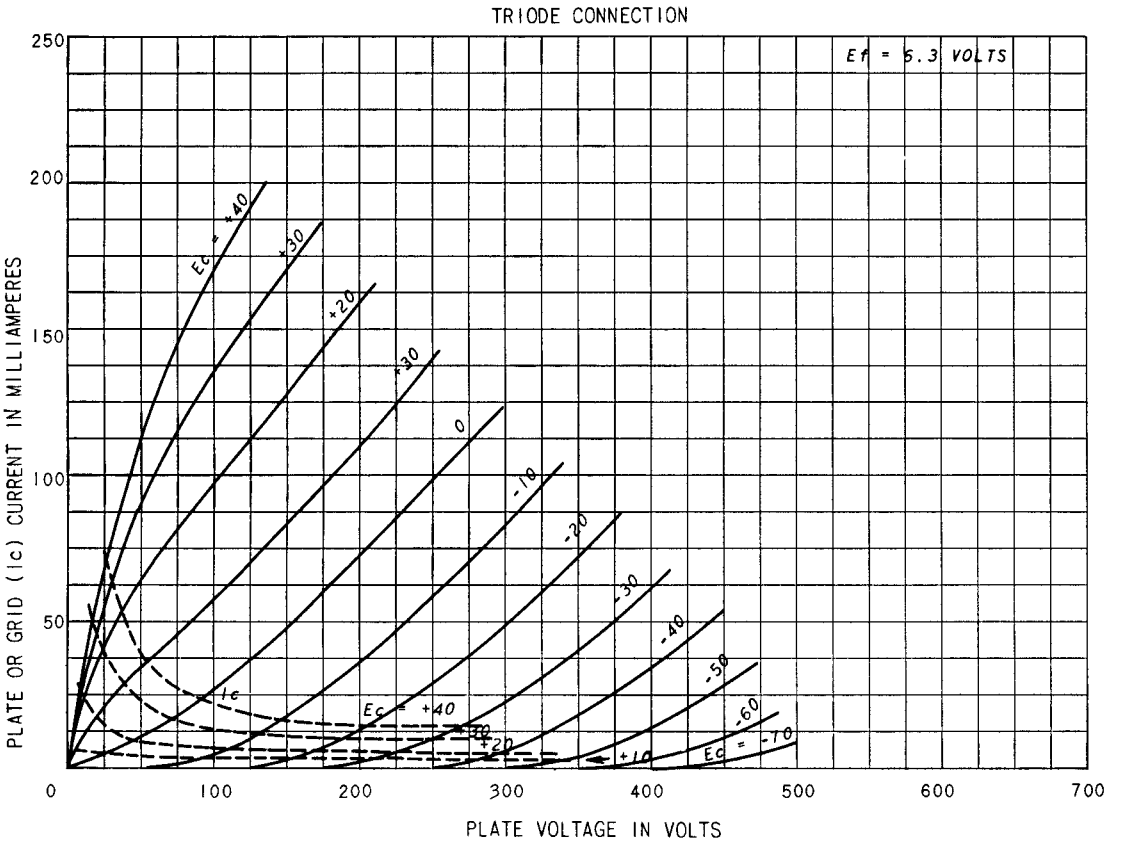
** *The d-c resistance in the grid circuit, under maximum rated conditions, should not exceed 0.1 megohm for fixed bias operation and 0.5 megohm for cathode bias operation.*

Unless otherwise specified the values given are for two tubes.

AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

Electronic TUBE

47

Description and Rating

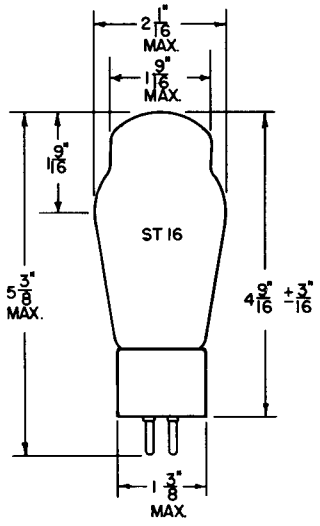
POWER-AMPLIFIER PENTODE

GENERAL DESCRIPTION

Principal Application: The 47 is a power amplifier pentode designed for use either singly or in push-pull in the output stage of home receivers.

Cathode	Coated Filament	Envelope	ST-16, Glass
Filament Voltage (A-C or D-C)	2.5 Volts	Base	A5-11, Medium 5-Pin
Filament Current	1.75 Amperes	Mounting Position *	Vertical

PHYSICAL DIMENSIONS

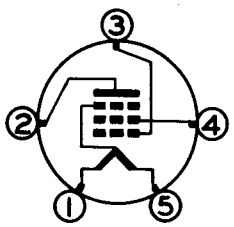


RTMA 16-1

TERMINAL CONNECTIONS

Pin 1 - Filament
Pin 2 - Plate
Pin 3 - Grid Number 1
Pin 4 - Grid Number 2 (Screen)
Pin 5 - Filament

BASING DIAGRAM



RTMA 5B
BOTTOM VIEW

MAXIMUM RATINGS

DESIGN CENTER VALUES

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid Number 1 Circuit Resistance:		
With Fixed Bias	0.1	Megohm
With Cathode Bias	0.5	Megohm

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

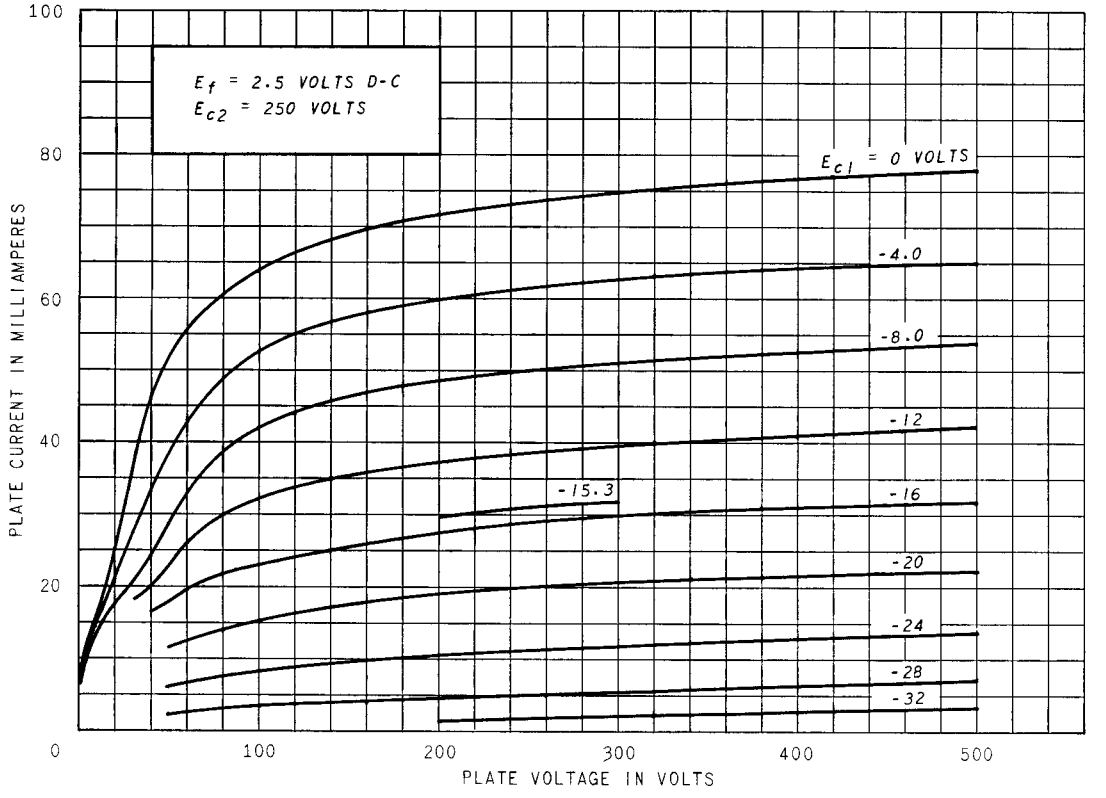
Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid Number 1 Voltage #	-15.3	Volts
Amplification Factor	150	
Plate Resistance (Approx)	60000	Ohms
Transconductance	2500	Micromhos
Plate Current	31	Milliamperes
Screen Current	6	Milliamperes
Load Resistance	7000	Ohms
Total Harmonic Distortion (Approx)	6	Per Cent
Power Output	2.7	Watts

** Horizontal operation permitted if pins 1 and 5 are in a vertical plane*

 # If filament is operated on a-c, the grid voltage should be -16.5 volts

Supersedes ET-T486 dated 5-47

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

50C5—12C5
17C5—25C5
BEAM PENTODE
FOR AF POWER AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 50C5 is a miniature beam pentode primarily designed for use in the audio-frequency power-output stage of radio receivers. The tube features high power sensitivity and high efficiency at relatively low plate and screen voltages normally available in this application.

The 25C5 differs from the 50C5 in heater ratings; the 12C5 and 17C5 differ from the 50C5 in heater and heater-cathode voltage ratings; in all other characteristics the four types are identical.

The controlled heater warm-up characteristic incorporated in the 12C5 and 17C5 make them especially suited for television receivers that employ series-connected heaters.

GENERAL

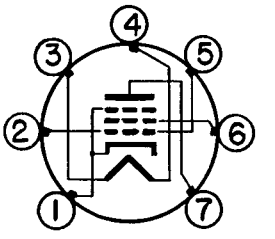
ELECTRICAL

	12C5	17C5	25C5	50C5	
Cathode—Coated Unipotential					
Heater Voltage, AC or DC	12.6	16.8	25.0	50.0	Volts
Heater Current	0.6	0.45	0.3	0.15	Amperes
Heater Warm-up Time*	11	11	....	....	Seconds
Direct Interelectrode Capacitances†					
Grid-Number 1 to Plate				0.55	μμf
Input				13	μμf
Output				9.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

BASING DIAGRAM

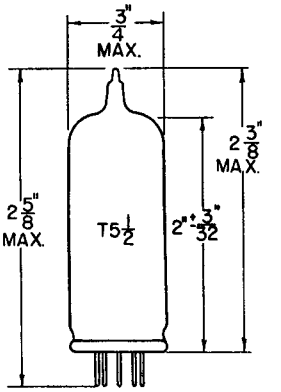


RETMA 7CV

TERMINAL CONNECTIONS

Pin 1—Cathode and Beam Plates
Pin 2—Grid Number 1
Pin 3—Heater
Pin 4—Heater
Pin 5—Grid Number 1
Pin 6—Grid Number 2 (Screen)
Pin 7—Plate

PHYSICAL DIMENSIONS



RETMA 5-3

GENERAL ELECTRIC

Supersedes ET-T990, dated 12-55

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage		135		Volts
Screen Voltage		117		Volts
Plate Dissipation		5.5		Watts
Screen Dissipation		1.25		Watts
Heater-Cathode Voltage	**12C5**		**25C5**	
Heater Positive with Respect to Cathode	**17C5**		**50C5**	
DC Component	100		100	Volts
Total DC and Peak	200		200	Volts
Heater Negative with Respect to Cathode				
DC Component	200		...	Volts
Total DC and Peak	300		200	Volts
Grid-Number 1 Circuit Resistance				
With Fixed Bias		0.1		Megohms
With Cathode Bias		0.5		Megohms
Bulb Temperature at Hottest Point		250		C

CHARACTERISTICS AND TYPICAL OPERATION

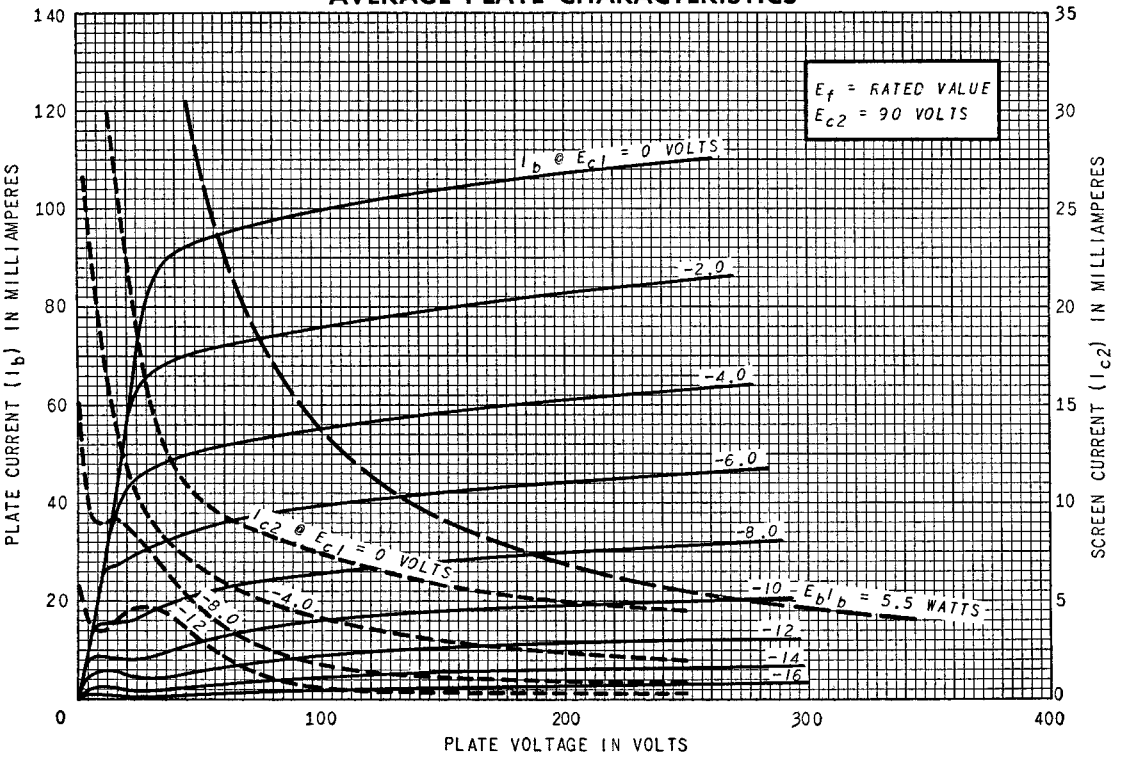
CLASS A_1 AMPLIFIER

Plate Voltage	110	Volts
Screen Voltage	110	Volts
Grid-Number 1 Voltage	−7.5	Volts
Peak AF Grid-Number 1 Voltage	7.5	Volts
Plate Resistance, approximate	10000	Ohms
Transconductance	7500	Micromhos
Zero-Signal Plate Current	49	Milliamperes
Maximum-Signal Plate Current	50	Milliamperes
Zero-Signal Screen Current	4.0	Milliamperes
Maximum-Signal Screen Current	8.5	Milliamperes
Load Resistance	2500	Ohms
Total Harmonic Distortion, approximate	9	Percent
Maximum-Signal Power Output	1.9	Watts

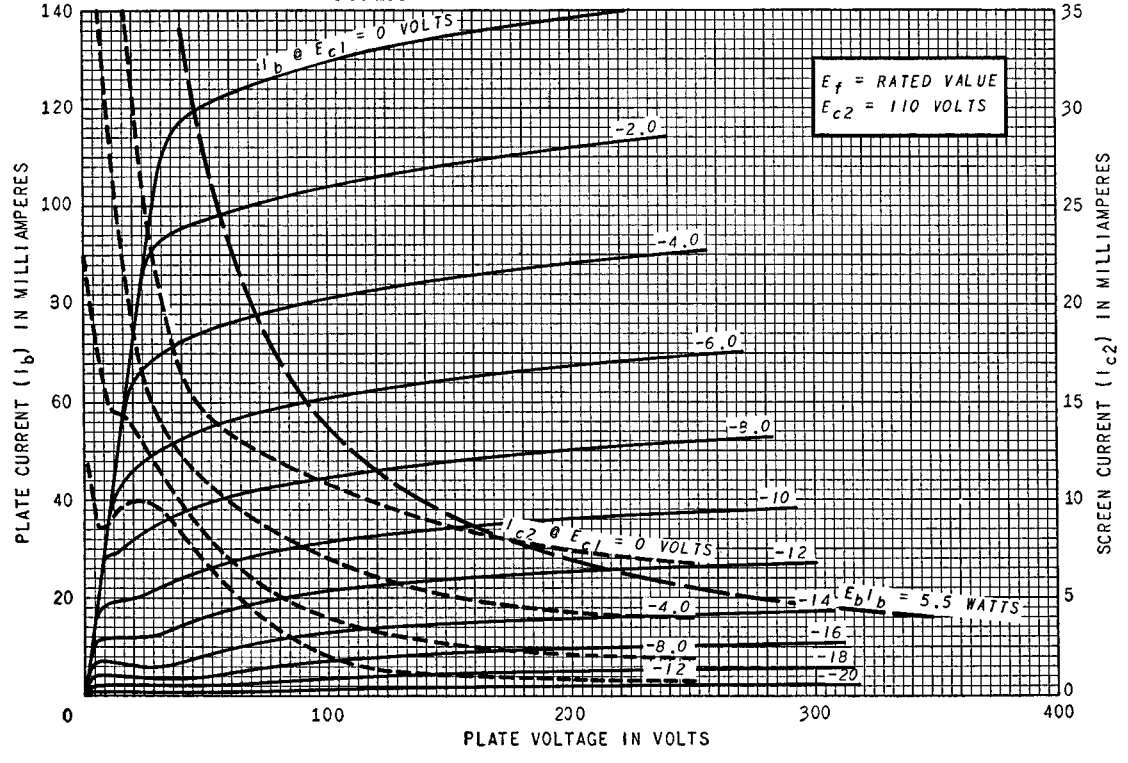
* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

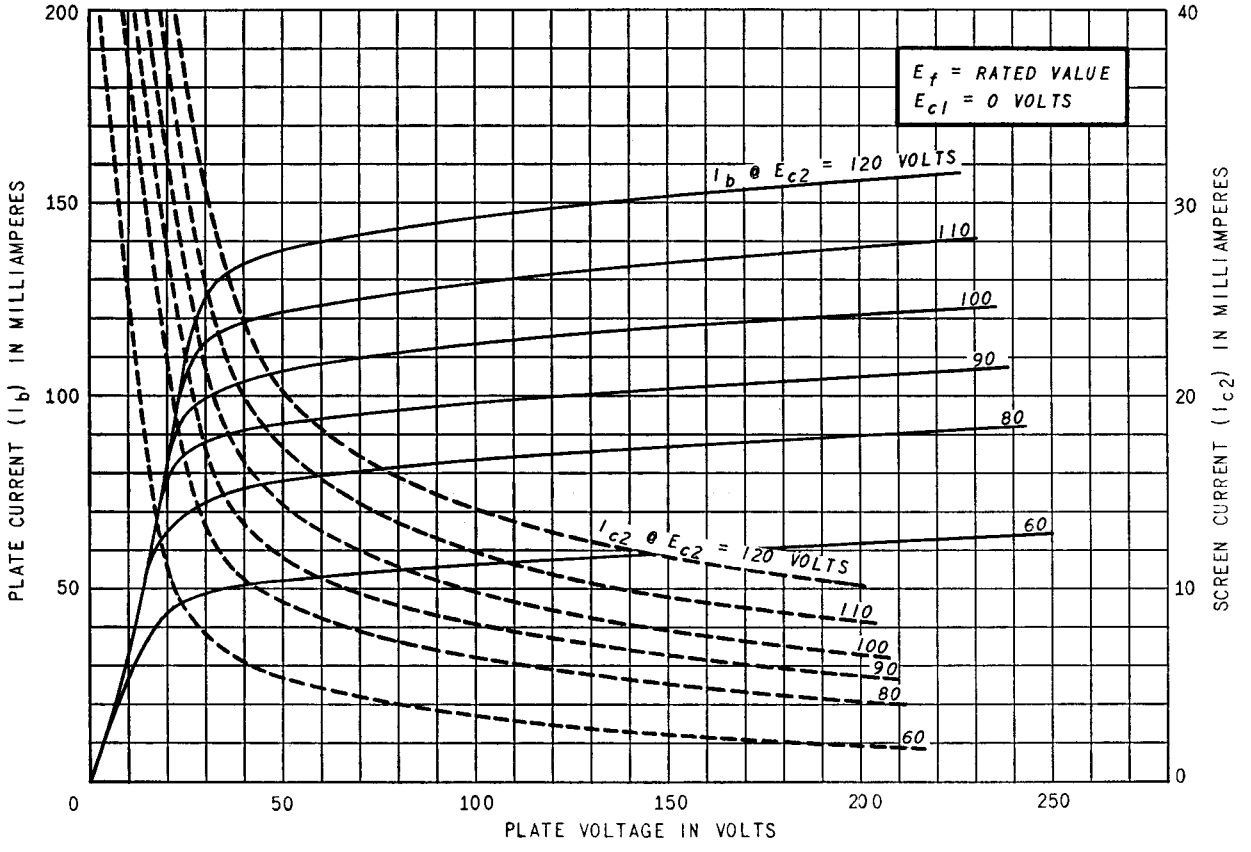
AVERAGE PLATE CHARACTERISTICS



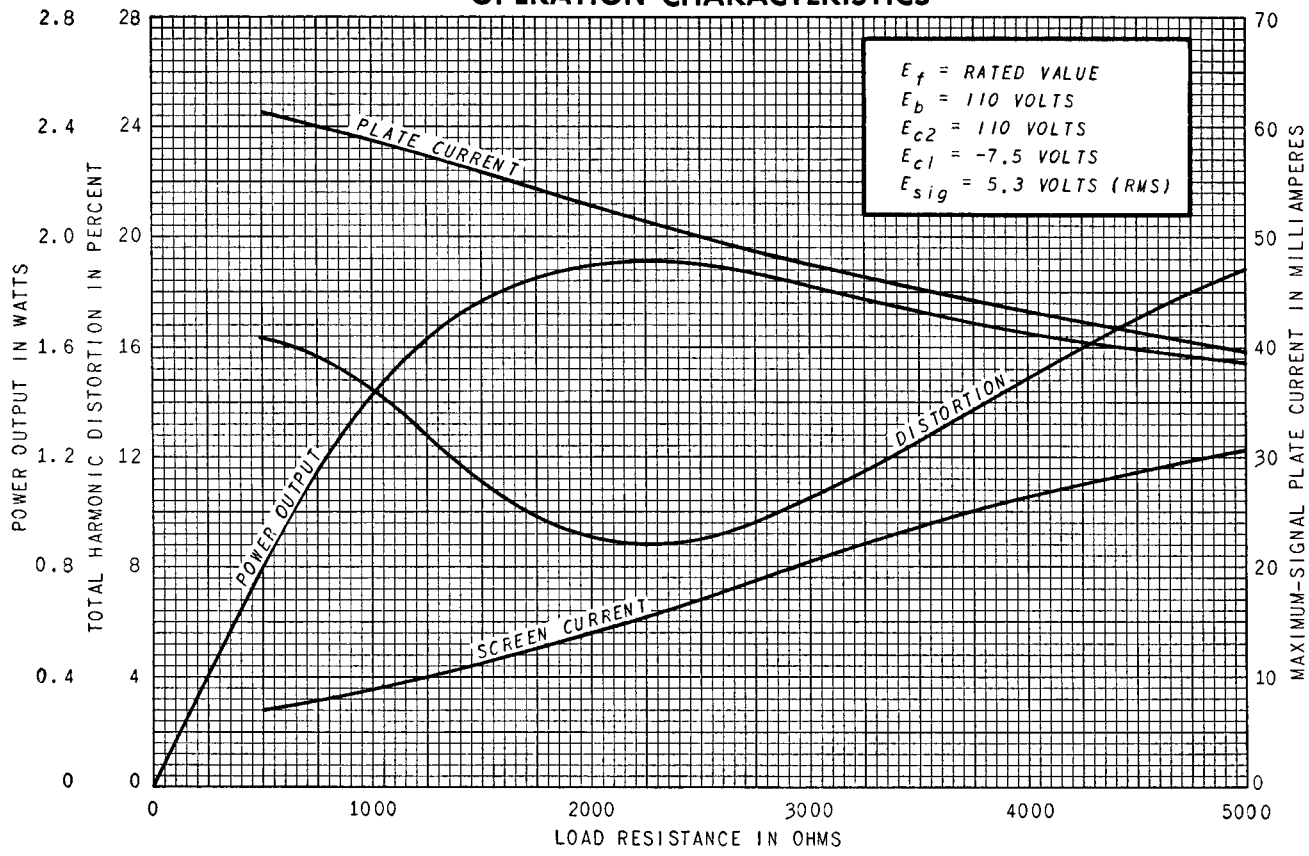
AVERAGE PLATE CHARACTERISTICS



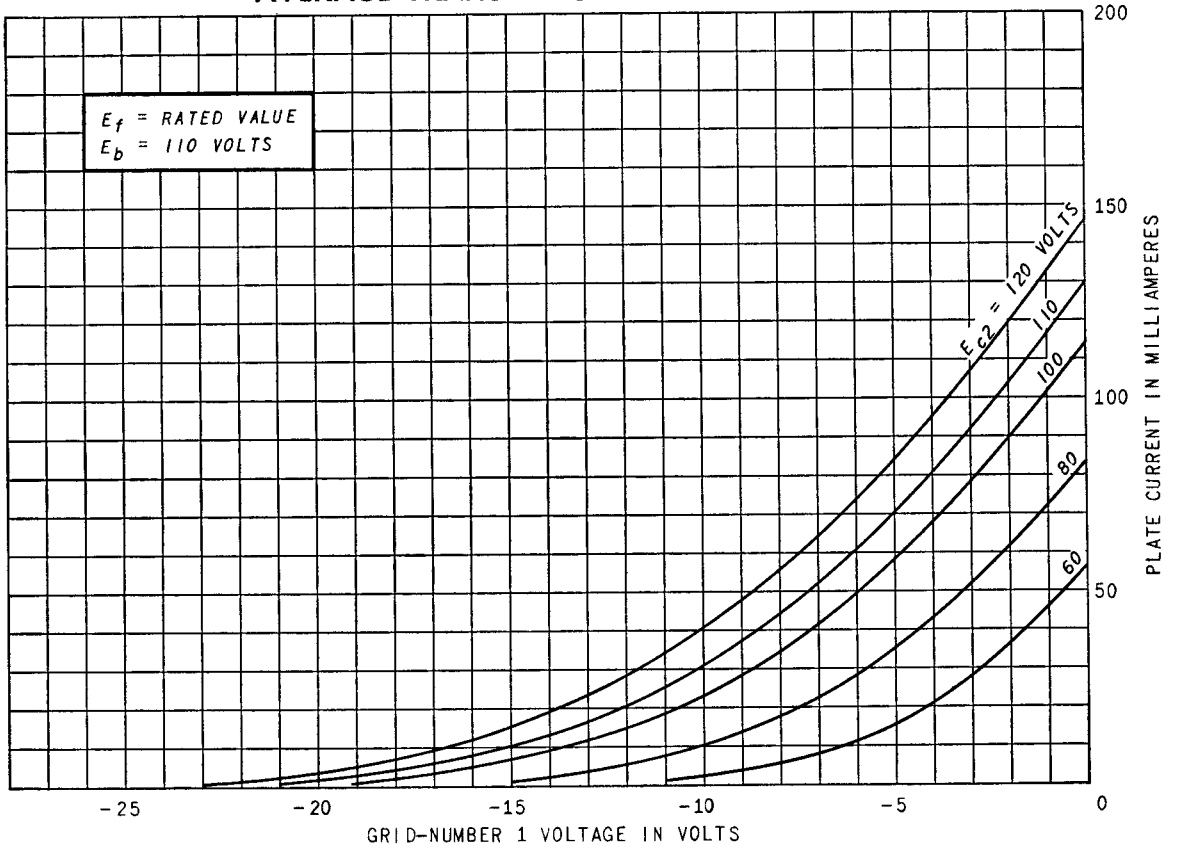
AVERAGE PLATE CHARACTERISTICS



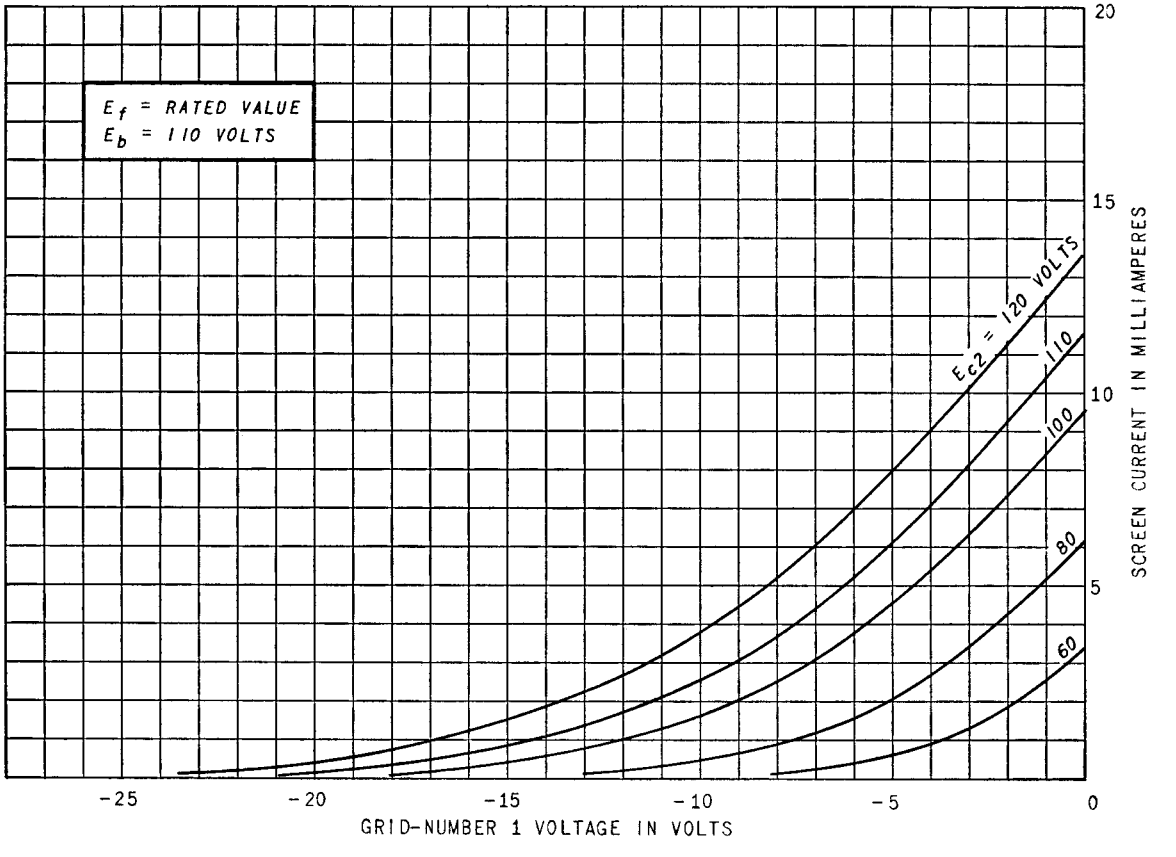
OPERATION CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



Electronic TUBES

50DC4

DIODE

FOR HALF-WAVE POWER RECTIFIER APPLICATIONS

DESCRIPTION AND RATING

The 50DC4 is a miniature half-wave rectifier designed for use in line-operated equipment having series-connected heaters. The heater is tapped to permit operation of a panel lamp.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Voltage, AC or DC*.....50 ± 10% Volts
Heater-Tap Voltage*.....7.5 Volts
Heater Current*.....0.15 Amperes

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

RECTIFIER SERVICE—DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage.....330 Volts
Steady-State Peak Plate Current.....720 Milliamperes
DC Output Current
  Without Panel Lamp.....120 Milliamperes
  With Panel Lamp and Shunting Resistor.....110 Milliamperes
  With Panel Lamp and No Shunting Resistor.....70 Milliamperes
Heater-Tap Voltage When Panel Lamp Fails, RMS.....16.5 Volts
Heater-Cathode Voltage
  Heater Positive with Respect to Cathode.....330 Volts
  Heater Negative with Respect to Cathode.....330 Volts

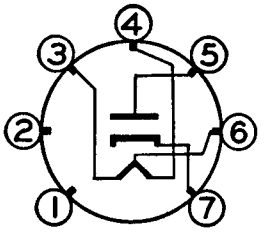
Design-Maximum Ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

GENERAL ELECTRIC

BASING DIAGRAM

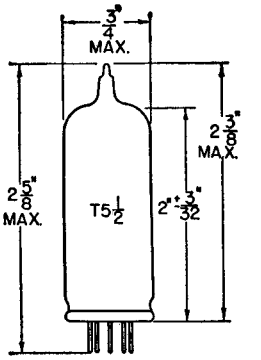


EIA 5BQ

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—No Connection
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Heater Tap
Pin 7—Cathode

PHYSICAL DIMENSIONS



EIA 5-3

CHARACTERISTICS AND TYPICAL OPERATION

HALF-WAVE RECTIFIER WITH PANEL LAMP NUMBER 40 OR NUMBER 47

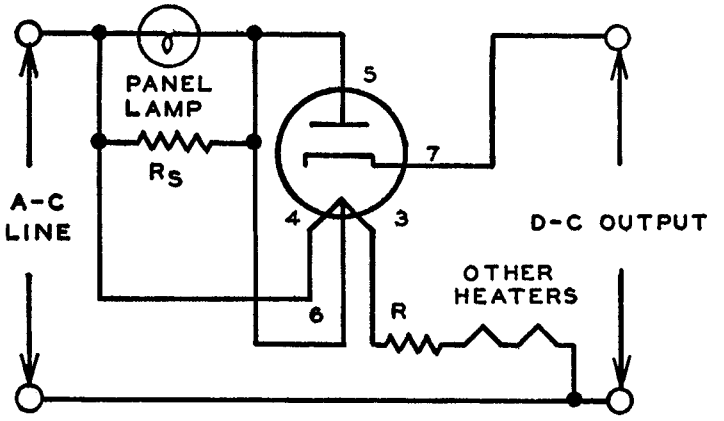
Heater Voltage (Pin 3 to Pin 4)	45	45	45	45	Volts
Heater-Tap Voltage (Pin 4 to Pin 6)	5.5	5.5	5.5	5.5	Volts
Heater Current (Between Pins 3 and 6)	150	150	150	150	Milliamperes
AC Plate-Supply Voltage, RMS	117	117	117	117	Volts
Filter Input Capacitor	40	40	40	40	Microfarads
Total Effective Plate-Supply Impedance	15	15	15	15	Ohms
Panel-Lamp Shunting Resistor	450	200	100	75	Ohms
DC Output Current	70	80	90	100	Milliamperes

HALF-WAVE RECTIFIER WITHOUT PANEL LAMP

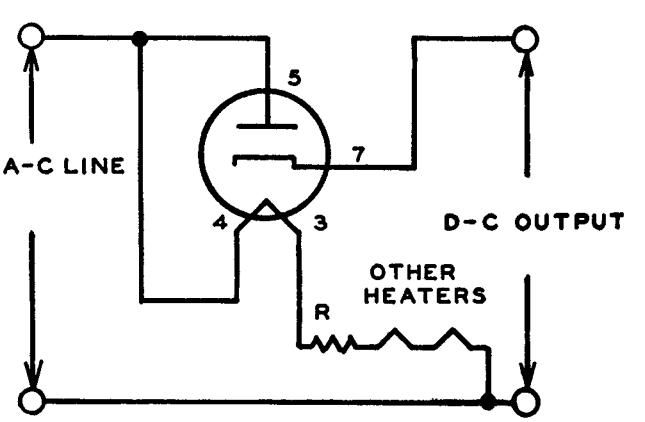
Heater Voltage (Pin 3 to Pin 4)	50	Volts
Heater-Tap Voltage (Pin 4 to Pin 6)	7.5	Volts
Heater Current (Between Pins 3 and 4)	150	Milliamperes
AC Plate-Supply Voltage, RMS	117	Volts
Filter Input Capacitor	40	Microfarads
Total Effective Plate-Supply Impedance	15	Ohms
DC Output Current	110	Milliamperes
DC Output Voltage at Filter Input, approximate		
For DC Output Current of 55 Milliamperes	130	Volts
For DC Output Current of 110 Milliamperes	110	Volts
Tube Voltage Drop		
Ib = 240 Milliamperes DC	21	Volts

*Operation without panel lamp.

TYPICAL CIRCUIT FOR OPERATION WITH PANEL LAMP



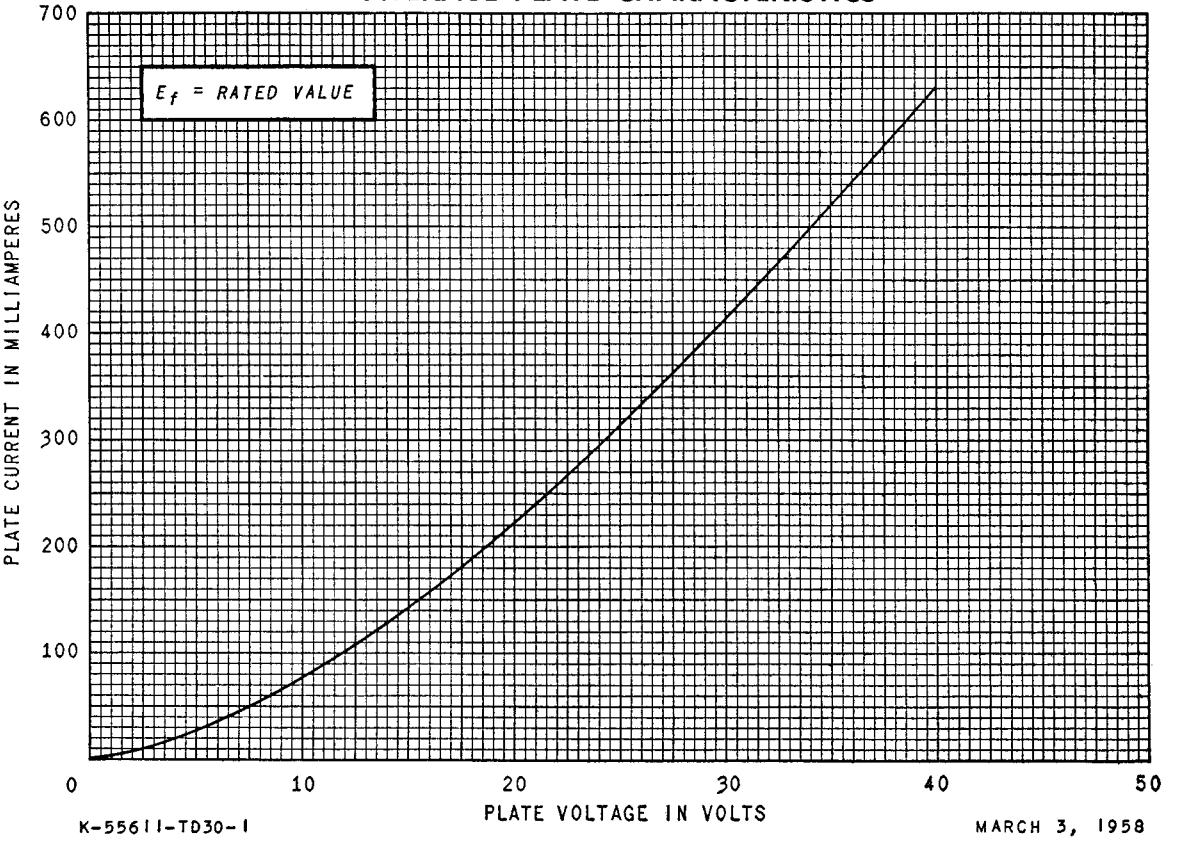
TYPICAL CIRCUIT FOR OPERATION WITHOUT PANEL LAMP



R_s = PANEL-LAMP SHUNTING RESISTOR

DROP ACROSS R AT 0.15 AMPERE SHOULD EQUAL DIFFERENCE BETWEEN LINE VOLTAGE AND TOTAL OF ALL RATED HEATER VOLTAGES

AVERAGE PLATE CHARACTERISTICS



Electronic TUBES

50EH5

PENTODE

FOR AF POWER-AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 50EH5 is a miniature power pentode primarily designed for use in the audio-frequency power-output stage of radio receivers and phonographs. The tube features high power sensitivity at low plate and screen voltages.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	50	Volts
Heater Current	0.15	Amperes
Direct Interelectrode Capacitances, approximate*		
Grid-Number 1 to Plate	0.65	μμf
Input	17	μμf
Output	9.0	μμf

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate Voltage	135	Volts
Screen Voltage	117	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	5.0	Watts
Screen Dissipation	1.75	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.5	Megohms
Bulb Temperature at Hottest Point	220	C

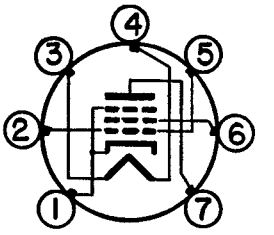
Design-Center ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under normal conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in tube characteristics.

The equipment manufacturer should design so that initially no design-center value for the intended service is exceeded with a bogey tube in equipment operating at the stated normal supply-voltage.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

BASING DIAGRAM

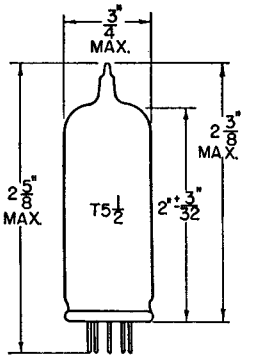


EIA 7CV

TERMINAL CONNECTIONS

Pin 1—Cathode and Grid Number 3 (Suppressor)
Pin 2—Grid Number 1
Pin 3—Heater
Pin 4—Heater
Pin 5—Grid Number 1
Pin 6—Grid Number 2 (Screen)
Pin 7—Plate

PHYSICAL DIMENSIONS



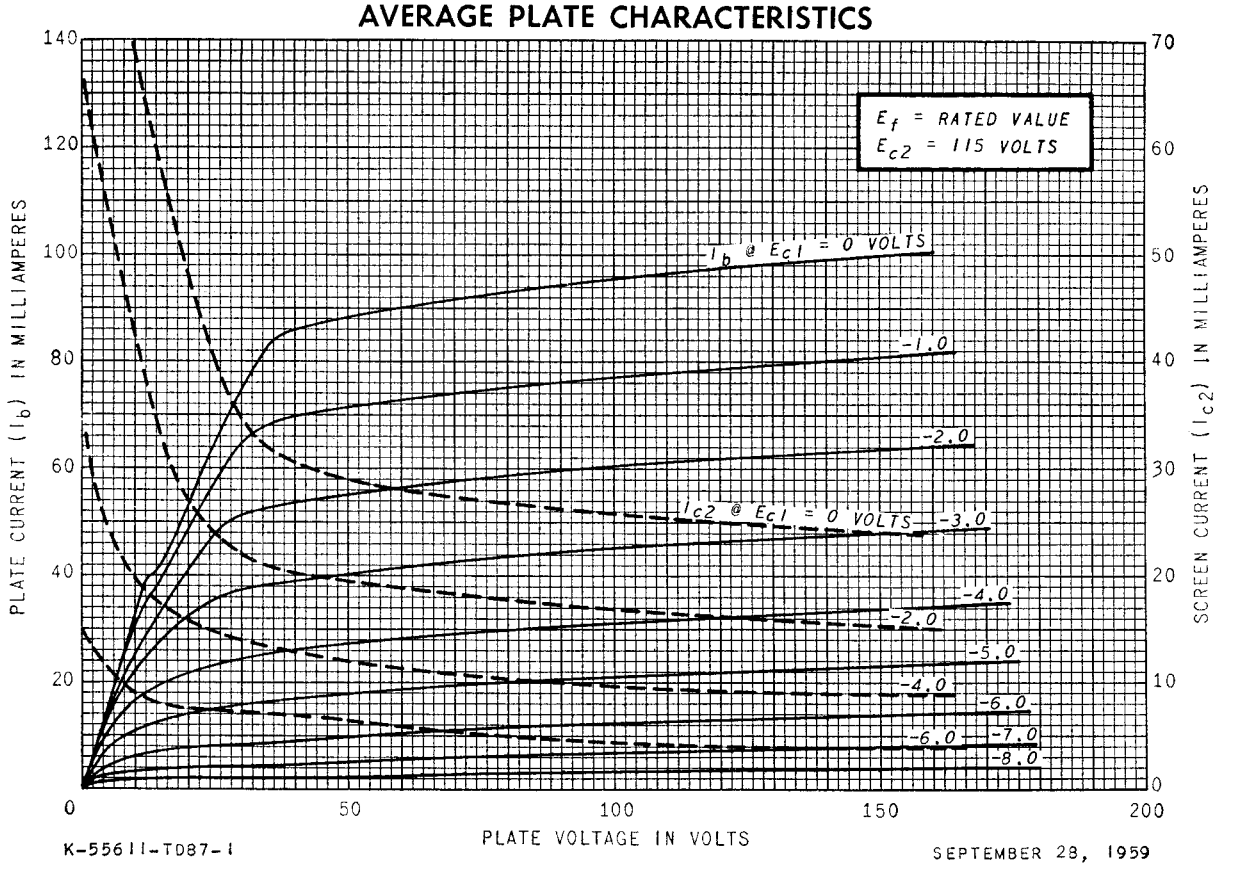
EIA 5-3

CHARACTERISTICS AND TYPICAL OPERATION

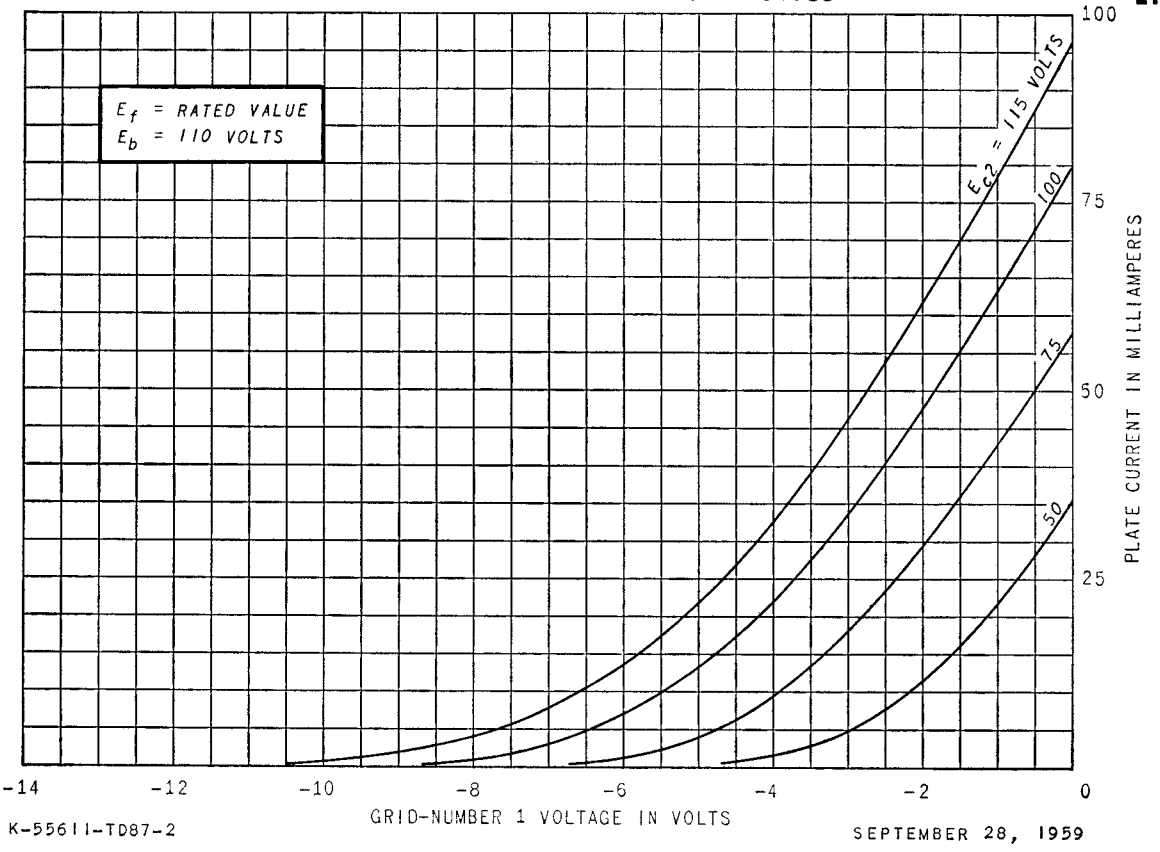
CLASS A_1 AMPLIFIER

Plate Voltage	110	Volts
Screen Voltage	115	Volts
Cathode-Bias Resistor	62	Ohms
Peak AF Grid-Number 1 Voltage	3.0	Volts
Plate Resistance, approximate	11000	Ohms
Transconductance	14600	Micromhos
Zero-Signal Plate Current	42	Milliamperes
Maximum-Signal Plate Current	42	Milliamperes
Zero-Signal Screen Current	11.5	Milliamperes
Maximum-Signal Screen Current	14.5	Milliamperes
Load Resistance	3000	Ohms
Total Harmonic Distortion, approximate	7	Percent
Maximum-Signal Power Output	1.4	Watts

* Without external shield.



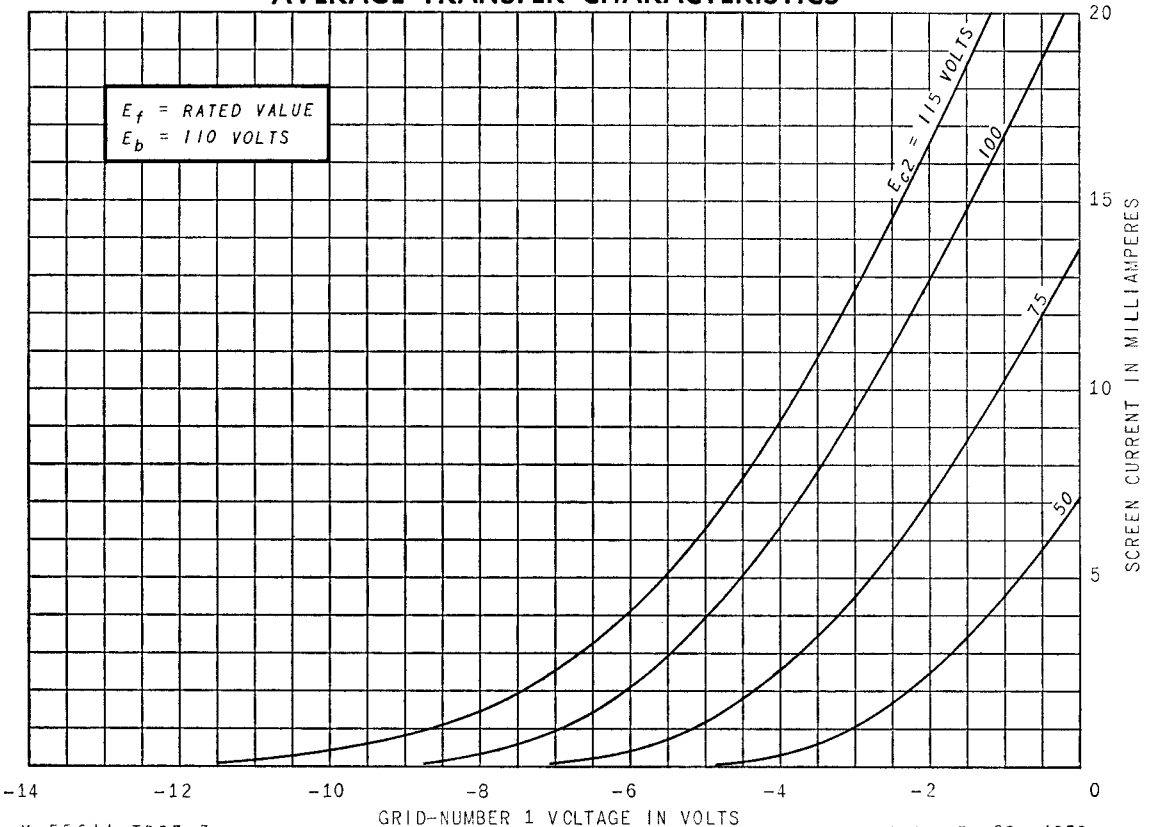
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD87-2

SEPTEMBER 28, 1959

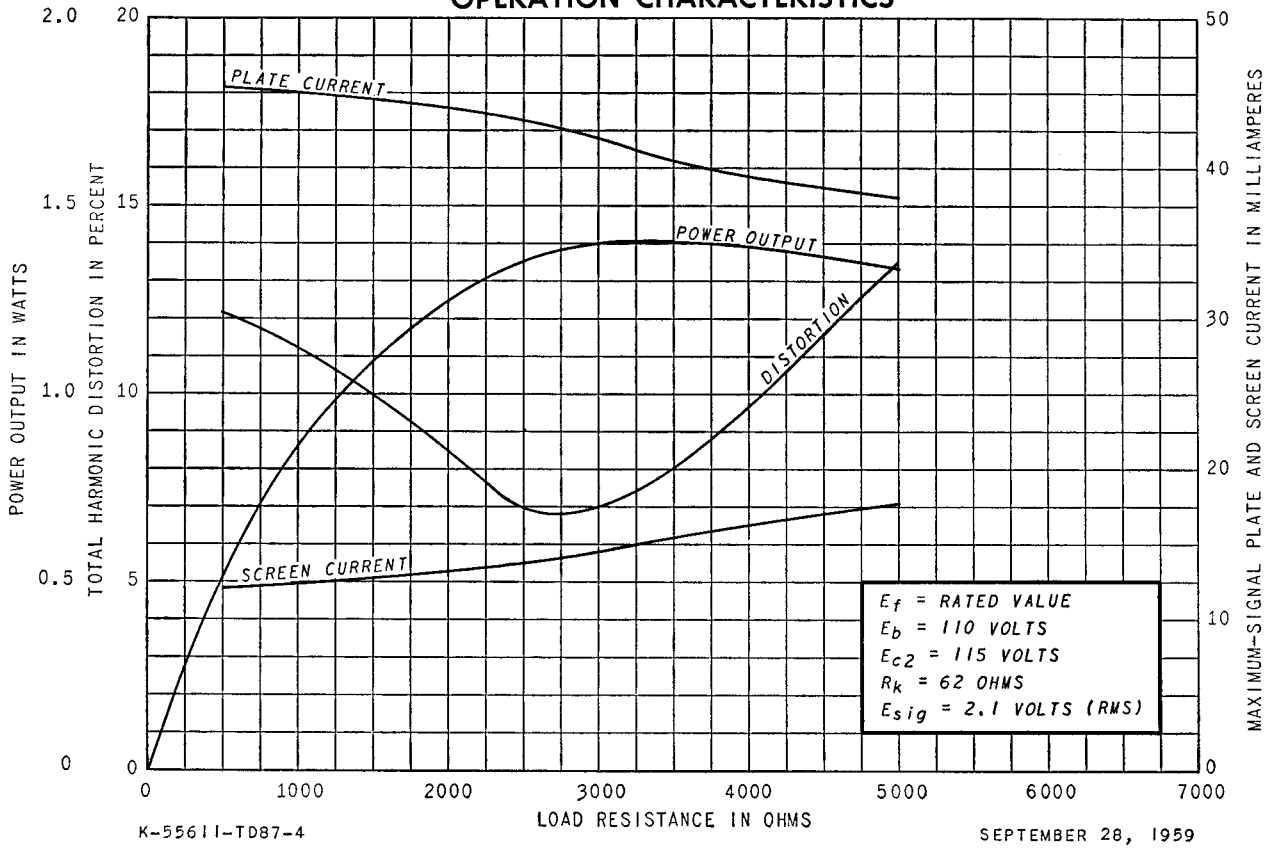
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD87-3

SEPTEMBER 28, 1959

OPERATION CHARACTERISTICS



K-55611-TD87-4

SEPTEMBER 28, 1959

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

from JEDEC release #3252, May 1, 1961

50HC6

For AF Power Amplifier Applications

The 50HC6 is a miniature power pentode primarily designed for use in the audio-frequency power output stage of radio receivers. Features of the tube include high power sensitivity at low plate and screen voltages and a heater tap to permit operation of a panel lamp.

GENERAL

Electrical

Cathode - Coated Unipotential
Heater Characteristics and Ratings (Design-Maximum Rating System)

Heater Voltage, AC or DC*	50	Volts
Heater Current+	0.15±0.009	Amperes
Heater Tap Voltage‡	7.0	Volts
Direct Interelectrode Capacitances, approximate§		
Grid-Number 1 to Plate: (g1 to p)	0.5	pf
Input: g1 to (h + k + g2 + g3)	17	pf
Output: p to (h + k + g2 + g3)	9.0	pf

Mechanical

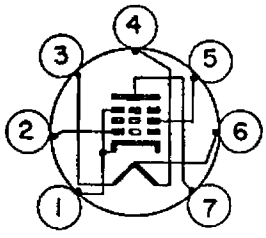
Mounting Position - Any
Envelope - T-5 1/2, Glass
Base - E7-1, Miniature Button, 7-Pin
Outline Drawing - EIA 5-3

Maximum Diameter	3/4	Inches
Maximum Over-all Length	2 5/8	Inches
Maximum Seated Height	2 3/8	Inches

TERMINAL CONNECTIONS

Pin 1 - Cathode and Grid Number 3 (Suppressor)
Pin 2 - Grid Number 1
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Grid Number 2 (Screen)
Pin 6 - Heater Tap
Pin 7 - Plate

BASING DIAGRAM



EIA 7FZ

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS

Design-Maximum Values

Heater-Tap Voltage When Panel Lamp Fails, RMS	14	Volts
Plate Voltage	150	Volts
Screen Voltage	130	Volts
Plate Dissipation	5.5	Watts
Screen Dissipation	2.0	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

Design-maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions. The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier

Plate Voltage	110	Volts
Screen Voltage	115	Volts
Cathode-Bias Resistor	62	Ohms
Peak AF Grid-Number 1 Voltage	3.0	Volts
Plate Resistance, approximate	11000	Ohms
Transconductance	14600	Micromhos
Zero-Signal Plate Current	42	Milliamperes
Maximum-Signal Plate Current	42	Milliamperes
Zero-Signal Screen Current	11.5	Milliamperes
Maximum-Signal Screen Current	14.5	Milliamperes
Load Resistance	3000	Ohms
Total Harmonic Distortion, approximate	7	Percent
Maximum-Signal Power Output	1.4	Watts

* Heater voltage at bogey heater current.

\+ For series heater operation, the equipment designer shall design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

‡ Without panel lamp.

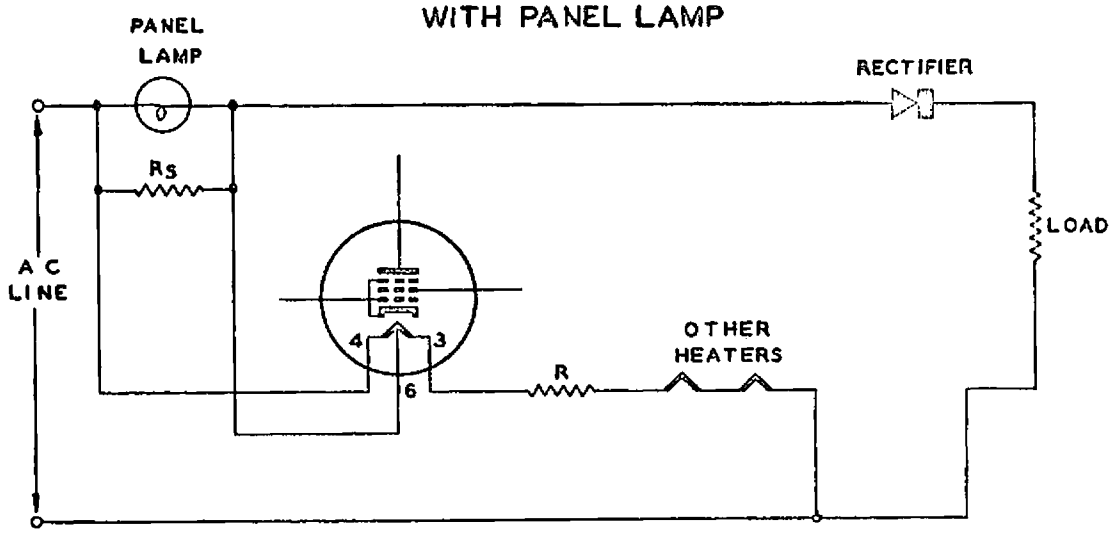
§ Without external shield.

The 50HC6 has a heater tap, which may be used for operating a 6.3-volt, 150-milliampere panel lamp in equipment employing semiconductor rectifiers. The table below gives the required values of panel-lamp shunting resistor for various rectifier load currents.

SHUNTING RESISTOR REQUIRED WITH PANEL LAMP NUMBER 40 OR NUMBER 47 (See Typical Circuit)

Heater Voltage (Pin 3 to Pin 4)	45	45	45	45	45	45	45	Volts
Heater-Tap Voltage (Pin 4 to Pin 6)	5.0	5.4	5.5	5.5	5.5	5.5	5.5	Volts
Heater Current (Between Pins 3 and 6)	150	150	150	150	150	150	150	Milliamperes
Panel-Lamp Shunting Resistor	---	---	370	175	120	88	73	Ohms
Rectifier Load Current¶	60	70	80	90	100	110	120	Milliamperes

TYPICAL CIRCUIT FOR OPERATION WITH PANEL LAMP



Rs = PANEL-LAMP SHUNTING RESISTOR

DROP ACROSS R AT 0.15 AMPERE SHOULD EQUAL DIFFERENCE BETWEEN LINE VOLTAGE AND TOTAL OF ALL RATED HEATER VOLTAGES

¶ Higher load currents will require smaller values of panel-lamp shunting resistor. For maximum panel-lamp life, the shunting resistor should be selected to allow a panel-lamp voltage of 5.5 volts with full rectifier load current.

—PRODUCT INFORMATION—

Compactron Diode-Pentode

53HK7

The 53HK7 is a compactron containing a high-perveance diode and a beam-power pentode. The diode is intended for service as the damping diode and the pentode as the horizontal-deflection amplifier in television receivers.

Except for heater characteristics and ratings, the 53HK7 is identical to the 38HK7.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	53.2	Volts
Heater Current‡	0.315±0.02	Amperes
Heater Warm-up Time, Average§	11	Seconds

NOTES

* Heater voltage for a bogey tube at If = 0.315 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ The time required for the voltage across the heater to reach 80 percent of the bogey value after applying 4 times the bogey heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the bogey heater voltage divided by the bogey heater current.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

TECHNICAL DATA
Electronic Tubes

56R9

COMPACTRON TRIODE - PENTODE

The 56R9 is a compactron containing a high-mu triode and a beam-power pentode. The triode is intended for audio-frequency voltage-amplifier service and the pentode for power-amplifier service.

A feature of the 56R9 is the incorporation of separate heaters for the two sections.

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings	Triode Section	Pentode Section	
Heater Voltage, AC or DC	14*	42+	Volts
Heater Current‡	0.15±0.01	0.15±0.01	Amperes
Direct Interelectrode Capacitances§			
Pentode Section			
Grid-Number 1 to Plate: (Pg1 to Pp)		0.36	pf
Input: Pg1 to (h + Pk + Pg2 + b.p.)		12	pf
Output: Pp to (h + Pk + Pg2 + b.p.)		6.5	pf
Triode Section			
Grid to Plate: (Tg to Tp)		3.0	pf
Input: Tg to (h + Tk)		3.4	pf
Output: Tp to (h + Tk)		0.6	pf

Mechanical

Mounting Position - Any		
Envelope - T-9, Glass		
Base - E12-70, Button 12-Pin		
Outline Drawing - EIA 9-58		
Maximum Diameter	1.188	Inches
Maximum Over-all Length	2.375	Inches
Maximum Seated Height	2.000	Inches

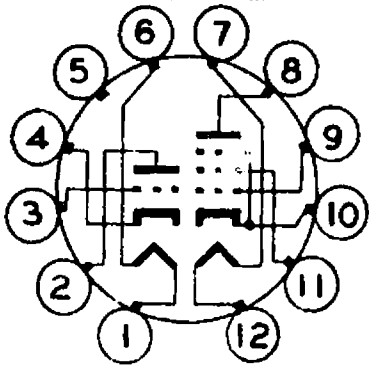
ETR-2186

from JEDEC release #4002, Dec. 3, 1962

TERMINAL CONNECTIONS

Pin 1 - Triode Heater
Pin 2 - Triode Plate
Pin 3 - Triode Grid
Pin 4 - Triode Cathode
Pin 5 - No Connection
Pin 6 - Triode Heater
Pin 7 - Pentode Heater
Pin 8 - Pentode Plate
Pin 9 - Pentode Grid Number 1
Pin 10 - Pentode Cathode and Beam Plates
Pin 11 - Pentode Grid Number 2 (Screen)
Pin 12 - Pentode Heater

BASING DIAGRAM



EIA 12EN

MAXIMUM RATINGS

Design-Maximum Values	Pentode Section	Triode Section	
Plate Voltage	150	150	Volts
Screen Voltage	135	---	Volts
Plate Dissipation	6.5	1.0	Watts
Screen Dissipation	1.8	---	Watts
DC Cathode Current	65	---	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	1.0	---	Megohms
With Cathode Bias	2.2	---	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier

	Pentode Section (Power Amplifier)	Triode Section (Voltage Amplifier)	
Plate Voltage	120	100	Volts
Screen Voltage	110	---	Volts
Grid-Number 1 Voltage	-8.0	---	Volts
Cathode-Bias Resistor	---	1500	Ohms
Peak AF Grid-Number 1 Voltage	8.0	---	Volts
Amplification Factor	---	100	
Plate Resistance, Approx.	10000	55500	Ohms
Transconductance	7500	1800	Micromhos
Plate Current	---	0.6	Milliamperes
Zero-Signal Plate Current	49	---	Milliamperes
Maximum-Signal Plate Current	50	---	Milliamperes
Zero-Signal Screen Current	4.0	---	Milliamperes
Maximum-Signal Screen Current	8.5	---	Milliamperes
Load Resistance	2500	---	Ohms
Total Harmonic Distortion, Approx.	10	---	Percent
Maximum-Signal Power Output	2.3	---	Watts

* Heater voltage for the triode section of a bogey tube at If = 0.15 amperes.

+ Heater voltage for the pentode section of a bogey tube at If = 0.15 amperes.

‡ The equipment designer should design the equipment so that heater current is centered at the specified bogey value, with heater supply variations restricted to maintain heater current within the specified tolerance.

§ Without external shield.

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Electronic TUBE
KEN-RAD

58

Description and Rating

RADIO-FREQUENCY-AMPLIFIER PENTODE

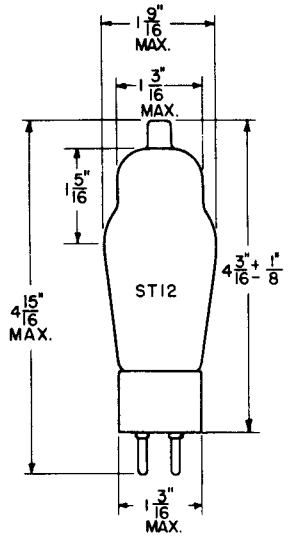
GENERAL DESCRIPTION

Principal Application: The 58 is a heater-cathode type pentode with remote cut-off characteristics and is designed for service as a radio-frequency or intermediate-frequency amplifier in a-c or battery operated equipment. Except for capacitances and heater rating the electrical ratings and characteristics of the 58 are the same as those of the 6D6 and 6U7-G.

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	2.5 Volts
Heater Current	1.0 Ampere
Envelope:	ST-12 Glass
Base:	A6-7 Small 6-Pin Phenolic
Top Cap	C1-1 Small Metal

Mounting Position	Any
Direct Interelectrode Capacitances: *	
Grid to Plate (Max)	0.007 μμf
Input	4.7 μμf
Output	6.3 μμf

PHYSICAL DIMENSIONS

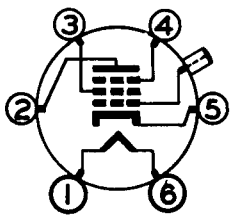


RMA 12-2

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Plate
Pin 3 - Grid Number 2 (Screen)
Pin 4 - Grid No. 3 (Suppressor)
Pin 5 - Cathode and Internal Shield
Pin 6 - Heater
Top Cap - Grid Number 1

BASING DIAGRAM



RMA 6F
BOTTOM VIEW

MAXIMUM RATINGS

	Design Center	Absolute	
Plate Voltage	300	330	Volts
Screen (Grid Number 2) Voltage	100	110	Volts
Screen Supply Voltage	300	330	Volts
Grid Bias Voltage	Never Positive		
Plate Dissipation	2.25	2.48	Watts
Screen Dissipation	0.25	0.28	Watt
D-C Heater-Cathode Voltage	90	100	Volts

** With close-fitting external shield connected to cathode and internal shield.*

CHARACTERISTICS AND TYPICAL OPERATION

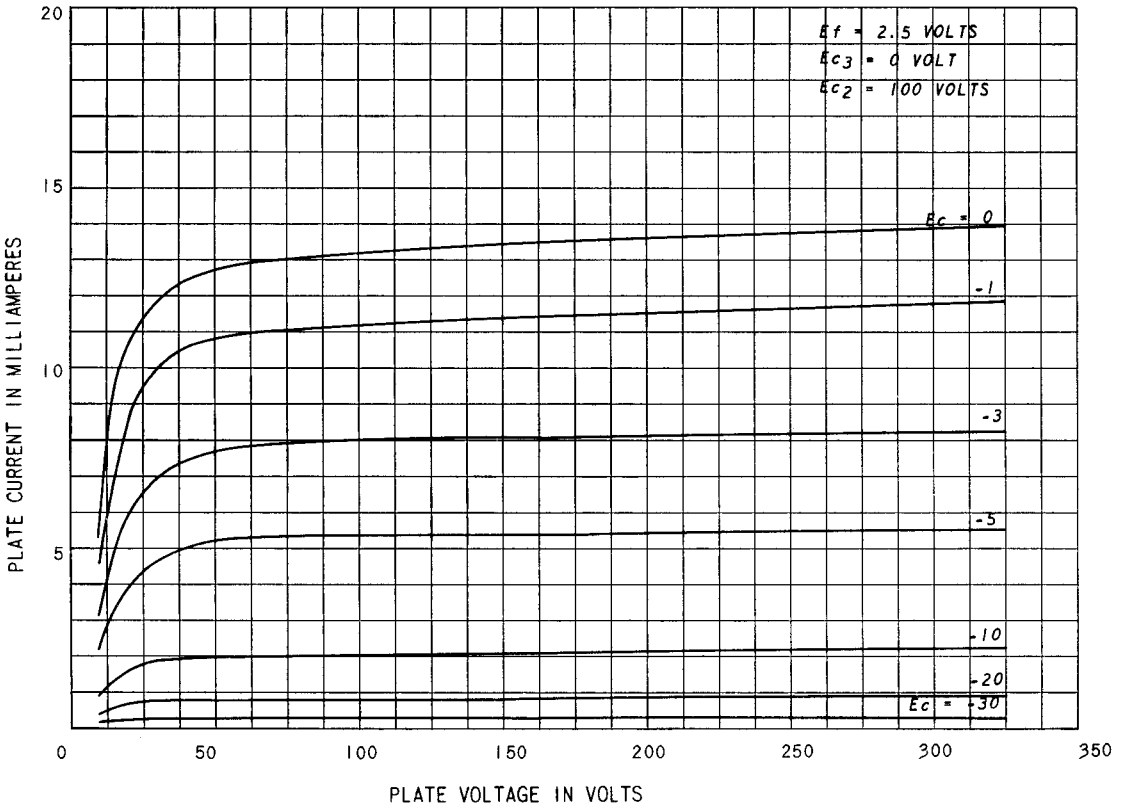
CLASS A AMPLIFIER

Heater Voltage	2.5	2.5	Volts
Plate Voltage	100	250	Volts
Screen Voltage	100	100	Volts
Suppressor (Grid No. 3) Voltage **	0	0	Volt
Grid Bias Voltage	-3	-3	Volts
Plate Resistance (Approx)	0.25	0.8	Megohm
Transconductance	1500	1600	Micromhos
Grid Bias Voltage §	-50	-50	Volts
Plate Current	8.0	8.2	Milliamperes
Screen Current	2.2	2.0	Milliamperes

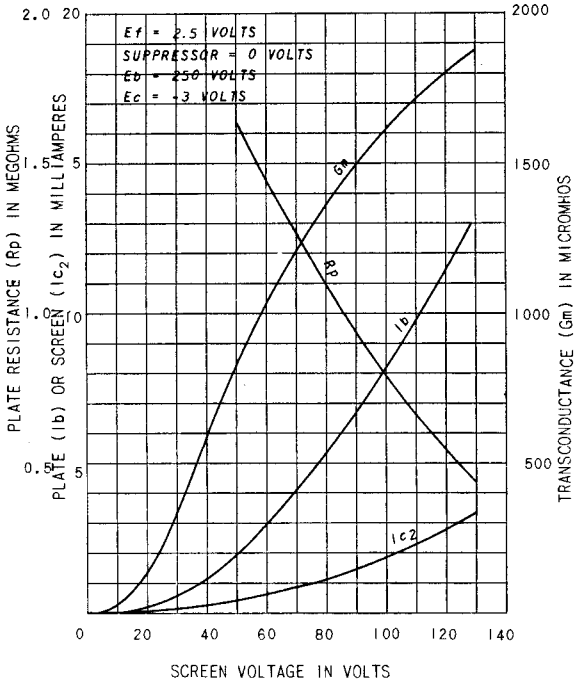
§ *Approximate values for a transconductance of 2 micromhos.*

** *Connected to cathode at socket terminal.*

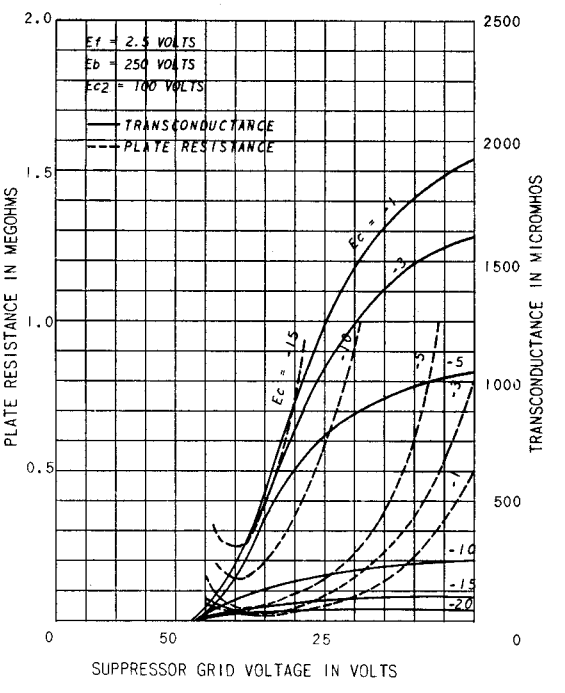
AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



AVERAGE CHARACTERISTICS



Electronic TUBE
KEN-RAD

70L7-GT

Description and Rating

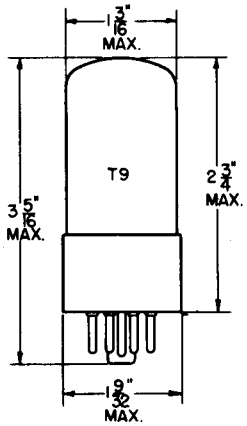
RECTIFIER-BEAM POWER AMPLIFIER

GENERAL DESCRIPTION

Principal Application: The 70L7-GT is a glass type tube containing a half-wave rectifier and a beam power amplifier in the same envelope. The 70L7-GT is intended for use as the power rectifier and power amplifier tube in circuits requiring series heater operation.

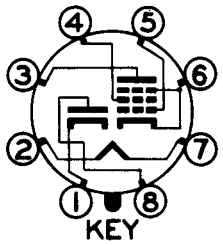
Cathode:	Coated Unipotential	
Heater Voltage (A-C or D-C)	70.0	Volts
Heater Current	0.15	Ampere
Envelope:	T-9 Glass	
Base:	B8-6 Intermediate Shell Octal 8-Pin, Phenolic	
Mounting Position:	Any	

PHYSICAL DIMENSIONS



RMA 9-11

BASING DIAGRAM



RMA 8AA

BOTTOM VIEW

TERMINAL CONNECTIONS

Pin 1 - Rectifier Cathode
Pin 2 - Heater
Pin 3 - Amplifier Plate
Pin 4 - Amplifier Screen
Pin 5 - Amplifier Grid
Pin 6 - Amplifier Cathode
Pin 7 - Heater
Pin 8 - Rectifier Plate

MAXIMUM RATINGS

AMPLIFIER UNIT	Design Center	Absolute	
Plate Voltage	117	129	Volts
Screen Voltage	117	129	Volts
Plate Dissipation	5.0	5.5	Watts
Screen Dissipation	1.0	1.1	Watts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A1 AMPLIFIER		
Plate Voltage	110	Volts
Screen Voltage	110	Volts
Grid Voltage*	-7.5	Volts
Peak A-F Grid Voltage	7.5	Volts
Zero-Signal Plate Current	40	Milliamperes
Zero-Signal Screen Current (Approximate)	3	Milliamperes
Maximum-Signal Plate Current	43	Milliamperes

(Continued on page 2)

Maximum-Signal Screen Current (Approximate)	6	Milliamperes
Plate Resistance	15000	Ohms
Transconductance	7500	Micromhos
Load Resistance	2000	Ohms
Total Harmonic Distortion	10	Per Cent
Maximum-Signal Power Output	1.8	Watts

RATINGS AND CHARACTERISTICS

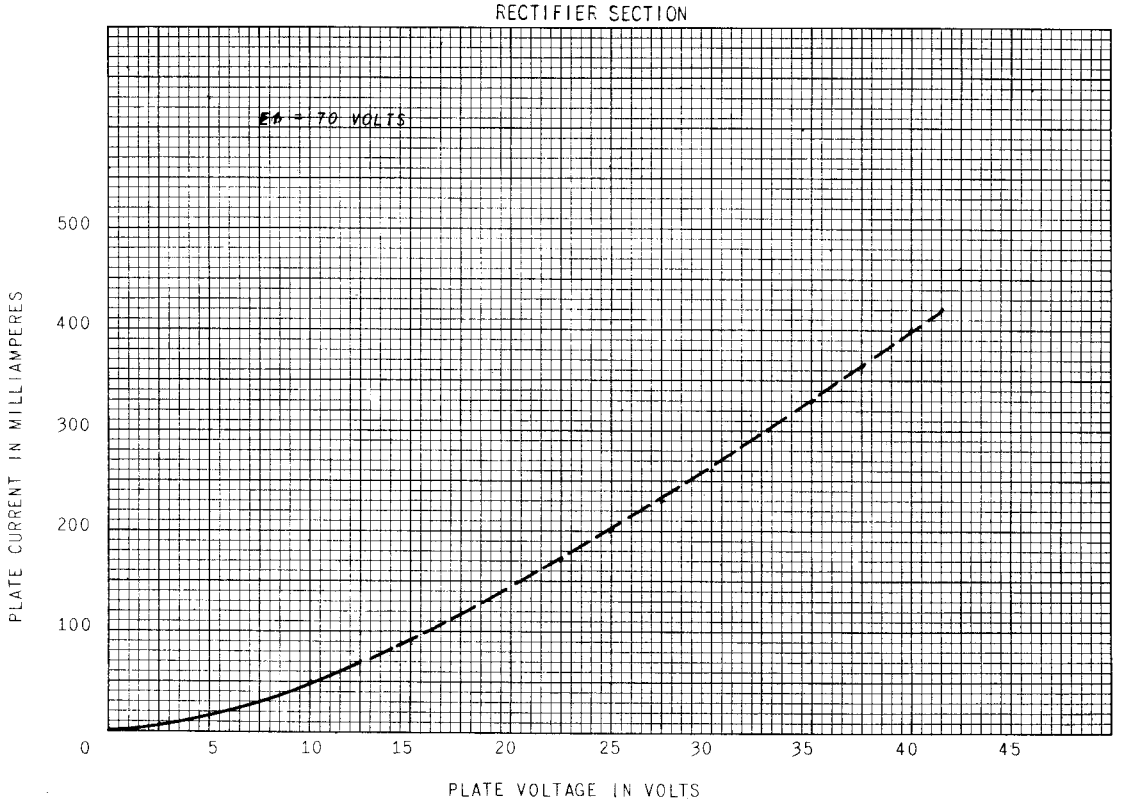
RECTIFIER UNIT

	Design Center	Absolute	
Maximum Peak Inverse Plate Voltage	350	385	Volts
Maximum Peak Plate Current	420	462	Milliamperes
Maximum D-C Heater-Cathode Voltage	175	193	Volts
Maximum A-C Plate Voltage (RMS)	117	129	Volts
Minimum Total Effective Plate-Supply Impedance#	15	17	Ohms
Maximum D-C Output Current	70	77	Milliamperes

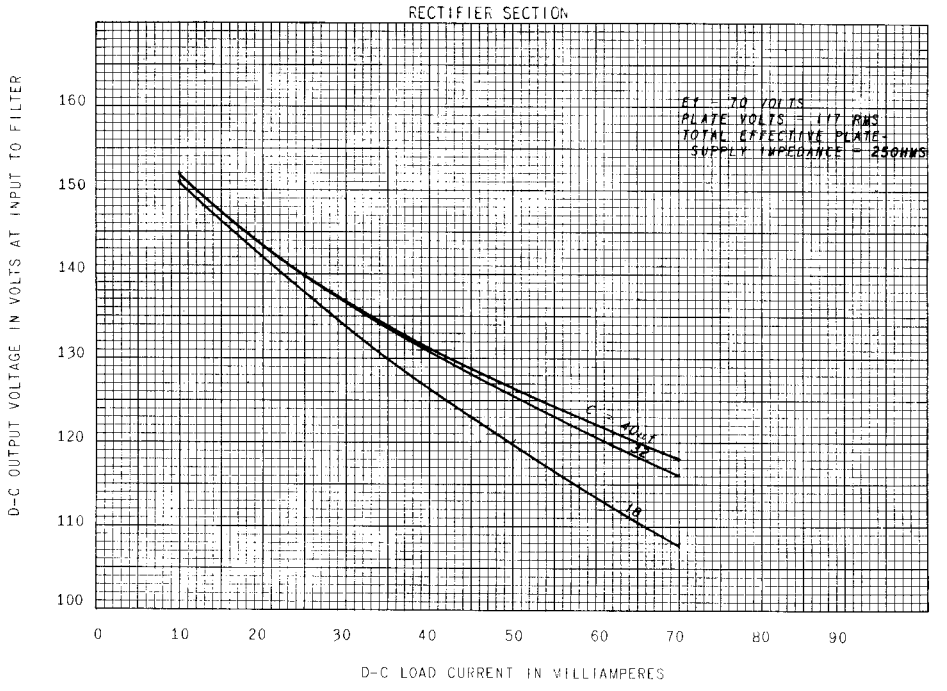
* *The type of input coupling used should not introduce too much resistance in the grid circuit. Transformer-or impedance-coupling devices are recommended. When the grid circuit has a resistance not higher than 0.1 megohm, fixed bias may be used; for higher values, cathode bias is required. With cathode bias, the grid circuit may have a resistance not higher than 0.5 megohm.*

\# *When a filter-input capacitor larger than 40 microfarads is used, it may be necessary to use more plate-supply impedance than the minimum value shown to limit the peak plate current to the rated value.*

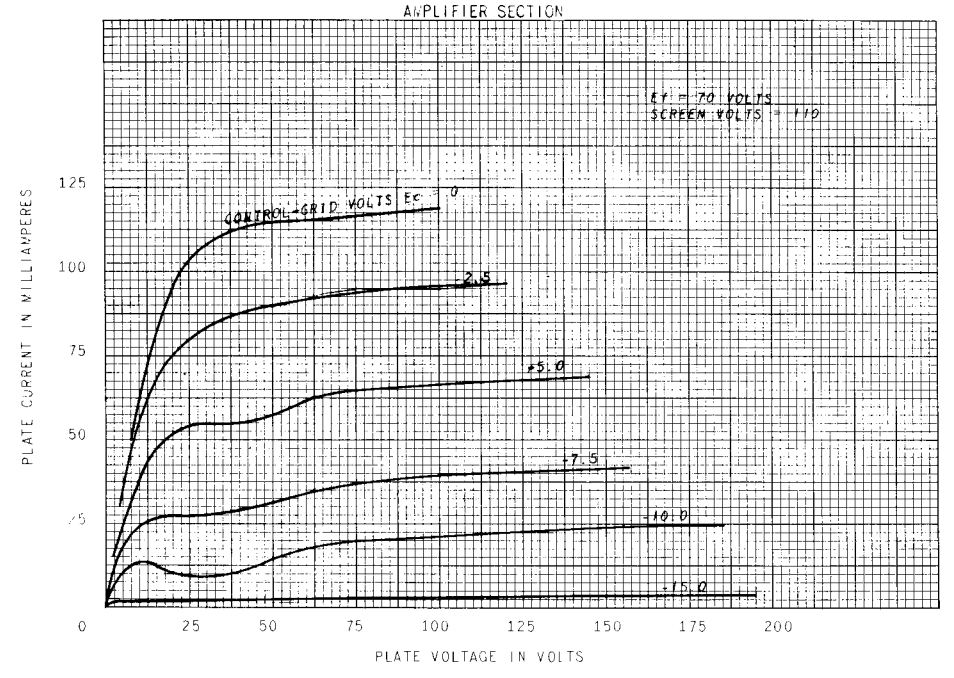
AVERAGE PLATE CHARACTERISTICS



OPERATION CHARACTERISTICS

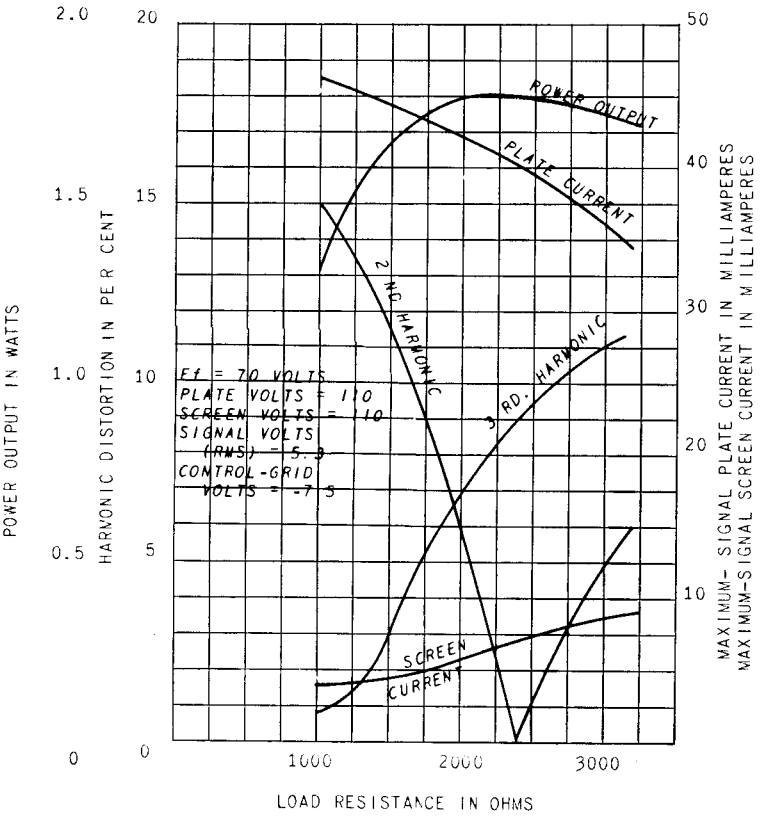


AVERAGE PLATE CHARACTERISTICS



OPERATION CHARACTERISTICS

AMPLIFIER SECTION



Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

GE Electronic TUBE — KEN-RAD

83

Description and Rating

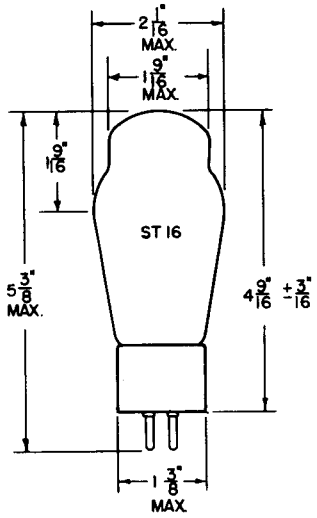
FULL-WAVE MERCURY-VAPOR RECTIFIER

GENERAL DESCRIPTION

Principal Application: The 83 is a glass type full-wave mercury-vapor rectifier. The tube is designed to supply d-c current at essentially constant voltage in spite of rather wide variations in output current.

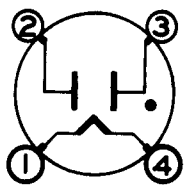
Cathode:	Coated Filament		Envelope:	ST-16 Glass	
Heater Voltage (A-C)	5.0	Volts	Base:	A4-9 Medium 4-Pin, Phenolic	
Heater Current	3.0	Ampere	Mounting Position:	Vertical, Base Down	

PHYSICAL DIMENSIONS



RMA 16-1

BASING DIAGRAM



RMA 4C

BOTTOM VIEW

TERMINAL CONNECTIONS

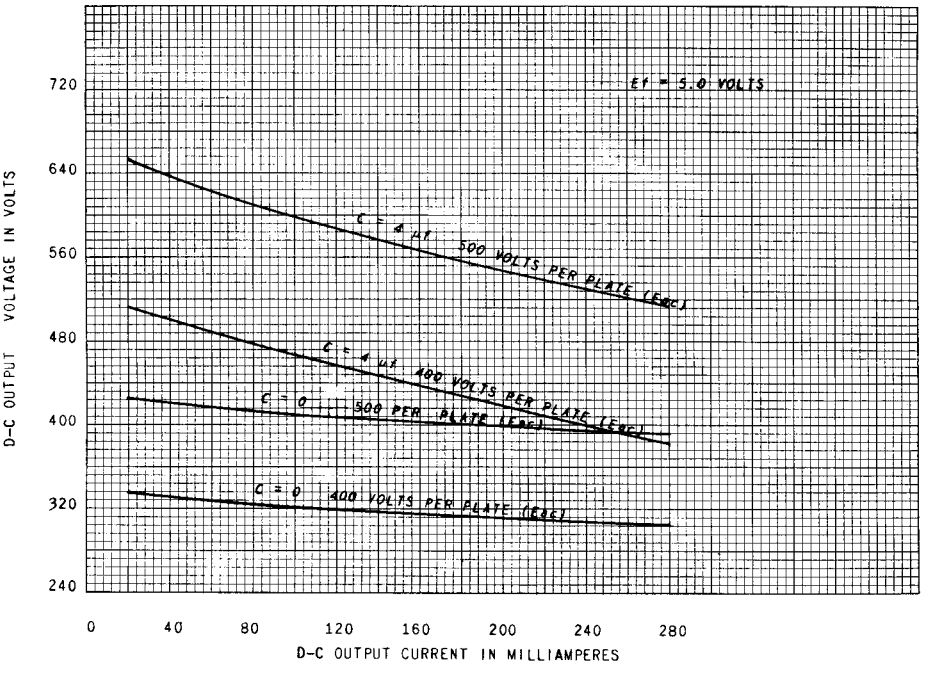
Pin 1 - Filament
Pin 2 - Plate Number 2
Pin 3 - Plate Number 1
Pin 4 - Filament

RATINGS AND CHARACTERISTICS

	Capacitor-Input Filter		Choke-Input Filter		
	Design Center	Absolute	Design Center	Absolute	
Maximum Peak Inverse Plate Voltage	1550	1705	1550	1705	Volts
Maximum Plate Current per Plate	1.0	1.1	1.0	1.1	Ampere
Minimum Condensed-Mercury Temperature	-	20	-	20	C
Maximum Condensed-Mercury Temperature	-	60	-	60	C
Maximum A-C Plate Voltage Per Plate (RMS)	450	495	550	595	Volts
Minimum Total Effective Plate-Supply Impedance*	50	55	-	-	Ohms
Minimum Input-Choke Inductance	-	-	3	3.3	Henries
Maximum D-C Output Current	225	248	225	248	Milliamperes
Tube Voltage Drop (Approximate)	-	-	15	17	Volts

* *When a filter-input capacitor larger than 40 microfarads is used, it may be necessary to use more plate-supply impedance than the minimum value shown to limit the peak plate current to the rated value.*

OPERATION CHARACTERISTICS



Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

GENERAL ELECTRIC

Type VT-191 Vacuum Tube - - Instructions

The VT-191 is a filamentary air-cooled triode designed for use as an ultrahigh-frequency oscillator and power amplifier. The tube develops a typical power output of 5 watts at a frequency of 500 Mc. The frequency limit of oscillation is 750 Mc.

GENERAL

Filament Voltage	2	volts
Current	3.65	amperes
Type - Thoriated tungsten		
Average Characteristic Values Calculated at		
Eb = 450 volts; Ib = 67 milliamperes		
Amplification Factor	8	
Grid-plate Transconductance	2400	micromhos
Direct Interelectrode Capacitances		
Plate to Grid	1.6	μμf
Grid to Filament	1.1	μμf
Plate to Filament	0.65	μμf
Type of Cooling - Air		

PLATE MODULATED OSC & RADIO-FREQUENCY POWER AMPLIFIER - CLASS C
(Carrier conditions to which a modulation factor up to 1.0 can be applied)

Maximum D-c Plate Voltage	400	volts
Maximum D-c Plate Current	80	milliamperes
Maximum D-c Grid Current	15	milliamperes
Maximum Plate Dissipation	20	watts

OSCILLATOR & RADIO-FREQUENCY POWER AMPLIFIER - CLASS C - UNMODULATED

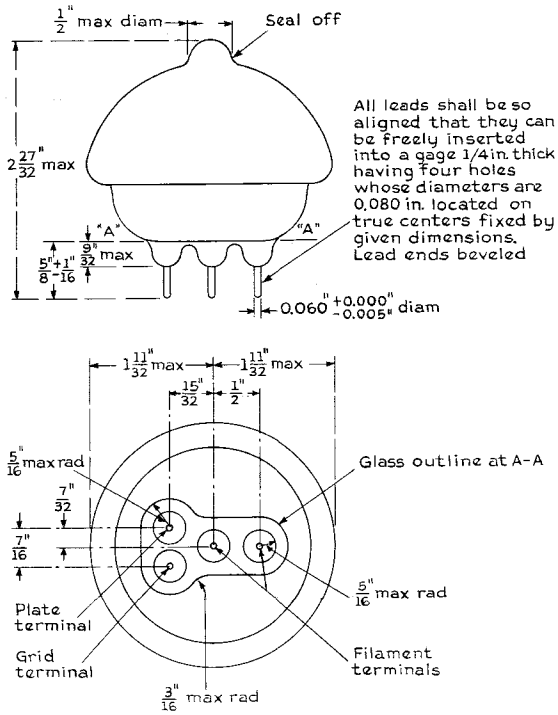
Maximum D-c Plate Voltage	450	volts
Maximum D-c Plate Current	90	milliamperes
Maximum D-c Plate Input	36	watts
Maximum D-c Grid Current	15	milliamperes
Maximum Plate Dissipation	30	watts

OSCILLATOR & RADIO-FREQUENCY POWER AMPLIFIER
Intermittent or keyed operation only.
Duration of operating period 0.1 second maximum.

Maximum D-c Plate Voltage	1100	volts
Maximum Peak D-c Plate Current	250	milliamperes
Maximum Average D-c Plate Current	25	milliamperes

OPERATING PRECAUTIONS

The VT-191 tube must not be subjected to appreciable mechanical shock or vibration. The thoriated tungsten filament of this tube is somewhat more fragile than the thoriated tungsten filaments of other transmitting tubes. These tubes should therefore be handled with more care to prevent filament breakage. In connecting to the terminals of the tube, care must be taken not to strain the glass. The tube may be supported from the terminals providing flexibility is maintained.



Outline VT-191

X-[illegible] 2-16-42

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

3-42 (80M)
Filing No. B8850

PRINTED IN U.S.A.

ELECTRONICS DEPARTMENT

GENERAL ELECTRIC

Kenotron 400--Description and Rating

The 400 is a two-electrode high-vacuum tube especially designed and tested to serve as a means for the study of fundamental electronic phenomena. The pure tungsten filament used renders this tube especially advantageous for emission studies.

TECHNICAL INFORMATION

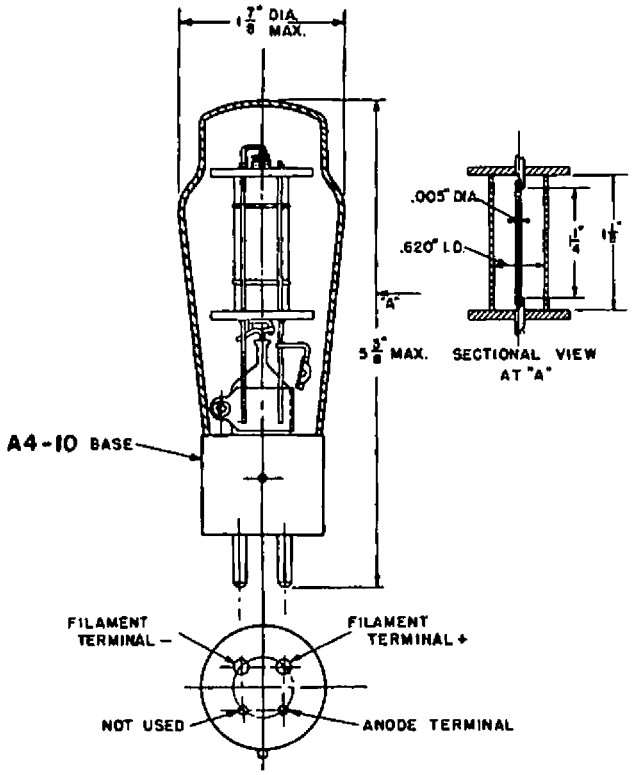
GENERAL DESIGN

Number of Electrodes	2
Filament - Tungsten	
Voltage	4.0 Volts
Current	2.25 Amperes
Diameter	0.005 Inches
Length, free length of filament	1.25 Inches
Average filament lead resistance, excluding filament	0.08 Ohms
Anode - Zirconium-coated Nickel	
Inside Diameter	0.620 Inches

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

	Typical Operation	Maximum Ratings	
Filament Voltage	4.0	4.75	Volts
Filament Current	2.25		Amperes
Anode Voltage	100	125	Volts
Anode Current	0.025		Ampere
Magnetron Characteristics			
Magnetic Field for			
Anode Voltage = 80 volts			
Normal Anode Current - Below 80 gauss			
Minimum Anode Current - Above 130 gauss			
Anode Dissipation, watts		15	

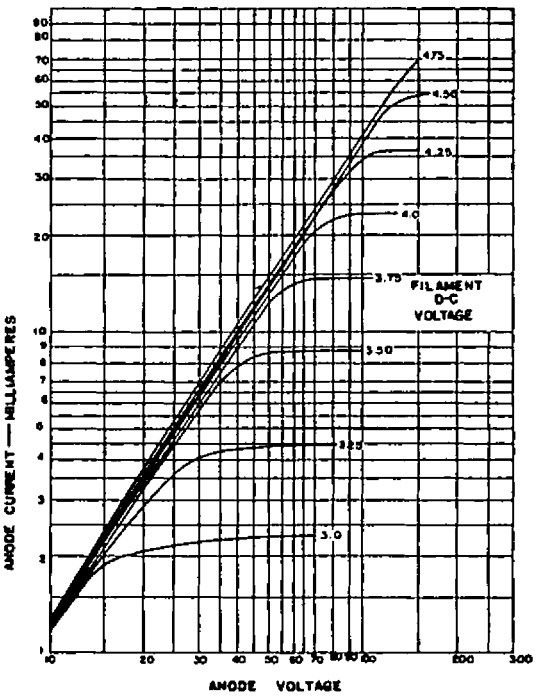
from RMA release # 670, June 25, 1948



Outline Kenotron 400
K-5965352 8-24-44

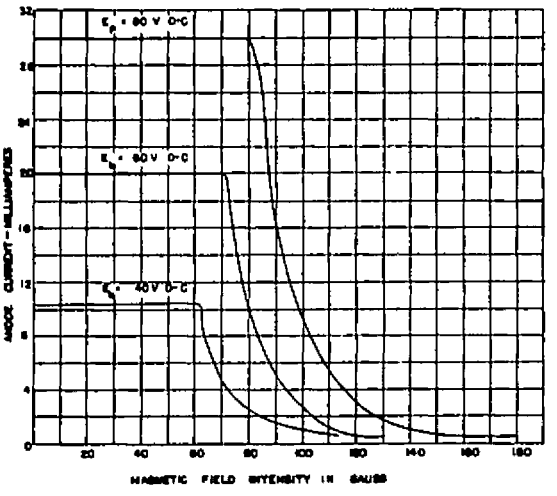
400

ANODE CURRENT CHARACTERISTICS



Anode Current Characteristics
K-8639677 8-29-44

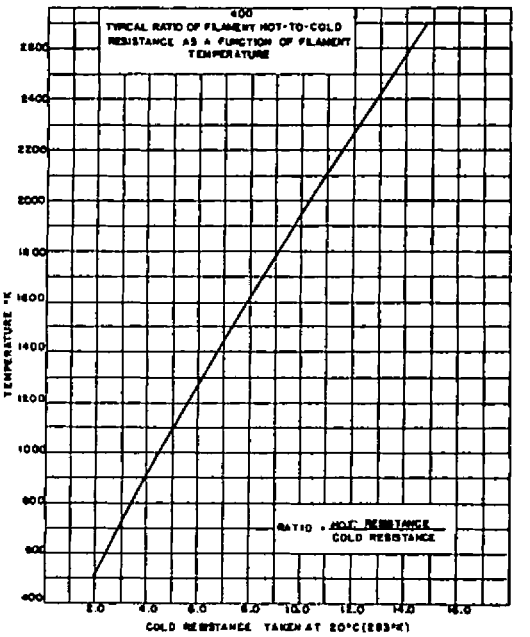
400



Typical Magnetic Control Characteristics
K-8639678 8-29-44

400

TYPICAL RATIO OF FILAMENT HOT-TO-COLD RESISTANCE AS A FUNCTION OF FILAMENT TEMPERATURE



Typical Ratio of Filament Hot-to-Cold Resistance as a Function of Filament Temperature
K-8639680 9-12-44

700E

GEC

INSTRUMENT CATHODE RAY TUBE

BRIEF DATA

The 700E has a 2 in. x 1 in. rectangular face and incorporates electrostatic focus and deflection. Low current flow to both x and y deflector plates enables numbers of tubes to be operated from common time base supplies. This together with the small dimensions of the tube and its high brightness makes the 700E particularly useful when the tube is to be used in banks for the display of digital information.

HEATER

Heater voltage	6.3	V
Heater current	0.3	A

SCREEN

Tube normally supplied with 24 phosphor as 724E.

Fluorescence	Green
Phosphorescence	Green
Persistence	1 – 5 ms
E.I.A. phosphor code	P31
GEC phosphor code	24
Pro Electron phosphor code	GH

Other screens are available to special order (see data sheet 'CRT Screeens').

RATINGS (Absolute)

	Max	Min	
Focus voltage	1.0	–	kV
First & third anode voltage	2.5	1.5	kV
*Negative grid voltage	200	0	V
X deflector plate to a1, a3 voltage (peak)	500	–	V
Y deflector plate to a1, a3 voltage (peak)	500	–	V
Heater-cathode voltage	180	–	V
X deflector plate to a1, a3 circuit resistance	0.25	–	MΩ
Y deflector plate to a1, a3 circuit resistance	1.0	–	MΩ
Grid-cathode circuit resistance	1.5	–	MΩ

*The dc value of the modulator voltage must never become positive with respect to cathode.

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April 1977
Issue 2

CAPACITANCES

Cathode to all	4	pF
Grid to all	7	pF
Deflector plates x1 to x2	2	pF
Deflector plates y1 to y2	3	pF
Deflector plates x1 to all electrodes except x2	5	pF
Deflector plates y1 to all electrodes except y2	6	pF
Deflector plates x2 to all electrodes except x1	5	pF
Deflector plates y2 to all electrodes except y1	6	pF

TYPICAL OPERATION (for character generation)

First & third anode voltage	$V_{a1,3}$	2.0	kV
Second anode voltage	V_{a2}	60	V
Control grid voltage for spot cut-off	$-V_g$	60 – 100	V
Maximum x deflection factor	D_x	46.0	V/cm
Maximum y deflection factor	D_y	107.2	V/cm
Line width (typical) at I_k = 500 μA		1.5	mm

CHARACTERISTICS

		Min	Max	
Focus voltage	V_{a2}	10	45	$V/kV_{a1,3}$
Control grid voltage for spot cut-off	$-V_g$	30	50	$V/kV_{a1,3}$
X deflection factor	D_x	20.4	23.0	$V/cm/kV_{a1,3}$
Y deflection factor	D_y	44.5	53.6	$V/cm/kV_{a1,3}$
*Heater-cathode resistance	r_{h-k}	1.5		MΩ
Grid-cathode resistance	r_{g-k}	10		MΩ

*With heater ±125V to cathode.

Pattern Distortion

The edges of a test raster will lie between two concentric rectangles of 46.5 mm x 20.75 mm and 43.5 mm x 19.25 mm.

Deflection Linearity

The deflection factor for a deflection of less than 75% of the useful scan will not differ from that for a deflection of 25% by more than 2%.

Orientation

Looking at the screen with the base spigot to the left, a positive potential applied to x1 will deflect the spot to the left and a positive potential applied to y1 will deflect the spot downwards.

Focus Current

The maximum focus electrode (a2) current will be 20 μA with the tube blacked out and V_{a2} = 60 V.

Deflector Plate Current

The maximum deflector plate current will be 7 μA with a 4.5 x 2.0 cm raster and I_k = 500 μA.

Minimum Scanned Area

X axis	4.5	cm
Y axis	2.4	cm

Angle between deflection axes: 90° ± 1°.

Spot Position

The undeflected spot will lie within a circle of 3.0 mm radius centred on the tube face.

MOUNTING

The tube should not be supported by the base alone, but should preferably be held in a suitable rubber mask at the screen and by a clamp round the magnetic shield near the base.

WEIGHT

The weight of the tube is 170 g (6 oz).

BASE CONNECTIONS

Base: B12A

Pin 1:	h	Pin 7:	y_2
2:	g	8:	$a_{1,3}$
3:	k	9:	x_2
4:	a_2	10:	x_1
5:	NC	11:	NC
6:	y_1	12:	h

SOCKET

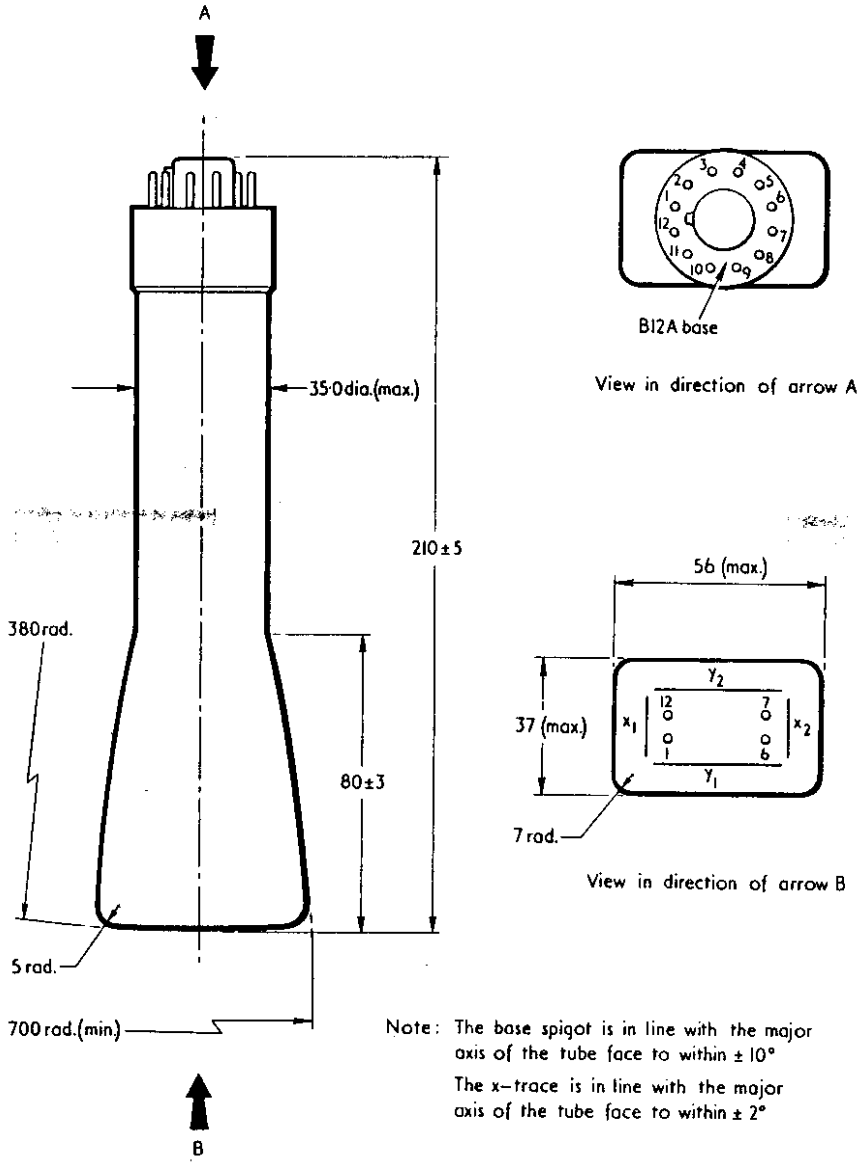
The socket should have sufficient freedom of movement to accommodate the tube overall length and base orientation tolerances.

MAGNETIC SHIELDING

The shield should be of high permeability material, of a thickness determined by the magnetic field at the tube position. The shield should be earthed. A suitable shield is available from Magnetic Shields Ltd., Headcorn Road, Staplehurst, Tonbridge, Kent.

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M-OV accepts no liability beyond that set out in its standard conditions of sale in respect of infringement of third party patents arising from the use of tubes or other devices in accordance with information contained herein.

OUTLINE



Note: The base spigot is in line with the major axis of the tube face to within ± 10°

The x–trace is in line with the major axis of the tube face to within ± 2°

All dimensions in millimetres

GENERAL ELECTRIC

Pliotron PT-841 - - Instructions

U.S. Army Signal Corps Tube Type VT-51

The 841 is a three-electrode high-vacuum tube particularly designed for use as a Class A voltage amplifier although it may also be used as a Class B or C amplifier.

TECHNICAL INFORMATION

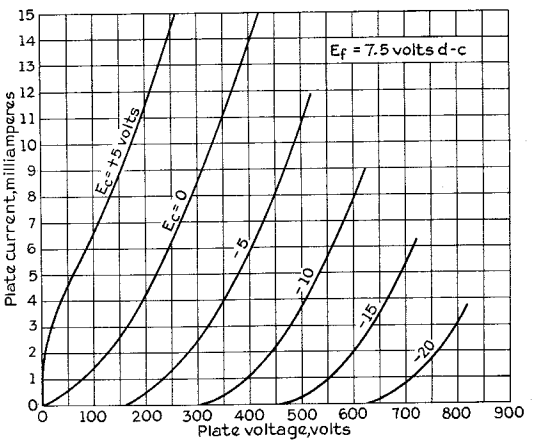
GENERAL CHARACTERISTICS:	
Filament Voltage, v	7.5
Filament Current, amp	1.25
Amplification Factor	30
Grid-plate Transconductance, mmhos, I_b = 2.2 ma	750
Direct Interelectrode Capacitances, μμf	
Grid-plate	7
Input	4
Output	3
Base or Terminal Description	Medium 4-pin Bayonet

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

	Typical Operation		Max Ratings
CLASS A A-F AMPLIFIER AND MODULATOR:			
D-c Plate Voltage, v	-	-	425
D-c Supply Voltage, v	425	1000	1250
Plate Dissipation, w	-	-	12
D-c Grid Voltage, v	-6	-9	-
Peak Grid Swing, approx v	6	9	-
D-c Plate Current, ma	0.7	2.2	-
Plate Resistance, ohms	63000	40000	-
Load Resistance, ohms	250000	250000	-
Voltage Output (5% second harmonic), v	126	225	-
CLASS B A-F POWER AMPLIFIER (TWO TUBES):			
D-c Plate Voltage, v	350	425	425
Max Signal Plate Current (per tube)§, ma	-	-	60
D-c Max Signal Plate Input (per tube)§, w	-	-	25
Plate Dissipation (per tube)§, w	-	-	15
D-c Grid Voltage, v	-5	-5	-
Peak A-f Grid Input Voltage, v	176	180	-
Zero Signal Plate Current, ma	7	13	-
Max Signal Plate Current, ma	114	120	-
Max Signal Driving Power, approx w	3.2	3.6	-
Effective Load (plate to plate), ohms	5200	7000	-
Max Signal Plate Power Output, w	21	23	-

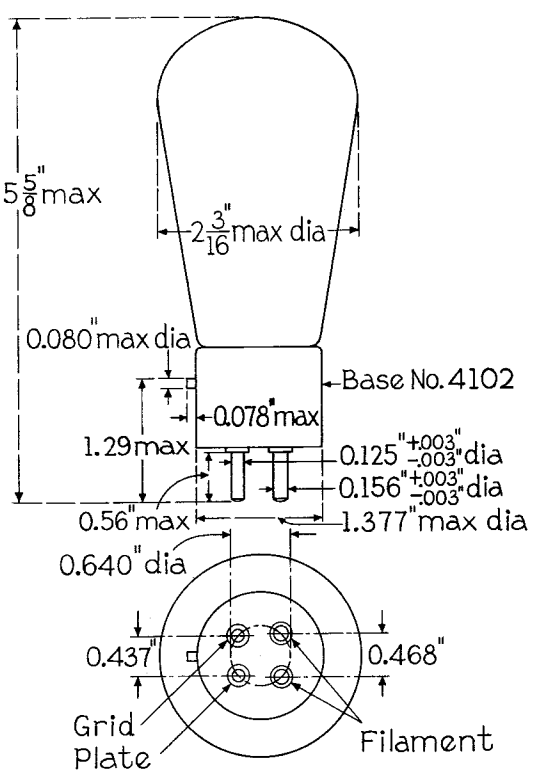
§ Averaged over any audio-frequency cycle

*Superseding GEI-9226A



Average Values of Plate Current vs Plate Voltage for Pliotron Tube PT-841

H-5339902 3-31-37



Outline Pliotron PT-841

K-3846099 3-1-37

	Typical Operation		Max Ratings
CLASS B R-F POWER AMPLIFIER:			
(Carrier conditions per tube for use with a maximum modulation factor of 1.0)			
D-c Plate Voltage, v	350	450	450
D-c Grid Voltage, v	-12	-15	-
D-c Plate Current, ma	45	45	50
Plate Input, w	-	-	22.5
Plate Dissipation, w	-	-	15
Peak R-f Grid Input Voltage, v	60	60	-
D-c Grid Current, approx ma	4	4	-
Driving Power†, approx w	3.5	3.5	-
Plate Power Output, w	425	6	-

† At crest of audio-frequency cycle

	Typical Operation		Max Ratings
CLASS C R-F POWER AMPLIFIER AND OSCILLATOR, PLATE MODULATED:			
(Carrier conditions per tube for use with a maximum modulation factor of 1.0)			
D-c Plate Voltage, v	250	350	350
D-c Grid Voltage, v	-40	-47	-200
D-c Plate Current, ma	50	50	60
D-c Grid Current, approx ma	15	15	20
Plate Input, w	-	-	21
Plate Dissipation, w	-	-	10
Peak R-f Grid Input Voltage, approx v	127	130	-
Driving Power, approx w	2	2	-
Plate Power Output	7	11	-

	Typical Operation		Max Ratings
CLASS C R-F POWER AMPLIFIER AND OSCILLATOR:			
(Key down conditions per tube without modulation)‡			
D-c Plate Voltage, v	350	450	450
D-c Grid Voltage, v	-30	-34	-200
D-c Plate Current, ma	50	50	60
D-c Grid Current, approx ma	15	15	20
Plate Input, w	-	-	27
Plate Dissipation, w	-	-	15
Peak R-f Grid Input Voltage, approx v	115	120	-
Driving Power, approx w	1.8	1.8	-
Plate Power Output, w	11	15	-

‡ Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions

The tube should be mounted so as to operate in an upright position with the filament end down.

The normal value of grid leak, when the tube is used as an oscillator or r-f power amplifier (Class C), is in the neighborhood of 5000 ohms, although this may be replaced by a suitable fixed bias. If self bias is used the cathode resistor should be approximately 500 ohms.

The maximum ratings apply only at frequencies below 6 megacycles. For operation at higher frequencies adequate ventilation and normal ambient temperatures must be maintained, and the plate voltage must be reduced as indicated.

Frequency, Megacycles	6	45	170
Percentage of Maximum Rated Plate Voltage and Plate Input	100	75	50

The resonant frequency of the grid-plate circuit is approximately 170 megacycles.

GENERAL ELECTRIC

Transmitting Tube GL-862 - - Description and Rating

TECHNICAL INFORMATION

The GL-862 is a three-electrode power tube designed for use as a radio-frequency amplifier, oscillator, or Class B modulator. The plate is water-cooled and is capable of dissipating 50 to 100 kw, depending upon the class of service in which the tube is operated.

CHARACTERISTICS AND RATINGS

Filament Voltage	33	Volts
Filament Current	207	Amperes
Amplification Factor	48	
Grid-plate Transconductance, I_b = 3.0	17200	Micromhos
Direct Interelectrode Capacitances:		
Grid-plate	75	μμf
Input	52	μμf
Output	2	μμf
Frequency for Maximum Ratings	1.6	Megacycle
Type of Cooling	Water	
Net Weight (approx)	30	Pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS B A-F POWER AMPLIFIER (TWO TUBES):

D-c Plate Voltage	12000	15000 max	Volts
Maximum Signal Plate Current (per tube)*		7.5 max	Amperes
D-c Maximum Signal Plate Input (per tube)*		100 max	Kilowatts
Plate Dissipation (per tube)*		50 max	Kilowatts
D-c Grid Voltage	0		Volts
Peak A-f Grid Input Voltage	2000		Volts
Zero Signal Plate Current	3		Amperes
Maximum Signal Plate Current	13		Amperes
Maximum Signal Plate Input*	156		Watts
Maximum Signal Driving Power (approx)	450		Watts
Effective Load Resistance (plate-to-plate)	1800		Ohms
Maximum Signal Plate Power Output	90		Kilowatts

CLASS B R-F POWER AMPLIFIER:
Carrier conditions per tube for use with a maximum modulation factor of 1.0

D-c Plate Voltage	12000	15000	18000	20000 max	Volts
D-c Grid Voltage	-100	-150	-200		Volts
D-c Plate Current	2.8	3.5	4.2	5.0	Amperes
Plate Input				100 max	Kilowatts
Plate Dissipation				75 max	Kilowatts
Peak R-f Grid Input Voltage	500	625	750		Volts
Driving Power (approx)**	0.5	0.75	1.1		Kilowatt
Plate Power Output	11	17.5	25		Kilowatts

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR - PLATE-MODULATED:
Carrier conditions per tube for use with a maximum modulation factor of 1.0

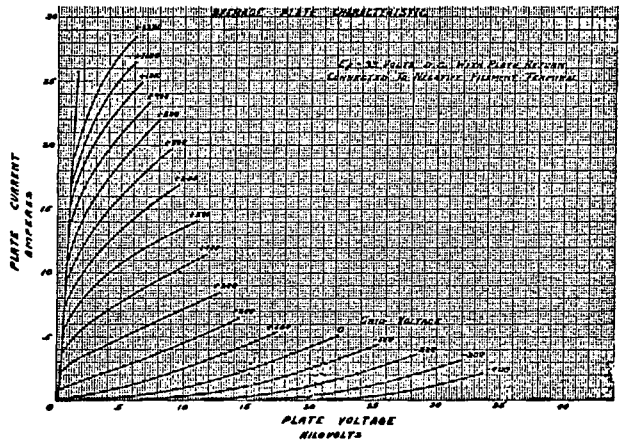
D-c Plate Voltage	8000	10000	12000	12000 max	Volts
D-c Grid Voltage	-700	-750	-800	-3000 max	Volts
D-c Plate Current	4	4.5	5	5.0 max	Amperes
D-c Grid Current (approx)	1	1	1	1.25 max	Ampere
Plate Input				60 max	Kilowatts
Plate Dissipation				50 max	Kilowatts
Peak R-f Grid Input Voltage(approx)	1700	1850	2000		Volts
Driving Power (approx)	1.7	1.85	2		Kilowatts
Plate Power Output	24	34	45		Kilowatts

from RMA release #335, April 26, 1943

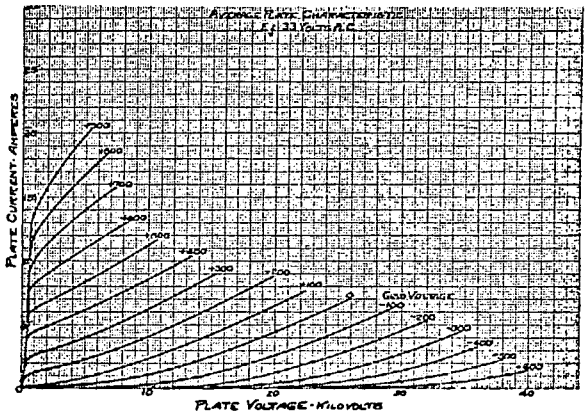
CLASS C R-F POWER AMPLIFIER AND OSCILLATOR:
Key-down conditions per tube without modulation #

D-c Plate Voltage	12000	15000	18000	20000 max	Volts
D-c Grid Voltage	-800	-900	-1000	-3000 max	Volts
D-c Plate Current (approx)	6.25	7.5	8.33	10 max	Amperes
D-c Grid Current (approx)	0.8	0.85	0.9	1.0 max	Ampere
Plate Input				200 max	Kilowatts
Plate Dissipation				100	Kilowatts
Peak R-f Grid Input Voltage(approx)	2050	2300	2550		Volts
Driving Power (approx)	1.6	2	2.4		Kilowatts
Plate Power Output	50	75	100		Kilowatts

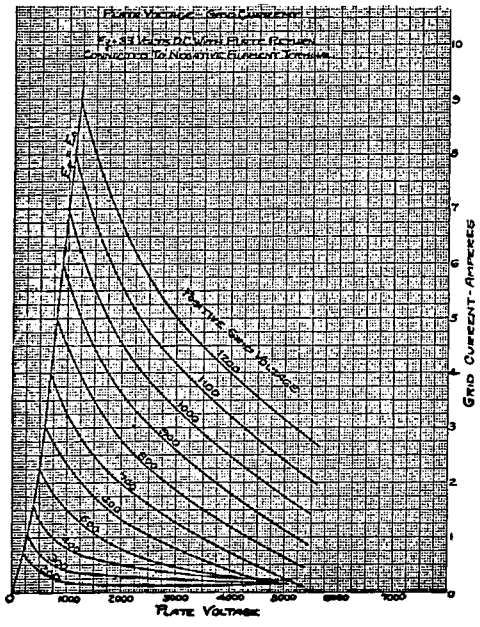
* Averaged over an audio-frequency cycle.
** At crest of audio-frequency cycle.
# Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.



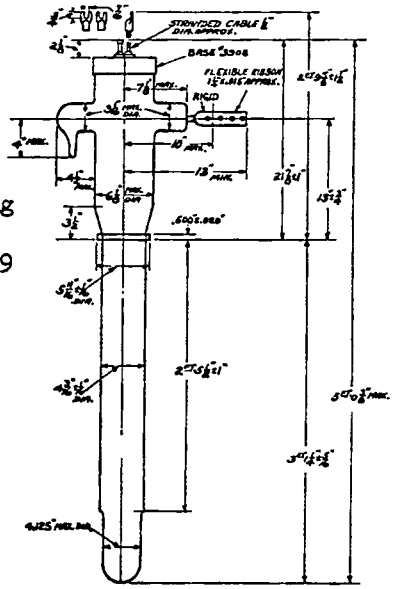
Average Plate Characteristics
for Transmitting Tube GL-862
K-7050573 4-26-33



Average Plate Characteristics
for Transmitting Tube GL-862
K-7050415 2-14-33



Left--
Plate Voltage Grid-current for Transmitting Tube GL-862
K-7050575 5-9-33



Right--
Outline Transmitting Tube GL-862
K-3846052 4-26-39

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

11-39 (2M)
Filing No. 8850

SUPPLEMENT TO GET-919 DESCRIPTION AND RATING SHEET FOR TRANSMITTING TUBE GL-862

GENERAL CHARACTERISTICS

MECHANICAL

Gasket, Cat. No. 5182028P1	
Type of Cooling	Water and Forced Air
Water Flow, gallons per minute	15-25
Air Flow, cubic feet per minute	
To Bulb	15
To Stem	3
Shipping Weight, lb approx	175
Installation and Operation	GEH-1152

APPLICATION NOTES

Plate Series Protective Resistors (see paragraph describing plate circuit under Installation in the Instructions).

Series Resistor, ohms	10	20	40	50
Maximum Power Output of Rectifier, kilowatts	100	250	640	1600

May, 1940 (2M)
Filing No. 8850

GENERAL ELECTRIC

Transmitting Tube GL-893 - - Description and Rating

Technical Information

The GL-893 is a three-electrode, water-cooled vacuum tube designed for use as a radio-frequency amplifier, oscillator, or Class B modulator. A particular advantage of this tube is the unique construction of the filament which permits operation from single-phase, three-phase, or six-phase alternating current, or from direct current, for all classes of service.

CHARACTERISTICS AND RATINGS

ELECTRICAL

Filament Voltage, per strand		10	Volts
Filament Current, per terminal		61	Amperes
Amplification Factor	E_b = 15 kv, I_b = 1.0 amp	36	
Grid-plate Transconductance	E_c = -300, E_f = 20 a-c	16000	Micromhos
Direct Interelectrode Capacitances:			
Grid-plate		33	μμf
Input		48	μμf
Output		3.2	μμf
Frequency for Maximum Ratings		5	Megacycles

MECHANICAL

Gasket, Cat. No. 5182028P2	
Type of Cooling	Water and Forced Air
Water Flow, gallons per minute	8-15
Air Flow, cubic feet per minute	
To Stem	2
Net Weight, approx	12 lb
Shipping Weight, approx	27 lb
Installation and Operation	GEH-1152

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS B A-F POWER AMPLIFIER (TWO TUBES)

D-c Plate Voltage	12000	15000	18000	20000 max	Volts
Max Signal Plate Current, per tube*				4.0 max	Amperes
D-c Max Signal Plate Input, per tube*				60 max	Kilowatts
Plate Dissipation, per tube*				20 max	Kilowatts
D-c Grid Voltage	-260	-350	-450		Volts
Peak A-f Grid Input Voltage	1480	1560	1720		Volts
Zero Signal Plate Current	0.8	0.8	0.8		Ampere
Max Signal Plate Current	7.0	6.0	5.5		Amperes
Max Signal Plate Input*	84.0	90.0	99.0		Kilowatts
Max Signal Driving Power, approx	220	190	140		Watts
Effective Load Resistance, Plate-to-plate	4000	6000	8000		Ohms
Max Signal Plate Power Output	52.0	60.0	70.0		Kilowatts

from RMA release #335, April 26, 1943

CLASS B R-F POWER AMPLIFIER

Carrier conditions per tube for use with a max modulation factor 1.0

D-c Plate Voltage	12000	15000	15000	20000 max	Volts
D-c Grid Voltage	-250	-340	-340		Volts
D-c Plate Current	1.5	1.5	2.0	2.0 max	Amperes
Plate Input				32 max	Kilowatts
Plate Dissipation				20 max	Kilowatts
Peak R-f Grid Input Voltage	700	790	900		Volts
Driving Power, approx **	130	150	200		Watts
Plate Power Output	6	7.5	10		Kilowatts

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR - PLATE-MODULATED

Carrier conditions per tube for use with a max modulation factor of 1.0

D-c Plate Voltage	10000	10000	12000	12000 max	Volts
D-c Grid Voltage	-800	-800	-1000	-3000 max	Volts
D-c Plate Current	1.5	2.0	2.0	2.0 max	Amperes
D-c Grid Current, approx	0.10	0.16	0.14	0.4 max	Amperes
Plate Input				24 max	Kilowatts
Plate Dissipation				12	Kilowatts
Peak R-f Grid Input Voltage, approx	1200	1280	1500		Volts
Driving Power, approx	120	210	210		Watts
Plate Power Output	11	15	18		Kilowatts

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR

Key-down conditions per tube without modulation #

D-c Plate Voltage	12000	15000	18000	20000 max	Volts
D-c Grid Voltage	-800	-900	-1000	-3000 max	Volts
D-c Plate Current	3.5	3.6	3.6	4.0 max	Amperes
D-c Grid Current, approx	0.26	0.25	0.21	0.4 max	Amperes
Plate Input				70 max	Kilowatts
Plate Dissipation				20 max	Kilowatts
Peak R-f Grid Input Voltage, approx	1430	1520	1630		Volts
Driving Power, approx	360	370	340		Watts
Plate Power Output	30	40	50		Kilowatts

* Averaged over any audio-frequency cycle.

** At crest of audio-frequency cycle.

\# Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

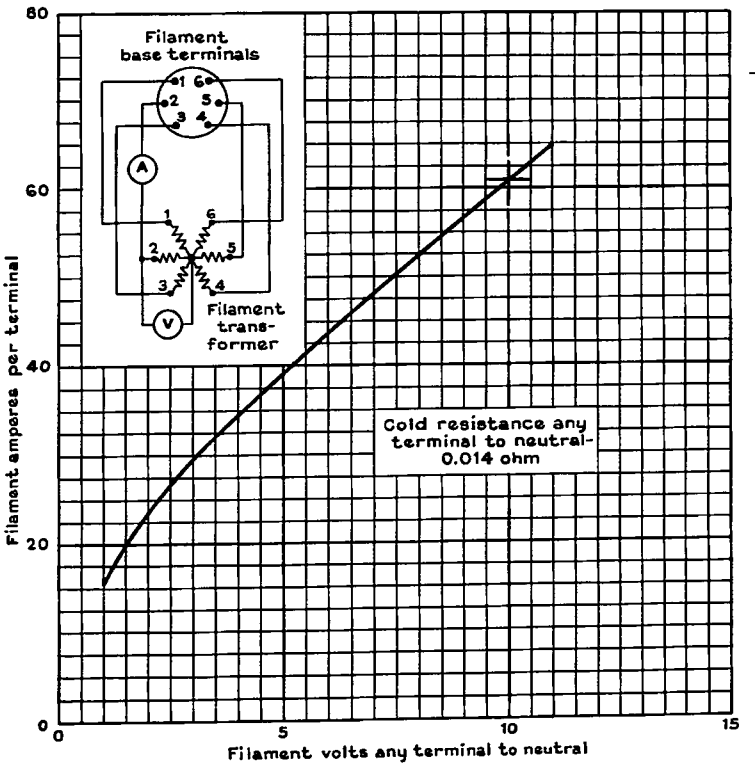
GL-893 can be operated at maximum ratings in all classes of service at frequencies as high as 5 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised (Other maximum ratings are the same as shown under CHARACTERISTICS and RATINGS.) The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used up to 40 mc for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

FREQUENCY	5	20	40	Mc
MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM RATED PLATE VOLTAGE AND PLATE INPUT:				
Class B R-f				
Percentage Plate Voltage	100	85	65	
Percentage Plate Input	100	82	73	
Class C Plate Modulated				
Percentage Plate Voltage	100	80	64	
Percentage Plate Input	100	75	64	
Class C				
Percentage Plate Voltage	100	80	60	
Percentage Plate Input	100	66	50	

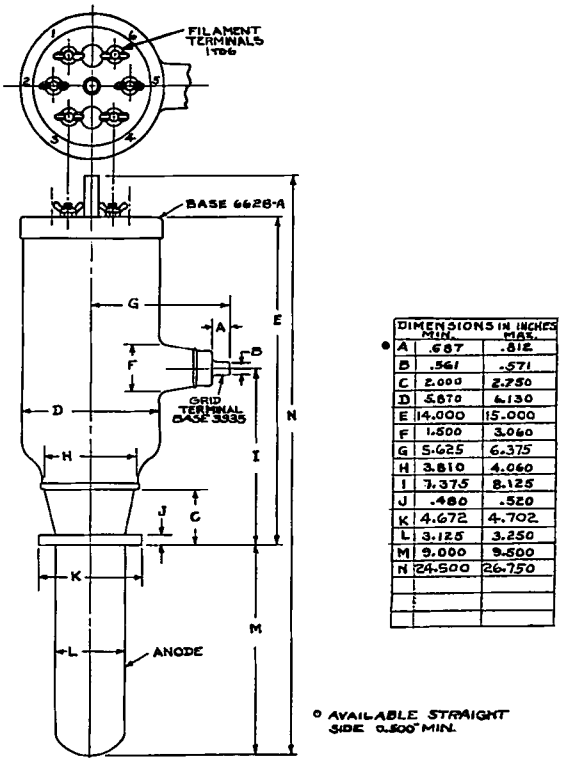
APPLICATION NOTES

Plate Series Protective Resistors (see paragraph describing plate circuit under Installation in the Instructions).

Series Resistor, ohms	10	20	40	80	100
Maximum Power Output of Rectifier, kilowatts	40	100	250	640	1600

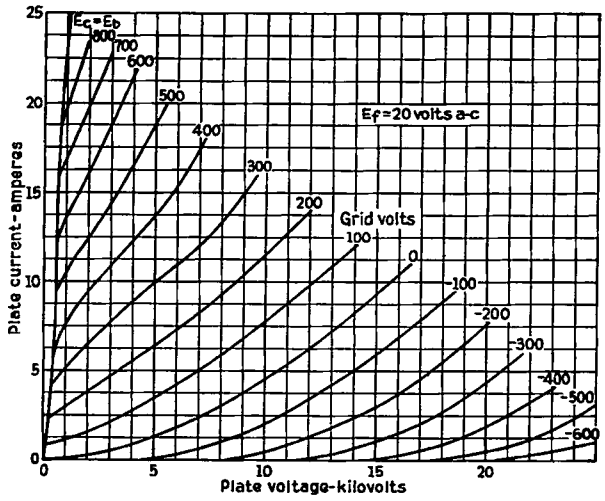


Average Filament Characteristic
K-7050605 5-22-39

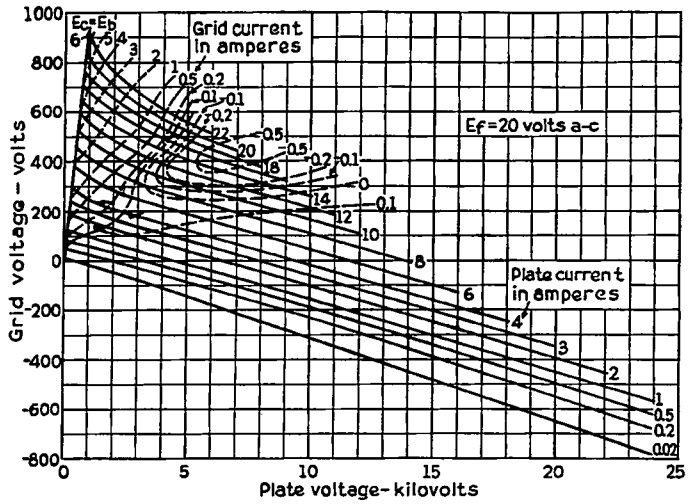


DIMENSIONS IN INCHES	MIN.	MAX.
A	.687	.812
B	.561	.571
C	2.000	2.250
D	5.670	6.130
E	14.000	15.000
F	1.500	3.060
G	5.625	6.375
H	3.810	4.060
I	7.375	8.125
J	.480	.520
K	4.672	4.702
L	3.125	3.250
M	9.000	9.500
N	24.500	26.750

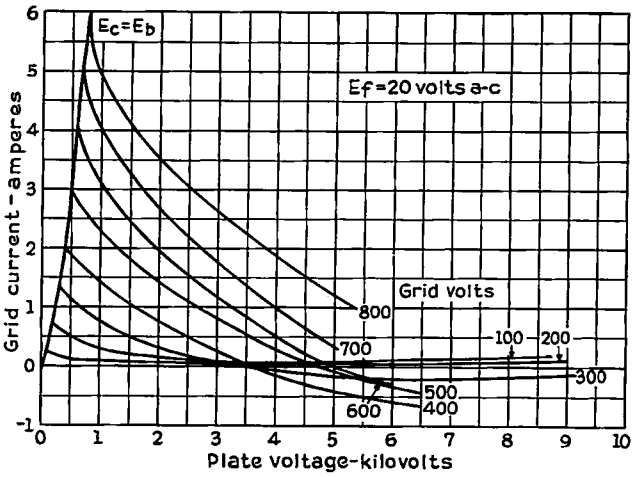
Outline Transmitting Tube
GL-893
K-5344783 2-11-42



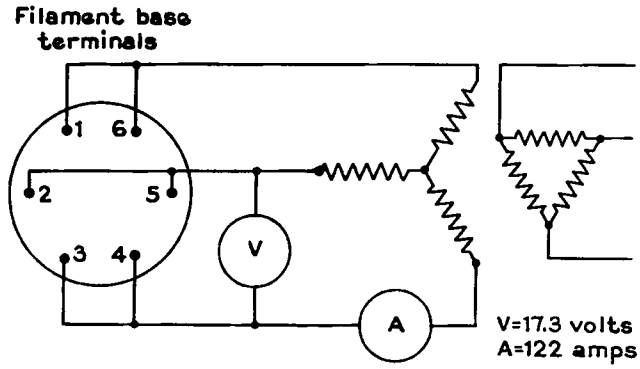
Average Plate Characteristics for
Transmitting Tube GL-893
K-7050615 5-22-39



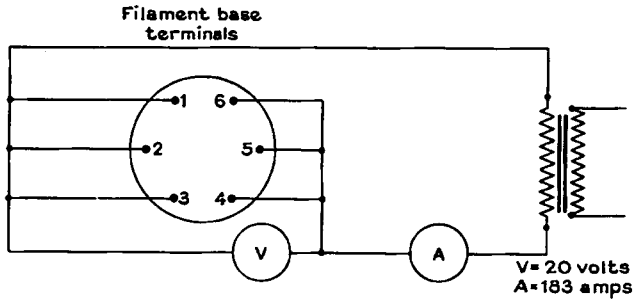
Characteristics for Transmitting
Tube GL-893
K-7050611 5-22-39



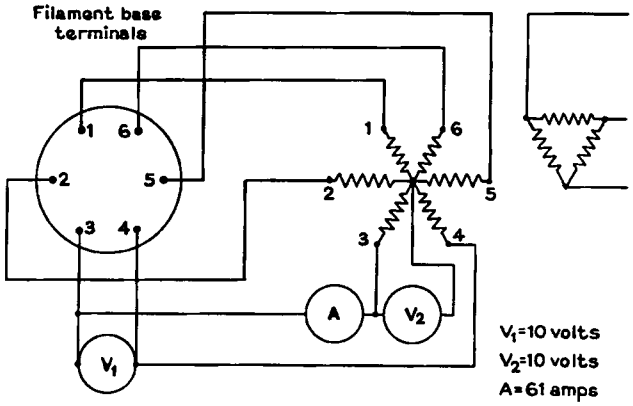
Typical Grid-plate Transfer
Characteristics for Transmitting
Tube GL-893
K-7050618 4-25-39



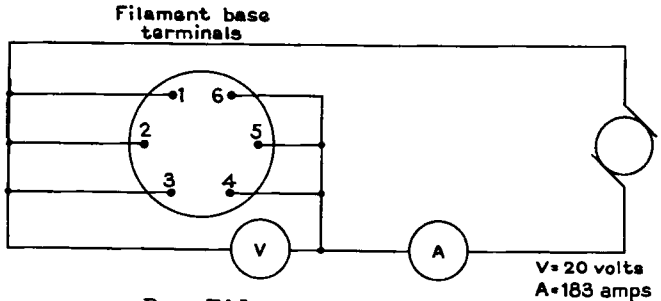
Three-phase A-c Filament Excitation



Single-phase A-c Filament Excitation



Six-phase A-c Filament Excitation



D-c Filament Excitation

NOTE: Terminals must be connected in correct phase relation as shown.

K-7050604 Filament Connections and Excitation Circuits 5-22-39

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

3-42- (3M)
Filing No. 8850

PRINTED IN U.S.A.

GENERAL ELECTRIC

Transmitting Tube GL-893-R -- Description and Rating

Description

The GL-893-R is a three-electrode, forced air-cooled vacuum tube designed for use as a radio-frequency amplifier, oscillator, or Class B modulator. A particular advantage of this tube is the unique construction of the filament which permits operation from single-phase, three-phase, or six-phase alternating current, or from direct current, for all classes of service.

Technical Information

These data are for reference only. For design information see the specifications.

GENERAL CHARACTERISTICS

ELECTRICAL		
Filament Voltage (per strand)	10	Volts
Filament Current (per terminal)	61	Amperes
Amplification Factor, E_b = 15 kv, I_b = 1.0 amp, E_c = -300, E_f = 20 a-c	36	
Grid-plate Transconductance	16000	Micromhos
Direct Interelectrode Capacitances, μμf		
Grid-plate	33	
Grid-filament	48	
Plate-filament	3.2	
MECHANICAL		
Type of Cooling	Forced Air	
Air Flow		
To radiator	1800	Cu ft per minute
To stem	2	Cu ft per minute
Net Weight (approx)	230	Pounds
Shipping Weight (approx)	290	Pounds
Installation and Operation	GEH-1198	

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

	Typical Operation			Maximum* Ratings	
CLASS B A-F POWER AMPLIFIER (TWO TUBES)					
D-c Plate Voltage	12000	15000	18000	20000	Volts
Max Signal Plate Current (per tube)†				4.0	Amperes
D-c Max Signal Plate Input (per tube)†				60	Kilowatts
Plate Dissipation (per tube)†				20	Kilowatts
Radiator Temperature‡				180	C
D-c Grid Voltage	-260	-350	-450		Volts
Peak A-f Grid Input Voltage	1480	1560	1720		Volts
Zero Signal Plate Current	0.8	0.8	0.8		Amperes
Max Signal Plate Current	7.0	6.0	5.5		Amperes
Max Signal Plate Input†	84	90	99		Kilowatts
Max Signal Driving Power (approx)	220	190	140		Watts
Effective Load Resistance (plate-to-plate)	4000	6000	8000		Ohms
Max Signal Plate Power Output	52	60	70		Kilowatts
CLASS B R-F POWER AMPLIFIER					
Carrier conditions per tube for use with a max modulation factor of 1.0					
D-c Plate Voltage	12000	15000	15000	20000	Volts
D-c Grid Voltage	-250	-340	-340		Volts
D-c Plate Current	1.5	1.5	2.0	2.0	Amperes

from RMA release #335, April 26, 1943

	Typical Operation			Maximum* Ratings	
Plate Input				32	Kilowatts
Plate Dissipation				20	Kilowatts
Radiator Temperature‡				180	C
Peak R-f Grid Input Voltage§	700	790	900		Volts
Driving Power (approx)§	130	150	200		Watts
Plate Power Output	6	7.5	10		Kilowatts
CLASS C R-F POWER AMPLIFIER AND OSCILLATOR - PLATE-MODULATED					
Carrier conditions per tube for use with a max modulation factor of 1.0					
D-c Plate Voltage	10000	10000	12000	12000	Volts
D-c Grid Voltage	-800	-800	-1000	-3000	Volts
D-c Plate Current	1.5	2.0	2.0	2.0	Amperes
D-c Grid Current (approx)	0.10	0.16	0.14	0.4	Ampere
Plate Input				24	Kilowatts
Plate Dissipation				12	Kilowatts
Radiator Temperature‡ (Modulation Factor = 1.0)				180	C
Peak R-f Grid Input Voltage (approx)	1200	1280	1500		Volts
Driving Power (approx)	120	210	210		Watts
Plate Power Output	11	15	18		Kilowatts
CLASS C R-F POWER AMPLIFIER AND OSCILLATOR					
Key-down conditions per tube without modulation¶					
D-c Plate Voltage	12000	15000	18000	20000	Volts
D-c Grid Voltage	-800	-900	-1000	-3000	Volts
D-c Plate Current	3.5	3.6	3.6	4.0	Amperes
D-c Grid Current (approx)	0.26	0.25	0.21	0.4	Ampere
Plate Input				70	Kilowatts
Plate Dissipation				20	Kilowatts
Radiator Temperature‡				180	C
Peak R-f Grid Input Voltage (approx)	1430	1520	1630		Volts
Driving Power (approx)	360	370	340		Watts
Plate Power Output	30	40	50		Kilowatts

† Averaged over any audio-frequency cycle.

‡ Measured in the thermometer well. This temperature corresponds to the maximum ratings when the air-flow is 1800 cubic feet per minute and the temperature of the incoming air does not exceed 45 C. The glass temperature must not be allowed to exceed 150 C.

§ At crest of audio-frequency cycle.

¶ Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

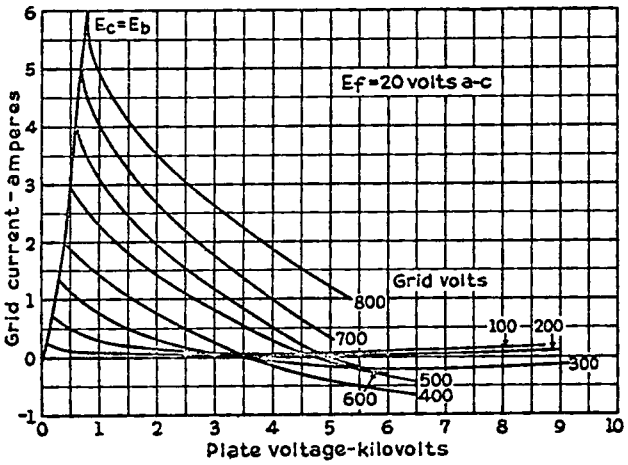
APPLICATION NOTES

* The GL-893-R can be operated at frequencies as high as 5 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised (other maximum ratings are the same as shown above). The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used up to 25 megacycles for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency - Mc	5	12	25
Class B R-f			
Per Cent Max Plate Voltage and Plate Input	100	86	74
Class C Plate-modulated			
Per Cent Max Plate Voltage and Plate Input	100	81	65
Class C			
Per Cent Max Plate Voltage	100	81	65
Per Cent Max Plate Input	100	75	50

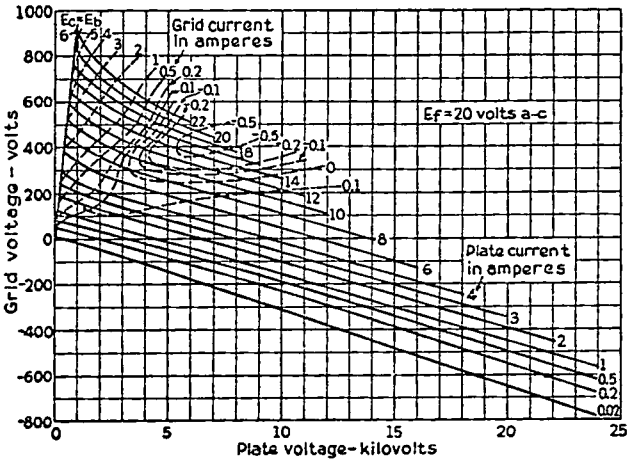
Plate Series Protective Resistors (see paragraph describing plate circuit under Installation in the Instructions).

Series Resistor, ohms	10	20	40	80	100
Maximum Power Output of Rectifier, kw	40	100	250	640	1600



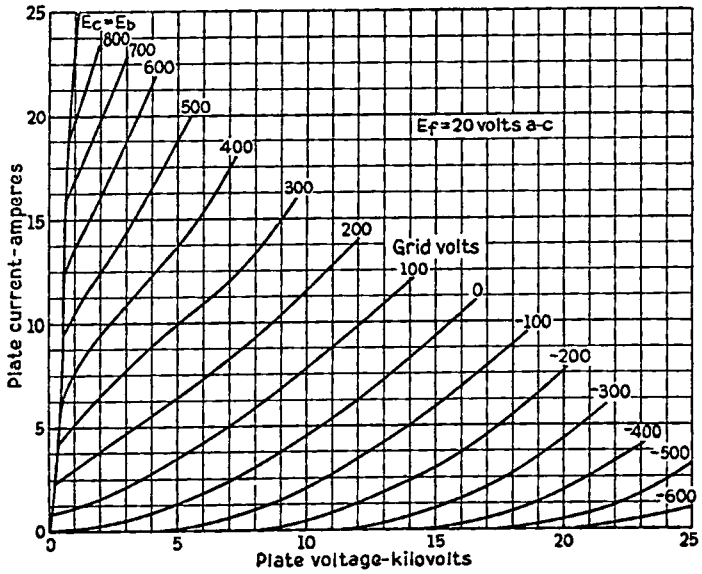
Typical Grid-plate Transfer Characteristics for Transmitting Tube GL-893-R

K-7050618 5-22-39



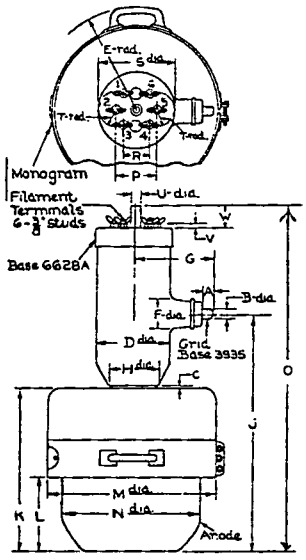
Characteristics for Transmitting Tube GL-893-R

K-7050611 5-22-39



Average Plate Characteristics for Transmitting Tube GL-893-R

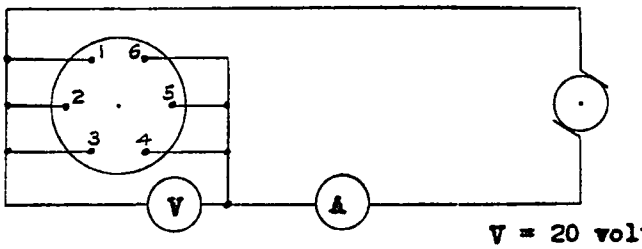
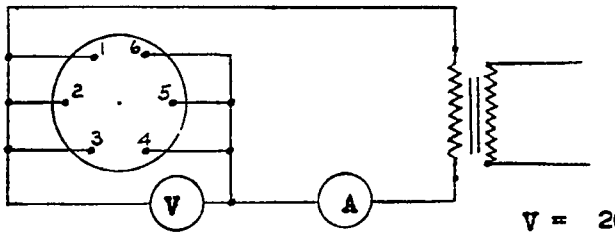
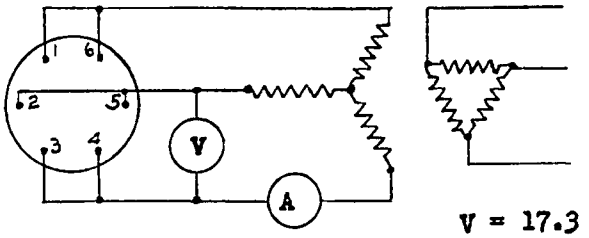
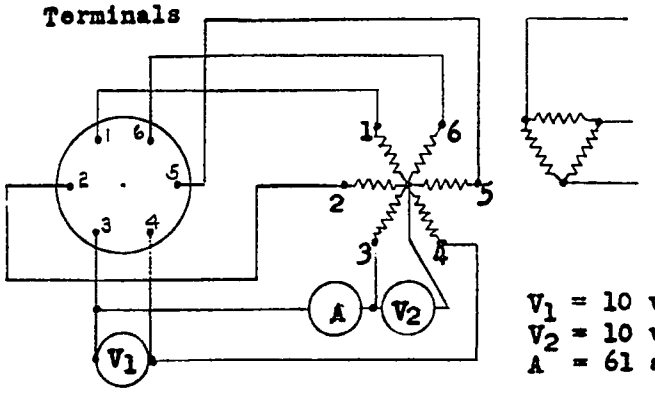
K-7050615 5-22-39



	Max.	Min.
A	8 1/2"	8 7/16"
B	5 11/16"	5 5/8"
C	1/2"	
D	6.130"	5.870"
E	6 1/16"	6"
F	3/4"	1/4"
G	6 1/4"	5 3/4"
H	4 1/16"	3 15/16"
J	18 1/4"	17 3/4"
K	12 1/16"	12"
L	6 1/16"	5 15/16"
M	14 1/4"	13 3/4"
N	11 1/4"	11 3/32"
O	28"	25 3/4"
P	3.410"	3.340"
R	2.035"	1.965"
S	6 1/4"	6"
T	1.535"	1.465"
U	.660"	.590"
V	.285"	.215"
W	2 1/4"	1 3/4"

Outline Transmitting Tube GL-893-R

K-6966982 12-26-40

D-C Filament Excitation	Filament Base Terminals  V = 20 volts A = 183 amps.
Single-Phase A-C Filament Excitation	Filament Base Terminals  V = 20 volts A = 183 amps.
Three-Phase A-C Filament Excitation	Filament Base Terminals  V = 17.3 volts A = 122 amps.
Six-Phase A-C Filament Excitation NOTE: Terminals must be connected in correct phase relation as shown	Filament Base Terminals  V_1 = 10 volts V_2 = 10 volts A = 61 amps.

Filament Connections and Excitation Circuits
K-7050604 5-22-39

GENERAL ELECTRIC COMPANY
SCHENECTADY, N. Y.

1-42 (2500)
Filing No. 8850

Supersedes GET-959

THE M-O VALVE
COMPANY LIMITED

900W

[Brimar D10-210 equivalent]

GEC

INSTRUMENT
CATHODE RAY TUBE

BRIEF DATA

3½" × 2¾"
display 7×5cm
A short 10cm diagonal (4 in) flat faced rectangular instrument tube with aluminised screen, mesh p.d.a. and deflection blanking. This tube is intended for use in general purpose and portable oscilloscopes. 230mm long

5y 9.8
5x 13.8

HEATER

Heater voltage	11	V
Heater current	68	mA

SCREEN

	974W	996W
Fluorescence	Green	Bluish-White
Phosphorescence	Green	Yellowish-Green
Persistence	1–5ms	10–60s
E.I.A. phosphor code	P31	P7
Pro Electron phosphor code	GH	GM
GEC phosphor code	74	96

Other screens are available to special order (see data sheet 'CRT Screens').

RATINGS (Absolute)

		Max	Min	
Fourth anode voltage	V_{a4}	7.0	5.0	kV
Third anode voltage	V_{a3}	0.7	0.5	kV
Ratio	V_{a4}/V_{a3}	10	–	
Focus voltage	V_{a2}	300	–	V
First anode voltage	V_{a1}	0.7	0.5	kV
Control grid voltage	$-V_{g1}$	200	1.0	V
Blanking plate to first anode voltage	V_{g2-a1}	+200	−200	V
Y plate to third anode voltage	V_{y-a3}	500	–	V
X plate to third anode voltage	V_{x-a3}	500	–	V
Grid to cathode circuit resistance	R_{g1-k}	1.0	–	MΩ
Y deflector plate circuit resistance	R_{y-a3}	100	–	kΩ
X deflector plate circuit resistance	R_{x-a3}	250	–	kΩ

Voltage ratings are to cathode unless otherwise shown.

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June 1975
Issue 2

CAPACITANCES (Typical)

Control grid to all other electrodes	9.3	pF
Blanking plate to all other electrodes	8.5	pF
Deflector plates y1 to y2	0.9	pF
Deflector plates y1 to all electrodes except y2	5.0	pF
Deflector plates y2 to all electrodes except y1	5.0	pF
Deflector plates x1 to x2	2.5	pF
Deflector plates x1 to all electrodes except x2	7.0	pF
Deflector plates x2 to all electrodes except x1	7.0	pF

EQUIPMENT DESIGN RANGE

		Max	Min	
Focus voltage	V_{a2}	400	233	V/kV_{a3}
Control grid voltage for spot cut-off	$-V_{g1}$	109	42	V/kV_{a1}
Blanking voltage	$V_{g2\text{-}a1}$	+83	−83	V/kV_{a3}
Y deflection factor	Dy	16	10.8	$V/cm/kV_{a3}$
X deflection factor	Dx	23	18.3	$V/cm/kV_{a3}$
Astigmatism correction voltage	$V_{a3\text{-}y\ mean}$	+83	−83	V/kV_{a3}
Pattern correction voltage	$V_{s\text{-}x\ mean}$	+83	−83	V/kV_{a3}

TYPICAL OPERATION (All operating potentials are with respect to cathode)

Fourth anode voltage	V_{a4}	6.0	kV
Third anode voltage	V_{a3}	600	V
Focus voltage	V_{a2}	140–240	V
First anode voltage	V_{a1}	600	V
Control grid voltage for spot cut-off.	$-V_{g1}$	65–25	V
Nominal blanking plate voltage	V_{g2}	600	V
Nominal geometry correction voltage	V_s	600	V
Maximum y deflection factor	Dy	9.6	V/cm
Maximum x deflection factor	Dx	13.8	V/cm
Line width (typical)74 screen		0.35	mm

Measured by means of a shrinking raster at $I_b = 5\mu A$

DISPLAY CHARACTERISTICS (Typical Operation)

Pattern Distortion

With pattern correction applied to s, the edges of a test raster will lie between two concentric rectangles of 70mm x 50mm and 68mm x 48mm. The angle between x and y axes will be $90^\circ \pm 1^\circ$ measured at face centre.

X Deflection Linearity
The deflection factor measured over any 10mm of deflection in the appropriate axis will not vary by more than ±3½% within the minimum scanned area.

Spot Position
The focused and undeflected spot will fall within a square 10mm x 10mm centred at the geometric centre of the faceplate.

Orientation
Looking at the screen with pins 1 and 12 uppermost, a positive voltage applied to x1 will deflect the beam to the left and a positive voltage applied to y1 will deflect the beam upwards.

Minimum Scanned Area

x major axis	7.0	cm
y minor axis	5.0	cm

This area will be centred on a point which is within 3mm of the major and minor axes of the tube face.

Axis Alignment
The electrical x axis of the tube will lie within ±5° of the major axis of the faceplate, and may be aligned with this axis by means of the field from an axial coil placed about the cone of the tube in the region shown in the outline drawing. The maximum ampere turns required for axis alignment will be given by $11\sqrt{k}V_{a4}$.

Beam Blanking (If g2 blanking not used join pins 5 & 10 externally)
Under typical operating conditions (i.e. $V_{a1} = V_{a3} = 600V$) and for a beam current (I_b) of 5μA a potential of 50V (preferably negative) with respect to a1, applied to the blanking electrode g2, will completely cut off the beam. This electrode should not be used as a brightness control.

MOUNTING

The tube may be mounted in any position but should not be supported by the base alone. It should preferably be held in a suitable rubber mask at the screen and by a clamp around the magnetic shield near the base. The socket should have sufficient freedom of movement to accommodate the maximum overall tube length and base orientation tolerances.

WEIGHT

The weight of the tube alone is 480gm (approx.).

BASE CONNECTIONS

Base: B12F

Pin 1:	g1	Pin 7:	x2
2:	k + h	8:	s (geometry)/IPS/Mesh
3:	h	9:	y2
4:	a2 (focus)	10:	a1
5:	g2 (blanking)	11:	y1
6:	x1	12:	a3 (astigmatism)

Side contact (CT8): a4

ACCESSORIES

Base sockets	Pressac Ltd., Leopold Street, Long Eaton, Nottingham NG10 4QL.	
CT8 connector	Pressac Ltd.	(cover) 12/426 (clip) 10/425
Magnetic shield	Magnetic Shields Ltd., Headcorn Road, Staplehurst, Tonbridge, Kent.	

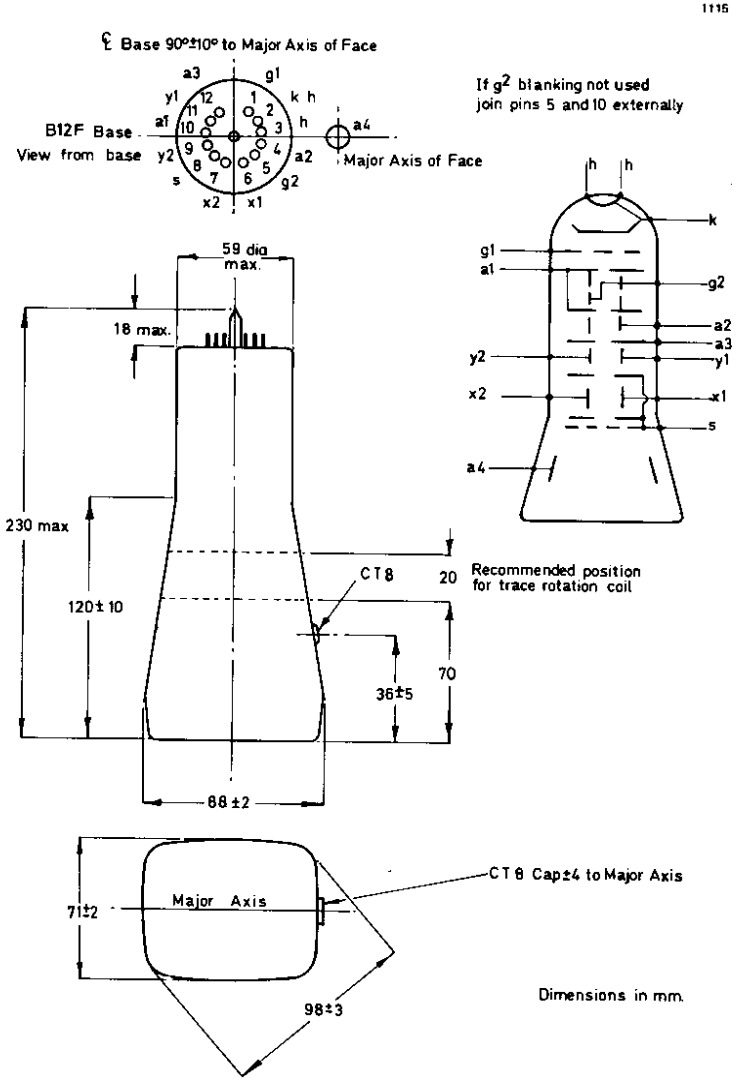
WARNING

Care should be taken not to expose the tube to strong magnetic fields either in use or during storage.

Whilst M-OV has taken care to ensure the accuracy of the information contained herein it accepts no responsibility for the consequences of any use thereof and also reserves the right to change the specification of goods without notice.
M-OV accepts no liability beyond that set out in its standard conditions of sale in respect of infringement of third party patents arising from the use of tubes or other devices in accordance with information contained herein.

OUTLINE

1115



4 in. (10cm) DOUBLE-GUN OSCILLOSCOPE TUBE (1074H)

The 1000H is a 4 in. dia. high sensitivity double gun tube with helical post deflection acceleration. It is intended for use in general purpose oscilloscopes where two independent signals are displayed on a common time base. The tube is also available with an aluminised screen giving higher trace brightness.

Mullard E10-12/E10-13C similar but not identical.

Used in Telequipment D43

BASE CONNECTIONS

Base: B12F

1.	g"	7.	trace registration
2.	k"	8.	a'_2
3.	h	9.	beam blanking
4.	h	10.	NC
5.	$a"_2$	11.	k'
6.	$a"_1$ and a'_1	12.	g'

Side contact (a_4): CT8

Side pin connections as viewed from base and reading clockwise from base pin No. 3: x_1 x_2 $a"_3$ $y"_2$ $y"_1$ IS y'_2 y'_1 a'_3

SCREEN

Fluorescence	Green	White	Blue
Phosphorescence:	Green	Yellow-green	Blue
Persistence:	1 - 5ms	10 - 60s	1 - 5ms
E.I.A. phosphor code:	P31	P7	P11
G.E.C. phosphor code:	24	46	08

For aluminised tubes add 50 to G.E.C. phosphor codes

Other screens are available to special order (see data sheet: Phosphor Codes)

HEATER

V_h	6.3	V
I_h	1.2 (total)	A

RATINGS (Design Centre)

	Max	Min (aluminised tubes)	Min (non-aluminised tubes)	
V_{a4}	8.0	4.0	3.0	kV
V_{a3}	2.0	1.0	0.8	kV
V_{a2}	1.5	-	-	kV
V_{a1}	2.0	1.0	0.8	kV
*-V_g	200	0	0	V
$V_{x1,x2-a3}$ (pk)	500	-	-	V
$V_{y1,y2-a3}$ (pk)	200	-	-	V
V_{h-k}	180	-	-	V
R_{x-a3}	5	-	-	MΩ
R_{y-a3}	0.25	-	-	MΩ
R_{g-k}	1.5	-	-	MΩ
$V_{isolation\ shield}$	2.0	1.0	0.8	kV
$V_{beam\ blanking}$	2.0	1.0	0.8	kV
$V_{trace\ registration}$	2.0	1.0	0.8	kV

Post accelerator ratio (V_{a4}/V_{a3}) = 4:1 max

*The d.c. value of the modulator voltage must never become positive with respect to cathode.

1000 H

Mullard
E10-12GH

CAPACITANCES

$c_{k\text{-all}}$:	5pF	$c_{x2\text{-all less x1}}$:	3.7pF	
$c_{g\text{-all}}$:	8.3pF	$c_{x1\text{-all less x2}}$:	3.7pF	4.0
$c_{x1\text{-x2}}$:	3.7pF	$c_{y1\text{-all less y2}}$:	3.3pF	
$c_{y1\text{-y2}}$:	2.0pF	$c_{y2\text{-all less y1}}$:	3.3pF	3.5
		$c_{\text{beam blanking}}$:	12.0pF	

TYPICAL OPERATION

V_{a4}	4.5	kV	3.0
*V_{a3}	1.2	kV	1.0
V_{a2} (for focus)	360	V	260
V_{a1}	1.2	kV	1.0
$-V_g$ (for cut-off)	54	V	-55
S_x	19.5	V/cm	220
S_y	7.25	V/cm	28
Line width	0.35	mm	0.5
†$V_{\text{isolation shield}}$	1.2	kV	1.0
length	386	mm	410

*It is recommended that individual adjustment of the a_3 potential be provided for astigmatism control.

†The inner end of the helix and the isolation shield are connected together inside the tube. With the correct potentials on these electrodes, barrel and pin cushion effects are minimised.

Superimposition of traces. The vertical traces may be superimposed along the vertical diameter by adjustment of the relative potentials of the trace registration electrode and a_1.

An adjustment of the position of the y traces at extreme x-deflection may be effected by adjustment of the cathode potentials. A maximum difference of $20V/kV_{a3}$ is required.

Flyback suppression (Re-trace blanking). A potential of $50V/kV_{a1}$ negative with respect to a_1 applied to the beam blanking electrode will completely cut off both beams. This electrode should not be used as a trace brightness control.

CHARACTERISTICS

V_{a2} (for focus)	200 to 400		V per $kV_{a1,3}$
$-V_g$ (for cut-off)	30 to 60		V per kV_{a1}
*S_x	15.0 to 17.5		V/cm per kV_{a3}
*S_y	5.4 to 6.67		V/cm per kV_{a3}
†$r_{h\text{-}k}$ (min)	1.5		MΩ
$r_{g\text{-}k}$ (min)	10		MΩ
Post accelerator helix resistance:	50 to 350		MΩ
$V_{\text{isolation shield}}$	967 to 1017		V per kV_{a3}

*The undeflected spots will lie within two circles of 4mm radius whose centres lie on the y axis ± 8mm from the centre of the tube face.

Minimum scan amplitude:

x:	8cm
y (each gun):	6cm
y (overlap) :	4cm

The centre of the 8cm x 4cm overlap rectangle will fall within a circle of 3mm radius from the centre of the tube face.

Minimum useful screen diameter:	9.5cm
Angle between deflection axes of each gun:	90° ± ½
Angle between deflection axes of the two guns:	x: ½° max y: ½° max

*Deflection linearity. The deflection factor for a deflection of less than 75% of the useful scan will not differ from that for a deflection of 25% by more than 2%.

*Pattern distortion. The edges of a test raster will lie between two concentric rectangles of 70mm x 40mm and 68.6mm x 39mm.

*At post accelerator ratio $V_{a4}/V_{a3} = 4$.

†With heater ±125V to cathode.

The deflector plates are designed for symmetrical operation. The y plates may intercept part of the beam and low impedance deflection should be employed.

MAGNETIC SHIELDING

The shield should be of high permeability material, of a thickness determined by the magnetic field at the tube position. The shield should be earthed. Suitable shields are available from Oliver & Randall Co. Ltd., Telcon Metals Ltd., and Magnetic & Electrical Alloys Ltd.

MOUNTING

The tube should not be supported by the base alone, but should preferably be held in a suitable rubber mask at the screen and by a clamp round the magnetic shield near the base. Rubber masks are available from the Standard Insulator Co. Ltd.

SOCKET

The socket should have sufficient freedom of movement to accommodate the tube overall length and base orientation tolerances.

Suitable sockets are available from Carr Fastener Co. Ltd. (Type 77/842).

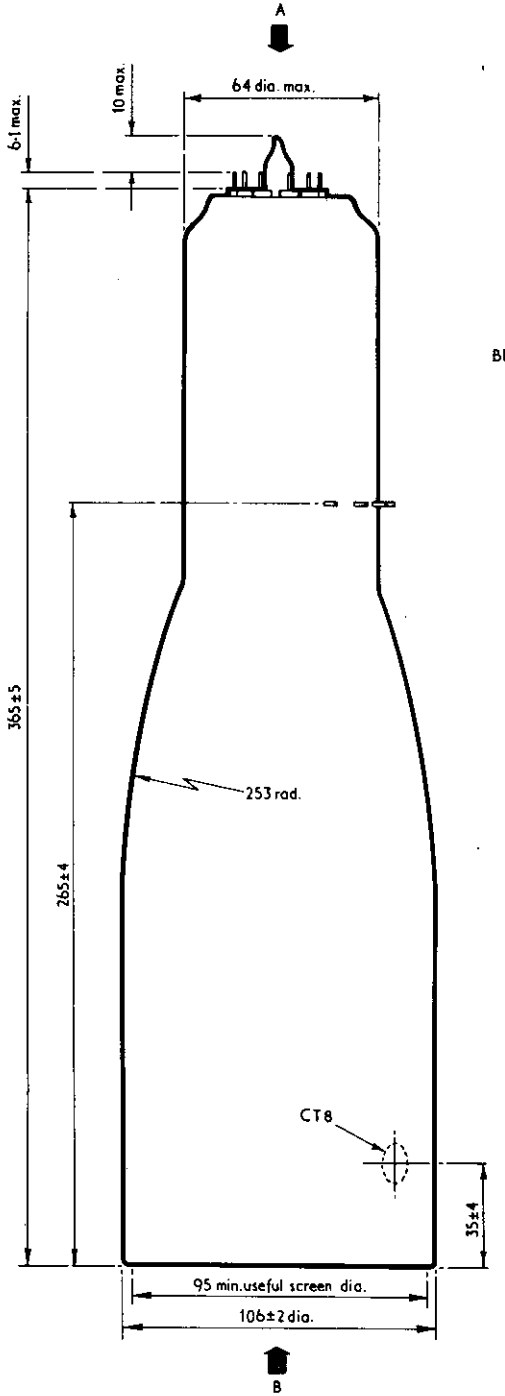
For the side contact and side pins, suitable connectors may be obtained from Carr Fastener Co. Ltd. (Type 77/699 and 75/602 respectively).

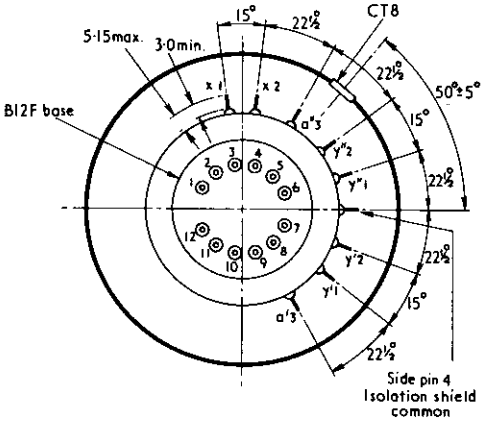
ORIENTATION

Looking at the screen with pins 9 and 10 of the base uppermost, a positive potential applied to x_1 will deflect the spot to the left and a positive potential applied to y_1 will deflect the spot upwards.

WEIGHT

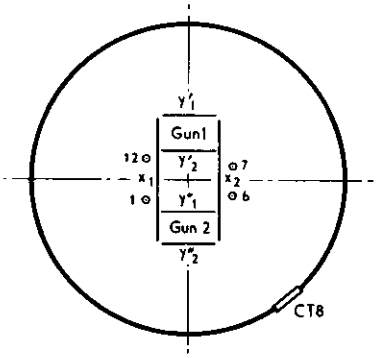
2¼ lb (1 kg approx).





View in direction of arrow A

Note: each pin can vary by 2½° in any direction. The X–trace can vary by ±5° with respect to the CT8 side contact.



View in direction of arrow B

The position of the CT8 side contact relative to the contour of the bulb conforms to BS448:1953, section 6/18.

All dimensions are in millimetres

THE M-O VALVE
COMPANY LIMITED

1300A/2

GEC
mono - accelerator

DOUBLE GUN CATHODE RAY TUBE

BRIEF DATA

A double gun oscilloscope tube with a 13 cm (5¼ inch) flat screen. Deflector plates and final anode connections are brought out to side pins. The screen is fully scanned by both guns. This tube is a shortened version of the 1300A which is now obsolete.

HEATER

Heater voltage	6.3	V
Heater current (each gun)	0.3	A

SCREEN

	1324A/2	1346A/2
Fluorescence	Green	White
Phosphorescence	Green	Yellowish-green
Persistence	1 – 5 ms	10 – 60 s
EIA phosphor code	P31	P7
GEC phosphor code	24	46
Pro Electron phosphor code	GH	GM

RATINGS (Absolute)

		Max	Min	
Third anode and wall coating voltage	V_{a3}, V_m	5.0	2.0	kV
Focus voltage	V_{a2}	1.5	–	kV
First anode voltage	V_{a1}	2.0	1.0	kV
Control grid voltage	$-V_g$	200	0	V
Y plates to third anode voltage	$V_{y1,y2\text{-}a3}$	300	–	V
X plates to third anode voltage	$V_{x1,x2\text{-}a3}$	300	–	V
Heater-cathode voltage	$V_{h\text{-}k}$	150	–	V
Y deflector plate circuit resistance	$R_{y\text{-}a3}$	2.0	–	MΩ
X deflector plate circuit resistance	$R_{x\text{-}a3}$	2.0	–	MΩ
Grid to cathode circuit resistance	$R_{g\text{-}k}$	1.0	–	MΩ
*Peak grid voltage	$+v_{g\,(pk)}$	2.0	–	V

*The dc value of the modulator voltage must never become positive with respect to cathode.

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December 1977
Issue 2

CAPACITANCES

Cathode to all other electrodes	5.0	pF
Grid to all other electrodes	7.0	pF
Deflector plates y1 to y2	2.0	pF
Deflector plates y1 to all electrodes except y2	3.0	pF
Deflector plates y2 to all electrodes except y1	3.0	pF
Deflector plates x1 to x2	2.0	pF
Deflector plates x1 to all electrodes except x2	4.0	pF
Deflector plates x2 to all electrodes except x1	4.0	pF

EQUIPMENT DESIGN RANGE

		Max	Min	
Focus voltage	V_{a2}	990	600	V
Control grid voltage for spot cut-off	$-V_g$	50	25	V/kV_{a1}
Y deflection factor	D_y	6.7	5.0	$V/cm/kV_{a3}$
X deflection factor	D_x	10	8.0	$V/cm/kV_{a3}$
Astigmatism correction	$V_{a3\text{-}y}$	+33	−33	V/kV_{a3}

TYPICAL OPERATION (All operating potentials are with respect to cathode)

Third anode and wall coating voltage	V_{a3}, V_m	3	kV
Focus voltage	V_{a2}	600 – 990	V
First anode voltage	V_{a1}	1.5	kV
Control grid voltage for spot cut-off	$-V_g$	58	V
Maximum y deflection factor	D_y	20	V/cm
Maximum x deflection factor	D_x	30	V/cm
*Line width typical		0.6	mm

*Measured by means of a microscope at the centre of x and y axes for each gun, at a beam current of 1.0 μA.

†The wall coating, m, and the mean potential of the deflector plates are normally held constant at a3 potential. Adjustment of the a'3 and a''3 potentials relative to the mean potential of the deflector plates may be used as an astigmatism control.

DISPLAY CHARACTERISTICS (Typical operation)

Spot Position

The undeflected spots will lie within two 10 mm dia. circles whose centres lie on the y axis ± 12.5 mm from the geometric centre of the tube face.

Minimum Scanned Area

Minimum useful scanned area is ±57 mm along the axes intersecting at the centre of the tube face.

Deflection Linearity

The difference between the deflection sensitivity for 25 % and 75 % of the useful scanned area will not be greater than 2 % for each gun.

Pattern Distortion

The edges of a test raster 72 mm x 72 mm will lie between two concentric squares of 68 mm and 72 mm sides.
Angle between deflection axes of each gun is 90 ° ± 1 °. Angle between the x deflection axes of the two guns is not greater than 1 °.

Orientation

Looking at the screen with pin 10 uppermost, a positive potential applied to x1 will deflect the spot to the left and a positive potential applied to y1 will deflect the spot upwards.

MOUNTING

The tube may be mounted in any position but must not be supported by the base alone. It should, preferably, be held in a suitable rubber mask at the screen and by a clamp round the magnetic shield near the base. The socket should have sufficient freedom of movement to accommodate overall length and base orientation tolerances.

WEIGHT

The weight of the tube alone is approximately 1.1 kg (2½ lb).

BASE CONNECTIONS

Base : B12F

Pin 1 :	g''	Pin 7 :	a1'
2 :	k''	8 :	a2'
3 :	h''	9 :	h'
4 :	h''	10 :	h'
5 :	a2''	11 :	k'
6 :	a1''	12 :	g'

Pins 6 and 7 are internally connected.

MAGNETIC SHIELD

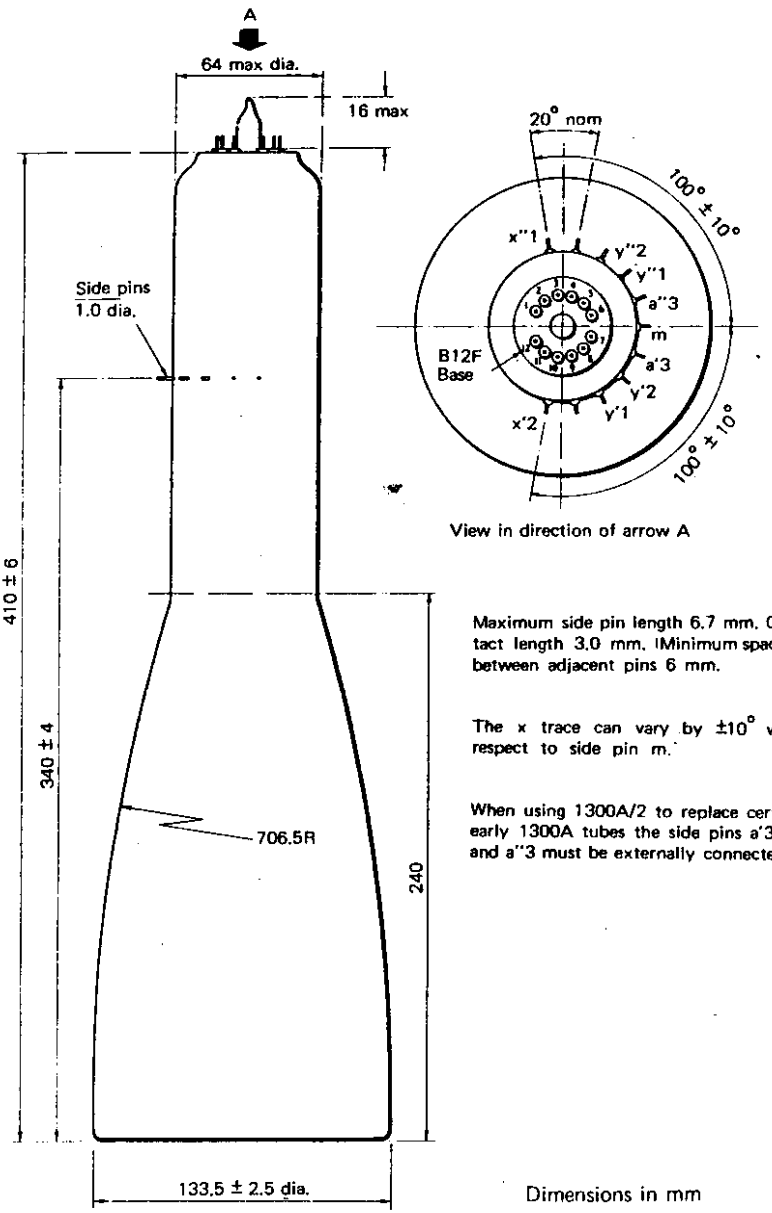
A suitable magnetic shield may be obtained from Magnetic Shields Ltd., Headcorn Road, Staplehurst, Tonbridge, Kent.

WARNING

Care should be taken not to expose the tube to strong magnetic fields either in use or during storage.

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OUTLINE



View in direction of arrow A

Maximum side pin length 6.7 mm. Contact length 3.0 mm. Minimum spacing between adjacent pins 6 mm.

The x trace can vary by ±10° with respect to side pin m.

When using 1300A/2 to replace certain early 1300A tubes the side pins a'3, m and a''3 must be externally connected.

Dimensions in mm

THE M-O VALVE
COMPANY LIMITED

1300M

Brimar SE5/2A CV9337

GEC

DOUBLE GUN CATHODE RAY TUBE

BRIEF DATA

A high sensitivity double-gun oscilloscope tube with a 13 cm (5¼ inch) diameter faceplate and helical post deflection acceleration. The two identical electron guns have a common horizontal deflection system and independent vertical deflection systems.

HEATER

Heater voltage	6.3	V
Heater current (total)	0.6 or 1.2	A

SCREEN

Tube normally supplied with 24 phosphor as 1324M.

Fluorescence	Green	
Phosphorescence	Green	
Persistence	1 – 5	ms
EIA phosphor code	P31	
GEC phosphor code	24	
Pro Electron phosphor code	GH	

Other screens are available to special order (see data sheet 'CRT Screens').

EQUIPMENT DESIGN RANGE

		Max	Min	
Focus voltage	V_{a2}	400	200	$V/kV_{a1,3}$
Control grid voltage for spot cut-off	$-V_{g1}$	60	30	V/kV_{a1}
Blanking voltage	V_{g3}	50	–	V/kV_{a1}
Y deflection factor	D_y (at $V_{a4}/V_{a3} = 4$)	6.6	5.4	$V/cm/kV_{a3}$
X deflection factor	D_x (at $V_{a4}/V_{a3} = 4$)	21	17	$V/cm/kV_{a3}$
p.d.a. spiral current		10	–	$\mu A/kV_{a3-a4}$

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December 1977
Issue 2

RATINGS (Absolute)

		Max	Min	
Fourth anode voltage	V_{a4}	8.0	3.0	kV
Third anode voltage	V_{a3}	2.0	0.8	kV
Ratio	V_{a4}/V_{a3}	4.0	–	–
Focus voltage	V_{a2}	1.5	0	kV
First anode voltage	V_{a1}	2.0	0.8	kV
Control grid voltage	$-V_{g1}$	200	0	V
Y plate to third anode voltage	$V_{y\text{-}a3}$	200	–	V
X plate to third anode voltage	$V_{x\text{-}a3}$	500	–	V
Heater - cathode voltage	$V_{h\text{-}k}$	180	–	V
Heater-cathode circuit resistance	$R_{h\text{-}k}$	1.5	–	MΩ
Y deflector plate circuit resistance	$R_{y\text{-}a3}$	0.25	–	MΩ
X deflector plate circuit resistance	$R_{x\text{-}a3}$	5.0	–	MΩ
Grid to cathode circuit resistance	$R_{g1\text{-}k}$	1.5	–	MΩ
Geometry correction voltage	V_{s1}	2.0	0.8	kV
Trace registration voltage	V_{g2}	2.0	0.8	kV
Beam blanking voltage	V_{g3}	2.0	0.8	kV

CAPACITANCES (each gun)

Cathode to all other electrodes	5.5	pF
Control grid to all other electrodes	8.5	pF
Blanking plate to all other electrodes (both guns)	12.0	pF
Deflector plates y1 to y2	2.5	pF
Deflector plates y1 to all electrodes except y2	4.0	pF
Deflector plates y2 to all electrodes except y1	4.0	pF
Deflector plates x1 to x2	4.0	pF
Deflector plates x1 to all electrodes except x2	4.0	pF
Deflector plates x2 to all electrodes except x1	4.0	pF

TYPICAL OPERATION (All operating potentials are with respect to cathode)

Fourth anode voltage	V_{a4}	4.0	kV
Third anode voltage	V_{a3}	1.0	kV
Focus voltage	V_{a2}	290.0	V
First anode voltage	V_{a1}	1.0	kV
Control grid voltage for spot cut-off	$-V_{g1}$	45.0	V
Nominal trace registration voltage	V_{g2}	1.0	kV
Nominal beam blanking voltage	V_{g3}	1.0	kV
Nominal geometry correction voltage	V_{s1}	1.0	kV
Maximum y deflection factor	D_y	6.6	V/cm
Maximum x deflection factor	D_x	21.0	V/cm
*Typical line width (for type 24 phosphor		0.4	mm

*Measured by means of a shrinking raster at the geometric centre of the face-plate.

DISPLAY CHARACTERISTICS

Minimum Scanned Area

x axis	10	cm
y (each gun)	6	cm
y (overlap)	4	cm

The centre of the 10 x 4 cm overlap rectangle will fall within a circle of 3 mm radius centred on the geometric centre of the faceplate.

Beam Blanking

A potential of 50 V/kV_{a1} (preferably negative) with respect to a1 applied to the blanking electrode g3, will completely cut off both beams. This electrode should not be used as a brightness control.

Superimposition of Traces

The vertical traces may be superimposed along the vertical diameter by adjustment of the potential of the trace registration electrode g2, relative to a1, A range of adjustment of ± 10 V/kV_{a1} may be required. Superimposition of the vertical traces at the extremes of x deflection may then be effected by adjustment of the relative cathode potentials. Provision should be made for a potential difference of up to 40 V/kV_{a3} between the two cathodes for this purpose.

Astigmatism Correction

Adjustment of the potential on a3 relative to the y deflection plate mean potential may be used for the purpose of astigmatism correction. A range of adjustment of ± 30 V/kV_{a3} should be allowed for this purpose.

Pattern Correction

Barrel or pincushion distortion may be minimised by the application of the appropriate potential to s1 relative to the x plate mean potential. A range of adjustment from −30 to +30 V/kV_{a3} should be allowed for this purpose. Astigmatism and pattern correction potentials are quoted for the condition where the x plate mean potential is equal to the y plate mean potential. If, in any application, a difference between x and y plate mean potentials is unavoidable, it is recommended that this difference should be kept to a minimum.

Pattern Distortion

For each beam with pattern correction applied, the edges of a test raster will lie between two concentric rectangles of 102 x 51 mm and 100 x 50 mm. The angle between x and y axes (each beam) will be 90 ° ± 1 °. The angle between y axes (beams superimposed) will be 0 ° ± 1.5 °.

Deflection Linearity

The deflection factor for a deflection of less than 75 % of the useful scan will not differ from that for a deflection of 25 % by more than 2 %.

Spot Position

The focused and undeflected spots will fall within two 10 mm dia. circles whose centres lie on the geometric y – axis and ±10 mm from the geometric centre of the faceplate.

Orientation

Looking at the screen with pins 9 and 10 of the base uppermost a positive potential applied to x1 will deflect the beam to the left and a positive potential applied to y1' or y1'' will deflect the appropriate beam upwards.

MOUNTING

The tube may be mounted in any position but should not be supported by the base alone. It should preferably be held in a suitable rubber mask at the screen and by a clamp round the magnetic shield near the base. The socket should have sufficient freedom of movement to accommodate the maximum overall tube length and base orientation tolerances.

BASE CONNECTIONS

Base: B12F

Pin 1 : g1''
2 : k''
3 : h
4 : h
5 : a2'' (focus)
6 : a2' (focus)

Side contact (CT8) : a4

Pin 7 : g1'
8 : k'
9 : g2 (trace registration)
10 : a1' and a1''
11 : g3 (beam blanking)
12 : IC

Side pin connections as viewed from base and reading clockwise from base pin 2:

x1 x2 a3'' y2'' y1'' s1 (geometry) a3' y2' y1'

WEIGHT

The weight of the tube alone is 1.25 kg (2¾ lb).

MAGNETIC SHIELDING

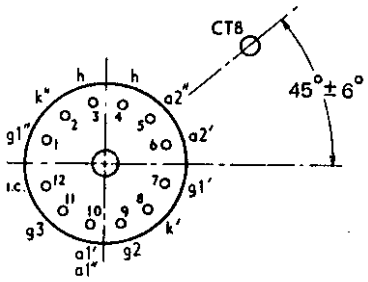
A suitable magnetic shield may be obtained from Magnetic Shields Ltd., Headcorn Road, Staplehurst, Tonbridge, Kent.

WARNING

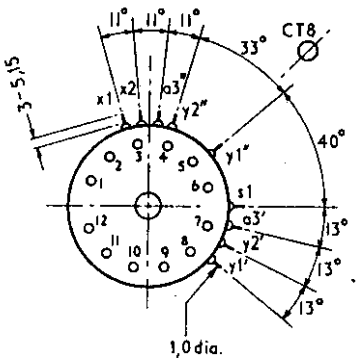
Care should be taken not to expose the tube to stray magnetic fields either in use or during storage.

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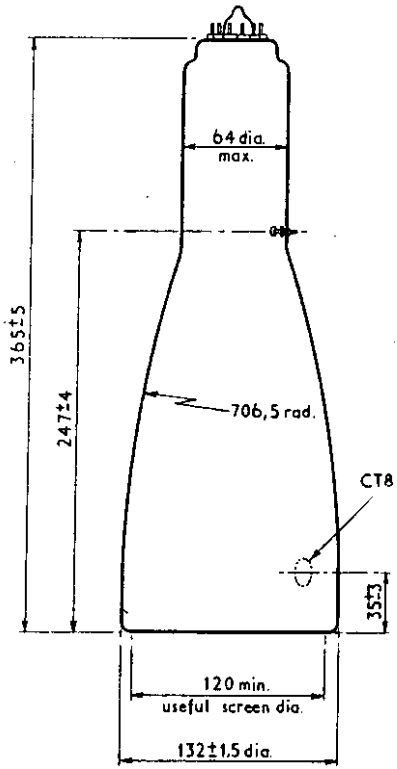
OUTLINE

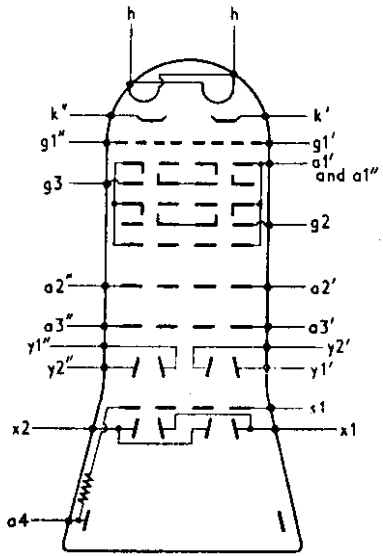


B12F Base



Minimum spacing between any side pins is 3.5 within a maximum total arc of 155°.





All dimensions are in mm

G.E.C. CATHODE RAY TUBES

11,5 × 9 cm RECTANGULAR FACED DUAL TRACE OSCILLOSCOPE TUBE

10 × 6

1300P series

ISSUE 1

used in EMI/SE 102
Telequipment D53

BRIEF DATA

A high sensitivity split beam dual trace oscilloscope tube with a 11,5×9cm faceplate. The tube has provision for brightness equalisation, independent astigmatism correction and incorporates mesh p.d.a.

Final anode voltage (p.d.a.)	10	kV
Display area @ V_{a4} = 6,7V_{a3} (each beam)	6 x 10	cm
Overlap	6	cm
Deflection factor (Dy)	< 5,7	V/cm
Deflection factor (Dx)	<10,2	V/cm

HEATER

V_h	6,3	V
I_h	0,3 (approx.)	A

RATINGS (Absolute)

	Max.	Min.	
V_{a4}	12	6	kV
V_{a3}	2,0	1,0	kV
Ratio ($V_{a4/a3}$)	10	-	
V_{a2}	1,0	-	kV
V_{a1}	2,0	1,0	kV
$-V_{g1}$	200	-	V
$+V_{g1}$	0	-	V
V_{h-k} Cathode positive d.c.	200	-	V
pk.	300	-	V
Cathode negative d.c.	125	-	V
pk.	250	-	V
V_{x-a3}	500	-	V
V_{y-a3}	250	-	V
V_{g2-a1}	±200	-	V
V_{g3-a1}	±200	-	V
I_k (mean)	500	-	μA
R_{g1-k}	1,0	-	MΩ
R_{x-a3}	1,0	-	MΩ
R_{y-a3}	100	-	kΩ
$V_{s1'}$, $s1''$-a3	200	-	V
V_{s3-a3}	200	-	V
V_{s2-a3}	200	-	V

1300P series

SCREEN

Fluorescence	Green	White
Phosphorescence	Green	Yellowish Green
Persistence	1-5 ms	10 - 60 secs.
E.I.A. Phosphor Code	P31	P7
G.E.C. Phosphor Code	74	96

Other screens are available to special order (see data sheet "Phosphor Codes").

CAPACITANCES (Max.)

C_k-all	5,0	pF
C_{g1}-all	10,0	pF
$C_{y1'-y2'}$	1,0	pF
$C_{y1''-y2''}$	1,0	pF
C_{x1-x2}	3,0	pF
$C_{y1'}$-all (less y2')	4,5	pF
$C_{y2'}$-all (less y1')	6,5	pF
$C_{y1''}$-all (less y2")	6,5	pF
$C_{y2''}$-all (less y1")	4,5	pF
C_{x1}-all (less x2)	6,5	pF
C_{x2}-all (less x1)	6,5	pF
C_{g3}-all	8,5	pF

EQUIPMENT DESIGN RANGE

	Max.	Min.	
V_{a2} (for focus)	220	40	V/kV_{a3}
$-V_{g1}$ (for cut-off)	67	30	V/kV_{a1}
$-V_{g3}$ (for blanking) (w.r.t.a_1)	30	-	V/kV_{a1}
Deflection factor D_y	3,8	2,87	$V/cm/kV_{a3}$
Deflection factor D_x	6,8	5,6	$V/cm/kV_{a3}$
p.d.a. spiral current	10	-	$\mu A/kV_{a3-a4}$

TYPICAL OPERATION (all operating voltages with respect to cathode)

V_{a4}	10	kV
V_{a3}	1,5	kV
V_{a2} (for focus)	60 - 330	V
V_{a1}	1,5	kV
$-V_{g1}$ (for cut-off)	100 max.	V
V_{g2} (nom)	1,5	kV
V_{g3} (nom)	1,5	kV
D_y (max)	5,7	V/cm
D_x (max)	10,2	V/cm
$V_{s1'}$ (nom)	1,48	kV
$V_{s1''}$ (nom)	1,45	kV
V_{s3} (nom)	1,48	kV
V_{s2} (nom)	1,5	kV
*Line width (typical for type 74 phosphor)	0,4	mm

*At 5μA in each beam and measured by shrinking raster.

Minimum Scanned Area

x	10	cm
y (each beam)	6	cm
y (overlap)	6	cm

Beam Blanking

A potential of $30V/kV_{a3}$ negative with respect to a1, applied to the beam blanking electrode g3 will completely cut off both beams. This electrode should not be used as a brightness control.

Beam Equality

The brightness of the traces may be equalised at low level by the application of a suitable potential to the beam equalising electrode, g2. A range of adjustment of -16,6 to +6,6 V/kV_{a1} should be allowed for this purpose.

Astigmatism Correction

Adjustment of the potentials on s1' and s1", relative to their nominal values, may be used for the purpose of independent astigmatism correction of the two traces. A range of adjustment of $\pm 14V/kV_{a3}$ should be allowed on $V_{s1'}$ and $\pm 20V/kV_{a3}$ on $V_{s1''}$ for this purpose. In order to minimise astigmatism and errors in geometry it is recommended that differences between the mean potentials of each deflection system and also a3 should be kept to a minimum.

Pattern Correction

Barrel and pincushion effects may be minimised by applying the appropriate potential to s2. However this should be kept to a minimum.

Axis Alignment

The electrical x axis of the tube will lie within ±5° of the major axis of the faceplate, and may be aligned with this axis by means of the field from an axial coil placed about the cone in the region shown in the outline drawing. The maximum ampere turns required for axis alignment will be given by $12\sqrt{kV_{a4}}$.

Background Suppression

Background illumination of the phosphor may be reduced and contrast improved by applying -20V to s_3 with respect to s_2.

DISPLAY CHARACTERISTICS

Pattern Distortion

For both beams simultaneously with no pattern correction applied, the edges of the test rasters will lie between two concentric rectangles of 100mm × 60mm and 98mm × 58mm. The angle between x and y axes (each beam) will be 90° ± 1°. The angle between y axes (beams superimposed) will be 0° ± 1,5°.

Deflection Linearity

The deflection factor for a deflection of less than 75% of the useful scan will not differ from that for a deflection of 25% by more than 2%.

Spot Position

The focused and undeflected spots will fall within a square 2,0cm × 2,0cm centred at the geometric centre of the faceplate.

The maximum displacement between the spots in the y direction will be 10mm.

Orientation

Looking at the screen with pins 1 and 12 uppermost, a positive voltage applied to x_1 will deflect the beam to the left and a positive voltage applied to y_1' or y_1'' will deflect the appropriate beam upwards.

MOUNTING

The tube may be mounted in any position but should not be supported by the base alone. It should preferably be held in a suitable rubber mask at the screen and by a clamp around the magnetic shield near the base. The socket should have sufficient freedom of movement to accommodate the maximum overall tube length and base orientation tolerances.

1300P series

BASE CONNECTIONS

Base: B12F

Pin 1:	g1	Pin 7:	g3 (blanking)
2:	k	8:	a3
3:	h	9:	s3 (contrast)
4:	h	10:	a1
5:	a2 (focus)	11:	s2 (geometry)
6:	g2 (beam equalising)	12:	s1' (astigmatism)

Side contact: (CT8): a4

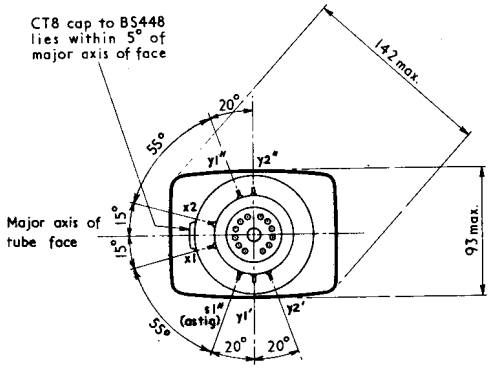
Side pin connections as viewed from the base and reading clockwise fro
base pin 12:-

y2' y1' s1" (astigmatism) x1 x2 y1" y2".

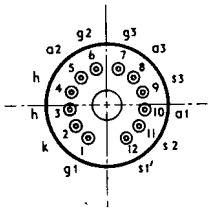
ACCESSORIES

Part	Manufacturer	Type N
Base Sockets	Carr Fastener	77/84
CT8 connector	" "	77/69
Side pin connector	A.E.1.	WS1
	Harwin.	W300
Magnetic Shield	Magnetic Shields Ltd.	

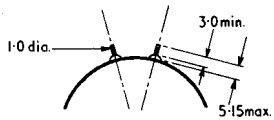
1300P series



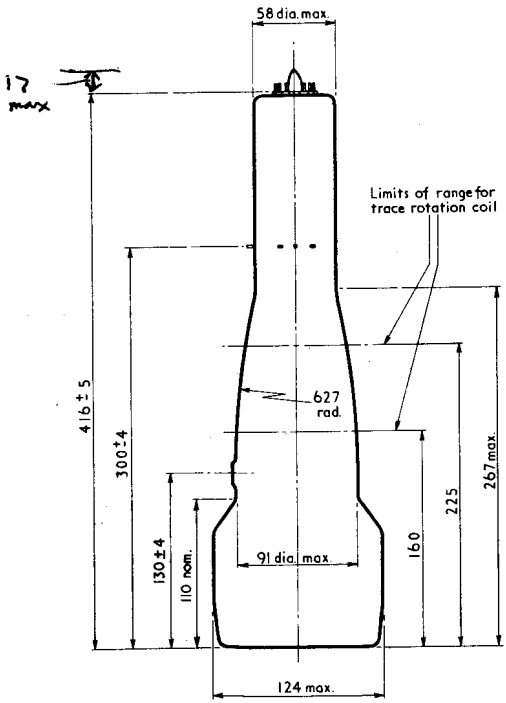
Positional tolerance of each side pin is 2,5° from datum

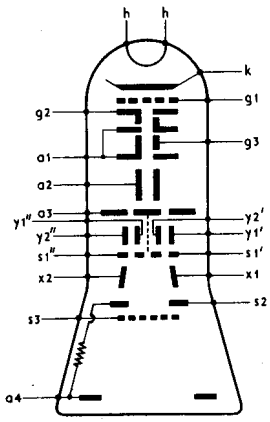


B12F base



Enlarged view of side pins





947

All dimensions are in millimetres

OUTLINE DRAWING

THE M-O VALVE
COMPANY LIMITED

1300Q

Brimar D13-51

GEC

INSTRUMENT
CATHODE RAY TUBE

10 × 6

BRIEF DATA

A 13cm diagonal (5¼") flat faced rectangular instrument tube with aluminised screen, mesh p.d.a. and deflection blanking. This tube has side connected deflection plates and is intended for use in general purpose oscilloscopes.

HEATER

Heater voltage	6.3	V
Heater current	300	mA

SCREEN

	1374Q	**1396Q**
Fluorescence	Green	Bluish-White
Phosphorescence	Green	Yellowish-Green
Persistence	1–5ms	10–60s
E.I.A. phosphor code	P31	P7
Pro Electron phosphor code	GH	GM
GEC phosphor code	74	96

Other screens are available to special order (see data sheet 'CRT Screens'). Preferred Type 1374Q/G8 with special purpose internal graticule.

CAPACITANCES (Typical)

Cathode to all other electrodes	4.4	pF
Control grid to all other electrodes	8.3	pF
Blanking plate to all other electrodes	6.9	pF
Deflector plate y_1 to y_2	1.0	pF
Deflector plate y_1 to all electrodes except y_2	2.8	pF
Deflector plate y_2 to all electrodes except y_1	2.8	pF
Deflector plate x_1 to x_2	1.5	pF
Deflector plate x_1 to all electrodes except x_2	5.3	pF
Deflector plate x_2 to all electrodes except x_1	5.3	pF

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December 1977
Issue 2

RATINGS (Absolute)

		Max	Min	
Fourth anode voltage	V_{a_4}	12	5.0	kV
Third anode voltage	V_{a_3}	2.0	0.9*	kV
Ratio	V_{a_4}/V_{a_3}	10	–	
Focus voltage	V_{a_2}	1.0	–	kV
First anode voltage	V_{a_1}	2.0	0.9*	kV
Control grid voltage	$-V_{g_1}$	200	1.0	V
Blanking plate to first anode voltage	$V_{g_2\text{-}a_1}$	+200	−200	V
Heater to cathode voltage	$V_{h\text{-}k}$	±125	–	V
Y plate to third anode voltage	$V_{y\text{-}a_3}$	500	–	V
X plate to third anode voltage	$V_{x\text{-}a_3}$	500	–	V
Heater to cathode circuit resistance	$R_{h\text{-}k}$	100	–	kΩ
Grid to cathode circuit resistance	$R_{g_1\text{-}k}$	1.0	–	MΩ
Y deflector plate circuit resistance	$R_{y\text{-}a_3}$	100	–	kΩ
X deflector plate circuit resistance	$R_{x\text{-}a_3}$	250	–	kΩ

*For 1374Q/G8 read 0.65kV minimum.

Voltage ratings are to cathode unless otherwise shown.

EQUIPMENT DESIGN RANGE

		Max	Min	
Focus voltage	V_{a_2}	143	28	V/kV_{a_3}
Control grid voltage for spot cut-off	$-V_{g_1}$	93	50	V/kV_{a_1}
Blanking voltage	$V_{g_2\text{-}a_1}$	+50	−50†	V/kV_{a_3}
Y deflection factor	D_Y	5.7	4.2	$V/cm/kV_{a_3}$
X deflection factor	D_X	14.3	11.4	$V/cm/kV_{a_3}$
Astigmatism correction voltage	$V_{a_3\text{-}y\ mean}$	+30	−60	V/kV_{a_3}
Pattern correction voltage	$V_{s_2\text{-}x mean}$	+50	−50	V/kV_{a_3}

†For visual extinction of the trace at a beam current of 5μA. The use of negative blanking is recommended.

TYPICAL OPERATION*(All operating potentials are with respect to cathode)

Fourth anode voltage	V_{a_4}	10	kv
Third anode voltage	V_{a_3}	1.0	kV
Focus voltage	V_{a_2}	28–143	V
First anode voltage	V_{a_1}	1.0	kV
Control grid voltage for spot cut-off	$-V_{g_1}$	93–50	V
Nominal blanking plate voltage	V_{g_2}	1.0	kV
Nominal beam alignment voltage	V_{g_3}	1.0	kV

Nominal i.p.s. voltage	V_{s_1}	1.0	kV
Nominal mesh voltage	V_{s_3}	0.975	kV
Nominal geometry correction voltage	V_{s_2}	1.0	kV
Maximum y deflection factor . .	D_y	5.7	V/cm
Maximum x deflection factor	D_x	14.3	V/cm
Line width (typical) 74 screen		0.35	mm

Measured by means of a shrinking raster at I_b = 5μA

*1374Q/G8 is a special purpose tube operating at 7.0/0.7kV

DISPLAY CHARACTERISTICS (Typical Operation)‡

‡These characteristics apply to 1374Q/G8 when suitably scaled for 7.0/0.7kV operation.

Pattern Distortion

With pattern correction applied to s_2, the edges of a test raster will lie between two concentric rectangles of 100mm x 60mm and 98mm x 58.5mm. The angle between x and y axis will be 90° ± ¾° measured at face centre.

Deflection Linearity

The deflection factor for a deflection of less than 75% of the useful scan will not differ from that for a deflection of 25% by more than 3%.

Spot Position

The focused and undeflected spot will fall within a rectangle 8mm x 20mm centred at the geometric centre of the faceplate, the greater dimension being aligned in the x-axis.

Orientation

Looking at the screen with pins 1 and 12 uppermost a positive voltage applied to x_1 will deflect the beam to the left and a positive voltage applied to y_1 will deflect the beam upwards.

Minimum Scanned Area

x major axis	10.0	cm
y minor axis	6.0	cm

This area will be centred on a point which is within 3mm of the major and minor axis of the tube face.

ASTIGMATISM CORRECTION

Adjustment of the potential on a_3 relative to the y deflector plate mean potential may be used for astigmatism correction. A range of adjustment from +30 to $-60V/kV_{a_3}$ should be allowed.

AXIS ALIGNMENT

The electrical x axis of the tube will lie within ±5° of the major axis of the faceplate, and may be aligned with this axis by means of the field from a close fitting axial coil placed about the cone of the tube in the region shown in the outline drawing. The maximum ampere turns required for axis alignment will be given by $14\sqrt{kV_{a_4}}$.

BEAM ALIGNMENT

Because of the close spacing of the deflector plates in order to achieve sensitivity, some tubes may exhibit a tendency towards x plate cut off within the specified minimum window size. This may be corrected by centralising the undeflected beam in the x deflector plates by means of a suitable potential applied to the beam aligning electrode g_3. A range of adjustment of $\pm 50V/kV_{a_1}$ with respect to a_1 should be allowed for this purpose.

BEAM BLANKING (If g_2 blanking not used join pins 7 & 10 externally)

Under typical operating conditions (i.e. $V_{a_1} = V_{a_3} = 1.0kV$) and for a beam current (I_b) of 5μA a potential of 50V (preferably negative) with respect to a_1, applied to the blanking electrode g_2, will completely cut off the beam. This electrode should not be used as a brightness control.

BACKGROUND SUPPRESSION

Background illumination may be reduced and contrast improved by applying a potential of −25V to s_3 with respect to s_2.

MOUNTING

The tube may be mounted in any position but should not be supported by the base alone. It should preferably be held in a suitable rubber mask at the screen and by a clamp around the magnetic shield near the base. The socket should have sufficient freedom of movement to accommodate the maximum overall tube length and base orientation tolerances.

WEIGHT

The weight of the tube alone is 800 gm (approx.).

BASE CONNECTIONS

Base: B12F

Pin 1:	g_1	Pin 7:	g_2 (blanking)
2:	k	8:	a_3
3:	h	9:	s_3 (contrast)
4:	h	10:	a_1
5:	a_2 (focus)	11:	s_2 (geometry)
6:	g_3 (beam alignment)	12:	IC

Side contact (CT8): a_4

ACCESSORIES

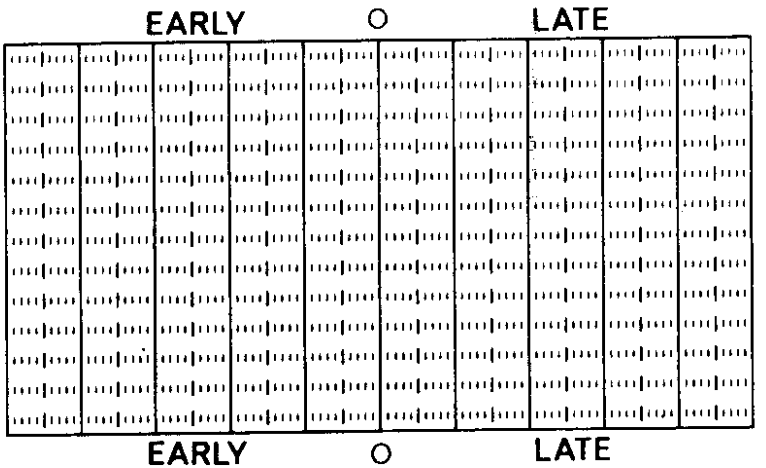
CT8 Connector	Pressac Ltd., Leopold Street, Long Eaton, Nottingham, NG10 4QL	(cover) 12/426 (clip) 10/425
Magnetic Shield	Magnetic Shields Ltd., Headcorn Road, Staplehurst, Tonbridge, Kent.	
Side Pin Connector	Auto Precision Ltd., Glendore Street, Bristol BS5 9SY	

WARNING

Care should be taken not to expose the tube to strong magnetic fields either in use or during storage.

SPECIAL PURPOSE INTERNAL GRATICULE

The preferred tube, type 1374Q/G8, is supplied with a special internal graticule for use in equipments designed to measure the distortion of pulse trains on telegraph lines.



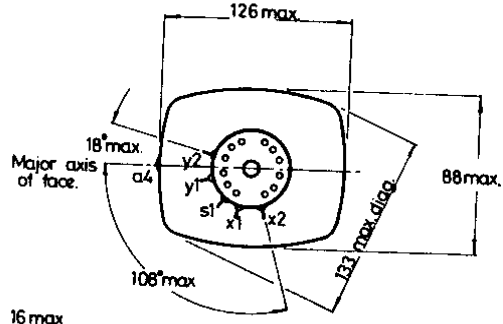
Other graticules are available to special order.

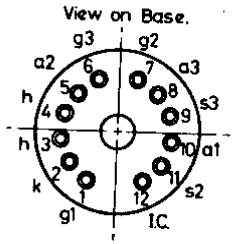
Whilst M-OV has taken care to ensure the accuracy of the information contained herein it accepts no responsibility for the consequences of any use thereof and also reserves the right to change the specification of goods without notice.
M-OV accepts no liability beyond that set out in its standard conditions of sale in respect of infringement of third party patents arising from the use of tubes or other devices in accordance with information contained herein.

OUTLINE

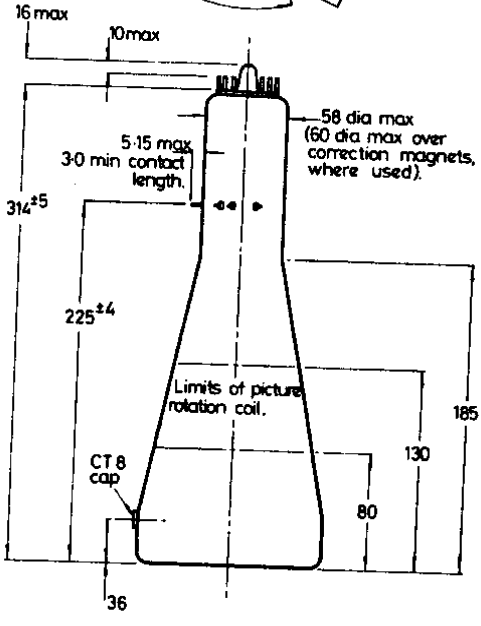
1138

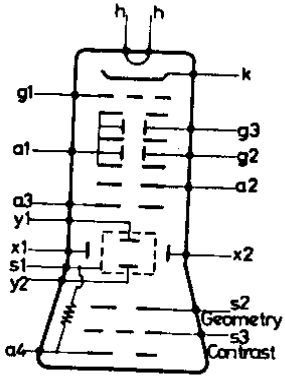
Centre line of base lies within 90 ± 5° of major axis of face. CT 8 position lies within ± 5 mm. of major axis of face. Side pins 1 mm. dia. Minimum spacing between adjacent side pins 6 mm.





B 12 F Base.





Dimensions in mm.

G.E.C. CATHODE RAY TUBES

D13-22

13 cm FLAT FACED OSCILLOSCOPE TUBE

CV 9510 = 1374R

1300R series

ISSUE 1

Equivalent to D13-22 (5CLP1/DH13-10 1960 version with 2 stage PDA)

BRIEF DATA

A flat faced oscilloscope tube with a 13 cm diameter faceplate, mesh post deflection acceleration and aluminised screen. The tube has side connected deflection plates and is intended for use in precision wide band oscilloscopes.

Final anode voltage (p.d.a.)	15	kV
Display area at $V_{a4} = 10V_{a3}$	6 x 10	cm
Deflection factor (D_y)	3,2 (max)	V/cm
Deflection factor (D_x)	12,3 (max)	V/cm

HEATER

V_h	6,3	V
I_h	300 (approx)	mA

RATINGS (Absolute) (Voltage ratings are to cathode unless otherwise shown)

	Max	Min	
V_{a4}	17,3	6,0	kV
V_{a3}	3,3	1,0	kV
Ratio (V_{a3}/V_{a4})	10	-	-
V_{a2}	1,5	-	kV
V_{a1}	1,7	0,8	kV
*- V_{g1}	200	1	V
V_{h-k} cathode positive d.c.	200	-	V
pk	300	-	V
cathode negative d.c.	125	-	V
pk	250	-	V
V_{y-a3}	500	-	V
V_{x-a3}	500	-	V
R_{h-k}	100	-	kΩ
R_{y-a3}	0,5	-	MΩ
R_{x-a3}	1,0	-	MΩ
R_{g1-k}	1,0	-	MΩ

*The d.c. value of grid voltage must never be allowed to become positive with respect to cathode.

1300R series

SCREEN (Aluminised)

Fluorescence	Green	White
Phosphorescence	Green	Yellowish - green
Persistence	1-5 ms	10 - 60 s
E.I.A. phosphor code	P31	P7
G.E.C. phosphor code	74	96

CAPACITANCES (Max.)

C_k - all	4,5	pF
C_{g1} - all	6,5	pF
C_{y1} - y2	2,5	pF
C_{y1} - all less y2	4,0	pF
C_{y2} - all less y1	4,0	pF
C_{x1} - x2	2,5	pF
C_{x1} - all less x2	6,5	pF
C_{x2} - all less x1	6,5	pF

EQUIPMENT DESIGN RANGE

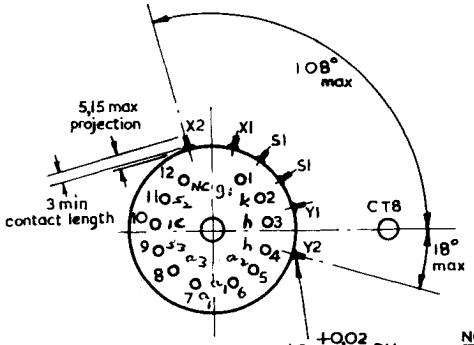
	Max	Min	
V_{a2} (For focus)	333	167	V/kV_{a3}
$-V_{g1}$ (For cut off)	56,5	30	V/kV_{a1}
D_y (at V_{a4}/V_{a3} = 10)	2,13	1,53	$V/cm/kV_{a3}$
D_x (at V_{a4}/V_{a3} = 10)	8,2	6,1	$V/cm/kV_{a3}$
p.d.a. spiral current	6	-	$\mu A/kV_{a3-a4}$
V_{a3} (astigmatism correction)	±50	-	V/kV_{a3}
V_{s2} (pattern correction)	±50	-	V/kV_{a3}

TYPICAL OPERATION

V_{a4}	15	kV
V_{a3}	1,5	kV
V_{a2} (For focus)	250 to 500	V
V_{a1}	1,5	kV
$-V_{g1}$ (For cut off)	45 to 85	V
D_y (max)	3,2	V/cm
D_x (max)	12,3	V/cm
V_{s1}	1,5	kV
V_{s2} (nom)	1,5	kV
V_{s3} (nom)	1,475	kV
*Line width (typical for type 74 phosphor)	0,7	mm

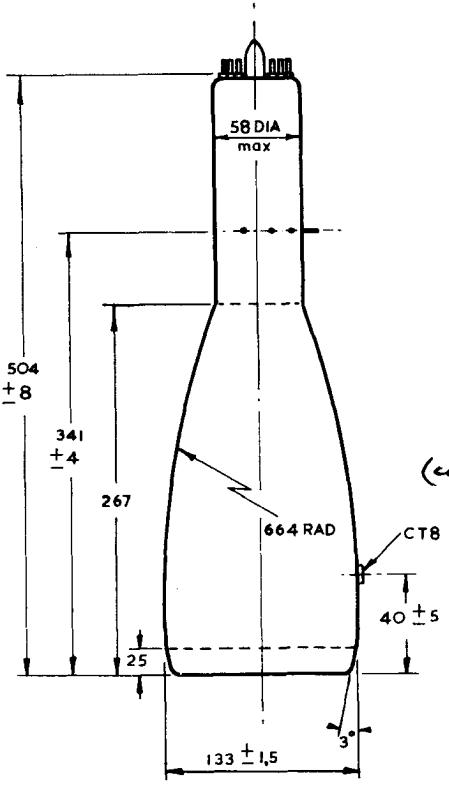
*Measured by means of a microscope at the geometric centre of the face-plate for I_b = 8μA.

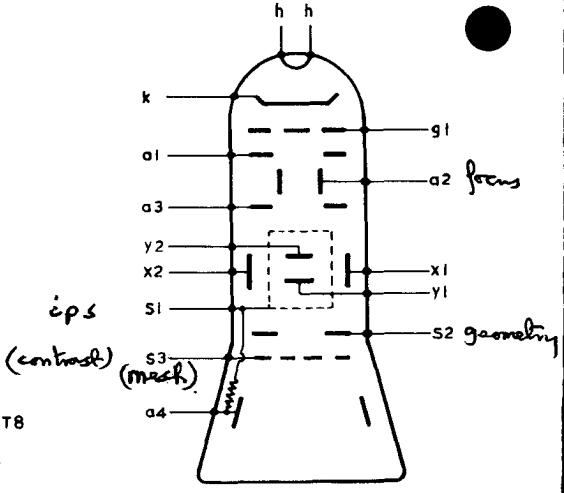
1300R series



B12F BASE

NOTE.
Minimum spacing between adjacent pins is 6 mm.





All dimensions are in millimetres

OUTLINE DRAWING

BASE CONNECTIONS

Base: B12F

Pin 1:	g1
2:	k
3:	h
4:	h
5:	a2 (focus)
6:	a1

Side Contact: CT8

Pin 7:	a1
8:	a3
9:	s3 (contrast)
10:	IC
11:	s2 (geometry)
12:	NC

Side pin connections as viewed from the base and reading clockwise from base pin 12.

x2 x1 s1 s1 y1 y2

WEIGHT

The weight of tube alone is 1,3 kgm.

ACCESSORIES

Part	Manufacturer	Type No.
Base socket	Carr Fastener Co. Ltd.	77/842
CT8 connector	" " " "	77/699
Side pin connector	Harwin	W3000
Magnetic shield	Magnetic Shields Ltd.	-
Screen mask	Standard Insulator Co.	SIC 5965

Provision of circuit information in this publication does not imply a right to use any invention which may be involved and which is the subject of patents by whomsoever owned.

Minimum Scanned Area

x	10	cm
y	6	cm

Astigmatism Correction

Adjustment of the potential on a3 relative to the y deflection plate mean potential may be used for the purpose of astigmatism correction. A range of adjustment of $\pm$ 33V/kV$_{a3}$ should be allowed for this purpose.

Pattern Correction

Barrel or pincushion distortion may be minimised by the application of the appropriate potential to s2 relative to the x plate mean potential. A range of adjustment of $\pm$ 33V/kV$_{a3}$ should be allowed for this purpose. Astigmatism and pattern correction potentials are quoted for the condition where the x plate mean potential is equal to the y plate mean potential. If, in any application, a difference between x and y plate mean potentials is unavoidable, it is recommended that this difference should be kept to a minimum.

Background Suppression

Background illumination of the phosphor may be reduced and contrast improved by applying a potential of -25V to s3 with respect to s2.

DISPLAY CHARACTERISTICS

Pattern Distortion

With pattern correction applied, the edges of a test raster will lie between two concentric rectangles of 100 $\times$ 60 mm and 98 $\times$ 58 mm.

Spot Position

The focused and undeflected spot will fall within a rectangle 12 x 20mm centred at the geometric centre of the faceplate, the greater dimension being in the x axis.

Orientation

Looking at the screen with pins 1 and 12 of the base uppermost a positive potential applied to x1 will deflect the beam to the left and a positive potential applied to y1 will deflect the beam upwards.

MOUNTING

The tube may be mounted in any position but should not be supported by the base alone. It should preferably be held in a suitable rubber mask at the screen and by a clamp round the magnetic shield near the base. The socket should have sufficient freedom of movement to accomodate the maximum overall tube length and base orientation tolerances.

G.E.C. CATHODE RAY TUBES

DUAL TRACE OSCILLOSCOPE TUBE

1300S series

ISSUE 1

BRIEF DATA

A 13cm (5 in) diameter, flat faced, split beam dual trace oscilloscope tube with distributed p.d.a. and side connections to the deflector plates. This tube incorporates deflection blanking and is intended for use in general purpose dual trace oscilloscopes.

Final anode voltage (p.d.a.)	3.5	kV
Display area	6 × 10	cm
y Deflection factor (D_y)	< 11.25	V/cm
x Deflection factor (D_x)	< 16.5	V/cm

HEATER

V_h	6.3	V
I_h	0.3 (approx.)	A

RATINGS (Absolute)

	Max.	Min.	
V_{a4}	5.0	2.0	kV
V_{a3}	2.0	0.65	kV
Ratio (V_{a4}/V_{a3})	3.5	-	-
V_{a2}	1.5	-	kV
V_{a1}	1.2	0.55	kV
$-V_{g1}$	200	1	V
V_{g2-a1}	±200	-	V
V_{h-k} Cathode positive			
d.c.	200	-	V
pk.	300	-	V
Cathode negative			
d.c.	125	-	V
pk.	250	-	V
V_{y-a3}	250	-	V
V_{x-a3}	500	-	V
I_k	500	-	μA
R_{g1-k}	1.0	-	MΩ
R_{y-a3}	100	-	kΩ
R_{x-a3}	1.0	-	MΩ
R_{h-k}	100		kΩ

Voltage ratings are to cathode unless otherwise shown.

1300S series

SCREEN

Fluorescence :	Green	White	Blue
Phosphorescence :	Green	Yellowish-green	Blue
Persistence :	1-5ms	10-60s	1-5ms
E.I.A. phosphor code :	P31	P7	P11
G.E.C. phosphor code :	24	46	08

CAPACITANCES

C_k-all	5.0	pF
C_{g1}-all	9.0	pF
C_{g2}-all	7.5	pF
$C_{y1'}$-all	4.5	pF
$C_{y2'}$-all	5.0	pF
$C_{y1''}$-all	5.0	pF
$C_{y2''}$-all	4.5	pF
$C_{y1'}$-$y2'$	1.0	pF
$C_{y1''}$-$y2''$	1.0	pF
C_{x1}-all	6.0	pF
C_{x2}-all	6.0	pF
C_{x1}-$x2$	4.0	pF

EQUIPMENT DESIGN RANGE

	Max.	Min.	
V_{a2} (for focus)	200	100	V/kV_{a3}
$-V_{g1}$ (for cut-off)	95	40	V/kV_{a1}
$-V_{g3}$ (for blanking) (w.r.t. a_1)	45	-	V/kV_{a1}
Deflection factor D_y	11.25	9.0	$V/cm/kV_{a3}$
Deflection factor D_x	16.5	13.5	$V/cm/kV_{a3}$
V_{a3} (astigmatism correction)	±40		V/kV_{a3}
V_{s1} (pattern correction)	±80		V/kV_{a3}
p.d.a. spiral current	33		$\mu A/kV_{a3-a4}$

TYPICAL OPERATION (all operating potential are with respect to cathode)

V_{a4}	3.5	kV
V_{a3}	1.0	kV
V_{a2} (for focus)	100 - 200	V
V_{a1}	1.0	kV
$-V_{g1}$ (for cut-off)	40 - 95	V
V_{g2} (nom)	1.0	kV
V_{s1} (nom)	1.0	kV
D_y (max.)	11.25	V/cm
D_x (max.)	16.5	V/cm
*Line width	0.75	mm
" by shrinking raster	0.30 est	

*Measured by means of microscope at the geometric centre of the faceplate, at a total beam current of 10μA.

Minimum scanned area

x	10	cm
y (each beam)	6	cm
y (overlap)	5	cm

Beam Blanking

At 10μA total beam current (i.e. 5μA each beam) a potential of $45V/kV_{a3}$, negative with respect to a1, applied to the blanking electrode g2 will completely cut off both beams. This electrode should not be used as a brightness control.

Beam Equality

The brightness of the traces may be equalised at low level by means of a suitable horizontally orientated lateral magnetic field, applied in the region between grid (g1) and first anode (a1). A suitable magnet may be obtained from Electro Acoustic Industries Ltd. under Type No. BC 13.

Astigmatism Correction

Adjustment of the potential on a3 relative to the y deflector plate mean potential may be used for the purpose of astigmatism correction. A range of adjustment of ±40 V/kVa3 should be allowed for this purpose.

Pattern Correction

Barrel or pincushion distortion may be minimised by the application of the appropriate potential on s1 relative to the x plate mean potential. A range of adjustment of ±80 V/kVa3 should be allowed for this purpose.

DISPLAY CHARACTERISTICS

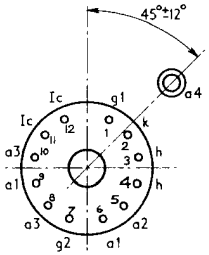
Pattern Distortion

For both beams simultaneously with no pattern correction applied, the edges of each test raster will lie between two concentric rectangles of 100mm × 60mm and 97.3mm × 58mm. The concentric rectangles are centred about the geometric vertical axis of the screen and 5mm above the geometric horizontal axis to accommodate the y' test raster and 5mm below the axis to accommodate the y" test raster. The angle between x and y axes (each beam) will be 90°± 1°, and the angle between the two y axes (beams superimposed) will be 0°±1.5°.

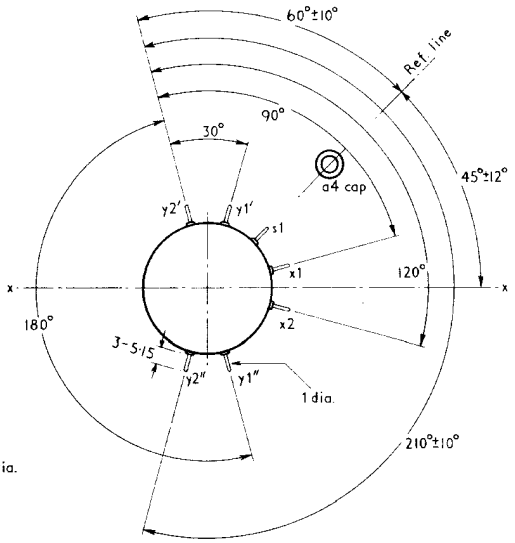
Deflection linearity

The deflection factor for a deflection of less than 75% of the useful scan will not differ from that for a deflection of 25% by more than 2%.

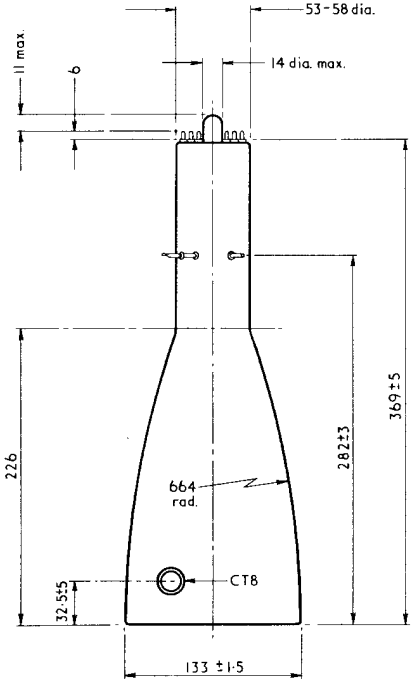
1300S series

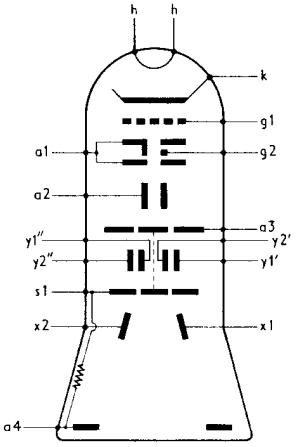


B12F base



View looking onto neck pins from base





904

All dimensions are in millimetres

Printed in England

Spot Position

The focused and undeflected spots will fall within a rectangle 1.2cm × 2.0cm centred at the geometric centre of the faceplate, the greater dimension being aligned in the x axis. The maximum displacement between the spots in the y direction will be 5mm.

Orientation

Looking at the screen with pins 1 and 12 uppermost, a positive potential applied to x_1 will deflect the beam to the left and a positive potential applied to y_1' or y_1'' will deflect the appropriate beam upwards.

MOUNTING

The tube may be mounted in any position but should not be supported by the base alone. It should preferably be held in a suitable rubber mask at the screen and by a clamp around the magnetic shield near the base. The socket should have sufficient freedom of movement to accommodate the maximum overall tube length and base orientation tolerances.

SE CONNECTIONS

Base: B12F

Pin 1:	gl	Pin 7:	g2 (blanking)
2:	k	8:	a3
3:	h	9:	al
4:	h	10:	a3
5:	a2 (focus)	11:	IC
6:	al	12:	IC

Side contact: (CT8): a4

Side pin connections as viewed from the base and reading clockwise from base pin 12:-

y2' y1' s1 (astigmatism) x1 x2 y1" y2"

NOTE: External connection should be made between pin 8 and pin 10 and between pin 6 and pin 9.

WEIGHT

The weight of the tube alone is 2.1/8lb (0.97kg).

ACCESSORIES

Part	Manufacturer	Type No
Base sockets	Carr Fastener	77/
CT8 connector	" "	77/699
Side pin connector	A.E.I. Harwin.	WS1 W3000
Magnetic shield	Magnetic Shields Ltd.	
Beam equalising magnet	Electro-Acoustic Industries Ltd.	BC 13

THE M-O VALVE COMPANY LIMITED

1300Y

GEC

INSTRUMENT CATHODE RAY TUBE

BRIEF DATA

A 13 cm flat faced, single gun, spiral p.d.a. tube for medium bandwidth applications. Features include electrostatic focus, electrostatic deflection and deflection blanking. The scan voltages required for this tube can be obtained from transistorised deflection circuits. Precision engineering renders astigmatism and geometry correction potentials unnecessary in many applications. The tube may also be used as a monoaccelerator with a larger scanned area.

	(i)	(ii)	
Final anode voltage (p.d.a.)	3	4	kV
p.d.a. ratio	3:1	4:1	
*Display area	8 x 10	8 x 10	cm
Y deflection factor (D_Y)	<8.7	<9.2	V/cm
X deflection factor (D_X)	<16.5	<18	V/cm

*Limited by a useful screen diameter of 12 cm.

HEATER

Heater voltage	6.3	V
Heater current	0.3	A

SCREEN

	1324Y	1346Y
Fluorescence	Green	White
Phosphorescence	Green	Yellowish-Green
Persistence	1–5 ms	10–60 s
E.I.A. phosphor code	P31	P7
GEC phosphor code	24	46
Pro Electron phosphor code	GH	GM

Other screens can be supplied to special order (see data sheet 'CRT Screens').

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October 1977
Issue 2

RATINGS (Absolute)

		Max	Min	
Fourth anode voltage	V_{a4}	7.0	1.8	kV
Third anode voltage	V_{a3}	2.5	0.8	kV
Ratio	V_{a4}/V_{a3}	4	1	
Focus voltage	V_{a2}	1.0	0	kV
First anode voltage	V_{a1}	2.2	0.8	kV
Control grid voltage	$-V_{g1}$	200	1.0	V
Blanking plate to first anode voltage	V_{g2-a1}	+200	−200	V
Y plate to third anode voltage	V_{y-a3}	500	–	V
X plate to third anode voltage	V_{x-a3}	500	–	V
Grid to cathode circuit resistance	R_{g1-k}	1.5	–	MΩ
Y deflector plate circuit resistance	R_{y-a3}	100	–	kΩ
X deflector plate circuit resistance	R_{x-a3}	500	–	kΩ
p.d.a. spiral resistance		–	75	MΩ

Voltage ratings are to cathode unless otherwise shown.

CAPACITANCES (Typical)

Heater-cathode to all other electrodes	3.3	pF
Control grid to all other electrodes	8.0	pF
Blanking plate to all other electrodes	11.0	pF
Deflector plates y1 to y2	1.5	pF
Deflector plates y1 to all electrodes except y2	5.0	pF
Deflector plates y2 to all electrodes except y1	5.5	pF
Deflector plates x1 to x2	2.0	pF
Deflector plates x1 to all electrodes except x2	6.2	pF
Deflector plates x2 to all electrodes except x1	6.2	pF

EQUIPMENT DESIGN RANGE

		Max	Min	
Focus voltage	V_{a2}	400	175	V/kV_{a3}
Control grid voltage for spot cut-off	$-V_{g1}$	75	35	V/kV_{a1}
Blanking voltage	V_{g2-a1}	+65	–	V/kV_{a1}
Y deflection factor	D_y (at $V_{a4}/V_{a3} = 4$)	9.2	7.5	$V/cm/kV_{a3}$
X deflection factor	D_x (at $V_{a4}/V_{a3} = 4$)	18	13	$V/cm/kV_{a3}$
Y deflection factor	D_y (at $V_{a4}/V_{a3} = 3$)	8.7	7.0	$V/cm/kV_{a3}$
X deflection factor	D_x (at $V_{a4}/V_{a3} = 3$)	16.5	12	$V/cm/kV_{a3}$
Astigmatism correction voltage	V_{a3}	+50	−50	V/kV_{a3}
Pattern correction voltage	V_s	+50	−50	V/kV_{a3}

TYPICAL OPERATION (All operating potentials are with respect to cathode)

		(i)	(ii)	
Fourth anode voltage	V_{a4}	3	4	kV
Third anode voltage	V_{a3}	1	1	kV
Focus voltage	V_{a2}	175–400	175–400	V
First anode voltage	V_{a1}	1	1	kV
Control grid voltage for spot cut-off	$-V_{g1}$	35–75	35–75	V
Nominal blanking plate voltage	V_{g2}	1	1	kV
Nominal geometry correction voltage	V_s	1	1	kV
Maximum y deflection factor	D_y	8.7	9.2	V/cm
Maximum x deflection factor	D_x	16.5	18.0	V/cm

DISPLAY CHARACTERISTICS (Typical Operation)

Minimum Scanned Area	(i)	(ii)	
X axis	10.5	10	cm
Y axis	8.4	8	cm

This area will be centred on a point which is within 3 mm of the centre of the tube face. The undeflected spot will lie within a 14 mm square at the centre of the tube face.

†Astigmatism Correction

Adjustment of the potential on a3 relative to the y plate mean potential may be used for the purpose of astigmatism correction. A range of adjustment of $\pm 50V/kV_{a3}$ should be allowed for this purpose.

†Pattern Correction

Barrel or pincushion distortion may be minimised by the application of the appropriate potential to s with respect to the x plate mean potential. A range of adjustment of $\pm 50V/kV_{a3}$ should be allowed for this purpose. Astigmatism and pattern correction potentials are quoted for the condition where the x plate mean potential is equal to the y plate mean potential. If in any application, a difference between x and y plate mean potentials is unavoidable it is recommended that this difference should be kept to a minimum.

†In many applications these correction potentials will be unnecessary.

Beam Blanking

At a beam current of 10 μA, a potential of +65V/kV_{a1} with respect to a1 applied to the blanking electrode g2, will completely cut off the beam. This electrode should not be used as a brightness control.

Pattern Distortion

With pattern correction applied the edges of a test raster will lie between two concentric rectangles 100 x 60 mm and 97.5 x 58.5 mm. The angle between the x and y axes will be 90° ± 1°.

Deflection Linearity

The deflection factor for a deflection of less than 75% of useful scan will not differ from that for a deflection of 25% by more than 2%.

MONOACCELERATOR OPERATION (Simple circuit)

First and third anode voltage	$V_{a1\ a3}$	2	kV
Focus voltage	V_{a2}	350–800	V
Control grid voltage for spot cut-off	$-V_{g1}$	70–150	V
Maximum y deflection factor	D_Y	13	V/cm
Maximum x deflection factor	D_X	21	V/cm
Minimum scanned area x axis		11.5	cm
y axis		10	cm

The CT8 contact and pins 5, 6, 9 and 11 must all be connected to each other when the tube is used in this way except where separate potentials are applied as previously described.

MOUNTING

The tube may be mounted in any position but should not be supported by the base alone. It should, preferably, be held in a suitable rubber mask at the screen and by a clamp round the magnetic shield near the base. The socket should have sufficient freedom of movement to accommodate overall length and base orientation tolerances.

BASE CONNECTIONS

Base : B 12 F

Side contact (CT8) : a4

Pin 1 :	g1	Pin 7 :	y1
2 :	hk	8 :	y2
3 :	h	9 :	s
4 :	a2	10 :	x1
5 :	g2	11 :	a1
6 :	a3	12 :	x2

WEIGHT

The weight of the tube alone is approximately 1.0 kg.

MAGNETIC SHIELDING

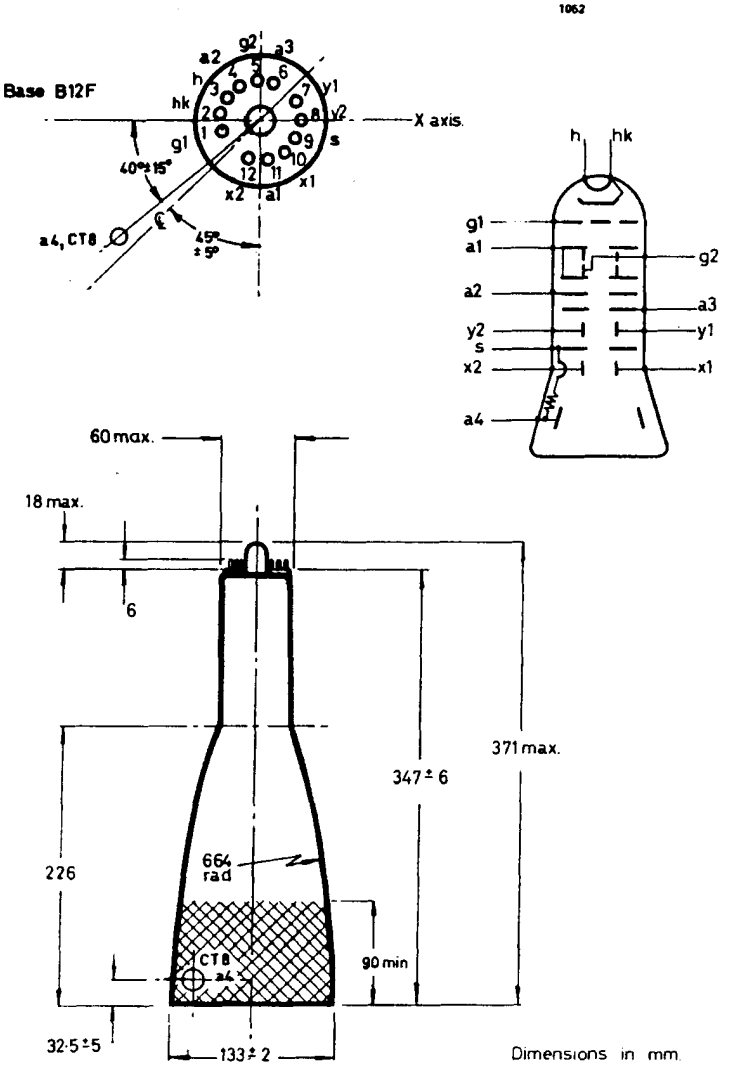
A suitable magnetic shield may be obtained from Magnetic Shields Ltd., Headcorn Road, Staplehurst, Tonbridge, Kent.

WARNING

Care should be taken not to expose the tube to strong magnetic fields either in use or during storage.

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OUTLINE


1062
Base B12F
g2
a2
a3
h
hk
y1
y2
s
g1
X axis
40°±15°
x2
a1
x1
a4, CT8
45°±5°
h
hk
g1
a1
g2
a2
a3
y2
y1
s
x2
x1
a4
60 max.
18 max.
6
371 max.
347±6
226
664 rad
CT8
a4
90 min
32·5±5
133±2
Dimensions in mm

THE M-O VALVE COMPANY LIMITED

1300Y same, LL deflection, low capacitance

1300Z

Brand 013-610

GEC

INSTRUMENT CATHODE RAY TUBE

BRIEF DATA

A 13 cm flat faced, single gun, spiral p.d.a. tube for medium bandwidth applications. Features include electrostatic focus, electrostatic deflection and deflection blanking. The scan voltages required for this tube can be obtained from transistorised deflection circuits. The tube may also be used as a mono-accelerator with a larger scanned area.

	(i)	(ii)	(iii)	
Final anode voltage (p.d.a.)	3	4	2**	kV
p.d.a. ratio	3:1	4:1	Mono	
*Display area	8 x 10	8 x 10	10 x 11.5	cm
Y deflection factor (D_Y)	<8.7	<9.2	<13	V/cm
X deflection factor (D_X)	<16.5	<18	<21	V/cm

*Limited by a useful screen diameter of 12 cm.

**Monoaccelerator a3 = 2 kV.

Length 371 mm

HEATER

Heater voltage	6.3	V
Heater current	0.3	A

SCREEN

	1324Z	1346Z
Fluorescence	Green	White
Phosphorescence	Green	Yellowish-Green
Persistence	1–5 ms	10–60 s
E.I.A. phosphor code	P31	P7
Pro Electron phosphor code	GH	GM
GEC phosphor code	24	46

Other screens can be supplied to special order (see data sheet 'CRT Screens').

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October 1977
Issue 2

RATINGS

		Max	Min	
Fourth anode voltage	V_{a4}	7.0	1.8	kV
Third anode voltage	V_{a3}	2.5	0.8	kV
Ratio	V_{a4}/V_{a3}	4	1	
Focus voltage	V_{a2}	1.0	0	kV
First anode voltage	V_{a1}	2.2	0.8	kV
Control grid voltage	$-V_{g1}$	200	1.0	V
Blanking plate to first anode voltage	V_{g2-a1}	+200	−200	V
Y plate to third anode voltage	V_{y-a3}	500	–	V
X plate to third anode voltage	V_{x-a3}	500	–	V
Heater-cathode voltage	V_{h-k}	125	–	V
Grid to cathode circuit resistance	R_{g1-k}	1.5	–	MΩ
Y deflector plate circuit resistance	R_{y-a3}	100	–	kΩ
X deflector plate circuit resistance	R_{x-a3}	500	–	kΩ
p.d.a. spiral resistance		–	75	MΩ

Voltage ratings are to cathode unless otherwise shown.

CAPACITANCES (Typical)

Cathode to all other electrodes	4	pF
Control grid to all other electrodes	8	pF
Blanking plate to all other electrodes	11	pF
Deflector plates y1 to y2	1.6	pF
Deflector plates y1 to all electrodes except y2	5.0	pF
Deflector plates y2 to all electrodes except y1	5.5	pF
Deflector plates x1 to x2	2.2	pF
Deflector plates x1 to all electrodes except x2	6.2	pF
Deflector plates x2 to all electrodes except x1	6.2	pF

EQUIPMENT DESIGN RANGE

		Max	Min	
Focus voltage	V_{a2}	400	175	V/kV_{a3}
Control grid voltage for spot cut-off	$-V_{g1}$	65	35	V/kV_{a1}
Blanking voltage	V_{g2-a1}	65	–	V/kV_{a1}
Y deflection factor	D_y (at $V_{a4}/V_{a3} = 4$)	9.2	7.5	$V/cm/kV_{a3}$
X deflection factor	D_x (at $V_{a4}/V_{a3} = 4$)	18	13	$V/cm/kV_{a3}$
Y deflection factor	D_y (at $V_{a4}/V_{a3} = 3$)	8.7	7.0	$V/cm/kV_{a3}$
X deflection factor	D_x (at $V_{a4}/V_{a3} = 3$)	16.5	12	$V/cm/kV_{a3}$
Y deflection factor	D_y (at $V_{a4} = V_{a3}$)	6.5	4.7	$V/cm/kV_{a3}$
X deflection factor	D_x (at $V_{a4} = V_{a3}$)	10.5	7.5	$V/cm/kV_{a3}$
Astigmatism correction voltage	V_{a3}	+50	−50	V/kV_{a3}
Pattern correction voltage	V_s	+50	−50	V/kV_{a3}

TYPICAL OPERATION (All operating potentials are with respect to cathode)

		(i)	(ii)	
Fourth anode voltage	V_{a4}	3	4	kV
Third anode voltage	V_{a3}	1	1	kV
Focus voltage	V_{a2}	175–400	175–400	V
First anode voltage	V_{a1}	1	1	kV
Control grid voltage for spot cut-off	$-V_{g1}$	35–65	35–65	V
Nominal blanking plate voltage	V_{g2}	1	1	kV
Nominal geometry correction voltage	V_s	1	1	kV
Maximum y deflection factor	D_y	8.7	9.2	V/cm
Maximum x deflection factor	D_x	16.5	18.0	V/cm

DISPLAY CHARACTERISTICS (Typical Operation)

Minimum Scanned Area	(i)	(ii)	
X axis	10.5	10	cm
Y axis	8.4	8	cm

This area will be centred on a point which is within 3 mm of the centre of the tube face. The undeflected spot will lie within a 14 mm square at the centre of the tube face.

†Astigmatism Correction

Adjustment of the potential on a3 relative to the y plate mean potential may be used for the purpose of astigmatism correction. A range of adjustment of $\pm 50V/kV_{a3}$ should be allowed for this purpose.

†Pattern Correction

Barrel or pincushion distortion may be minimised by the application of the appropriate potential to s with respect to the x plate mean potential. A range of adjustment of $\pm 50V/kV_{a3}$ should be allowed for this purpose. Astigmatism and pattern correction potentials are quoted for the condition where the x plate mean potential is equal to the y plate mean potential. If in any application, a difference between x and y plate mean potentials is unavoidable it is recommended that this difference should be kept to a minimum.

†In many applications these correction potentials will be unnecessary.

Beam Blanking

At a beam current of 10 μA, a potential of +65V/kV_{a1} with respect to a1 applied to the blanking electrode g2, will completely cut off the beam. This electrode should not be used as a brightness control.

Pattern Distortion

With pattern correction applied the edges of a test raster will lie between two concentric rectangles 100 x 60 mm and 97.5 x 58.5 mm. The angle between the x and y axes will be 90° ± 1°.

Deflection Linearity

The deflection factor for a deflection of less than 75% of useful scan will not differ from that for a deflection of 25% by more than 2%.

MONOACCELERATOR OPERATION (Simple circuit)

First and third anode voltage	$V_{a1\ a3}$	2	kV
Focus voltage	V_{a2}	350–800	V
Control grid voltage for spot cut-off	$-V_{g1}$	70–130	V
Maximum y deflection factor	D_y	13	V/cm
Maximum x deflection factor	D_x	21	V/cm
Minimum scanned area x axis		11.5	cm
y axis		10	cm

The two CT8 contacts and pins 5, 9 and 12 must all be connected to each other when the tube is used in this way except where separate potentials are applied as previously described.

MOUNTING

The tube may be mounted in any position but should not be supported by the base alone. It should, preferably, be held in a suitable rubber mask at the screen and by a clamp round the magnetic shield near the base. The socket should have sufficient freedom of movement to accommodate overall length and base orientation tolerances.

BASE CONNECTIONS

Base : B 12 F Side contact (CT8) : a4 Neck contact (CT8) : s

Pin 1 : g1	Pin 5 : g2 (12)	Pin 9 : a3
2 : k	6 : a2	10 : x1
3 : h	7 : y1	11 : x2
4 : h	8 : y2	12 : a1

NOTE: If any electrode is not used, it must be connected to the pin shown in brackets.

WEIGHT

The weight of the tube alone is approximately 1 kg.

MAGNETIC SHIELDING

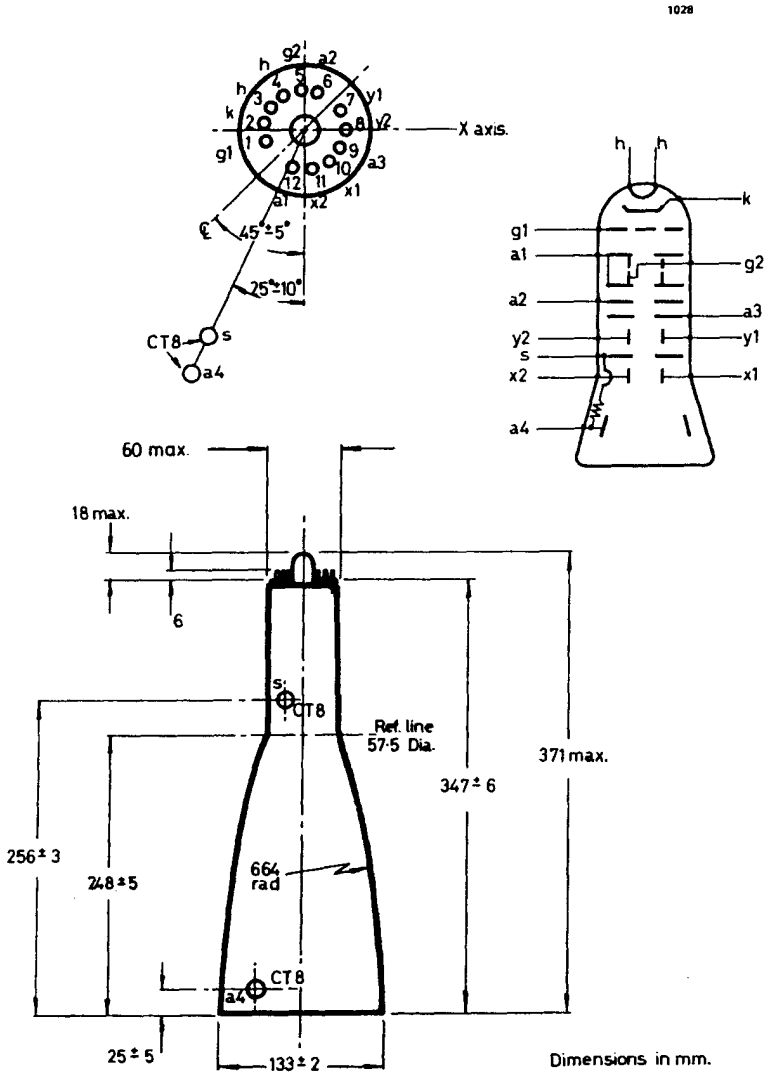
A suitable magnetic shield may be obtained from Magnetic Shields Ltd., Headcorn Road, Staplehurst, Tonbridge, Kent.

WARNING

Care should be taken not to expose the tube to strong magnetic fields either in use or during storage.

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OUTLINE


1028
X axis.
45°±5°
25°±10°
CT8
s
a4
k
g1
a1
g2
a2
a3
y2
y1
s
x2
x1
60 max.
18 max.
6
Ref. line
57·5 Dia.
371 max.
347 ± 6
256 ± 3
248 ± 5
664
rad
25 ± 5
133 ± 2
Dimensions in mm.

THE M-O VALVE
COMPANY LIMITED

1400A

used in EMI/SE SM111

GEC

INSTRUMENT
CATHODE RAY TUBE

very similar to D13-47 6x10cm
improved version is 1402J / D14-180 both are 398 mm long.

BRIEF DATA

A rectangular, flat faced, single gun oscilloscope tube with spiral p.d.a. and full 8 x 10 cm display.

Final anode voltage (p.d.a.)	4	kV
Display area	8 x 10	cm
Y deflection factor (D_y)	<9.5	V/cm
X deflection factor (D_x)	<18	V/cm

Length 368

HEATER

Heater voltage	6.3	V
Heater current	0.3	A

SCREEN

Tube normally supplied with type 24 phosphor as 1424A

Fluorescence	Green
Phosphorescence	Green
Persistence	1 – 5 ms
E.I.A. phosphor code	P31
GEC phosphor code	24
Pro Electron phosphor code	GH

Other screens are available to special order (see data sheet 'CRT Screens')

CAPACITANCES (Typical)

Cathode to all other electrodes	5.5	pF
Control grid to all other electrodes	11.0	pF
Blanking plate to all other electrodes	10.0	pF
Deflector plates y1 to y2	1.8	pF
Deflector plates y1 to all electrodes except y2	6.4	pF
Deflector plates y2 to all electrodes except y1	6.4	pF
Deflector plates x1 to x2	2.0	pF
Deflector plates x1 to all electrodes except x2	6.8	pF
Deflector plates x2 to all electrodes except x1	6.8	pF

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August 1977
Issue 2

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originally 1970/71

RATINGS (Absolute)

		Max	Min	
Fourth anode voltage	V_{a4}	7.0	2.5	kV
Third anode voltage	V_{a3}	1.7	0.6	kV
Ratio	V_{a4}/V_{a3}	4	–	–
Focus voltage	V_{a2}	1.0	0	kV
First anode voltage	V_{a1}	1.75	0.6	kV
Control grid voltage	$-V_{g1}$	200	1.0	V
Blanking plate to first anode voltage	$V_{g2\text{-}a1}$	±200	–	V
Y plate to third anode voltage	$V_{y\text{-}a3}$	500	–	V
X plate to third anode voltage	$V_{x\text{-}a3}$	500	–	V
Heater-cathode voltage	$V_{h\text{-}k}$	±150	–	V
Grid to cathode circuit resistance	$R_{g1\text{-}k}$	1.5	–	MΩ
Y deflector plate circuit resistance	$R_{y\text{-}a3}$	100	–	kΩ
X deflector plate circuit resistance	$R_{x\text{-}a3}$	500	–	kΩ

Voltage ratings are to cathode unless otherwise shown.

EQUIPMENT DESIGN RANGE

	Max	Min	
V_{a2} (for focus)	400	175	V/kV_{a3}
$-V_{g1}$ (for cut-off)	65	35	V/kV_{a1}
V_{g2} (for blanking) (w.r.t. a1)	60	–	V/kV_{a1}
D_y (at $V_{a4}/V_{a3} = 4$)	9.5	7.8	$V/cm/kV_{a3}$
D_x (at $V_{a4}/V_{a3} = 4$)	18	14.8	$V/cm/kV_{a3}$
V_{a3} (astigmatism correction)	+50	−50	V/kV_{a3}
V_s (pattern correction)	+50	−50	V/kV_{a3}

TYPICAL OPERATION (All operating potentials are with respect to cathode)

Fourth anode voltage	V_{a4}	4	kV
Third anode voltage	V_{a3}	1	kV
Focus voltage	V_{a2}	175 – 400	V
First anode voltage	V_{a1}	1	kV
Nominal blanking plate voltage	V_{g2}	1	kV
Nominal geometry correction voltage	V_s	1	kV
Control grid voltage for spot cut-off	$-V_{g1}$	35 – 65	V
Maximum y deflection factor	D_y	9.5	V/cm
Maximum x deflection factor	D_x	18.0	V/cm
*Line width (typical)		0.6	mm

Line width by shrinking raster 0.3

*For type 24 (P31) phosphor, measured by means of a microscope at the geometric centre of the faceplate, at a beam current of 5 μA.

DISPLAY CHARACTERISTICS

Pattern Distortion

With pattern correction applied the edges of a test raster will lie between two concentric rectangles of 100 x 80 mm and 98 x 77.5 mm.
The angle between the x and y axes will be 90° ± 1°.

Deflection Linearity

The deflection factor for a deflection of less than 75% of the useful scan will not differ from that for a deflection of 25% by more than 2%.

Spot Position

The focused and undeflected spot will fall within a rectangle 8 x 10 mm centred at the geometric centre of the faceplate, the greater dimension being parallel to the x axis.

Orientation

When looking at the screen with pins 6 and 7 of the base uppermost, a positive potential applied to x1 will deflect the beam to the left and a positive potential applied to y1 will deflect the beam upwards.

Minimum Scanned Area

x axis	10	cm
y axis	8	cm

This area will be centred on a point which is within 3 mm of the major and minor axes of the tube face.

Beam Blanking

At a cathode current of 500 μA, a potential of +60V/kV_{a1} with respect to a1 applied to the blanking electrode g2, will completely cut off the beam. This electrode should not be used as a brightness control.

Astigmatism Correction

Adjustment of the potential on a3 relative to the y plate mean potential may be used for the purpose of astigmatism correction. A range of adjustment of ±50 V/kV_{a3} should be allowed for this purpose.

Pattern Correction

Barrel or pincushion distortion may be minimised by the application of the appropriate potential to s with respect to the x plate mean potential. A range of adjustment of $\pm 50V/kV_{a3}$ should be allowed for this purpose. Astigmatism and pattern correction potentials are quoted for the condition where the x plate mean potential is equal to the y plate mean potential. If in any application, a difference between x and y plate mean potentials is unavoidable it is recommended that this difference should be kept to a minimum.

Axis Alignment

The electrical x axis of the tube will lie within $\pm 5^{\circ}$ of the major axis of the faceplate and may be aligned with this axis by means of the field from an axial coil placed about the cone of the tube in the region shown in the outline drawing. The maximum ampere turns required for axis alignment will not exceed $12\sqrt{kV_{a4}}$.

MOUNTING

The tube may be mounted in any position but should not be supported by base alone. It should, preferably, be held in a suitable rubber mask at the screen and by a clamp round the magnetic shield near the base. The socket should have sufficient freedom of movement to accommodate overall length and base orientation tolerances.

WEIGHT

The weight of the tube alone is approximately 1.0 kg.

BASE CONNECTIONS

Base: B12F

Pin 1:	g1
2:	hk
3:	h
4:	a2
5:	g2
6:	a3

Side contact (CT8): a4

Pin 7:	y1
8:	y2
9:	s
10:	x1
11:	a1
12:	x2

MAGNETIC SHIELD

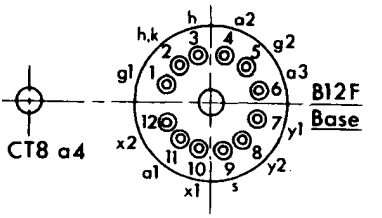
A suitable magnetic shield may be obtained from Magnetic Shields Ltd., Headcorn Road, Staplehurst, Tonbridge, Kent.

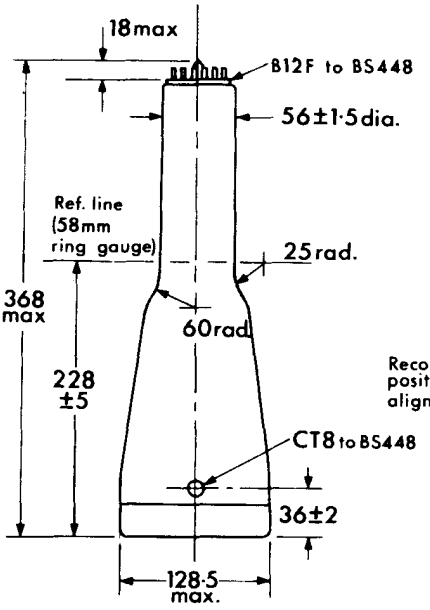
WARNING

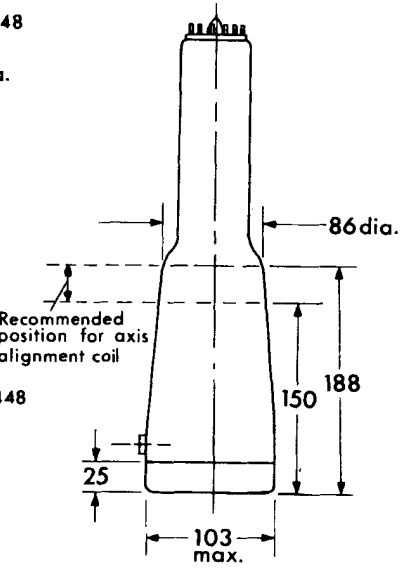
Care should be taken not to expose the tube to strong magnetic fields either in use or during storage.

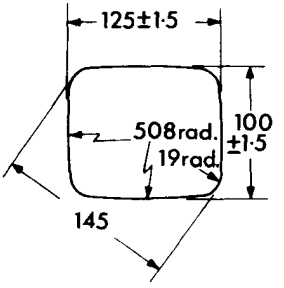
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OUTLINE

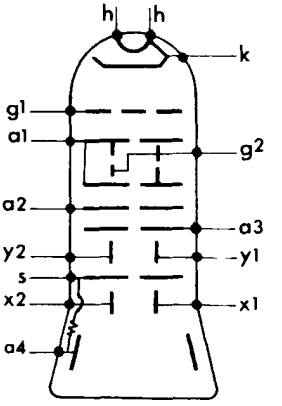








Dimensions in mm



THE M-O VALVE
COMPANY LIMITED

1400B

comparable Telefunken D14-131, different

GEC

used in Cossor CT531
EM1/5E 5M112

INSTRUMENT
CATHODE RAY TUBE

Mullard 55451

BRIEF DATA

A 14 cm (5½ inch) diagonal rectangular, flat faced, single gun oscilloscope tube with aluminised screen, mesh p.d.a. and side connected deflector plate.

Final anode voltage (p.d.a.)	12	kV
Display area	10 x 8	cm
Y deflection factor (D_Y)	<5.3	V/cm
X deflection factor (D_X)	<11.0	V/cm

HEATER

Heater voltage	6.3	V
Heater current	0.3	A

SCREEN

	1474B	**1496B**
Fluorescence	Green	White
Phosphorescence	Green	Yellowish-green
Persistence	1 – 5 ms	10 – 60 s
E.I.A. phosphor code	P31	P7
GEC phosphor code	74	96
Pro Electron phosphor code	GH	GM

CAPACITANCES (Typical)

Cathode to all other electrodes	5.0	pF
Control grid to all other electrodes	9.0	pF
Deflector plates y1 to y2	1.8	pF
Deflector plates y1 to all electrodes except y2	3.6	pF
Deflector plates y2 to all electrodes except y1	3.6	pF
Deflector plates x1 to x2	3.0	pF
Deflector plates x1 to all electrodes except x2	6.0	pF
Deflector plates x2 to all electrodes except x1	6.0	pF

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RATINGS (Absolute)

		Max	Min	
Fourth anode voltage	V_{a4}	13.5	6.0	kV
Third anode voltage	V_{a3}	2.0	1.0	kV
Ratio	V_{a4}/V_{a3}	10	–	–
Focus voltage	V_{a2}	1.0	–	kV
First anode voltage	V_{a1}	2.0	1.0	kV
Control grid voltage	$-V_g$	200	1.0	V
Y plate to third anode voltage	$V_{y\text{-}a3}$	500	–	V
X plate to third anode voltage	$V_{x\text{-}a3}$	500	–	V
Heater-cathode voltage	$V_{h\text{-}k}$	+150	−150	V
Grid to cathode circuit resistance	$R_{g\text{-}k}$	1.0	–	MΩ
Y deflector plate circuit resistance	$R_{y\text{-}a3}$	100	–	kΩ
X deflector plate circuit resistance	$R_{x\text{-}a3}$	500	–	kΩ

Voltage ratings are to cathode unless otherwise shown.

EQUIPMENT DESIGN RANGE

		Max	Min	
Focus voltage	V_{a2}	290	125	V/kV_{a3}
Control grid voltage for spot cut-off	$-V_{g1}$	67	33	V/kV_{a1}
Y deflection factor (at $V_{a4}/V_{a3} = 10$)	D_y	4.42	3.58	$V/cm/kV_{a3}$
X deflection factor (at $V_{a4}/V_{a3} = 10$)	D_x	9.2	7.1	$V/cm/kV_{a3}$
Astigmatism correction voltage	V_{a3}	+42	−42	V/kV_{a3}
Pattern correction voltage	V_{s2}	+42	−42	V/kV_{a3}
p.d.a. spiral current	I_{a4}	8	–	$\mu A/kV_{a4\text{-}a3}$

TYPICAL OPERATION

Fourth anode voltage	V_{a4}	12	kV
Third anode voltage (nom.)	V_{a3}	1.2	kV
Focus voltage	V_{a2}	150 to 350	V
First anode voltage	V_{a1}	1.2	kV
Control grid voltage for spot cut-off	$-V_{g1}$	40 to 80	V
Nominal neck voltage	V_{s1}	1.2	kV
Nominal geometry voltage	V_{s2}	1.2	kV
Nominal mesh voltage	V_{s3}	1.18	kV
Maximum y deflection factor	D_y	5.3	V/cm
Maximum x deflection factor	D_x	11.0	V/cm
‡Line width (typical) 74 screen		0.4	mm

‡Measured by means of a shrinking raster at the geometric centre of the faceplate, at a beam current of 10 μA.

DISPLAY CHARACTERISTICS (Typical operation unless stated)

Pattern Distortion
With pattern correction applied, the edges of a test raster will lie between two concentric rectangles of 100 x 80 mm and 98 x 78 mm.
The angle between x and y axes will be $90^\circ \pm 1^\circ$ measured at the face centre.

Deflection Linearity
The deflection factor, measured over any 10 mm of deflection in the appropriate axis, will not vary by more than 5% within the central 100 x 80 mm area.

Spot Position
The focused and undeflected spot will fall within a square 10 x 10 mm centred at the geometric centre of the faceplate.

Background Suppression
Background illumination may be reduced and contrast improved by applying a potential of −20 V to s3 with respect to s2.

Orientation
When looking at the screen with pins 1 and 12 of the base uppermost, a positive voltage applied to x1 will deflect the beam to the left and a positive voltage applied to y1 will deflect the beam upwards.

Minimum Scanned Area

x axis	10	cm
y axis	8	cm

Axis Alignment
The electrical x axis of the tube will lie within ± 5° of the major axis of the faceplate and may be aligned with the axis by means of the field from an axial coil placed about the cone of the tube in the region shown in the outline drawing. The maximum ampere turns required for axis alignment will not exceed $7\sqrt{kV_{a4}}$.

MOUNTING

The tube may be mounted in any position but should not be supported by the base alone. It should, preferably, be held in a suitable resilient mask at the screen and by a clamp round the magnetic shield near the base. The socket should have sufficient freedom of movement to accommodate overall length and base orientation tolerances.

BASE CONNECTIONS

Base:	B12F	Side contact (CT8):	a4
Pin 1:	g	Pin 7:	a1*
2:	k	8:	a3
3:	h	9:	s3
4:	h	10:	a1*
5:	a2	11:	s2
6:	s1	12:	IC

*Pins 7 and 10 must be connected together externally.

Side pin connections (use connector 50LS/156) as viewed from the base and reading clockwise from base pin 12:-

x2 x1 y1 y2

WEIGHT

The weight of the tube alone is approximately 1.15 kgm.

MAGNETIC SHIELD

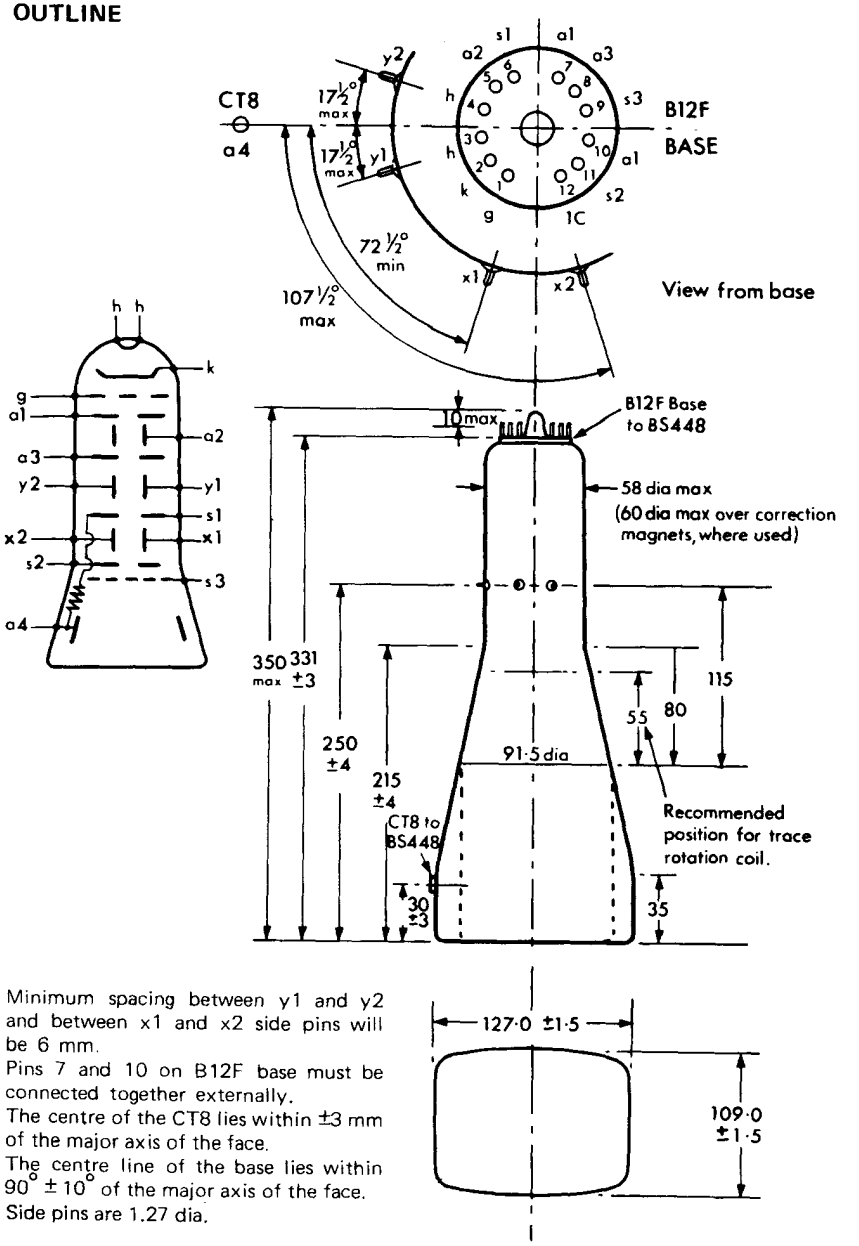
A suitable magnetic shield with trace rotation coil may be obtained from Magnetic Shields Ltd., Headcorn Road, Staplehurst, Tonbridge, Kent.

WARNING

Care should be taken not to expose the tube to strong magnetic fields either in use or during storage.

Whilst M-OV has taken care to ensure the accuracy of the information contained herein it accepts no responsibility for the consequences of any use thereof and also reserves the right to change the specification of goods without notice.
M-OV accepts no liability beyond that set out in its standard conditions of sale in respect of infringement of third party patents arising from the use of tubes or other devices in accordance with information contained herein.

OUTLINE



Minimum spacing between y1 and y2 and between x1 and x2 side pins will be 6 mm.
Pins 7 and 10 on B12F base must be connected together externally.
The centre of the CT8 lies within ±3 mm of the major axis of the face.
The centre line of the base lies within $90^{\circ} \pm 10^{\circ}$ of the major axis of the face.
Side pins are 1.27 dia.

1474C

Advance Technical Information

1400C SERIES

8 × 10cm FLAT FACED OSCILLOSCOPE TUBE

ISSUE 1

(1400J similar, but with deflection plates to base ≡ D14-180 format)

BRIEF DATA

A rectangular, flat faced, single gun oscilloscope tube with spiral p.d.a., thin aluminium backed screen and 8 × 10cm display. Side connections

Final anode voltage (p.d.a.)	4	kV
Display area	8 × 10	cm
Y deflection factor (D_y)	8·5	V/cm
X deflection factor (D_x)	15·5	V/cm

HEATER

V_h	6·3	V
I_h	0·3	A

RATINGS (Absolute)

	Max.	Min.	
V_{a4}	7·0	3·5	kV
V_{a3}	1·7	0·6	kV
Ratio (V_{a4}/V_{a3})	4	—	—
V_{a2}	1·0	0	kV
V_{a1}	1·75	0·6	kV
$-V_{g1}$	200	1·0	V
V_{g2-a1}	±200	—	V
V_{y-a3}	500	—	V
V_{x-a3}	500	—	V
V_{h-k}	±150	—	V
R_{g1-k}	1·5	—	MΩ
R_{y-a3}	100	—	kΩ
R_{x-a3}	500	—	kΩ

Voltage ratings are to cathode unless otherwise shown.

SCREEN

Fluorescence	Green
Phosphorescence	Green
Persistence	1-5 ms
E.I.A. phosphor code	P31
G.E.C. phosphor code	74

CAPACITANCES (Typical)

C_k – all	4·4	pF
C_{g1} – all	9·3	pF
C_{g2} – all	10·0	pF
C_{y1-y2}	1·2	pF
C_{y1} – all less y2	2·7	pF
C_{y2} – all less y1	3·0	pF
C_{x1-x2}	2·1	pF
C_{x1} – all less x2	4·1	pF
C_{x2} – all less x1	4·1	pF

EQUIPMENT DESIGN RANGE

	Max.	Min.	
V_{a2} (for focus)	400	175	V/kV_{a3}
$-V_{g1}$ (for cut-off)	65	35	V/kV_{a1}
V_{g2} (for blanking) (w.r.t. a1)	60	—	V/kV_{a1}
D_y (at $V_{a4}/V_{a3}=4$)	8·5	6·9	$V/cm/kV_{a3}$
D_x (at $V_{a4}/V_{a3}=4$)	15·5	12·7	$V/cm/kV_{a3}$
V_{a3} (astigmatism correction)	+50	−50	V/kV_{a3}
V_s (pattern correction)	+50	−50	V/kV_{a3}

TYPICAL OPERATION

V_{a4}	4	kV
V_{a3}	1	kV
V_{a2} (for focus)	175 to 400	V
V_{a1}	1	kV
V_{g2} (nom)	1	kV
V_s (nom)	1	kV
$-V_{g1}$ (for cut-off)	35 to 65	V
D_y (max)	8·5	V/cm
D_x (max)	15·5	V/cm
*Line width (typical)	0·7	mm
" by shrinking raster	0·3 ect.	

*For type 74 (P31) phosphor, measured by means of a microscope at the geometric centre of the faceplate, at a beam current of 5μA.

Minimum Scanned Area

x	10	cm
y	8	cm

This area will be centred on a point which is within 3mm of the major and minor axes of the tube face.

Beam Blanking

At a cathode current of 500μA, a potential of $+60V/kV_{a1}$ with respect to a1, applied to the blanking electrode g2, will completely cut off the beam. This electrode should not be used as a brightness control.

Astigmatism Correction

Adjustment of the potential on a3 relative to the y plate mean potential may be used for the purpose of astigmatism correction. A range of adjustment of $\pm 50V/kV_{a3}$ should be allowed for this purpose.

Pattern Correction

Barrel or pincushion distortion may be minimised by the application of the appropriate potential to s with respect to the x plate mean potential. A range of adjustment of $\pm 50V/kV_{a3}$ should be allowed for this purpose. Astigmatism and pattern correction potentials are quoted for the condition where the x plate mean potential is equal to the y plate mean potential. If in any application, a difference between x and y plate mean potentials is unavoidable it is recommended that this difference should be kept to a minimum.

Axis Alignment

The electrical x axis of the tube will lie within $\pm 5°$ of the major axis of the faceplate and may be aligned with this axis by means of the field from an axial coil placed about the cone of the tube in the region shown in the outline drawing. The maximum ampere turns required for axis alignment will not exceed $12\sqrt{kV_{a4}}$.

DISPLAY CHARACTERISTICS

Pattern Distortion

With pattern correction applied the edges of a test raster will lie between two concentric rectangles of 100 × 80mm and 98 × 77·5mm.
The angle between the x and y axes will be 90° ±1°.

Deflection Linearity

The deflection factor for a deflection of less than 75% of the useful scan will not differ from that for a deflection of 25% by more than 2%.

Spot Position

The focused and undeflected spot will fall within a rectangle 8 × 10mm centred at the geometric centre of the faceplate, the greater dimension being parallel to the x axis.

ORIENTATION

When looking at the screen with pins 6 and 7 of the base uppermost, a positive potential applied to x1 will deflect the beam to the left and a positive potential applied to y1 will deflect the beam upwards.

MOUNTING

The tube may be mounted in any position but should not be supported by the base alone. It should, preferably, be held in a suitable rubber mask at the screen and by a clamp round the magnetic shield near the base. The socket should have sufficient freedom of movement to accommodate overall length and base orientation tolerances.

BASE CONNECTIONS

Base: B12 F

Pin 1:	g1
2:	k
3:	h
4:	h
5:	a2
6:	a1

Side contact (CT8): a4

Pin 7:	g2
8:	a3
9:	IC
10:	IC
11:	s
12:	IC

Side pin connections as viewed from the base and reading clockwise from base pin 9:— y1, y2, x1, x2

WEIGHT

The weight of the tube alone is approximately 1·0kgm.

ACCESSORIES

Part	Manufacturer	Type No.
Base socket	Carr Fastener Co. Ltd.	77/842
CT8 connector	Carr Fastener Co. Ltd.	77/699
Magnetic shield	Magnetic Shields Ltd.	

WARNING

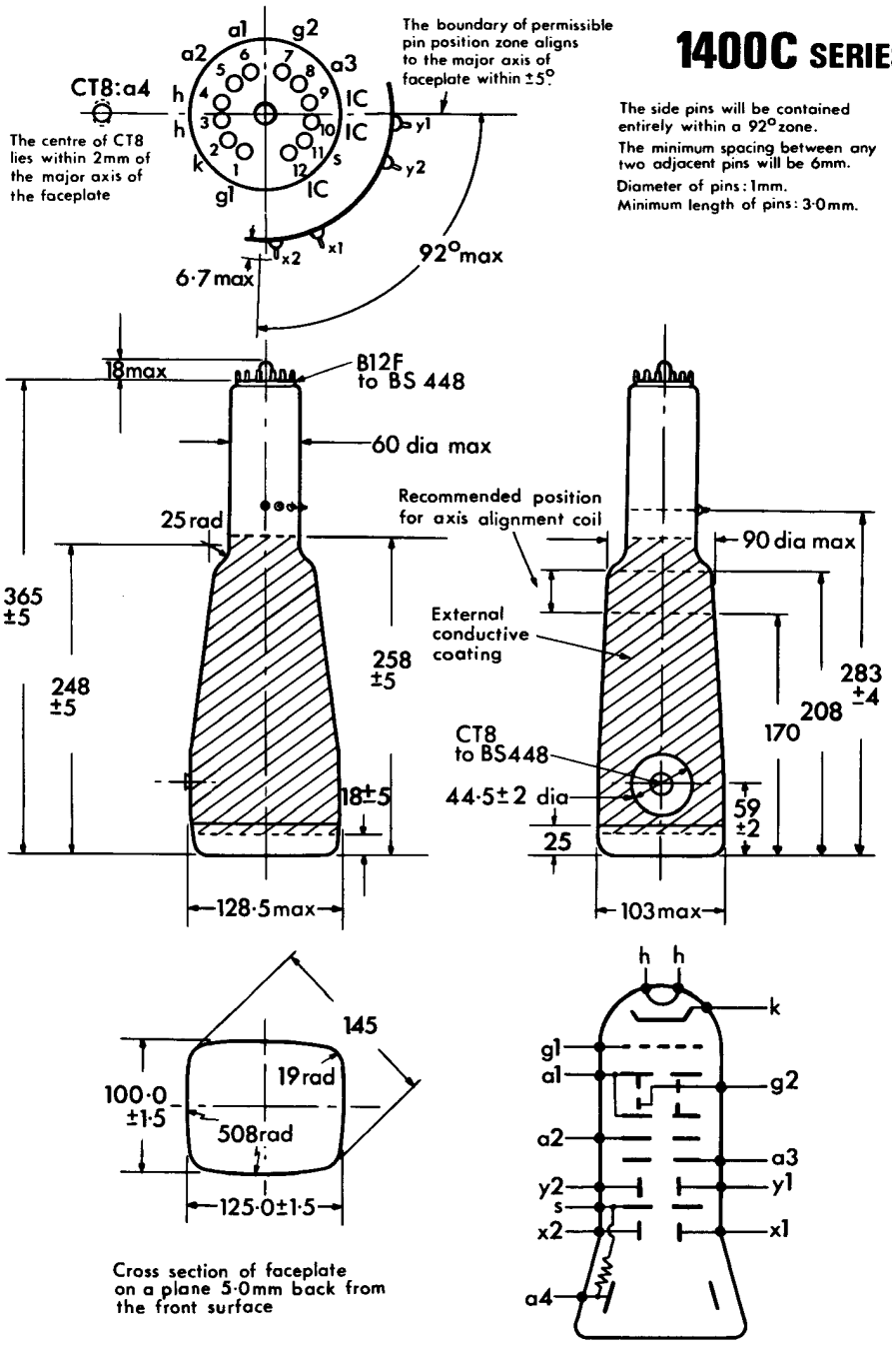
Care should be taken not to expose the tube to strong magnetic fields either in use or during storage.

1400C SERIES

The side pins will be contained entirely within a 92° zone.

The minimum spacing between any two adjacent pins will be 6mm.

Diameter of pins: 1mm.
Minimum length of pins: 3·0mm.



Cross section of faceplate on a plane 5·0mm back from the front surface

Dimensions in mm

OUTLINE DRAWING

THE M-O VALVE
COMPANY LIMITED

1400J

Brimar D14-180

GEC

INSTRUMENT
CATHODE RAY TUBE

BRIEF DATA

A rectangular flat faced, single gun, spiral p.d.a. tube with full 10 x 8 cm display for medium bandwidth applications. Features include electrostatic focus, electrostatic deflection and deflection beam-blanking.
The scan voltages required for this tube can be obtained from transistorised deflection circuits.

	(i)	(ii)	
Final anode voltage (p.d.a.)	5	4	kV
p.d.a. ratio	3.3:1	4:1	
Display area	8 x 10	8 x 10	cm
Y deflection factor (D_y)	<12.8	<8.7	V/cm
X deflection factor (D_x)	<24.8	<17	V/cm

6 yfs 384

HEATER

Heater voltage	6.3	V
Heater current	0.3	A

SCREEN

	1424J	1446J
Fluorescence	Green	White
Phosphorescence	Green	Yellowish-Green
Persistence	1–5 ms	10 - 60s
E.I.A. phosphor code	P31	P7
Pro Electron phosphor code	GH	GM
GEC phosphor code	24	46

Other screens can be supplied to special order.

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April 1977
Issue 2

RATINGS (Absolute)

		Max	Min	
Fourth anode voltage	V_{a4}	7.0	2.0	kV
Third anode voltage	V_{a3}	2.5	0.8	kV
Ratio	V_{a4}/V_{a3}	4	1	
Focus voltage	V_{a2}	1.0	0	kV
First anode voltage	V_{a1}	2.2	0.8	kV
Control grid voltage	$-V_{g1}$	200	1.0	V
Blanking plate to first anode voltage	V_{g2-a1}	+200	−200	V
Y plate to third anode voltage	V_{y-a3}	500	–	V
X plate to third anode voltage	V_{x-a3}	500	–	V
Grid to cathode circuit resistance	R_{g1-k}	1.5	–	MΩ
Y deflector plate circuit resistance	R_{y-a3}	100	–	kΩ
X deflector plate circuit resistance	R_{x-a3}	500	–	kΩ
p.d.a. spiral resistance		–	50	MΩ

Voltage ratings are to cathode unless otherwise shown.

CAPACITANCES (Typical)

Heater + cathode to all other electrodes	3.3	pF
Control grid to all other electrodes	8.0	pF
Blanking plate to all other electrodes	11.0	pF
Deflector plates y1 to y2	1.5	pF
Deflector plates y1 to all electrodes except y2	5.0	pF
Deflector plates y2 to all electrodes except y1	5.5	pF
Deflector plates x1 to x2	2.0	pF
Deflector plates x1 to all electrodes except x2	6.2	pF
Deflector plates x2 to all electrodes except x1	6.2	pF

EQUIPMENT DESIGN RANGE

		Max	Min	
Focus voltage	V_{a2}	400	175	V/kV_{a3}
Control grid voltage for spot cut-off	$-V_{g1}$	65	35	V/kV_{a1}
Blanking voltage	$-V_{g2-a1}$	65	–	V/kV_{a1}
Y deflection factor	D_y (at $V_{a4}/V_{a3} = 4$)	8.7	7.0	$V/cm/kV_{a3}$
X deflection factor	D_x (at $V_{a4}/V_{a3} = 4$)	17	14	$V/cm/kV_{a3}$
Y deflection factor	D_y (at $V_{a4}/V_{a3} = 3.3$)	8.5	6.5	$V/cm/kV_{a3}$
X deflection factor	D_x (at $V_{a4}/V_{a3} = 3.3$)	16.5	12.5	$V/cm/kV_{a3}$
Astigmatism correction voltage	V_{a3}	+50	−50	V/kV_{a3}
Pattern correction voltage	V_s	+50	−50	V/kV_{a3}

TYPICAL OPERATION (All operating potentials are with respect to cathode)

		(i)	(ii)	
Fourth anode voltage	V_{a4}	5	4	kV
Third anode voltage	V_{a3}	1.5	1	kV
Focus voltage	V_{a2}	260–600	175–400	V
First anode voltage	V_{a1}	1.5	1	kV
Control grid voltage for spot cut-off	$-V_{g1}$	52–98	35–65	V
Nominal blanking plate voltage	V_{g2}	1.5	1	kV
Nominal geometry correction voltage	V_s	1.5	1	kV
Maximum y deflection factor	D_y	12.8	8.7	V/cm
Maximum x deflection factor	D_x	24.8	17.0	V/cm
*Line width (typical)		0.6	0.6	mm

*Measured by microscope at the centre of the tube face with a type 24 (P31) phosphor using a 5 μA pulsed line.

DISPLAY CHARACTERISTICS (Typical Operation)

Minimum Scanned Area	(i)	(ii)	
X axis	10	10	cm
Y axis	8	8	cm

This area will be centred on a point which is within 3 mm of the centre of the tube face.

The undeflected spot will lie within a square of side 10 mm at the centre of the tube face.

Beam Blanking

At a cathode current of 500 μA, a potential of $-65V/kV_{a1}$ with respect to a1 applied to the blanking electrode g2, will completely cut off the beam. This electrode should not be used as a brightness control.

Astigmatism Correction

Adjustment of the potential on a3 relative to the y plate mean potential may be used for the purpose of astigmatism correction. A range of adjustment of $\pm 50V/kV_{a3}$ should be allowed for this purpose.

Pattern Correction

Barrel or pincushion distortion may be minimised by the application of the appropriate potential to s with respect to the x plate mean potential. A range of adjustment of $\pm 50V/kV_{a3}$ should be allowed for this purpose. Astigmatism and pattern correction potentials are quoted for the condition where the x plate mean potential is equal to the y plate mean potential. If in any application, a difference between x and y plate mean potentials is unavoidable it is recommended that this difference should be kept to a minimum.

Axis Alignment

The electrical x axis of the tube will lie within $\pm 5^{\circ}$ of the major axis of the faceplate and may be aligned with this axis by means of the field from an axial coil placed about the cone of the tube in the region shown in the outline drawing. The maximum ampere turns required for axis alignment will not exceed $12\sqrt{kV_{a4}}$.

Pattern Distortion

With pattern correction applied, the edges of a test raster will lie between two concentric rectangles 100 x 80 mm and 97.5 x 78 mm. The angle between the x and y axes will be $90^{\circ} \pm 1^{\circ}$.

Deflection Linearity

The deflection factor for a deflection of less than 75% of useful scan will not differ from that for a deflection of 25% by more than 2%.

MOUNTING

The tube may be mounted in any position but should not be supported by the base alone. It should, preferably, be held in a suitable rubber mask at the screen and by a clamp round the magnetic shield near the base. The socket should have sufficient freedom of movement to accommodate overall length and base orientation tolerances.

WEIGHT

The weight of the tube alone is approximately 1.1 kg

BASE CONNECTIONS

Base : B 12 F

Pin 1:	g1
2:	hk
3:	h
4:	a2
5:	g2
6:	a3

Side contact (CT8) : a4

Pin 7:	y1
8:	y2
9:	s
10:	x1
11:	a1
12:	x2

MAGNETIC SHIELDING

A suitable magnetic shield can be obtained from Magnetic Shields Ltd., Headcorn Road, Staplehurst, Tonbridge, Kent.

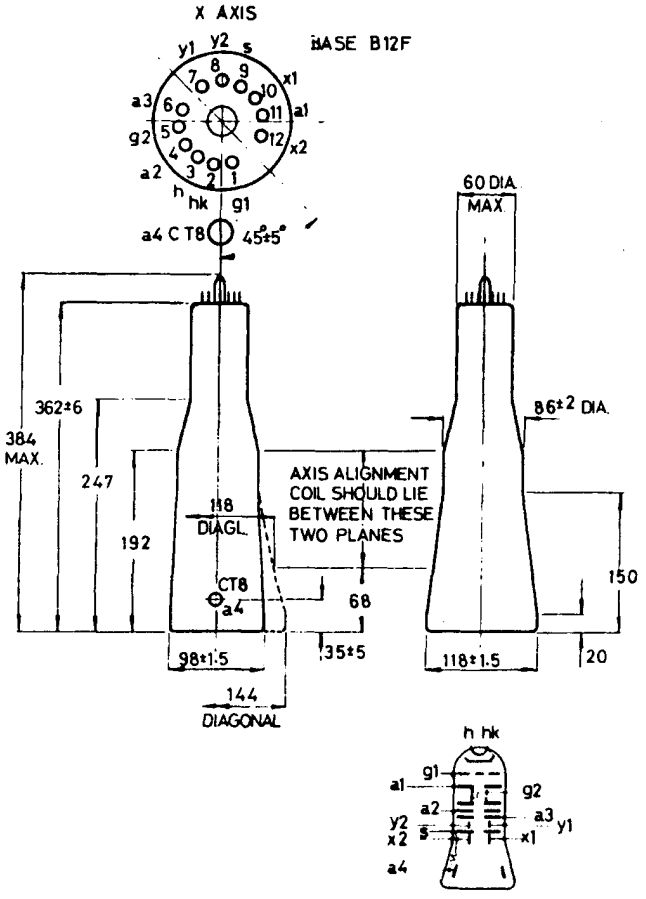
WARNING

Care should be taken not to expose the tube to strong magnetic fields either in use or during storage.

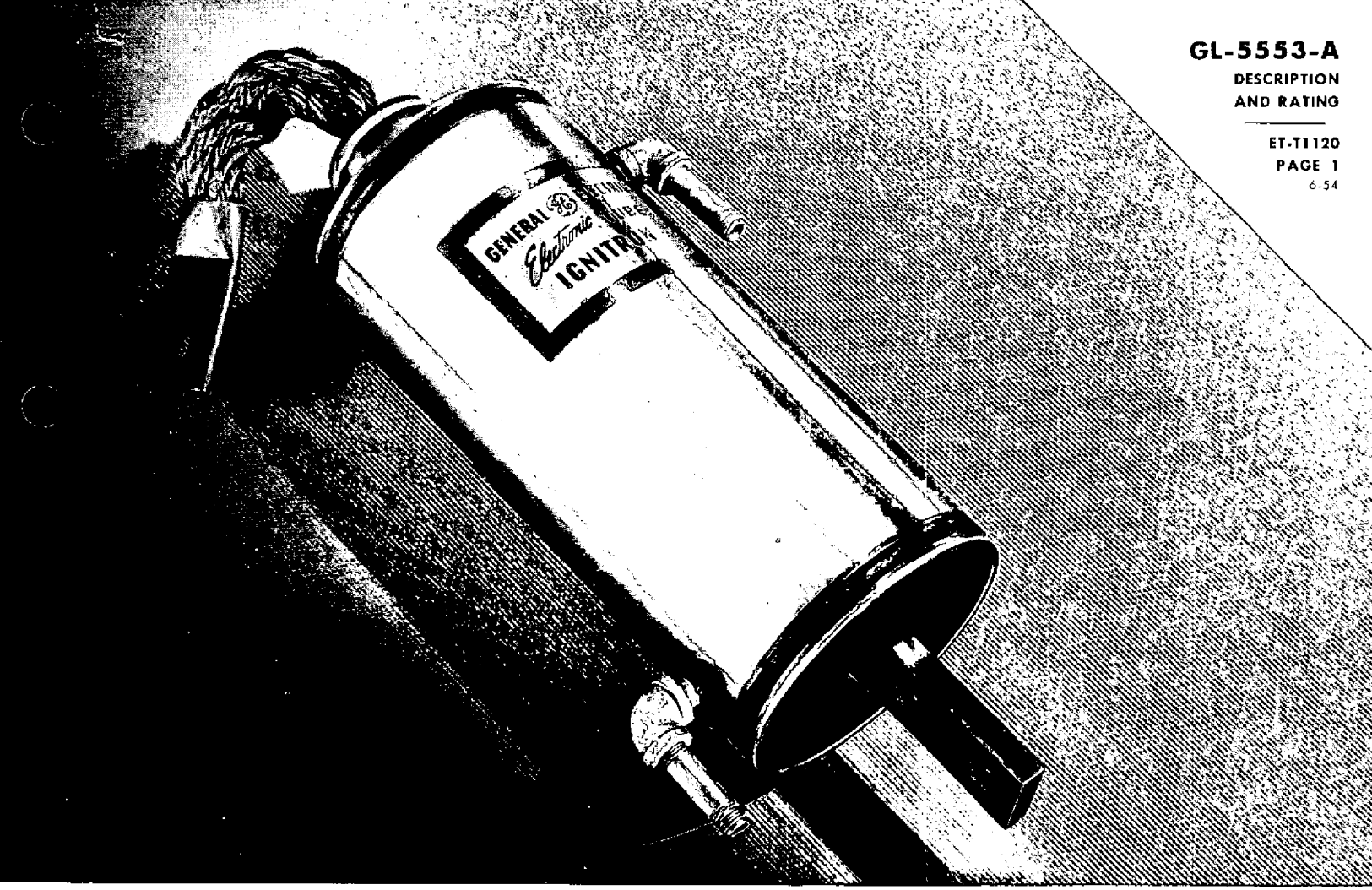
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OUTLINE

1056



Dimensions in mm.



IGNITRON

The GL-5553-A ignitron is a sealed, stainless-steel-jacketed, water-cooled, mercury-pool tube designed primarily for resistance-welding-control service. In this service, two tubes in the inverse-parallel connection will control 2400 kilovolt-amperes at voltages of 250 to 600 volts over the frequency range of 25 to 60 cycles. The ability of this tube to carry very high peak currents for short periods makes it especially suited to such service.

Ease of installation, economical use of space, and reliability of operation are assured by design and construction features inherent in the steel-jacketed construction.

The GL-5553-A ignitron is equivalent to a 1200-ampere magnetic contactor.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation—Cyclic		
Cathode Spot Starting Ignitor		
Number of Electrodes		
Main Anodes	1	
Main Cathodes	1	
Ignitors	1	
Arc Drop at 13,600 Peak Amperes	36	Volts
Arc Drop at 1115 Peak Amperes	17	Volts

GE Electronic TUBE

GENERAL ELECTRIC

Supersedes ETI-1118, dated 3-50

from JETEC release #1341, Aug. 16, 1954

TECHNICAL INFORMATION (CONT'D)

Electrical

Cathode Excitation Requirements		
Ignitor Voltage Required to Fire	200	Volts
Ignitor Current Required to Fire	30	Amperes
Starting Time at Required Voltage or Current	100	Microseconds

Mechanical

Envelope Material—Metal		
Net Weight	21	Pounds

Thermal

Type of Cooling—Water		
Inlet Water Temperature, minimum	10	C
Inlet Water Temperature, maximum	40	C
Water Flow, minimum	3.0	Gallons per Minute
Characteristics for Water Cooling at Rated Minimum Flow		
Water Temperature Rise, maximum	9	C
Pressure Drop at 3 Gallons per Minute, maximum	5.1	Pounds per Square Inch

MAXIMUM RATINGS AND TYPICAL OPERATION

Power-Rectifier Service, Intermittent Duty

Ratings are for Zero Phase-Control Angle—See Curve for Details.

Maximum Peak Anode Voltage				
Inverse	600	1200	1500	Volts
Forward	600	1200	1500	Volts
Maximum Anode Current				
Peak	4000	3000	2400	Amperes
Corresponding Average	54	40	32	Amperes
Average	190	140	112	Amperes
Corresponding Peak	1140	840	672	Amperes
Maximum Averaging Time	6.23	6.25	6.25	Seconds
Ratio of Average to Peak Current, maximum				
Averaging Time 0.2 Second	0.166	0.166	0.166	
Ratio of Fault to Maximum Peak Current	12.5	12.5	12.5	
Maximum Duration of Fault Current	0.15	0.15	0.15	Seconds
Frequency Range	50–60	50–60	50–60	Cycles per Second

Resistance-Welding-Control Service*

Two Tubes in Inverse Parallel, Ratings Per Tube.

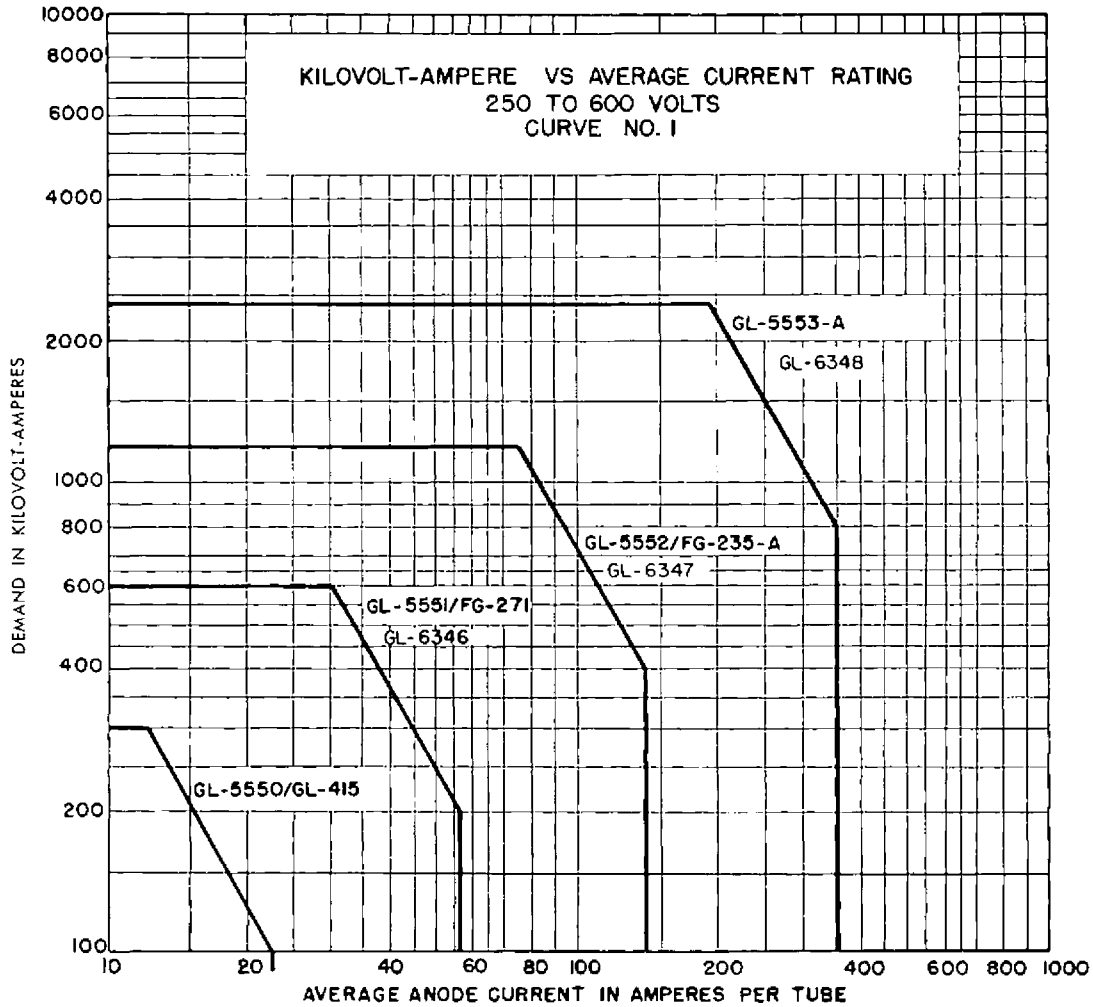
Voltage Range	250 to 600	Volts RMS
Maximum Demand	2400	Kilovolt-Amperes
Average Current at Maximum Demand	192	Amperes
Maximum Average Current	355	Amperes
Demand at Maximum Average Current	800	Kilovolt-Amperes
Maximum Averaging Time at 250 Volts RMS	11.0	Seconds
Maximum Averaging Time at 600 Volts RMS	4.6	Seconds
Maximum Peak Fault Current at 250 Volts	27,000	Amperes
Maximum Peak Fault Current at 600 Volts	11,200	Amperes

Ignitor

Maximum Voltage		
Positive—Anode Voltage		
Negative	5	Volts
Maximum Current		
Peak	100	Amperes
Root Mean Square	10	Amperes
Average	1	Amperes
Maximum Averaging Time	5	Seconds

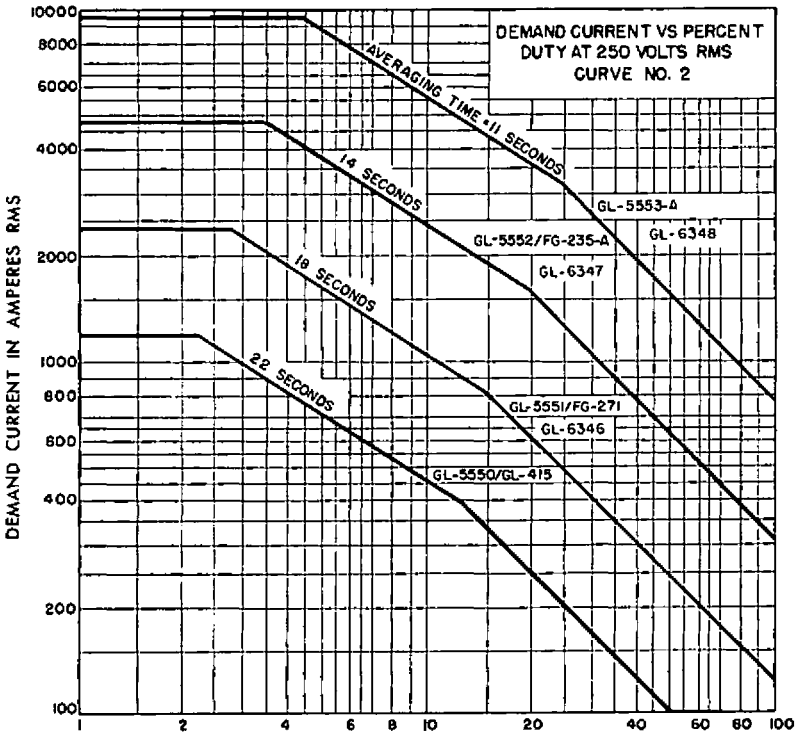
* RMS demand voltage, current, and kilovolt-ampere demand are all on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used. For voltages below the minimum, the minimum-voltage current rating applies. With the use of log-log paper straight-line interpolation between tabulated points may be used for other detailed ratings of: Demand kva vs average anode current. Maximum averaging time vs anode voltage.

CURVES K-69087-72A217, K-69087-72A218, AND K-69087-72A219
DO NOT APPLY FOR INTERMITTENT-RECTIFIER SERVICE

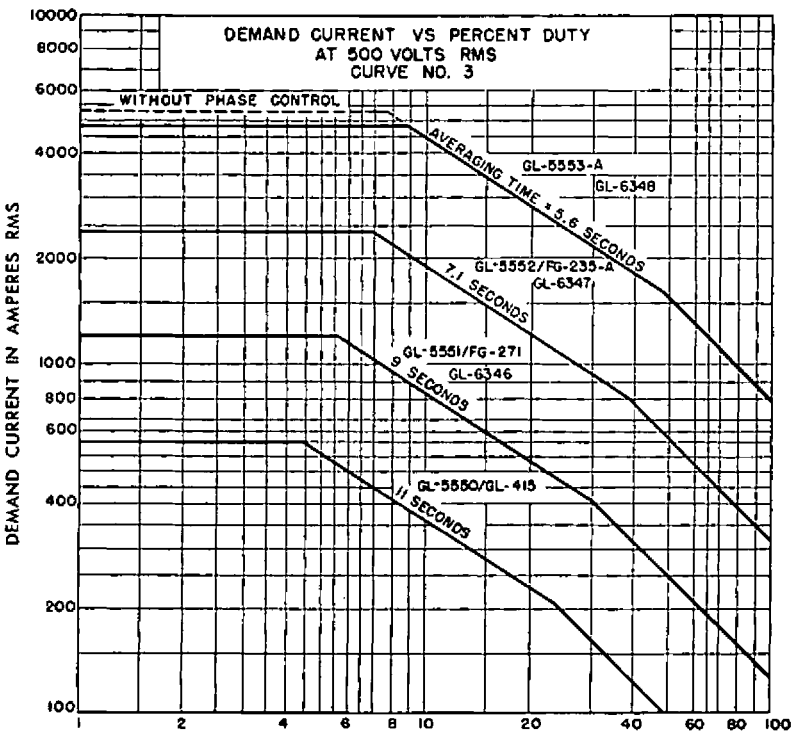


K-69087-72A217 5-25-54

Note: For capacitor-corrected welder service, this curve may be used to 2000 volts rms to allow for the additional voltage caused by the presence of the capacitor.

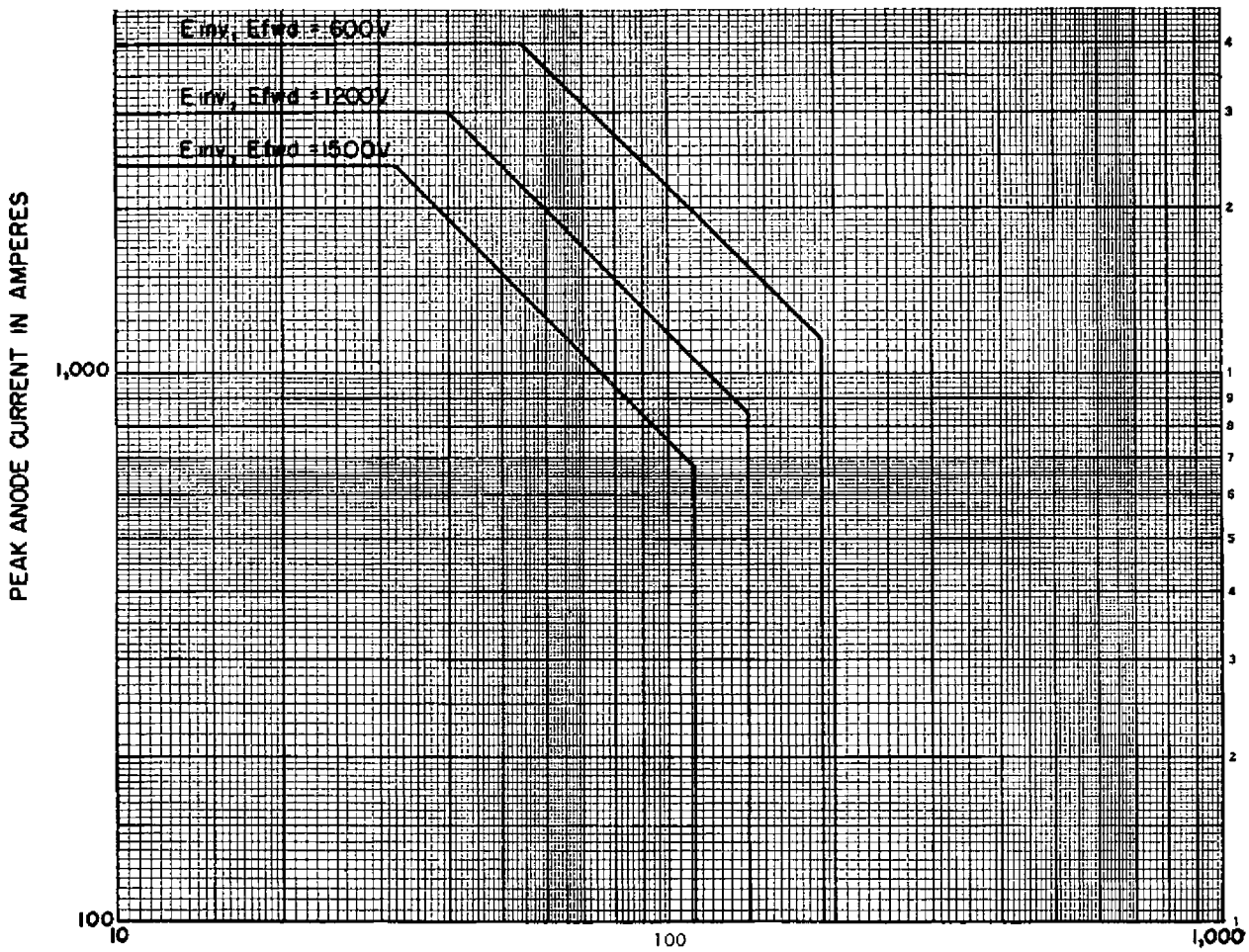


K-69087-72A218 5-25-54



K-60987-72A219 5-25-54

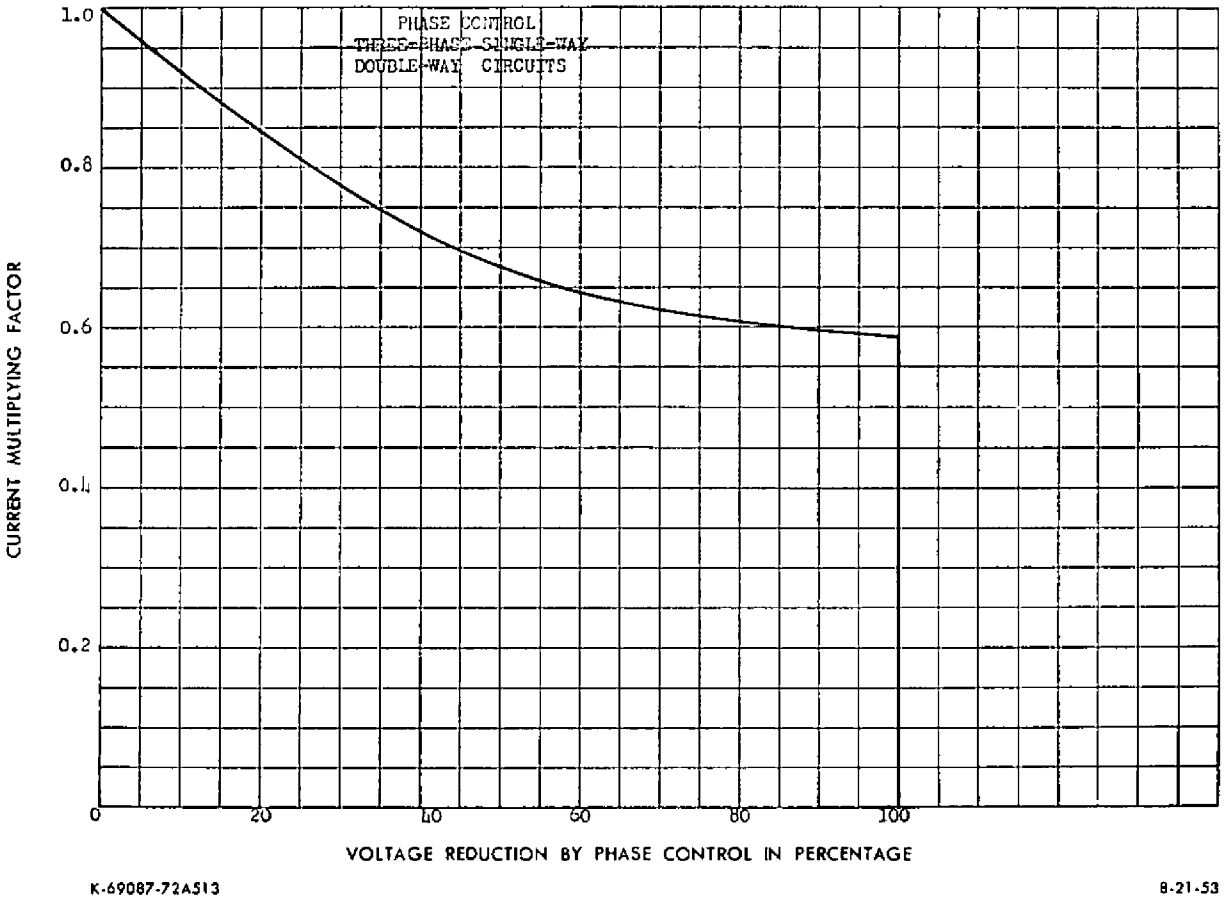
POWER RECTIFIER RATING—INTERMITTENT SERVICE



MAXIMUM AVERAGING TIME = 6.25 SECONDS

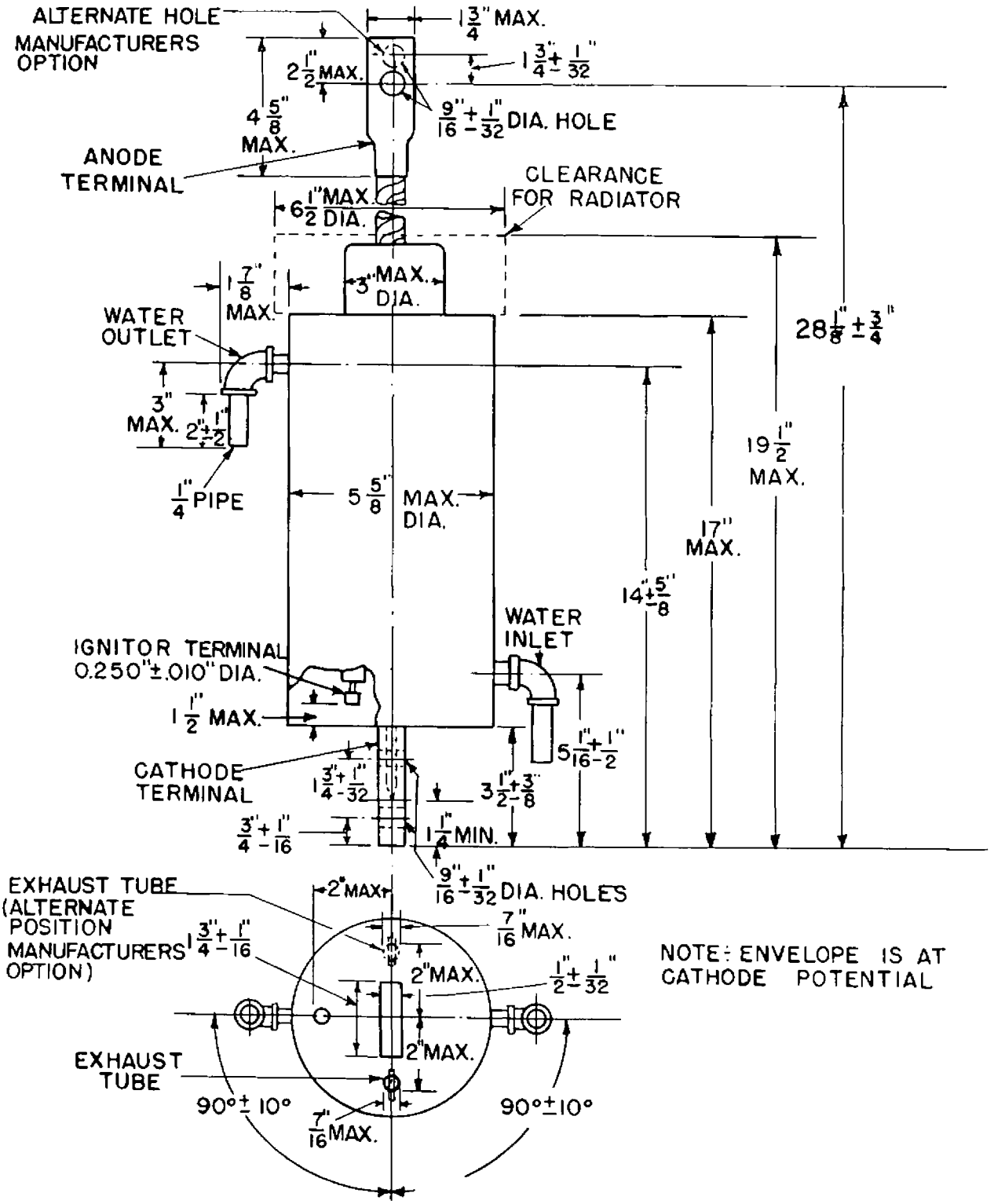
$\frac{1 \text{ Average}}{1 \text{ Peak}}$ Maximum Averaging Time 0.2 Second = 0.166 Maximum

$\frac{1 \text{ Fault}}{1 \text{ Peak Max}}$ Maximum Duration of Fault Current 0.15 Second = 12.5 Maximum



K-69087-72A513

8-21-53



K-5340877

10-29-46

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

7-45 (10M)

PRINTED IN U.S.A.

Electronic TUBES

5636
PENTODE
Five-Star Tube
★★★★★

FOR GATED-AMPLIFIER AND MIXER APPLICATIONS

8-LEAD SUBMINIATURE
SHARP-CUTOFF CHARACTERISTICS

SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING

DESCRIPTION AND RATING

The 5636 is a subminiature dual-control pentode in which both grid-number 1 and grid-number 3 can be used as independent control electrodes. It is suitable for service as a gated or gain-controlled amplifier, or as a mixer at frequencies up to approximately 400 megacycles.

Intended for use in critical industrial and military applications in which operational dependability is of primary importance, the 5636 exhibits a high degree of mechanical strength and incorporates a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ±5%	Volts
Heater Current	0.15	Amperes

Direct Interelectrode Capacitances

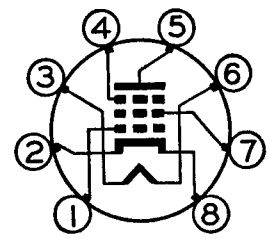
	With Shield*	Without Shield	
Grid-Number 1 to Plate, maximum	0.015	0.030	μμf
Grid-Number 3 to Plate, maximum	1.1	1.1	μμf
Grid-Number 1 to All	4.0	4.0	μμf
Grid-Number 3 to All	4.0	3.8	μμf
Plate to All	3.4	1.9	μμf
Grid-Number 1 to Grid-Number 3, maximum	0.15	0.17	μμf

* With external shield of 0.405-inch inside diameter connected to cathode.

MECHANICAL

Mounting Position—Any
Envelope—T-3, Glass
Base—E8-10, Subminiature

BASING DIAGRAM

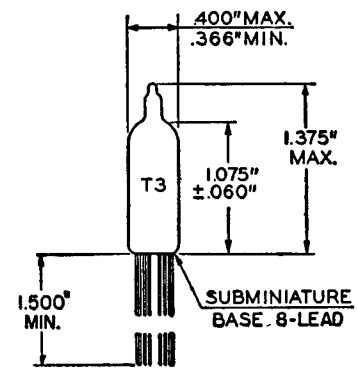


RETMA 8DC

TERMINAL CONNECTIONS

Lead 1—Grid Number 1
Lead 2—Cathode
Lead 3—Heater
Lead 4—Grid Number 3
Lead 5—Plate
Lead 6—Heater
Lead 7—Grid Number 2 (Screen)
Lead 8—Cathode

PHYSICAL DIMENSIONS



RETMA 3-1

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES†

Plate Voltage	165	Volts
Screen Voltage	155	Volts
Positive DC Grid-Number 3 Voltage	30	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Plate Dissipation	0.55	Watts
Screen Dissipation	0.45	Watts
DC Cathode Current	16	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	200	Volts
Heater Negative with Respect to Cathode	200	Volts
Bulb Temperature at Hottest Point	220	C
Grid-Number 1 Circuit Resistance	1.1	Megohms

† Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur. To obtain satisfactory circuit performance, therefore, the equipment designer must establish the circuit design so that no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	100	100	Volts
Screen Voltage	100	100	Volts
Grid-Number 3 Voltage	−1	‡	Volts
Cathode-Bias Resistor	150	150	Ohms
Plate Resistance, approximate	....	0.11	Megohms
Grid-Number 1 Transconductance	....	3200	Micromhos
Grid-Number 3 Transconductance	950	....	Micromhos
Plate Current	....	5.3	Milliamperes
Screen Current	....	3.6	Milliamperes
Grid-Number 1 Voltage, approximate			
Ib = 10 Microamperes	....	−7.5	Volts
Grid-Number 3 Voltage, approximate			
Ib = 10 Microamperes	−8	....	Volts

‡ Grid-Number 3 connected to cathode at socket.

CHARACTERISTICS LIMITS

		Minimum	Maximum	
Heater Current				
Ef = 6.3 volts	Initial	140	160	Milliamperes
	500-Hr	138	164	Milliamperes
Plate Current				
Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed), g3 tied to k	Initial	3.7	6.9	Milliamperes
Screen Current				
Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed), g3 tied to k	Initial	2.8	5.4	Milliamperes
Grid-Number 1 Transconductance (1)				
Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed), g3 tied to k	Initial	2700	4000	Micromhos
Transconductance Change with Heater Voltage				
Difference between Grid-Number 1 Transconductance (1) and Grid-Number 1 Transconductance at Ef = 5.7 volts (other conditions the same) expressed as a percentage of Grid-Number 1 Transconductance (1)	Initial	....	15	Percent
	500-Hr	....	15	Percent
Transconductance Change with Operation				
Difference between Grid-Number 1 Transconductance (1) initially and after operation expressed as a percentage of initial value	500-Hr	....	20	Percent
Average Transconductance Change with Operation				
Average of Values for "Transconductance Change with Operation"	500-Hr	....	15	Percent
Grid-Number 3 Transconductance				
Ef = 6.3 volts, Eb = 100 volts, Ec3 = −1.0 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed)	Initial	500	1800	Micromhos
Plate Current Cutoff (1)				
Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Ec1 = −7.5 volts, g3 tied to k	Initial	....	100	Microamperes
Plate Current Cutoff (2)				
Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Ec1 = −4.5 volts, g3 tied to k	Initial	50	....	Microamperes
Plate Current Cutoff (3)				
Ef = 6.3 volts, Eb = 100 volts, Ec3 = −8.0 volts, Ec2 = 100 volts, Rk = 150 ohms	Initial	....	100	Microamperes
Plate Current Cutoff (4)				
Ef = 6.3 volts, Eb = 100 volts, Ec3 = −6.0 volts, Ec2 = 100 volts, Ec1 = −3.0 volts	Initial	5.0	....	Microamperes
Plate Current Cutoff (5)				
Ef = 6.3 volts, Eb = 100 volts, Ec3 = −15 volts, Ec2 = 100 volts, Ec1 = −2.0 volts	Initial	....	20	Microamperes

CHARACTERISTICS LIMITS CONTINUED ON PAGE 4

CHARACTERISTICS LIMITS (Cont'd)

		Minimum	Maximum	
Interelectrode Capacitances				
Grid-Number 1 to Plate (g1 to p)	Initial	....	0.015	μμf
Grid-Number 3 to Plate (g3 to p)	Initial	....	1.10	μμf
Grid-Number 1 to All (g1 to h, k, g2, g3, p)	Initial	3.5	4.5	μμf
Grid-Number 3 to All (g3 to h, k, g1, g2, p)	Initial	3.5	4.5	μμf
Output (p to h, k, g1, g2, g3)	Initial	2.9	3.9	μμf
Grid-Number 1 to Grid-Number 3 (g1 to g3)	Initial	....	0.15	μμf
Measured with external shield of 0.405-inch inside diameter connected to cathode.				
Negative Grid-Number 1 Current				
Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed), Rg1 = 1.0 meg, g3 tied to k	Initial	0	0.3	Microamperes
	500-Hr	0	0.9	Microamperes
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	Initial	0	5	Microamperes
	500-Hr	0	10	Microamperes
Heater Negative with Respect to Cathode	Initial	0	5	Microamperes
	500-Hr	0	10	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid-Number 1 to All at 100 Volts DC	Initial	100	....	Megohms
	500-Hr	50	....	Megohms
Plate to All at 300 Volts DC	Initial	100	....	Megohms
	500-Hr	50	....	Megohms
Vibrational Noise Output Voltage, RMS				
Ef = 6.3 volts, Ebb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed), R_L = 10,000 ohms, g3 tied to k, vibrational acceleration = 15 G at 40 cps	Initial	....	60	Millivolts
Grid-Number 1 Emission Current				
Ef = 7.5 volts, Eb = 100 volts, Ec2 = 100 volts, Ec1 = −7.5 volts, Rg1 = 1.0 meg, g3 tied to k	Initial	0	0.5	Microamperes

The indicated 500-hour values are life-test end points for the following conditions of operation: Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms, Rg1 = 1.0 meg, g3 tied to k, Ehk = 200 volts with heater positive with respect to cathode, and bulb temperature = 220 C minimum.

SPECIAL TESTS AND RATINGS

Stability Life Test
Statistical sample operated for one hour to evaluate and control initial variations in transconductance.

Survival Rate Life Test
Statistical sample operated for one hundred hours to evaluate and control early-life electrical and mechanical inoperatives.

Heater-Cycling Life Test
Statistical sample operated for 2000 cycles to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.0 volts cycled for one minute on and four minutes off, Eb = Ec3 = Ec2 = Ec1 = 0 volts, and Ehk = 140 volts RMS.

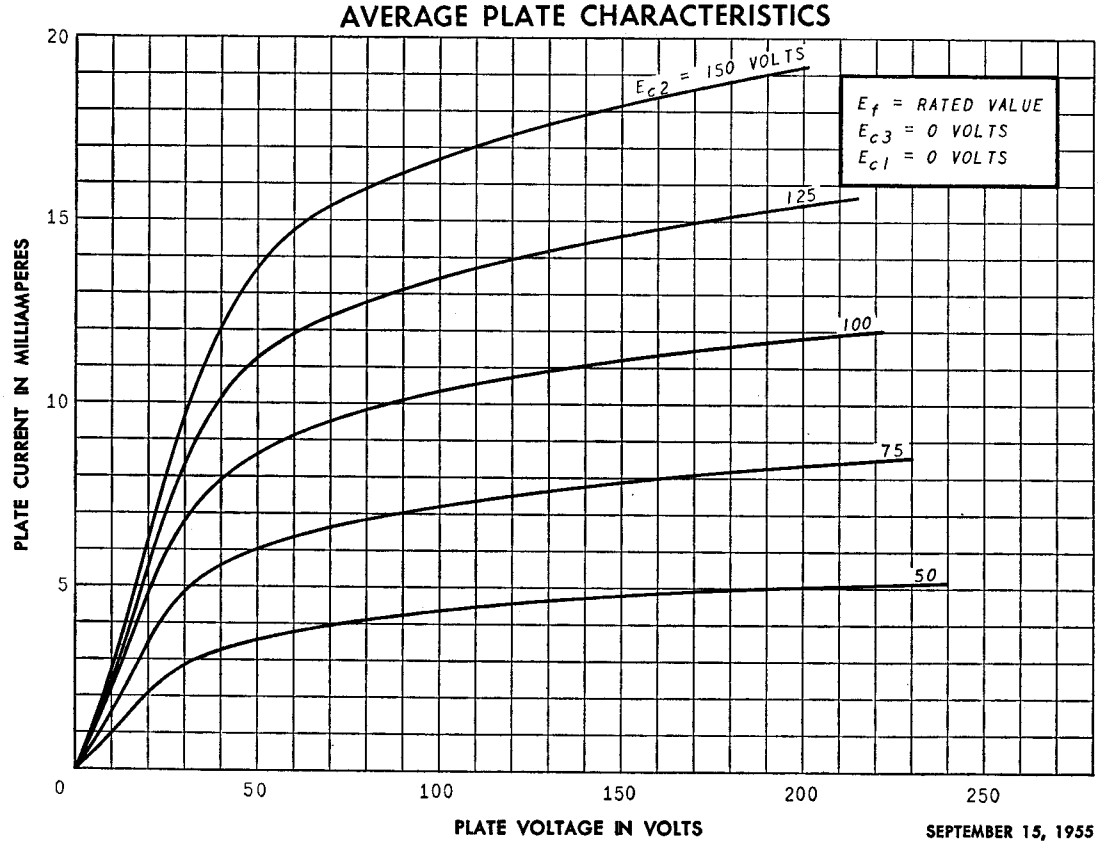
Shock Rating—450 G
Statistical sample subjected to five impact accelerations of 450 G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

Fatigue Rating—2.5 G
Statistical sample subjected to vibrational acceleration of 2.5 G for 32 hours minimum in each of three different positions. The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

Altitude Rating—60,000 Feet
Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

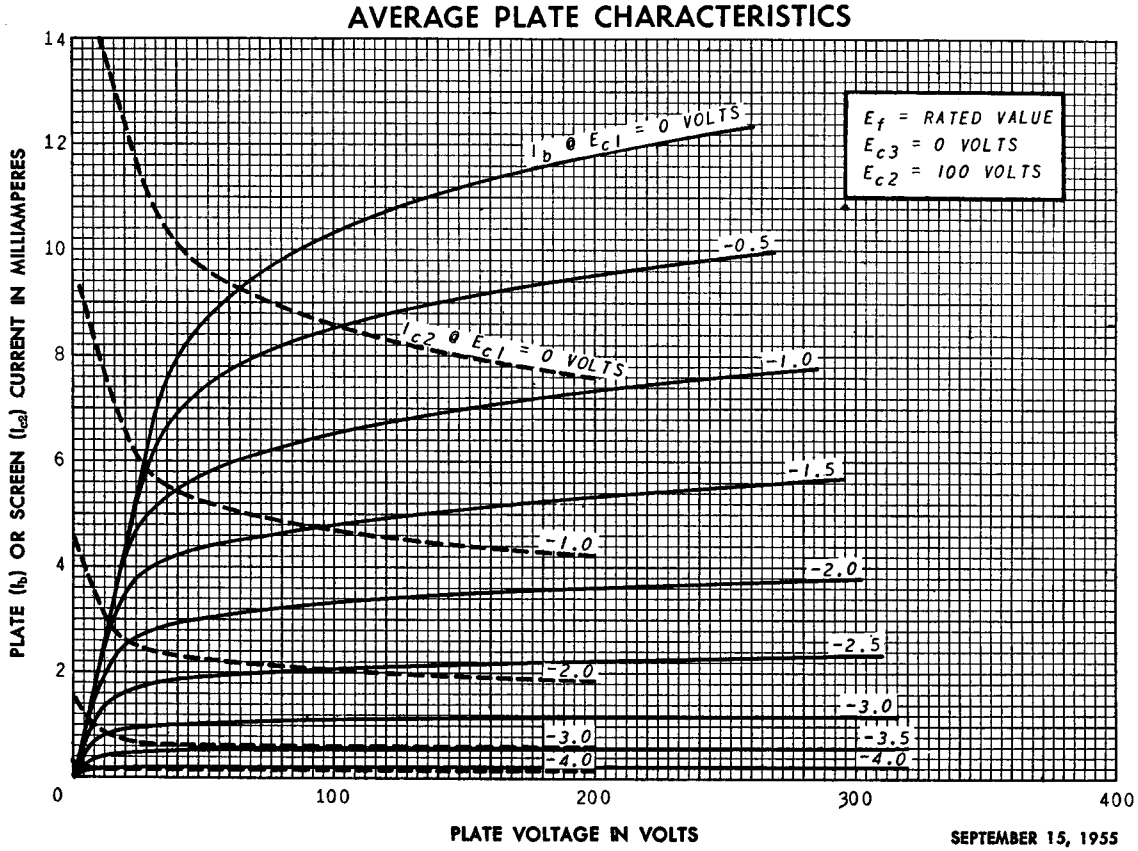
Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.
In the design of military equipment employing this tube, reference should be made to the appropriate MIL-E-1B specification.

AVERAGE PLATE CHARACTERISTICS



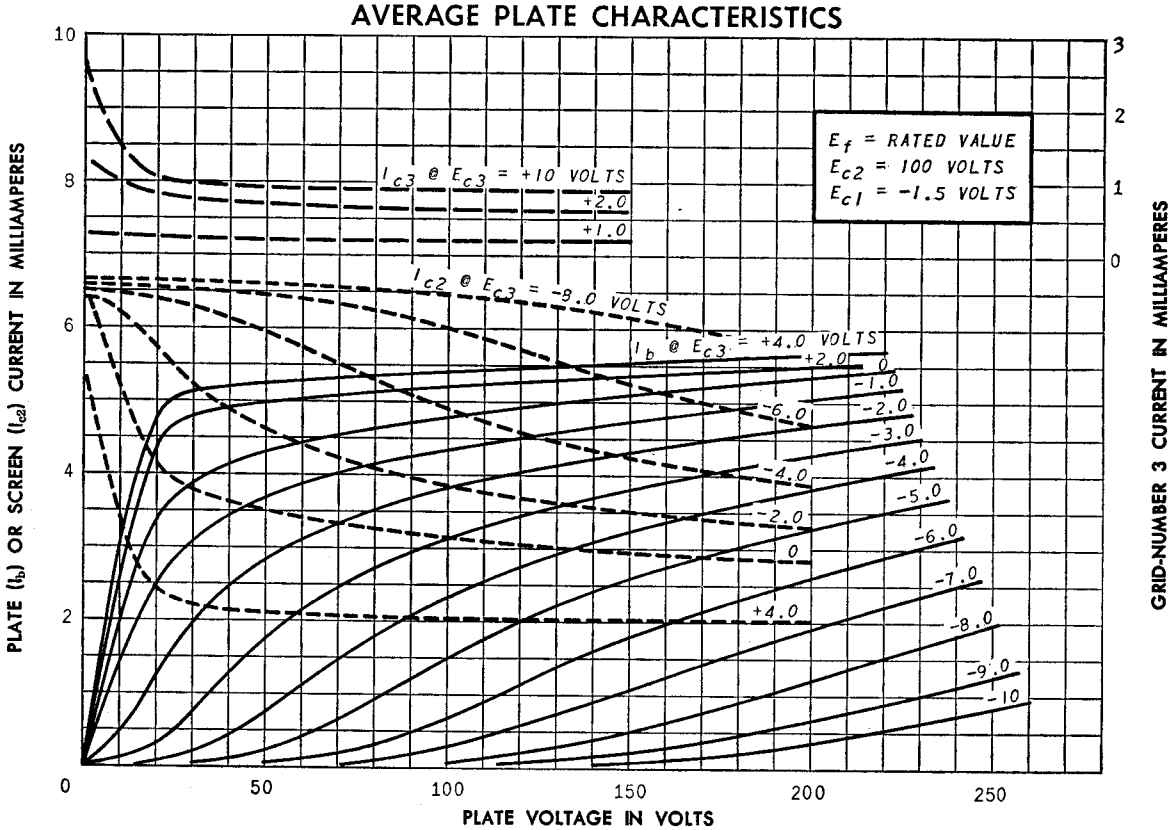
SEPTEMBER 15, 1955

AVERAGE PLATE CHARACTERISTICS



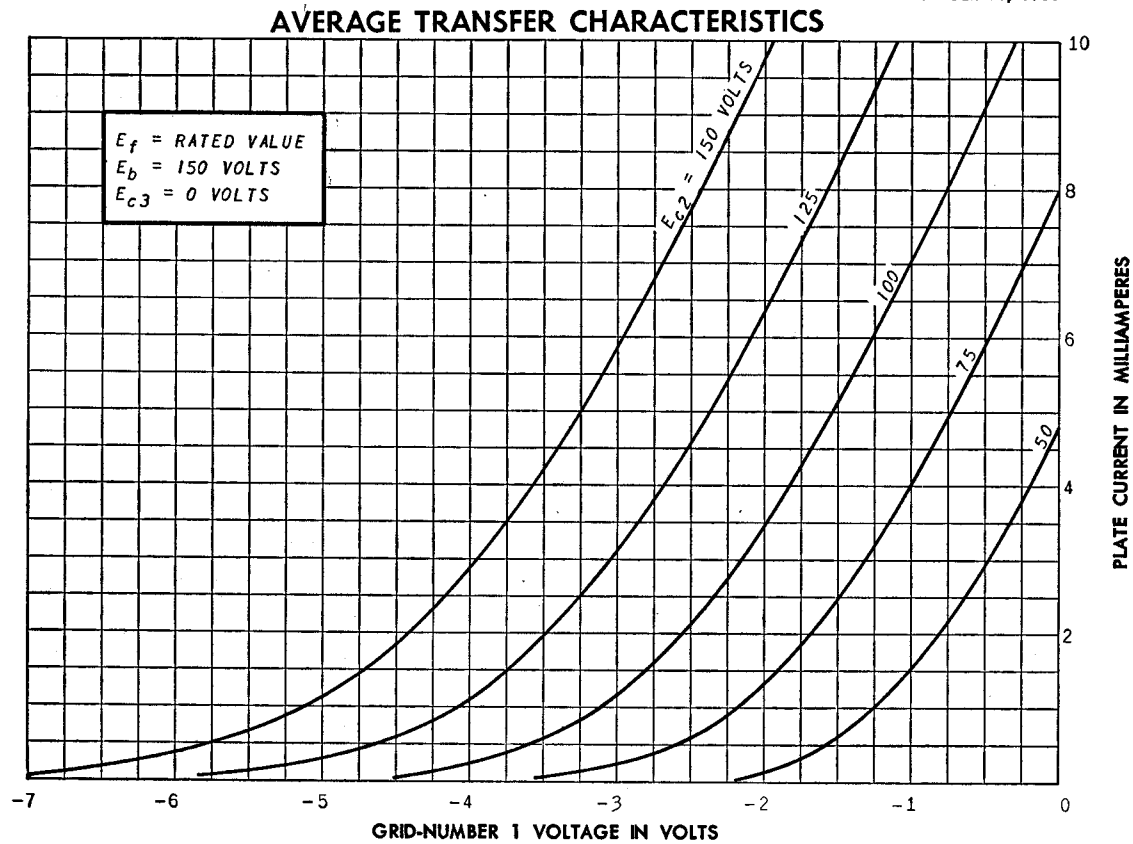
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AVERAGE PLATE CHARACTERISTICS



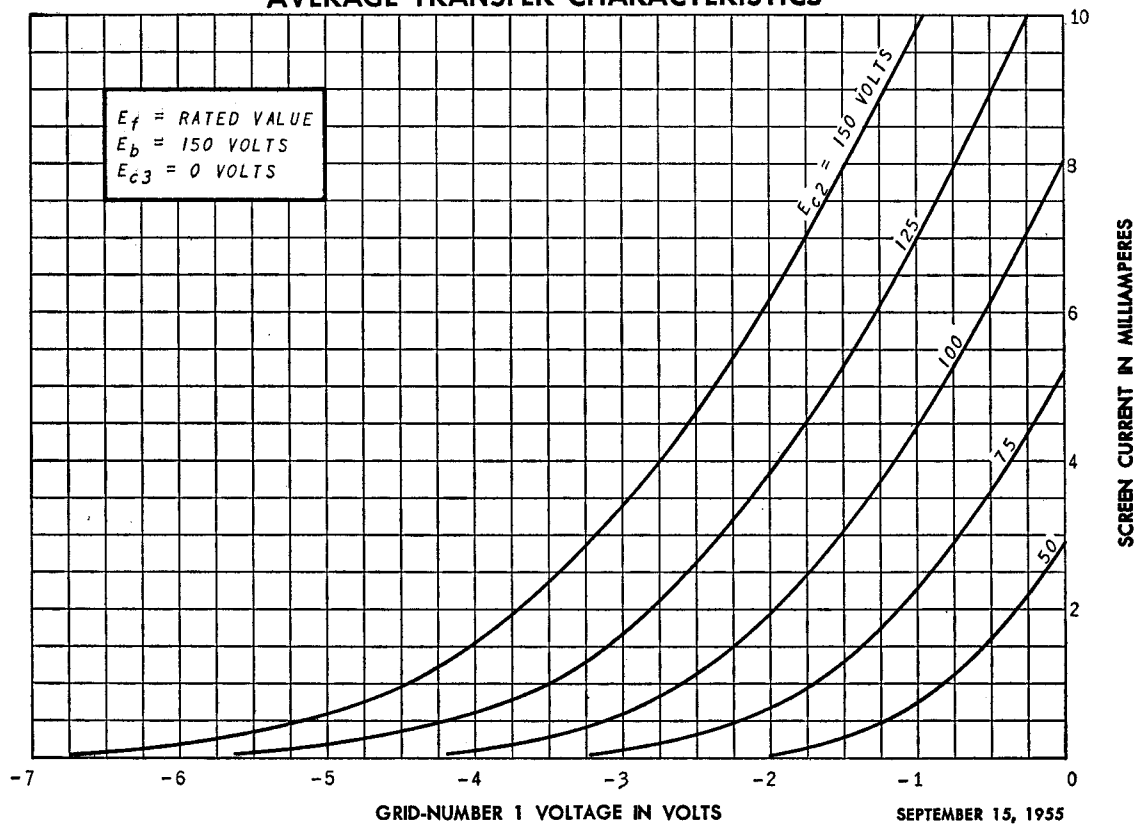
SEPTEMBER 15, 1955

AVERAGE TRANSFER CHARACTERISTICS



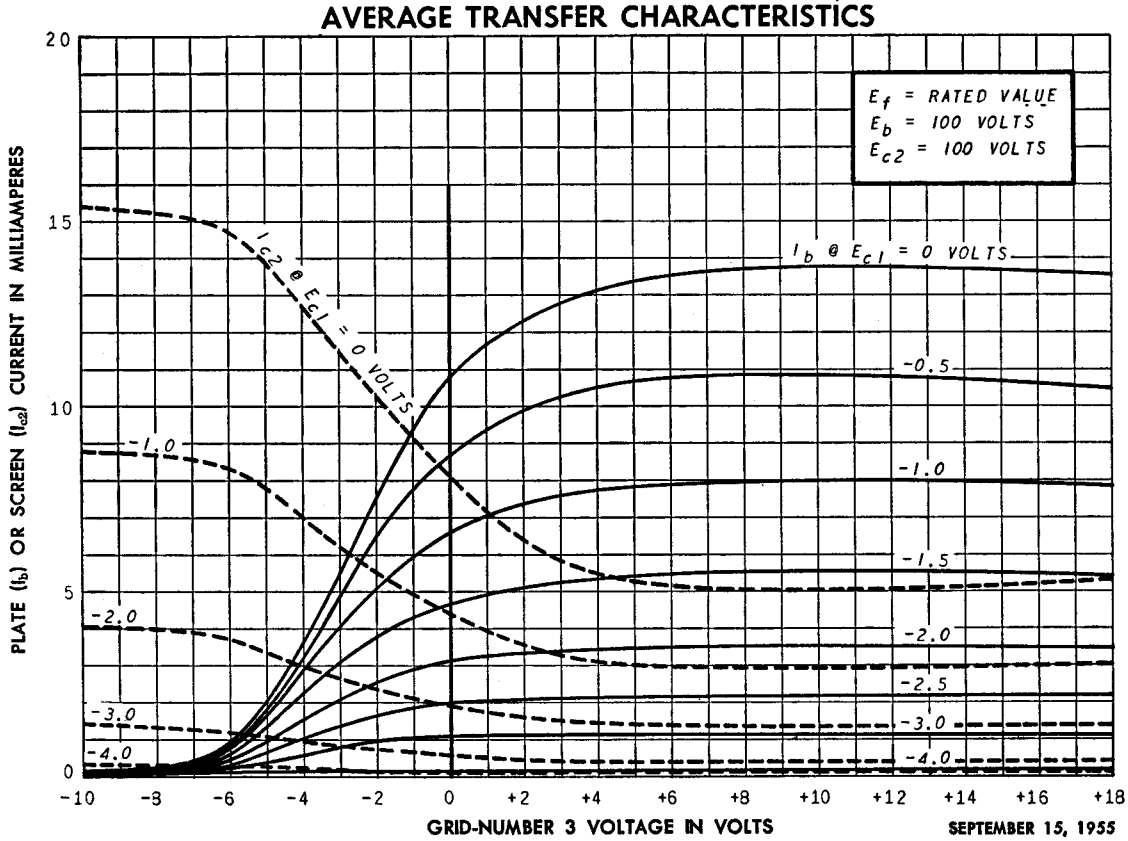
SEPTEMBER 15, 1955

AVERAGE TRANSFER CHARACTERISTICS



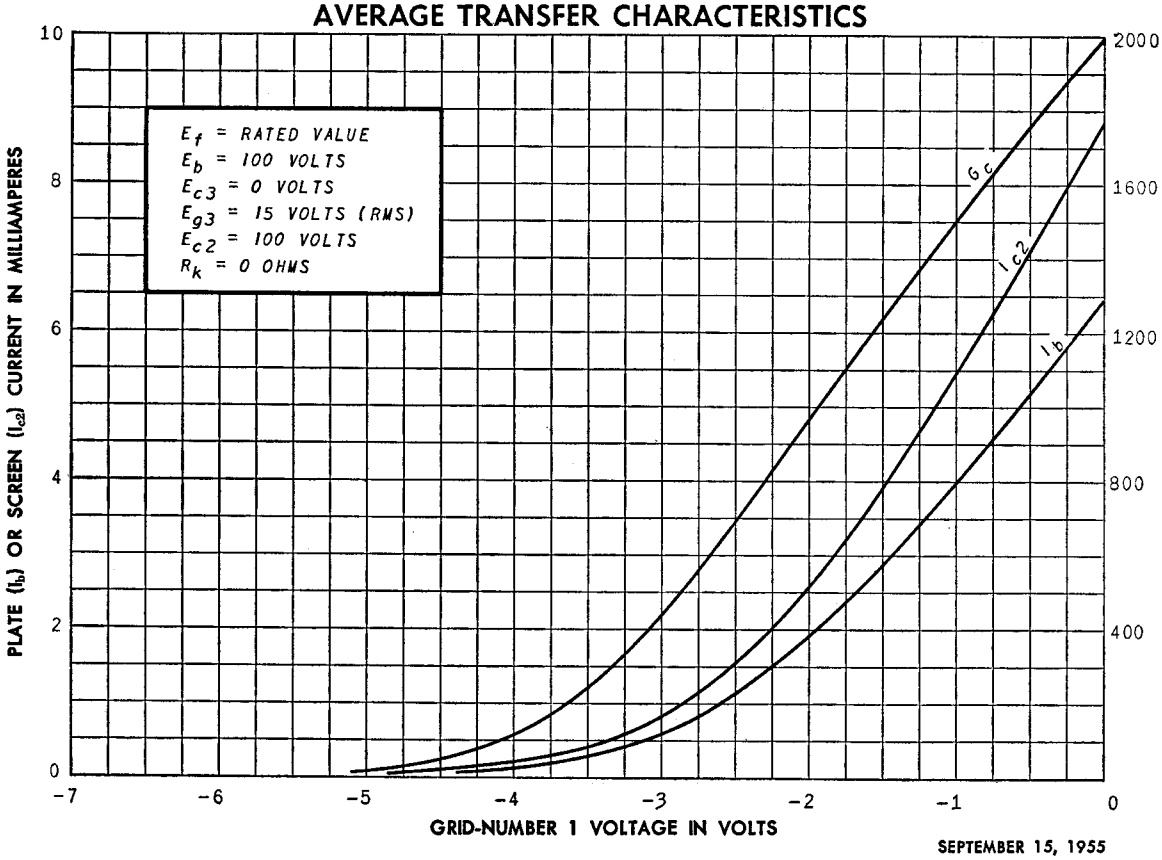
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AVERAGE TRANSFER CHARACTERISTICS



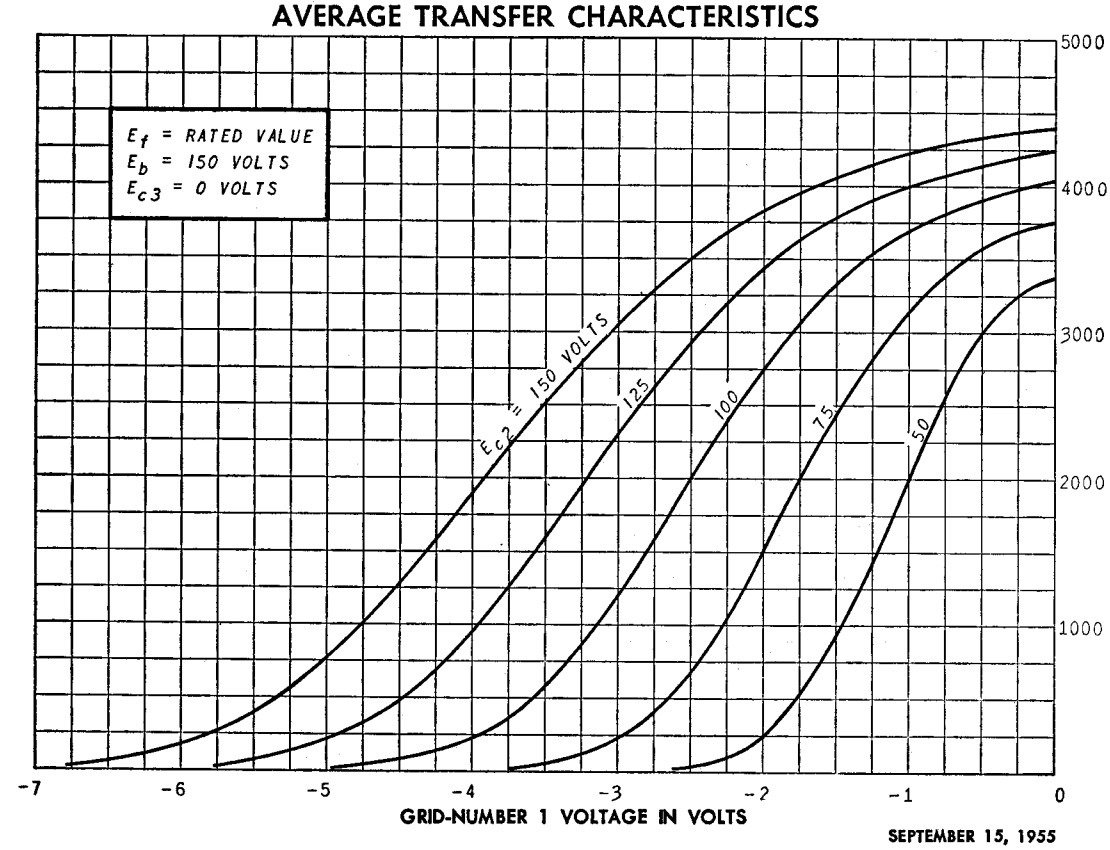
SEPTEMBER 15, 1955

AVERAGE TRANSFER CHARACTERISTICS



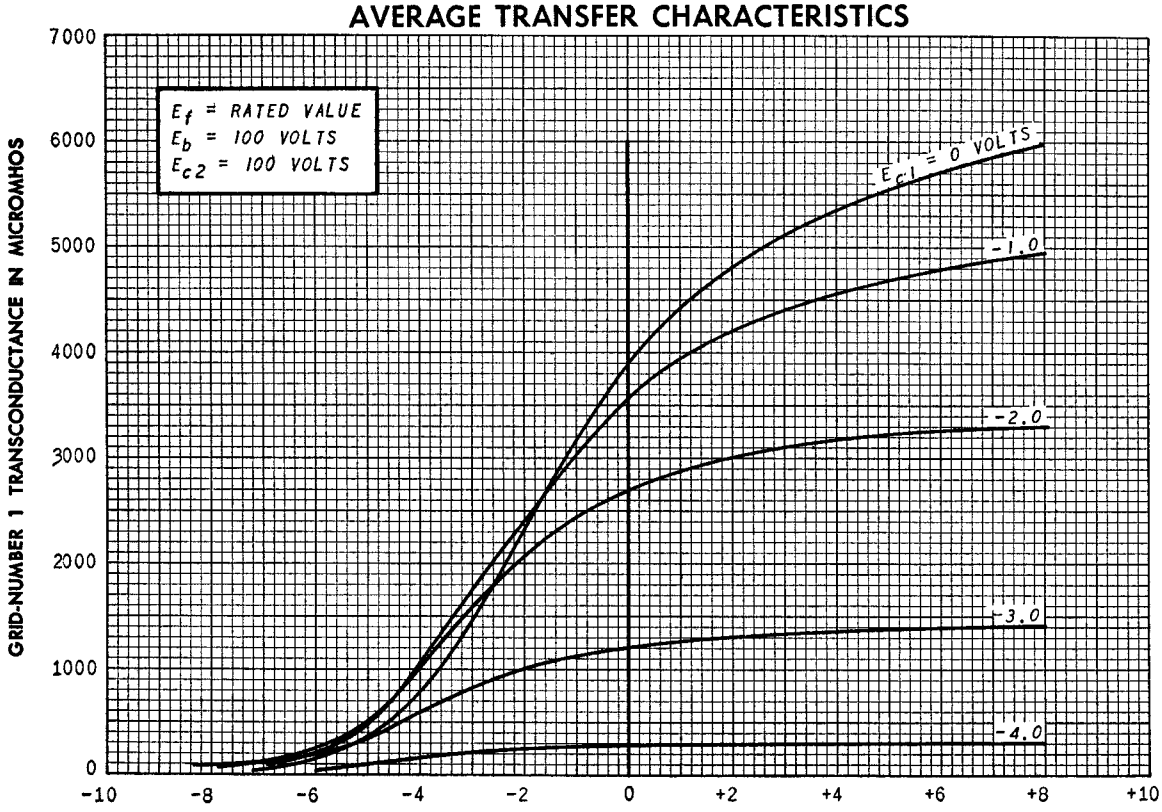
SEPTEMBER 15, 1955

AVERAGE TRANSFER CHARACTERISTICS



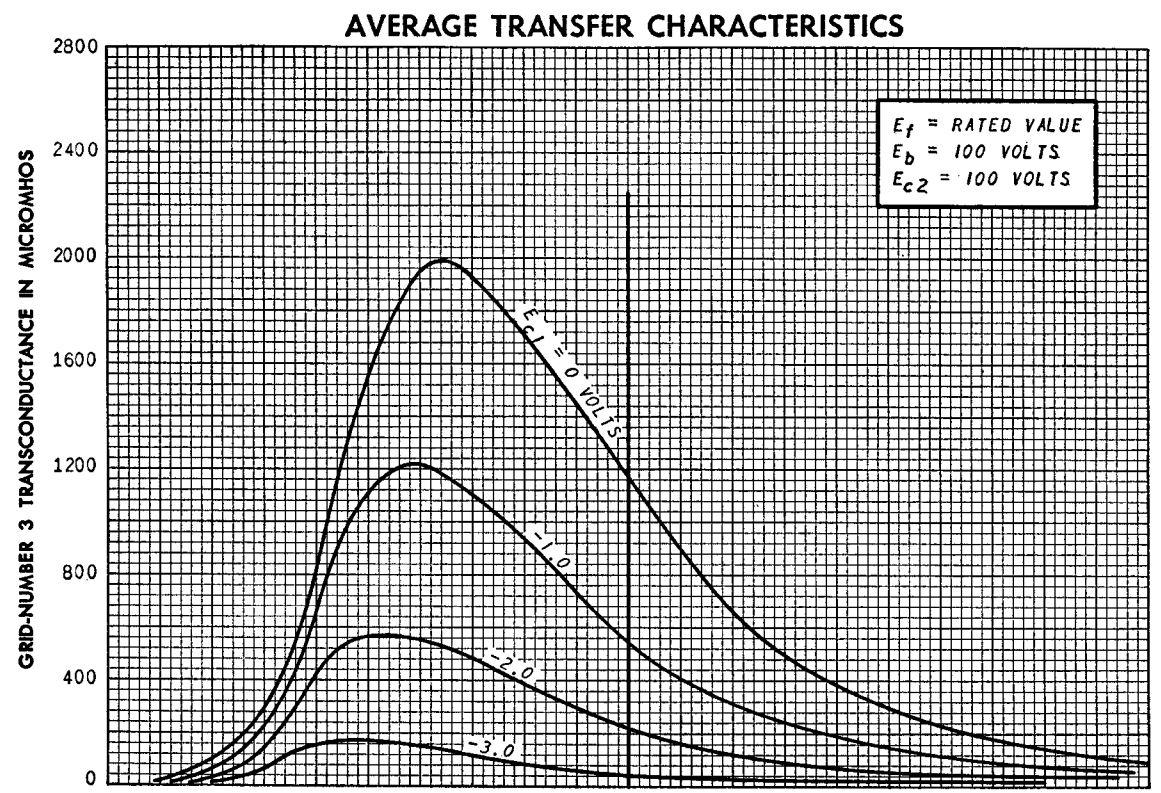
SEPTEMBER 15, 1955

AVERAGE TRANSFER CHARACTERISTICS



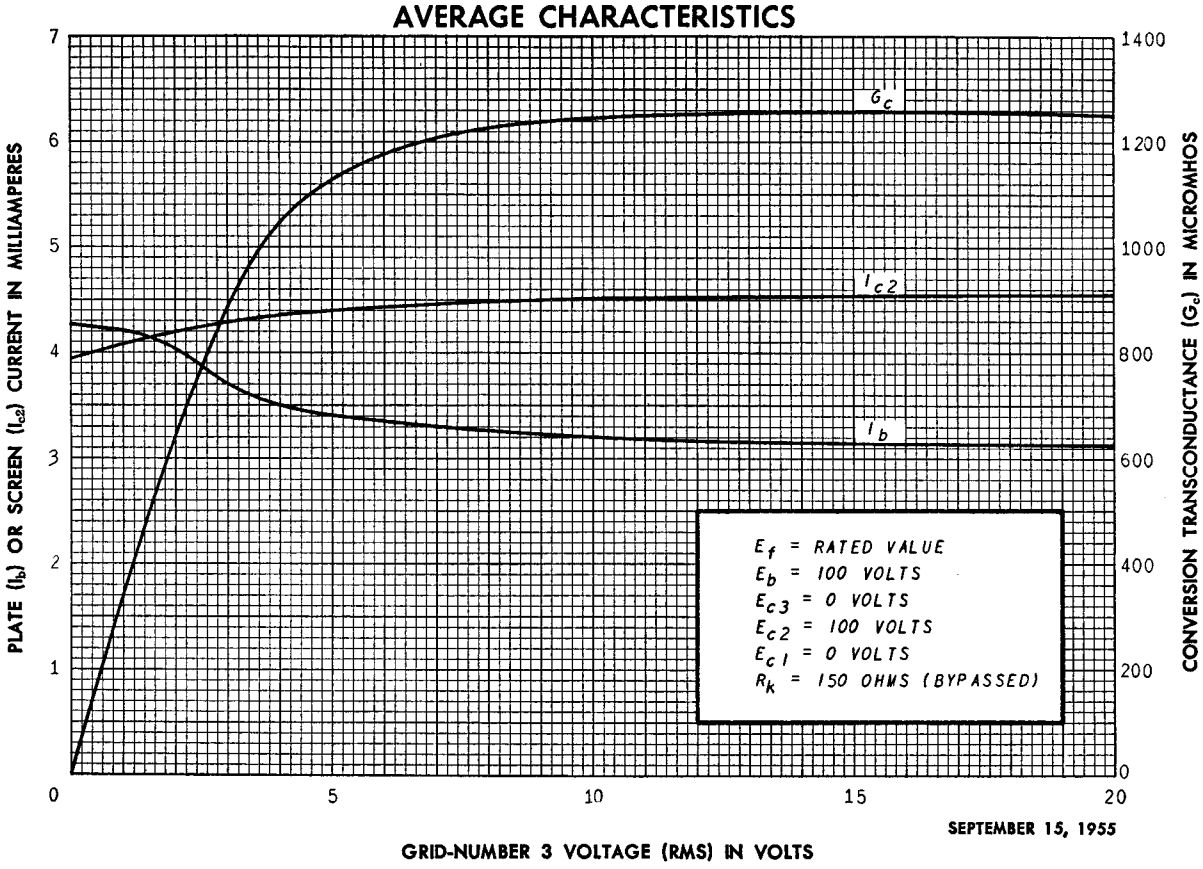
SEPTEMBER 15, 1955

AVERAGE TRANSFER CHARACTERISTICS



SEPTEMBER 15, 1955

AVERAGE CHARACTERISTICS



Electronic TUBES

5654
PENTODE
Five-Star Tube
★ ★ ★ ★ ★

FOR WIDE-BAND HIGH-FREQUENCY AMPLIFIER APPLICATIONS

SHARP-CUTOFF CHARACTERISTIC
7-PIN MINIATURE
SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING
HIGH TRANSCONDUCTANCE

DESCRIPTION AND RATING

The 5654 is a miniature sharp-cutoff pentode for use as a wide-band, high-frequency amplifier. It is also useful in video and audio amplifiers, oscillators, mixers, frequency multipliers, and cathode followers.

The 5654 is a special-quality tube intended for use in critical industrial and military applications in which operational dependability is of primary importance. Features of the tube include a high degree of mechanical strength and a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

Analysis of the electrical characteristics of this tube with those of the 6AK5 will indicate that the 5654 is essentially similar.

GENERAL

ELECTRICAL

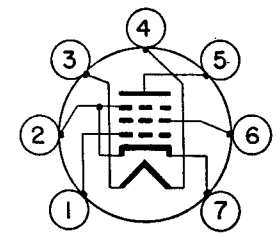
Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.175	Amperes
Direct Interelectrode Capacitances*		
Grid-Number 1 to Plate, maximum	0.02	μμf
Input	4.0	μμf
Output	2.85	μμf

*With external shield (RETMA 316) connected to cathode.

MECHANICAL

Mounting Position—Any
Envelope—T-5½, Glass
Base—E7-1, Miniature Button 7-Pin

BASING DIAGRAM

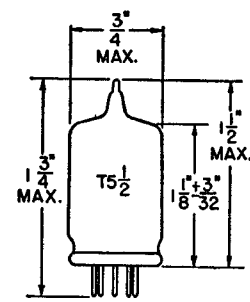


RETMA 7BD

TERMINAL CONNECTIONS

Pin 1—Grid Number 1
Pin 2—Cathode, Internal Shield, and Grid Number 3
Pin 3—Heater
Pin 4—Heater
Pin 5—Plate
Pin 6—Grid Number 2 (Screen)
Pin 7—Cathode, Internal Shield, and Grid Number 3

PHYSICAL DIMENSIONS



RETMA 5-1

GENERAL ELECTRIC

Supersedes ET-T1082 dated 8-54

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES

Plate Voltage	200 Volts
Screen Voltage	155 Volts
Positive DC Grid-Number 1 Voltage	0 Volts
Negative DC Grid-Number 1 Voltage	50 Volts
Plate Dissipation	1.65 Watts
Screen Dissipation	0.55 Watts
DC Grid-Number 1 Current	1.0 Milliamperes
DC Cathode Current	20 Milliamperes
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	135 Volts
Heater Negative with Respect to Cathode	135 Volts
Grid-Number 1 Circuit Resistance	0.1 Megohms
Bulb Temperature at Hottest Point	165 C

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	120 Volts
Screen Voltage	120 Volts
Grid-Number 1 Voltage	−2.0 Volts
Plate Resistance, approximate	0.34 Megohms
Transconductance	5000 Micromhos
Plate Current	7.5 Milliamperes
Screen Current	2.5 Milliamperes
Grid-Number 1 Voltage, approximate Ib = 10 Microamperes	−8.5 Volts

CLASS A RESISTANCE-COUPLED AMPLIFIER

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

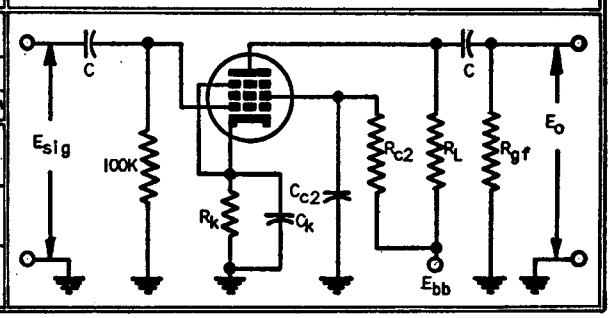
R_L	R_{gf}	Ebb = 90 Volts				Ebb = 180 Volts				Ebb = 300 Volts			
		R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain
0.10	0.10	700	0.2	12	62	400	0.3	21	120	200	0.4	38	170
0.10	0.24	800	0.2	16	85	400	0.3	28	170	300	0.4	51	260
0.24	0.24	4100	0.3	13	53	900	0.7	22	160	500	0.9	35	250
0.24	0.51	4800	0.3	15	68	1000	0.8	26	200	500	1.0	40	300
0.51	0.51	7100	0.9	11	73	2000	1.5	22	170	1200	1.8	34	290
0.51	1.0	7500	1.0	14	93	2500	1.6	26	220	1400	1.9	42	390

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	Ebb = 90 Volts				Ebb = 180 Volts				Ebb = 300 Volts			
		R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain
0.10	0.10	1600	0.1	13	42	300	0.4	23	120	200	0.4	41	160
0.10	0.24	1800	0.1	16	64	400	0.4	31	160	200	0.4	53	290
0.24	0.24	5300	0.2	14	43	700	1.0	26	160	400	1.1	44	240
0.24	0.51	5500	0.3	15	65	700	1.2	33	200	500	1.2	54	310
0.51	0.51	11000	0.5	12	50	2000	1.6	23	180	800	2.5	47	290
0.51	1.0	11000	0.7	13	72	2000	1.7	27	250	900	2.8	58	370

Notes:

1. E_o is maximum RMS voltage output for approximately five percent total harmonic distortion.
2. Gain is measured for an output voltage of two volts RMS.
3. R_k is in ohms; R_{c2}, R_L, and R_{gf} are in megohms.
4. Coupling capacitors (C) should be selected to give desired frequency response. R_k and R_{c2} should be adequately by-passed.



CHARACTERISTICS LIMITS

		Minimum	Maximum	
Heater Current				
Ef = 6.3 volts	Initial	160	190	Milliamperes
	500 Hr	160	190	Milliamperes
	1000 Hr	160	190	Milliamperes
Plate Current				
Ef = 6.3 volts, Eb = 120 volts, Ec2 = 120 volts, Ec1 = −2.0 volts	Initial	5.0	11.0	Milliamperes
Screen Current				
Ef = 6.3 volts, Eb = 120 volts, Ec2 = 120 volts, Ec1 = −2.0 volts	Initial	0.8	4.0	Milliamperes
Transconductance (1)				
Ef = 6.3 volts, Eb = 120 volts, Ec2 = 120 volts, Ec1 = −2.0 volts	Initial	3800	6200	Micromhos
Transconductance Change with Heater Voltage				
Difference between Transconductance (1) and Transconductance at Ef = 5.7 volts (other conditions the same) expressed as a percentage of Transconductance (1)	Initial	....	15	Percent
	500 Hr	....	15	Percent
Transconductance Change with Operation				
Difference between Transconductance (1) initially and after operation expressed as a percentage of initial value	500 Hr	....	20	Percent
	1000 Hr	....	25	Percent
Average Transconductance Change with Operation				
Average of values for "Transconductance Change with Operation"	500 Hr	....	15	Percent
Plate Resistance				
Ef = 6.3 volts, Eb = 120 volts, Ec2 = 120 volts, Ec1 = −2.0 volts	Initial	0.25	....	Megohms
Plate Current Cutoff (1)				
Ef = 6.3 volts, Ebb = 120 volts, Ec2 = 120 volts, Ec1 = −10 volts, R_L = 0.1 meg	Initial	....	200	Microamperes
Plate Current Cutoff (2)				
Ef = 6.3 volts, Eb = 120 volts, Ec2 = 120 volts, Ec1 = −5.5 volts	Initial	5.0	....	Microamperes
Interelectrode Capacitances				
Grid-Number 1 to Plate (g1 to p)	Initial	....	0.02	μμf
Input (g1 to h, k, g2, g3)	Initial	3.4	4.6	μμf
Output (p to h, k, g2, g3)	Initial	2.45	3.25	μμf
Measured with external shield (RETMA 316) connected to cathode.				
Negative Grid-Number 1 Current				
Ef = 6.3 volts, Eb = 120 volts, Ec2 = 120 volts, Ecc1 = −2.0 volts, Rg1 = 0.5 meg	Initial	0	0.1	Microamperes
	500 Hr	0	0.1	Microamperes
Heater-Cathode Leakage Current	1000 Hr	0	0.1	Microamperes
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	Initial	....	10	Microamperes
	500 Hr	....	10	Microamperes
	1000 Hr	....	10	Microamperes
Heater Negative with Respect to Cathode	Initial	....	10	Microamperes
	500 Hr	....	10	Microamperes
	1000 Hr	....	10	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid-Number 1 to All at 100 Volts DC	Initial	100	....	Megohms
	500 Hr	50	....	Megohms
Plate to All at 300 Volts DC	Initial	100	....	Megohms
	500 Hr	50	....	Megohms
Vibrational Noise Output Voltage, RMS				
Ef = 6.3 volts, Ebb = 120 volts, Ec2 = 120 volts, Ec1 = −2.0 volts, R_L = 10,000 ohms, vibrational acceleration = 2.5 G at 25 cps	Initial	....	150	Millivolts
Grid-Number 1 Emission Current				
Ef = 7.5 volts, Eb = 120 volts, Ec2 = 120 volts, Ecc1 = −45 volts, Rg1 = 0.1 meg	Initial	....	0.5	Microamperes

The indicated 500-hour and 1000-hour values are life-test end points for the following conditions of operation: Ef = 6.3 volts, Eb = 150 volts, Ec2 = 125 volts, Rk = 130 ohms, Rgl = 0.1 meg, Ehk = 135 volts with heater positive with respect to Cathode, and bulb temperature = 165 C minimum.

†*Supersedes pages 3 and 4 only dated 8-56*

SPECIAL TESTS AND RATINGS

Stability Life Test

Statistical sample operated for one hour to evaluate and control initial variations in transconductance.

Survival Rate Life Test

Statistical sample operated for one hundred hours to evaluate and control early-life electrical and mechanical inoperatives.

Heater-Cycling Life Test

Statistical sample operated for 2000 cycles to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.5 volts cycled for one minute on and one minute off, Eb = Ec2 = Ec1 = 0 volts, and Ehk = 135 volts with heater positive with respect to cathode.

Shock Rating—450 G

Statistical sample subjected to five impact accelerations of 450 G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

Fatigue Rating—2.5 G

Statistical sample subjected to vibrational acceleration of 2.5 G for 32 hours minimum in each of three different positions. The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

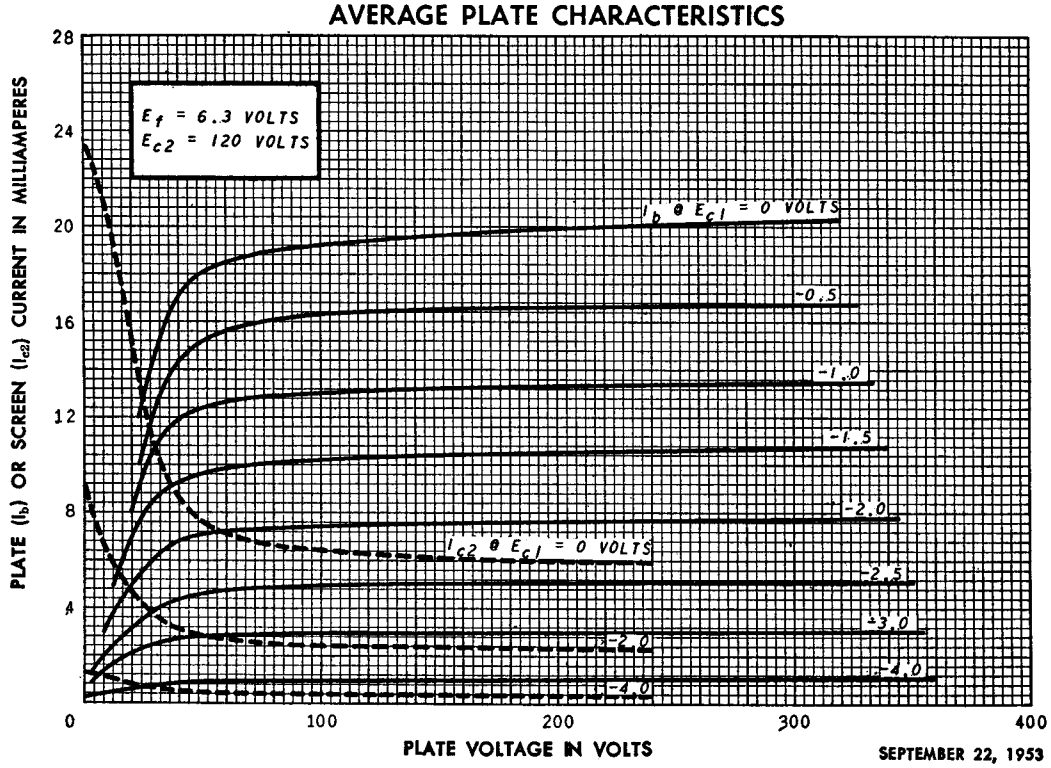
Altitude Rating—60,000 Feet

Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

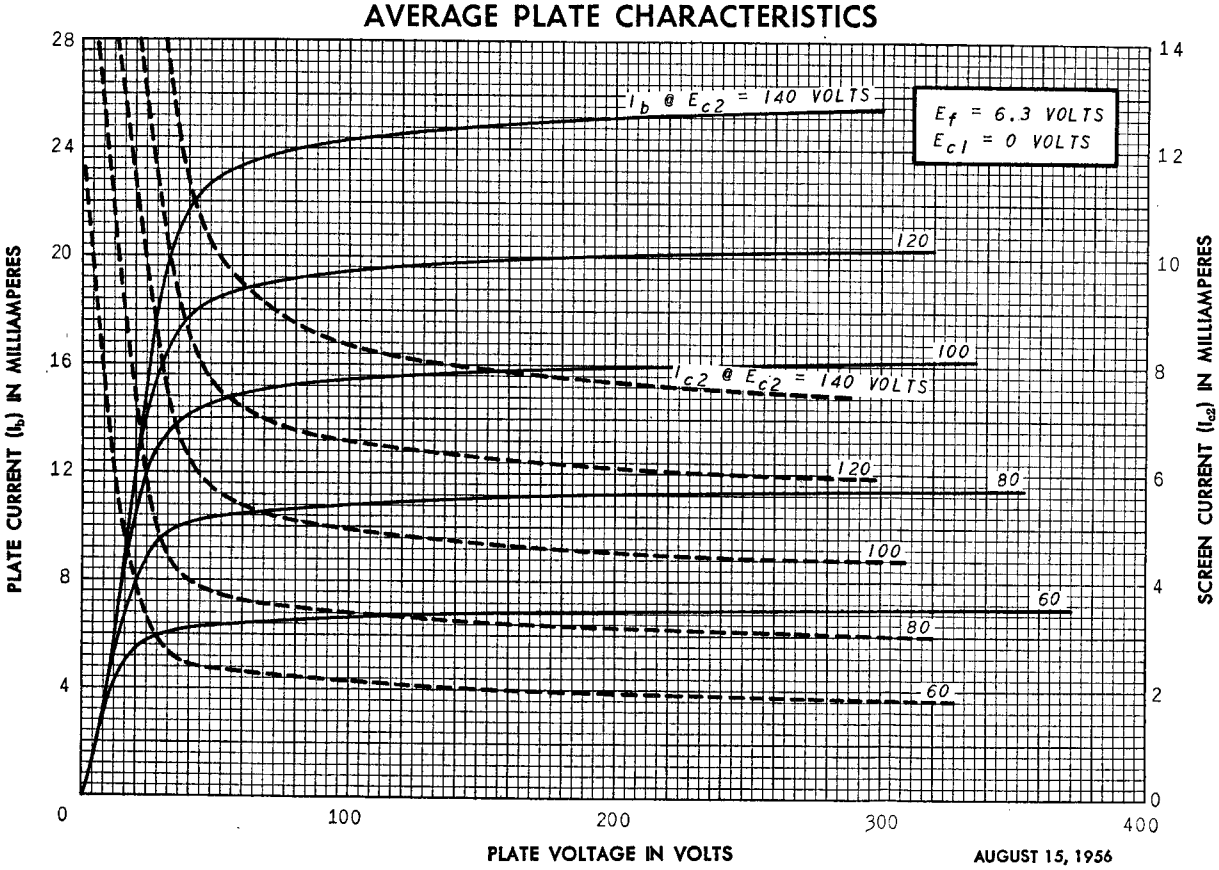
Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

In the design of military equipment employing this tube, reference should be made to the appropriate MIL-E-1C specification.

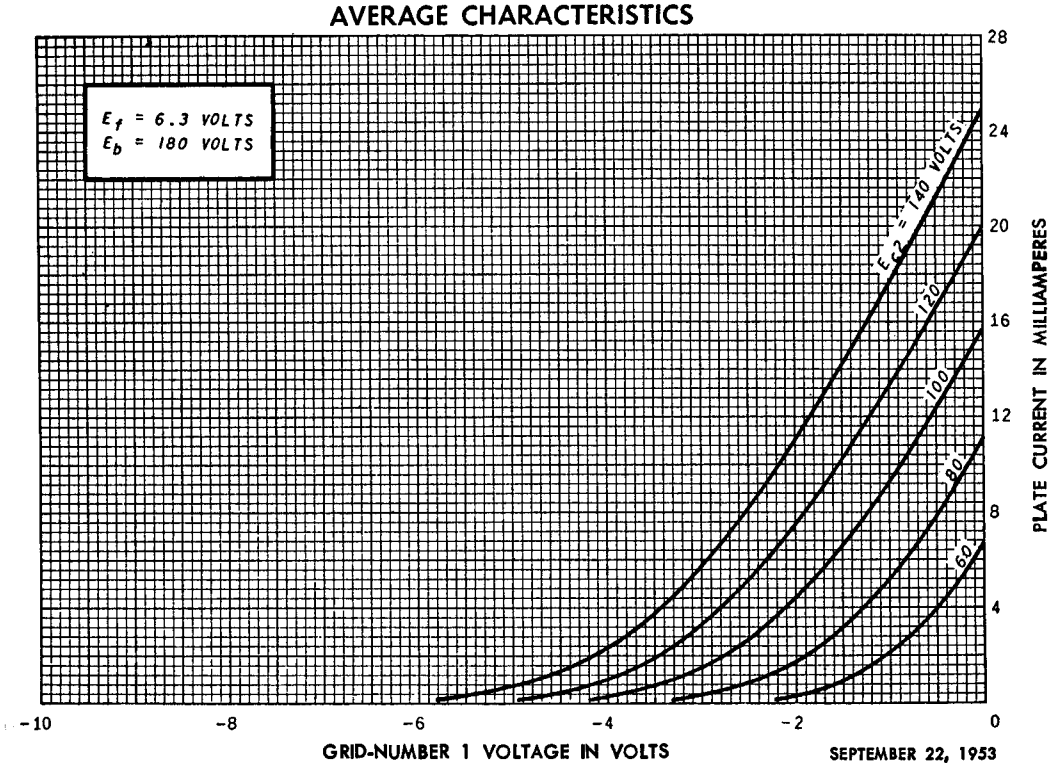
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

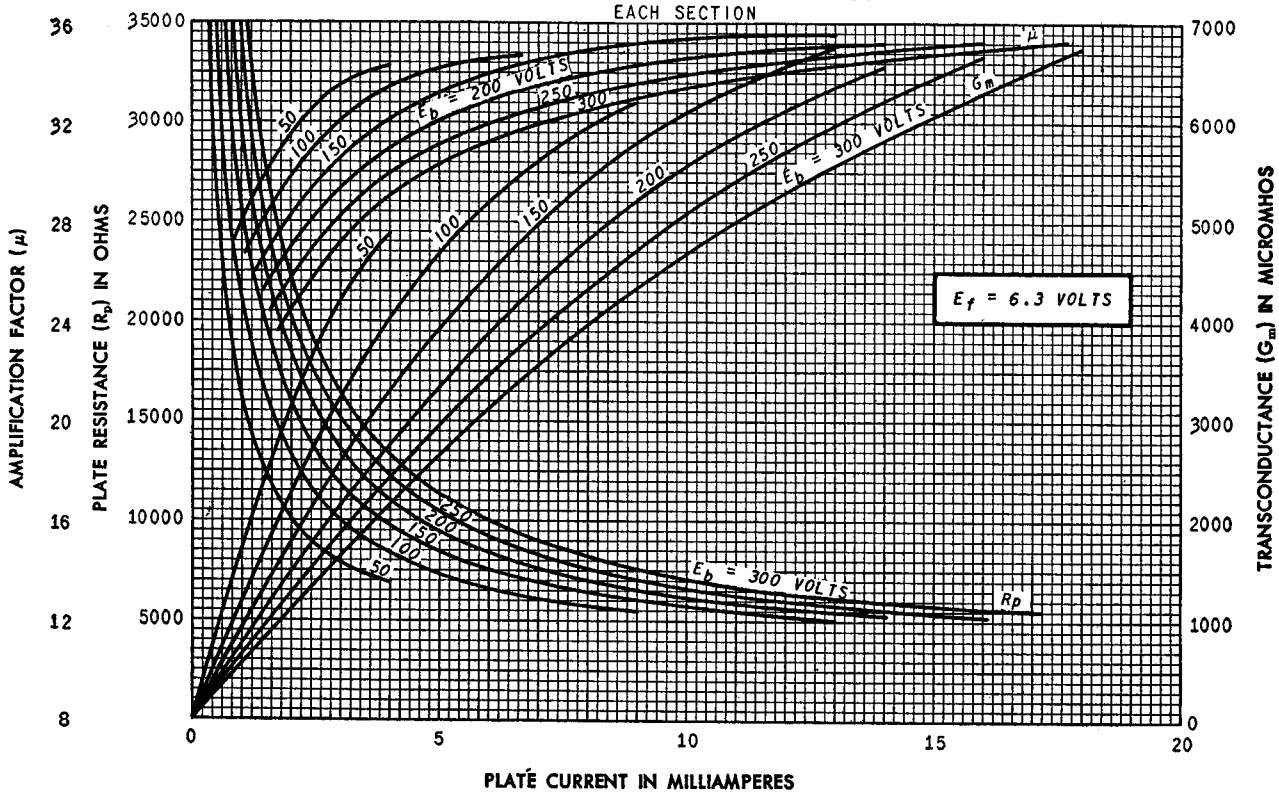


AVERAGE CHARACTERISTICS



AVERAGE CHARACTERISTICS

EACH SECTION



OCTOBER 9, 1953

from RMA release # 616, Nov. 15, 1947

Electronics Department

G E N E R A L E L E C T R I C

Pliotron 5659--Preliminary Technical Information

The 5659 is a beam power amplifier pentode similar to the 12A6 designed for reliable performance under conditions of severe vibration and intermittent operation.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode - Indirectly Heated

Heater Voltage (A-C or D-C)	12.6	Volts
Heater Current	0.150	Ampere

Mechanical Data

Envelope - MT-8
Base - Small Wafer Octal 7-Pin

Maximum Diameter	1 5/16	Inches
Maximum Overall Length	3 1/4	Inches
Maximum Seated Height	2 1/16	Inches

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Design Center		
Plate Voltage	250	Volts
Screen Voltage	250	Volts
Plate Dissipation	7.5	Watts
Screen Dissipation	1.5	Watts
Typical Operation		
Class A_1 Amplifier		
Heater Voltage	12.6	Volts
Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid Voltage**	-12.5	Volts
Peak A-F Signal Voltage	12.5	Volts
Transconductance	3000	Micromhos
Plate Resistance, approximate	70000	Ohms
Zero Signal Plate Current	30	Milliamperes
Zero Signal Screen Current, Nominal	3.5	Milliamperes
Maximum-Signal Plate Current	32	Milliamperes
Maximum-Signal Screen Current, Nominal	5.5	Milliamperes
Load Resistance	7500	Ohms
Total Harmonic Distortion	7	Per Cent
Power Output	3.4	Watts
Vibration Output, maximum***	25	Millivolts

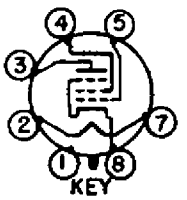
** The D-C resistance in the grid circuit, under rated maximum conditions, should not exceed 0.5 megohm for self-bias operation and 0.1 megohm for fixed bias operation.

*** RMS voltage measured across a load resistor of 2,000 ohms when tube is vibrated with a total sinusoidal motion of .08 inches at 25 cycles per second. Grid voltage = -22 volts. Average output is less than value shown.

TERMINAL CONNECTIONS

Pin 1 - Shell
Pin 2 - Heater
Pin 3 - Plate
Pin 4 - Grid #2
Pin 5 - Grid #1
Pin 7 - Heater
Pin 8 - Cathode and beam plates

BASING DIAGRAM



7AC

Electronics Department

G E N E R A L E L E C T R I C

Pliotron 5660--Preliminary Technical Information

The 5660 is a duplex-diode pentode similar to the 12C8 designed for reliable performance under conditions of severe vibration and intermittent operation.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode - Indirectly Heated

Heater Voltage (A-C or D-C)	12.6	Volts
Heater Current	0.150	Ampere

Mechanical Data

Envelope - MT-8
Cap - Miniature
Base - Small Wafer Octal 8-Pin
Mounting Position - Any

Direct Interelectrode Capacitances*		
Grid to Plate	0.005	Maximum uuf
Input	6	uuf
Output	9	uuf

* Shell connected to cathode.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Design Center		
Plate Voltage	300	Volts
Screen Supply Voltage	300	Volts
Screen Voltage	125	Volts
Plate Dissipation	2.25	Watts
Screen Dissipation	0.3	Watts
Minimum External Grid Bias Voltage	0	Volts
Maximum Diode Current per Plate for Continuous Operation	1.0	Milliamperes

Typical Operation		
Pentode Section: Class A_1 Amplifier		
Heater Voltage	12.6	Volts
Plate Voltage	250	Volts
Screen Voltage	125	Volts
Grid Voltage	-3	Volts
Plate Resistance, approximate	0.6	Megohm
Transconductance	1325	Micromhos

Typical Operation

Pentode Section: Class A_1 Amplifier

Plate Current	10	Milliamperes
Screen Current	2.3	Milliamperes
Grid Bias For Cathode Current Cut-Off, approximate	-21	Volts
Vibration Output, maximum**	25	Millivolts

Diode Sections:

Minimum Diode Current per Plate With 10 Volts D-C Applied	0.8	Milliamperes

** RMS voltage measured across a load resistor of 10,000 ohms when tube is vibrated with a total sinusoidal motion of .08 inches at 25 cycles per second. Average output is less than value shown.

TERMINAL CONNECTIONS

Pin 1 - Shell
Pin 2 - Heater
Pin 3 - Pentode Plate
Pin 4 - Diode Plate #2
Pin 5 - Diode Plate #1
Pin 6 - Grid #2
Pin 7 - Heater
Pin 8 - Cathode and Grid #3
Cap - Grid #1

BASING DIAGRAM



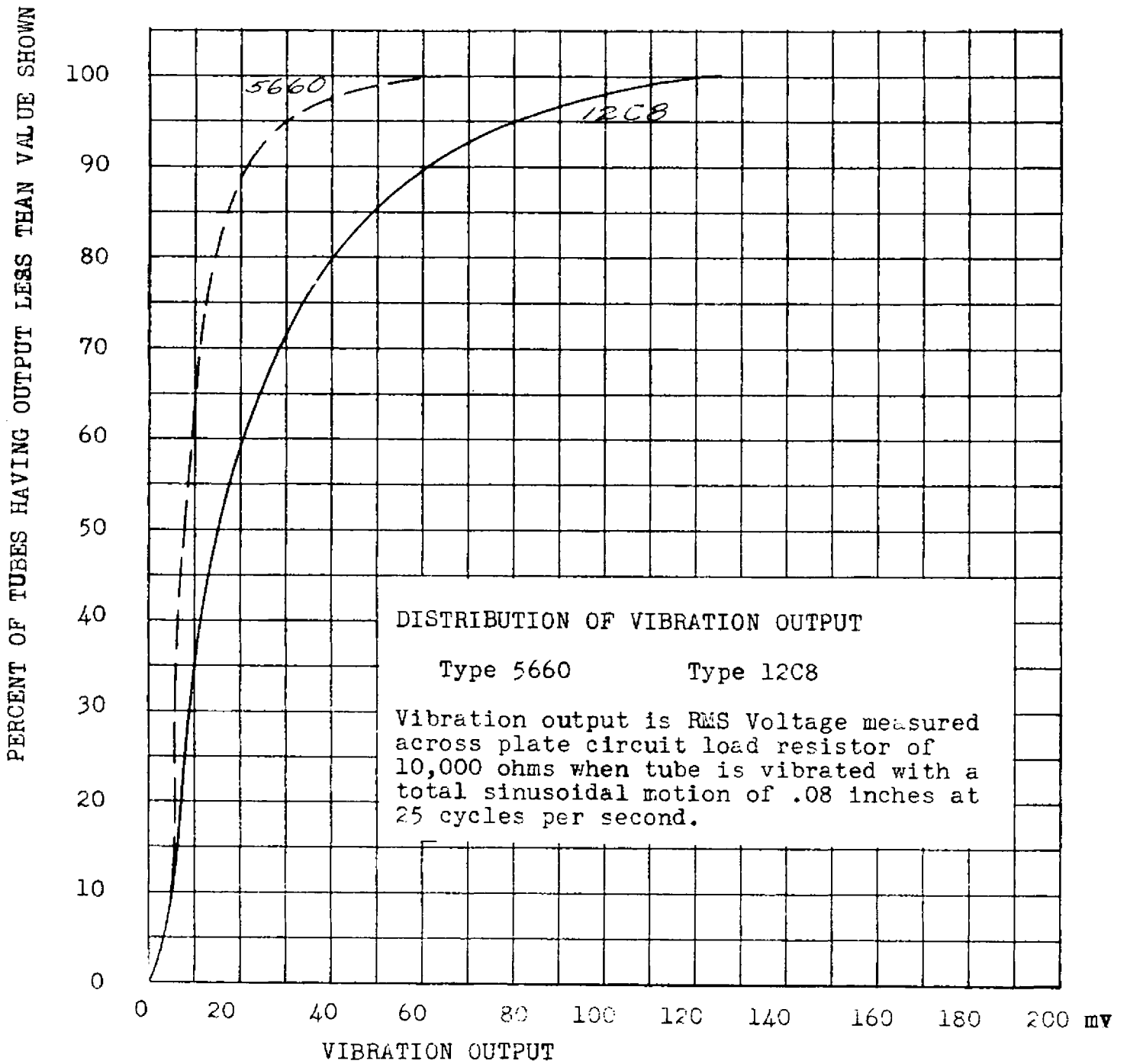
8E

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release 616A

February 10, 1948

VIBRATION OUTPUT



from RMA release # 616, Nov. 15, 1947

Electronics Department

G E N E R A L E L E C T R I C

Pliotron 5661--Preliminary Technical Information

The 5661 is a voltage amplifier pentode similar to the 12SK7 designed for reliable performance under conditions of severe vibration and intermittent operation.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode - Indirectly Heated

Heater Voltage (A-C or D-C)	12.6	Volts
Heater Current	0.150	Ampere

Mechanical Data

Envelope - MT-8
Base - Small Wafer Octal 8-Pin
Mounting Position - Any

Direct Interelectrode Capacitances*		
Grid to Plate	.003	Maximum uuf
Input	6.0	uuf
Output	7.0	uuf

* Shell connected to cathode.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Design Center		
Plate Voltage	300	Volts
Screen Supply Voltage	300	Volts
Screen Voltage	125	Volts
Plate Dissipation	4.0	Watts
Screen Dissipation	0.4	Watts
Minimum External Control Grid Bias Voltage	0	Volts

Typical Operation
Class A_1 Amplifier

Heater Voltage	12.6	12.6	Volts
Plate Voltage	100	250	Volts
Screen Voltage	100	100	Volts
Control Grid Voltage	-1	-3	Volts
Suppressor - Connected to Cathode at Socket			
Plate Resistance, approximate	0.12	0.8	Megohm
Transconductance	2350	2000	Micromhos
Control Grid Voltage for Transconductance = 10, approximate	-35	-35	Volts

Typical Operation
Class A_1 Amplifier (Cont'd)

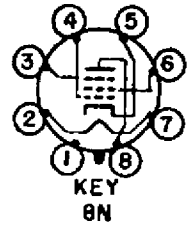
Plate Current	13	9.2	Milliamperes
Screen Current	4	2.6	Milliamperes
Vibration Output, maximum**	---	15	Millivolts

** RMS voltage measured across a load resistor of 2,000 ohms when tube is vibrated with a total sinusoidal motion of .08 inches at 25 cycles per second. Average output is less than value shown.

TERMINAL CONNECTIONS

Pin 1 - Shell and internal shield
Pin 2 - Heater
Pin 3 - Grid #3
Pin 4 - Grid #1
Pin 5 - Cathode
Pin 6 - Grid #2
Pin 7 - Heater
Pin 8 - Plate

BASING DIAGRAM

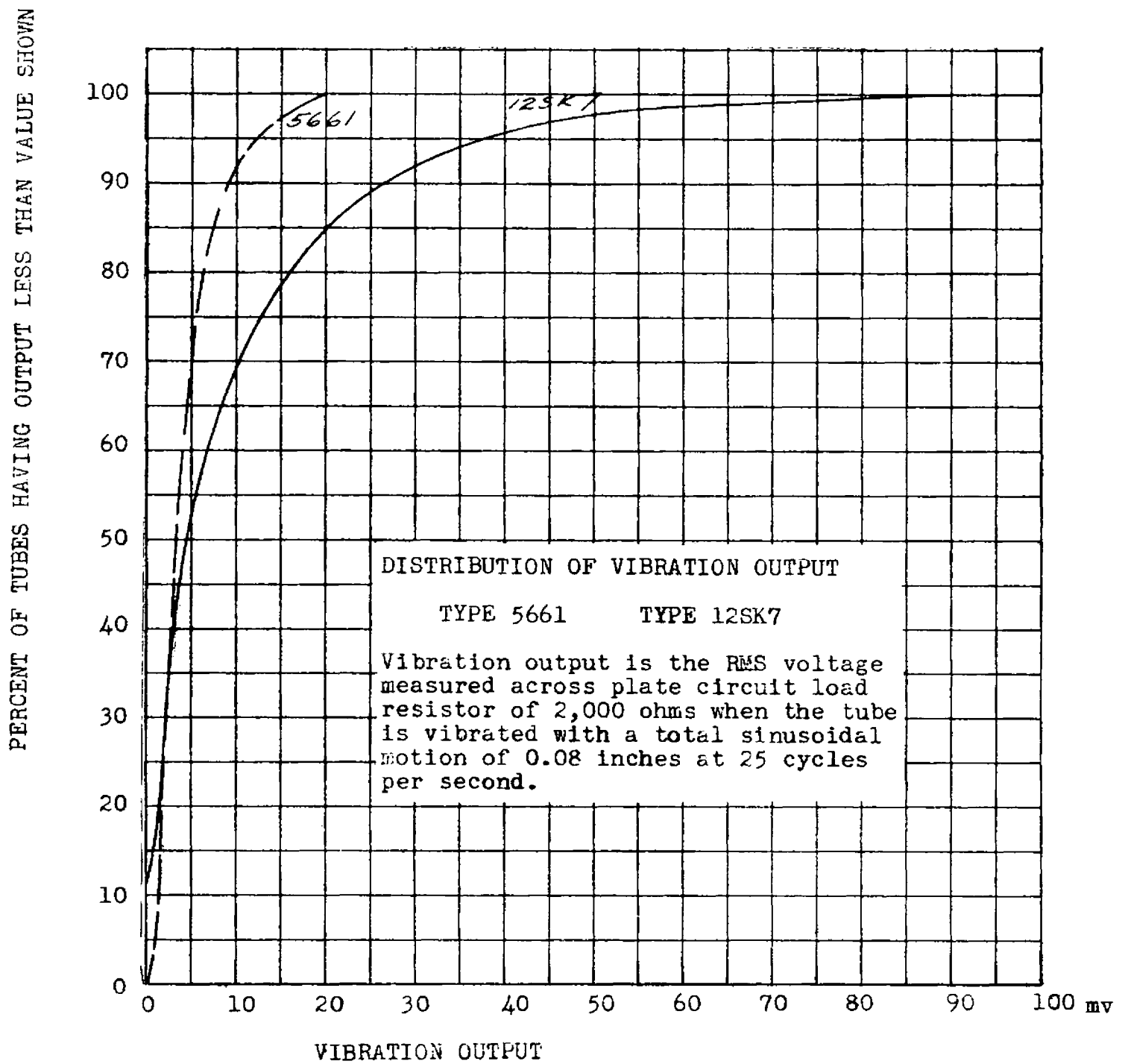


RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

Release 616A

February 10, 1948

VIBRATION OUTPUT



Electronic TUBES

5670
TWIN TRIODE
Five-Star Tube
★ ★ ★ ★ ★

FOR GENERAL-PURPOSE APPLICATIONS

MEDIUM MU
9-PIN MINIATURE
SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING
HIGH TRANSCONDUCTANCE

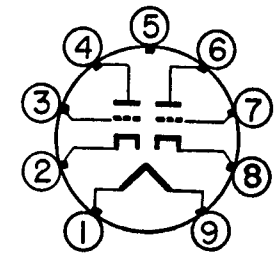
DESCRIPTION AND RATING

The 5670 is a miniature medium-mu twin triode each section of which has a separate cathode connection. The tube is suited for use in a wide-variety of general-purpose amplifier and mixer circuits as well as numerous multivibrator and oscillator applications. The useful operating range extends from low frequencies through the VHF region.

The 5670 is a special-quality tube intended for use in critical industrial and military applications in which operational dependability is of primary importance. Features of the tube include a high degree of mechanical strength and a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

Analysis of the electrical characteristics of this tube with those of the 2C51 will indicate that the 5670 is essentially similar.

BASING DIAGRAM

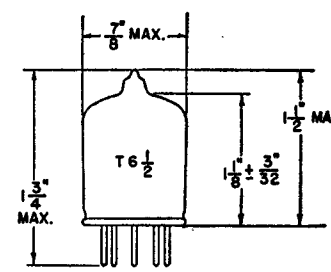


RETMA 8CJ

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—Cathode (Section 2)
Pin 3—Grid (Section 2)
Pin 4—Plate (Section 2)
Pin 5—Internal Shield†
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Heater
† It is recommended that Pin 5 be grounded.

PHYSICAL DIMENSIONS



RETMA 6-1

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.35	Amperes
Direct Interelectrode Capacitances*		
Grid to Plate, Each Section	1.1	μμf
Input, Each Section	2.2	μμf
Output, Each Section	1.0	μμf
Grid to Grid	0.0017	μμf
Plate to Plate	0.05	μμf

* Without external shield.

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

GENERAL ELECTRIC

Supersedes ET-T1083 dated 8-54

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES, EACH SECTION

Plate Voltage	330 Volts
Positive DC Grid Voltage	0 Volts
Negative DC Grid Voltage	−55 Volts
Plate Dissipation	1.35 Watts
DC Grid Current	3.0 Milliamperes
DC Cathode Current	18 Milliamperes
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	100 Volts
Heater Negative with Respect to Cathode	100 Volts
Grid Circuit Resistance	0.5 Megohms
Bulb Temperature at Hottest Point	165 C

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	150 Volts
Cathode-Bias Resistor	240 Ohms
Amplification Factor	35
Plate Resistance, approximate	6400 Ohms
Transconductance	5500 Micromhos
Plate Current	8.2 Milliamperes
Grid Voltage, approximate	
Ib = 10 Microamperes	−8 Volts

PUSH-PULL CLASS AB_1 AMPLIFIER

Plate Voltage	300 Volts
Cathode-Bias Resistor	800 Ohms
AF Grid-to-Grid Voltage, RMS	14 Volts
Zero-Signal Plate Current, Each Section	4.9 Milliamperes
Maximum-Signal Plate Current, Each Section	6.3 Milliamperes
Effective Load Impedance, Plate-to-Plate	27,000 Ohms
Total Harmonic Distortion, approximate	10 Percent
Maximum-Signal Power Output	1.0 Watts

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

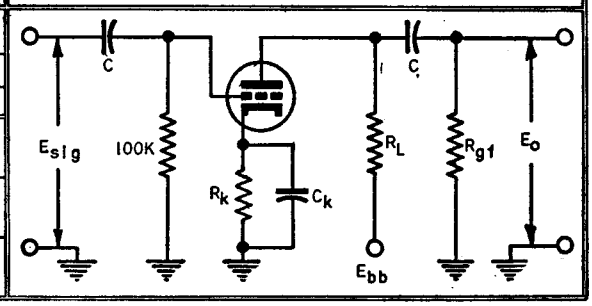
R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2000	5.7	20	1200	15	24	900	28	26
0.10	0.24	2400	8.2	21	1500	21	25	1300	37	27
0.24	0.24	4900	7.4	21	3400	18	23	3000	33	25
0.24	0.51	5700	9.7	21	4300	23	24	4200	41	25
0.51	0.51	11000	8.5	20	7800	20	22	7600	36	24
0.51	1.0	13000	10	21	9600	26	23	9200	46	24

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2600	9.2	20	1500	21	23	1100	38	26
0.10	0.24	3200	12	20	2000	29	24	1500	51	26
0.24	0.24	6200	11	20	4100	25	23	3200	45	24
0.24	0.51	7500	14	21	5000	32	23	4300	55	25
0.51	0.51	13000	12	20	8800	28	22	7100	48	24
0.51	1.0	15000	15	20	11000	34	22	9700	59	24

Notes:

1. E_o is maximum RMS voltage output for approximately five percent total harmonic distortion.
2. Gain is measured for an output voltage of two volts RMS.
3. R_k is in ohms; R_L and R_{gf} are in megohms.
4. Coupling capacitors (C) should be selected to give desired frequency response. R_k should be adequately by-passed.



CHARACTERISTICS LIMITS

		Minimum	Maximum	
Heater Current				
Ef = 6.3 volts	Initial	330	370	Milliamperes
	500 Hr	330	370	Milliamperes
	1000 Hr	330	370	Milliamperes
Plate Current, Each Section				
Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, (bypassed)	Initial	5.9	10.5	Milliamperes
Plate Current Difference between Sections				
Difference between plate currents for each section at Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, (bypassed)	Initial	....	1.8	Milliamperes
Transconductance (1), Each Section				
Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, (bypassed)	Initial	4500	6500	Micromhos
Transconductance Change with Heater Voltage, Each Section				
Difference between Transconductance (1), and Transconductance at Ef = 5.7 volts (other conditions the same) expressed as a percentage of Transconductance (1)	Initial	....	15	Percent
	500 Hr	....	15	Percent
Transconductance Change with Operation, Each Section				
Difference between Transconductance (1) initially and after operation expressed as a percentage of initial value	500 Hr	....	20	Percent
	1000 Hr	....	25	Percent
Average Transconductance Change with Operation, Each Section				
Average of values for "Transconductance Change with Operation"	500 Hr	....	15	Percent
Amplification Factor, Each Section				
Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, (bypassed)	Initial	26	44	
Plate Current Cutoff (1), Each Section				
Ef = 6.3 volts, Ebb = 150 volts, Ec = −10 volts, R_L = 0.25 meg	Initial	....	45	Microamperes
Plate Current Cutoff (2), Each Section				
Ef = 6.3 volts, Eb = 150 volts, Ec = 4.0 volts	Initial	5.0	....	Microamperes
Interelectrode Capacitances				
Grid to Plate (g to p), Each Section	Initial	0.8	1.4	μμf
Input (g to k+h), Each Section	Initial	1.7	2.7	μμf
Output (p to k+h), Each Section	Initial	0.7	1.3	μμf
Plate to Plate (p to p)	Initial	....	0.1	μμf
Measured without external shield.				
Negative Grid Current, Each Section				
Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, (bypassed) Rg = 0.5 meg.	Initial	0	0.3	Microamperes
	500 Hr	0	0.3	Microamperes
	1000 Hr	0	0.3	Microamperes
Heater-Cathode Leakage Current, Each Section				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	Initial	....	7.0	Microamperes
	500 Hr	....	7.0	Microamperes
	1000 Hr	....	7.0	Microamperes
Heater Negative with Respect to Cathode	Initial	....	7.0	Microamperes
	500 Hr	....	7.0	Microamperes
	1000 Hr	....	7.0	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid (Each Section) to All at 100 Volts DC	Initial	100	....	Megohms
	500 Hr	50	....	Megohms
Plate (Each Section) to All at 300 Volts DC	Initial	100	....	Megohms
	500 Hr	50	....	Megohms

CHARACTERISTICS LIMITS CONTINUED ON PAGE 4

CHARACTERISTICS LIMITS (Cont'd)

		Minimum	Maximum	
Vibrational Noise Output Voltage, RMS Ef = 6.3 volts, Ebb = 150 volts, Ec = −3.0 volts, R_L = 2000 ohms, vibrational acceleration = 2.5 G at 25 cps. Sections in parallel	Initial	....	100	Millivolts
Grid Emission Current, Each Section Ef = 7.5 volts, Eb = 150 volts, Ecc = −10 volts, Rg = 0.5 meg	Initial	0	0.5	Microamperes

The indicated 500-hour and 1000-hour values are life-test end points for the following conditions of operation for each section: Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, Rg = 0.5 meg, Ehk = 135 volts with heater positive with respect to cathode, and bulb temperature = 165 C minimum.

SPECIAL TESTS AND RATINGS

Stability Life Test
Statistical sample operated for one hour to evaluate and control initial variations in transconductance.

Survival Rate Life Test
Statistical sample operated for one hundred hours to evaluate and control early-life electrical and mechanical inoperatives.

Heater-Cycling Life Test
Statistical sample operated for 2000 cycles to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.5 volts cycled for one minute on and one minute off, Eb = Ec = 0 volts, and Ehk = 135 volts with heater positive with respect to cathode.

Shock Rating—600 G
Statistical sample subjected to five impact accelerations of 600 G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

Fatigue Rating—2.5 G
Statistical sample subjected to vibrational acceleration of 2.5 G for 32 hours minimum in each of three different positions. The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

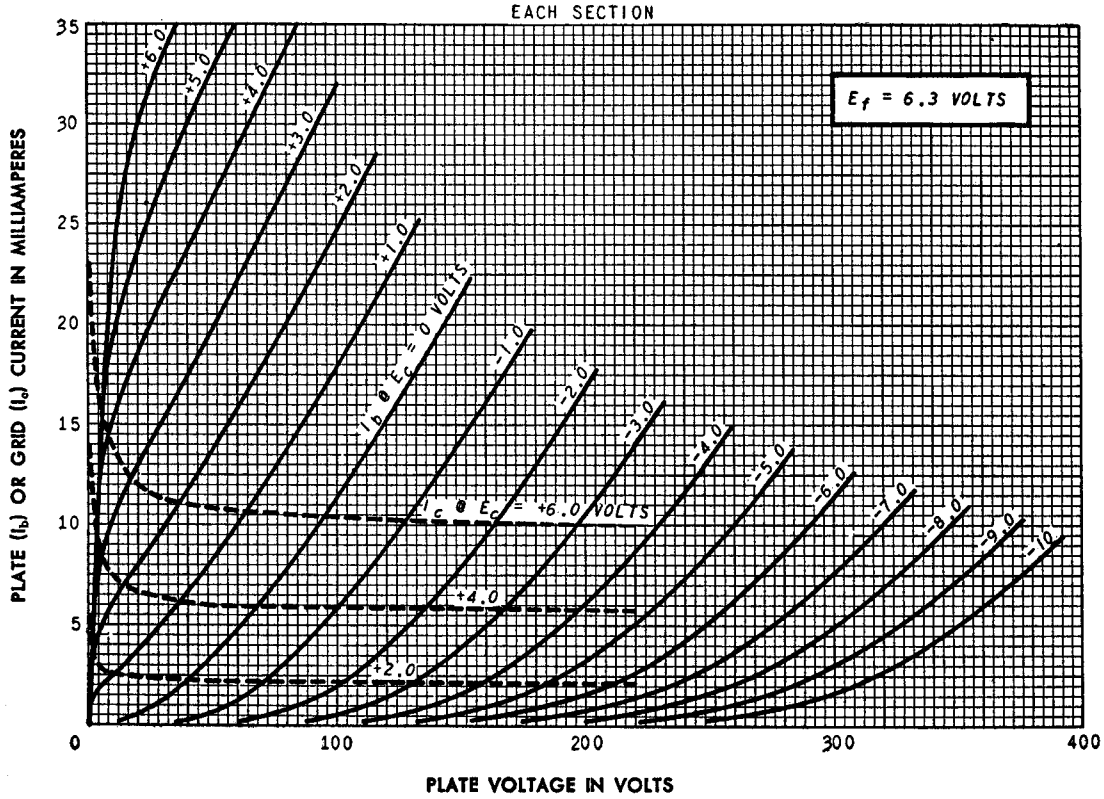
Altitude Rating—60,000 Feet
Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

In the design of military equipment employing this tube, reference should be made to the appropriate MIL-E-1C specification.

AVERAGE PLATE CHARACTERISTICS

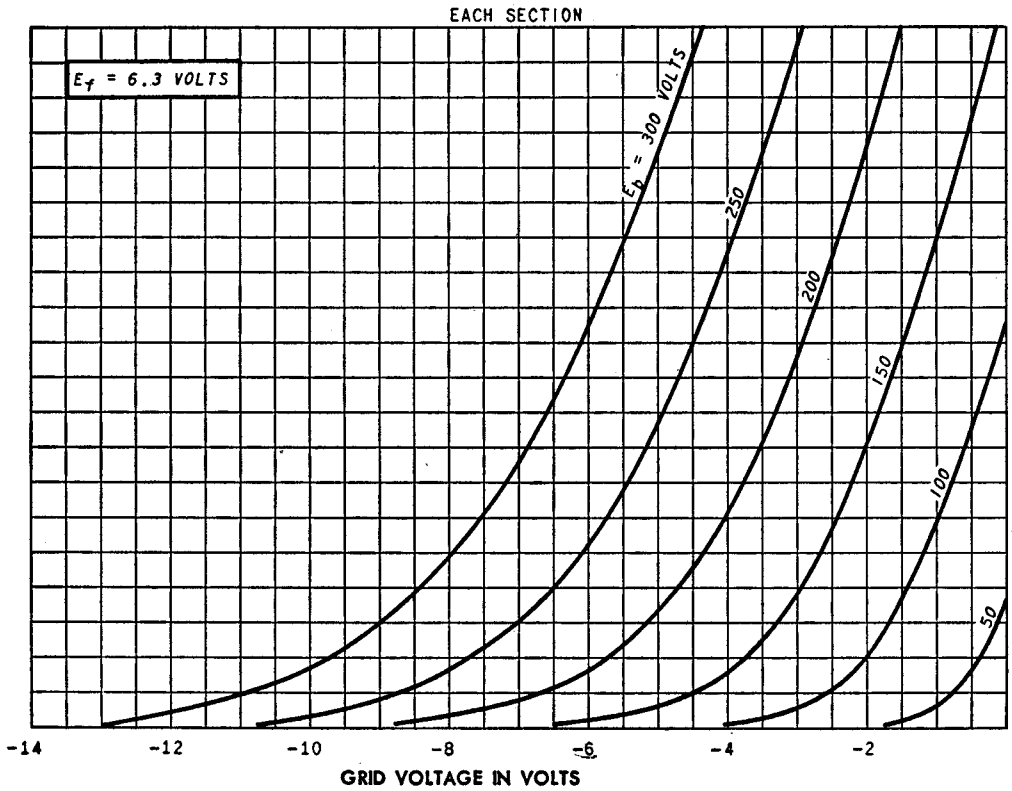
EACH SECTION



APRIL 10, 1953

AVERAGE TRANSFER CHARACTERISTICS

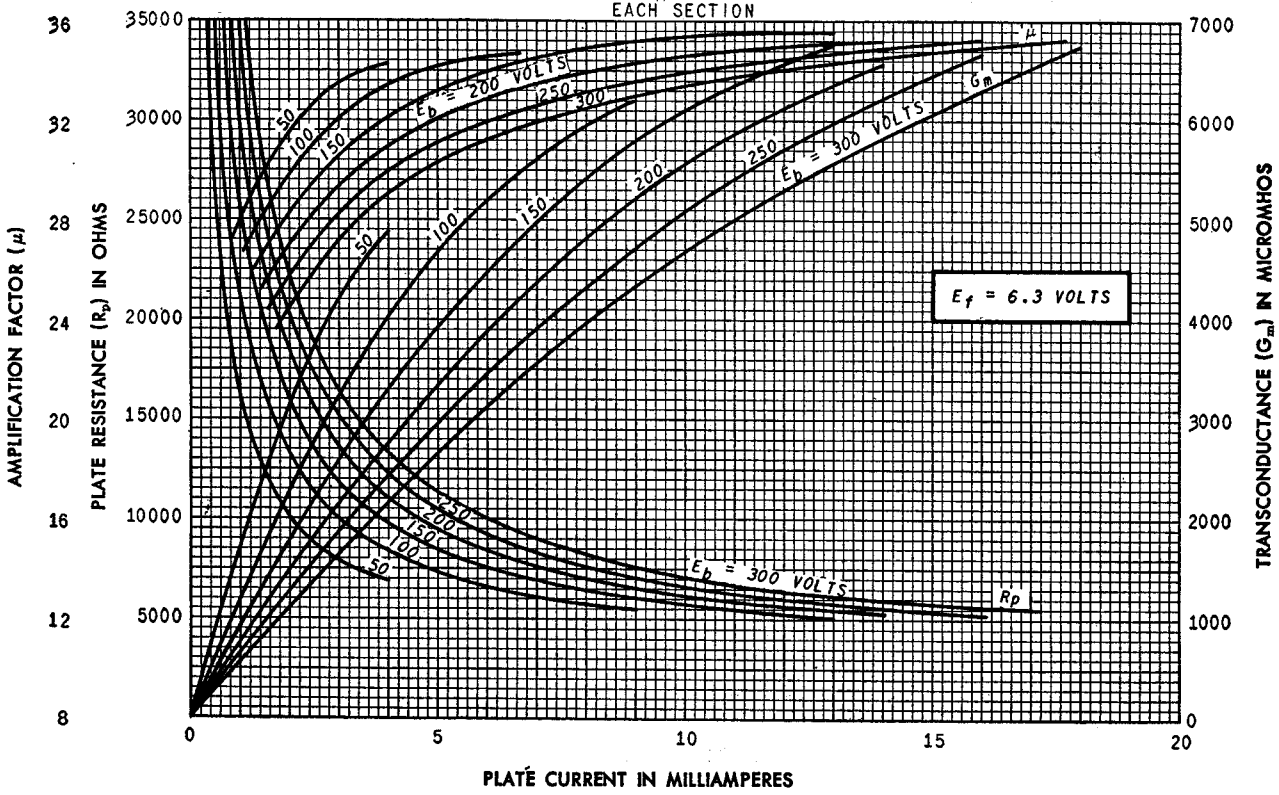
EACH SECTION



APRIL 10, 1953

AVERAGE CHARACTERISTICS

EACH SECTION

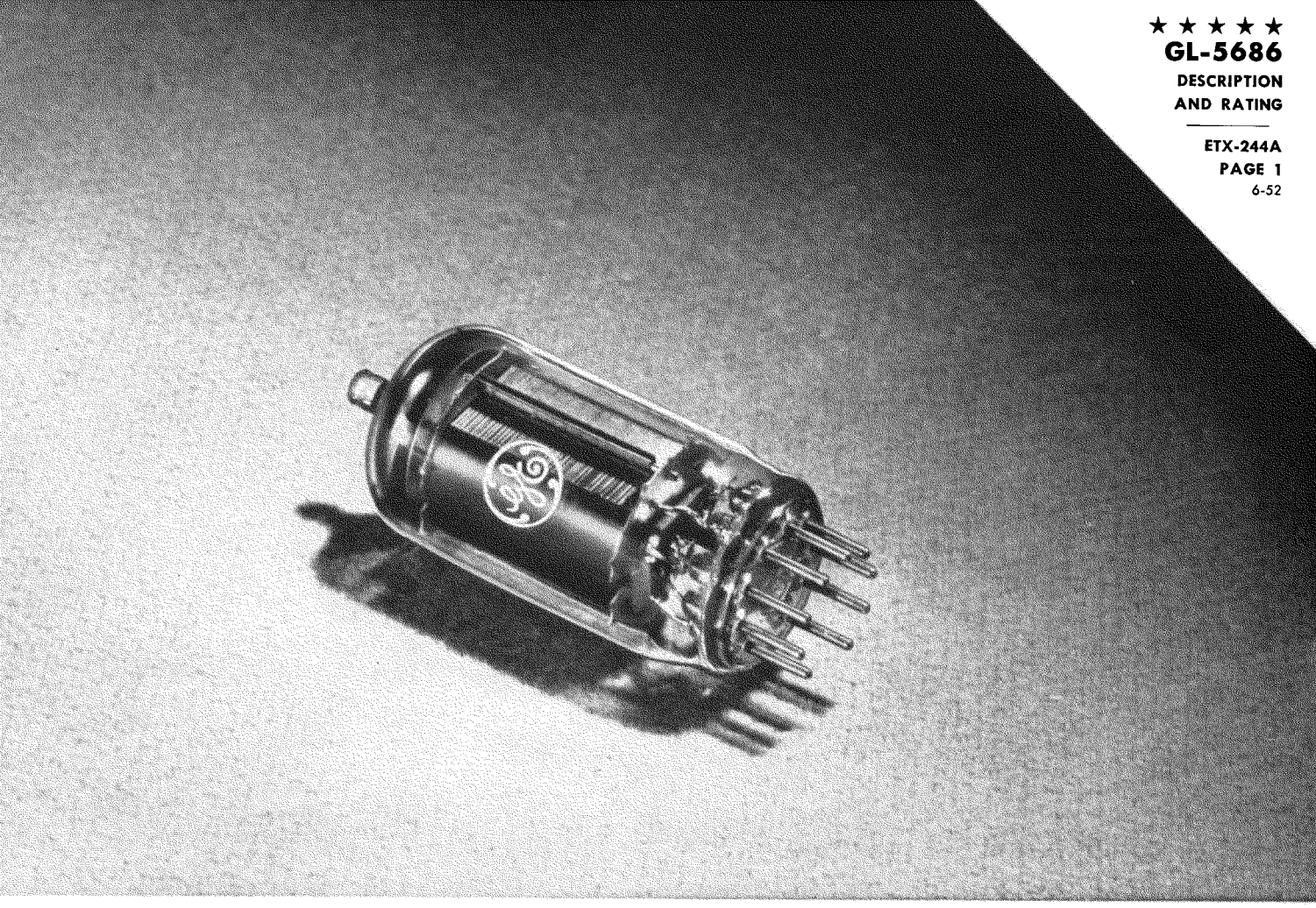


OCTOBER 9, 1953

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.



BEAM POWER AMPLIFIER

DESCRIPTION

The GL-5686 is a heater-cathode type miniature beam power amplifier designed for dependable operation under service conditions encountered in mobile and aircraft use. The tube is suitable for Class A audio power-amplifier service or for Class C radio-frequency power-amplifier service up to 160 megacycles. Multiple leads on the cathode and screen grid facilitate radio-frequency by-passing at high frequencies.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode—indirectly heated			
Heater voltage		6.3	volts
Heater current		0.35	ampere
Direct interelectrode capacitances	**With Shield**	**Without Shield**	
Grid No. 1 to plate	0.08 max	0.11 max	uuf
Input	6.5	6.4	uuf
Output	8.5	4.0	uuf

GE Electronic TUBE

GENERAL ELECTRIC

Supersedes ETX-244 dated 5-50

TECHNICAL INFORMATION (CONT'D)

Mechanical Data

Mounting position—any
Envelope—T-6½ glass
Base—Miniature button 9-pin

MAXIMUM RATINGS Design Center Values

CLASS A_1 AMPLIFIER

Plate voltage	250	volts
Grid No. 2 voltage	250	volts
Plate dissipation	7.5	watts
Grid No. 2 dissipation	3.0	watts
Grid No. 1 circuit resistance		
Fixed bias	0.1	megohm
Self bias	0.5	megohm
Peak heater-cathode voltage	±90	volts

TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate voltage	250	volts
Grid No. 2 voltage	250	volts
Grid No. 1 voltage	−12.5	volts
Transconductance	3100	micromhos
Plate current (no signal)	27	milliamperes
Grid No. 2 current (no signal)	5.0	milliamperes
Load resistance	9000	ohms
Power output	2.7	watts

MAXIMUM RATINGS Design Center Values

CLASS C RADIO-FREQUENCY AMPLIFIER

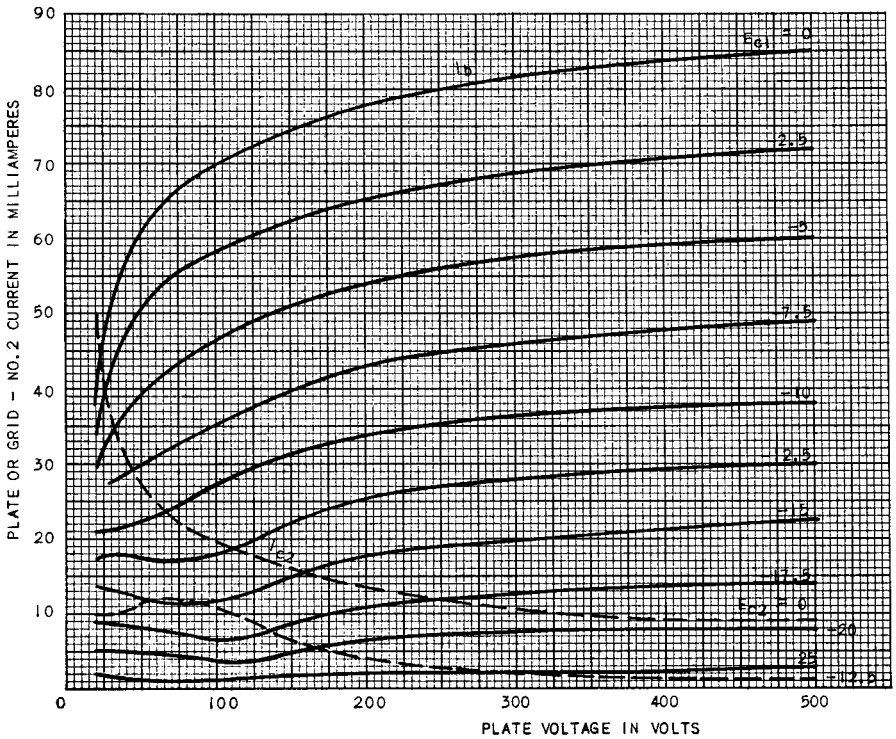
Plate voltage	250	volts
Grid No. 2 voltage	250	volts
Grid No. 1 voltage	−150	volts
Plate Dissipation	7.5	watts
Grid No. 2 dissipation	3.0	watts
Plate input power	10	watts
Plate current	40	milliamperes
Grid No. 2 current	15	milliamperes
Grid No. 1 current	3.0	milliamperes
Peak heater-cathode voltage	±90	volts
Grid No. 1 circuit resistance	50,000	ohms

TYPICAL OPERATION

CLASS C TELEGRAPHY RADIO-FREQUENCY AMPLIFIER UP TO 160 MEGACYCLES

Plate voltage	250	250	volts
Grid No. 2 voltage	180	250	volts
Grid No. 1 voltage	−30	−50	volts
or Grid No. 1 resistor	15,000	25,000	ohms
Peak R-f grid No. 1 voltage	50	75	volts
Plate current	30	40	milliamperes
Grid No. 2 current, approximate	6.5	10.5	milliamperes
Grid No. 1 current, approximate	2.0	2.0	milliamperes
R-f grid driving power, approximate	0.10	0.15	watts
Power output, approximate	5.0	6.5	watts
Useful power output at 125 megacycles		5.25	watts

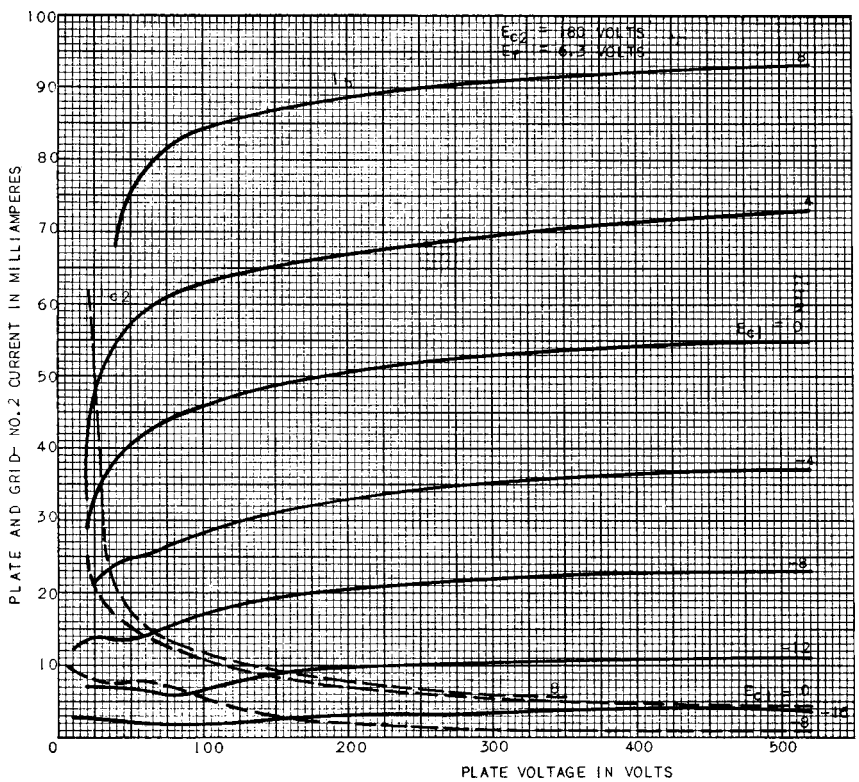
GL-5686
AVERAGE PLATE CHARACTERISTICS
E_{c2} = 250 VOLTS
E_f = 6.3 VOLTS



K-69087-72A364

3-31-50

GL-5686
AVERAGE PLATE CHARACTERISTICS
E_{c2} = 180 VOLTS
E_f = 6.3 VOLTS



K-69087-72A365

3-31-50

★ ★ ★ ★ ★

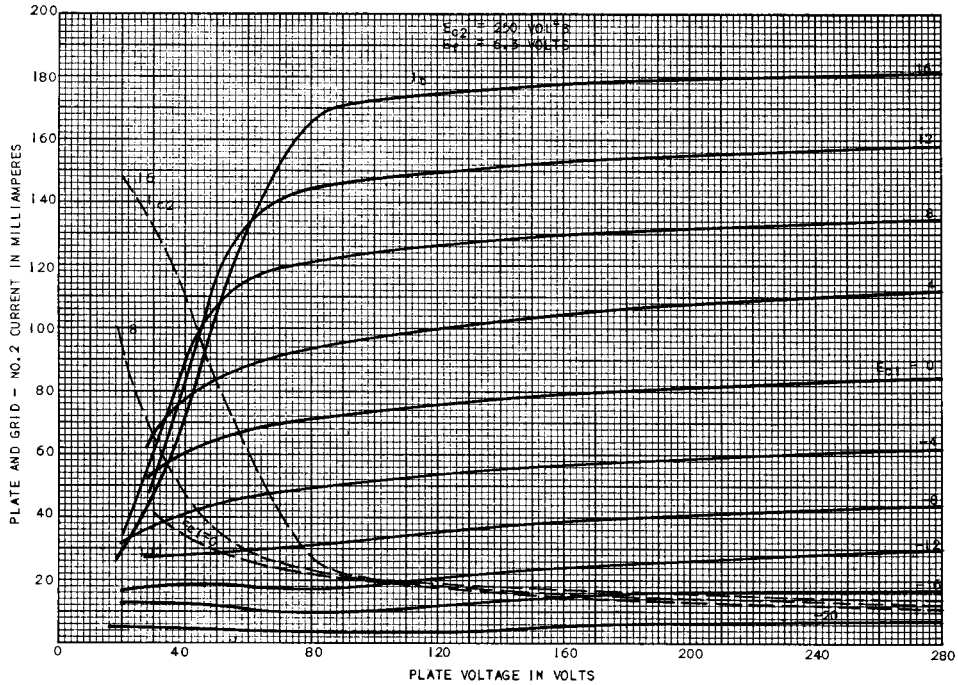
GL-5686

ETX-244A

PAGE 4

6-52

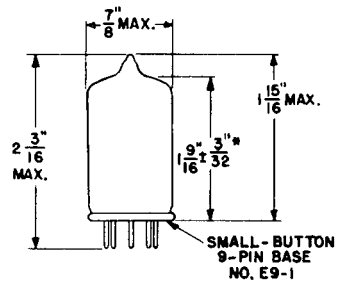
GL-5686
AVERAGE PLATE CHARACTERISTICS
E_{c2} = 250 VOLTS E_f = 6.3 VOLTS



K-69087-72A366

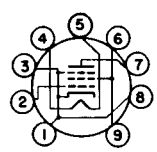
3-31-50

OUTLINE GL-5686



*MEASURED FROM BASE SEAT TO BULB-TOP LINE AS DETERMINED BY RING GAGE OF 7/16" I.D.

BASING DIAGRAM



PIN 1: CATHODE AND GRID NO. 3
PIN 2: GRID NO. 1
PIN 3: CATHODE AND GRID NO. 3
PIN 4: HEATER
PIN 5: HEATER
PIN 6: GRID NO. 2
PIN 7: PLATE
PIN 8: CATHODE AND GRID NO. 3
PIN 9: GRID NO. 2

N-15172AZ

2-21-50

Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.

6-52 (25M)

ELECTRONICS DEPARTMENT

GENERAL ELECTRIC

Transmitting Tube 5710--Description and Rating

The 5710 is a three-electrode tube designed for use as a Class C radio-frequency pulse amplifier and oscillator. The anode is forced-air-cooled. The cathode is a thoriated-tungsten filament. Maximum ratings apply up to a frequency of 20 megacycles.

TECHNICAL INFORMATION

GENERAL

Electrical Data	Minimum	Bogey	Maximum	
Filament Voltage*	---	10	10.5	Volts
Filament Current at Bogey Voltage	400	420	440	Amperes
Filament Starting Current	---	---	630	Amperes
Filament Cold Resistance	0.002	---	---	Ohms
Amplification Factor, I_b = 0.5 amp, E_c = -70 volts	---	95	---	
Grid Plate Transconductance, I_b = 0.5 amp, E_c = -70 volts	---	14500	---	Micromhos
Interelectrode Capacitances				
Grid-Plate	31	36	41	uuf
Grid-Filament	56	66	76	uuf
Plate-Filament	---	---	1.0	uuf

Mechanical Data

Mounting Position - Vertical, Anode Down				
Type of Cooling - Forced Air				
Maximum Incoming Air Temperature			45	C

Required Air Flow on Anode

Plate Dissipation - Kilowatts	5	4	3
Air Flow - Cubic Feet per Minute	450	400	350
Static Pressure - Inches of Water	1.5	1.0	0.8

Required Air Flow		
Filament and Grid Seals, Air Directed Downward from a 4-inch Diameter Nozzle	200	CFM
Maximum Glass Temperature	150	C
Net Weight, approximate	40	Pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Grid-pulsed Radio-frequency Amplifier and Oscillator - Class C

Maximum Ratings, Absolute Values		
D-C Plate Voltage	20,000 max	Volts
D-C Grid Voltage	-1,000 max	Volts
Peak Plate Current	300 max	Amperes
D-C Grid Current, average	0.10 max	Ampere
Peak Grid Current	150 max	Amperes
Peak Cathode Current	400 max	Amperes
Duty	0.004 max	
Pulse Width	100 max	Microseconds
Plate Dissipation, average	5,000 max	Watts

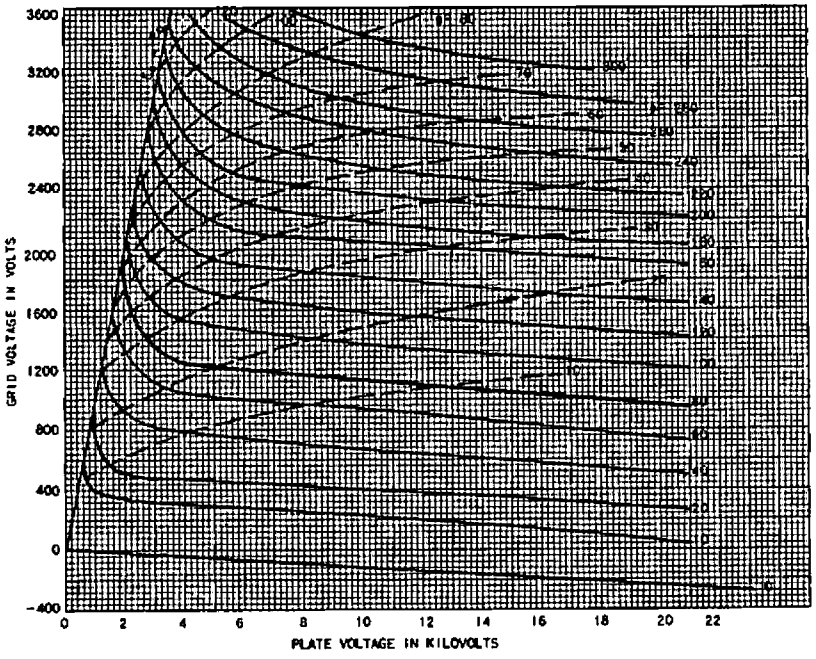
* The filament supply should be continuously variable. It is recommended that the filament voltage be increased gradually during starting.

from RMA release # 658, May 5, 1948

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS (CONTINUED)

Grid-pulsed Radio-frequency Amplifier and Oscillator - Class C (Continued)

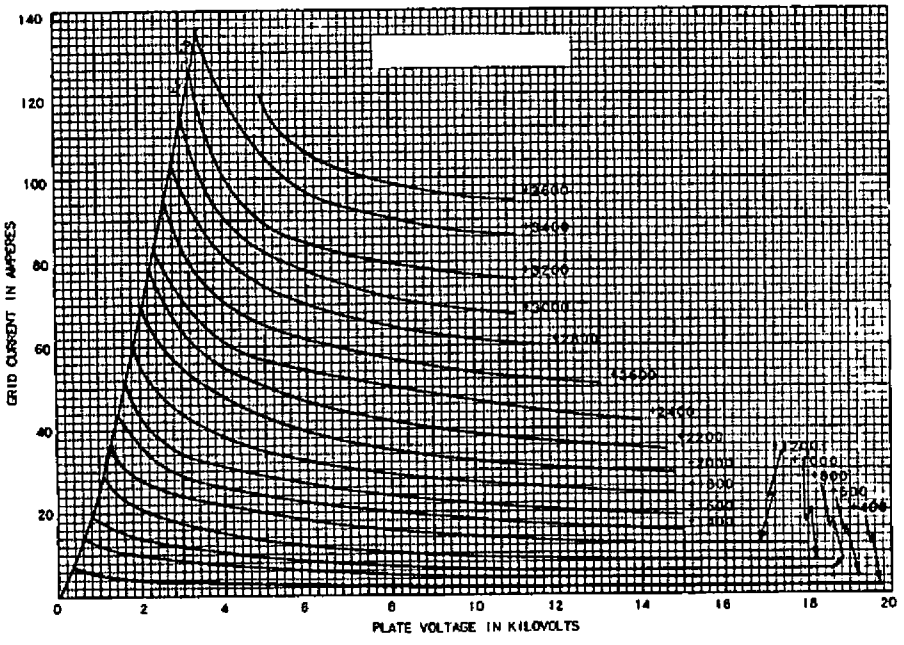
Typical Operation		
D-C Plate Voltage	17,500	Volts
D-C Grid Voltage	-400	Volts
Peak R-F Grid Voltage	3,700	Volts
Peak Plate Current	240	Amperes
Peak Grid Current	110	Amperes
Peak Driving Power, approximate	80	Kilowatts
Peak Power Output, approximate	825	Kilowatts



K-69087-72A190 March 3, 1948

5710

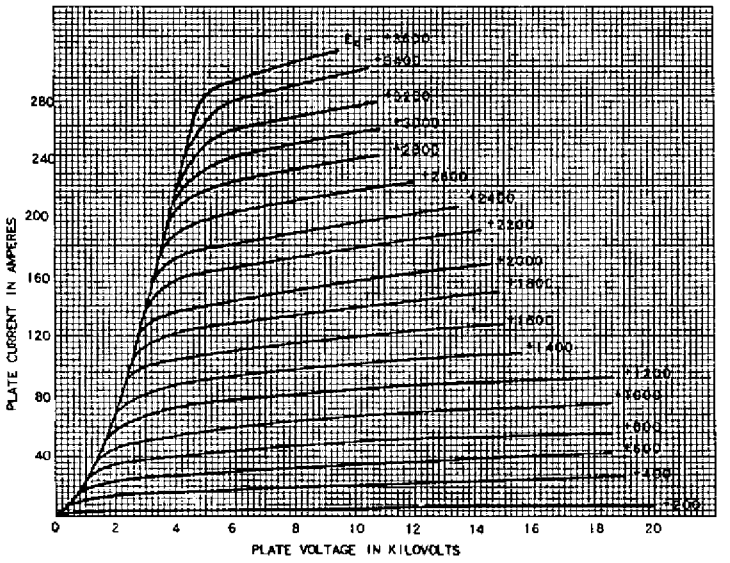
Constant Current Characteristics



K-69087-72A191 March 3, 1948

5710

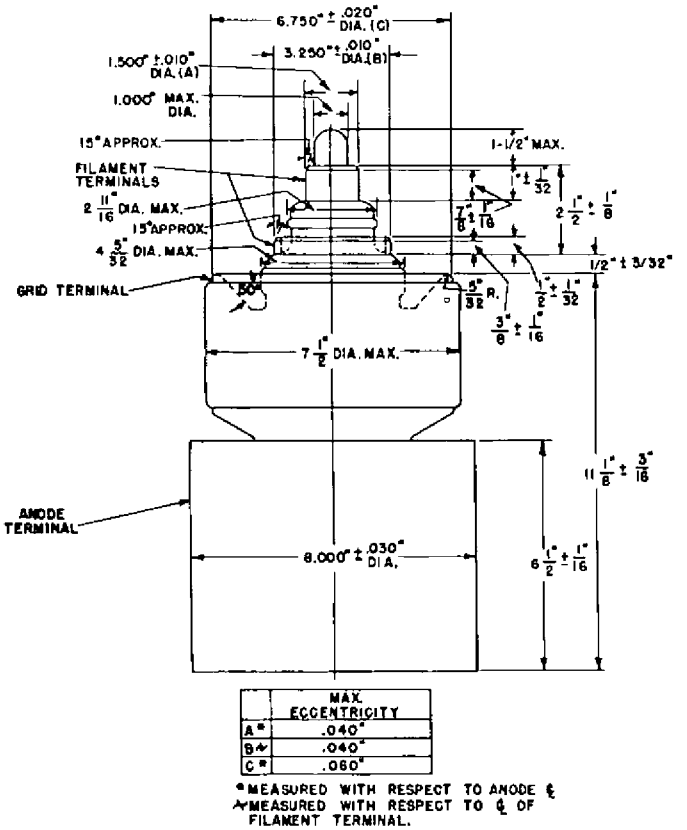
Grid Characteristics



K-690?7-72A192 March 3, 1948

5710

Plate Characteristics



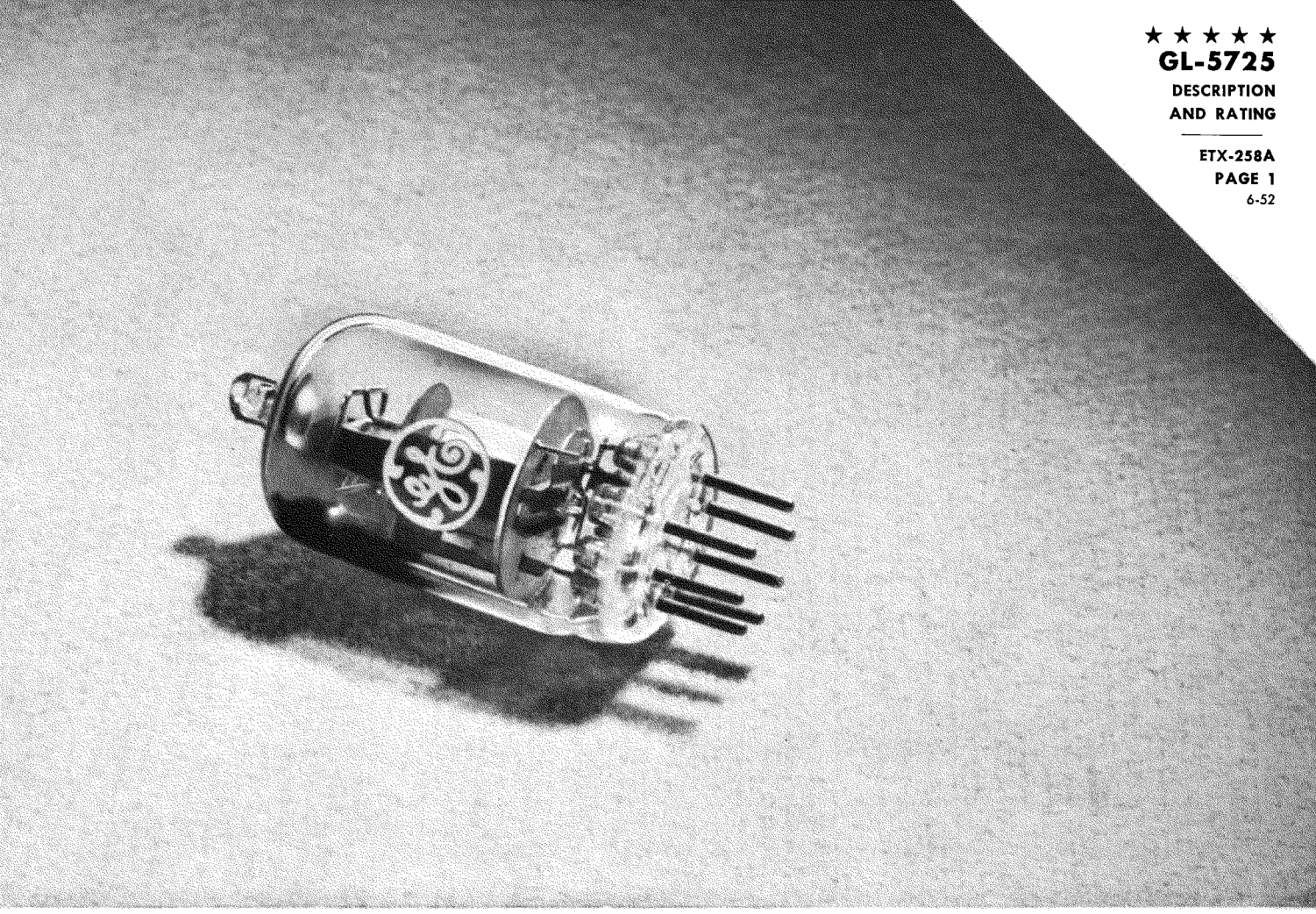
	MAX. ECCENTRICITY
A*	.040"
B*	.040"
C*	.060"

*MEASURED WITH RESPECT TO ANODE ℄
*MEASURED WITH RESPECT TO ℄ OF FILAMENT TERMINAL.

N-20716AZ March 2, 1948

Outline

5710



PENTODE

DESCRIPTION

The GL-5725 is a miniature, dual-control, radio-frequency pentode designed for dependable operation under conditions encountered in mobile and aircraft service. The control grid and the suppressor grid can be used as independent control elements. The tube is suitable for use in gated or gain-controlled amplifiers, and in delay or mixer circuits.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode—Indirectly Heated		
Heater Voltage (A-C or D-C)	6.3	Volts
Heater Current (Nominal)	0.175	Ampere
Direct Interelectrode Capacitances*		
Grid No. 1 to Plate	0.01	uuf
Grid No. 1 to All Other Electrodes Except Plate	3.9	uuf
Plate to All Other Electrodes Except Grid No. 1	3.0	uuf
Grid No. 1 to Grid No. 3	0.1	uuf

GE Electronic TUBE

GENERAL ELECTRIC

Supersedes ETX-258 dated 6-50

TECHNICAL INFORMATION (CONT'D)

Mechanical Data

Mounting position—any
Envelope—T-5½ glass
Base—Miniature button 7-pin, E7-1

MAXIMUM RATINGS, Design Center Values

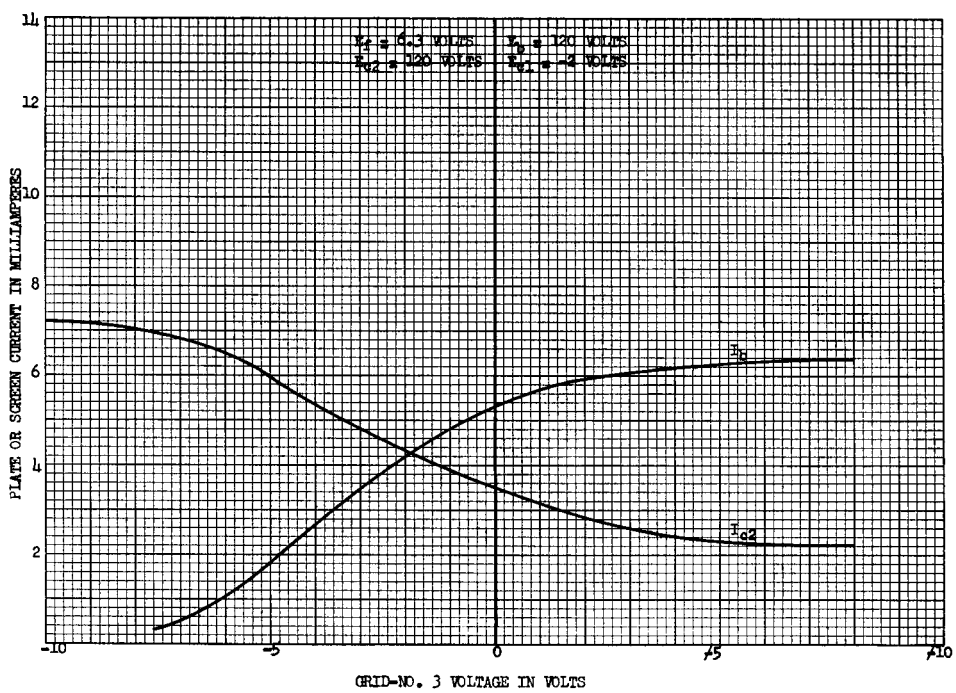
Plate voltage	180	volts
Grid No. 2 voltage	140	volts
Grid No. 3 voltage	27	volts
Plate dissipation	1.7	watts
Grid No. 2 dissipation	0.75	watt
Cathode current	18	milliamperes
Heater-cathode voltage	90	volts
Bulb temperature	120	C

TYPICAL OPERATION

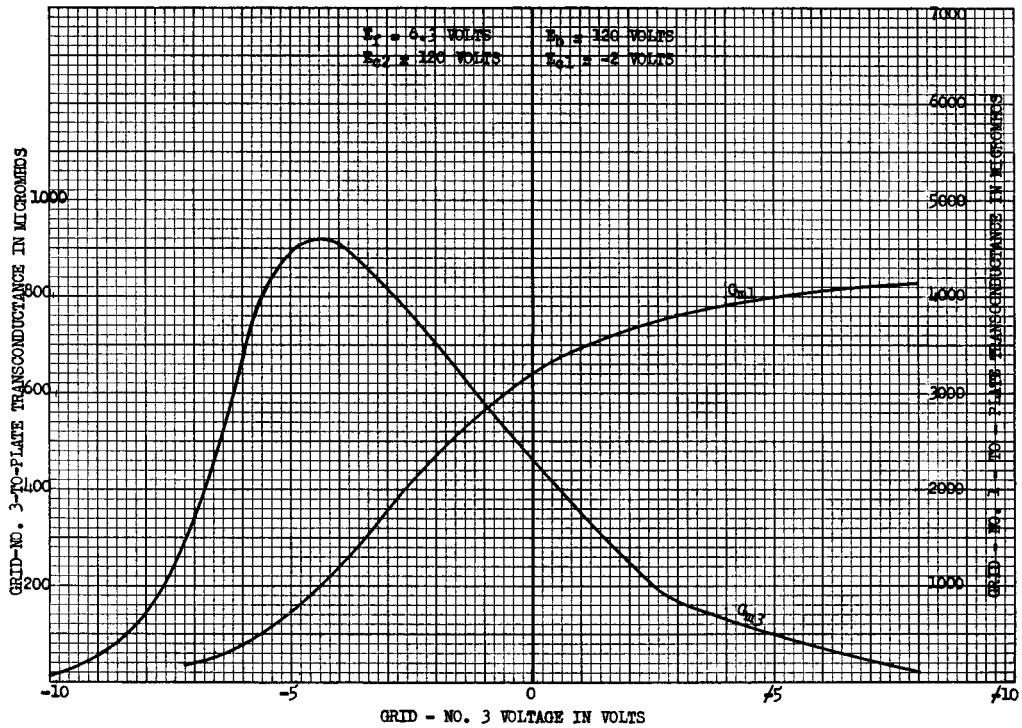
Plate voltage	120	volts
Grid No. 3 voltage	0	volts
Grid No. 2 voltage	120	volts
Grid No. 1 voltage	−2	volts
Plate current	5.2	milliamperes
Grid No. 2 current	3.5	milliamperes
Transconductance		
Grid No. 1 to plate	3200	micromhos
Grid No. 3 to plate	470	micromhos
Heater cycles of intermittent operation, minimum**	5000	cycles

*With external shield.
**The 5725 heater is designed to withstand at least 5000 cycles of intermittent operation at 7.5 volts.

AVERAGE CHARACTERISTICS

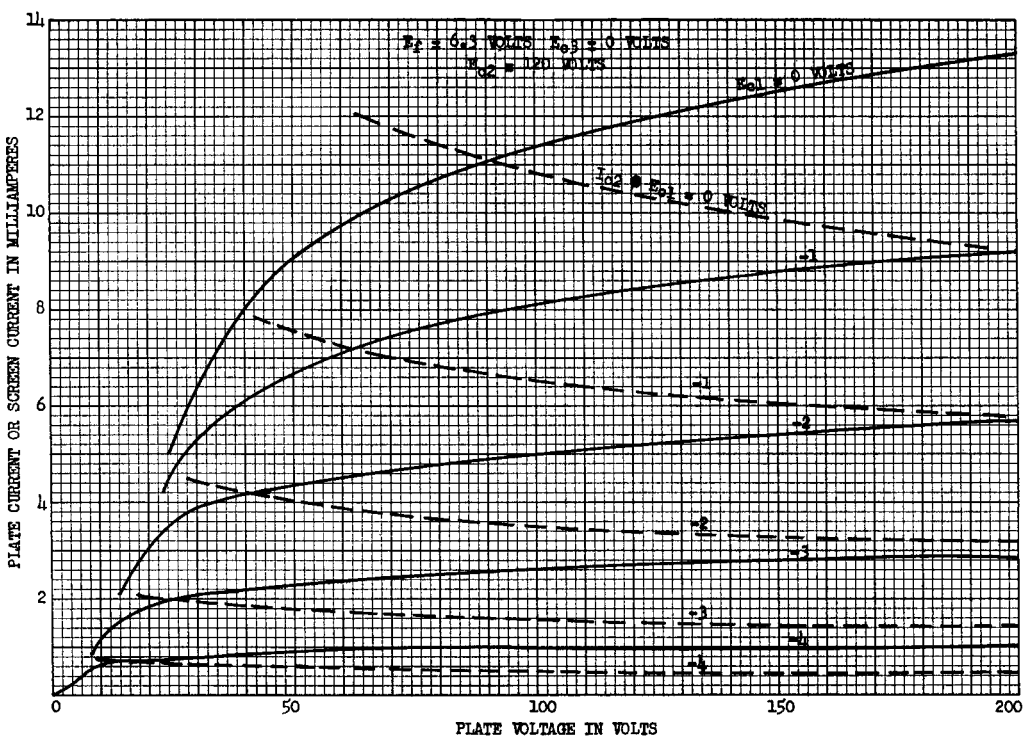


AVERAGE CHARACTERISTICS



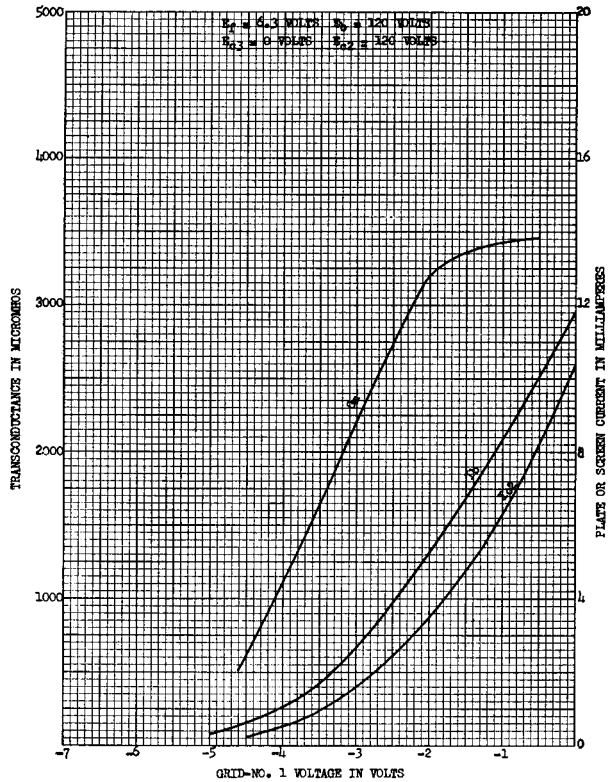
K-69087-72A472 7-19-51

AVERAGE PLATE CHARACTERISTICS



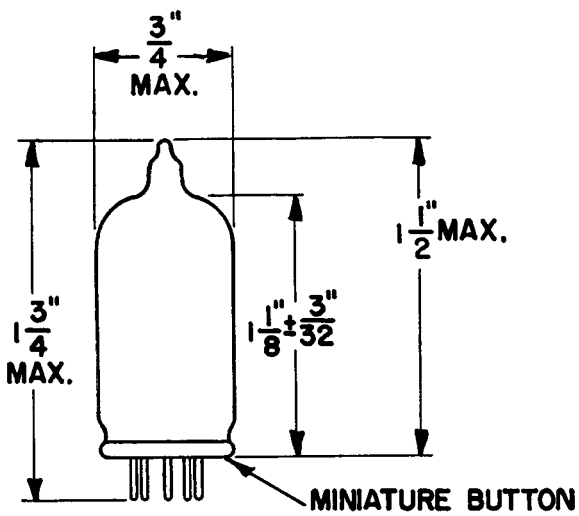
K-69087-72A474 7-25-51

AVERAGE CHARACTERISTICS



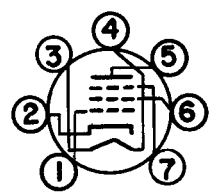
K-69087-72A473 7-23-51

OUTLINE
GL-5725



N-15171AZ

BASING DIAGRAM



7CM

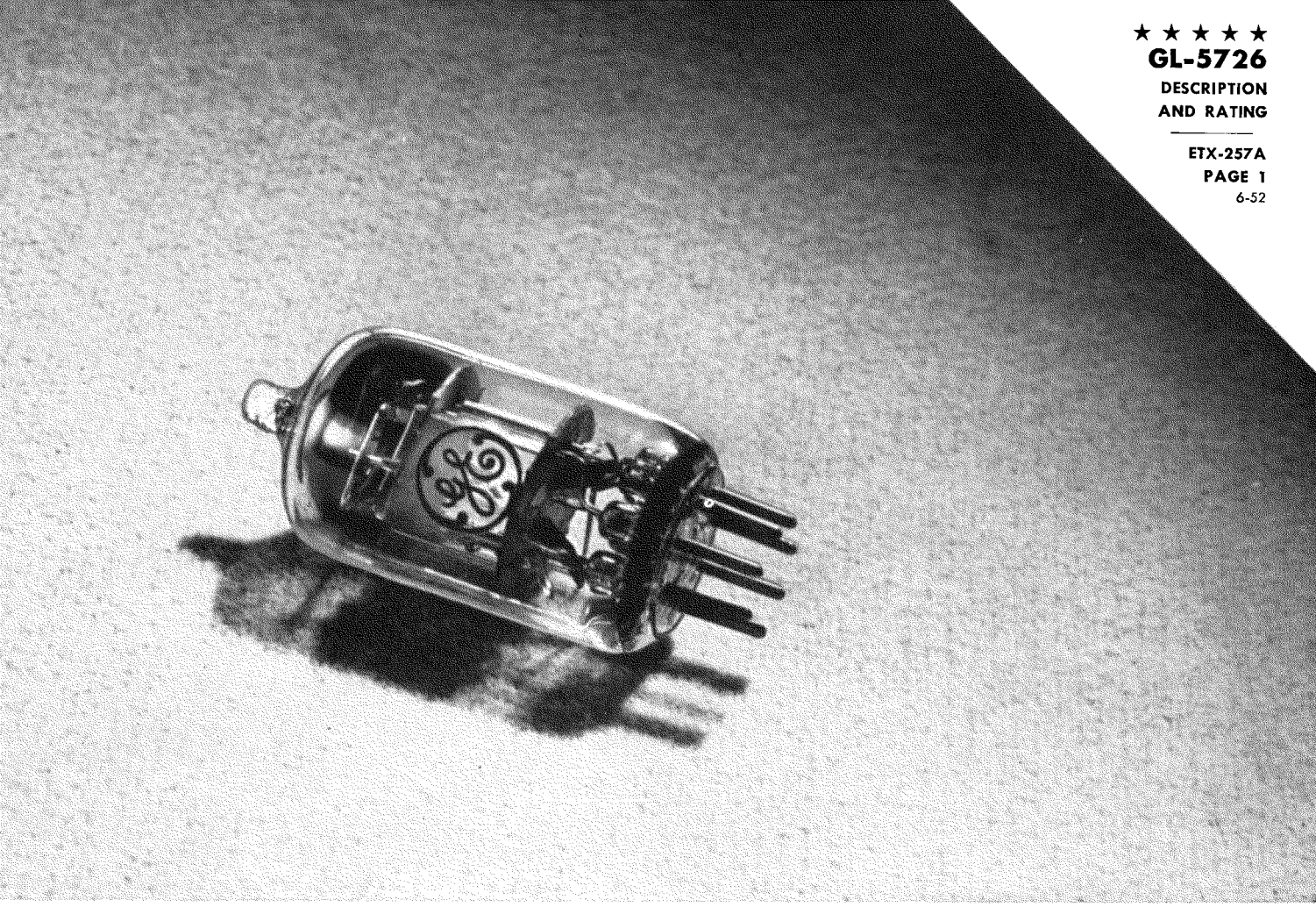
PIN 1: GRID NO. 1
PIN 2: CATHODE
PIN 3: HEATER
PIN 4: HEATER
PIN 5: PLATE
PIN 6: GRID NO. 2
PIN 7: GRID NO. 3

2-21-50

Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.



TWIN-DIODE

DESCRIPTION

The GL-5726 is a miniature double-diode designed for dependable operation under conditions encountered in mobile and aircraft service. The heaters for the two diode units are internally connected in series so that a heater failure makes both units inoperative and are designed to minimize the possibility of failure under severe intermittent on-off operation.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode—indirectly heated

Heater voltage	6.3	volts
Heater current	0.30	ampere
Direct interelectrode capacitances		
Plate to cathode (Section No. 1)*	3.2	uuf
Plate to cathode (Section No. 2)*	3.2	uuf
Cathode to plate (Section No. 1)§	3.9	uuf
Cathode to plate (Section No. 2)§	3.9	uuf
Plate (Section No. 1) to plate (Section No. 2)△	0.026 max	uuf

Mechanical Data

Mounting position—any
Envelope—T-5½ glass
Base—Miniature button 7-pin, E7-1

GE Electronic TUBE

GENERAL ELECTRIC

Supersedes ETX-257 dated 5-50

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS Design Center Values

Peak inverse plate voltage	330	volts
Peak plate current, per plate	54	milliamperes
D-c output current, per plate	9	milliamperes
D-c heater-cathode voltage	330	volts

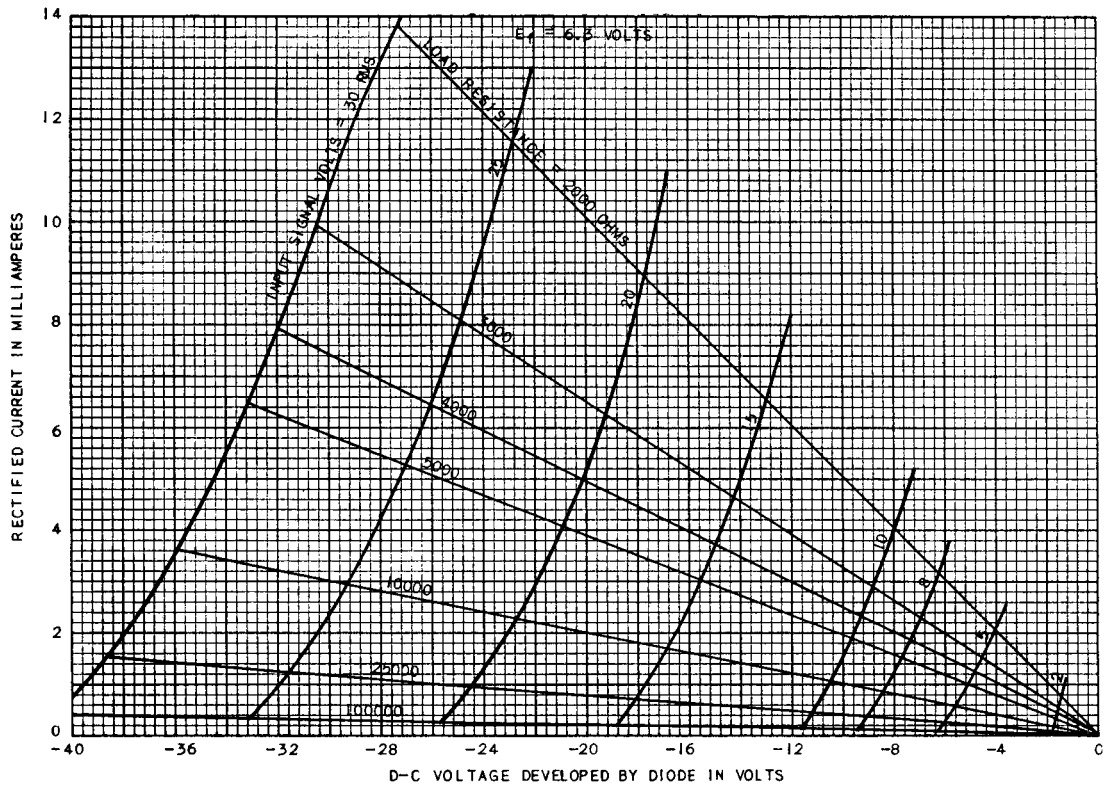
Typical Operation

Half-wave rectifier†

A-c plate voltage, per plate (RMS)	117	volts
Minimum total effective plate supply impedance, per plate	300	ohms
D-c output current, per plate	9	milliamperes
Heater cycles of intermittent operation‡, minimum	5000	cycles

*With JETEC Shield No. 313 connected to heater, internal shield, and cathode of unit under test.
§With JETEC Shield No. 313 connected to heater, internal shield, and plate of unit under test.
△With JETEC Shield No. 313 connected to ground.
†In half-wave service the two units can be used separately or in parallel.
‡The 5726 heater is designed to withstand at least 5000 cycles of intermittent operation at 7.5 volts.

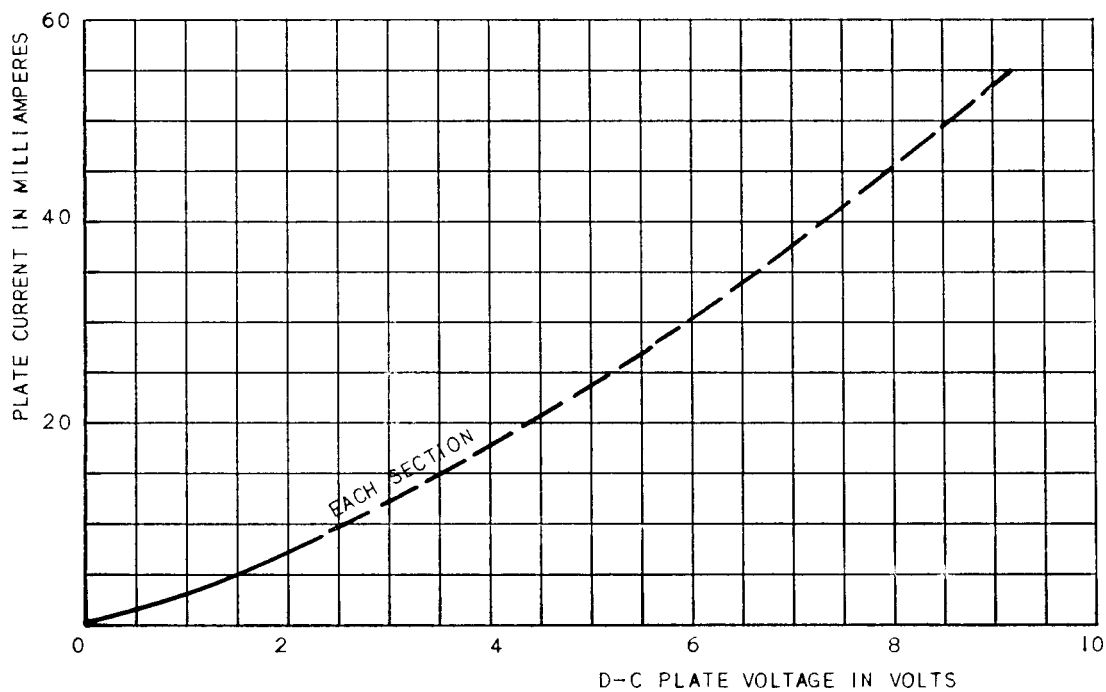
GL-5726
OPERATION CHARACTERISTICS
HALF-WAVE EACH SECTION
$E_f = 6.3$ VOLTS



K-69087-72A350

2-10-50

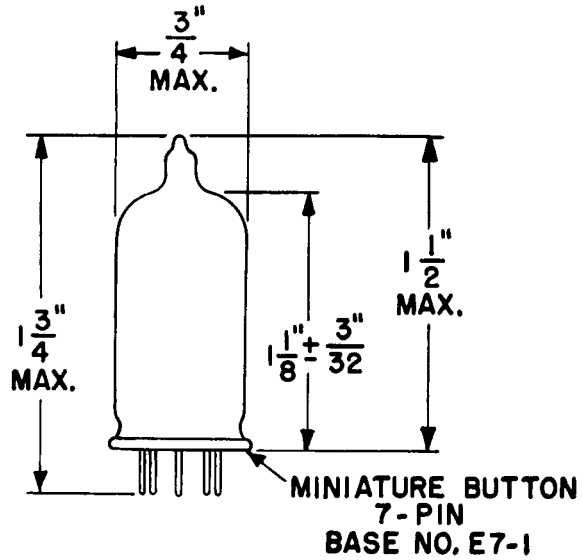
GL-5726
AVERAGE PLATE CHARACTERISTICS
$E_f = 6.3$ VOLTS



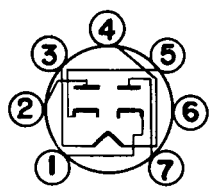
K-69087-72A351

2-10-50

OUTLINE
GL-5726



BASING DIAGRAM

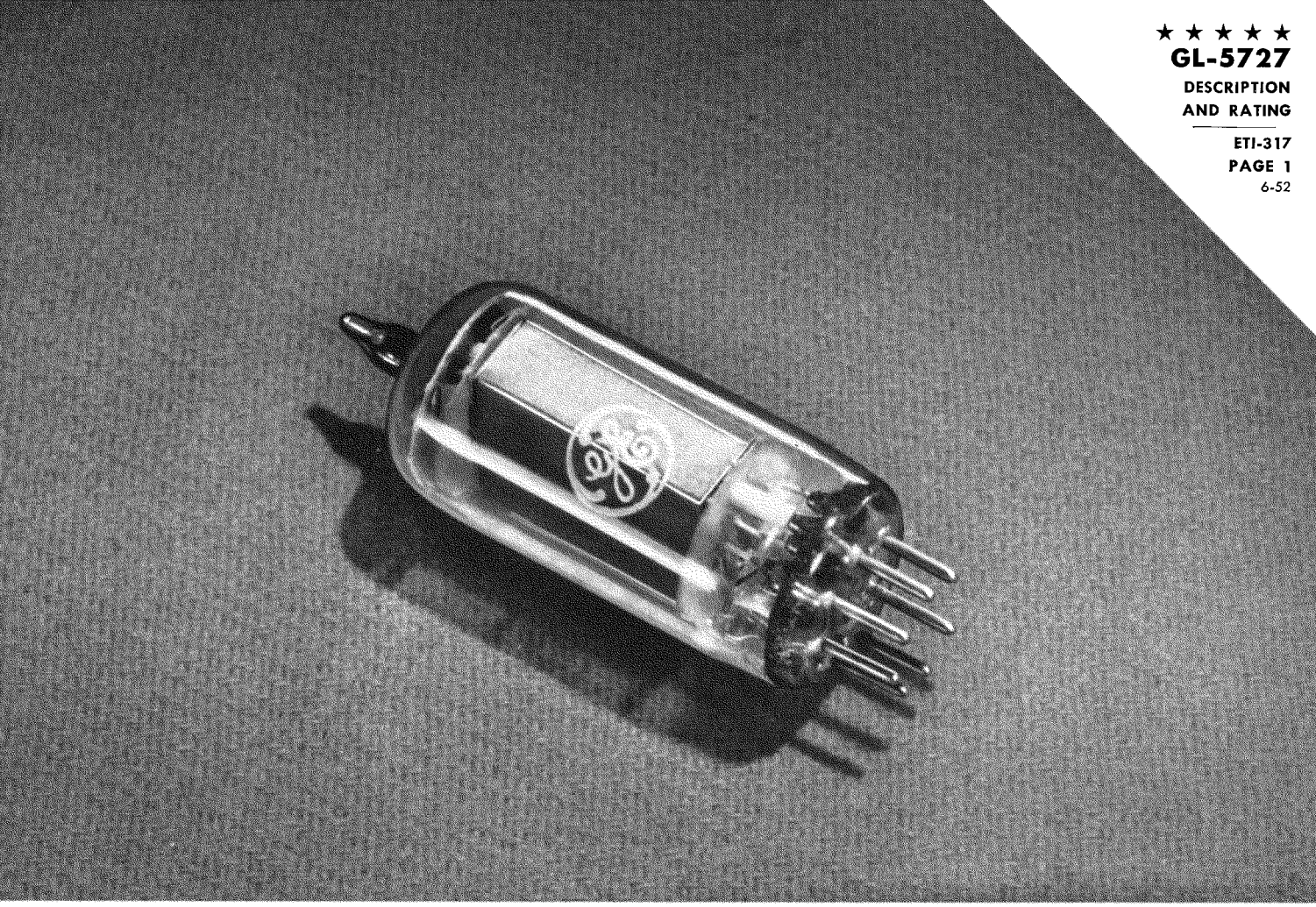


6BT

PIN 1: CATHODE (SECTION NO. 1)
PIN 2: PLATE (SECTION NO. 2)
PIN 3: HEATER
PIN 4: HEATER
PIN 5: CATHODE (SECTION NO. 2)
PIN 6: INTERNAL SHIELD
PIN 7: PLATE (SECTION NO. 1)

N-15169AZ 2-10-50

Tube Department
GENERAL ELECTRIC
Schenectady, N. Y.



THYRATRON

DESCRIPTION

The GL-5727 is a miniature, four-electrode, inert-gas-filled thyratron with negative control characteristics which is suitable for use in relay and grid-controlled-rectifier applications. Operating characteristics of the tube include a high-control ratio essentially independent of temperature over a wide range, low grid-anode capacitance, and very low grid current. The GL-5727 is specially designed to assure dependable life and reliable service under the exacting conditions encountered in mobile and aircraft applications. Features include a high degree of mechanical strength and a heater-cathode construction designed to withstand many-thousand cycles of intermittent operation.

TECHNICAL INFORMATION

GENERAL

Electrical Data	Minimum	Bogey	Maximum	
Heater Voltage	5.7	6.3	6.9	Volts
Heater Current, E_f = 6.3 volts		0.60	0.66	Ampere
Cathode Heating Time	10			Seconds
Anode-to-Control-Grid Capacitance		0.026		uuf
Control-Grid to Cathode and Shield-Grid Capacitance		2.4		uuf
Deionization Time, approximate				
E_{bb} = 125 volts d-c, I_b = 0.1 ampere d-c				
E_{c1} = −100 volts d-c		35		Microseconds
E_{c1} = −11 volts d-c		75		Microseconds
Ionization Time, approximate		0.5		Microseconds
Anode Voltage Drop		8		Volts
Critical Grid Current, E_{bb} = 460 volts rms			0.5	Microampere

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical Data

Type of Cooling—Air
Mounting Position—Any
Net Weight, maximum ..... 0.3 Ounce

MAXIMUM RATINGS, Absolute Values

GRID-CONTROLLED RECTIFIER SERVICE

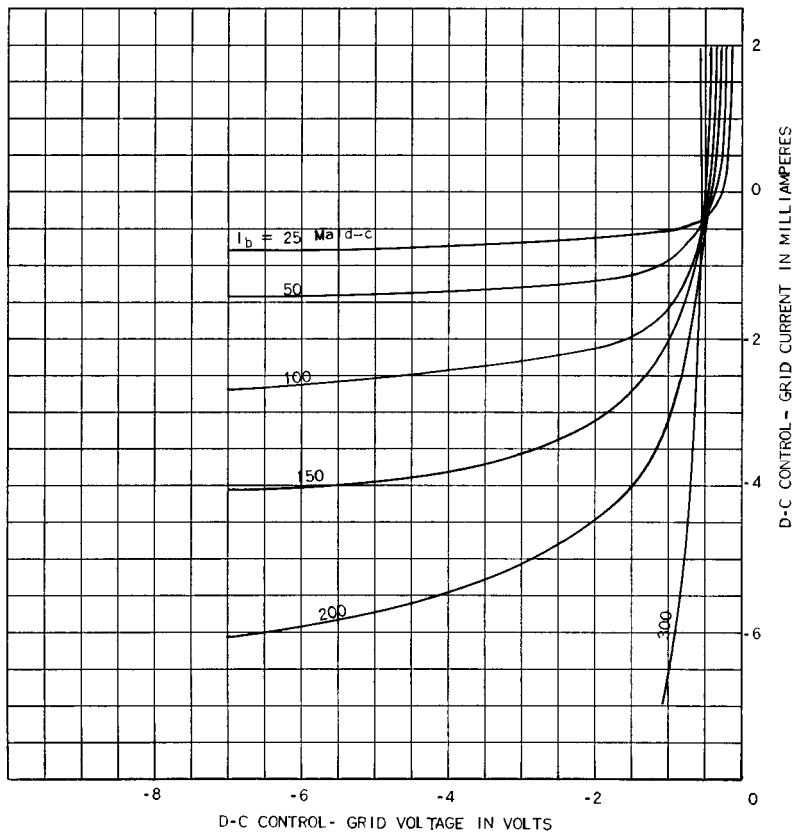
Maximum Peak Anode Voltage		
Inverse	1300	Volts
Forward	650	Volts
Maximum Cathode Current		
Peak	0.5	Ampere
Average	0.1	Ampere
Maximum Averaging Time	30	Seconds
Fault, Maximum Duration 0.1 Second	10	Amperes
Maximum Negative Control-Grid Voltage		
Before Conduction	−100	Volts
During Conduction	−10	Volts
Maximum Positive Control-Grid Current		
Average, Averaging Time, One Cycle	10	Milliamperes
Maximum Negative Shield-Grid Voltage		
Before Conduction	−100	Volts
During Conduction	−10	Volts
Maximum Positive Shield-Grid Current		
Average, Averaging Time, One Cycle	10	Milliamperes
Maximum Heater-Cathode Voltage		
Heater Negative	−100	Volts
Heater Positive	+25	Volts
Maximum Control-Grid Circuit Resistance	0.1	Megohm
Ambient Temperature Limits	−75 to +90	C

PULSE-MODULATOR SERVICE

Maximum Peak Anode Voltage		
Inverse	100	Volts
Forward†	500	Volts
Maximum Cathode Current		
Peak	10	Amperes
Average	0.01	Ampere
Maximum Negative Control-Grid Voltage		
Before Conduction	−100	Volts
During Conduction	−10	Volts
Maximum Positive Control-Grid Current		
Peak	20	Milliamperes
Maximum Negative Shield-Grid Voltage		
Before Conduction	−50	Volts
During Conduction	−10	Volts
Maximum Positive Shield-Grid Current		
Peak	20	Milliamperes
Maximum Pulse Duration	5	Microseconds
Maximum Pulse Recurrence Rate	500	Pulses per Second
Maximum Duty Cycle	0.001	
Maximum Rate of Change of Cathode Current	100	Amperes per Microsecond
Maximum Heater-Cathode Voltage	0	Volt
Maximum Shield-Grid Circuit Resistance	25000	Ohms
Minimum Shield-Grid Circuit Resistance	2000	Ohms
Maximum Control-Grid Circuit Resistance	0.5	Megohm
Ambient Temperature Limits	−75 to +90	C
Maximum Impact Acceleration in Any Direction	750	G

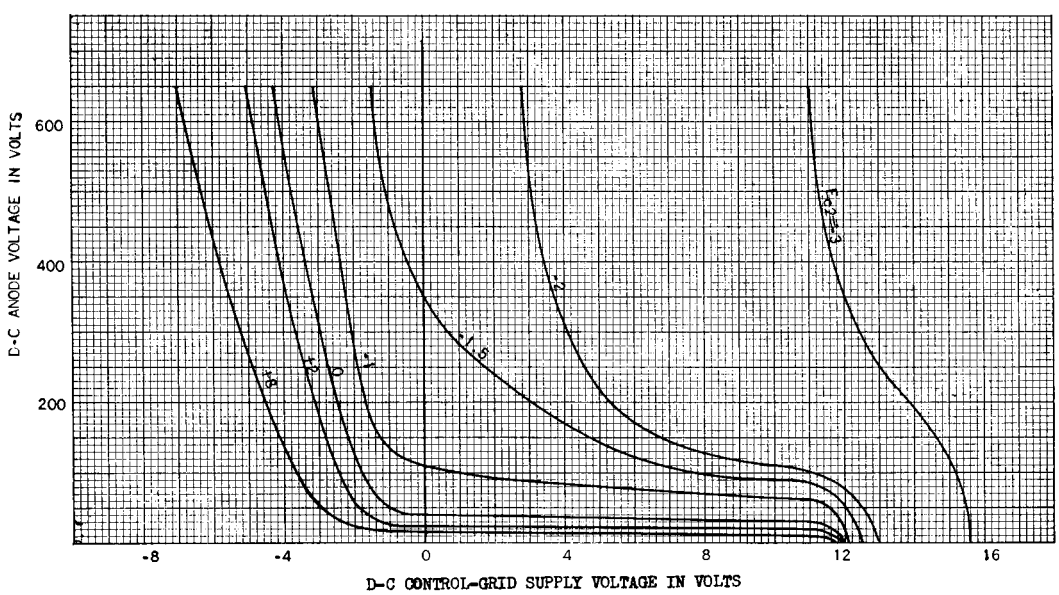
† After the completion of a pulse, a 20-microsecond delay is required before a positive voltage of more than 10 volts is applied to the tube.

AVERAGE GRID CHARACTERISTICS DURING ANODE CONDUCTION
$E_f = 6.3$ VOLTS
SHIELD-GRID VOLTS = 0



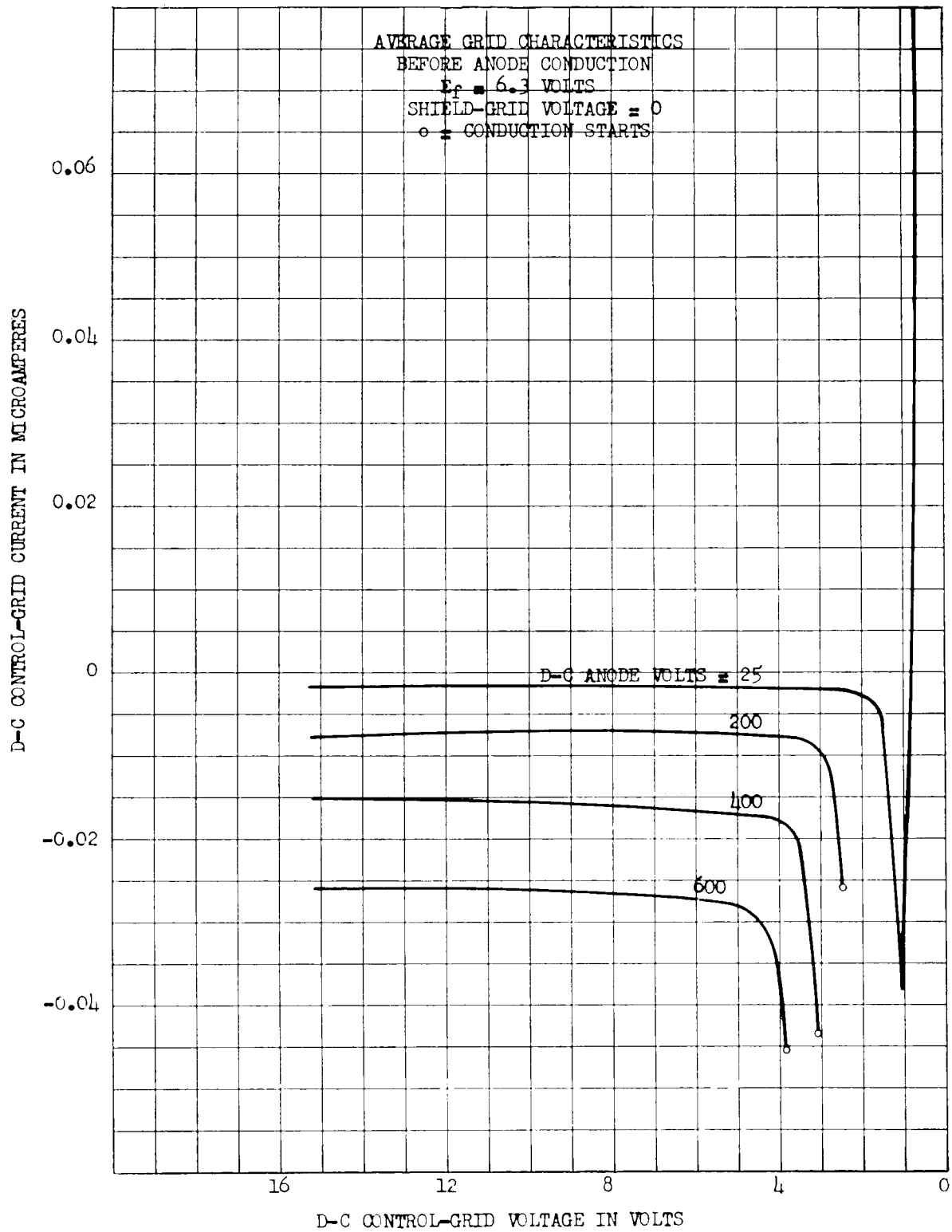
K-69087-72A153 9-19-51

AVERAGE CONTROL CHARACTERISTICS
$E_f = 6.3$ VOLTS
GRID RESISTOR = 0.1 MEGOHM



K-69087-72A152 9-19-51

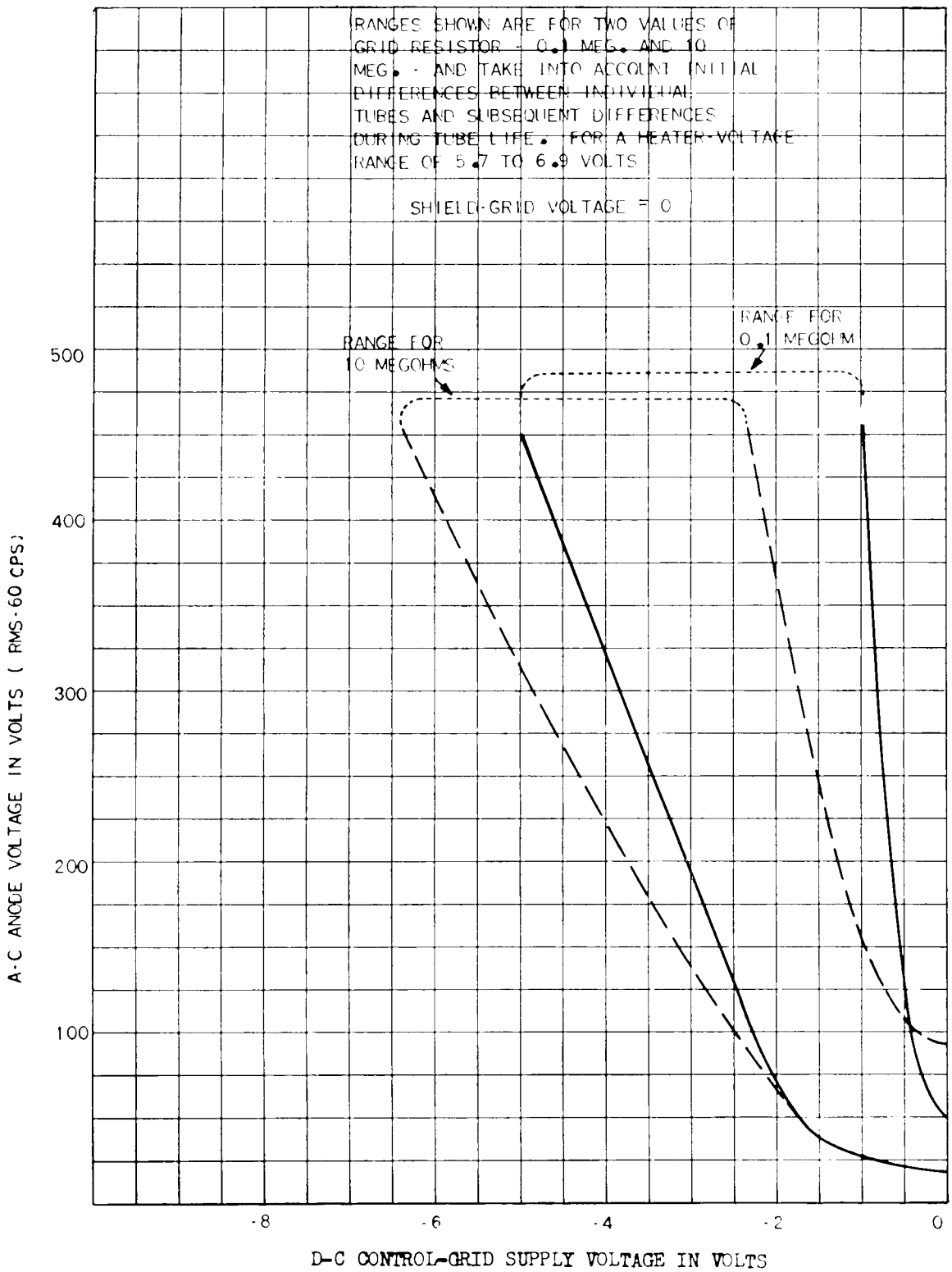
AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION



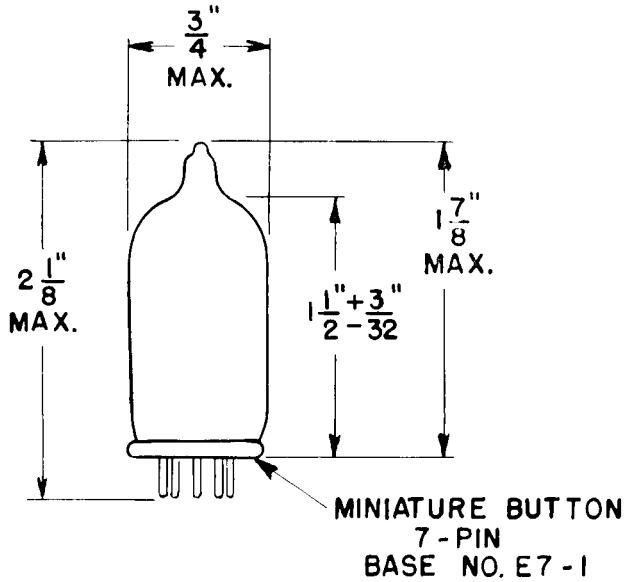
K-69087-72A460

9-19-51

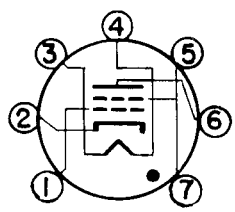
OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



OUTLINE



BASING DIAGRAM



7BN

PIN 1: GRID NO.1
PIN 2: CATHODE
PIN 3: HEATER
PIN 4: HEATER
PIN 5: GRID NO.2
PIN 6: ANODE
PIN 7: GRID NO.2

K-69087-72A481 8-22-51

Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.

ELECTRONICS DEPARTMENT

GENERAL ELECTRIC

Kenotron 5741--Description and Rating

The 5741 is a two-electrode tube designed for use as a rectifier. The anode is radiation-cooled. The cathode is a pure-tungsten filament.

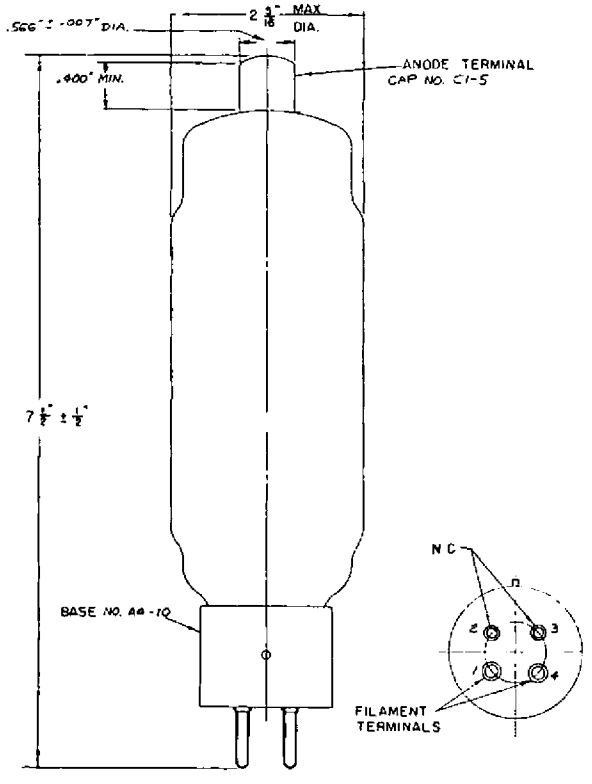
TECHNICAL INFORMATION

GENERAL

Electrical Data		
Filament Voltage	10	Volts
Filament Current	5	Amperes
Tube Voltage Drop, I_b = 100 Milliamperes	280	Volts
Interelectrode Capacitance	1.8	uuf
Mechanical Data		
Mounting Position - Vertical, Base Down		
Maximum Glass Temperature	150	C
Net Weight, approximate	3.5	Ounces

MAXIMUM RATINGS

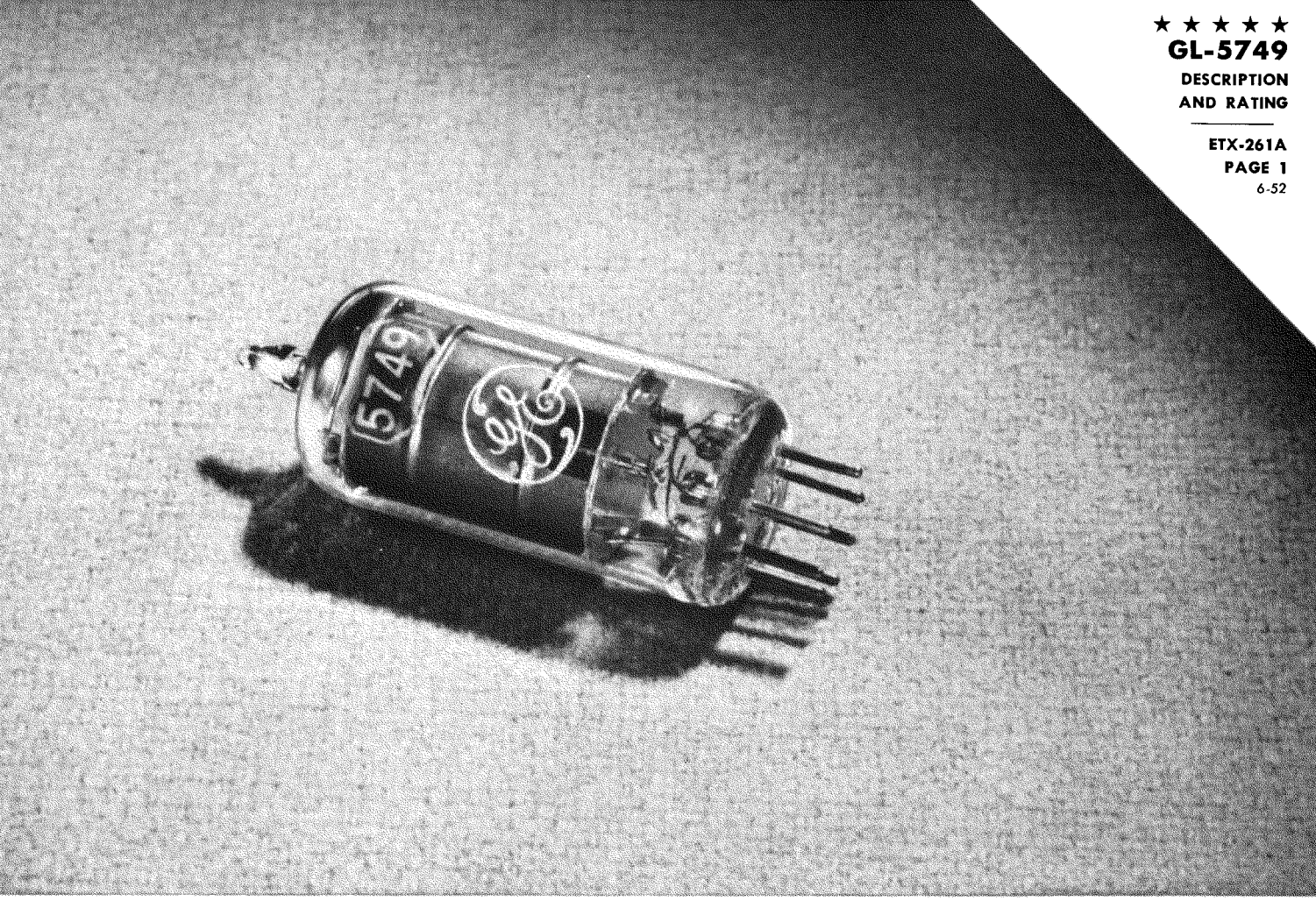
Absolute Values		
Peak Inverse Voltage	20,000 Max	Volts
Peak Plate Current	100 Max	Milliamperes
Average Plate Current	20 Max	Milliamperes



K-8639604 May 24, 1948

Outline
5741 Kenotron

from RMA release # 680, July 27, 1948



PENTODE

DESCRIPTION

The 5749 is a miniature remote-cut-off amplifier pentode intended for use as a radio-frequency or intermediate-frequency amplifier. This tube is designed for reliable life under conditions of intermittent operation.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode—Indirectly Heated		
Heater Voltage (A-c or D-c)	6.3	Volts
Heater Current	0.300	Ampere

Direct Interelectrode Capacitances	With Shield*	Without Shield	
Grid to plate, maximum	0.0035	0.0035	uuf
Input	5.5	5.5	uuf
Output	5.5	5.0	uuf

Mechanical Data

Mounting position—any
Envelope—T-5½ glass

GE Electronic TUBE

GENERAL ELECTRIC

Supersedes ETX-261 dated 6-50

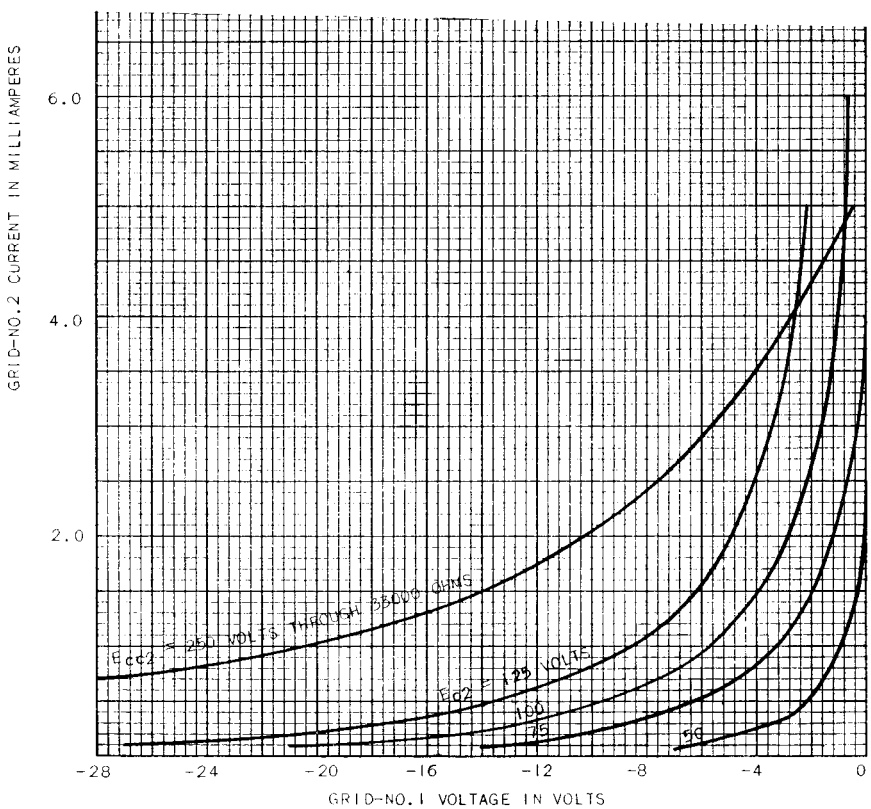
TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum ratings, design center			
Plate voltage		300	volts
Screen voltage		125	volts
Screen supply voltage		300	volts
Positive grid—No. 1 bias voltage		0	volts
Negative grid—No. 1 bias voltage		50	volts
Plate dissipation		3.0	watts
Screen dissipation		0.6	watts
Heater-cathode voltage		90	volts
Typical operation			
Class A1 amplifier			
Plate voltage	100	250	volts
Grid—No. 3 voltage	0	0	volts
Screen voltage	100	100	volts
Cathode bias resistor	68	68	ohms
Plate resistance, approximate	0.25	1.0	megohms
Transconductance	4300	4400	micromhos
Plate current	10.8	11.0	milliamperes
Screen current	4.4	4.2	milliamperes
Grid—No. 1 voltage, Gm = 40 umhos	−20	−20	volts

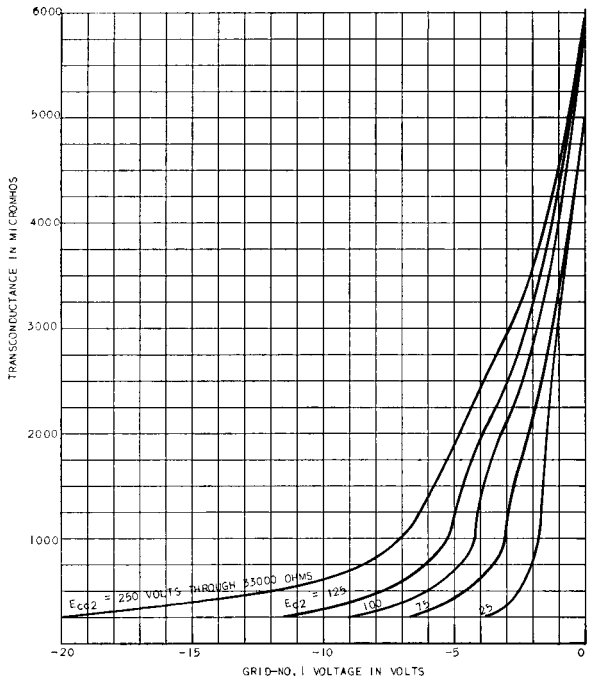
*With external shield No. 316 connected to pin 7.

GL-5749
AVERAGE CHARACTERISTICS
PENTODE CONNECTION
E_f = 6.3 VOLTS, E_b = 250 VOLTS
E_{c2} = GRID NO. 2 VOLTAGE, E_{c3} = 0 VOLTS
E_{cc2} = GRID NO. 2 SUPPLY VOLTAGE



GL-5749
AVERAGE CHARACTERISTICS
PENTODE CONNECTION

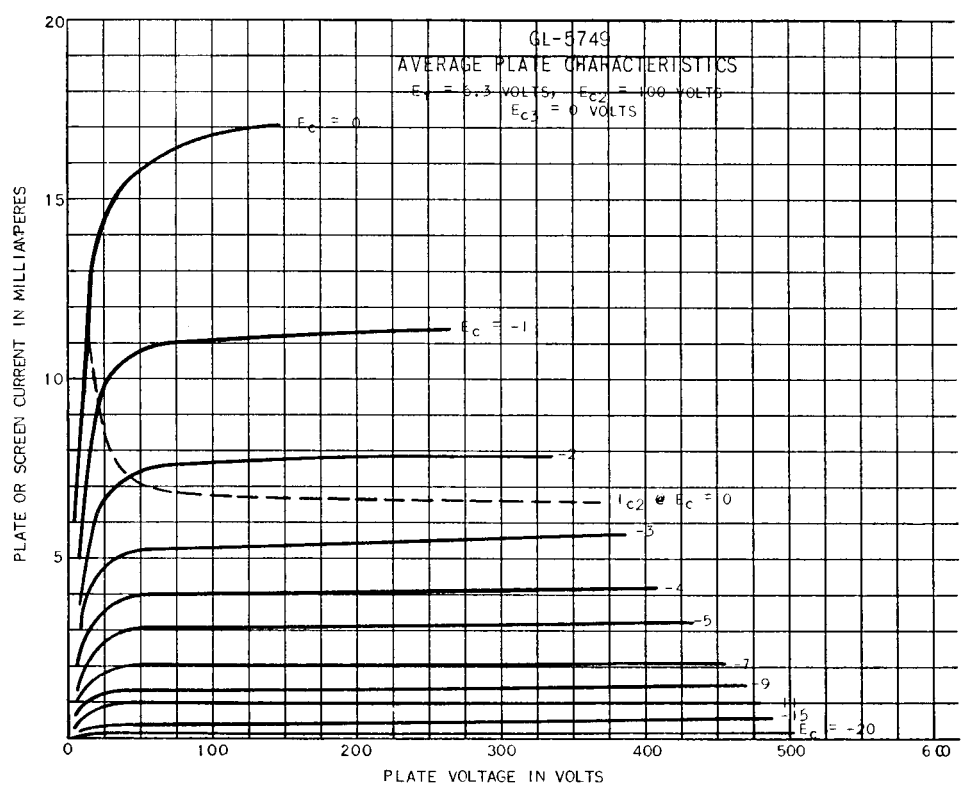
$E_f = 6.3$ VOLTS, $E_b = 250$ VOLTS
E_{c2} = GRID NO. 2 VOLTAGE, $E_{c3} = 0$ VOLTS
E_{cc2} = GRID NO. 2 SUPPLY VOLTAGE



K-69087-72A346 2-7-50

GL-5749
AVERAGE PLATE CHARACTERISTICS

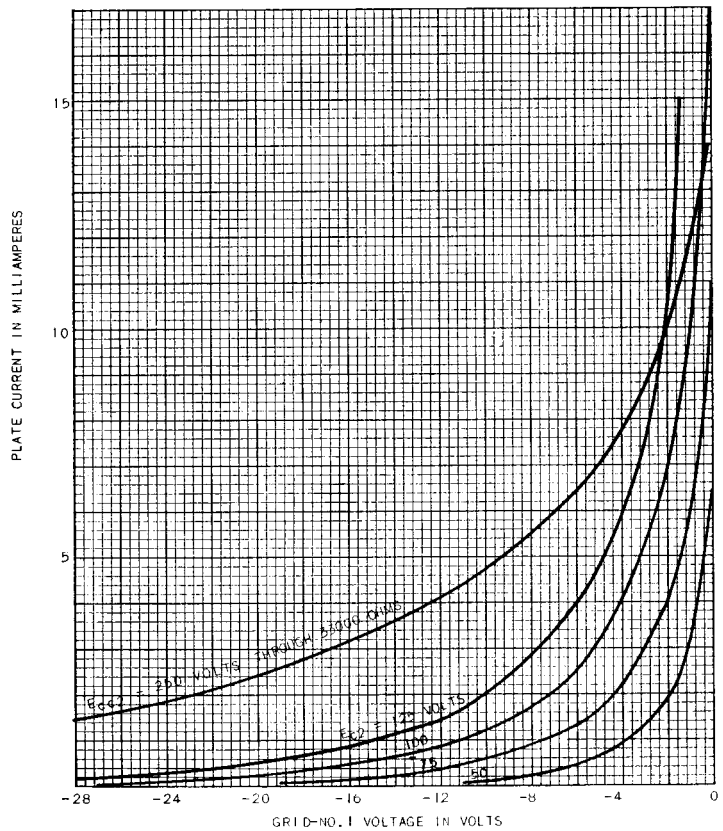
$E_f = 6.3$ VOLTS, $E_{c2} = 100$ VOLTS
$E_{c3} = 0$ VOLTS



K-69087-72A343 1-19-50

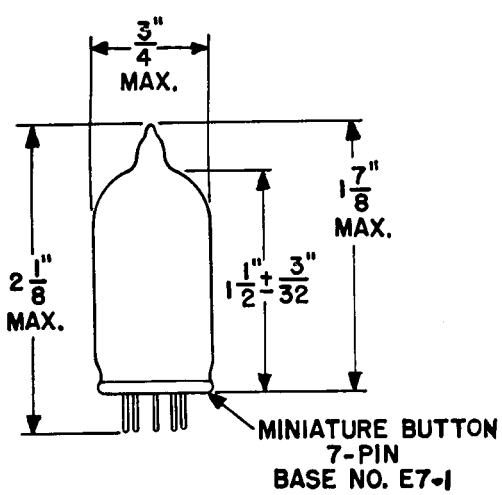
GL-5749
AVERAGE CHARACTERISTICS
PENTODE CONNECTION

$E_f = 6.3$ VOLTS, $E_b = 250$ VOLTS
E_{c2} = GRID NO. 2 VOLTAGE, $E_{c3} = 0$ VOLTS
E_{cc2} = GRID NO. 2 SUPPLY VOLTAGE

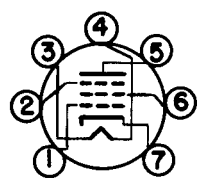


K-69087-72A345 2-7-50

OUTLINE
GL-5749



BASING DIAGRAM



7BK

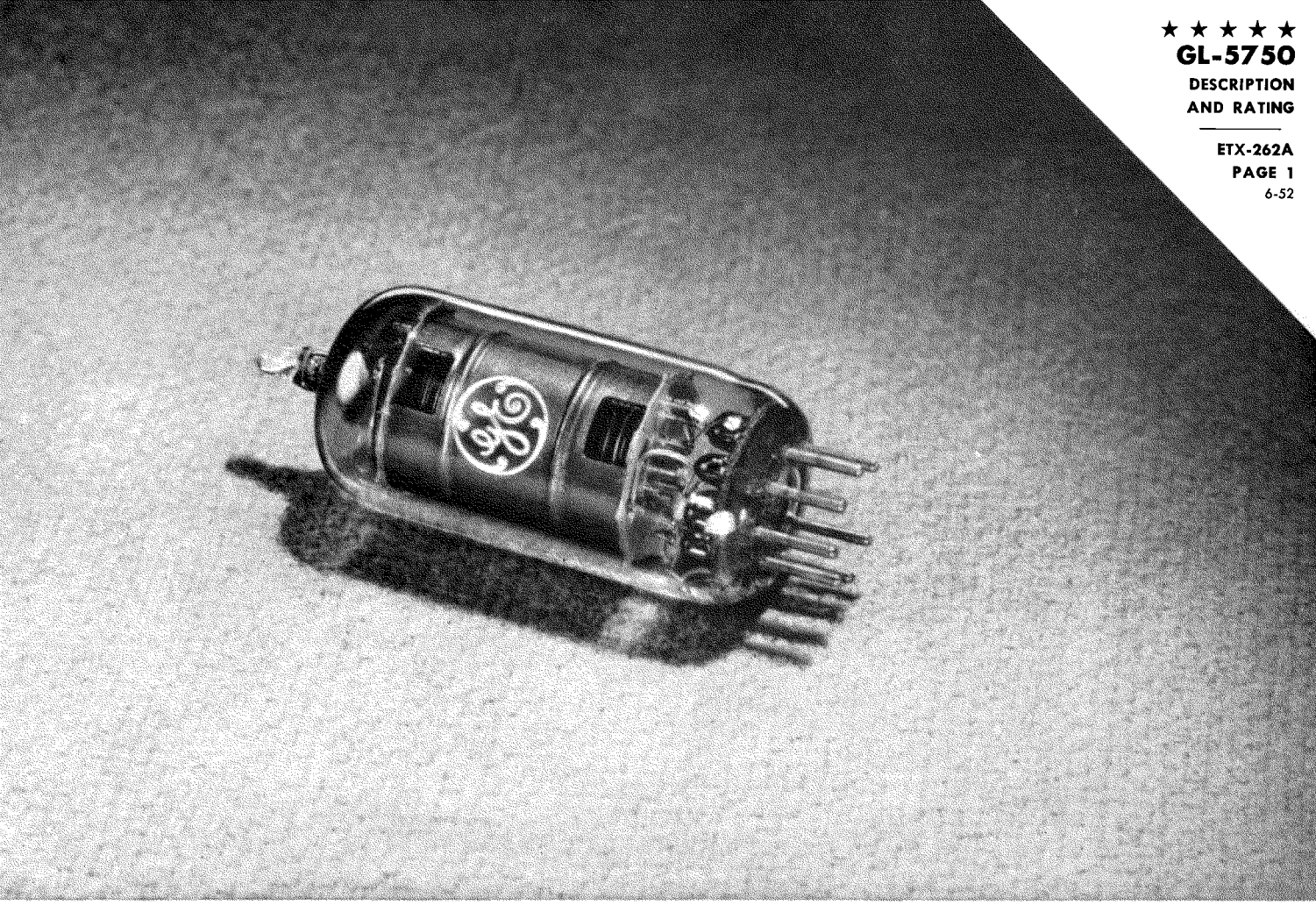
PIN 1: GRID NO.1
PIN 2: GRID NO. 3 AND INTERNAL SHIELD
PIN 3: HEATER
PIN 4: HEATER
PIN 5: PLATE
PIN 6: GRID NO.2 (SCREEN)
PIN 7: CATHODE

N-15167A 1-12-50

Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.



PENTAGRID CONVERTER

DESCRIPTION

The GL-5750 is a miniature pentagrid converter designed for reliable life under conditions of intermittent operation.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode—indirectly heated

Heater voltage (A-C or D-C)	6.3	Volts
Heater current	0.300	Ampere
Direct interelectrode capacitances (without external shield)		
Mixer grid to plate, maximum	0.30	uuf
Mixer grid to oscillator grid, maximum	0.15	uuf
R-f input	7.1	uuf
Oscillator input	5.5	uuf
Mixer output	7.6	uuf
Oscillator grid to cathode	3.0	uuf
Oscillator output	15.0	uuf

Mechanical Data

Mounting position—any

Envelope—T-5½ glass

GENERAL ELECTRIC

Electronic TUBE

Supersedes ETX-262 dated 6-50

TECHNICAL INFORMATION (CONT'D)

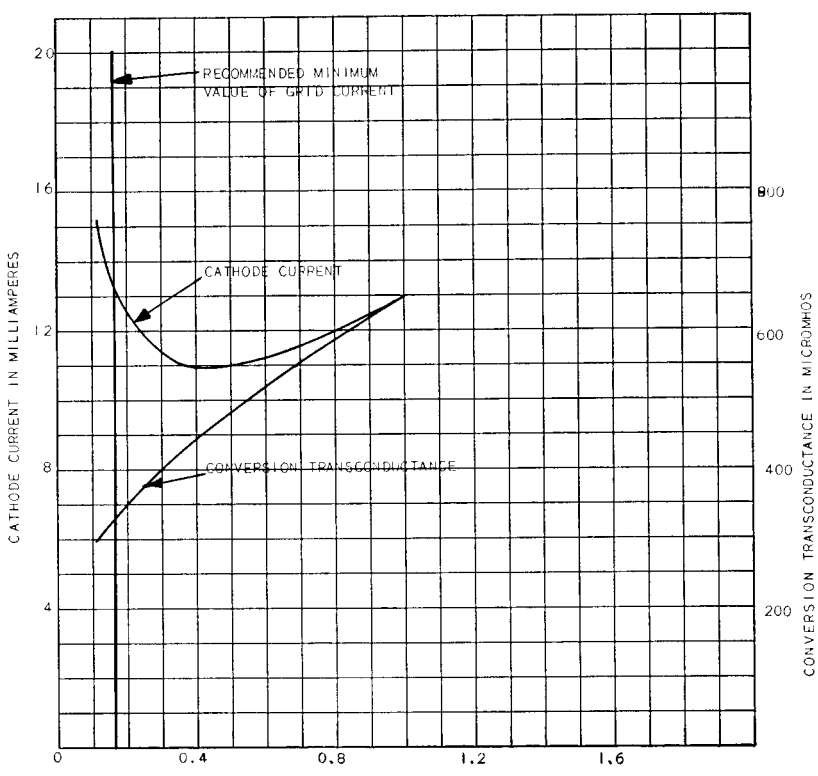
MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum ratings, design center			
Plate voltage		300	volts
Screen voltage		100	volts
Screen supply voltage		300	volts
Positive grid No. 3 bias voltage		0	volts
Negative grid No. 3 bias voltage		50	volts
Plate dissipation		1.0	watts
Grid No. 2 dissipation		1.0	watts
Total cathode current		14	milliamperes
Heater-cathode voltage		90	volts
Typical operation			
Converter service—separate excitation*			
Plate voltage	100	250	volts
Grid No. 3 voltage	−1.5	−1.5	volts
Screen voltage	100	100	volts
Oscillator grid voltage, rms	10	10	volts
Oscillator grid resistance	20,000	20,000	ohms
Plate resistance, approximate	0.4	1.0	megohms
Oscillator grid current	0.5	0.5	milliamperes
Conversion transconductance	455	475	micromhos
Plate current	2.6	2.6	milliamperes
Screen current	7.5	7.5	milliamperes
Total cathode current	10.6	10.6	milliamperes
Grid No. 3 voltage, G_c = 10 umhos	−30	−30	volts
Grid No. 3 voltage, G_c = 100 umhos	−6	−6	volts
Oscillator transconductance§	7800	7800	micromhos
Oscillator plate current§	25	25	milliamperes
Oscillator amplification factor§	20	20	

*The characteristics shown with separate excitation correspond very closely to those obtained in a self-excited oscillator circuit operating with zero bias.

§Approximate values with grids number 1 and number 3 at zero volts and with grids number 2 and number 4 connected to plate and operated at 100 volts.

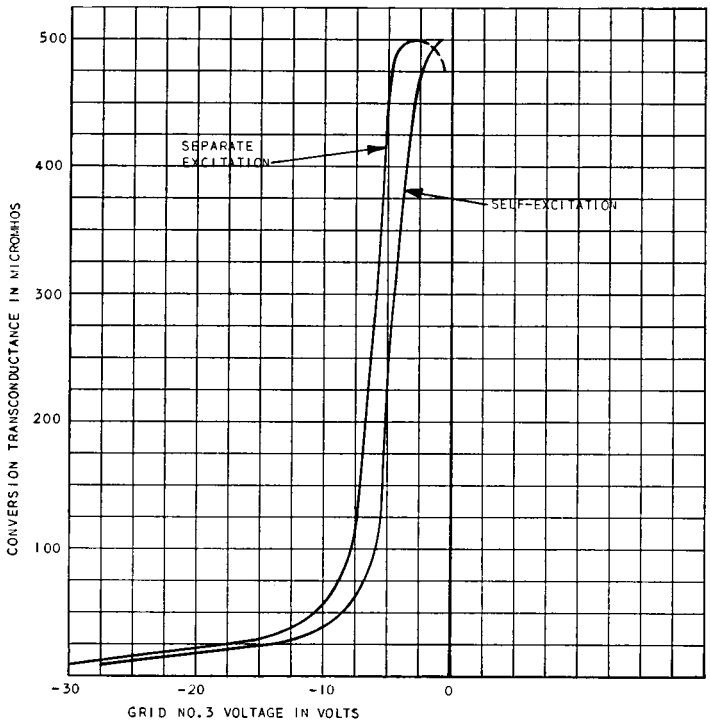
GL-5750
OPERATION CHARACTERISTICS
E_f = 6.3 VOLTS, E_b = 250 VOLTS
E_{c2} AND E_{c4} = 100 VOLTS
E_{c3} = −1.5 VOLTS, R_g = 20,000 OHMS



K-69087-72A339

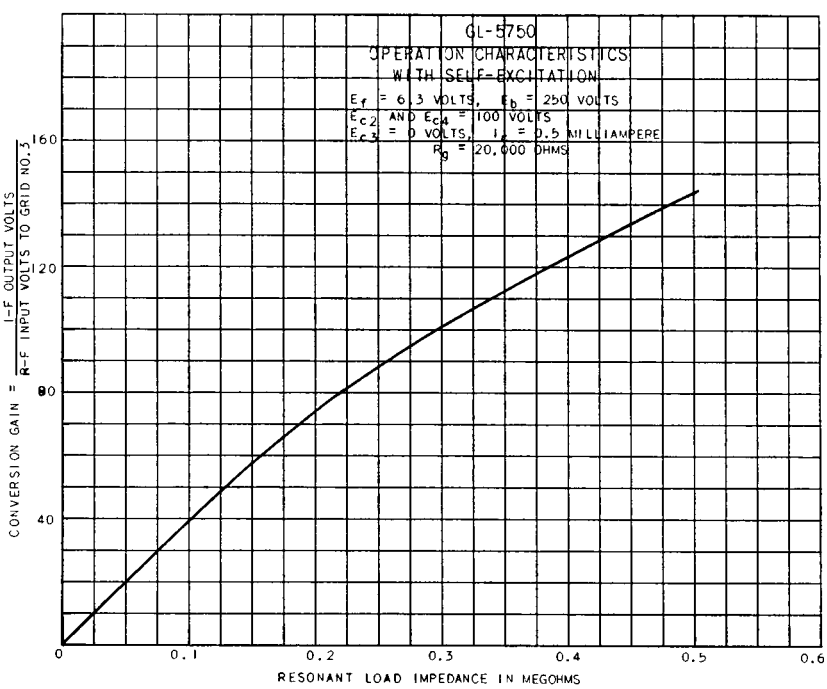
1-12-50

5750
OPERATION CHARACTERISTICS
$E_f = 6.3$ VOLTS, $E_b = 250$ VOLTS
E_{c2} AND $E_{c4} = 100$ VOLTS
$1_c = 0.5$ MILLIAMPERE, $R_g = 20{,}000$ OHMS



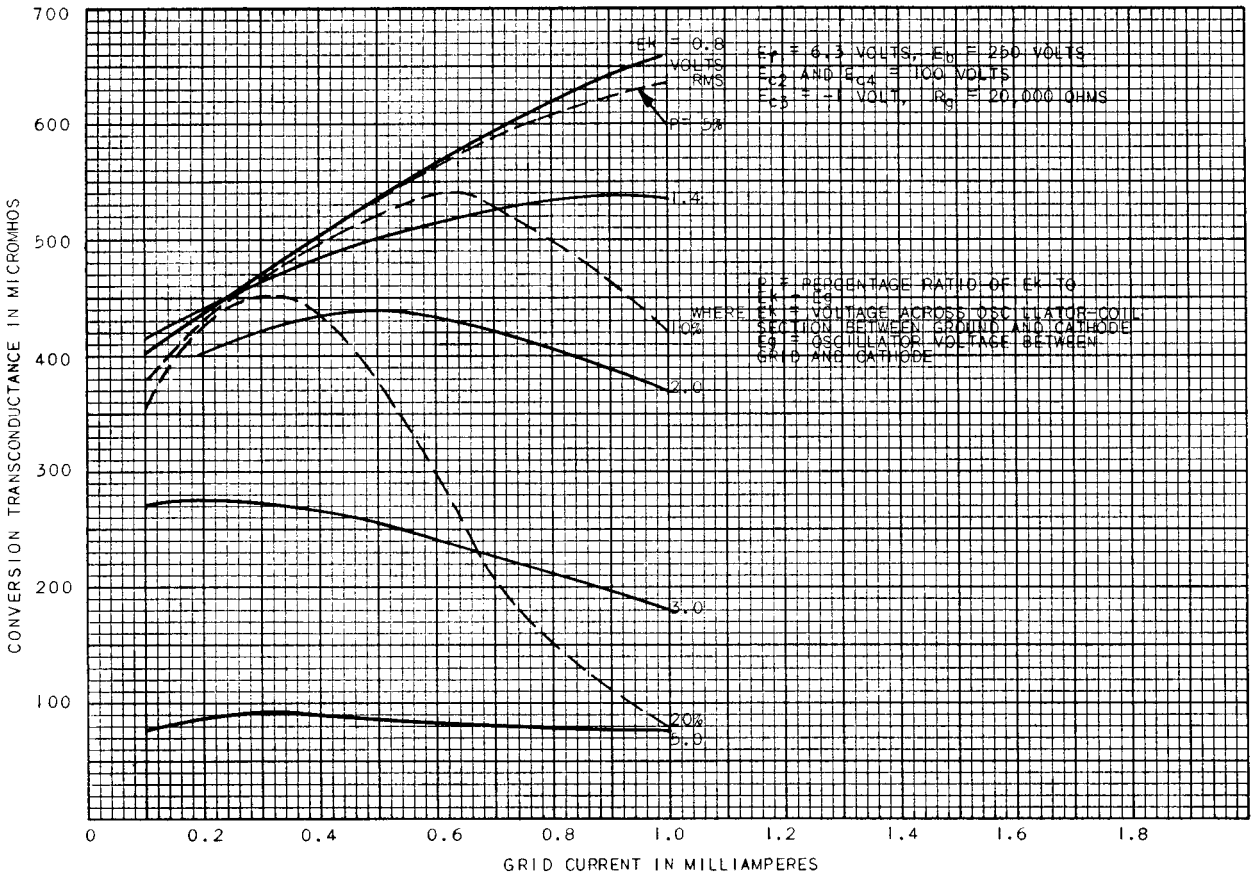
K-69087-72A340 1-12-50

5750
OPERATION CHARACTERISTICS
WITH SELF-EXCITATION
$E_f = 6.3$ VOLTS, $E_b = 250$ VOLTS
E_{c2} AND $E_{c4} = 100$ VOLTS
$E_{c3} = 0$ VOLTS, $1_c = 0.5$ MILLIAMPERE
$R_g = 20{,}000$ OHMS



K-69087-72A341 1-12-50

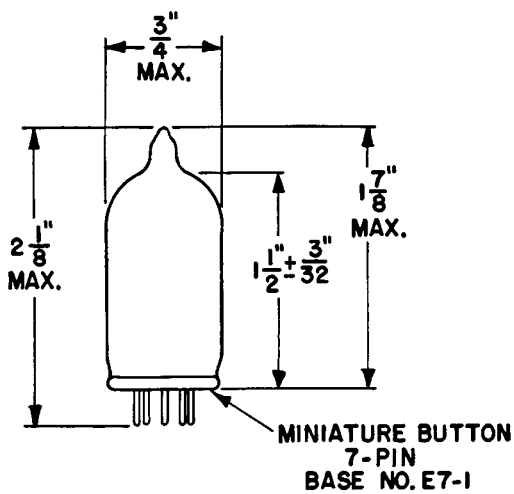
5750
OPERATION CHARACTERISTICS
WITH SELF-EXCITATION



K-69087-72A342

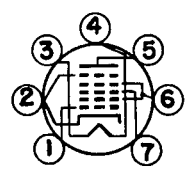
1-12-50

OUTLINE
GL-5750



N15166AZ

BASING DIAGRAM



7CH

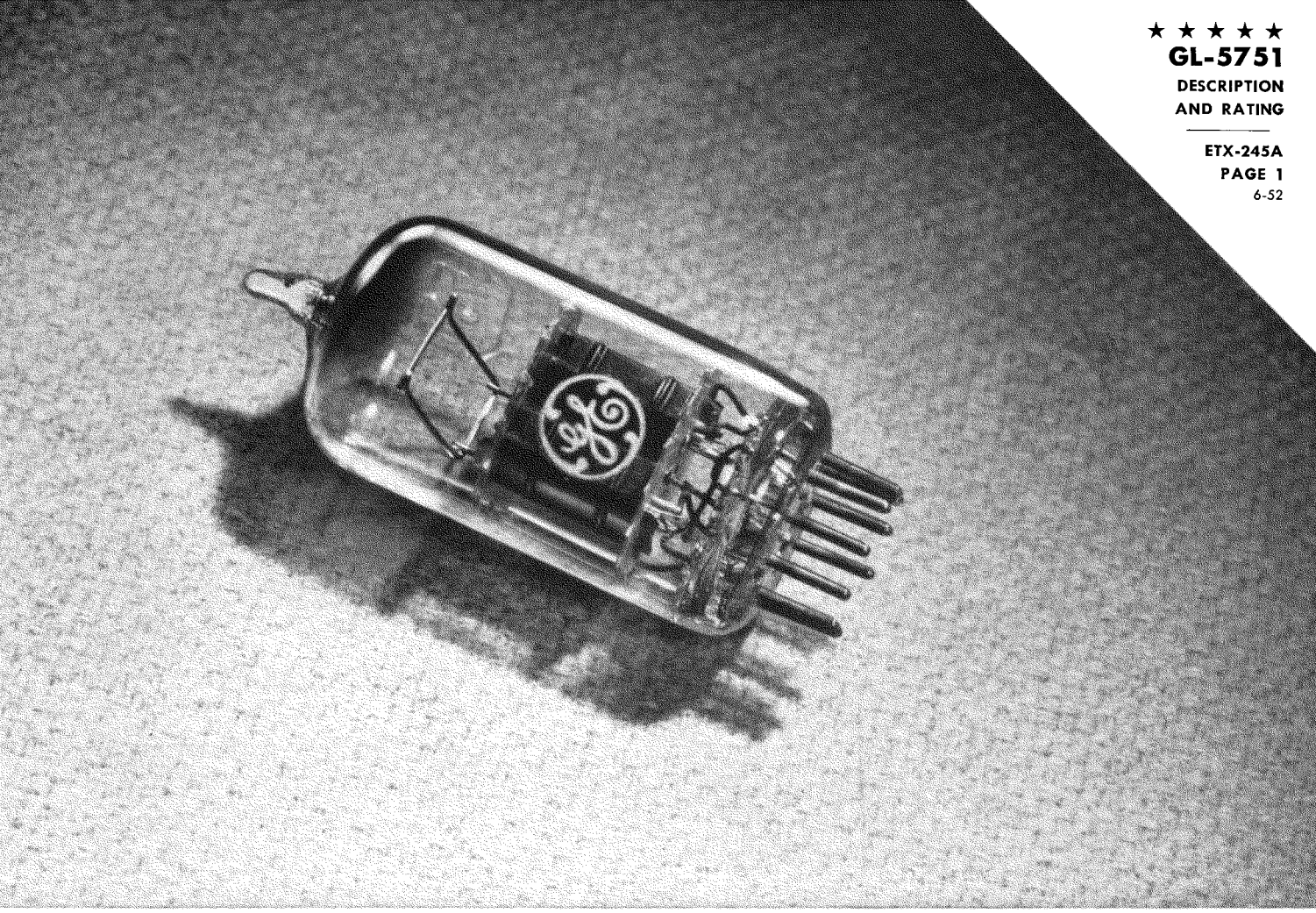
PIN 1: GRID NO. 1 (OSCILLATOR GRID)
PIN 2: CATHODE AND GRID NO. 5
PIN 3: HEATER
PIN 4: HEATER
PIN 5: PLATE
PIN 6: GRID NO. 2 AND GRID NO. 4 (SCREEN)
PIN 7: GRID NO. 3

1-12-50

Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.



TWIN TRIODE

DESCRIPTION

The GL-5751 is a high-mu nine-pin miniature tube with two triode sections, each of which has an individual cathode connection. The heater may be connected for either series or parallel operation. Distinctive design features of this twin triode result in a sturdy vibration-resistant tube for industrial or other applications where dependable operation under rigorous service conditions is a necessity. It is also well adapted to intermittent service conditions. To provide a safety factor in cathode performance, the heater current is slightly higher than in conventional tubes of this type.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode—Coated unipotential	Parallel	Series	
Heater voltage (A-c or D-c)	6.3	12.6	volts
Heater current	0.350	0.175	amperes

Mechanical Data

Mounting position—Any
Envelope—T-6½ Glass

GE Electronic TUBE

GENERAL ELECTRIC

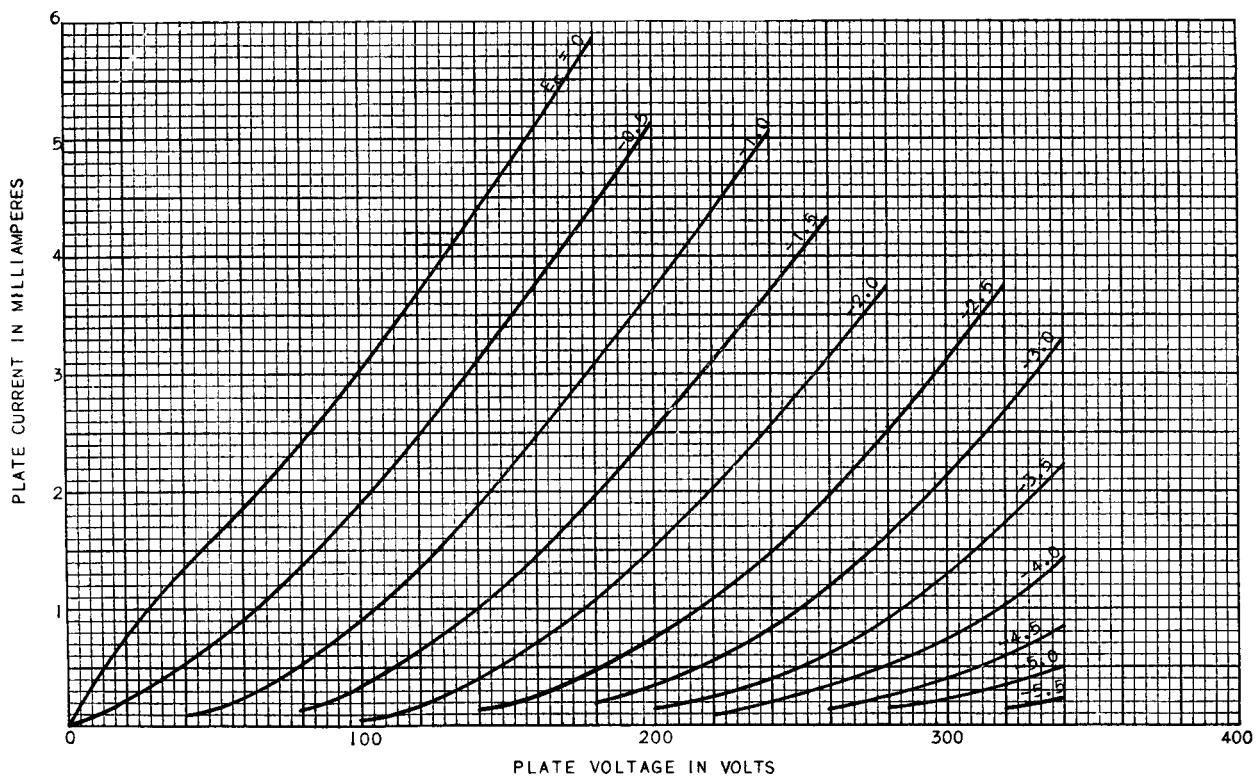
Supersedes ETX-245 dated 5-50

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings	Design Center	Absolute
Plate voltage	300	330 volts
Grid voltage		
Negative-bias value	50	55 volts
Positive-bias value	0	0 volts
Plate dissipation (each section)	1.0	1.1 watts
Peak heater-cathode voltage	90	100 volts
Typical Operation		
Class A amplifier (each triode section)		
Heater voltage	6.3	6.3 volts
Plate voltage	100	250 volts
Grid bias voltage	−1	−3 volts
Amplification factor	70	70
Plate resistance	58000	58000 ohms
Transconductance	1200	1200 micromhos
Plate current	0.8	1.0 milliampere

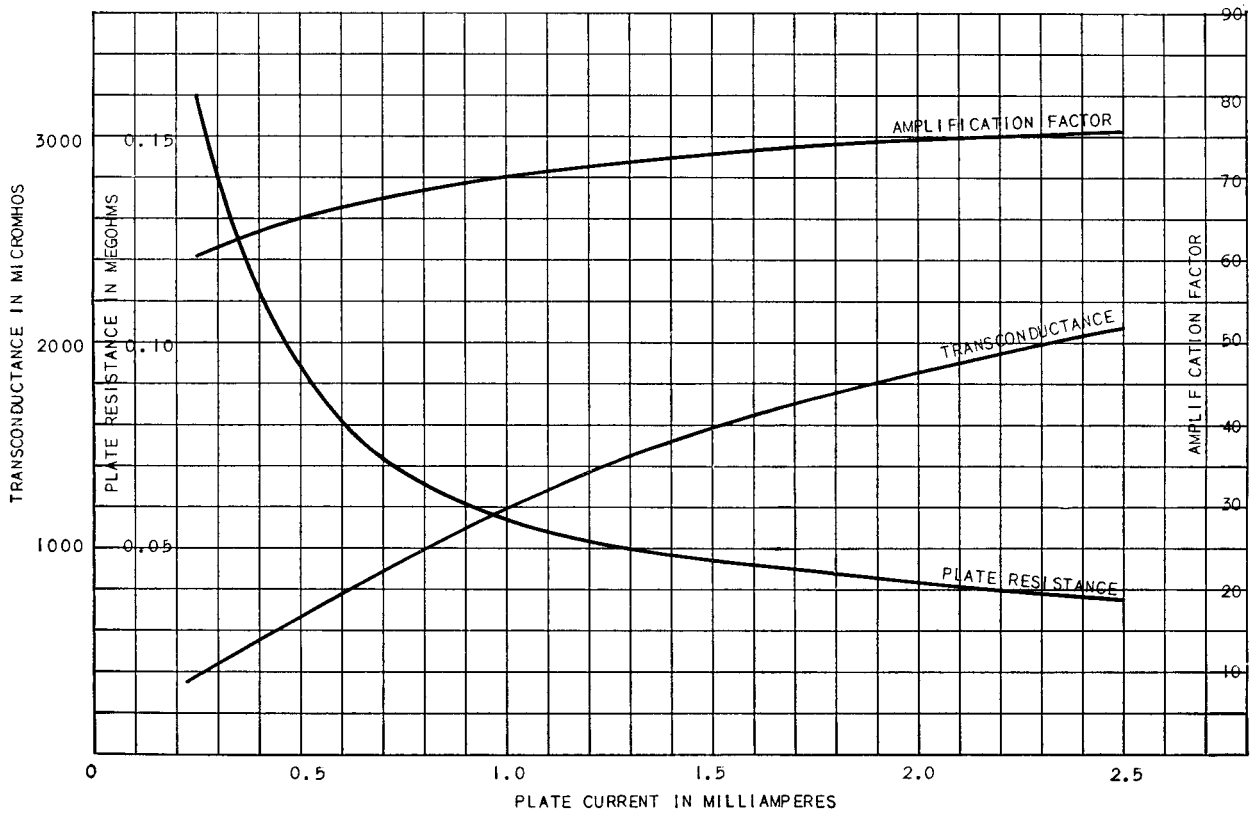
GL-5751
AVERAGE PLATE CHARACTERISTICS
TRIODE UNIT $E_f = 6.3$ VOLTS



K-69087-72A305

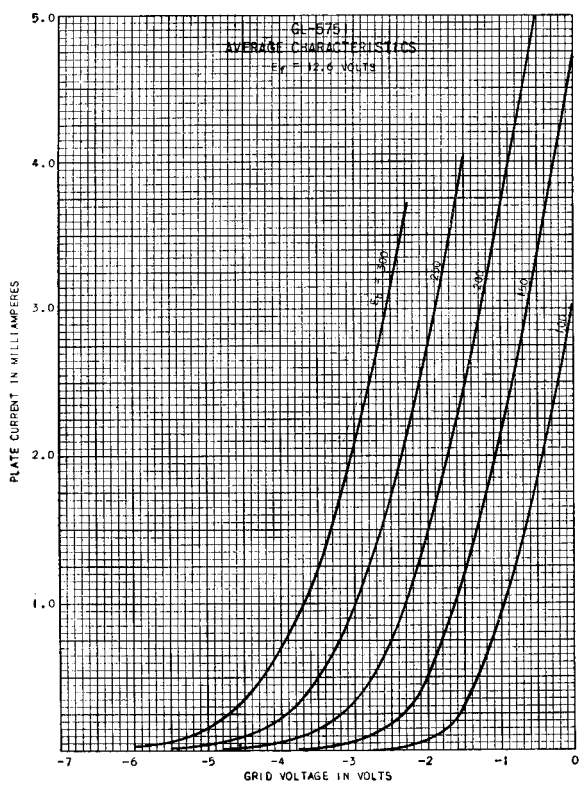
2-7-50

GL-5751
AVERAGE CHARACTERISTICS
$E_f = 250$ VOLTS $E_f = 12.6$ VOLTS



K-69087-72A349

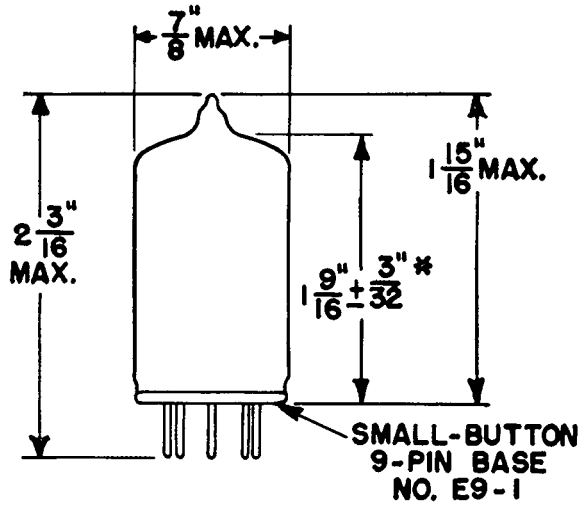
2-9-50



K-69087-72A348

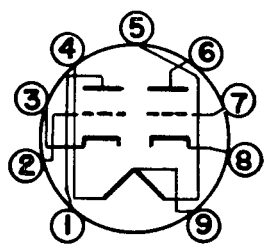
2-9-50

OUTLINE
PLIOTRON GL-5751



*MEASURED FROM BASE SEAT TO BULB-TOP LINE AS DETERMINED BY RING GAGE OF 7/16" I.D.

BASING DIAGRAM



PIN 1: PLATE (SECTION NO. 2)
PIN 2: GRID (SECTION NO. 2)
PIN 3: CATHODE (SECTION NO. 2)
PIN 4: HEATER
PIN 5: HEATER
PIN 6: PLATE (SECTION NO. 1)
PIN 7: GRID (SECTION NO. 1)
PIN 8: CATHODE (SECTION NO. 1)
PIN 9: HEATER CENTER-TAP

N-15155AZ 8-10-49

Tube Department
GENERAL ELECTRIC
Schenectady, N. Y.

from JETEC release
#1453, April 25, 1955

GL-5788

IGNITRON

DESCRIPTION AND RATING

The GL-5788 is a permanently sealed water-cooled rectifier ignitron similar in construction and rating to the GL-5555/FG-238-B. Special features are reliable operation at higher water temperature and lower water pressure drop, than is possible with that tube, and distinctive (larger diameter) ignitor terminals. These features make possible the use of economical water-to-air heat exchangers at higher ambient temperatures, than are possible with the other tube, the operation of six tube cooling jackets in series on normal water supply line pressures, and assure the user against premature ignitor failures caused by connecting the auxiliary anode lead to an ignitor terminal. The tube is designed for operation in 300, 600 and 900 volt d-c industrial rectifier circuits. The continuous average anode current rating is 200 amperes per tube in rectifiers rated up to 400 volts d-c.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation - Cyclic		
Cathode-Spot Starting - Ignitor		
Number of Electrodes		
Main Anodes	1	
Main Cathodes	1	
Auxiliary Anodes	1	
Ignitors	2	
Arc Drop		
At 600 Amperes Peak	16.2 ≠ 0.5	Volts
Cathode Excitation Requirements		
Ignitor Voltage Required to Fire	450	Volts
Ignitor Current Required to Fire	45	Amperes
Excitation Arc Current Required, minimum	8	Amperes
Excitation Arc-Drop Voltage	9 ≠ 0.5	Volts
Excitation Arc-Open-Circuit Voltage, minimum	55	Volts AC

Mechanical

Envelope Material - Metal		
Net Weight, Approximate	25	pounds
Type of Cooling - Water		
Characteristics for Water Cooling		
Water Temperature Rise, maximum	4.5	C
Pressure Drop at 3 Gallons per Minute, maximum	3	Pounds per Square Inch

Thermal	
Water Cooling	
Outlet Water Temperature, maximum	
Peak Inverse Anode Voltage = 900	60 Centigrade
Peak Inverse Anode Voltage =2100	55 Centigrade
Inlet Water Temperature, minimum	6 C
Water Flow	
At Continuous Rated Average Current, minimum	3 Gallons per Minute
At No Load, minimum	1 Gallon per Minute

MAXIMUM RATINGS

As Power Rectifier Tube*

Maximum Peak Anode Voltage		
Inverse	900	2100 Volts
Forward	900	2100 Volts
Maximum Anode Current		
Peak	1800	1200 Amperes
Average		
Continuous	200	150 Amperes
2 Hours	300	225 Amperes
1 Minute	400	300 Amperes
Surge	12000	9000 Amperes
Maximum Duration of Surge Current	0.15	0.15 Second
Frequency Range	25 to 60	25 to 60 Cycles per Second

* Ratings are for zero phase-control angle.

As AC Control Tube

Two Tubes in Inverse Parallel	
Voltage	2400 RMS Volts
Maximum Demand	2400 Kilovolt-Amperes
Average Current at Maximum Demand	135 Amperes
Maximum Average Current	207 Amperes
Demand at Maximum Average Current	1105 Kilovolt-Amperes
Maximum Averaging Time at 2400 Volts RMS	1.66 Seconds
Maximum Surge Current	6000 Peak Amperes

Ignitor	
Maximum Voltage	
Positive	Anode Volts
Negative	5 Volts
Maximum Current	
Peak	100 Amperes
Root Mean Square	15 Amperes
Average	2.0 Amperes
Maximum Averaging Time	10 Seconds
Starting Time at Required Voltage or Current	100 Microseconds

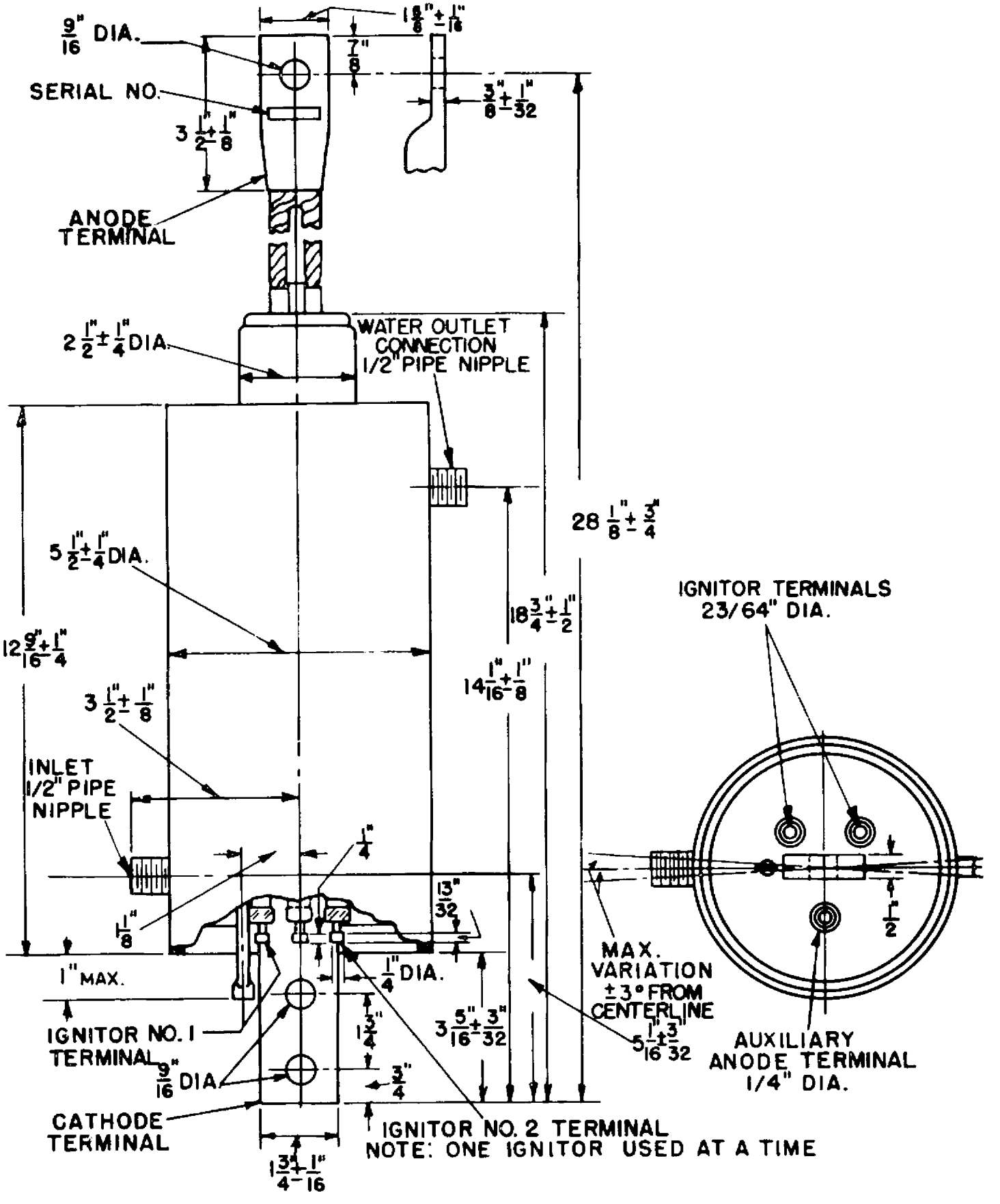
Auxiliary Anode	
Maximum Current	
Peak	30 Amperes
Average	9 Amperes
Maximum Averaging Time	10 Seconds
Root Mean Square	15 Amperes
Maximum Peak Forward Voltage	160 Volts
Maximum Peak Inverse Voltage	
Main Anode Conducting	25 Volts
Main Anode Not Conducting	160 Volts

January 17, 1955

TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

SCHENECTADY 5, N. Y.


9/16" DIA.
SERIAL NO.
3 1/2" ± 1/8"
ANODE TERMINAL
1 5/8" ± 1/16"
7/8"
3/8" ± 1/32"
2 1/2" ± 1/4" DIA.
WATER OUTLET CONNECTION 1/2" PIPE NIPPLE
28 1/8" ± 3/4"
5 1/2" ± 1/4" DIA.
12 9/16" ± 1/4"
18 3/4" ± 1/2"
14 1/16" ± 1/8"
3 1/2" ± 1/8"
INLET 1/2" PIPE NIPPLE
1/4"
1 1/8"
13/32"
1" MAX.
1/4" DIA.
IGNITOR NO. 1 TERMINAL 9/16" DIA
3/4"
3/4"
3 5/16" ± 3/32"
CATHODE TERMINAL
1 3/4" ± 1/16"
IGNITOR NO. 2 TERMINAL
NOTE: ONE IGNITOR USED AT A TIME
IGNITOR TERMINALS 23/64" DIA.
MAX. VARIATION ± 3° FROM CENTERLINE
5 1/16" ± 3/32"
1/2"
AUXILIARY ANODE TERMINAL 1/4" DIA.

DESCRIPTION AND RATING

PLIOTRON GL-5797

The GL-5797 is a subminiature semi-remote-cutoff pentode suitable for use as a radio-frequency amplifier at frequencies up to approximately 400 megacycles. The tube is designed to give reliable service and dependable life under conditions of shock, vibration, and high ambient temperature as encountered in aircraft service. The heater-cathode construction is designed to withstand many-thousand cycles of intermittent operation. The GL-5797 is especially suited for applications where the supply voltage for the heater, plate, and screen is approximately 26.5 volts.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode - Coated Unipotential

Heater Voltage	26.5	Volts
Heater Current	0.045	Ampere
Direct Interelectrode Capacitances*		
Grid-No. 1 to Plate	0.028	Max uuf
Input	4.0	uuf
Output	4.2	uuf

Mechanical Data

Mounting Position - Any
Envelope - T-3 Glass
Base - Subminiature Button 8-Lead, K8-1**

MAXIMUM RATINGS

Electrical - Design Center Values

Plate Voltage	50	Volts
Screen Voltage	50	Volts
Plate Dissipation	0.8	Watt
Screen Dissipation	0.25	Watt
Cathode Current	9.0	Milliamperes
Heater-Cathode Voltage	90	Volts
Mechanical		
Peak Impact Acceleration in Any Direction	300	G
Vibrational Acceleration in Any Direction /	2.5	G
Ambient Temperature	+175	C

CHARACTERISTICS AND TYPICAL OPERATION

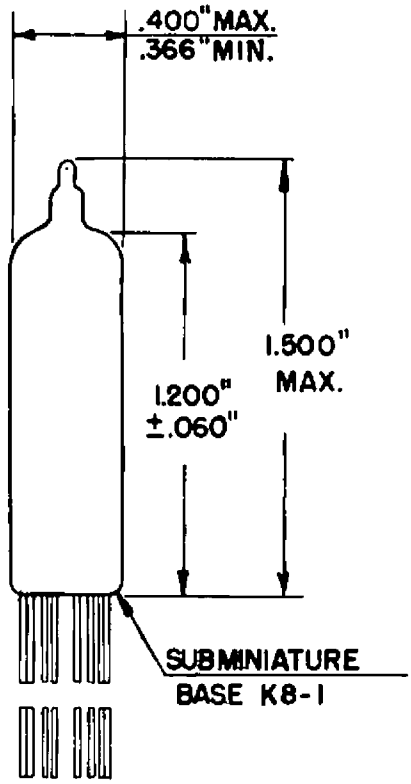
Class A_1 Amplifier

Plate Voltage	26.5	Volts
Suppressor Voltage #	0	Volt
Screen Voltage	26.5	Volts
Grid-No. 1 Voltage	0	Volt
Plate Resistance, approximate	0.07	Megohm
Transconductance	3450	Micromhos
Plate Current	2.75	Milliamperes
Screen Current	0.9	Milliampere
Grid-No. 1 Voltage, approximate for Gm = 10 Micromhos	-3.5	Volts

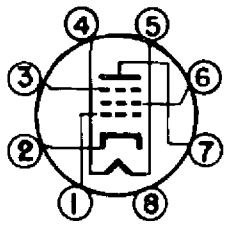
from RTMA release #1020, Sept. 17, 1951, & release #1020A, Dec. 12, 1952

GENERAL ELECTRIC

* With minimum lead length of 1.500 inches as specified.
** With external shield of 0.0405 inch diameter connected to cathode.
/ For a period of at least 96 hours at 25 cycles per second.
Lead 3 externally connected to lead 2.



BASING DIAGRAM



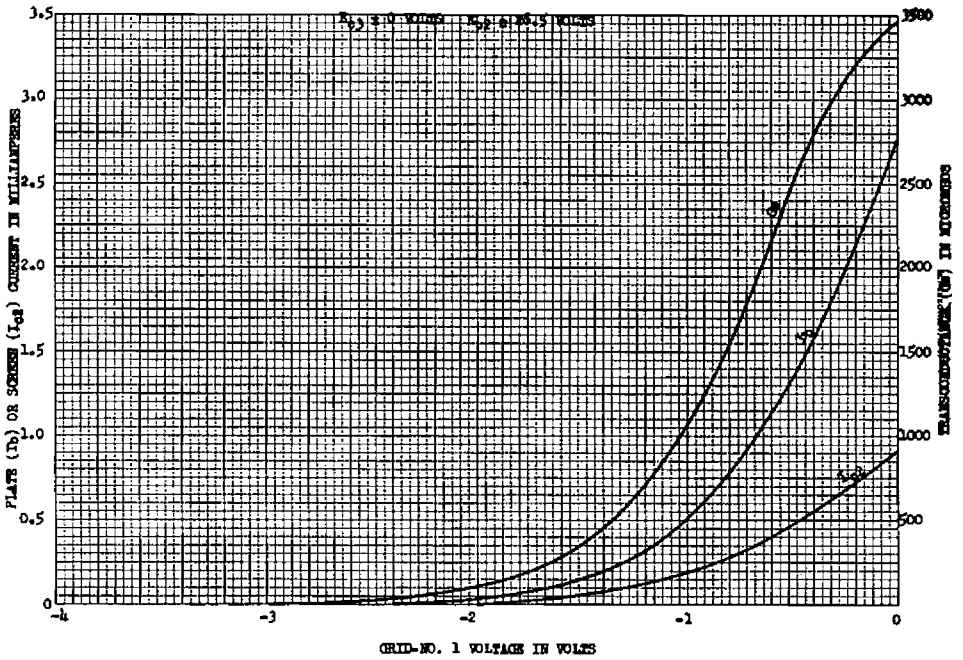
8CY
(BOTTOM VIEW)

LEAD 1: GRID NUMBER 1
LEAD 2: CATHODE
LEAD 3: INTERNAL SHIELD AND GRID NUMBER 3 (SUPPRESSOR)
LEAD 4: HEATER
LEAD 5: HEATER
LEAD 6: GRID NUMBER 2 (SCREEN)
LEAD 7: PLATE
LEAD 8: NO CONNECTION

K-69087-72A476 July 23, 1951

OUTLINE
GL-5797

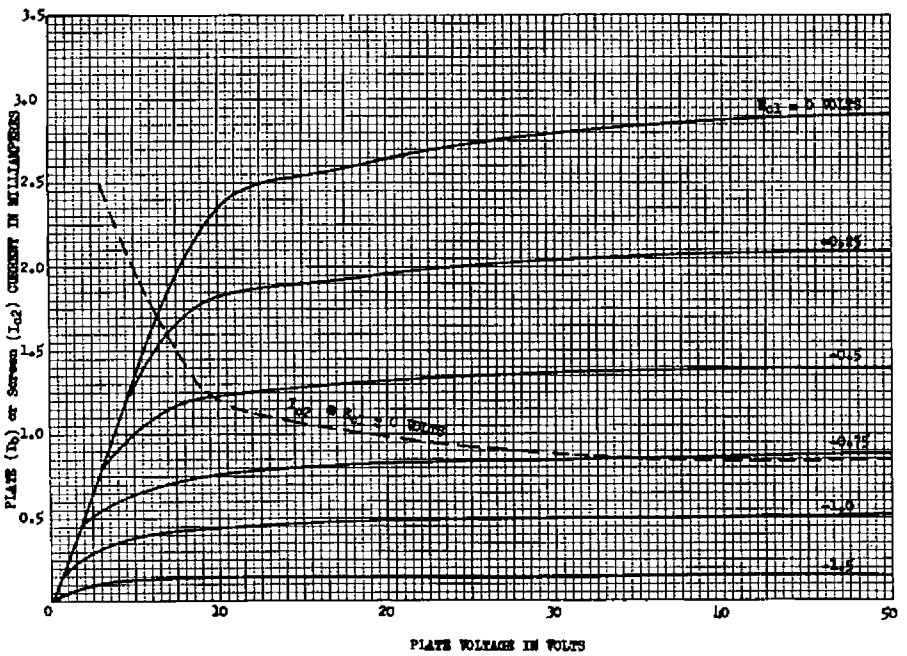
Ef = 26.5 Volts Eb = 26.5 Volts



K-69087-72A467 July 23, 1951

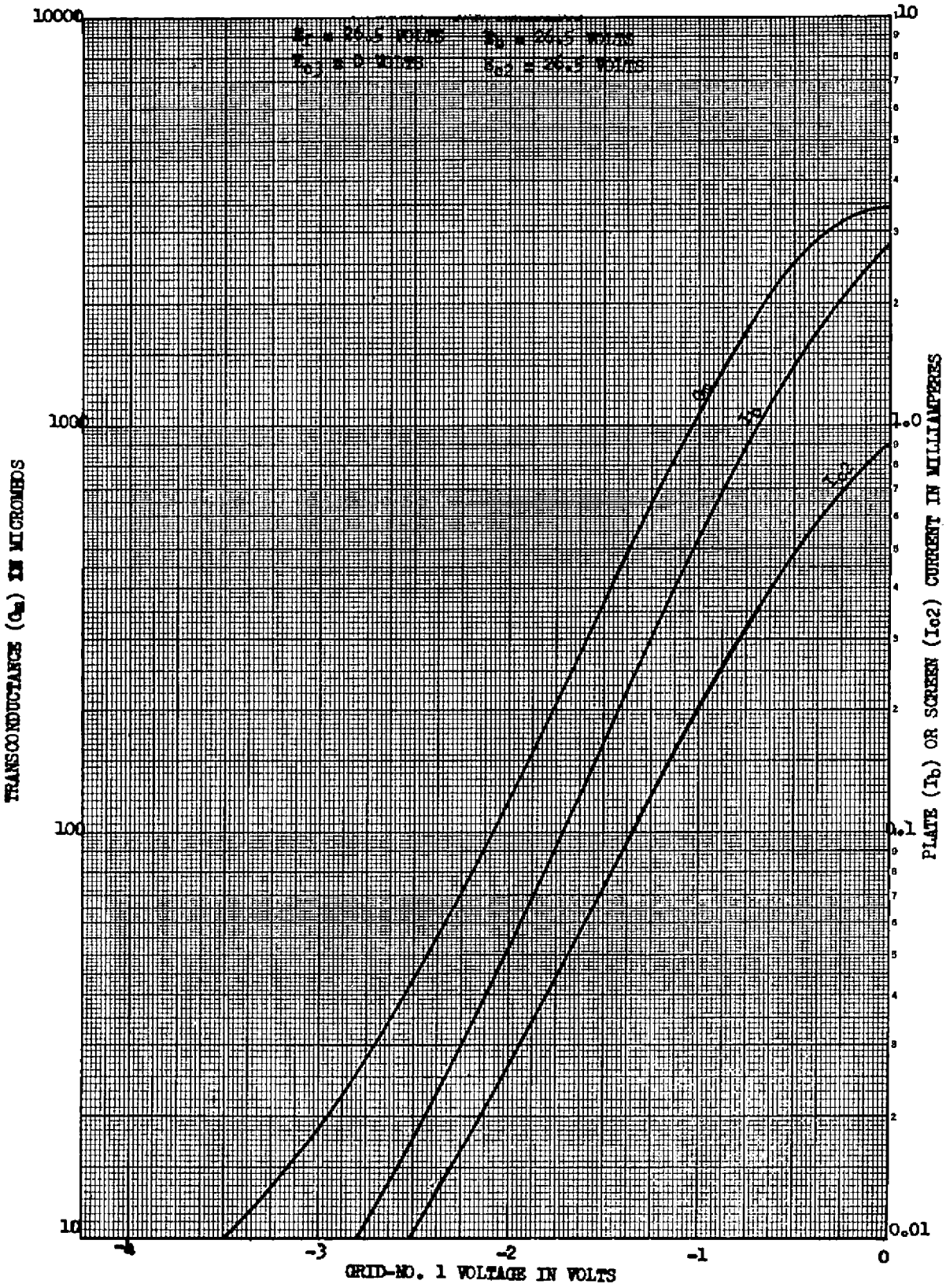
GL-5797
AVERAGE CHARACTERISTICS

Ef = 26.5 Volts EC3 = 0 Volts
EC2 = 26.5 Volts



K-69087-72A469 July 19, 1951

GL-5797
AVERAGE PLATE CHARACTERISTICS



K-69087-72A468

July 23, 1951

GL-5797
AVERAGE CHARACTERISTICS

GENERAL ELECTRIC

ELECTRONICS DEPARTMENT, TUBE DIVISIONS
SCHENECTADY, NEW YORK

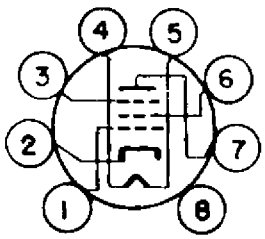
8-51 (1M)

Correction Notice for 5797 and 5798 Data Sheets

Direct Interelectrode Capacitances should be referenced with a double asterisk instead of a single one.

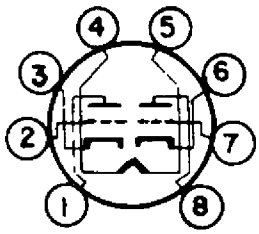
Base-Subminiature Button 8-Lead, K8-1 should be referenced with a single asterisk instead of a double one.

The Basing Diagram should show an eighty-degree spacing between leads one and eight and a forty-degree spacing between all other leads. The proper delineation of this diagram appears below.



8CY
(BOTTOM VIEW)

5797



8CZ
(BOTTOM VIEW)

5798

RADIO-TELEVISION MANUFACTURERS ASSOCIATION

ENGINEERING DEPARTMENT

RECEIVED
RTMA DATA BUREAU
489 Fifth Avenue
New York 17, N. Y.
MUrray Hill 2-6150

Release No. 1020 A (Tent.)

December 12, 1952

To Tube Engineers:

On September 17, 1951, in Release No. 1020, the RTMA Engineering Office announced registration of the tube type designations

5797
5798

under sponsorship of General Electric Company, Schenectady 5, New York.

Sponsor now proposes the following modifications in designation 5797:

Item	As Registered	As Proposed
Direct Interelectrode Capacitances		
Grid No.1 to Plate, maximum,	0.028	0.024 uuf
Input	4.0	4.2 uuf
Output	4.2	3.2 uuf
Heater Voltage	26.5	26.5±5% Volts
Base - Subminiature Button 8-Lead	K8-1	E8-10
MAXIMUM RATINGS		
Mechanical		
Peak Impact Acceleration	300	450 G
Ambient Temperature	±175	omit Centigrade
Bulb Temperature at Hottest Point	not given	±225 Centigrade
CHARACTERISTICS AND TYPICAL OPERATION		
Plate Current	2.75	2.8 Milliamperes

And the following modifications to designation 5798:

Heater Voltage	26.5	26.5±5% Volts
Base-Subminiature Button 8-Lead	K8-1	E8-10
MAXIMUM RATINGS		
Electrical		
Plate Dissipation (Each Section)	0.4	0.2 Watt
Mechanical		
Peak Impact Acceleration	300	450 G
Ambient Temperature	±175	omit Centigrade
Bulb Temperature at Hottest Point	not given	±225 Centigrade
CHARACTERISTICS AND TYPICAL OPERATION		
Amplification Factor	21	24
Plate Resistance, approximate	6700	7100 Ohms
Transconductance	3150	3400 Micromhos
Plate Current	2.3	2.0 Milliamperes

Unless valid objection to these reregistrations are lodged with the Engineering Office prior to January 12, 1953, these registrations will be made and this material will be reissued marked "Final".

Very truly yours,

Chief Engineer
Radio-Television Manufacturers Association

RRBa tcher:mg

DESCRIPTION AND RATING

PLIOTRON GL-5798

The GL-5798 is a subminiature medium-mu twin triode suitable for use as an oscillator-mixer at frequencies up to approximately 400 megacycles. The tube is designed to give reliable service and dependable life under conditions of shock, vibration, and high ambient temperature as encountered in aircraft service. The heater-cathode construction is designed to withstand many-thousand cycles of intermittent operation. The GL-5798 is especially suited for applications in which the supply voltage for the heater and plates is approximately 26.5 volts.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode - Coated Unipotential

Heater Voltage	26.5	Volts
Heater Current	0.090	Ampere
Direct Interelectrode Capacitances*		
Grid to Plate (Each Section)	1.7	uuf
Input (Each Section)	1.9	uuf
Output (Each Section)	1.7	uuf

Mechanical Data

Mounting Position - Any
Envelope - T-3 Glass
Base - Subminiature Button 8-Lead, K8-1**

MAXIMUM RATINGS

Electrical - Design Center Values

Plate Voltage	50	Volts
Plate Dissipation (Each Section)	0.4	Watt
Heater-Cathode Voltage	90	Volts

Mechanical

Peak Impact Acceleration in Any Direction	300	G
Vibrational Acceleration in Any Direction ⁄	2.5	G
Ambient Temperature	+175	C

CHARACTERISTICS AND TYPICAL OPERATION

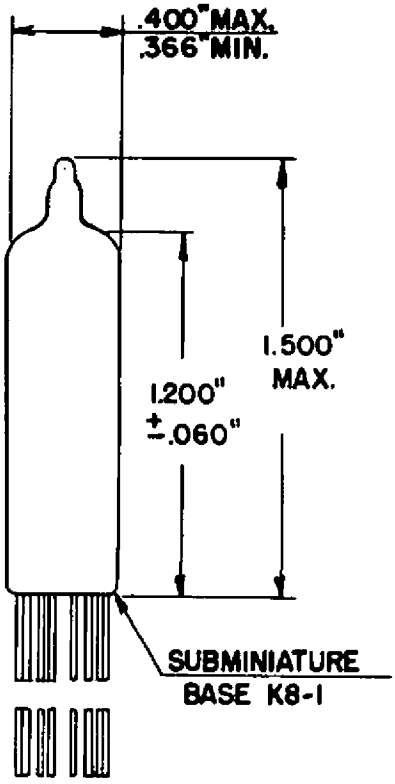
Class A_1 Amplifier - Each Section

Plate Voltage	26.5	Volts
Grid Voltage	0	Volt
Amplification Factor	21	
Plate Resistance, approximate	6700	Ohms
Transconductance	3150	Micromhos
Plate Current	2.3	Milliamperes
Grid Voltage, approximate for Ib = 10 Microamperes	-2.5	Volts

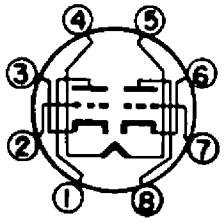
* With minimum lead length of 1.500 inches as specified.
** With external shield of 0.405 inch diameter connected to cathode of section under test.
⁄ For a period of at least 96 hours at 25 cycles per second.

from RTMA release #1020, Sept. 17, 1951, & release #1020A, Dec. 12, 1952

GENERAL ELECTRIC



BASING DIAGRAM

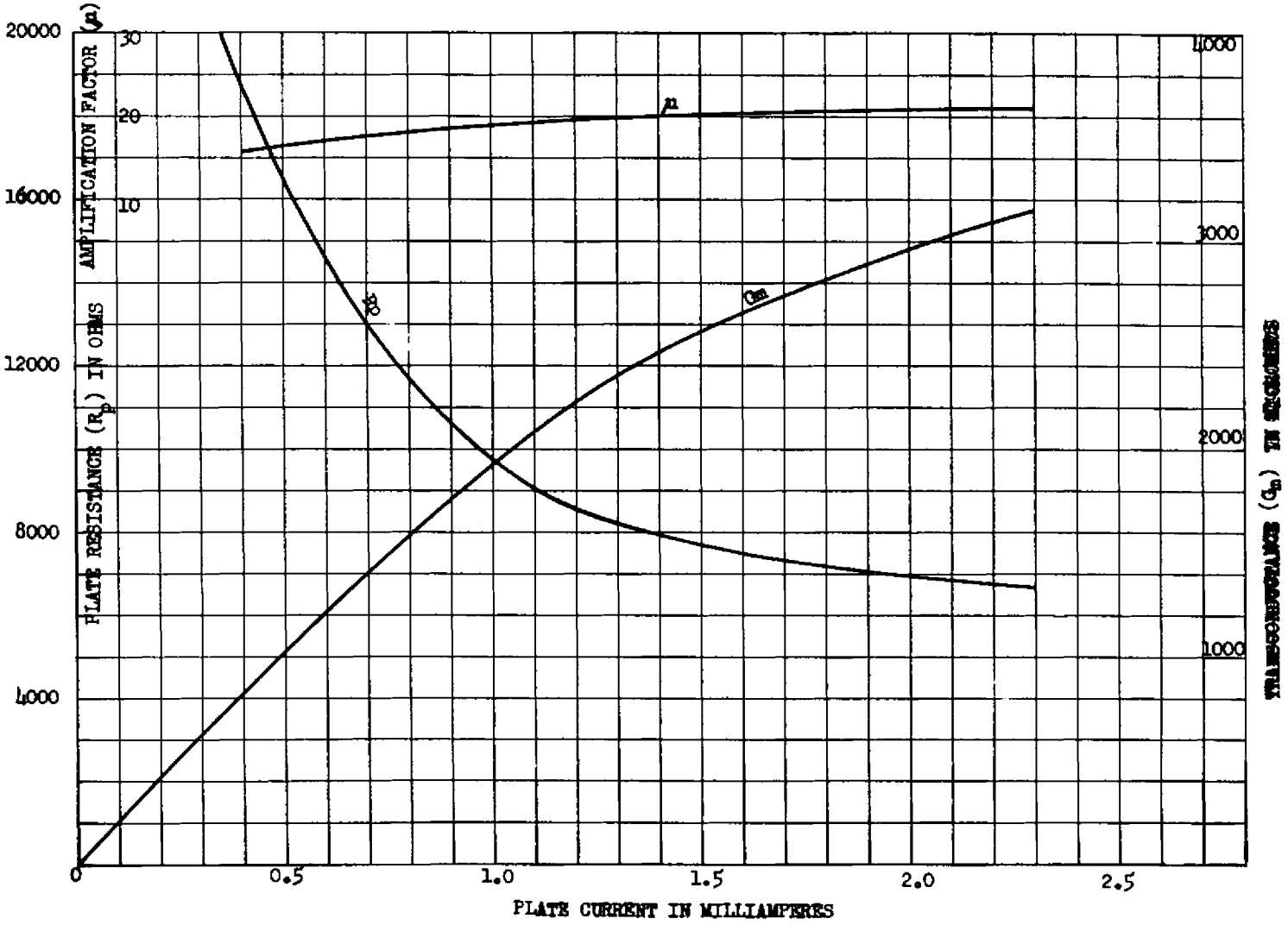


8CZ
(BOTTOM VIEW)

LEAD 1: PLATE (SECTION 2)
LEAD 2: GRID (SECTION 2)
LEAD 3: CATHODE (SECTION 2)
LEAD 4: POSITIVE HEATER
LEAD 5: NEGATIVE HEATER AND INTERNAL SHIELD
LEAD 6: CATHODE (SECTION 1)
LEAD 7: GRID (SECTION 1)
LEAD 8: PLATE (SECTION 1)

K69087-72A477 July 23, 1951

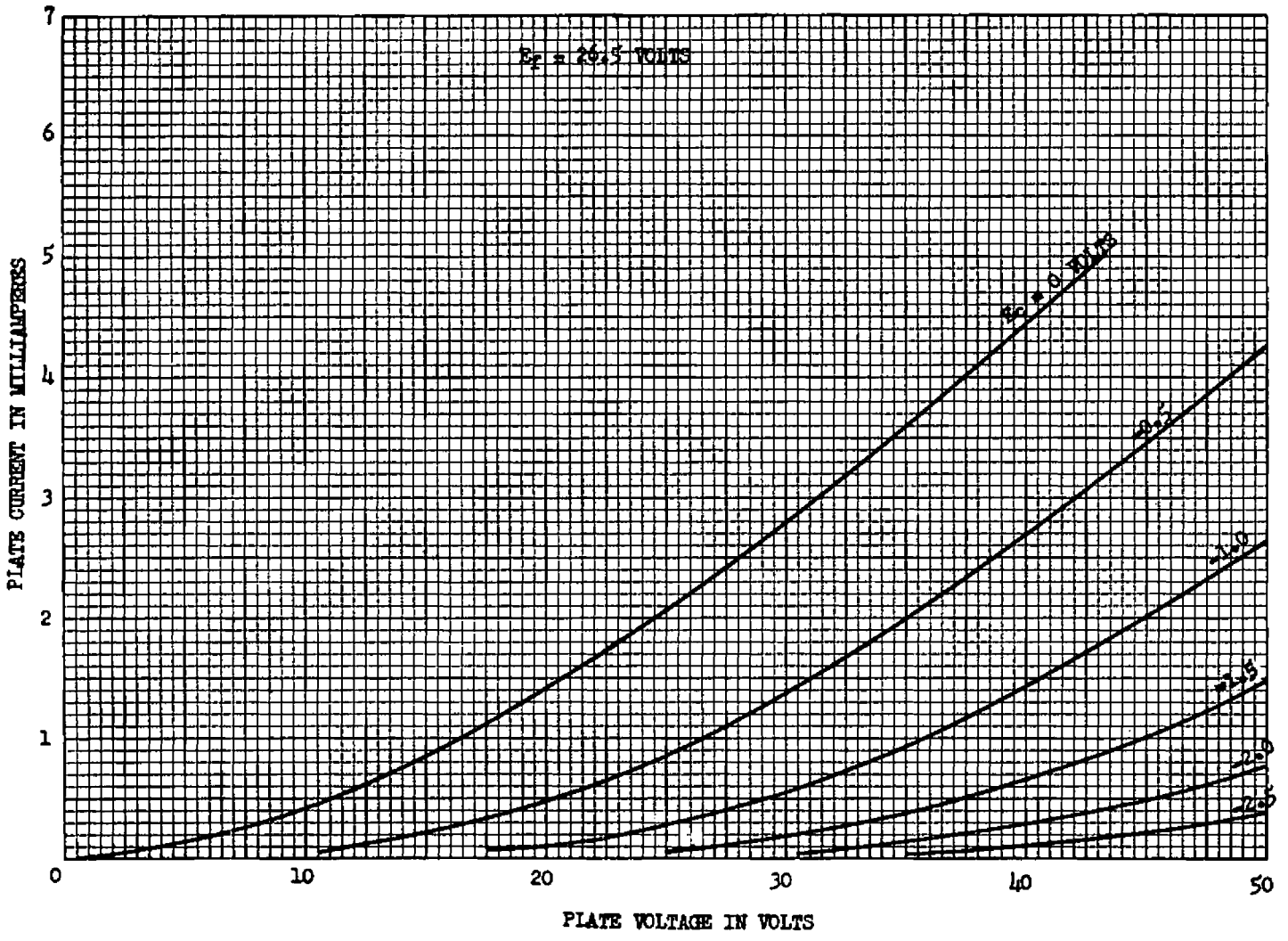
OUTLINE
GL-5798



K-69087-72A470

July 23, 1951

GL-5798
AVERAGE CHARACTERISTICS
(EACH SECTION)
Ef = 26.5 Volts Eb = 26.5 Volts



K-69087-72A466

July 19, 1951

GL-5798
AVERAGE PLATE CHARACTERISTICS
(EACH SECTION)

GENERAL ELECTRIC

ELECTRONICS DEPARTMENT, TUBE DIVISIONS

SCHENECTADY, NEW YORK

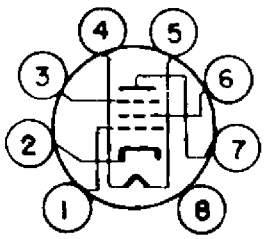
8-51 (IM)

Correction Notice for 5797 and 5798 Data Sheets

Direct Interelectrode Capacitances should be referenced with a double asterisk instead of a single one.

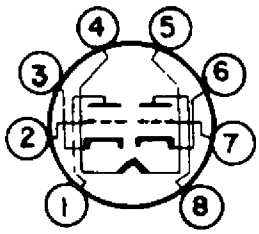
Base-Subminiature Button 8-Lead, K8-1 should be referenced with a single asterisk instead of a double one.

The Basing Diagram should show an eighty-degree spacing between leads one and eight and a forty-degree spacing between all other leads. The proper delineation of this diagram appears below.



8CY
(BOTTOM VIEW)

5797



8CZ
(BOTTOM VIEW)

5798

RADIO-TELEVISION MANUFACTURERS ASSOCIATION

ENGINEERING DEPARTMENT

RECEIVED
RTMA DATA BUREAU
489 Fifth Avenue
New York 17, N. Y.
MUrray Hill 2-6150

Release No. 1020 A (Tent.)

December 12, 1952

To Tube Engineers:

On September 17, 1951, in Release No. 1020, the RTMA Engineering Office announced registration of the tube type designations

5797
5798

under sponsorship of General Electric Company, Schenectady 5, New York.

Sponsor now proposes the following modifications in designation 5797:

Item	As Registered	As Proposed
Direct Interelectrode Capacitances		
Grid No.1 to Plate, maximum,	0.028	0.024 uuf
Input	4.0	4.2 uuf
Output	4.2	3.2 uuf
Heater Voltage	26.5	26.5±5% Volts
Base - Subminiature Button 8-Lead	K8-1	E8-10
MAXIMUM RATINGS		
Mechanical		
Peak Impact Acceleration	300	450 G
Ambient Temperature	±175	omit Centigrade
Bulb Temperature at Hottest Point	not given	±225 Centigrade
CHARACTERISTICS AND TYPICAL OPERATION		
Plate Current	2.75	2.8 Milliamperes

And the following modifications to designation 5798:

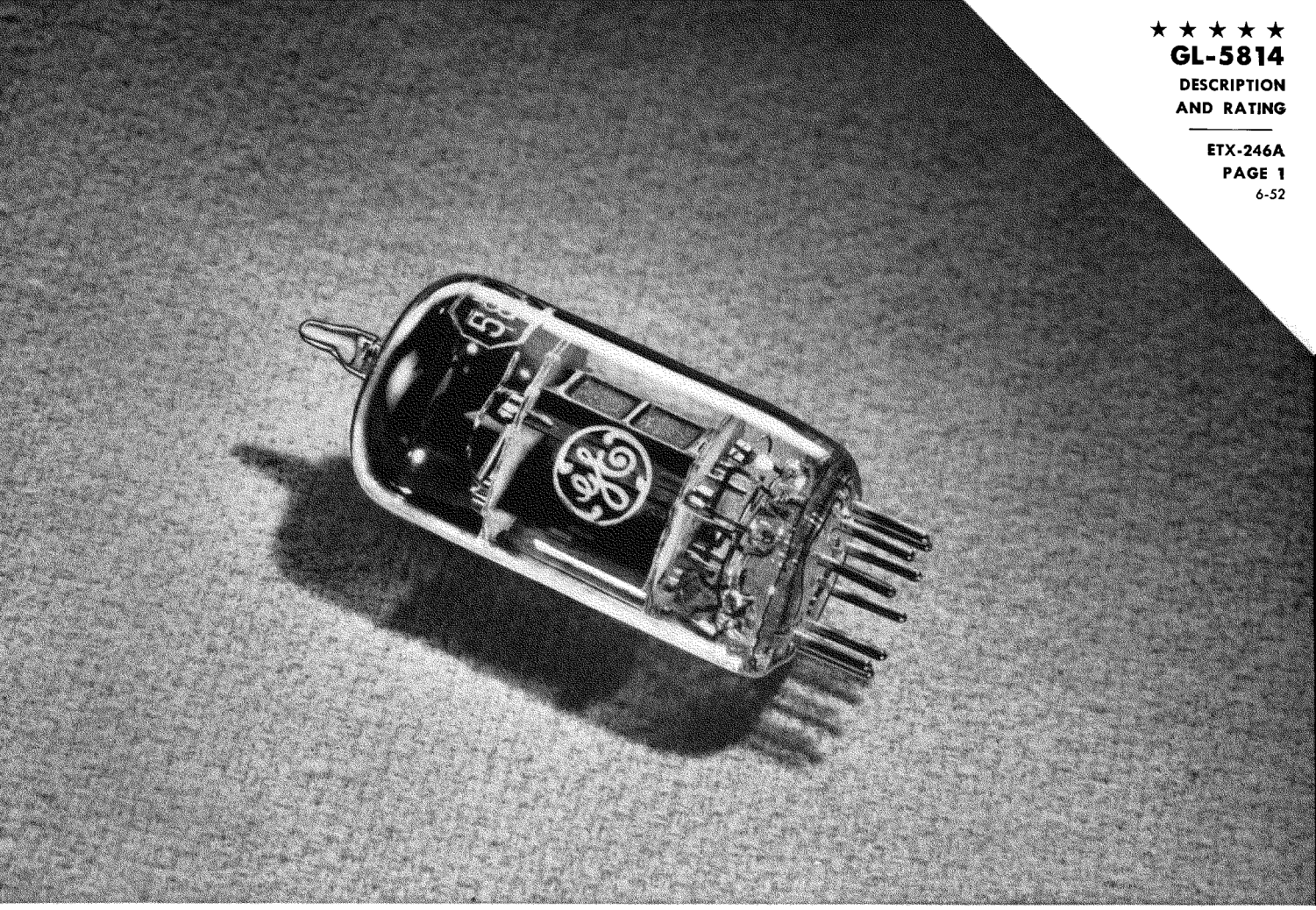
Heater Voltage	26.5	26.5±5% Volts
Base-Subminiature Button 8-Lead	K8-1	E8-10
MAXIMUM RATINGS		
Electrical		
Plate Dissipation (Each Section)	0.4	0.2 Watt
Mechanical		
Peak Impact Acceleration	300	450 G
Ambient Temperature	±175	omit Centigrade
Bulb Temperature at Hottest Point	not given	±225 Centigrade
CHARACTERISTICS AND TYPICAL OPERATION		
Amplification Factor	21	24
Plate Resistance, approximate	6700	7100 Ohms
Transconductance	3150	3400 Micromhos
Plate Current	2.3	2.0 Milliamperes

Unless valid objection to these reregistrations are lodged with the Engineering Office prior to January 12, 1953, these registrations will be made and this material will be reissued marked "Final".

Very truly yours,

Chief Engineer
Radio-Television Manufacturers Association

RRBa tcher:mg



TWIN TRIODE

DESCRIPTION

The GL-5814 is a nine-pin miniature medium-mu tube with two triode sections with individual cathode connections. It is similar in electrical characteristics to the 12AU7 receiving tube. The GL-5814, however, incorporates distinctive mechanical design features, and increased heater current which provides a safety factor in cathode performance. These features combine to produce a sturdy shock-resistant tube and one which will give long life under conditions of intermittent operation.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode—Coated Unipotential

	Parallel	Series	
Heater voltage	6.3	12.6	volts
Heater current	0.350	0.175	amperes
Direct interelectrode capacitances†			
Grid to plate (section number 1)	1.5		uuf
Grid to plate (section number 2)	1.5		uuf
Input (section number 1)	1.6		uuf
Input (section number 2)	1.6		uuf
Output (section number 1)	0.50		uuf
Output (section number 2)	0.35		uuf

GE Electronic TUBE

GENERAL ELECTRIC

Supersedes ETX-246 dated 5-50

TECHNICAL INFORMATION (CONT'D)

Mechanical Data

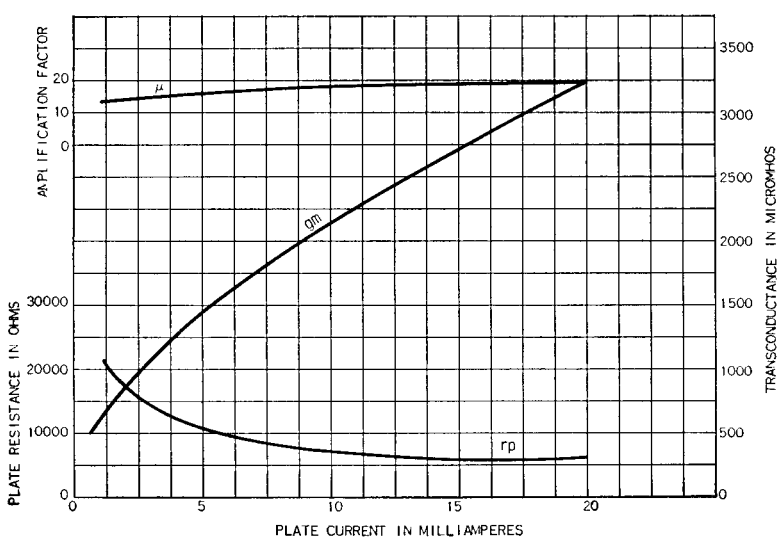
Mounting position—Any
Envelope—T-6½ glass

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings	**Design Center**	**Absolute**	
Plate voltage	300	330	volts
Cathode current (each section)	20	22	milliamperes
Plate dissipation (each section)	2.75	3.03	watts
Peak heater-cathode voltage			
Heater negative with respect to cathode	90	100	volts
Heater positive with respect to cathode	90	100	volts
Typical Operation			
Class A1 amplifier (each triode section)			
Plate voltage	100	250	volts
Grid voltage‡	0	−8.5	volts
Amplification factor	19.5	17	
Plate resistance	6250	7700	ohms
Transconductance	3100	2200	micromhos
Plate current	11.8	10.5	milliamperes

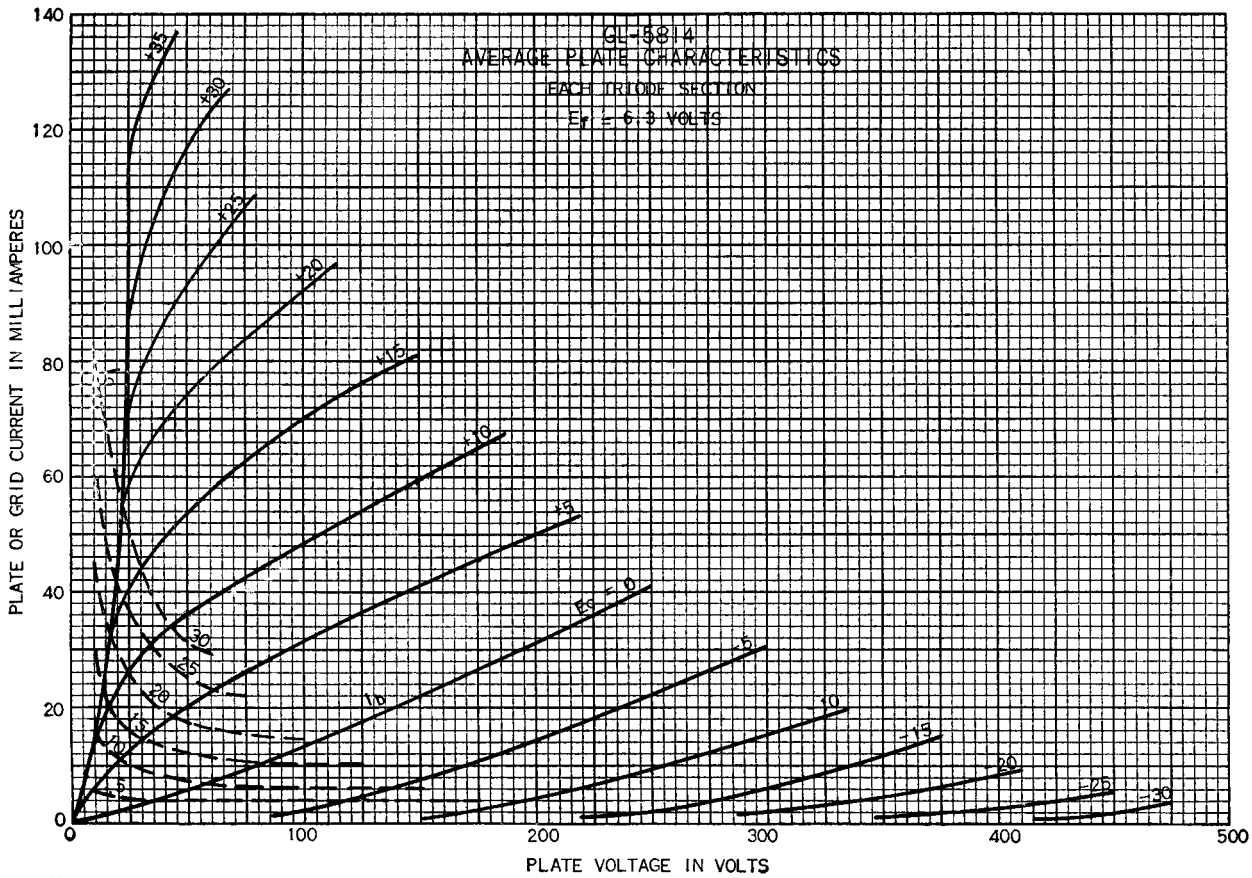
†Measured with no external shield.
‡The d-c resistance in the grid circuit under rated maximum conditions should not exceed 0.25 megohm for fixed-bias operation and 1.0 megohm for cathode-bias operation.

GL-5814
AVERAGE CHARACTERISTICS
$E_f = 6.3$ VOLTS PLATE VOLTAGE = 250



K-69087-72A303 8-8-49

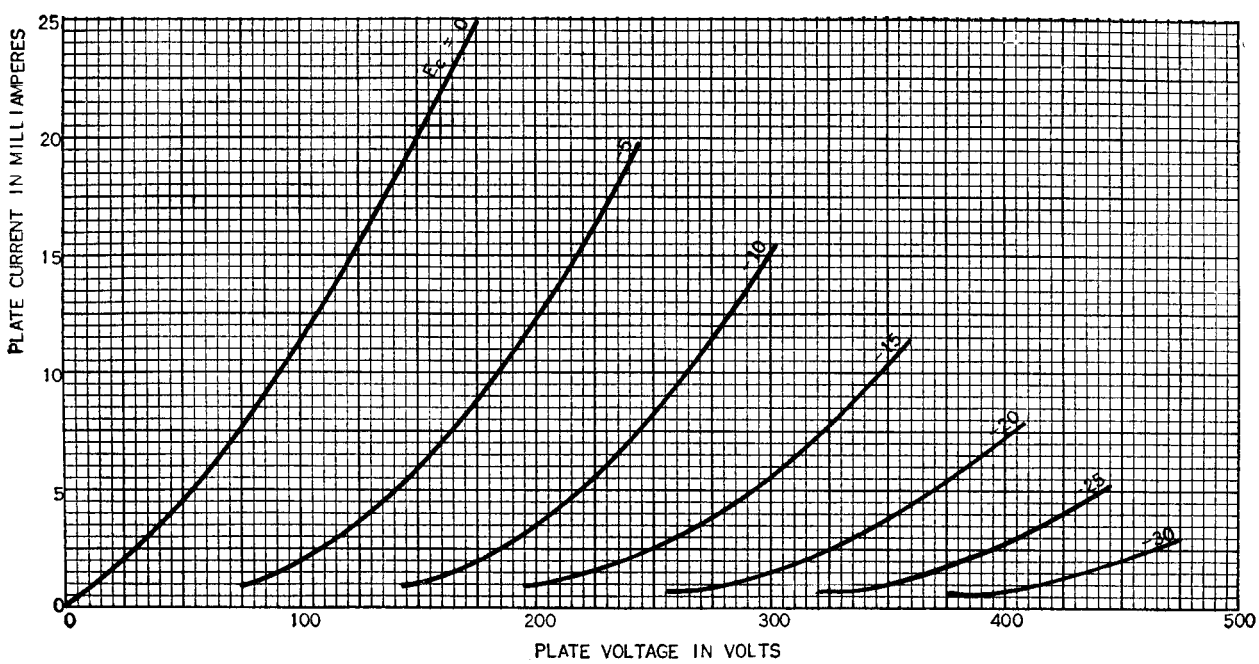
GL-5814
AVERAGE PLATE CHARACTERISTICS
EACH TRIODE SECTION $E_f = 6.3$ VOLTS



K-69087-72A302

8-8-49

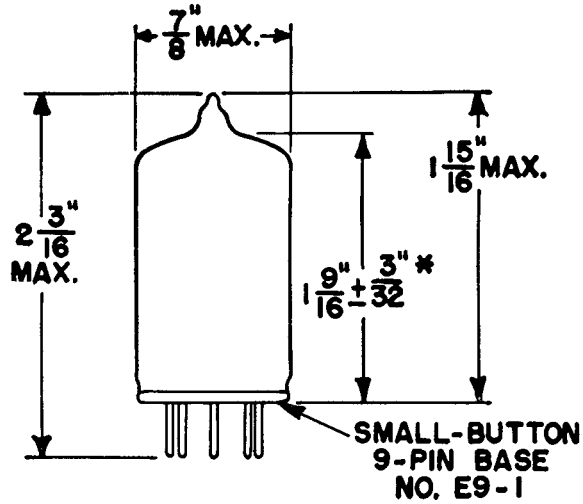
GL-5814
AVERAGE PLATE CHARACTERISTICS
EACH TRIODE SECTION $E_f = 6.3$ VOLTS
HEATERS CONNECTED IN PARALLEL



K-69087-72A304

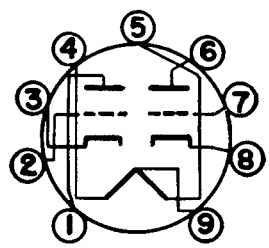
8-8-49

OUTLINE
PLIOTRON GL-5814



***MEASURED FROM BASE SEAT TO BULB-TOP LINE AS DETERMINED BY RING GAGE OF 7/16" I.D.**

BASING DIAGRAM



PIN 1: PLATE (SECTION NO. 2)
PIN 2: GRID (SECTION NO. 2)
PIN 3: CATHODE (SECTION NO. 2)
PIN 4: HEATER
PIN 5: HEATER
PIN 6: PLATE (SECTION NO. 1)
PIN 7: GRID (SECTION NO. 1)
PIN 8: CATHODE (SECTION NO. 1)
PIN 9: HEATER CENTER-TAP

N-15155AZ 8-10-49

Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.

Electronic TUBES

5840
PENTODE
Five-Star Tube
★ ★ ★ ★ ★

FOR WIDE-BAND HIGH-FREQUENCY AMPLIFIER APPLICATIONS

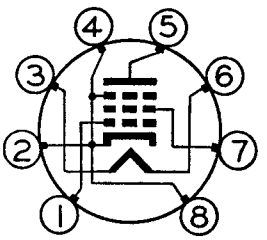
8-LEAD SUBMINIATURE
SHARP-CUTOFF CHARACTERISTIC
SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING
HIGH TRANSCONDUCTANCE

DESCRIPTION AND RATING

The 5840 is a subminiature sharp-cutoff pentode for use in high-frequency circuits.

The 5840 is a special-quality tube for use in critical industrial and military applications where operational dependability is of primary importance. Features of the tube include a high degree of mechanical strength and a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

BASING DIAGRAM



RETMA 8DL

TERMINAL CONNECTIONS

Lead 1—Grid Number 1
Lead 2—Cathode and Grid Number 3
Lead 3—Heater
Lead 4—Cathode and Grid Number 3
Lead 5—Plate
Lead 6—Heater
Lead 7—Grid Number 2 (Screen)
Lead 8—Cathode and Grid Number 3

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ± 5%	Volts
Heater Current	0.15	Amperes

Direct Interelectrode Capacitances

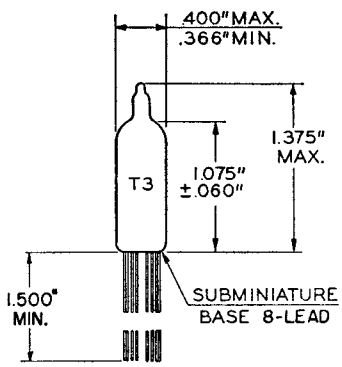
	With Shield*	Without Shield	
Grid-Number 1 to Plate, maximum	0.015	0.03	μμf
Input	4.2	4.0	μμf
Output	3.4	1.9	μμf

*With external shield of 0.405-inch inside diameter connected to cathode.

MECHANICAL

Mounting Position—Any
Envelope—T-3, Glass
Base—E8-10, Subminiature Button 8-Lead

PHYSICAL DIMENSIONS



RETMA 3-1

GENERAL ELECTRIC

Supersedes ET-T1096 dated 8-54

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES

Plate Voltage	165	Volts
Screen Voltage	155	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Plate Dissipation	0.8	Watts
Screen Dissipation	0.35	Watts
DC Cathode Current	16.5	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	200	Volts
Heater Negative with Respect to Cathode	200	Volts
Bulb Temperature at Hottest Point	220	C

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	100	Volts
Screen Voltage	100	Volts
Cathode-Bias Resistor	150	Ohms
Plate Resistance, approximate	0.26	Megohms
Transconductance	5000	Micromhos
Plate Current	7.5	Milliamperes
Screen Current	2.4	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 10 Microamperes	−9.0	Volts

CLASS A RESISTANCE-COUPLED AMPLIFIER

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

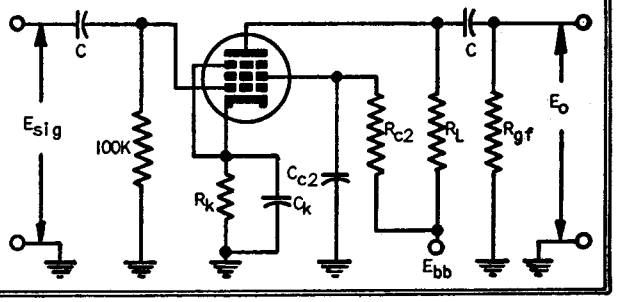
R_L	R_{gf}	Ebb = 90 Volts				Ebb = 150 Volts				Ebb = 225 Volts			
		R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain
0.10	0.10	1000	0.2	13	50	500	0.3	19	83	400	0.3	29	110
0.10	0.24	1000	0.2	16	73	500	0.3	25	120	400	0.3	38	160
0.24	0.24	1700	0.5	13	72	1500	0.6	20	100	700	0.8	29	160
0.24	0.51	2000	0.6	15	89	1500	0.7	24	140	700	0.9	35	210
0.51	0.51	2500	1.3	11	93	2000	1.5	18	140	1000	1.7	28	200
0.51	1.0	3000	1.5	13	110	2000	1.7	20	180	1000	2.0	31	260

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	Ebb = 90 Volts				Ebb = 150 Volts				Ebb = 225 Volts			
		R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain
0.10	0.10	1200	0.2	13	48	700	0.2	18	77	500	0.3	28	110
0.10	0.24	1300	0.2	16	70	800	0.3	24	110	500	0.3	37	150
0.24	0.24	2800	0.4	12	68	1700	0.6	20	100	1200	0.8	29	150
0.24	0.51	3000	0.5	15	82	1800	0.7	24	140	1300	0.8	35	190
0.51	0.51	5500	1.0	11	76	3500	1.3	18	120	2400	1.6	26	180
0.51	1.0	6200	1.2	12	92	3800	1.6	19	160	2500	1.8	31	230

Notes:

1. E_o is maximum RMS voltage output for approximately five percent total harmonic distortion.
2. Gain is measured for an output voltage of two volts RMS
3. R_k is in ohms; R_{c2}, R_L, and R_{gf} are in megohms.
4. Coupling capacitors (C) should be selected to give desired frequency response. R_k and R_{c2} should be adequately by-passed.



CHARACTERISTICS LIMITS

		Minimum	Maximum	
Heater Current				
Ef = 6.3 volts	Initial	140	160	Milliamperes
	500-Hr	138	164	Milliamperes
Plate Current				
Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed)	Initial	5.5	9.5	Milliamperes
Screen Current				
Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed)	Initial	1.5	3.3	Milliamperes
Transconductance (1)				
Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 Ohms (by-passed)	Initial	4200	5800	Micromhos
Transconductance Change with Heater Voltage				
Difference between Transconductance (1) and Transconductance at Ef = 5.7 volts (other conditions the same) expressed as a percentage of Transconductance (1)	Initial	....	10	Percent
	500-Hr	....	15	Percent
Transconductance Change with Operation				
Difference between Transconductance (1) initially and after operation expressed as a percentage of initial value	500-Hr	....	20	Percent
Average Transconductance Change with Operation				
Average of values for "Transconductance Change with Operation"	500-Hr	....	15	Percent
Plate Resistance				
Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed)	Initial	0.175	....	Megohms
Plate Current Cutoff				
Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Ec1 = −9.0 volts	Initial	....	50	Microamperes
Interelectrode Capacitances				
Grid-Number 1 to Plate (g1 to p)	Initial	....	0.015	μμf
Input (g1 to h, k, g2, g3)	Initial	3.5	4.9	μμf
Output (p to h, k, g2, g3)	Initial	2.9	3.9	μμf
Measured with external shield of 0.405-inch inside diameter connected to cathode.				
Negative Grid-Number 1 Current				
Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed), Rg1 = 1.0 meg	Initial	....	0.3	Microamperes
	500-Hr	....	0.8	Microamperes
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts,				
Heater Positive with Respect to Cathode	Initial	....	5.0	Microamperes
	500-Hr	....	10	Microamperes
Heater Negative with Respect to Cathode	Initial	....	5.0	Microamperes
	500-Hr	....	10	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results				
Grid-Number 1 to All at 100 Volts DC	Initial	100	....	Megohms
	500-Hr	50	....	Megohms
Plate to All at 300 Volts DC	Initial	100	....	Megohms
	500-Hr	50	....	Megohms
Vibrational Noise Output Voltage RMS				
Ef = 6.3 volts, Ebb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed), R_L = 10,000 ohms, Vibrational acceleration = 15 G at 40 cps	Initial	....	60	Millivolts
Grid-Number 1 Emission Current				
Ef = 7.5 volts, Eb = 100 volts, Ec2 = 100 volts, Ecc1 = −9.0 volts, Rg1 = 1.0 meg	Initial	....	0.5	Microamperes

The indicated 500-hour values are life-test end points for the following conditions of operation: Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms, Rg1 = 1.0 meg, Ehk = 200 volts with heater positive with respect to cathode, and bulb temperature = 220 C minimum.

SPECIAL TESTS AND RATINGS

Stability Life Test
Statistical sample operated for one hour to evaluate and control initial variations in transconductance.

Survival Rate Life Test
Statistical sample operated for one hundred hours to evaluate and control early-life electrical and mechanical inoperatives.

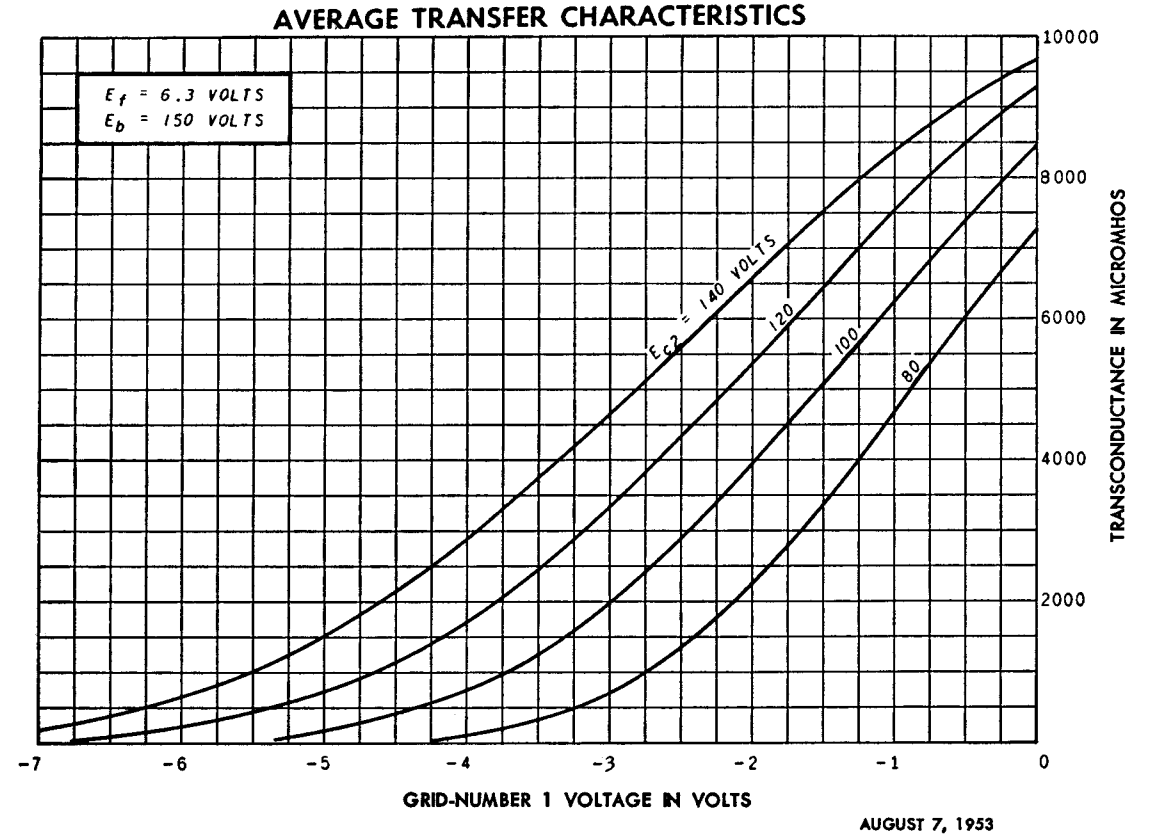
Heater-Cycling Life Test
Statistical sample operated for 2000 cycles to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.0 volts cycled for one minute on and four minutes off, Eb = Ec2 = Ec1 = 0 volts, and Ehk = 140 volts RMS.

Shock Rating—450 G
Statistical sample subjected to five impact accelerations of 450 G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

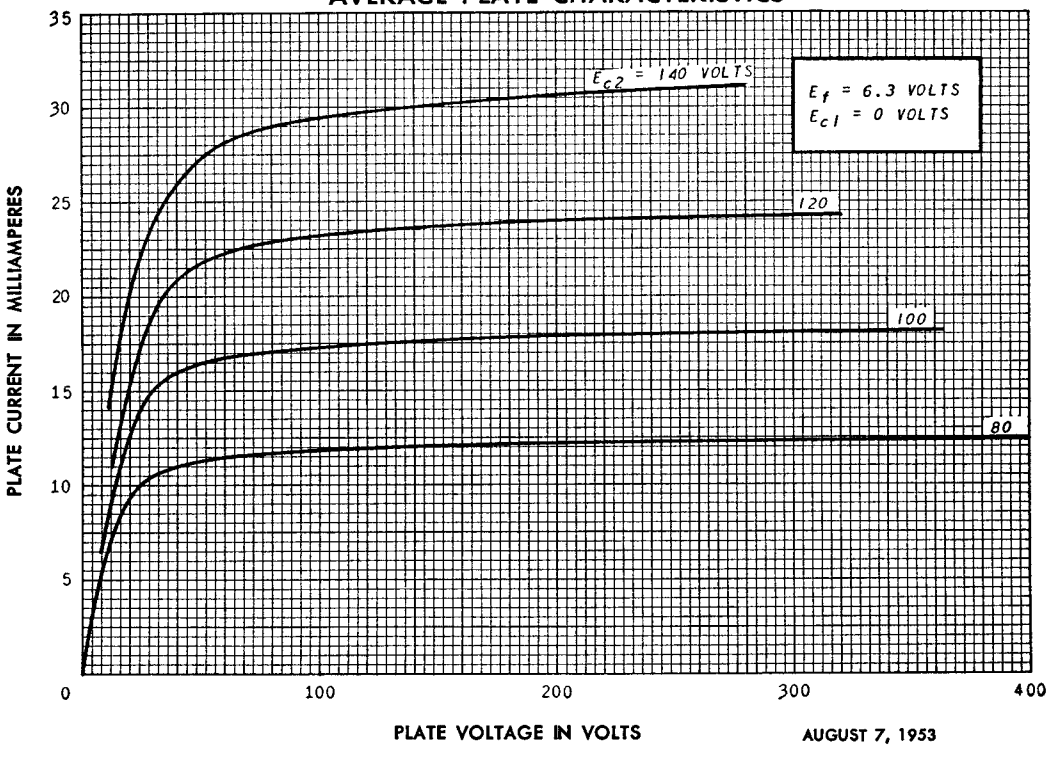
Fatigue Rating—2.5 G
Statistical sample subjected to vibrational acceleration of 2.5 G for 32 hours minimum in each of three different positions. The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

Altitude Rating—60,000 Feet
Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

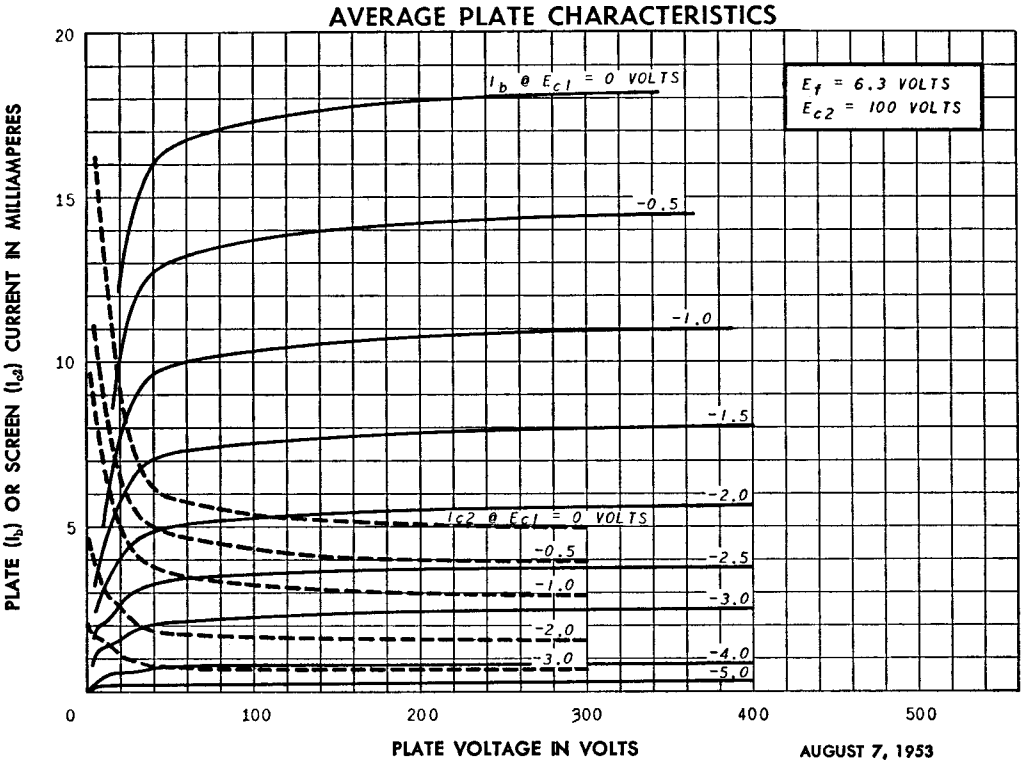
Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.
In the design of military equipment employing this tube, reference should be made to the appropriate MIL-E-1 specification.



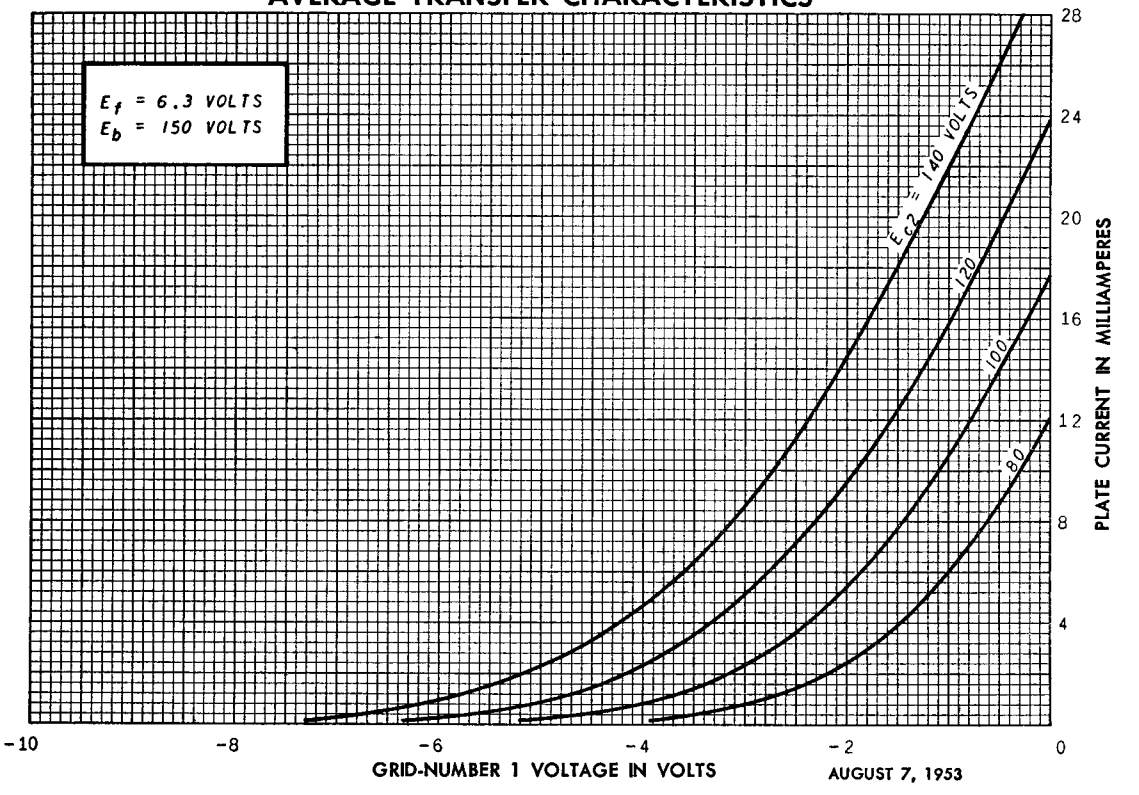
AVERAGE PLATE CHARACTERISTICS



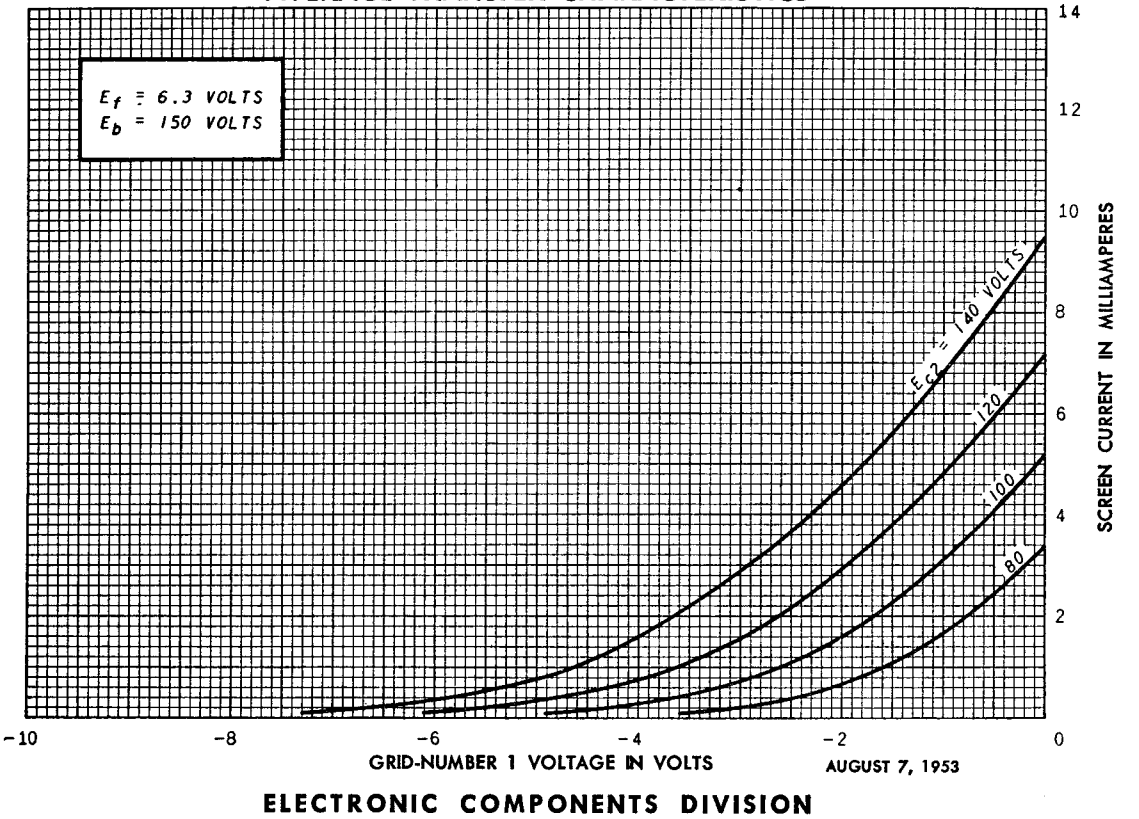
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

DESCRIPTION AND RATING

PENTODE GL-5899

FIVE-STAR TUBE

★ ★ ★ ★ ★

The GL-5899 is a subminiature semi-remote-cutoff pentode intended for use as a wide-band, high-frequency amplifier. Its semi-remote-cutoff characteristic makes it suitable for use in circuits to which it is desired to apply automatic-gain-control. This tube is designed for service under severe conditions of mechanical shock and mechanical vibration, and where high ambient temperatures will be encountered. The tube is especially suited for compact military applications because of its dependable performance, stable operating characteristics, and small size.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Voltage (A-c or D-c*)		6.3 ± 5%	Volts
Heater Current		0.15	Ampere
Direct Interelectrode Capacitances	With Shield†	Without Shield	
Grid-No. 1 to Plate, maximum	0.015	0.03	uuf
Input	4.2	4.0	uuf
Output	3.4	1.9	uuf

Mechanical

Mounting Position - Any
Envelope - T-3, Glass
Base - E8-10, Subminiature Button 8-Lead

MAXIMUM RATINGS

Electrical - Absolute Maximum Values

Plate Voltage	165	Volts
Screen Voltage	155	Volts
Negative D-c Grid-No. 1 Voltage	55	Volts
Plate Dissipation	1.1	Watts
Screen Dissipation	0.55	Watt
D-c Cathode Current	16.5	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	200	Volts
Heater Negative with Respect to Cathode	200	Volts

Mechanical

Peak Impact Acceleration ‡	450	G
Uniform Acceleration §	1000	G
Vibrational Acceleration π	2.5	G
Bulb Temperature at Hottest Point Δ	+250	Centigrade

CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier

Plate Voltage	100	Volts
Screen Voltage	100	Volts
Cathode-bias Resistor	120	Ohms
Plate Resistance, approximate	0.26	Megohm
Transconductance	4500	Micromhos
Plate Current	7.2	Milliamperes
Screen Current	2.0	Milliamperes
Grid-No. 1 Voltage, approximate		
Gm = 25 Micromhos	-14	Volts
Maximum Noise Output Voltage ◊	0.060	Volts
Life Expectancy		
For Ambient Temperature = +30 C	5000	Hours
For Ambient Temperature = +175 C	1000	Hours

* Tube life and reliability of performance are directly related to the degree of regulation of the heater voltage to its center-rated value of 6.3 volts.

† With external shield of 0.405-inch inside diameter connected to cathode.

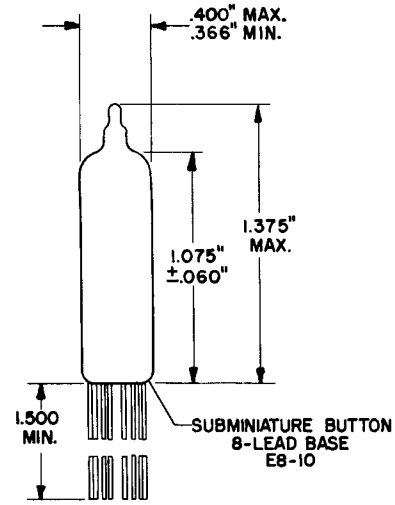
‡ Forces in any direction as applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

§ Forces in any direction applied gradually as in a centrifuge.

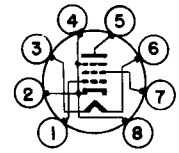
π Vibrational forces in any direction for a period of at least 100 hours at a frequency of 60 cycles per second.

Δ The indicated maximum bulb temperature rating should never be exceeded under any circumstances. Tube life and reliability of performance will be enhanced by operation at lower temperatures.

◊ Across a plate load resistor of 10,000 ohms with an applied vibrational acceleration of 15 G at a frequency of 40 cycles per second.



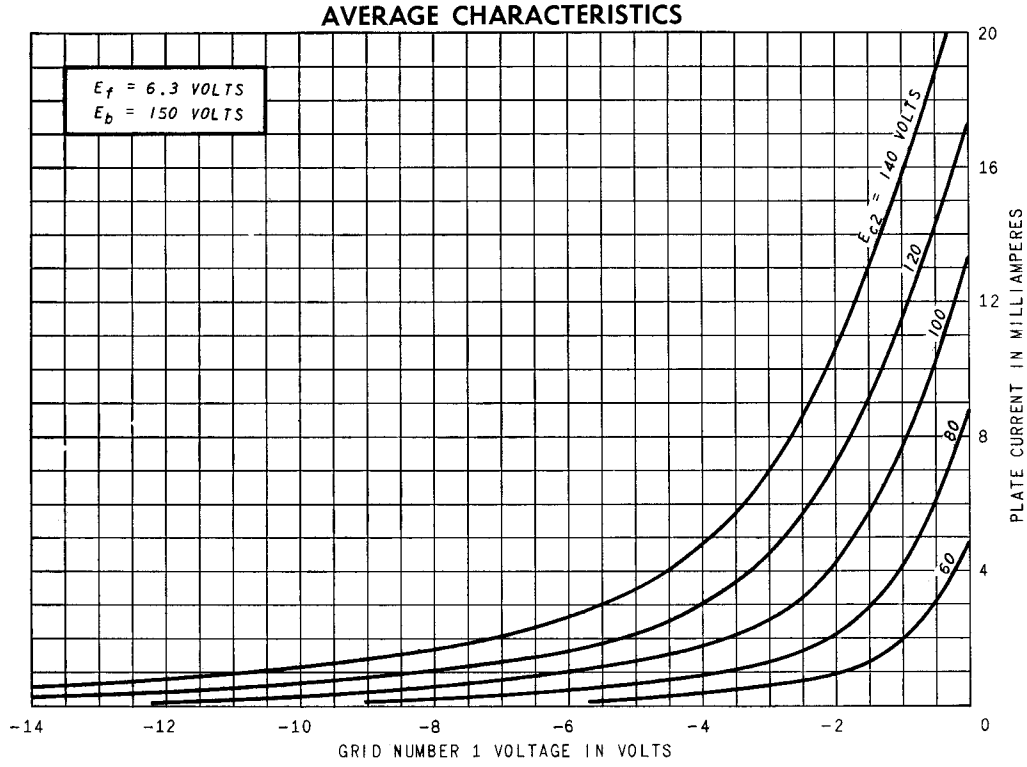
BASING DIAGRAM



8DL
(BOTTOM VIEW)

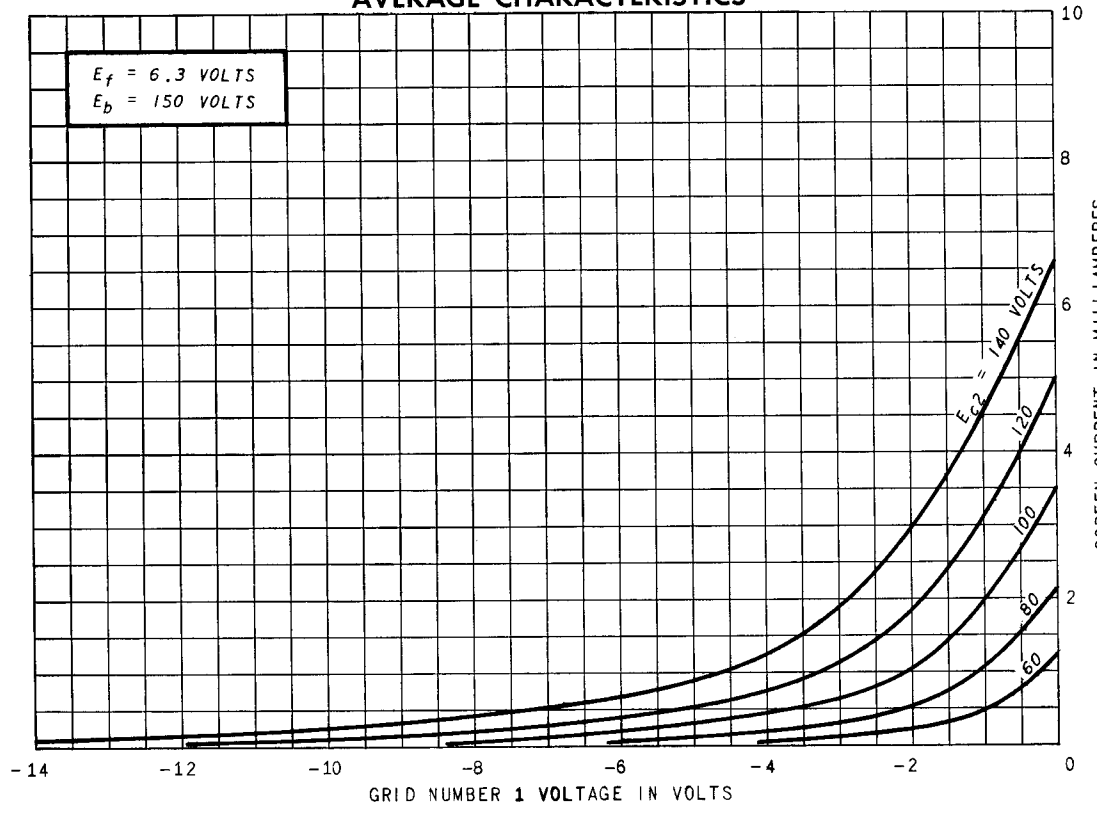
LEAD 1: - GRID NUMBER 1
LEAD 2: - CATHODE AND GRID NUMBER 3
LEAD 3: - HEATER
LEAD 4: - CATHODE AND GRID NUMBER 3
LEAD 5: - PLATE
LEAD 6: - HEATER
LEAD 7: - GRID NUMBER 2 (SCREEN)
LEAD 8: - CATHODE AND GRID NUMBER 3

AVERAGE CHARACTERISTICS



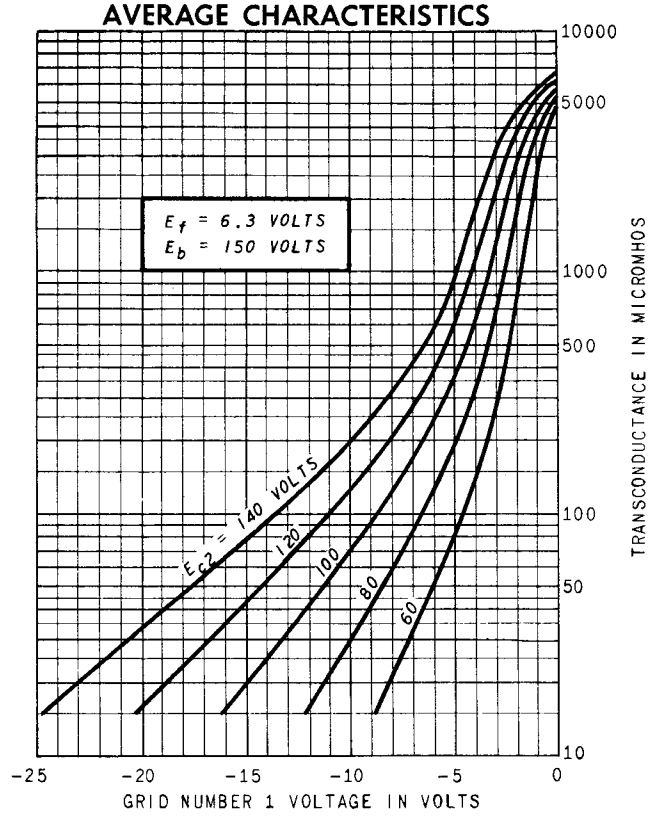
April 3, 1953

AVERAGE CHARACTERISTICS



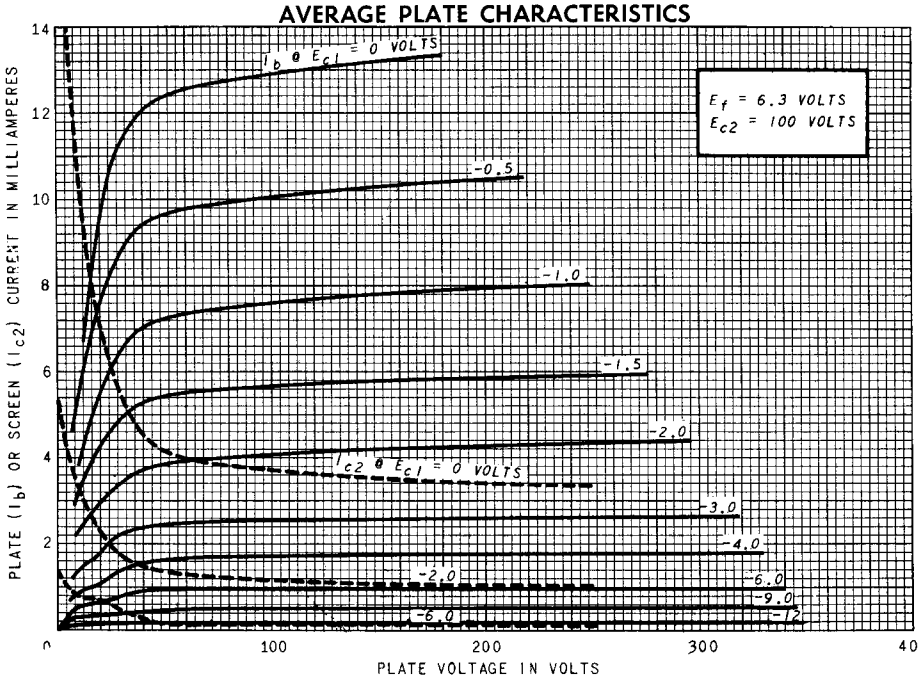
April 3, 1953

AVERAGE CHARACTERISTICS



April 3, 1953

AVERAGE PLATE CHARACTERISTICS



April 3, 1953

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

Electronic TUBES

5902
PENTODE
Five-Star Tube
★ ★ ★ ★ ★

FOR AF POWER AMPLIFIER APPLICATIONS

8-LEAD SUBMINIATURE
POWER OUTPUT—1 WATT
SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING

DESCRIPTION AND RATING

The 5902 is a subminiature beam power pentode for use as an audio-frequency power amplifier. In this application the tube is capable of delivering an output of approximately one watt.

The 5902 is a special-quality tube for use in critical industrial and military applications in which operational dependability is of primary importance. Features of the tube include a high degree of mechanical strength and a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Voltage, AC or DC . . . . . 6.3 ± 5% Volts
Heater Current . . . . . 0.45 Amperes
Direct Interelectrode Capacitances

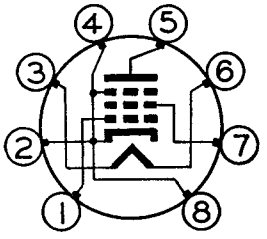
	With Shield*	Without Shield	
Grid-Number 1 to Plate	0.11	0.15	μμf
Input	6.5	6.5	μμf
Output	7.5	4.5	μμf

*With external shield of 0.405-inch inside diameter connected to cathode.

MECHANICAL

Mounting Position—Any
Envelope—T-3, Glass
Base—E8-10, Subminiature Button 8-Lead

BASING DIAGRAM

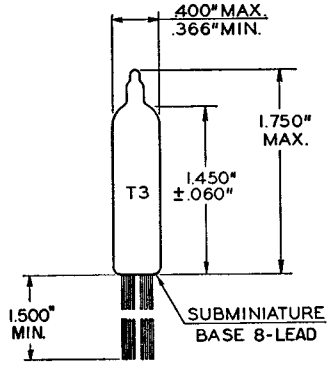


RETMA 8DL

TERMINAL CONNECTIONS

Lead 1—Grid Number 1
Lead 2—Cathode and Beam Plates
Lead 3—Heater
Lead 4—Cathode and Beam Plates
Lead 5—Plate
Lead 6—Heater
Lead 7—Grid Number 2 (Screen)
Lead 8—Cathode and Beam Plates

PHYSICAL DIMENSIONS



RETMA 3-3

GENERAL ELECTRIC

Supersedes ET-T1099 dated 8-54

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES

Plate Voltage	165	Volts
Screen Voltage	155	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Plate Dissipation	3.7	Watts
Screen Dissipation	0.4	Watts
DC Cathode Current	50	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	200	Volts
Heater Negative with Respect to Cathode	200	Volts
Bulb Temperature at Hottest Point	220	C

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	110	Volts
Screen Voltage	110	Volts
Cathode-Bias Resistor	270	Ohms
Peak AF Grid-Number 1 Voltage, RMS	6.4	Volts
Plate Resistance, approximate	15,000	Ohms
Transconductance	4200	Micromhos
Zero-Signal Plate Current	30	Milliamperes
Maximum-Signal Plate Current, approximate	29	Milliamperes
Zero-Signal Screen Current	2.2	Milliamperes
Maximum-Signal Screen Current	5.5	Milliamperes
Load Resistance	3000	Ohms
Total Harmonic Distortion, approximate	10	Percent
Maximum-Signal Power Output	1.0	Watts
Grid-Number 1 Voltage, approximate		
Ib = 10 Microamperes	−40	Volts

CHARACTERISTICS LIMITS

		Minimum	Maximum	
Heater Current				
Ef = 6.3 volts	Initial	420	480	Milliamperes
	500-Hr	414	492	Milliamperes
Plate Current				
Ef = 6.3 volts, Eb = 110 volts, Ec2 = 110 volts, Rk = 270 ohms (by-passed)	Initial	23.0	37.0	Milliamperes
Screen Current				
Ef = 6.3 volts, Eb = 110 volts, Ec2 = 110 volts, Rk = 270 ohms (by-passed)	Initial	0	4.0	Milliamperes
Transconductance				
Ef = 6.3 volts, Eb = 110 volts, Ec2 = 110 volts, Rk = 270 ohms (by-passed)	Initial	3500	4900	Micromhos
Plate Resistance				
Ef = 6.3 volts, Eb = 110 volts, Ec2 = 110 volts, Rk = 270 ohms (by-passed)	Initial	0.01	....	Megohms
Power Output (1)				
Ef = 6.3 volts, Eb = 110 volts, Ec2 = 110 volts, Rk = 270 ohms (by-passed), RL = 3000 ohms, Esig = 6.4 volts RMS	Initial	0.75	....	Watts
Power Output Change with Heater Voltage				
Difference between Power Output (1) and Power Output at Ef = 5.7 volts (other conditions the same) expressed as a percentage of Power Output (1)	Initial	....	15	Percent
	500-Hr	....	15	Percent
Power Output Change with Operation				
Difference between Power Output (1) initially and after operation expressed as a percentage of initial value	500-Hr	....	20	Percent

CHARACTERISTICS LIMITS CONTINUED ON PAGE 3

CHARACTERISTICS LIMITS (Cont'd)

		Minimum	Maximum	
Average Power Output Change with Operation				
Average of values for "Power Output Change with Operation"	500-Hr	....	15	Percent
Plate Current Cutoff				
Ef = 6.3 volts, Ebb = 110 volts, Ec2 = 110 volts, Ec1 = −40 volts	Initial	....	100	Microamperes
Interelectrode Capacitances				
Grid-Number 1 to Plate (g1 to p)	Initial	....	0.20	μμf
Input (g1 to h, k, g2)	Initial	5.5	7.5	μμf
Output (p to h, k, g2)	Initial	6.5	8.5	μμf
Measured with external shield of 0.405-inch inside diameter connected to cathode.				
Negative Grid-Number 1 Current				
Ef = 6.3 volts, Eb = 110 volts, Ec2 = 110 volts, Rg1 = 1.0 meg, Rk = 270 ohms	Initial	....	1.0	Microamperes
	500-Hr	....	2.0	Microamperes
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	Initial	....	15	Microamperes
	500-Hr	....	60	Microamperes
Heater Negative with Respect to Cathode	Initial	....	15	Microamperes
	500-Hr	....	60	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results				
Grid-Number 1 to All at 100 Volts DC	Initial	50	....	Megohms
	500-Hr	25	....	Megohms
Plate to All at 300 Volts DC	Initial	50	....	Megohms
	500-Hr	25	....	Megohms
Vibrational Noise Output Voltage, RMS				
Ef = 6.3 volts, Ebb = 110 volts, Ec2 = 110 volts, Rk = 270 ohms (by-passed), R_L = 2000 ohms, Vibrational acceleration = 15 G at 40 cps	Initial	....	100	Millivolts
Grid-Number 1 Emission Current				
Ef = 7.5 volts, Eb = 110 volts, Ec2 = 110 volts, Ecc1 = −40 volts, Rg1 = 1.0 meg	Initial	....	2.0	Microamperes

The indicated 500-hour values are life-test end points for the following conditions of operation: Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 220 ohms, Rg1 = 0.47 meg, Ehk = 200 volts with heater positive with respect to cathode, and bulb temperature = 220 C minimum.

SPECIAL TESTS AND RATINGS

Stability Life Test
Statistical sample operated for one hour to evaluate and control initial variations in power output.

Survival Rate Life Test
Statistical sample operated for one hundred hours to evaluate and control early-life electrical and mechanical inoperatives.

Heater-Cycling Life Test
Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.0 volts cycled for one minute on and four minutes off, Eb = Ec2 = Ec1 = 0 volts, and Ehk = 140 volts RMS.

Shock Rating—450 G
Statistical sample subjected to five impact accelerations of 450 G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

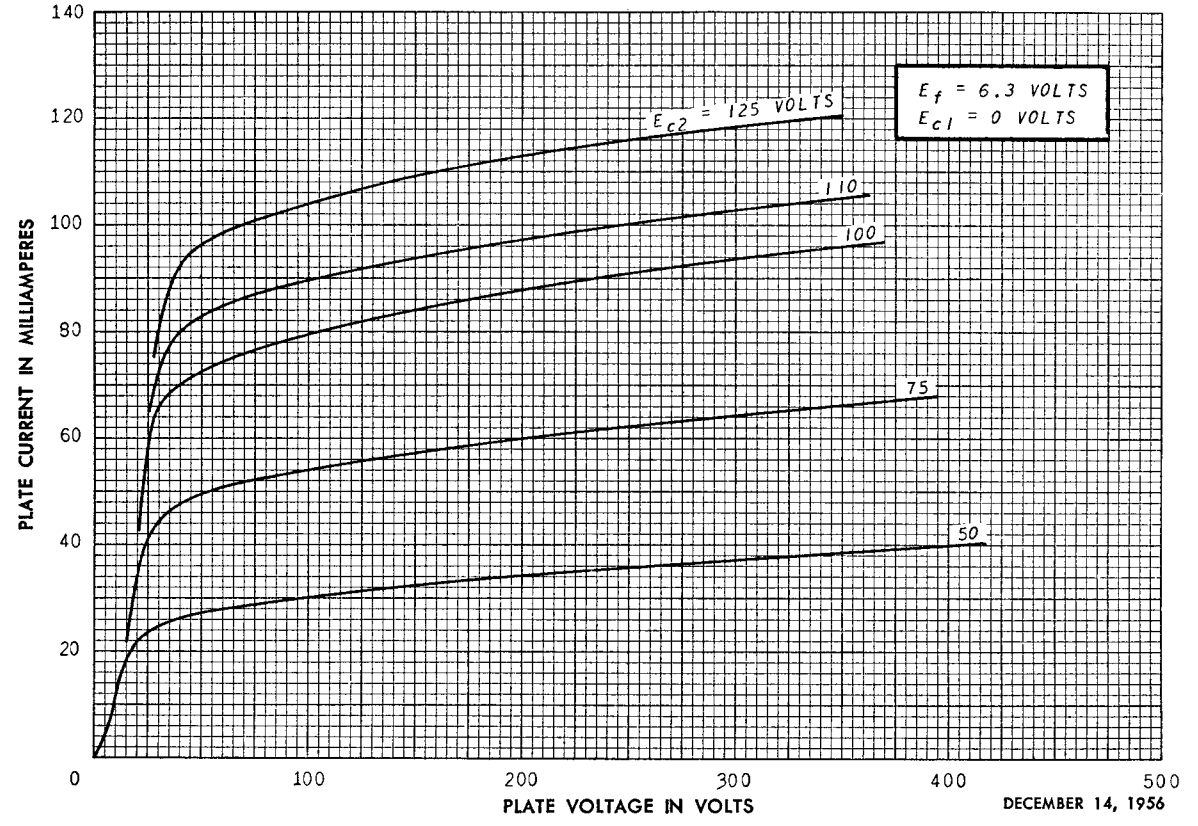
Fatigue Rating—2.5 G
Statistical sample subjected to vibrational acceleration of 25 G for 32 hours minimum in each of three different positions. The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

Altitude Rating—60,000 Feet
Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

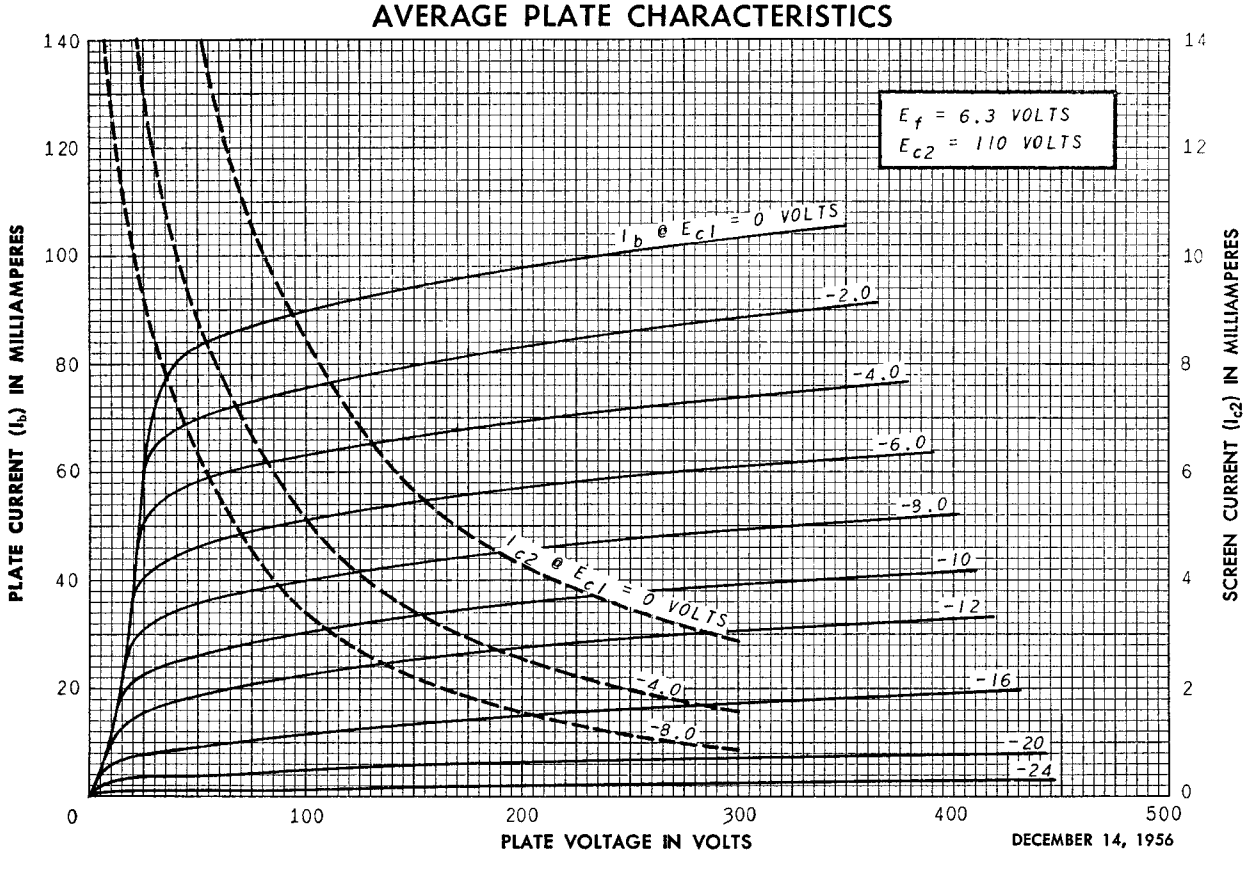
Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

In the design of military equipment employing this tube, reference should be made to the appropriate MIL-E-1 specification.

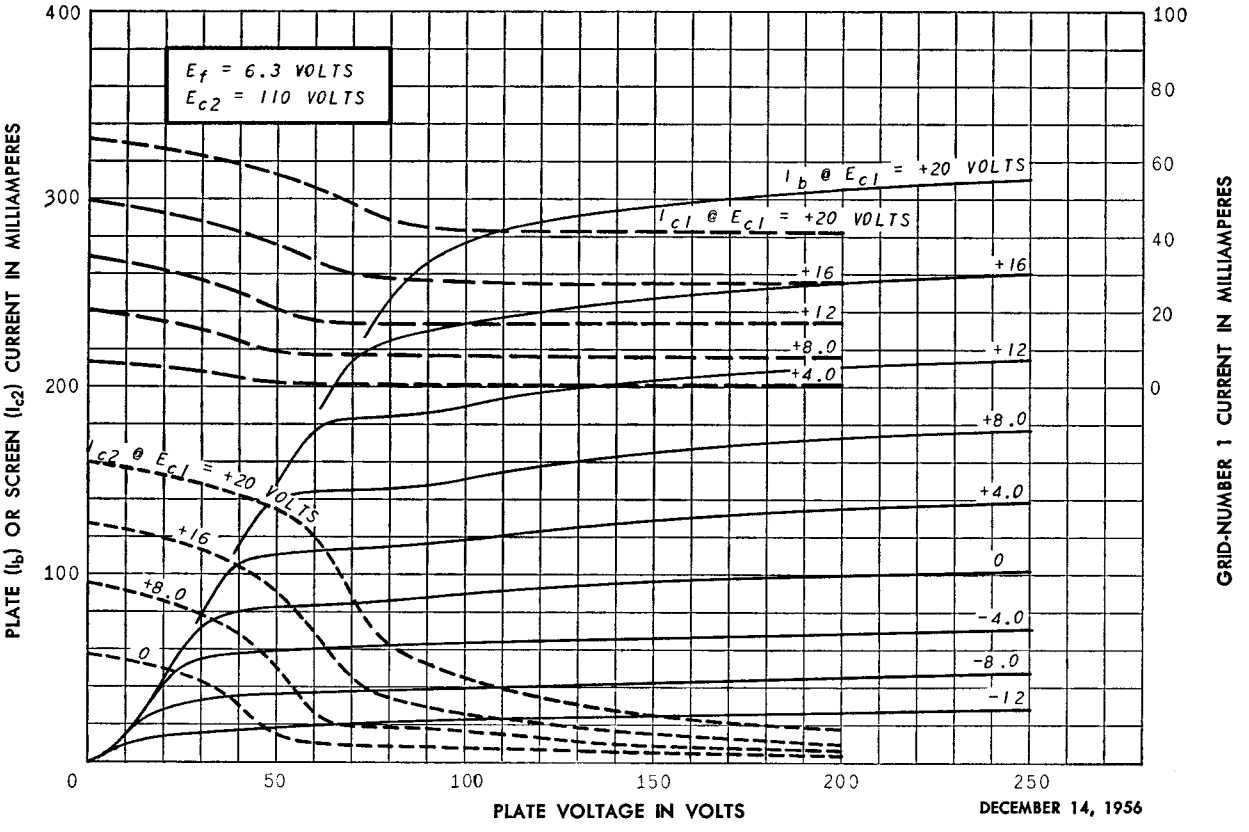
AVERAGE PLATE CHARACTERISTICS



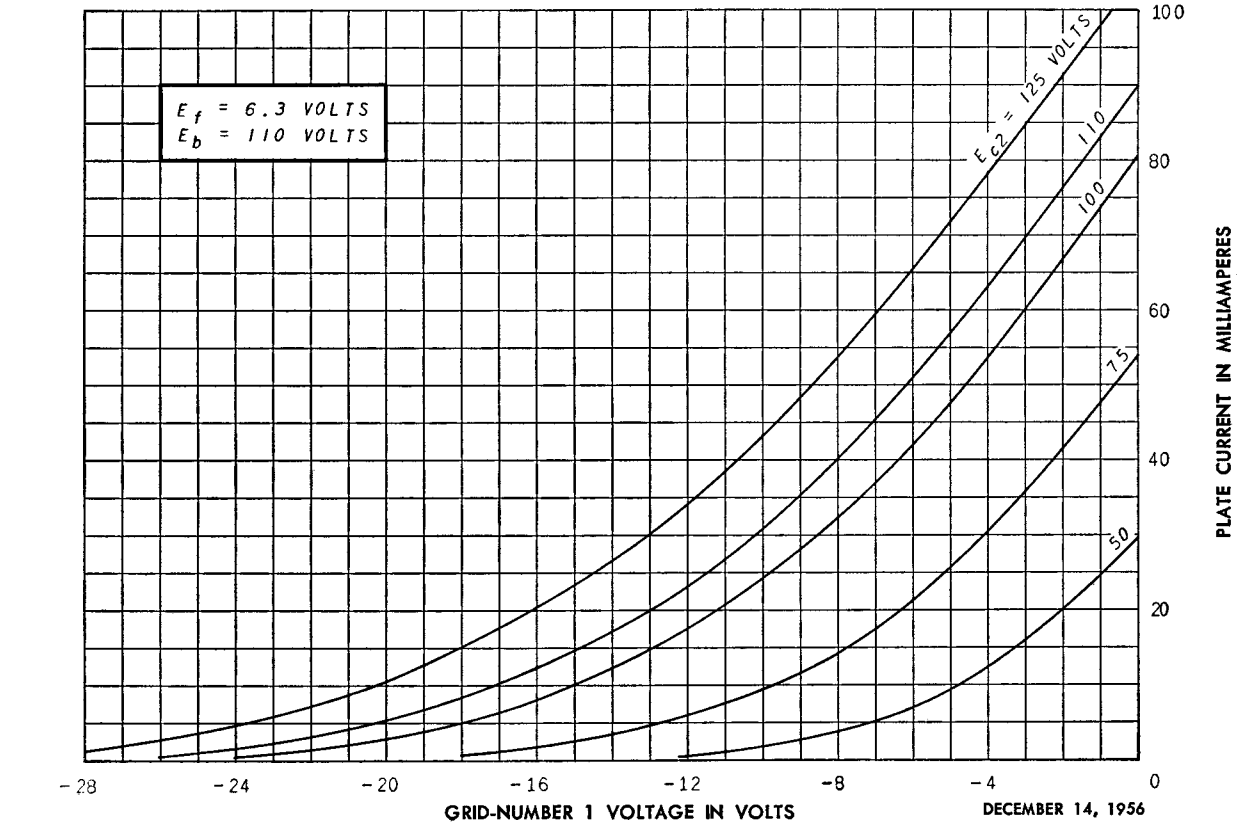
AVERAGE PLATE CHARACTERISTICS



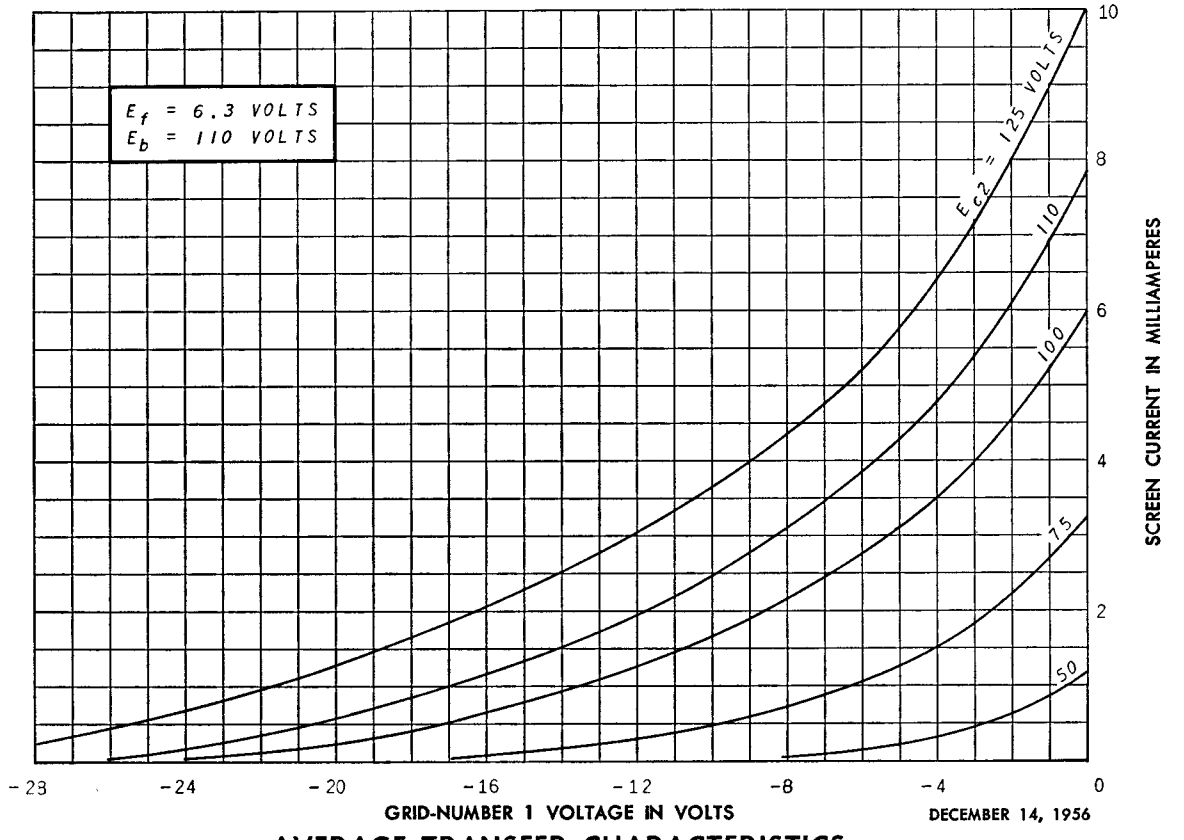
AVERAGE PLATE CHARACTERISTICS



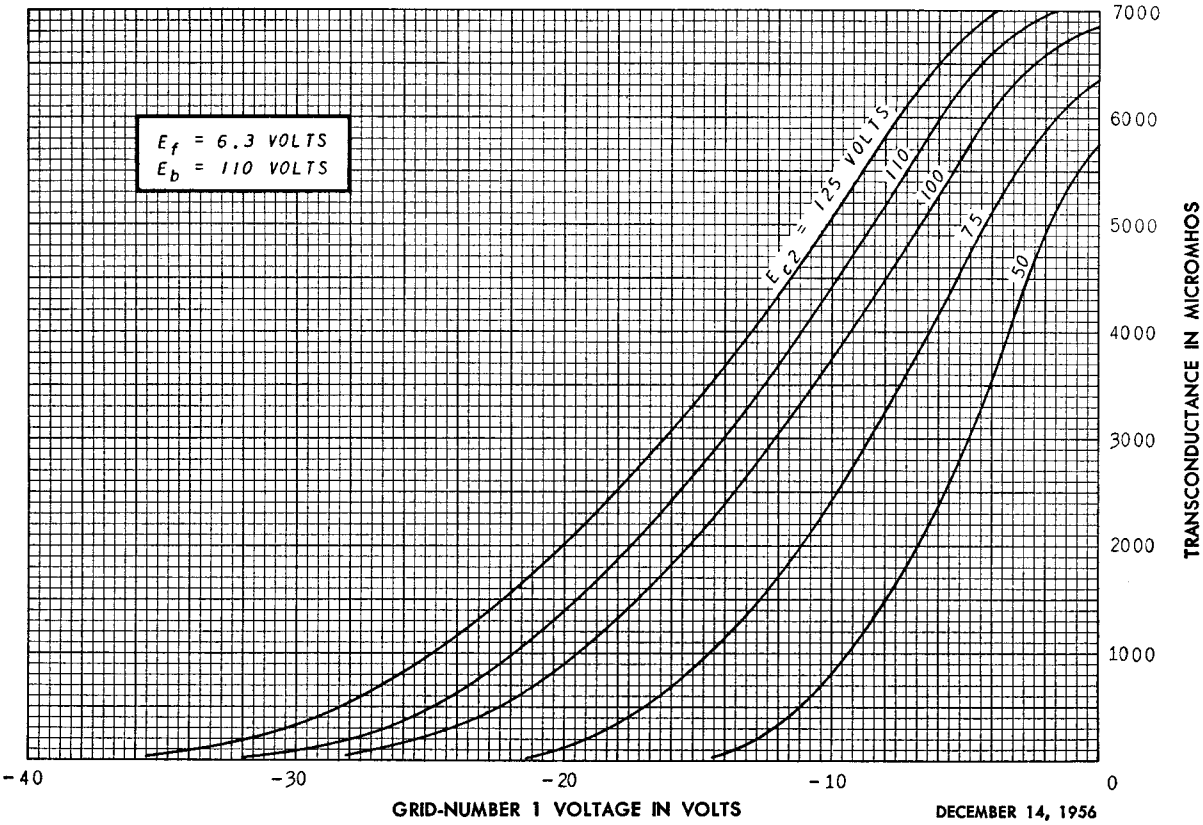
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



from RTMA release #938, Jan 5, 1951

DESCRIPTION AND RATING

KENOTRON 5973

The 5973 is a two-electrode high-vacuum tube designed for use as a rectifier or surge-limiting diode. The anode is radiation-cooled and capable of dissipating 850 watts. The cathode is a thoriated-tungsten filament.

TECHNICAL INFORMATION

GENERAL

Electrical Data	Minimum	Bogey	Maximum	
Filament Voltage	15.2	16	16.8	Volts
Filament Current	18.0	19.1	20.2	Amperes
Filament Starting Current			30	Amperes
Filament Cold Resistance		0.1		Ohm
Filament Heating Time (before applying plate voltage)	30			Seconds
Tube Voltage Drop, I_b = 5 Amperes	850	950	1050	Volts
Interelectrode Capacitance		14		uuf

Mechanical Data

Mounting Position - Vertical, Cathode Base Down		
Maximum Glass Temperature*	300	C
Maximum Base Temperature	150	C
Net Weight, approximate	3	Pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Rectifier Service

Maximum Ratings, Absolute Values

Peak Inverse Voltage	75	Kilovolts
Plate Current		
Peak	5	Amperes
Average		
Peak Inverse Voltage = 40 Kilovolts or Less	1.25	Amperes
Peak Inverse Voltage = More than 40 Kilovolts	1.00	Ampere
Average Plate Dissipation**	850	Watts

GENERAL ELECTRIC

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS (CONT'D)

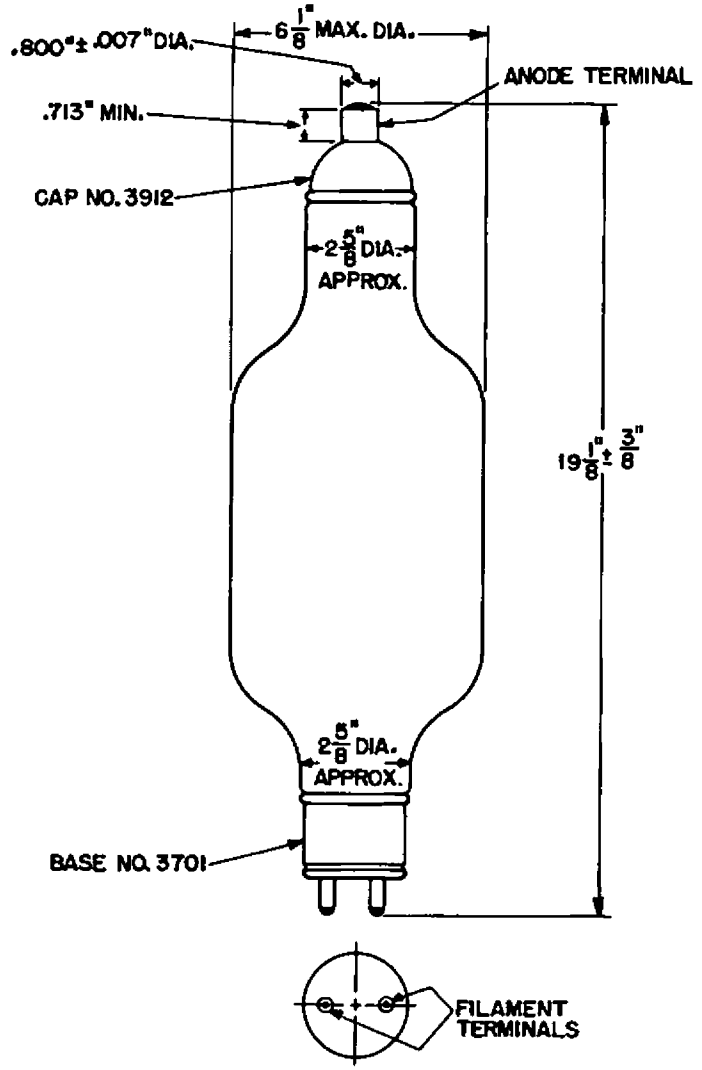
Limiter Service

Maximum Ratings, Absolute Values

Peak Inverse Voltage	75	Kilovolts
Peak Forward Voltage	20	Kilovolts
Peak Plate Current, minimum	10	Amperes
Average Plate Dissipation**	850	Watts

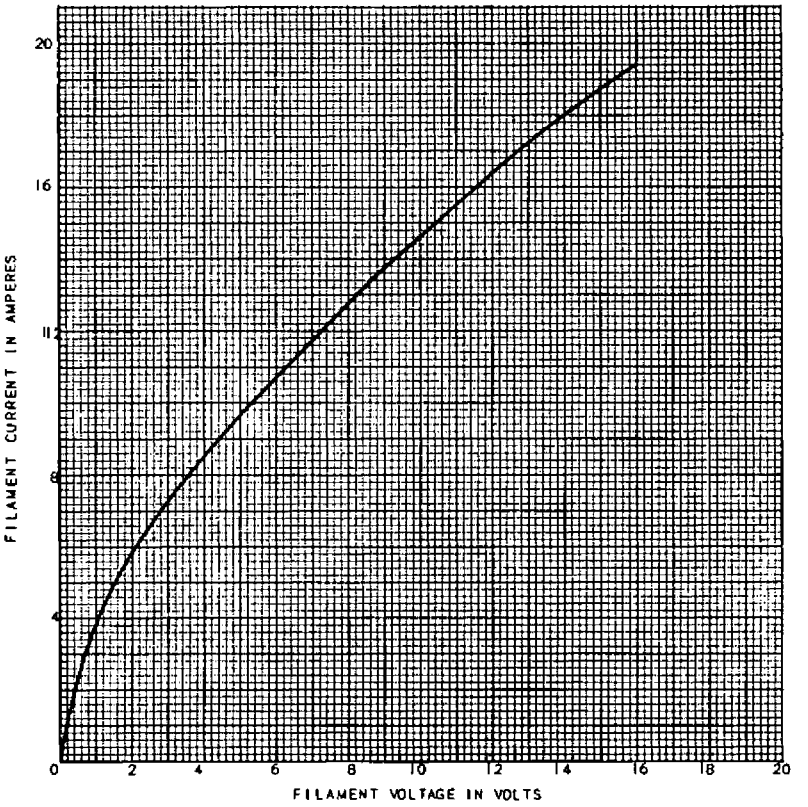
* Where tubes are enclosed or operated in close proximity to each other, forced-air cooling may be required to limit bulb and base temperatures to the allowable maximum.

** Maximum observed temperature of 1010 C at any point on the anode.



N21009AZ June 21, 1950

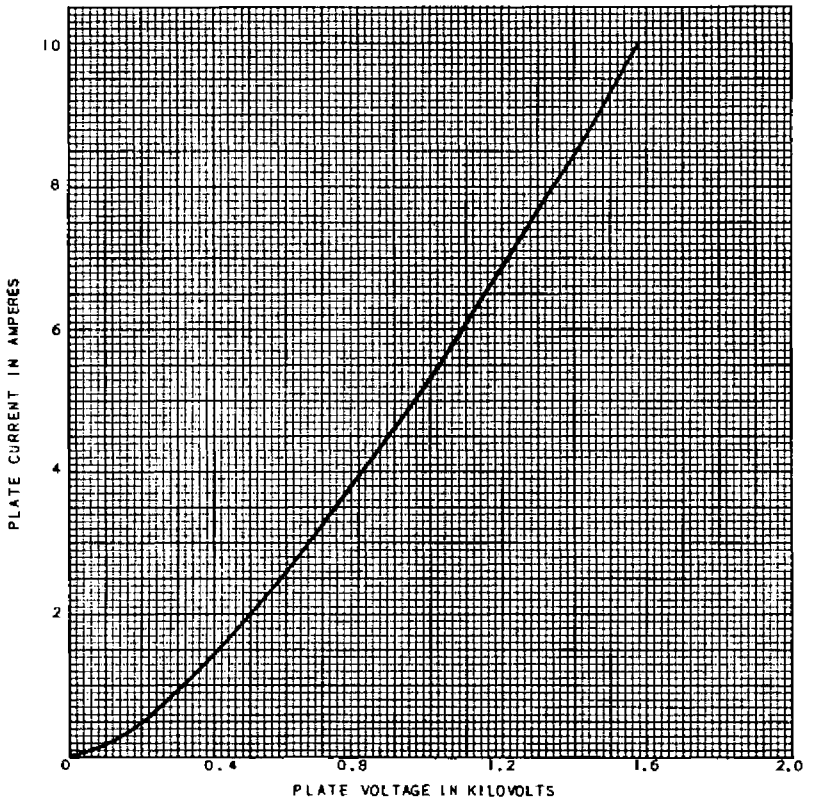
Outline
5973



K-69087-72A380 May 24, 1950

5973

Typical Filament-Current Characteristic



K-69087-72A381 May 24, 1950

5973

Typical Plate Characteristic

E_f = 16 Volts

GENERAL ELECTRIC

ELECTRONICS DEPARTMENT, TUBE DIVISIONS

SCHENECTADY, NEW YORK

11-50

DESCRIPTION AND RATING

ION CHAMBER 5978

The 5978 is a high-pressure ion chamber for detecting gamma radiation. A distinctive design feature is the use of a grounded guard ring separated from the two electrodes by ceramic insulators having unusually high electrical resistance over a wide temperature range. The hermetically sealed envelope has ceramic-to-metal seals between the electrodes and insulators.

In operation the signal is taken from the central electrode, and the outer electrode, which is also the outside wall, is at the operating voltage.

TECHNICAL INFORMATION

Electrical Data

Maximum Voltage	300	Volts
Interelectrode Capacitance	6	uuf
Sensitivity to Gamma Radiation ‡	1.3×10^{-10}	Amperes per Roentgen per Hour
Insulator Resistance at 25 C	10^{15}	Ohms

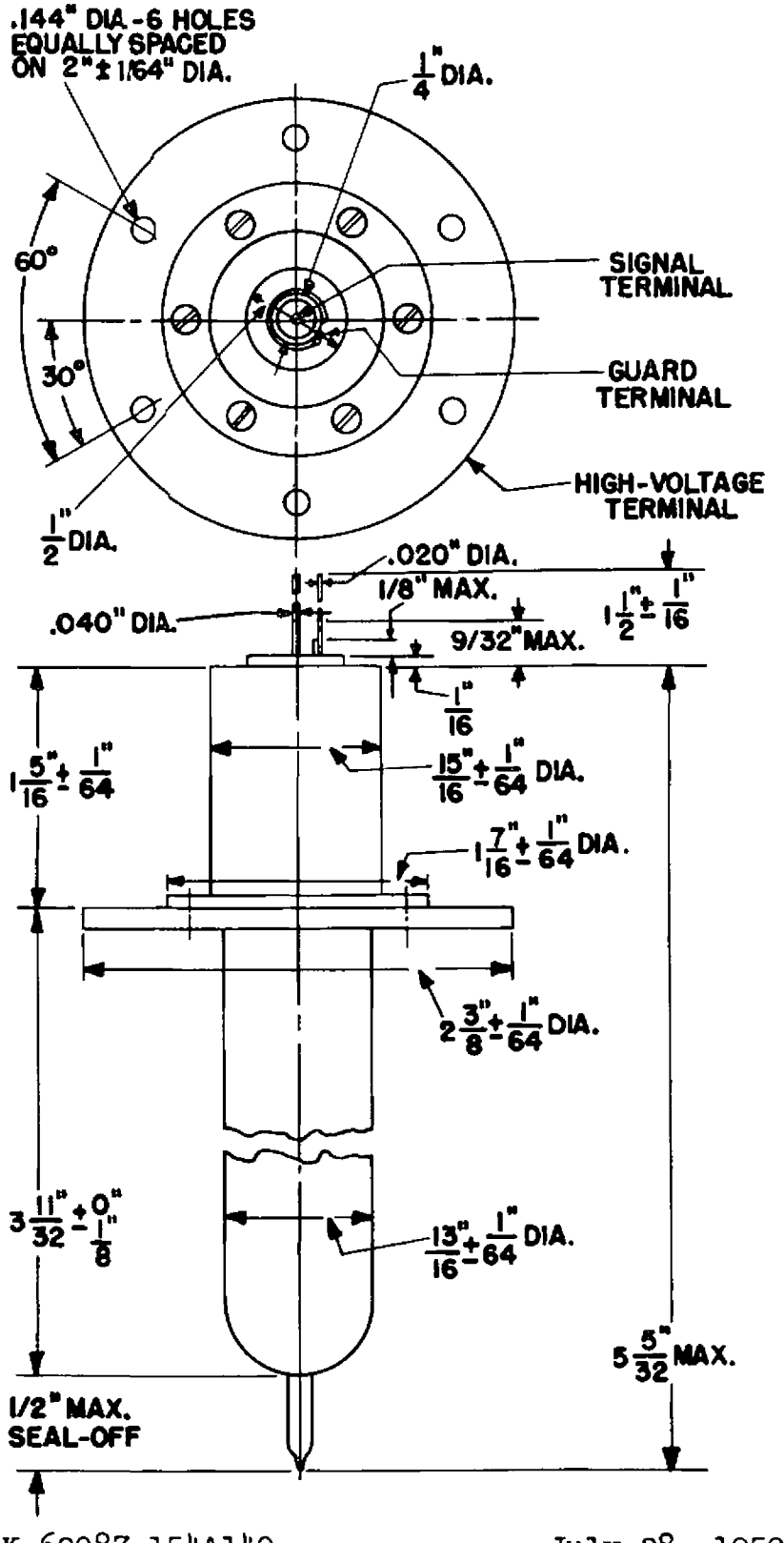
Maximum Ratings

Ambient Temperature	-55 to +100	C
Operating Voltage	300	Volts
Altitude	50,000	Feet
Relative Humidity, operating	35	Percent
Relative Humidity, non-operating	100	Percent

‡ From source containing radium in equilibrium with its decay products at intensity of 2 roentgens per hour.

from RTMA release #972, May 15, 1951

GENERAL ELECTRIC



K-69087-154A140 July 28, 1950

Outline
5978 Ion Chamber

GENERAL ELECTRIC

ELECTRONICS DEPARTMENT, TUBE DIVISIONS
SCHENECTADY, NEW YORK



BEAM POWER AMPLIFIER

DESCRIPTION

The GL-6005 is a miniature beam-power amplifier intended for use in medium-power audio-frequency applications. The tube is specially designed to assure dependable life and reliable service under the exacting conditions encountered in mobile and aircraft applications. Features include mechanical ruggedization and a heater-cathode construction designed to withstand many-thousand cycles of intermittent operation.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode	Coated Unipotential
Heater Voltage (A-c or D-c)	6.3 Volts
Heater Current	0.45 Ampere

Mechanical Data

Peak Impact Acceleration in Any Direction	600G
Vibrational Acceleration in Any Direction	2.5G
Bulb Temperature at Any Point	250C
Envelope	T-5½ Glass
Base	E7-1, Miniature Button 7-pin
Mounting Position	Any

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

ELECTRICAL (DESIGN CENTER VALUES)

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Plate Dissipation	12	Watts
Screen Dissipation	2	Watts
Heater-Cathode Voltage	90	Volts
Grid Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohm
With Cathode Bias	0.5	Megohm

CHARACTERISTICS AND TYPICAL OPERATION

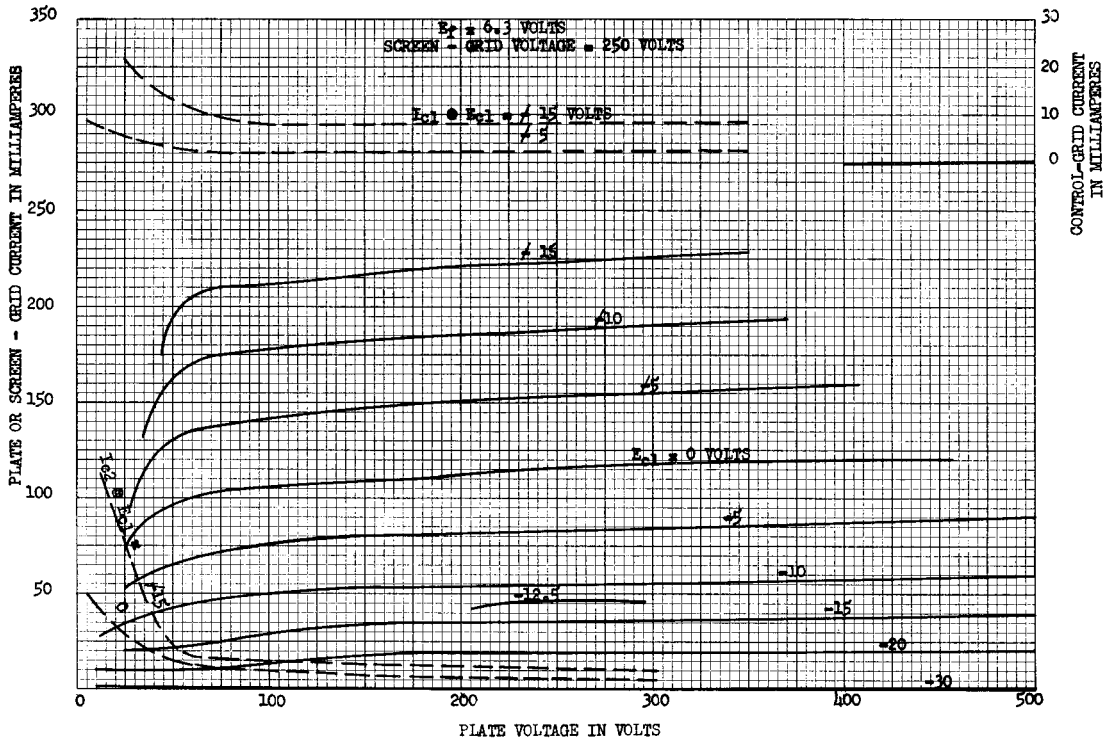
CLASS A_1 AMPLIFIER

Plate Voltage	180	250	Volts
Screen Voltage	180	250	Volts
Grid Number 1 Voltage	−8.5	−12.5	Volts
Peak A-F Grid Number 1 Voltage	8.5	12.5	Volts
Plate Resistance (Approx)	58000	52000	Ohms
Transconductance	3700	4100	Micromhos
Zero-Signal Plate Current	29	45	Milliamperes
Maximum-Signal Plate Current	30	47	Milliamperes
Zero-Signal Screen Current	3	4.5	Milliamperes
Maximum-Signal Screen Current	4	7	Milliamperes
Load Resistance	5500	5000	Ohms
Total Harmonic Distortion (Approx.)	8	8	Per Cent
Power Output	2.0	4.5	Watts

PUSH-PULL CLASS AB_1 AMPLIFIER (VALUES FOR TWO TUBES)

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid Number 1 Voltage	−15	Volts
Peak A-F Grid-to-Grid Voltage	30	Volts
Plate Resistance (Each Tube)	60000	Ohms
Transconductance (Each Tube)	3750	Micromhos
Zero-Signal Plate Current	70	Milliamperes
Maximum-Signal Plate Current	79	Milliamperes
Zero-Signal Screen Current	5	Milliamperes
Maximum-Signal Screen Current	13	Milliamperes
Effective Load Resistance (Plate to Plate)	10000	Ohms
Total Harmonic Distortion	5	Per Cent
Maximum-Signal Power Output	10	Watts

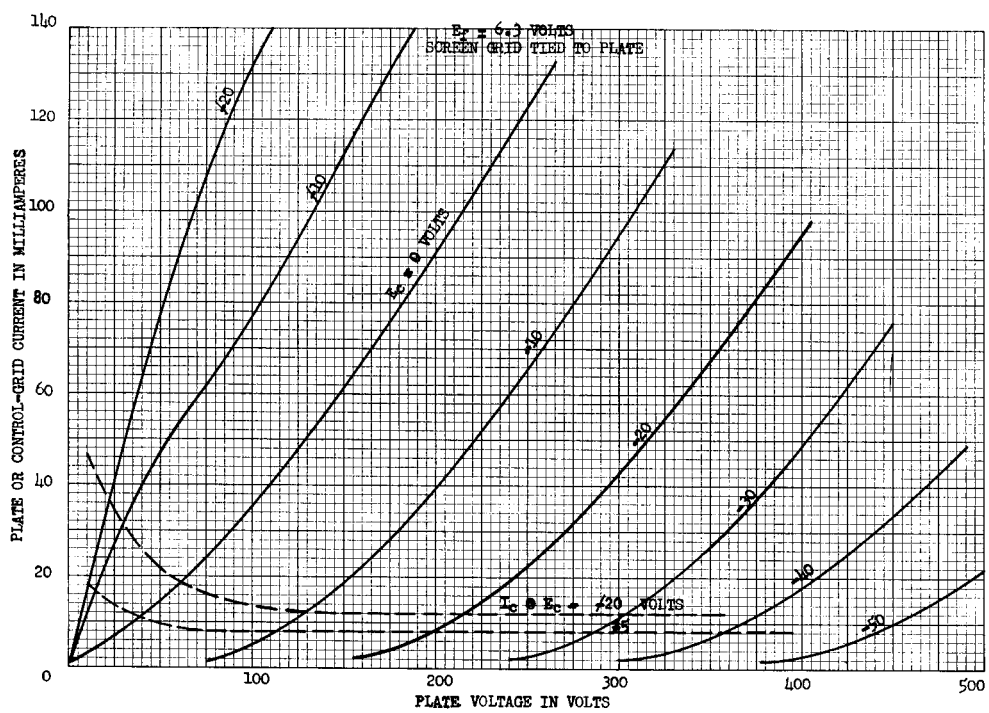
AVERAGE PLATE CHARACTERISTICS
PENTODE CONNECTION



K-69087-72A456

5-1-51

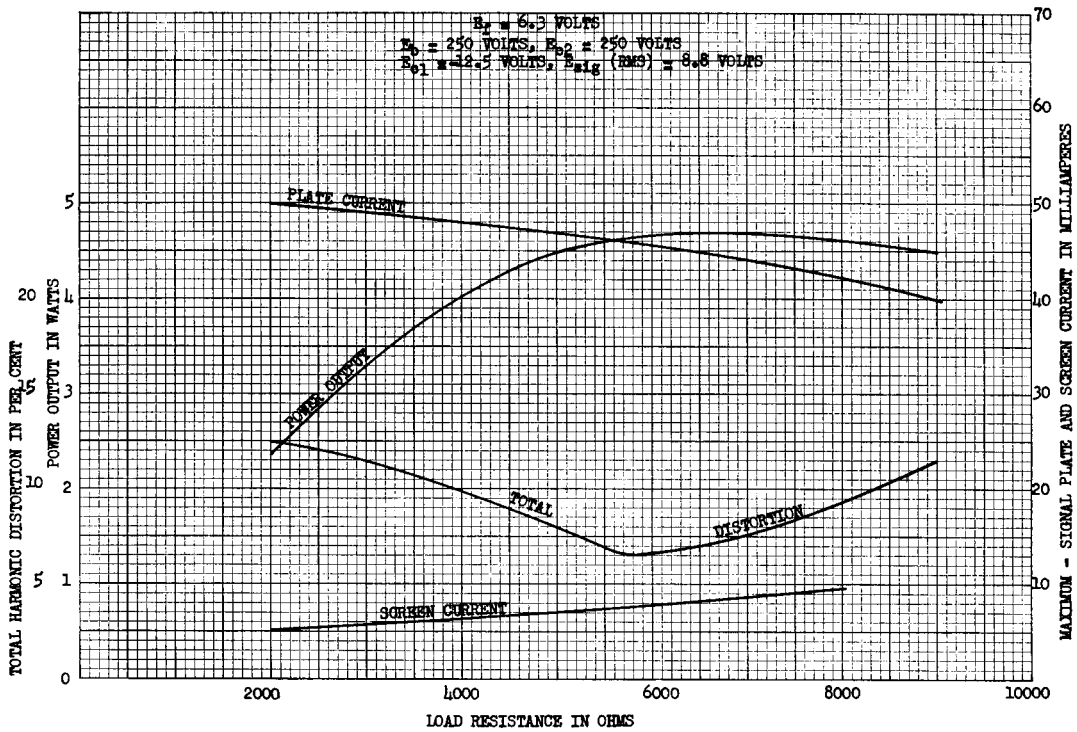
AVERAGE PLATE CHARACTERISTICS
TRIODE CONNECTION



K-69087-72A455

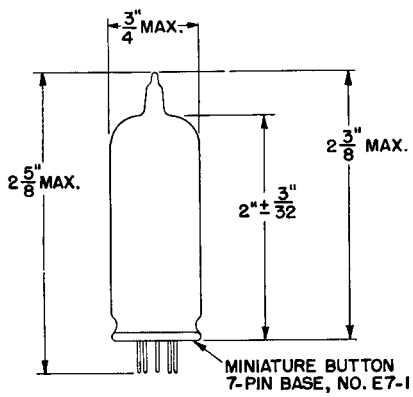
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OPERATION CHARACTERISTICS
PENTODE CONNECTION



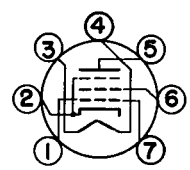
K-69087-72A454 5-1-51

OUTLINE



N-15192AZ

BASING DIAGRAM



7BZ

PIN 1 - GRID #1
PIN 2 - CATHODE AND GRID #3
PIN 3 - HEATER
PIN 4 - HEATER
PIN 5 - PLATE
PIN 6 - GRID #2 (SCREEN)
PIN 7 - GRID # 1

3-30-51

Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.

DESCRIPTION AND RATING

TRANSMITTING TUBE GL-6017

The GL-6017 is a three-electrode transmitting tube with a metal-and-ceramic envelope for use as a power amplifier or oscillator in Class B or Class C service for industrial or communications applications. This tube is designed particularly for grounded-grid operation.

The GL-6017 has an indirectly heated thoria-coated cathode, a plate dissipation of 1000 watts, and is forced-air cooled. Maximum ratings apply at frequencies up to 400 megacycles.

In Class C grounded-grid service this tube can deliver a peak power output of 1100 watts. In grounded-filament service the output is 900 watts.

The GL-6017 provides a compact triode for those applications which require the same power ratings as the four-electrode types GL-6019 and GL-6183, but where the higher frequencies at which these tubes are rated are not required.

TECHNICAL INFORMATION

GENERAL

Electrical Data	Minimum	Bogey	Maximum	
Heater Voltage*	---	10	10.5	Volts
Heater Current at Bogey Voltage	---	17	---	Amperes
Heater Starting Current	---	---	26	Amperes
Heater Cold Resistance	---	0.049	---	Ohms
Cathode Heating Time	1	---	---	Minutes
Amplification Factor, I_b = 100 ma, E_b = 1750 v	---	40	---	
Peak Cathode Current†	---	---	5.5	Amperes
Direct Interelectrode Capacitances				
Grid-plate	---	9	---	uuf
Grid-cathode	---	11	---	uuf
Plate Cathode‡	---	0.05	---	uuf

Mechanical Data

Mounting Position - Vertical

Air Flow

Through Radiator

Plate Dissipation - Watts	1000	800	600
Air Flow - Cubic Feet per Minute	55	40	30
Static Pressure - Inches Water	1.5	0.9	0.6

To Seals		
Incoming Air Temperature	45 Max	C
Glass Temperature, heater seal	150 Max	C
Ceramic-seal Temperature	200 Max	C
Net Weight, approximate	3.5	Pounds

Forced-air cooling of the filament terminals must be provided to limit the temperature of the glass seal to 150 C. Air cooling to be applied before and during the application of any voltages. Air cooling of the anode may be discontinued with removal of all voltages. Air flow on heater-to-cathode seal must be maintained for one minute after removal of heater voltage.

from RTMA release #1099,
June 20, 1952

GENERAL ELECTRIC

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Radio-frequency Power Amplifier - Class B
Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings, Absolute Values		
D-c Plate Voltage	3000 Max	Volts
D-c Plate Current	580 Max	Milliamperes
Plate Input	1500 Max	Watts
Plate Dissipation	1000 Max	Watts
Typical Operation - Grounded-filament Circuit		
D-c Plate Voltage	2500	Volts
D-c Grid Voltage	-50	Volts
Peak R-f Plate Voltage	1000	Volts
Peak R-f Grid Voltage	150	Volts
D-c Plate Current	570	Milliamperes
D-c Grid Current	75	Milliamperes
Driving Power, approximate$^{\pi}$	78	Watts
Power Output, approximate	450	Watts
Typical Operation - Grounded-grid Circuit		
D-c Plate Voltage	2500	Volts
D-c Grid Voltage	-50	Volts
Peak R-f Plate Voltage	1000	Volts
Peak R-f Grid Voltage	150	Volts
D-c Plate Current	570	Milliamperes
D-c Grid Current	75	Milliamperes
Driving Power, approximate$^{\pi\Delta}$	240	Watts
Power Output$^{\Delta}$	515	Watts

Radio-frequency Power Amplifier - Class B Television Service
Synchronizing-level conditions per tube unless otherwise specified

Maximum Ratings, Absolute Values		
D-c Plate Voltage	3000 Max	Volts
D-c Plate Current	0.7 Max	Ampere
Plate Input	2000 Max	Watts
Plate Dissipation	1000 Max	Watts
Grid Dissipation	50 Max	Watts
Typical Operation - Grounded-grid Circuit up to 220 Megacycles		
Bandwidth 6 Megacycles		
D-c Plate Voltage	2000	Volts
D-c Grid Voltage	-35	Volts
Peak R-f Plate Voltage		
Synchronizing Level	1000	Volts
Pedestal Level	750	Volts
Peak R-f Driving Voltage		
Synchronizing Level	180	Volts
Pedestal Level	135	Volts
D-c Plate Current		
Synchronizing Level	700	Milliamperes
Pedestal Level	525	Milliamperes
D-c Grid Current		
Synchronizing Level	150	Milliamperes
Pedestal Level	80	Milliamperes
Driving Power at Tube$^{\Delta}$, approximate		
Synchronizing Level	130	Watts
Pedestal Level	70	Watts
Power Output$^{\Delta}$, approximate		
Synchronizing Level	660	Watts
Pedestal Level	375	Watts

Plate-modulated Radio-frequency Power Amplifier - Class C Telephony
Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings, Absolute Values			
D-c Plate Voltage		2400 Max	Volts
D-c Grid Voltage		-400 Max	Volts
D-c Plate Current		580 Max	Milliamperes
D-c Grid Current		150 Max	Milliamperes
Plate Input		1340 Max	Watts
Plate Dissipation		670 Max	Watts
Typical Operation - Grounded-filament Circuit			
D-c Plate Voltage	2400	2000	Volts
D-c Grid Voltage	-200	-200	Volts
Peak R-f Plate Voltage	1800	1500	Volts
Peak R-f Grid Voltage	350	330	Volts
D-c Plate Current	425	350	Milliamperes
D-c Grid Current, approximate	125	110	Milliamperes
Driving Power, approximate	50	35	Watts
Power Output, approximate	675	470	Watts
Typical Operation - Grounded-grid Circuit			
D-c Plate Voltage	2400	2000	Volts
D-c Grid Voltage	-200	-200	Volts
Peak R-f Plate Voltage	1800	1500	Volts
Peak R-f Grid Voltage	350	330	Volts
D-c Plate Current	425	350	Milliamperes
D-c Grid Current, approximate	125	110	Milliamperes
Driving Power◊, approximate	175	137	Watts
Power Output△, approximate	800	575	Watts

Class C Radio-frequency Power Amplifier and Oscillator - Class C Telegraphy
Key-down conditions per tube without amplitude modulation§

Maximum Ratings, Absolute Values			
D-c Plate Voltage		3000 Max	Volts
D-c Grid Voltage		-500 Max	Volts
D-c Plate Current		700 Max	Milliamperes
D-c Grid Current		150 Max	Milliamperes
Plate Input		2000 Max	Watts
Plate Dissipation		1000 Max	Watts
Typical Operation, Grounded-filament Circuit			
D-c Plate Voltage	2500	2800	Volts
D-c Grid Voltage	-200	-250	Volts
Peak R-f Plate Voltage	1700	1800	Volts
Peak R-f Grid Voltage	325	425	Volts
D-c Plate Current	380	600	Milliamperes
D-c Grid Current, approximate	95	110	Milliamperes
Driving Power, approximate	28	50	Watts
Power Output, approximate	375	900	Watts
Typical Operation, Grounded-grid Circuit			
D-c Plate Voltage	2500	2800	Volts
D-c Grid Voltage	-200	-250	Volts
Peak R-f Plate Voltage	1700	1800	Volts
Peak R-f Grid Voltage	325	425	Volts
D-c Plate Current	380	600	Milliamperes
D-c Grid Current, approximate	95	110	Milliamperes
Driving Power△	150	250	Watts
Power Output△	500	1100	Watts

* Heater and cathode life can be conserved by operating the heater at the lowest voltage which will give the desired power output. The proper operating value may be found by reducing the heater voltage with normal modulation applied until a reduction in output is observed. The heater voltage must then be increased by an amount equivalent to the maximum percentage regulation of the heater voltage supply.

† Represents maximum useable cathode current (Plate current plus grid current for any condition of operation).

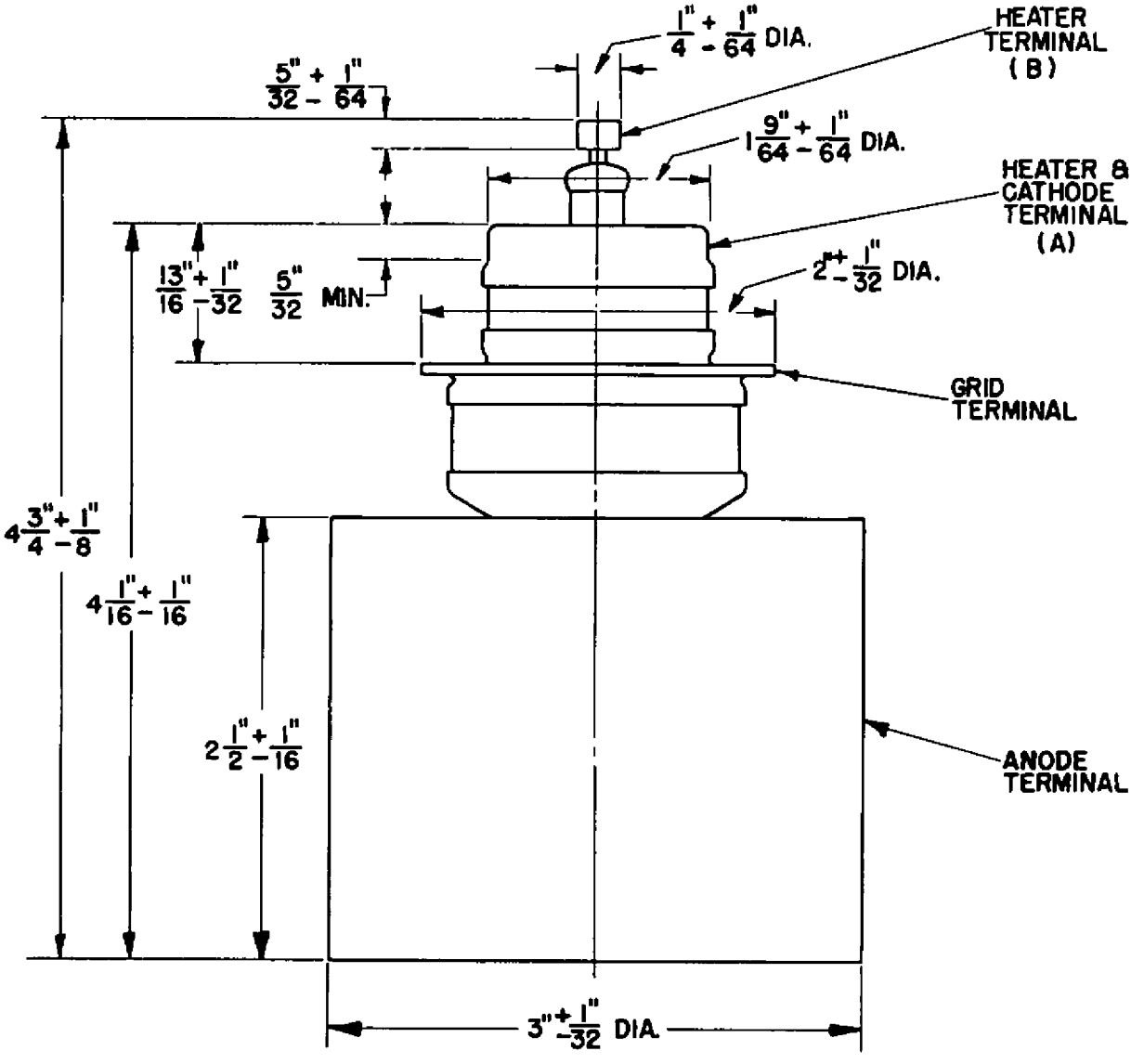
‡ Measured with a 6-inch outside diameter and 1 1/2-inch inside diameter flat shield connected to the grid terminal and grounded.

π At crest of audio-frequency cycle with modulation factor of 1.

Δ Includes power transferred from driver stage.

◊ The carrier of the driver modulated 100 percent.

§ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier condition.



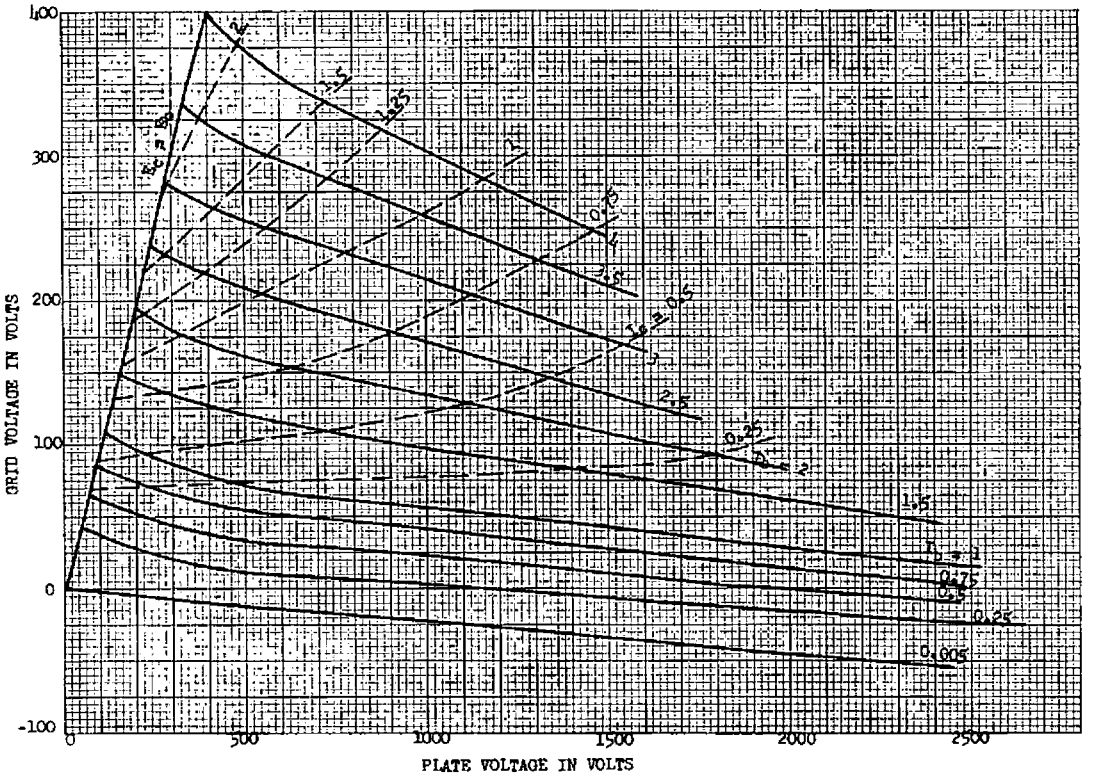
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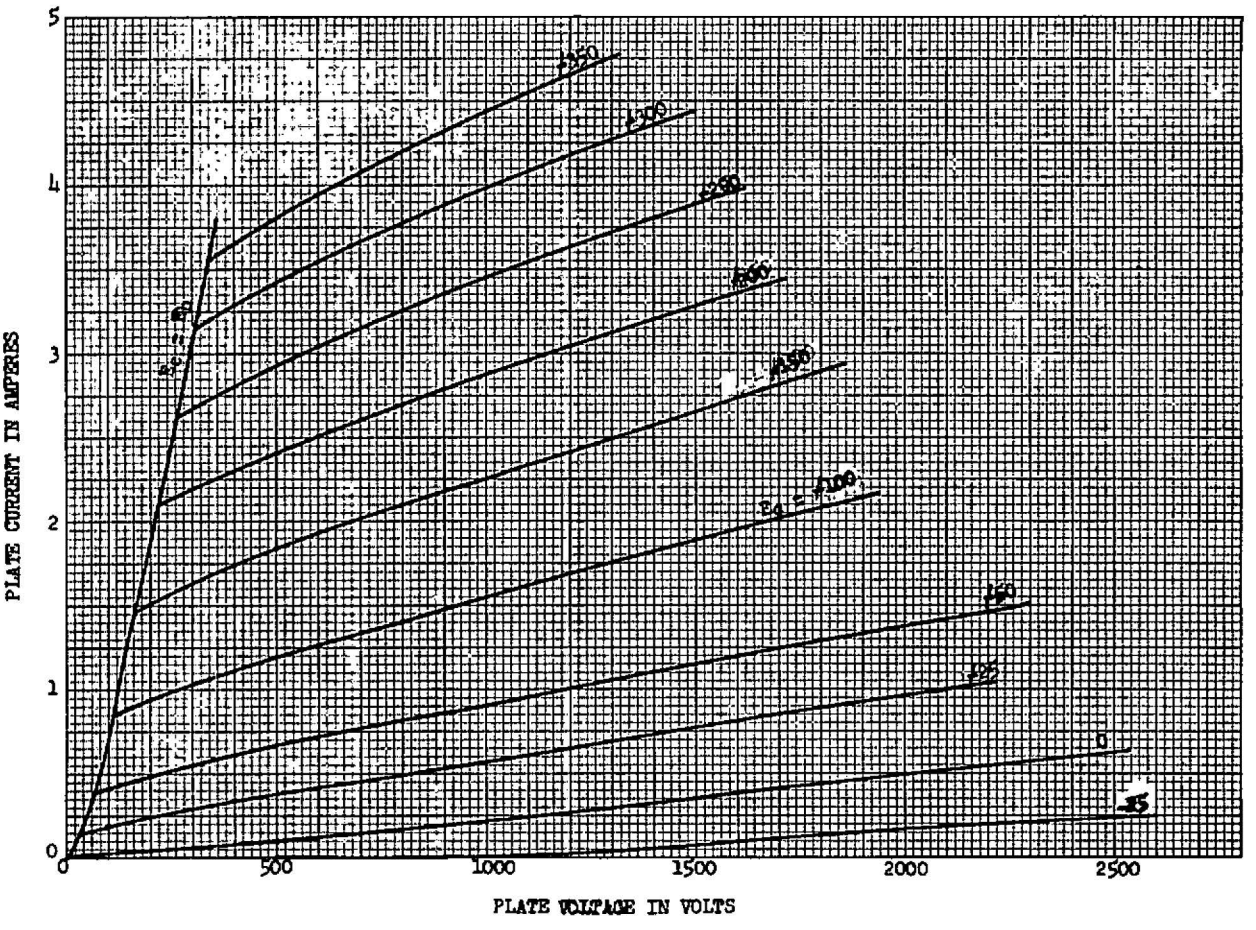
(A) MAXIMUM ECCENTRICITY 0.050" WITH RESPECT TO THE AXIS OF RADIATOR.

(B) MAXIMUM ECCENTRICITY 0.040" WITH RESPECT TO CENTERLINE DETERMINED BY THE CENTERS OF BOTTOM OF RADIATOR AND HEATER TERMINAL (A).

N20722AZ

May 20, 1952


GRID VOLTAGE IN VOLTS
PLATE VOLTAGE IN VOLTS
300
200
100
0
-100
500
1000
1500
2000
2500
Ec = 0
-1
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K-69087-72A412 May 26, 1952

GL-6017
Average Plate Characteristics
E_f = 10 Volts A-c

GENERAL ELECTRIC

TUBE DEPARTMENT
SCHENECTADY, NEW YORK

DESCRIPTION AND RATING

TRANSMITTING TUBE GL-6019

The GL-6019 is a four-electrode transmitting tube featuring a metal-and-ceramic envelope designed for use as a power amplifier or oscillator in grounded-grid circuits with both grids maintained at radio-frequency ground potential. The output circuit is connected between the anode and the screen grid. The anode is capable of dissipating two kilowatts. Cooling is accomplished by water and forced air with the water jacket an integral part of the anode. The cathode is indirectly heated and thoria coated. Maximum ratings apply up to 900 megacycles.

When used as a Class B grounded-grid broadband television amplifier this tube has a useful synchronizing peak-power output of one kilowatt at 900 megacycles; in narrowband Class C service the output is one kilowatt of continuous power as an amplifier or oscillator. Because of its ratings, the GL-6019 is also well adapted to use in dielectric heating equipment.

The small size and close spacing of electrodes in the design of the tube combine with the ring-seal construction and the low-loss factor due to the gold-over-silver-plated external parts and the ceramic permit high operating efficiency. In addition, the grounded-grid construction eliminates the necessity for neutralization in a properly designed circuit. The small size of the GL-6019 permits compact mounting, and the integral water jacket and ring-seal construction allow quick plug-in installation.

TECHNICAL INFORMATION

GENERAL

Electrical Data	Minimum	Bogey	Maximum	
Heater Voltage*		6.3	6.8	Volts
Heater Current at Bogey Voltage		24		Amperes
Heater Starting Current			36	Amperes
Heater Cold Resistance		0.022		Ohm
Cathode Heating Time	1			Minutes
Amplification Factor, G_2 to G_1 E_b=500 Volts, I_b=0.250 Ampere		10		
Peak Cathode Current†			4	Amperes
Direct Interelectrode Capacitances				
Cathode - Plate‡		0.03		uuf
Input, G_2 tied to G_1		16.0		uuf
Output, G_2 tied to G_1◊		4.6		uuf

Mechanical Data		
Mounting Position - Vertical		
Water Flow		
Anode	0.6 Min	Gallon per Minute
Pressure Drop at Rated Flow	3.5	Pounds per Square Inch
Water Pressure	80 Max	Pounds per Square Inch
Outlet Water Temperature	70 Max	C
Air Flow		
Screen Grid to Control-Grid Seals	2 Min	Cubic Feet per Minute
Heater to Cathode Seals	12 Min	Cubic Feet per Minute
Ceramic Temperature at any Point	200 Max	C
Net Weight, approximate	1.25	Pounds

from RTMA releases #987, June 15, 1951 & 987A, May 26, 1952

Mechanical Data (CONT'D)

Water and air cooling to be applied before and during the application of any voltages. Water cooling may be discontinued with removal of all voltages. Air flow on heater-to-cathode seal must be maintained for one minute after removal of heater voltage.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Radio-frequency Amplifier - Class B Television Service
Synchronizing-level conditions per tube unless otherwise specified

Maximum Ratings, Absolute Values			
D-c Plate Voltage	4000	Max	Volts
D-c Grid-No. 2 Voltage	600	Max	Volts
D-c Plate Current	0.7	Max	Ampere
Plate Input	2.5	Max	Kilowatts
Grid-No. 2 Input	25	Max	Watts
Plate Dissipation	2.0	Max	Kilowatts
Grid-No. 1 Dissipation	16	Max	Watts
Typical Operation - Grounded-grid circuit up to 900 megacycles Band Width 6 megacycles			
D-c Plate Voltage	3500		Volts
D-c Grid-No. 2 Voltage	500		Volts
D-c Grid-No. 1 Voltage	-40		Volts
Peak R-f Plate Voltage			
Synchronizing Level	2500		Volts
Pedestal Level	1875		Volts
Peak R-f Grid Voltage			
Synchronizing Level	110		Volts
Pedestal Level	70		Volts
D-c Plate Current			
Synchronizing Level	0.520		Ampere
Pedestal Level	0.360		Ampere
D-c Grid-No. 2 Current (Pedestal Level)	0.035		Ampere
D-c Grid-No. 1 Current			
Synchronizing Level	0.110		Ampere
Pedestal Level	0.035		Ampere
Driving Power at Tube, approximate			
Synchronizing Level	100		Watts
Pedestal Level	25		Watts
Power Output, approximate			
Synchronizing Level[π]	1000		Watts
Pedestal Level[π]	560		Watts

Radio-frequency Power Amplifier and Oscillator - Class C Telegraphy
Key-down conditions per tube without amplitude modulation[Δ]

Maximum Ratings, Absolute Values			
D-c Plate Voltage	4000	Max	Volts
D-c Grid-No. 2 Voltage	600	Max	Volts
D-c Grid-No. 1 Voltage	-150	Max	Volts
D-c Plate Current	0.7	Max	Ampere
D-c Grid-No. 1 Current	0.10	Max	Ampere
Plate Input	2.8	Max	Kilowatts
Grid-No. 2 Input	25	Max	Watts
Plate Dissipation	2	Max	Kilowatts
Grid-No. 1 Dissipation	16	Max	Watts
Typical Operation			
D-c Plate Voltage	4000		Volts
D-c Grid-No. 2 Voltage	600		Volts
D-c Grid-No. 1 Voltage	-120		Volts
Peak R-f Plate Voltage, approximate	2750		Volts

Radio-frequency Power Amplifier and Oscillator - Class C Telegraphy
Key-down conditions per tube without amplitude modulation$^{\Delta}$ (CONT'D)

Typical Operation (CONT'D)		
Peak R-f Grid-No. 1 Voltage	195	Volts
D-c Plate Current	0.550	Ampere
D-c Grid-No. 2 Current	0.035	Ampere
D-c Grid-No. 1 Current, approximate	0.065	Ampere
Driving Power, approximate	150	Watts
Power Output, approximate #	1200	Watts

* The cathode of the GL-6019 in ultra-high-frequency service is subjected to considerable back bombardment, due to transit-time effects, which raises the temperature of the cathode. The amount of heating due to bombardment is a function of the operating conditions and frequency and must be compensated for by a reduction of the heater input to prevent overheating of the cathode with resulting short life. For long life, the GL-6019 should be put in operation with rated heater voltage. After the circuit is adjusted for proper tube operation, heater voltage is adjusted to a value slightly above that at which circuit performance is affected. At 900 megacycles with typical operating conditions the heater voltage can be reduced to approximately 5 volts. At lower frequencies, the reduction will be less. Minor circuit readjustment may be necessary after the above adjustment.

† Represents maximum usable cathode current (plate current plus current to each grid) for any condition of operation.

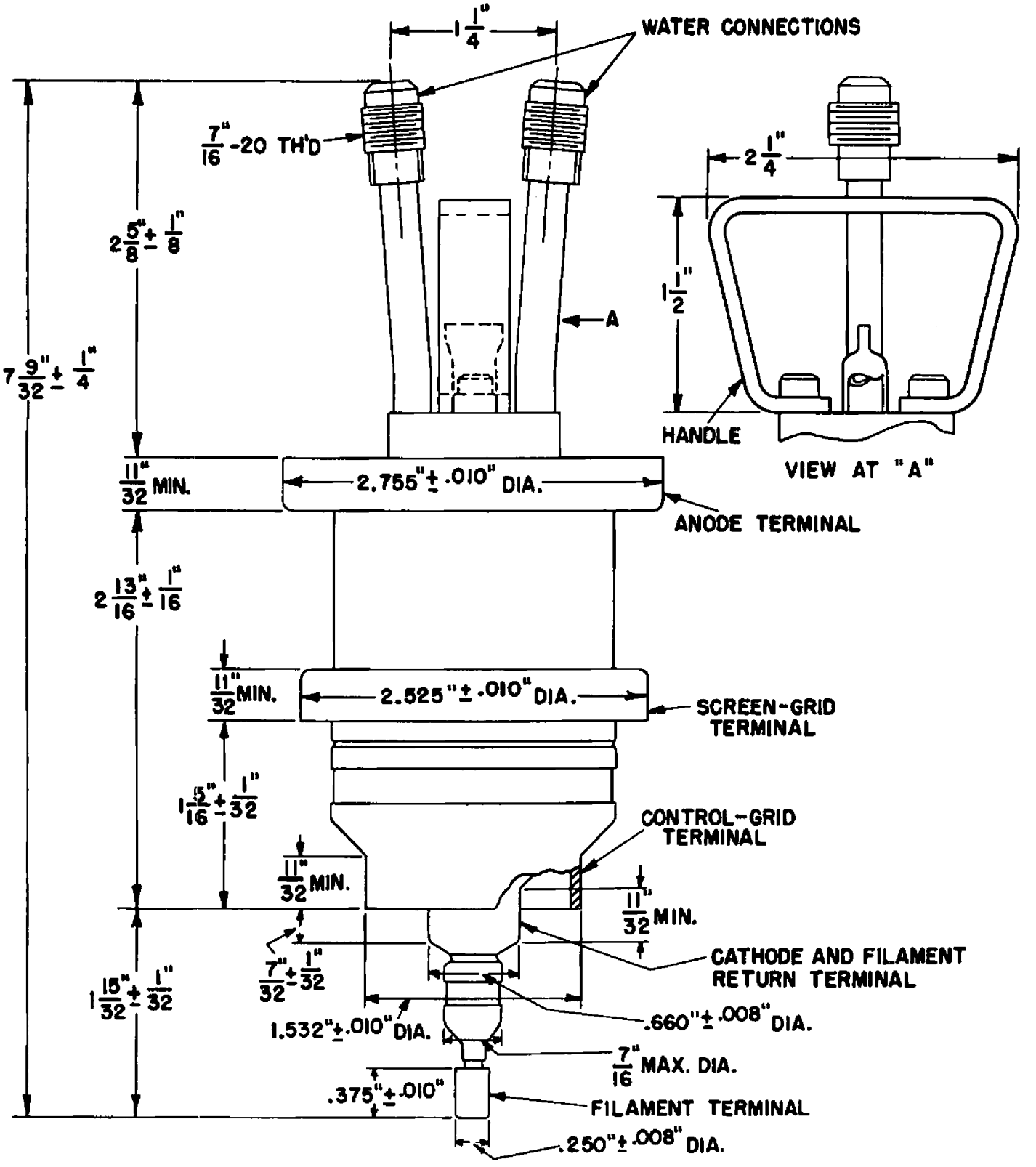
‡ Measured with a 6-inch diameter flat metal disk attached to the screen-grid ring. Control grid connected to the screen grid.

◊ Output capacitance measured between anode and screen grid. Control grid connected directly to screen grid.

π Useful power output including power transferred from driver stage.

Δ Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 percent of the carrier conditions.

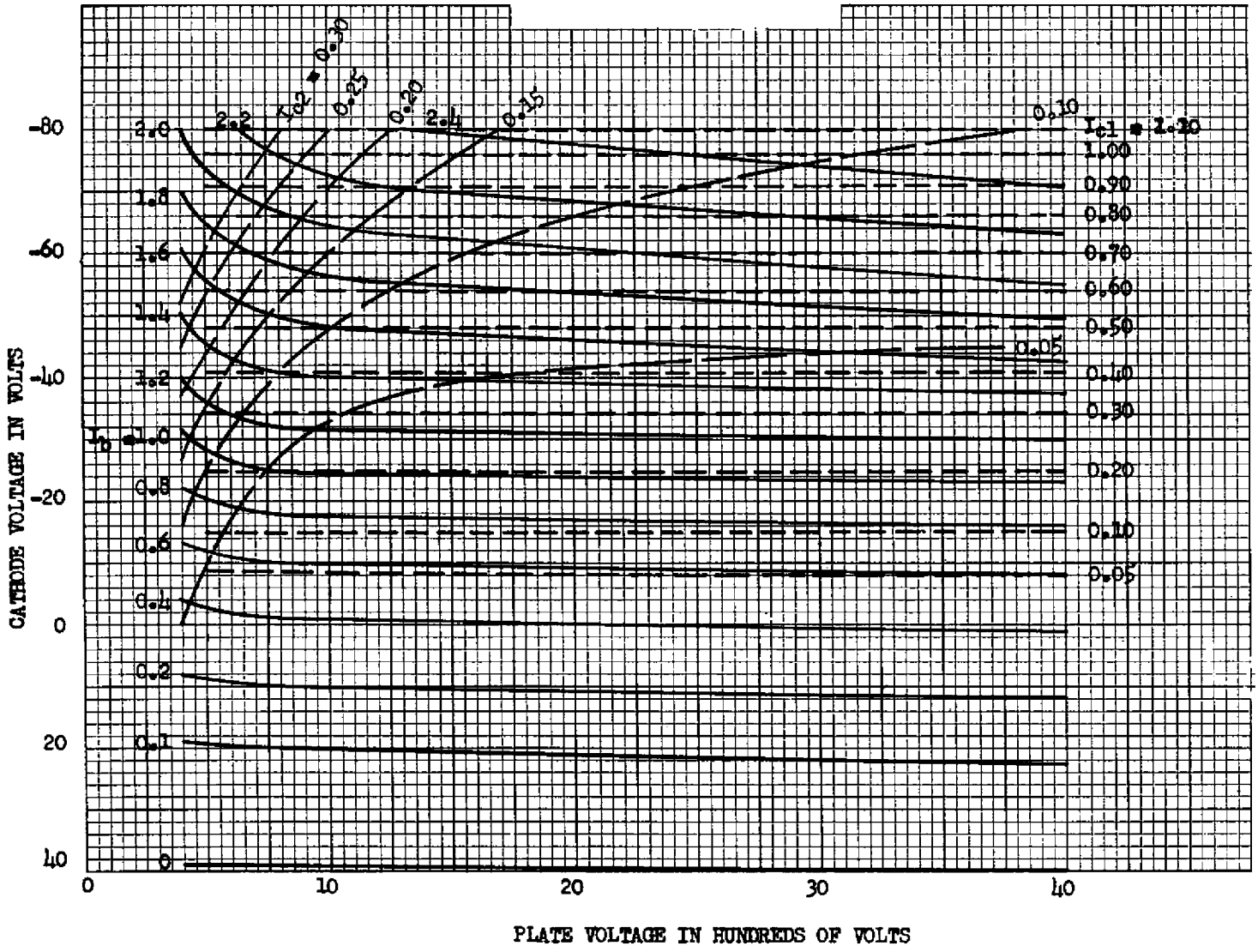
\# Total anode power output including power transferred from driver stage.



N20720AZ

March 15, 1951

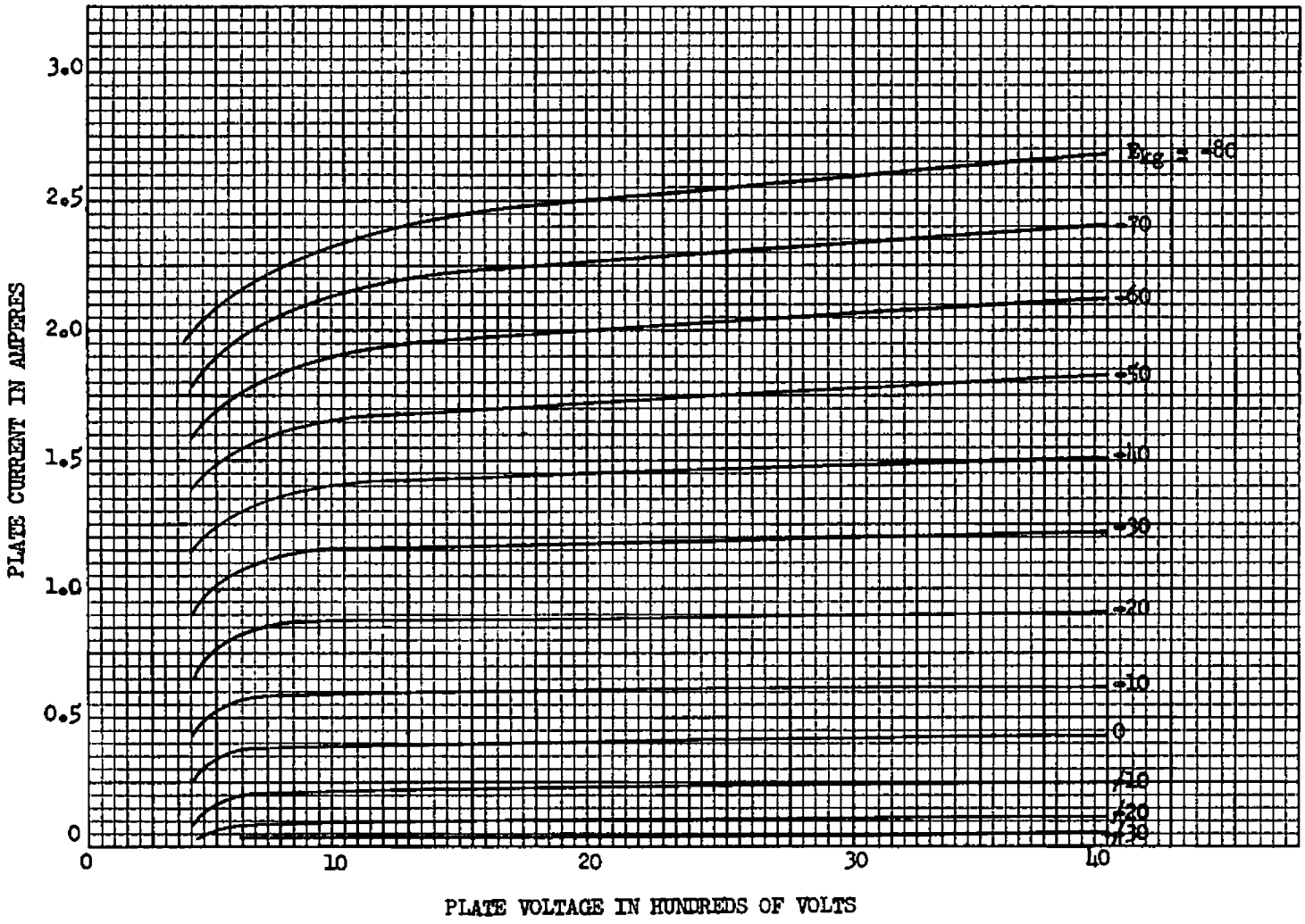
OUTLINE
GL-6019



K-69087-72A458

May 8, 1951

GL-6019
CONSTANT-CURRENT CHARACTERISTICS
E_f=6.3 VOLTS
SCREEN VOLTAGE = 500 VOLTS



K-69087-72A464

May 9, 1951

GL-6019
AVERAGE-PLATE CHARACTERISTICS
E_f=6.3 VOLTS
SCREEN VOLTAGE = 500 VOLTS

GENERAL ELECTRIC

ELECTRONICS DEPARTMENT, TUBE DIVISIONS

SCHENECTADY, NEW YORK

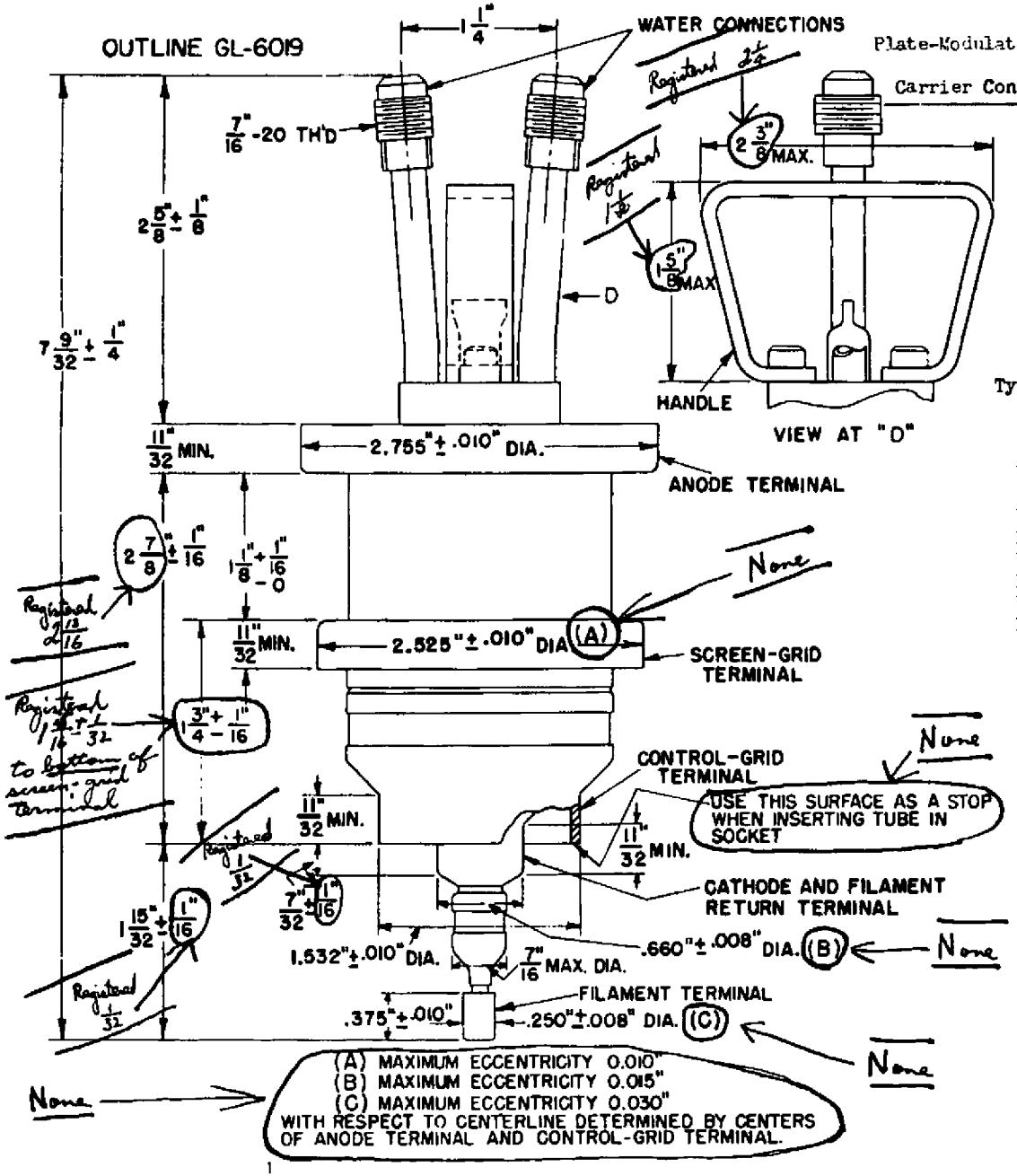


Plate-Modulated Radio-Frequency Power Amplifier - Class C Telephony

Carrier Conditions with a Maximum Modulation Factor of 1.0

Maximum Ratings, Absolute Values

D-C Plate Voltage	3200	max	Volts
D-C Grid-No. 2 Voltage	600	max	Volts
D-C Grid-No. 1 Voltage	-120	max	Volts
D-C Plate Current	0.35	max	Amperes
D-C Grid-No. 1 Current	0.10	max	Amperes
Plate Input	1.12	max	Kilowatts
Grid-No. 2 Input	10	max	Watts
Plate Dissipation	1200	max	Watts

Typical Operation, Grounded-Grid Circuit

D-C Plate Voltage	3000	Volts
D-C Grid-No. 2 Voltage	500	Volts
D-C Grid-No. 1 Voltage	-100	Volts
Peak R-F Plate Voltage	2300	Volts
Peak R-F Grid-No. 1 Voltage	137	Volts
D-C Plate Current	0.25	Amperes
D-C Grid-No. 2 Current	0.01	Amperes
D-C Grid-No. 1 Current, approx	0.047	Amperes
Driving Power, approximate ≠	38	Watts
Power Output ≠	565	Watts

≠ The carrier of the driver modulated 100 percent.

≠ Includes power transferred from driver stage.

Electronic TUBES

6021
TWIN TRIODE
Five-Star Tube
★ ★ ★ ★ ★

FOR GENERAL-PURPOSE AMPLIFIER APPLICATIONS

8-LEAD SUBMINIATURE
MEDIUM MU

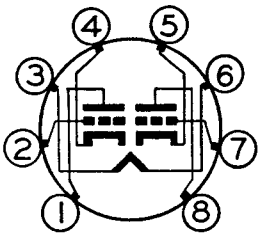
SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING

DESCRIPTION AND RATING

The 6021 is a subminiature medium-mu twin triode for use in general-purpose amplifier applications. Each section has an individual cathode and is electrically independent.

The 6021 is a special-quality tube for use in critical industrial and military applications in which operational dependability is of primary importance. Features of the tube include a high degree of mechanical strength and a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

BASING DIAGRAM



RETMA 8DG

TERMINAL CONNECTIONS

Lead 1—Plate (Section 2)
Lead 2—Grid (Section 2)
Lead 3—Heater
Lead 4—Cathode (Section 2)
Lead 5—Cathode (Section 1)
Lead 6—Heater
Lead 7—Grid (Section 1)
Lead 8—Plate (Section 1)

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ± 5%	Volts
Heater Current	0.3	Amperes

Direct Interelectrode Capacitances

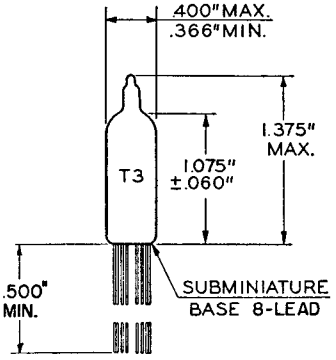
	With Shield*	Without Shield	
Grid to Plate, Each Section	1.4	1.5	μμf
Input, Each Section	2.1	2.4	μμf
Output, Section 1	1.3	0.28	μμf
Output, Section 2	1.4	0.32	μμf
Grid to Grid, maximum	0.011	0.013	μμf
Plate to Plate, maximum	0.33	0.52	μμf

*With external shield of 0.405-inch inside diameter connected to cathode of section under test.

MECHANICAL

Mounting Position—Any
Envelope—T-3, Glass
Base—E8-10, Subminiature Button 8-Lead

PHYSICAL DIMENSIONS



RETMA 3-1

GENERAL ELECTRIC

Supersedes ET-T1101 dated 8-54

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES, EACH SECTION

Plate Voltage	165	Volts
Negative DC Grid Voltage	55	Volts
Plate Dissipation	0.7	Watts
DC Plate Current	22	Milliamperes
DC Grid Current	5.5	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	200	Volts
Heater Negative with Respect to Cathode	200	Volts
Grid Circuit Resistance	1.1	Megohms
Bulb Temperature at Hottest Point	220	C

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	100	Volts
Cathode-Bias Resistor	150	Ohms
Amplification Factor	35	
Plate Resistance, approximate	6500	Ohms
Transconductance	5400	Micromhos
Plate Current	6.5	Milliamperes
Grid Voltage, approximate		
Ib = 10 Microamperes	−6.5	Volts

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

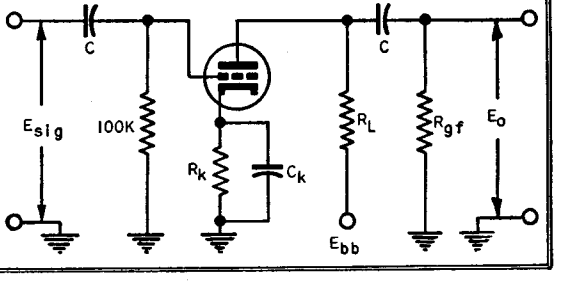
R_L	R_{gf}	Ebb = 90 Volts			Ebb = 150 Volts			Ebb = 225 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	1900	7.3	18	1400	14	20	1300	22	22
0.10	0.24	2300	11	20	1800	19	22	1600	30	22
0.24	0.24	4700	9.6	19	3800	18	20	3400	27	22
0.24	0.51	5600	13	19	4700	23	21	4300	35	22
0.51	0.51	10000	11	18	9000	20	20	8300	31	21
0.51	1.0	13000	14	19	11000	25	20	10000	39	21

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	Ebb = 90 Volts			Ebb = 150 Volts			Ebb = 225 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2500	9.8	17	1800	18	20	1400	29	22
0.10	0.24	3100	13	18	2300	25	21	1900	39	22
0.24	0.24	6200	12	18	4800	22	20	4000	34	21
0.24	0.51	7500	15	18	6000	27	20	5200	43	21
0.51	0.51	13000	13	18	10000	24	20	9000	37	21
0.51	1.0	16000	16	18	13000	30	19	12000	46	21

Notes:

1. E_o is maximum RMS voltage output for approximately five percent total harmonic distortion.
2. Gain is measured for an output voltage of two volts RMS.
3. R_k is in ohms; R_L and R_{gf} are in megohms.
4. Coupling capacitors (C) should be selected to give desired frequency response. R_k should be adequately by-passed.



CHARACTERISTICS LIMITS

		Minimum	Maximum	
Heater Current				
Ef = 6.3 volts	Initial	280	320	Milliamperes
	500-Hr	276	328	Milliamperes
Plate Current, Each Section				
Ef = 6.3 volts, Eb = 100 volts, Rk = 150 ohms (by-passed)	Initial	4.5	8.5	Milliamperes
Plate Current Difference between Sections				
Difference between plate currents for each section at Ef = 6.3 volts, Eb = 100 volts, Rk = 150 ohms (by-passed)	Initial	....	1.6	Milliamperes
Transconductance (1), Each Section				
Ef = 6.3 volts, Eb = 100 volts, Rk = 150 ohms (by-passed)	Initial	4450	6350	Micromhos
Transconductance Change with Heater Voltage, Each Section				
Difference between Transconductance (1) and Transconductance at Ef = 5.7 volts (other conditions the same) expressed as a percentage of Transconductance (1)	Initial	....	15	Percent
	500-Hr	....	15	Percent
Transconductance Change with Operation, Each Section				
Difference between Transconductance (1) initially and after operation expressed as a percentage of initial value	500-Hr	....	25	Percent
Average Transconductance Change with Operation, Each Section				
Average of values for "Transconductance Change with Operation"	500-Hr	....	15	Percent
Amplification Factor, Each Section				
Ef = 6.3 volts, Eb = 100 volts, Rk = 150 ohms (by-passed)	Initial	30	40	
Plate Current Cutoff, Each Section				
Ef = 6.3 volts, Eb = 100 volts, Ec = −6.5 volts	Initial	....	100	Microamperes
Interelectrode Capacitances				
Grid to Plate (g to p), Each Section	Initial	1.2	1.8	μμf
Input (g to k+h), Each Section	Initial	1.8	3.0	μμf
Output (p to k+h), Section 1	Initial	0.20	0.36	μμf
Output (p to k+h), Section 2	Initial	0.22	0.42	μμf
Grid to Grid (g to g)	Initial	....	0.013	μμf
Plate to Plate (p to p)	Initial	....	0.52	μμf
Measured without external shield				
Negative Grid Current, Each Section				
Ef = 6.3 volts, Eb = 150 volts, Rk = 300 ohms (by-passed), Rg = 1.0 meg	Initial	....	0.3	Microamperes
	500-Hr	....	0.9	Microamperes
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	Initial	....	5.0	Microamperes
	500-Hr	....	10	Microamperes
Heater Negative with Respect to Cathode	Initial	....	5.0	Microamperes
	500-Hr	....	10	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid (Each Section) to All at 100 Volts DC	Initial	100	....	Megohms
	500-Hr	50	....	Megohms
Plate (Each Section) to All at 300 Volts DC	Initial	100	....	Megohms
	500-Hr	50	....	Megohms
Vibrational Noise Output Voltage, RMS				
Ef = 6.3 volts, Ebb = 100 volts, Rk = 150 ohms (by-passed), R_L = 10,000 ohms, Vibrational acceleration = 15 G at 40 cps	Initial	....	50	Millivolts

CHARACTERISTICS LIMITS CONTINUED ON PAGE 4

CHARACTERISTICS LIMITS (Cont'd)

		Minimum	Maximum	
Grid Emission Current, Each Section Ef = 7.5 volts, Eb = 150 volts, Ecc = −7.5 volts, Rg = 1.0 meg	Initial	....	0.5	Microamperes
Pulse Cathode Current Ef = 6.0 volts. Pulse of 25 microseconds duration, 200-cycle repetition rate, and 50 volt amplitude is applied to plate and grid tied together. Pulse cathode current is measured for each section with opposite section floating	Initial	300	....	Milliamperes

The indicated 500-hour values are life-test end points for the following conditions of operation for each section: Ef = 6.3 volts, Eb = 100 volts, Rk = 150 ohms, Rg = 1.0 meg, Ehk = 200 volts with heater positive with respect to cathode, and bulb temperature = 220 C minimum.

SPECIAL TESTS AND RATINGS

Stability Life Test
Statistical sample operated for one hour to evaluate and control initial variations in transconductance.

Survival Rate Life Test
Statistical sample operated for one hundred hours to evaluate and control early-life electrical and mechanical inoperatives.

Heater-Cycling Life Test
Statistical sample operated for 2000 cycles to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.0 volts cycled for one minute on and four minutes off, Eb = Ec = 0 volts, and Ehk = 140 volts RMS.

Shock Rating—450 G
Statistical sample subjected to five impact accelerations of 450 G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

Fatigue Rating—2.5 G
Statistical sample subjected to vibrational acceleration of 2.5 G for 32 hours in each of three different positions. The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

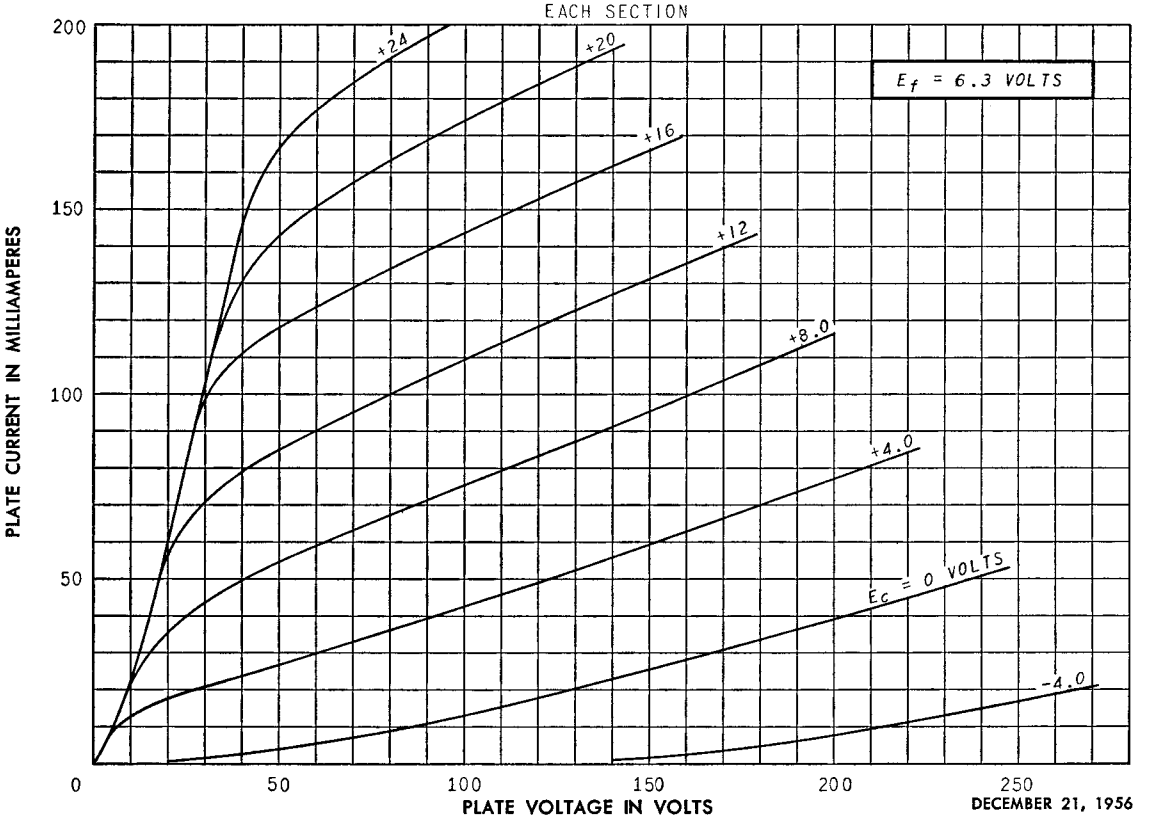
Altitude Rating—60,000 Feet
Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

In the design of military equipment employing this tube, reference should be made to the appropriate MIL-E-1 specification.

AVERAGE PLATE CHARACTERISTICS

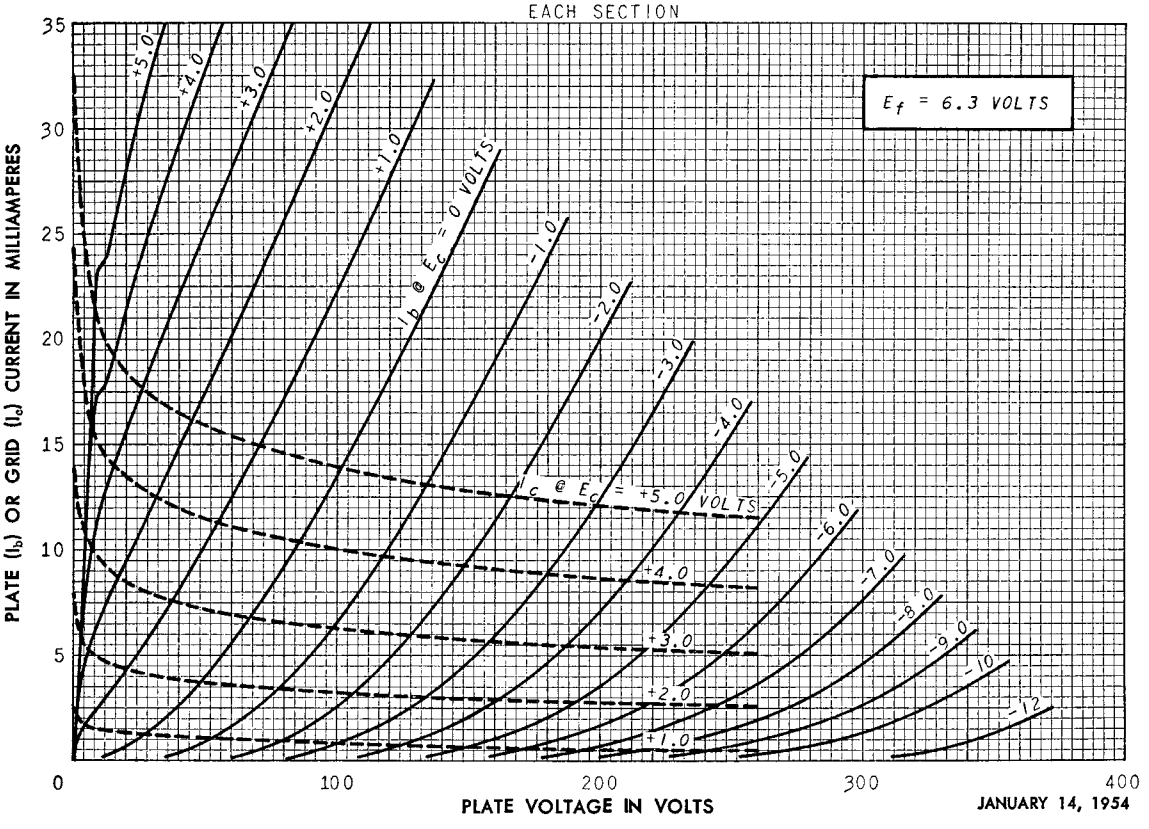
EACH SECTION



DECEMBER 21, 1956

AVERAGE PLATE CHARACTERISTICS

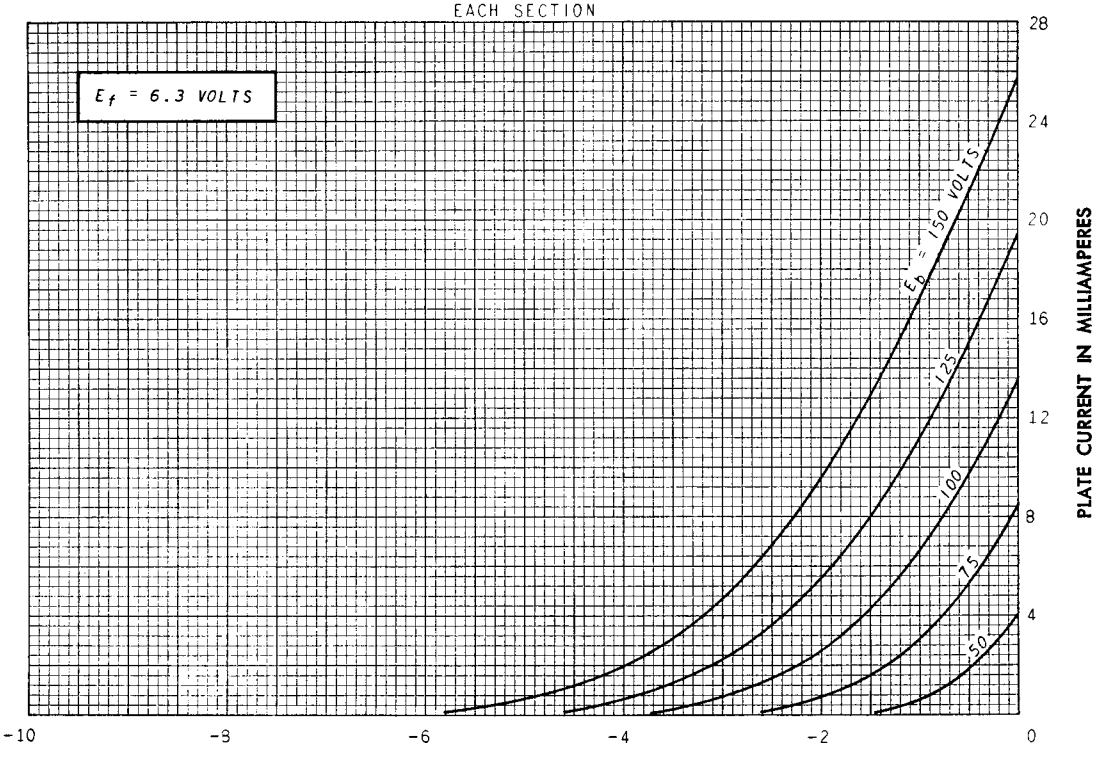
EACH SECTION



JANUARY 14, 1954

AVERAGE TRANSFER CHARACTERISTICS

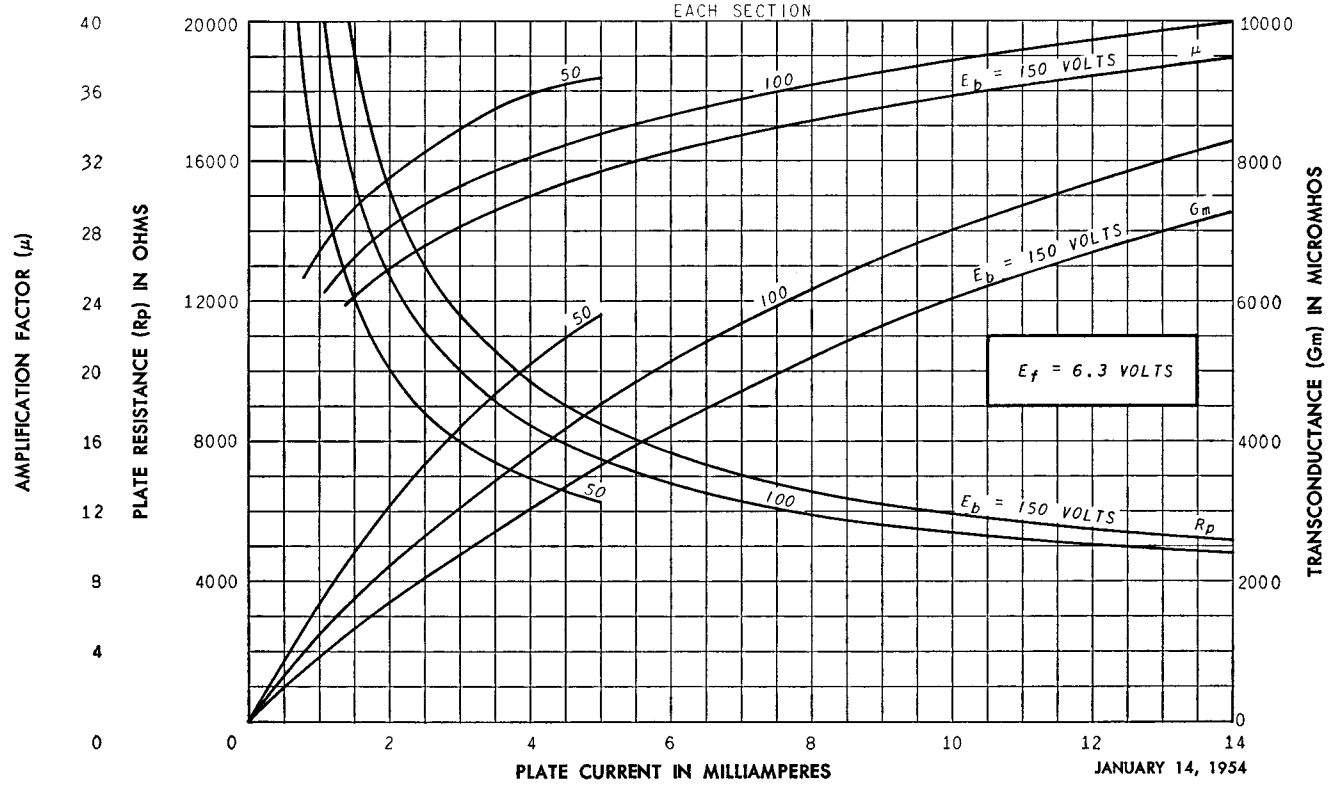
EACH SECTION



JANUARY 14, 1954

AVERAGE CHARACTERISTICS

EACH SECTION



JANUARY 14, 1954

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

DESCRIPTION AND RATING

TRANSMITTING TUBE 6039

The 6039 is a three-electrode tube designed for use as a grounded-grid class B radio-frequency amplifier and class C radio-frequency amplifier and oscillator in television and FM services. The anode is water-cooled and capable of dissipating 7 kilowatts. The cathode is a thoriated-tungsten filament. Maximum ratings apply up to 220 megacycles.

Utilizing the same general design principles that have proved so successful in the operation of the GL-9C24, this tube's predecessor, the 6039 has several features that enable it to give improved service over the older tube in both the television and FM bands. A material reduction in power cost results from use of a thoriated-tungsten filament which requires only 25.8 percent of the amount of power required. Higher output can be obtained - A pair of 6039's are capable of 10 kilowatts output in television service and 25 kilowatts in FM. Other features of the tube are low lead inductance, large terminal-contact areas, and silver-plated metal parts to reduce radio-frequency losses. In addition, neutralization is unnecessary in a properly designed circuit, and the problem of filament starting is eliminated since special precautions to limit the filament starting current are not required.

The 6039 can be substituted for the GL-9C24 with a saving of 74.2 percent in filament power providing modification of the filament circuit and minor mechanical changes are made.

TECHNICAL INFORMATION

These data are for reference only. For design information see the Specifications.

GENERAL

Electrical Data	Minimum	Bogey	Maximum	
Filament Voltage	4.8	5.0	5.2	Volts
Filament Current at 5 Volts	74	78	82	Amperes
Amplification Factor, I_b = 1.0 Amp, E_c = 50V	17	21	25	
Interelectrode Capacitances				
Grid-plate	13.8	15.7	17.6	uuf
Grid-filament	20	24	28	uuf
Plate-filament*	0.34	0.47	0.60	uuf

Mechanical Data		
Mounting Position - Vertical, Anode Down		
Type of Cooling - Water and Forced Air		
Water Flow on Anode	11	GPM
Maximum Outgoing Water Temperature	70	C
Air Flow to Center Filament Terminal	7	CFM
Maximum Glass Temperature§	150	C
Gasket - JETEC Type No. 19		
Net Weight, approximate	3.5	Pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Radio-frequency Power Amplifier - Class B Video Service

Synchronizing peak conditions per tube in a grounded-grid circuit - 5 megacycles bandwidth

Maximum Ratings, Absolute Values		
D-c Plate Voltage	6000 Max	Volts
D-c Plate Current	2.25 Max	Amperes

GENERAL ELECTRIC

from RTMA release #948, March 2, 1951

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS (Cont'd)

Radio-frequency Power Amplifier - Class B Video Service (Cont'd)
Synchronizing peak conditions per tube in a grounded-grid circuit - 5 megacycles bandwidth

Maximum Ratings, Absolute Values (Cont'd)			
Plate Input		13.5 Max	Kilowatts
Plate Dissipation		7 Max	Kilowatts
Typical Operation			
D-c Plate Voltage	5000	5000	Volts
D-c Grid-No. 1 Voltage	270	300	Volts
Peak R-f Grid-No. 1 Voltage	700	580	Volts
D-c Plate Current	2.2	2.1	Amperes
D-c Grid-No. 1 Current, approximate	0.21	0.17	Ampere
Driving Power, approximate†	1300	1060	Watts
Power Output, approximate†	5.6	4.9	Kilowatts

Radio-frequency Power Amplifier and Oscillator - Class C Telegraphy
Key-down conditions per tube without amplitude modulation‡

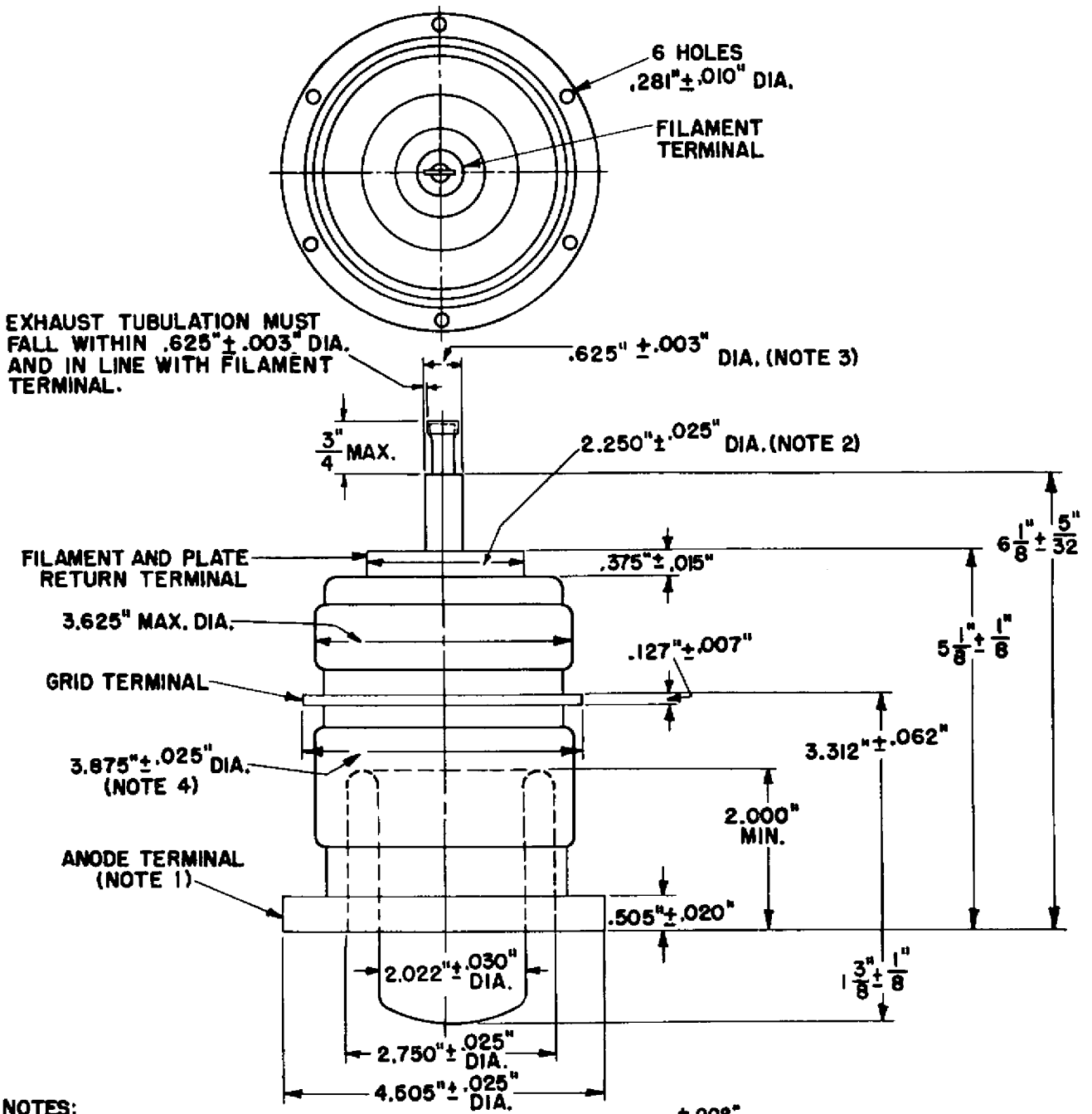
Maximum Ratings, Absolute Values			
D-c Plate Voltage		7500 Max	Volts
D-c Grid-No. 1 Voltage		1000 Max	Volts
D-c Plate Current		2.25 Max	Amperes
D-c Grid-No. 1 Current		0.400 Max	Ampere
Plate Input		16 Max	Kilowatts
Plate Dissipation		7 Max	Kilowatts
Typical Operation, Grounded-filament Circuit			
D-c Plate Voltage		7000	Volts
D-c Grid-No. 1 Voltage		900	Volts
Peak R-f Grid-No. 1 Voltage		1540	Volts
D-c Plate Current		2.08	Amperes
D-c Grid-No. 1 Current, approximate		0.40	Ampere
Driving Power, approximate		620	Watts
Power Output, approximate		10	Kilowatts
Typical Operation, Grounded-grid Circuit			
D-c Plate Voltage		7000	Volts
D-c Grid-No. 1 Voltage		900	Volts
Peak R-f Grid-No. 1 Voltage		1540	Volts
D-c Plate Current		2.08	Amperes
D-c Grid-No. 1 Current, approximate		0.40	Ampere
Driving Power, approximate†		3.4	Kilowatts
Power Output, approximate†		12.8	Kilowatts

* Measured with a 10-inch outer diameter and 3 5/8-inch inner diameter flat shield on grid terminal.

§ Sufficient air flow must be applied to the grid-anode and grid-cathode seals to limit the temperature to this value.

† This value includes power transferred from driver to output.

‡ Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 percent of the carrier conditions.

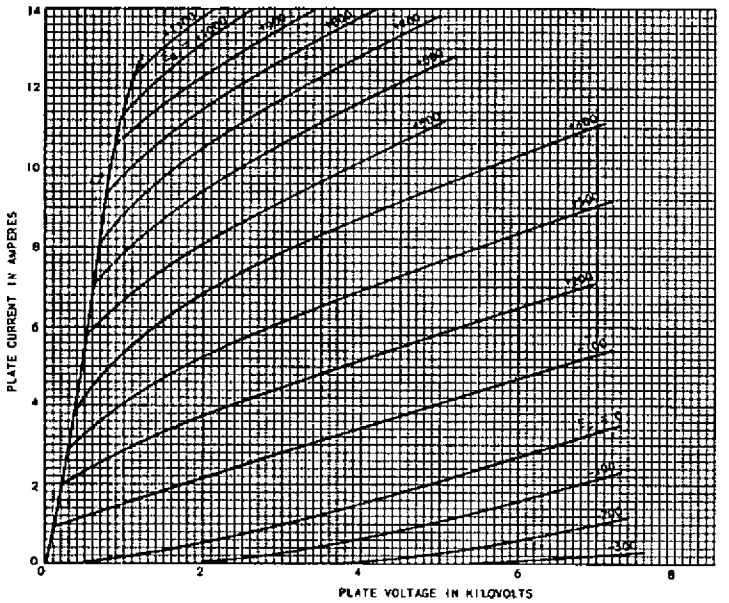


NOTES:

1. HOLES IN ANODE TERMINAL POSITIONED TO FIT SIX .250"$^{+.002"}_{-.000"}$ DIA. PINS INSERTED TO DEPTH OF FLANGE AND LOCATED ON A CIRCLE 4.000"±.003" DIA. AT ANGLES OF 60±0 DEG. 10'. HOLES NOT INDEXED WITH RESPECT TO HOLES IN FILAMENT AND PLATE-RETURN TERMINAL.
2. ECCENTRICITY .060" FROM CENTER LINE OF BOLT HOLES IN ANODE TERMINAL.
3. ECCENTRICITY .060" FROM CENTER LINE OF OUTSIDE CIRCUMFERENCE OF PLATE-RETURN TERM.
4. ECCENTRICITY .030" FROM CENTER LINE OF BOLT HOLES IN ANODE TERMINAL.

N15176AZ January 17, 1951

Outline
6039

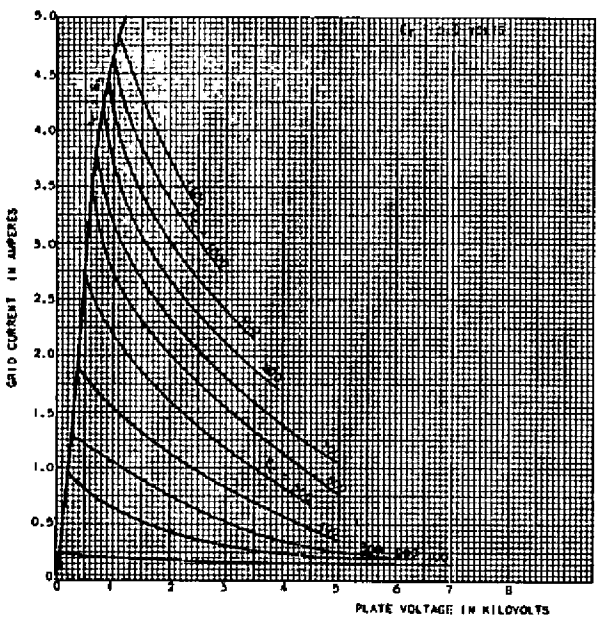


K-69087-72A415 November 22, 1950

6039

Average Plate Characteristics

E_f = 5.0 Volts

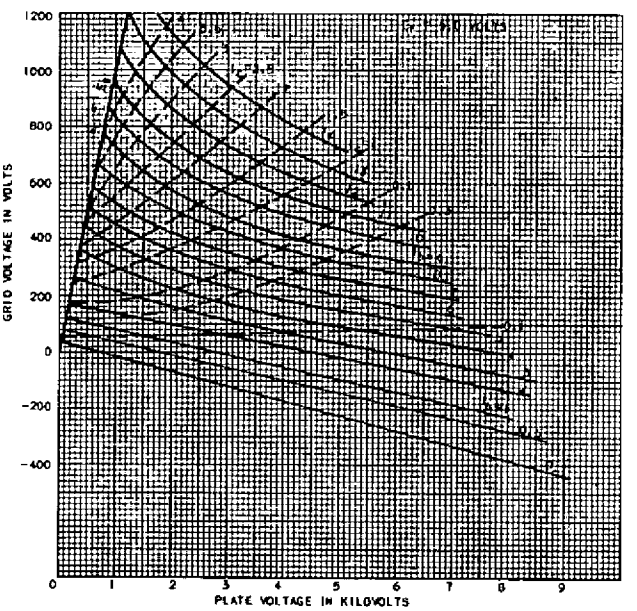


K-69087-72A416 November 22, 1950

6039

Average Grid Characteristics

E_f = 5.0 Volts



K-69087-72A368 November 14, 1950

6039

Characteristics

E_f = 5.0 Volts

GENERAL ELECTRIC

ELECTRONICS DEPARTMENT, TUBE DIVISIONS

SCHENECTADY, NEW YORK

DESCRIPTION AND RATING

THYRATRON 6044

The 6044 is a three-electrode, inert-gas-filled thyratron with negative control characteristic designed especially for motor-control circuits where short ionization time is required.

Satisfactory and dependable performance under conditions of shock and vibration is a particular advantage to be gained with the use of this tube. Utilizing a design where both electrical connection and mechanical support are provided by a single set of connections, the tube can be fastened to a control panel by means of the screws on the terminals. Because of this feature the tube can be held rigidly and securely in control apparatus, and the circuit design is simplified since sockets are unnecessary.

TECHNICAL INFORMATION

MAXIMUM RATINGS, Absolute Values

Maximum Peak Anode Voltage		
Inverse	500	Volts
Forward	350	Volts
Maximum Cathode Current		
Peak	77	Amperes
Average	6.4	Amperes
Surge (maximum duration 0.1 second)	770	Amperes
Maximum Averaging Time	6	Seconds
Maximum Negative Control-grid Voltage		
Before Conduction	250	Volts
During Conduction	10	Volts
Maximum Positive Control-grid Current		
Average (Averaging time, one cycle)	0.2	Ampere
Ambient Temperature Limits	-55 to +75	C

GENERAL

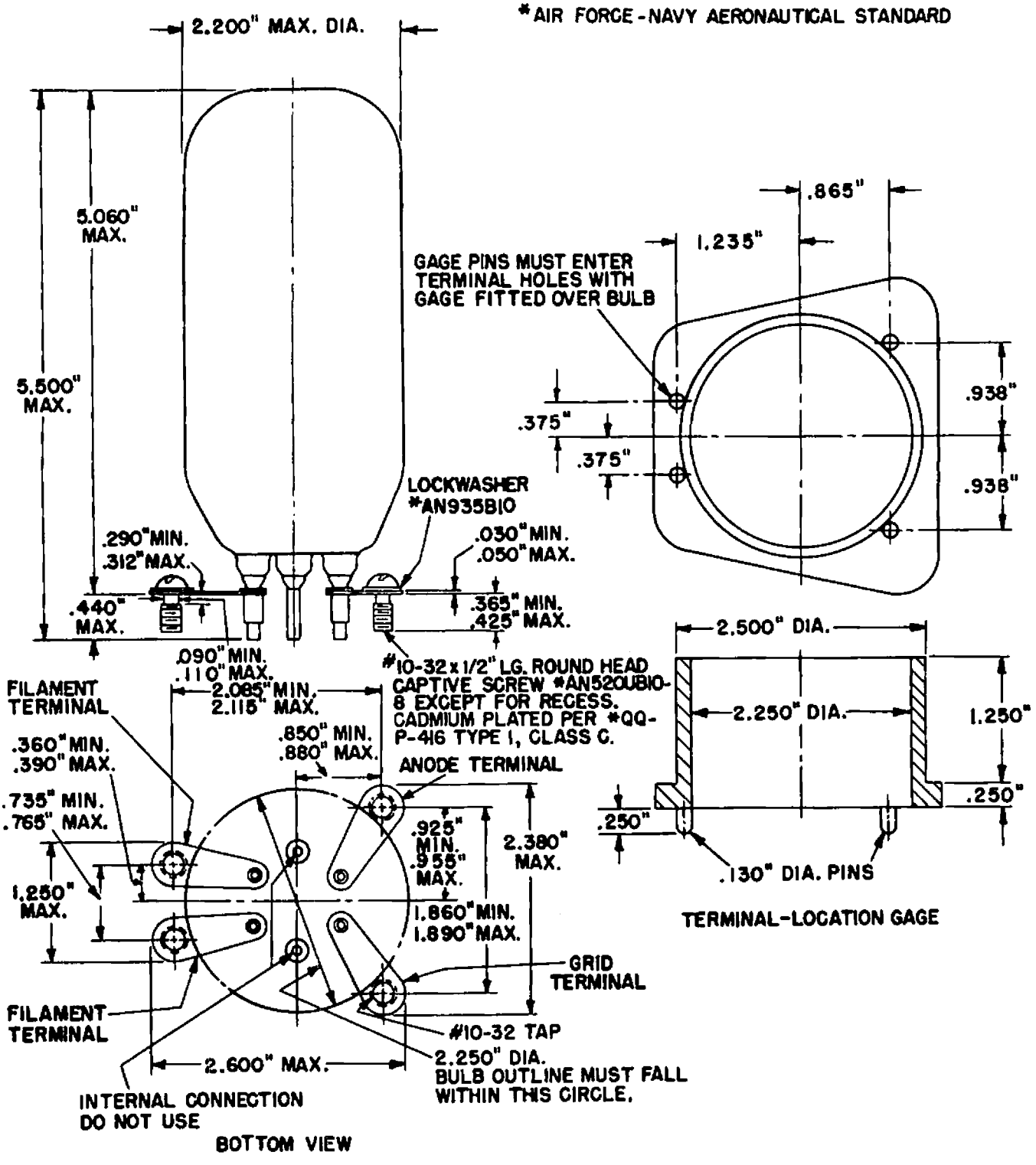
Electrical Data	Minimum	Bogey	Maximum	
Filament Voltage	2.37	2.5	2.62	Volts
Filament Current at 2.5 Volts		17	19	Amperes
Cathode Heating Time	60			Seconds
Anode-to-control-grid Capacitance		12.5		uuf
Control Grid - Cathode Capacitance		22.5		uuf
Ionization Time, approximate		10		Microseconds
Anode Voltage Drop		12		Volts

Mechanical Data

Type of Cooling - Convection		
Mounting Position - Vertical, Base Down		
Net Weight, maximum	0.33	Pound

GENERAL ELECTRIC

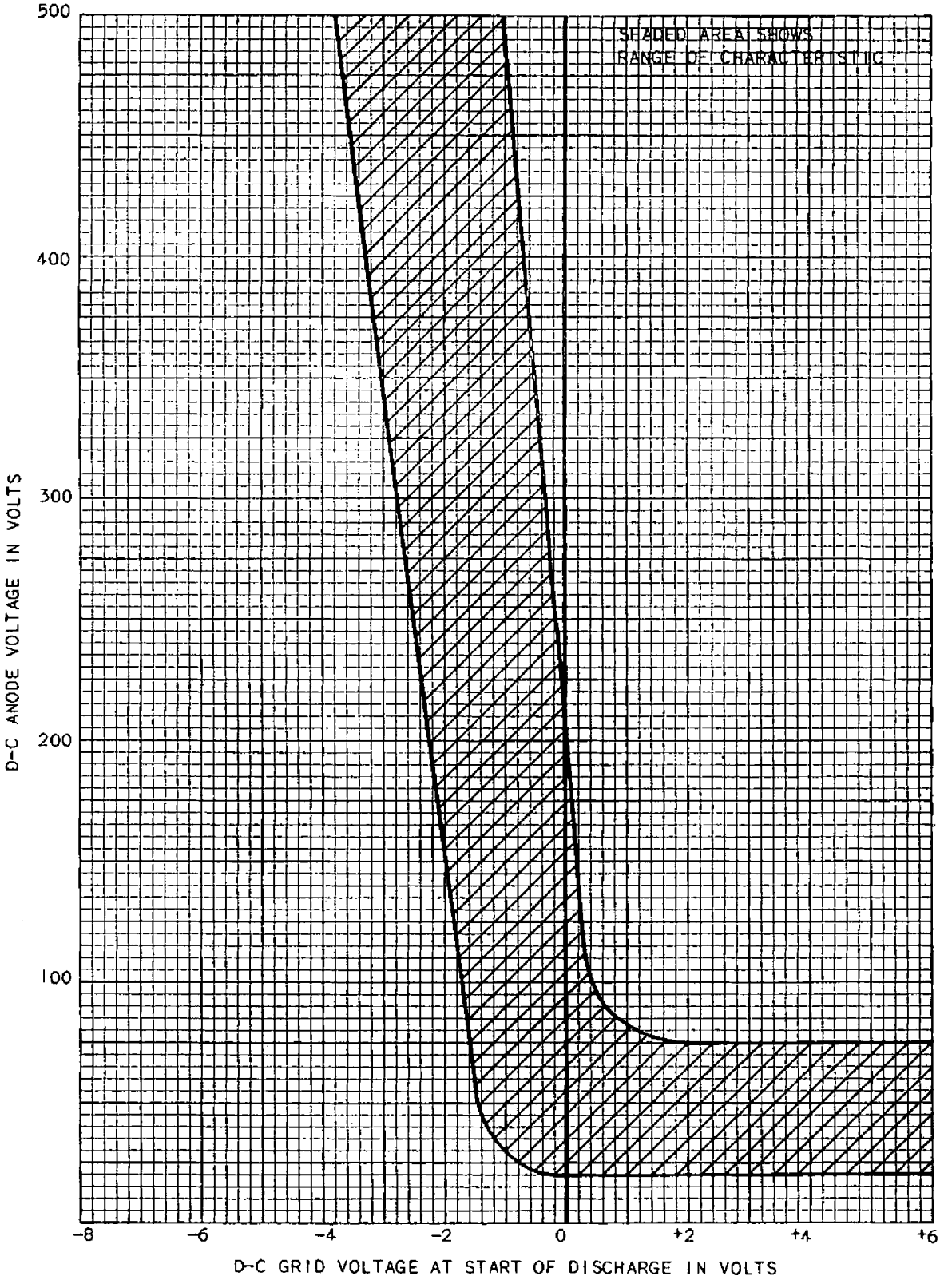
from RTMA release #947, Feb. 20, 1951



N21552AZ

January 19, 1951

Outline
6044



K-69087-72A440 January 3, 1951

6044

Typical Control Characteristic

GENERAL ELECTRIC

ELECTRONICS DEPARTMENT, TUBE DIVISIONS

SCHENECTADY, NEW YORK

DESCRIPTION AND RATING

PLIOTRON GL-6046

The GL-6046 is a beam power amplifier intended for use in industrial applications which require relatively high plate currents at low plate and screen supply voltages. The GL-6046 is designed to maintain its emission capabilities after long periods of non-conduction. In addition the control grid is specially treated to minimize grid emission. The tube is electrically and physically a replacement for the 25L6-GT.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode - Coated Unipotential

Heater Voltage (A-c or D-c)	25.0	Volts
Heater Current	0.30	Ampere

Mechanical Data

Mounting Position - Any
Envelope - T-9 Glass
Base - Intermediate Shell Octal 7-Pin, B7-7

MAXIMUM RATINGS Design Center Values

Plate Voltage	200	Volts
Screen Voltage	125	Volts
Plate Dissipation	10	Watts
Screen Dissipation	1.5	Watts
Peak Heater-Cathode Voltage	150	Volts

CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier

Heater Voltage (A-c or D-c)	25	25	Volts
Plate Voltage	110	200	Volts
Screen Voltage	110	125	Volts
Grid-No. 1 Voltage*	-7.5	---	Volts
Cathode Bias Resistor	---	180	Ohms
Peak A-f Grid-No. 1 Voltage	7.5	8.5	Volts
Plate Resistance, approximate	13,000	28,000	Ohms
Transconductance	8,000	8,000	Micromhos
Zero-Signal Plate Current	49	46	Milliamperes
Maximum-Signal Plate Current	50	47	Milliamperes
Zero-Signal Screen Current	4.0	2.2	Milliamperes
Maximum-Signal Screen Current	10.0	8.5	Milliamperes
Load Resistance	2,000	4,000	Ohms
Total Harmonic Distortion, approximate	10	10	Percent
Power Output	2.1	3.8	Watts

Relay Energizer

Heater Voltage (A-c or D-c)**	23	Volts
Plate Supply Voltage	115	Volts
Screen Supply Voltage	115	Volts

from RTMA release #989, July, 20, 1951

GENERAL ELECTRIC

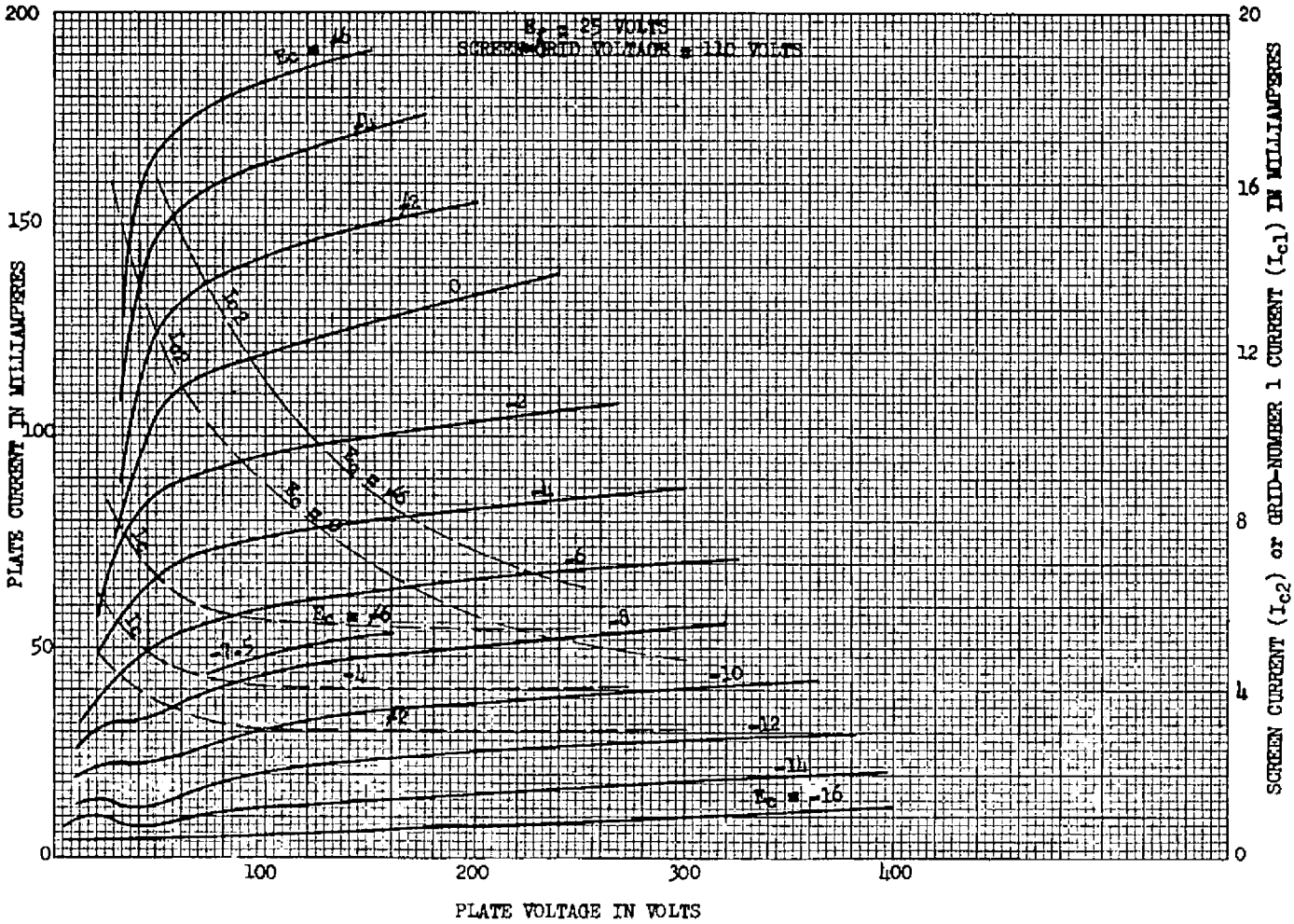
CHARACTERISTICS AND TYPICAL OPERATION (CONT'D)

Relay Energizer

Plate Load Resistor	500	Ohms
Screen Resistor	1000	Ohms
Grid-No. 1 Circuit Resistance	2	Megohms
Grid-No. 1 Bias Voltage	0	Volt
Plate Current	105	Milliamperes
Screen Current	12.8	Milliamperes
Plate Current for Ec_1 = -25 Volts, approximate	0.1	Milliampere

* The D-c resistance in the grid circuit, under rated maximum conditions, should not exceed 0.1 megohm for fixed-bias operation and 0.5 megohm for cathode-bias operation.

** Five tubes in series across 115-volt supply.

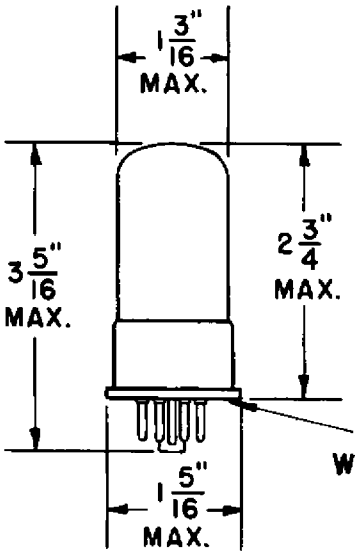


K-69087-72A461

May 15, 1951

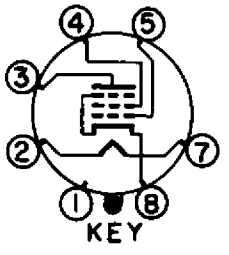
GL-6046

AVERAGE PLATE CHARACTERISTICS
E_f = 25 VOLTS
SCREEN-GRID VOLTAGE = 110 VOLTS



INTERMEDIATE SHELL
~~SMALL WAFER~~ OCTAL 7-PIN
WITH ~~SLEEVE~~ BASE NO. ~~B7-27~~ B7-7

BASING DIAGRAM



7AC

PIN 1: ~~BASE SLEEVE~~ NO CONNECTION
PIN 2: HEATER
PIN 3: PLATE
PIN 4: GRID NO. 2 (SCREEN)
PIN 5: GRID NUMBER 1
PIN 7: HEATER
PIN 8: CATHODE AND BEAM PLATES

N15190AZ

May 15, 1951

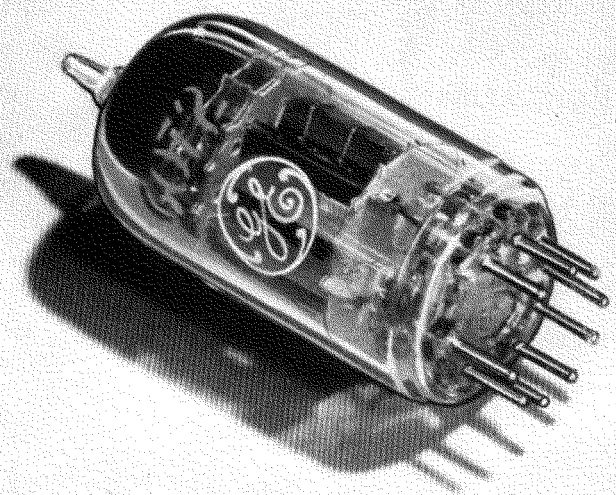
OUTLINE
GL-6046

GENERAL ELECTRIC

ELECTRONICS DEPARTMENT, TUBE DIVISIONS

SCHENECTADY, NEW YORK

5-51 (1M)



TWIN TRIODE

DESCRIPTION

The GL-6072 is a low-noise, low-microphonic miniature twin triode intended primarily for use in the low-level stages of high-gain audio-frequency amplifiers. The tube is specially designed to assure dependable life and reliable service under the exacting conditions encountered in mobile and aircraft applications. Additional features include mechanical ruggedization and a heater-cathode construction designed to withstand many thousand cycles of intermittent operation.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode—Coated Unipotential

Heater Voltage (A-c or D-c)	6.3	12.6	Volts
Heater Current	350	175	Milliamperes
Direct Interelectrode Capacitances*			
Grid to Plate (Each Section)	1.4		uuf
Input (Each Section)	1.4		uuf
Output (Section Number 1)	0.5		uuf
Output (Section Number 2)	0.4		uuf

Mechanical Data

Mounting Position—Any
Envelope—T-6½ Glass
Base—Small Button 9-Pin, E9-1

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

Electrical—Design Center Values—Each Section		
Plate Voltage	300	Volts
Positive D-c Grid Voltage	0	Volt
Plate Dissipation	1.5	Watts
Heater-Cathode Voltage	90	Volts
Mechanical		
Peak Impact Acceleration in Any Direction	600	G

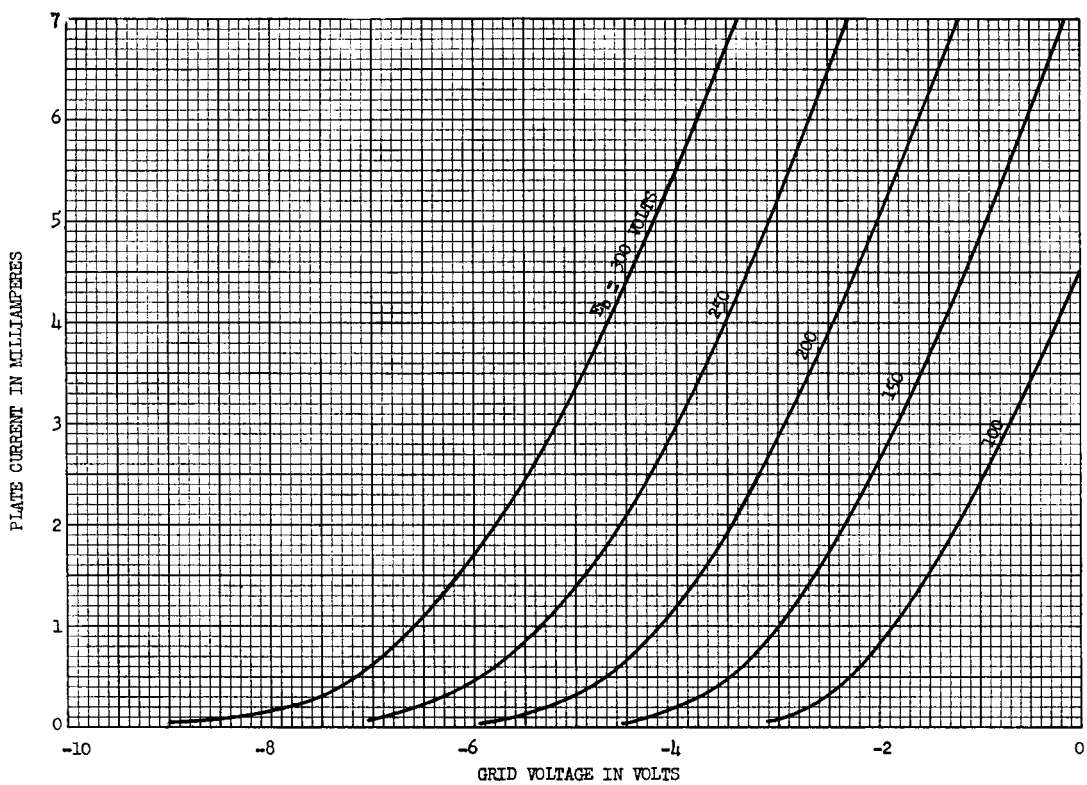
CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier—Each Section		
Plate Voltage	250	Volts
Grid Voltage	−4.0	Volts
Amplification Factor	44	
Plate Resistance, approximate	25000	Ohms
Transconductance	1750	Micromhos
Plate Current	3.0	Milliamperes
Grid Voltage, approximate, I_b = 10 Microamperes	−8	Volts
Low-Level-Amplifier Service—Each Section		
Heater Voltage**	6.3	Volts
Plate-Supply Voltage	150	Volts
Plate Load Resistor	20000	Ohms
Grid Resistor	0.1	Megohm
Cathode Resistor	2700	Ohms
Cathode Capacitor	40	Microfarads
Voltage Gain	12.5	

* Without external shield.

** Pin 9 connected to negative B supply.

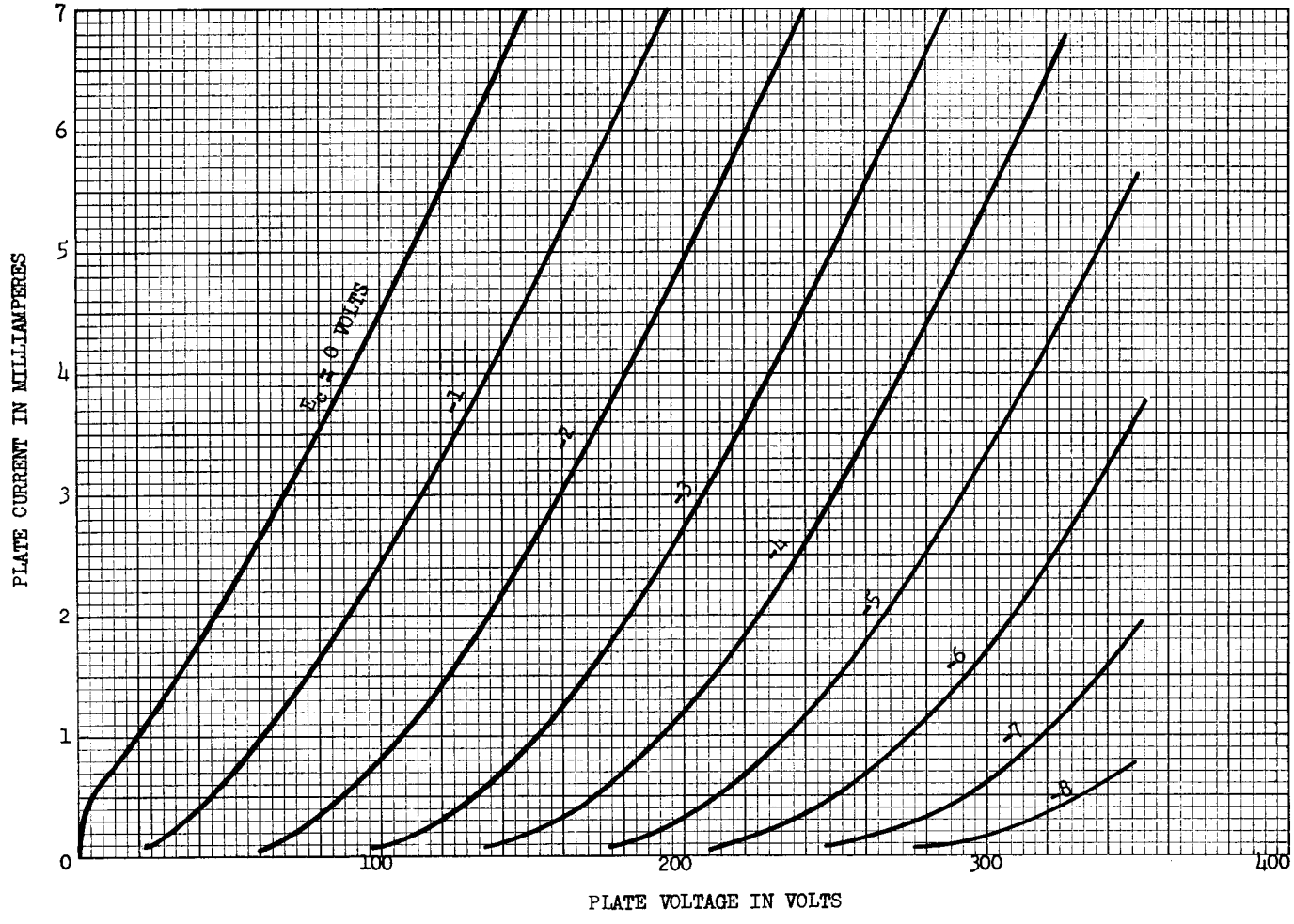
GL-6072
AVERAGE CHARACTERISTICS
EACH SECTION
E_f = 12.6 VOLTS



K-69087-72A499

11-2-51

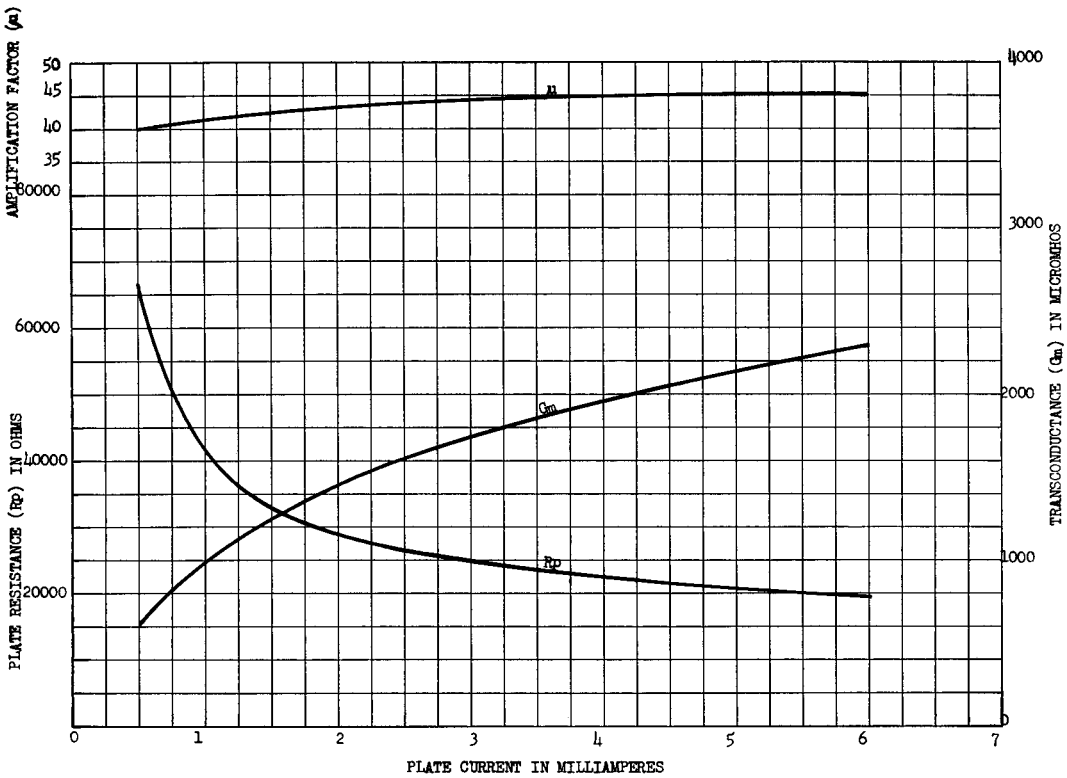
GL-6072
AVERAGE PLATE CHARACTERISTICS
EACH SECTION
$E_f = 12.6$ VOLTS



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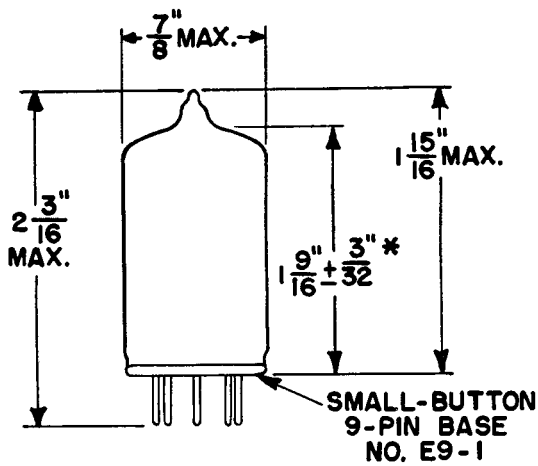
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GL-6072
AVERAGE CHARACTERISTICS
EACH SECTION
$E_f = 12.6$ VOLTS $E_b = 250$ VOLTS



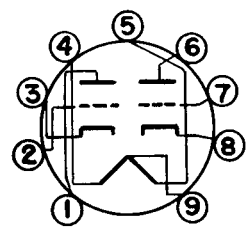
K-69087-72A498 10-26-51

OUTLINE



*MEASURED FROM BASE SEAT TO BULB-TOP LINE AS DETERMINED BY RING GAGE OF 7/16" I.D.

BASING DIAGRAM



9A

PIN 1: PLATE (SECTION NO. 2)
PIN 2: GRID (SECTION NO. 2)
PIN 3: CATHODE (SECTION NO. 2)
PIN 4: HEATER
PIN 5: HEATER
PIN 6: PLATE (SECTION NO. 1)
PIN 7: GRID (SECTION NO. 1)
PIN 8: CATHODE (SECTION NO. 1)
PIN 9: HEATER CENTER-TAP

N-15155AZ 10-26-51

Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.

DESCRIPTION AND RATING

FULL-WAVE RECTIFIER GL-6087

FIVE-STAR TUBE

★ ★ ★ ★ ★

The GL-6087 is a full-wave high-vacuum rectifier for use in power supplies of moderate current requirements. The tube incorporates a unipotential cathode which is internally connected to the filament. The heating time of the tube, consequently, is approximately the same as that of other heater-cathode tubes in the equipment. This construction minimizes excessive surge voltages across the filter input capacitors during the warm-up period.

The GL-6087 is especially designed to assure dependable life and reliable service under the exacting conditions encountered in mobile and aircraft applications. Features include a high degree of mechanical strength, a heater-cathode construction designed to withstand many-thousand cycles of intermittent operation, and the ability to perform satisfactorily at altitudes as high as 60.000 feet. Within the limitations of its maximum ratings, the GL-6087 is a replacement for the 5Y3-GT.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode - Coated Unipotential

Heater Voltage (A-c or D-c)	5.0	Volts
Heater Current	2.0	Amperes

Mechanical Data

Mounting Position - Any *
Envelope - T-9 Glass
Base - Short Intermediate-Shell Octal 5-pin, B5-62

MAXIMUM RATINGS
Electrical †, Design Center Values
Rectifier Service - Sinusoidal Supply Voltages,
Frequency Range 25 to 1000 Cycles per Second

Peak Inverse Plate Voltage		
Altitudes up to 60,000 Feet	1400	Volts
A-c Plate Supply Voltage, per Plate, RMS - See Rating Chart I ‡		
Steady-State Peak Plate Current, per Plate	375	Milliamperes
Transient Peak Plate Current, per Plate		
(maximum duration 0.2 second)	1.7	Amperes
D-c Output Current - See Rating Chart I ‡		

Mechanical

Peak Impact Acceleration §	700	G
Bulb Temperature at Hottest Point (Absolute Maximum)	+220	C

CHARACTERISTICS AND TYPICAL OPERATION Full-Wave Rectifier	Capacitor Input Filter	Choke Input Filter	
A-c Plate-Supply Voltage, per Plate, RMS	350	500	Volts
Filter Input Capacitor	10	--	Microfarads

GENERAL ELECTRIC

CHARACTERISTICS AND TYPICAL OPERATION (CONT'D)	Capacitor Input Filter	Choke Input Filter	
Filter Input Choke	--	10	Henrys
Total Plate-Supply Resistance, per Plate	130	--	Ohms
D-c Output Current	125	125	Milliamperes
D-c Output Voltage at Filter Input	315	390	Volts
Tube Voltage Drop Measured With Applied D-c at 125 Milliamperes per Plate		50	Volts

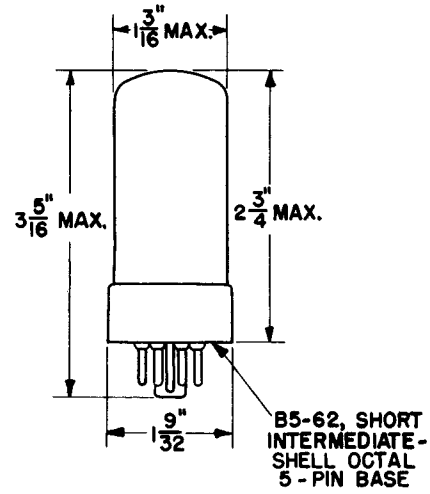
* So that the tube socket will not become a limiting factor in high-altitude operation care should be taken to select one with high voltage-breakdown capabilities.

† To simplify the application of the maximum ratings to circuit design, the electrical design center maximum ratings are also presented in chart form as Rating Charts I, II, and III. Rating Chart I presents the maximum ratings for a-c plate-supply voltage and d-c output current. Rating Chart II provides a convenient method for checking conformance with the maximum steady-state peak-plate-current rating. Rating Chart III offers a convenient method for checking conformance with the maximum transient peak-plate-current rating.

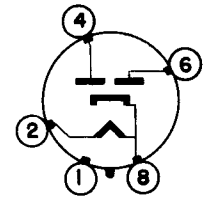
With a capacitor-input filter, the conditions of each of Rating Charts I, II, and III must be satisfied in order to obtain performance within all of the electrical maximum ratings. With a choke-input filter, operation within the indicated boundary of Rating Chart I will assure performance within all of the appropriate electrical maximum ratings.

‡ The maximum ratings for a-c plate supply voltage and d-c output current are interrelated and are also dependent on whether a choke or capacitor-input filter is employed. This relationship is shown in Rating Chart I. With a capacitor-input filter, the operating point of d-c output current and a-c supply voltage must fall within the curve FAEDG. With a choke-input filter, the operating point must fall within the curve FABCDG.

§ Forces in any direction as applied by the Navy-type High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.



BASING DIAGRAM

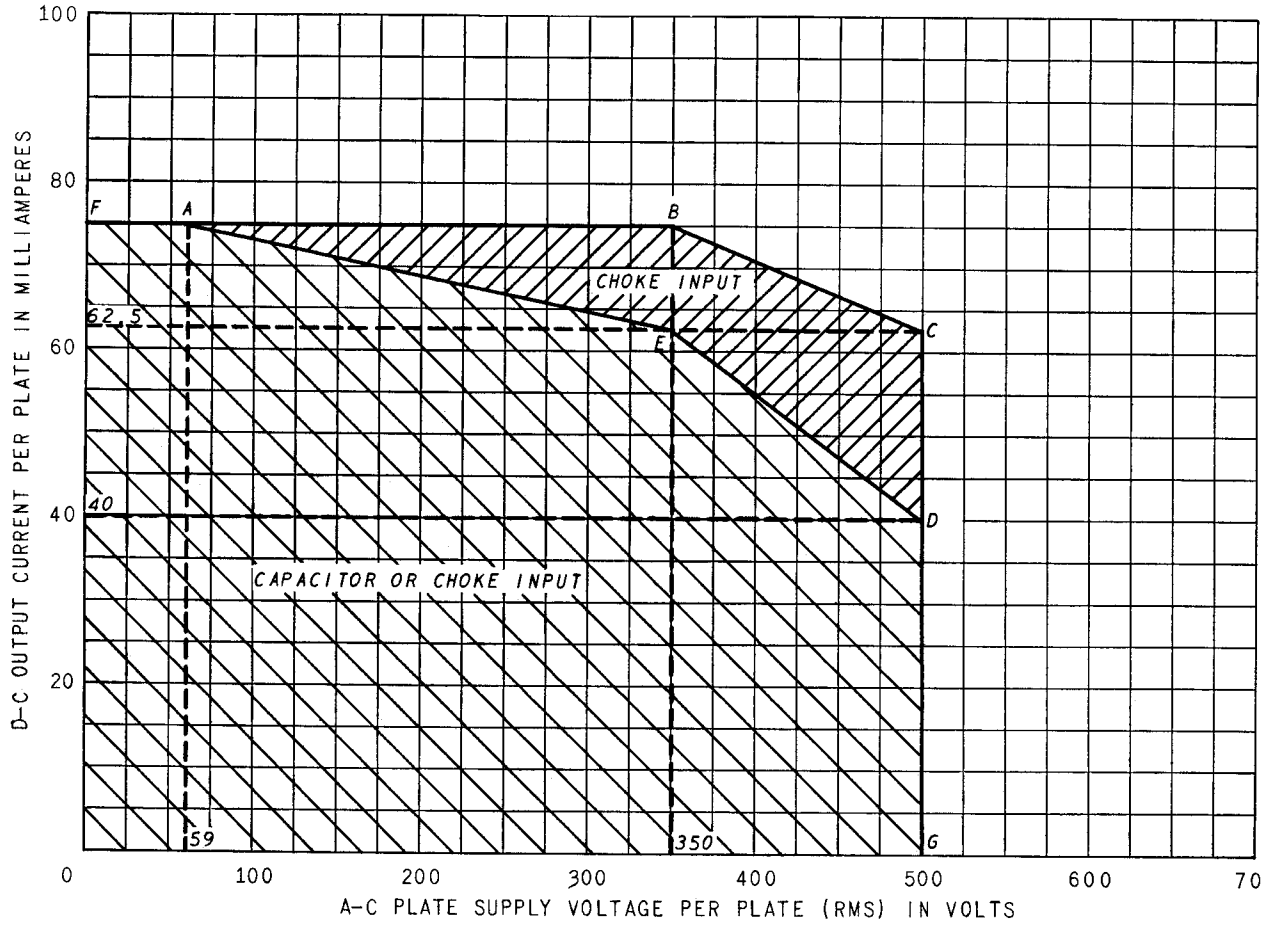


KEY
5L

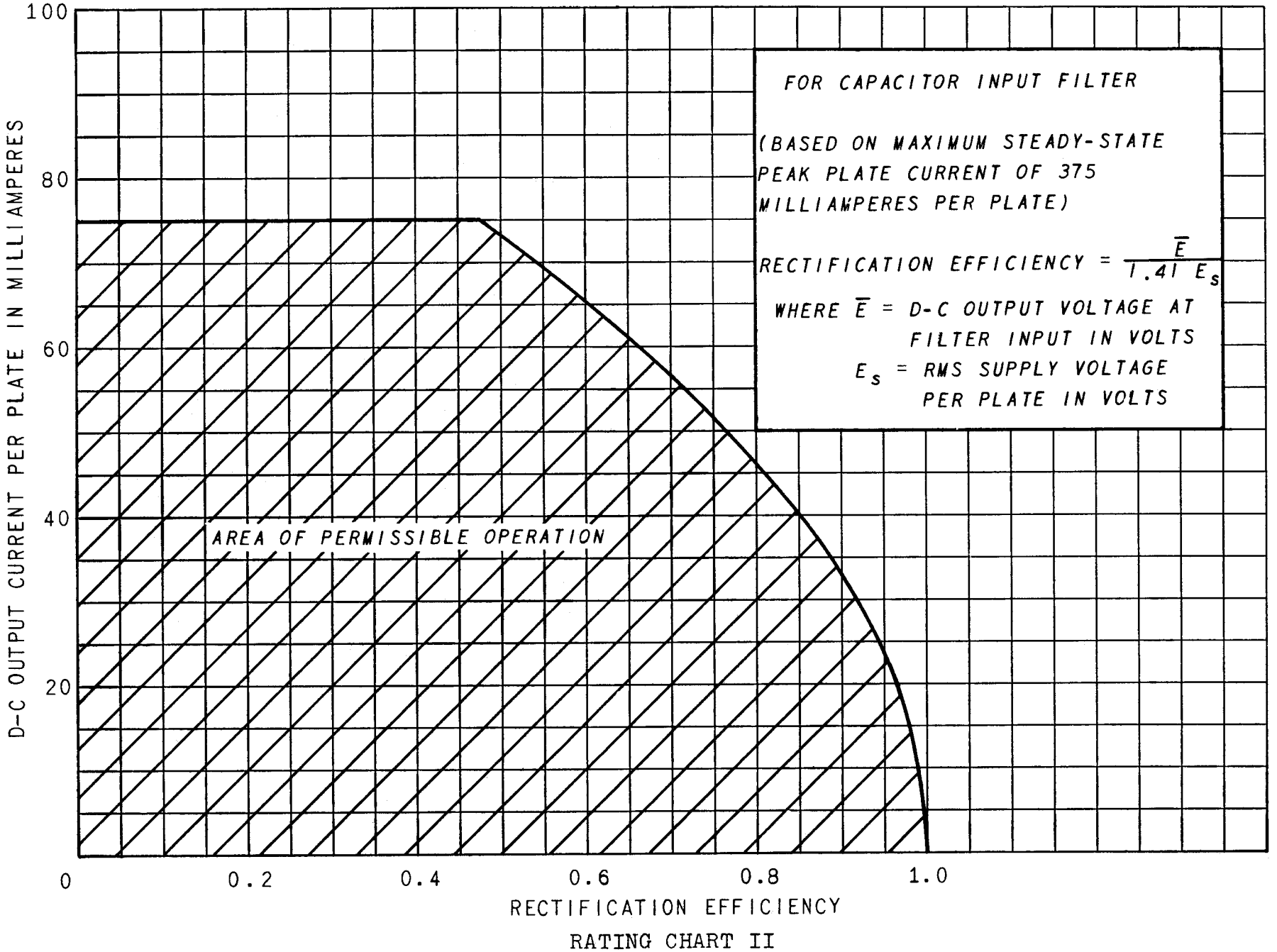
PIN 1: NO CONNECTION
PIN 2: HEATER
PIN 4: PLATE NO. 2
PIN 6: PLATE NO. 1
PIN 8: HEATER AND CATHODE

K-69087-72A547 September 17, 1952

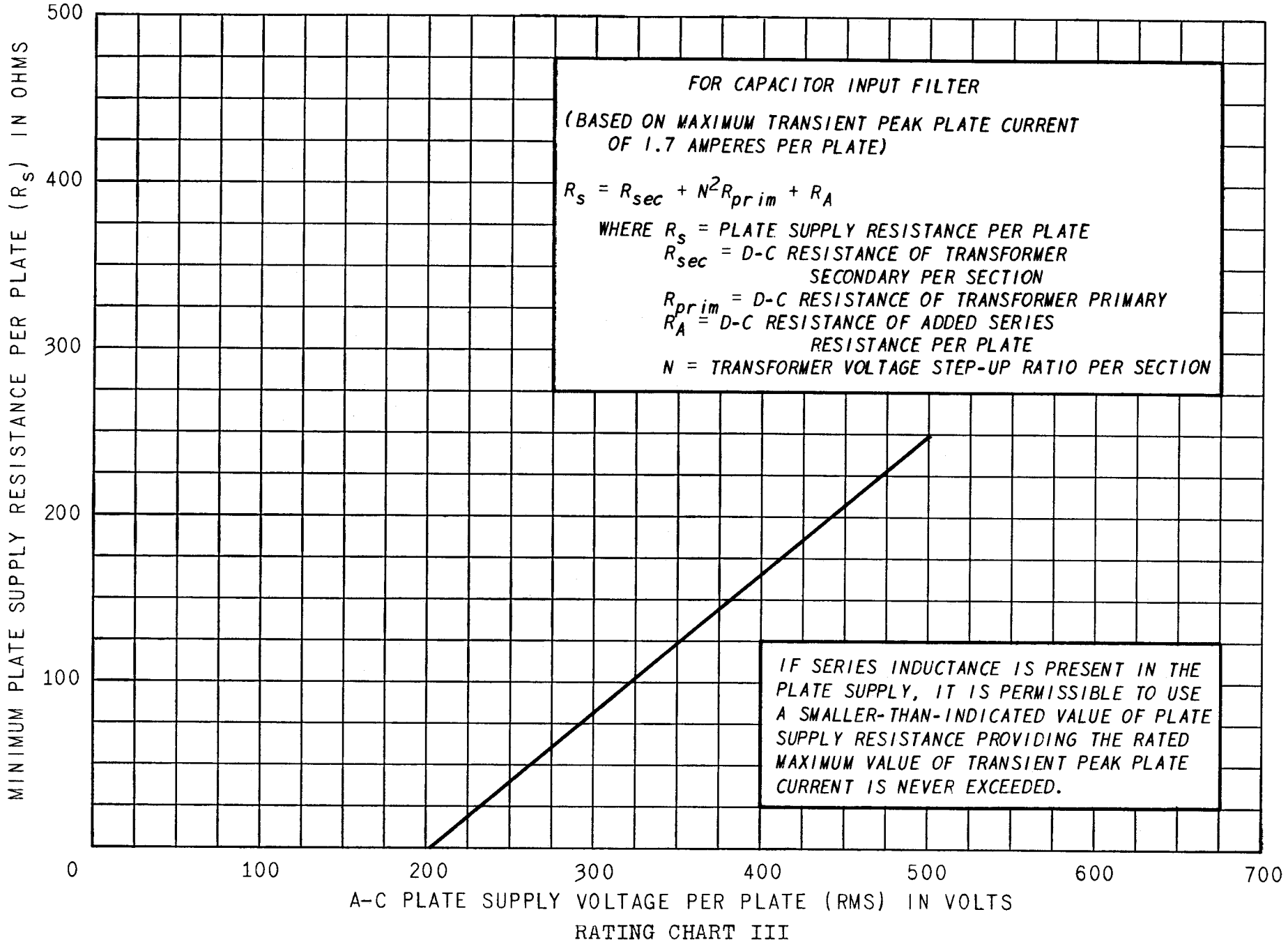
Outline
GL-6087



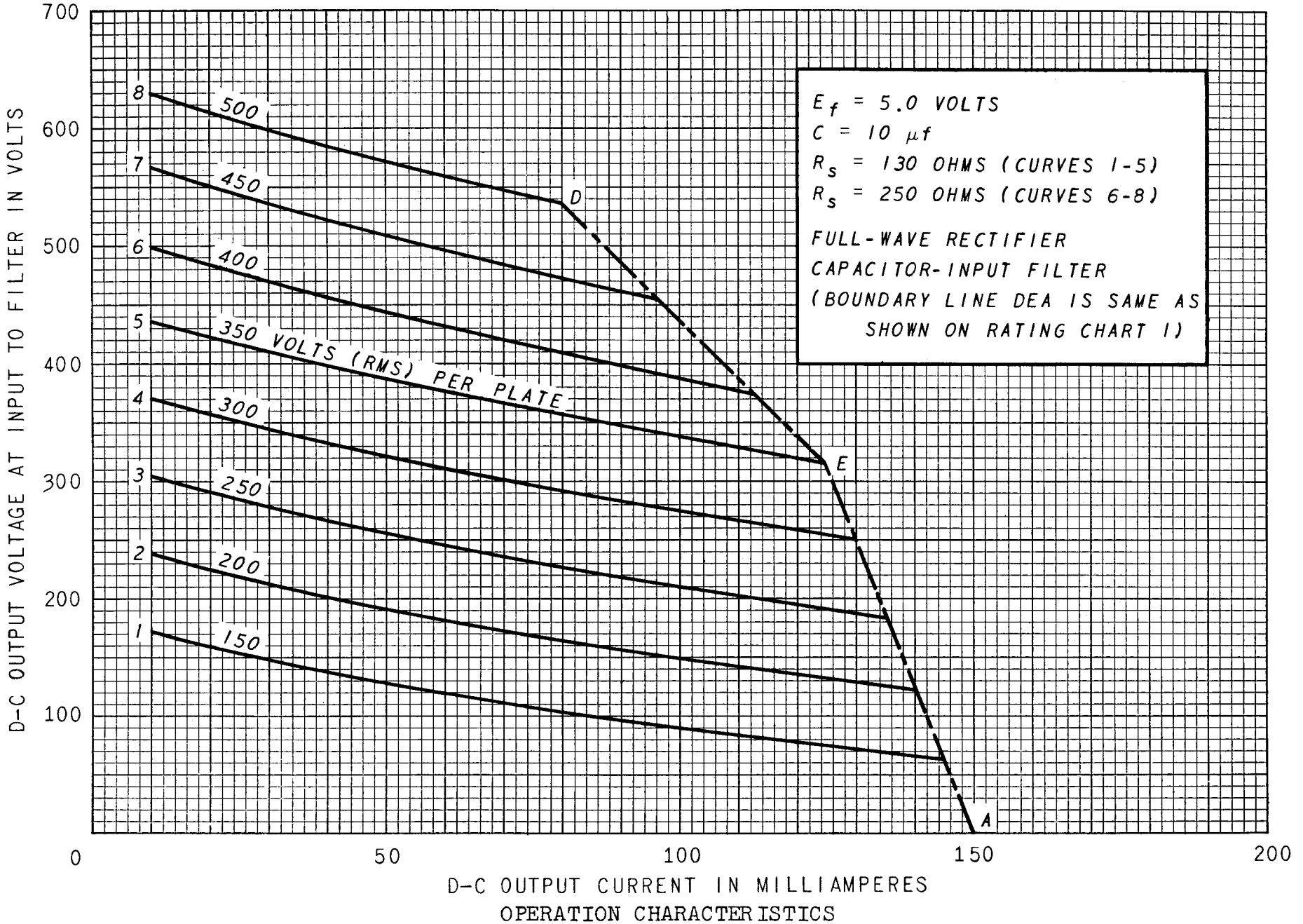
RATING CHART I



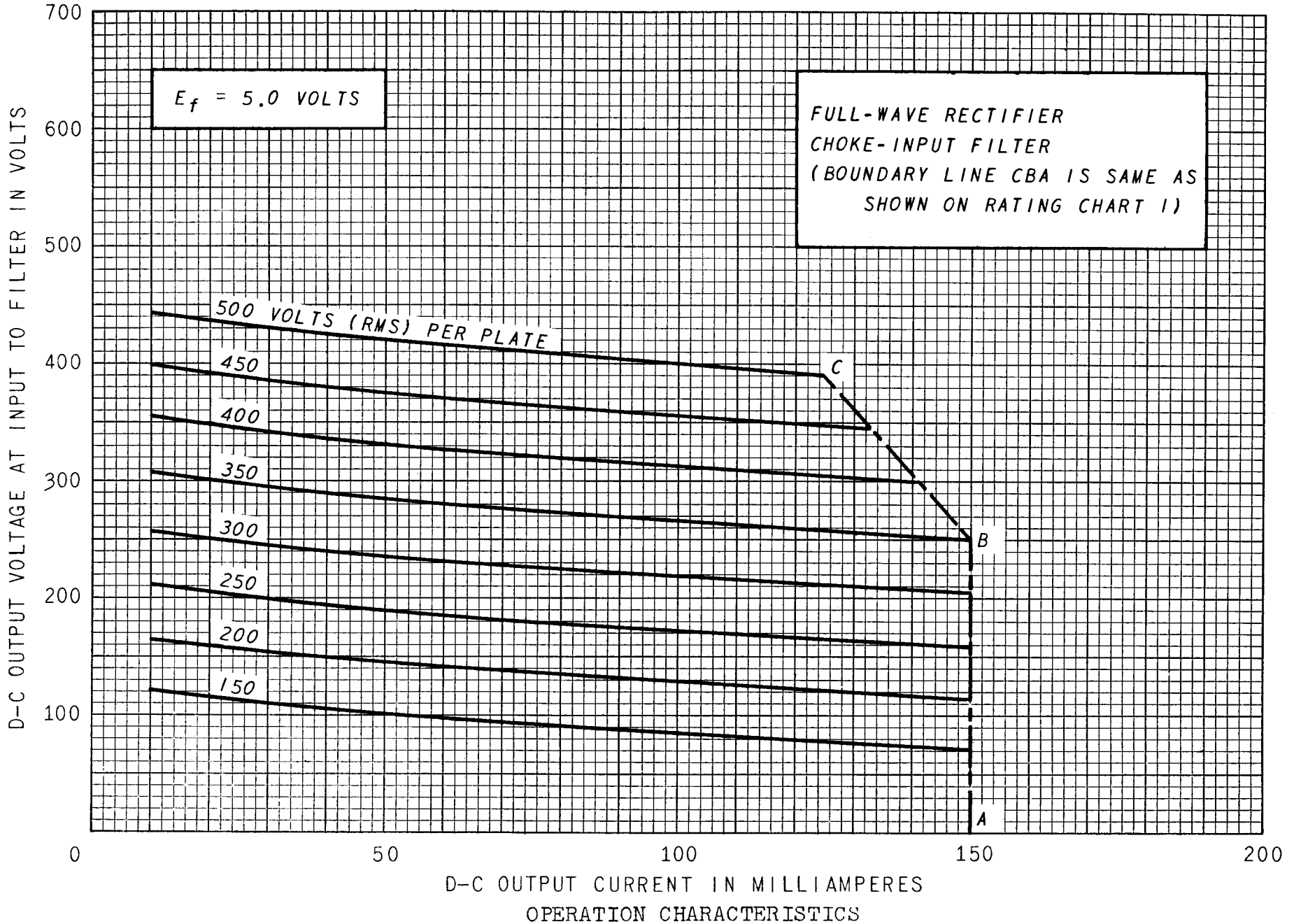
RATING CHART II



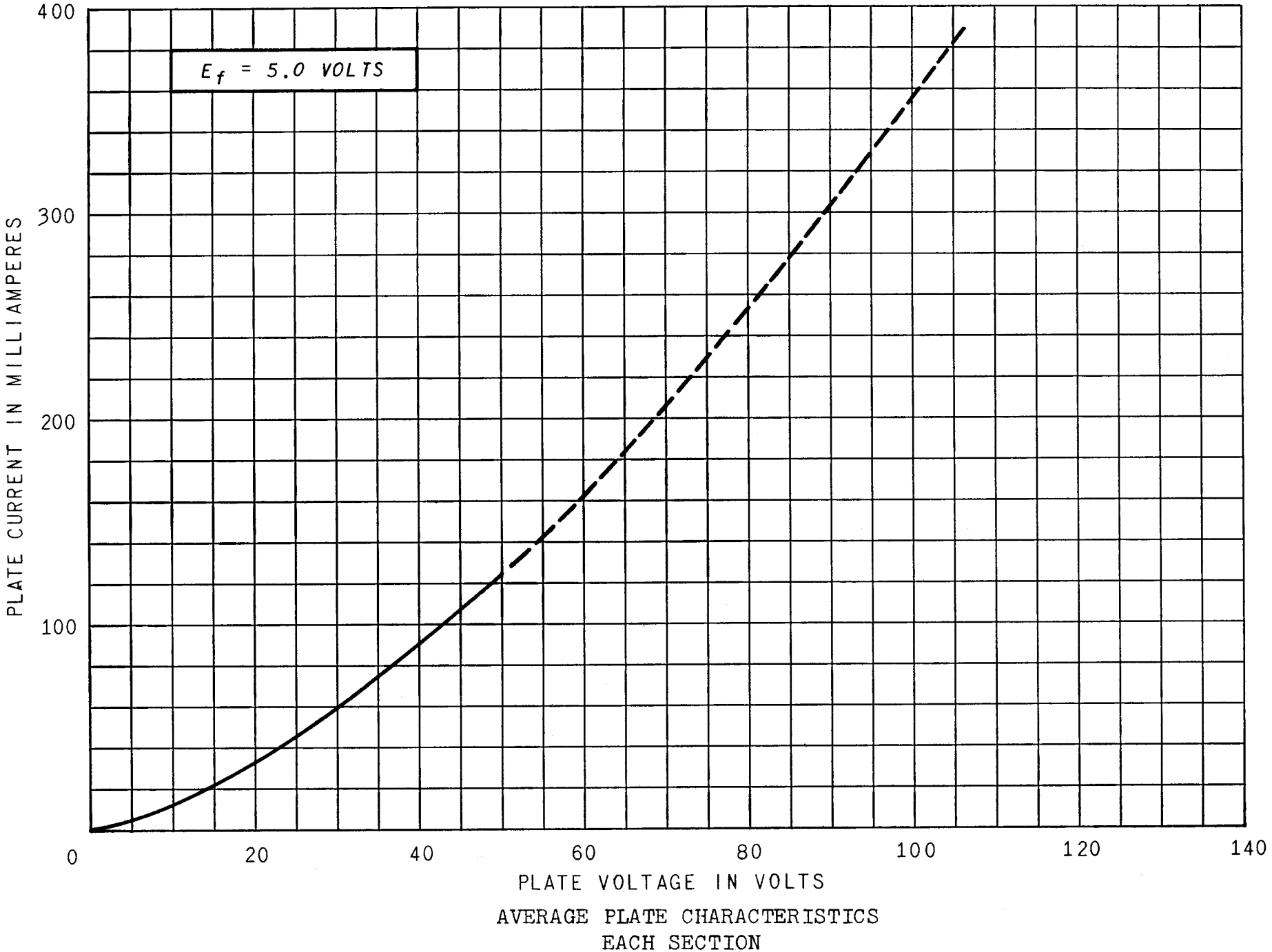
RATING CHART III



OPERATION CHARACTERISTICS



OPERATION CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS
EACH SECTION

The maximum ratings of high-vacuum rectifier tubes are based on inherent physical limitations of the tubes. Generally these ratings are expressed by the following quantities:

Maximum peak inverse plate voltage
Maximum a-c plate supply voltage (per plate)
Maximum steady-state peak plate current (per plate)
Maximum transient peak plate current (per plate)
Maximum d-c output current
Maximum heater-cathode voltage (cathode types only)

Although operation within the specified limits of these maximum ratings assures proper tube usage, the system involves some relatively difficult measurements and consequently imposes a considerable burden on the circuit designer.

To simplify the application of these maximum ratings to circuit design, a system of presenting rectifier ratings in the form of three rating charts has been developed. These rating charts, which are designated as Rating Charts I, II, and III, represent an alternate presentation of the maximum ratings and are applicable whenever the tube is used in a conventional rectifier circuit with an applied sinusoidal supply voltage.

Use of the rating charts requires only simple measurements of circuit characteristics with standard industrial meters. With a capacitor-input filter, proper tube usage requires that the operating characteristics satisfy the conditions of each of Rating Charts I, II, and III. With a choke-input filter, proper tube usage requires that the operating characteristics be within the prescribed area of permissible operation on Rating Chart I. In the case of heater-cathode types, the maximum heater-cathode-voltage rating is not covered by the rating charts, and attention must also be directed to this rating which is given as a numerical value on the Description and Rating sheet.

The ratings as presented in chart form are on the basis of the standard RTMA System of Design Center Maximums. In addition, the values of a-c supply voltage as presented refer to the unloaded supply voltages.

Rating Chart I

The maximum ratings for a-c plate supply voltage and d-c output current are interrelated and are also dependent on whether a choke- or capacitor-input filter is employed. This relationship is shown in Rating Chart I. As indicated on this chart, more lenient operation for one parameter permits the use of more severe operation for the other parameter.

To determine whether a given set of operating conditions is within the maximum ratings presented in Rating Chart I, the operating point of a-c supply voltage (RMS) per plate and d-c output current per plate for the application should be entered on the chart. If, for choke-input-filter operation, this point falls within the boundary FABCDG, operation within the ratings of a-c supply voltage and d-c output current is assured. For capacitor-input-filter operation, the operating point must fall within the boundary FAEDG.

If the operating point falls outside of the prescribed area of permissible operation, either the d-c output current or the a-c supply voltage must be reduced until operation within the area of permissible operation is obtained. The type of corrective action to be taken necessarily depends on the requirements of the application.

Rating Chart II

Rating Chart II represents a curve of maximum permissible rectification efficiency for capacitor-input-filter operation as a function of d-c output current. The purpose of this rating chart is to assure operation within the maximum steady-state peak-plate-current rating.

Rectification efficiency (η) is defined as follows:

$$\eta = \frac{\bar{E}}{\sqrt{2}\,Es} \tag{1}$$

where $\bar{E}$ = d-c output voltage at input to filter in volts
and E_s = RMS supply voltage per plate in volts.

To determine whether a given set of operating conditions is within the maximum ratings presented in Rating Chart II, the operating point of d-c output current per plate and rectification efficiency should be entered on the chart. If this point falls within the shaded area of the chart, operation within the maximum steady-state peak plate current is assured.

If the operating point falls outside of the prescribed area of permissible operation, corrective action must be taken. For a given a-c supply voltage and d-c output current, the rectification efficiency can usually be reduced either by increasing the total supply resistance per plate or by decreasing the filter input capacitor.

Rating Chart III

Rating Chart III presents a curve of minimum series plate supply resistance as a function of a-c supply voltage. The purpose of this chart is to assure operation within the maximum transient peak-plate-current rating. The transient peak plate current is often referred to as the hot-switching current.

Hot switching can occur in capacitor-input-filter circuits if the equipment is switched off and then switched on again before the temperature of the rectifier tube cathode has decreased appreciably. If during the off period the filter capacitor has discharged, a large transient current will flow at the time the supply voltage is reapplied. The largest transient current will occur when the supply voltage is at its peak amplitude at the instant it is reapplied to the circuit.

When the supply voltage is reapplied, the resulting transient current is limited only by the resistance offered by the tube and any resistance which might be in the circuit. Unless sufficient resistance is available to limit the transient current to the rated maximum value, excessive currents can flow which will destroy the rectifier tube. The minimum series plate supply resistance per plate (Rs) which is required to maintain the hot-switching current to its rated maximum value can be expressed as

$$Rs = \frac{\sqrt{2}\,Es - \hat{e}_{d(surge)}}{\hat{I}_{surge}} \tag{2}$$

where Es = RMS supply voltage per plate in volts,
$\hat{I}_{surge}$ = Maximum transient peak plate current per plate,
and $\hat{e}_{d(surge)}$ = Tube voltage drop in volts corresponding to $\hat{I}_{surge}$.

This equation forms the basis of Rating Chart III.

The minimum series-plate-supply resistance per plate is defined as consisting of the following components.

$$Rs = Rsec + N^2\,Rprim + Ra \tag{3}$$

where Rsec = d-c resistance of transformer secondary per section,
Rprim = d-c resistance of transformer primary,
Ra = d-c resistance of added series resistance per plate,
and N = Transformer voltage step-up ratio per section.

Series inductance in the plate supply is also effective in limiting the transient peak plate current. If appreciable series inductance is present in the plate supply, a smaller-than-indicated value of series-plate-supply resistance may be used providing it is determined experimentally that the combined effect of the available supply resistance and inductance is adequate to limit the transient peak plate current to its rated maximum value.

To determine whether a given set of operating conditions is within the maximum ratings presented in Rating Chart III, the total Rs is first calculated from measurements of Rpri, Rsec, Ra, and N. The operating point of Rs and a-c supply voltage is then entered on Rating Chart III. If the total plate-supply resistance is equal to or greater than the minimum value of Rs, as indicated by the curve, operation within the maximum transient peak-plate-current rating is assured. If the conditions of Rating Chart III are not satisfied, additional resistance should be added in series with each diode plate so that the indicated minimum value of Rs is obtained.

It should be noted that the plate-supply resistance serves to limit both the steady-state peak current and the transient peak current. The minimum value of resistance required for these two functions will not necessarily be the same. The larger value of resistance must be used.

Typical Example

To illustrate the use of the rating charts, consider the following example.

Problem:

A full-wave rectifier circuit employing a GL-6087 is operated with an 800-volt center-tapped transformer from a 117-volt supply. The input filter capacitor is 8 microfarads. Determine if the operation of the rectifier tube is within its maximum ratings.

Procedure:

The following measurements are made with the circuit operating:

Total D-c Output Current = 110 milliamperes
D-c Output Voltage at Filter Input, $\bar{E}$ = 410 volts

The following measurements are made with the tube removed from its socket:

RMS Transformer Primary Voltage, E_{pri} = 117 volts RMS
RMS Transformer Secondary Voltage per Plate, E_s = 400 volts RMS

The following measurements are made with the supply voltage removed:

D-c Resistance of the Transformer Primary, R_{pri} = 2.4 ohms
D-c Resistance of the Transformer Secondary per Section, R_{sec} = 88 ohms

Reference is next made to the published rating charts for the GL-6087.

Rating Chart I

A-c Plate Supply Voltage per Plate (RMS) = 400 volts.
D-c Output Current per Plate = $\frac{110}{2}$ = 55 milliamperes.

The point having as coordinates 400 volts and 55 milliamperes is entered on Rating Chart I. As this point is within the area indicated for capacitor-input filter, the conditions of Rating Chart I are satisfied.

Rating Chart II

Rectification Efficiency, η, is calculated from Equation (1).

$$\eta = \frac{\bar{E}}{\sqrt{2}\, E_s} \qquad (1)$$

$\bar{E}$ = 410 volts
E_s = 400 volts

$$\eta = \frac{410}{1.414\ (400)} = 0.725$$

D-c Output Current per Plate = 55 milliamperes

The point having as coordinates 0.725 and 55 milliamperes is entered on Rating Chart II. As this point is not within the area of permissible operation, the conditions of Rating Chart II are not satisfied. Before corrective action is taken, however, conformance with Rating Chart III will be examined.

Rating Chart III

The supply resistance per plate, R_s, is calculated from Equation (3).

$$R_s = R_{sec} + N^2 R_{prim} + R_a \qquad (3)$$

$$N = \frac{400 \text{ volts RMS}}{117 \text{ volts RMS}} = 3.42$$

$N^2 = 11.7$

$R_{sec} = 88$ ohms

$R_{prim} = 2.4$ ohms

$R_a = 0$ ohms

$$R_s = 88 + 11.7\ (2.4) + 0$$

$R_s = 116$ ohms

A-c Plate Supply Voltage per Plate (RMS) = 400 volts

The point having as coordinates 116 ohms and 400 volts is entered on Rating Chart III. As 116 ohms is less than the required minimum value of 165 ohms, the conditions of Rating Chart III are not satisfied. Corrective action is therefore required both for the conditions of Rating Charts II and III.

Corrective Action

The corrective action may take any of several forms. Assume, for the present example, that it is decided to add a resistor in series with each plate.

From Rating Chart III, the minimum value of R_s required for a 400 volt supply is 165 ohms. Therefore, a 56-ohm resistor should be added in series with each plate so that R_s will be increased from 116 ohms to a value greater than the required 165 ohms.

With a 56-ohm resistor added to each plate, the d-c output voltage and current are again measured and found to be 395 volts and 110 milliamperes. The three Rating Charts are again checked for conformity, but now using $\eta = 0.698$ and Rs = 172 ohms. The conditions of all three rating charts are now satisfied, and proper tube usage is assured.

The chief advantage of the rating chart method for checking tube operation is that only simple measurements need be made. These include the d-c measurement of output current, output voltage, several resistances, and the a-c measurements of supply voltage and transformer voltage step-up ratio.

The information contained in the rating charts can also be used to advantage in the initial design of the rectifier circuit. When used in conjunction with the published regulation curves, conformity of performance to the maximum ratings can be predicted to a good degree of accuracy.

TUBE DEPARTMENT

GENERAL ELECTRIC

SCHENECTADY, NEW YORK

9-52 (5M)

Electronic TUBES

6111
TWIN TRIODE
Five-Star Tube
★ ★ ★ ★ ★

FOR GENERAL-PURPOSE AMPLIFIER APPLICATIONS

8-LEAD SUBMINIATURE
MEDIUM MU

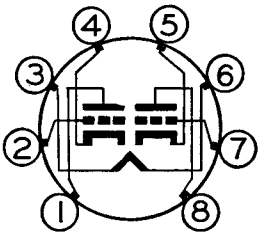
SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING

DESCRIPTION AND RATING

The 6111 is a subminiature medium-mu twin triode for use in general-purpose amplifier applications. Each section has an individual cathode and is electrically independent. The tube may also be used as a combined oscillator and mixer in high-frequency circuits.

The 6111 is a special-quality tube intended for use in critical industrial and military applications in which operational dependability is of primary importance. Features of the tube include a high degree of mechanical strength and a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

BASING DIAGRAM



RETMA 8DG

TERMINAL CONNECTIONS

Lead 1—Plate (Section 2)
Lead 2—Grid (Section 2)
Lead 3—Heater
Lead 4—Cathode (Section 2)
Lead 5—Cathode (Section 1)
Lead 6—Heater
Lead 7—Grid (Section 1)
Lead 8—Plate (Section 1)

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3±5%	Volts
Heater Current	0.3	Amperes

Direct Interelectrode Capacitances

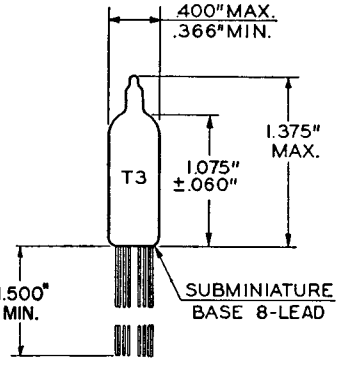
	With Shield*	Without Shield	
Grid to Plate, Each Section	1.4	1.5	μμf
Input, Each Section	2.1	1.9	μμf
Output, Section 1	1.3	0.28	μμf
Output, Section 2	1.4	0.32	μμf
Grid to Grid, maximum	0.010	0.011	μμf
Plate to Plate, maximum	0.3	0.5	μμf

*With external shield of 0.405-inch inside diameter connected to cathode of section under test.

MECHANICAL

Mounting Position—Any
Envelope—T-3, Glass
Base—E8-10, Subminiature Button 8-Lead

PHYSICAL DIMENSIONS



RETMA 3-1

GENERAL ELECTRIC

Supersedes ET-T1104 dated 8-54

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES, EACH SECTION

Plate Voltage	165	Volts
Negative DC Grid Voltage	55	Volts
Plate Dissipation	0.95	Watts
DC Plate Current	22	Milliamperes
DC Grid Current	5.5	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	200	Volts
Heater Negative with Respect to Cathode	200	Volts
Grid Circuit Resistance	1.1	Megohms
Bulb Temperature at Hottest Point	220	C

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	100	Volts
Cathode-Bias Resistor	220	Ohms
Amplification Factor	20	
Plate Resistance, approximate	4000	Ohms
Transconductance	5000	Micromhos
Plate Current	8.5	Milliamperes
Grid Voltage, approximate		
Ib = 10 Microamperes	−9.0	Volts

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

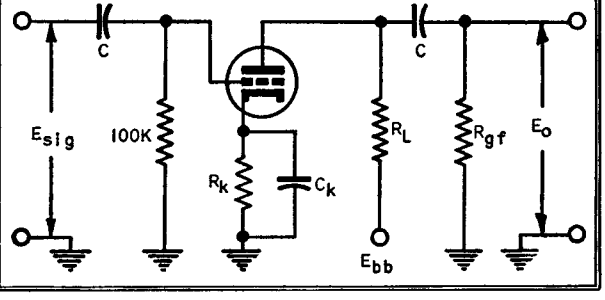
R_L	R_{gf}	Ebb = 90 Volts			Ebb = 150 Volts			Ebb = 225 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2400	8.4	13	2100	16	14	1900	25	15
0.10	0.24	3100	12	14	2800	22	15	2600	34	16
0.24	0.24	6200	10	14	5600	19	15	5200	30	16
0.24	0.51	7800	13	14	7200	25	15	7000	38	15
0.51	0.51	14000	11	13	13000	21	14	12000	32	15
0.51	1.0	19000	14	13	17000	26	14	16000	40	15

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	Ebb = 90 Volts			Ebb = 150 Volts			Ebb = 225 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	3200	11	13	2500	21	14	2100	32	15
0.10	0.24	4200	15	14	3400	28	15	3000	43	15
0.24	0.24	8400	13	13	6800	24	14	6000	36	15
0.24	0.51	10000	16	13	8700	29	15	7800	45	15
0.51	0.51	17000	13	13	15000	25	14	13000	38	15
0.51	1.0	21000	17	13	19000	30	14	17000	47	15

Notes:

1. E_o is maximum RMS voltage output for approximately five percent total harmonic distortion.
2. Gain is measured for an output voltage of two volts RMS.
3. R_k is in ohms; R_L and R_{gf} are in megohms.
4. Coupling capacitors (C) should be selected to give desired frequency response. R_k should be adequately by-passed.



CHARACTERISTICS LIMITS

		Minimum	Maximum	
Heater Current				
Ef = 6.3 volts	Initial	280	320	Milliamperes
	500-Hr	276	328	Milliamperes
Plate Current, Each Section				
Ef = 6.3 volts, Eb = 100 volts, Rk = 220 ohms (by-passed)	Initial	6.0	11	Milliamperes
Plate Current Difference between Sections				
Difference between plate currents for each section at Ef = 6.3 volts, Eb = 100 volts, Rk = 220 ohms (by-passed)	Initial	....	2.0	Milliamperes
Transconductance (1), Each Section				
Ef = 6.3 volts, Eb = 100 volts, Rk = 220 ohms (by-passed)	Initial	4100	5900	Micromhos
Transconductance Change with Heater Voltage, Each Section				
Difference between Transconductance (1) and Transconductance at Ef = 5.7 volts (other conditions the same) expressed as a percentage of Transconductance (1)	Initial	....	15	Percent
	500-Hr	....	15	Percent
Transconductance Change with Operation, Each Section				
Difference between Transconductance (1) initially and after operation expressed as a percentage of initial value	500-Hr	....	20	Percent
Average Transconductance Change with Operation, Each Section				
Average of values for "Transconductance Change with Operation"	500-Hr	....	15	Percent
Amplification Factor, Each Section				
Ef = 6.3 volts, Eb = 100 volts, Rk = 220 ohms (by-passed)	Initial	17	23	
Plate Current Cutoff, Each Section				
Ef = 6.3 volts, Eb = 100 volts, Ec = −9.0 volts	Initial	....	100	Microamperes
Interelectrode Capacitances				
Grid to Plate (g to p), Each Section	Initial	1.2	1.8	$\mu\mu$f
Input (g to k + h), Each Section	Initial	1.4	2.4	$\mu\mu$f
Output (p to k + h), Section 1	Initial	0.20	0.36	$\mu\mu$f
Output (p to k + h), Section 2	Initial	0.22	0.42	$\mu\mu$f
Grid to Grid (g to g)	Initial	....	0.011	$\mu\mu$f
Plate to Plate (p to p)	Initial	....	0.50	$\mu\mu$f
Measured without external shield				
Negative Grid Current, Each Section				
Ef = 6.3 volts, Eb = 100 volts, Rk = 220 ohms (by-passed), Rg = 1.0 meg	Initial	....	0.3	Microamperes
	500-Hr	....	0.9	Microamperes
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	Initial	....	5.0	Microamperes
	500-Hr	....	10	Microamperes
Heater Negative with Respect to Cathode	Initial	....	5.0	Microamperes
	500-Hr	....	10	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid (Each Section) to All at 100 Volts DC	Initial	100	....	Megohms
	500-Hr	50	....	Megohms
Plate (Each Section) to All at 300 Volts DC	Initial	100	....	Megohms
	500-Hr	50	....	Megohms
Vibrational Noise Output Voltage, RMS				
Ef = 6.3 volts, Ebb = 100 volts, Rk = 220 ohms (by-passed), R_L = 10,000 ohms, Vibrational acceleration = 15 G at 40 cps	Initial	....	50	Millivolts
Grid Emission Current, Each Section				
Ef = 7.5 volts, Eb = 100 volts, Ecc = −9.0 volts, Rg = 1.0 meg	Initial	....	0.5	Microamperes
Pulse Cathode Current				
Ef = 6.0 volts, Pulse of 25 microseconds duration, 200-cycle repetition rate, and 50 volt amplitude is applied to plate and grid tied together. Pulse cathode current is measured for each section with opposite section floating	Initial	300	....	Milliamperes

SPECIAL TESTS AND RATINGS

Stability Life Test
Statistical sample operated for one hour to evaluate and control initial variations in transconductance.

Survival Rate Life Test
Statistical sample operated for one hundred hours to evaluate and control early-life electrical and mechanical inoperatives.

Heater-Cycling Life Test
Statistical sample operated for 2000 cycles to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.0 volts cycled for one minute on and four minutes off, Eb = Ec = 0 volts, and Ehk = 140 volts RMS.

Shock Rating—450 G
Statistical sample subjected to five impact accelerations of 450 G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

Fatigue Rating—2.5 G
Statistical sample subjected to vibrational acceleration of 2.5 G for 32 hours in each of three different positions. The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

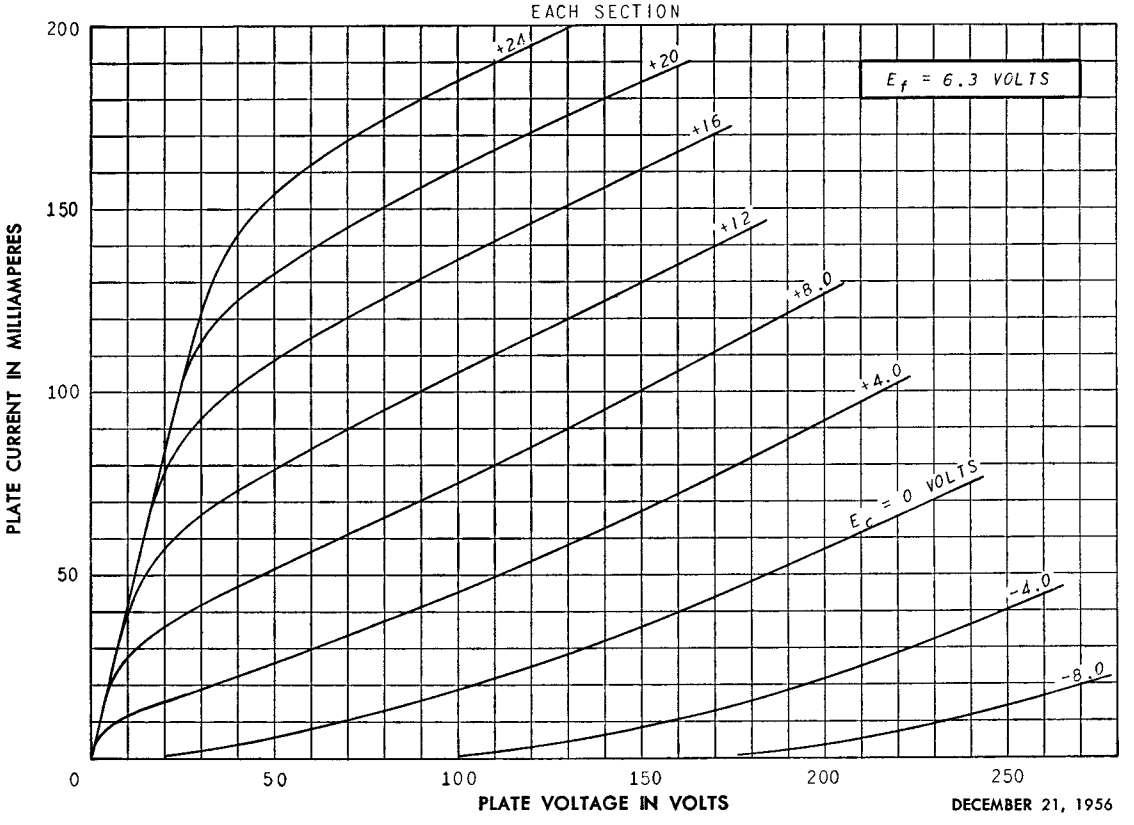
Altitude Rating—60,000 Feet
Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

In the design of military equipment employing this tube, reference should be made to the appropriate MIL-E-1 specification.

AVERAGE PLATE CHARACTERISTICS

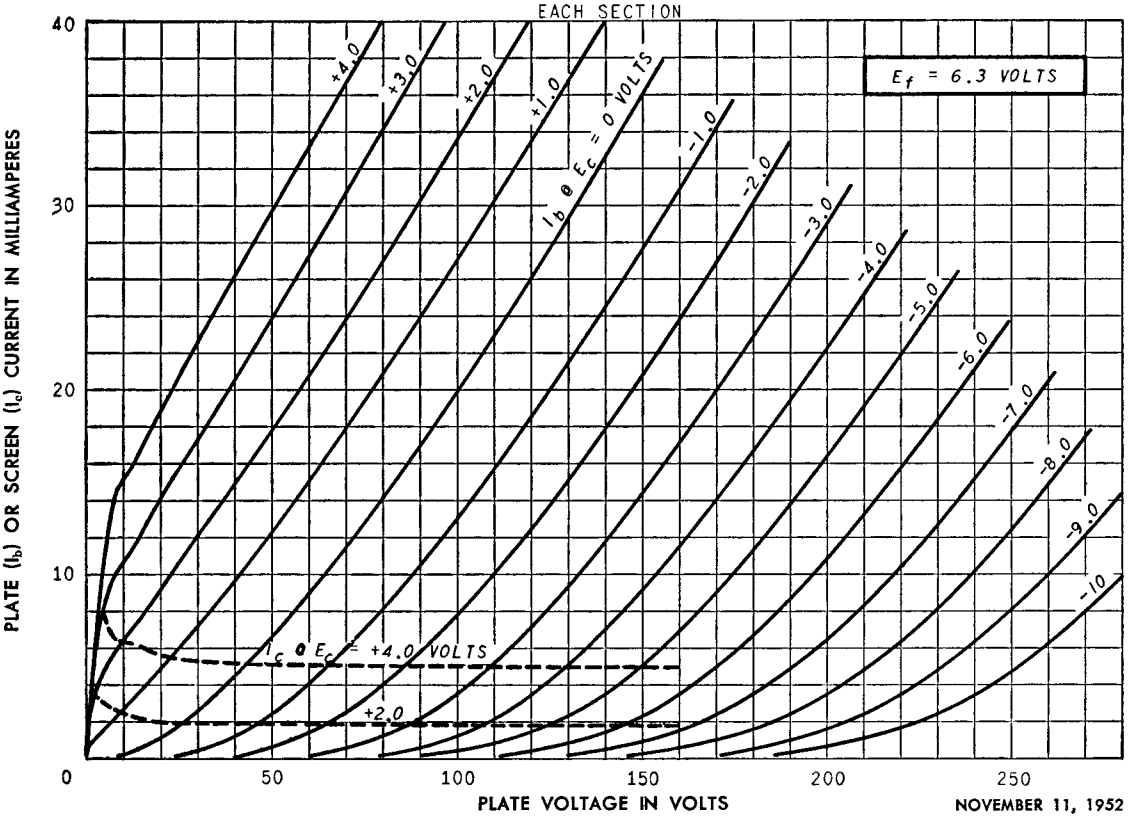
EACH SECTION



DECEMBER 21, 1956

AVERAGE PLATE CHARACTERISTICS

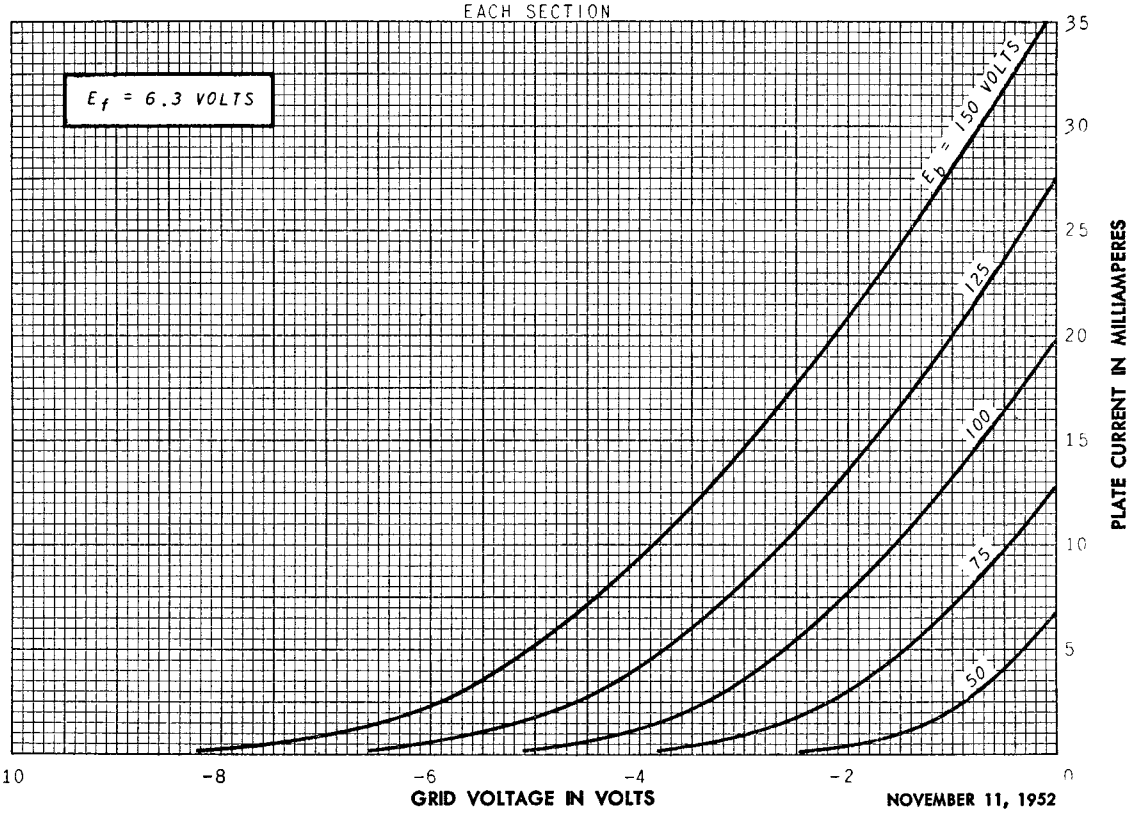
EACH SECTION



NOVEMBER 11, 1952

AVERAGE CHARACTERISTICS

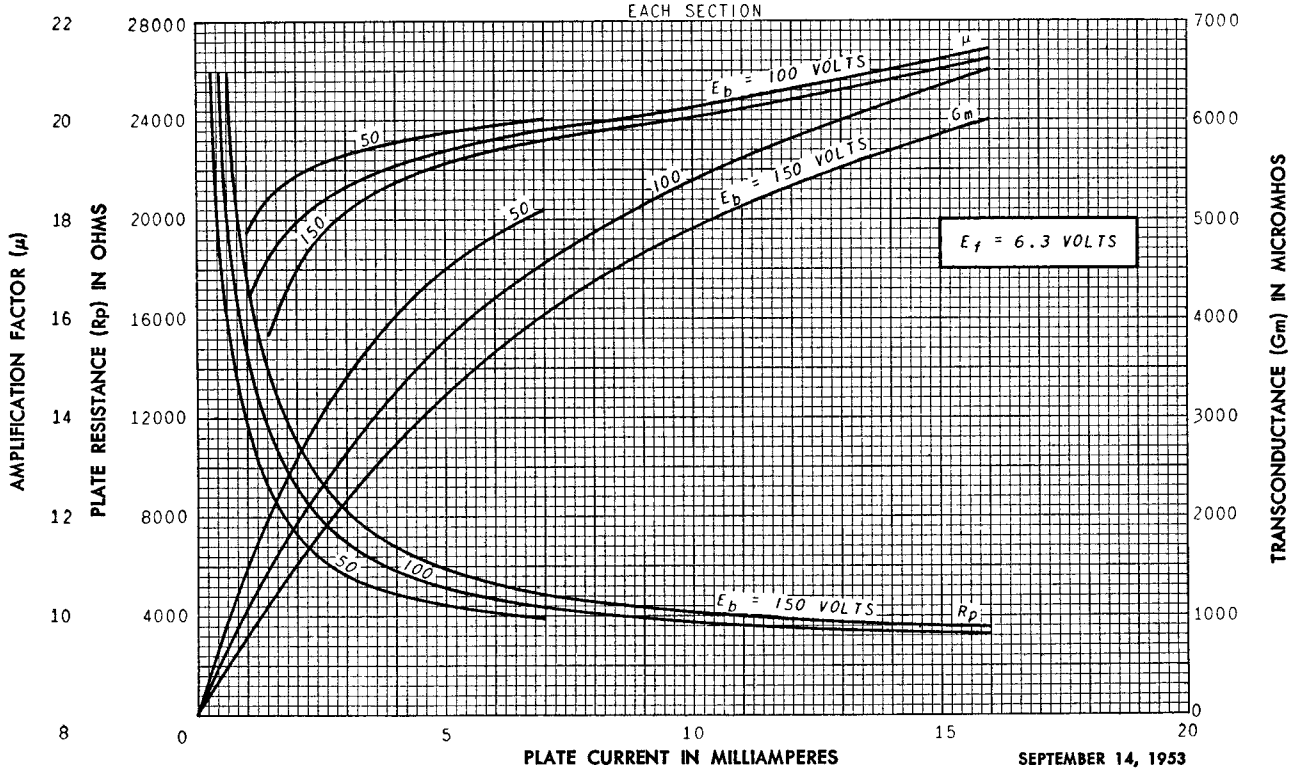
EACH SECTION



NOVEMBER 11, 1952

AVERAGE CHARACTERISTICS

EACH SECTION



SEPTEMBER 14, 1953

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

DESCRIPTION AND RATING

PENTODE GL-6134

FIVE-STAR TUBE

★★★★★

The GL-6134 is a sharp-cutoff pentode intended for service as a wide-band radio-frequency or intermediate-frequency amplifier or as a video-amplifier. The tube is specially designed to assure dependable life and reliable service under the exacting conditions encountered in mobile and aircraft applications. Features include a high degree of mechanical strength and a heater-cathode construction designed to withstand many-thousand cycles of intermittent operation. Electrically and physically, the GL-6134 is a replacement for the 6AC7.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Voltage (A-c or D-c)	6.3	Volts
Heater Current	0.45	Ampere
Direct Interelectrode Capacitances*		
Grid-No. 1 to Plate, maximum	0.015	uuf
Input	11	uuf
Output	5.0	uuf

Mechanical

Mounting Position - Any
Envelope - MT-8, Metal Shell
Base - B8-21, Small Wafer Octal 8-Pin

MAXIMUM RATINGS

Electrical - Design-center Values

Plate Voltage	300	Volts
Screen Supply Voltage	300	Volts
Screen Voltage - See Screen Rating Chart		
Plate Dissipation	3.0	Watts
Screen Dissipation	0.38	Watt
Heater-cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Grid-No. 1 Circuit Resistance with Cathode Bias†		
Fixed Screen Voltage	0.25	Megohm
Series Screen Resistor	0.5	Megohm

Mechanical

Peak Impact Acceleration‡	450	G

CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier

Plate Voltage	300	Volts
Suppressor Voltage§	0	Volt
Screen Voltage	150	Volts
Cathode-bias Resistor	160	Ohms
Plate Resistance, approximate	1.0	Megohm
Transconductance	9000	Micromhos

GENERAL ELECTRIC

CHARACTERISTICS AND TYPICAL OPERATION (CONT'D)

Class A_1 Amplifier (Cont'd)

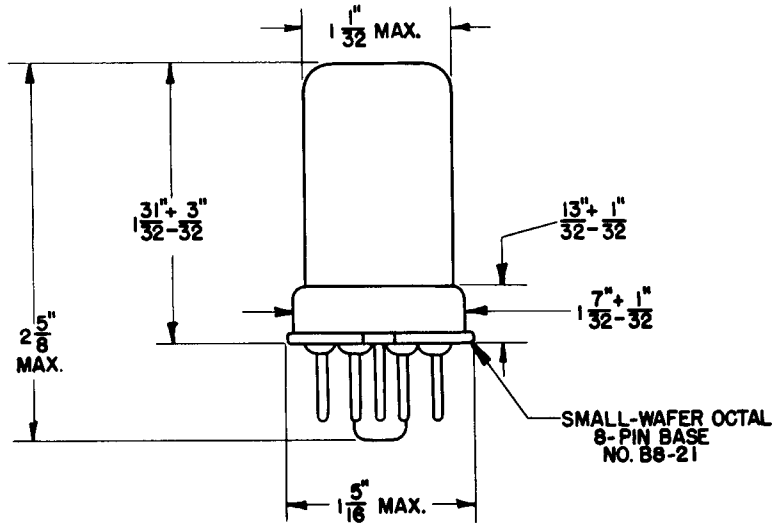
Plate Current	10	Milliamperes
Screen Current	2.5	Milliamperes
Grid-No. 1 Voltage, approximate		
Ib = 10 Microamperes	-10	Volts

* With pin 1 connected to pin 5.

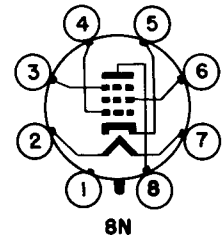
† Operation with fixed bias is not recommended.

‡ Forces in any direction as applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

§ In radio-frequency and intermediate-frequency stages, the suppressor should be connected directly to ground to minimize feedback.



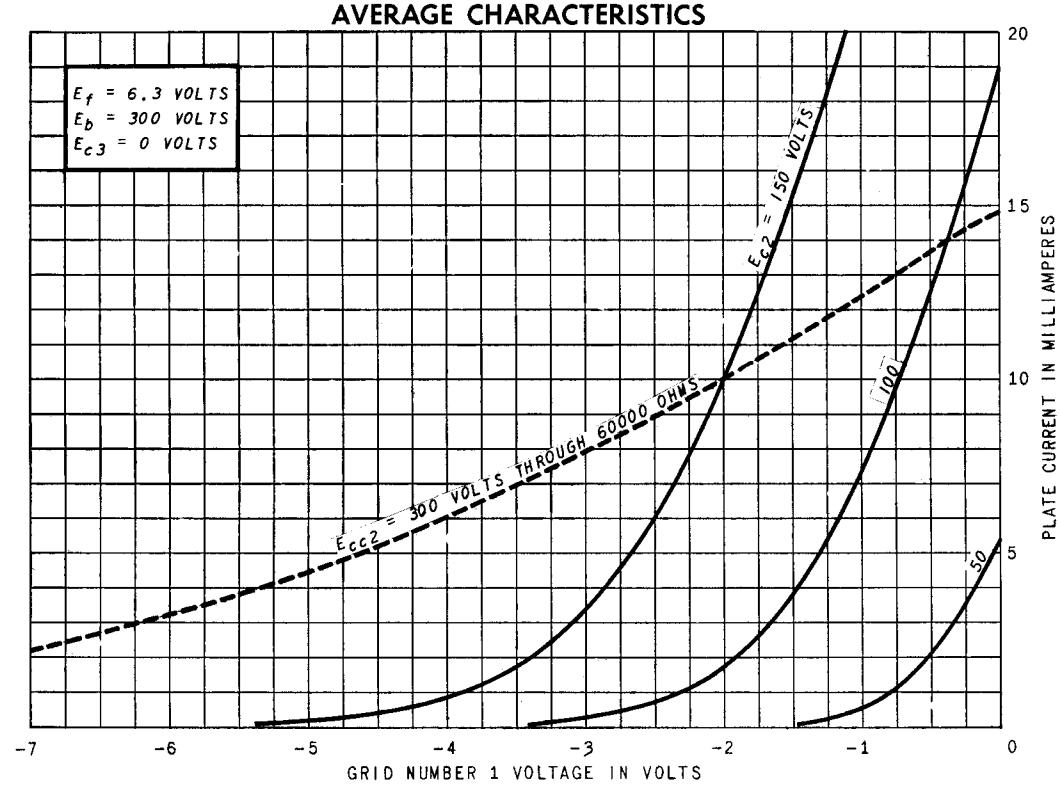
BASING DIAGRAM



8N

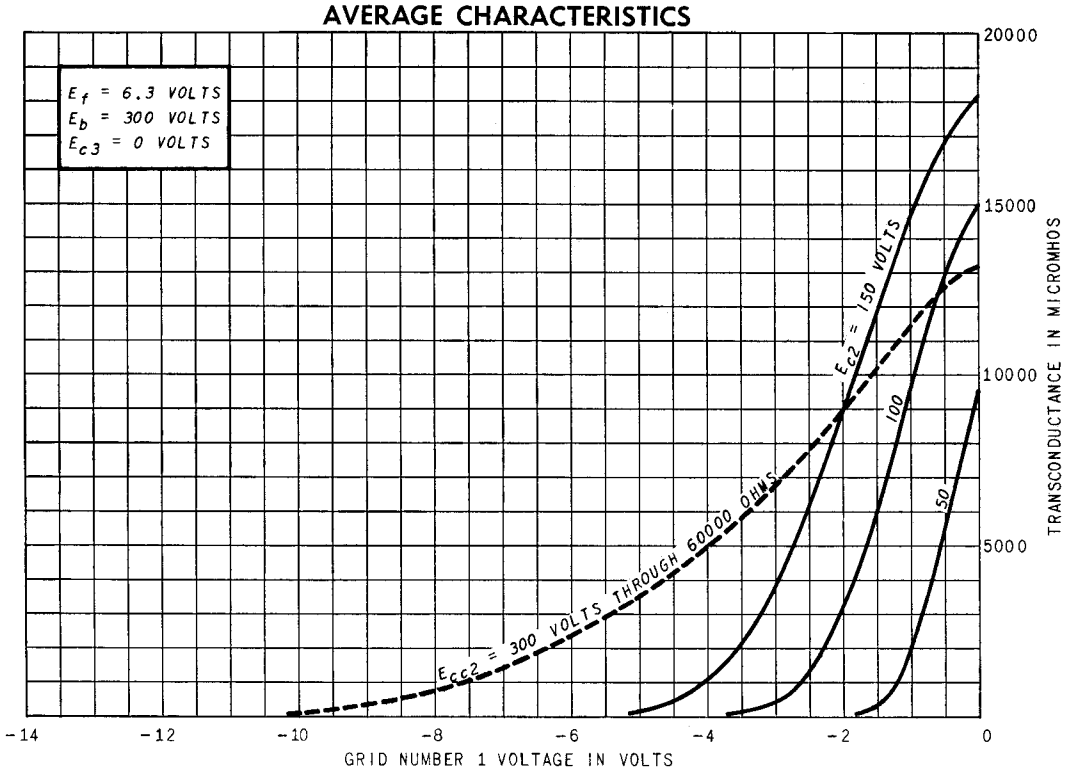
PIN 1: SHELL AND INTERNAL SHIELD
PIN 2: HEATER
PIN 3: GRID NUMBER 3 (SUPPRESSOR)
PIN 4: GRID NUMBER 1
PIN 5: CATHODE
PIN 6: GRID NUMBER 2 (SCREEN)
PIN 7: HEATER
PIN 8: PLATE

AVERAGE CHARACTERISTICS



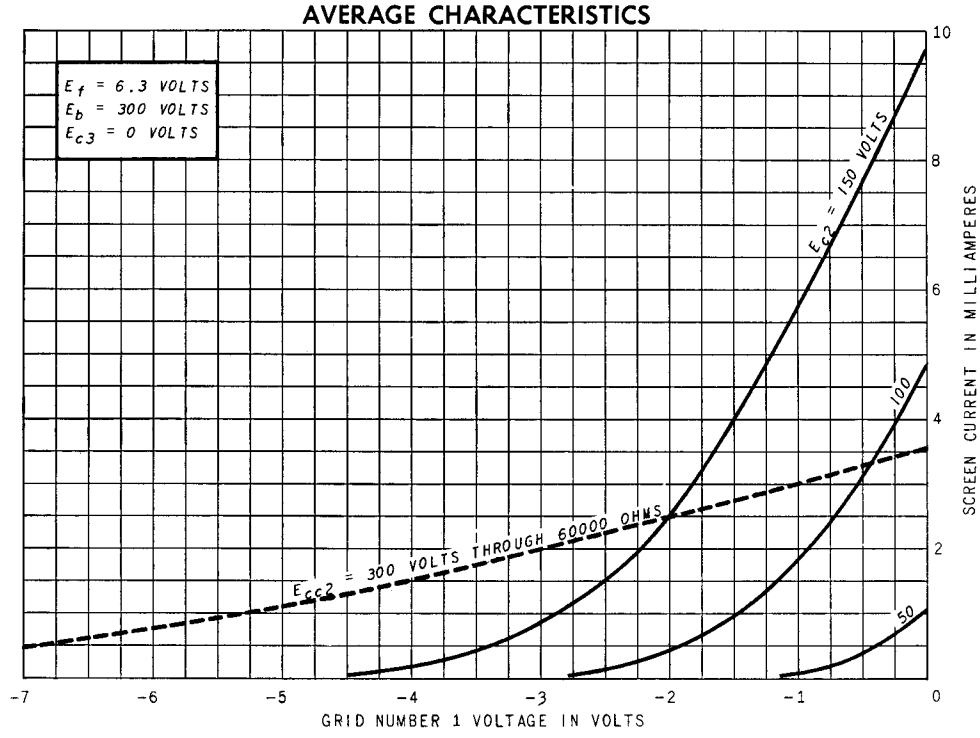
March 27, 1953

AVERAGE CHARACTERISTICS



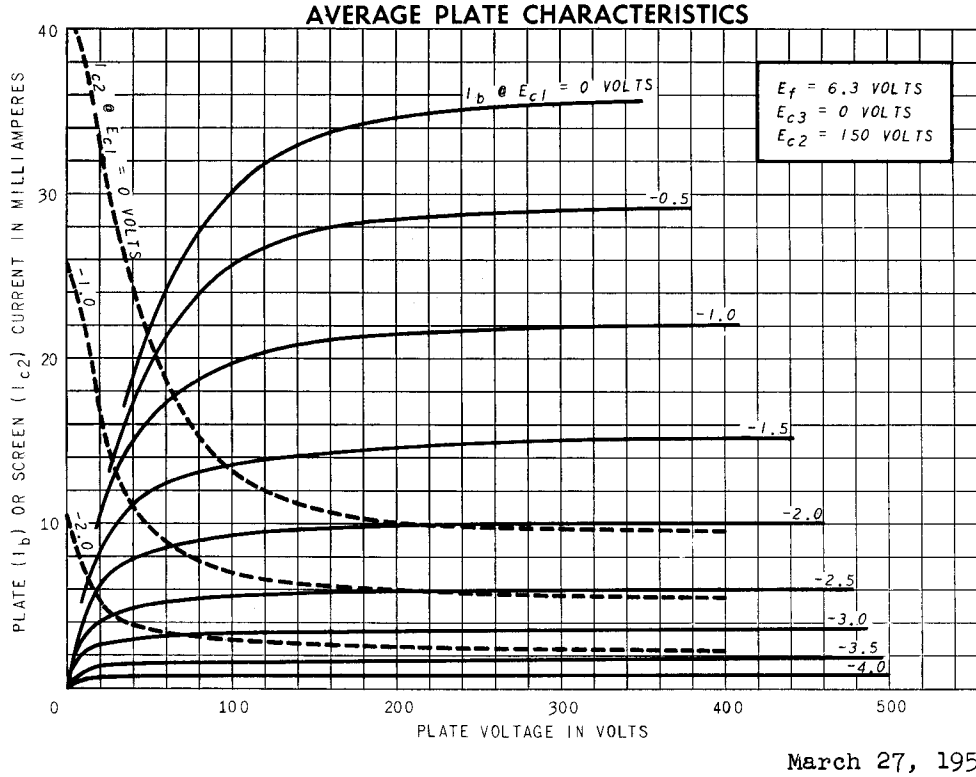
March 27, 1953

AVERAGE CHARACTERISTICS



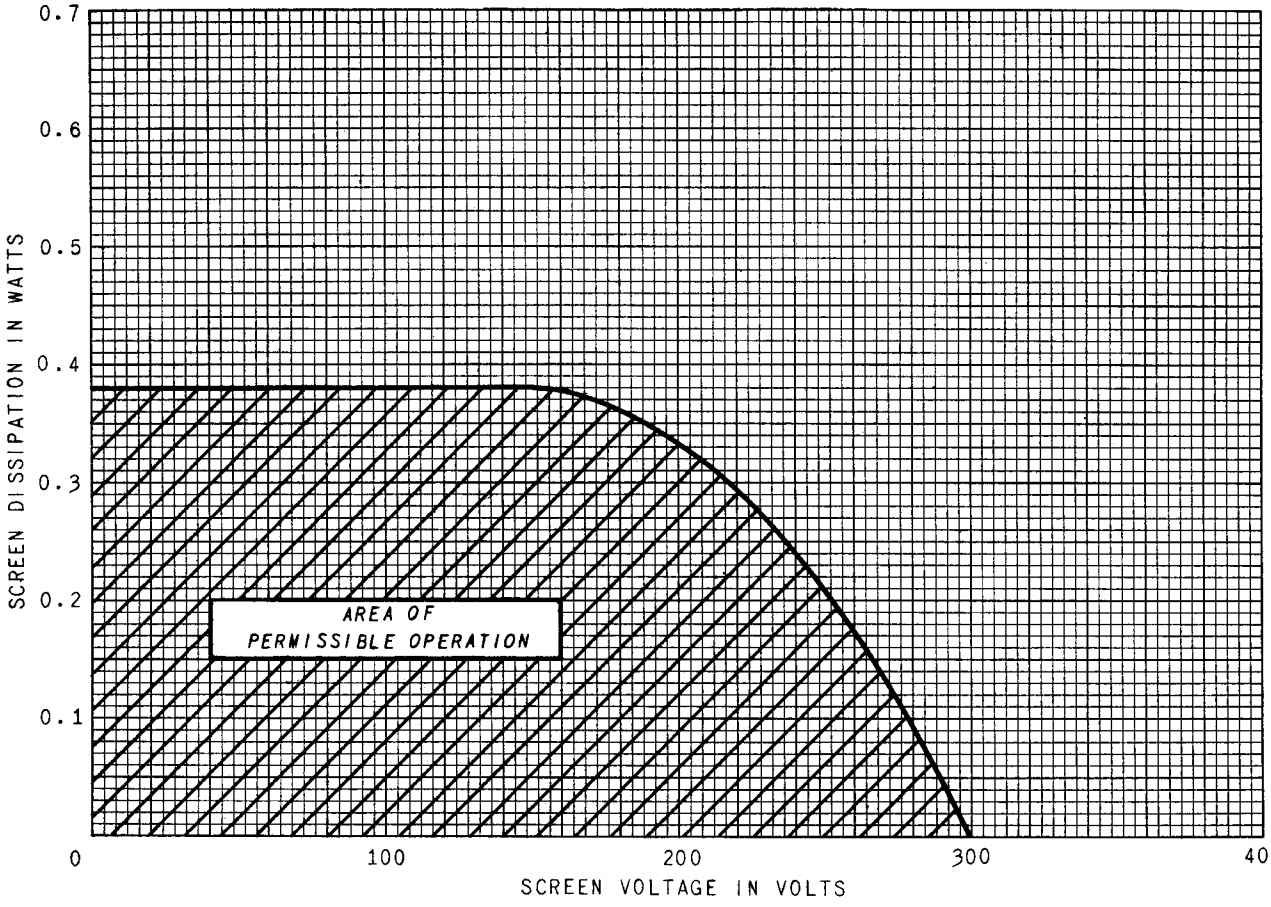
March 27, 1953

AVERAGE PLATE CHARACTERISTICS



March 27, 1953

SCREEN RATING CHART

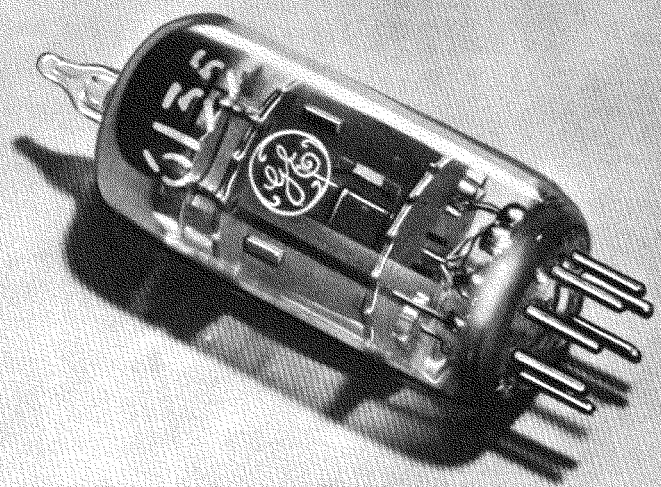


March 27, 1953

TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

4-53 (5M)

PRINTED IN U.S.A.



TRIODE

DESCRIPTION

The GL-6135 is a miniature medium-mu triode designed for use as a local oscillator in very-high-frequency receivers. It is also suitable for use as an audio amplifier and for use in general-purpose applications. The GL-6135 is specifically designed to assure dependable life and reliable service under the exacting conditions encountered in mobile and aircraft applications. Features include a high degree of mechanical strength, a heater-cathode construction designed to withstand many-thousand cycles of intermittent operation, and a relatively high value of plate-to-grid insulation resistance throughout life.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode—Coated Unipotential

Heater Voltage (A-c or D-c)	6.3	Volts
Heater Current	0.175	Ampere

Direct Interelectrode Capacitances	With Shield*	Without Shield	
Grid to Plate	1.4	1.4	uuf
Input	1.7	1.5	uuf
Output	2.6	0.7	uuf

Mechanical Data

Mounting Position—Any
Envelope—T-5½ Glass
Base—Miniature Button 7-pin, E7-1

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

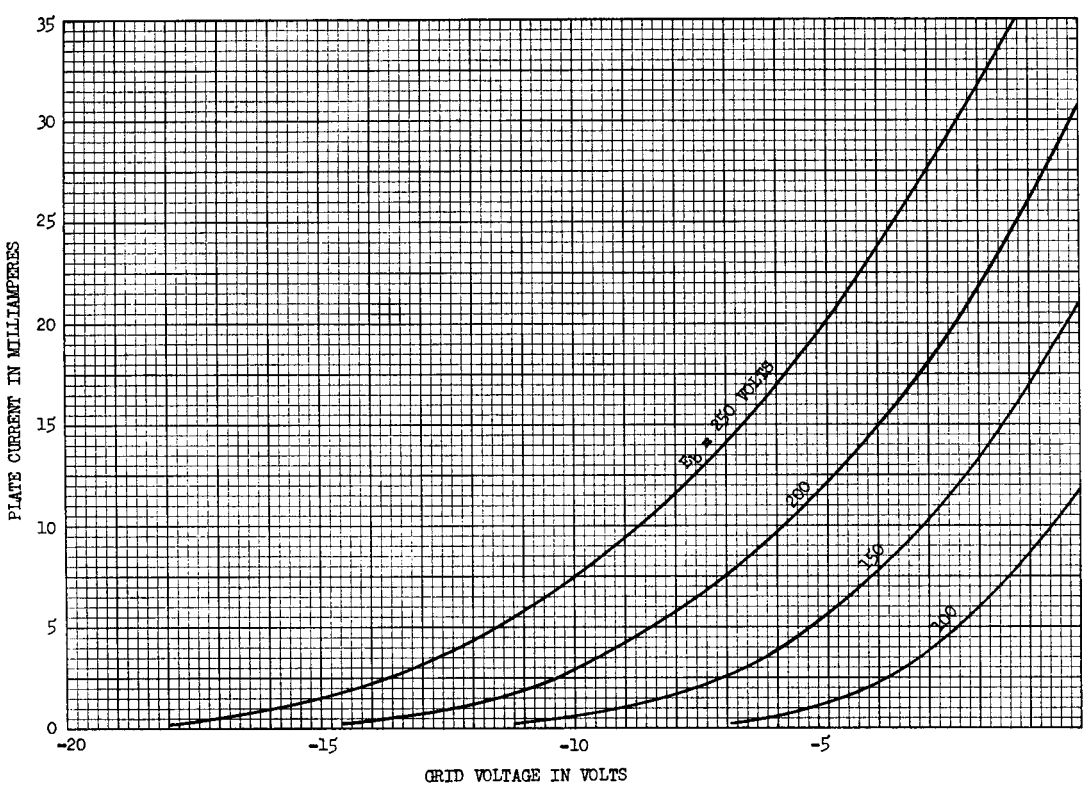
Electrical—Design Center Values		
Plate Voltage	300	Volts
Plate Dissipation	3.5	Watts
D-c Cathode Current	25	Milliamperes
Heater-Cathode Voltage	90	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.25	Megohm
With Cathode Bias	1.0	Megohm
Mechanical		
Peak Impact Acceleration in Any Direction	600	G

CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier			
Plate Voltage	100	250	Volts
Grid Voltage	0	−8.5	Volts
Amplification Factor	19.5	17	
Plate Resistance, approximate	6250	7700	Ohms
Transconductance	3100	2200	Micromhos
Plate Current	11.8	10.5	Milliamperes
Grid Voltage, approximate for I_b = 10 Microamperes		−21	Volts

* With external shield No. 316 connected to cathode.

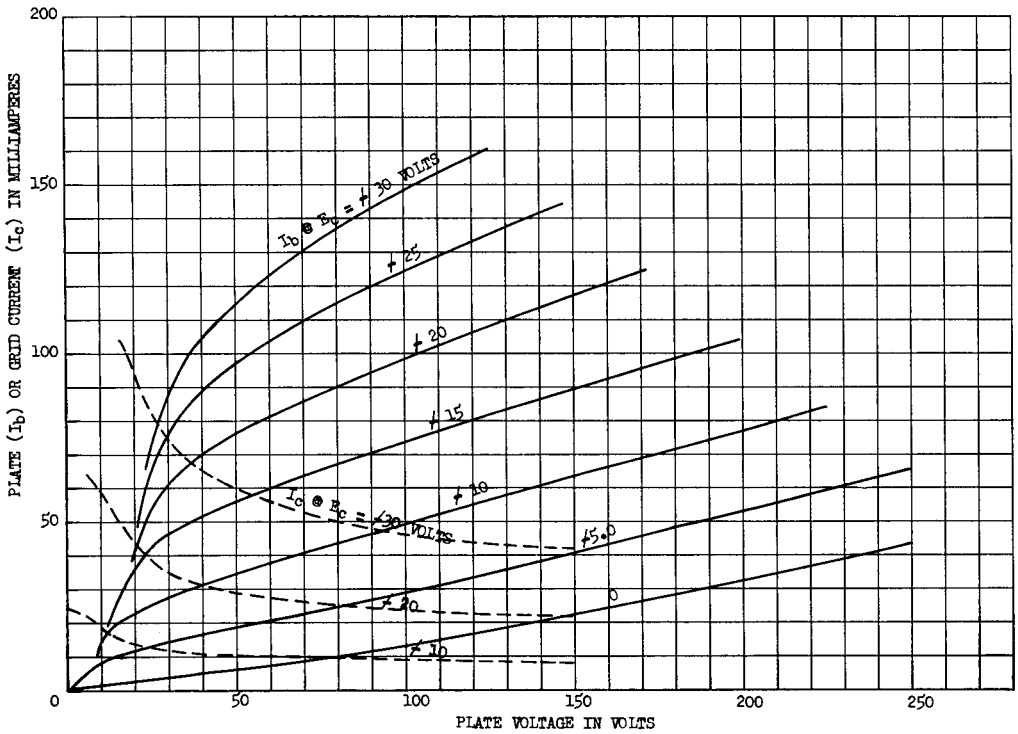
AVERAGE CHARACTERISTICS



K-69087-72A520

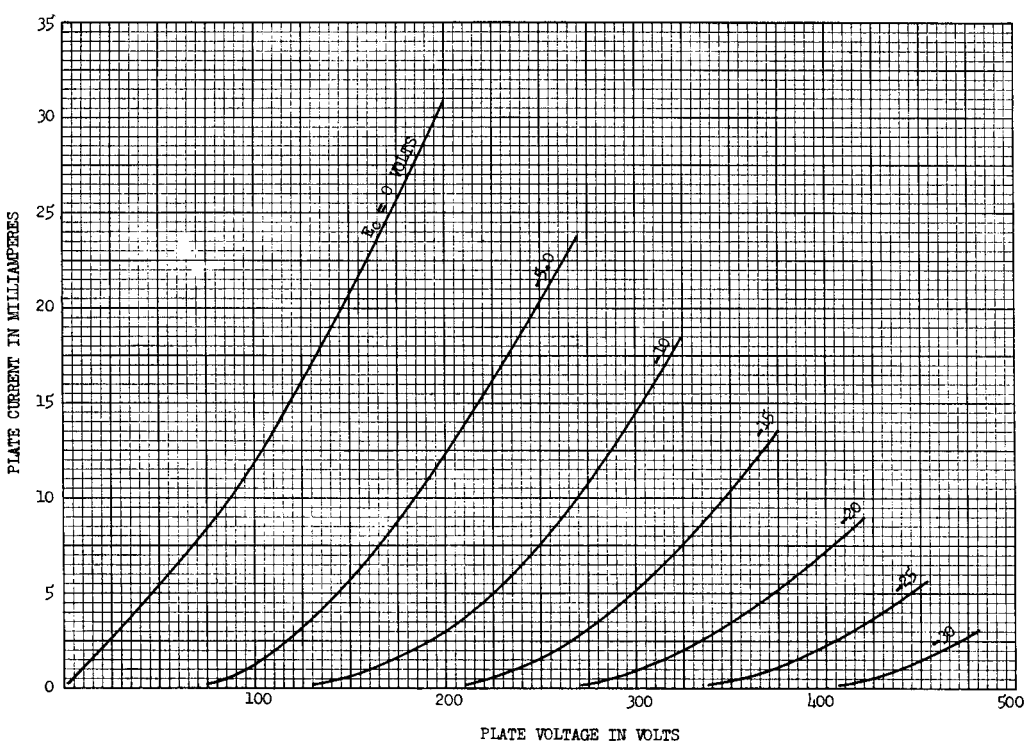
4-9-52

AVERAGE PLATE CHARACTERISTICS



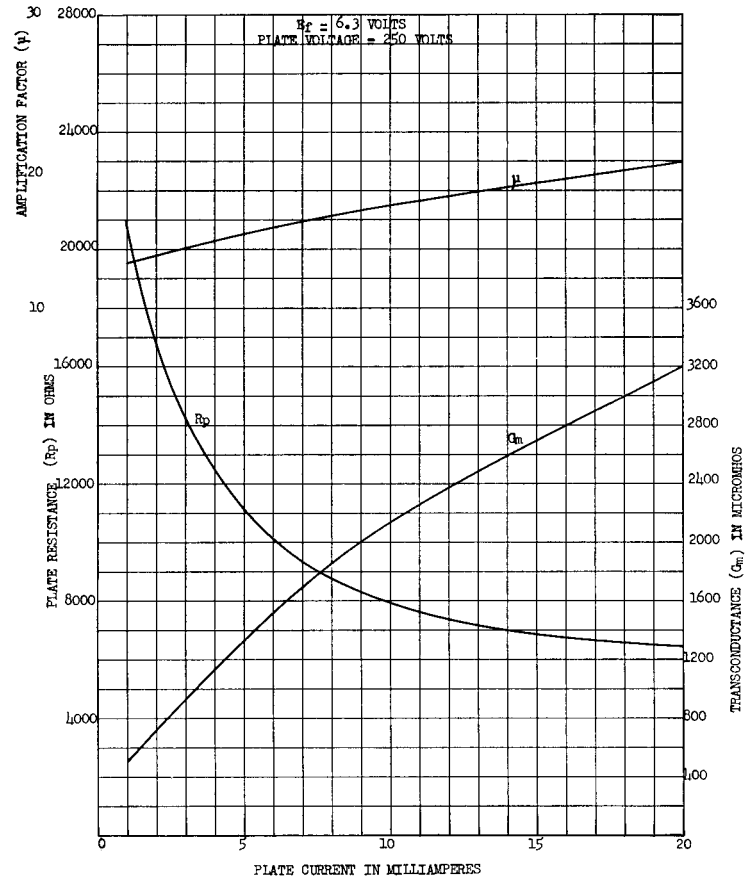
K-69087-72A522 4-9-52

AVERAGE PLATE CHARACTERISTICS



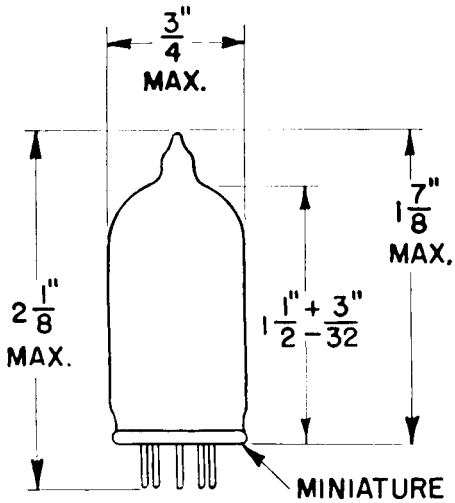
K-69087-72A519 4-9-52

AVERAGE CHARACTERISTICS
PLATE VOLTAGE = 250 VOLTS



K-69087-72A521 4-9-52

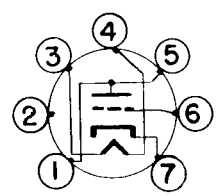
OUTLINE



MINIATURE BUTTON
7-PIN
BASE NO. E7-1

K-69087-72A518

BASING DIAGRAM



6BG

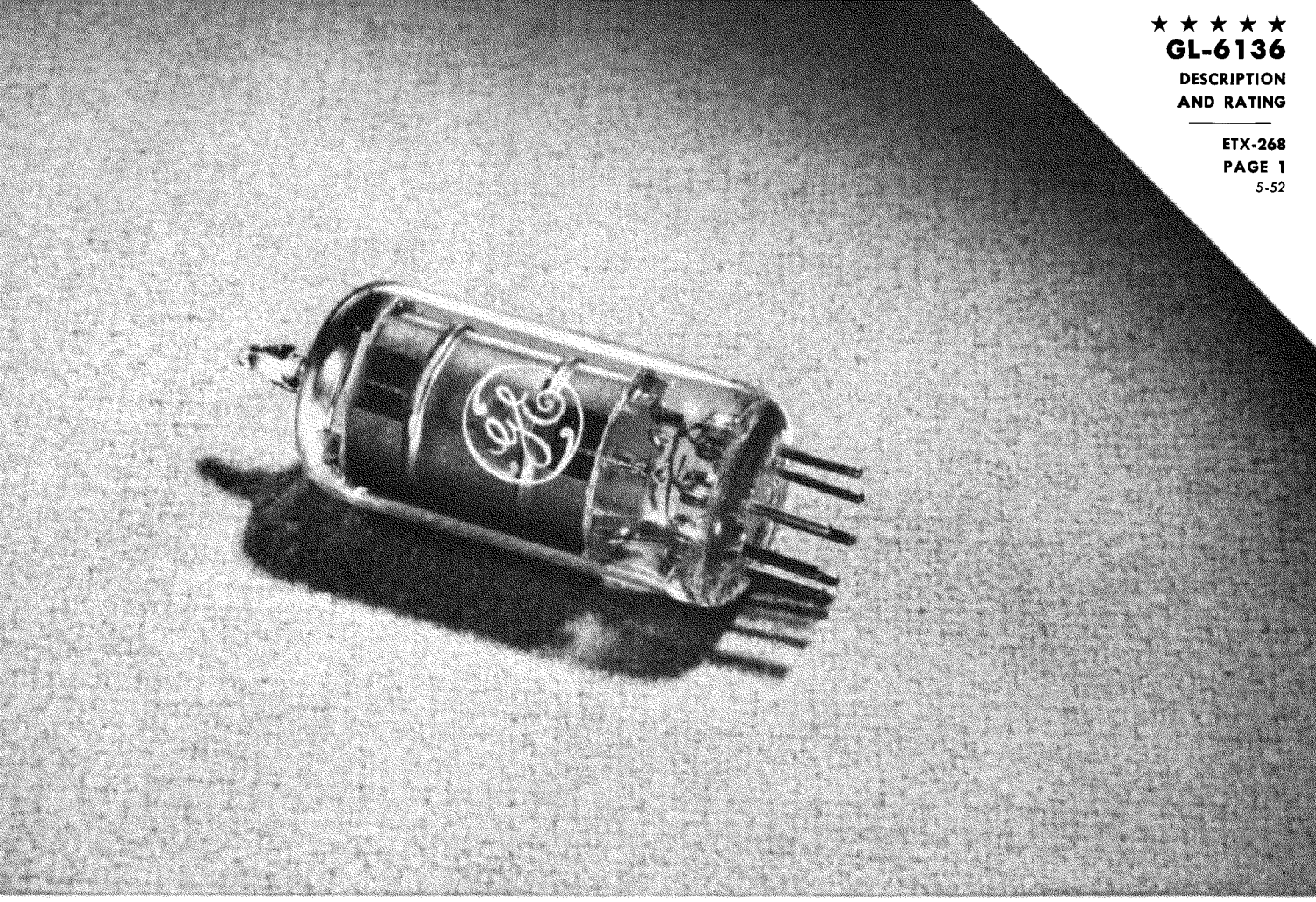
PIN 1: PLATE
PIN 2: INTERNAL CONNECTION
PIN 3: HEATER
PIN 4: HEATER
PIN 5: PLATE
PIN 6: GRID
PIN 7: CATHODE

4-3-52

Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.



PENTODE

DESCRIPTION

The GL-6136 is a miniature sharp cutoff pentode for use as a high-gain radio-frequency or intermediate-frequency amplifier. The tube is specially designed to assure dependable life and reliable service under the exacting conditions encountered in mobile and aircraft applications. Features include a high degree of mechanical strength and a heater-cathode construction designed to withstand many-thousand cycles of intermittent operation.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode—Coated Unipotential			
Heater Voltage (A-c or D-c)	6.3		Volts
Heater Current	0.3		Ampere
Direct Interelectrode Capacitances	**With Shield***	**Without Shield**	
Grid—No. 1 to Plate, maximum	0.0035	0.0035	uuf
Input	6.5	6.0	uuf
Output	5.5	5.0	uuf

Mechanical Data

Mounting Position—Any
Envelope—T-5½ Glass
Base—Miniature Button 7-Pin, E7-1

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

Electrical—Design Center Values	
Plate Voltage	300 Volts
Suppressor Voltage†	0 Volt
Screen Supply Voltage	300 Volts
Screen Voltage	150 Volts
Positive D-c Grid—No. 1 Voltage	0 Volt
Plate Dissipation	3.0 Watts
Screen Dissipation	0.65 Watt
Heater-Cathode Voltage	90 Volts
Mechanical	
Peak Impact Acceleration in Any Direction	600 G

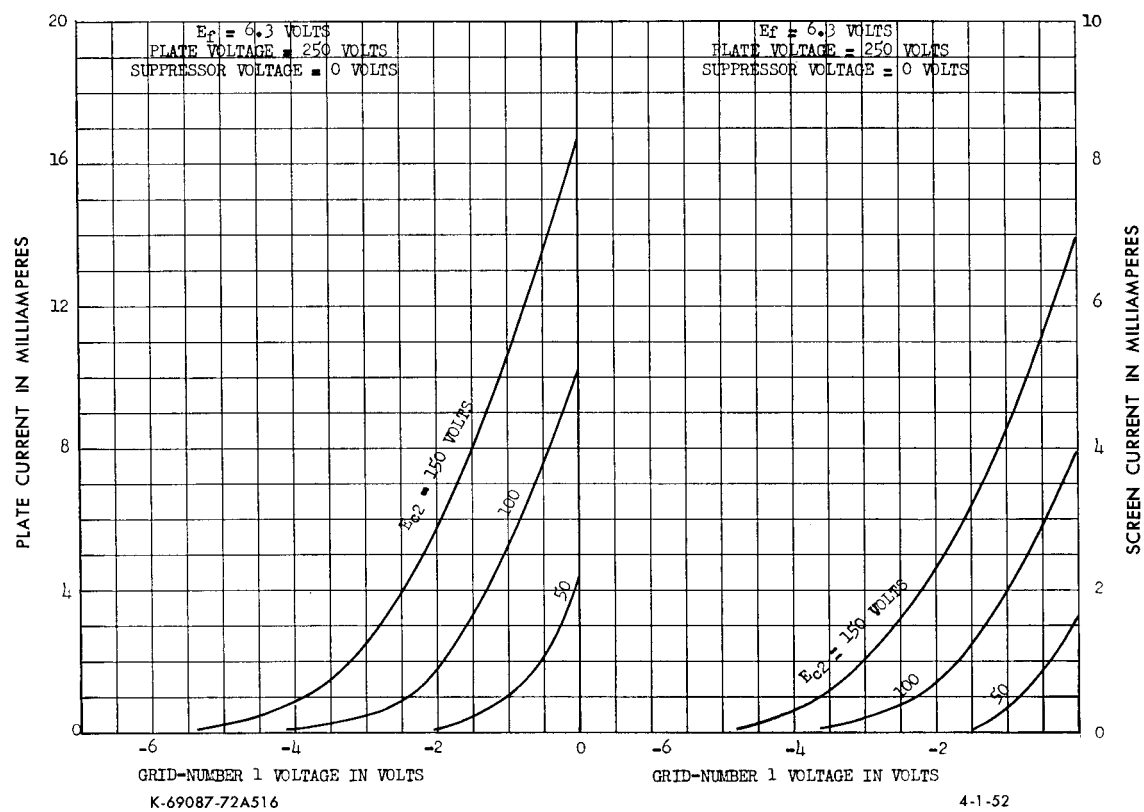
CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier		
Plate Voltage	100	250 Volts
Suppressor Voltage†	0	0 Volt
Screen Voltage	100	150 Volts
Cathode Bias Resistor	150	68 Ohms
Plate Resistance, approximate	0.5	1.0 Megohm
Transconductance	3900	5200 Micromhos
Plate Current	5.0	10.6 Milliamperes
Screen Current	2.1	4.3 Milliamperes
Grid—No. 1 Voltage, approximate for I_b = 10 Microamperes	−4.2	−6.5 Volts

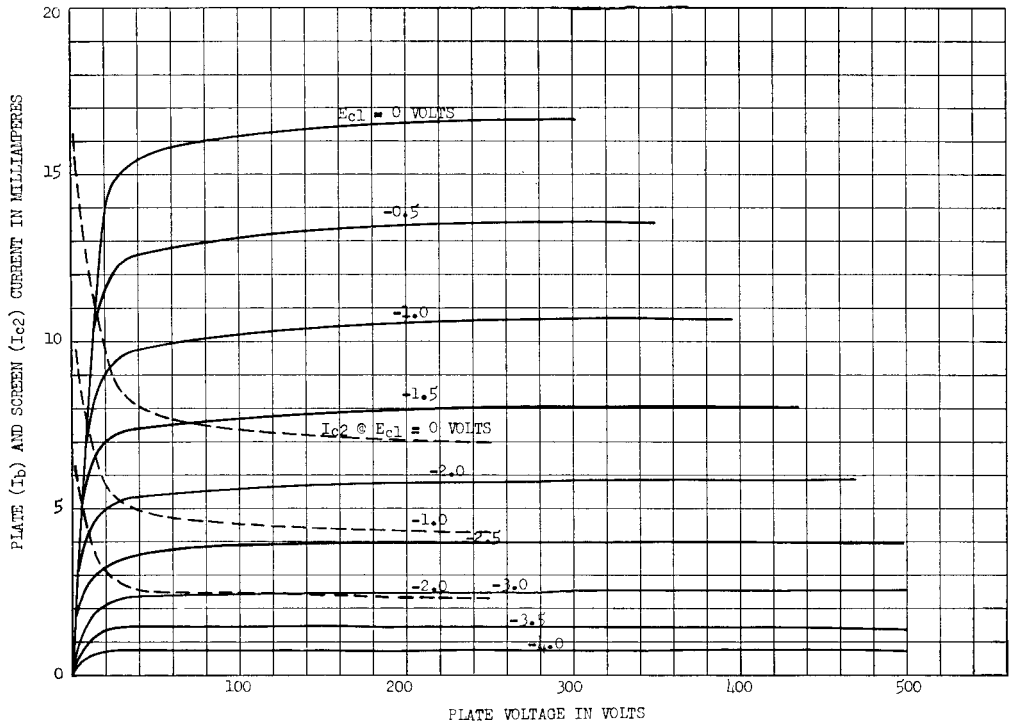
* With external shield No. 316 connected to pin 7.

† Pin 2 connected to pin 7 at socket.

GL-6136
AVERAGE CHARACTERISTICS

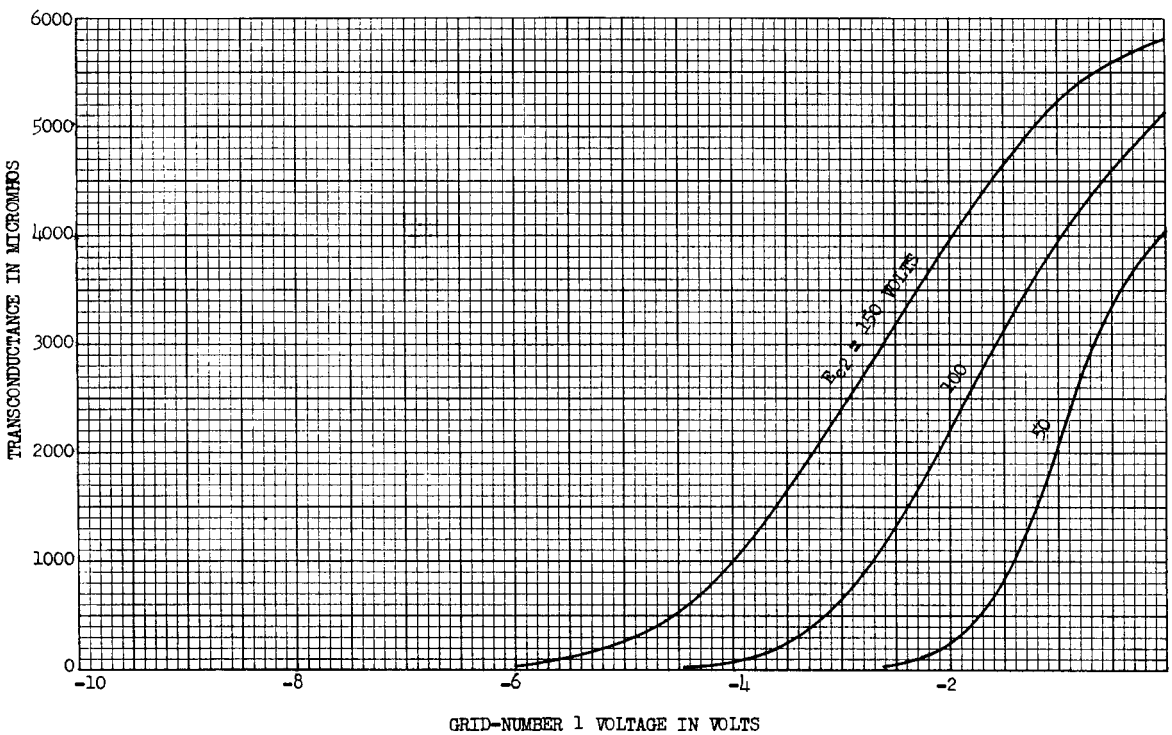


AVERAGE PLATE CHARACTERISTICS
$E_f = 6.3$ VOLTS
SCREEN VOLTAGE = 150 VOLTS
SUPPRESSOR VOLTAGE = 0 VOLTS



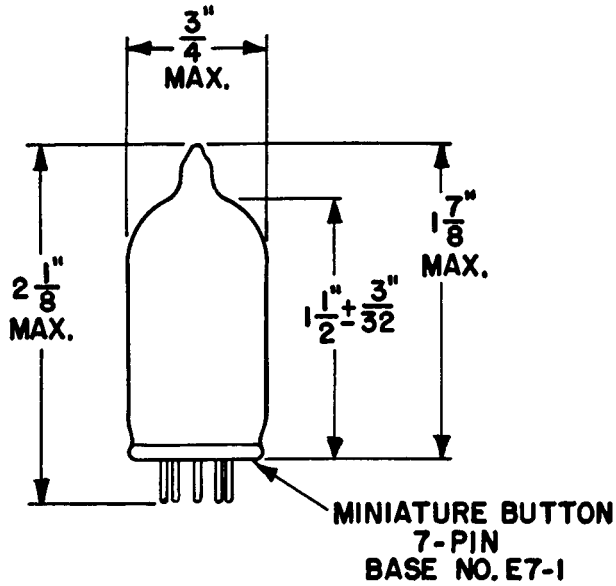
K-69087-72A515 4-1-52

AVERAGE CHARACTERISTICS
$E_f = 6.3$ VOLTS
PLATE VOLTAGE = 250 VOLTS
SUPPRESSOR VOLTAGE = 0 VOLTS

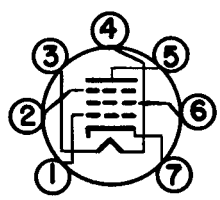


K-69087-72A517 4-1-52

OUTLINE
GL-6136



BASING DIAGRAM



7BK

PIN 1: GRID NO.1
PIN 2: GRID NO.3 AND INTERNAL SHIELD
PIN 3: HEATER
PIN 4: HEATER
PIN 5: PLATE
PIN 6: GRID NO.2 (SCREEN)
PIN 7: CATHODE

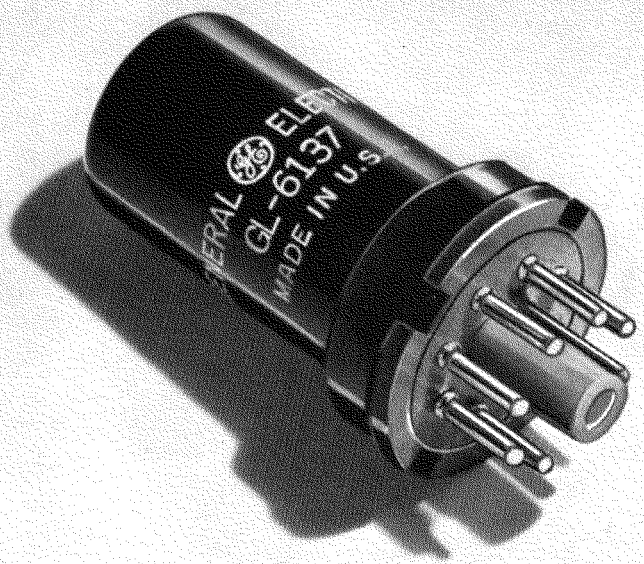
N-15167AZ

4-3-52

Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.



PENTODE

DESCRIPTION

The GL-6137 is a remote-cutoff pentode designed for use as a high-gain radio-frequency or intermediate-frequency amplifier. The tube is specially designed to assure dependable life and reliable service under the exacting conditions encountered in mobile and aircraft applications. Features include a high degree of mechanical strength and a heater-cathode construction designed to withstand many thousand cycles of intermittent operation.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode—Coated Unipotential		
Heater Voltage (A-c or D-c)	6.3	Volts
Heater Current	0.3	Ampere
Direct Interelectrode Capacitance*		
Grid No. 1 to Plate, maximum	0.003	uuf
Input	5.0	uuf
Output	6.5	uuf

Mechanical Data

Mounting Position—Any
Envelope—MT-8, Metal Shell
Base—Small Wafer Octal 8-pin, B8-21

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

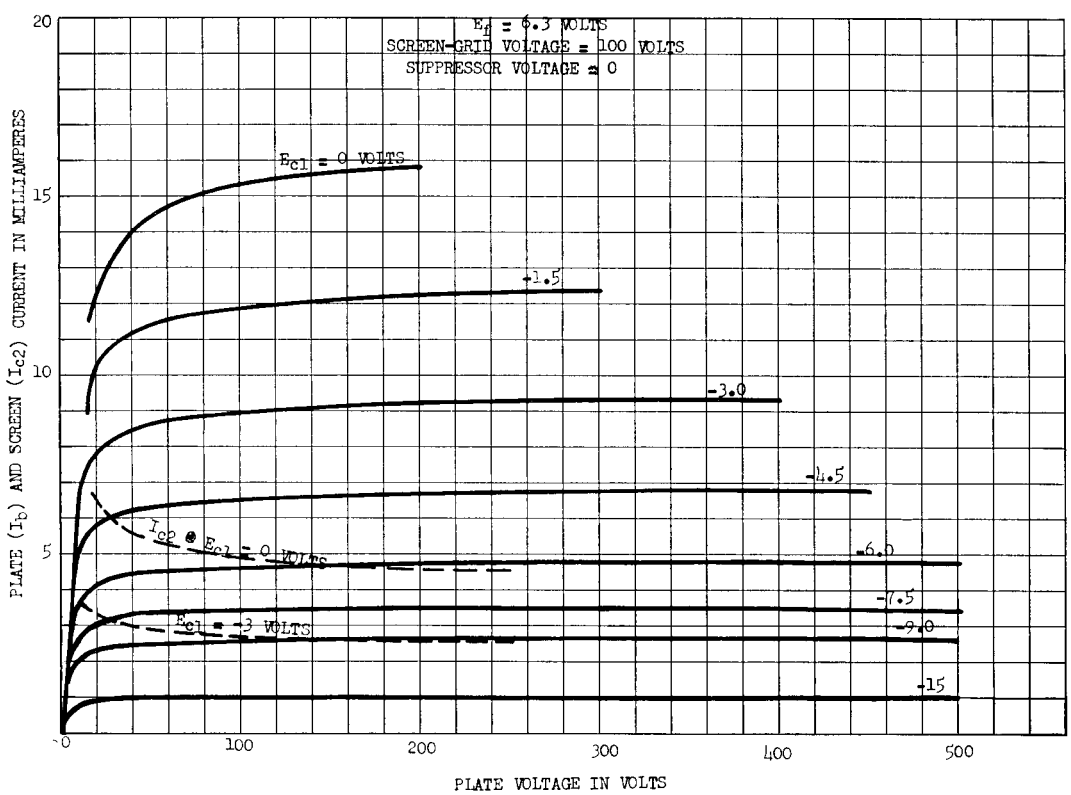
Electrical—Design Center Values	
Plate Voltage	300 Volts
Screen Supply Voltage	300 Volts
Screen Voltage	125 Volts
Positive D-c Grid—No. 1 Voltage	0 Volt
Plate Dissipation	3.0 Watts
Screen Dissipation	0.4 Watt
Heater-cathode Voltage	90 Volts
Mechanical	
Peak Impact Acceleration in Any Direction	600 G

CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier		
Plate Voltage	100	250 Volts
Suppressor Voltage△	0	0 Volt
Screen Voltage	100	100 Volts
Grid—No. 1 Voltage	−1	−3 Volts
Plate Resistance, approximate	0.12	0.8 Megohm
Transconductance	2350	2000 Micromhos
Plate Current	13	9.2 Milliamperes
Screen Current	4.0	2.6 Milliamperes
Grid—No. 1 Voltage, approximate for Gm = 10 Micromhos	−35	−35 Volts

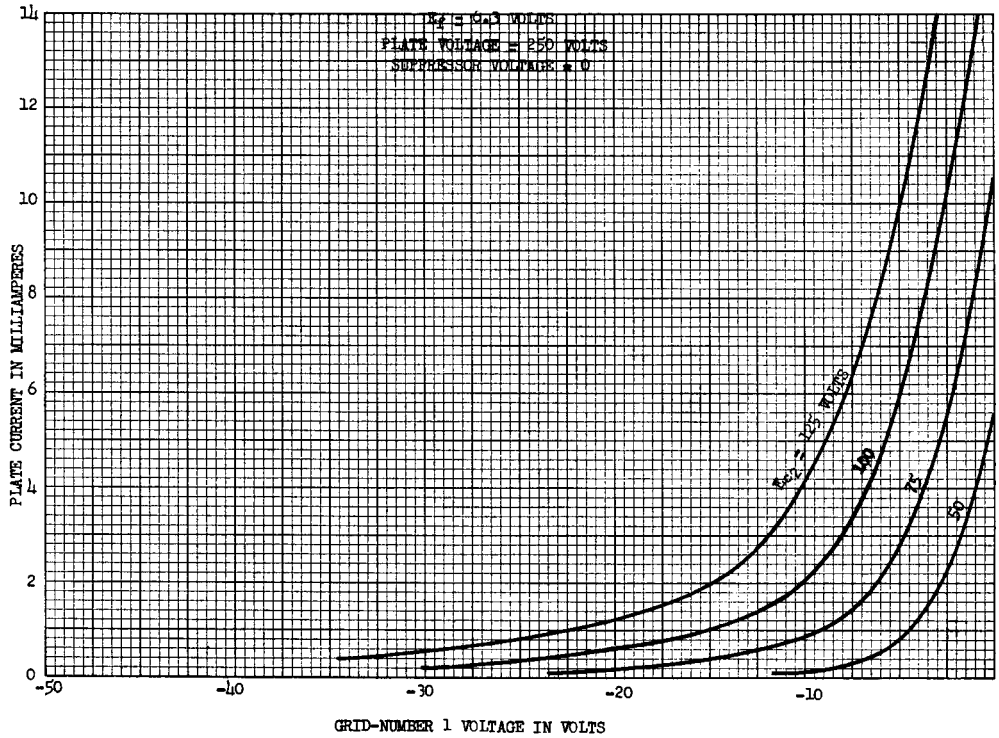
* Measured with Pin 1 connected to Pin 5.
△Pin 3 connected to Pin 5 at socket.

AVERAGE PLATE CHARACTERISTICS



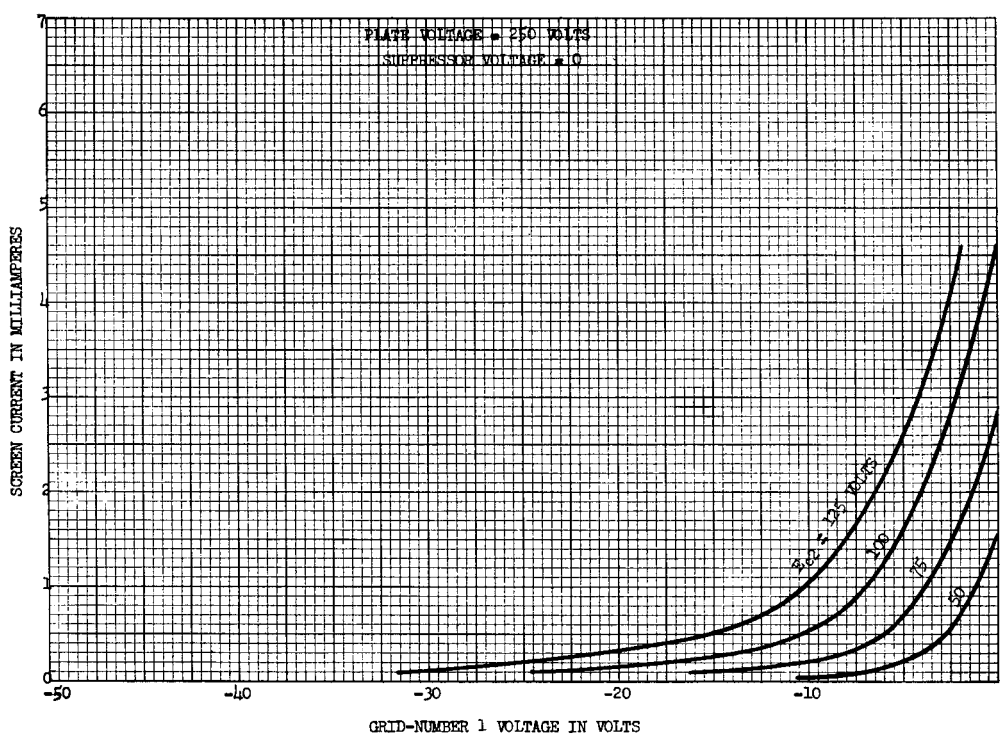
K-69087-72A508 1-9-52

AVERAGE CHARACTERISTICS



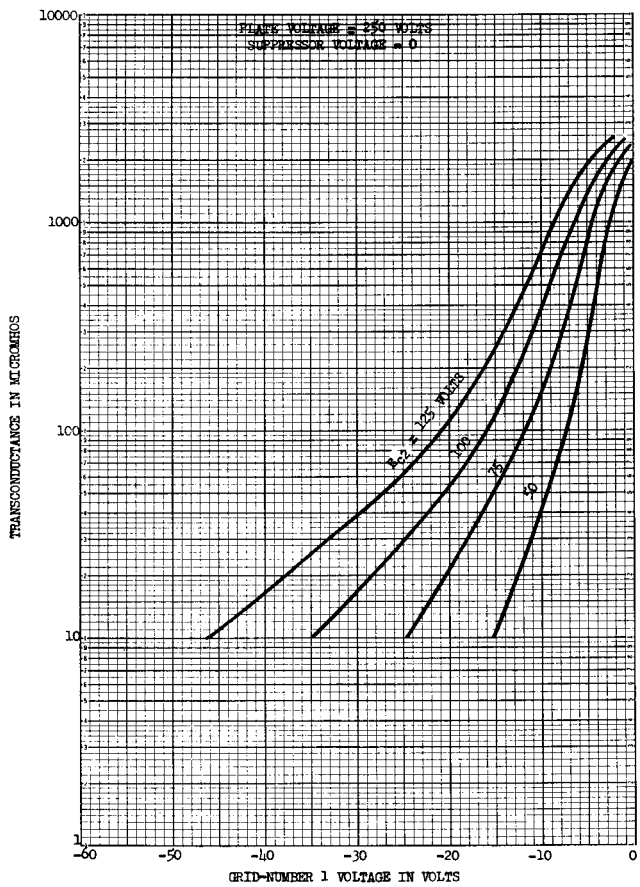
K-69087-72A507 1-9-52

AVERAGE CHARACTERISTICS



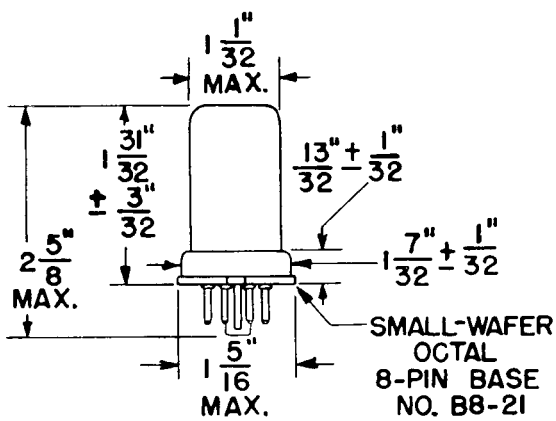
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AVERAGE CHARACTERISTICS



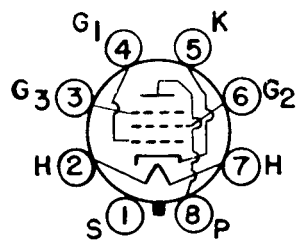
K-69087-72A509 1-9-52

OUTLINE



N-15119AZ

BASING DIAGRAM



8N

PIN 1:	SHELL	PIN 5:	CATHODE
PIN 2:	HEATER	PIN 6:	GRID NO. 2
PIN 3:	GRID NO. 3	PIN 7:	HEATER
PIN 4:	GRID NO. 1	PIN 8:	PLATE

1-9-52

Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.

—PRODUCT INFORMATION—

Beam Pentode

6146-A

FOR POWER AMPLIFIER, OSCILLATOR, AND MODULATOR APPLICATIONS

HIGH POWER SENSITIVITY

90 WATTS CW INPUT (ICAS) UP TO 60 MC

T-12 BULB

OCTAL 8-PIN BASE

The 6146-A is a beam pentode designed for use as a radio-frequency power amplifier and oscillator or as an audio-frequency power amplifier and modulator in mobile or fixed equipment. Featuring high power sensitivity the 6146-A may be operated with full input up to 60 megacycles and with reduced input to 175 megacycles.

The 6146-A incorporates triple-base-pin connections for the cathode and beam plates to permit effective r-f grounding, and an octal base with a metal sleeve having its own base-pin terminal. The sleeve, which shields the input to the tube and isolates it from the output circuit, eliminates the necessity for external shielding.

GENERAL

ELECTRICAL

Heater Characteristics and Ratings

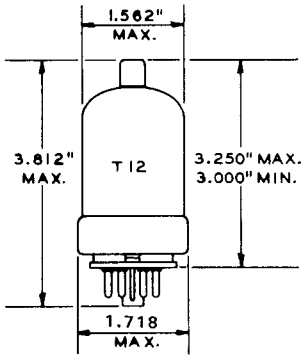
Cathode-Coated Unipotential	
Heater Voltage, AC or DC *	6.3 10% Volts
Heater Current •	1.250 Amperes
Direct Interelectrode Capactiances	
Grid-Numer 1 to Plate, maximum	0.24 pf
Input	13.5 pf
Output	8.5 pf

MECHANICAL

Mounting Position – Any
Envelope – T-12, Glass
Base – B8-150, Small-Wafer Octal 8-Pin with Sleeve or B8-159, Small-Wafer Octal 8-Pin with External Barriers and Sleeve
Top Cap – C1-1 or C1-38
Outline Drawing

Maximum Diameter	1.562	Inches
Maximum Over-all Length	3.812	Inches
Maximum Seated Height	3.250	Inches
Minimum Seated Height	3.000	Inches
Bulb Temperature at Hottest Point	220	°C

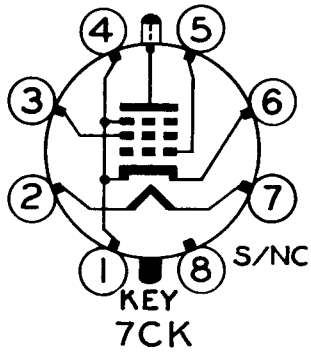
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pin 1 – Cathode, Beam Plates, and Internal Shield
Pin 2 – Heater
Pin 3 – Grid-Number 2 (Screen)
Pin 4 – Cathode, Beam Plates, and Internal Shield
Pin 5 – Grid-Number 1
Pin 6 – Cathode, Beam Plates, and Internal Shield
Pin 7 – Heater
Pin 8 – Base Sleeve
Cap – Plate

BASING DIAGRAM



CHARACTERISTICS MAXIMUM RATINGS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	200	Volts
Screen Voltage	200	Volts
Plate Current	100	Milliamperes
Transconductance	7000	Micromhos
Amplification Factor (Grid–Number 1 to Grid–Number 2)	4.5	

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS AB_1
MAXIMUM RATINGS ABSOLUTE-MAXIMUM VALUES

	CCS ♦	ICAS □	
DC Plate Voltage	600	750	Volts
DC Screen Voltage	250	250	Volts
Maximum–Signal DC Plate Current	125	135	Milliamperes
Maximum–Signal Plate Input	60	85	Watts
Maximum–Signal Screen Input	3.0	3.0	Watts
Plate Dissipation	20	25	Watts
Peak Heater–Cathode Voltage			
Heater Positive with Respect to Cathode	135	135	Volts
Heater Negative with Respect to Cathode	135	135	Volts

TYPICAL OPERATION, VALUES FOR 2 TUBES

DC Plate Voltage	400	500	600	600	750	Volts
DC Screen Voltage	190	185	180	200	195	Volts
DC Grid Number 1 Voltage						
From Fixed Bias Source	−40	−40	−45	−50	−50	Volts
Peak AF Grid–Number 1–to–Grid Number 1 Voltage	80	80	90	100	100	Volts
Zero–Signal DC Plate Current	63	57	26	28	23	Milliamperes
Maximum–Signal DC Plate Current	228	215	200	229	220	Milliamperes
Zero–Signal DC Screen Current	2.5	2.0	1.0	1.0	1.0	Milliamperes
Maximum–Signal DC Screen Current	25	25	23	27	26	Milliamperes
Effective Plate–to–Plate Load Resistance	4000	5500	7000	6000	8000	Ohms
Maximum–Signal Power Output, approximate	55	70	82	95	120	Watts

MAXIMUM CIRCUIT VALUES (CCS OR ICAS)

Grid Number 1 Circuit Resistance			
With Fixed Bias	0.1	0.1	Megohms
With Cathode Bias	Not Recommended	Not Recommended	

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR CLASS AB_2
MAXIMUM RATINGS ABSOLUTE-MAXIMUM VALUES

DC Plate Voltage	600	750	Volts
DC Screen Voltage	250	250	Volts
Maximum–Signal DC Plate Current	125	135	Millamperes
Maximum–Signal Plate Input	62.5	90	Watts
Maximum–Signal Screen Input	3.0	3.0	Watts
Plate Dissipation	20	25	Watts
Peak Heater–Cathode Voltage			
Heater Positive with Respect to Cathode	135	135	Volts
Heater Negative with Respect to Cathode	135	135	Volts

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR CLASS AB_2

(Continued)

TYPICAL OPERATION, VALUES FOR 2 TUBES	CCS ♦			ICAS □		
DC Plate Voltage	400	500	600	600	750	Volts
DC Screen Voltage ▲	175	175	165	190	165	Volts
DC Grid–Number 1 Voltage From Fixed Bias Source	–41	–44	–44	–48	–46	Volts
Peak AF Grid–Number 1–to–Grid–Number 1 Voltage	95	102	97	109	108	Volts
Zero–Signal DC Plate Current	33	27	22	28	22	Milliamperes
Maximum–Signal DC Plate Current	232	242	207	270	240	Milliamperes
Zero–Signal DC Screen Current	1.1	0.7	0.6	1.2	0.3	Milliamperes
Maximum–Signal DC Screen Current	18	18	17	20	20	Milliamperes
Maximum-Signal DC Grid–Number 1 Current	1.6	1.9	1.1	2.0	2.6	Milliamperes
Effective Plate–to–Plate Load Resistance	3700	4600	6800	5000	7400	Ohms
Maximum–Signal Driving Power, approximate ⊕	0.2	0.3	0.2	0.3	0.4	Watts
Maximum–Signal Power Output, approximate	62	83	90	113	131	Watts

MAXIMUM CIRCUIT VALUES (CCS OR ICAS)		
Grid–Number 1 Circuit Resistance		
With Fixed Bias	0.3	0.3 Megohms
With Cathode Bias	Not Recommended	Not Recommended

PLATE–MODULATED RADIO–FREQUENCY POWER AMPLIFIER–CLASS C TELEPHONY CARRIER CONDITIONS PER TUBE FOR USE WITH A MAXIMUM MODULATION FACTOR OF 1.0

MAXIMUM RATINGS, ABSOLUTE VALUES	CCS ♦	ICAS □	
DC Plate Voltage	480	600	Volts
DC Screen Voltage	250	250	Volts
DC Grid–Number 1 Voltage	–150	–150	Volts
DC Plate Current	117	125	Milliamperes
DC Grid–Number 1 Current	3.5	4.0	Milliamperes
Plate Input	45	67.5	Watts
Screen Input	2.0	2.0	Watts
Plate Dissipation	13.3	16.7	Watts
Peak Heater–Cathode Voltage			
Heater Positive with Respect to Cathode	135	135	Volts
Heater Negative with Respect to Cathode	135	135	Volts

TYPICAL OPERATION				
DC Plate Voltage	400	475	600	Volts
DC Screen Voltage †	150	135	150	Volts
From a Series Resistor of	33000	51000	56000	Ohms
DC Grid–Number 1 Voltage	–87	–77	–87	Volts
From a Grid Resistor of	27000	27000	27000	Ohms
Peak RF Grid–Number 1 Voltage	107	95	107	Volts
DC Plate Current	112	94	112	Millamperes
DC Screen Current	7.8	6.4	7.8	Milliamperes
DC Grid–Number 1 Current, approximate	3.4	2.8	3.4	Milliamperes
Driving Power, approximate	0.4	0.3	0.4	Watts
Power Output, approximate	32	34	52	Watts

MAXIMUM CIRCUIT VALUES (CCS OR ICAS)

Grid–Number 1 Circuit Resistance				
With Fixed Bias	0.3		0.3	Megohms
With Cathode Bias	Not Recommended		Not Recommended	

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR –CLASS C TELEPHONY AND RADIO FREQUENCY POWER AMPLIFIER – CLASS C FM TELEPHONY

MAXIMUM RATINGS, ABSOLUTE VALUES

	CCS ♦	ICAS □	
DC Plate Voltage	600	750	Volts
DC Screen Voltage	250	250	Volts
DC Grid–Number 1 Voltage	–150	–150	Volts
DC Plate Current	140	150	Milliamperes
DC Grid–Number 1 Current	3.5	4.0	Milliamperes
Plate Input	67.5	190	Watts
Screen Input	3.0	3.0	Watts
Plate Dissipation	20	25	Watts
Peak Heater–Cathode Voltage			
Heater Positive with Respect to Cathode	135	135	Volts
Heater Negative with Respect to Cathode	135	135	Volts

TYPICAL OPERATION AS AMPLIFIER UP TO 60 MEGAHERTZ

DC Plate Voltage	500	600	600	750	Volts
DC Screen Voltage	170	150	180	160	Volts
From a Series Resistor of	36000	51000	43000	56000	Ohms
DC Grid–Number 1 Voltage ‡	–66	–58	–71	–62	Volts
From a Grid Resistor of	27000	20000	24000	20000	Ohms
From a Cathode Resistor of	470	470	430	470	Ohms
Peak RF Grid–Number 1 Voltage	84	73	91	79	Volts
DC Plate Current	135	112	150	120	Milliamperes
DC Screen Current	9.0	9.0	10	11	Milliamperes
DC Grid–Number 1 Current, approximate	2.5	2.8	2.8	3.1	Milliamperes
Driving Power, approximate	0.2	0.2	0.3	0.2	Watts
Power Output, approximate	48	52	66	70	Watts

TYPICAL OPERATION AS AMPLIFIER UP TO 175 MEGAHERTZ

DC Plate Voltage	320	400	Volts
DC Screen Voltage	180	190	Volts
From a Series Resistor of	13000	20000	Ohms
DC Grid–Number 1 Voltage	–51	–54	Volts
From a Grid Resistor of	27000	24000	Ohms
From a Cathode Resistor of	330	330	Ohms
Peak RF Grid–Number 1 Voltage	64	68	Volts
DC Plate Current	140	150	Milliamperes
DC Screen Current	10	10.4	Milliamperes
DC Grid–Number 1 Current, approximate	2.0	2.2	Milliamperes
Driving Power, approximate	3.0	3.0	Watts
Power Output, approximate	25	35	Watts

MAXIMUM CIRCUIT VALUES (CCS OR ICAS)

Grid–Number 1 Circuit Resistance	.03	.03	Megohm

INITIAL CHARACTERISTICS LIMITS

	MINIMUM	MAXIMUM	
Heater Current Ef = 6.3 volts	1175	1325	Milliamperes
Plate Current Ef = 6.3 volts, Eb = 300V, Ec2 = 200V, Ec1 = −33V	46	94	Milliamperes
Screen Current Ef = 6.3 volts, Eb = 300V, Ec2 = 200V, Ec1 = −33V	− −	5.5	Milliamperes
Power Output Ef = 6.3 volts, Eb = 600V, Ec2 = 180V, Rg1 = 30,000 Ohms ±10%, Ib = 100–112 Ma and Ic1 = 2 to 2.5 Ma. Measured in self-excited oscillator and circuit operating at 15 mhz	47	− −	Watts
Interelectrode Capacitances §			
Grid–Number 1 to Plate (g1 to p)	− −	0.24	μμf
Input (g1 to k g3 I.S. Base Sleeve g2 h)	11.1	15.9	μμf
Output (p to k g3 I.S. Base Sleeve g2 h)	6.4	10.6	μμf

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef 6.3 volts.

♦ Continuous Commercial Service

□ Intermittent Commercial and Amateur Service

▲ Obtained preferably from a separate source or from the plate voltage with a voltage divider.

§ Measured without external shield.

⊕ Driver stage should be capable of supplying the specified driving power at low distortion to the number 1 grids of the AB2 stage. To minimize distortion, the effective resistance per grid number 1 circuit of the AB2 stage should be held at low value. For this purpose the use of transformer coupling is recommended. In no case, however, should the total dc grid number 1 circuit resistance exceed 30,000 ohms when the tube is operated at maximum ratings. For operation at less than maximum ratings, the dc grid number 1 circuit resistance may be as high as 100,000 ohms.

† Obtained preferably from a separate source modulated with the plate supply, or from the modulated plate supply through a series resistor.

‡ Obtained from grid number 1 resistor or from a combination of grid number 1 resistor with either fixed supply or cathode resistor.

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DESCRIPTION AND RATING

TRANSMITTING TUBE GL-6183

The GL-6183 is a four-electrode transmitting tube featuring a metal-and-ceramic envelope designed for use as a power amplifier or oscillator in grounded-grid circuits with both grids maintained at radio-frequency ground potential. The output circuit is connected between the anode and the screen grid. The anode is capable of dissipating one and one-half kilowatts. Cooling is accomplished by forced air with the radiator an integral part of the anode. The cathode is indirectly heated and thoria coated. Maximum ratings apply up to 900 megacycles.

When used as a Class B grounded-grid broadband television amplifier this tube has a useful synchronizing peak-power output of one kilowatt at 900 megacycles; in narrow band Class C service the output is one kilowatt of continuous power as an amplifier or oscillator. Because of its ratings, the tube is also well adapted to use in dielectric-heating equipment.

High operating efficiency is assured because of the small size and close spacing of the tube electrodes, the ring-seal construction, and the low-loss factor due to the gold-over-silver-plated external parts and the ceramic insulator. In addition, the grounded-grid construction eliminates the necessity for neutralization in a properly designed circuit. The small size of the GL-6183 permits compact mounting, and the ring-seal construction allows quick plug-in installation.

TECHNICAL INFORMATION

GENERAL

Electrical Data	Minimum	Bogey	Maximum	
Heater Voltage*	---	6.3	6.8	Volts
Heater Current at Bogey Voltage	---	24	---	Amperes
Heater Starting Current	---	---	36	Amperes
Heater Cold Resistance	---	0.022	---	Ohm
Cathode Heating Time	1	---	---	Minute
Amplification Factor, G_2 to G_1				
E_b = 500 Volts, I_b = 0.250 Ampere	---	10	---	
Peak Cathode Current†	---	---	4	Amperes
Direct Interelectrode Capacitances				
Cathode - Plate‡	---	0.03	---	uuf
Input, G_2 tied to G_1	---	16.0	---	uuf
Output, G_2 tied to G_1§	---	4.6	---	uuf

Mechanical Data			
Mounting Position - Vertical			
Air Flow			
Through Radiator			
See drawing in Instruction Book for form of air duct			
Plate Dissipation	1.5 Kilowatts		
Air Flow	60 Min Cu Ft per Min		
Static Pressure	1.5 Inches Water		
Screen-grid to Control-grid Seals		2 Min	Cu Ft per Min
Heater to Cathode Seals		12 Min	Cu Ft per Min
Incoming Air Temperature		45 Max	C
Radiator Hub Temperature at Fin Adjacent to Anode Seal		180 Max	C
Ceramic Temperature at any Point		200 Max	C

from RTMA releases #1069, March 19, 1952 & #1069A, Feb. 6, 1953

GENERAL ELECTRIC

Mechanical Data (Cont'd)

Net Weight	3.6	Pounds

Forced-air cocling to be applied before and during the application of any voltages. Forced-air cooling must be maintained for 1 minute after the removal of all voltages.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Radio-frequency Amplifier - Class B Television Service
Synchronizing-level conditions per tube unless otherwise specified

Maximum Ratings, Absolute Values		
D-c Plate Voltage	4000 Max	Volts
D-c Grid-No. 2 Voltage	600 Max	Volts
D-c Plate Current	0.7 Max	Ampere
Plate Input	2.5 Max	Kilowatts
Grid-No. 2 Input	25 Max	Watts
Plate Dissipation	1.5 Max	Kilowatts
Grid-No. 1 Dissipation	16 Max	Watts
Typical Operation - Grounded-grid Circuit up to 900 Megacycles		
Band Width 6 Megacycles		
D-c Plate Voltage	3500	Volts
D-c Grid-No. 2 Voltage	500	Volts
D-c Grid-No. 1 Voltage	-40	Volts
Peak R-f Plate Voltage		
Synchronizing Level	2500	Volts
Pedestal Level	1875	Volts
Peak R-f Grid Voltage		
Synchronizing Level	110	Volts
Pedestal Level	70	Volts
D-c Plate Current		
Synchronizing Level	0.520	Ampere
Pedestal Level	0.360	Ampere
D-c Grid-No. 2 Current (Pedestal Level)	0.035	Ampere
D-c Grid-No. 1 Current		
Synchronizing Level	0.110	Ampere
Pedestal Level	0.035	Ampere
Driving Power at Tube, approximate		
Synchronizing Level	100	Watts
Pedestal Level	25	Watts
Power Output, approximate		
Synchronizing Level◊	1000	Watts
Pedestal Level◊	560	Watts

Radio-frequency Power Amplifier and Oscillator - Class C Telegraphy
Key-down conditions per tube without amplitude modulation$^{\pi}$

Maximum Ratings, Absolute Values		
D-c Plate Voltage	4000 Max	Volts
D-c Grid-No. 2 Voltage	600 Max	Volts
D-c Grid-No. 1 Voltage	-150 Max	Volts
D-c Plate Current	0.7 Max	Ampere
D-c Grid-No. 1 Current	0.10 Max	Ampere
Plate Input	2.5 Max	Kilowatts
Grid-No. 2 Input	25 Max	Watts
Plate Dissipation	1.5 Max	Kilowatts
Grid-No. 1 Dissipation	16 Max	Watts
Typical Operation		
D-c Plate Voltage	4000	Volts
D-c Grid-No. 2 Voltage	600	Volts
D-c Grid-No. 1 Voltage	-120	Volts

Radio-frequency Power Amplifier and Oscillator - Class C Telegraphy
Key-down conditions per tube without amplitude modulation$^{\pi}$ (Cont'd)

Typical Operation (Cont'd)		
Peak R-f Plate Voltage, approximate	2750	Volts
Peak R-f Grid-No. 1 Voltage	195	Volts
D-c Plate Current	0.550	Ampere
D-c Grid-No. 2 Current	0.035	Ampere
D-c Grid-No. 1 Current, approximate	0.065	Ampere
Driving Power, approximate	150	Watts
Power Output, approximate$^{\Delta}$	1200	Watts

* The cathode of the GL-6183, because of transit-time effects which raise the temperature of the cathode is subjected to considerable back bombardment in ultra-high-frequency service. The amount of heating due to bombardment is a function of the operating conditions and frequency, and must be compensated for by a reduction of the heater input to prevent overheating of the cathode with resulting short life. For long life, the GL-6183 should be put in operation with rated heater voltage. After the circuit has been adjusted for proper tube operation, the heater voltage should be reduced to a value slightly above that at which circuit performance is affected. At a frequency of 900 megacycles and with typical operating conditions the heater voltage can be reduced to approximately 5 volts. At lower frequencies, the reduction will be less. Minor circuit readjustment may be necessary after this adjustment.

† Represents maximum useable cathode current (plate current plus current to each grid) for any condition of operation.

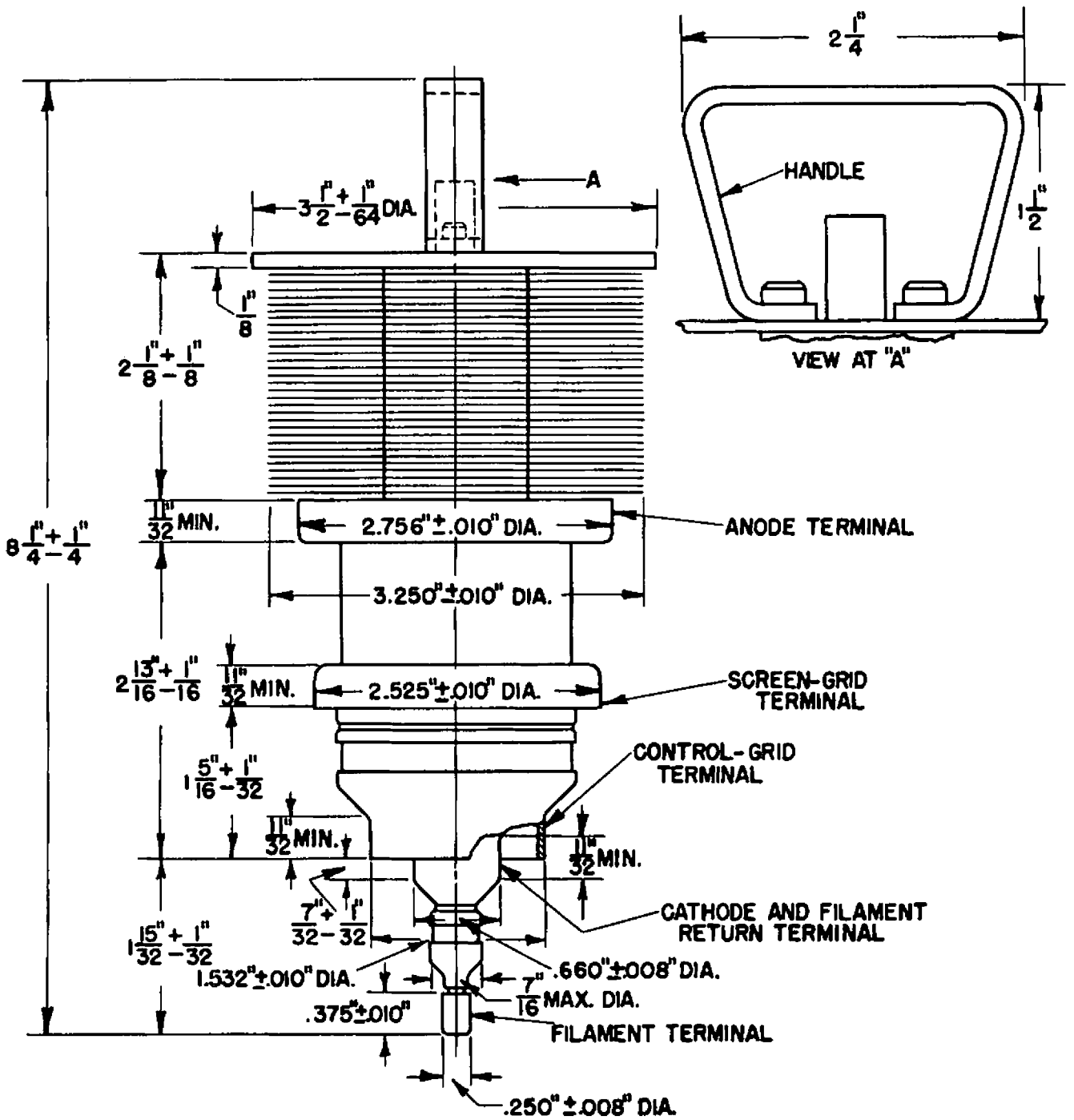
‡ Measured with a 6-inch diameter flat metal disk attached to the screen-grid ring. Control grid connected to the screen grid.

§ Output capacitance measured between anode and screen grid. Control grid connected directly to screen grid.

◊ Useful power output including power transferred from driver stage.

π Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 percent of the carrier conditions.

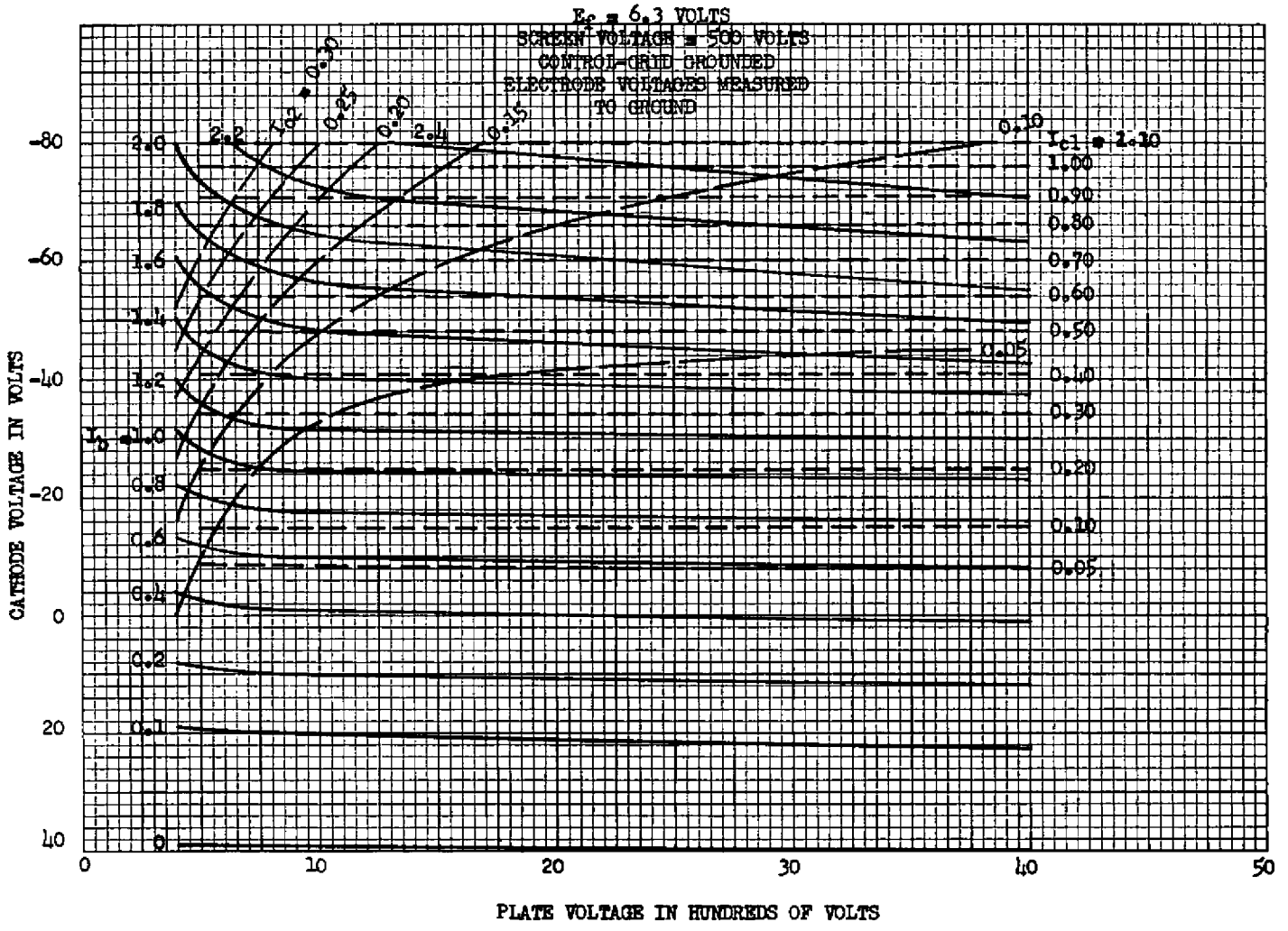
Δ Total anode power output including power transferred from driver stage.



K-69087-72A475

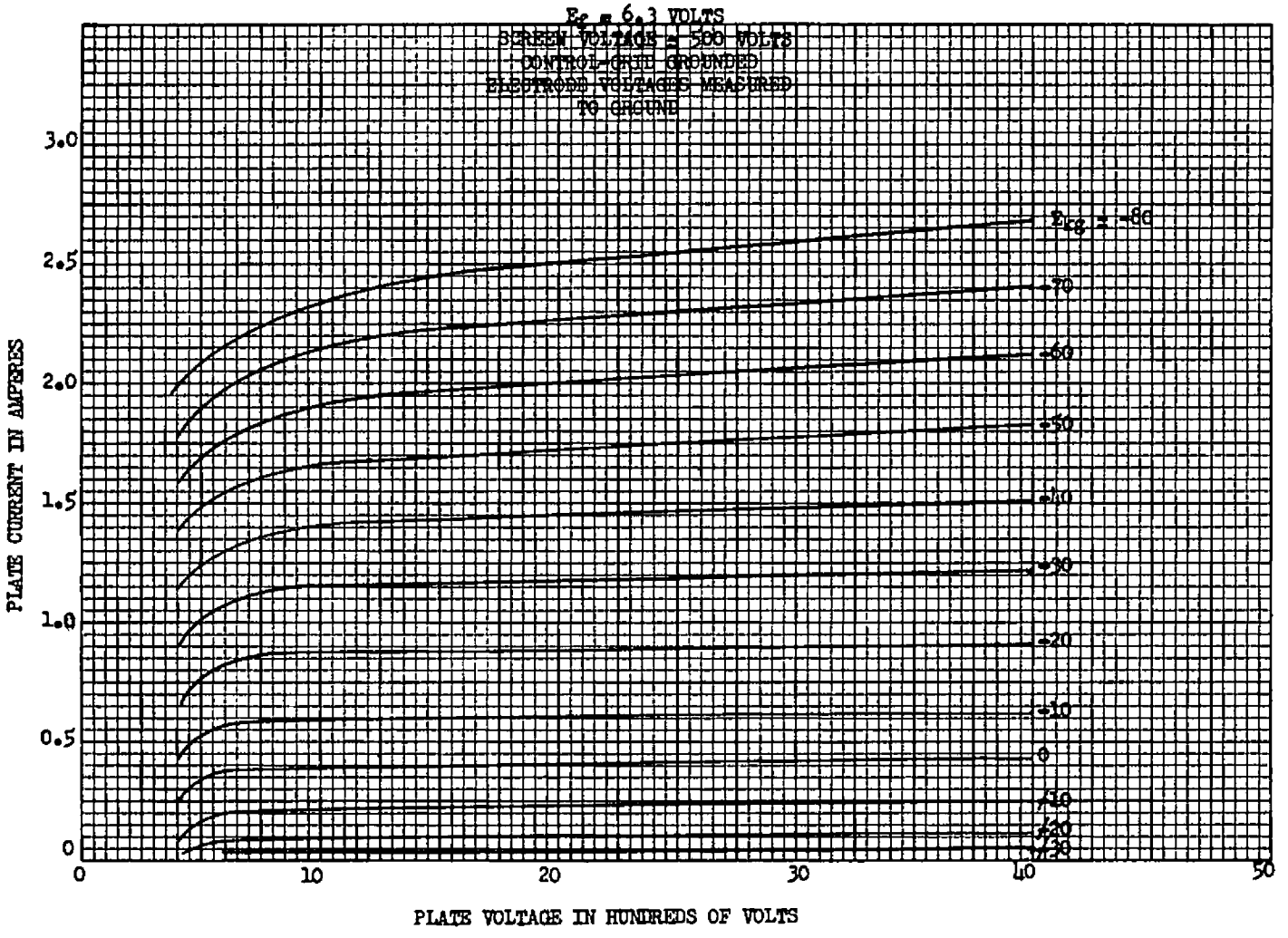
February 21, 1952

Outline
GL-6183



K-69087-72A458 February 21, 1952

GL-6183
Constant-current Characteristics



K-69087-72A464

February 21, 1952

GL-6183
Average Plate Characteristics

GENERAL ELECTRIC

ELECTRONICS DIVISION, TUBE DEPARTMENT

SCHENECTADY, NEW YORK

As Registered	As Proposed
Typical Operation - Grounded-grid Circuit up to 900 Megacycles Band Width 6 Megacycles	Typical Operation - Grounded-grid Circuit up to 900 Megacycles Bandwidth 6 Megacycles
Peak R-f Grid Voltage	Peak R-f Driving Voltage

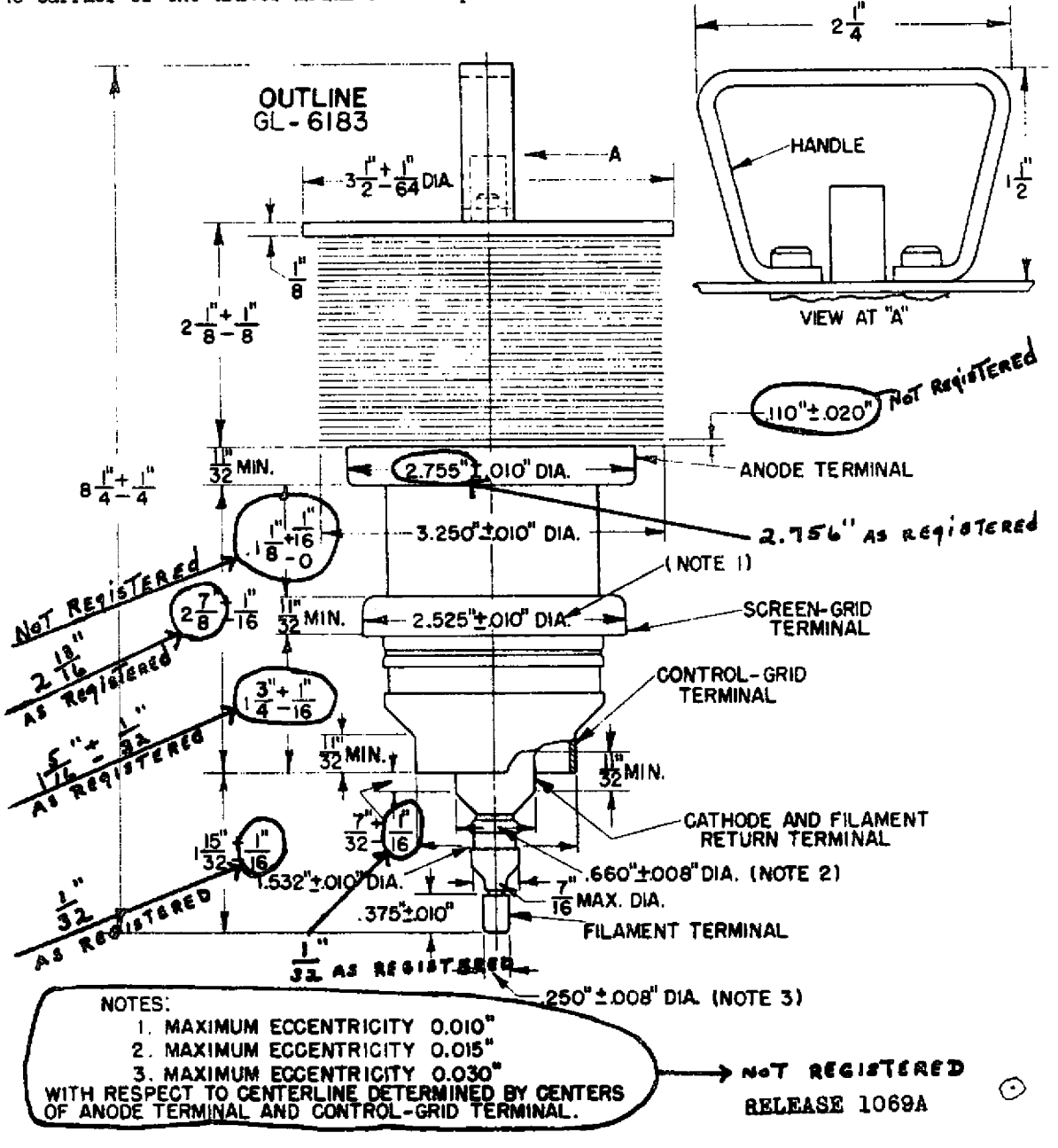
Addition of new service:

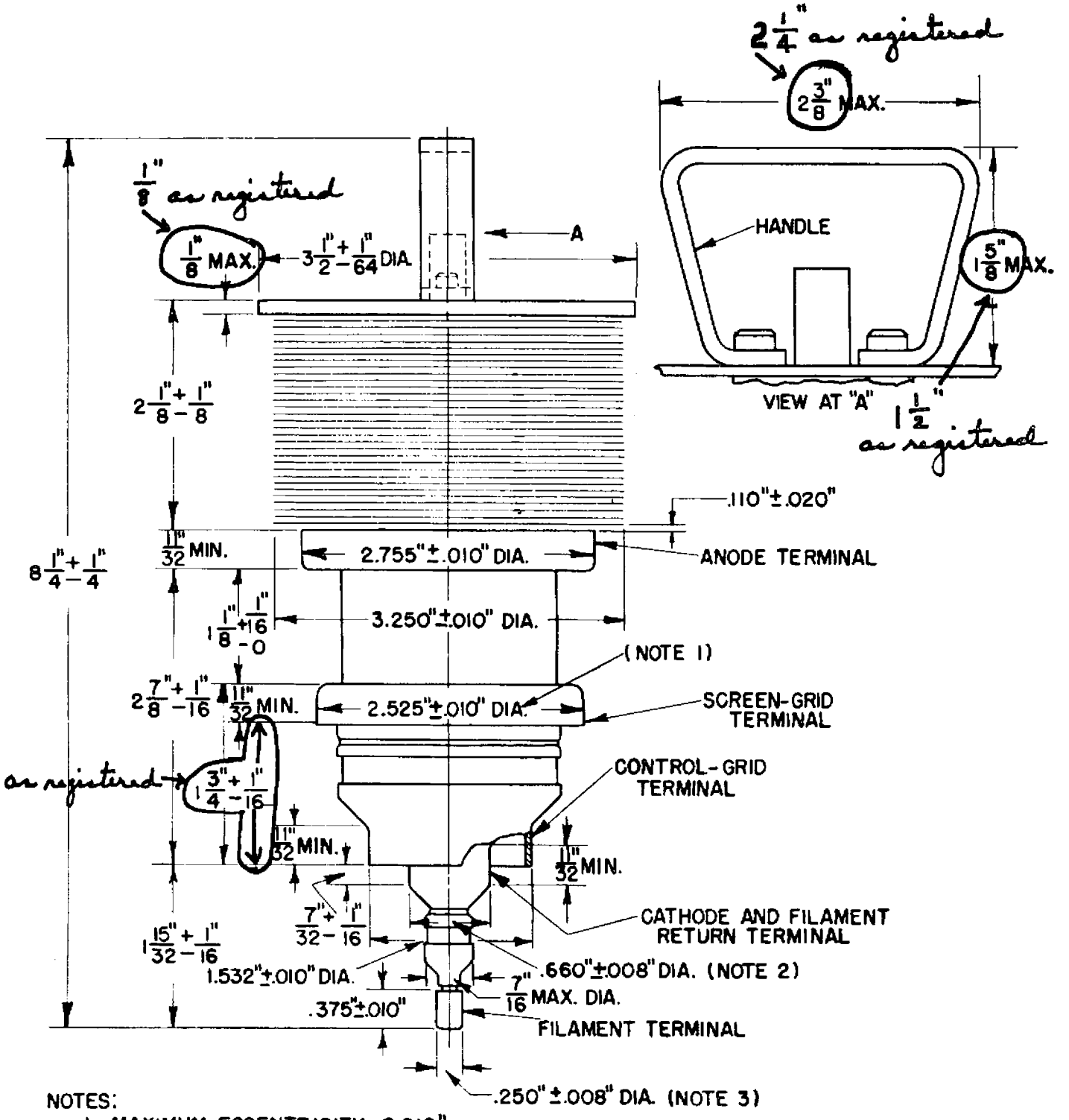
Plate-modulated Radio-frequency Power Amplifier - Class C Telephony
Carrier Conditions with a Maximum Modulation Factor of 1.0

Maximum Ratings, Absolute Values		
D-c Plate Voltage	3200 Max	Volts
D-c Grid-No. 2 Voltage	600 Max	Volts
D-c Grid-No. 1 Voltage	-120 Max	Volts
D-c Plate Current	0.35 Max	Ampere
D-c Grid-No. 1 Current	0.10 Max	Ampere
Plate Input	1.12 Max	Kilowatts
Grid-No. 2 Input	10 Max	Watts
Plate Dissipation	1200 Max	Watts

Typical Operation, Grounded-grid Circuit		
D-c Plate Voltage	3000	Volts
D-c Grid-No. 2 Voltage	500	Volts
D-c Grid-No. 1 Voltage	-100	Volts
Peak R-f Plate Voltage	2300	Volts
Peak R-f Driving Voltage	137	Volts
D-c Plate Current	0.25	Ampere
D-c Grid-No. 2 Current	0.01	Ampere
D-c Grid-No. 1 Current, approx.	0.047	Ampere
Driving Power, approximate #	38	Watts
Power Output	565	Watts

The carrier of the driver modulated 100 percent.



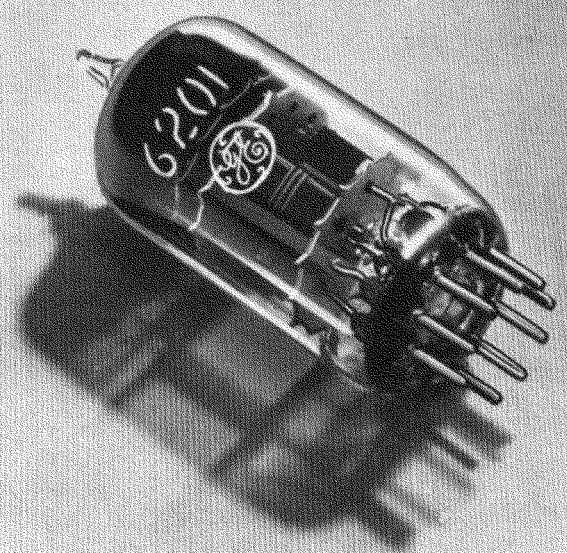


NOTES:

1. MAXIMUM ECCENTRICITY 0.010"
2. MAXIMUM ECCENTRICITY 0.015"
3. MAXIMUM ECCENTRICITY 0.030"

WITH RESPECT TO CENTERLINE DETERMINED BY CENTERS OF ANODE TERMINAL AND CONTROL-GRID TERMINAL.

OUTLINE
GL-6183



TWIN TRIODE

DESCRIPTION

The GL-6201 is a miniature twin triode designed for use as a grounded-grid amplifier or as a frequency converter in very-high-frequency applications. The tube is specially designed to assure dependable life and reliable service under the exacting conditions encountered in mobile and aircraft applications. Features include a high degree of mechanical strength and a heater-cathode construction designed to withstand many-thousand cycles of intermittent operation.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode—Coated Unipotential		
Heater Voltage (A-c or D-c)	6.3	12.6 Volts
Heater Current	0.3	0.15 Ampere
Direct Interelectrode Capacitances	**With Shield***	**Without Shield**
Grid to Plate (Each Section)	1.6	1.6 uuf
Input (Each Section)	2.5	2.3 uuf
Output (Section 1)	1.2	0.4 uuf
Output (Section 2)	1.3	0.38 uuf
Heater to Cathode (Each Section)	2.8	2.8 uuf
Grounded-Grid Operation	**With Shield†**	**Without Shield**
Plate to Cathode (Section 1)	0.18	0.2 uuf
Plate to Cathode (Section 2)	0.2	0.24 uuf
Input (Each Section)	5.0	5.0 uuf
Output (Section 1)	2.7	1.9 uuf
Output (Section 2)	2.7	1.8 uuf

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical Data

Mounting Position—Any
Envelope—T-6½ Glass
Base—Small Button 9-Pin, E9-1

MAXIMUM RATINGS

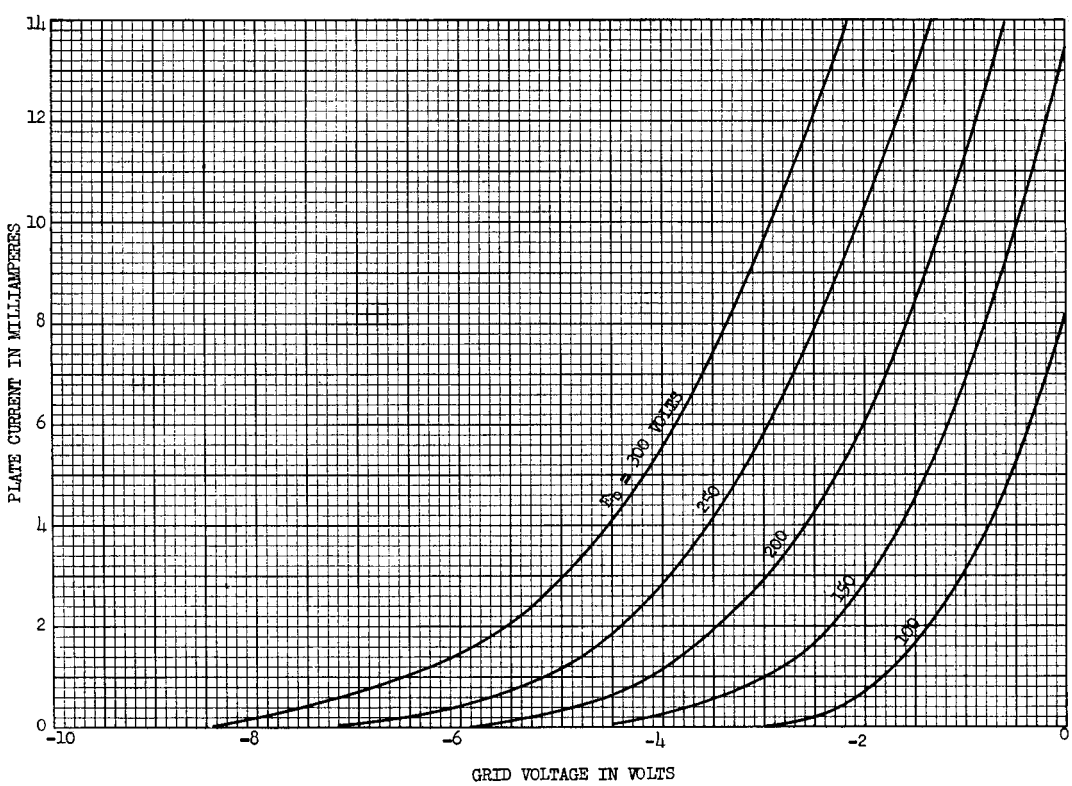
Electrical—Design Center Values—Each Section		
Plate Voltage	300	Volts
Negative D-c Grid Voltage	50	Volts
Plate Dissipation	2.5	Watts
Heater-Cathode Voltage	90	Volts
Mechanical		
Peak Impact Acceleration in Any Direction	600	G

CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier—Each Section			
Plate Voltage	100	250	Volts
Cathode Bias Resistor	270	200	Ohms
Amplification Factor	57	60	
Plate Resistance, approximate	14,300	10,900	Ohms
Transconductance	4000	5500	Micromhos
Plate Current	3.3	10	Milliamperes
Grid Voltage, approximate for I_b = 10 Microamperes	−5	−12	Volts

* With external shield No. 315 connected to cathode of section under test.
† With external shield No. 315 connected to grid of section under test.

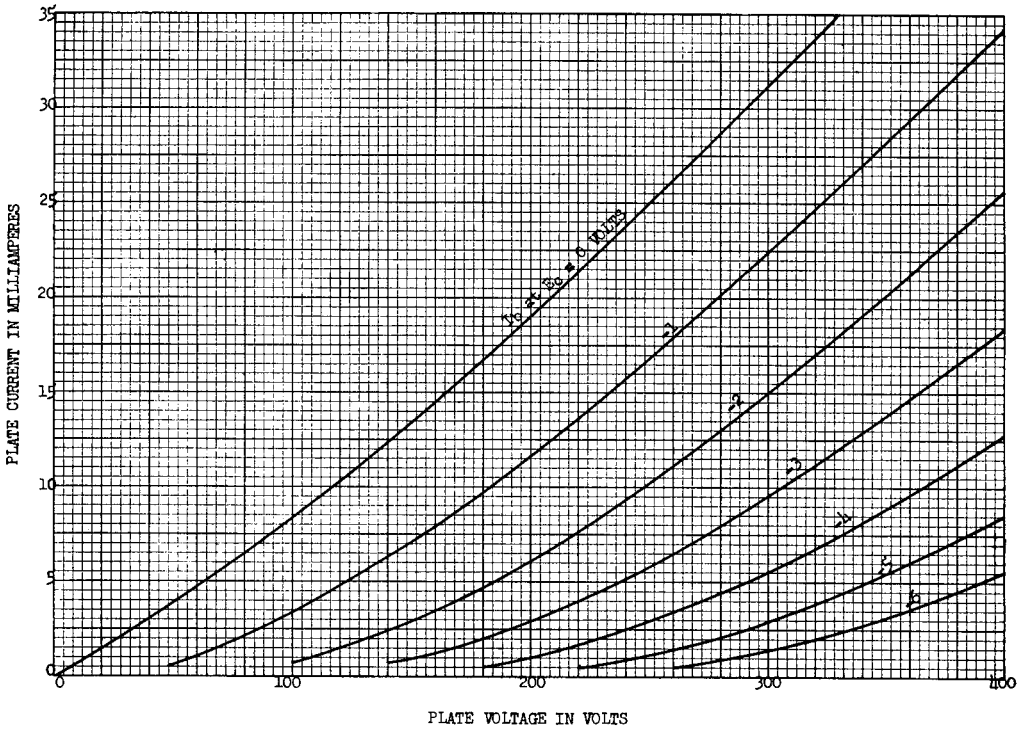
AVERAGE CHARACTERISTICS
(EACH SECTION)



K-69087-72A523

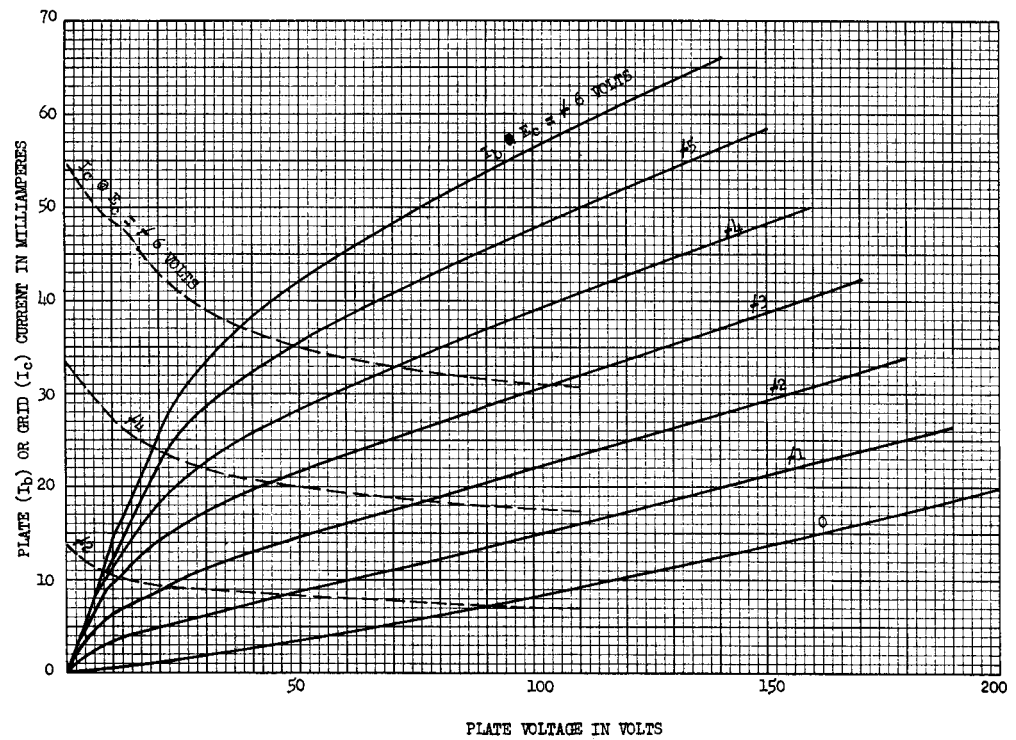
5-9-52

AVERAGE PLATE CHARACTERISTICS
(EACH SECTION)



K-69087-72A525 4-9-52

AVERAGE PLATE CHARACTERISTICS
(EACH SECTION)



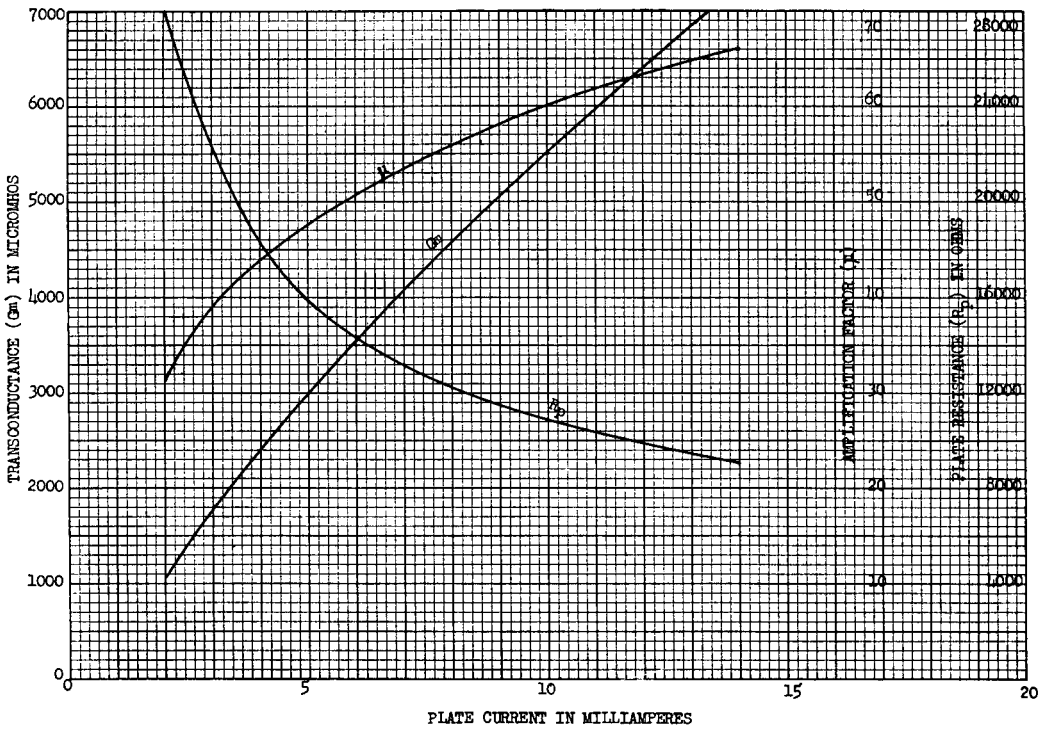
K-69087-72A526 4-9-52

★ ★ ★ ★ ★

GL-6201

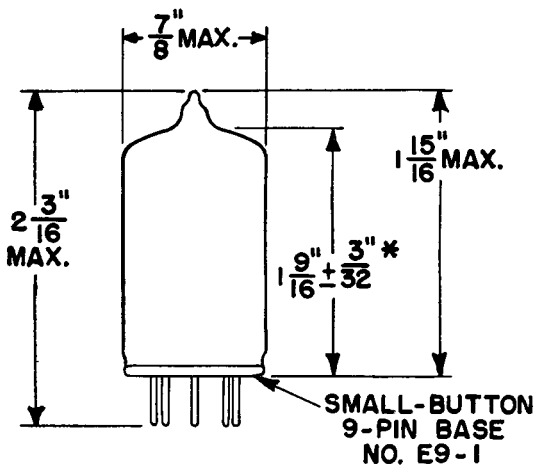
ETX-270
PAGE 4
6-52

AVERAGE CHARACTERISTICS
(EACH SECTION)
$E_f = 12.6$ VOLTS
PLATE VOLTAGE = 250 VOLTS

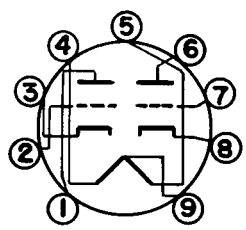


K-69087-72A524 4-9-52

OUTLINE



BASING DIAGRAM



9A

PIN 1: PLATE (SECTION NO. 2)
PIN 2: GRID (SECTION NO. 2)
PIN 3: CATHODE (SECTION NO. 2)
PIN 4: HEATER
PIN 5: HEATER
PIN 6: PLATE (SECTION NO. 1)
PIN 7: GRID (SECTION NO. 1)
PIN 8: CATHODE (SECTION NO. 1)
PIN 9: HEATER CENTER-TAP

*MEASURED FROM BASE SEAT TO BULB-TOP LINE AS DETERMINED BY RING GAGE OF 7/16" I.D.

N-15155AZ 4-3-52

Tube Department

GENERAL ELECTRIC

Schenectady, N. Y.

DESCRIPTION AND RATING

TWIN DIODE GL-6202

FIVE-STAR TUBE

★ ★ ★ ★ ★

The GL-6202 is a miniature full-wave high-vacuum rectifier intended for use in power supplies in which the d-c current requirements do not exceed 50 milliamperes. Within the limitations of its maximum ratings, the GL-6202 is a replacement for the 6X4.

The GL-6202 is specially designed to assure dependable life and reliable service under the exacting conditions encountered in mobile and aircraft applications. Features include a high degree of mechanical strength and a heater-cathode construction designed to withstand many-thousand cycles of intermittent operation. This tube may be used in applications which are subjected to altitudes as high as 60,000 feet.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Voltage (A-c or D-c)	6.3	Volts
Heater Current	0.6	Ampere

Mechanical

Mounting Position - Any
Envelope - T-5 1/2, Glass
Base - Miniature Button 7-pin, E7-1

MAXIMUM RATINGS

Electrical*, Design-center Values

Rectifier Service - Sinusoidal Supply Voltages, Frequency Range 25 to 1000 Cycles per Second

Peak Inverse Plate Voltage		
Altitudes up to 40,000 Feet†	1250	Volts
Altitudes from 40,000 to 60,000 Feet†	850	Volts
A-c Plate-supply Voltage, per Plate, RMS - See Rating Chart I‡		
Steady-state Peak Plate Current per Plate	200	Milliamperes
Transient Peak Plate Current per Plate, Maximum Duration 0.2 Second	1.45	Amperes
D-c Output Current - See Rating Chart I‡		
Heater-cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	450	Volts

Mechanical

Peak Impact Acceleration§	700	G
Bulb Temperature at Hottest Point (Absolute Maximum)	+165	C

CHARACTERISTICS AND TYPICAL OPERATION

Full-wave Rectifier, Altitudes up to 40,000 Feet

	Capacitor Input Filter	Choke Input Filter	
A-c Plate-supply Voltage per plate, RMS	325	450	Volts
Filter Input Capacitor	4	---	Microfarads
Filter Input Choke	---	8	Henrys
Total Plate-supply Resistance per plate	175	---	Ohms

GENERAL ELECTRIC

CHARACTERISTICS AND TYPICAL OPERATION (CONT'D)

Full-wave Rectifier, Altitudes up to 40,000 Feet

	Capacitor Input Filter	Choke Input Filter	
D-c Output Current	50	50	Milliamperes
D-c Output Voltage at Filter Input	365	375	Volts
Tube Voltage Drop Measured with Applied D-c at 50 Milliamperes per Plate		22	Volts

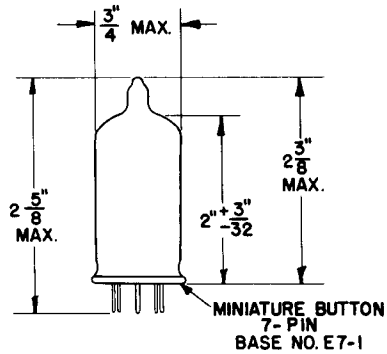
* To simplify the application of the maximum ratings to circuit design, the electrical design-center maximum ratings are also presented in chart form as Rating Charts I, II, and III. Rating Chart I presents the maximum ratings for a-c plate-supply voltage and d-c output current. Rating Chart II provides a convenient method for checking conformance with the maximum steady-state peak plate current rating. Rating Chart III offers a convenient method for checking conformance with the maximum transient peak plate current rating.

With a capacitor-input filter, the conditions of each of Rating Charts I, II, and III must be satisfied in order to obtain performance within all of the appropriate electrical maximum ratings. With a choke-input filter, operation within the indicated boundary of Rating Chart I will assure performance within all of the appropriate electrical maximum ratings.

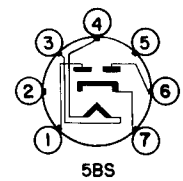
† The altitude ratings as presented refer to the limitations of the tube itself. Because the socket employed can become the limiting factor in high-altitude operation, consideration must be given to the voltage-breakdown capabilities of the tube and socket combination employed.

‡ The maximum ratings for a-c plate supply voltage and d-c output current are interrelated and are also dependent on whether a choke or capacitor-input filter is employed. This relationship is shown in Rating Chart I. With a capacitor-input filter, the operating point of d-c output current and a-c supply voltage must fall within the curve FAEDG. With a choke-input filter, the operating point must fall within the curve FABCDG.

§ Forces in any direction as applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.



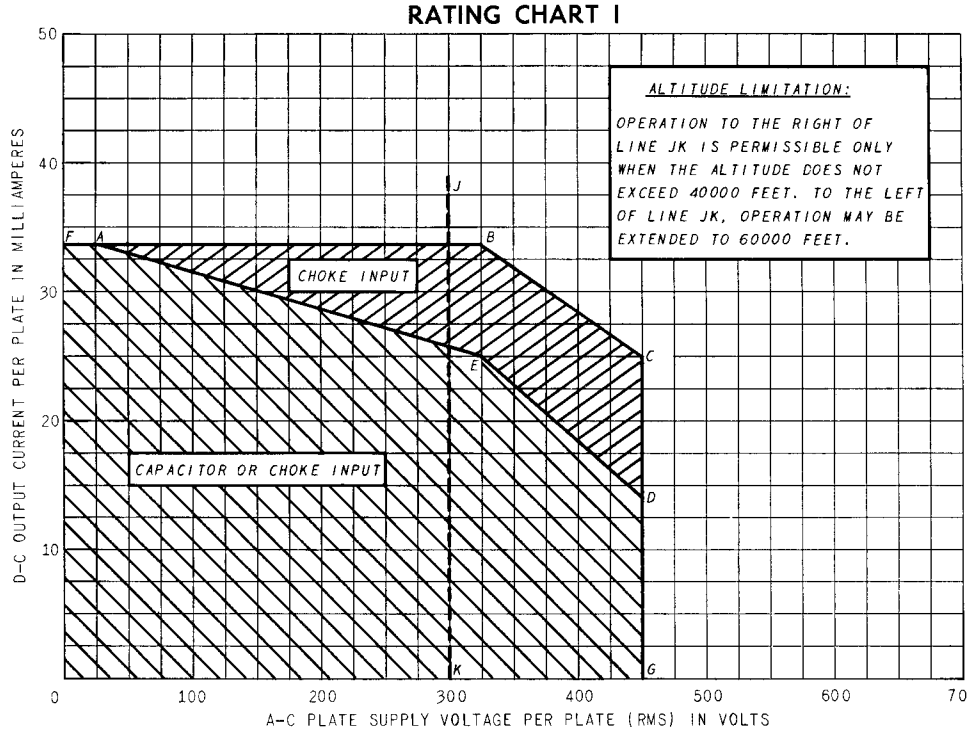
BASING DIAGRAM



5BS

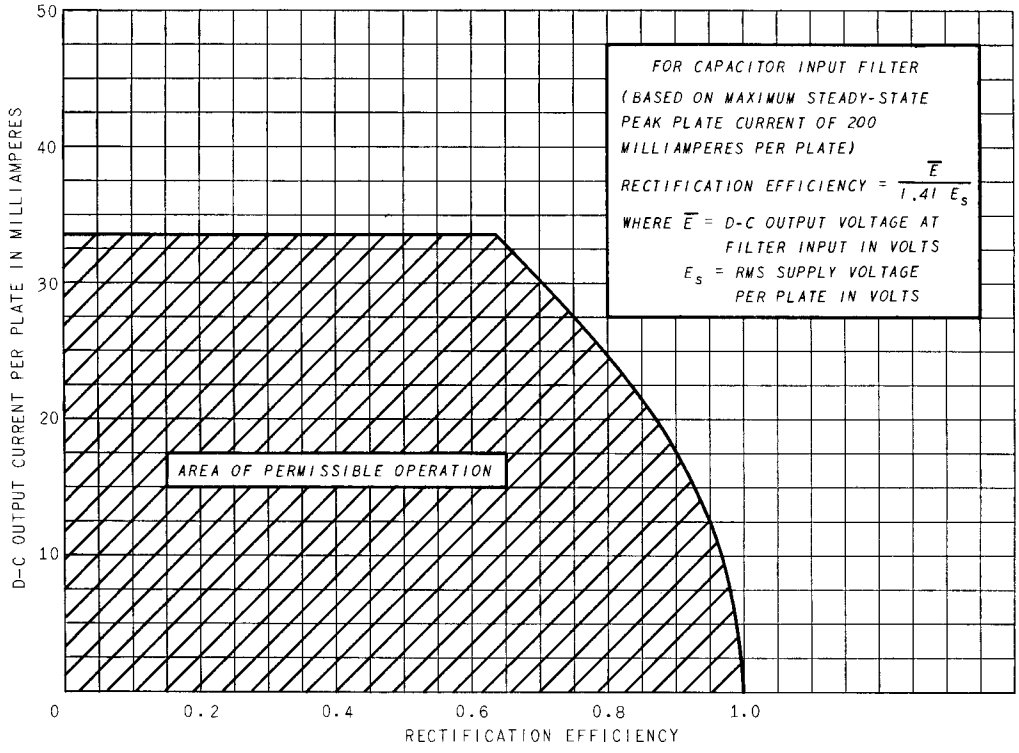
PIN 1: PLATE NUMBER 2
PIN 2: NO CONNECTION
PIN 3: HEATER
PIN 4: HEATER
PIN 5: NO CONNECTION
PIN 6: PLATE NUMBER 1
PIN 7: CATHODE

RATING CHART I



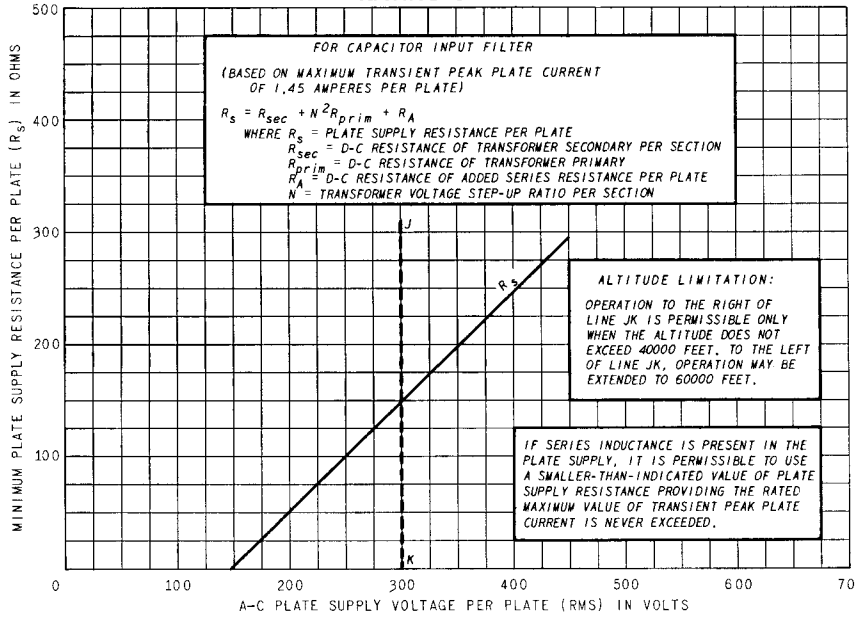
February 12, 1953

RATING CHART II



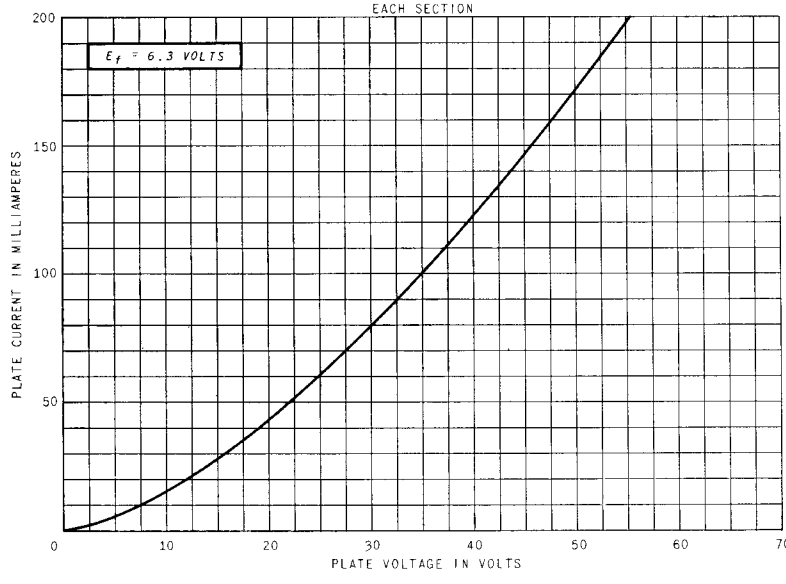
February 12, 1953

RATING CHART III



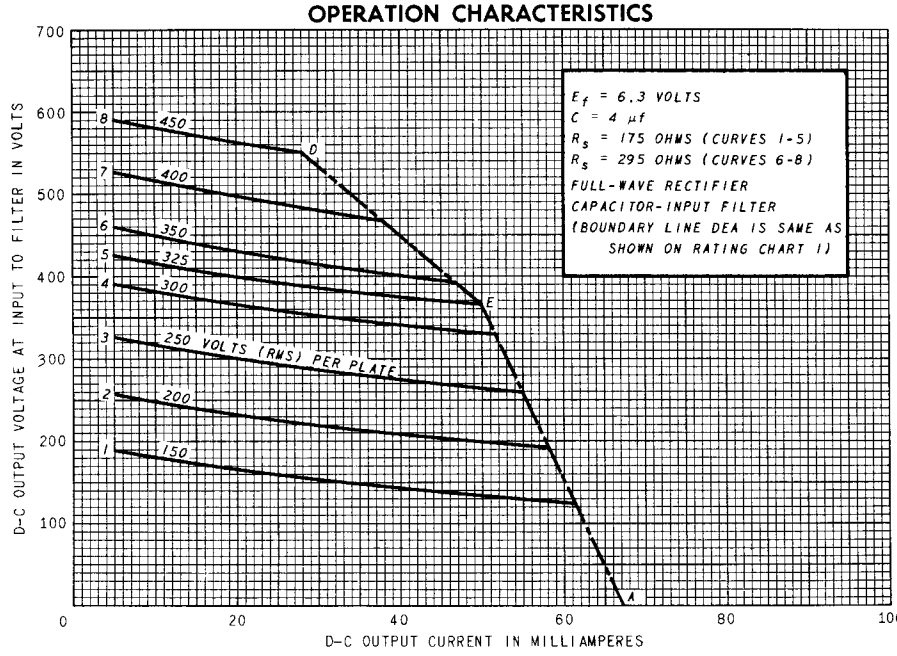
February 12, 1953

AVERAGE PLATE CHARACTERISTICS



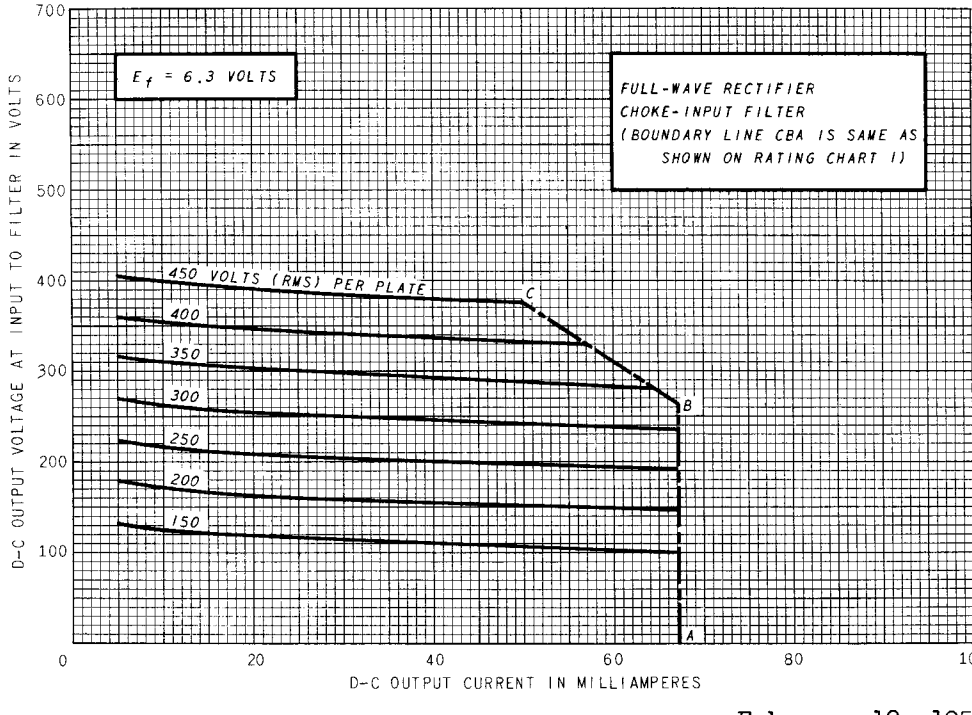
February 12, 1953

OPERATION CHARACTERISTICS



February 12, 1953

OPERATION CHARACTERISTICS



February 12, 1953

TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

4-53 (5M)

PRINTED IN U.S.A.

DESCRIPTION AND RATING

TWIN DIODE GL-6203

FIVE-STAR TUBE

★ ★ ★ ★ ★

The GL-6203 is a miniature full-wave high-vacuum rectifier intended for use in power supplies of a-c and storage-battery-operated equipment. The tube is specially designed to assure dependable life and reliable service under the exacting conditions encountered in mobile and aircraft applications. Features include a high degree of mechanical strength and a heater-cathode construction designed to withstand many-thousand cycles of intermittent operation. This tube may be used in applications which are subjected to altitudes as high as 60,000 feet.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Voltage (A-c or D-c)	6.3	Volts
Heater Current	0.9	Ampere

Mechanical

Mounting Position - Any
Envelope - T-6 1/2, Glass
Base - Small Button 9-pin, E9-1

MAXIMUM RATINGS

Electrical*, Design-center Values

Rectifier Service - Sinusoidal Supply Voltages, Frequency Range 25 to 1000 Cycles per Second

Peak Inverse Plate Voltage		
Altitudes up to 60,000 Feet†	1250	Volts
A-c Plate-supply Voltage per Plate, RMS - See Rating Chart I‡		
Steady-state Peak Plate Current per Plate	270	Milliamperes
Transient Peak Plate Current per Plate, Maximum Duration 0.2 Second	1.8	Amperes
D-c Output Current - See Rating Chart I‡		
Heater-cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	450	Volts

Mechanical

Peak Impact Acceleration§	700	G
Bulb Temperature at Hottest Point (Absolute Maximum)	+200	C

CHARACTERISTICS AND TYPICAL OPERATION

Full-wave Rectifier

	Capacitor Input Filter	Choke Input Filter	
A-c Plate-supply Voltage per Plate, RMS	325	450	Volts
Filter Input Capacitor	4	---	Microfarads
Filter Input Choke	---	8	Henrys
Total Plate-supply Resistance per Plate	150	---	Ohms
D-c Output Current	70	70	Milliamperes
D-c Output Voltage at Filter Input	355	375	Volts

Tube Voltage Drop

Measured with Applied D-c at 70 Milliamperes per Plate	22	Volts

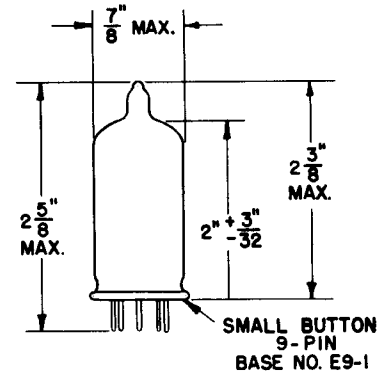
* To simplify the application of the maximum ratings to circuit design, the electrical design-center maximum ratings are also presented in chart form as Rating Charts I, II, and III. Rating Chart I presents the maximum ratings for a-c plate-supply voltage and d-c output current. Rating Chart II provides a convenient method for checking conformance with the maximum steady-state peak plate current rating. Rating Chart III offers a convenient method for checking conformance with the maximum transient peak plate current rating.

With a capacitor-input filter, the conditions of each of Rating Charts I, II, and III must be satisfied in order to obtain performance within all of the appropriate electrical maximum ratings. With a choke-input filter, operation within the indicated boundary of Rating Chart I will assure performance within all of the appropriate electrical maximum ratings.

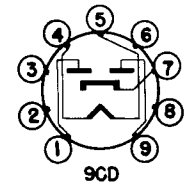
† The altitude ratings as presented refer to the limitations of the tube itself. Because the socket employed can become the limiting factor in high-altitude operation, consideration must be given to the voltage-breakdown capabilities of the tube and socket combination employed.

‡ The maximum ratings for a-c plate supply voltage and d-c output current are interrelated and are also dependent on whether a choke or capacitor-input filter is employed. This relationship is shown in Rating Chart I. With a capacitor-input filter, the operating point of d-c output current and a-c supply voltage must fall within the curve FAEDG. With a choke-input filter, the operating point must fall within the curve FABCDG.

§ Forces in any direction as applied by the Navy-type, Hign Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.



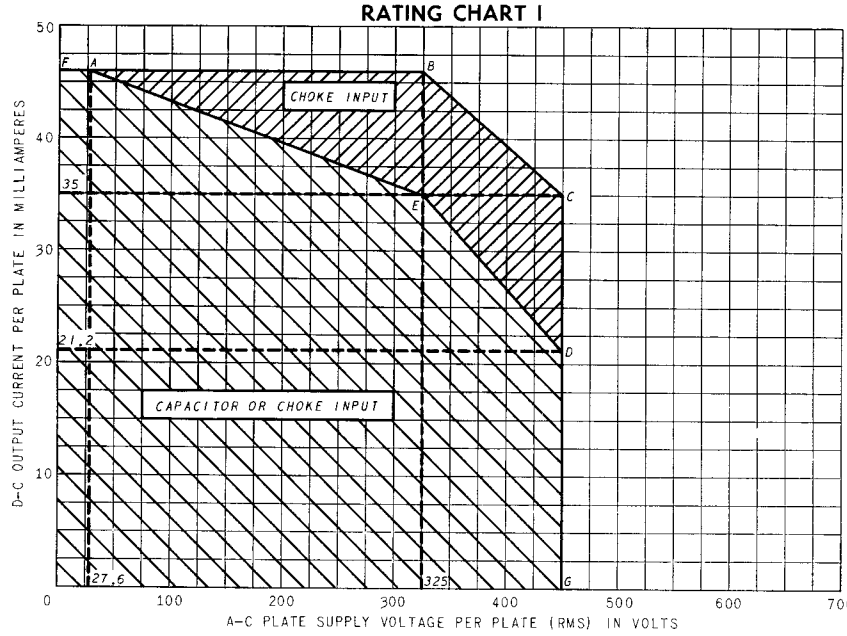
BASING DIAGRAM



9CD

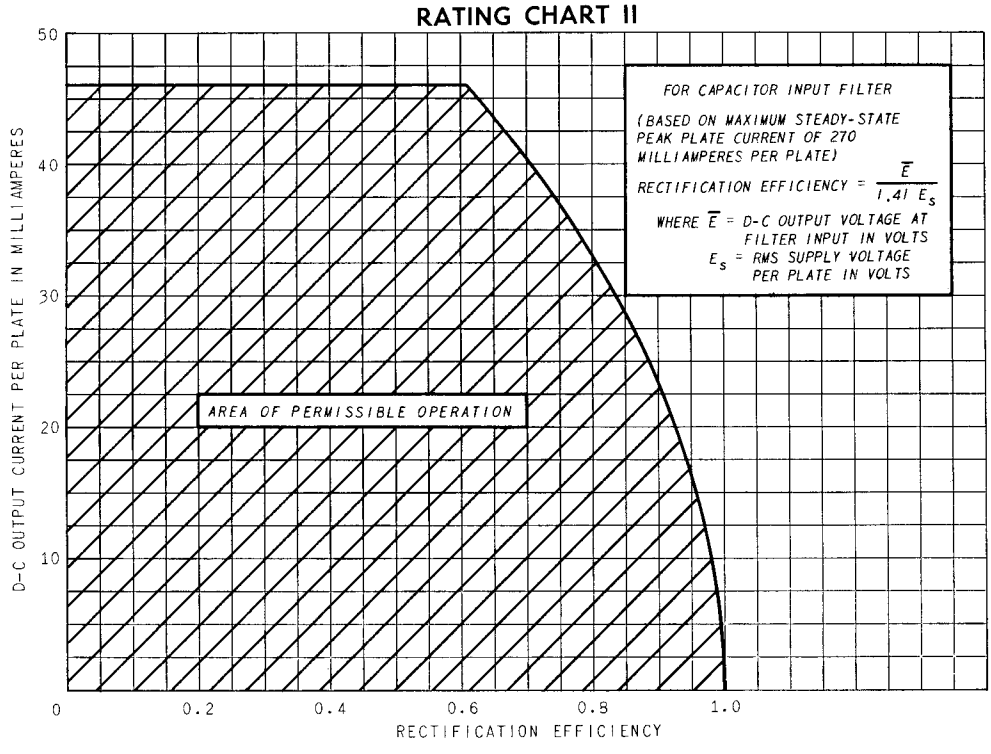
PIN 1: PLATE NUMBER 2
PIN 2: NO CONNECTION
PIN 3: NO CONNECTION
PIN 4: HEATER
PIN 5: HEATER
PIN 6: NO CONNECTION
PIN 7: CATHODE
PIN 8: NO CONNECTION
PIN 9: PLATE NUMBER 1

RATING CHART I



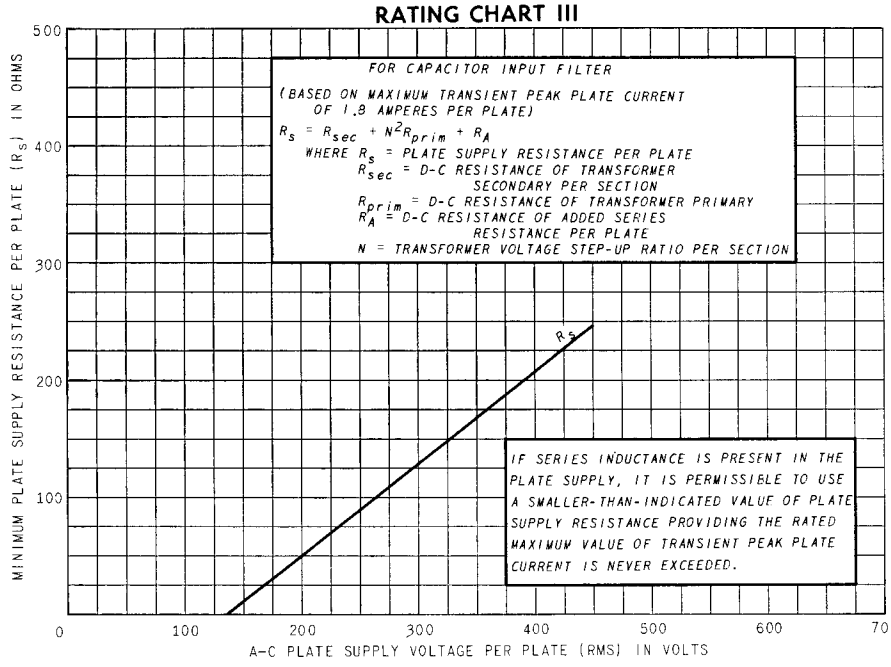
February 16, 1953

RATING CHART II



February 16, 1953

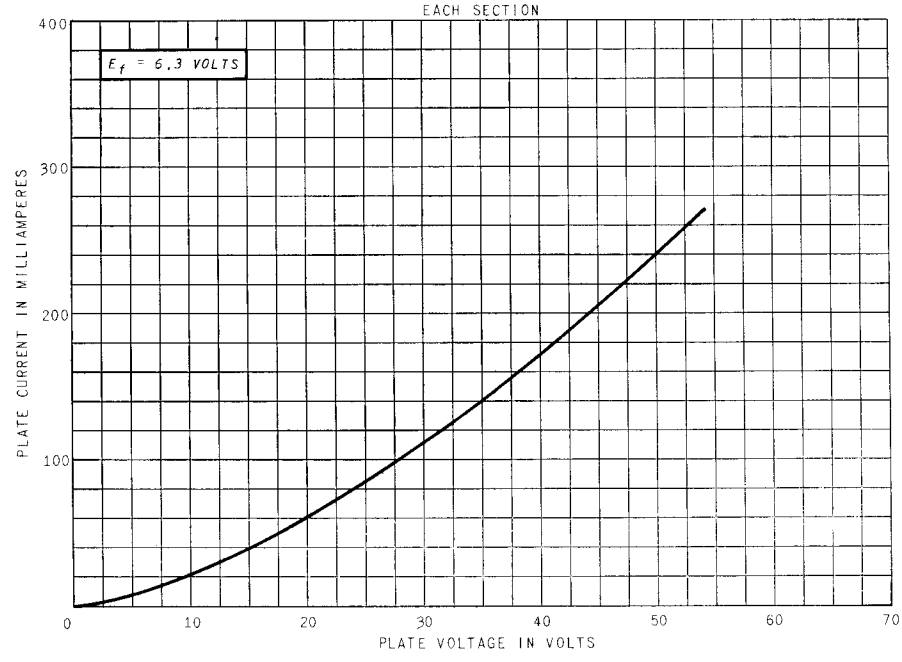
RATING CHART III



February 16, 1953

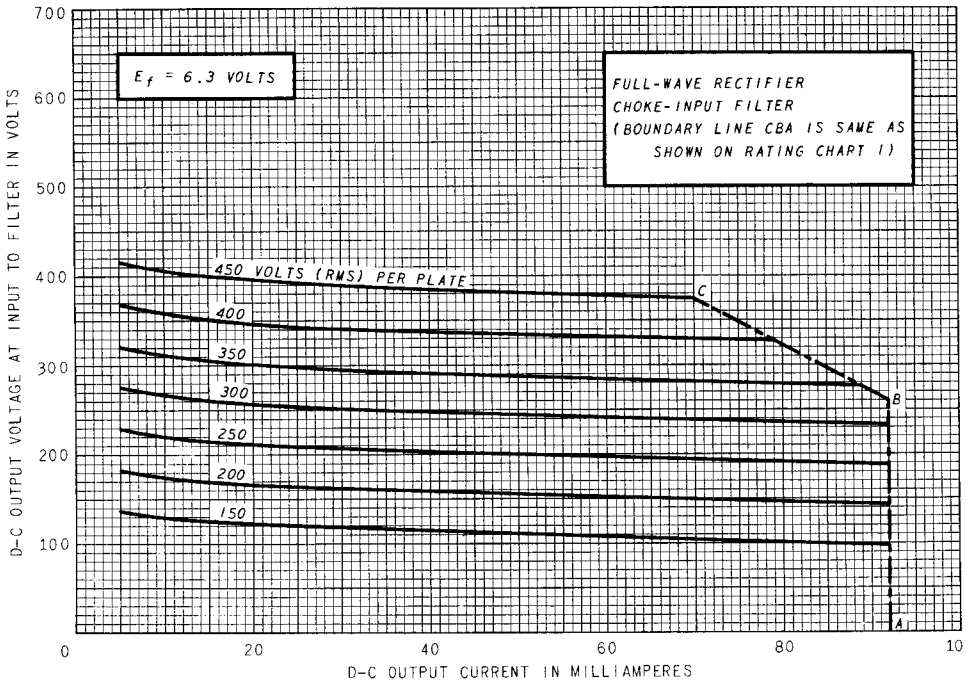
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



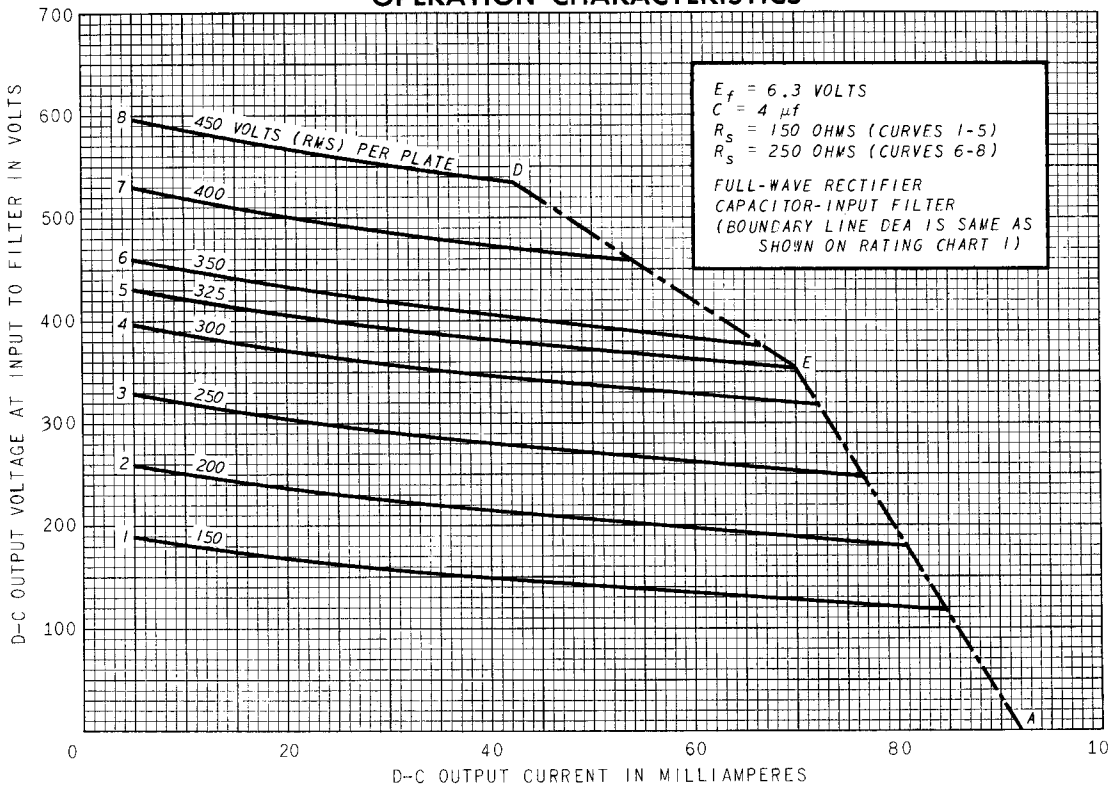
February 16, 1953

OPERATION CHARACTERISTICS



February 16, 1953

OPERATION CHARACTERISTICS



February 16, 1953

TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

4-53 (5M)

PRINTED IN U.S.A.

DESCRIPTION AND RATING

DIODE GL-6215

The GL-6215 is a half-wave high-vacuum rectifier designed for use in high-voltage low-current applications which operate from a 60-cycle supply voltage. The tube is particularly suited for dust precipitator and other industrial applications in which dependable performance is required.

TECHNICAL INFORMATION

GENERAL

Electrical Data

Cathode - Coated Filament

Filament Voltage (A-c or D-c)	1.25	Volts
Filament Current	0.2	Ampere
Direct Interelectrode Capacitance		
Plate to Filament	1.4	uuf

Mechanical Data

Mounting Position - Any
Envelope - T-9 Glass
Base - Short Intermediate-Shell Octal 6-Pin, B6-60

MAXIMUM RATINGS Design Center Values
Rectifier Service at 60 Cycles per Second

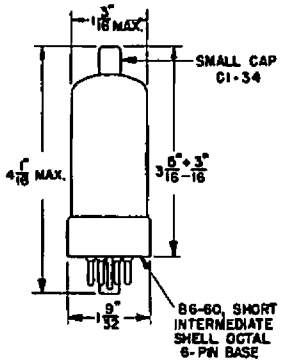
Peak Inverse Plate Voltage	18,000	Volts
Steady-State Peak Plate Current	8.0	Milliamperes
Transient Peak Plate Current (maximum duration 0.2 second)	30	Milliamperes
D-c Output Current	1.0	Milliampere

AVERAGE CHARACTERISTICS

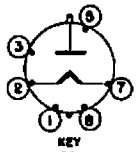
Tube Voltage Drop		
Measured With Applied D-c at 2 Milliamperes	56	Volts

Note: The voltages employed in some high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce soft x-rays which can constitute a health hazard unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

from RTMA release #1111, Aug. 1, 1952



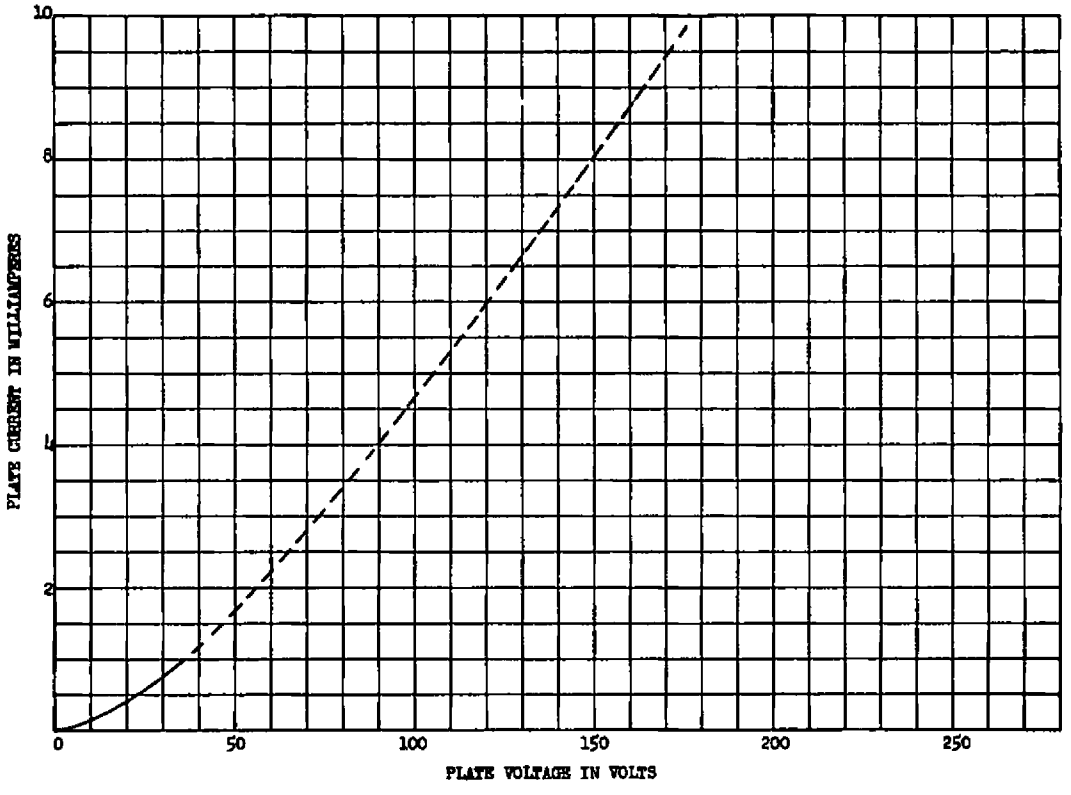
BASING DIAGRAM



PIN 1: INTERNAL CONNECTION-DO NOT USE
PIN 2: FILAMENT
PIN 3: INTERNAL CONNECTION-DO NOT USE
PIN 5: INTERNAL CONNECTION-DO NOT USE
PIN 7: FILAMENT AND INTERNAL SHIELD
PIN 8: INTERNAL CONNECTION- DO NOT USE
CAP : PLATE

K-69087-72A540 June 24, 1952

Outline
GL-6215



K-69087-72A541 June 24, 1952

GL-6215
Average Plate Characteristics
E_f = 1.25 Volts

GENERAL ELECTRIC

TUBE DEPARTMENT
SCHENECTADY, NEW YORK

DESCRIPTION AND RATING

IGNITRON GL-6228/506

The GL-6228/506 ignitron is a sealed, stainless-steel-jacketed, water-cooled mercury-pool tube designed primarily for use in electronic frequency changers. In this service, six tubes will rectify or invert up to 7500 kilowatts at 17,000 volts. The tube is also designed for use in intermittent-rectifier service, capacitor-discharge service, and as a d-c short-circuiting switch.

TECHNICAL INFORMATION

GENERAL

Electrical

Type Cathode Excitation - Cyclic		
Type Cathode-Spot Starting - Ignitor		
Number of Electrodes		
Main Anodes	1	
Main Cathode	1	
Ignitors	3	
Auxiliary Anodes	2	
Shield Grids	1	
Control Grids	1	
Gradient Grids	1	
Arc Drop		
At 600 Amperes Peak	20 ± 2	Volts
At 2000 Amperes Peak	30 ± 2	Volts
Cathode-Excitation Requirements		
See specific class of service		
Grid-Excitation Requirements		
See specific class of service		

Mechanical

Envelope Material - Metal		
Net Weight	100 ± 10	Pounds
Type of Cooling - Water		
Characteristics for Water Cooling		
Water Temperature Rise	4	C
Pressure Drop at 5 Gallons per Minute, maximum	4	Pounds per Square Inch
Inlet Water Temperature, minimum	35	C
Outlet Water Temperature, maximum	45	C
Water Flow, minimum	5	Gallons per Minute
Recommended Temperature Range	40 to 45	C

MAXIMUM RATINGS

Power-Rectifier Service ASA (See ASA Standards 2.103)	Minimum	Maximum	
Peak Anode Voltage			
Inverse	---	20,000	Volts
Forward	---	20,000	Volts

from RTMA release #1136,
Nov. 28, 1952

GENERAL ELECTRIC

Power-Rectifier Service ASA (See ASA Standards 2.103) (Cont'd)	Minimum	Maximum	
Anode Current *			
Peak	---	900	Amperes
Average			
Continuous	---	150	Amperes
2 Hours	---	200	Amperes
1 Minute	---	300	Amperes
Fault	---	6,000	Amperes
Duration of Fault Current ‡		0.15	Second
Peak Control-Grid Voltage			
Forward	200	500	Volts
Inverse	100	200	Volts
Peak Shield-Grid Voltage			
Forward	200	500	Volts
Inverse	50	200	Volts
Peak Control-Grid Current			
Forward	---	5	Amperes
Inverse	---	0.4	Amperes
Peak Shield-Grid Current			
Forward	---	5	Amperes
Inverse	---	0.2	Amperes
Peak Gradient-Grid Voltage			
Forward	1/2	1/2	Anode-Cathode Voltage
Inverse	1/2	1/2	Anode-Cathode Voltage
Peak Gradient-Grid Current			
Forward	0.010	0.020	Amperes
Inverse	0.010	0.020	Amperes
Ignitor Ratings			
Peak Ignitor Voltage			
Forward, Open-Circuit Voltage	450	750	Volts
Inverse	0	5	Volts
Width of Current Pulse, Sinusoidal Waveshape			
At 60 Cycles	500	1500	Microseconds
At 25 Cycles	500	4000	Microseconds
Peak Ignitor Current, Short-Circuit Current	45	75	Amperes
Auxiliary Anode Ratings			
Available Instantaneous Auxiliary Anode Voltage During Desired Conduction Period	40	---	Volts
Peak Auxiliary-Anode Voltage			
Forward	---	200	Volts
Inverse	---	25	Volts
Peak Auxiliary-Anode Current			
Forward	---	20	Amperes
Inverse	---	0.100	Amperes
Average	---	5	Amperes
RMS	---	10	Amperes
Minimum Forward Current During Desired Conduction Period	7	---	Amperes
Continuous Duty, No Overloads			
Peak Anode Voltage			
Inverse	---	20,000	Volts
Forward	---	20,000	Volts
Anode Current *			
Peak	---	600	Amperes
Average	---	200	Amperes

Power-Rectifier Service	Minimum	Maximum	
Continuous Duty, No Overloads (Cont'd)			
Anode Current* (Cont'd)			
Fault	---	6,000	Amperes
Duration of Fault Current ‡	---	0.15	Second
Product of Inverse or Forward Voltage and Average Current	---	3	Megavolt-Amperes
Peak Control-Grid Voltage			
Forward	200	500	Volts
Inverse	100	200	Volts
Peak Shield-Grid Voltage			
Forward	200	500	Volts
Inverse	50	200	Volts
Peak Control-Grid Current			
Forward	---	5	Amperes
Inverse	---	0.4	Amperes
Peak Shield-Grid Current			
Forward	---	5	Amperes
Inverse	---	0.2	Amperes
Peak Gradient-Grid Voltage			
Forward	1/2	1/2	Anode-Cathode Voltage
Inverse	1/2	1/2	Anode-Cathode Voltage
Peak Gradient-Grid Current			
Forward	0.010	0.020	Amperes
Inverse	0.010	0.020	Amperes
Ignitor Ratings			
Peak Ignitor Voltage			
Forward	450	750	Volts
Inverse	0	5	Volts
Width of Current Pulse, Sinusoidal Waveshape	500	---	Microseconds
At 60 Cycles	---	1500	Microseconds
At 25 Cycles	---	9000	Microseconds
Peak Ignitor Current	45	75	Amperes
Auxiliary Anode Ratings			
Available Instantaneous Auxiliary Anode Voltage During Desired Conduction Period	40	---	Volts
Peak Auxiliary-Anode Voltage			
Forward	---	200	Volts
Inverse	---	25	Volts
Peak Auxiliary-Anode Current			
Forward	---	20	Amperes
Inverse	---	0.100	Amperes
Average	---	5	Amperes
RMS	---	10	Amperes
Minimum Forward Current During Desired Conduction Period	7	---	Amperes
Intermittent Duty †			
Peak Anode Voltage			
Inverse	---	20,000	Volts
Forward	---	20,000	Volts
Anode Current*			
Peak	---	1500	Amperes
Average	---	150	Amperes
Averaging Time	---	0.15	Second
RMS	---	500	Amperes
Averaging Time	---	0.15	Second

Power-Rectifier Service	Minimum	Maximum	
Intermittent Duty † (Cont'd)			
Anode Current* (Cont'd)			
Fault	---	6,000	Amperes
Duration of Fault Current ‡	---	0.15	Second
Product of Inverse or Forward Voltage and Peak Anode Current	---	22.5	Megavolt-Amperes
Peak Control-Grid Voltage			
Forward	200	500	Volts
Inverse	100	200	Volts
Peak Shield-Grid Voltage			
Forward	200	500	Volts
Inverse	50	200	Volts
Peak Control-Grid Current			
Forward	---	5	Amperes
Inverse	---	0.4	Amperes
Peak Shield-Grid Current			
Forward	---	5	Amperes
Inverse	---	0.2	Amperes
Peak Gradient-Grid Voltage			
Forward	1/2	1/2	Anode-Cathode Voltage
Inverse	1/2	1/2	Anode-Cathode Voltage
Peak Gradient-Grid Current			
Forward	0.010	0.020	Amperes
Inverse	0.010	0.020	Amperes
Ignitor Ratings			
Peak Ignitor Voltage			
Forward	450	750	Volts
Inverse	0	5	Volts
Width of Current Pulse, Sinusoidal Waveshape	500	---	Microseconds
At 60 Cycles	---	1500	Microseconds
At 25 Cycles	---	9000	Microseconds
Peak Ignitor Current	45	75	Amperes
Auxiliary Anode Ratings			
Available Instantaneous Auxiliary Anode Voltage During Desired Conduction Period	40	---	Volts
Peak Auxiliary-Anode Voltage			
Forward	---	200	Volts
Inverse	---	25	Volts
Peak Auxiliary-Anode Current			
Forward	---	20	Amperes
Inverse	---	0.100	Amperes
Average	---	5	Amperes
RMS	---	10	Amperes
Minimum Forward Current During Desired Conduction Period	7	---	Amperes

A-c Control or Capacitor-Discharge Service - Sinusoidal Current, Pulse Duty †

	Minimum	Maximum	
Peak Anode Voltage			
Inverse	---	20,000	Volts
Forward	---	20,000	Volts
Anode Current			
Peak	---	2,000	Amperes
Average	---	200	Amperes
Maximum Averaging Time - One conduction pulse plus one non-conducting period			
RMS	---	500	Amperes
Maximum Averaging Time - One conduction pulse plus one non-conducting period			

A-c Control or Capacitor-Discharge Service - Sinusoidal Current, Pulse Duty † (Cont'd)

	Minimum	Maximum	
Fault	---	2,000	Amperes
Duration of Fault Current	---	0.15	Second
Product of Inverse or Forward Voltage and Average Current	---	3	Megavolt-Amperes
Equivalent Frequency - 25 to 60 Cycles			
Above 60 Cycles Use Commutating Reactors			
Current At Start of Commutation Period	---	60	Amperes
Current At End of Commutation Period	---	0	Amperes
Length of Commutation Period	200	---	Microseconds

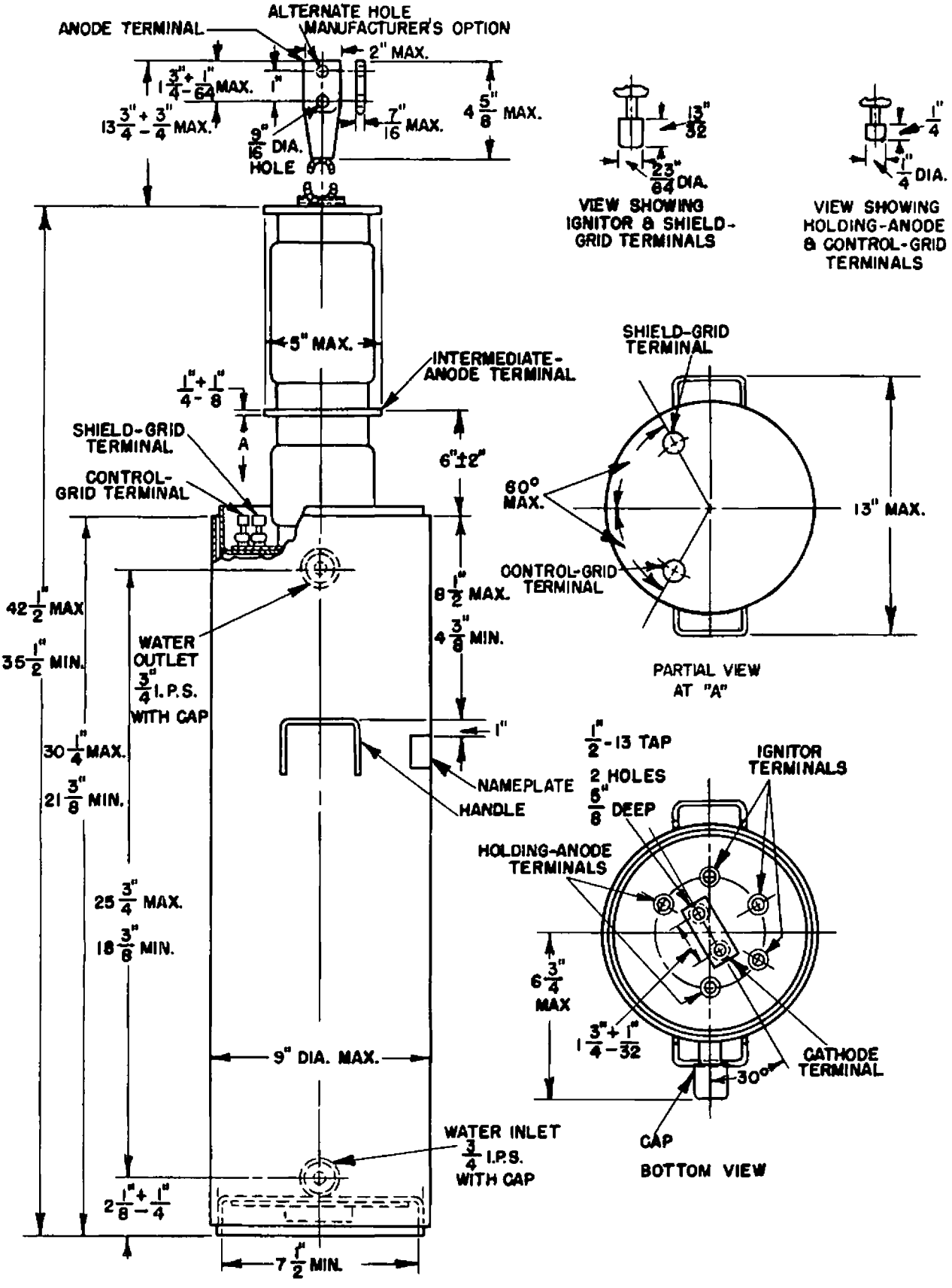
D-c Short-Circuiting Switch †

Anode Voltage			
Peak	---	20,000	Volts
Forward	100	---	Volts
Anode Current			
Peak	---	6,000	Amperes
Average	---	90	Amperes
Averaging Time	---	10	Seconds
Frequency of Current-Conduction Periods	---	100	Per Hour
Ionization Time	---	10	Microseconds
Control-Grid Open-Circuit Voltage	1500	2500	Volts
Control-Grid Short-Circuit Current	5	10	Amperes
Shield-Grid Open-Circuit Voltage	1500	2500	Volts
Shield-Grid Short-Circuit Current	2.5	5.0	Amperes
Time Constant of Shield- and Control-Grid Circuits	50	100	Microseconds
Peak Gradient-Grid Voltage			
Forward	1/2	1/2	Anode-Cathode Voltage
Inverse	1/2	1/2	Anode-Cathode Voltage
Peak Gradient-Grid Current			
Forward	0.010	0.020	Amperes
Inverse	0.010	0.020	Amperes
Ignitor Ratings			
Ignitor Voltage			
Forward Open-Circuit Voltage	1500	2500	Volts
Negative Voltage	---	5	Volts
Ignitor Current			
Short-Circuit Current	200	250	Amperes
Time Constant of Ignitor Circuit	50	100	Microseconds

* Ratings are for zero-phase-control angle - See curve "Phase Control" for ratings at other phase-control angles.

‡ Reduce duration of fault current by suppressing rectifier by removing ignitor and grid excitation

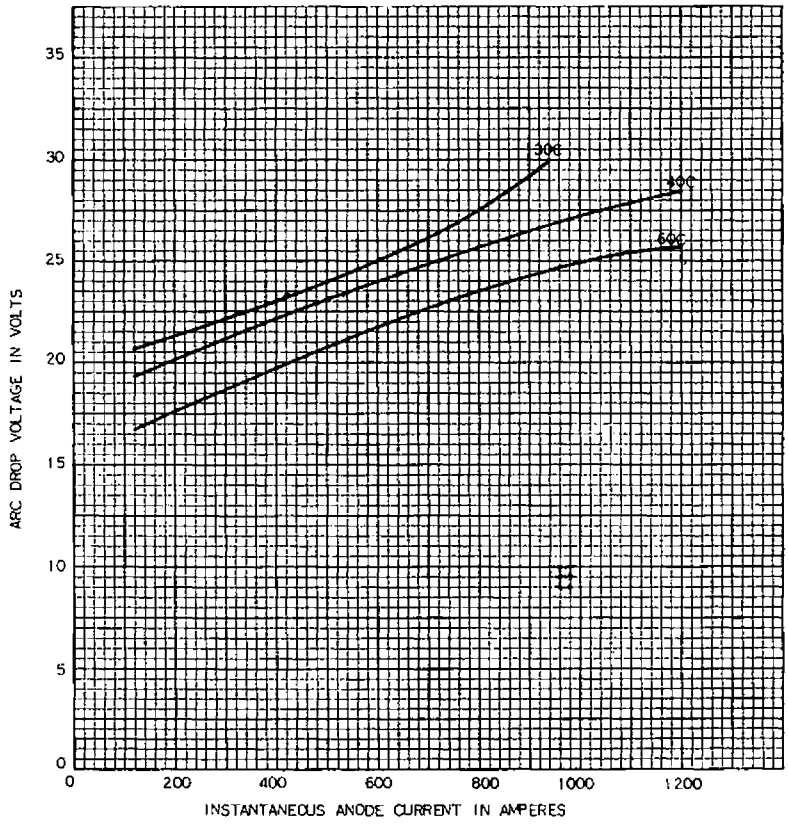
† Precautions should be taken to assure that magnetic fields of adjacent conductors do not deflect the arc in the tube.



N22002AZ

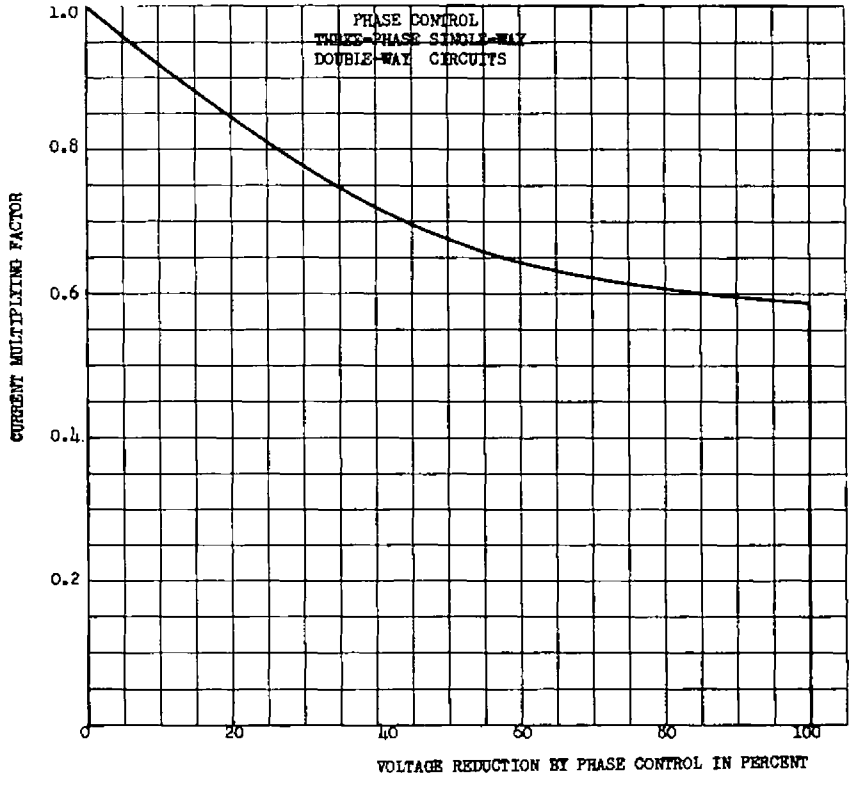
September 8, 1952

Outline
Ignitron GL-6228/506



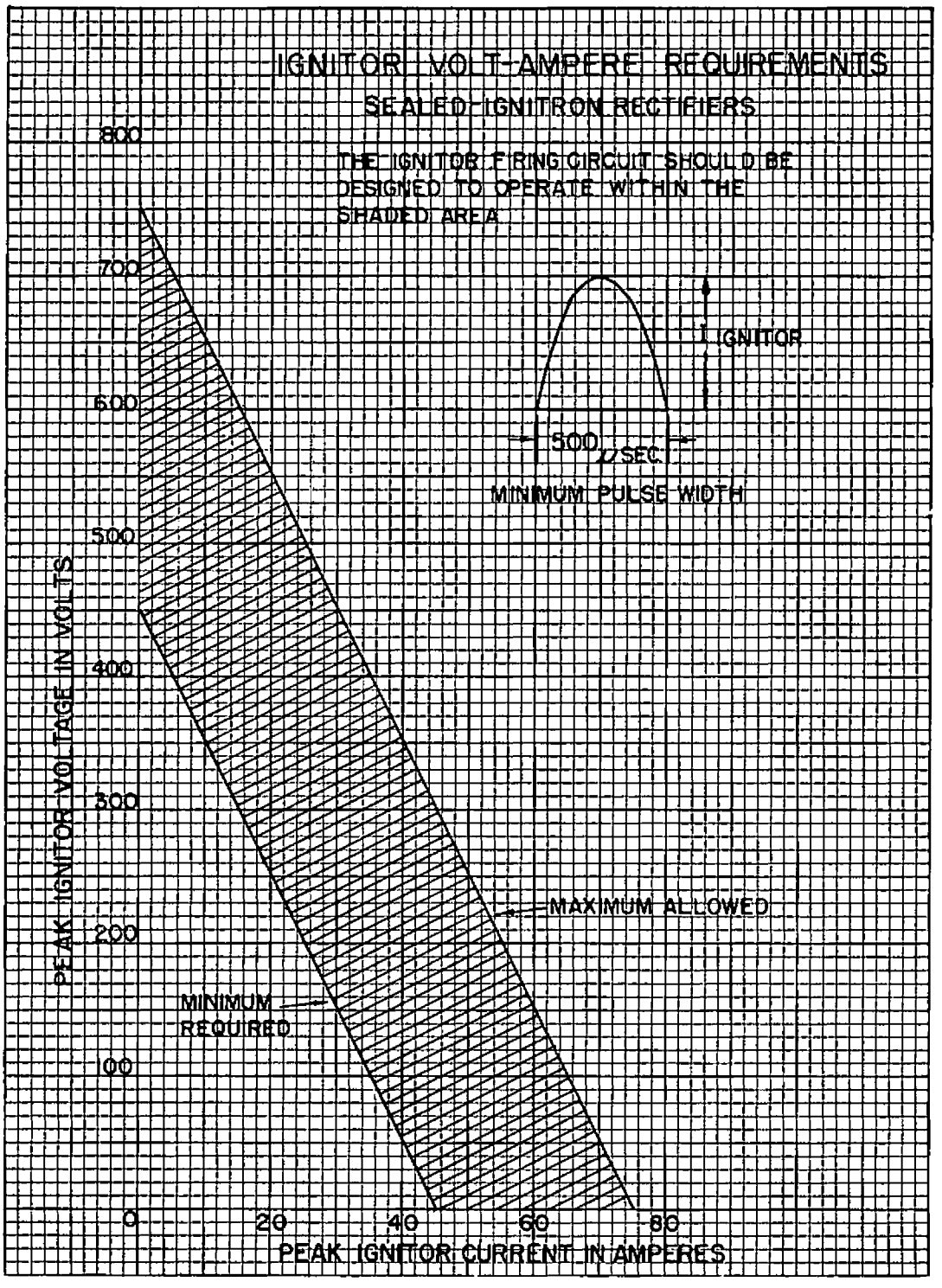
K-69087-72A196 May 2, 1949

GL-6228/506
Arc-Drop Characteristic
For Cooling-Water Temperatures of
30-60C



K-69087-72A513 September 10, 1952

GL-6228/506
Phase Control



K-9033883 June 14, 1945

Ignitor Volt-Ampere Requirements
Sealed-Ignitron Rectifiers

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

10-52 (1.5M)

Supersedes ET-T571

DESCRIPTION AND RATING

KLYSTRON

GL-6237 GL-6238 GL-6239 GL-6240 GL-6241 GL-6242

Tube Type	Frequency Range Megacycles	Television Channel Coverage
GL-6237	470 - 530	14 - 23
GL-6238	530 - 590	24 - 33
GL-6239	590 - 656	34 - 44
GL-6240	656 - 728	45 - 56
GL-6241	728 - 806	57 - 69
GL-6242	806 - 890	70 - 83

These tubes are three-resonator tunable klystrons for use as radio-frequency amplifiers. They cover the UHF television band, 470 to 890 megacycles, and each type will provide 12 kilowatts of power output at synchronizing peak level with a power gain of approximately 200 in broadband visual-amplifier service. Broadband operation is obtained by stagger-tuning the input and output resonators on the low side of the center frequency and the center resonator on the high side.

The tubes have unipotential tantalum disk-type cathodes heated by bombardment, collectors capable of dissipating 51 kilowatts, and require electro-magnetic focusing of the electron beam. The cathode seals and the output seals are forced-air cooled; the drift tubes and the collectors are water cooled. There will be two basic resonator diameters for the six types.

PRELIMINARY TECHNICAL INFORMATION

GENERAL

Electrical

	Bogey	Maximum	
Heater Voltage *	6.3		Volts
Heater Starting Voltage	8		
Heater Current at 6.3 Volts	38		Amperes
Heater Current at 8 Volts	55		
Heater Starting Current		100	Amperes
Heater Cold Resistance	0.017		
Cathode Bombarder Voltage	2.4	3	Kilovolts
Cathode Bombarder Current	460	550	Milliamperes
Cathode Bombarder Input		1200	Watts
Cathode Heating Time †	3		Minutes
Magnetic Field, approximate range ‡	300 to 400		Gausses

Mechanical

Mounting Position - Vertical-Collector End Up		
Water Flow		
Collector	15 Min	Gallons per Minute
Pressure Drop at Rated Flow, approximate	65	Pounds per Square Inch
Drift Tubes	2 Min	Gallons per Minute
Pressure Drop at Rated Flow, approximate	65	Pounds per Square Inch
Water Pressure	80 Max	Pounds per Square Inch
Outlet Water Temperature	70 Max	C
Air Flow		
Cathode and Heater Seals	300 Min	Cubic Feet per Minute
Output Seals	15 Min	Cubic Feet per Minute
Glass Temperature	150 Max	C
Maximum Over-all Length, approximate	4 1/2 to 5	Feet
Maximum Over-all Diameter	21 1/2	Inches
Net Weight, approximate §	180 to 280	Pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Radio-frequency Amplifier - Broadband Television Service
Synchronizing-level conditions per tube unless otherwise specified

Maximum Ratings, Absolute Values		
D-c Beam Voltage	18 Max	Kilovolts
D-c Beam Current	3.25 Max	Amperes
Collector Dissipation	51 Max	Kilowatts
Drift Tube Collection Current	250 Max	Milliamperes
Driving Power	150 Max	Watts
Typical Operation - Bandwidth 6 Megacycles		
D-c Beam Voltage	17	Kilovolts
D-c Beam Current Δ	2.5 to 3	Amperes
Driving Power		
Synchronizing Level	60	Watts
Pedestal Level	33.7	Watts
Power Output		
Saturation Level π	15	Kilowatts
Synchronizing Level	12	Kilowatts
Pedestal Level	6.72	Kilowatts

* The bogey value is the approximate value of bombarder heater voltage required to furnish just sufficient bombarder current which with a bombarder voltage of 2400 volts maintains the main cathode at an operating temperature adequate to furnish a beam current of 3 amperes. To avoid excessively long cathode-heating time the heater voltage should be started at approximately 8 volts and gradually reduced to the normal operating value as the cathode reaches the proper operating temperature. Voltage stability of the heater and bombarder supplies is important to prevent fluctuation in beam current.

† Approximate time required to permit normal operation. Beam voltage may be applied earlier.

‡ The magnetic field required will vary with the type and the channel to which the tube is tuned. It ranges between 300 and 400 gausses. Three independently regulated electromagnets around the body assembly and one around the cathode structure are required for proper electron-beam focusing. Details regarding the design and positioning of these magnets will be found in the Installation and Operation Instructions.

§

Approximate Weights

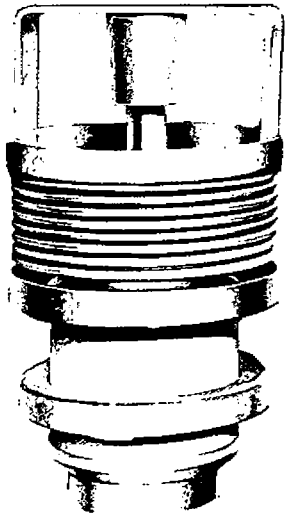
GL-6237	280	Pounds
GL-6238	280	Pounds
GL-6239	280	Pounds
GL-6240	180	Pounds
GL-6241	180	Pounds
GL-6242	180	Pounds

Δ The amount of beam current for a given beam voltage and power output will be approximately 2.5 amperes for the GL-6237 and will range up to 3 amperes for the GL-6242 since efficiency decreases somewhat at the higher frequencies.

π Saturation power level is the maximum radio-frequency power level which the tube will deliver for a given beam input power. Under operating conditions for a 15-kilowatt saturation level, the power output versus driving power characteristic is linear enough to permit application in video television up to a 12-kilowatt synchronizing peak level with a moderate amount of synchronizing peak pre-emphasis in the driver stage.

TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

GL-6283
TETRODE



RADIO-FREQUENCY AMPLIFIER
CW SERVICE
GROUNDED-GRID OPERATION

The GL-6283 is a reliable power tetrode that delivers useful output to 1250 megacycles or higher. This tube is particularly suitable for application in the final output or driver stage of military-communications systems.

As a Class B linear amplifier in the 225–400-megacycle range, the tube will deliver 110 watts of carrier power modulated up to 100 percent. Since a power gain of 20 may be realized, drive requirements are low—approximately 5 watts at carrier level.

FORCED-AIR COOLED
METAL AND CERAMIC
INTEGRAL RADIATOR

Operating as a Class C CW amplifier at 900 megacycles, the gain is approximately 15 at the 200-watt level.

Features of the GL-6283 include long life and reliability, high gain, high linearity, and resistance to shock and vibration.

These together with such design factors as an oxide-coated cathode, coaxial elements, and metal-ceramic construction make the tube well adapted to application in modern systems where performance and reliability are important.

Electrical

	Minimum	Bogey	Maximum	
Heater Voltage*	—	6.3	6.8	Volts
Heater Current at Bogey Voltage	—	3.6	—	Amperes
Cathode Heating Time	1	—	—	Minutes
Amplification Factor, G_2 to G_1, E_b=1000 V DC; E_{c_2}=275 V DC; I_b=0.2 A DC	—	14	—	
Peak Cathode Current†	—	—	1.75	Amperes
Direct Interelectrode Capacitances				
Cathode-Plate‡	—	0.006	—	μμf
Input, G_2 tied to G_1	—	18.25	—	μμf
Output, G_2 tied to G_1♦	—	6.4	—	μμf

Mechanical

Mounting Position—Any				
Net Weight, approximate	—	—	1.0	Pounds

Thermal

Cooling—Forced Air§				
Through Radiator, at Sea Level**				
Plate Dissipation	500	400	300	Watts
Air Flow, 45 C Incoming Air Temperature, minimum	17.0	12.0	6.5	Cubic Feet per Minute
Static Pressure, approximate	0.9	0.5	0.2	Inches-Water
Radiator Hub Temperature, at Point Adjacent to Anode Seal	—	—	250	C
Seals				
Screen-Grid to Control-Grid, approximate	—	—	1	Cubic Feet per Minute
Heater to Cathode, approximate	—	—	1	Cubic Feet per Minute
Ceramic Temperature at Any Point, maximum	—	—	200	C

GENERAL ELECTRIC

Supersedes ET-T1050 dated 12-59

from JEDEC release #1170L, June 1, 1964

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B LINEAR

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings

DC Plate Voltage	2000	Volts
DC Grid-No. 2 Voltage	320	Volts
DC Plate Current	0.250	Amperes
Plate Input	500	Watts
Grid-No. 2 Input	5	Watts
Plate Dissipation	500	Watts

Typical Operation

Grounded-Grid Circuit at 225–400 Megacycles

DC Plate Voltage	1750	Volts
DC Grid-No. 2 Voltage	250	Volts
DC Grid-No. 1 Voltage, approximate	−20	Volts
Peak RF Plate Voltage ♯, approximate	1250	Volts
Peak RF Grid-No. 1 Voltage ♯, approximate	40	Volts
DC Plate Current	0.200	Amperes
Zero Signal DC Plate Current (E_{c1} adjusted)	0.020	Amperes
DC Grid-No. 2 Current	0.005	Amperes
DC Grid-No. 1 Current	0.010	Amperes
Driving Power, approximate	5	Watts
Power Output ♥	110	Watts

RADIO-FREQUENCY AMPLIFIER—CLASS B TELEVISION SERVICE

Synchronizing-Level Conditions Per Tube Unless Otherwise Specified

Maximum Ratings, Absolute Values

DC Plate Voltage	1600 Max	Volts
DC Grid-No. 2 Voltage	320 Max	Volts
DC Plate Current	0.400 Max	Amperes
Plate Input	600 Max	Watts
Grid-No. 2 Input	15 Max	Watts
Plate Dissipation	300 Max	Watts
Grid-No. 1 Dissipation	2 Max	Watts

Typical Operation—Grounded-Grid Circuit up to 900 Megacycles

Bandwidth 6 Megacycles

DC Plate Voltage	1500	Volts
DC Grid-No. 2 Voltage	250	Volts
DC Grid-No. 1 Voltage	−25	Volts
Peak RF Plate Voltage		
Synchronizing Level	1100	Volts
Pedestal Level	825	Volts
Peak RF Driving Voltage		
Synchronizing Level	35	Volts
Pedestal Level	27	Volts
DC Plate Current		
Synchronizing Level	0.400	Amperes
Pedestal Level	0.295	Amperes
DC Grid-No.2 Current (Pedestal Level)	0.007	Amperes
DC Grid-No. 1 Current		
Synchronizing Level	0.036	Amperes
Pedestal Level	0.016	Amperes
Driving Power at Tube, approximate		
Synchronizing Level	25	Watts
Pedestal Level	15	Watts
Power Output, approximate		
Synchronizing Level ¶	260	Watts
Pedestal Level ¶	145	Watts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key-down conditions per tube without amplitude modulation △

Maximum Ratings	900 Megacycles	400 Megacycles	
DC Plate Voltage	1600	2000	Volts
DC Grid-No. 2 Voltage	320	320	Volts
DC Grid-No. 1 Voltage	−100	−100	Volts
DC Plate Current	0.300	0.300	Ampere
DC Grid-No. 1 Current	0.050	0.050	Ampere
Plate Input	480	600	Watts
Grid-No. 2 Input	15	15	Watts
Plate Dissipation	500	500	Watts
Grid-No. 1 Dissipation	2	2	Watts

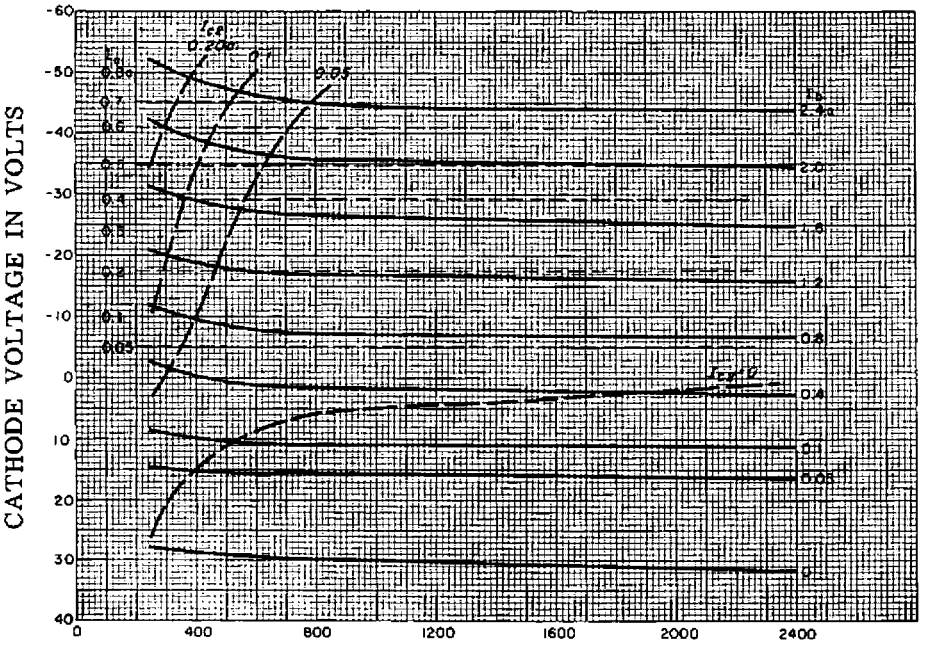
Typical Operation

Grounded-Grid Circuit at 900 Megacycles

DC Plate Voltage	1500	2000	Volts
DC Grid-No. 2 Voltage	210	225	Volts
DC Grid-No. 1 Voltage	−40	−40	Volts
DC Plate Current	0.300	0.250	Ampere
DC Grid-No. 2 Current, approximate	0.010	0.010	Ampere
DC Grid-No. 1 Current, approximate	0.020	0.020	Ampere
Driving Power, approximate	14	15	Watts
Power Output, approximate ¶	205	300	Watts

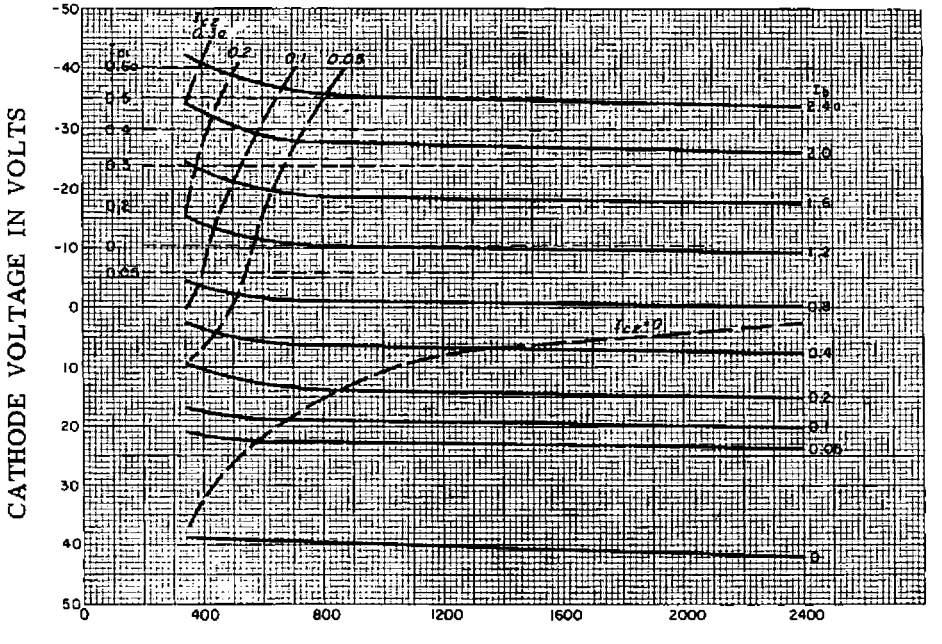
* Because the temperature of the cathode is increased by back bombardment of electrons at UHF, required heater voltage for optimum life decreases with increasing frequency. The amount of heater-voltage reduction is dependent on operating conditions. However, this voltage should not be less than 5.5 volts.
† Represents maximum usable cathode current (plate current plus current to each grid) for any condition of operation.
‡ Measured with a 6-inch minimum diameter flat metal disk attached to the screen-grid ring. Control grid connected to the screen grid.
♦ Output capacitances measured between anode and screen grid. Control grid connected directly to screen grid.
§ Forced-air cooling to be applied before and during the application of any voltages.
**Provision must be made for unobstructed passage of cooling air between radiator fins and between the anode terminal and adjacent radiator fin.
♥ Useful power output as measured in output-circuit load.
¶ Useful power output including power transferred from driver stage. Output circuit efficiency approximately 80 percent.
△ Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 percent of the carrier conditions.

CONSTANT CURRENT CHARACTERISTIC
SCREEN VOLTAGE = 250 VOLTS
ALL VOLTAGES REFERENCED TO CONTROL GRID

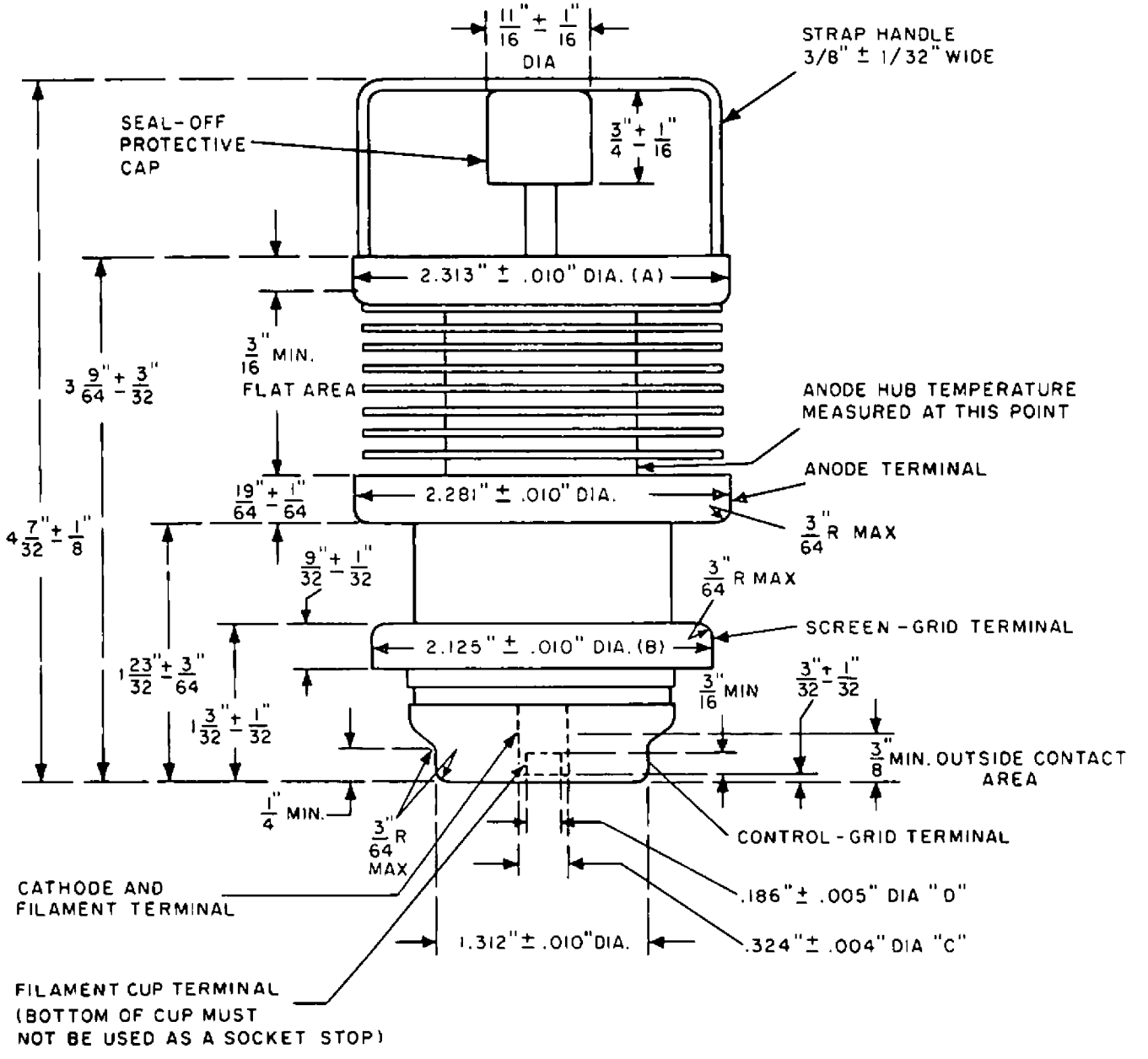


A69087 - 72B67 1-30-63

CONSTANT CURRENT CHARACTERISTIC
SCREEN VOLTAGE = 350 VOLTS
ALL VOLTAGES REFERENCED TO CONTROL GRID



A69087 - 72B68 1-30-63



CONCENTRICITIES

THE FOLLOWING TOTAL INDICATOR READINGS ARE MEASURED WITH RESPECT TO A CENTERLINE DETERMINED BY THE CENTERS OF THE ANODE TERMINAL AND CONTROL GRID TERMINAL

DIAMETER A – 0.030 INCHES
DIAMETER B – 0.016 INCHES
DIAMETER C – 0.036 INCHES
DIAMETER D – 0.042 INCHES

TOTAL INDICATOR READING OF FILAMENT CUP TERMINAL DIAMETER (D) MEASURED WITH RESPECT TO CENTER OF CATHODE AND FILAMENT TERMINAL DIAMETER (C) – 0.016 INCHES

K-69087-72A578

8-1-62

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

FOR GROUNDED-GRID CLASS A UHF AMPLIFIER APPLICATIONS

6299

The 6299 is a high-mu, metal-and-ceramic triode intended for operation as a grounded-grid, Class A radio-frequency amplifier at frequencies as high as 3000 megacycles.

Features of the tube include small size, planar electrode construction with close spacing, inherent rigidity, and an envelope structure convenient for coaxial circuit applications.

At 1200 megacycles a noise figure of less than 8.5 decibels may be obtained when the 6299 is used in a grounded-grid coaxial circuit.

In radar receivers, or similar applications, where the grid of the tube may be driven positive by leakage pulses, consideration should be given to use of the 7644 in place of the 6299.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.3	Volts
Heater Current‡	0.3	Amperes

Direct Interelectrode Capacitances§

Grid to Plate: (g to p)	1.75	pf
Grid to Cathode and Heater:		
g to (h + k)	3.65	pf
Plate to Cathode and Heater:		
p to (h + k)	0.015	pf

MECHANICAL

Operating Position - Any

Net Weight, approximate	1/6	Ounce

Cooling - Conduction¶

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Plate Voltage	200	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	15	Volts
Plate Dissipation	2.0	Watts
DC Plate Current	12	Milliamperes
DC Grid Current#	0Δ	Milliamperes
Envelope Temperature at Hottest Point	150	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

The devices and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of devices by General Electric Company conveys any license under patent claims covering combinations of these devices with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of these devices with other devices or elements by any purchaser or others.

GENERAL ELECTRIC

Supersedes PI Sheet dated 10-66

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	175	Volts
Grid Voltage¢	---	Volts
Amplification Factor	110	
Plate Resistance, approximate	7300	Ohms
Transconductance	15000	Micromhos
Plate Current	10	Milliamperes
Plate Voltage, approximate, Ib = 10 Milliamperes, Ec = 0 volts	125	Volts

CLASS A, RF AMPLIFIER—GROUNDED-GRID, COAXIAL-TYPE CIRCUIT

Frequency	450	1200	1200	1200	3000	Megacycles
Plate Voltage	**	---	**	175	**	Volts
Plate-Supply Voltage‡‡	---	300	---	---	---	Volts
Resistor in Plate Circuit (bypassed)	---	17500	---	---	---	Ohms
Grid Voltage§§	0	0	0	¶¶	0	Volts
Plate Current	10	10	10	10	10	Milliamperes
Bandwidth, min	9	10	10	10	10	Megacycles
Gain	17.5	17	17	17	11	Decibels
Noise Figure, Power-Matched	4.5	8.2	8.0	8.5	13.2	Decibels

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ Good thermal contact to the anode and cathode must be provided to conduct heat from the elements. The anode contact must be sufficiently flexible to keep lateral force on the anode terminal at a minimum.

The 6299 is rated only for Class A amplifier service.

Δ Does not apply to initial-emission-velocity current.

¢ Adjusted for Ib = 10 milliamperes.

** Adjust for Ib = 10 milliamperes; range must be variable from 75 to 200 volts.

‡‡ Supply should be regulated.

§§ For operation above 1000 megacycles, the minimum noise figure will generally be obtained by operation at zero bias. For operation below 1000 megacycles, the use of a cathode resistor or grid bias should be evaluated for the particular application.

¶¶ Adjusted for Ib = 10 milliamperes; 200 ohm variable cathode resistor recommended.

INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
Ef = 6.3 volts	280	300	320	Milliamperes
Plate Voltage				
Ef = 6.3 volts, Ec = 0 volts, Eb adjusted for Ib = 10 ma	75	125	175	Volts
Transconductance				
Ef = 6.3 volts, Eb = 175 volts, Ec adjusted for Ib = 10 ma.	11500	15000	---	Micromhos
Amplification Factor				
Ef = 6.3 volts, Eb = 175 volts, Ec adjusted for Ib = 10 ma	85	110	140	
Interelectrode Leakage Resistance				
Ef = 6.3 volts, Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid to Cathode and Heater at 45 volts d-c	0.25	---	---	Megohms
Grid to Plate at 500 volts d-c	5.0	---	---	Megohms
Interelectrode Capacitances				
Grid to Plate: (g to p)	1.5	1.75	2.0	Picofarads
Grid to Cathode and Heater: g to (h + k)	3.0	3.65	5.0	Picofarads
Plate to Cathode and Heater: p to (h + k)	---	0.015	0.025	Picofarads

SPECIAL PERFORMANCE TESTS

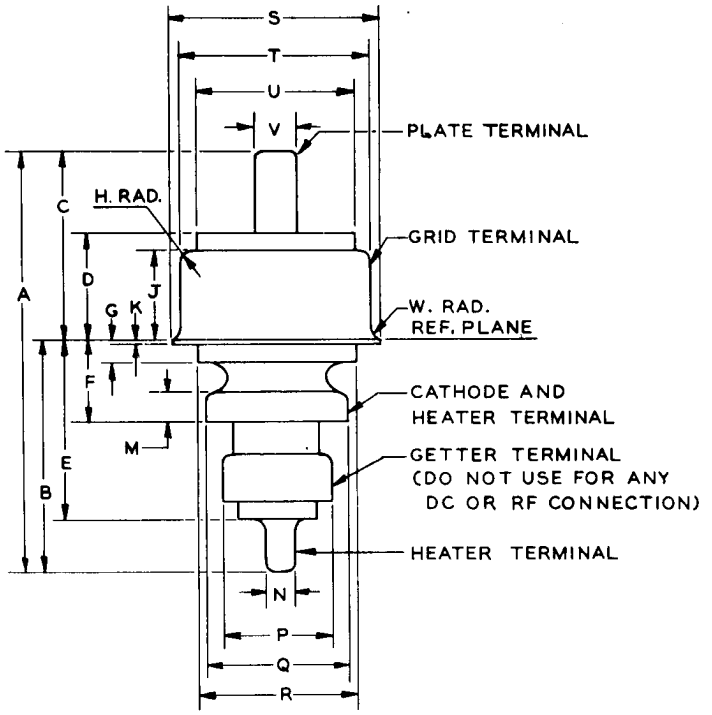
	Min.	Max.	
Noise Figure - 450 MC			
Ef = 6.3 volts, Ec = 0 volts, Eb adjusted for Ib = 10 ma, F = 450±5 MC	---	5.0	Decibels
Noise Figure - 1200 MC			
Ef = 6.3 volts, Ec = 0 volts, Eb adjusted for Ib = 10 ma, F = 1200±5 MC	---	8.5	Decibels
Noise Figure - 3000 MC			
Ef = 6.3 volts, Ec = 0 volts, Eb adjusted for Ib = 10 ma, F = 3000±5 MC	---	13.5	Decibels
Power Gain - 450 Mc			
Ef = 6.3 volts, Ec = 0 volts, Eb adjusted for Ib = 10 ma, F = 450±5 MC, Bandwidth = 9 MC, min	15	---	Decibels
Power Gain - 1200 MC			
Ef = 6.3 volts, Ec = 0 volts, Eb adjusted for Ib = 10 ma, F = 1200±5 MC, Bandwidth = 10 MC, min.	15	---	Decibels
Power Gain - 3000 MC			
Ef = 6.3 volts, Ec = 0 volts, Eb adjusted for Ib = 10 ma, F = 3000±5 MC, Bandwidth = 10 MC, min.	10	---	Decibels

DEGRADATION RATE TESTS

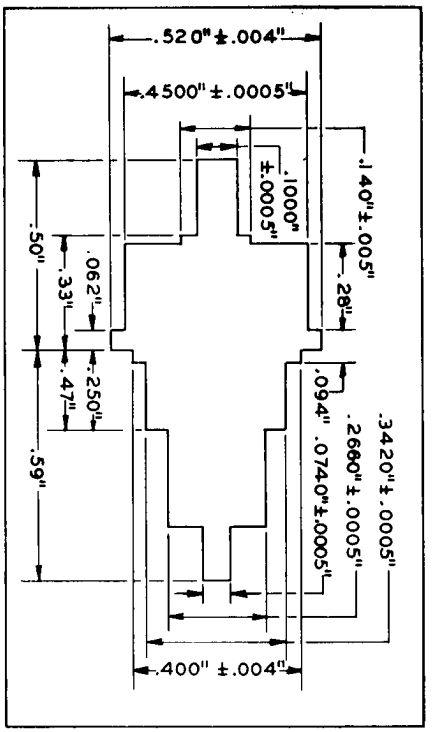
1000-Hour Life

Statistical sample operated for 1000 hours to evaluate changes in transconductance and noise figure with life.

PHYSICAL DIMENSIONS

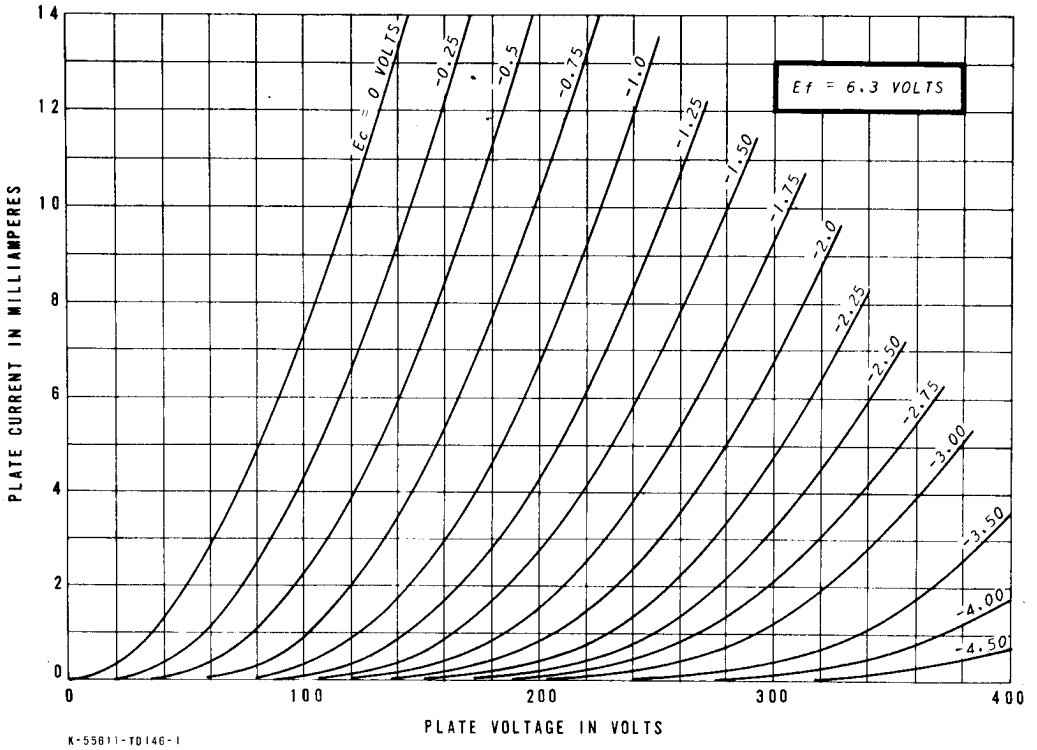


ALIGNMENT GAUGE

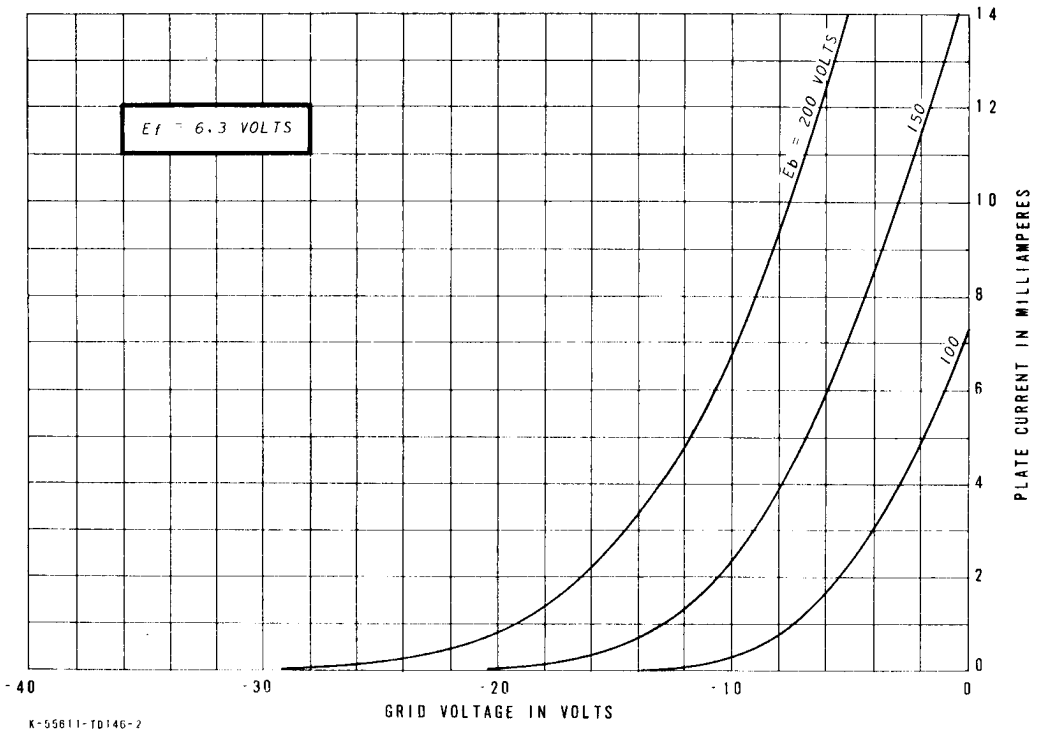


Ref.	INCHES		MILLIMETERS	
	Minimum	Maximum	Minimum	Maximum
A	0.960	1.040	24.38	26.42
B	0.530	0.590	13.46	14.99
C	0.410	0.470	10.41	11.94
D	---	0.272	---	6.91
E	---	0.475	---	12.07
F	0.163	0.193	4.14	4.90
G	---	0.060	---	1.52
H	---	0.030	---	0.76
J	0.190	0.210	4.83	5.33
K	0.009	0.015	0.23	0.38
M	0.040	0.070	1.02	1.78
N	0.059	0.065	1.50	1.65
P	---	0.257	---	6.53
Q	0.326	0.334	8.28	8.48
R	---	0.385	---	9.78
S	0.483	0.497	12.27	12.62
T	0.435	0.445	11.05	11.30
U	---	0.385	---	9.78
V	0.088	0.094	2.24	2.39
W	---	0.008	---	0.20

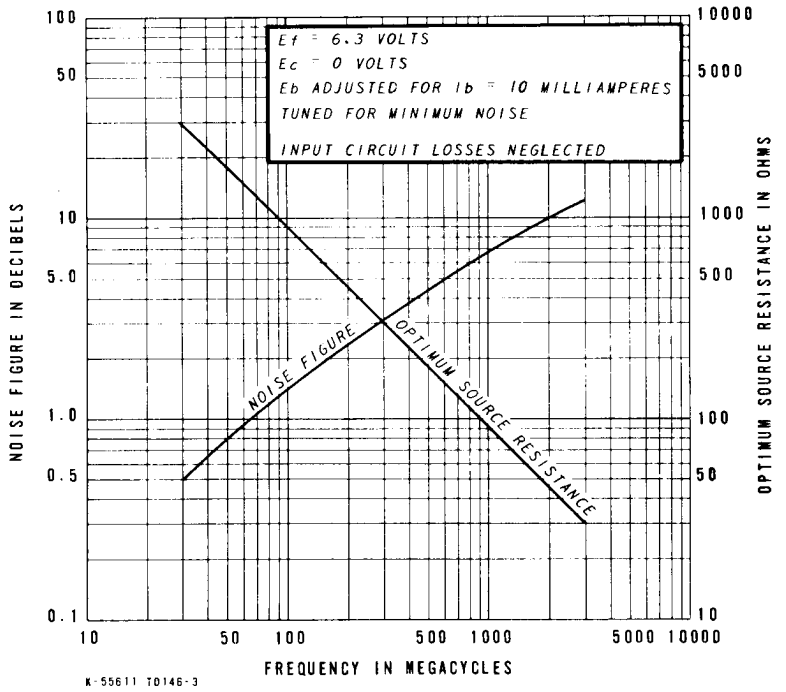
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



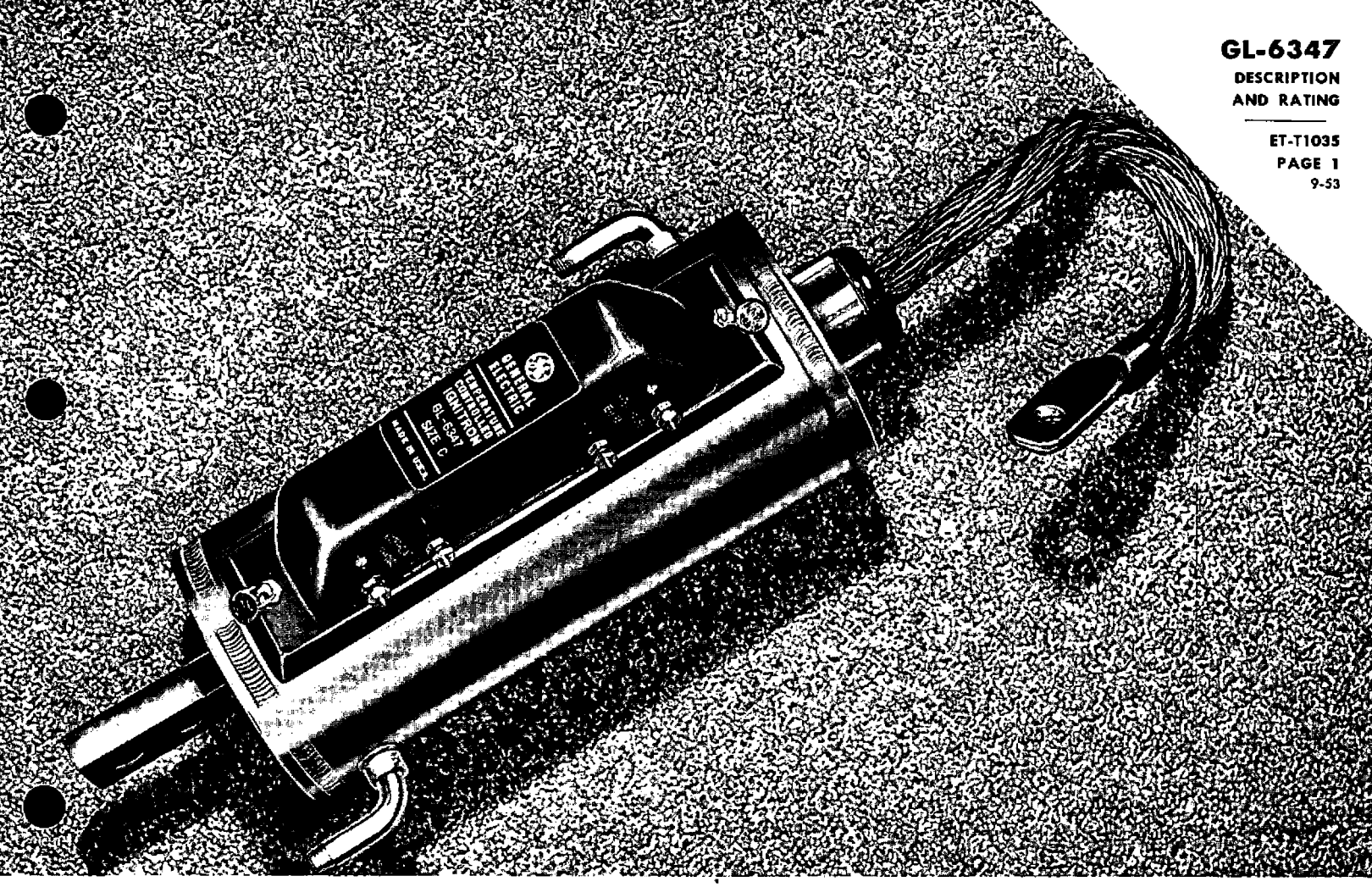
PREDICATED NOISE PERFORMANCE



TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301



IGNITRON

Temperature Controlled

The GL-6347 ignitron is a sealed, stainless-steel-jacketed, water-cooled, mercury-pool tube especially suited to resistance-welding-control service. In this service two tubes in the inverse-parallel connection will control 1200 kilovolt-amperes at voltages of 250 to 600 volts over the frequency range of 25 to 60 cycles. The ability of this tube to carry very high peak currents for short periods makes it especially suited to such service.

Ease of installation, economical use of space, and reliability of operation are assured by design and construction features inherent in the steel-jacketed construction.

This tube is identical in ratings and characteristics to the GL-5552/FG-235-A. Mechanically, it has the additional feature of an integral temperature-control device with protective features. The control includes a switch which operates a solenoid valve in the water-supply line to the tube in response to increasing and decreasing tube temperature, thus maintaining the amount of cooling water to the minimum required by the operating conditions. An over-temperature switch is included to remove power from the ignitron when its temperature exceeds a safe value. In applications where the cooling water flows through two tubes in series, this tube can be used with the GL-5552/FG-235-A since the GL-6347, in the position nearer the water drain where it receives the warmer water, can control the flow to both under normal conditions.

This new construction prevents excessive condensation over the external parts of the tube under conditions of high humidity. Another advantage is the appreciable saving in maintenance costs over tubes of the old design since this control feature, in addition to greatly reducing the amount of water required, eliminates the necessity for such safety devices as water-flow relays, water over-temperature relays, and water-pressure interlocks required with the older design tubes. The GL-6347 ignitron is equivalent to a 600-ampere magnetic contactor.

from RTMA release #1242,
Sept. 25, 1953

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode excitation—cyclic		
Cathode spot starting—ignitor		
Number of electrodes		
Main anodes	1	
Main cathodes	1	
Ignitors	1	
Arc drop at 6800 peak amperes	28	volts
Arc drop at 440 peak amperes	14	volts
Cathode excitation requirements		
Ignitor voltage required to fire	200	volts
Ignitor current required to fire	30	amperes
Starting time at required voltage or current	100	microseconds

Mechanical

Envelope material—metal		
Net weight	8	pounds

Thermal

Type of cooling—water		
Inlet water temperature, minimum	10	C
Inlet water temperature, maximum	30	C
Water flow, minimum, solenoid water valve open	1.5	gallons per minute
Characteristics for water cooling at rated minimum flow		
Water temperature rise, maximum	6	C
Pressure drop at 1.5 gallons per minute, maximum	4.5	pounds per square inch

MAXIMUM RATINGS AND TYPICAL OPERATION

Power-rectifier service, intermittent duty

Ratings are for zero phase-control angle—see curve for details.

Maximum peak anode voltage		
Inverse	500	volts
Forward	500	volts
Maximum anode current		
Peak	1600	amperes
Average	100	amperes
Maximum averaging time	6	seconds
Fault	6000	amperes
Maximum duration of fault current	0.15	second
Frequency range	25–60	cycles per second

Resistance-welding-control service*

Two tubes in inverse parallel, ratings per tube

Voltage range	250 to 600	volts rms
Maximum demand	1200	kilovolt-amperes
Average current at maximum demand	75.6	amperes
Maximum average current	140	amperes
Demand at maximum average current	400	kilovolt-amperes
Maximum averaging time at 600 volts rms	5.8	seconds
Maximum averaging time at 250 volts rms	14.0	seconds
Maximum peak fault current at 250 volts	13450	amperes
Maximum peak fault current at 600 volts	5600	amperes

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATING AND TYPICAL OPERATION (Cont'd)

Ignitor

Maximum voltage
Positive—anode voltage
Negative ..... 5 volts
Maximum current
Peak ..... 100 amperes
Root mean square ..... 10 amperes
Average ..... 1 ampere
Maximum averaging time ..... 5 seconds

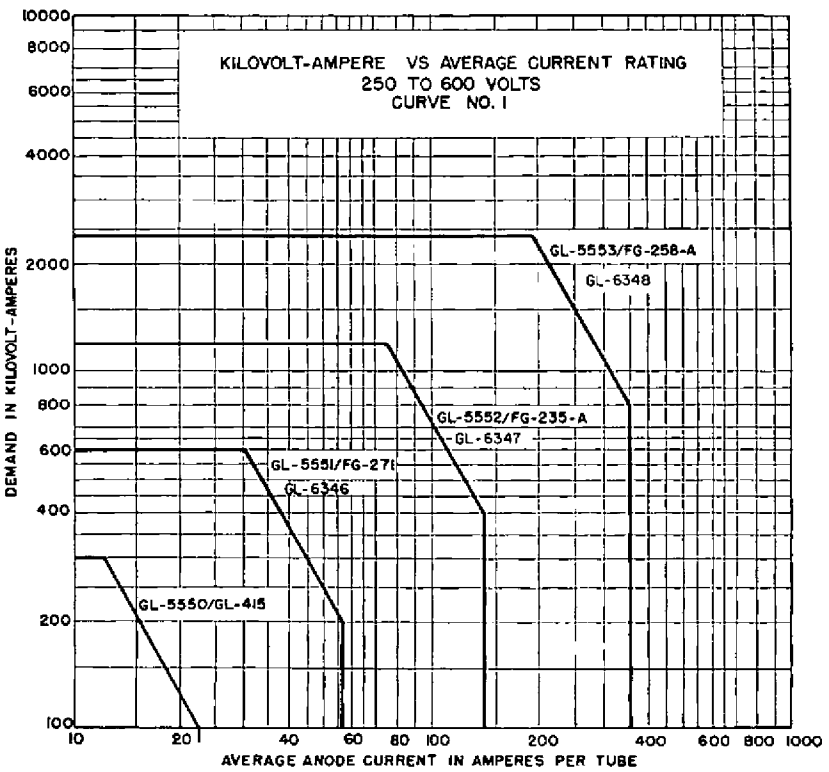
Temperature-control-switch ratings†

Maximum voltage ..... 575 volts
Maximum current ..... 3 amperes
Maximum potential of tube water cylinder
Above ground ..... 1500 volts peak
Switch-contact arrangement
Over-temperature switch—normally closed
(Contacts open on temperature rise)
Water-control switch—normally open
(Contacts close on temperature rise)

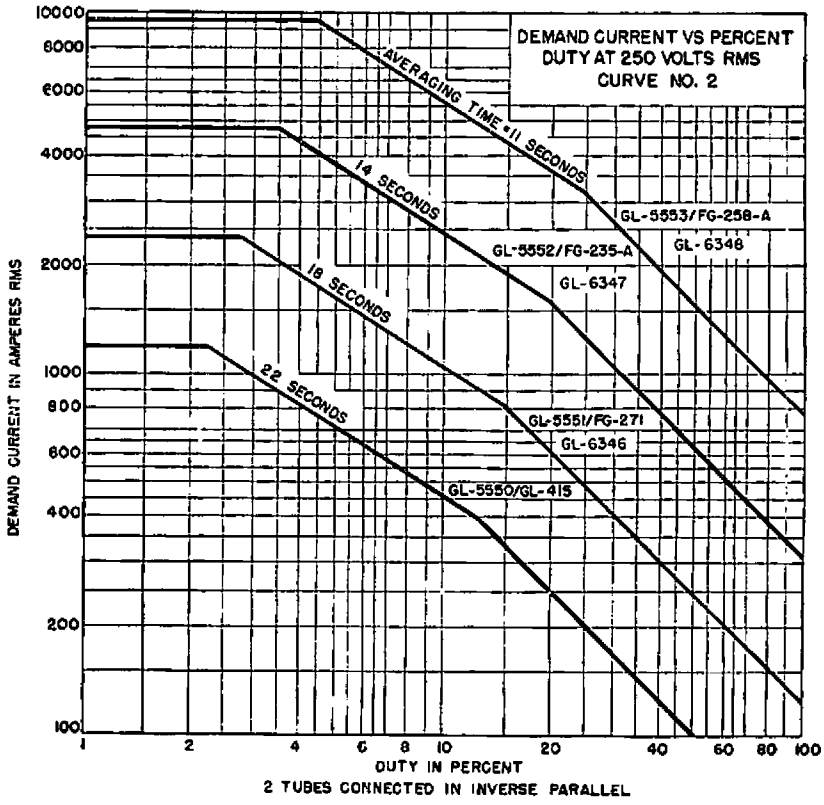
* RMS demand voltage, current, and kilovolt-ampere demand are all on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used. For voltages below the minimum, the minimum-voltage current rating applies. With the use of log-log paper straight-line interpolation between tabulated points may be used for other detailed ratings of: Demand kva vs average anode current. Maximum averaging time vs anode voltage.

† Suitable fuses should be provided in the switch circuits to prevent a power arc should a ground occur in the switch or wiring.

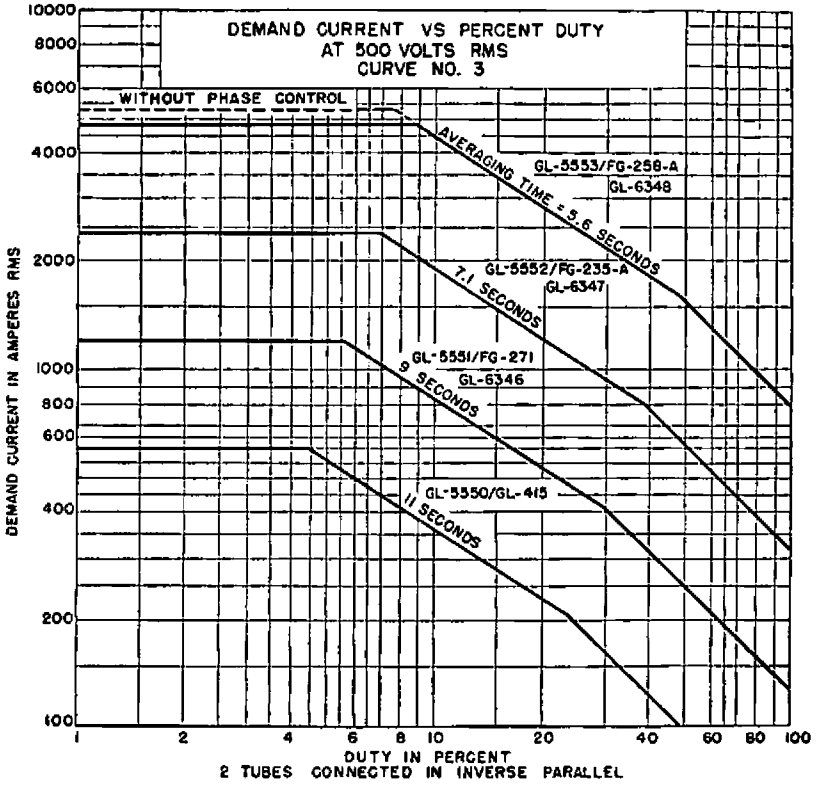
CURVES K-69087-72A217, K-69087-72A218, AND K-69087-72A219 DO NOT APPLY FOR INTERMITTENT-RECTIFIER SERVICE



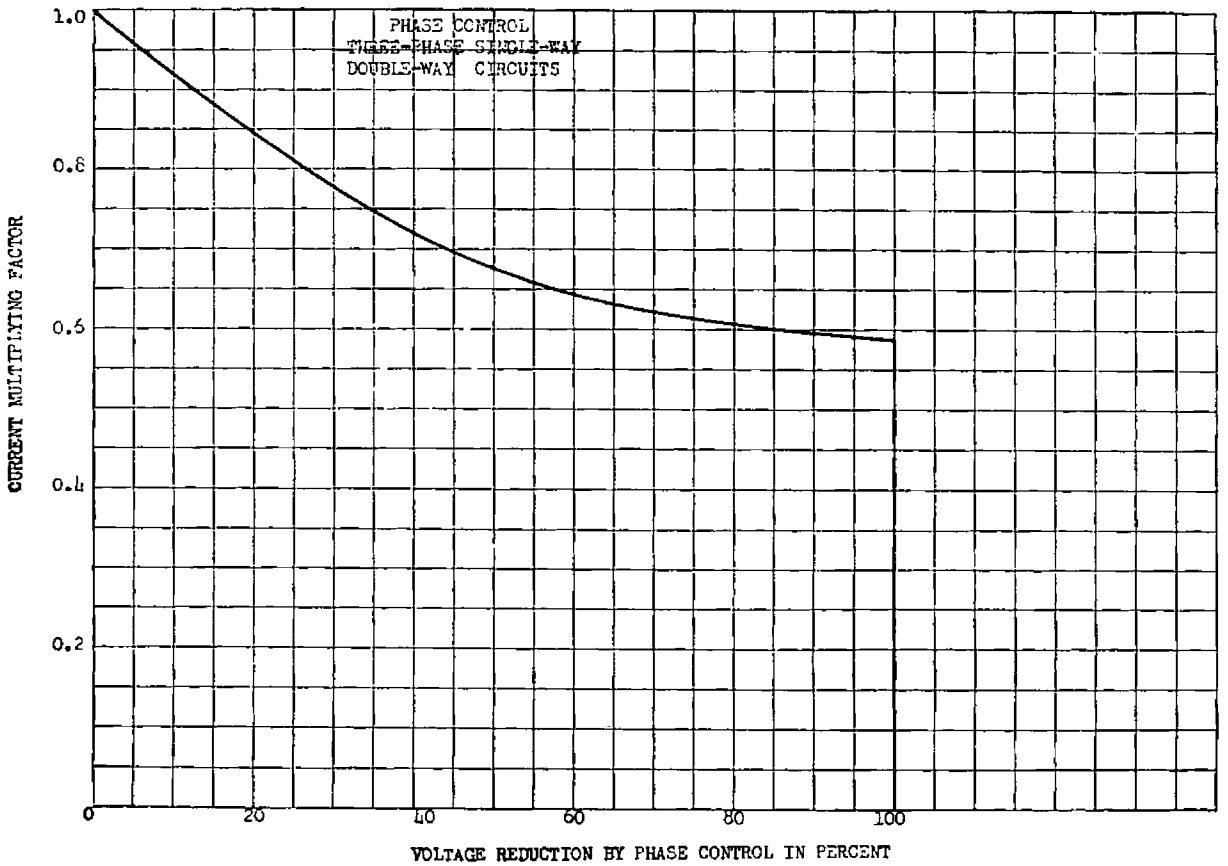
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K-69087-72A218 8-21-53

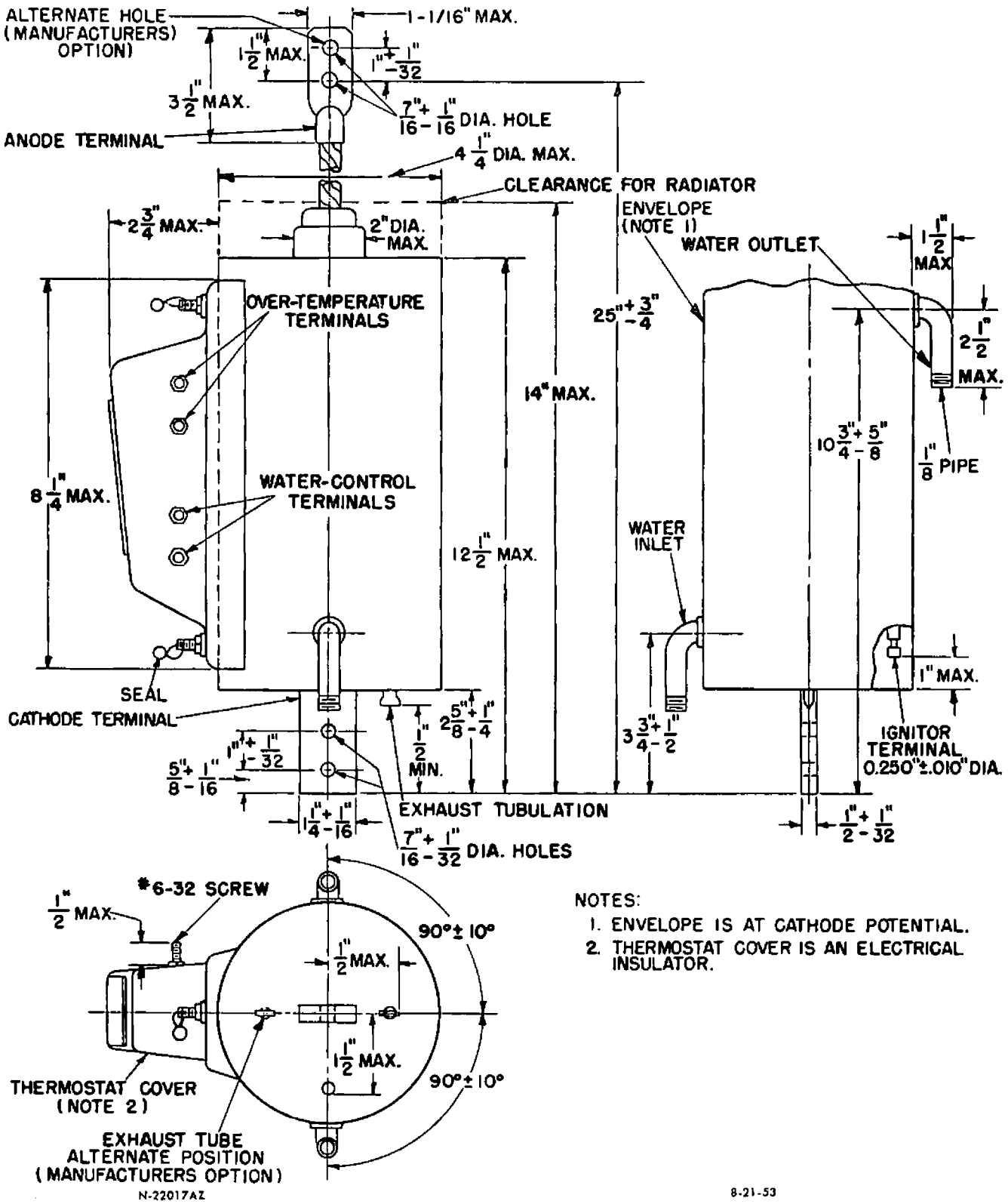


K-69087-72A219 8-21-53



K-69087-72A513

8-21-53



N-22017AZ

NOTES:

1. ENVELOPE IS AT CATHODE POTENTIAL.
2. THERMOSTAT COVER IS AN ELECTRICAL INSULATOR.

8-21-53

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

Electronic TUBES

6386
TWIN TRIODE
Five-Star Tube
★ ★ ★ ★ ★

FOR REMOTE-CUTOFF CASCODE-AMPLIFIER APPLICATIONS

REMOTE-CUTOFF CHARACTERISTIC
9-PIN MINIATURE
SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING
MEDIUM-MU

DESCRIPTION AND RATING

The 6386 is a miniature medium-mu twin triode in which each section exhibits a remote-cutoff characteristic. It is designed primarily for use as a cascode radio-frequency amplifier, intermediate-frequency amplifier, or mixer in circuits to which it is desired to apply automatic-gain-control. When used in cascode applications, the performance of the 6386 is characterized by high gain, low noise figure, and low higher-order harmonic distortion.

The 6386 is a special-quality tube intended for use in critical industrial and military applications in which operational dependability is of primary importance. Features of the tube include a high degree of mechanical strength and a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

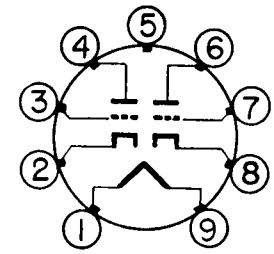
Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.35	Amperes
Direct Interelectrode Capacitances*		
Grid to Plate, Each Section	1.2	μμf
Input, Each Section	2.0	μμf
Output, Each Section	1.1	μμf
Heater to Cathode, Each Section	2.6	μμf
Grid to Grid	0.003	μμf
Plate to Plate	0.11	μμf

*Without external shield.

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

BASING DIAGRAM

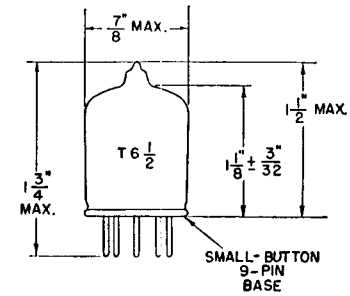


RETMA 8CJ

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—Cathode (Section 2)
Pin 3—Grid (Section 2)
Pin 4—Plate (Section 2)
Pin 5—Internal Shield†
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Heater
† It is recommended that Pin 5 be grounded.

PHYSICAL DIMENSIONS



RETMA 6-1

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-CENTER VALUES, EACH SECTION

Plate Voltage	300	Volts
Plate Dissipation	1.5	Watts
DC Cathode Current	18	Milliamperes
Heater-Cathode Voltage‡		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts

‡ When the GL-6386 is used as a cascode amplifier and the two sections are connected in series, the heater-cathode voltage of the grounded-grid stage may be as high as 250 volts maximum with the heater negative with respect to the cathode.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	100	Volts
Cathode-Bias Resistor	200	Ohms
Amplification Factor	17	
Plate Resistance, approximate	4250	Ohms
Transconductance	4000	Micromhos
Plate Current	9.6	Milliamperes
Grid Voltage, approximate		
Gm = 100 Micromhos	−16	Volts

CASCODE AMPLIFIER—SEE CIRCUIT DIAGRAM

Plate-Supply Voltage	300	200	Volts
Plate Load Resistor	10000	0	Ohms
Voltage-Divider Supply Voltage	250	200	Volts
Grid-Supply Voltage	−5	−2	Volts
Cascode Transconductance	...	4000	Micromhos
Cascode Plate Current	...	10.5	Milliamperes
Third Harmonic Distortion			
Esig = 1.0 Volts, Peak	0.5	....	Percent

SPECIAL TESTS AND RATINGS

Inoperatives Control

Minimum continuous operating time under life-test conditions or equivalent for all tubes prior to characteristics testing ..... 46 Hours

Heater-Cycling Rating

Cycles of Intermittent Operation, minimum ..... 2000 Cycles

Ef = 7.5 volts cycled for one minute on and one minute off. Eb = Ec = 0 volts. Ehk = 135 volts with heater positive with respect to cathode.

Shock Rating

Impact Acceleration in Any Direction ..... 600 G

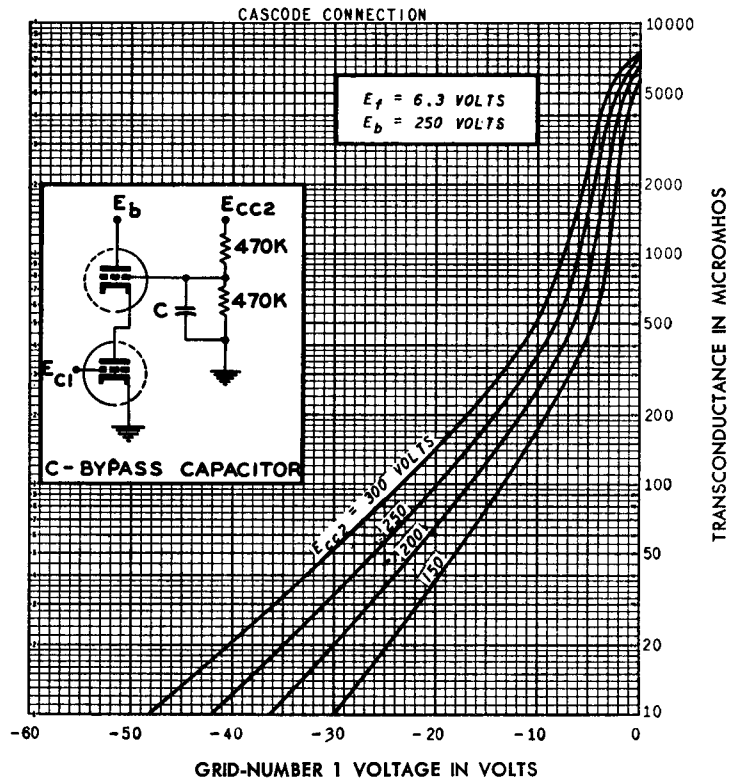
Forces as applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

Fatigue Rating

Vibrational Acceleration in Any Direction ..... 2.5 G

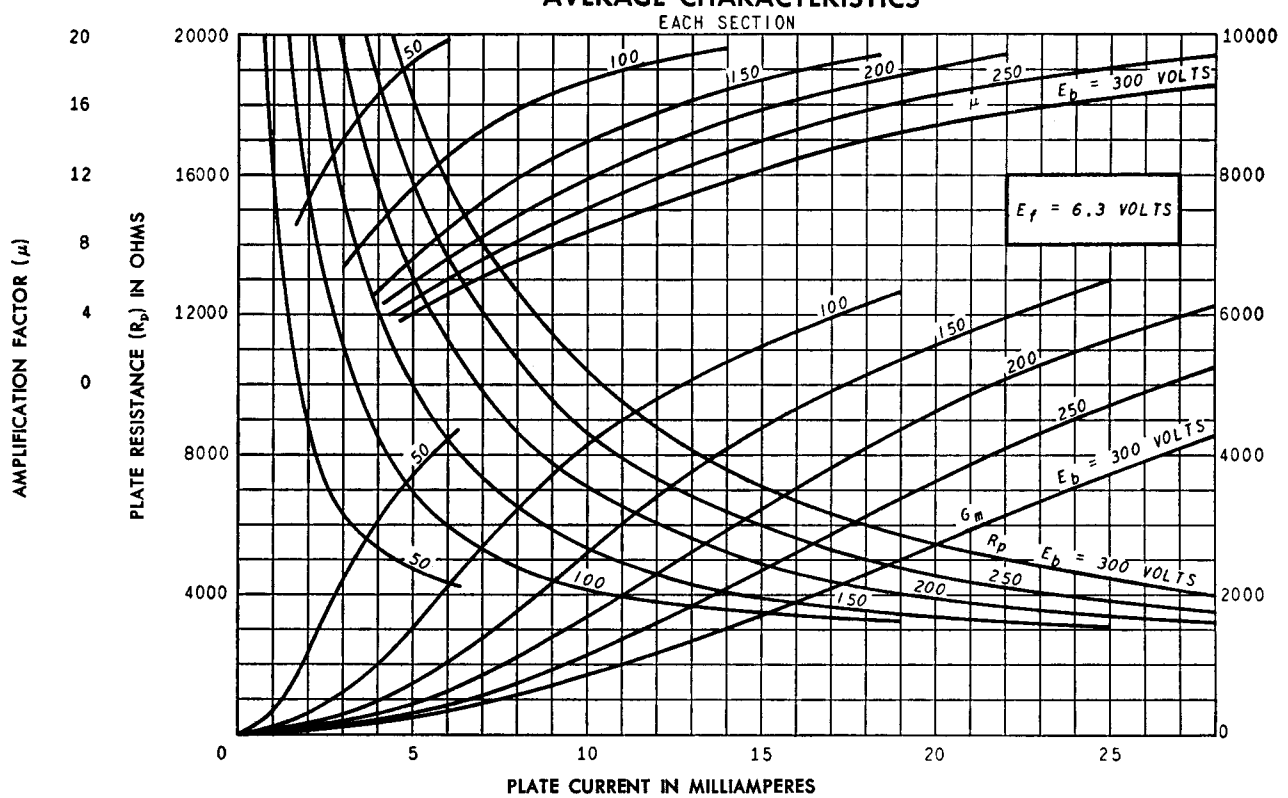
Vibrational forces for a period of at least 100 hours at a frequency of 25 cycles per second.

AVERAGE TRANSFER CHARACTERISTICS



AUGUST 21, 1953

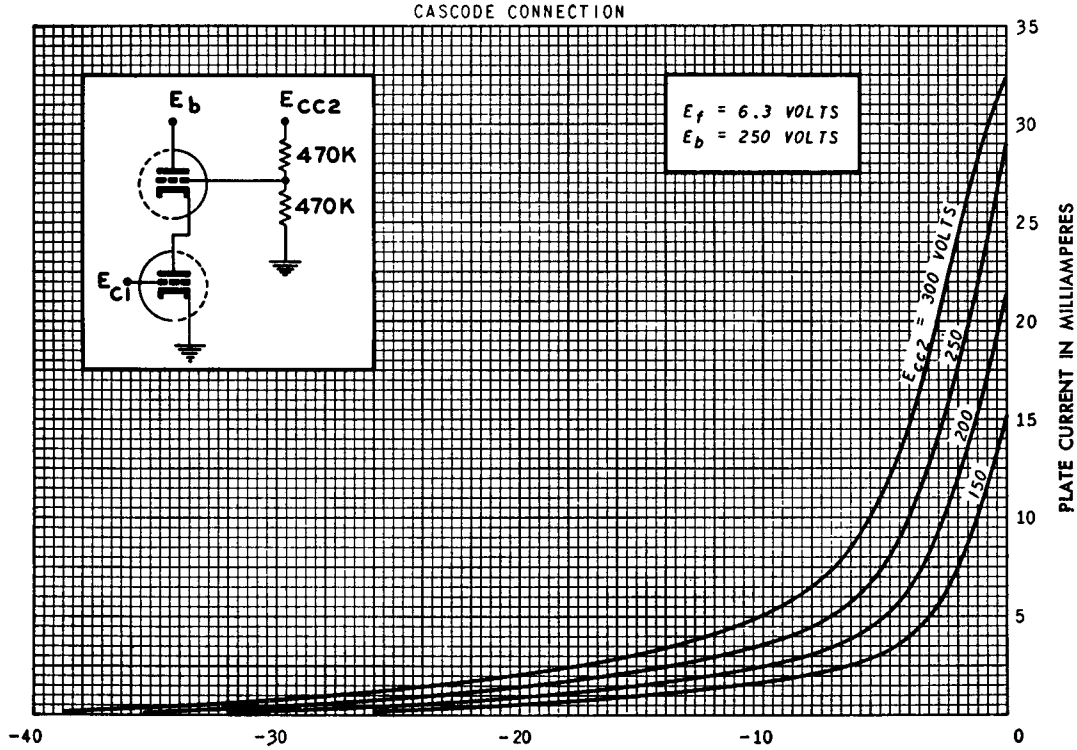
AVERAGE CHARACTERISTICS



AUGUST 21, 1953

AVERAGE TRANSFER CHARACTERISTICS

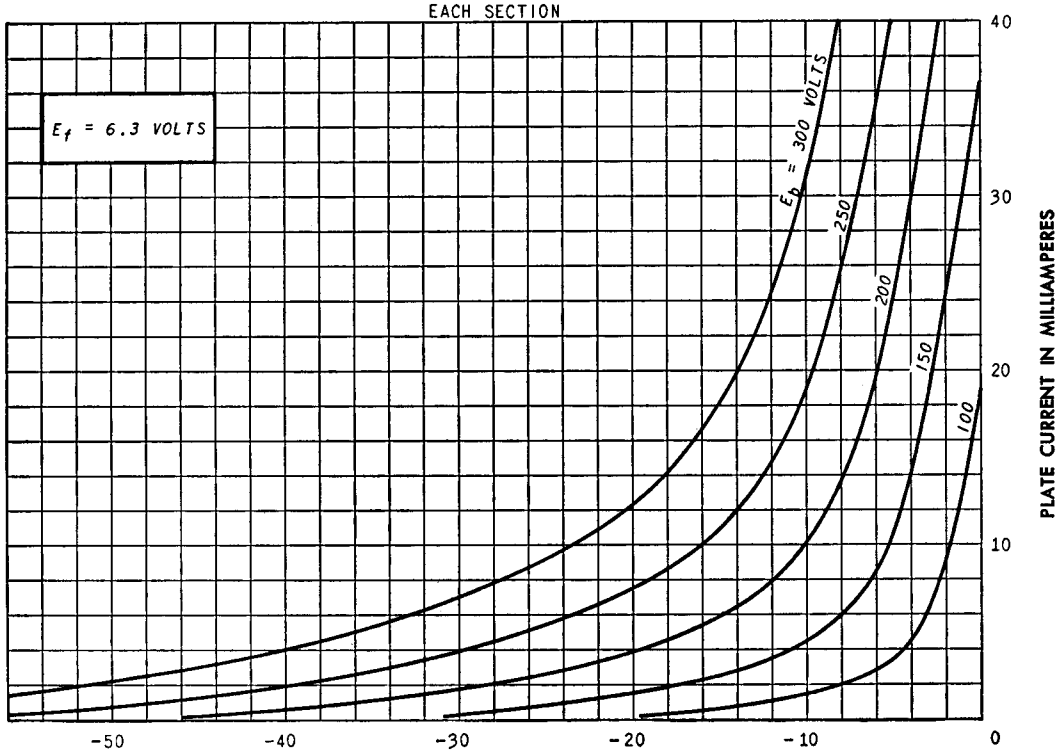
CASCODE CONNECTION



AUGUST 21, 1953

AVERAGE TRANSFER CHARACTERISTICS

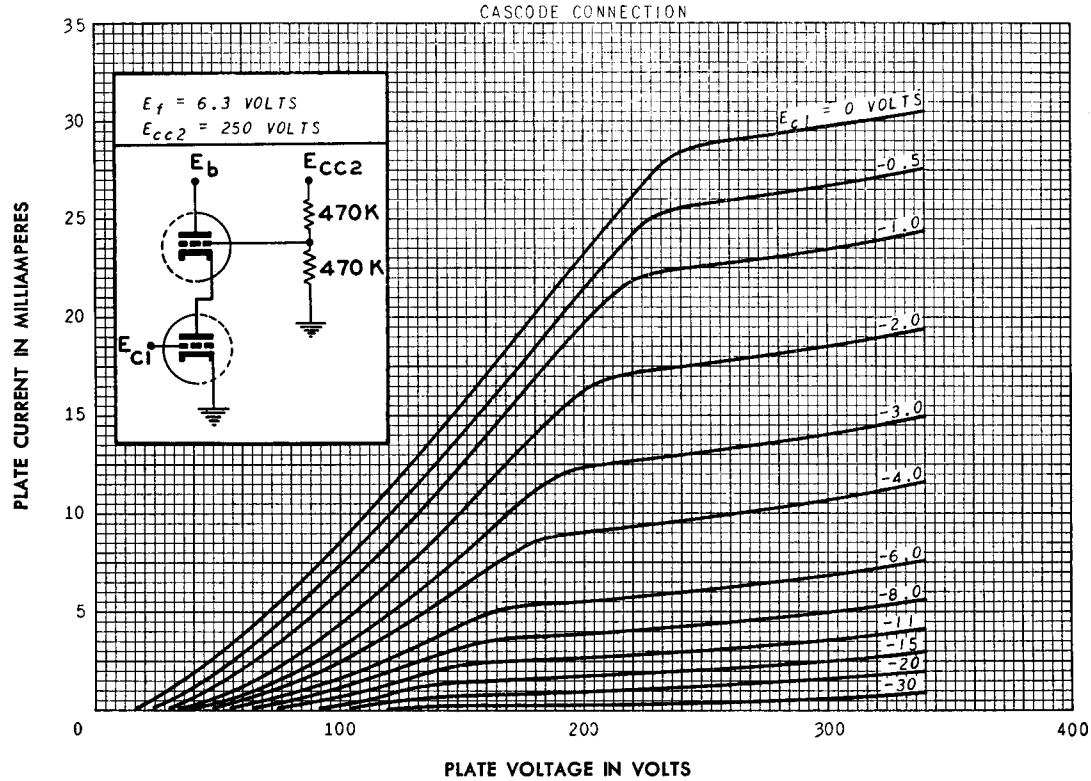
EACH SECTION



AUGUST 21, 1953

AVERAGE PLATE CHARACTERISTICS

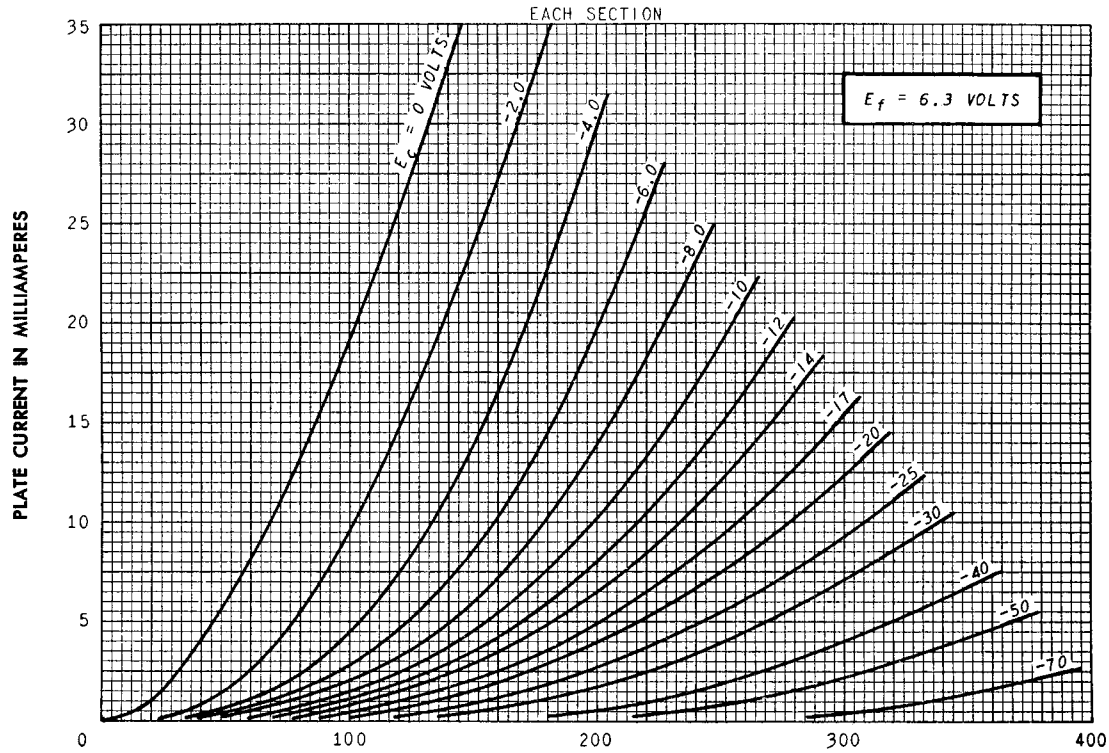
CASCODE CONNECTION



AUGUST 21, 1953

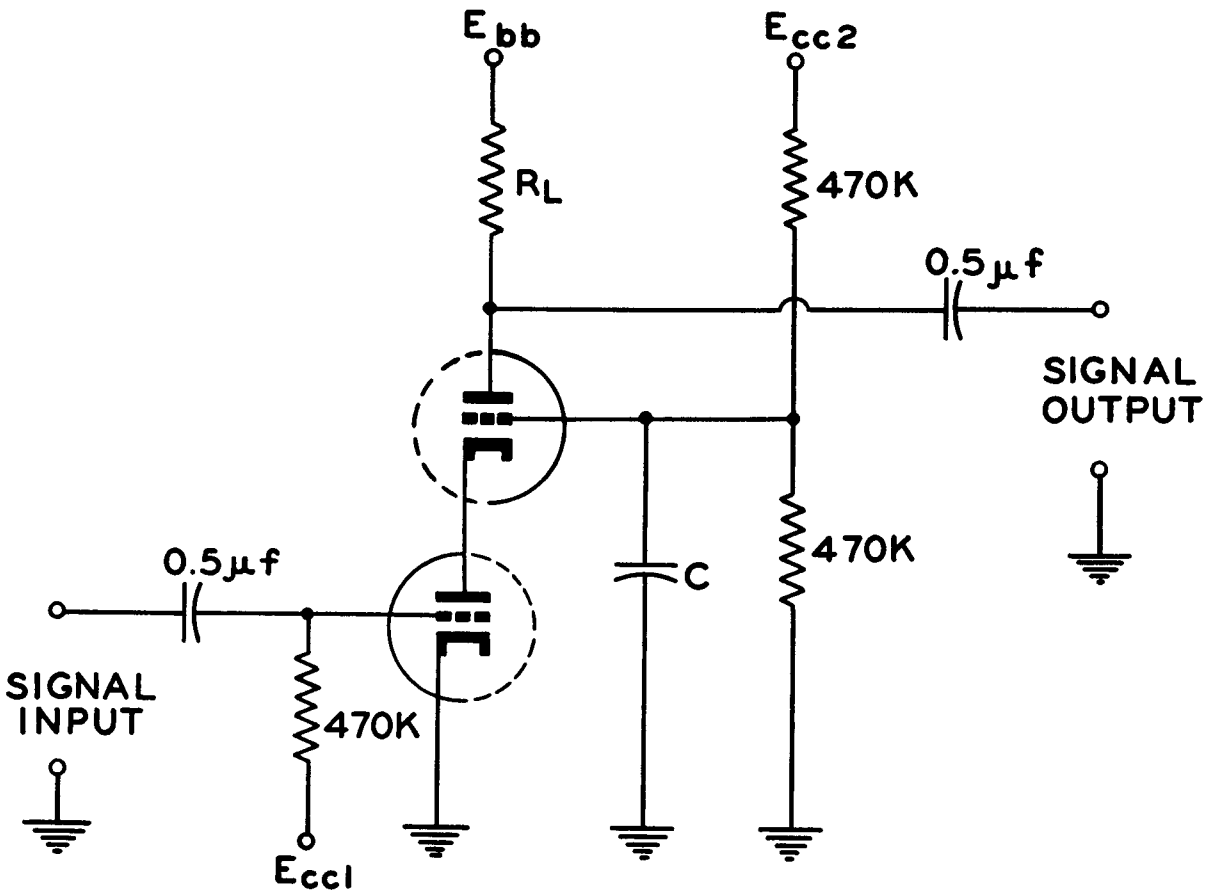
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



AUGUST 21, 1953

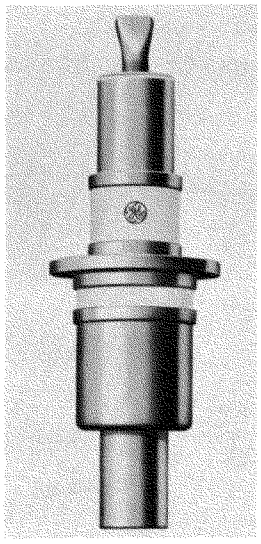
TYPICAL CIRCUIT FOR CASCODE OPERATION



C - BYPASS CAPACITOR

ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.

6442
PLANAR TRIODE



DESCRIPTION AND RATING

FOR GROUNDED-GRID OSCILLATOR AND AMPLIFIER SERVICE

Metal and Ceramic — Small Size

Two Kilowatts Useful Pulse Power Output

The 6442 is a high-mu, metal-and-ceramic triode intended for operation as a plate-pulsed, grounded-grid oscillator at frequencies as high as 5000 megacycles. The 6442 is also useful as a CW, radio-frequency power amplifier or frequency multiplier at frequencies as high as 2500 megacycles.

Features of the 6442 include small size, planar electrode construction with close spacing, inherent rigidity, an envelope structure convenient for coaxial circuit applications, and excellent resistance to vibration and shock.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC	*	Volts
Heater Current at Ef = 6.3 volts	0.9†	Amperes

Direct Interelectrode Capacitances‡

Grid to Plate: (g to p)	2.3	pf
Grid to Cathode: (g to k)	5.0	pf
Plate to Cathode: (p to k), max.	0.045	pf

MECHANICAL

Mounting Position—Any

Net Weight, approximate	1	Ounce

Cooling—Conduction and Convection

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

PLATE-PULSED OSCILLATOR SERVICE

Heater Voltage*	5.7 to 6.3	Volts
Cathode Heating Time, minimum	60	Seconds
Frequency	5000	Megacycles
Peak Positive-Pulse Plate Supply Voltage	3000	Volts
Duty Factor of Plate Pulse¶ ⁂	0.001	
Pulse Duration	2.0	Microseconds
Plate Current		
Average ⁂	2.5	Milliamperes
Average During Plate Pulse △	2.5	Amperes
Negative Grid Voltage		
Average During Plate Pulse	100	Volts
Grid Current		
Average ⁂	1.25	Milliamperes
Average During Plate Pulse	1.25	Amperes
Plate Dissipation ⁂	7.5	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Envelope Temperature at Hottest Point	175	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

Supersedes ET-T1167B dated 3-60

MAXIMUM RATINGS (Continued)

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key-down Conditions per Tube Without Amplitude Modulation**

Heater Voltage*	4.5 to 5.7	Volts
Cathode Heating Time, minimum	30	Seconds
Frequency	2500	Megacycles
DC Plate Voltage	350	Volts
Negative DC Grid Voltage	50	Volts
DC Plate Current	35	Milliamperes
DC Grid Current	15	Milliamperes
Plate Dissipation	8.0	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Envelope Temperature at Hottest Point	175	C

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEPHONY

Carrier Conditions per Tube For Use With a Maximum Modulation Factor of 1.0

Heater Voltage*	4.5 to 5.7	Volts
Cathode Heating Time, minimum	30	Seconds
Frequency	2500	Megacycles
DC Plate Voltage	275	Volts
Negative DC Grid Voltage	50	Volts
DC Plate Current	35	Milliamperes
DC Grid Current	15	Milliamperes
Plate Dissipation	6.0	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Envelope Temperature at Hottest Point	175	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Heater Voltage	6.3	Volts
Plate Voltage	350	Volts
Grid Voltage	−4.25	Volts
Amplification Factor	50	
Transconductance	16500	Micromhos
Plate Current	35	Milliamperes

PLATE-PULSED OSCILLATOR

Frequency	3500	5000	Megacycles
Heater Voltage	6.0	6.0	Volts
Duty Factor	0.001	0.001	
Pulse Duration	1.0	1.0	Microseconds
Pulse Repetition Rate	1000	1000	Pulses per Second
Peak Positive-Pulse Plate Supply Voltage	3000	3000	Volts
Negative Grid Voltage			
Average During Plate Pulse	75	75	Volts
Grid-Bias Resistor	50	50	Ohms
Plate Current			
Average	2.5	2.5	Milliamperes
Average During Plate Pulse	2.5	2.5	Amperes
Grid Current			
Average	1.25	1.25	Milliamperes
Average During Plate Pulse	1.25	1.25	Amperes
Useful Power Output			
Average	2.0	0.5	Watts
Average During Plate Pulse	2.0	0.5	Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEGRAPHY

Frequency	1000	Megacycles
Heater Voltage	5.7	Volts
DC Plate Voltage	250	Volts
DC Plate Current	23	Milliamperes
DC Grid Current	6.0	Milliamperes
Driving Power	0.35	Watts
Useful Power Output	2.8	Watts

* The equipment designer should design the equipment so that heater voltage is centered at some value within the range of 4.5 to 5.7 volts for CW operation, or 5.7 to 6.3 volts for pulse operation. Heater voltage variations about the center value should be kept as small as practical and should not, in any case, exceed ±5%. The optimum center value of heater voltage depends on the cathode current and on other parameters of circuit design and operation. For specific recommendations, contact your General Electric tube sales representative.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Measured in a special shielded socket.

¶ Applications with a duty factor greater than 0.001 should be referred to your General Electric tube sales representative for recommendations.

⁂ In any 5000 microsecond interval.

△ The regulation and/or series plate-supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 25 amperes.

** Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier conditions.

INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
Ef = 6.3 volts	840	900	960	Milliamperes
Grid Voltage				
Ef = 6.3 volts, Eb = 350 volts				
Ib = 35 ma	−2.5	−4.25	−5.75	Volts
Transconductance				
Ef = 6.3 volts, Eb = 350 volts				
Ec adjusted for Ib = 35 ma	13500	16500	19000	Micromhos
Amplification Factor				
Ef = 6.3 volts, Eb = 350 volts				
Ec adjusted for Ib = 35 ma	35	50	65	
Negative Grid Current				
Ef = 6.3 volts, Eb = 350 volts				
Ec adjusted for Ib = 35 ma	.....	.....	0.5	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts, Polarity of applied d-c interelectrode voltage is such that no cathode emission results				
Grid to Cathode at 100 volts d-c	25	.....	.....	Megohms
Grid to Plate at 500 volts d-c	250	.....	.....	Megohms
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	.....	.....	100	Microamperes
Heater Negative with Respect to Cathode	.....	.....	100	Microamperes
Interelectrode Capacitances				
Grid to Plate: (g to p)	2.10	2.3	2.45	Picofarads
Grid to Cathode: (g to k)	4.60	5.0	5.45	Picofarads
Plate to Cathode: (p to k)	.....	.....	0.045	Picofarads

SPECIAL PERFORMANCE TESTS

	Min.	Max.	
Pulsed-Oscillator Power Output Tubes are tested for power output as an oscillator under the following conditions: Ef = 6.0 volts; F = 3450 MC, min.; epy = 3000 volts; tp = 1.0 μsec. ± 10%; prr adjusted for Du = 0.001 ± 5%; Rg adjusted for Ib = 2.5 ma	1.75	.....	Watts
Pulse Emission Tubes are tested for pulse emission under the following conditions: Ef = 6.3 volts; tp = 1 to 3 μsec.; Du = 0.0005, min.; prr = 500 pps, max.; eb = ec and adjusted for is = 8 amp	....	175	Volts
Low Pressure Voltage Breakdown Test Statistical sample tested for voltage breakdown at a pressure of 250 mm Hg. Tubes shall not give visual evidence of flashover when 3000 volts RMS, 60 cps, is applied between the plate and grid terminals			
Low Pressure Voltage Breakdown Test Statistical sample tested for voltage breakdown at a pressure of 20 mm Hg. Tubes shall not give visual evidence of flashover when 500 volts RMS, 60 cps, is applied between the plate and grid terminals			

DEGRADATION RATE TESTS

Shock

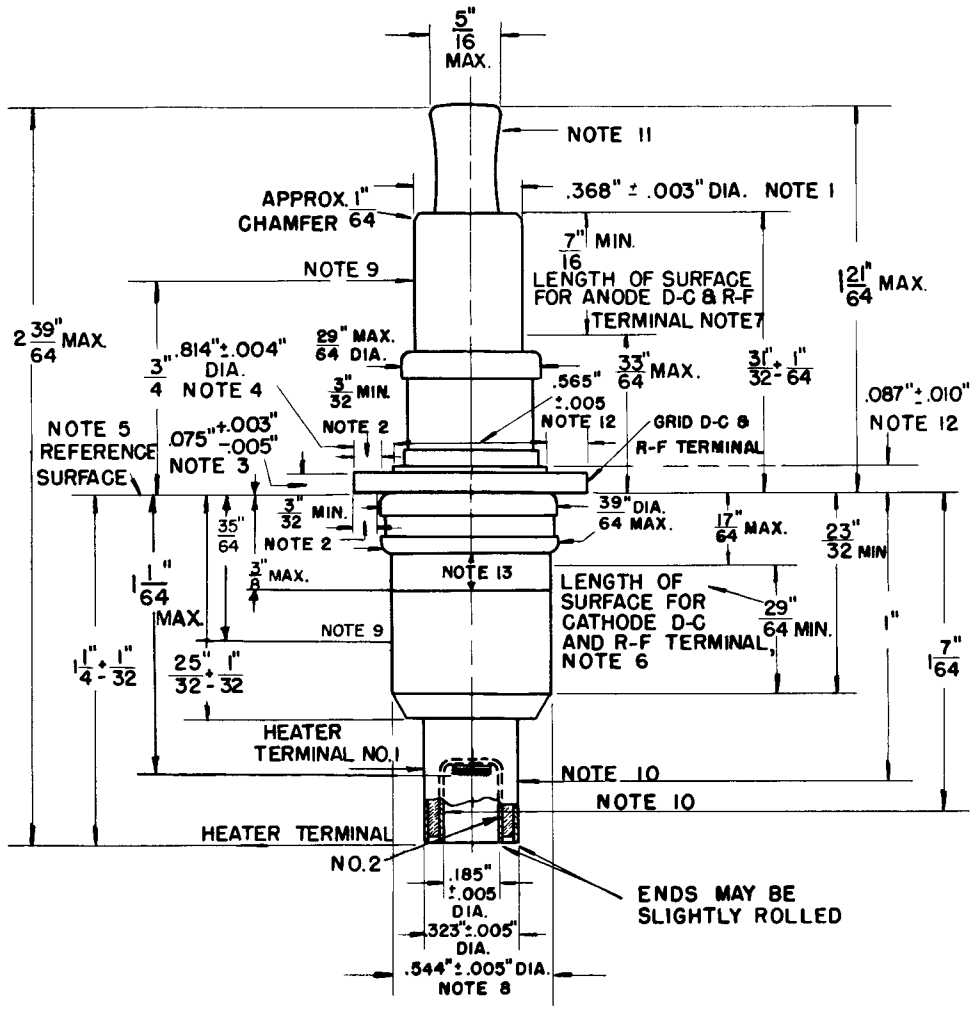
Statistical sample subjected to 5 impact accelerations of approximately 400 G and 1.0 milliseconds duration in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine.

500-Hour Life Test

Statistical sample operated for 500 hours as a pulsed oscillator to evaluate changes in power output with life.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

PHYSICAL DIMENSIONS



K-69087-72A684

4-59

Note 1. Applies to minimum surface for anode d-c and r-f terminal only. Other surfaces must not be used for these terminal purposes.

Note 2. Applies to minimum surface for grid d-c and r-f terminal only. Other surfaces, except for Notes 3 and 4, must not be used for terminal purposes.

Note 3. Applies to minimum surfaces for grid d-c and r-f terminal only.

Note 4. The cylindrical surface of this diameter may be used for grid d-c and r-f terminal purposes.

Note 5. The surfaces defined by Notes 2, 3, and 4 shall be the only surfaces used for tube stops and clamping purposes.

Note 6. Other surfaces shall not be used for cathode d-c and r-f terminal purposes.

Note 7. Other surfaces shall not be used for anode d-c and r-f terminal purposes.

Note 8. Applies to surface designated for cathode d-c and r-f terminal. Solder at brazed joint will not exceed the maximum diameter.

Note 9. The maximum eccentricity of the anode and cathode with respect to the grid terminal in a prescribed jig is 0.010 (or maximum total runout of 0.020) and is measured by indicators at the points designated.

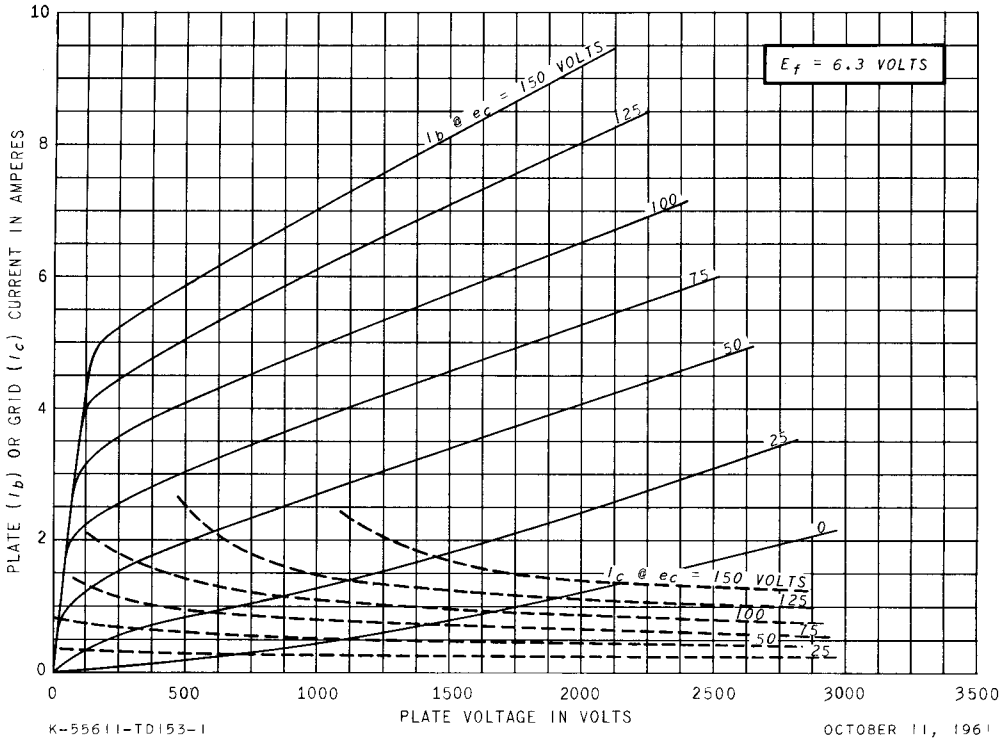
Note 10. The maximum eccentricity of heater-terminal No. 1 and heater-terminal No. 2 with respect to the grid terminal in a prescribed jig is 0.015 (or maximum total runout of 0.030) and is measured by indicators at the points designated.

Note 11. Exhaust tubulation must not be subjected to any mechanical stress.

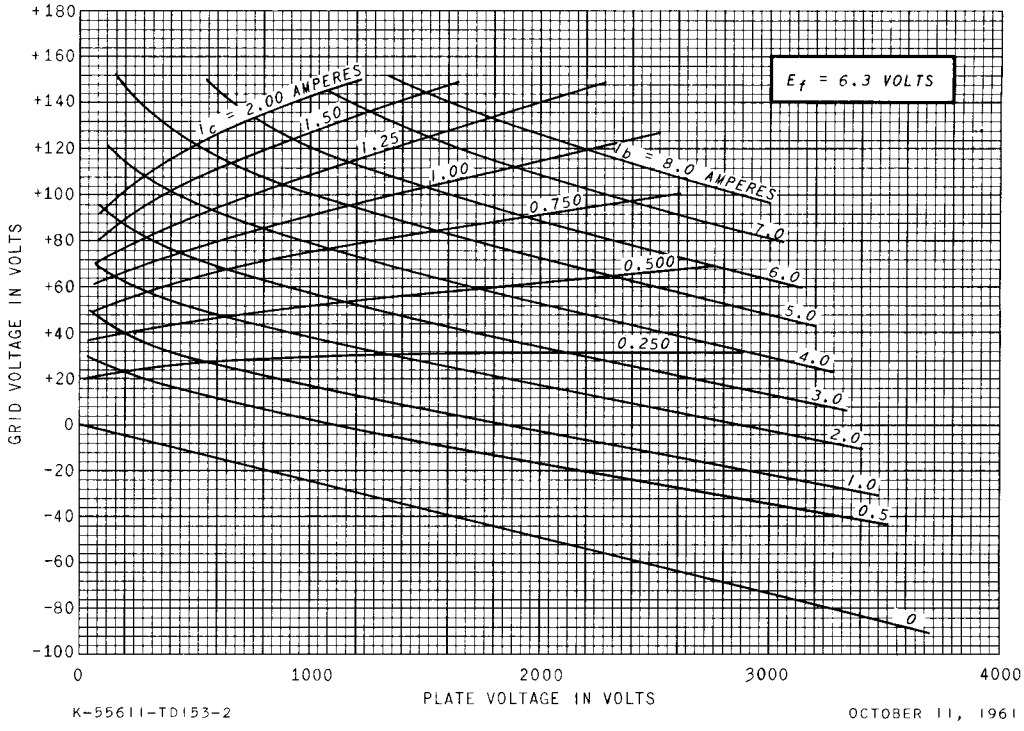
Note 12. For reference only. Dimension does not include any possible solder fillet.

Note 13. This area is reserved for tube stamping and coding.

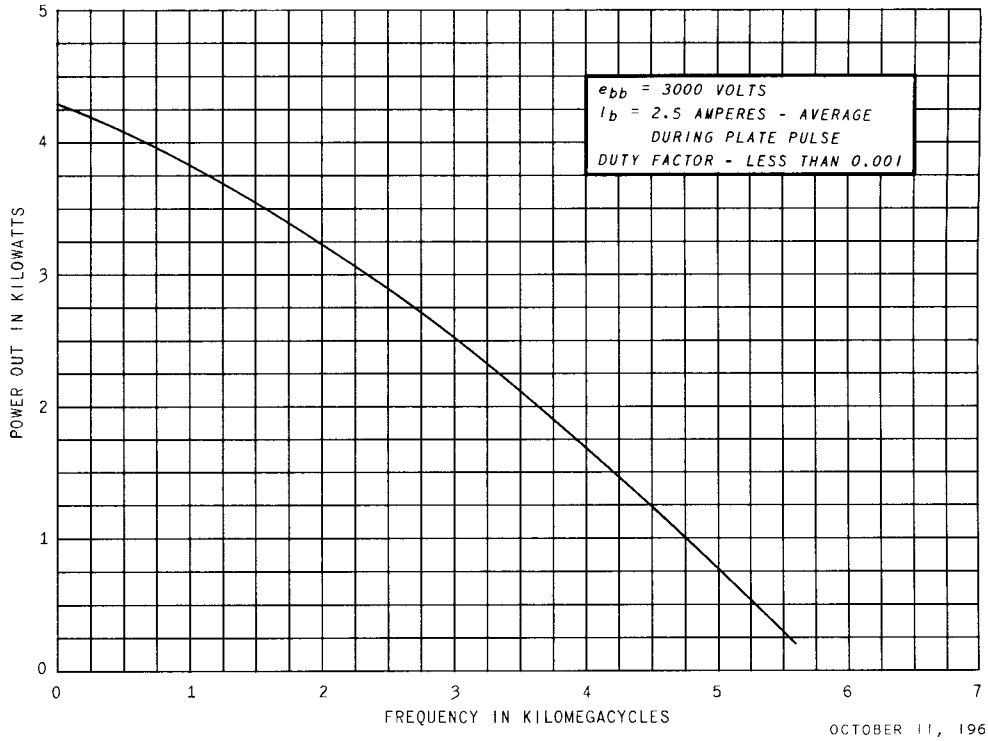
AVERAGE PLATE CHARACTERISTICS



AVERAGE CONSTANT-CURRENT CHARACTERISTICS

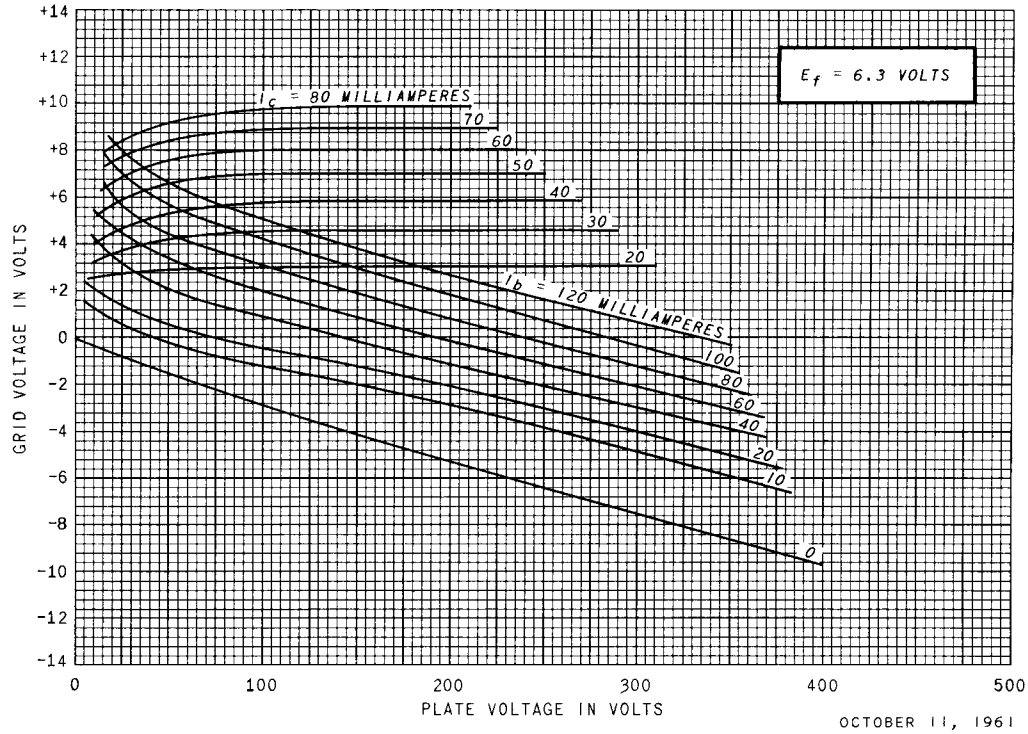


PULSED-OSCILLATOR PERFORMANCE
POWER OUTPUT VS. FREQUENCY

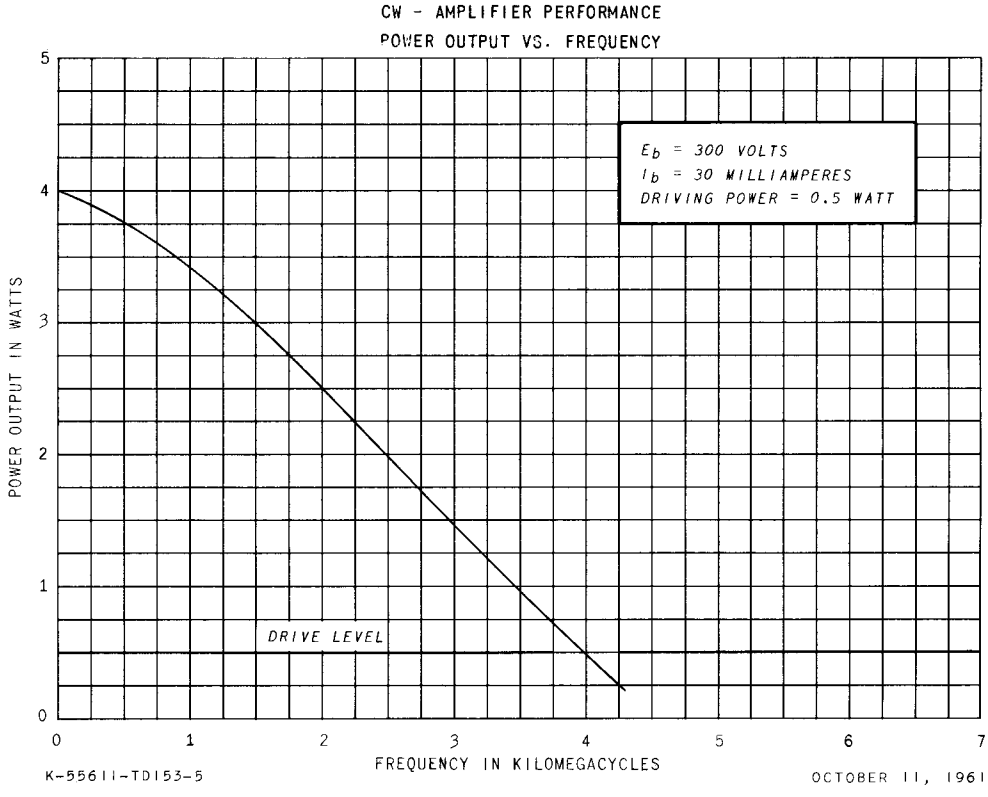


OCTOBER 11, 1961

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



OCTOBER 11, 1961



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

PRELIMINARY DESCRIPTION AND RATING

IGNITRON GL-6504

The GL-6504 is a double-grid ignitron designed for railroad locomotive rectifier service. In this service twelve tubes will supply d-c power for a 4000-horsepower locomotive.

A coaxial cathode-current return provides magnetic shielding. The tube also features baffles in the mercury pool to assure contact between the mercury and the ignitor points during swaying of the equipment.

A companion tube, the GL-6509 ignitron, has been designed to supply the auxiliary power requirements of applications which use the 6504 as the main power source.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation - Cyclic		
Cathode-Spot Starting - Ignitor		
Number of Electrodes		
Main Anodes	1	
Main Cathodes	1	
Ignitors	3	
Shield Grids	1	
Control Grids	1	
Arc Drop		
At 1000 Amperes Peak	20 ± 2	Volts
At 2000 Amperes Peak	25 ± 2	Volts

Mechanical

Envelope Material - Metal		
Net Weight	95	Pounds
Tube Mounting - See Outline Drawing		

Thermal

Type of Cooling - Water		
Inlet Water Temperature, minimum	30	Centigrade
Outlet Water Temperature, maximum	55	Centigrade
Water Flow		
At Continuous Rated Average Current, minimum	10	Gallons per Minute
At No Load, minimum	1	Gallon per Minute
Recommended Temperature Range	40 to 45	Centigrade
Characteristics for Water Cooling		
Water Temperature Rise, maximum	6.5	Centigrade
Pressure Drop at 10 Gallons per Minute, maximum	1.5	Pounds per Square Inch

G E N E R A L E L E C T R I C C O M P A N Y

from JETEC release #1335, July 23, 1954

MAXIMUM RATINGS

Power-Rectifier Service *, Continuous Duty

Maximum Peak Anode Voltage		
Inverse	4000	Volts
Forward	100	Volts
Maximum Anode Current		
Peak	1250	Amperes
Average		
Continuous	350	Amperes
2 Hours	400	Amperes
15 Minutes	500	Amperes
5 Minutes	700	Amperes
1 Minute	800	Amperes
Fault		
Forward Direction	15000	Amperes
Reverse Direction	30000	Amperes
Maximum Duration of Fault Current	0.15	Seconds

* Ratings are for Zero Phase-Control Angle at Frequency of 25 Cycles

Ignitor Requirements

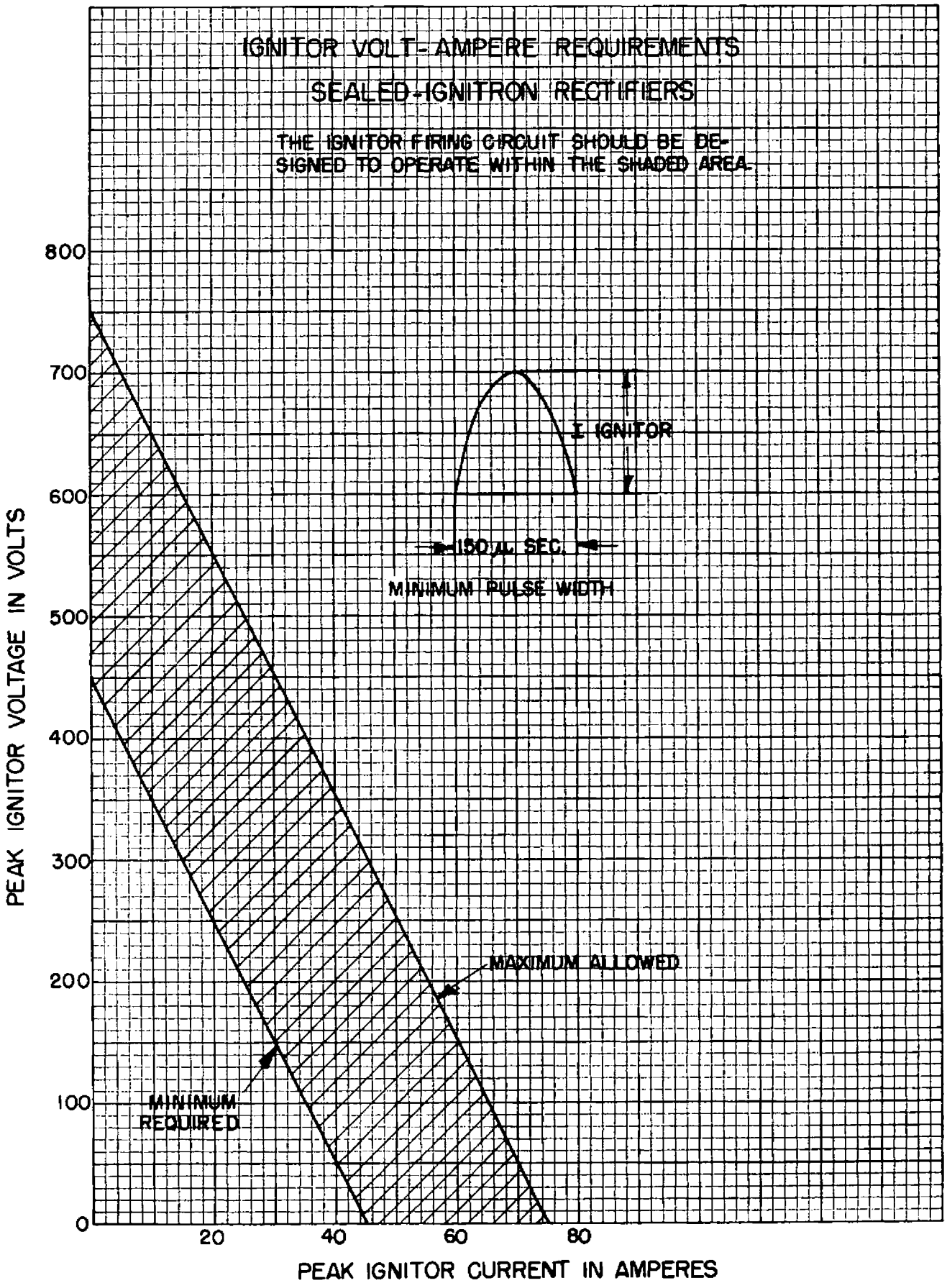
Volt-Ampere-Time Requirements - See Curve K-9033883			
Maximum Inverse Voltage		5	Volts
Maximum Current			
Root Mean Square		15	Amperes
Average		2.0	Amperes
Maximum Averaging Time		10	Seconds
Shield-Grid Voltage			
Peak Forward	200	500	Volts
Peak Inverse	-	200	Volts
Shield-Grid Current			
Peak Forward	0.2	5	Amperes
Peak Inverse	-	0.2	Amperes
Control-Grid Voltage			
Peak Forward	200	500	Volts
Peak Inverse	100	200	Volts
Control-Grid Current			
Peak Forward	0.4	5	Amperes
Peak Inverse	0.4	1	Amperes

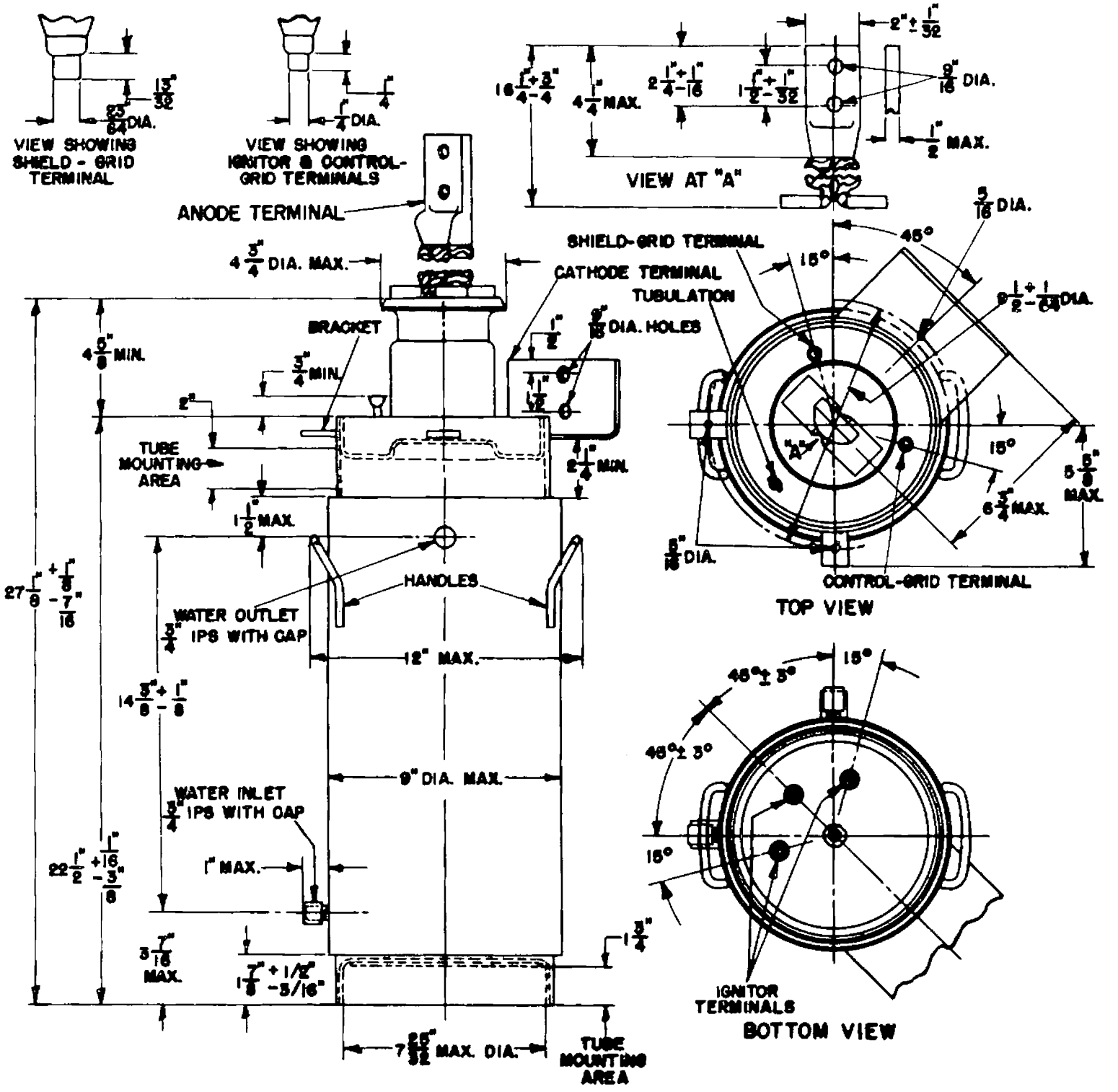
June 28, 1954

TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

SCHENECTADY 5, NEW YORK


IGNITOR VOLT-AMPERE REQUIREMENTS
SEALED-IGNITRON RECTIFIERS
THE IGNITOR FIRING CIRCUIT SHOULD BE DESIGNED TO OPERATE WITHIN THE SHADED AREA.
I IGNITOR
150 μ SEC.
MINIMUM PULSE WIDTH
MAXIMUM ALLOWED
MINIMUM REQUIRED
PEAK IGNITOR VOLTAGE IN VOLTS
PEAK IGNITOR CURRENT IN AMPERES
800
700
600
500
400
300
200
100
0
20
40
60
80



OUTLINE
GL-6504

PRELIMINARY DESCRIPTION AND RATING

IGNITRON GL-6509

The GL-6509 is an ignitron for railroad locomotive rectifier service. This tube is designed to supply the auxiliary power requirements in those locomotives that utilize the GL-6504 ignitron as the main power supply. In addition to this service the 6509 ratings also make the tube particularly suitable for use as the main power source in multiple-unit car installations.

The tube is similiar in construction to the GL-5555/FG-238-B ignitron but has the additional feature of baffles in the mercury pool to assure contact between the mercury and the ignitor points during swaying of the equipment.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation - Cyclic		
Cathode-Spot Starting - Ignitor		
Number of Electrodes		
Main Anodes	1	
Main Cathodes	1	
Ignitors	3	
Arc Drop		
At 600 Amperes Peak	16.2 ± 0.5	Volts

Mechanical

Envelope Material - Metal		
Net Weight	25	Pounds

Thermal

Type of Cooling - Water		
Inlet Water Temperature, minimum	30	Centigrade
Outlet Water Temperature, maximum		
Peak Inverse Anode Voltage = 900	60	Centigrade
Peak Inverse Anode Voltage = 2100	45	Centigrade
Water Flow		
At Continuous Rated Average Current, minimum	3	Gallons per Minute
At No Load, minimum	1	Gallon per Minute
Characteristics for Water Cooling at Rated Minimum Flow		
Water Temperature Rise, maximum	4.5	Centigrade
Pressure Drop at 3 Gallons per Minute, maximum	2	Pounds per Square Inch

MAXIMUM RATINGS

Power-Rectifier Service *, Continuous Duty

Maximum Peak Anode Voltage			
Inverse	900	2100	Volts
Forward	900	2100	Volts

from JETEC release #1335, July 23, 1954

MAXIMUM RATINGS (Cont'd)

Power-Rectifier Service *, ASA - Continuous Duty

Maximum Anode Current			
Peak	1800	1200	Amperes
Average			
Continuous	200	150	Amperes
2 Hours, Averaged Over any 2-Minute Period	300	225	Amperes
1 Minute, Averaged Over any 1-Minute Period	400	300	Amperes
Fault	12000	9000	Amperes
Maximum Duration of Fault Current	-	0.15	Seconds
Frequency Range	25 to 60	25 to 60	Cycles per Second

* Ratings are for Zero Phase-Control Angle

Ignitor Requirements

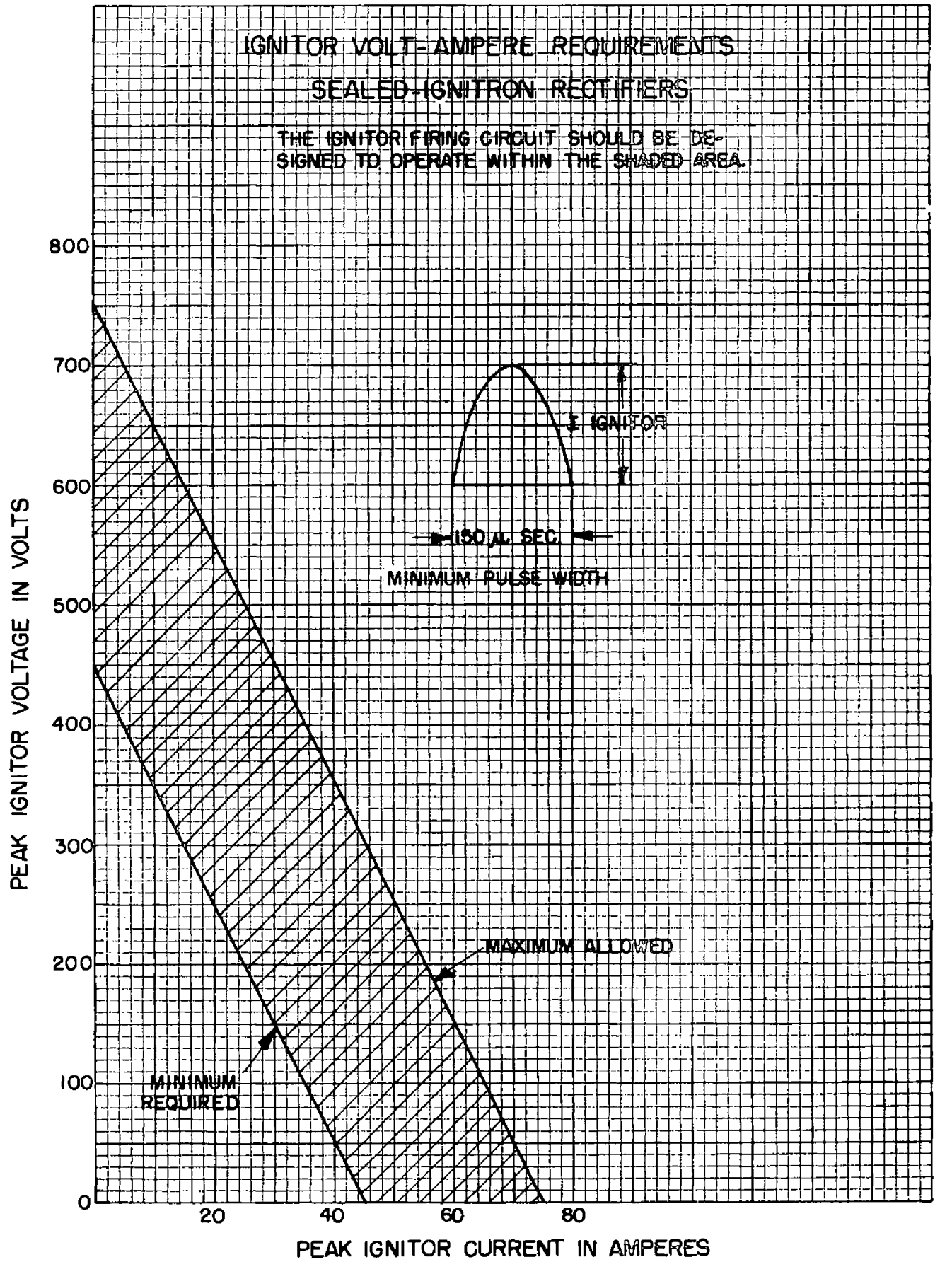
Volt-Ampere-Time Requirements - See Curve K-9033883		
Maximum Inverse Voltage	5	Volts
Maximum Current		
Root Mean Square	15	Amperes
Average	2.0	Amperes
Maximum Averaging Time	10	Seconds

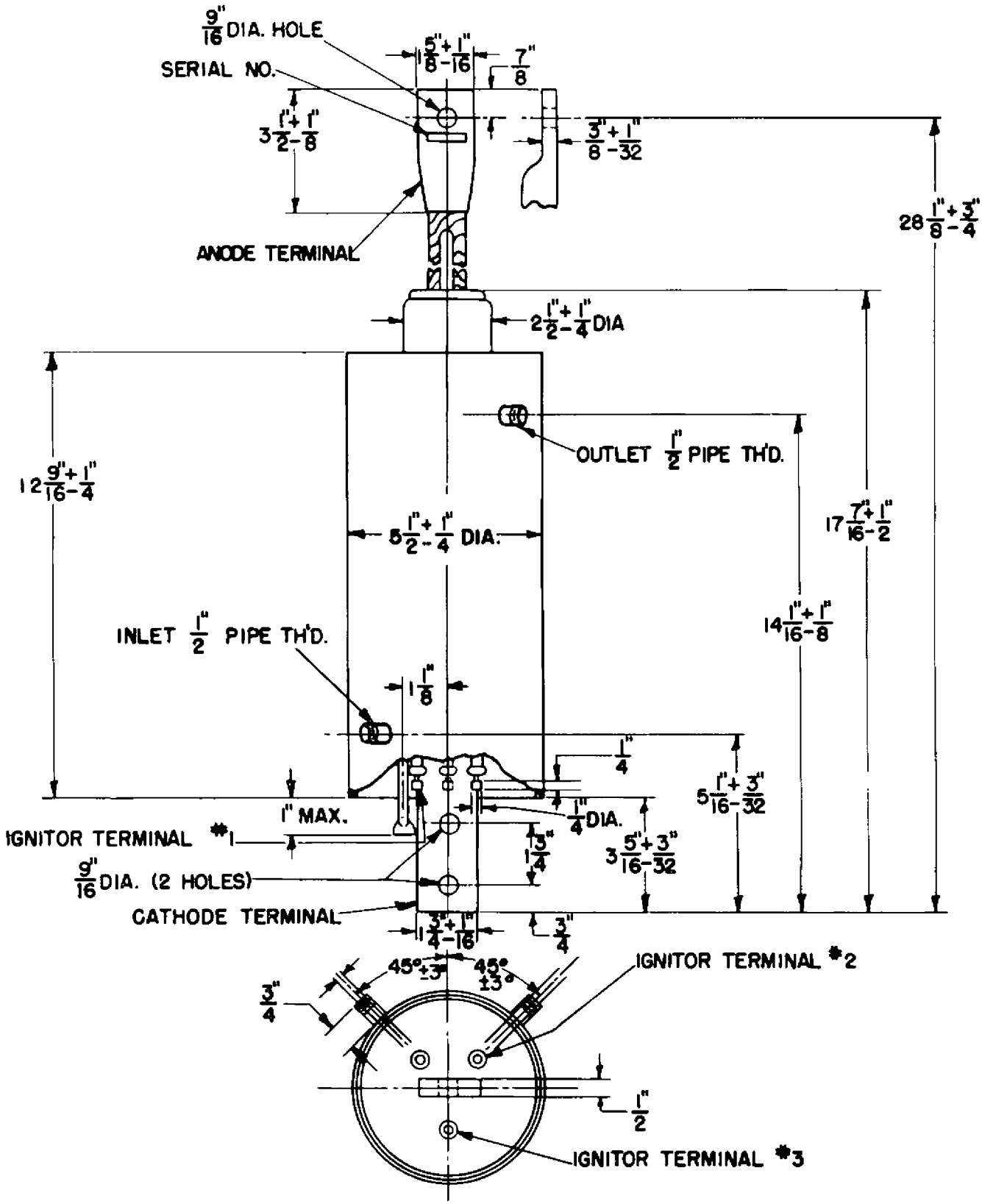
June 28, 1954

TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

SCHENECTADY 5, NEW YORK


IGNITOR VOLT-AMPERE REQUIREMENTS
SEALED-IGNITRON RECTIFIERS
THE IGNITOR FIRING CIRCUIT SHOULD BE DE-SIGNED TO OPERATE WITHIN THE SHADED AREA.
I IGNITOR
150 μ SEC.
MINIMUM PULSE WIDTH
MAXIMUM ALLOWED
MINIMUM REQUIRED
PEAK IGNITOR VOLTAGE IN VOLTS
PEAK IGNITOR CURRENT IN AMPERES
0
100
200
300
400
500
600
700
800
20
40
60
80



OUTLINE
GL-6509

DESCRIPTION AND RATING

TEMPERATURE-CONTROLLED IGNITRON GL-6511

The GL-6511 ignitron is a sealed, stainless-steel jacketed, water-cooled mercury-pool tube for control of frequency-changer resistance welders. This method of resistance welding converts three-phase 60-cycle power to single-phase power at four to twelve cycles per second. A particular advantage of this method is the appreciable reduction of kilovolt-ampere demand from that required in single-phase welding, with consequent saving in the amount of power required. In addition, the three-phase circuit balances the power load and makes possible improved results in welding aluminum, magnesium, and their alloys.

This tube is identical in ratings and characteristics to the GL-5822. Mechanically, it has the additional feature of an integral temperature-control device with protective features. The control includes a switch which operates a solenoid valve in the water-supply line to the tube in response to increasing and decreasing tube temperature, thus maintaining the amount of cooling water to the minimum required by the operating conditions. It also includes an over-temperature switch which may be used to remove power from the ignitron when its temperature exceeds a safe value.

This new construction prevents excessive condensation over the external parts of the tube under conditions of high humidity. Another advantage is the appreciable saving in maintenance costs over tubes of the old design since this control feature, in addition to greatly reducing the amount of water required, eliminates the necessity for such safety devices as water-flow relays, water over-temperature relays, and water-pressure interlocks required with the older design tubes. In applications where the cooling water flows through three tubes in series, this tube can be used with the GL-5822 since the GL-6511, in the position nearer the water drain where it receives the warmer water, can control the flow to all under normal conditions.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation - Cyclic		
Cathode Spot Starting - Ignitor		
Number of Electrodes		
Main Anodes	1	
Main Cathodes	1	
Ignitors	1	
Arc Drop at 1500 Peak Amperes	25	Volts
Cathode Excitation Requirements		
Ignitor Voltage Required to Fire	200	Volts
Ignitor Current Required to Fire	30	Amperes
Starting Time at Required Voltage or Current	100	Microseconds

Mechanical

Envelope Material - Stainless Steel		
Net Weight	8.4	Pounds

from JETEC release #1378, Dec. 6, 1954

Thermal

Type of Cooling - Water

Inlet Water Temperature, minimum	10	C
Inlet Water Temperature, maximum	30	C
Water Flow, minimum		
At No Load	0.5	Gallons per Minute
At Continuous Rated Average Current	1.5	Gallons per Minute

Characteristics for Water Cooling at Rated Minimum Flow

Water Temperature Rise, maximum	6	C
Pressure Drop at 1.5 Gallons per Minute, maximum	5	Pounds per Square Inch

MAXIMUM RATINGS AND TYPICAL OPERATION

Maximum Peak Anode Voltage			
Inverse	1200	1500	Volts
Forward	1200	1500	Volts
Maximum Anode Current*			
Peak	1500	1200	Amperes
Corresponding Average	20	16	Amperes
Average	70	56	Amperes
Corresponding Peak	420	336	Amperes
Maximum Averaging Time	6.25	6.25	Seconds
Ratio of Average to Peak Current	0.166	0.166	
Maximum Averaging Time	0.2	0.2	Seconds
Ratio of Fault to Peak Current	12.5	1.25	
Maximum Duration of Fault Current	0.15	0.15	Seconds
Frequency Range	50-60	50-60	Cycles per Second

Ignitor

Maximum Voltage		
Positive - Anode Voltage		
Negative	5	Volts
Maximum Current		
Peak	100	Amperes
Root Mean Square	10	Amperes
Average	1	Amperes
Maximum Averaging Time	5	Seconds

Temperature-Control-Switch Ratings ∤

Maximum Voltage	575	Volts
Maximum Current		
Over-Temperature Switch	6	Amperes
Water-Control Switch	1.5	Amperes

Temperature-Control-Switch Ratings + (Cont'd)

Maximum Peak Potential of Tube Water Cylinder (Above Switch Circuit)	1500	Volts
Switch-Contact Arrangement		
Over-Temperature-Switch - Normally Closed (Contacts Open on Temperature Rise)		
Water-Control Switch - Normally Open (Contacts Close on Temperature Rise)		

* Straight line interpolation on log-log paper is allowed between corresponding points. Ratings are for zero phase-control angle.

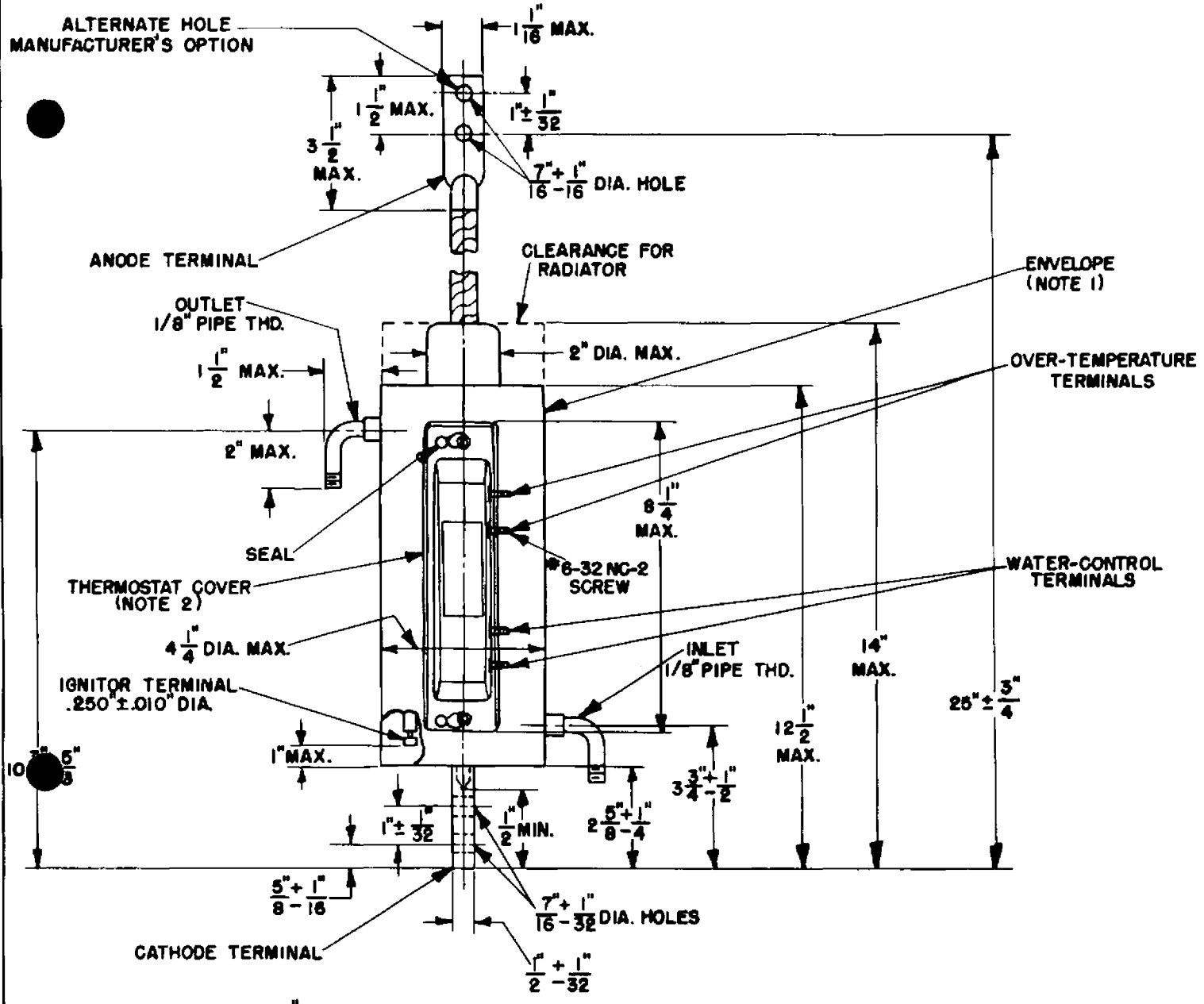
+ Suitable fuses should be provided in the switch circuits to prevent a power arc, should a ground occur in the switch or wiring.

November 11, 1954

TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

SCHENECTADY 5, NEW YORK



NOTES:

1. ENVELOPE IS AT CATHODE POTENTIAL.
2. THERMOSTAT COVER IS AN ELECTRICAL INSULATOR.

OUTLINE
GL-6511

REVISIONS	MADE BY A. Lastha, Nov. 3-1954	ASSIGNED BY Nov. 3, 54 acor	UN-7279
	GENERAL ELECTRIC ELECTRONICS DIVISION TUBE DEPARTMENT	K-69087-72A674 SHEET NO.....CONT. ON SHEET.....	PRINTS TO

7 45
5 15
9 1

RTD-227-A (3-54) PRINTED IN U.S.A.

K-69087-72A674

DESCRIPTION AND RATING

TEMPERATURE-CONTROLLED IGNITRON GL-6512

The GL-6512 ignitron is a sealed, steel-jacketed, water-cooled, mercury-pool tube designed for rectifier service in the 125-, 250-, 600-, and 900-volt d-c power fields. It is suitable for use in rectifiers rated up to 200 kilowatts output, depending on the number of ignitrons used, the output voltage, and the circuit. It has a continuous average current rating of 100 amperes per tube for this service. The tube is also designed for 2400-volt a-c control service where it has a rating of 1200 kilovolt-amperes.

This tube is identical in ratings and characteristics to the GL-5554/FG-259-B. Mechanically, it has the additional feature of an integral temperature-control device with protective features. The control includes a switch which operates a solenoid valve in the water-supply line to the tube in response to increasing and decreasing tube temperature, thus maintaining the amount of cooling water to the minimum required by the operating conditions. It also includes an over-temperature switch which may be used to remove power from the ignitron when its temperature exceeds a safe value.

This new construction prevents excessive condensation over the external parts of the tube under conditions of high humidity. Another advantage is the appreciable saving in maintenance costs over tubes of the old design since this control feature, in addition to greatly reducing the amount of water required, eliminates the necessity for such safety devices as water-flow relays, water over-temperature relays, and water-pressure interlocks required with the older design tubes. In applications where the cooling water flows through two or three tubes in series, this tube can be used with the GL-5554/FG-259-B since the GL-6512 in the position nearer the water drain where it receives the warmer water, can control the flow to all under normal conditions.

Like its prototype, the GL-6512 has an auxiliary anode and two ignitors. Excitation of the auxiliary anode permits stabilizing the cathode spot for very small anode currents. The two ignitors assure long life since only one is used at a time. Phase control of the ignitor impulses permits voltage control of the rectified output. In common with other ignitors arc losses in the GL-6512 are low, and design and construction features inherent in the steel-jacketed construction assure ease of installation, economical use of space, and reliability of operation.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation - Cyclic	
Cathode Spot Starting - Ignitor	
Number of Electrodes	
Main Anodes	1
Main Cathodes	1
Auxiliary Anodes	1
Ignitors	2

from JETEC release #1378, Dec. 6, 1954

Electrical (Cont'd)

Arc Drop at 100 Peak Amperes		12.6 ± 0.5	Volts
Arc Drop at 300 Peak Amperes		14.4 ± 0.5	Volts
Arc Drop at 600 Peak Amperes		17.3 ± 0.5	Volts
Cathode Excitation Requirements			
Ignitor Voltage Required to Fire		450	Volts
Ignitor Current Required to Fire		45	Amperes
Starting Time at Required Voltage or Current		100	Microseconds

Mechanical

Envelope Material - Stainless Steel			
Net Weight		13.5	Pounds

Thermal

Type of Cooling - Water

Inlet Water Temperature, minimum		0	C
Inlet Water Temperature*, maximum			
Power-Rectifier Service			
Peak Inverse Anode Voltage = 900 Volts		50	C
Peak Inverse Anode Voltage = 2100 Volts		35	C
AC Control Service			
Voltage = 2400 Volts RMS		30	C
Water Flow, minimum			
At Continuous Rated Average Current		1.5	Gallons per Minute
Characteristics for Water Cooling at Rated Minimum Flow			
Water Temperature Rise, maximum		6	C
Pressure Drop at 3 Gallons per Minute, maximum		5	Pounds per Square Inch

MAXIMUM RATINGS AND TYPICAL OPERATION

Power-Rectifier Service, Continuous Duty
Ratings are for Zero-Phase-Control

Maximum Peak Anode Voltage			
Inverse	900	2100	Volts
Forward	900	2100	Volts
Maximum Anode Current			
Peak	900	600	Amperes
Average			
Continuous	100	75	Amperes
Two-Hours - Averaged Over Any Two-Minute Interval	150	112.5	Amperes
One-Minute - Averaged Over Any One-Minute Interval	200	150	Amperes
Fault	6000	4500	Amperes
Maximum Duration of Fault Current	0.15	0.15	Seconds
Frequency Range	25-60	25-60	Cycles per Second

AC Control Service †
Two Tubes in Inverse Parallel, Ratings per Tube

Voltage	2400	Volts RMS
Maximum Demand	1200	Kilovolt-Amperes
Average Current at Maximum Demand	75	Amperes
Maximum Average Current	113	Amperes
Demand at Maximum Average Current	600	Kilovolt-Amperes
Maximum Averaging Time at 2400 Volts RMS	1.50	Seconds
Maximum Peak Fault Current	1500	Amperes
Frequency Range	25-60	Cycles per Second

Ignitor

Maximum Voltage		
Positive - Anode Voltage		
Negative	5	Volts
Maximum Current		
Peak	100	Amperes
Root Mean Square	15	Amperes
Average	2	Amperes
Maximum Averaging Time	10	Seconds
Typical Resistance Added to Ignitor Circuit for Anode Firing		
At Anode Voltage of 600 Volts or Less	4	Ohms
At Anode Voltage of 601 Volts to 1000 Volts	10	Ohms
At Anode Voltage of 1001 Volts to 1500 Volts	20	Ohms
At Anode Voltage of 1501 Volts to 2000 Volts	35	Ohms
At Anode Voltage of 2001 Volts to 2400 Volts	50	Ohms

Auxiliary-Anode

Maximum Peak Forward Voltage	160	Volts
Maximum Peak Inverse Voltage		
Main Anode Conducting	25	Volts
Main Anode Not Conducting	160	Volts
Maximum Current		
Peak	30	Amperes
Average	9	Amperes
Maximum Averaging Time	10	Seconds
Root Mean Square	15	Amperes

Temperature-Control-Switch Ratings ‡

Maximum Voltage	575	Volts
Maximum Current		
Over-Temperature Switch	6	Amperes
Water-Control Switch	1.5	Amperes
Maximum Peak Potential of Tube Water Cylinder Above Ground	1500	Volts

Switch Contact Arrangement
Over-Temperature Switch - Normally Closed
(Contacts Open on Temperature Rise)
Water-Control Switch - Normally Open
(Contacts Close on Temperature Rise)

* No more than three tubes should be connected in series for water flow. When the series connection is used the temperature of the incoming water must be within the rated limit for the warmest tubes in the series.

† RMS demand voltage, current, and kilovolt-ampere demand are all on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used.

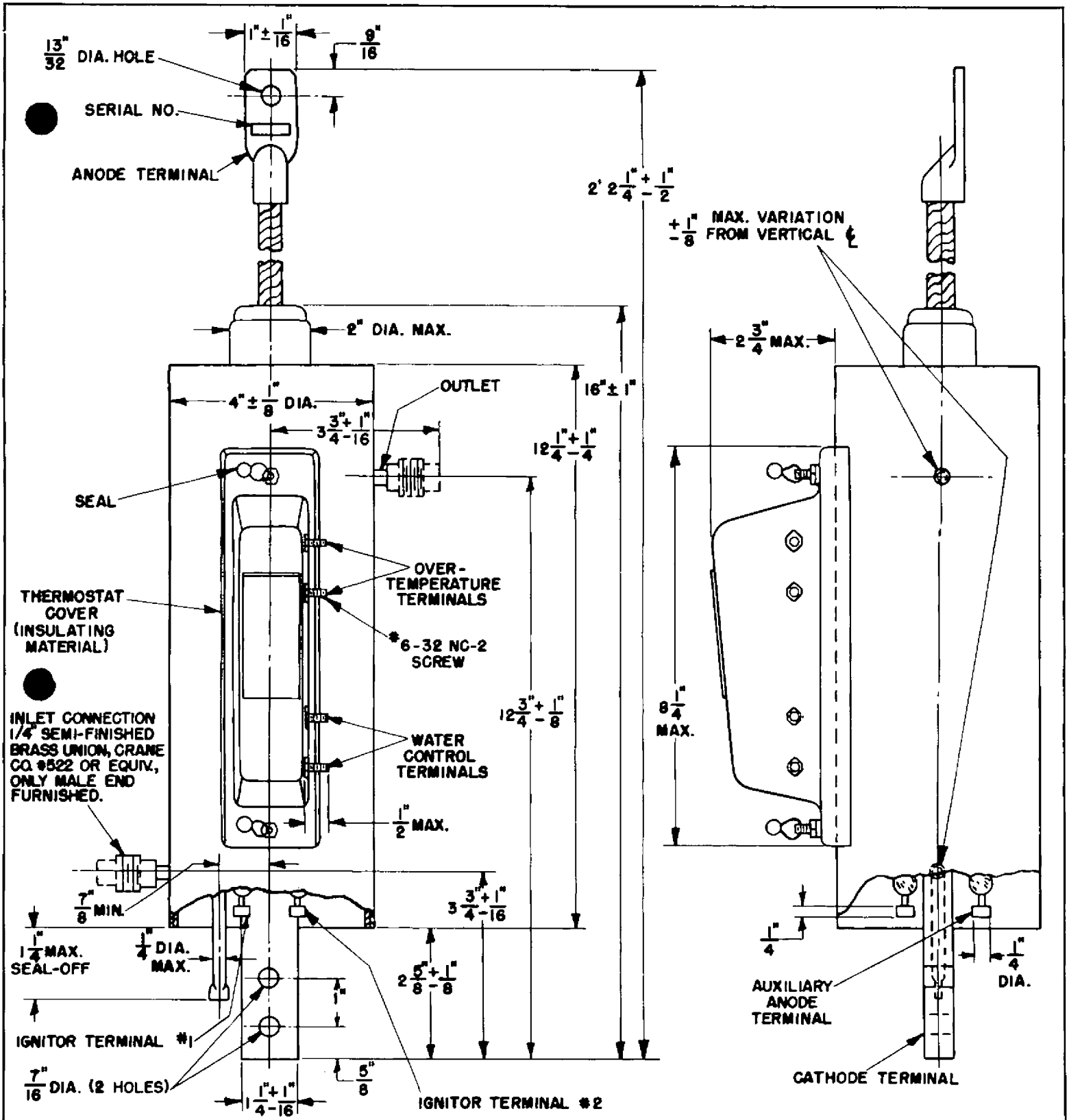
‡ Suitable fuses should be provided in the switch circuits to prevent a power arc should a ground occur in the switch or wiring.

November 11, 1954

TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

SCHENECTADY 5, NEW YORK



OUTLINE
GL-6512

1. 4 Oct 1954 ccm Castle JK-18488 REVISIONS	MADE BY E. J. Semizbratov, Oct 13-1954	RE-INSPECTED BY Prof. 19 Oct 54 ccm	JK-18476
	GENERAL ELECTRIC ELECTRONICS DIVISION — TUBE DEPARTMENT	N22022AZ SHEET NO. ..... CONT. ON SHEET	PRINTS TO

RTD-227-A (3-54) PRINTED IN U.S.A.

DESCRIPTION AND RATING

TEMPERATURE-CONTROLLED IGNITRON GL-6513

The GL-6513 ignitron is a sealed, stainless-steel-jacketed, water-cooled, mercury-pool tube designed for rectifier service in the 125-, 250-, 600-, and 900-volt d-c power fields. It is suitable for use in rectifiers rated up to 1000 kilowatts output, depending on the number of ignitrons used, the output voltage, and the circuit. Continuous average current rating is 200 amperes per tube in such service. The tube is also designed for 2400-volt a-c control service where it has a rating of 2400 kilovolt-amperes.

This tube is identical in ratings and characteristics to the GL-5555/FG-238-B. Mechanically, it has the additional feature of an integral temperature-control device with protective features. The control includes a switch which operates a solenoid valve in the water-supply line to the tube in response to increasing and decreasing tube temperature, thus maintaining the amount of cooling water to the minimum required by the operating conditions. It also includes an over-temperature switch which may be used to remove power from the ignitron when its temperature exceeds a safe value.

This new construction prevents excessive condensation over the external parts of the tube under conditions of high humidity. Another advantage is the appreciable saving in maintenance costs over tubes of the old design since this control feature, in addition to greatly reducing the amount of water required, eliminates the necessity for such safety devices as water-flow relays, water over-temperature relays, and water-pressure interlocks required with the older design tubes. In applications where the cooling water flows through two or three tubes in series this tube can be used with the GL-5555/FG-238-B since the GL-6513 in the position nearer the water drain where it receives the warmer water, can control the flow to all under normal conditions.

Like its prototype, the GL-6513 has an auxiliary anode and two ignitors. Excitation of the auxiliary anode permits stablizing the cathode spot for very small anode currents. The two ignitors assure long life since only one is used at a time. Phase control of the ignitor impulses permits voltage control of the rectified output. In common with other ignitrons arc losses in the GL-6513 are low, and design and construction features inherent in the steel-jacketed construction assure ease of installation, economical use of space, and reliability of operation.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation - Cyclic
Cathode Spot Starting - Ignitor
Number of Electrodes

Main Anodes	1
Main Cathodes	1
Auxiliary Anodes	1
Ignitors	2

G E N E R A L E L E C T R I C C O M P A N Y

from JETEC release #1378, Dec. 6, 1954

Electrical (Cont'd)

Arc Drop at 600 Peak Amperes		16.2 ± 0.5	Volts
Cathode Excitation Requirements			
Ignitor Voltage Required to Fire		450	Volts
Ignitor Current Required to Fire		45	Amperes
Starting Time at Required Voltage or Current		100	Microseconds

Mechanical

Envelope Material - Stainless Steel			
Net Weight		25	Pounds

Thermal

Type of Cooling - Water			
Inlet Water Temperature, minimum		-15 0	C
Inlet Water Temperature*, maximum			
Power-Rectifier Service			
Peak Inverse Anode Voltage = 900 Volts		50	C
Peak Inverse Anode Voltage = 2100 Volts		35	C
AC Control Service			
Voltage = 2400 Volts RMS		25	C
Water Flow, minimum			
At Continuous Rated Average Current		3	Gallons per Minute
Characteristics for Water Cooling at Rated Minimum Flow			
Water Temperature Rise, maximum		7	C
Pressure Drop at 3 Gallons per Minute, maximum		6	Pounds per Square Inch

MAXIMUM RATINGS AND TYPICAL OPERATION

Power-Rectifier Service, Continuous Duty
Ratings are for Zero-Phase-Control

Maximum Peak Anode Voltage			
Inverse	900	2100	Volts
Forward	900	2100	Volts
Maximum Anode Current			
Peak	1800	1200	Amperes
Average			
Continuous	200	150	Amperes
Two-Hours - Averaged Over Any Two-Minute Interval	300	225	Amperes
One-Minute - Averaged Over Any One-Minute Interval	400	300	Amperes
Fault	12,000	9000	Amperes
Maximum Duration of Fault Current	0.15	0.15	Seconds
Frequency Range	25-60	25-60	Cycles per Second

AC Control Service †
Two Tubes in Inverse Parallel, Ratings per Tube

Voltage	2400	Volts RMS
Maximum Demand	2400	Kilovolt-Amperes
Average Current at Maximum Demand	135	Amperes
Maximum Average Current	207	Amperes
Demand at Maximum Average Current	1105	Kilovolt-Amperes
Maximum Averaging Time at 2400 Volts RMS	1.66	Seconds
Maximum Peak Fault Current	6000 ~~3000~~	Amperes
Frequency Range	25-60	Cycles per Second

Ignitor

Maximum Voltage		
Positive - Anode Voltage		
Negative	5	Volts
Maximum Current		
Peak	100	Amperes
Root Mean Square	15	Amperes
Average	2	Amperes
Maximum Averaging Time	10	Seconds

Auxiliary-Anode

Maximum Peak Forward Voltage	160	Volts
Maximum Peak Inverse Voltage		
Main Anode Conducting	25	Volts
Main Anode Not Conducting	160	Volts
Maximum Current		
Peak	30	Amperes
Average	9	Amperes
Maximum Averaging Time	10	Seconds
Root Mean Square	15	Amperes

Temperature-Control-Switch Ratings ‡

Maximum Voltage	575	Volts
Maximum Current		
Over-Temperature Switch	6	Amperes
Water-Control Switch	1.5	Amperes
Maximum Peak Potential of Tube Water Cylinder		
Above Ground	1500	Volts
Switch-Contact Arrangement		
Over-Temperature Switch - Normally Closed (Contacts Open on Temperature Rise)		
Water-Control Switch - Normally Open (Contacts Close on Temperature Rise)		

* No more than three tubes should be connected in series for water flow. When the series connection is used the temperature of the incoming water must be within the rated limit for the warmest tubes in the series.

† RMS demand voltage, current, and kilovolt-ampere demand are all on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used.

‡ Suitable fuses should be provided in the switch circuits to prevent a power arc should a ground occur in the switch or wiring.

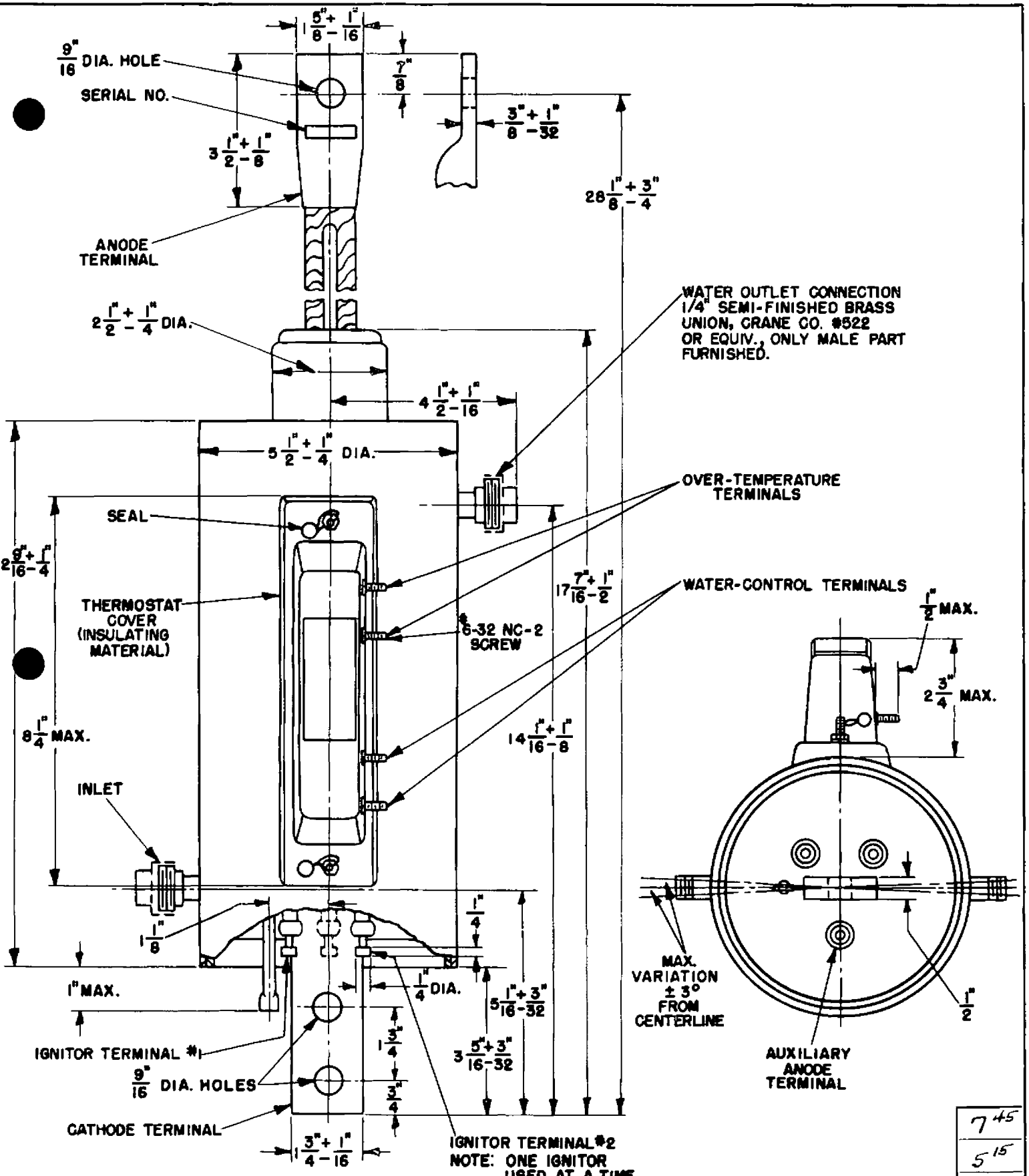
November 16, 1954

TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

SCHENECTADY 5, NEW YORK

N22023AZ



N22023AZ

OUTLINE
GL-6513

-1	OCT 19-54 A. Castle JA-18488	REVISIONS	

MADE BY E. J. SONNENBERG - Oct. 13-1954 | RE-INSPECTED BY Oct 19 '54 | JA-18975

GENERAL ELECTRIC — ELECTRONICS DIVISION — TUBE DEPARTMENT

N22023AZ

SHEET NO. ..... CONT. ON SHEET .....

PRINTS TO

7 45
5 15

RTD-227-A (3-54)

PRINTED IN U.S.A.

from JETEC release
#1453, April 25, 1955

GL-6514

IGNITRON

DESCRIPTION AND RATING

The GL-6514 is a permanently sealed water-cooled rectifier ignitron similar in contruction and rating to the GL-5788. Special features are the addition of an integral temperature-control device with protective features, low water-pressure drop, and distinctive (larger diameter) ignitor terminals. The tube is designed for operation in 300, 600, and 900 volt d-c industrial rectifier circuits. The continuous average anode current rating is 200 amperes per tube in rectifiers rated up to 400 volts d-c. The control includes a switch which operates a solenoid valve in the water-supply line to the tube in response to increasing and decreasing tube temperature, thus maintaining the amount of cooling water to the minimum required by the operating conditions. It also includes an over-temperature switch which may be used to remove power from the ignitron when its temperature exceeds a safe value.

This new design of tube eliminates the need for the heat exchangers and recirculating water systems required to ensure safe operation of the non-temperature-controlled tube when the available cooling water temperature is too low to provide the minimum reliable mercury-vapor pressure in the tubes. Another advantage is that the temperature-controlled tubes can be used to replace the usual safety devices such as water-flow relays, water over-temperature relays, and water-pressure inter-locks which have required considerable maintenance in the past. Another advantage is that these tubes may be used to prevent excessive moisture condensation over the external parts of the tubes under conditions of high humidity.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation - Cyclic	
Cathode-Spot Starting - Ignitor	
Number of Electrodes	
Main Anodes	1
Main Cathodes	1
Auxiliary Anodes	1
Ignitors	2
Arc Drop	
At 600 Amperes Peak	16.2 ± 0.5 Volts
Cathode Excitation Requirements	
Ignitor Voltage Required to Fire	450 Volts
Ignitor Current Required to Fire	45 Amperes
Excitation Arc Current Required, minimum	8 Amperes

Excitation Arc-Drop Voltage	9 ± 0.5 Volts
Excitation Arc Open-Circuit Voltage, minimum	55 Volts AC

Mechanical

Envelope Material - Metal	
Net Weight, Approximate	25 Pounds
Type of Cooling - Water	
Characteristics for Water Cooling	
Water Temperature Rise, maximum	4.5 C
Pressure Drop at 3 Gallons per Minute, maximum	3 Pounds per Square Inch

Thermal

Water Cooling	
Inlet Water Temperature, maximum	
Peak Inverse Anode Voltage = 900	55 Centigrade
Peak Inverse Anode Voltage = 2100	50 Centigrade
Inlet Water Temperature, minimum	6 C
Water Flow	
At Continuous Rated Average Current, minimum	3 Gallons per Minute

MAXIMUM RATINGS

As Power Rectifier Tube *

Maximum Peak Anode Voltage		
Inverse	900	2100 Volts
Forward	900	2100 Volts
Maximum Anode Current		
Peak	1800	1200 Amperes
Average		
Continuous	200	150 Amperes
2 Hours	300	225 Amperes
1 Minute	400	300 Amperes
Surge	12000	9000 Amperes
Maximum Duration of Surge Current	0.15	0.15 Second
Frequency Range	25 to 60	25 to 60 Cycles per Second

* Ratings are for zero phase-control angle.

As AC Control Tube

Two Tubes in Inverse Parallel	
Voltage	2400 RMS Volts
Maximum Demand	2400 Kilovolt-Amperes
Average Current at Maximum Demand	135 Amperes

Maximum Average Current	207 Amperes
Demand at Maximum Average Current	1105 Kilovolt-Amperes
Maximum Averaging Time at 2400 Volts RMS	1.66 Seconds
Maximum Surge Current	6000 Peak Amperes

Ignitor	
Maximum Voltage	
Positive	Anode Volts
Negative	5 Volts
Maximum Current	
Peak	100 Amperes
Root Mean Square	15 Amperes
Average	2.0 Amperes
Maximum Averaging Time	10 Seconds
Starting Time at Required Voltage or Current	100 Microseconds

Auxiliary Anode	
Maximum Current	
Peak	30 Amperes
Average	9 Amperes
Maximum Averaging Time	10 Seconds
Root Mean Square	15 Amperes
Maximum Peak Forward Voltage	160 Volts
Maximum Peak Inverse Voltage	
Main Anode Conducting	25 Volts
Main Anode Not Conducting	160 Volts

Temperature-Control-Switch Ratings [1]	
Maximum Voltage	575 Volts
Maximum Current	
Over-Temperature Switch	6 Amperes
Water-Control Switch	1.5 Amperes
Maximum Peak Potential Difference Between Tube Water Cylinder and Switch Circuit	1500 Volts
Switch Contact Arrangement	
Over-Temperature Switch - Normally Closed (Contacts Open on Temperature Rise)	
Water-Control Switch - Normally Open (Contacts Close on Temperature Rise)	

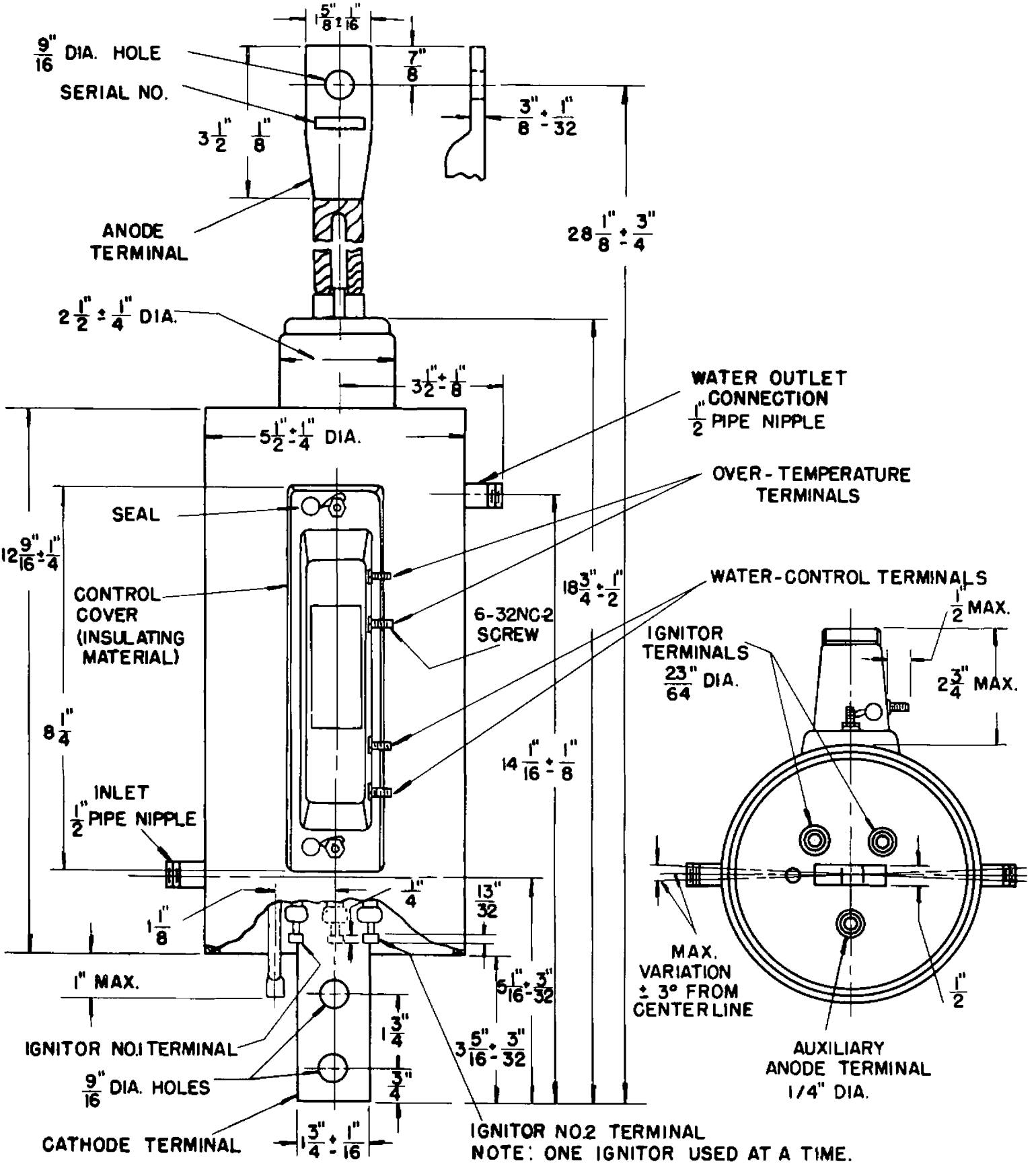
[1] Suitable fuses should be provided in the switch circuits to prevent a power arc, should a ground occur in the switch or wiring.

January 31, 1955

TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

SCHENECTADY 5, N. Y.


9/16" DIA. HOLE
SERIAL NO.
1 5/8" ± 1/16"
7/8"
3" ± 1/32"
3 1/2"
1/8"
ANODE TERMINAL
28 1/8" ± 3/4"
2 1/2" ± 1/4" DIA.
3 1/2" ± 1/8"
WATER OUTLET CONNECTION
1/2" PIPE NIPPLE
5 1/2" ± 1/4" DIA.
OVER-TEMPERATURE TERMINALS
SEAL
12 9/16" ± 1/4"
CONTROL COVER (INSULATING MATERIAL)
18 3/4" ± 1/2"
WATER-CONTROL TERMINALS
6-32NC-2 SCREW
1/2" MAX.
IGNITOR TERMINALS 23/64" DIA.
2 3/4" MAX.
8 1/4"
14 1/16" ± 1/8"
INLET 1/2" PIPE NIPPLE
1 1/8"
1/4"
13/32"
1" MAX.
5 1/16" ± 3/32"
MAX. VARIATION ± 3° FROM CENTER LINE
1/2"
IGNITOR NO.1 TERMINAL
1 3/4"
3 5/16" ± 3/32"
9/16" DIA. HOLES
3/4"
AUXILIARY ANODE TERMINAL 1/4" DIA.
CATHODE TERMINAL
1 3/4" ± 1/16"
IGNITOR NO.2 TERMINAL
NOTE: ONE IGNITOR USED AT A TIME.

DESCRIPTION AND RATING

TEMPERATURE-CONTROLLED IGNITRON GL-6515

The GL-6515 is a mercury-pool tube of permanently sealed steel construction designed for rectifier service in the 125-, 250-, 600-, and 900-volt d-c power fields. It is suitable for use in rectifiers rated up to 2000 kilowatts output, depending on the number of ignitrons used, the output voltage, and the circuit. Continuous average current rating is 400 amperes per tube in such service. The tube is also designed for 2400-volt a-c control service where it has a rating of 4800 kilovolt amperes.

This tube is identical in ratings and characteristics to the GL-5564/GL-507. Mechanically, it has the additional feature of an integral temperature-control device with protective features. The control includes a switch which operates a solenoid valve in the water-supply line to the tube in response to increasing and decreasing tube temperature, thus maintaining the amount of cooling water to the minimum required by the operating conditions. It also includes an over-temperature switch which may be used to remove power from the ignitron when its temperature exceeds a safe value.

This new construction prevents excessive condensation over the external parts of the tube under conditions of high humidity. Another advantage is the appreciable saving in maintenance costs over tubes of the old design since this control feature, in addition to greatly reducing the amount of water required, eliminates the necessity for such safety devices as water-flow relays, water over-temperature relays, and water-pressure interlocks required with the older design tubes. In applications where the cooling water flows through two or three tubes in series, this tube can be used with the GL-5564/GL-507 since the GL-6515, in the position nearer the water drain where it receives the warmer water, can control the flow to all under normal conditions.

Like its prototype, the GL-6515 has an auxiliary anode and two ignitors. Excitation of the auxiliary anode permits stabilizing the cathode spot for very small anode currents. The two ignitors assure long life since only one is used at a time. Phase control of the ignitor impulses permits voltage control of the rectified output. In common with other ignitrons arc losses in the GL-6515 are low, and design and construction features inherent in the steel-jacketed construction assure ease of installation, economical use of space, and reliability of operation.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation - Cyclic
Cathode Spot Starting - Ignitor
Number of Electrodes

Main Anodes	1
Main Cathodes	1
Auxiliary Anodes	1
Ignitors	2
Control Grids	1

from JETEC release #1378, Dec. 6, 1954

Electrical (Cont'd)

Arc Drop at 1200 Peak Amperes	18.2 ± 0.1	Volts
Arc Drop at 8000 Peak Amperes	35 ± 0.1	Volts
Cathode Excitation Requirements		
Ignitor Voltage Required to Fire	450	Volts
Ignitor Current Required to Fire	45	Amperes
Starting Time at Required Voltage or Current	100	Microseconds
Peak Excitation Arc Current Required, minimum	6	Amperes
Excitation Arc-Drop Voltage	12	Volts
Grid Requirements*		
Minimum Voltage to Establish Conduction	50	Volts
Minimum Voltage to Prevent Conduction	100	Volts
Positive Current to Establish Conduction	0.1	Amperes

Mechanical

Envelope Material - Stainless Steel		
Net Weight	90	Pounds

Thermal

Type of Cooling - Water

Inlet Water Temperature ≠, minimum	0	C
Inlet Water Temperature ≠, maximum		
Power-Rectifier Service		
Peak Inverse Anode Voltage = 900 Volts	50	C
Peak Inverse Anode Voltage = 2100 Volts	40	C
AC Control Service		
Voltage = 250 Volts RMS	30	C
Voltage = 600 Volts RMS	30	C
Voltage = 2400 Volts RMS	30	C
Water Flow, minimum		
At Continuous Rated Average Current	6	Gallons per Minute
Characteristics for Water Cooling at Rated Minimum Flow		
Water Temperature Rise, maximum	19	C
Pressure Drop at 6 Gallons per Minute, maximum	1	Pound per Square Inch

≠ Dependent upon load conditions. For substantially constant load 0 C is is satisfactory. For widely fluctuating loads 25 C is required.

MAXIMUM RATINGS AND TYPICAL OPERATION

Power-Rectifier Service, Continuous Duty
Ratings are for Zero-Phase-Control Angle

Maximum Peak Anode Voltage		
Inverse	900	2100 Volts
Forward	900	2100 Volts
Maximum Anode Current		
Peak	3600	2400 Amperes
Average		
Continuous	400	300 Amperes
Two-Hours - Averaged Over Any Two-Minute Interval	600	450 Amperes
One-Minute - Averaged Over Any One-Minute Interval	800	600 Amperes
Fault	25,000	19,000 Amperes
Maximum Duration of Fault Current	0.15	0.15 Seconds
Frequency Range	25-60	25-60 Cycles per Second

AC Control Service
Two Tubes in Inverse Parallel, Ratings per Tube

Voltage	250	600	2400	Volts RMS
Maximum Demand	1500	3600	4800	Kilovolt-Amperes
Average Current at Maximum Demand	850	530	270	Amperes
Maximum Average Current	850	850	414	Amperes
Demand at Maximum Average Current	1500	1600	2210	Kilovolt-Amperes
Maximum Averaging Time	9	3.4	1.66	Seconds
Maximum Peak Fault Current	17,000	17,000	6000	Amperes
Frequency Range	25-60	25-60	25-60	Cycles per Second

Ignitor

Maximum Voltage		
Positive - Anode Voltage		
Negative	5	Volts
Maximum Current		
Peak	100	Amperes
Root Mean Square	15	Amperes
Average	2	Amperes
Maximum Averaging Time	10	Seconds

Typical Resistance Added to Ignitor Circuit for Anode Firing		
At Anode Voltage of 600 Volts or Less	4	Ohms
At Anode Voltage of 601 Volts to 1000 Volts	10	Ohms
At Anode Voltage of 1001 Volts to 1500 Volts	20	Ohms
At Anode Voltage of 1501 to 2000 Volts	35	Ohms
At Anode Voltage of 2001 to 2400 Volts	50	Ohms

Auxiliary-Anode

Maximum Peak Forward Voltage	160	Volts
Maximum Peak Inverse Voltage		
Main Anode Conducting	25	Volts
Main Anode Not Conducting	160	Volts
Maximum Current		
Peak	30	Amperes
Average	9	Amperes
Maximum Averaging Time	10	Seconds
Root Mean Square	15	Amperes

Grid*

Maximum Peak Forward Voltage	250	Volts
Maximum Peak Inverse Voltage	300	Volts
Maximum Grid-Current		
Peak Positive	1.5	Amperes
Peak Negative	0.5	Amperes
Average	0.5	Amperes
Root Mean Square	1.0	Amperes

Temperature-Control-Switch Ratings ††

Maximum Voltage	575	Volts
Maximum Current		
Over-Temperature Switch	6	Amperes
Water-Control Switch	1.5	Amperes
Maximum Peak Potential of Tube Water Cylinder		
Above Ground	1500	Volts
Switch-Contact Arrangement		
Over-Temperature Switch - Normally Closed (Contacts Open on Temperature Rise)		
Water-Control Switch - Normally Open (Contacts Close on Temperature Rise)		

* At main anode voltages of 500 volts and over, the grid circuits should provide a negative d-c bias of 100 volts and a suitable turn-on voltage to swing the grid positive at the time the ignitor is fired. At lower anode voltages, it is sufficient to connect the grid to the main anode through a resistor. In either case, the grid-circuit resistance should be 500 to 1000 ohms.

† No more than three tubes should be connected in series for water flow. When the series connection is used the temperature of the incoming water must be within the rated limit for the warmest tubes in the series.

5 RMS demand voltage, current, and kilovolt-ampere demand are all on the basis of full-cycle conduction (no phase delay) regardless of where or not phase control is used. For voltages below the minimum, the minimum-voltage current rating applies. With the use of log-log paper straight-line interpolation between tabulated points may be used for other detailed ratings of: Demand kva vs average anode current, and maximum averaging time vs anode voltage.

11 Suitable fuses should be provided in the switch circuits to prevent a power arc should a ground occur in the switch or wiring.

November 11, 1954

TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

SCHENECTADY 5, NEW YORK

GENERAL ELECTRIC

N22024AZ

CONT ON SHEET SH NO.

REV NO.

N22024AZ

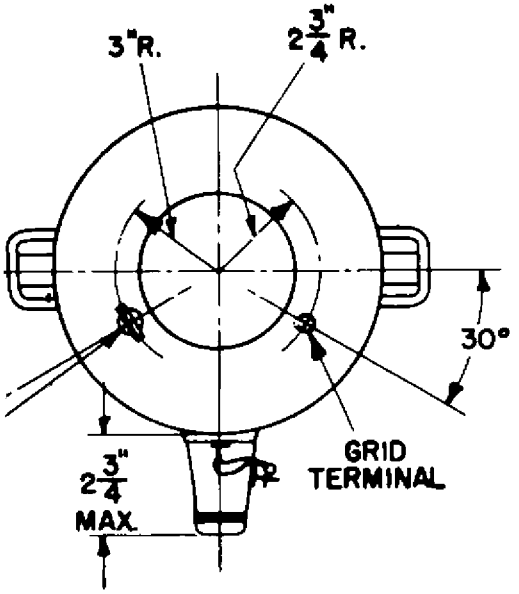
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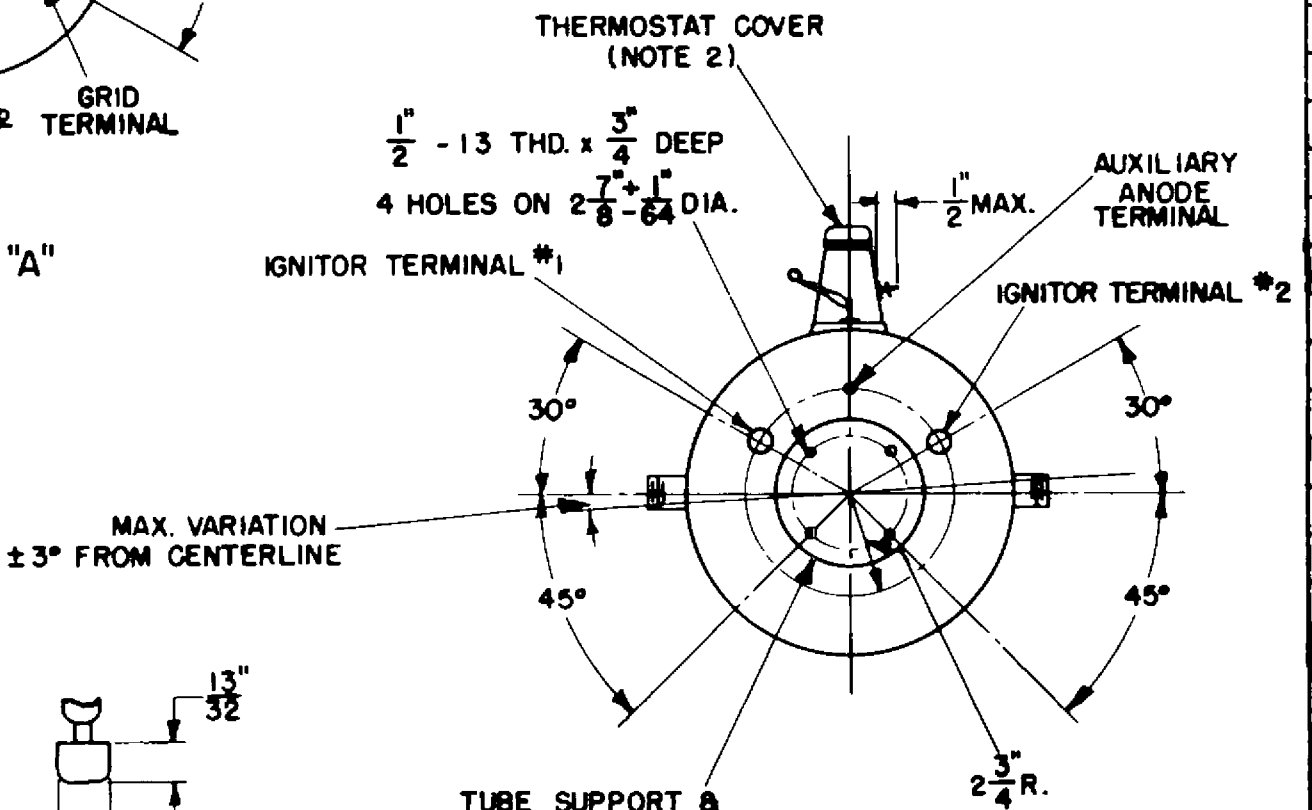
OUTLINE
GL-6515

FIRST MADE FOR

NOTES:
1. ENVELOPE IS AT CATHODE POTENTIAL.
2. THERMOSTAT COVER IS AN ELECTRICAL INSULATOR.



VIEW AT "A"



VIEW AT "B"

IGNITOR TERMINALS

1/4

1/4 DIA.

IY ANODE &
ERMINALS

REVISIONS	PRINTS TO
	7 #5
	515
	91

MADE BY
L. Cooke, Dec. 4-1954
ISSUED
Nov. 4. 1954

JK-18532

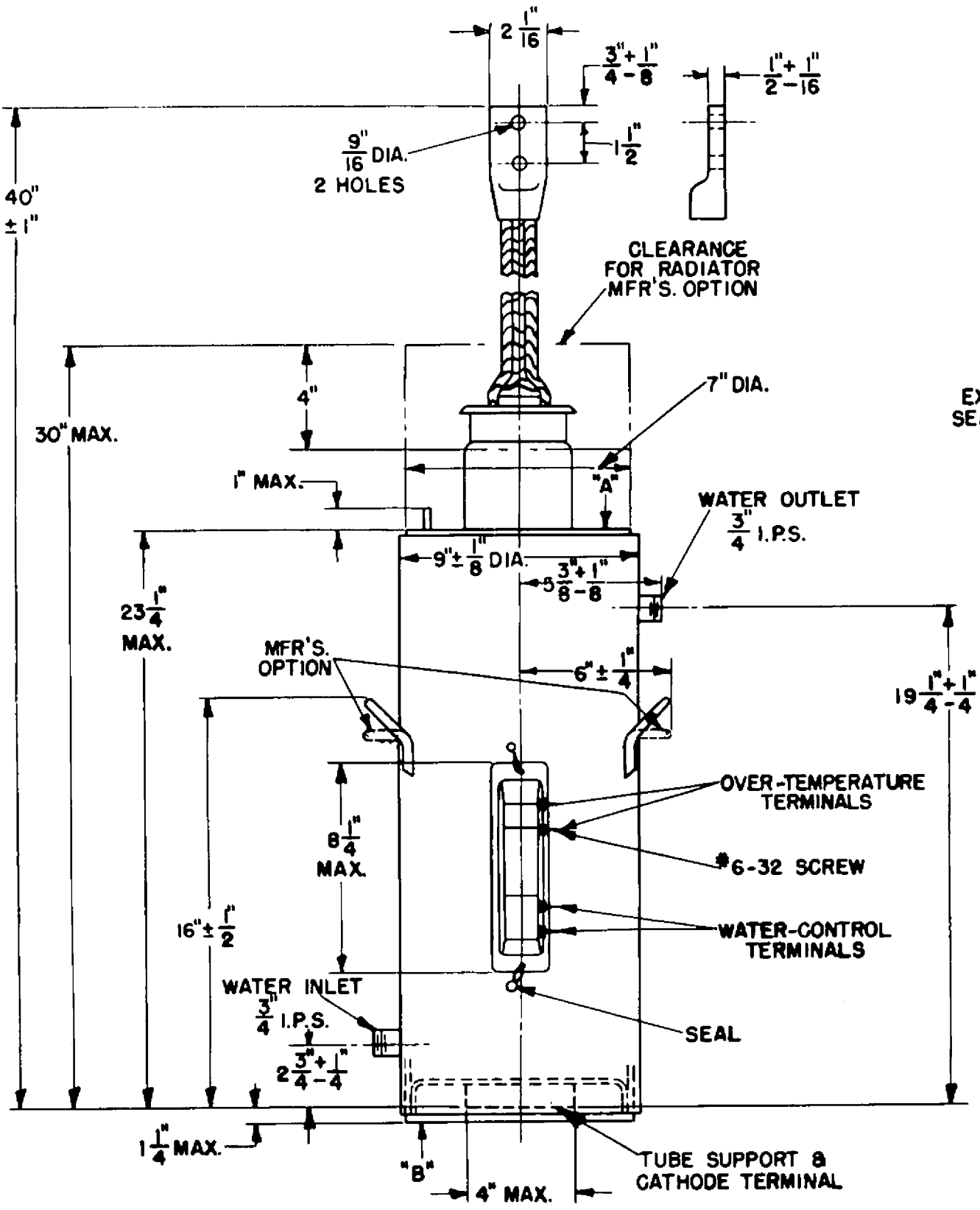
ELECT. & TUBE DIV. OR DEPT.
SCH'TDY LOCATION

N22024AZ
CONT ON SHEET SH NO.

VT

DRAWING NO. N22024AZ

CONT ON SHEET SH NO.



from JETEC release #1431, Aug. 16, 1954

Description and Rating

MAGNETRON GL-6527

9345 - 9405 MEGACYCLES	INTEGRAL MAGNET
9 KILOWATTS PEAK OUTPUT	FORCED-AIR-COOLED
PULSED	HIGH-ALTITUDE OPERATION

The GL-6527 is a forced-air-cooled fixed-frequency pulsed-type oscillator tube. A particular feature of this tube is its ability to operate reliably at altitudes as high as 60,000 feet.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Voltage - Pre-Heat	6.3 ± 10%	Volts
Heater Current at 6.3 Volts - Pre-Heat	500	Milliamperes
Heating Time - Pre-Heat, minimum	2	Minutes

Mechanical

Mounting Position - Any
Mounting Support - UG-40/U Choke Flange

Output Coupling - UG-40/U Flange
Load Transmission Line - RG-52/U Waveguide

Anode Temperature, Maximum [redacted]	200	C
Cathode Stem Temperature, Maximum [redacted]	200	C
Net Weight, approximate	3	Pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Absolute Values

Duty Cycle	0.0025	
Heater Voltage	7.0 Max	Volts
Heater Current	0.60 Max	Amperes
Peak Anode Voltage	6000 Max	Volts
Peak Anode Current	5.5 Max	Amperes
Average Power Input	82.5 Max	Watts
Pulse Duration	2.5 Max	Microseconds
Rate of Rise of Anode Voltage	60 Max	Kilovolts per Microsecond

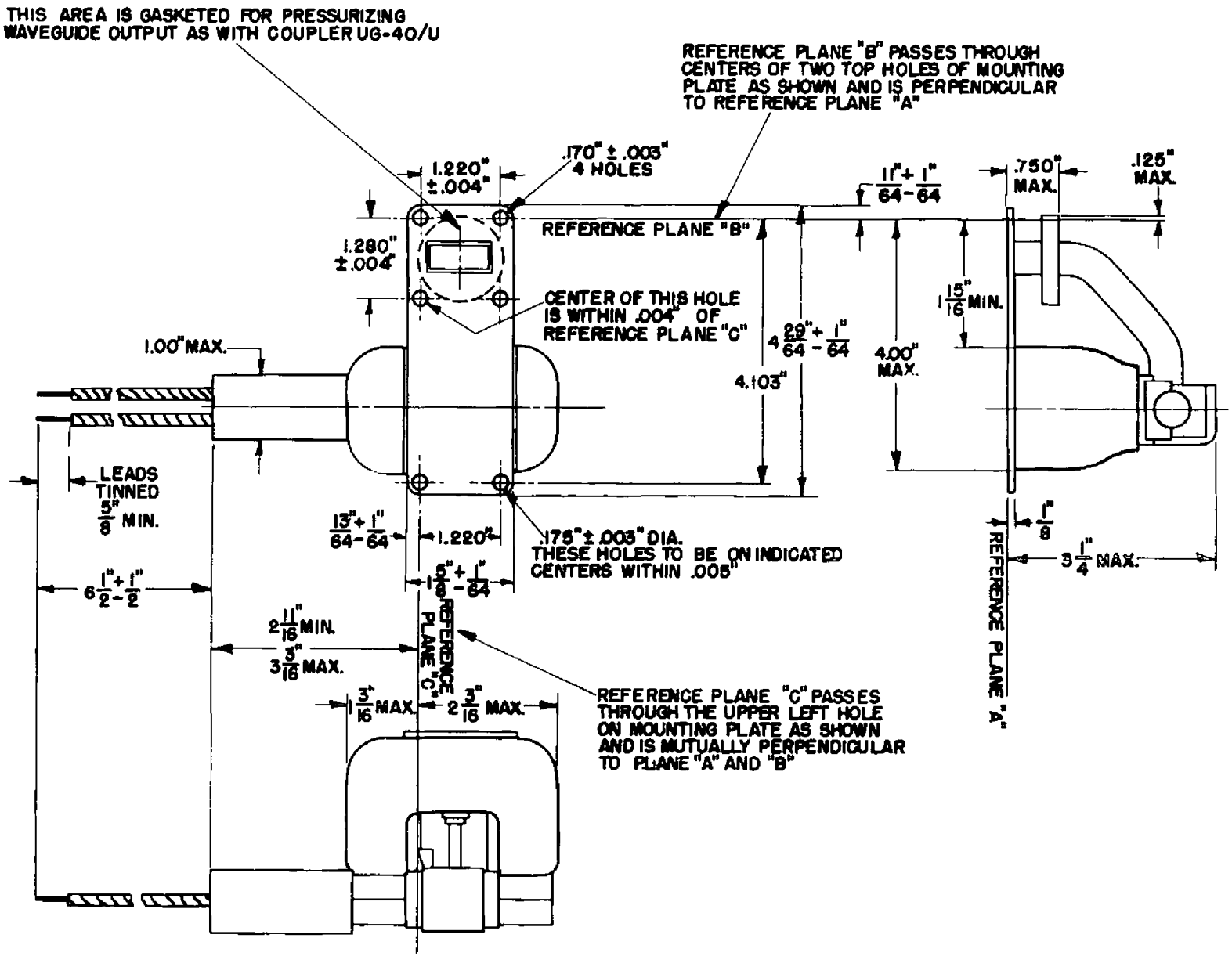
Maximum Ratings, Absolute Values (Cont'd)

Output Circuit Pressurization			45 Max	Pounds per Square Inch Absolute
Maximum Altitude without Pressurization				
Output Circuit			60,000	Feet
Input Terminals			60,000	Feet
Load Voltage Standing Wave Ratio			1.5	

Typical Operation

Peak Anode Voltage			5.5 ± 0.2	Kilovolts
Pulling Factor, VSWR 1.5/1			12	Megacycles
Frequency			9375 ± 30	Megacycles
Duty Cycle	0.002	0.0008	0.00064	
Heater Voltage	4.5	6.3	6.3	Volts
Heater Current	-	0.5	0.5	Amperes
Peak Anode Voltage	5500	5500	5500	Volts
Current Pulse Width	1.0 ± 10%	2.2 ± 10%	0.8 ± 10%	Microseconds
Voltage Pulse, Rate of Rise	55 ± 5	55 ± 5	55 ± 5	Kilovolts per Microsecond
Peak Power Output	9000	9000	9000	Watts

GENERAL ELECTRIC COMPANY
TUBE DEPARTMENT
SCHENECTADY 5, NEW YORK


THIS AREA IS GASKETED FOR PRESSURIZING WAVEGUIDE OUTPUT AS WITH COUPLER UG-40/U
REFERENCE PLANE "B" PASSES THROUGH CENTERS OF TWO TOP HOLES OF MOUNTING PLATE AS SHOWN AND IS PERPENDICULAR TO REFERENCE PLANE "A"
1.220" ±.004"
.170" ± .003" 4 HOLES
11"/64 + 1"/64
.750" MAX.
.125" MAX.
REFERENCE PLANE "B"
1.280" ±.004"
CENTER OF THIS HOLE IS WITHIN .004" OF REFERENCE PLANE "C"
1.00" MAX.
4 29"/64 + 1"/64
4.103"
4.00" MAX.
1 15"/16 MIN.
LEADS TINNED 5"/8 MIN.
13"/64 + 1"/64
1.220"
.175" ± .003" DIA. THESE HOLES TO BE ON INDICATED CENTERS WITHIN .005"
1"/8
3 1"/4 MAX.
6 1"/2 - 2"
5"/8 + 1"/64
2 11"/16 MIN.
3"/16 MAX.
REFERENCE PLANE "C"
REFERENCE PLANE "A"
1 3"/16 MAX.
2 3"/16 MAX.
REFERENCE PLANE "C" PASSES THROUGH THE UPPER LEFT HOLE ON MOUNTING PLATE AS SHOWN AND IS MUTUALLY PERPENDICULAR TO PLANE "A" AND "B"

ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Beam Pentode

6550-A

FOR AF POWER-AMPLIFIER APPLICATIONS

- AUDIO POWER OUTPUT
- UP TO 100 WATTS OUTPUT - 2 TUBES IN PUSH-PULL
- 42 WATTS PLATE DISSIPATION

The 6550-A is a beam-power pentode primarily designed for use in audio-frequency power-amplifier applications. It carries a 42 watt plate dissipation rating which provides for push-pull amplifier designs up to 100 watts output.

The 6550-A features a straight sided T-14 envelope and may be used as a direct replacement for the 6550.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	6.3±0.6	Volts
Heater Current●	1.6	Amperes

Direct Interelectrode Capacitances▲

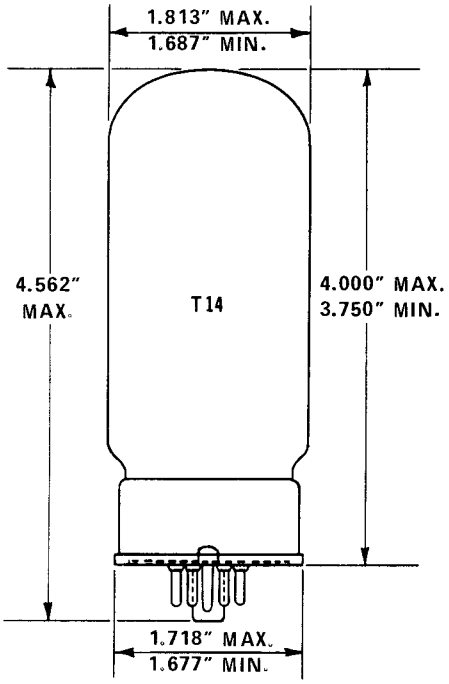
Grid-Number 1 to Plate: (g1 to p)	0.8	pf
Input: g1 to (h+k+g2+b.p.)	15	pf
Output: p to (h+k+g2+b.p.)	10	pf

MECHANICAL

Mounting Position - Any
Envelope - T-14, Glass
Base - B7-99, Large-Wafer Octal with Sleeve Low Loss 7-Pin Micanol
Outline Drawing - EIA 14-16

Maximum Diameter	1.813	Inches
Minimum Bulb Diameter	1.687	Inches
Maximum Over-all Length	4.562	Inches
Maximum Seated Height	4.000	Inches
Minimum Seated Height	3.750	Inches

PHYSICAL DIMENSIONS

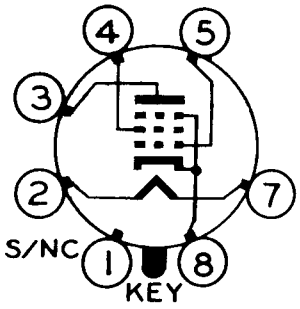


EIA 14-16

TERMINAL CONNECTIONS

Pin 1 - No Connection or Base Shell
Pin 2 - Heater
Pin 3 - Plate
Pin 4 - Grid-Number 2 (Screen)
Pin 5 - Grid-Number 1
Pin 7 - Heater
Pin 8 - Cathode and Beam Plates

BASING DIAGRAM



EIA 7AC

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Connection	Triode Connection ♦	
DC Plate Voltage	660	500	Volts
DC Screen Voltage	440 §	---	Volts
Positive DC Grid-Number 1 Voltage	0	0	Volts
Negative DC Grid-Number 1 Voltage	300	300	Volts
Plate Dissipation	42	42	Watts
Screen Dissipation (Average)	6.0	---	Watts
Screen Dissipation (Peak)	10	---	Watts
DC Cathode Current	190	190	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	300	300	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.05	0.05	Megohms
With Cathode Bias	0.25	0.25	Megohms
Bulb Temperature at Hottest Point ⊕	250	250	°C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, PENTODE CONNECTION

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	-14	Volts
Plate Current	140	Milliamperes
Screen Current	12	Milliamperes
Transconductance	11,000	Micromhos
Plate Resistance, approximate	15,000	Ohms
Triode Amplification Factor	8	
Grid-Number 1 Voltage		
Ib = 1.0 Milliamperes	-40	Volts

CLASS A_1 AUDIO-AMPLIFIER, SINGLE TUBE

DC Plate Voltage	250	400	Volts
DC Screen Voltage	250	225	Volts
DC Grid-Number 1 Voltage	-14	-16.5	Volts
Peak AF Grid-Number 1 Voltage	14	16.5	Volts
Zero-Signal DC Plate Current	140	87	Milliamperes
Maximum-Signal DC Plate Current	150	105	Milliamperes
Zero-Signal DC Screen Current	12	4.0	Milliamperes
Maximum-Signal DC Screen Current	22	14	Milliamperes
Load Resistance	1,500	3,000	Ohms
Total Harmonic Distortion	7	13.5	Percent
Maximum-Signal Power Output	12.5	20	Watts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

PUSH-PULL CLASS AB_1 AMPLIFIER, VALUES FOR TWO TUBES, PENTODE CONNECTION

	Cathode Bias	Fixed Bias			
DC Plate Voltage	400	400	450	600	Volts
DC Screen Voltage	310	270	310	300	Volts
DC Grid-Number 1 Voltage	---	-23	-29.5	-32.5	Volts
Cathode-Bias Resistor	140	---	---	---	Ohms
Peak AF Grid-to-Grid Voltage	43	46	58	65	Volts
Zero-Signal DC Plate Current	170	170	150	100	Milliamperes
Maximum-Signal DC Plate Current	185	275	295	270	Milliamperes
Zero-Signal DC Screen Current	10	9.0	9.0	5.0	Milliamperes
Maximum-Signal DC Screen Current	25	35	38	33	Milliamperes
Effective Load Resistance, Plate-to-Plate	5,000	3,500	3,500	5,000	Ohms
Total Harmonic Distortion	0.7	0.6	1.5	3.0	Percent
Maximum-Signal Power Output	40	60	77	100	Watts

PUSH-PULL AUDIO-AMPLIFIER—ULTRA-LINEAR OPERATION, VALUES FOR TWO TUBES

SCREEN TAPPED AT 40% OF PRIMARY TURNS

	Cathode Bias Class A1	Fixed Bias Class AB1	
DC Plate Voltage	395	450	Volts
DC Screen Voltage	395	450	Volts
DC Grid-Number 1 Voltage	---	-48	Volts
Cathode-Bias Resistor	200	---	Ohms
Peak AF Grid-to-Grid Voltage	70	96	Volts
Zero-Signal DC Plate Current	170	150	Milliamperes
Maximum-Signal DC Plate Current	174	265	Milliamperes
Zero-Signal DC Screen Current	12.5	12	Milliamperes
Maximum-Signal DC Screen Current	23	38	Milliamperes
Effective Load Resistance, Plate-to-Plate	5,600	4,000	Ohms
Total Harmonic Distortion	1.5	2.4	Percent
Maximum-Signal Power Output	34	70	Watts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

▲ Without external shield.

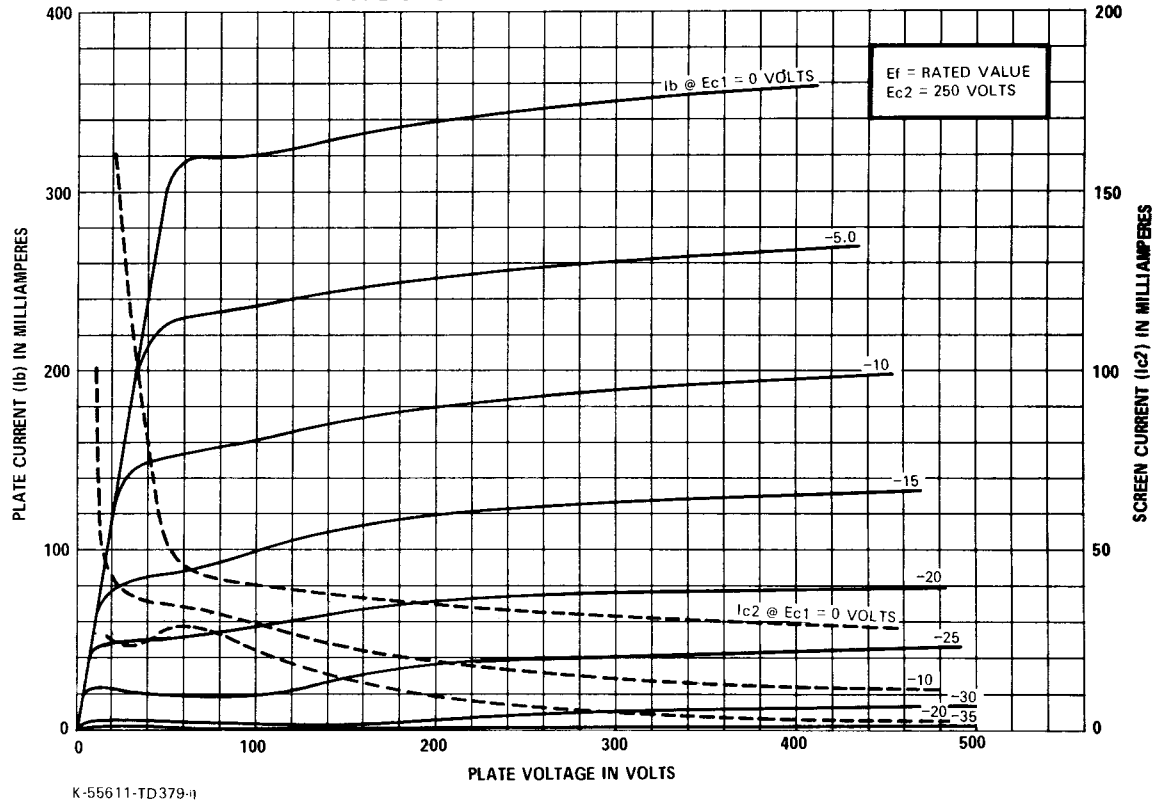
♦ With screen connected to plate.

§ The maximum screen voltage rating is 450 volts in push-pull circuits where the screen of each tube is connected to a tap on the plate winding of the output transformer.

⊕ Measured with an infrared thermometer, Ircon Model 700 BC or equivalent, at an ambient temperature of 40° C.

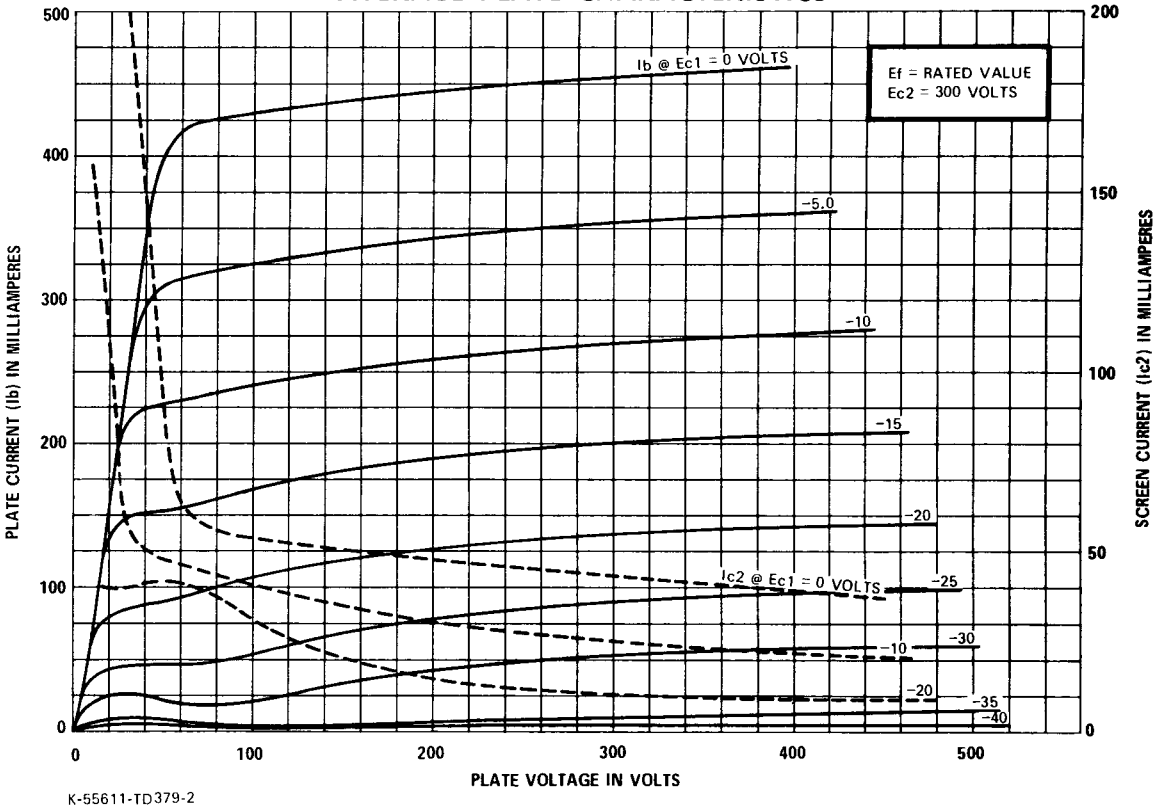
The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



K-55611-TD379-1

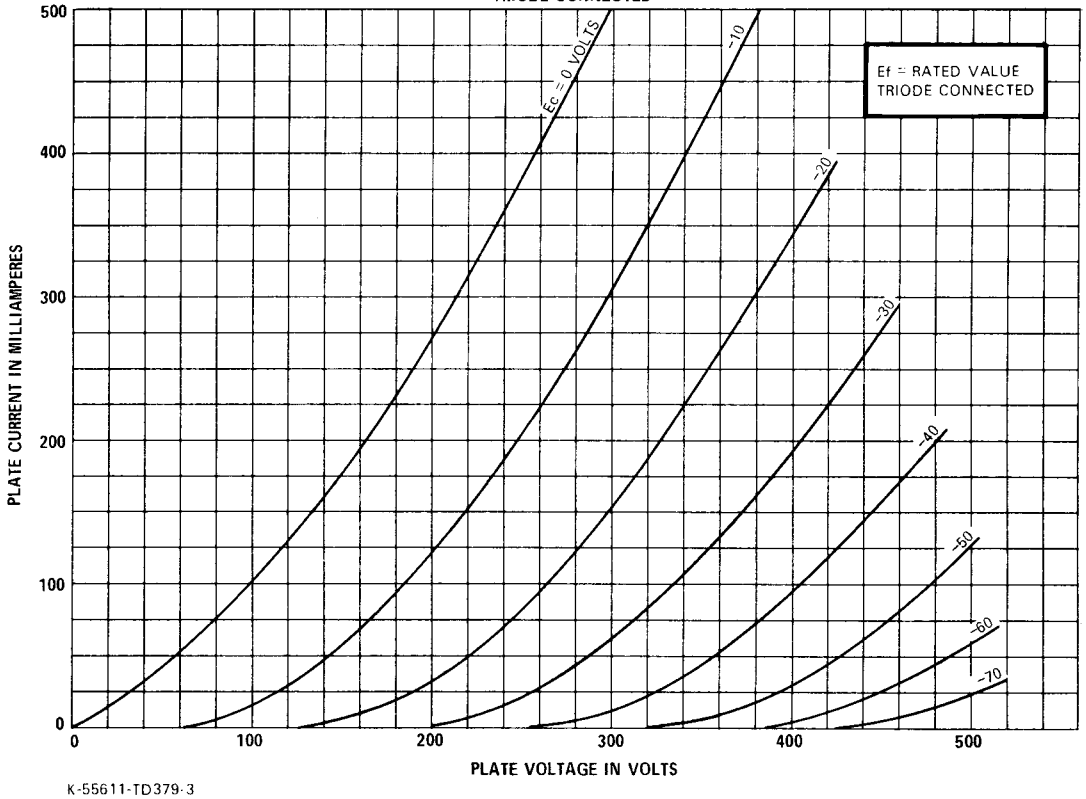
AVERAGE PLATE CHARACTERISTICS



K-55611-TD379-2

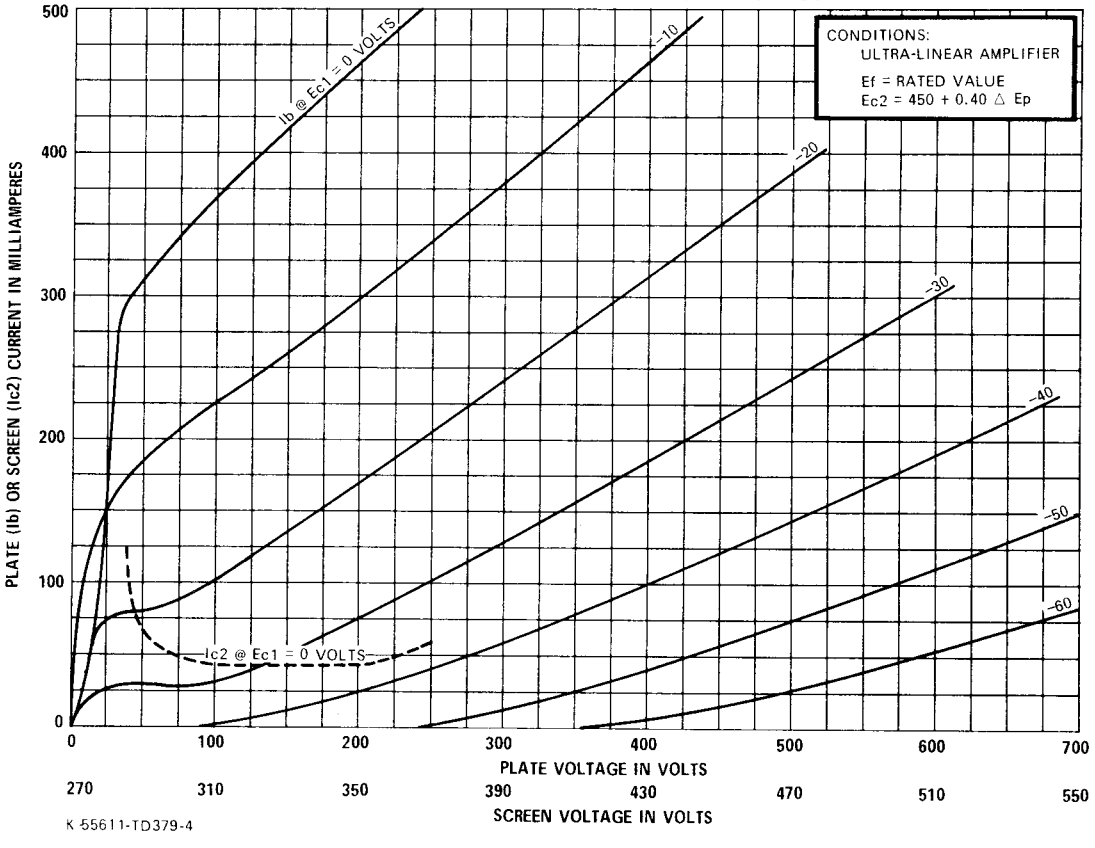
AVERAGE PLATE CHARACTERISTICS

TRIODE CONNECTED



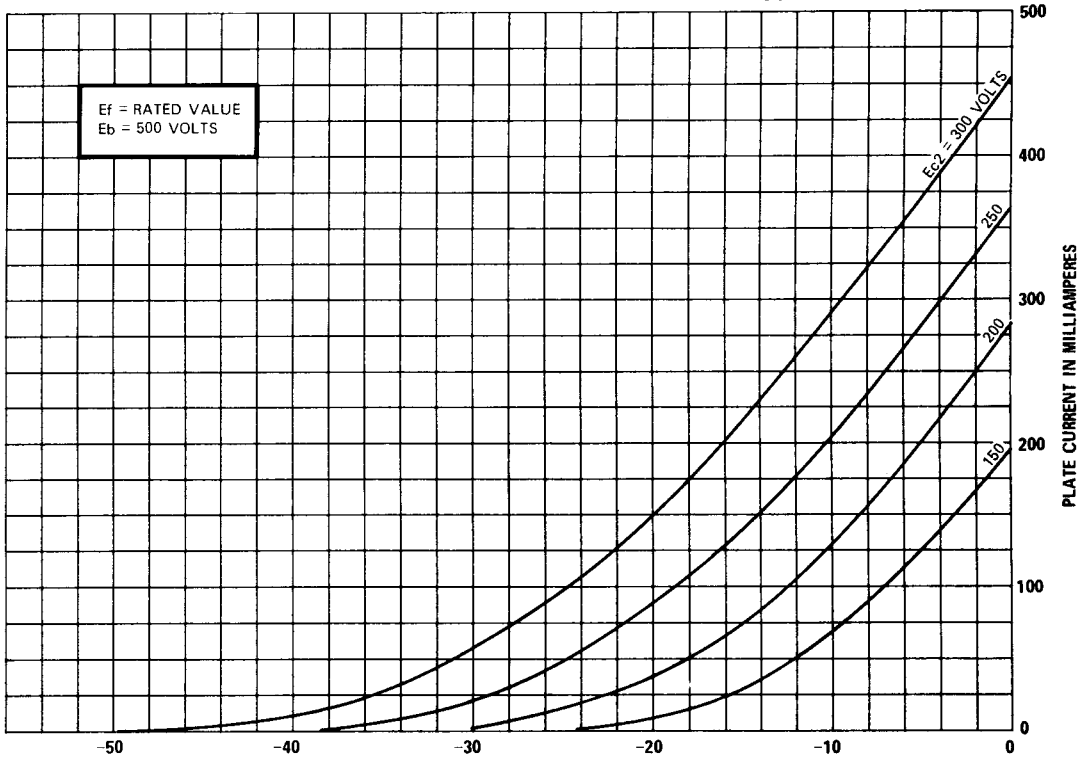
K-55611-TD379-3

AVERAGE PLATE CHARACTERISTICS



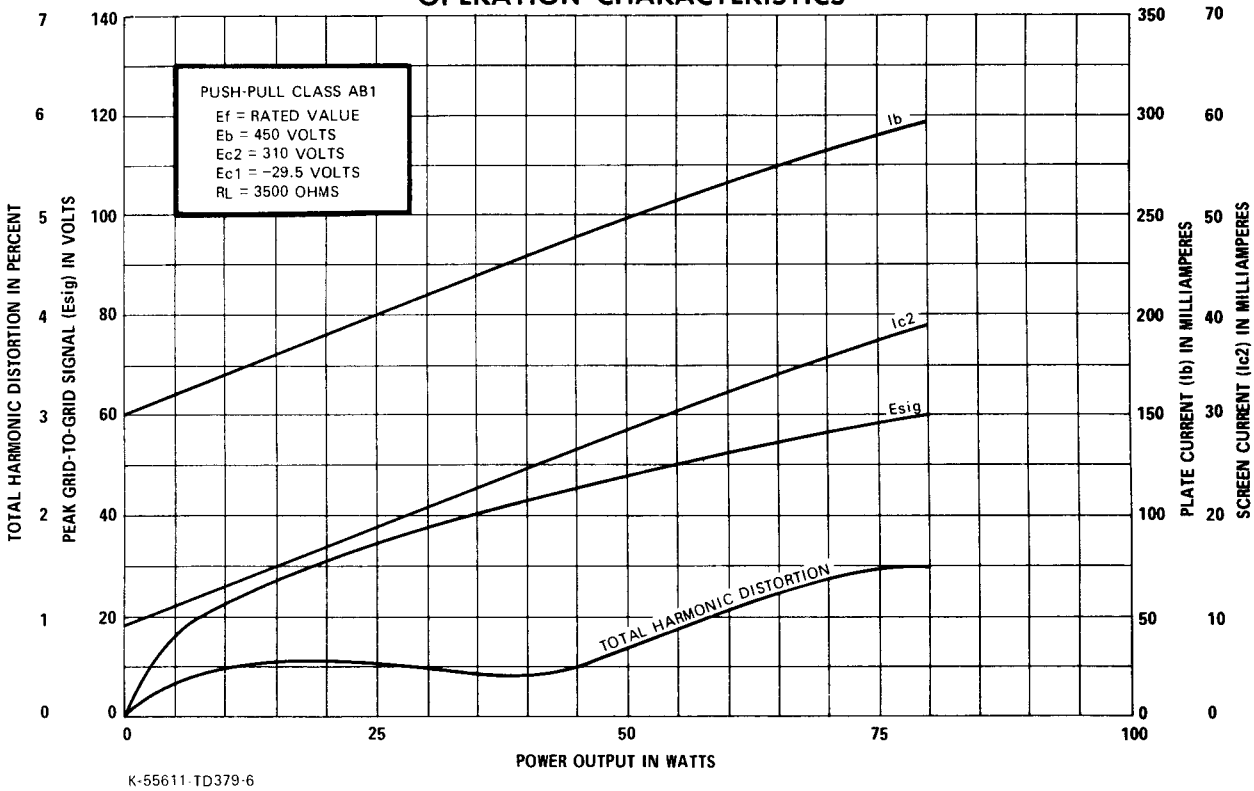
K-55611-TD379-4

AVERAGE TRANSFER CHARACTERISTICS



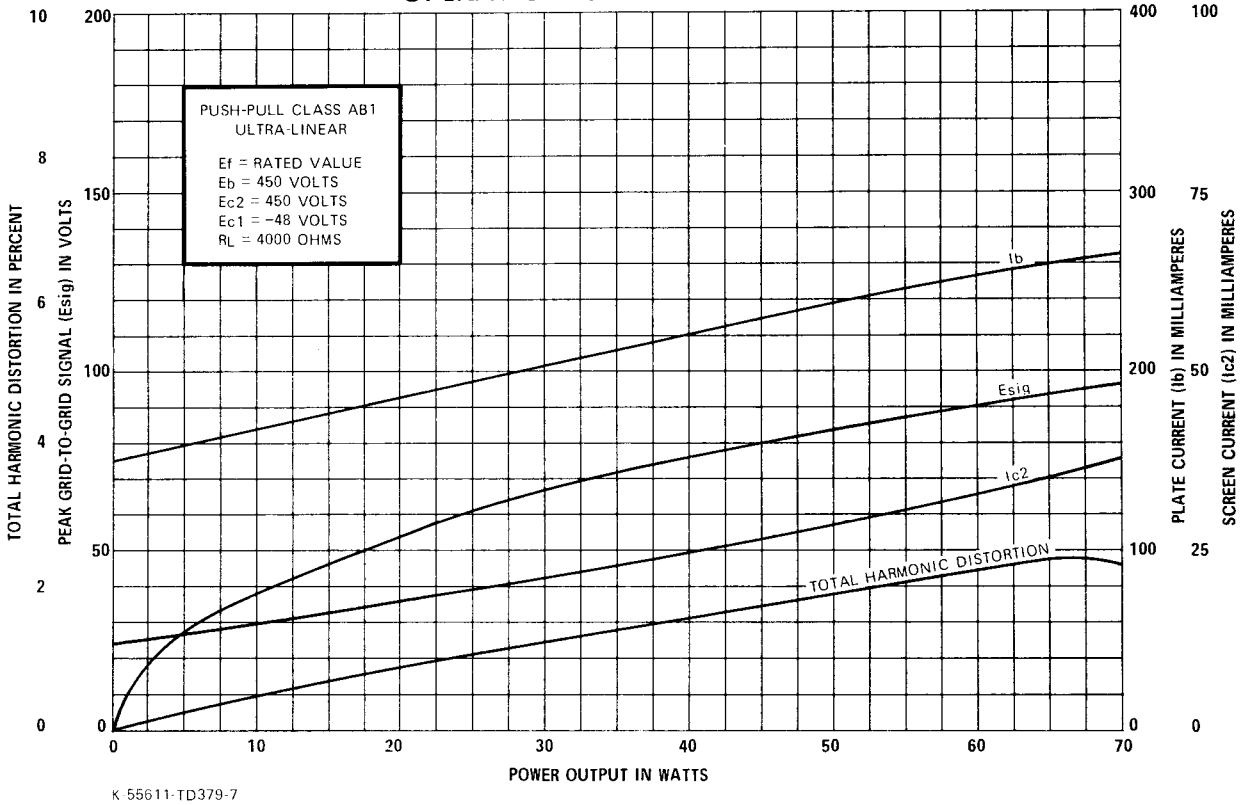
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OPERATION CHARACTERISTICS



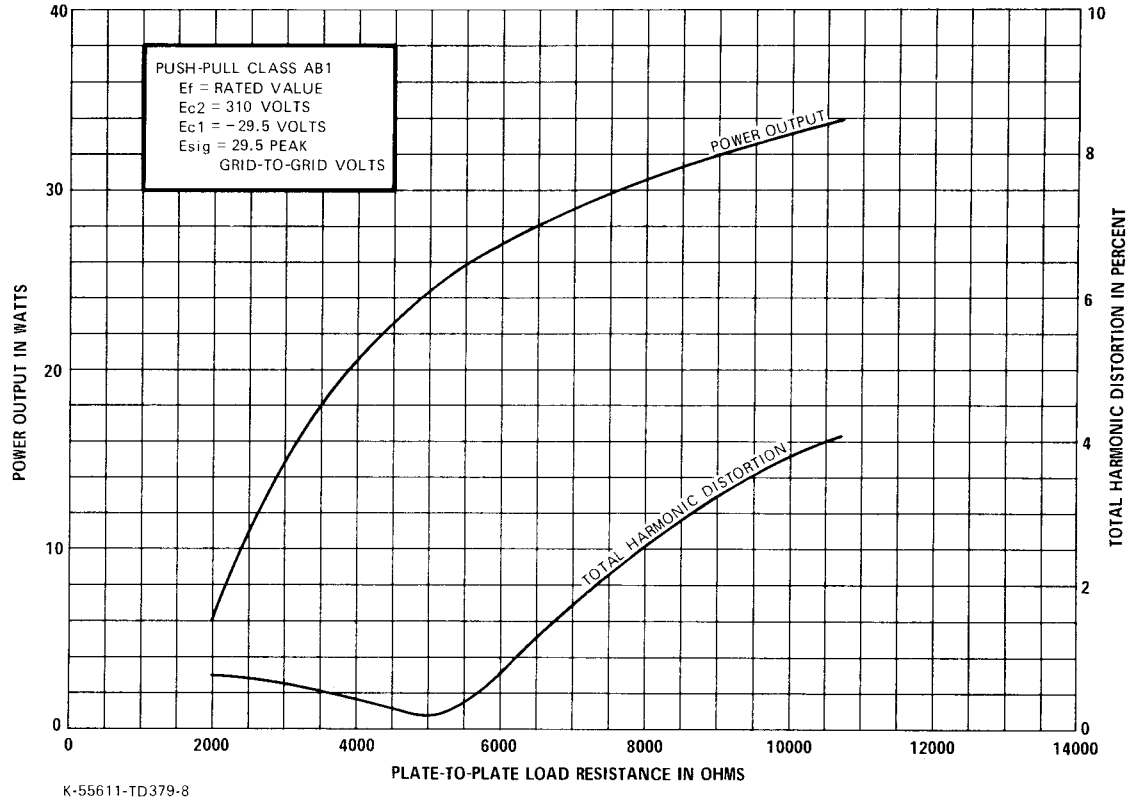
K-55611-TD379-6

OPERATION CHARACTERISTICS



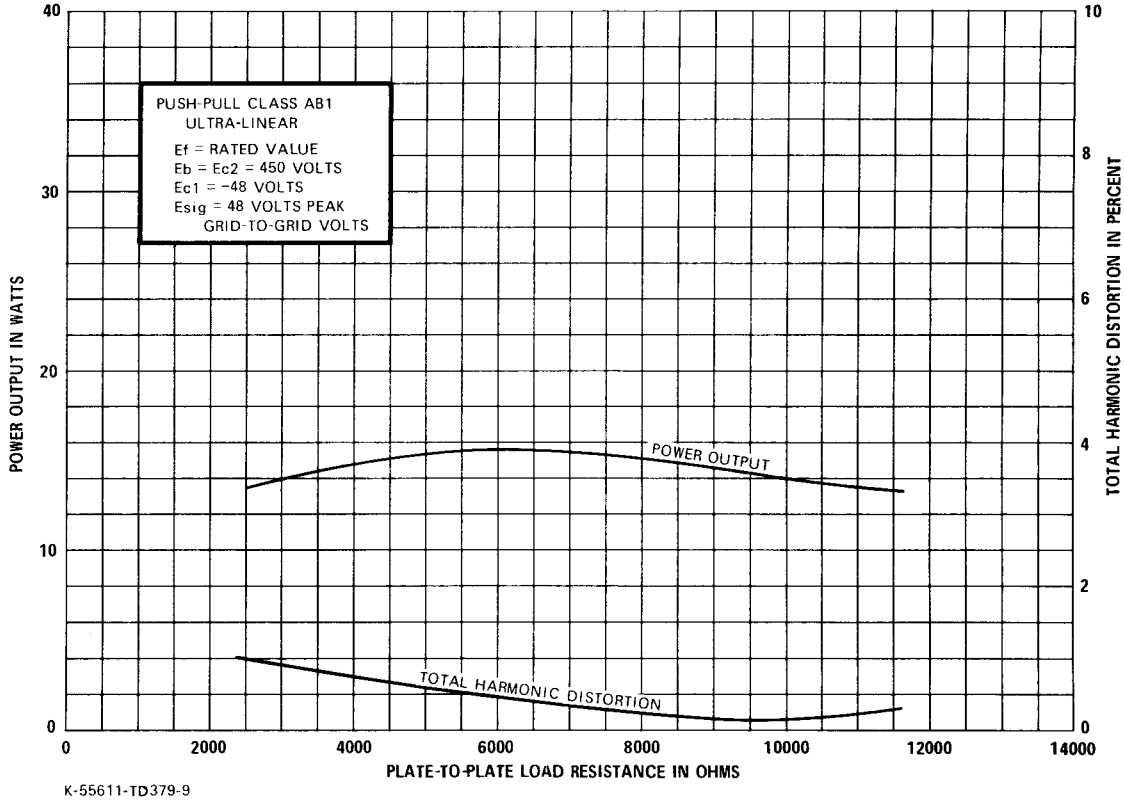
K-55611-TD379-7

OPERATION CHARACTERISTICS



K-55611-TD379-8

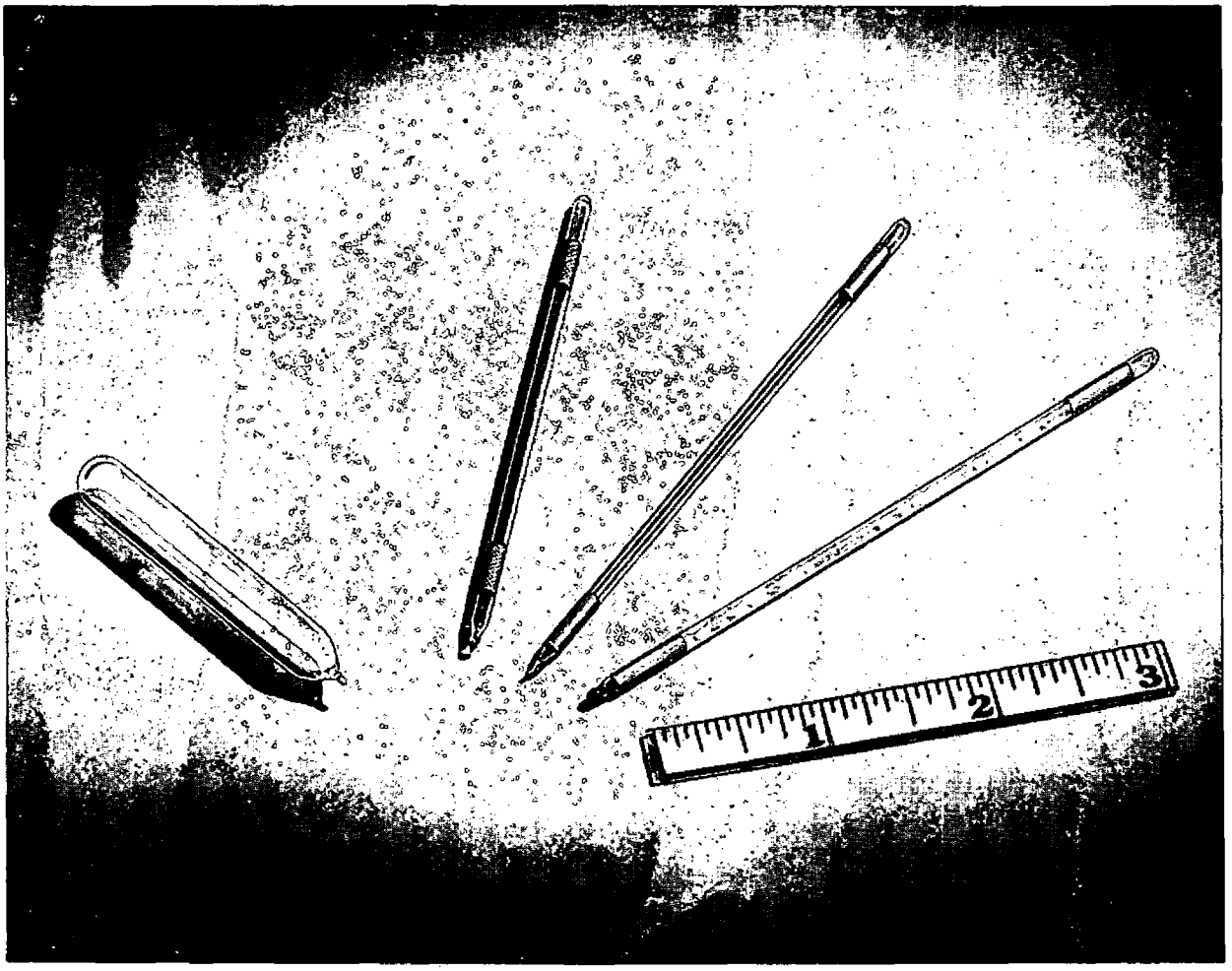
OPERATION CHARACTERISTICS



K-55611-TD379-9

GENERAL ELECTRIC

TUBE PRODUCTS DEPARTMENT
OWENSBORO, KENTUCKY 42301



GAS-DISCHARGE DEVICE

These gas-discharge devices are for use in polarization or branching-type duplexers in radar systems. In such service they perform the same function as A-TR and Pre-TR tubes and can be used to replace these switching tubes where higher power levels are required. In operation the gas-filled envelope ionizes to form a highly conductive gas column when high radio-frequency power is applied during the transmission period, and deionizes when the power is removed.

APPLICATION

GL-6619—Groups of ten to twenty in polarization twist duplexers, 2700 to 2900 megacycles.
GL-6620—Groups of two in branching-type duplexers, 3400 to 3600 megacycles.
GL-6621—Groups of ten to twenty in polarization twist duplexers, 2700 to 2900 megacycles.

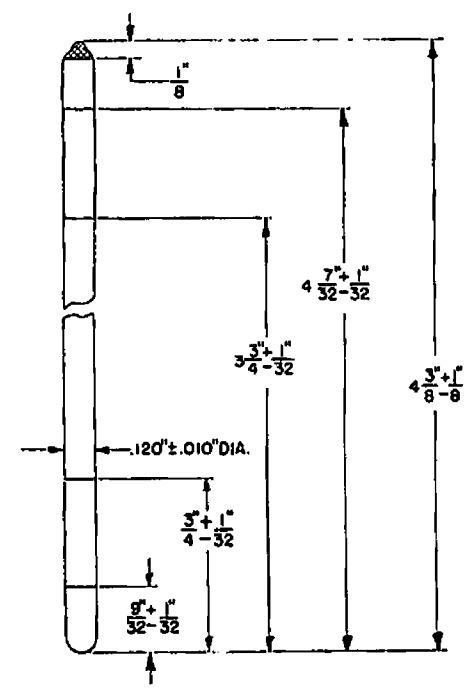
GENERAL ELECTRIC

from JETEC release #1467, May 16, 1955

TECHNICAL INFORMATION

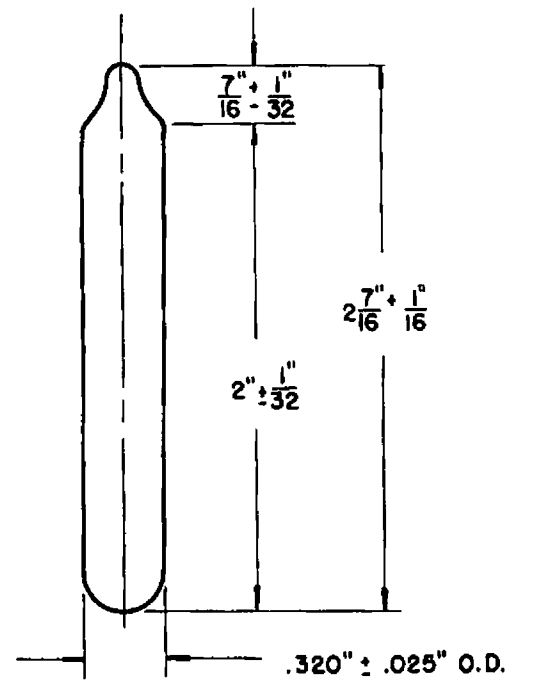
GENERAL

Tube Type Number	GL-6619	GL-6620	GL-6621	
Electrical				
Firing Power	250	250	250	Min Kilowatts
	Tube axis 85 degrees from direction of electric field vector.			
Recovery Time (single tube)	25 Peak power = 50 kw; pulse repetition rate = 1000 pps; pulse duration = 1.0 μ sec; magnetron frequency = 2800 ±20 mc; probing signal frequency = 2900 ±30 mc.	40 Peak power = 50 kw; pulse repetition rate = 1000 pps; pulse duration = 1.0 μ sec; magnetron frequency = 3500 ±20 mc; probing signal frequency = 3570 ±30 mc.	50 Peak power = 50 kw; pulse repetition rate = 1000 pps; pulse duration = 1.0 μ sec; magnetron frequency = 2800 ±20 mc; probing signal frequency = 2900 ±30 mc.	Max Microseconds
	Tube axis is parallel to incident electric field vector.			
Mechanical				
Mounting Position	Any	Any	Any	
Ambient Temperature Range (non-operating)	−40 to +100	−40 to +100	−40 to +100	C
Net weight, approximate	3	3	2	Ounces
Maximum Ratings				
Transmitter Peak Power	2.5	2	5	Megawatts
Frequency Range	2700 to 2900	3400 to 3600	2700 to 2900	Megacycles per Second



K-69087-186A67 1-24-55

OUTLINE
GL-6619, GL-6621



K-69087-186A78 1-24-55

OUTLINE
GL-6620

TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady 5, N. Y.

GL-6625

KLYSTRON

960-1215 MEGACYCLES — INTEGRAL RESONATORS

22 KILOWATTS PEAK OUTPUT — ELECTROSTATICALLY FOCUSED

DESCRIPTION AND RATING

The GL-6625 is a three-resonator tunable amplifier klystron for pulsed operation up to a maximum duty of twelve percent. The tube covers a frequency range of 960 to 1215 megacycles and will provide a peak power output of 22 kilowatts. The unipotential cathode is oxide-coated and indirectly heated. The r-f output coupling is for 7/8-inch coaxial 50-ohm line and matches UG-1126/U connectors. The input and center-cavity-monitor fittings are BNC type to accommodate UG-88/U connectors. The tube is forced-air cooled, features mechanically tuned integral resonators, and is electrostatically focused, which eliminates the necessity for external magnets or focus coils.

TECHNICAL INFORMATION

GENERAL

Electrical	Minimum	Bogey	Maximum	
Heater Voltage	4.5	5.0	5.5	Volts
Heater Current at 5 Volts	35	---	45	Amperes
Heater Starting Current	---	---	70	Amperes
Heater Cold Resistance	---	0.02	---	Ohms
Cathode Heating Time	5.0	---	---	Minutes
Frequency	960	---	1215	Megacycles
Capacitance, Cathode Gun	---	35	---	Micromicrofarads

Mechanical

Base and RF Connections - See Outline Drawing
Dimensions - See Outline Drawing
Mounting Position - Any

Air Flow	220 Min	Cubic Feet per Minute

Air flow of at least 220 cubic feet per minute is required for operation at maximum ratings. In any case, sufficient air cooling must be provided and distributed to keep temperatures below the indicated limits.

Operating Temperature		
Tube Body	100 Max	C
Cooling Fin Assembly	125 Max	C
Net Weight, approximate	30	Pounds

G E N E R A L E L E C T R I C C O M P A N Y

from JETEC release #1443, April 18, 1955

MAXIMUM RATINGS AND TYPICAL OPERATION

Radio-Frequency Pulse Amplifier
Maximum Ratings, Absolute Values

Peak Beam Voltage	20 Max	Kilovolts
Peak Beam Current	9.35 Max	Amperes
Average Beam Power	2400 Max	Watts
RF Output Power, average	300 Max	Watts
Beam Pulse Length	10 Max	Microseconds
Duty Cycle	12	Percent

For periods of time not to exceed one millisecond, duty cycles up to forty percent may be used.

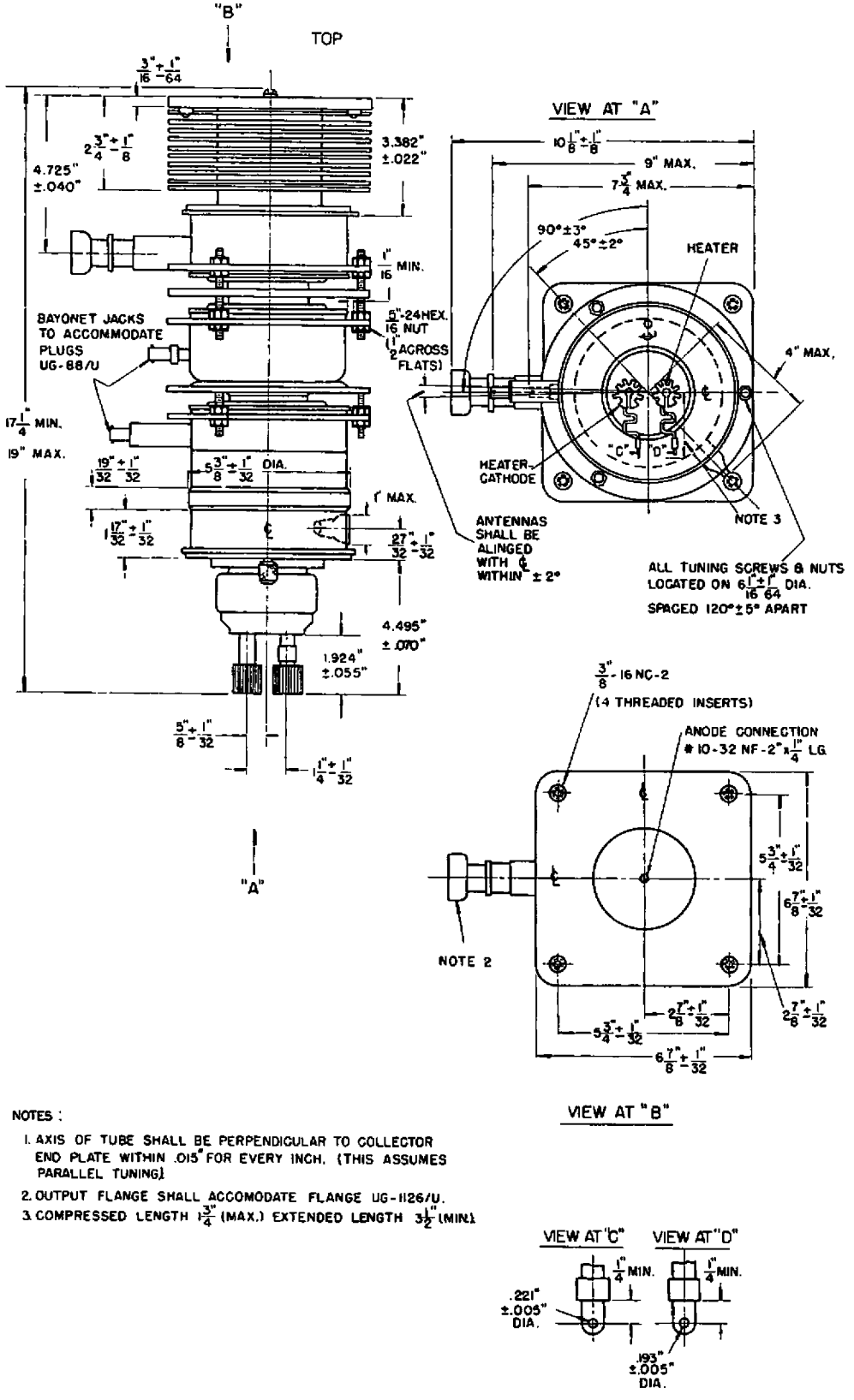
Typical Operation

Peak Beam Voltage	10	18	Kilovolts
Peak Beam Current	3	6.6	Amperes
Peak RF Input Power	40	100	Watts
Peak RF Output Power	7.5	22	Kilowatts
RF Pulse Length	3.5	3.5	Microseconds
Duty Cycle	6	1	Percent

TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

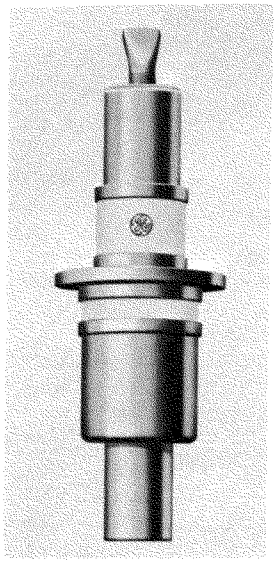
SCHENECTADY 5, N. Y.



NOTES :

1. AXIS OF TUBE SHALL BE PERPENDICULAR TO COLLECTOR END PLATE WITHIN .015" FOR EVERY INCH. (THIS ASSUMES PARALLEL TUNING)
2. OUTPUT FLANGE SHALL ACCOMODATE FLANGE UG-1126/U.
3. COMPRESSED LENGTH 1 3/4" (MAX.) EXTENDED LENGTH 3 1/2" (MIN.)

6771
PLANAR TRIODE



DESCRIPTION AND RATING

FOR GROUNDED-GRID OSCILLATOR, AMPLIFIER, AND FREQUENCY MULTIPLIER SERVICE

Metal and Ceramic — Small Size

The 6771 is a high-mu, metal-and-ceramic triode intended for operation as a grounded-grid oscillator, radio-frequency power amplifier, or frequency multiplier at frequencies as high as 4000 megacycles. The 6771 is also useful as a plate-pulsed, grounded-grid oscillator at frequencies as high as 5000 megacycles.

Features of the 6771 include small size, planar electrode construction with close spacing, inherent rigidity, an envelope structure convenient for coaxial circuit applications, and excellent resistance to vibration and shock.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC	*	Volts
Heater Current at Ef = 6.3 volts	0.575†	Amperes

Direct Interelectrode Capacitances‡

Grid to Plate: (g to p)	2.03	pf
Grid to Cathode: (g to k)	4.05	pf
Plate to Cathode: (p to k)	0.018	pf

MECHANICAL

Mounting Position—Any

Net Weight, approximate	0.9	Ounces

Cooling—Conduction and Convection

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

RADIO-FREQUENCY AMPLIFIER—CLASS A

Heater Voltage*	4.5 to 5.7	Volts
DC Plate Voltage	300	Volts
Negative DC Grid Voltage	25	Volts
DC Plate Current	25	Milliamperes
Plate Dissipation	6.25	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Grid Circuit Resistance	0.5	Megohms
Envelope Temperature at Hottest Point	175	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

Supersedes ET-T1518A dated 3-60

MAXIMUM RATINGS (Continued)

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key-Down Conditions per Tube Without Amplitude Modulation§

Heater Voltage*	4.5 to 5.7	Volts
DC Plate Voltage	275	Volts
Negative DC Grid Voltage	25	Volts
DC Plate Current	25	Milliamperes
DC Grid Current	8.0	Milliamperes
Plate Dissipation	6.25	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Grid Circuit Resistance	0.1	Megohms
Envelope Temperature at Hottest Point	175	C

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEPHONY

Carrier Conditions per Tube for Use With a Maximum Modulation Factor of 1.0

Heater Voltage*	4.5 to 5.7	Volts
DC Plate Voltage	250	Volts
Negative DC Grid Voltage	25	Volts
DC Plate Current	22	Milliamperes
DC Grid Current	8.0	Milliamperes
Plate Dissipation	5.0	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Grid Circuit Resistance	0.1	Megohms
Envelope Temperature at Hottest Point	175	C

FREQUENCY MULTIPLIER

Heater Voltage*	4.5 to 5.7	Volts
DC Plate Voltage	250	Volts
Negative DC Grid Voltage	50	Volts
DC Plate Current	20	Milliamperes
DC Grid Current	5.0	Milliamperes
Plate Dissipation	5.0	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Grid Circuit Resistance	0.1	Megohms
Envelope Temperature at Hottest Point	175	C

PLATE-PULSED OSCILLATOR SERVICE

Heater Voltage*	5.7 to 6.3	Volts
Cathode Heating Time, minimum	60	Seconds
Frequency	5000	Megacycles
Peak Positive-Pulse Plate Supply Voltage	1750	Volts
Duty Factor of Plate Pulse¶ ✱	0.001	
Pulse Duration	2.0	Microseconds
Plate Current		
Average ✱	1.25	Milliamperes
Average During Plate Pulse△	1.25	Amperes
Negative Grid Voltage		
Average During Plate Pulse	75	Volts
Grid Current		
Average ✱	0.7	Milliamperes
Average During Plate Pulse	700	Milliamperes
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Envelope Temperature at Hottest Point	175	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Heater Voltage	6.3	Volts
Plate Voltage	250	Volts
Grid Voltage, approximate	−1.6	Volts
Amplification Factor	90	
Transconductance	23000	Micromhos
Plate Current	25	Milliamperes

RADIO-FREQUENCY OSCILLATOR

Frequency	4000	Megacycles
Heater Voltage	4.5	Volts
DC Plate Voltage	275	Volts
DC Plate Current	25	Milliamperes
Power Output	300	Milliwatts

FREQUENCY MULTIPLIER—DOUBLER TO 1000 MEGACYCLES

Heater Voltage	5.25	Volts
DC Plate Voltage	250	Volts
DC Plate Current	20	Milliamperes
DC Grid Voltage	−10	Volts
DC Grid Current	5.0	Milliamperes
Driving Power	300	Milliwatts
Power Output	2.0	Watts

* The equipment designer should design the equipment so that heater voltage is centered at some value within the range of 4.5 to 5.7 volts for CW operation, or 5.7 to 6.3 volts for pulse operation. Heater voltage variations about the center value should be kept as small as practical and should not, in any case, exceed ±5%. The optimum center value of heater voltage depends on the cathode current and on other parameters of circuit design and operation. For specific recommendations, contact your General Electric tube sales representative.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Measured in a special shielded socket.

§ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier conditions.

¶ Applications with a duty factor greater than 0.001 should be referred to your General Electric tube sales representative for recommendations.

⁂ In any 5000 microsecond interval.

△ The regulation and/or series plate-supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 12.5 amperes.

INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
Ef = 6.3 volts	530	575	620	Milliamperes
Grid Voltage				
Ef = 6.3 volts, Eb = 250 volts, Ib = 25 ma	−0.90	−1.60	−2.65	Volts
Grid Voltage				
Ef = 6.3 volts, Eb = 250 volts, Ib = 2 ma	−2.00	−3.50	−5.40	Volts
Transconductance				
Ef = 6.3 volts, Eb = 250 volts, Ec adjusted for Ib = 25 ma	18500	23000	27500	Micromhos
Amplification Factor				
Ef = 6.3 volts, Eb = 250 volts, Ec adjusted for Ib = 25 ma	60	90	120	
Negative Grid Current				
Ef = 6.3 volts, Eb = 250 volts, Ec adjusted for Ib = 25 ma	.....	.....	0.35	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts, Polarity of applied d-c interelectrode voltage is such that no cathode emission results				
Grid to Cathode at 100 volts d-c	25	.....	.....	Megohms
Grid to Plate at 500 volts d-c	250	.....	.....	Megohms
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	.....	.....	100	Microamperes
Heater Negative with Respect to Cathode	.....	.....	100	Microamperes
Interelectrode Capacitances				
Grid to Plate: (g to p)	1.75	2.03	2.30	Picofarads
Grid to Cathode: (g to k)	3.60	4.05	4.55	Picofarads
Plate to Cathode: (p to k)	0.012	0.018	0.024	Picofarads

SPECIAL PERFORMANCE TESTS

	Min.	Max.	
Oscillator Power Output			
Tubes are tested for power output as an oscillator under the following conditions: Ef = 4.5 volts; F = 4000 MC, min.; Eb = 275 volts, Ec adjusted for Ib = 25 ma	200	...	Milliwatts
Low Pressure Voltage Breakdown Test			
Statistical sample tested for voltage breakdown at a pressure of 20 mm Hg. Tubes shall not give visual evidence of flashover when 500 volts RMS, 60 cps, is applied between the plate and grid terminals.			

DEGRADATION RATE TESTS

Shock

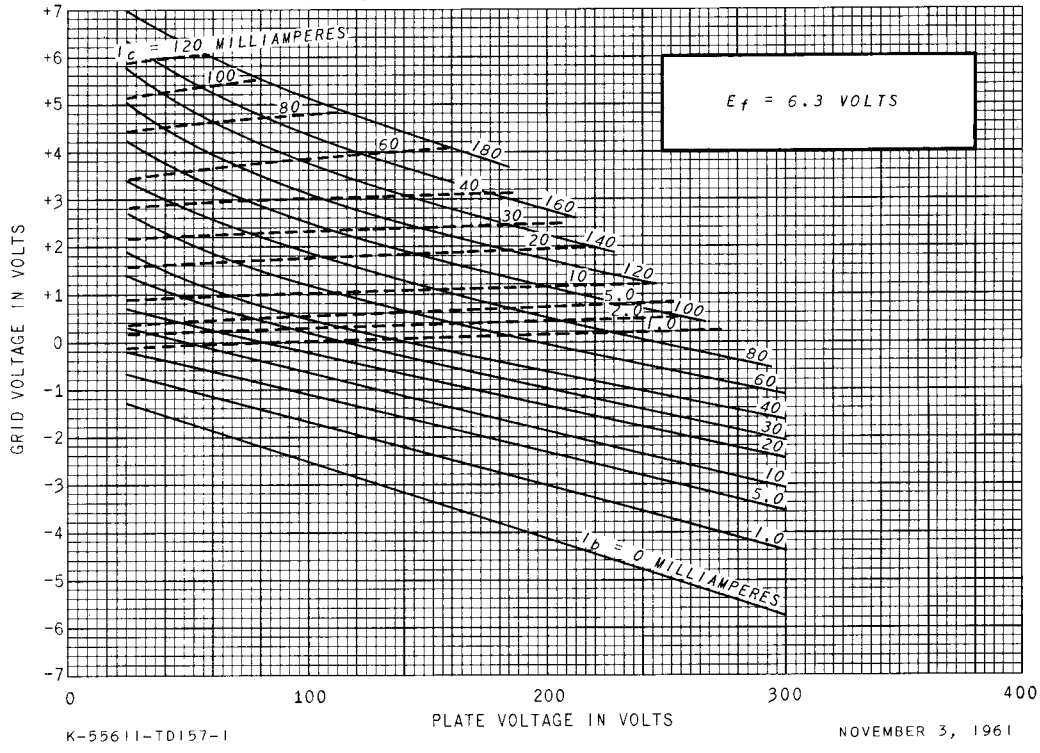
Statistical sample subjected to 5 impact accelerations of approximately 400 G and 1.0 milliseconds duration in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine.

1000-Hour Life Test

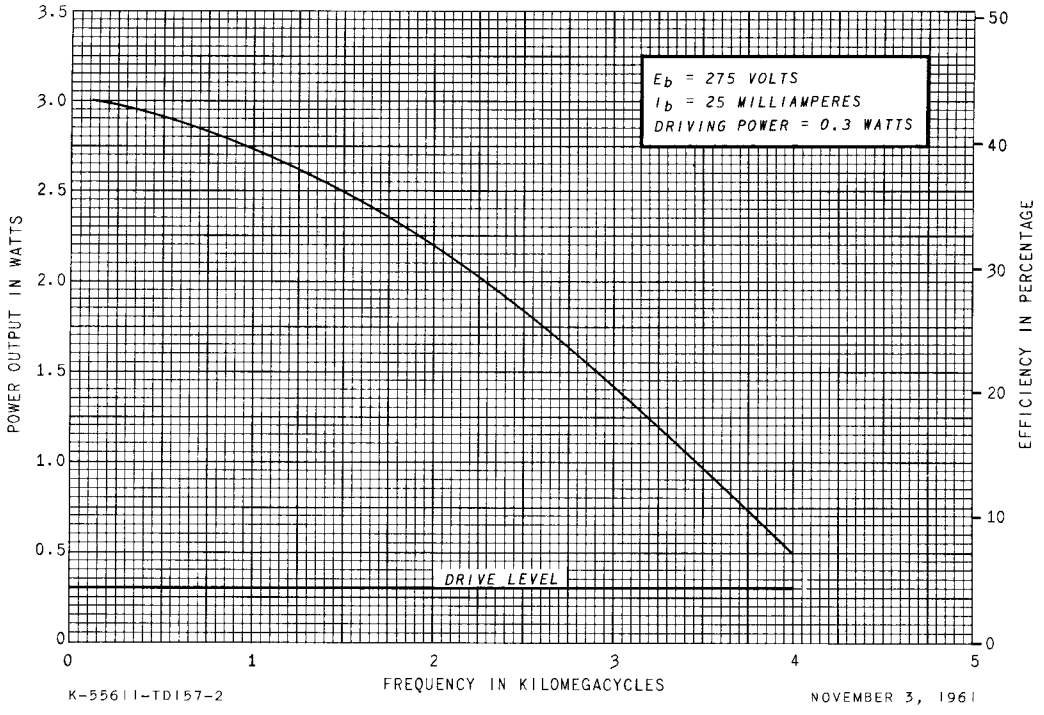
Statistical sample operated for 1000 hours as an oscillator to evaluate changes in power output with life.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



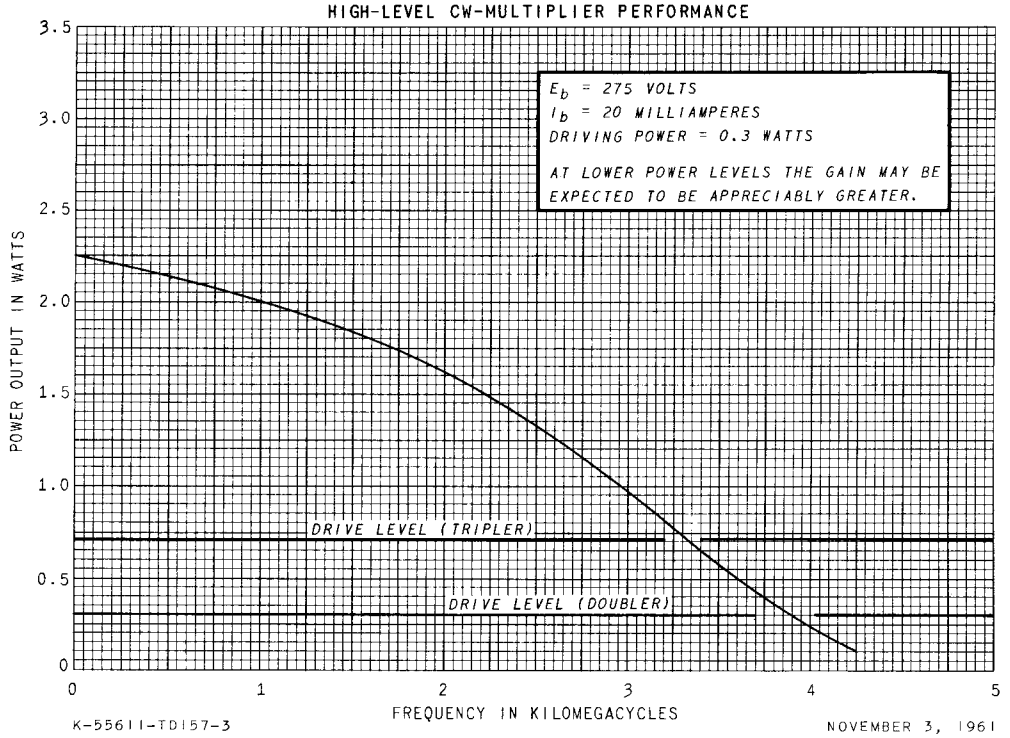
CW AMPLIFIER PERFORMANCE



K-5561I-TDI57-2

NOVEMBER 3, 1961

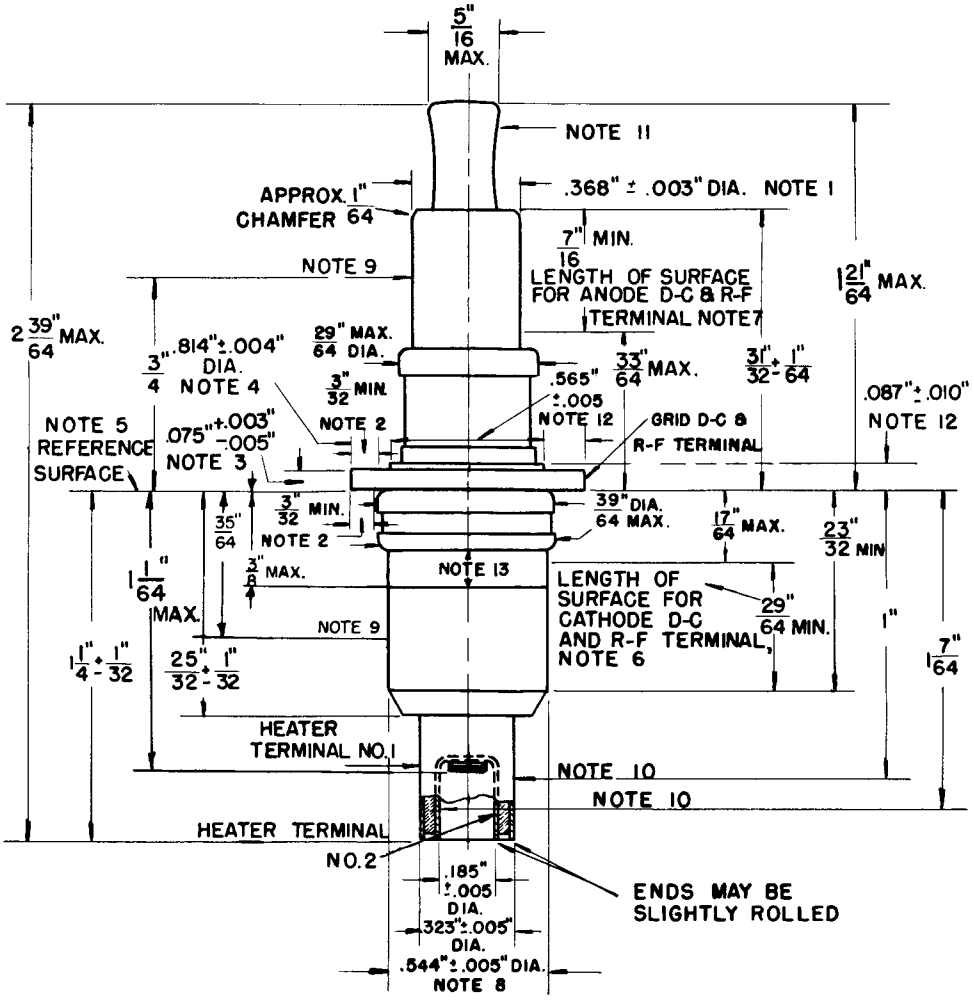
HIGH-LEVEL CW-MULTIPLIER PERFORMANCE



K-5561I-TDI57-3

NOVEMBER 3, 1961

PHYSICAL DIMENSIONS



K-69087-72A684

4-59

Note 1. Applies to minimum surface for anode d-c and r-f terminal only. Other surfaces must not be used for these terminal purposes.

Note 2. Applies to minimum surface for grid d-c and r-f terminal only. Other surfaces, except for Notes 3 and 4, must not be used for terminal purposes.

Note 3. Applies to minimum surfaces for grid d-c and r-f terminal only.

Note 4. The cylindrical surface of this diameter may be used for grid d-c and r-f terminal purposes.

Note 5. The surfaces defined by Notes 2, 3, and 4 shall be the only surfaces used for tube stops and clamping purposes.

Note 6. Other surfaces shall not be used for cathode d-c and r-f terminal purposes.

Note 7. Other surfaces shall not be used for anode d-c and r-f terminal purposes.

Note 8. Applies to surface designated for cathode d-c and r-f terminal. Solder at brazed joint will not exceed the maximum diameter.

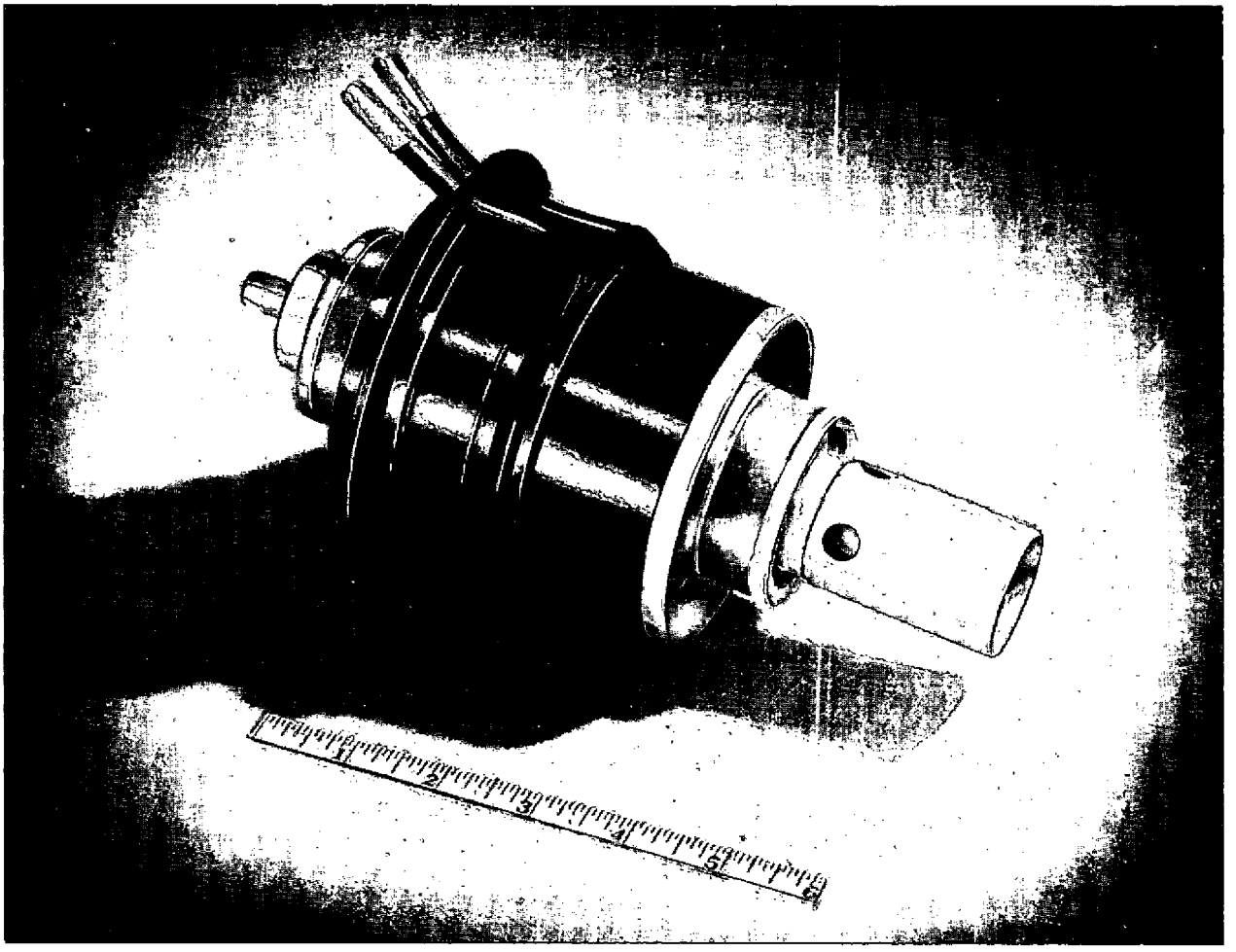
Note 9. The maximum eccentricity of the anode and cathode with respect to the grid terminal in a prescribed jig is 0.010 (or maximum total runout of 0.020) and is measured by indicators at the points designated.

Note 10. The maximum eccentricity of heater-terminal No. 1 and heater-terminal No. 2 with respect to the grid terminal in a prescribed jig is 0.015 (or maximum total runout of 0.030) and is measured by indicators at the points designated.

Note 11. Exhaust tubulation must not be subjected to any mechanical stress.

Note 12. For reference only. Dimension does not include any possible solder fillet.

Note 13. This area is reserved for tube stamping and coding.



CW MAGNETRON

METAL AND CERAMIC

2.5 KILOWATTS OF CW POWER

FOR DIELECTRIC HEATING

915 MEGACYCLES

TUNGSTEN FILAMENT

HIGH EFFICIENCY

The GL-6787 is a water and forced-air-cooled CW magnetron designed for use as a power source in dielectric heating. It can produce 2.5 kilowatts of useful power and operates at a fixed frequency between 890 and 940 megacycles. The magnetic field is supplied externally, and may be an electromagnet connected in series with the plate current.

TECHNICAL INFORMATION

GENERAL

Electrical

Preheat Filament Voltage*	12 ± 1.2	Volts
Preheat Filament Current at 12 Volts	56 ± 5	Amperes
Minimum Preheat Time	20	Seconds
Filament Cold Resistance	0.018	Ohms
Anode-Cathode Capacitance	14	$\mu\mu$f

GENERAL ELECTRIC

from JETEC release #1572, Jan. 23, 1956

TECHNICAL INFORMATION (CONT'D)

Mechanical

Mounting Position—Tube Axis Vertical—Cathode Up or Down
Mounting Support and Tube Connections—See K-69087-72A732 on page six for details.

Net Weight	4.6	Pounds

Thermal

Type of Cooling—Forced Air and Water

Water Flow through Tube, minimum	2	Quarts per Minute
Outgoing Water Temperature	70	Max C
Air Flow on Output Seal	10	Cubic Feet per Minute
Air Flow on Cathode Structure	10	Cubic Feet per Minute

Provision must be made to prevent application of filament or plate power to the tube before water and air cooling is applied, and to remove power in the case of cooling-system failure.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Absolute Values

Filament Voltage*	13.2	Volts
Filament Current	61	Amperes
Filament Surge Current	85	Amperes
Anode Voltage	4100	Volts
Anode Current	1.5	Amperes
Plate Input	6000	Watts
Plate Dissipation	3500	Watts
Outgoing Anode Cooling Water	70	Max C
Cathode Stem Temperature (See Outline K-69087-72A731 on page seven for details)	200	Max C
Voltage Standing Wave Ratio—Presented by the Load	3:1	

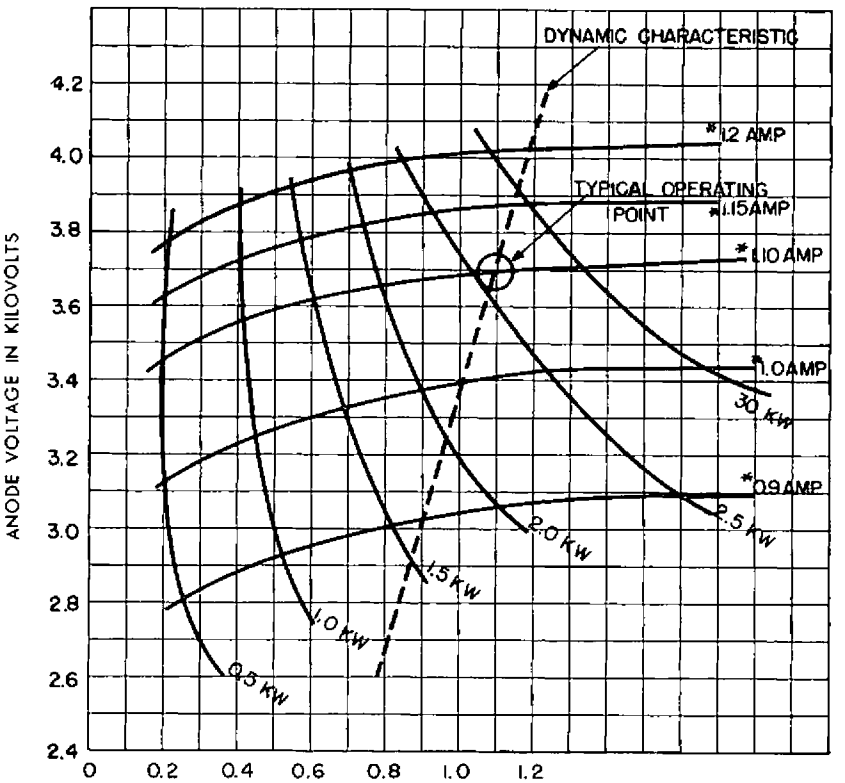
Typical Operating Conditions

Filament Voltage*	12.0	Volts
Filament Current	55	Amperes
Frequency	890 to 940	Megacycles
Anode Voltage	3700	Volts
Anode Current	1.10	Amperes
Power Output, minimum	2.5	Kilowatts
Pulling Factor, VSWR 1.5:1	2	Megacycles
Pushing Factor, I_b from 0.3 to 1.0 ampere	2.6	Megacycles per Second per Ampere
Thermal Coefficient of Temperature	−0.07	Megacycles per Second per C

Magnetic Field—See K-69087-71A286 on page five for details.

* While the magnetron is oscillating, a portion of the input plate power (depending on load conditions) will cause the filament to overheat. Maximum life will be obtained by reducing the filament power during oscillation; if the loading changes rapidly, this reduction can best be done by an automatic control, otherwise, a manual correction may be used. The required reduction of power can be ascertained by decreasing the filament voltage until the hot filament resistance during oscillation is the same as that when the magnetron is not oscillating.

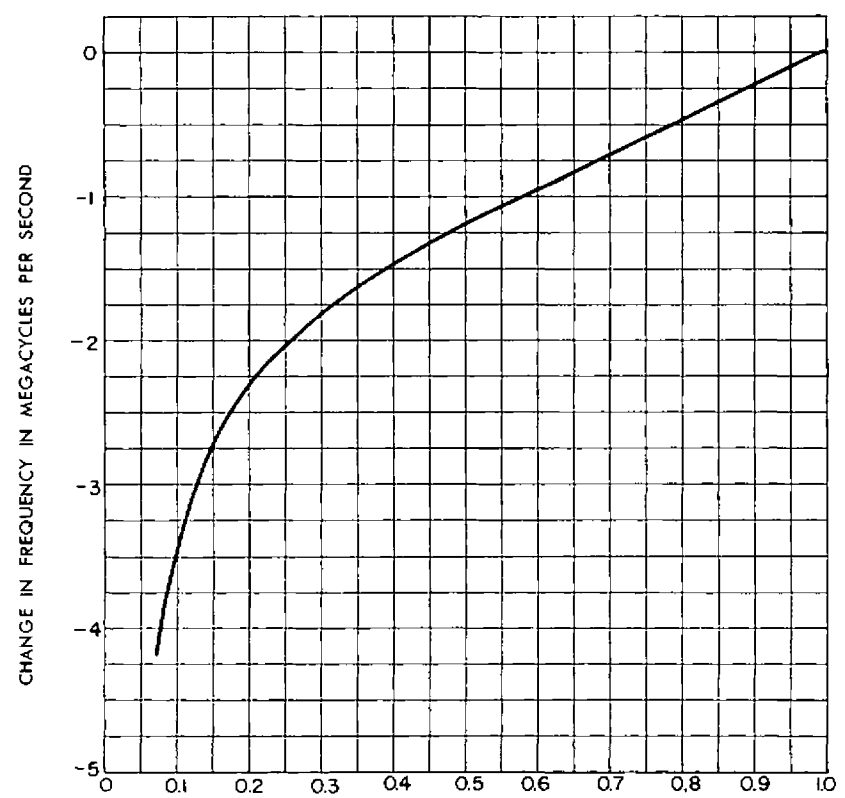
TYPICAL PERFORMANCE CHART



*CURRENT THROUGH ELECTROMAGNET. SEE OUTLINE K-69087-71A286 ON PAGE FIVE.

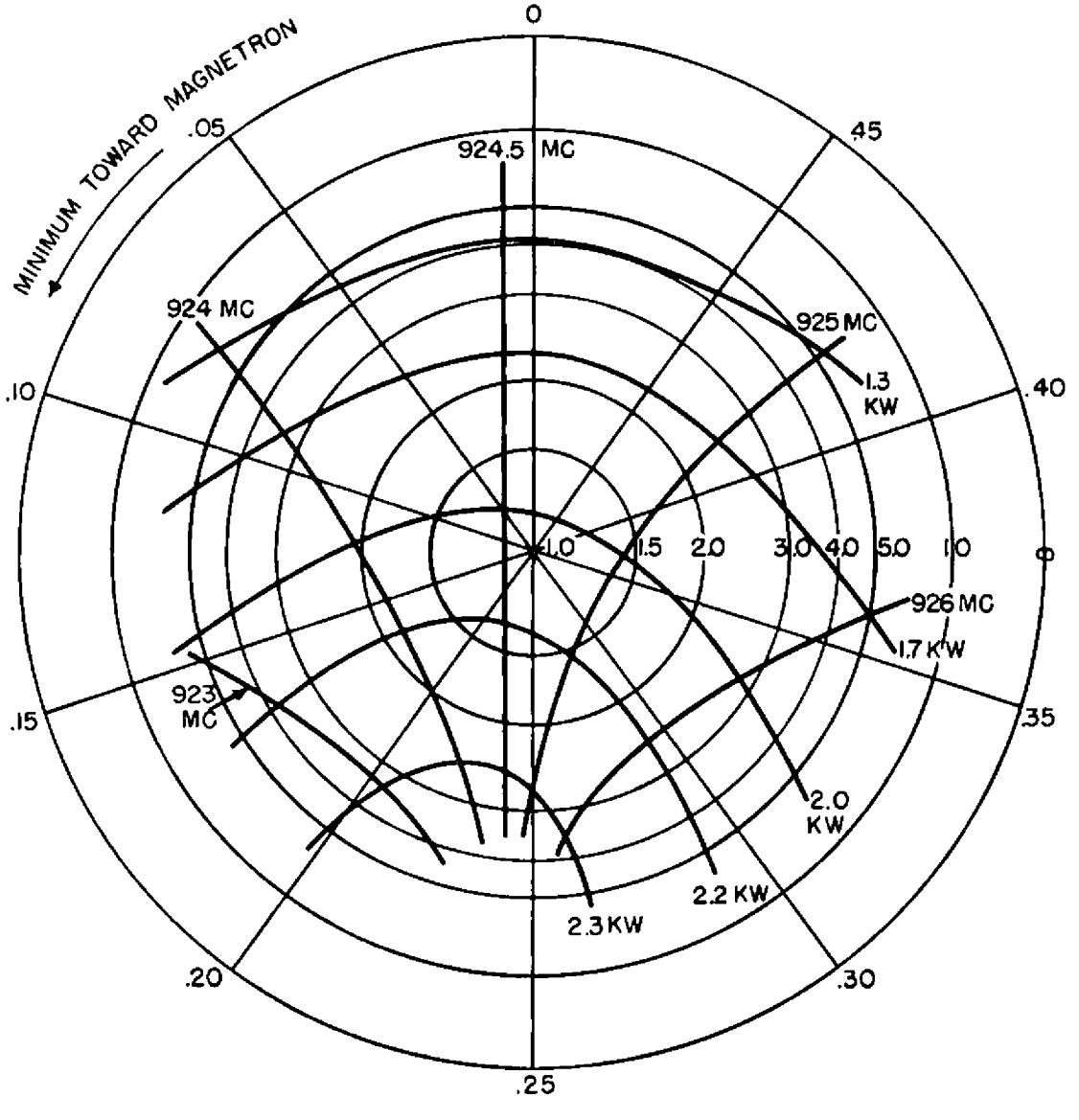
K-69087-72A734 12-20-55

TYPICAL PUSHING CURVE



K-69087-72A735 11-9-55

RIEKE DIAGRAM

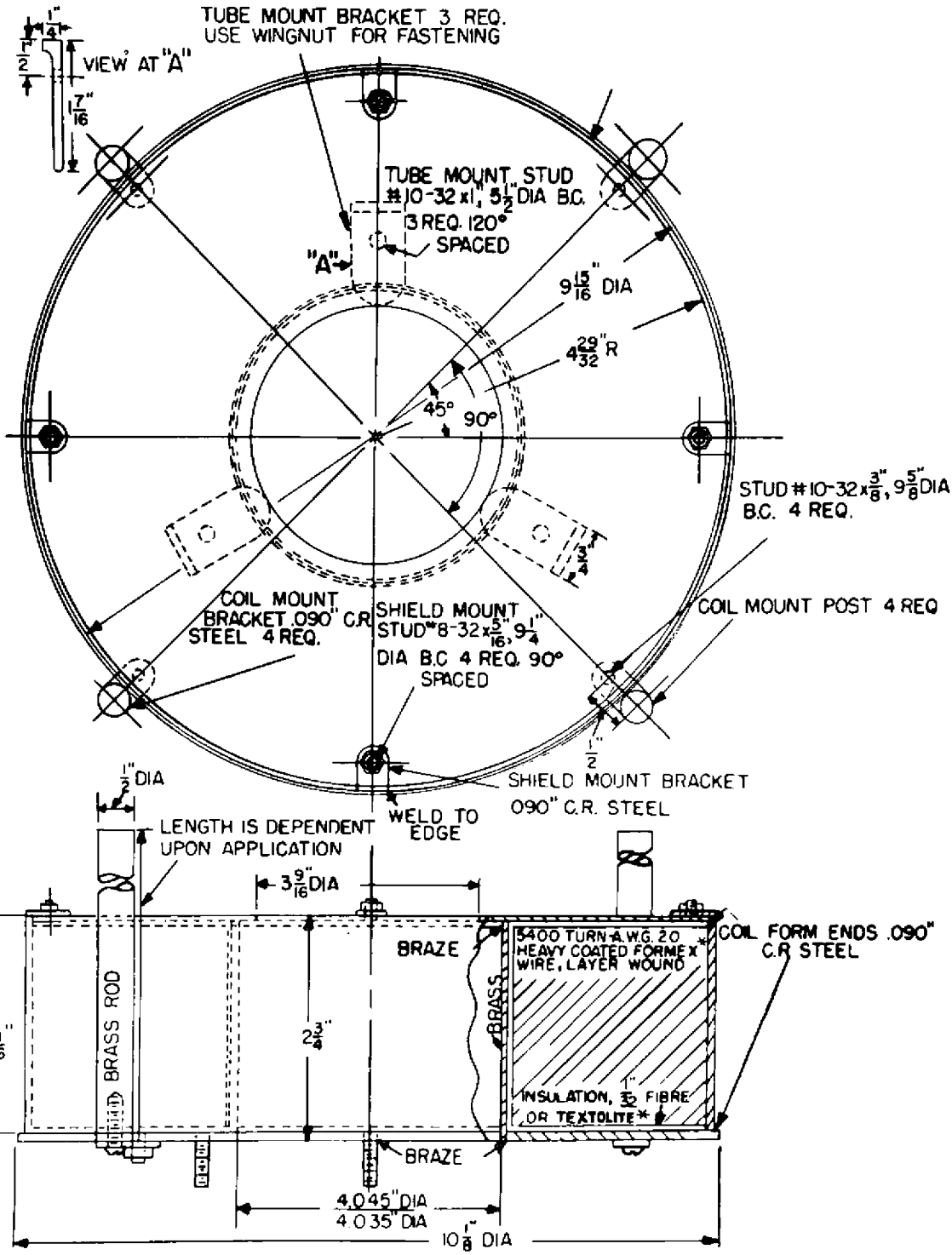


CONSTANT ANODE VOLTAGE = 3.3 KILOVOLTS.
ELECTROMAGNET—SEE OUTLINE K-69087-71A286 ON PAGE FIVE FOR DETAILS.
REFERENCE POINT IS 1 ¾" BELOW MOUNTING FLANGE (CENTER OF THE ANODE).
FIELD SHUNT RESISTANCE = 5 KILOHMS.

K-69087-72A733

11-7-55

ELECTROMAGNET FOR GL-6787

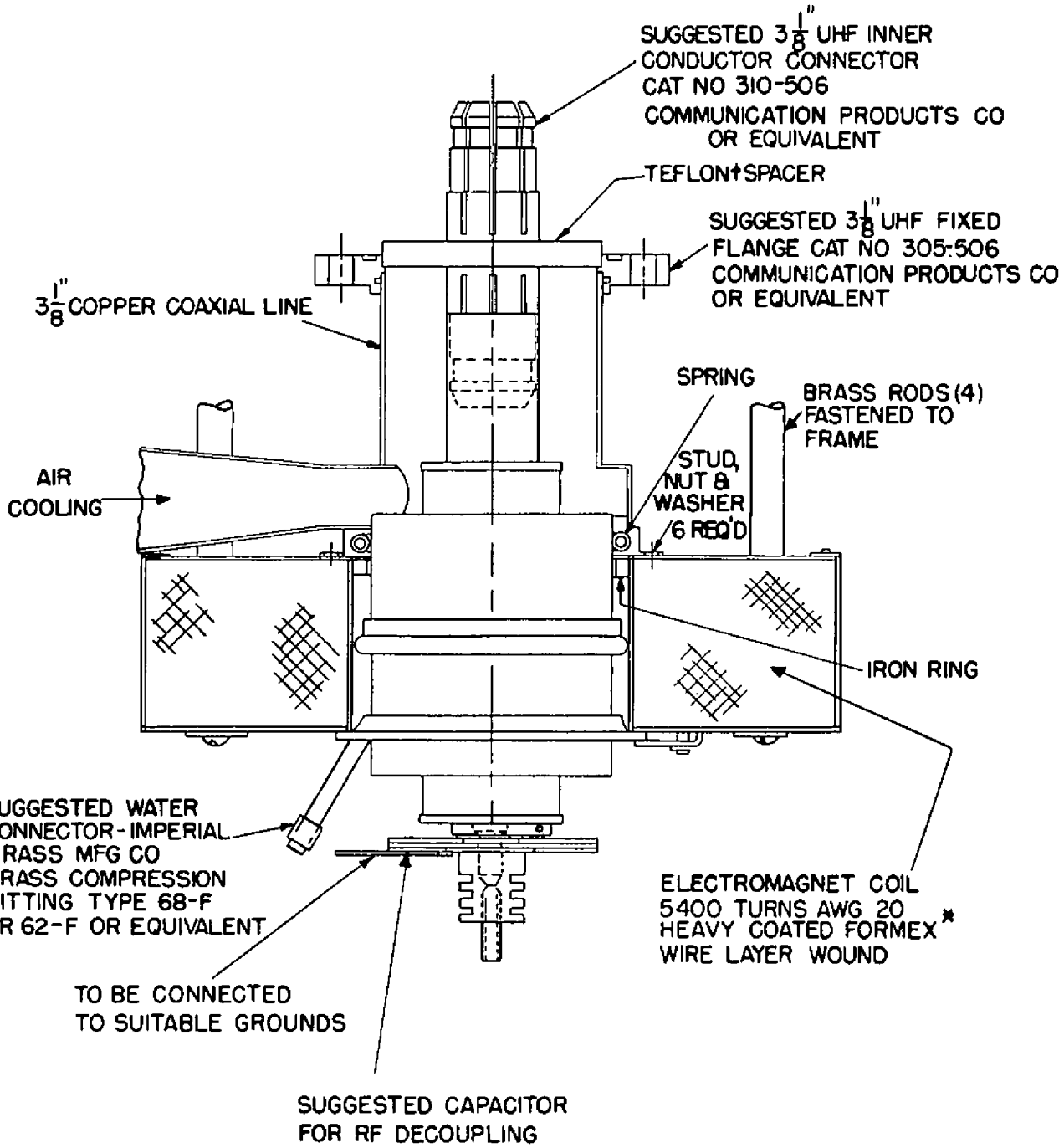


NOTES:

1. ALL STUDS PROTRUDING FROM COIL FORM ARE SET INTO TAPPED HOLES, BRAZED, AND THEN GROUND FLUSH ON INSIDE OF FORM.

*REGISTERED TRADEMARK OF GENERAL ELECTRIC COMPANY.

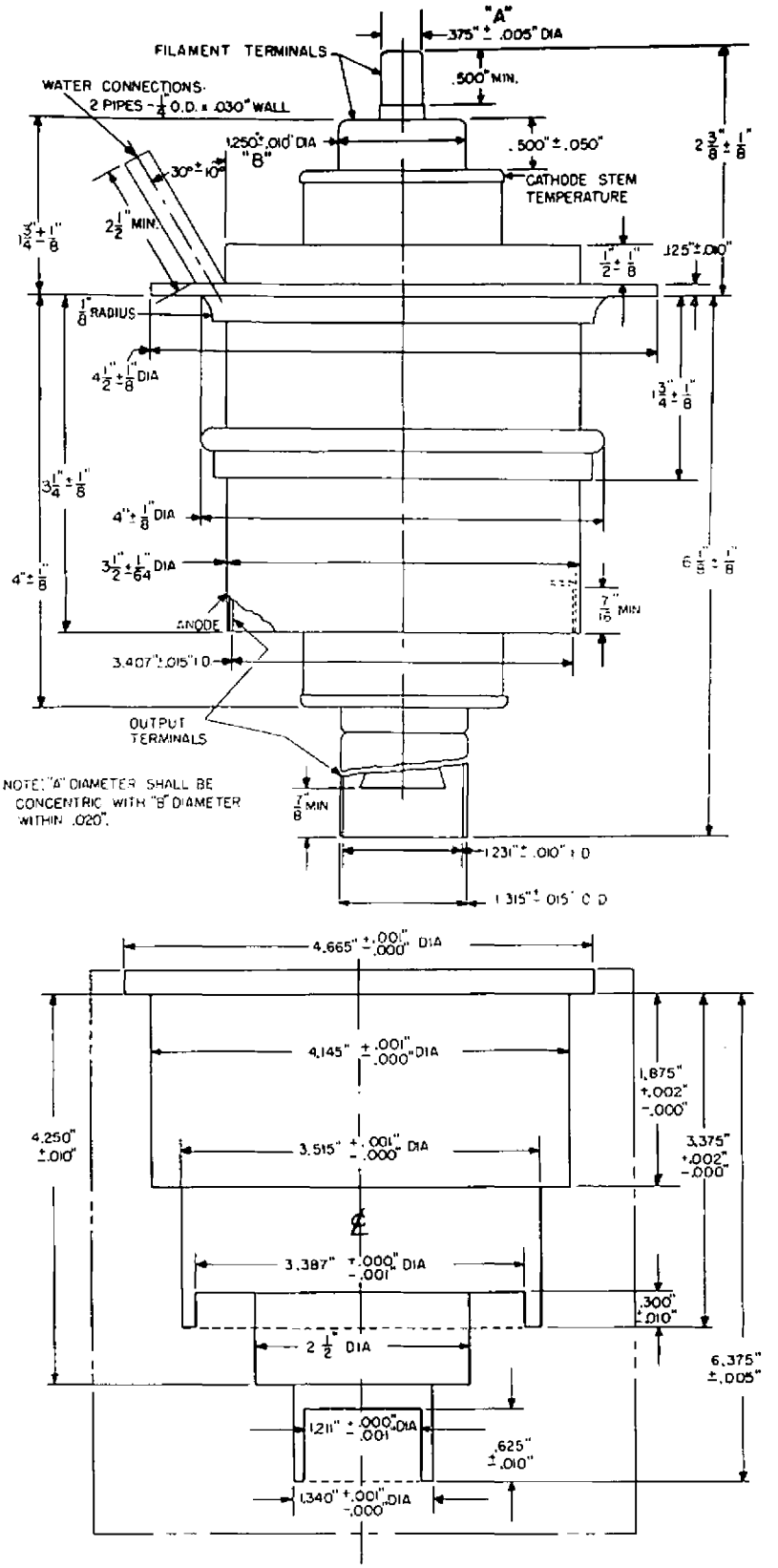
MOUNTING FOR GL-6787



*REGISTERED TRADEMARK OF GENERAL ELECTRIC COMPANY.

†REGISTERED TRADEMARK OF E. I. du PONT de NEMOURS AND COMPANY, INC.

OUTLINE



NOTE: THE CONCENTRICITY AND OVALNESS OF THE TUBE SHALL BE DEFINED BY THE ABOVE FIXTURE INTO WHICH THE TUBE SHALL FIT FREELY.

ALL DIAMETERS OF THE ABOVE FIXTURE SHALL BE CONCENTRIC WITH THE 3.515" +.001" -.000" DIAMETER WITHIN .001".

March 18, 1957
Release No. 1572C
Type No. 6787

ITEM	AS REGISTERED	AS PROPOSED
Thermal		
Water Flow through Tube, minimum	2	3 Quarts per Minute
Typical Operating Conditions		
Frequency	890 to 940	910 to 928 Megacycles with footnote reference**

**Variations in operating parameters within maximum specified ratings may cause the frequency to deviate beyond the specified limits. The maximum deviation however, will not exceed 890 to 940 megacycles.

Rieke Diagram

Change:	924.5 to	0 Megacycles
	925 to	+0.5 Megacycles
	926 to	+1.5 Megacycles
	923 to	-1.5 Megacycles
	924 to	-0.5 Megacycles

Add Footnote: Frequency stated in megacycles deviation from center frequency.

Electromagnet

Change:	9 15/16"	Diameter	11 7/16 Inches
	4 29/32"	Radius	5 21/32 Inches

Mounting

Remove capacitors and delete the two notes referenced to them

Outline

change - Water, Connections, 2 Pipes	1/4	3/8 Inch OD

GL-6808

THYRATRON

TRIODE TYPE — QUICK-HEATING CATHODE

DESCRIPTION AND RATING

The GL-6808 is a three-electrode, inert-gas-filled thyratron with a negative control characteristic for all control applications. This tube combines the desirable temperature characteristic of gas tubes, maximum ratings over a wide temperature range, with the long life of mercury tubes. Another feature useful in industrial applications is the quick-heating cathode which requires only one minute to reach operating temperature.

The GL-6808 is equipped with a bracket-type base for panel mounting.

TECHNICAL INFORMATION

GENERAL

Electrical

	Minimum	Bogey	Maximum	
Cathode* - Filamentary				
Filament Voltage	2.37	2.5	2.63	Volts
Filament Current at 2.5 Volts	---	21	23	Amperes
Heating Time	60	---	---	Seconds
Anode to Control-Grid Capacitance	---	10	---	μμf
Control-Grid to Cathode Capacitance	---	10	---	μμf
Deionization Time, approximate				
E_c = -250 volts	---	100	---	Microseconds
E_c = -42 volts	---	700	---	Microseconds
Ionization Time, approximate	---	10	---	Microseconds
Anode Voltage Drop	---	16	---	Volts
Critical Grid Current, E_p = 200 volts a-c	---	---	10	Microamperes

Control Characteristics

Anode Voltage	60	100	1000	Volts
Grid Voltage	+6	0	-7	Volts

Mechanical

Type of Cooling - Convection
Mounting Position - Any
Net Weight, maximum . . . . . 12 Ounces
The anode and grid-circuit returns should be made to the center tap of the filament transformer.

from JETEC release #1639, May 7, 1956

MAXIMUM RATINGS, Absolute Values

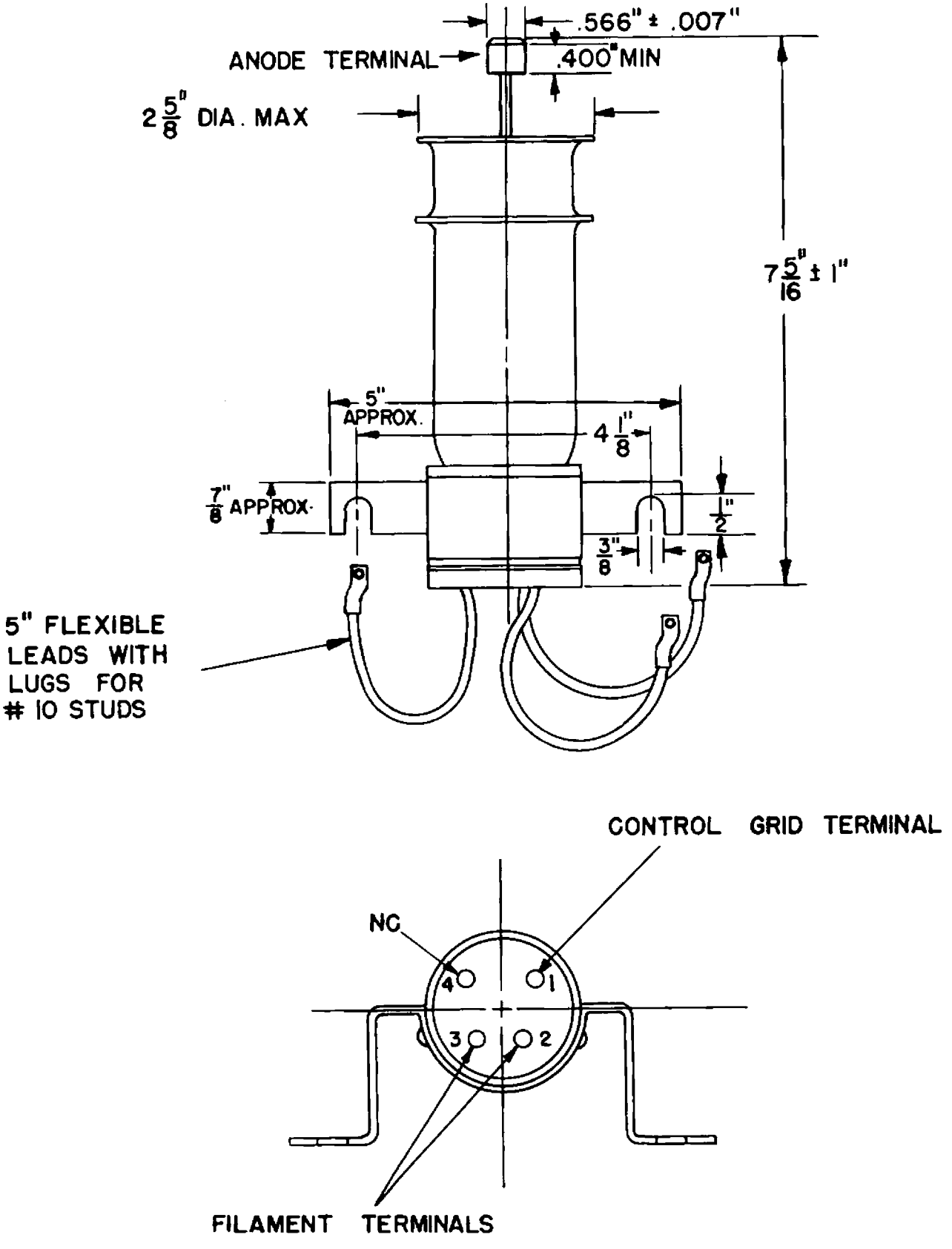
Maximum Peak Anode Voltage		
Inverse	1500	Volts
Forward	1500	Volts
Maximum Cathode Current		
Peak	80	Amperes
Average	6.4	Amperes
Maximum Averaging Time	15	Seconds
Fault	1120	Amperes
Maximum Duration	0.1	Seconds
Maximum Negative Control-Grid Voltage		
Before Conduction	250	Volts
During Conduction	10	Volts
Maximum Positive Control-Grid Current		
Anode Positive	0.20	Amperes
Anode Negative	0.10	Amperes
Commutation Factor ⁄	130	
Ambient Temperature Limits	-55 to +70	C

Most satisfactory performance and life will result with quadrature filament operation, i.e., with the filament voltage 90 degrees out of phase with the anode voltage. When quadrature operation is used the voltage on the filament lead (lead No. 2) adjacent to the grid lead (lead No. 1) should be crossing zero from positive toward negative when the anode voltage is at the peak of the positive half cycle.

In three-phase systems each tube should be connected so that its anode and filament voltages approximate as nearly as possible the quadrature phasing, i.e., filament voltage 90 plus or minus 30 degrees out of phase with the anode voltage.

When quadrature operation is not practicable, filament lead No. 2 should be negative when the anode is positive.

⁄ Commutation factor is the product of the rate of current decay in amperes-per microsecond just prior to commutation, and the rate of inverse voltage rise in volts-per-microsecond just after commutation.



OUTLINE
GL-6808

Electronic TUBES

6840
TWIN TRIODE
Five-Star Tube

★★★★★

FOR FREQUENCY-DIVIDER SERVICE IN COMPUTER APPLICATIONS

HIGH PERVEANCE
MEDIUM-MU

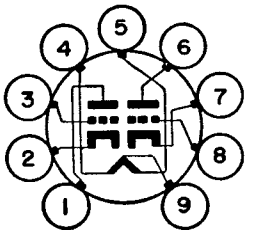
SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING

DESCRIPTION AND RATING

The 6840 is a miniature medium-mu twin triode primarily designed for service in computer applications. As required for this service, the tube incorporates an extremely high zero-bias plate current and a sharp-cutoff characteristic.

Intended for use in critical industrial and military applications in which operational dependability is of primary importance, the 6840 exhibits a high degree of mechanical strength and incorporates a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

BASING DIAGRAM



RETMA 9CZ

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Cathode (Section 2)
Pin 3—Grid (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Cathode (Section 1)
Pin 8—Grid (Section 1)
Pin 9—Heater Center Tap

GENERAL

ELECTRICAL

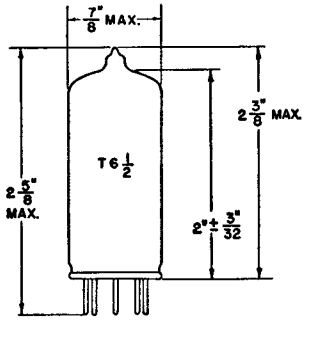
Cathode—Coated Unipotential	Series	Parallel	
Heater Voltage, AC or DC	12.6±5%	6.3±5%	Volts
Heater Current	0.4	0.8	Amperes
Direct Interelectrode Capacitances*			
Grid to Plate, Each Section		5.5	μμf
Input, Each Section		4.0	μμf
Output, Section 1		0.70	μμf
Output, Section 2		0.65	μμf
Heater to Cathode, Each Section		7.5	μμf
Grid to Grid, maximum		0.03	μμf
Plate to Plate, maximum		1.0	μμf

* Without external shield.

MECHANICAL

Mounting Position
  Preferred Orientation—Upright or with Plate Majors in Vertical Position
  Permissible Orientation—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

PHYSICAL DIMENSIONS



RETMA 6-3

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION†

Plate Voltage	300	Volts
Peak Positive Pulse Plate Voltage	600	Volts
Positive DC Grid Voltage	1.0	Volts
Negative DC Grid Voltage	75	Volts
Peak Positive Grid Voltage††	22	Volts
Peak Negative Grid Voltage	300	Volts
Plate Dissipation, Each Plate	4.0	Watts
Total Plate Dissipation, Both Plates	7.0	Watts
DC Grid Current	2.0	Milliamperes
Peak Grid Current††	70	Milliamperes
DC Cathode Current	35	Milliamperes
Peak Cathode Current††	500	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode§	100	Volts
Heater Negative with Respect to Cathode§	100	Volts
Grid Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.5	Megohms
Bulb Temperature at Hottest Point	185	C

† Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

††Rating based on a pulse of 10 microsecond duration, 1 percent duty cycle, and 1000-cycle repetition rate.

§ For pulse voltages of less than 1-percent duty cycle, the peak voltage may be 150 volts maximum.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage	80	100	250	Volts
Grid Voltage	¶	–6.5	....	Volts
Cathode-Bias Resistor	....	....	620	Ohms
Amplification Factor	....	..	20	
Plate Resistance, approximate	....	....	3000	Ohms
Transconductance	....	....	6700	Micromhos
Plate Current	31	0.10	14	Milliamperes

¶ With grid current adjusted for approximately 200 microamperes.

CHARACTERISTICS LIMITS

		Minimum	Maximum	
Heater Current				
Ef = 12.6 volts	Initial	370	430	Milliamperes
	500-Hr**	370	435	Milliamperes
	1000-Hr**	370	440	Milliamperes
Zero-Bias Plate Current (1), Each Section				
Ef = 12.6 volts, Eb = 80 volts, Ic = 200 μa (Rg = 0.40 meg to +80 volts)	Initial	26	....	Milliamperes
	500-Hr‡	24	....	Milliamperes
	500-Hr**	24	....	Milliamperes
	1000-Hr**	22	....	Milliamperes
Plate Current, Each Section				
Ef = 12.6 volts, Eb = 250 volts, Rk = 620 ohms (by-passed)	Initial	11.0	17.0	Milliamperes
	500-Hrϕ	9.8	....	Milliamperes
	1000-Hrϕ	9.1	....	Milliamperes
Transconductance, Each Section				
Ef = 12.6 volts, Eb = 250 volts, Rk = 620 ohms (by-passed)	Initial	5300	8100	Micromhos
Zero-Bias Plate Current Change with Heater Voltage, Each Section				
Difference between Zero-Bias Plate Current (1) and Zero-Bias Plate Current at Ef = 11.4 volts (other conditions the same) expressed as a percentage of Zero-Bias Plate Current (1)	Initial	....	15	Percent
	500-Hr**	....	15	Percent
Amplification Factor, Each Section				
Ef = 12.6 volts, Eb = 250 volts, Rk = 620 ohms (by-passed)	Initial	16	24	
Grid Voltage Cutoff, Each Section				
Ef = 12.6 volts, Eb = 100 volts, Ib = 100 μa	Initial	....	−8.5	Volts
	500-Hr‡	....	−8.5	Volts
Interelectrode Capacitances				
Grid to Plate (g to p), Each Section	Initial	4.5	6.7	μμf
Input (g to k+h), Each Section	Initial	3.0	5.0	μμf
Output (p to k+h), Section 1	Initial	0.56	.84	μμf
Output (p to k+h), Section 2	Initial	0.51	0.77	μμf
Heater to Cathode (h to k), Each Section	Initial	5.5	9.1	μμf
Grid to Grid (g to g)	Initial	....	0.03	μμf
Plate to Plate (p to p)	Initial	....	1.0	μμf
Measured without external shield.				
Negative Grid Current, Each Section				
Ef = 12.6 volts, Eb = 250 volts, Rk = 620 ohms (by-passed), Rg = 0.5 meg	Initial	....	1.0	Microamperes
	500-Hrϕ	....	1.0	Microamperes
	500-Hr**	....	1.0	Microamperes
	1000-Hrϕ	....	1.0	Microamperes
	1000-Hr**	....	1.0	Microamperes
Heater-Cathode Leakage Current, Each Section				
Ef = 12.6 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	Initial	....	7	Microamperes
	500-Hrϕ	....	7	Microamperes
	500-Hr**	....	7	Microamperes
	1000-Hrϕ	....	7	Microamperes
	1000-Hr**	....	7	Microamperes
Heater Negative with Respect to Cathode	Initial	....	7	Microamperes
	500-Hrϕ	....	7	Microamperes
	500-Hr**	....	7	Microamperes
	1000-Hrϕ	....	7	Microamperes
	1000-Hr**	....	7	Microamperes

CHARACTERISTICS LIMITS (Continued)

		Minimum	Maximum	
Interelectrode Leakage Resistance				
Ef = 12.6 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid (Each Section) to All at 100 Volts DC	Initial	100	....	Megohms
	500-Hrϕ	50	....	Megohms
	500-Hr**	50	....	Megohms
Plate (Each Section) to All at 300 Volts DC	Initial	100	....	Megohms
	500-Hrϕ	50	....	Megohms
	500-Hr**	50	....	Megohms
Vibrational Noise Output Voltage, RMS, Each Section				
Ef = 12.6 volts, Ebb = 250 volts, Rk = 620 ohms (by-passed), R_L = 2000 ohms, Vibrational acceleration = 2.5 G at 25 cps	Initial	....	300	Millivolts
Grid Emission Current, Each Section				
Ef = 15.0 volts, Eb = 250 volts, Ecc = −30 volts, Rg = 0.5 meg	Initial	....	1.0	Microamperes
Pulse Cathode Current				
Ef = 12.6 volts, Eb = 200 volts, Ecc = −30 volts. Grid is driven 21 volts positive with a pulse of 1.0 percent duty cycle and 1000-cycle repetition rate. Pulse cathode current is measured for each section with both sections operating under pulse conditions	Initial	400	....	Milliamperes
	1000-Hr§§	350	....	Milliamperes

ϕ Regular Intermittent Life Test: Conditions of operation for each section are Ef = 12.6 volts, Eb = 250 volts, Rk = 620 ohms, Rg = 0.5 meg, Ehk = 180 volts with heater positive with respect to cathode, and bulb temperature = 185 C minimum.

**Zero-Bias Life Test: Conditions of operation for each section are Ef = 12.6 volts, Ebb = 125 volts, R_L = 1500 ohms, and Ic = 200 μa (Rg = 0.62 meg to +125 volts).

‡ Cutoff Life Test: Conditions of operation for each section are Ef = 12.6 volts, Eb = 150 volts, Ec = −30 volts, Rg = 0.1 meg, and Ehk = 180 volts with heater positive with respect to cathode.

§§Pulse Life Test: Conditions of operation for each section are Ef = 12.6 volts, Ebb = 180 volts, Ecc = −30 volts, R_L = 50 ohms, and Rg = 25 ohms. Grid is driven with a 25 volt positive-going pulse (measured on driver side of Rg) of 1 percent duty cycle and 1000-cycle repetition rate.

SPECIAL TESTS AND RATINGS

Stability Life Test
Statistical sample operated for one hour to evaluate and control initial variations in zero-bias plate current.

Survival-Rate Life Test
Statistical sample operated for one hundred hours to evaluate and control early life electrical and mechanical inoperatives.

Heater-Cycling Life Test
Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.5 volts (parallel-heater connection) cycled for one minute on and one minute off, Eb = Ec = 0 volts, and Ehk = 135 volts with heater positive with respect to cathode.

Shock Rating—450 G
Statistical sample subjected to five impact accelerations of 450 G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

Fatigue Rating—2.5 G
Statistical sample subjected to vibrational acceleration of 2.5 G for 32 hours minimum in each of three different positions. The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

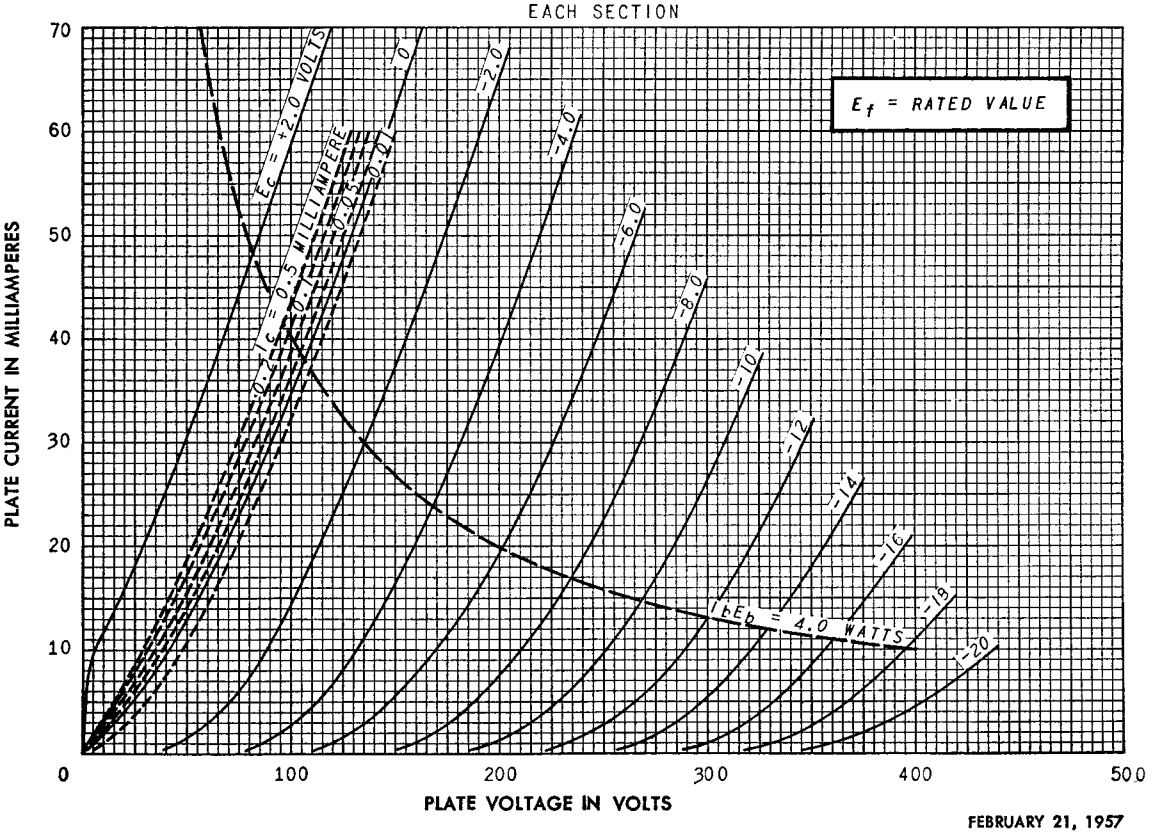
Cathode-Interface Impedance Life Test
Statistical sample operated without cathode current to evaluate and control the development of cathode interface impedance.

Altitude Rating—60,000 Feet
Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

AVERAGE PLATE CHARACTERISTICS

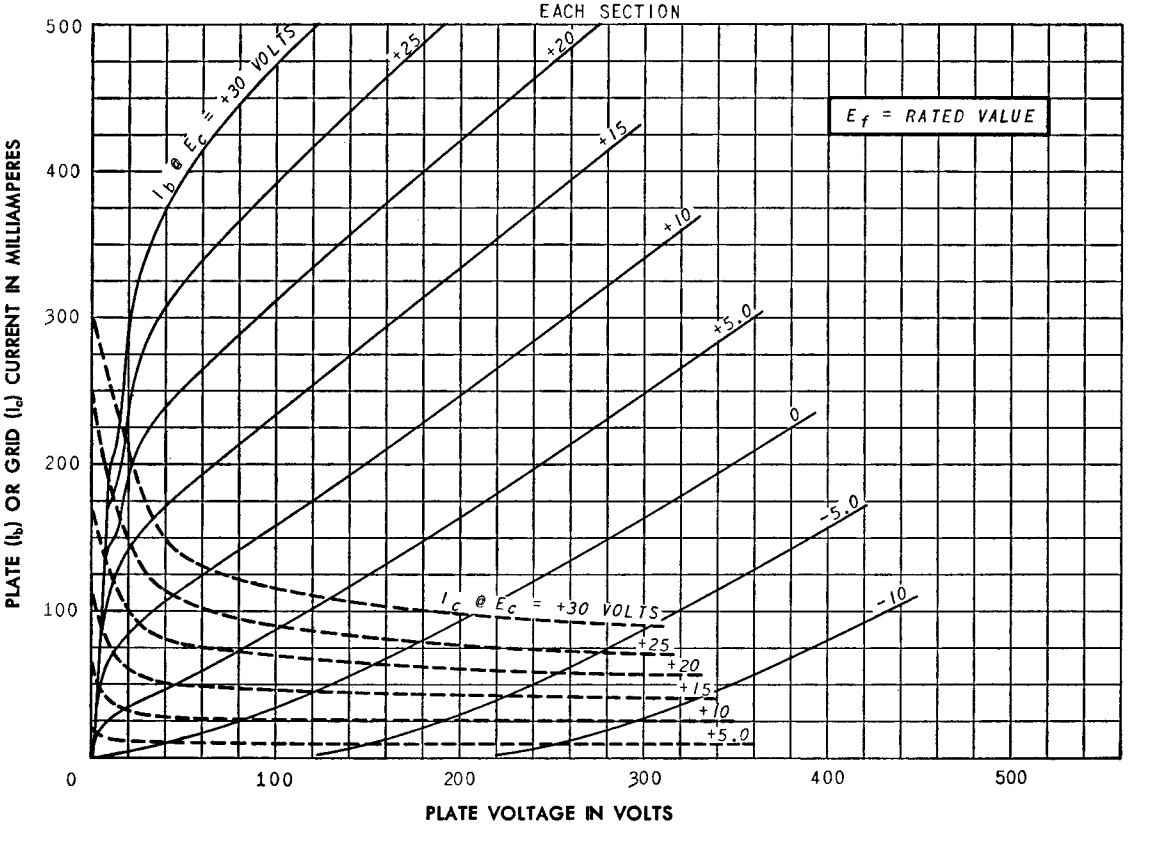
EACH SECTION



FEBRUARY 21, 1957

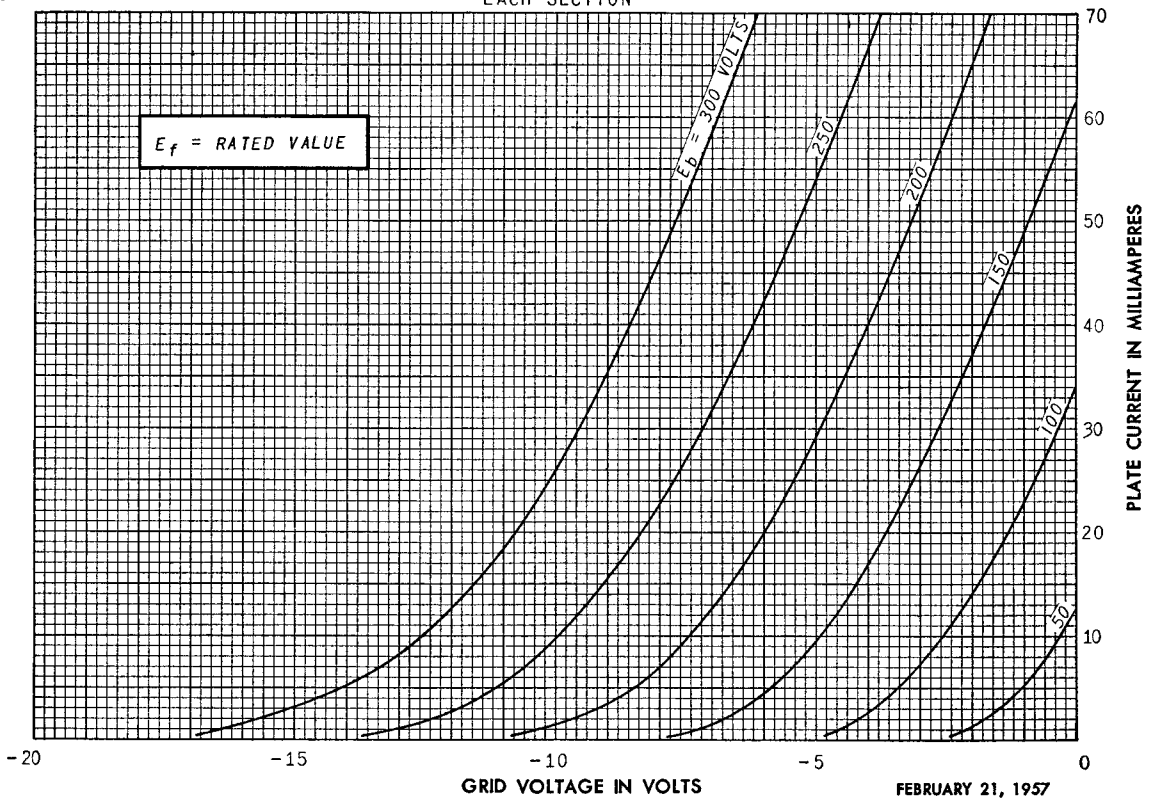
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



AVERAGE TRANSFER CHARACTERISTICS

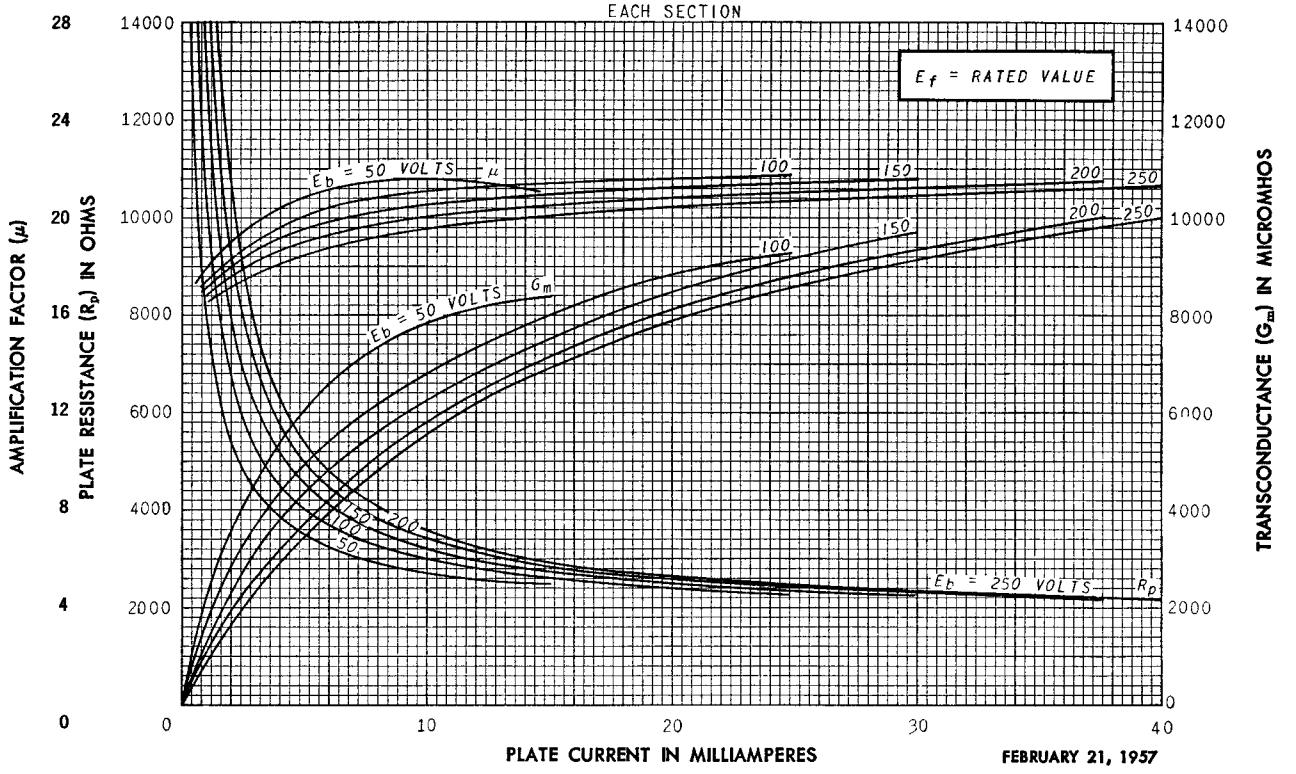
EACH SECTION



FEBRUARY 21, 1957

AVERAGE CHARACTERISTICS

EACH SECTION



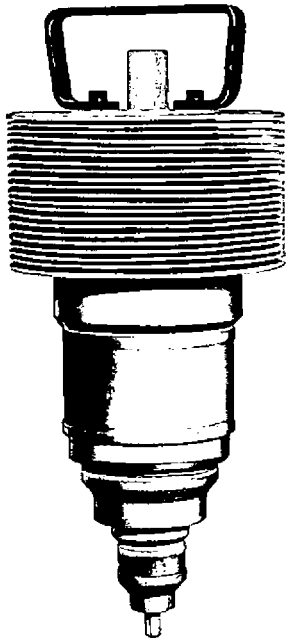
FEBRUARY 21, 1957

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.



GL-6848
TETRODE

VHF-UHF **FORCED-AIR COOLED**

RING-SEAL CONSTRUCTION **METAL AND CERAMIC**

GROUNDED-GRID CIRCUIT

The GL-6848 is a four-electrode transmitting tube featuring a metal-and-ceramic envelope for use as a power amplifier or oscillator in grounded-grid circuits with both grids maintained at radio-frequency ground potential. The output circuit is connected between the anode and the screen grid. The anode is capable of dissipating 2 kilowatts. Cooling is accomplished by forced air with the radiator an integral part of the anode. The cathode is a unipotential thoriated-tungsten cylinder, heated by electron bombardment. Maximum ratings apply up to 800 megacycles, although higher frequency operation is possible.

In narrow band, Class C, grounded-grid, amplitude-modulated service, the GL-6848 has a useful carrier-power output in excess of one kilowatt. In Class C Telegraphy, it has a useful power output of 3.0 kilowatts of continuous power as an amplifier or oscillator.

Electrical

	Minimum	Bogey	Maximum	
Cathode				
Heater Voltage	—	6.7	7.0	Volts
Heater Current at 7.0 Volts				
Without Cathode Bombarding	—	14.5	—	Amperes
With 150 Watts Cathode Bombarding	—	13.5	—	Amperes
Heater Starting Current	—	—	25	Amperes
Heater Cold Resistance	—	0.041	—	Ohms
Cathode Bombarding Power*†	—	170	195	Watts
Cathode Bombarding Voltage, DC				
For 170 Watts Bombarding Power	—	650	—	Volts
For 195 Watts Bombarding Power	—	700	—	Volts
Cathode Heating Time	1	—	—	Minutes
Amplification Factor, G_2 to G_1, E_b=4000 volts, I_b=0.5 Ampere	—	20	—	
Peak Cathode Current‡	—	—	6	Amperes
Direct Interelectrode Capacitances				
Cathode to Plate§	0.007	0.01	0.017	μμf
Input, G_2 tied to G_1	27.0	28.0	30.5	μμf
Output, G_2 tied to G_1¶	6.4	6.6	6.9	μμf

Mechanical

Mounting Position—Vertical, Anode-end Up

Net Weight, approximate . . . . . 6.0 Pounds

Thermal

Type of Cooling—Forced Air

Air Flow				
Through Radiator				
Percentage Rated Plate Dissipation	100	80	60	Percent
Air Flow	120	70	48	Cubic Feet per Minute
Static Pressure	3.2	1.5	0.8	Inches
Screen-grid to Control-grid Seals			15	Min Cubic Feet per Minute
Heater-to-Cathode Seals			7.5	Min Cubic Feet per Minute
Anode Ceramic			10	Min Cubic Feet per Minute
Incoming Air Temperature			45	Max C
Ceramic Temperature at Any Point			200	Max C

Forced-air cooling to be applied before and during the application of any voltages. Air flow on heater-to-cathode seals must be maintained for one minute after removal of heater voltage. The air duct can be constructed so that air is forced along the anode seal and ceramic through the anode contact fingers to accomplish the anode ceramic and anode seal cooling.

from JEDEC release #3203, March 27, 1961

PLATE MODULATED RADIO-FREQUENCY AMPLIFIER—CLASS C TELEPHONY

Carrier Conditions With a Maximum Modulation Factor of 1.0, Screen Modulation Required

Maximum Ratings, Absolute Values

DC Plate Voltage	4500	Volts
DC Grid-No. 2 Voltage	500	Volts
DC Grid-No. 1 Voltage	−120	Volts
DC Plate Current	0.80	Ampere
DC Grid-No. 1 Current	0.120	Ampere
Plate Input	3.60	Kilowatts
Grid-No. 2 Input	25	Watts
Plate Dissipation	2.0	Kilowatts

Typical Operation

Grounded-grid Circuit at 400 Megacycles

DC Plate Voltage	4000	Volts
DC Grid-No. 2 Voltage	400	Volts
DC Grid-No. 1 Voltage	−100	Volts
Peak RF Plate Voltage	2500	Volts
Peak RF Driving Voltage	120	Volts
DC Plate Current	0.570	Ampere
DC Grid-No. 2 Current	0.020	Ampere
DC Grid-No. 1 Current, approximate	0.100	Ampere
Driving Power, approximate	100	Watts
Power Output#	1250	Watts
Output Circuit Efficiency	90	Percent
Cathode Bombarding Power*	165	Watts
Cathode Bombarding Voltage, approx.	630	Volts
Cathode Bombarding Current, approx.	0.260	Ampere

RADIO-FREQUENCY AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key Down Conditions per Tube Without Amplitude Modulation

Maximum Ratings, Absolute Values

DC Plate Voltage	7000	Volts
DC Grid-No. 2 Voltage	750	Volts
DC Plate Current	1.0	Amperes
Plate Input	6.0	Kilowatts
Grid-No. 2 Input	40	Watts
Plate Dissipation	2.0	Kilowatts
DC Grid-No. 1 Voltage	120	Volts
DC Grid-No. 1 Current	0.150	Ampere

Typical Operation

Grounded-grid Circuit at 400 Megacycles			
DC Plate Voltage	4500	6500	Volts
DC Grid-No. 2 Voltage	600	700	Volts
DC Grid-No. 1 Voltage	−120	−100	Volts
Peak RF Plate Voltage, approximate	3000	—	Volts
Peak RF Grid-No. 1 Voltage	140	140	Volts
DC Plate Current	0.6	0.8	Ampere
DC Grid-No. 2 Current	0.018	0.025	Ampere
DC Grid-No. 1 Current	0.080	0.100	Ampere
Driving Power, approximate	100	100	Watts
Power Output, approximate#	1800	3200	Watts
Output Circuit Efficiency	90	90	Percent
Cathode Bombarding Power*	160	165	Watts
Cathode Bombarding Voltage, approximate	610	630	Volts
Cathode Bombarding Current, approximate	0.260	0.260	Ampere

Grounded-grid Circuit at 800 Megacycles

DC Plate Voltage	4500	Volts
DC Grid-No. 2 Voltage	600	Volts
DC Grid-No. 1 Voltage	−120	Volts
Peak RF Plate Voltage, approximate	3000	Volts
Peak RF Grid-No. 1 Voltage	140	Volts
DC Plate Current	0.6	Ampere
DC Grid-No. 2 Current	0.018	Ampere
DC Grid-No. 1 Current	0.080	Ampere
Driving Power, approximate	90	Watts
Power Output, approximate#	1250	Watts
Output Circuit Efficiency	83	Percent
Cathode Bombarding Power*	150	Watts
Cathode Bombarding Voltage, approximate	600	Volts
Cathode Bombarding Current, approximate	0.250	Ampere

* The cathode of the GL-6848, because of transit-time effects which raise the temperature of the cathode, is subjected to considerable back bombardment in ultra-high-frequency service. The amount of heating due to bombardment is a function of the operating conditions and frequency, and must be compensated for by a reduction of the cathode power input to prevent overheating of the cathode with resulting short life. In any case it is important from a tube life standpoint to keep the cathode power at as low a level as possible consistent with required performance. Bombarder power should be monitored by a suitable wattmeter or DC voltmeter and milliammeter arrangement. For long life, the tube should be put in operation with about 180 watts bombarding power. After the circuit has been adjusted for proper tube operation, bombarding voltage should be reduced to a value slightly above that at which circuit performance is affected. Minor circuit readjustment may be necessary after the above adjustment. The procedure for determining proper bombarding power should be repeated periodically.

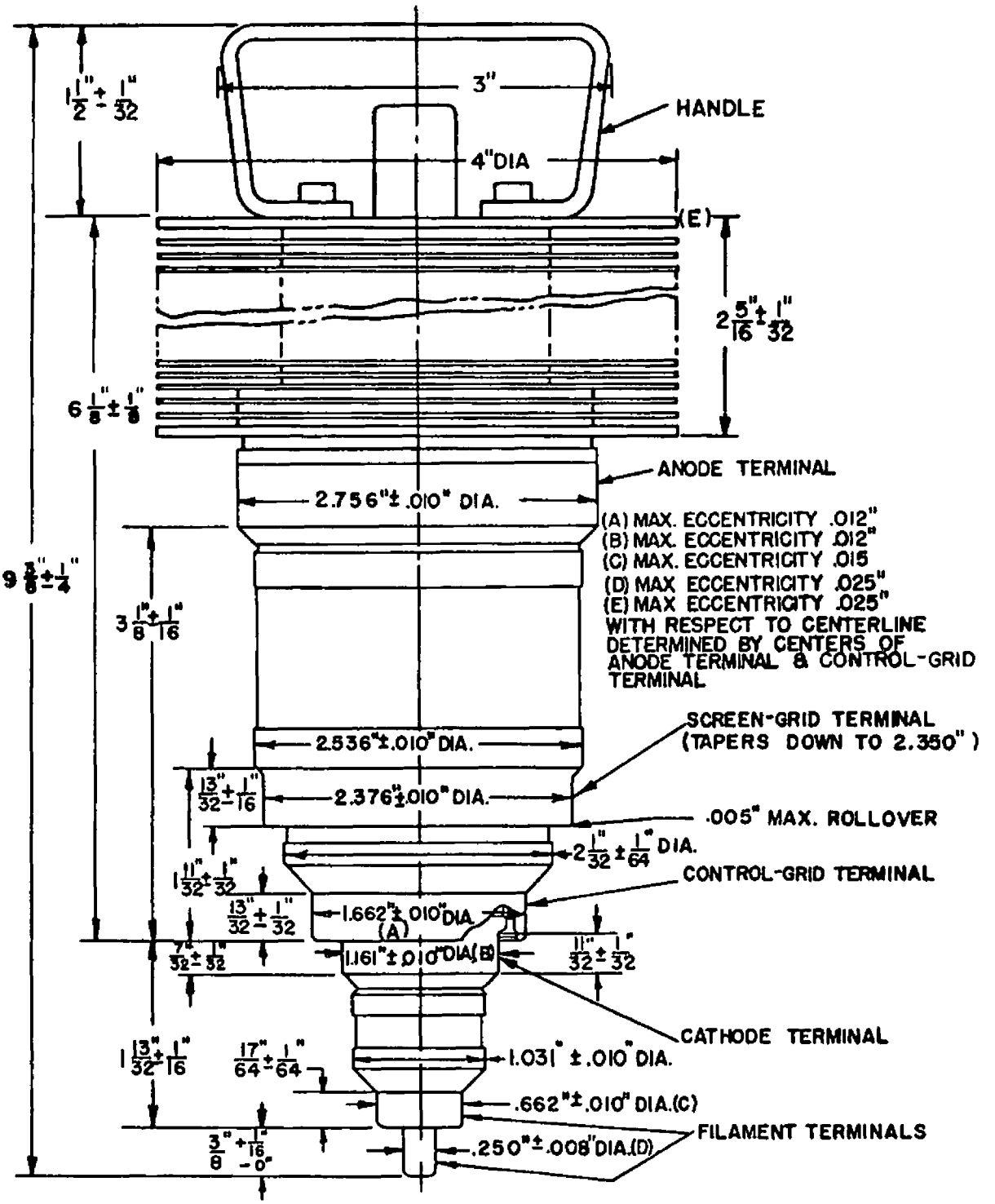
† A bombarder supply designed for an output of 700 volts with a load of 300 milliamperes will serve adequately.

‡ Represents maximum usable cathode current.(plate current plus current to each grid) for any condition of operation.

§ Measured with complete isolation between cathode and plate.

¶ Output capacitance measured between anode and screen grid. Control grid connected directly to screen grid.

\# Useful power output including power transferred from driver stage.



K69087-72810

3-61

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

from JETEC release #1622, April 2, 1956

GL-6855

THYRATRON

TRIODE TYPE — QUICK-HEATING CATHODE

NEGATIVE CONTROL CHARACTERISTICS — INERT-GAS AND MERCURY-VAPOR TYPE

DESCRIPTION AND RATING

The GL-6855 is a three-electrode inert-gas and mercury-vapor thyratron with negative control characteristics for use in all control applications. The GL-6855 combines the desirable temperature characteristic of gas tubes, maximum ratings over a wide temperature range, with the long life of mercury tubes. Another feature useful in industrial applications is a quick-heating filamentary-type cathode - only 15 seconds is required for the cathode to reach operating temperature.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode - Filamentary		
Filament Voltage	2.5	Volts
Filament Current at 2.5 Volts	6.3 ± 0.8	Amperes
Heating Time	15	Seconds
Anode to Control-Grid Capacitance	3	uuf
Deionization Time, approximate	1000	Microseconds
Ionization Time, approximate	10	Microseconds
Anode Voltage Drop	8	Volts
Critical Grid Current	10	Microamperes
Control Characteristics		
Anode Voltage	100 500 1250	Volts
Grid Voltage	-1.5 -3.5 -5.2	Volts

Mechanical

Mounting Position - Vertical, Base Down		
Equilibrium Condensed-Mercury Temperature Rise Above Ambient	30	
Net Weight, maximum	3	Ounces

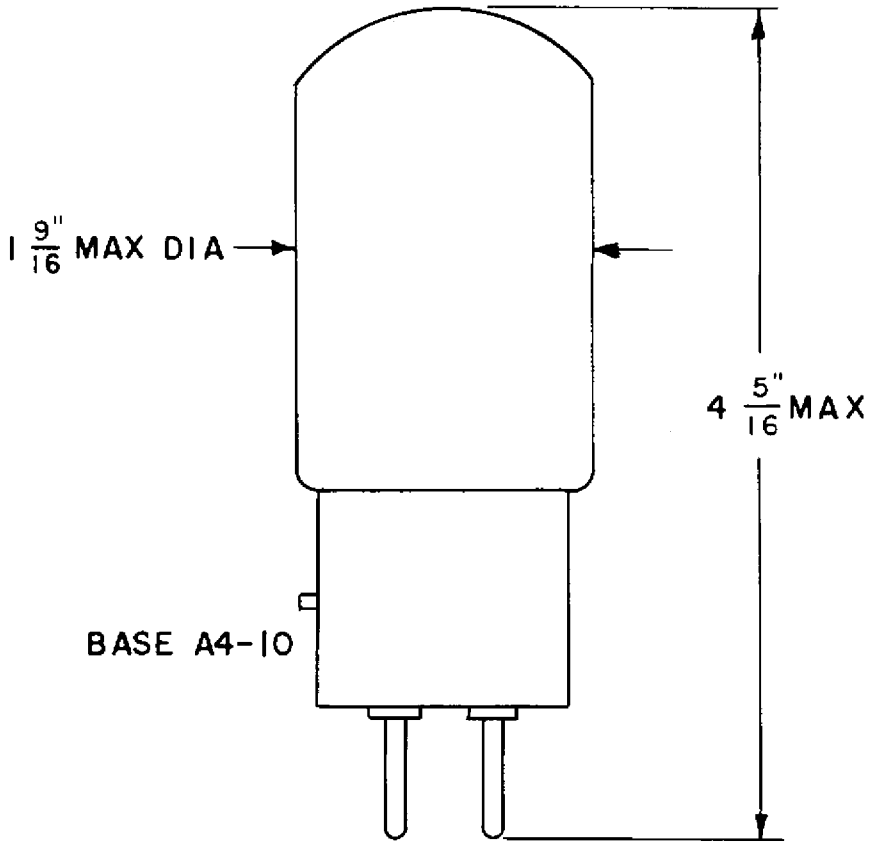
MAXIMUM RATINGS, Absolute Values

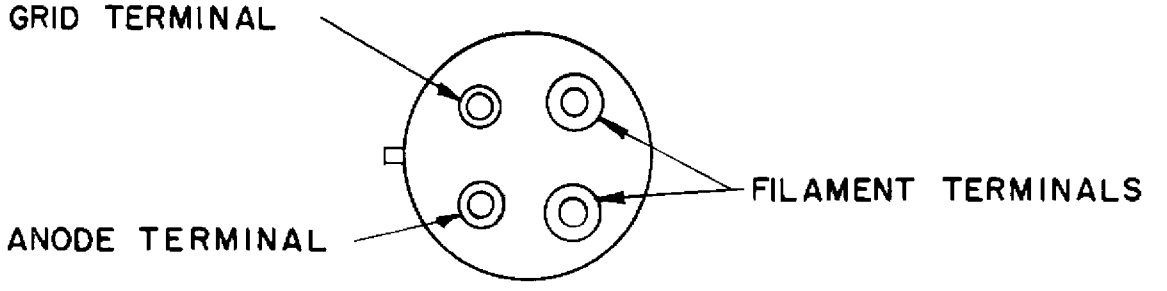
Maximum Peak Anode Voltage		
Inverse	1250	Volts
Forward	1250	Volts

MAXIMUM RATINGS, Absolute Values (Cont'd)

Maximum Cathode Current		
Peak	8.0	Amperes
Average	1.0	Amperes
Maximum Averaging Time	5	Seconds
Fault	80	Amperes
Maximum Duration	0.1	Seconds
Maximum Negative Control-Grid Voltage		
Before Conduction	500	Volts
During Conduction	10	Volts
Condensed Mercury Temperature Limits	-40 to +80	C

OUTLINE-GL-6855





from JETEC release #1622, April 2, 1956

GL-6856 - GL-6857

THYRATRONS

TRIODE TYPE — QUICK-HEATING CATHODE

NEGATIVE CONTROL CHARACTERISTICS — INERT-GAS AND MERCURY-VAPOR TYPE

DESCRIPTION AND RATING

These tubes are three-electrode inert-gas and mercury-vapor thyratrons with negative control characteristics for use in all control applications. They combine the desirable temperature characteristic of gas tubes, maximum ratings over a wide temperature range, with the long life of mercury tubes. Another feature useful in industrial applications is a quick-heating filamentary-type cathode - only 30 seconds is required for the cathode to reach operating temperature.

The tubes are alike except for the type base used. The GL-6856 has a four-pin base for conventional socket mounting; the GL-6857 a bracket-type base for panel mounting.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode - Filamentary		
Filament Voltage	2.5	Volts
Filament Current at 2.5 Volts	16 ± 2	Amperes
Heating Time	30	Seconds
Anode to Control-Grid Capacitance	3	uuf
Deionization Time, approximate	1000	Microseconds
Ionization Time, approximate	10	Microseconds
Anode Voltage Drop	12	Volts
Critical Grid Current	10	Microamperes
Control Characteristics		
Anode Voltage	100 500 1250	Volts
Grid Voltage	-1.0 -3.0 -5.2	Volts

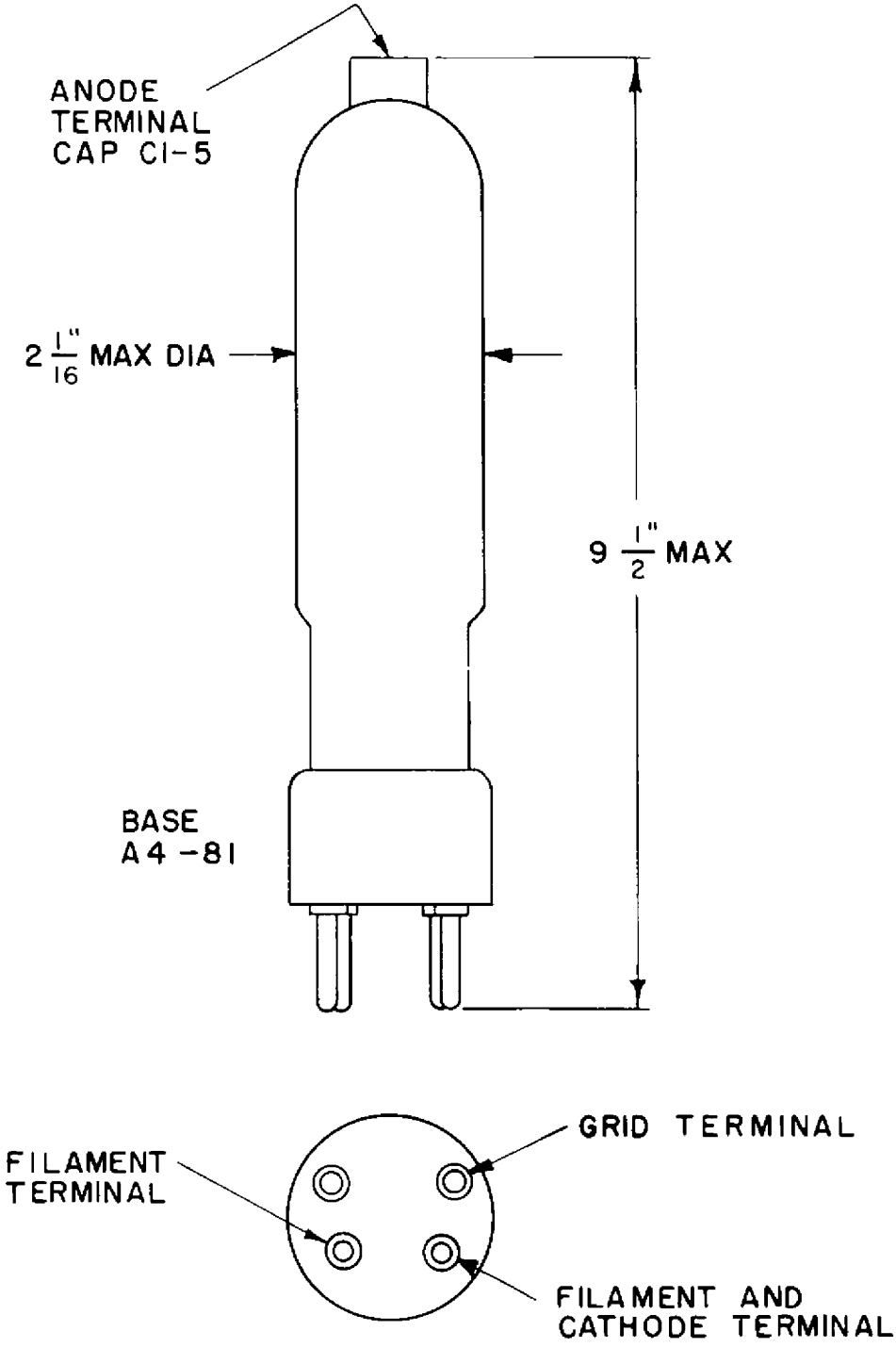
Mechanical

Mounting Position - Vertical, Base Down		
Equilibrium Condensed-Mercury Temperature Rise Above Ambient	25	
Net Weight, maximum	7	Ounces

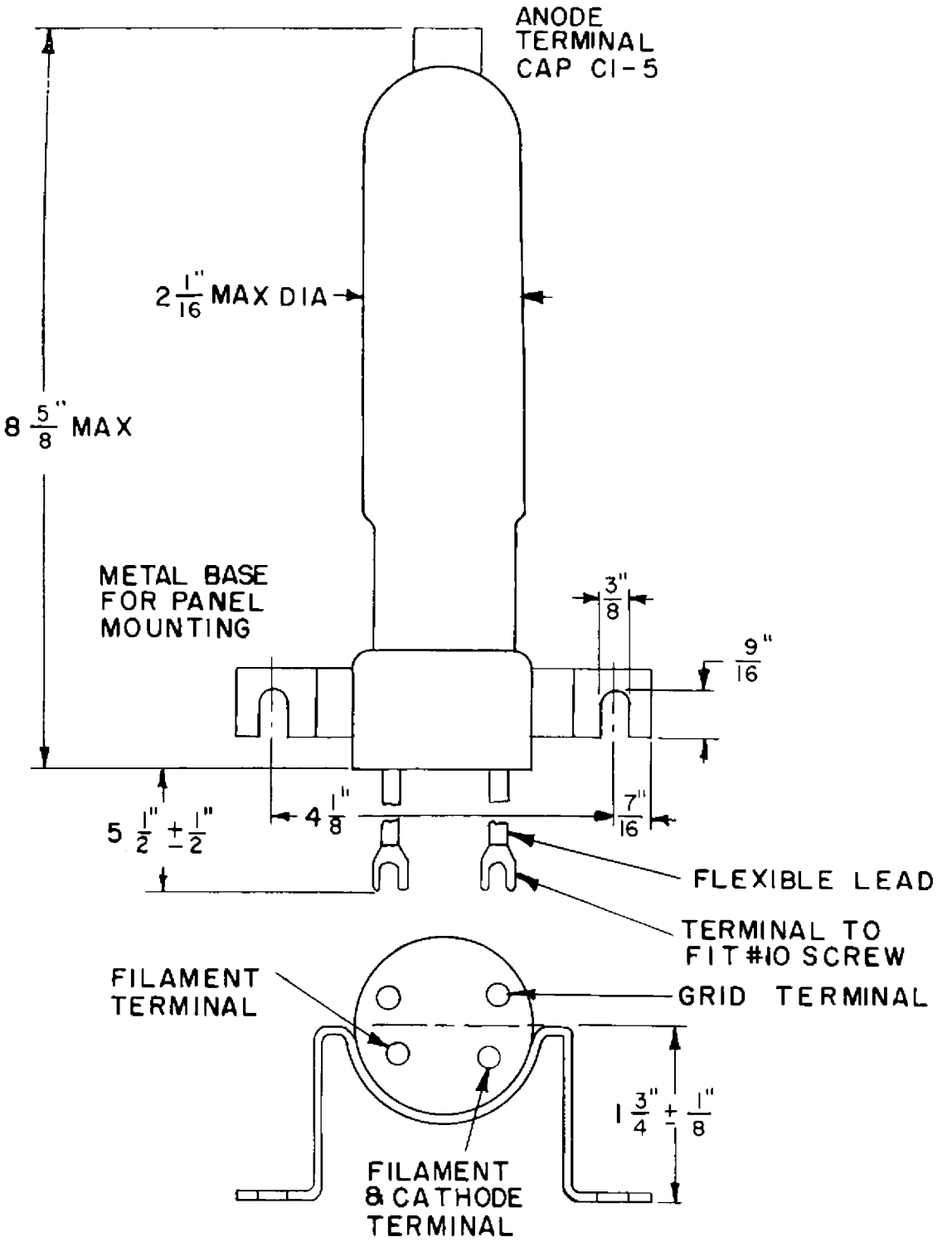
MAXIMUM RATINGS, Absolute Values

Maximum Peak Anode Voltage				
Inverse	1500	1500		Volts
Forward	1500	1500		Volts
Maximum Cathode Current				
Peak	30	50		Amperes
Average	4.0	2.5		Amperes
Maximum Averaging Time	5.0	5.0		Seconds
Fault	400	400		Amperes
Maximum Duration	0.1	0.1		Seconds
Maximum Negative Control-Grid Voltage				
Before Conduction			500	Volts
During Conduction			10	Volts
Condensed-Mercury Temperature Limits			-40 to +80	C

OUTLINE-GL-6856



OUTLINE-GL-6857



from JETEC release #1622, April 2, 1956

GL-6858 - GL-6859

THYRATRONS

TRIODE TYPE — FILAMENTARY-TYPE CATHODE

NEGATIVE CONTROL CHARACTERISTICS — INERT-GAS AND MERCURY-VAPOR TYPE

DESCRIPTION AND RATING

These tubes are three-electrode inert-gas and mercury-vapor thyratrons with negative control characteristics for use in all control applications. They combine the desirable temperature characteristic of gas tubes, maximum ratings over a wide temperature range, with the long life of mercury tubes. Another feature useful in industrial applications is a filamentary-type cathode which requires only one minute to reach operating temperature.

The tubes are alike except for the type base used. The GL-6858 has a four pin base for conventional socket mounting; the GL-6859 a bracket-type base for panel mounting.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode - Filamentary		
Filament Voltage	2.5	Volts
Filament Current at 2.5 Volts	21 ± 2	Amperes
Heating Time	60	Seconds
Anode to Control-Grid Capacitance	4	uuf
Deionization Time, approximate	1000	Microseconds
Ionization Time, approximate	10	Microseconds
Anode Voltage Drop	12	Volts
Critical Grid Current	10	Microamperes

Control Characteristics

Anode Voltage	200	500	1250	Volts
Grid Voltage	-2.8	-4.0	-5.5	Volts

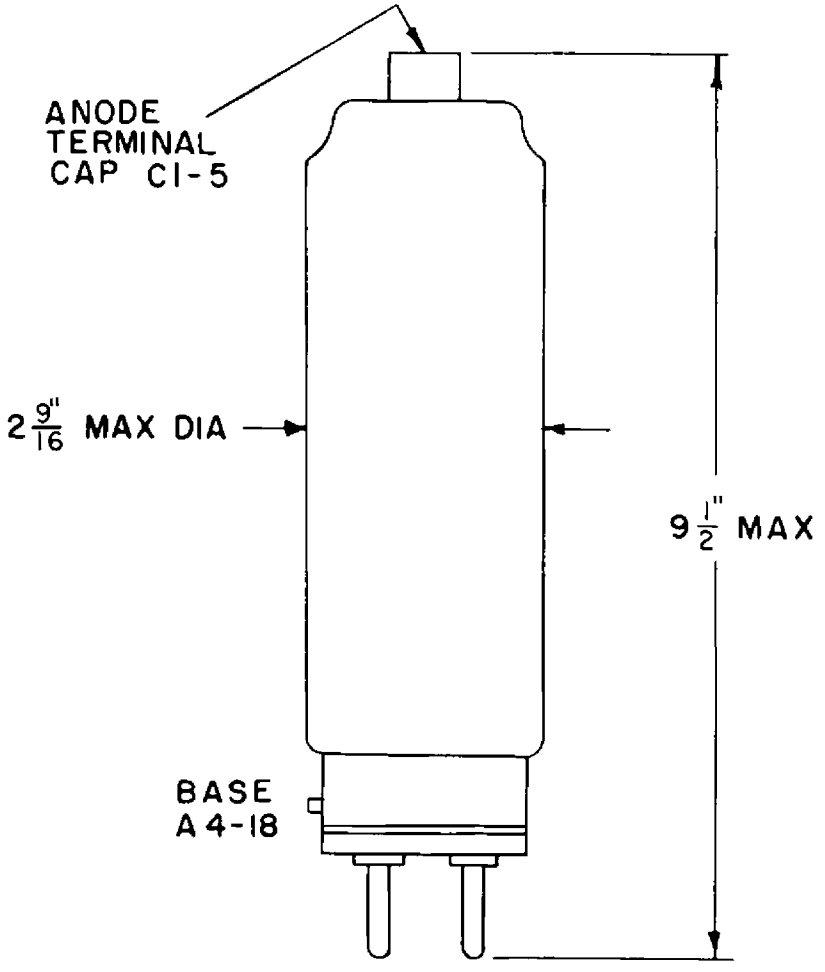
Mechanical

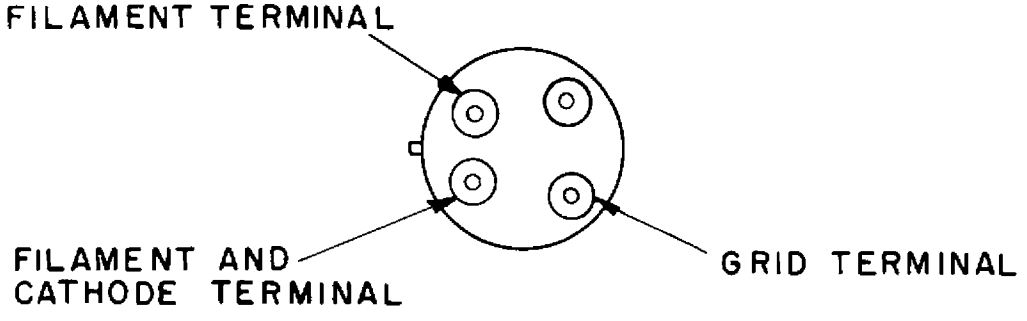
Mounting Position - Vertical, Base Down		
Equilibrium Condensed-Mercury Temperature Rise Above Ambient	30	
Net Weight, maximum	9	Ounces

MAXIMUM RATINGS, Absolute Values

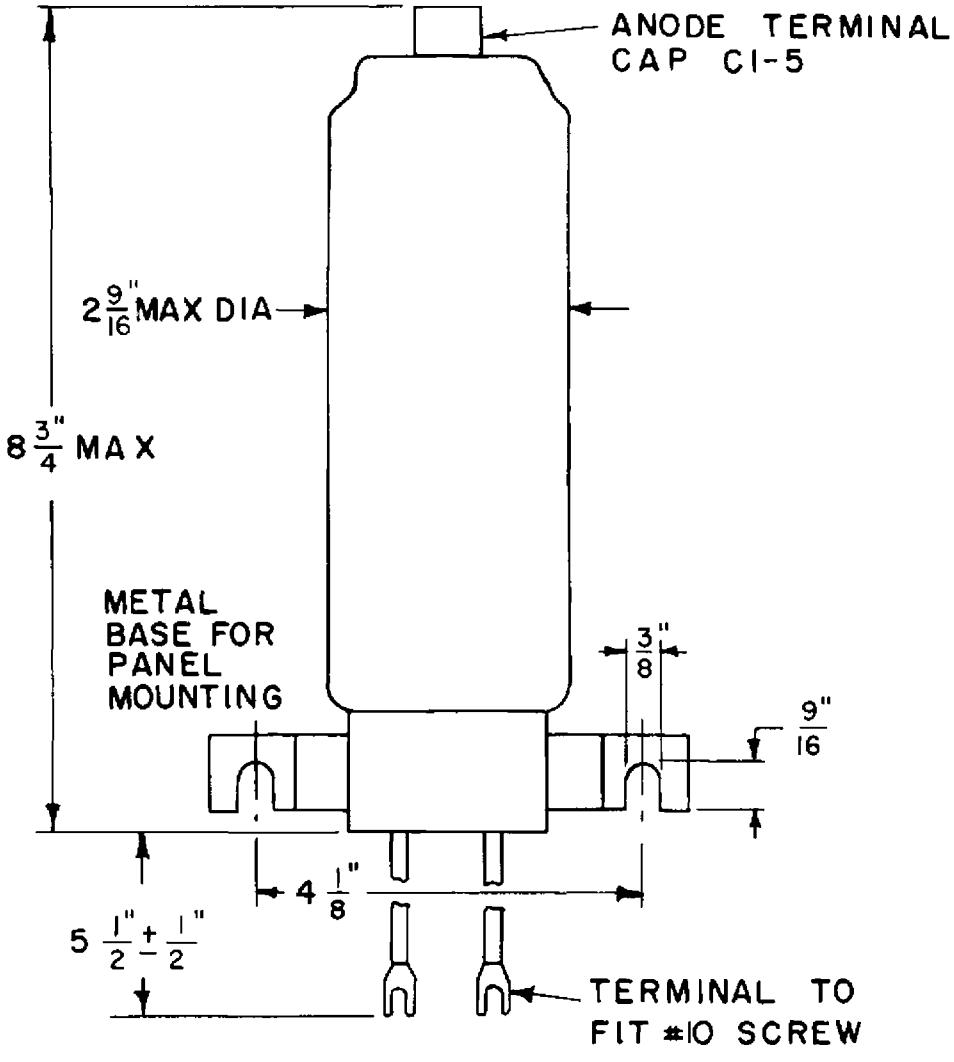
Maximum Peak Anode Voltage		
Inverse	1500	Volts
Forward	1500	Volts
Maximum Cathode Current		
Peak	77	Amperes
Average	6.4	Amperes
Maximum Averaging Time	15	Seconds
Fault	770	Amperes
Maximum Duration	0.1	Seconds
Maximum Negative Control-Grid Voltage		
Before Conduction	500	Volts
During Conduction	10	Volts
Condensed-Mercury Temperature Limits	-40 to +80	C

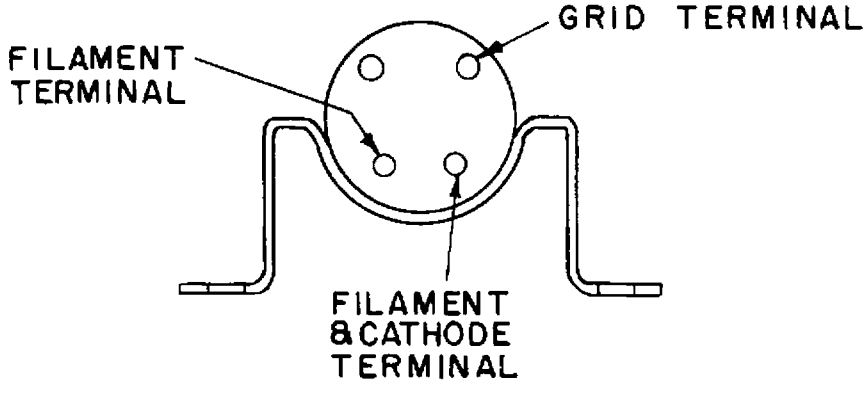
OUTLINE- GL-6858





OUTLINE-GL-6859





from JETEC release #1622, April 2, 1956

GL-6860

THYRATRON

TRIODE TYPE INERT-GAS TYPE

NEGATIVE CONTROL CHARACTERISTICS

DESCRIPTION AND RATING

The GL-6860 is a three-electrode inert-gas filled thyratron with a negative control characteristic for use in grid-control rectifier applications. The GL-6860 combines the desirable temperature characteristic of gas tubes, maximum ratings over a wide temperature range, with the long life of mercury tubes. A useful feature in industrial applications is the filamentary-type cathode which requires only one minute to reach operating temperature.

This tube is equipped with a bracket-type base for panel mounting.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode - Filamentary		
Filament Voltage	2.5	Volts
Filament Current at 2.5 Volts	21 ± 2	Amperes
Heating Time	60	Seconds
Anode to Control-Grid Capacitance	4	uuf
Deionization Time, approximate	1000	Microseconds
Ionization Time, approximate	10	Microseconds
Anode Voltage Drop	12	Volts
Critical Grid Current	10	Microamperes

Control Characteristics

Anode Voltage	100	500	1250	Volts
Grid Voltage	-0.5	-2.4	-5.8	Volts

Mechanical

Mounting Position - Vertical, Base Down		
Net Weight, maximum	8	Ounces

MAXIMUM RATINGS, Absolute Values

Maximum Peak Anode Voltage		
Inverse	1250	Volts
Forward	1000	Volts
Maximum Cathode Current		
Peak	77	Amperes
Average	6.4	Amperes
Maximum Averaging Time	6	Seconds
Fault	770	Amperes
Maximum Duration	0.1	Seconds
Maximum Negative Control-Grid Voltage		
Before Conduction	100	Volts
During Conduction	10	Volts
Commutation Factor*	0.66	
Ambient Temperature Limits	-55 to +75	C

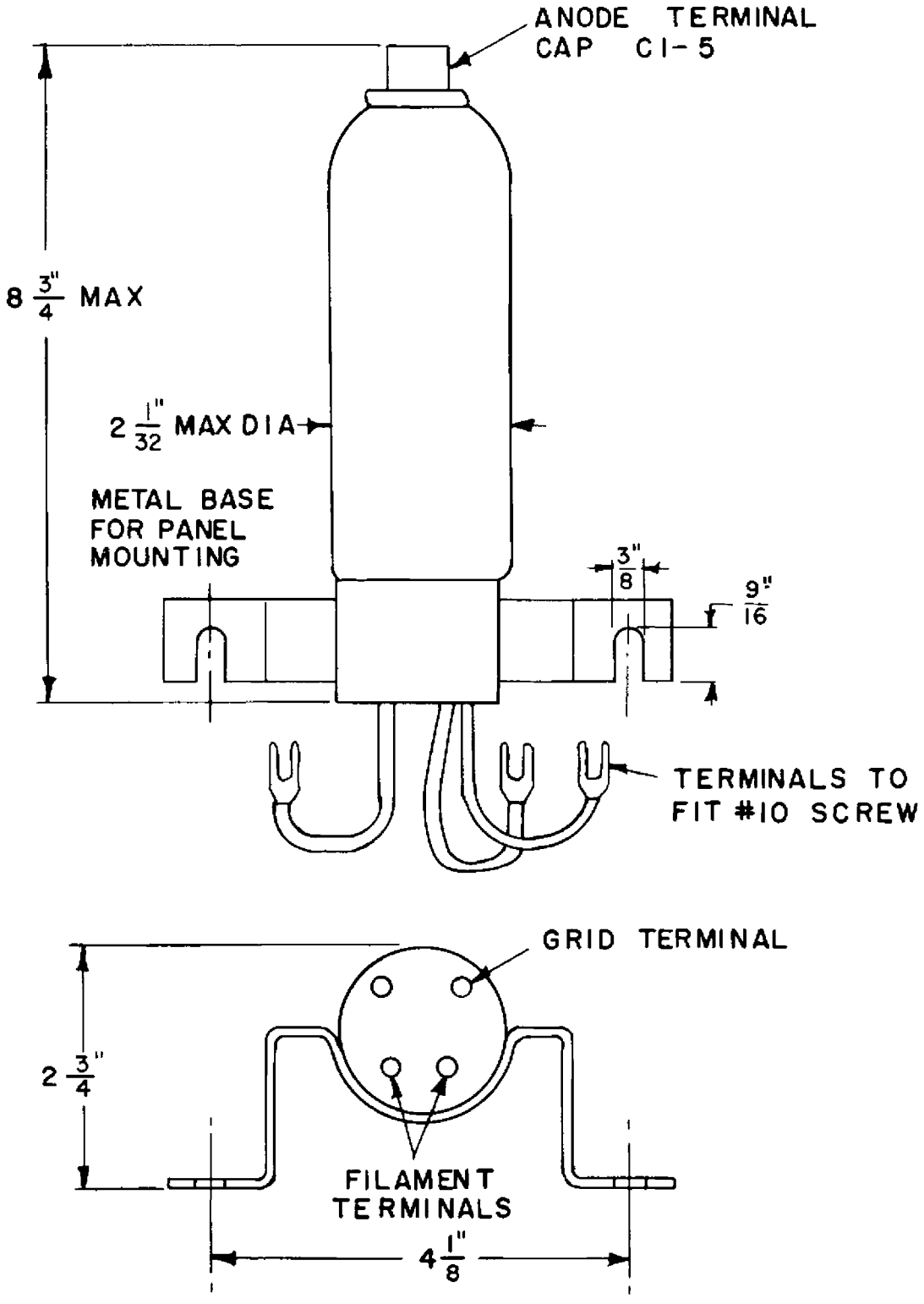
* Commutation factor is the product of the rate of current decay in amperes-per-microsecond just prior to commutation and the rate of inverse voltage rise in volts-per-microsecond just after commutation.

TUBE DEPARTMENT

GENERAL ELECTRIC COMPANY

Schenectady 5, N. Y.

OUTLINE-GL-6860



GL-6878

IGNITRON

LOCOMOTIVE RECTIFIER SERVICE - 675 AMPERES — THREE IGNITORS

DESCRIPTION AND RATING

The GL-6878 is a double-grid ignitron designed for railroad locomotive rectifier service.

A coaxial cathode-current return reduces magnetic fields due to tube currents. The tube also features baffles in the mercury pool to assure contact between the mercury and the ignitor points during swaying of the equipment.

A companion tube, the GL-6509 ignitron, has been designed to supply the auxiliary power requirements of applications which use the GL-6878 as the main power source.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation - Cyclic
Cathode-Spot Starting - Ignitor

Number of Electrodes	
Main Anodes	1
Main Cathodes	1
Ignitors	3
Shield Grids	1
Control Grids	1

Mechanical

Envelope Material - Stainless Steel

Net Weight	190	Pounds

Thermal

Type of Cooling - Water

Inlet Water Temperature, minimum	30	C
Outlet Water Temperature, maximum	55	C
Water Flow, minimum		
At Continuous Rated Average Current	10	Gallons per Minute
At No Load	1	Gallons per Minute
Temperature Range	40 to 45	C

from JETEC release #1639, May 7, 1956

Thermal (Cont'd)

Characteristics for Water Cooling at Rated Minimum Flow		
Water Temperature Rise, maximum	10	C
Pressure Drop at 10 Gallons per Minute, maximum	2.5	Pounds per Square Inch

MAXIMUM RATINGS AND TYPICAL OPERATION

Power-Rectifier Service, Continuous Duty
Ratings are for Zero-Phase-Control Angle

Maximum Peak Anode Voltage		
Inverse	4000	Volts
Forward	100	Volts
Maximum Anode Current		
Peak	2500	Amperes
Average*		
Continuous	675	Amperes
Fifty Minutes	675	Amperes
Twelve Minutes	750	Amperes
Six Minutes	810	Amperes
Four Minutes	875	Amperes
Fault		
Peak Forward Direction, without damage	20,000	Amperes
Peak Reverse Direction	40,000	Amperes
Maximum Duration of Fault Current	0.15	Seconds
Frequency Range	25-60	Cycles per Second

Ignitor

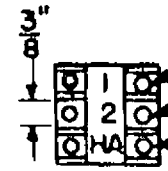
Maximum Inverse Voltage		5	Volts
Maximum Current			
Root Mean Square		15	Amperes
Average		2	Amperes
Maximum Averaging Time		10	Seconds
Shield-Grid Voltage	Minimum	Maximum	
Peak Forward	200	500	Volts
Peak Inverse	---	200	Volts
Shield-Grid Current			
Peak Forward	0.2	5	Amperes
Peak Inverse	---	0.2	Amperes

Ignitor (Cont'd)

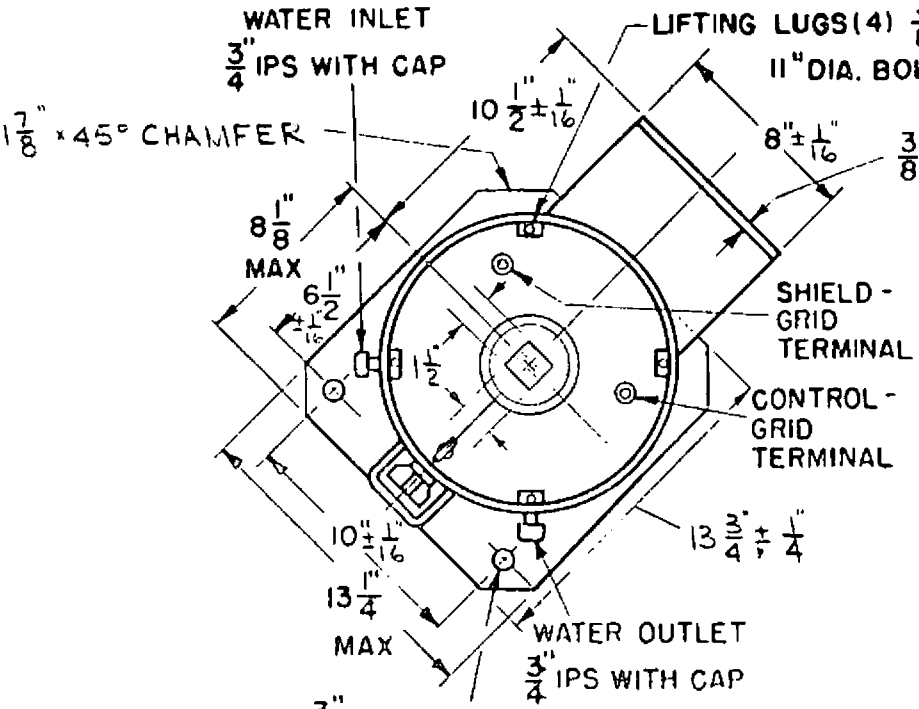
	Minimum	Maximum	
Control-Grid Voltage			
Peak Forward	200	500	Volts
Peak Inverse	100	200	Volts
Control-Grid Current			
Peak Forward	0.4	5	Amperes
Peak Inverse	0.4	1	Amperes

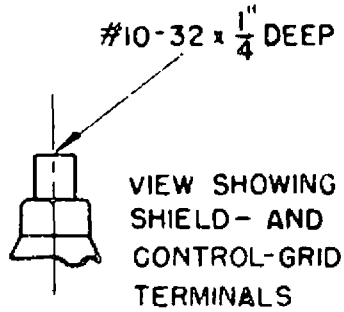
* Short time loads applied following light load.

OUTLINE GL-6878

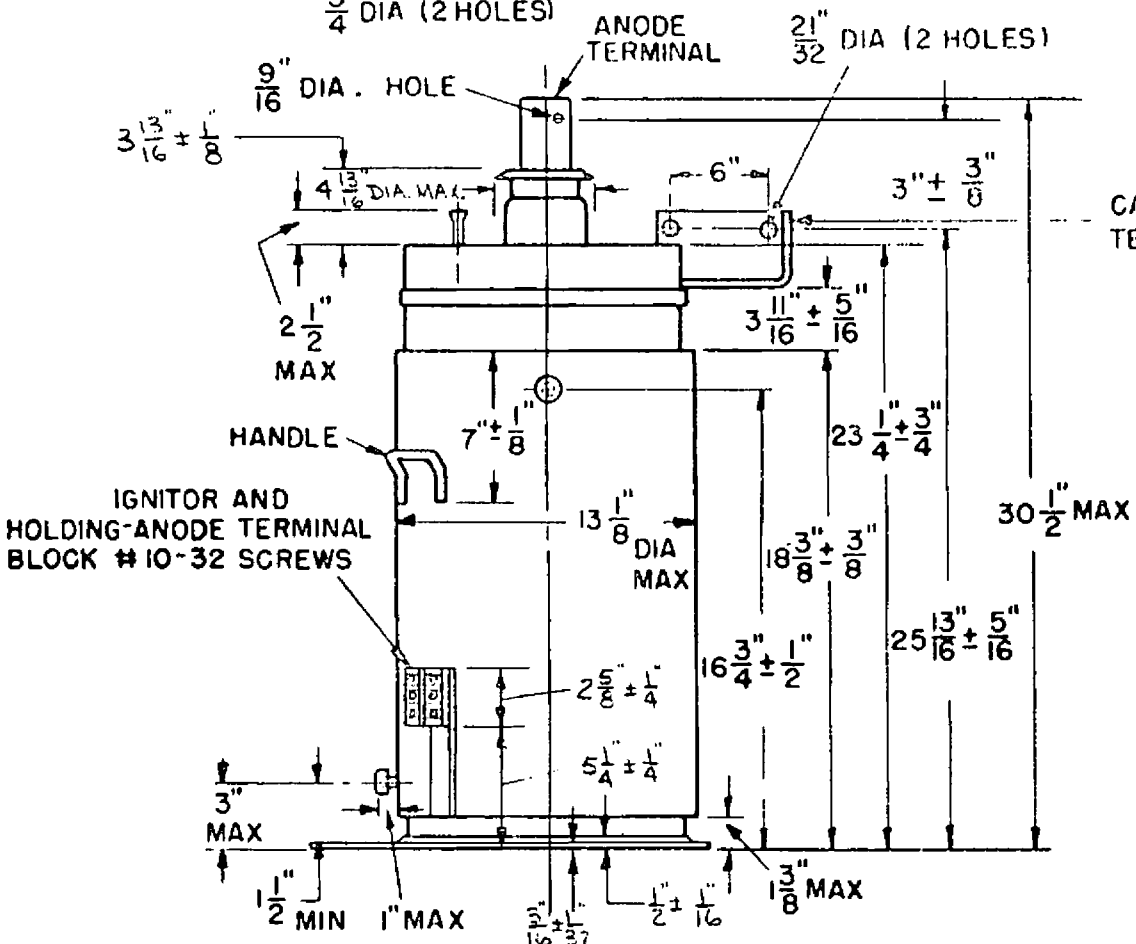


VIEW SHOWING IGNITOR AND HOLDING-ANODE TERMINALS





VIEW SHOWING SHIELD- AND CONTROL-GRID TERMINALS



7	Aug 27, 56 AM 12 Keller JN-8804			
6	K. Kent Jun 20, 56 AM JN8742			
5	K. Hamilton June 22, 56 AM JN8683			

4	Apr 27, 56 AM J Bella JN-8579	MADE BY J.J. STOTE DEC. 2, 1957	RE INSPECTED BY APR. 2, 56 PM	JN #226
3	S Bella JN-8433	GENERAL ELECTRONICS DIVISION ELECTRIC TUBE DEPARTMENT	K-69087-72A740	PRINTS TO
REVISIONS			SHEET NO. ... CONT ON SHEET	

RTD-227-A (3-64) PRINTED IN U.S.A.

PLANAR TRIODE



DESCRIPTION AND RATING

FOR GROUNDED-GRID OSCILLATOR AND AMPLIFIER SERVICE

Metal and Ceramic — Low Interelectrode Capacitances
High Transconductance — Shock Resistant
100 Watts Plate Dissipation

The 6897 is a metal-and-ceramic, high-mu triode designed for use as a grounded-grid oscillator or amplifier at frequencies as high as 2500 megacycles.

Features of the 6897 include planar electrode construction, high plate dissipation capability, excellent electrode isolation, low radio-frequency losses, high transconductance, and low interelectrode capacitances.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC	*	Volts
Heater Current at Ef = 6.3 volts	1.03†	Amperes

Direct Interelectrode Capacitances‡

Grid to Plate: (g to p)	2.01	pf
Grid to Cathode: (g to k)	6.5	pf
Plate to Cathode: (p to k)	0.023	pf

MECHANICAL

Mounting Position—Any—Only Plate Flange to be Used as a Socket Stop and Clamp

Net Weight, approximate	2	Ounces

Cooling
Plate and Plate Seal—Conduction and Forced Air
Grid and Cathode Seals—Conduction and Forced Air
Recommended Air Flow Cowling—157-JAN
Recommended Air Flow on Plate Radiator at Sea Level
Incoming Air Temperature 25C,
Plate Dissipation

100 Watts	12.5	Cu. Ft./Min.

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR —CLASS C TELEGRAPHY

Key-down Conditions per Tube Without Amplitude Modulation§

Heater Voltage*	4.5 to 6.3	Volts
DC Plate Voltage	1000	Volts
Negative DC Grid Voltage	150	Volts
Peak Positive RF Grid Voltage	30	Volts
Peak Negative RF Grid Voltage	400	Volts
DC Grid Current	50	Milliamperes
DC Cathode Current	125	Milliamperes
Plate Dissipation	100	Watts
Grid Dissipation	2.0	Watts
Envelope Temperature at Hottest Point #	250	C

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR —CLASS C TELEPHONY

Carrier Conditions per Tube for Use With a Maximum Modulation Factor of 1.0

Heater Voltage*	4.5 to 6.3	Volts
DC Plate Voltage¶	600	Volts
Negative DC Grid Voltage	150	Volts
Peak Positive RF Grid Voltage	30	Volts
Peak Negative RF Grid Voltage	400	Volts
DC Grid Current	50	Milliamperes
DC Cathode Current	100	Milliamperes
Plate Dissipation	70	Watts
Grid Dissipation	2.0	Watts
Envelope Temperature at Hottest Point #	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Heater Voltage	6.3	Volts
Plate Voltage	600	Volts
Grid Voltage△		Volts
Amplification Factor	95	
Transconductance	24800	Micromhos
Plate Current	75	Milliamperes

RADIO-FREQUENCY OSCILLATOR—CLASS C

Frequency	500	2500	Megacycles
Heater Voltage	6.0	5.0	Volts
DC Plate Voltage	900	900	Volts
DC Plate Current	90	90	Milliamperes
DC Grid Current	30	27	Milliamperes
DC Grid Voltage	−40	−22	Volts
Useful Power Output	40	17	Watts

* The equipment designer should design the equipment so that heater voltage is centered at some value within the range of 4.5 to 6.3 volts. Heater voltage variations about the center value should be kept as small as practical and should not, in any case, exceed ±5%. The optimum center value of heater voltage depends on the cathode current and on other parameters of circuit design and operation. For specific recommendations, contact your General Electric tube sales representative.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Measured in a special shielded socket.

§ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier conditions.

⁂ Where long life and reliable operation are important, lower envelope temperatures should be used.

¶ For modulation factors less than 1.0, a higher d-c plate voltage may be used if the sum of the peak positive audio voltage and the d-c plate voltage does not exceed 1200 volts.

△ Adjusted for Ib = 75 milliamperes.

INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
Ef = 6.3 volts	950	1030	1100	Milliamperes
Grid Voltage				
Ef = 6.3 volts, Eb = 600 volts, Ib = 75 ma	−1.3	−2.5	−3.5	Volts
Grid Voltage				
Ef = 6.3 volts, Eb = 600 volts, Ib = 1.0 ma	−7.0	−9.5	−15	Volts
Transconductance				
Ef = 6.3 volts, Eb = 600 volts, Ec adjusted for Ib = 75 ma	22000	24800	27500	Micromhos
Amplification Factor				
Ef = 6.3 volts, Eb = 600 volts, Ec adjusted for Ib = 75 ma	75	95	115	
Negative Grid Current				
Ef = 6.3 volts, Eb = 600 volts, Ec adjusted for Ib = 75 ma			3.0	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts, Polarity of applied d-c interelectrode voltage is such that no cathode emission results				
Grid to Cathode at 500 volts d-c	50			Megohms
Interelectrode Capacitances				
Grid to Plate: (g to p)	1.89	2.01	2.13	Picofarads
Grid to Cathode: (g to k)	6.0	6.5	7.0	Picofarads
Plate to Cathode: (p to k)	0.018	0.023	0.029	Picofarads

SPECIAL PERFORMANCE TESTS

	Min.	Max.	
Oscillator Power Output Tubes are tested for power output as an oscillator under the following conditions: Ef = 5.0 volts; F = 2500 MC, min.; Eb = 1000 volts; Ib = 90 ma.	15	....	Watts
Low Pressure Voltage Breakdown Test Statistical sample tested for voltage breakdown at a pressure of 27 mm Hg. Tubes shall not give visual evidence of flashover when 1000 volts RMS, 60 cps, is applied between the plate and grid terminals			

DEGRADATION RATE TESTS

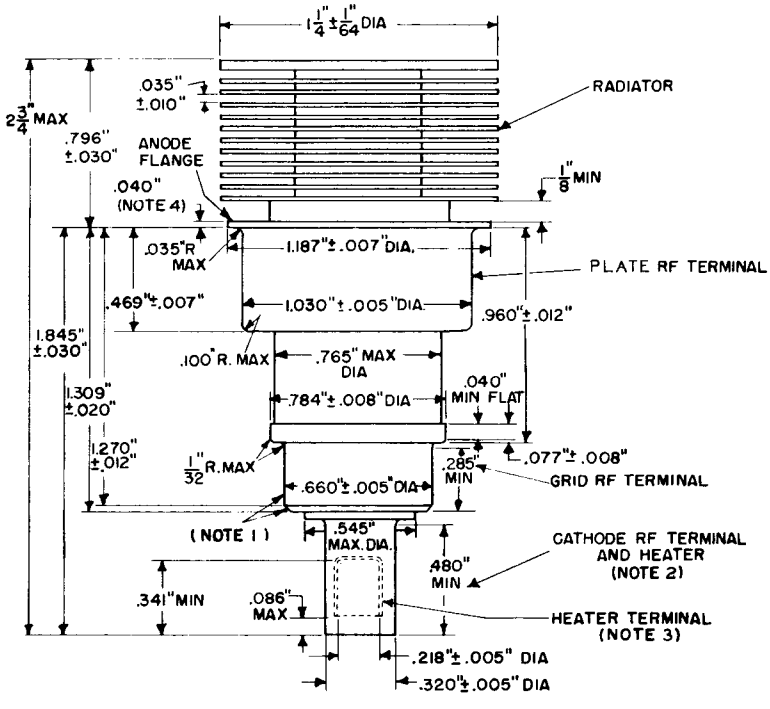
Shock

Statistical sample subjected to 5 impact accelerations of approximately 400 G and 1.0 milliseconds duration in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine.

500-Hour Life Test

Statistical sample operated for 500 hours as an oscillator to evaluate changes in power output with life.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

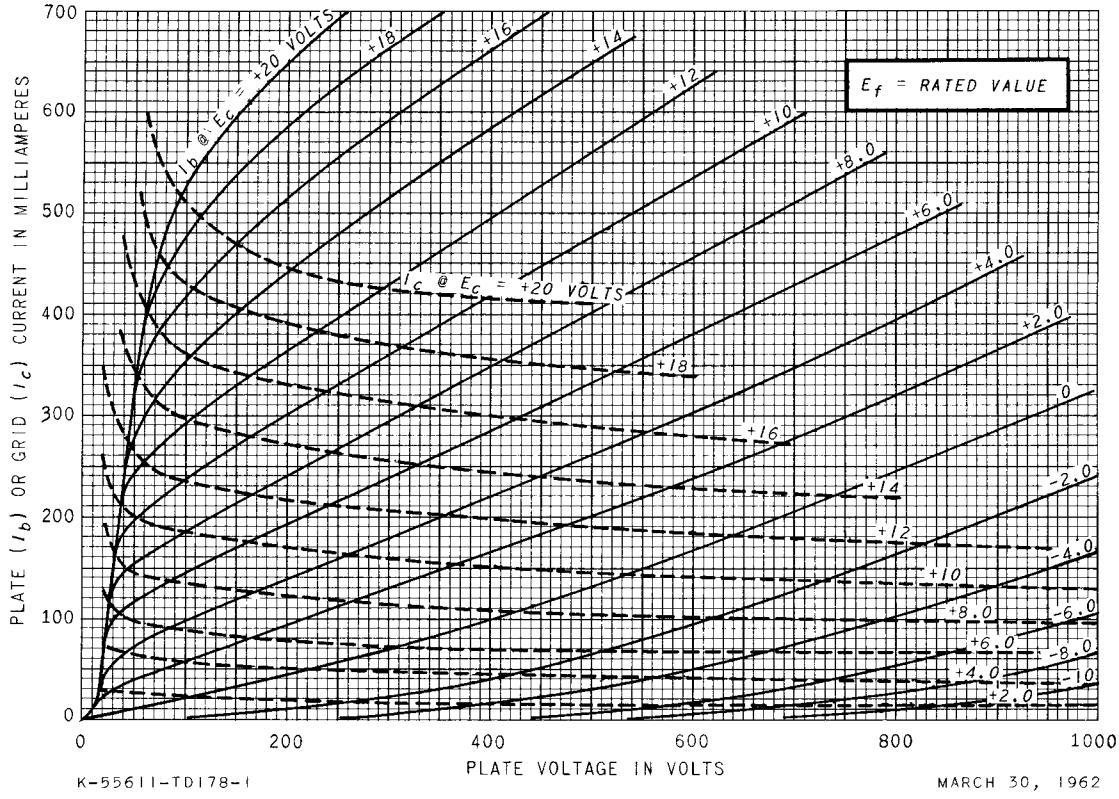


NOTES:

1. Solder not to extend radially beyond grid RF terminal.
2. Total indicated runout of the grid-contact surface and the cathode-contact surface with respect to the anode shall not exceed 0.020".
3. Total indicated runout of the cathode-contact surface with respect to the heater-contact surface shall not exceed 0.012".
4. Only this flange to be used as a socket stop and clamp.

¶ New pages 3 to 6 supersede pages 3 and 4 dated 12-61.

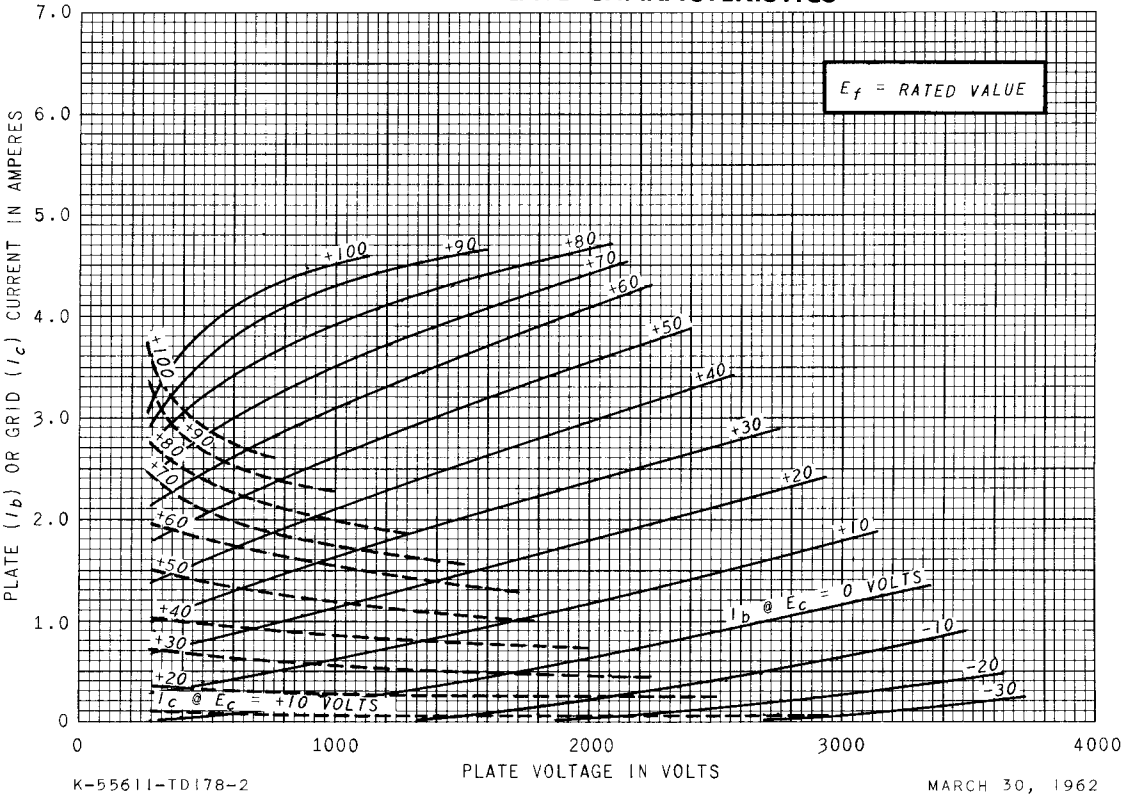
AVERAGE PLATE CHARACTERISTICS



K-55611-TD178-1

MARCH 30, 1962

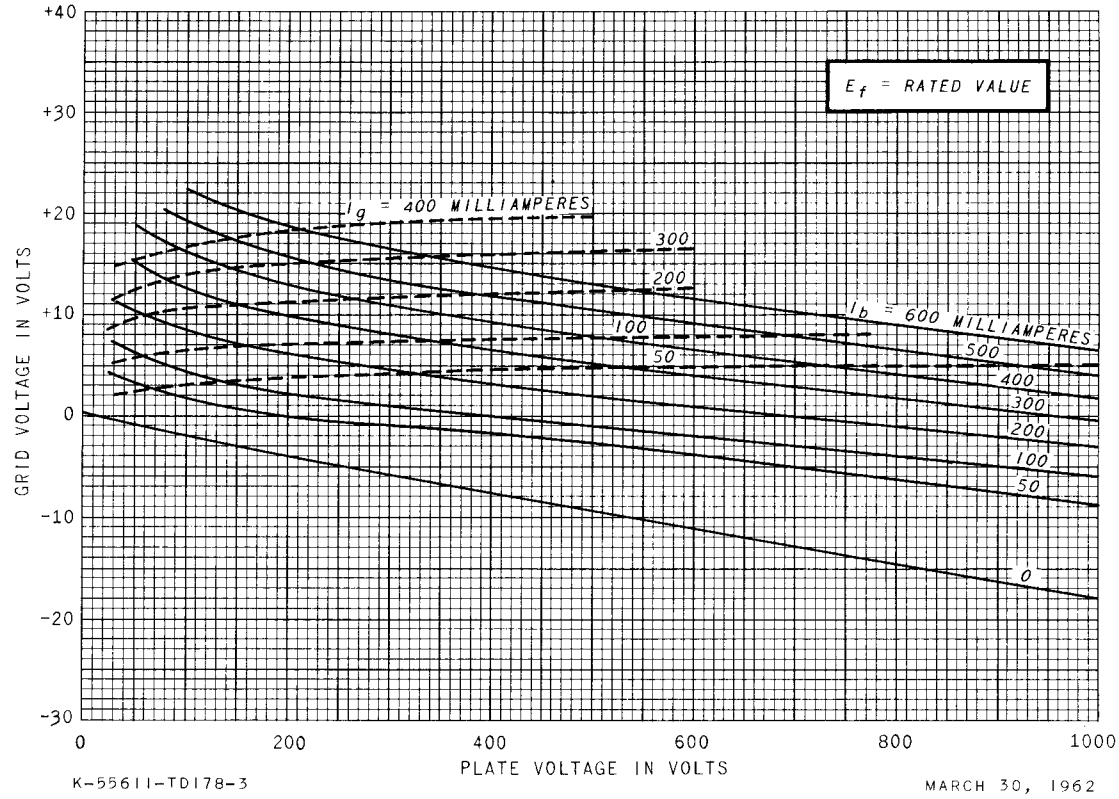
AVERAGE PLATE CHARACTERISTICS



K-55611-TD178-2

MARCH 30, 1962

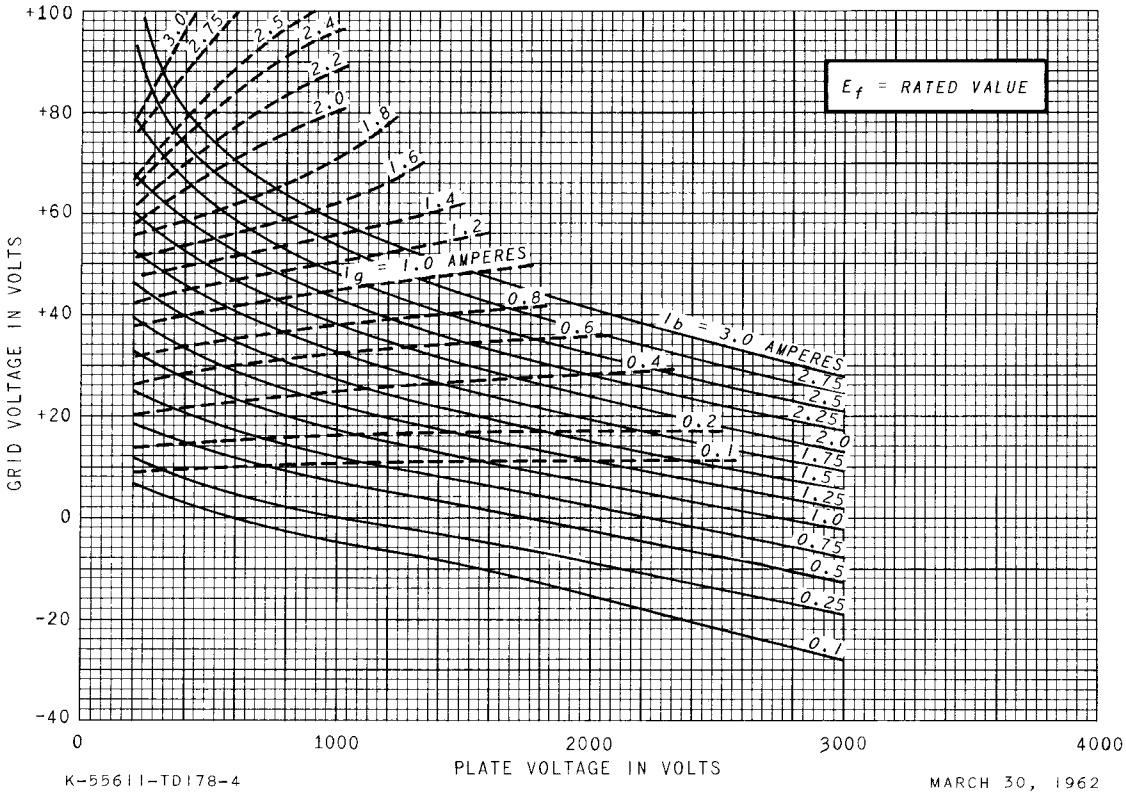
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



K-55611-TD178-3

MARCH 30, 1962

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



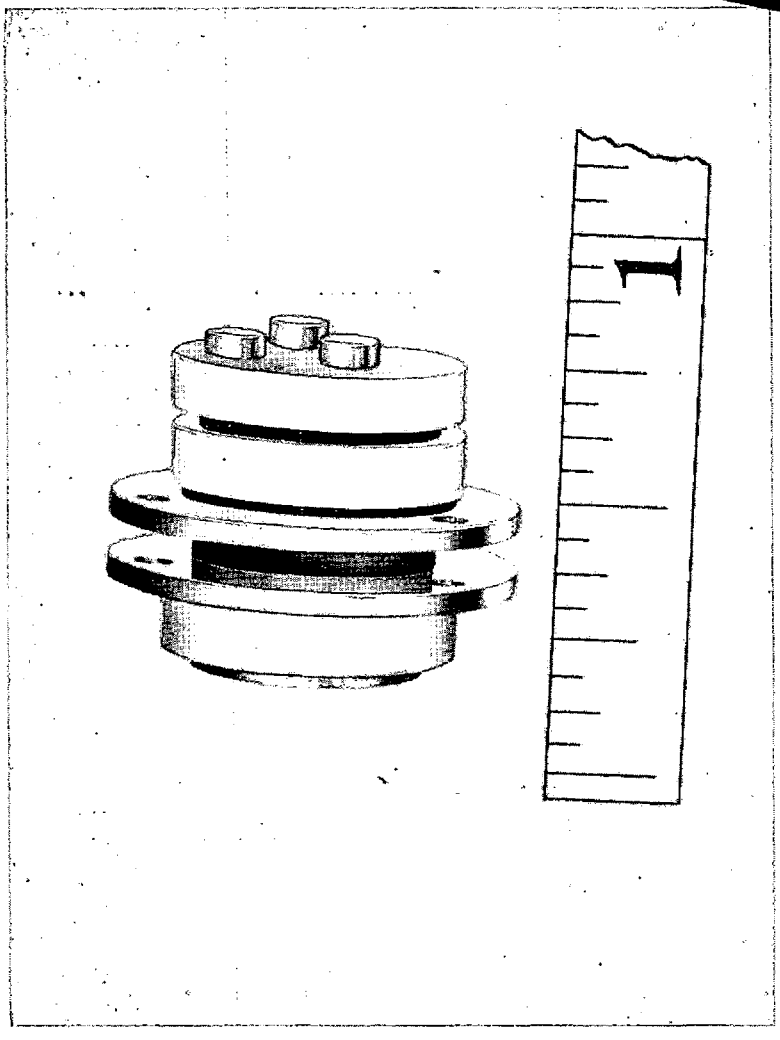
K-55611-TD178-4

MARCH 30, 1962

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky



VOLTAGE-TUNABLE MAGNETRON

METAL AND CERAMIC
POWER OUTPUT—10 WATTS
2000-4000 MEGACYCLES
VOLTAGE-TUNED OVER FREQUENCY RANGE

The GL-6917 is a CW interdigital voltage-tunable magnetron for operation in the 2000-to-4000-megacycle range. In a narrow-band circuit, this tube has a power output up to 10 watts. In a circuit covering 2000 to 4000 megacycles, it has a power output up to 1.0 watt.

A novel ceramic-to-metal seal construction results in a tube extremely small in size—⅝ inch long and ¾ inch in diameter—and one which is particularly suitable for operation at microwave frequencies.

The GL-6917, in an external r-f circuit, may be voltage-tuned over a portion or all of the frequency range for which it is designed. The frequency of the generated signal is a linear function of the anode voltage. The r-f power output at any frequency is a function of the impedance of the external r-f circuit.

from JETEC release #1989, Aug. 5, 1957

Electrical

	Minimum	Bogey	Maximum	
Cathode—Directly Heated				
Filament Voltage*	2.0	2.25	2.5	Volts
Filament Current*	...	3.0	...	Amperes
Direct Interelectrode Capacitances				
Anode to Anode			4.9	$\mu\mu$f
Both Anodes to Filament			1.3	$\mu\mu$f
Both Anodes to Injection Electrode			2.9	$\mu\mu$f
Both Anodes to Cold Cathode			3.3	$\mu\mu$f

Mechanical

Mounting Position—Any

Thermal

Type of Cooling—Forced Air		
Envelope Temperature, maximum	150	C

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Absolute Values

Anode Voltage	2500	Volts
Anode Current	40	Milliamperes
Power Input, with forced-air cooling	60	Watts
Injection Electrode Voltage	500	Volts
Control Electrode Current	1.0	Milliamperes
Filament Current	3.2	Amperes
Voltage Standing Wave Ratio	1.5	

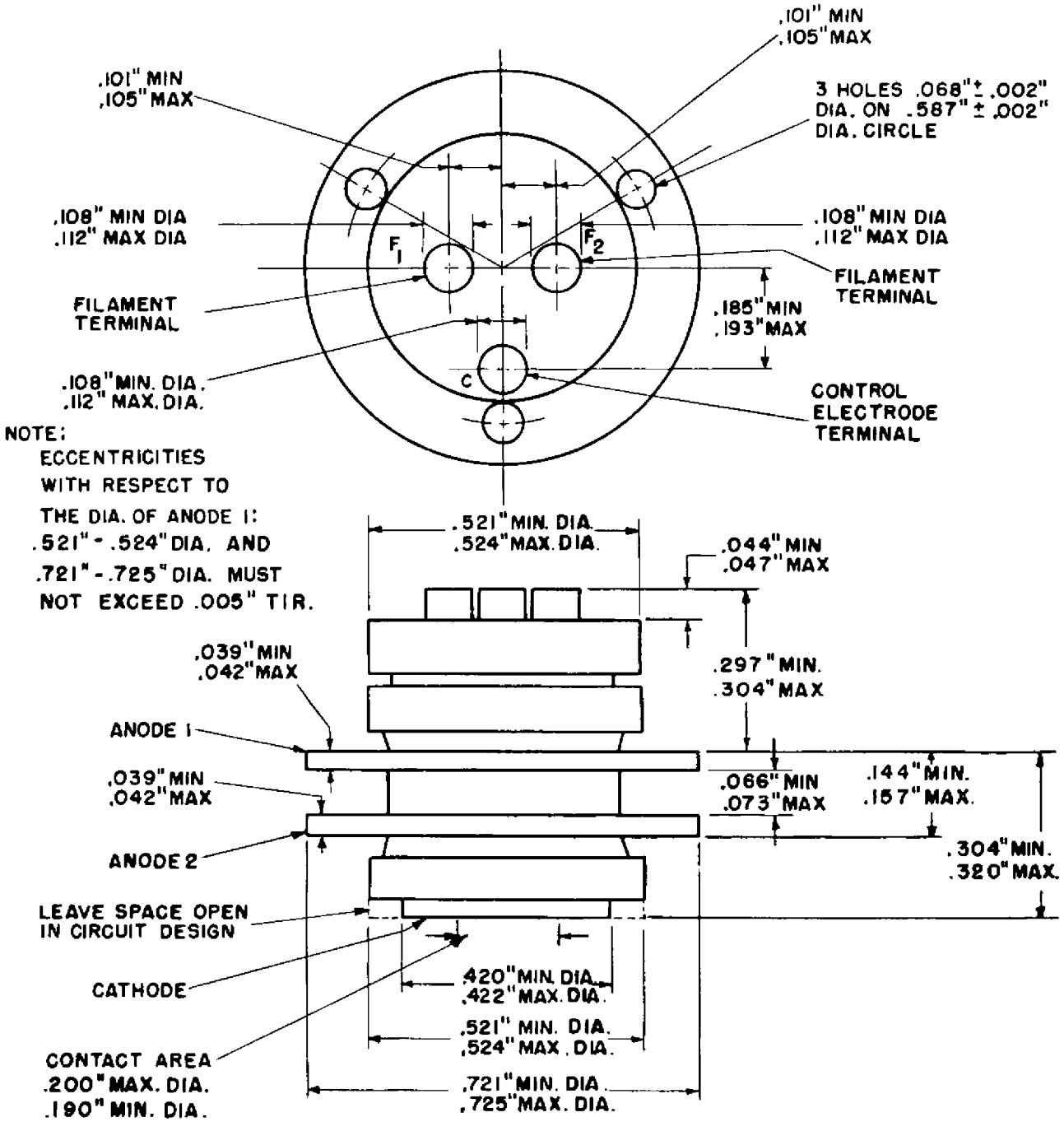
Typical Operating Conditions

Operation with 60-Cycle Sweep Voltage in a Wide-Band Circuit

Tunable Range†	2000 to 4000	Megacycles
Magnetic Field Strength	2500 ± 50	Gausses
Tuning Rate, approximate	3.0	Megacycles per Volt
Filament Voltage, approximate*	2.25	Volts
Filament Current*	3.0	Amperes
Anode Voltage at 3 Kilomegacycles, 2500 gausses	1150	Volts
Anode Current, average	10 to 20	Milliamperes
Injection Electrode Voltage, positive with respect to cathode	300 to 500	Volts
Control-Electrode Current	0.1	Milliamperes
Voltage Standing Wave Ratio	1.3	
Power Output, average	0.5 to 1.0	Watts

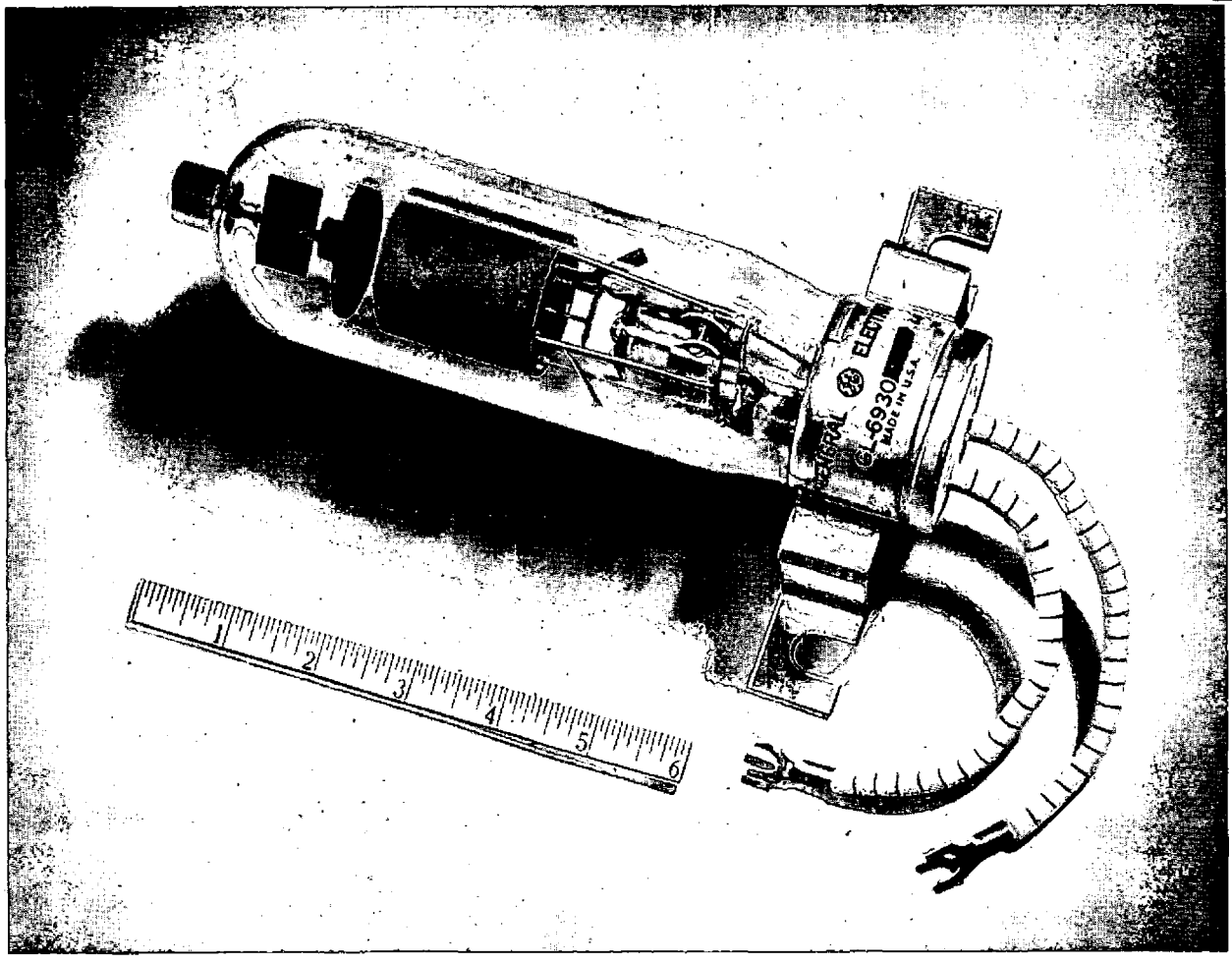
* Filament current should be adjusted to 3.0 amperes.

† Frequency controlled by anode voltage.



K-69087-72A766

7-2-57



RECTIFIER

HALF-WAVE MERCURY-VAPOR

The GL-6930[redacted] is a half-wave, mercury-vapor rectifier tube for use in industrial power-rectifier applications that require 250 volts d-c.

TECHNICAL INFORMATION

GENERAL

Electrical	Minimum	Bogey	Maximum	
Cathode*—Filamentary				
Filament Voltage	—	2.5	—	Volts
Filament Current at 2.5 Volts	16	—	20	Amperes
Heating Time	1	—	—	Minutes
Arc Drop at 20 Peak Amperes	—	9	—	Volts
Filament Starting Voltage	—	20	—	Volts

GENERAL ELECTRIC

from JETEC release #1835, Feb. 4, 1957

TECHNICAL INFORMATION (Cont'd)

Mechanical

Mounting Position—Vertical, Base Down		
Equilibrium Condensed-Mercury Temperature		
Rise Above Ambient		
No Load	30	C
Full Load	40	C
Net Weight, approximate	6	Ounces

MAXIMUM RATINGS, Absolute Values

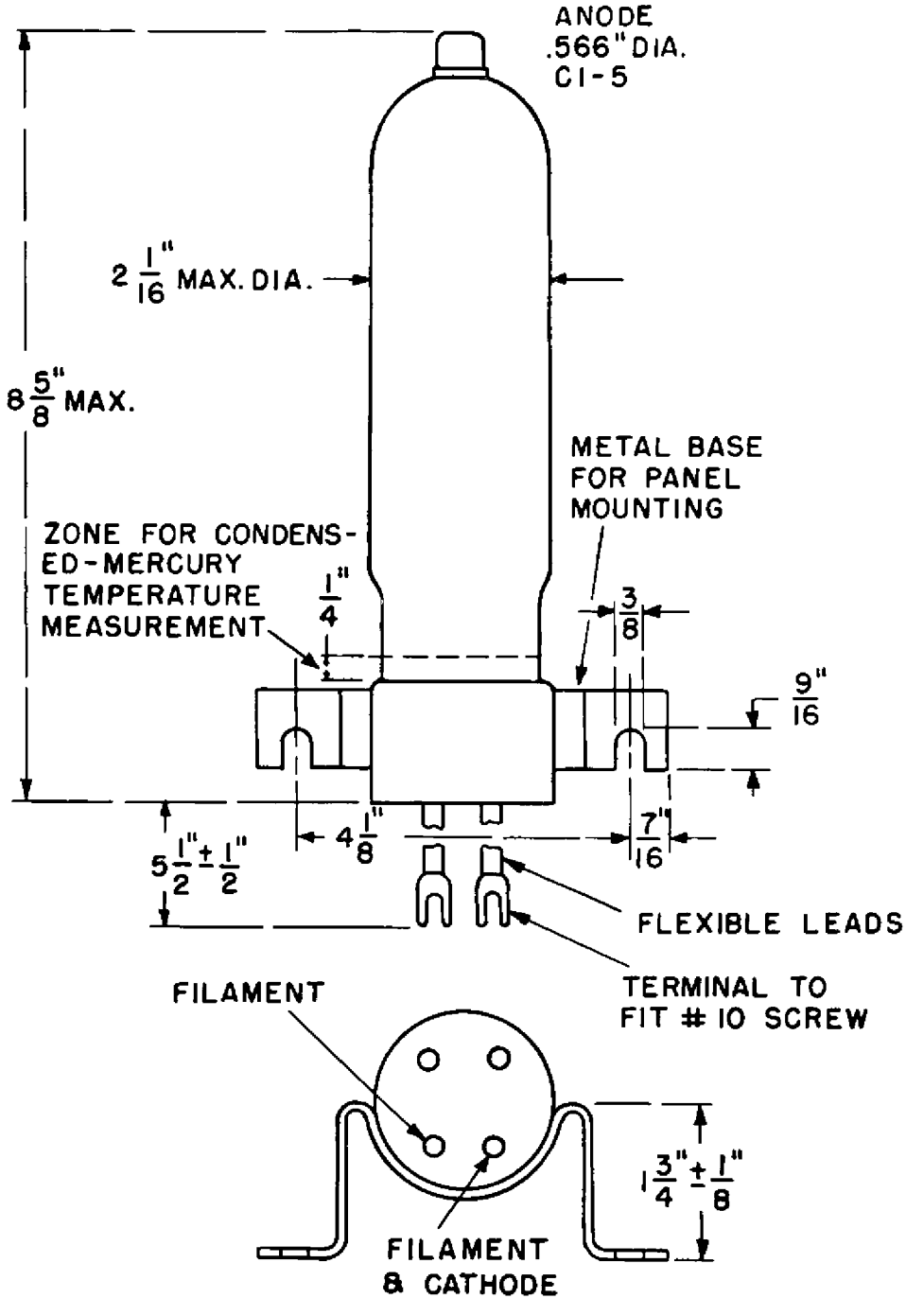
Maximum Peak Anode Voltage		
Inverse	1000	Volts
Maximum Cathode Current		
Peak	77	Amperes
Average	6.4	Amperes
Maximum Averaging Time	20	Seconds
Fault	770	Amperes
Maximum Duration	0.1	Seconds
Condensed-Mercury Temperature Limits	+35 to +100	C
Maximum Frequency	150	Cycles per Second

* Most satisfactory performance and life will result with quadrature filament operation, i.e., with the filament voltage 90 degrees out of phase with the anode voltage. When quadrature operation is used the voltage on the filament and cathode terminal should be crossing zero from positive toward negative when the anode voltage is at the peak of the positive half cycle.

In three-phase systems each tube should be connected so that its anode and filament voltages approximate as nearly as possible the quadrature phasing, i.e., filament voltage 90 plus or minus 30 degrees out of phase with the anode voltage.

When quadrature operation is not practicable, the filament and cathode terminal should be negative when the anode is positive.

The anode and grid-circuit returns should be made to the filament and cathode terminal. However, they can be made to the center tap of the filament transformer.


ANODE
.566" DIA.
C1-5
2 1/16" MAX. DIA.
8 5/8" MAX.
METAL BASE
FOR PANEL
MOUNTING
ZONE FOR CONDENS-
ED-MERCURY
TEMPERATURE
MEASUREMENT
1/4"
3/8
9/16"
4 1/8"
7/16"
5 1/2" ± 1/2"
FLEXIBLE LEADS
TERMINAL TO
FIT # 10 SCREW
FILAMENT
1 3/4" ± 1/8"
FILAMENT
& CATHODE

GL-6942

TETRODE

ONE KILOWATT UHF TELEVISION OUTPUT — FORCED-AIR COOLED

UHF TETRODE — METAL AND CERAMIC

GROUNDED-GRID CIRCUITS — INTEGRAL RADIATOR

THORIATED TUNGSTEN CATHODE

DESCRIPTION AND RATING

The GL-6942 is a four-electrode transmitting tube featuring a metal-and-ceramic envelope designed for use as a power amplifier or oscillator in grounded-grid circuits with both grids maintained at radio-frequency ground potential. The output circuit is connected between the anode and the screen grid. The anode is capable of dissipating one and one-half kilowatts. Cooling is accomplished by forced air with the radiator an integral part of the anode. The cathode is indirectly heated thoriated tungsten. Maximum ratings apply up to 900 megacycles.

When used as a Class B grounded-grid broad-band television amplifier this tube has a useful synchronizing peak-power output of one kilowatt at 900 megacycles; in narrow band Class C service the output is one kilowatt of continuous power as an amplifier or oscillator. Because of its ratings, the tube is also well adapted to use in dielectric-heating equipment.

High operating efficiency is assured because of the small size and close spacing of the tube electrodes, the ring-seal construction, and the low-loss factor due to the silver-plated external parts and the ceramic insulators. In addition, the grounded-grid construction eliminates the necessity for neutralization in a properly designed circuit. The small size of the GL-6942 permits compact mounting, and the ring-seal construction allows quick plug-in installation.

TECHNICAL INFORMATION

GENERAL

Electrical	Minimum	Bogey	Maximum	
Heater Voltage*	--	5.7	6.0	Volts
Heater Current at Bogey Voltage	21	23	24	Amperes
Heater Starting Current	--	--	36	Amperes
Heater Cold Resistance	--	0.02	--	Ohms
Cathode Heating Time	1	--	--	Minutes

G E N E R A L E L E C T R I C C O M P A N Y

from JETEC release #1818, Jan. 7, 1957

Electrical (Cont'd)	Minimum	Bogey	Maximum	
Amplification Factor, G_2 to G_1 E_b=475 Volts, I_b=0.250 Ampere	12	17	22	
Peak Cathode Current ≠	--	--	3.0	Amperes
Direct Interelectrode Capacitances				
Cathode - Plate ≠	--	--	0.04	µµf
Input, G_2 tied to G_1	15.5	17.0	18.5	µµf
Output, G_2 tied to G_1 ≠	4.8	5.5	5.8	µµf

Mechanical

Mounting Position - Vertical
Air Flow ≠≠
Through Radiator (See drawing for air duct form)

Plate Dissipation	1.5	Kilowatts
Air Flow	60 Min	Cubic Feet per Minute
Static Pressure	1.5	Inches Water
Heater to Cathode Seals	12 Min	Cubic Feet per Minute
Screen-Grid to Control-Grid Seals	6 Min	Cubic Feet per Minute
Anode to Screen-Grid Ceramic Insulator	6 Min	Cubic Feet per Minute
Incoming Air Temperature	45 Max	C
Radiator Hub Temperature at Fin Adjacent to Anode Seal	180 Max	C
Ceramic Temperature at Any Point	200 Max	C
Net Weight	3.6	Pounds

Forced-air cooling to be applied before and during the application of any voltages. Forced-air cooling must be maintained for one minute after the removal of all voltages.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Radio-Frequency Amplifier - Class B Television Service
Synchronizing-Level Conditions per Tube Unless Otherwise Specified

Maximum Ratings, Absolute Values

DC Plate Voltage	4000 Max	Volts
DC Grid-No. 2 Voltage	600 Max	Volts
DC Plate Current	0.7 Max	Amperes
Plate Input	2.5 Max	Kilowatts
Grid-No. 2 Input	25 Max	Watts
Plate Dissipation	1.5 Max	Kilowatts

Typical Operation - Grounded-Grid Circuit up to 900 Megacycles
Bandwidth 6 Megacycles, measured to 1 db point

DC Plate Voltage	3500	Volts
DC Grid-No. 2 Voltage	500	Volts
DC Grid-No. 1 Voltage	-40	Volts
Peak RF Plate Voltage		
Synchronizing Level	2500	Volts
Pedestal Level	1875	Volts

Peak RF Driving Voltage		
Synchronizing Level	110	Volts
Pedestal Level	70	Volts
DC Plate Current		
Synchronizing Level	0.520	Amperes
Pedestal Level	0.360	Amperes
DC Grid-No. 2, Pedestal Level	0.035	Amperes
DC Grid-No. 1 Current		
Synchronizing Level	0.110	Amperes
Pedestal Level	0.035	Amperes
Driving Power at Tube, approximate		
Synchronizing Level	100	Watts
Pedestal Level	25	Watts
Power Output, approximate		
Synchronizing Level ◊	1000	Watts
Pedestal Level ◊	560	Watts

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER - CLASS C TELEPHONY

Carrier Conditions with a Maximum Modulation Factor of 1.0

Maximum Ratings, Absolute Values		
DC Plate Voltage	3200 Max	Volts
DC Grid-No. 2 Voltage	600 Max	Volts
DC Grid-No. 1 Voltage	-120 Max	Volts
DC Plate Current	0.35 Max	Amperes
DC Grid-No. 1 Current	0.10 Max	Amperes
Plate Input	1.12 Max	Kilowatts
Grid-No. 2 Input	10 Max	Watts
Plate Dissipation	1200 Max	Watts

Typical Operation, Grounded-Grid Circuit up to 900 Megacycles		
DC Plate Voltage	3000	Volts
DC Grid-No. 2 Voltage	500	Volts
DC Grid-No. 1 Voltage	-100	Volts
Peak RF Plate Voltage	2300	Volts
Peak RF Driving Voltage	137	Volts
DC Plate Current	0.25	Amperes
DC Grid-No. 2 Current	0.01	Amperes
DC Grid-No. 1 Current, approximate	0.047	Amperes
Driving Power, approximate ⊓	38	Watts
Power Output △	565	Watts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR - CLASS C TELEGRAPHY

Key-Down Conditions per Tube without Amplitude Modulation ∅

Maximum Ratings, Absolute Values		
DC Plate Voltage	4000 Max	Volts
DC Grid-No. 2 Voltage	600 Max	Volts
DC Grid-No. 1 Voltage	-150 Max	Volts
DC Plate Current	0.7 Max	Amperes
DC Grid-No. 1 Current	0.10 Max	Amperes
Plate Input	2.5 Max	Kilowatts
Grid-No. 2 Input	25 Max	Watts
Plate Dissipation	1.5 Max	Kilowatts

Typical Operation - Grounded-Grid Circuit up to 900 Megacycles

DC Plate Voltage	3800	Volts
DC Grid-No. 2 Voltage	500	Volts
DC Grid-No. 1 Voltage	-120	Volts
Peak RF Plate Voltage, approximate	2750	Volts
Peak RF Grid-No. 1 Voltage	195	Volts
DC Plate Current	0.500	Amperes
DC Grid-No. 2 Current	0.022	Amperes
DC Grid-No. 1 Current, approximate	0.075	Amperes
Driving Power, approximate	150	Watts
Power Output, approximate Δ	1200	Watts

* The cathode of the GL-6942 because of transit-time effects which raise the temperature of the cathode, is subjected to considerable back bombardment in ultra-high-frequency service. The amount of heating due to bombardment is a function of the operating conditions and frequency, and must be compensated for by a reduction of the heater input to prevent overheating of the cathode with resulting short life. For long life, the GL-6942 should be put in operation with rated heater voltage. After the circuit has been adjusted for proper tube operation the heater voltage should be reduced to a value slightly above that at which circuit performance is affected. At a frequency of 900 megacycles and with typical operating conditions the heater voltage can be reduced to approximately 5.3 volts. At lower frequencies, the reduction will be less. Minor circuit readjustment may be necessary after this adjustment.

ƒ Represents maximum useable cathode current (plate current plus current to each grid) for any condition of operation.

ƒƒ Measured with a 6-inch diameter flat metal disk attached to the screen-grid ring. Control grid connected to the screen grid.

ƒƒƒ Output capacitance measured between anode and screen grid. Control grid connected directly to screen grid.

ƒƒƒƒ The volume of cooling air indicated for the various seals is approximate only. Distribution of cooling air will vary with the cavity configuration about the tube. For most satisfactory operation the maximum temperature of any point on the tube shall be below 200 C.

◊ Useful power output including power transferred from driver stage.

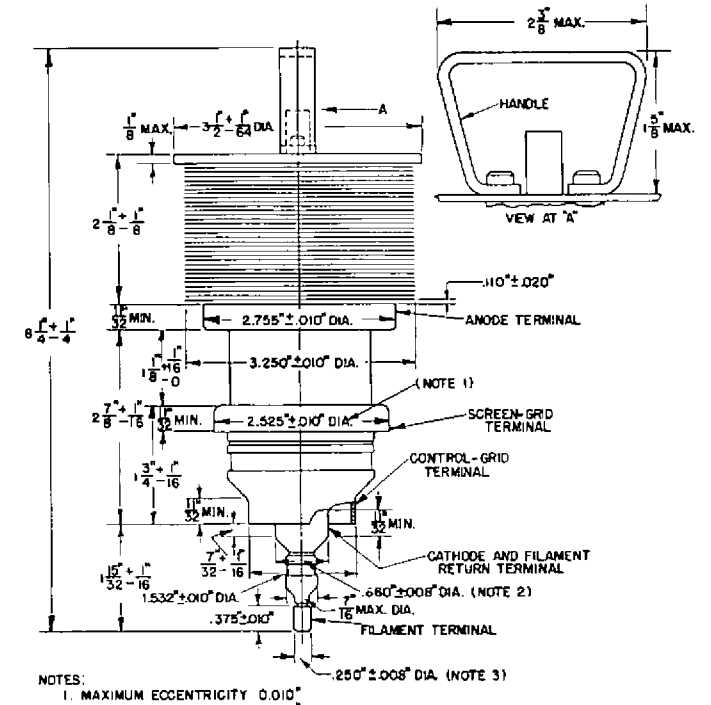
π The carrier of the driver modulated 100 percent.

ø Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 percent of the carrier conditions.

Δ Total anode power output including power transferred from driver stage.

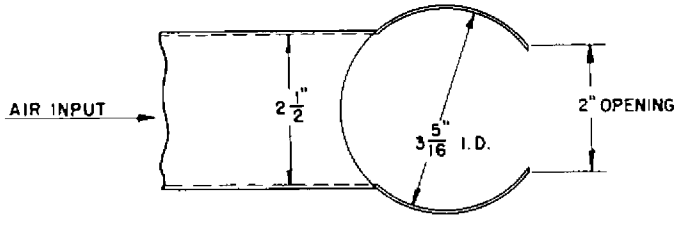
ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.

GL-6942

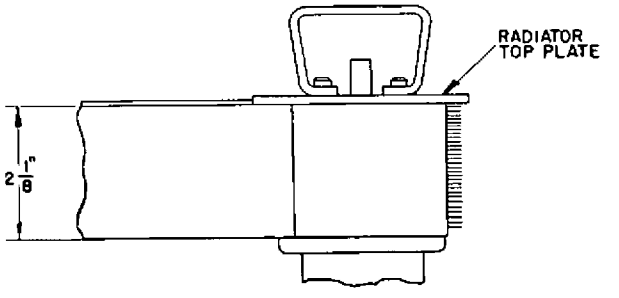


NOTES:
1. MAXIMUM ECCENTRICITY 0.010"
2. MAXIMUM ECCENTRICITY 0.015"
3. MAXIMUM ECCENTRICITY 0.030"
WITH RESPECT TO CENTERLINE DETERMINED BY CENTERS OF ANODE TERMINAL AND CONTROL-GRID TERMINAL.

BLOWER DUCT



TOP VIEW



SIDE VIEW (WITH TUBE IN PLACE)

from JETEC release #2044, Nov. 11, !957

GL-6958

IGNITRON

The GL-6958 is a double-grid ignitron designed for industrial rectifier or inverter applications where it will operate at peak inverse voltages as high as 4000 volts. In such applications six tubes will supply 3000 kilowatts at voltages of 1800 or 3600 volts d-c, depending upon the circuit used.

A particular design feature of this tube makes it especially suitable for use where voltage control by phase retard is in excess of the amounts usually required. In addition, the tube features a coaxial cathode current return which reduces magnetic fields caused by the tube currents.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation - Cyclic
Cathode Spot Starting - Ignitor

Number of Electrodes		
Main Anodes	1	
Auxiliary Anodes	1	
Main Cathodes	1	
Ignitors	2	
Shield Grids	1	
Control Grids	1	
Arc Drop		
At 1000 Peak Amperes	20.5 ± 2	Volts
At 2000 Peak Amperes	24.0 ± 2	Volts

Mechanical

Envelope Material - Stainless Steel

Net Weight	95	Pounds

Thermal

Type of Cooling - Water

Inlet Water Temperature, minimum	30	C
Outlet Water Temperature, maximum	55	C
Water Flow		
At Continuous Rated Average Current, minimum	10	Gallons per Minute
At No Load, * minimum	1	Gallons per Minute
Temperature Range	40 to 45	C

Characteristics for Water Cooling at 10 Gallons per Minute

Water Temperature Rise, maximum	6.5	C
Pressure Drop, maximum	1.5	Pounds per Square Inch
Working Pressure - Non Shock, maximum	100	Pounds per Square Inch

MAXIMUM RATINGS AND TYPICAL OPERATION

Power-Rectifier or Inverter Service, Continuous Duty
Ratings are for Zero-Phase-Control Angle

Maximum Peak Anode Voltage		
Inverse	4000	Volts
Forward	4000	Volts
Maximum Anode Current		
Peak	2000	Amperes
Average		
Continuous	275	Amperes
Two Hours	350	Amperes
One Minute	570	Amperes
Fault		
Forward Direction	15,000	Amperes
Reverse Direction	30,000	Amperes
Maximum Duration of Fault Current	0.15	Seconds
Frequency Range	25 to 60	Cycles per Second

Ignitor Characteristics		
Maximum Inverse Voltage	5	Volts
Recommended Pulse Width	800	Microseconds
Minimum Pulse Width		
Average Anode Current Greater than 8 Amperes	150	Microseconds
Maximum Pulse Width	4000	Microseconds

	Minimum	Maximum	
Shield-Grid Voltage			
Peak Forward	200	500	Volts
Peak Inverse	--	200	Volts
Shield-Grid Current			
Peak Forward	0.2	5.0	Amperes
Peak Inverse	--	0.2	Amperes
Control-Grid Voltage			
Peak Forward	200	500	Volts
Peak Inverse	100	200	Volts
Control-Grid Current			
Peak Forward	0.4	5.0	Amperes
Peak Inverse	0.4	1.0	Amperes
DC Bias	-90	-110	Volts

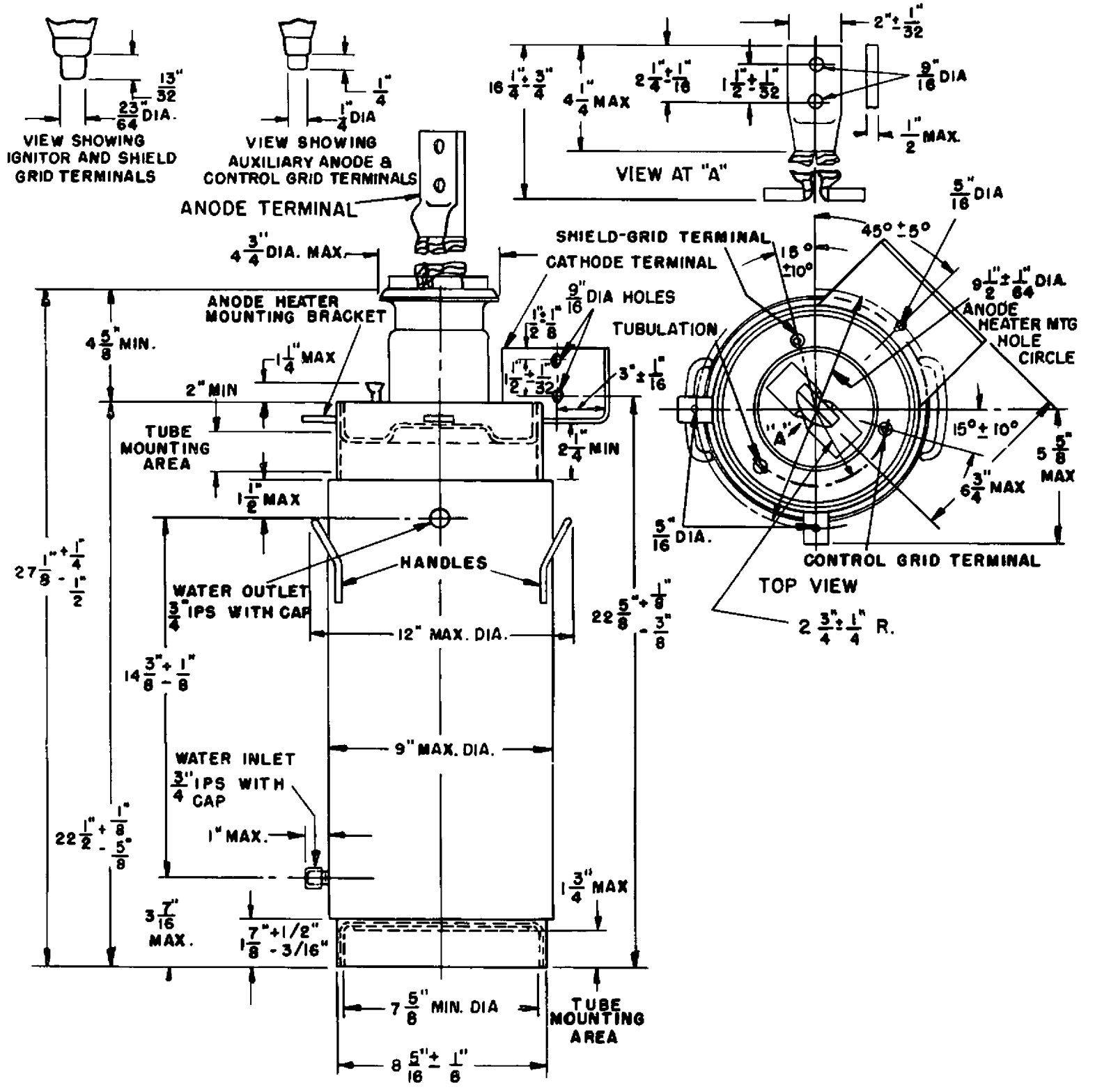
* Water flow should be continued for 30 minutes after removal of anode power.

Electronic Components Division

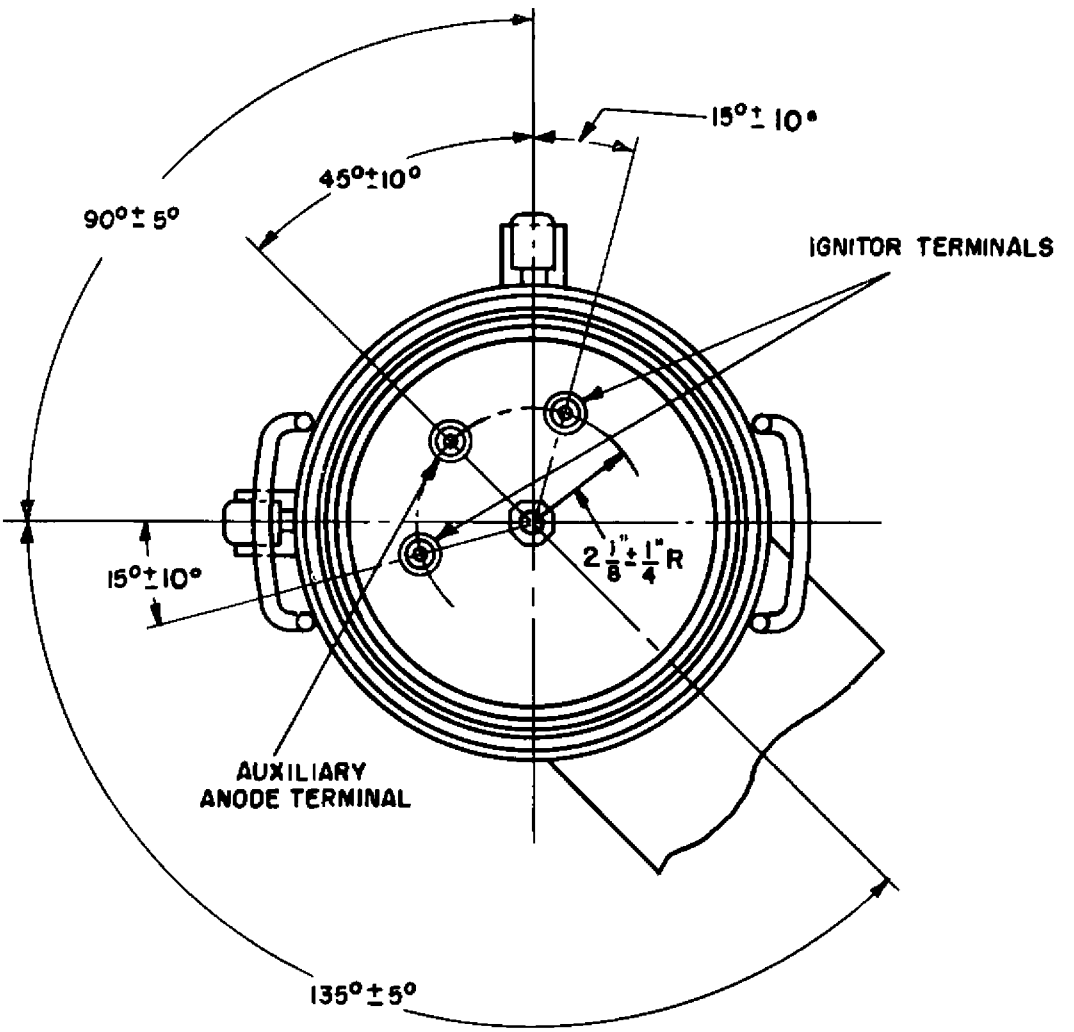
GENERAL ELECTRIC COMPANY

Schenectady 5, N. Y.

OUTLINE


VIEW SHOWING IGNITOR AND SHIELD GRID TERMINALS
VIEW SHOWING AUXILIARY ANODE & CONTROL GRID TERMINALS
VIEW AT "A"
ANODE TERMINAL
SHIELD-GRID TERMINAL
CATHODE TERMINAL
ANODE HEATER MOUNTING BRACKET
TUBULATION
ANODE HEATER MTG HOLE CIRCLE
TUBE MOUNTING AREA
HANDLES
WATER OUTLET
WATER INLET
CONTROL GRID TERMINAL
TOP VIEW
12" MAX. DIA.
9" MAX. DIA.
TUBE MOUNTING AREA

BOTTOM VIEW


15° ± 10°
45° ± 10°
90° ± 5°
IGNITOR TERMINALS
15° ± 10°
2 1/8 ± 1/4" R
AUXILIARY
ANODE TERMINAL
135° ± 5°

ELECTRONICS

7025

TWIN TRIODE

DESCRIPTION AND RATING

The 7025 is a miniature, high-mu, twin triode primarily designed for use in low-level stages of high-gain audio-frequency amplifiers. Use of the 7025 in this application is advantageous because of its low hum output.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

	Series*	Parallel†	
Heater Voltage, AC or DC . . .	12.6±1.3‡	6.3±0.6‡	Volts
Heater Current†	0.15§	0.3¶	Amperes

Direct Interelectrode Capacitances

	Section 1		Section 2		
	With Shield #	Without Shield	With Shield #	Without Shield	
Grid to Plate: (g to p)	1.7	1.7	1.7	1.7	pf
Input: g to (h + k)	1.8	1.6	1.8	1.6	pf
Output: p to (h + k)	1.9	0.46	1.9	0.34	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

Maximum Diameter. . .	0.875	Inches
Maximum Over-all Length	2.188	Inches
Maximum Seated Height .	1.938	Inches

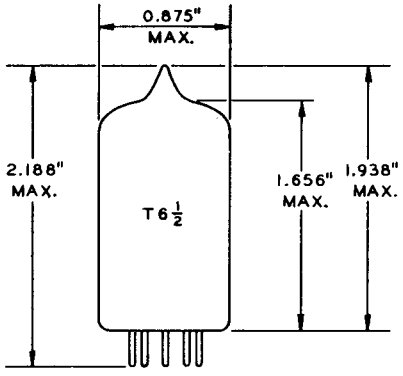
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

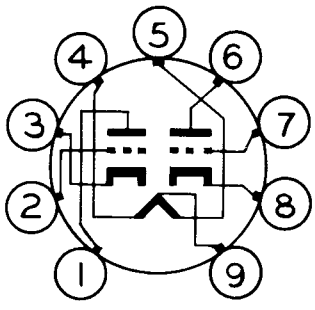


EIA 6-2

TERMINAL CONNECTIONS

Pin 1 - Plate (Section 2)
Pin 2 - Grid (Section 2)
Pin 3 - Cathode (Section 2)
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Plate (Section 1)
Pin 7 - Grid (Section 1)
Pin 8 - Cathode (Section 1)
Pin 9 - Heater Center-Tap

BASING DIAGRAM



EIA 9A

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	55	Volts
Plate Dissipation, Each Plate	1.2	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	100	250	Volts
Grid Voltage	-1.0	-2.0	Volts
Amplification Factor	100	100	
Plate Resistance, approximate	80000	62500	Ohms
Transconductance	1250	1600	Micromhos
Plate Current	0.5	1.2	Milliamperes
Equivalent Noise and Hum Voltage, Each Section, average, true RMSΔ	---	1.8	Microvolts
Equivalent Noise and Hum Voltage, Each Section, maximum, true RMS$\not\subset$	---	7.0	Microvolts

NOTES

* Operated with the two sections of the heater connected in series.

† Operated with the two sections of the heater connected in parallel.

‡ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

§ Heater current of a bogey tube at Ef = 12.6 volts

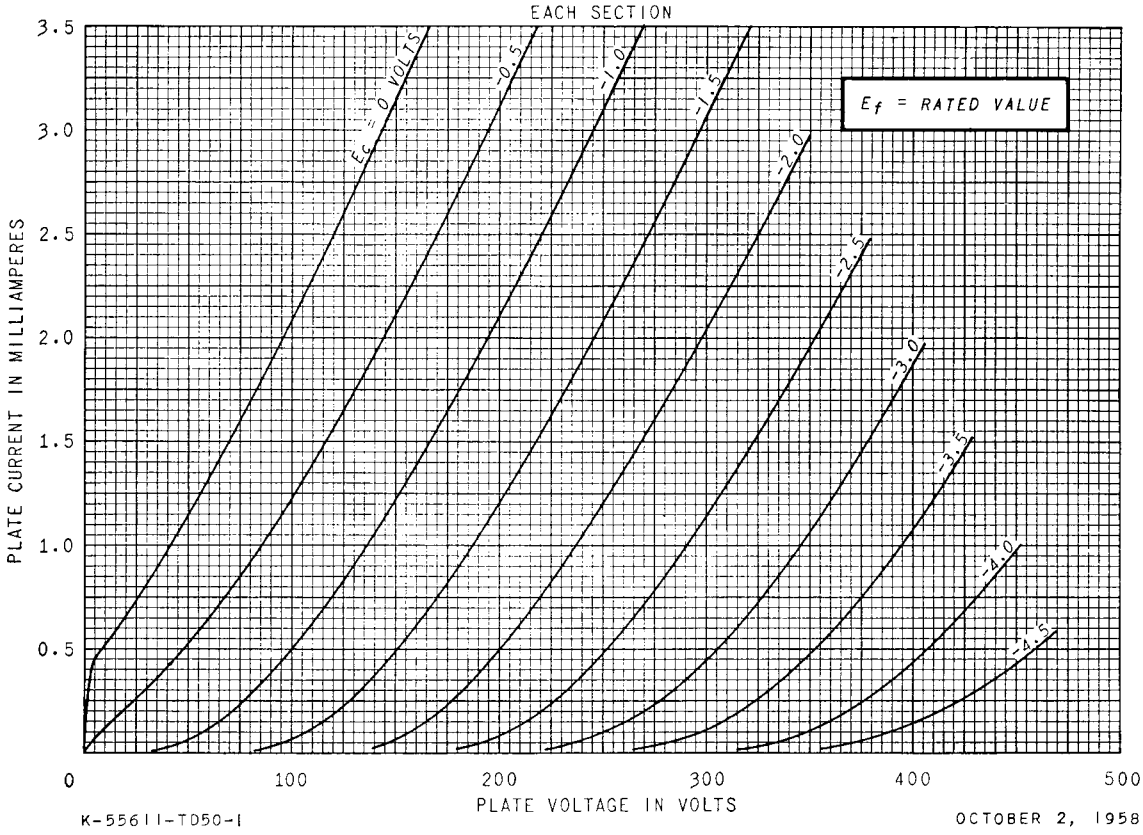
¶ Heater current of a bogey tube at Ef = 6.3 volts.

\# With external shield (EIA 315) connected to cathode.

Δ Referred to grid and measured under the following conditions:
Ef = 6.3 volts AC (parallel connection), CT of heater transformer grounded; Ebb = 250 volts; Rb = 100,000 ohms; Rk = 2700 ohms, bypassed with 100µf; Rg = 0 ohms; Amplifier frequency range = 25 to 10,000 cps.

$\not\subset$ Referred to grid and measured under the following conditions:
Ef = 6.3 volts AC (parallel connection), CT of heater transformer grounded; Ebb = 250 volts; Rb = 100,000 ohms; Rk = 2700 ohms, unbypassed; Rg = 50,000 ohms; Amplifier frequency range = 25 to 10,000 cps.

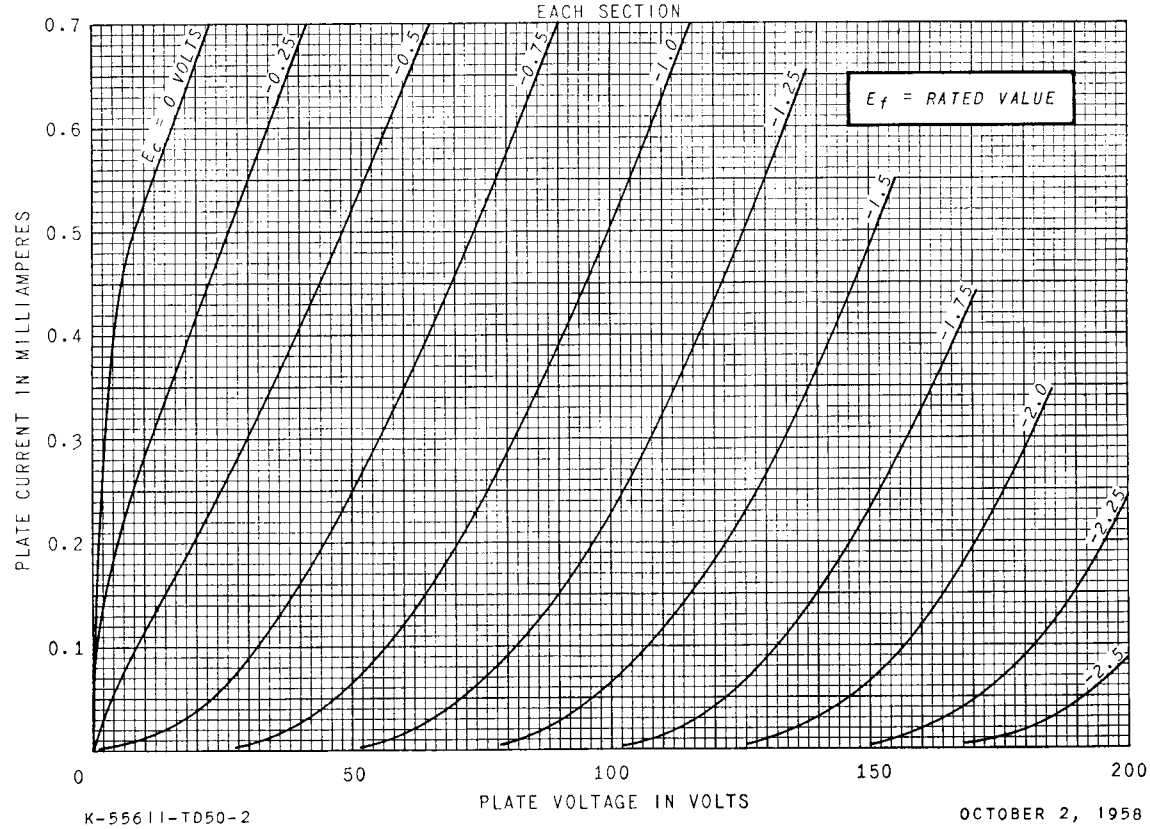
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD50-1

OCTOBER 2, 1958

AVERAGE PLATE CHARACTERISTICS

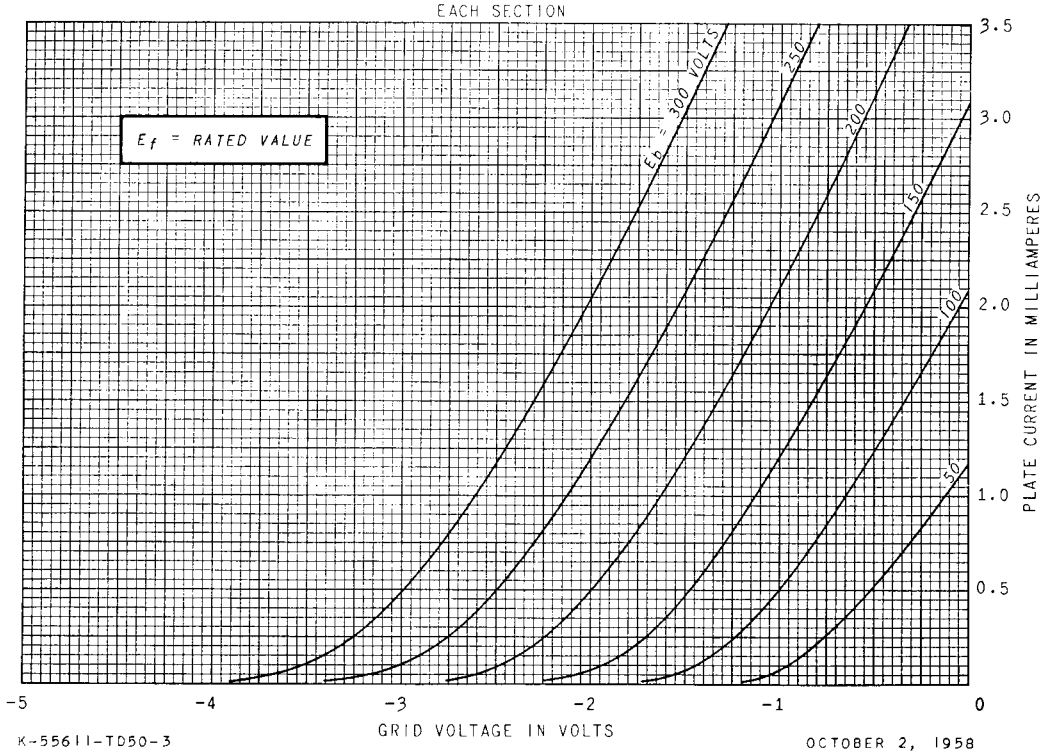


K-5561I-TD50-2

OCTOBER 2, 1958

AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION

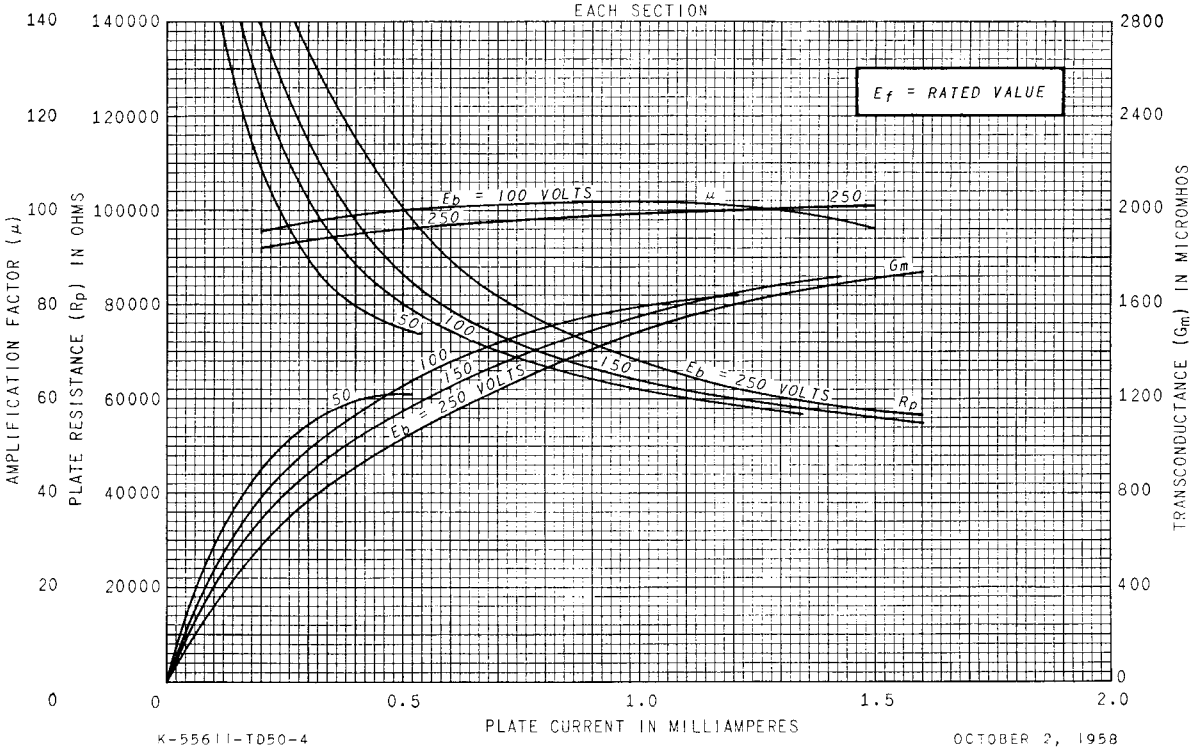


K-5561I-TD50-3

OCTOBER 2, 1958

AVERAGE CHARACTERISTICS

EACH SECTION



K-5561I-TD50-4

OCTOBER 2, 1958

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONIC INNOVATIONS IN ACTION

TUBES

7077

METAL-CERAMIC TRIODE

FOR UHF AMPLIFIER APPLICATIONS



DESCRIPTION AND RATING

The 7077 is a high-mu-triode of ceramic and metal planar construction primarily intended for use as an r-f amplifier in the UHF range. It features an extremely low noise figure throughout its frequency range. The 7077 is especially suited for use where unfavorable conditions of mechanical shock, mechanical vibration, and nuclear radiation are encountered.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.3	Volts
Heater Current†	0.24	Amperes

Direct Interelectrode Capacitances‡

Grid to Plate: (g to p)	1.0	pf
Input: g to (h+k)	1.7	pf
Output: p to (h+k)	0.01	pf
Heater to Cathode: (h to k)	1.1	pf

MECHANICAL

Mounting Position—Any

See Outline Drawing on page 3 for dimensions and electrical connections

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Plate Voltage	250	Volts
Positive Peak and DC Grid Voltage	0	Volts
Negative Peak and DC Grid Voltage	50	Volts
Plate Dissipation	1.1	Watts
DC Cathode Current	11	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature§	250	C
Grid-Circuit Resistance	0.01	Megohms

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

Supersedes ET-T1488 dated 3-58 and 10-59

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Supply Voltage	250	Volts
Resistor in Plate Circuit (bypassed)	18000	Ohms
Cathode-Bias Resistor	82	Ohms
Amplification Factor	90	
Plate Resistance, approximate	9000	Ohms
Transconductance	10000	Micromhos
Plate Current	6.5	Milliamperes
Grid Voltage, approximate Gm = 50 Micromhos	−5	Volts

GROUNDED-GRID AMPLIFIER—450 MEGACYCLES

Plate Supply Voltage¶	250	Volts
Resistor in Plate Circuit (bypassed)¶	18000	Ohms
Cathode-Bias Resistor	82	Ohms
Plate Current	6.5	Milliamperes
Bandwidth, approximate	7.5	Megacycles
Power Gain, approximate	14.5	Decibels
Noise Figure (Measured with power-matched input, using argon lamp noise source), approximate	5.5	Decibels

FOOTNOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

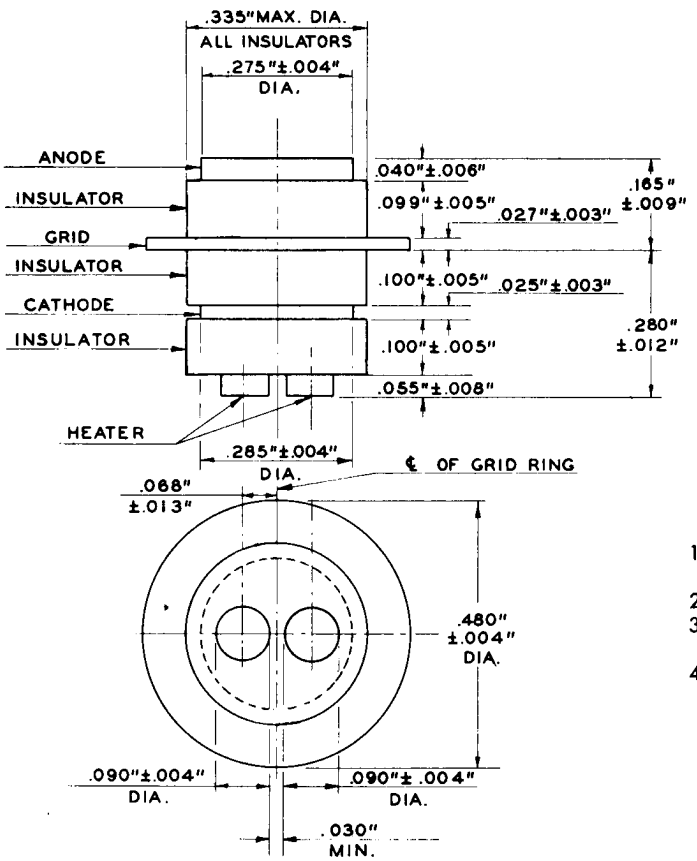
† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Measured using a grounded adapter that provides shielding between external terminals of tube.

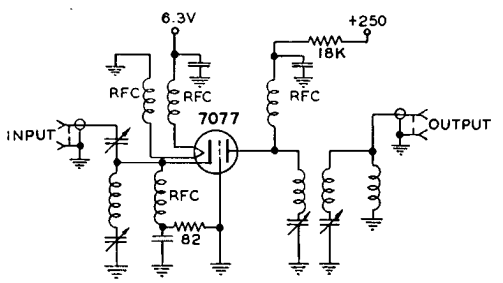
§ Operation below the rated maximum envelope temperature is recommended for applications requiring the longest possible tube life. The 7077 is also capable of operation at envelope temperatures much higher than the rated maximum values. For specific recommendations concerning higher temperature operation, contact your General Electric tube sales representative.

¶ Lower supply voltage and a lower value of resistor may be used in the plate circuit with some sacrifice in uniformity of performance.

OUTLINE DRAWING



TYPICAL GROUNDED-GRID AMPLIFIER CIRCUIT USING THE 7077



1—Maximum eccentricity of anode, grid, and cathode 0.005" from center line.
2—Maximum eccentricity of insulators 0.010" from center line.
3—Center line of grid ring used as reference line for horizontal tolerances.
4—Bottom surface of grid ring used as reference line for vertical tolerances.

INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
Ef = 6.3 volts	222	240	258	Milliamperes
Plate Current				
Ef = 6.3 volts, Ebb = 250 volts, R_L = 18000 ohms, Rk = 82 ohms (bypassed)	4.5	6.5	8.5	Milliamperes
Transconductance				
Ef = 6.3 volts, Ebb = 250 volts, R_L = 18000 ohms (bypassed), Rk = 82 ohms (bypassed)	7000	10000	13000	Micromhos
Transconductance Change with Heater Voltage				
Difference between Transconductance measured at Ef = 6.3 and Ef = 6.0 volts (other conditions the same) expressed as a percentage	....	.....	20	Percent
Amplification Factor				
Ef = 6.3 volts, Ebb = 250 volts, R_L = 18000 ohms (bypassed), Rk = 82 ohms (bypassed)	65	90	115	
Interelectrode Capacitances				
Grid to Plate: (g to p)	0.84	1.00	1.16	Picofarads
Input: g to (h+k)	1.25	1.70	2.15	Picofarads
Output: p to (h+k)	0.004	0.010	0.016	Picofarads
Heater to Cathode: (h to k)	0.80	1.10	1.40	Picofarads
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	....	.....	20	Microamperes
Heater Negative with Respect to Cathode	....	.....	20	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts, Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid to All at 100 volts d-c	100	.....	.....	Megohms
Plate to All at 300 volts d-c	100	.....	.....	Megohms
Grid Emission Current				
Ef = 7.0 volts, Ebb = 250 volts, Ecc = −20 volts, Rk = 82 ohms (bypassed), Rg = 0.1 meg, R_L = 18000 ohms (bypassed)	....	.....	2.0	Microamperes

SPECIAL PERFORMANCE TESTS

	Min.	Bogey	Max.	
Noise Figure				
Ef = 6.3 volts, Ebb = 250 volts, Rk = 82 ohms, R_L = 18000 ohms, F = 450 mc	....	5.5	6.6	Decibels
Noise Figure at Reduced Heater Voltage				
Ef = 6.0 volts, Ebb = 250 volts, Rk = 82 ohms, R_L = 18000 ohms, F = 450 mc	....	.....	8.1	Decibels
Power Gain				
Ef = 6.3 volts, Ebb = 250 volts, Rk = 82 ohms, R_L = 18000 ohms, F = 450 mc	12.5	14.5	.....	Decibels

SPECIAL PERFORMANCE TESTS (Continued)

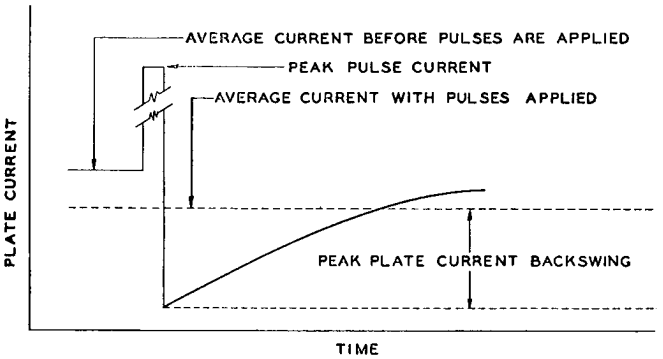
Grid Recovery

Change in Average Plate Current	0.6	Milliamperes
Peak Plate Current Backswing	1.0	Milliamperes

Tubes with poor grid recovery affect circuit operation, when the grid is driven positive by a pulse of signal or noise, somewhat as if a parallel RC circuit were in series with the grid. This effect may occur in tubes of any type, but is unimportant in many applications. In the majority of 7077 tubes the effect is negligible, but to eliminate the few in which it may be excessive, tubes are tested under the following conditions: Ef = 6.3 volts, Ebb = 250 volts, R_L = 0.01 meg. Ec is adjusted for Ib = 3.0 ma.

Upon application to the grid of a 5 volts positive pulse (prr = 60 pps, duty factor = 0.0012) the change in average plate current is noted, and the peak plate current backswing is measured. The following diagram shows qualitatively the plate current-time relationship for a tube (with poor grid recovery) subjected to this test.

PLATE CURRENT VS. TIME
—GRID RECOVERY TEST



	Min.	Bogey	Max.	
Low Frequency Vibrational Output			10	Millivolts RMS

Statistical sample is subjected to vibration in each of two planes at 40 cps, with peak acceleration 15G. Tube is operated with Ef = 6.3 volts, Ebb = 150 volts, Rk = 82 ohms (bypassed), R_L = 10000 ohms.

Variable Frequency Vibrational Output

The tube is designed to be free of vibrational outputs in excess of 15 mv RMS at any frequency within the range 100–2000 cps, when vibrated in either of two planes at 10G peak acceleration. Electrical conditions for this test are the same as for Low Frequency Vibrational Output.

Low Pressure Voltage Breakdown Test

Statistical sample tested for voltage breakdown at a pressure of 8mm Hg, to simulate an altitude of 100,000 feet. Tubes shall not give visual evidence of flashover or corona when 300 volts RMS, 60 cps, is applied between the plate and grid terminals.

DEGRADATION RATE TESTS

Fatigue

Statistical sample vibrated for a total of 96 hours, 48 hours in each of two planes, at a peak acceleration of 10G. Frequency is 60 cps. Tubes are operated during the test with Ef = 6.3 volts (no other voltages applied). Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, heater current, noise figure, and gain.

Shock

Statistical sample subjected to 5 impact accelerations of approximately 450G in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine using a 30° hammer angle. Tubes are operated during the test with Ef = 6.3 volts, Eb = 150 volts, Ehk = +100 volts, and Rk = 82 ohms. Following the test, tubes are evaluated for low frequency

from JETEC release #2016, Dec. 16, 1957

GL-7085

TRIODE

The GL-7085 is a three-electrode tube designed for induction and dielectric heating as well as broadcast use. A thoriated-tungsten-filament version of the GL-880, the tube features a free-hung or self-supporting filament and a glass envelope incorporating rugged fernico-to-glass seals throughout. The anode is water cooled and is capable of dissipating 22.5 kilowatts with a water flow of approximately 12 gallons per minute. Maximum ratings of 12.5 kilovolts d-c plate voltage and 60 kilowatts plate input apply at frequencies up to 25 megacycles; operation at 50 megacycles is permissible with voltage and input reduced to three-quarters maximum ratings.

TECHNICAL INFORMATION

GENERAL

Electrical

Filament Voltage	7.5	Volts
Filament Current at 7.5 Volts	170	Amperes
Filament Starting Current, maximum	800	Amperes
Filament Cold Resistance	0.0056	Ohms
Amplification Factor	20	
Interelectrode Capacitances		
Grid-to-Plate	24.5	µµf
Grid-to-Filament	35	µµf
Plate-to-Filament	2.5	µµf

Mechanical

Mounting Position - Vertical, Anode Down

Net Weight, approximate	7	Pounds

Thermal

Type of Cooling - Water and Forced Air

Water Flow on Anode		
Minimum for 22.5 Kilowatts Dissipation	12	Gallons per Minute *
Maximum Outgoing Water Temperature	70	C
Air Flow on Dish from 3-Inch Nozzle	50	Cubic Feet per Minute ≠

Air flow should be directed vertically downward to provide uniform distribution over the dish with nozzle as close as free air circulation permits.

Maximum Glass Temperature	165	C

Air and water cooling should continue for a minimum of 5 minutes after removal of power.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio-Frequency Power Amplifier and Modulator - Class B

Maximum Ratings, Absolute Values		
DC Plate Voltage	12,500	Volts
Maximum Signal DC Plate Current ‡	5	Amperes
Maximum Signal Plate Input ‡	45	Kilowatts
Plate Dissipation	22.5	Kilowatts
Typical Operation, values are for two tubes		
DC Plate Voltage	12,500	Volts
DC Grid Voltage	-600	Volts
Peak AF Grid-to-Grid Voltage	1900	Volts
Zero-Signal DC Plate Current	1	Amperes
Maximum Signal DC Plate Current	6.4	Amperes
Effective Load Resistance, plate to plate	4400	Ohms
Maximum Signal Driving Power, approximate §	430	Watts
Maximum Signal Power Output, approximate	55	Kilowatts

Radio-Frequency Power Amplifier - Class B
Carrier Conditions per Tube for Use With a Maximum Modulation Factor of 1.0

Maximum Ratings, Absolute Values		
DC Plate Voltage	12,500	Volts
DC Plate Current	4	Amperes
Plate Input	33	Kilowatts
Plate Dissipation	22.5	Kilowatts
Typical Operation		
DC Plate Voltage	12,500	Volts
DC Grid Voltage	-625	Volts
Peak RF Grid Voltage	625	Volts
DC Plate Current	2.4	Amperes
DC Grid Current ø	0	Amperes
Driving Power, approximate Δ ø	1070	Watts
Power Output, approximate	12	Kilowatts

Plate Modulated Radio-Frequency Power Amplifier - Class C Telephony
Carrier Conditions per Tube for Use With a Maximum Modulation Factor of 1.0

Maximum Ratings, Absolute Values		
DC Plate Voltage	10,000	Volts
DC Grid Voltage	-2000	Volts
DC Plate Current	4	Amperes
DC Grid Current	0.8	Amperes
Plate Input	40	Kilowatts
Plate Dissipation	15	Kilowatts
Typical Operation		
DC Plate Voltage	10,000	Volts
DC Grid Voltage **	-840	Volts
Peak RF Grid Voltage	1440	Volts
DC Plate Current	3.8	Amperes
DC Grid Current, approximate ø	0.78	Amperes
Driving Power, approximate ø	1010	Watts
Power Output, approximate	29	Kilowatts

Radio-Frequency Power Amplifier and Oscillator - Class C Telegraphy
Key-Down Conditions per Tube Without Modulation ***

	Frequency 25 Megacycles			Frequency 2 Megacycles	
Maximum Ratings, Absolute Values					
DC Plate Voltage		12,500		15,000	Volts
DC Grid Voltage		-2000		-2000	Volts
DC Plate Current		6		6	Amperes
DC Grid Current		0.8		0.8	Amperes
Plate Input		60		67.5	Kilowatts
Plate Dissipation		22.5		22.5	Kilowatts
Typical Operation					
DC Plate Voltage	10,000	10,000	12,500	15,000	Volts
DC Grid Voltage	-1150	-1300	-1400	-1500	Volts
Peak RF Grid Voltage	1810	2080	2060	2130	Volts
Peak RF Plate Voltage	7900	7600	9900	12,500	Volts
DC Plate Current	4.5	5.6	4.7	4.4	Amperes
DC Grid Current, approximate ø	0.55	0.72	0.42	0.37	Amperes
Driving Power, approximate ø	960	1440	850	770	Watts
Power Output, approximate	32	38	42	51	Kilowatts

* This flow for jackets with spiral water deflector. Older straight-wall jackets will require 16.2 gallons per minute at 22.5 kilowatts.

/ At frequencies above 10 megacycles special attention should be given to adequate ventilation of the dish and seals to keep the temperature at the hottest point below 165 C. Heat-radiating connectors for grid and filament posts are recommended when tube operation is at frequencies greater than 10 megacycles.

‡ Averaged over any audio-frequency cycle of sine-wave form.

§ The driving stage should have good regulation and should be capable of supplying considerably more than the specified driving power.

ø Subject to wide variations depending on the impedance of the load circuit. High-impedance load circuits require more grid current and driving power to obtain the desired output. Low-impedance circuits require less grid current and driving power but sacrifice plate-circuit efficiency. The driving stage should have a tank circuit with good regulation and should be capable of supplying considerably more than the required driving power.

Δ At crest of audio-frequency cycle with modulation factor of 1.0.

** Obtained by grid resistor of 1075 ohms or by partial self-bias methods.

*** Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier conditions.

MAXIMUM FREQUENCY VS RATINGS

The GL-7085 will operate at maximum ratings in all classes of service at frequencies as high as 25 megacycles. The tube will operate at higher frequencies provided the maximum values of plate voltage and plate input are reduced according to the tabulation below. In Class C Telegraphy service at frequencies below 2 megacycles, the plate voltage and input can be increased as indicated over the maximum values permissible at 25 megacycles.

Frequency Megacycles	Class of Service	Percentage of Maximum Rated Plate Voltage and Plate Input	
		Plate Voltage	Plate Current
25	B, C - Telephony, C - Telegraphy	100	100
50	B	80	94
	C - Telephony	75	75
	C - Telegraphy	75	75
2	C - Telegraphy	120	112.5

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

Characteristics	Conditions		Limits Minimum	Bogey	Maximum	
Grid Voltage	ib=28 Amp; eb=1800 Volts	ec:	--	--	1100	Volts
Grid Current	ib=28 Amp; eb=1800 Volts	ic:	--	--	10.0	Amperes
Plate Voltage	Ib=2.0 Amp d-c; Ec=0	Eb:	2.5	3.2	3.6	KV d-c
Plate Voltage	Ib=2.0 Amp d-c; Ec=200 Volts d-c	Eb:	6.2	7.2	8.2	KV d-c
Grid Voltage	Eb=10 KV d-c; Ib=0.020 Amp d-c	Ec:	-460	-530	-600	Volts d-c
Plate Power Output	Eb=12.5 KV d-c; Ib=4.8 Amp d-c; Ic=0.8 Amp d-c; Ec=-1440 Volts d-c; F=25 Mc	Po:	34	--	--	KW

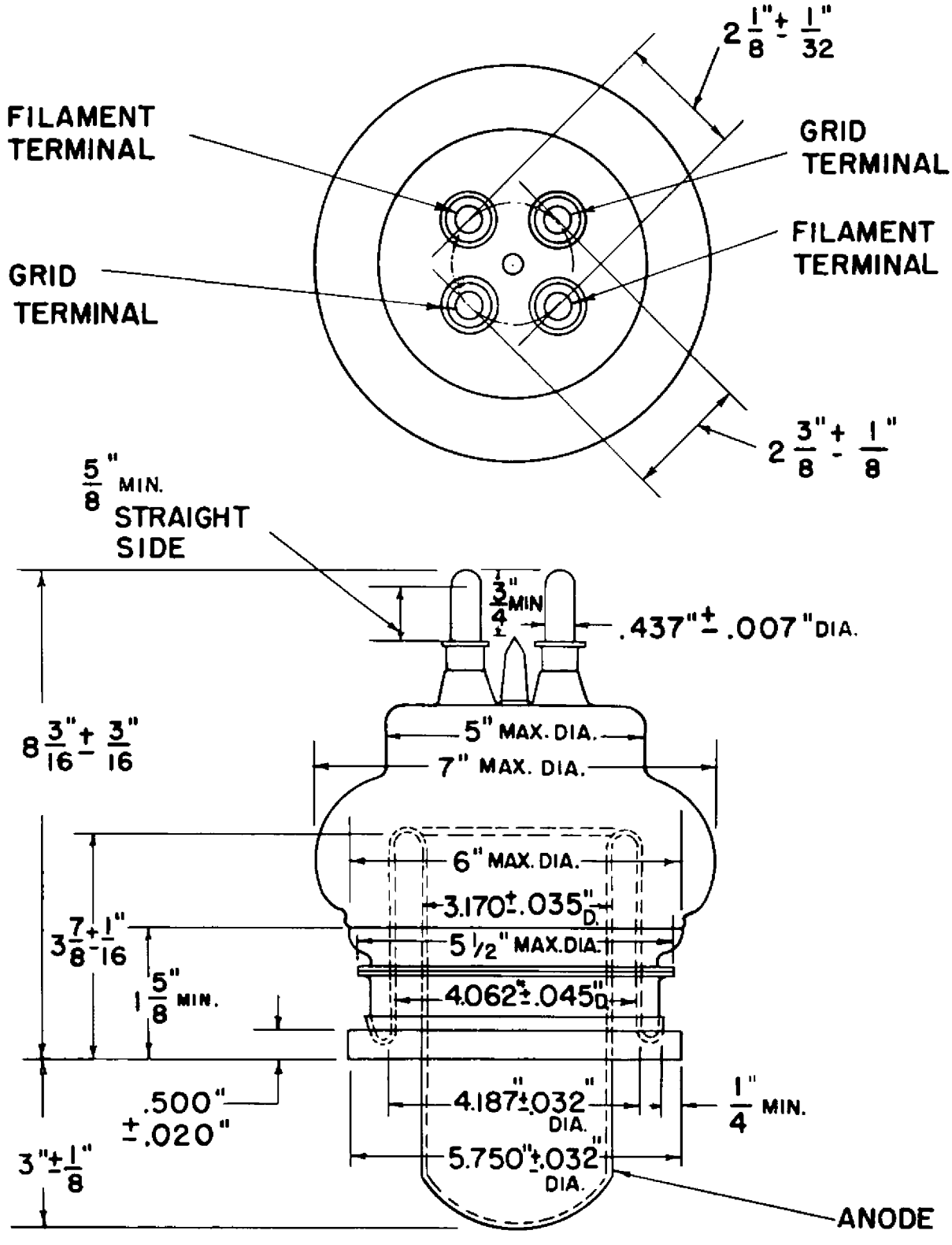
Electronic Components Division

GENERAL ELECTRIC COMPANY

Schenectady 5, N. Y.

OUTLINE

GL-7085



from JETEC release #2083, Jan. 20, 1958

GL-7151

IGNITRON

DESCRIPTION AND RATING

The GL-7151 is a sealed water-cooled ignitron with a stainless-steel jacket for a-c control service. In such application two tubes in an inverse-parallel connection will control 4800 kilovolt-amperes at voltages of 250 to 500 volts over a frequency range of 25 to 60 cycles. The water-cooling chamber is especially designed to provide high cooling efficiency, where this requirement exists, without increasing the over-all water-pressure drop of the cooling jacket.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation - Cyclic		
Cathode Spot Starting - Ignitor		
Number of Electrodes		
Main Anodes	1	
Main Cathodes	1	
Ignitors	1	

Mechanical

Envelope Material - Stainless Steel		
Net Weight	70	Pounds

Thermal

Type of Cooling - Water		
Inlet Water Temperature, minimum	0	C
Outlet Water Temperature, maximum	40	C
Water Flow, minimum	10	Gallons per Minute
Maximum Working Water Pressure	100	Pounds per Square Inch

MAXIMUM RATINGS

AC Control Service, Two Tubes in Inverse Parallel, Ratings per Tube

Voltage Range	250 to 600	Volts RMS
Maximum Demand	4800*	Kilovolt-Amperes
Average Current at Maximum Demand	486	Amperes
Maximum Average Current	900	Amperes
Demand at Maximum Average Current	1600	Kilovolt-Amperes

MAXIMUM RATINGS (Cont'd)

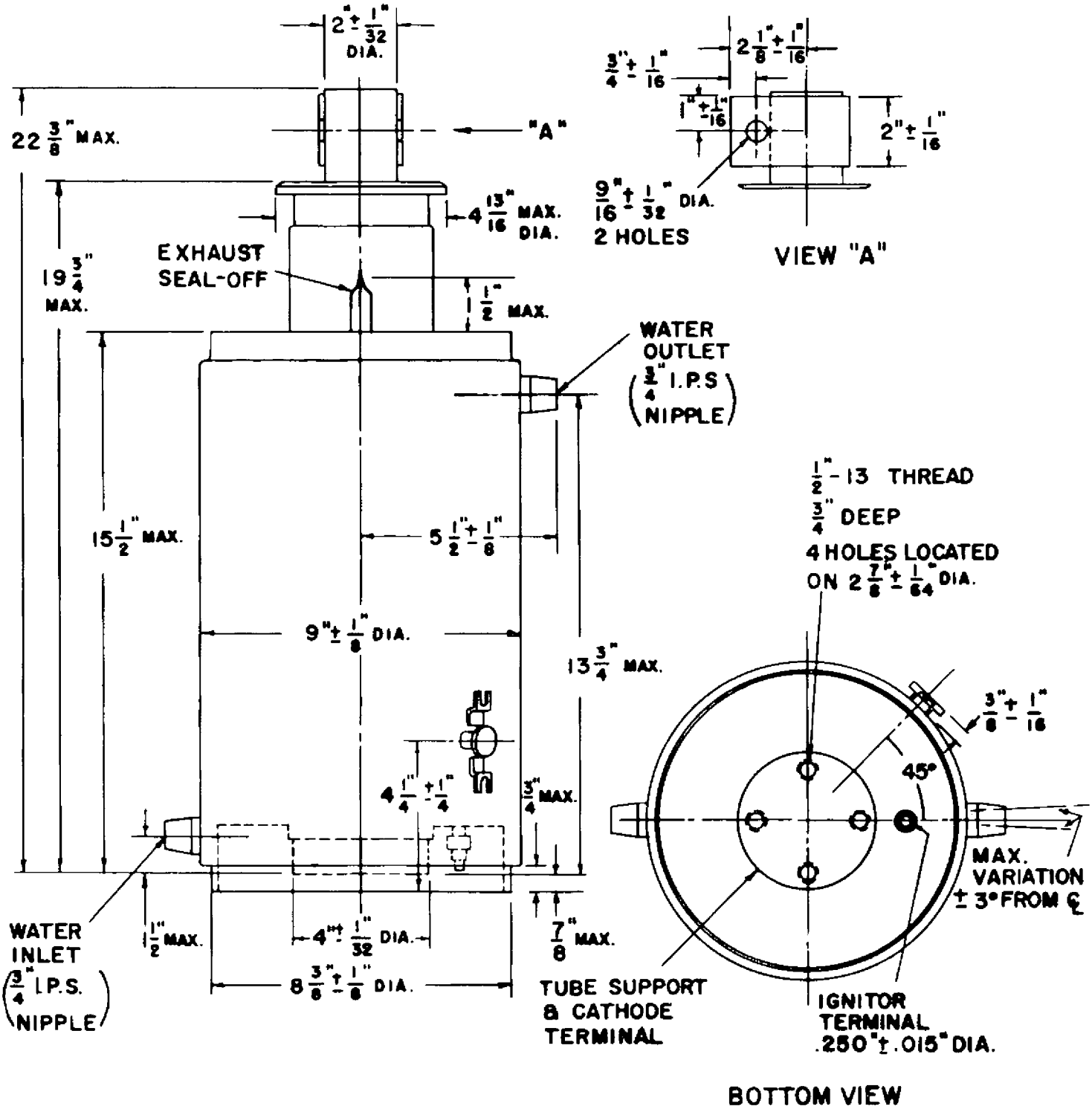
Maximum Peak Fault Current at 250 Volts.	54,000	Amperes
Maximum Peak Fault Current at 600 Volts.	22,400	Amperes
Frequency Range.	25-60	Cycles per Second

Ignitor Characteristics

Maximum Inverse Voltage.	5	Volts
Recommended Pulse Length	500	Microseconds
Minimum Pulse Length, for average anode currents greater than 20 amperes	150	Microseconds
Maximum Pulse Length	4000	Microseconds

* Maximum demand current at voltages below 500 is 9600 amperes RMS.

OUTLINE


2" ± 1/32 DIA.
22 3/8" MAX.
"A"
4 13/16" MAX. DIA.
19 3/4" MAX.
EXHAUST SEAL-OFF
1 1/2" MAX.
WATER OUTLET (3/4" I.P.S NIPPLE)
15 1/2" MAX.
5 1/2" ± 1/8
9" ± 1/8" DIA.
13 3/4" MAX.
4 1/4" ± 1/4"
3/4" MAX.
WATER INLET (3/4" I.P.S. NIPPLE)
1 1/2" MAX.
4" ± 1/32" DIA.
7/8" MAX.
8 3/8" ± 1/8" DIA.
3/4" ± 1/16"
2 1/8" ± 1/16"
1" ± 1/16"
2" ± 1/16"
9/16" ± 1/32" DIA.
2 HOLES
VIEW "A"
1/2"-13 THREAD
3/4" DEEP
4 HOLES LOCATED ON 2 7/8" ± 1/64" DIA.
3/8" ± 1/16"
45°
MAX. VARIATION ± 3° FROM ℄
TUBE SUPPORT & CATHODE TERMINAL
IGNITOR TERMINAL .250" ± .015" DIA.
BOTTOM VIEW

GL-7171

IGNITRON

CAPACITOR - DISCHARGE SERVICE

PULSED

DC SHORT-CIRCUITING-SWITCH SERVICE

20,000 AMPERES PEAK

DESCRIPTION AND RATING

The GL-7171 is a sealed, stainless-steel jacketed ignitron for use as a switch in capacitor-discharge circuits operating up to 10,000 volts. In this service the tube will carry peak currents up to 20,000 amperes.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation - Cyclic			
Cathode Spot Starting - Ignitor			
Number of Electrodes			
Main Anodes		1	
Main Cathodes		1	
Ignitors		1	
Arc Drop			
At 4000 Amperes		20	Volts
At 30,000 Amperes		55	Volts
Critical Anode Starting Voltage, minimum		100	Volts
Ignitor Ratings			
Separate Excitation			
Ignitor Voltage			
Forward Open Circuit	1500 -	3000	Volts
Inverse, maximum	5	5	Volts
Ignitor Current Short Circuit	200 -	250	Amperes
Length of Firing Pulse, sine wave	5 -	10	Microseconds
Anode Firing			
Ignitor Voltage			
Forward, maximum		3000	Volts
Inverse, maximum		5	Volts
Peak Ignitor Current	200 -	250	Amperes

Mechanical

Envelope Material - Stainless Steel			
Mounting Position - Axis Vertical, Anode Lead Up			
Net Weight		2	Pounds

Thermal

Type of Cooling - Convection			
Envelope Temperature	20 -	40	C

GENERAL ELECTRIC COMPANY

from JETEC release #2203, May 26, 1958

MAXIMUM RATINGS AND TYPICAL OPERATION

Capacitor-Discharge Service, Pulse Duty, Sinusoidal Current

Peak Anode Voltage		
Forward	10,000	Volts
Inverse	10,000	Volts
Anode Current		
Peak	20,000	Amperes
Average	0.1	Amperes
Maximum Averaging Time	1	Cycles
Fault	20,000	Amperes
Maximum Duration	0.002	Seconds

DC Short-Circuiting Switch Service

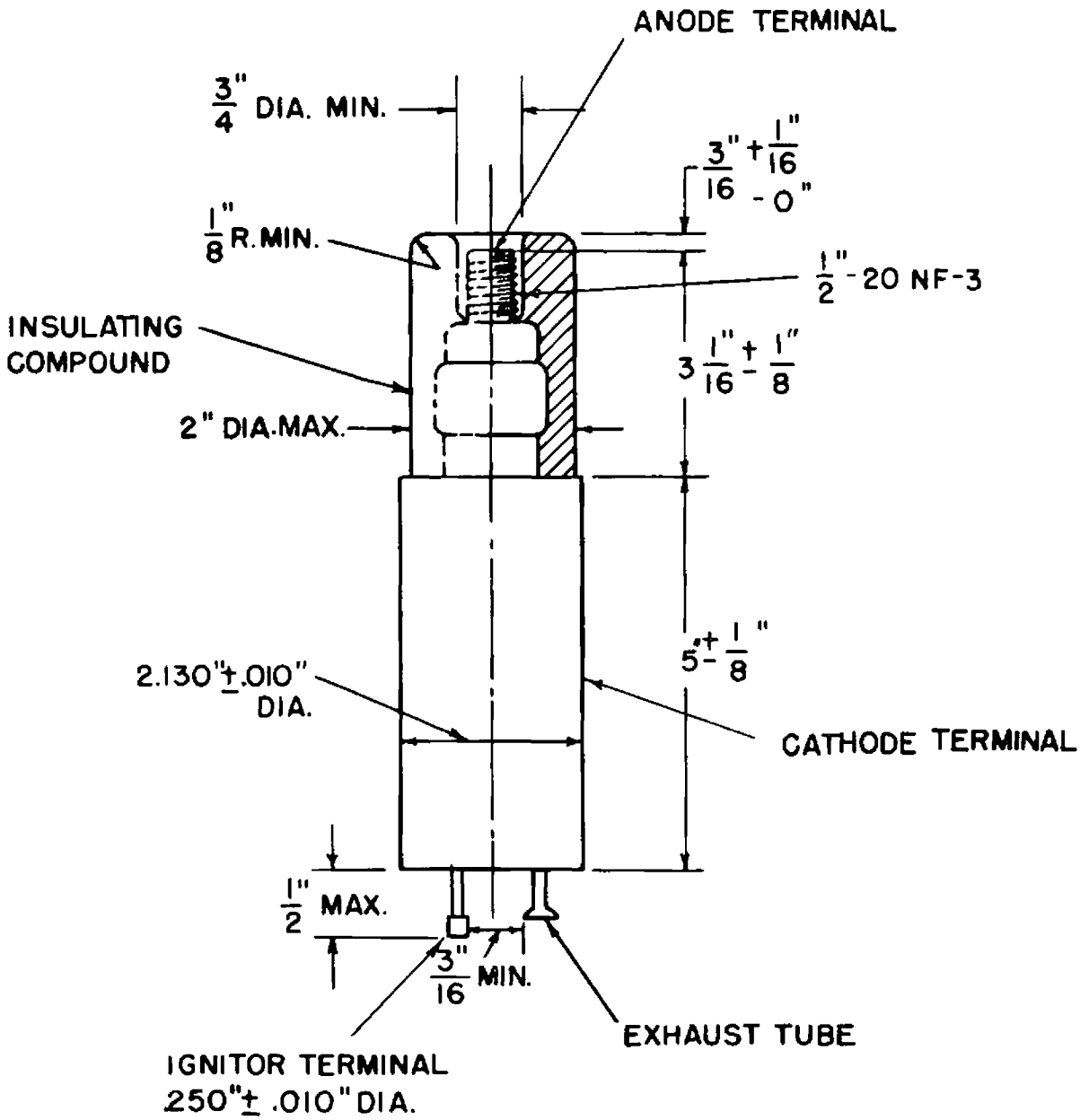
Peak Anode Voltage		
Forward	10,000	Volts
Inverse	10,000	Volts
Anode Current		
Peak	20,000	Amperes
Average	0.25	Amperes
Fault	20,000	Amperes
Maximum Duration	0.002	Seconds
Frequency of Current Conduction Periods, maximum	1	Per Minute
Ionization Time	0.5	Microseconds

Electronic Components Division

GENERAL ELECTRIC COMPANY

Schenectady 5, N. Y.

OUTLINE



OUTLINE
GL-7171 IGNITRON

Aug. 4, 1958
Release No. 2203A
Type 7171

ITEM	AS REGISTERED	AS PROPOSED
Thermal		
Envelope Temperature	20 - 40°C	Delete
Temperature		
Ambient	---	25°C
Cathode Header	---	35°C
Anode Header	---	55°C
Capacitor-Discharge Service, DC Short-Circuiting Switch Service		
Anode Current		
Peak	20,000	35,000 amps
Fault	20,000	35,000 amps
Rate of Rise		
Maximum	---	5600 amps per usec
Minimum	---	1400 amps per usec
Outline Drawing		
Remove Insulating Compound and Reference thereto		
Threaded Anode Terminal Height	---	1-1/8 inches
Height from Top of Envelope to Anode-Terminal Top	3-1/16 ± 1/8	3 ± 1/8 inches
Anode Bushing Diameter	---	1-1/16 inches
Bottom of Tube to End of Exhaust Tube	---	1/2 max. inches
Bottom of Tube to End of Ignitor Terminal	1/2	1/4 max. inches
Length of Ignitor Terminal	---	1/4 ± 1/32 inches

from JETEC release #2129, March 10, 1958

GL-7179

IGNITRON

RECTIFIER SERVICE - 670 AMPERES TWO IGNITORS

AUXILIARY ANODE

DESCRIPTION AND RATING

The GL-7179 is a 12-inch single-grid ignitron designed for industrial rectifier service. In such applications, six tubes in a double-wye circuit will supply 1000 kilowatts continuously at 250 volts d-c. In addition it will withstand the normal industrial overloads.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode Excitation - Cyclic		
Cathode Spot Starting - Ignitor		
Number of Electrodes		
Main Anodes	1	
Auxiliary Anodes	1	
Ignitors	2	
Control Grids	1	
Arc Drop at 200 Peak Amperes	20	Volts

Mechanical

Envelope Material - Stainless Steel		
Net Weight, approximate	.190	Pounds

Thermal

Type of Cooling - Water		
Inlet Water Temperature, minimum	30	C
Outlet Water Temperature, maximum	50	C
Water Flow, minimum *		
At Continuous Rated Load	10	Gallons per Minute
At No Load	1	Gallons per Minute
Characteristics for Water Cooling at 10 Gallons per Minute		
Water Temperature Rise, maximum	9	C
Pressure Drop, maximum	2.5	Pounds per Square Inch
Maximum Working Water Pressure	100	Pounds per Square Inch

MAXIMUM RATINGS AND TYPICAL OPERATION

Power Rectifier Service, Continuous Duty
Ratings are for Zero-Phase Control Angle

Maximum Peak Anode Voltage	700	Volts
Maximum Anode Current		
Peak	2500	Amperes
Average		
Continuous	670	Amperes
Two Hours, Averaged Over Any Two-Minute Interval	840	Amperes
One Minute, Averaged Over Any One-Minute Interval	1340	Amperes
Fault		
Peak Forward Direction	20,000	Amperes
Peak Reverse Direction	40,000	Amperes
Maximum Duration of Fault Current	0.15	Seconds
Frequency	.25 - 60	Cycles per Second
Ignitor Characteristics		
Maximum Inverse Voltage	5	Volts
Recommended Pulse Length	800	Microseconds
Minimum Pulse Length, average anode current greater than 20 Amperes	150	Microseconds
Maximum Pulse Length	4000	Microseconds

	Minimum	Maximum	
Grid			
Peak Forward Voltage	200	500	Volts
Peak Inverse Voltage	100	200	Volts
Peak Forward Current	0.4	5	Amperes
Peak Inverse Current	0.4	1	Amperes
Excitation Anode Characteristics			
Recommended Peak Forward Voltage	75 - 150		Volts
Maximum Peak Inverse Current		0.1	Amperes
Recommended Forward Current, average	3 - 10		Amperes

* Water flow should be continued for one hour after removal of anode power.

APPLICATION NOTES

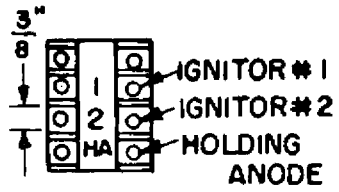
To prevent excessive condensation of mercury on the inside of the glass, heat should be externally applied to the anode glass-seal area.

Electronic Components Division

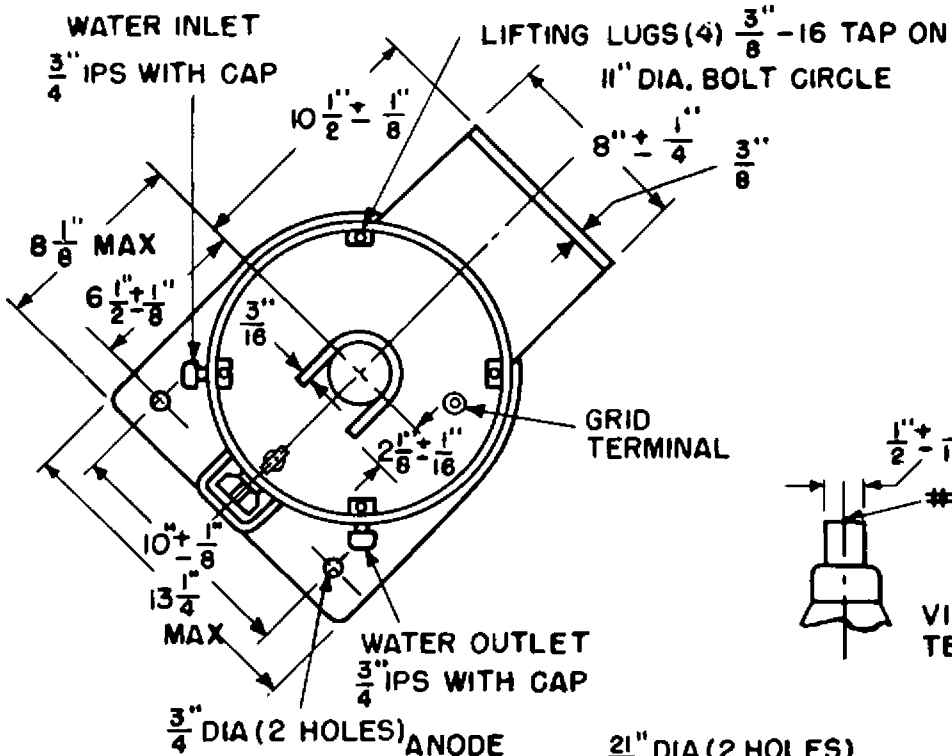
GENERAL ELECTRIC COMPANY

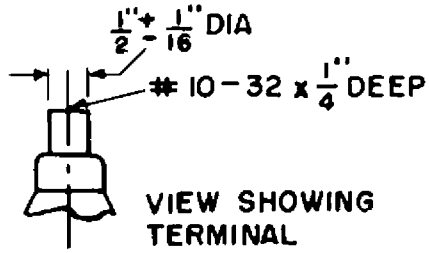
Schenectady 5, N. Y.

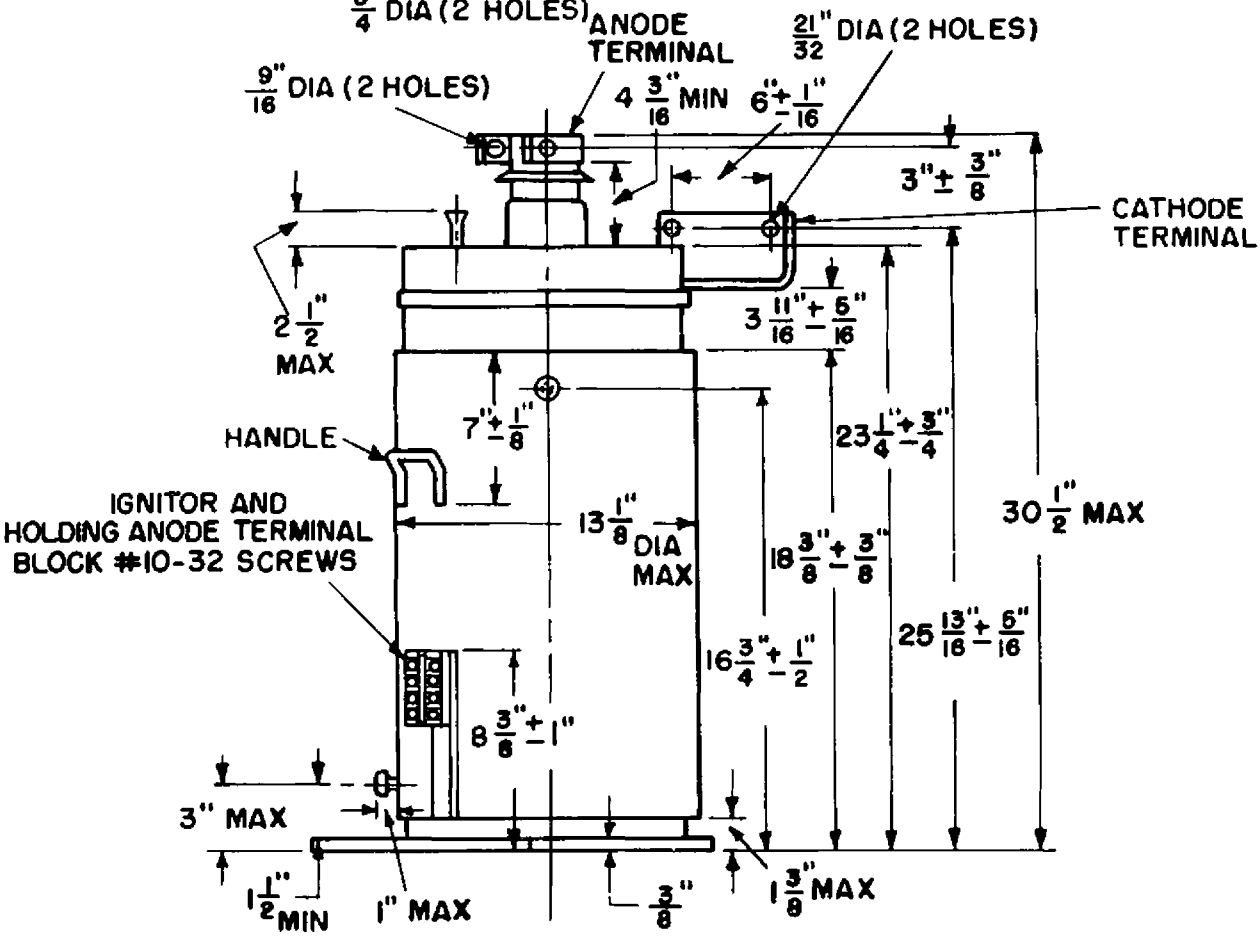
OUTLINE GL-7179



VIEW SHOWING IGNITOR AND HOLDING ANODE TERMINALS







JOINT ELECTRON TUBE ENGINEERING COUNCIL

650 Salmon Tower
11 West Forty-Second Street
New York 36, N.Y.
Telephone: LOngacre 5-3450

Announcement

of

Electron Device Type Registration

Release No. 2129

March 10, 1958

The Joint Electron Tube Engineering Council announces the registration of the following electron device designations

7179*
7180**

according to the ratings and characteristics found on the attached data sheets on the application of

General Electric Company
Schenectady 5, New York

*The prefix "GL" used on the attached data sheets is not to be considered part of the JETEC assigned type designation.

**The type 7180 has the identical electrical characteristics as the 7179, but features an integral type thermostatic arrangement, which provides automatic control of the cooling water supply valve and over-temperature protection.

E. I. A.
REGISTRATION
FILE

ELECTRONICS

7189-A
PENTODE
FOR AF POWER AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 7189-A is a power-amplifier pentode designed for use in the audio-frequency power output stage of television and radio receivers and high-fidelity amplifiers.

The 7189-A is unilaterally interchangeable, both electrically and mechanically, with the 7189. It differs from the 7189 in having a higher screen-voltage rating and in specifying the internal connections to pins 1 and 6.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.76	Amperes

Direct Interelectrode Capacitances§

Grid-Number 1 to Plate: (g1 to p)	0.5	pf
Input: g1 to (h + k + g2 + g3)	10.8	pf
Output: p to (h + k + g2 + g3)	6.5	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-4

Maximum Diameter	0.875	Inches
Maximum Over-all Length	3.063	Inches
Maximum Seated Height	2.813	Inches

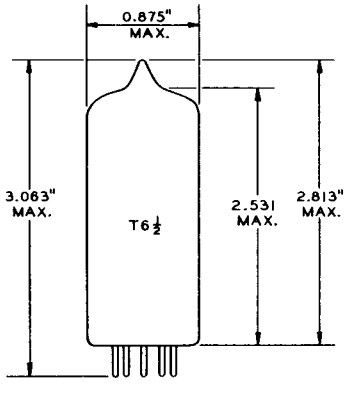
MAXIMUM RATINGS

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

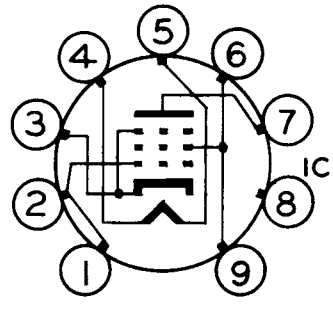


EIA 6-4

TERMINAL CONNECTIONS

Pin 1 - Grid Number 1
Pin 2 - Grid Number 1
Pin 3 - Cathode and Grid Number 3 (Suppressor)
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Plate
Pin 8 - Internal Connection-Do Not Use
Pin 9 - Grid Number 2 (Screen)

BASING DIAGRAM



EIA 9LE

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

DESIGN-MAXIMUM VALUES

Plate Voltage	440	Volts
Screen Voltage	400¶	Volts
Plate Dissipation	13.2	Watts
Screen Dissipation	2.2#	Watts
DC Cathode Current	72	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	100	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.3	Megohms
With Cathode Bias	1.0	Megohms

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	-7.3	Volts
Plate Resistance, approximate	40000	Ohms
Transconductance	11300	Micromhos
Plate Current	48	Milliamperes
Screen Current	5.5	Milliamperes
Amplification Factor (Grid-Number 1 to Grid-Number 2)	19.5	

CLASS A_1 AMPLIFIER

Plate Voltage	250	250	250	250	Volts
Screen Voltage	250	250	250	210	Volts
Grid-Number 1 Voltage	-7.3	-7.3	-8.4	-6.4	Volts
Peak AF Grid-Number 1 Voltage	6.1	6.2	4.95	4.8	Volts
Zero-Signal Plate Current	48	48	36	36	Milliamperes
Maximum-Signal Plate Current	49.5	50.6	36.8	36.6	Milliamperes
Zero-Signal Screen Current	5.5	5.5	4.1	3.9	Milliamperes
Maximum-Signal Screen Current	10.8	10	8.5	7.3	Milliamperes
Load Resistance	5200	4500	7000	7000	Ohms
Total Harmonic Distortion, approximate	10	10	10	10	Percent
Maximum-Signal Power Output	5.7	5.7	4.2	4.3	Watts

PUSH-PULL CLASS AB_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	250	300	400	Volts
Screen Voltage	250	300	300	Volts
Cathode-Bias Resistor	130	130	---	Ohms
Grid-Number 1 Voltage	---	---	-15	Volts
Peak AF Grid-to-Grid Voltage	22.6	28.2	30	Volts
Zero-Signal Plate Current	62	72	15	Milliamperes
Maximum-Signal Plate Current	75	92	105	Milliamperes
Zero-Signal Screen Current	7.0	8.0	1.6	Milliamperes
Maximum-Signal Screen Current	15	22	25	Milliamperes
Effective Load Resistance, Plate-to-Plate	8000	8000	8000	Ohms
Total Harmonic Distortion	3	4	4	Percent
Maximum-Signal Power Output	11	17	24	Watts

PUSH-PULL CLASS B AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	250	300	Volts
Screen Voltage	250	300	Volts
Grid-Number 1 Voltage	-11.6	-14.7	Volts
Peak AF Grid-to-Grid Voltage	22.6	28.2	Volts
Zero-Signal Plate Current	20	15	Milliamperes
Maximum-Signal Plate Current	75	92	Milliamperes
Zero-Signal Screen Current	2.2	1.6	Milliamperes
Maximum-Signal Screen Current	15	22	Milliamperes
Effective Load Resistance, Plate-to-Plate	8000	8000	Ohms
Total Harmonic Distortion	3	4	Percent
Maximum-Signal Power Output	11	17	Watts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

CLASS A_1 AMPLIFIER, TRIODE CONNECTION△

Plate Voltage	250	Volts
Cathode-Bias Resistor	270	Ohms
Peak AF Grid-Number 1 Voltage	9.5	Volts
Zero-Signal Plate Current	34	Milliamperes
Maximum-Signal Plate Current	36	Milliamperes
Load Resistance	3500	Ohms
Total Harmonic Distortion, approximate	9	Percent
Maximum-Signal Power Output	1.95	Watts

PUSH-PULL CLASS AB_1 AMPLIFIER, TRIODE CONNECTION, VALUES FOR TWO TUBES△

Plate Voltage	250	300	Volts
Cathode-Bias Resistor	270	270	Ohms
Peak AF Grid-to-Grid Voltage	23.4	28.2	Volts
Zero-Signal Plate Current	40	48	Milliamperes
Maximum-Signal Plate Current	43.4	52	Milliamperes
Effective Load Resistance, Plate-to-Plate	10000	10000	Ohms
Total Harmonic Distortion	2.5	2.5	Percent
Maximum-Signal Power Output	3.4	5.2	Watts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

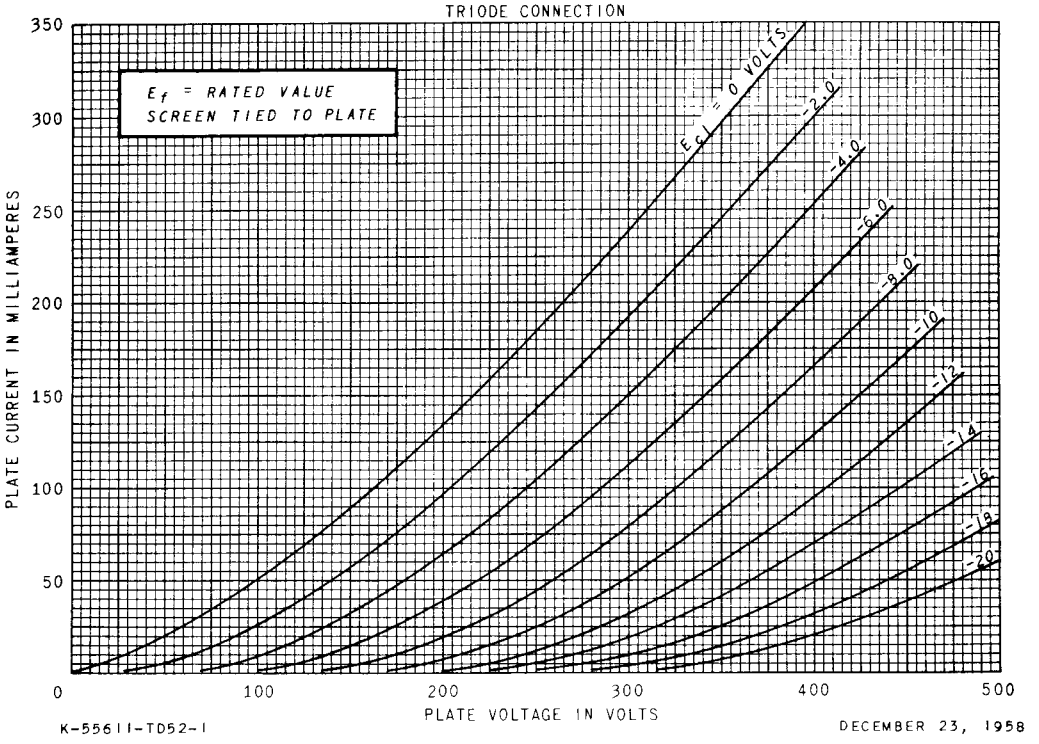
¶ The Design-Maximum screen voltage rating is 415 volts in push-pull circuits where the screen of each tube is connected to a tap on the plate winding of the output transformer.

\# Screen dissipation may reach 4.4 watts during periods of maximum input of speech and music signals, under worst probable operating conditions as specified for the Design-Maximum rating system.

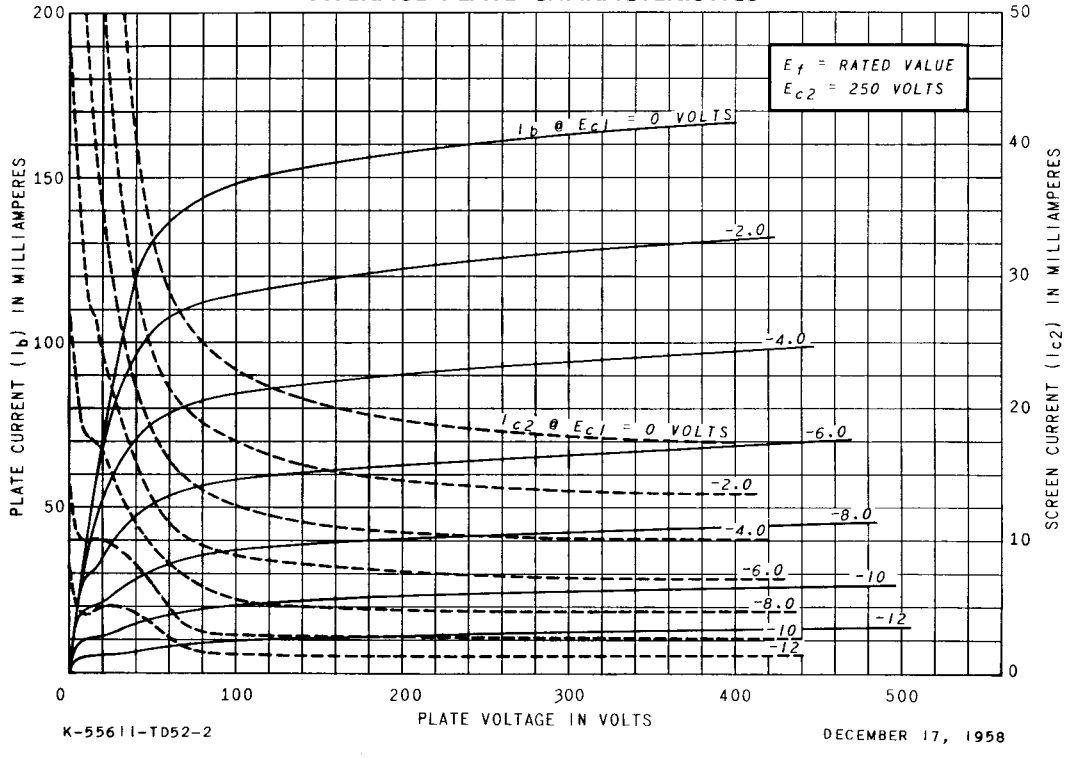
△ With screen tied to plate.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

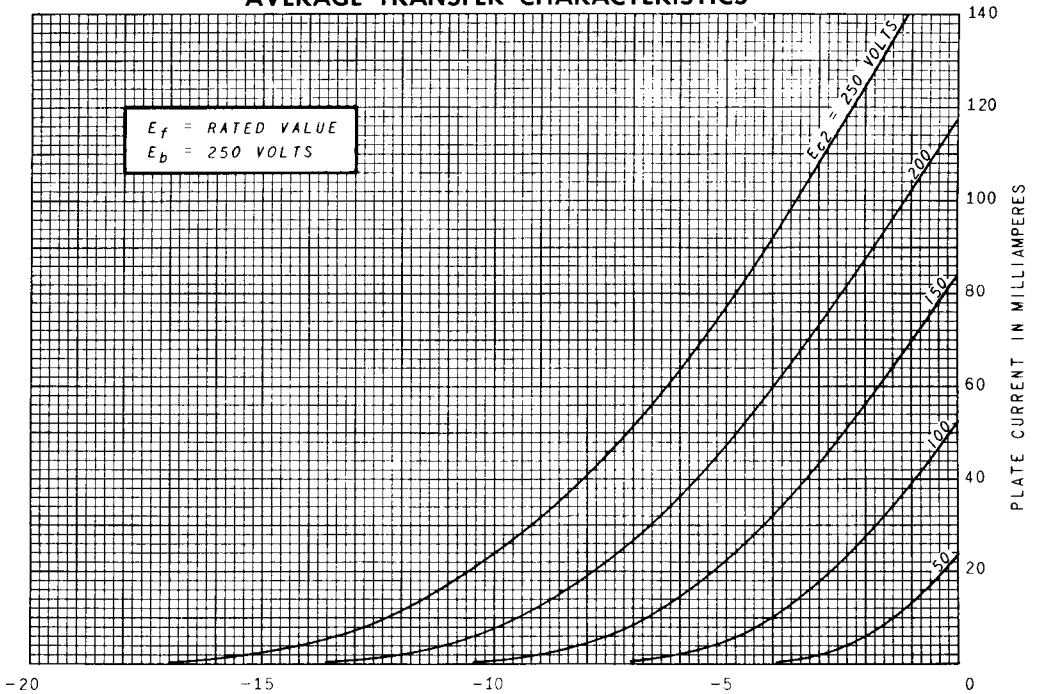
AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



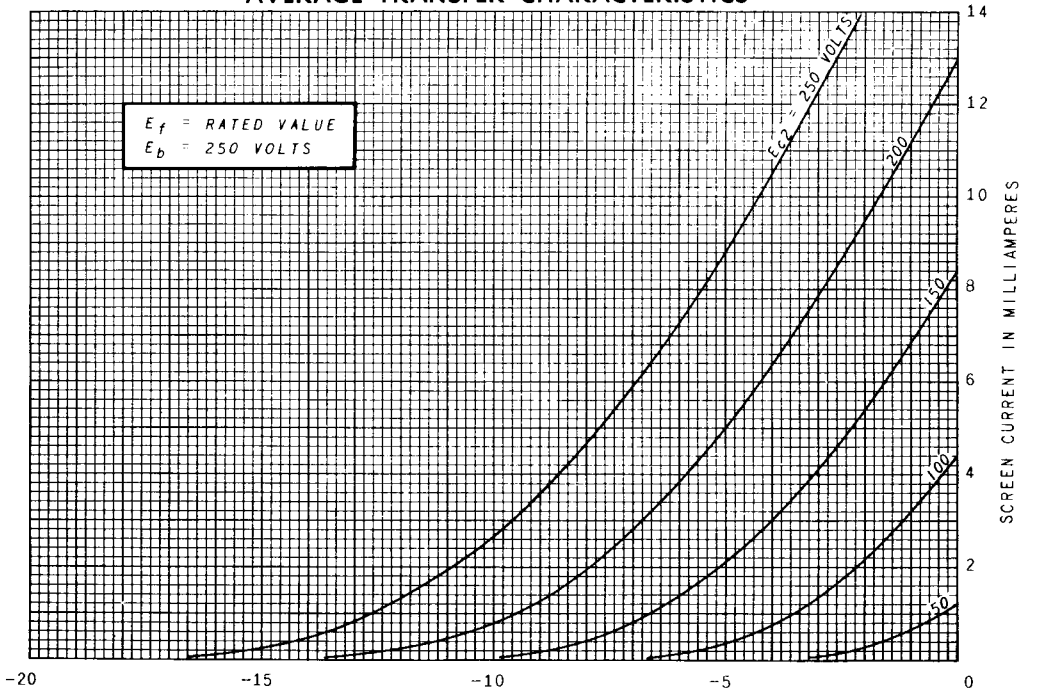
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD52-3

DECEMBER 23, 1958

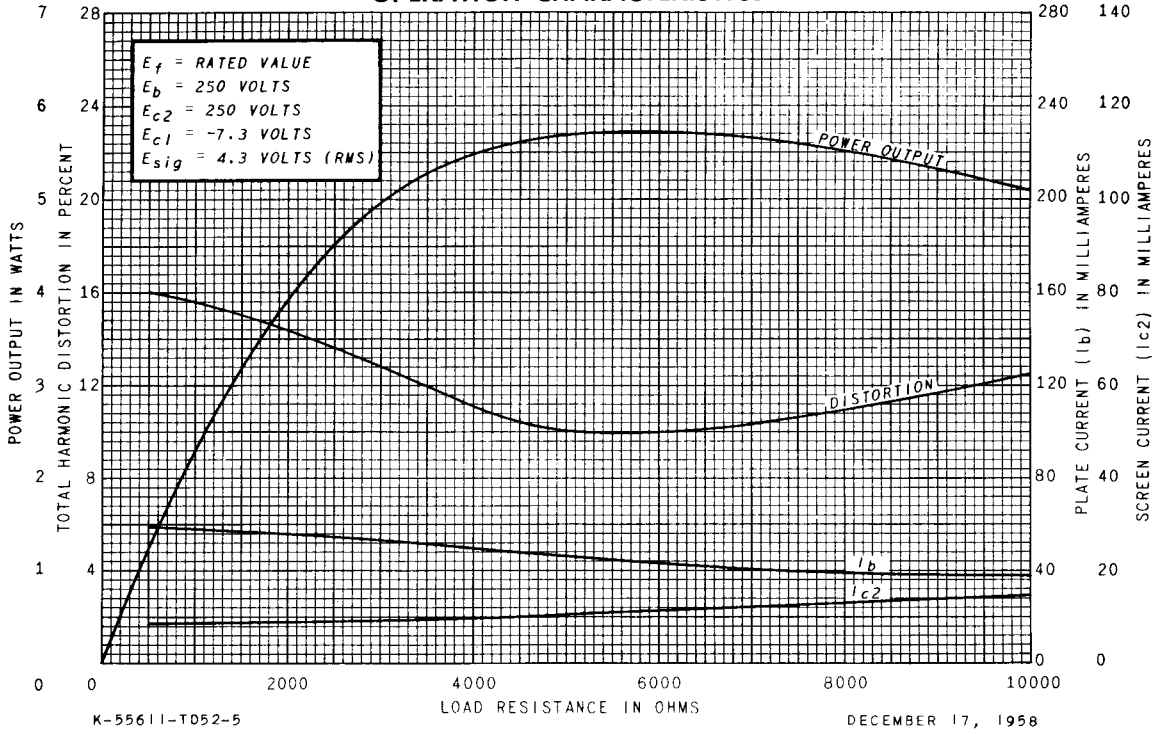
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD52-4

DECEMBER 23, 1958

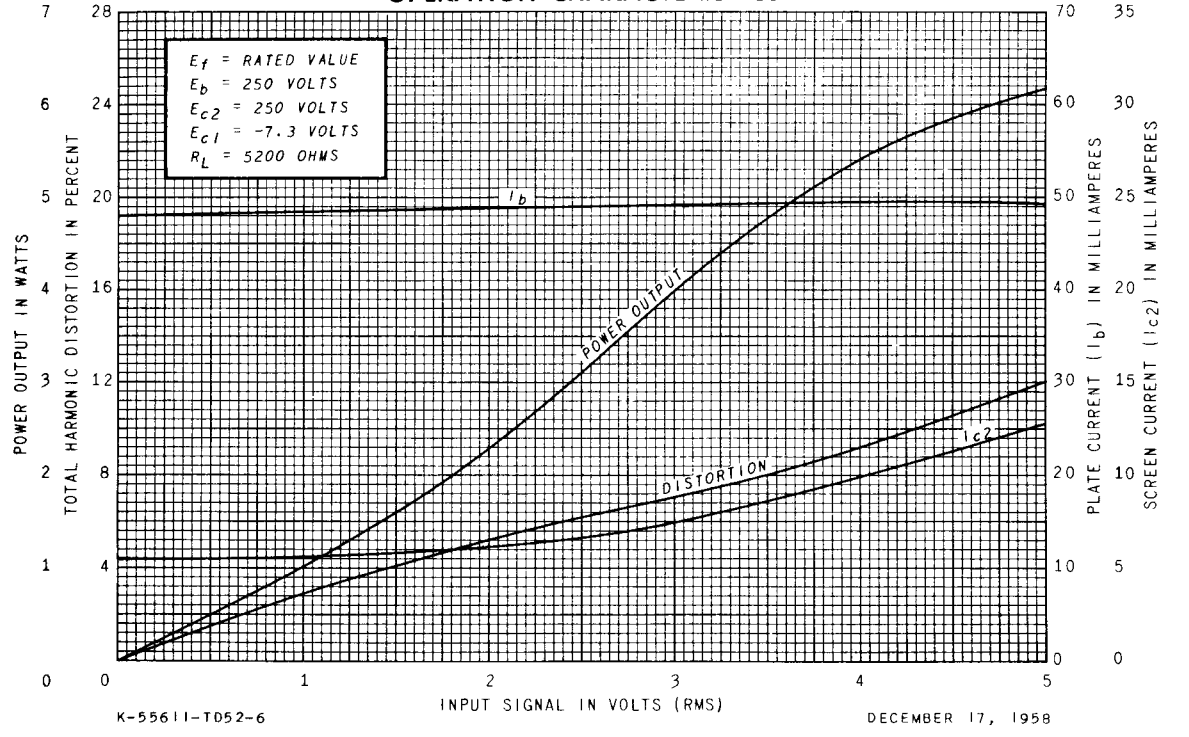
OPERATION CHARACTERISTICS



K-55611-TD52-5

DECEMBER 17, 1958

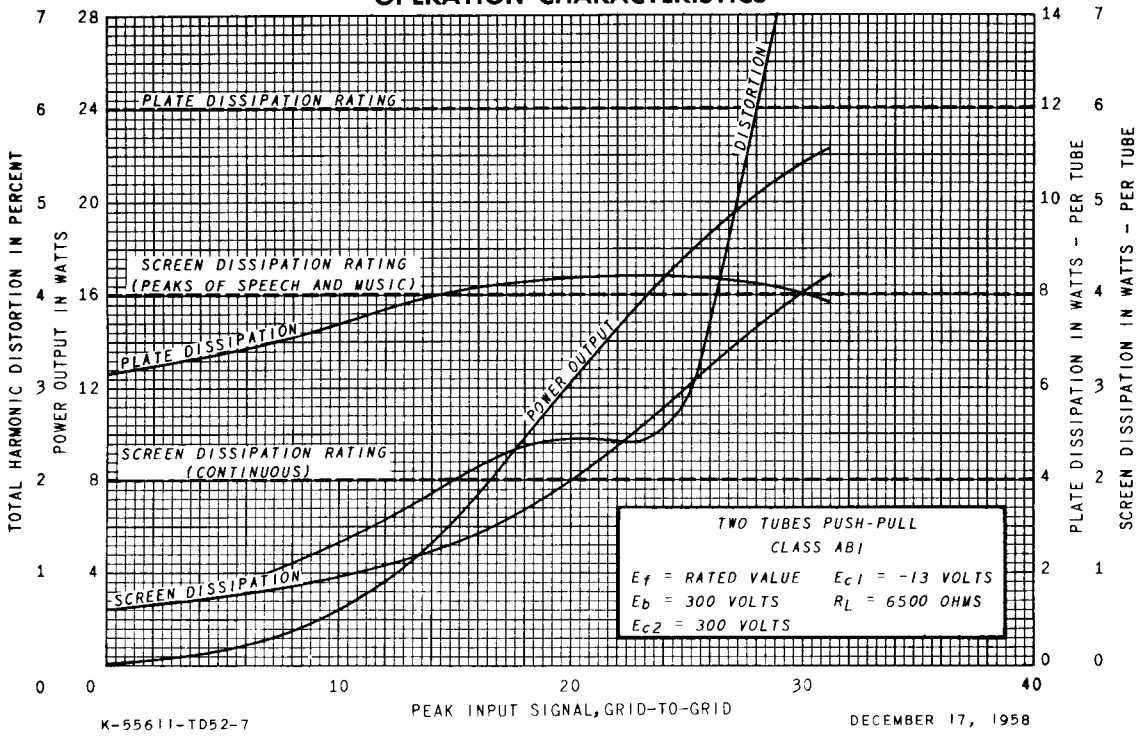
OPERATION CHARACTERISTICS



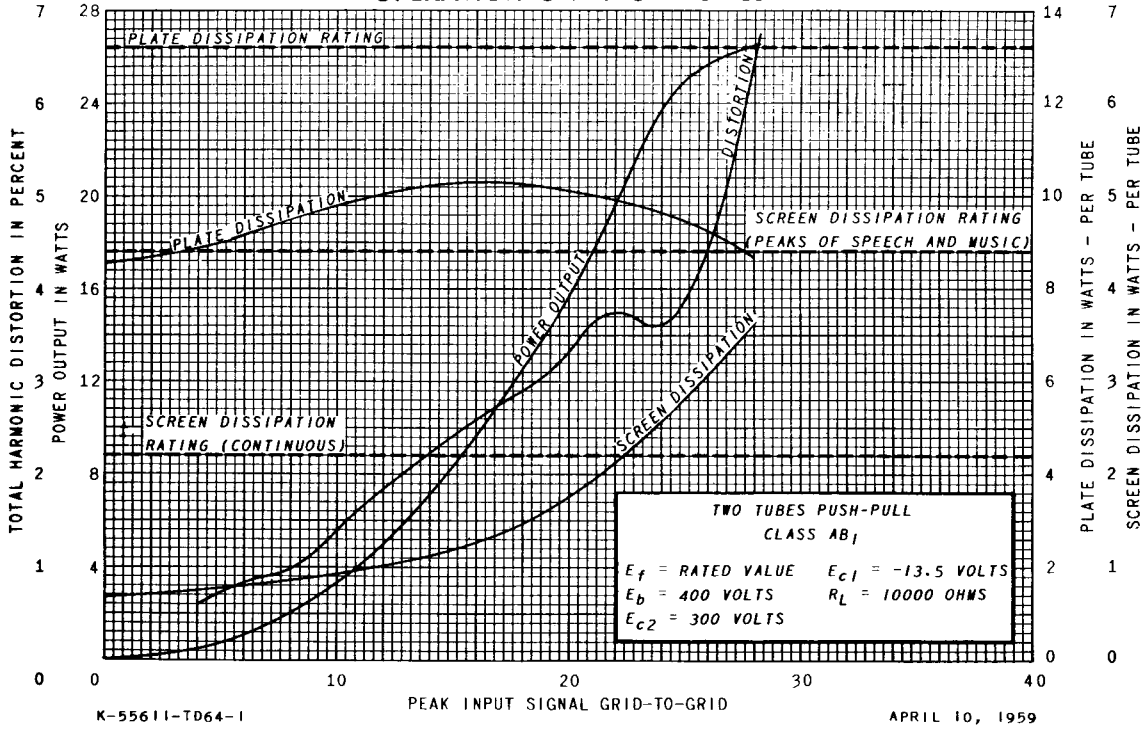
K-55611-TD52-6

DECEMBER 17, 1958

OPERATION CHARACTERISTICS



OPERATION CHARACTERISTICS



DESCRIPTION AND RATING

The 7233 is a miniature, low-mu triode designed for service as a series regulator tube in power supplies. It is especially suited for use in compact electronic instruments.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	1.0	Amperes
Direct Interelectrode Capacitances, approximate‡		
Grid to Plate: (g to p)	14	μμf
Input: g to (h+k)	7.5	μμf
Output: p to (h+k)	2.2	μμf

MECHANICAL

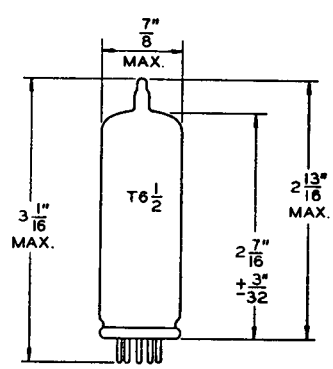
Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

SERIES-REGULATOR SERVICE—ABSOLUTE-MAXIMUM VALUES

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	135	Volts
Plate Dissipation	8.0	Watts
DC Cathode Current	150	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	300	Volts
Heater Negative with Respect to Cathode	300	Volts
Grid-Circuit Resistance		
With Fixed Bias§	0.1	Megohms
With Cathode Bias	1.0	Megohms
Cathode Resistor, minimum	See Rating Chart, Page 2	
Bulb Temperature at Hottest Point	200	C

PHYSICAL DIMENSIONS

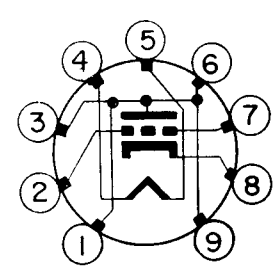


EIA 6-4

TERMINAL CONNECTIONS

Pin 1—Plate
Pin 2—Grid
Pin 3—Plate
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate
Pin 7—Grid
Pin 8—Cathode
Pin 9—Plate

BASING DIAGRAM



EIA 9FR

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Supply Voltage	50	
Plate Voltage	125	Volts
Cathode-Bias Resistor	22	Ohms
Amplification Factor	4.0	
Plate Resistance, approximate	230	Ohms
Transconductance	17500	Micromhos
Plate Current	120	Milliamperes
Grid Voltage, approximate		
Ib = 1.0 Milliampere	−60	Volts

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ The use of fixed bias is not recommended when two or more tubes are used in parallel.

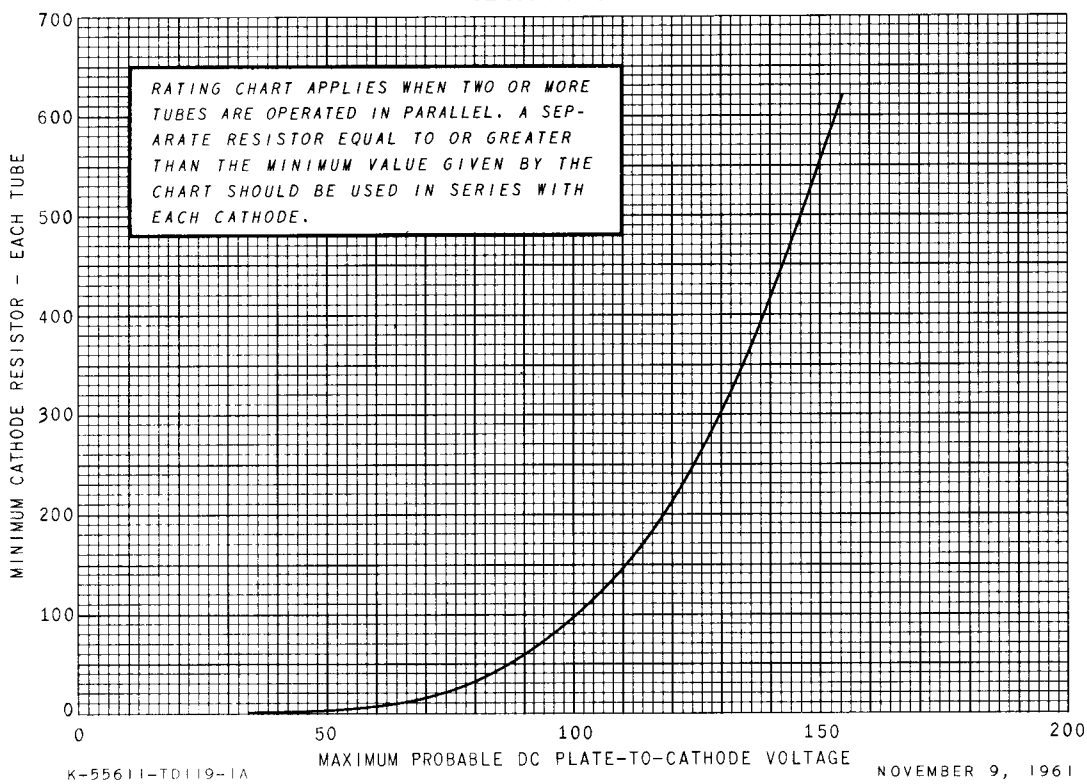
Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

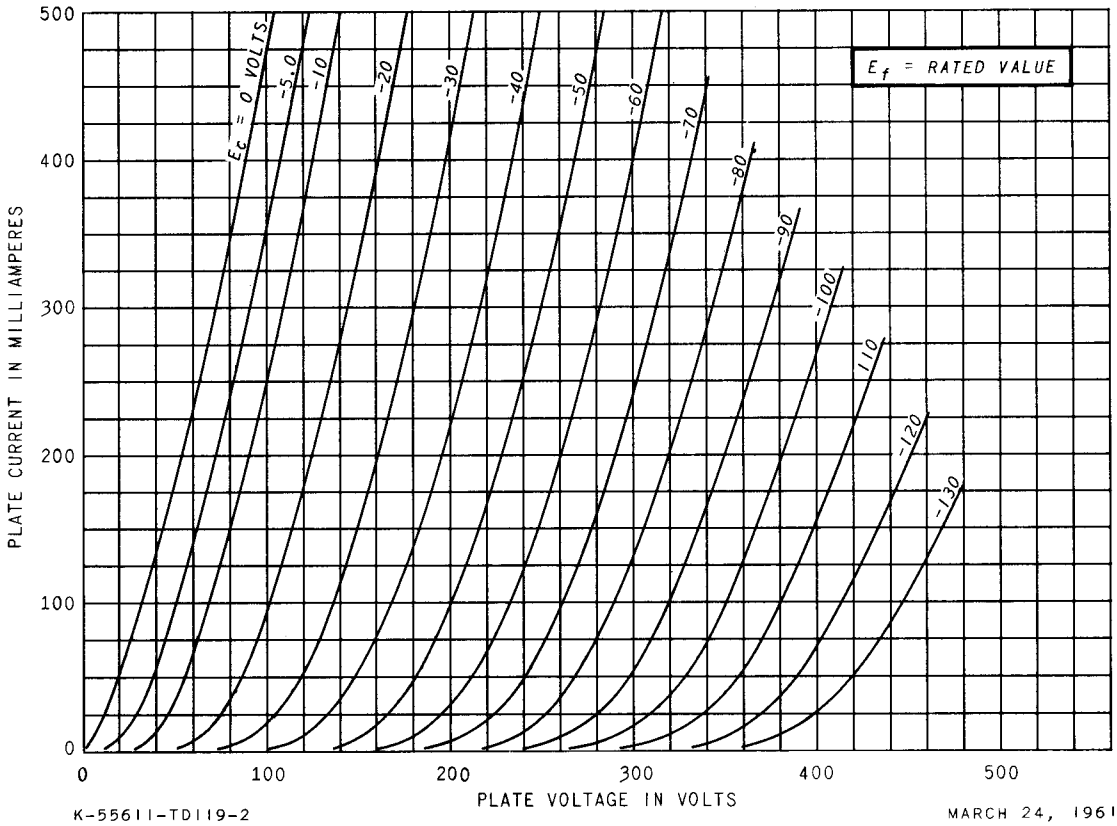
The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

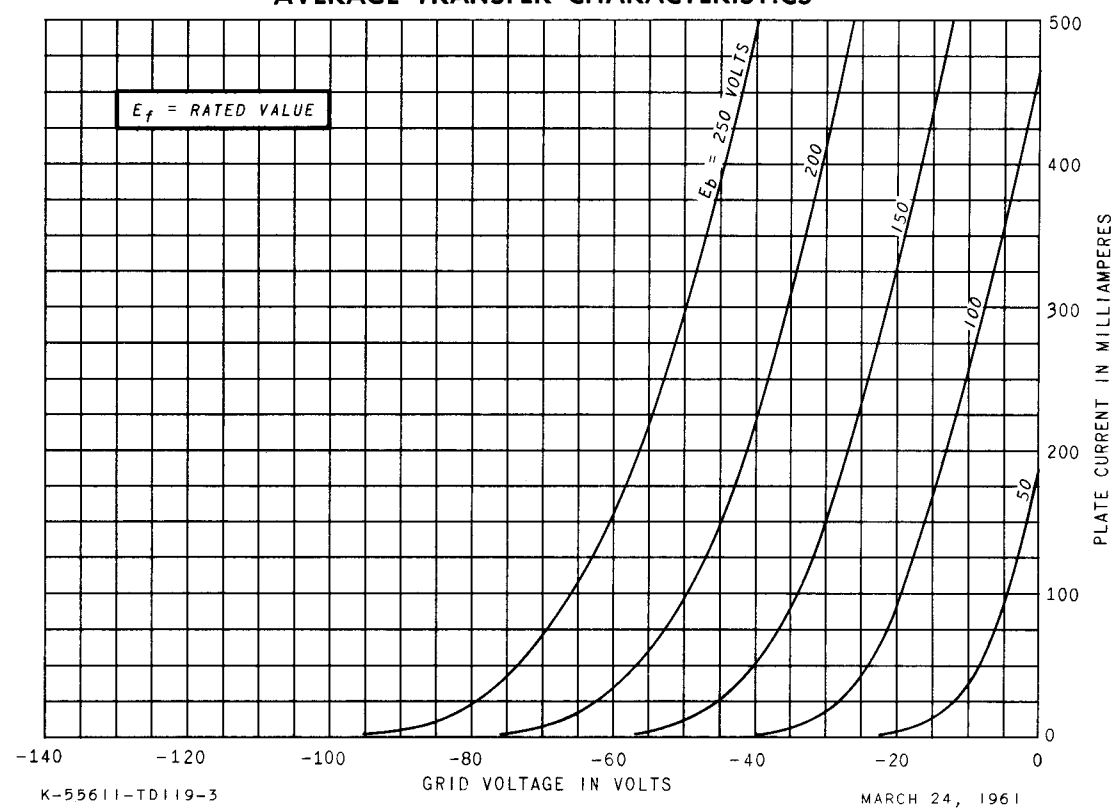
RATING CHART



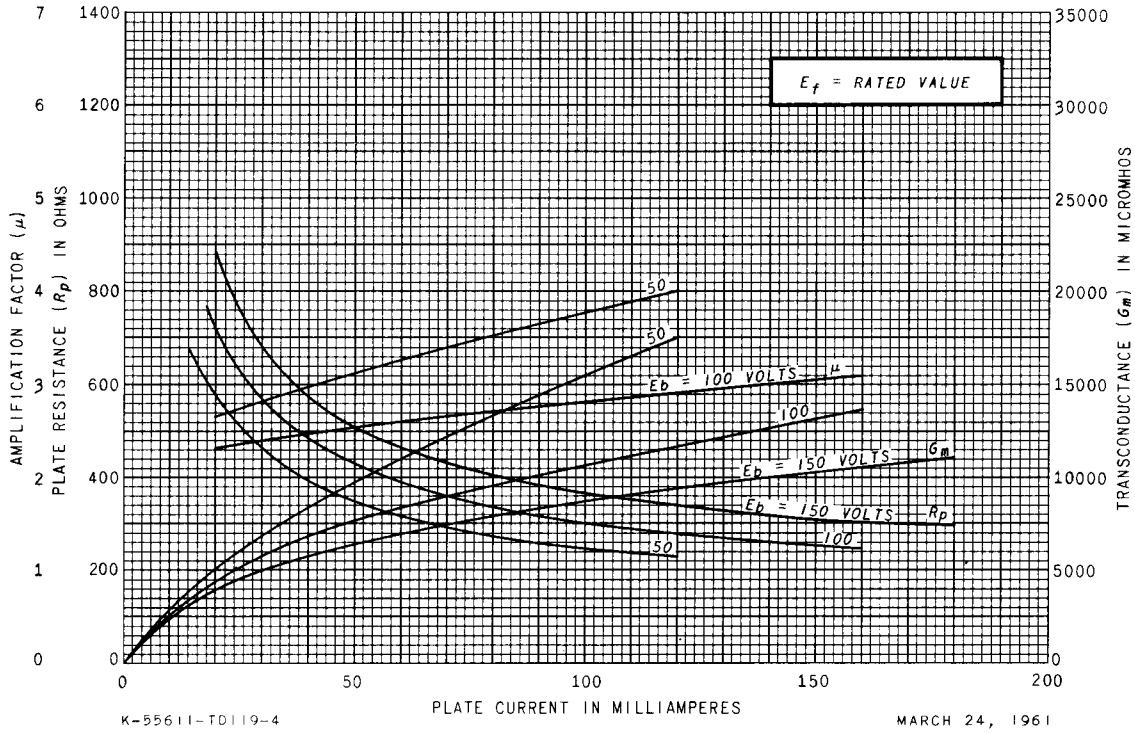
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

DOUBLE TRIODE

DESCRIPTION AND RATING

The 7247 is a dissimilar double-triode designed for use in high-fidelity audio amplifiers. Section 1, which is similar to one section of a 7025, is intended for application in low-level, high-gain stages where low hum and microphonism are desired. Section 2, which is similar to one section of a 12AU7, is intended for cathode follower or phase-inverter service.

GENERAL

ELECTRICAL

	Series	Parallel	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC*	12.6 ± 1.3	6.3 ± 0.6	Volts
Heater Current†	0.15	0.3	Amperes
Direct Interelectrode Capacitances‡	Section 1§	Section 2¶	
Grid to Plate: (g to p)	1.7	1.4	pf
Input: g to (h+k)	1.6	9.8	pf
Output: p to (h+k)	0.37	0.33	pf

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Section 1§	Section 2¶	
Plate Voltage	330	330	Volts
Positive DC Grid Voltage	0	0	Volts
Negative DC Grid Voltage	−55	−55	Volts
Plate Dissipation	1.2	3.0	Watts
DC Cathode Current	...	22	Milliamperes
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts
Grid-Circuit Resistance			
With Fixed Bias	15	0.5	Megohms
With Cathode Bias	...	1.0	C

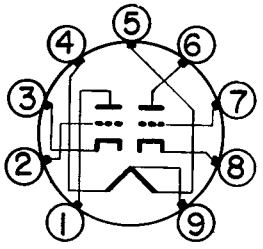
Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

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BASING DIAGRAM

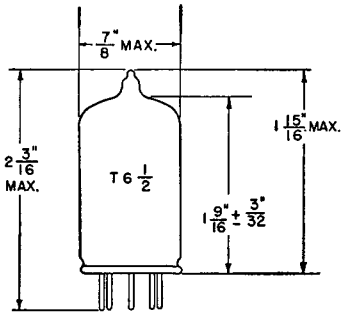


EIA 9A

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Heater Center-Tap

PHYSICAL DIMENSIONS



EIA 6-2

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

	Section 1§		Section 2¶		
Plate Voltage	100	250	100	250	Volts
Grid Voltage	−1.0	−2.0	0	−8.5	Volts
Amplification Factor	100	100	20	17	
Plate Resistance, approximate	80,000	62,500	6500	7700	Ohms
Transconductance	1250	1600	3100	2200	Micromhos
Plate Current	0.5	1.2	11.8	10.5	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	.....	.....	....	−24	Volts
Equivalent Noise and Hum Voltage, Section 1, average, true RMS△				1.8	Microvolts
Equivalent Noise and Hum Voltage, Section 1, maximum, true RMSϕ				7.0	Microvolts

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current at bogey heater voltage.

‡ Without external shield.

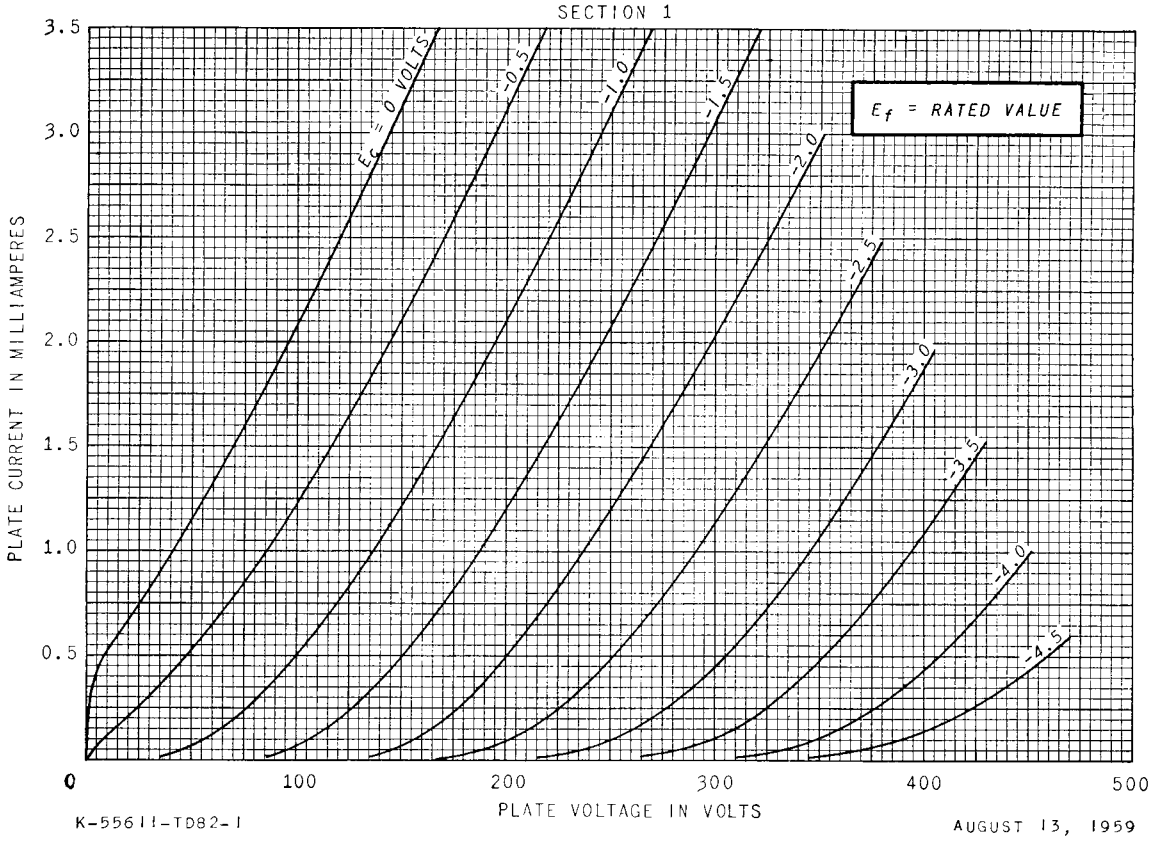
§ Section 1 connects to Pins 6, 7, and 8.

¶ Section 2 connects to Pins 1, 2, and 3.

△Referred to grid and measured under the following conditions:
Ef = 6.3 volts AC (parallel connection), CT of heater transformer grounded; Ebb = 250 volts; Rb = 100,000 ohms; Rk = 2700 ohms, bypassed with 100 μf; Rg = 0 ohms; Amplifier frequency range = 25 to 10,000 cps.

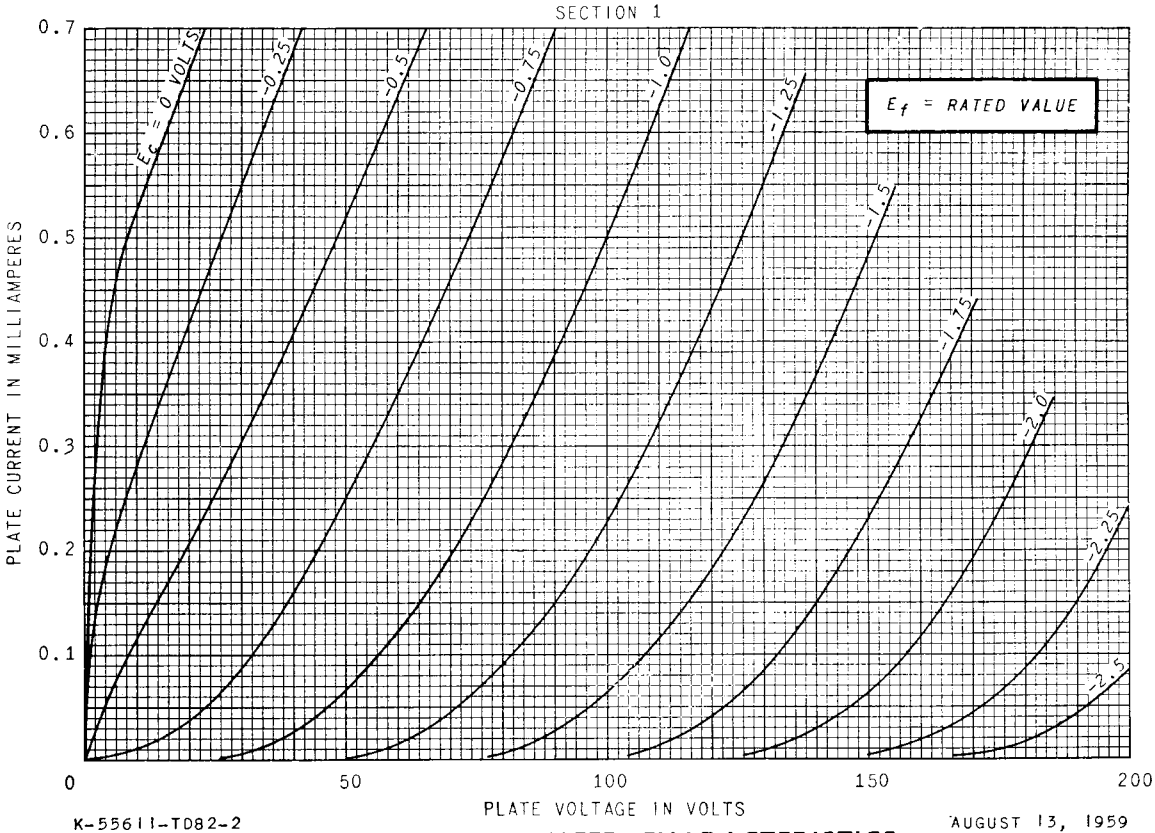
ϕ Referred to grid and measured under the following conditions:
Ef = 6.3 volts AC (parallel connection), CT of heater transformer grounded; Ebb = 250 volts; Rb = 100,000 ohms; Rk = 2700 ohms, unbypassed; Rg = 50,000 ohms; Amplifier frequency range = 25 to 10,000 cps.

AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS

SECTION 1

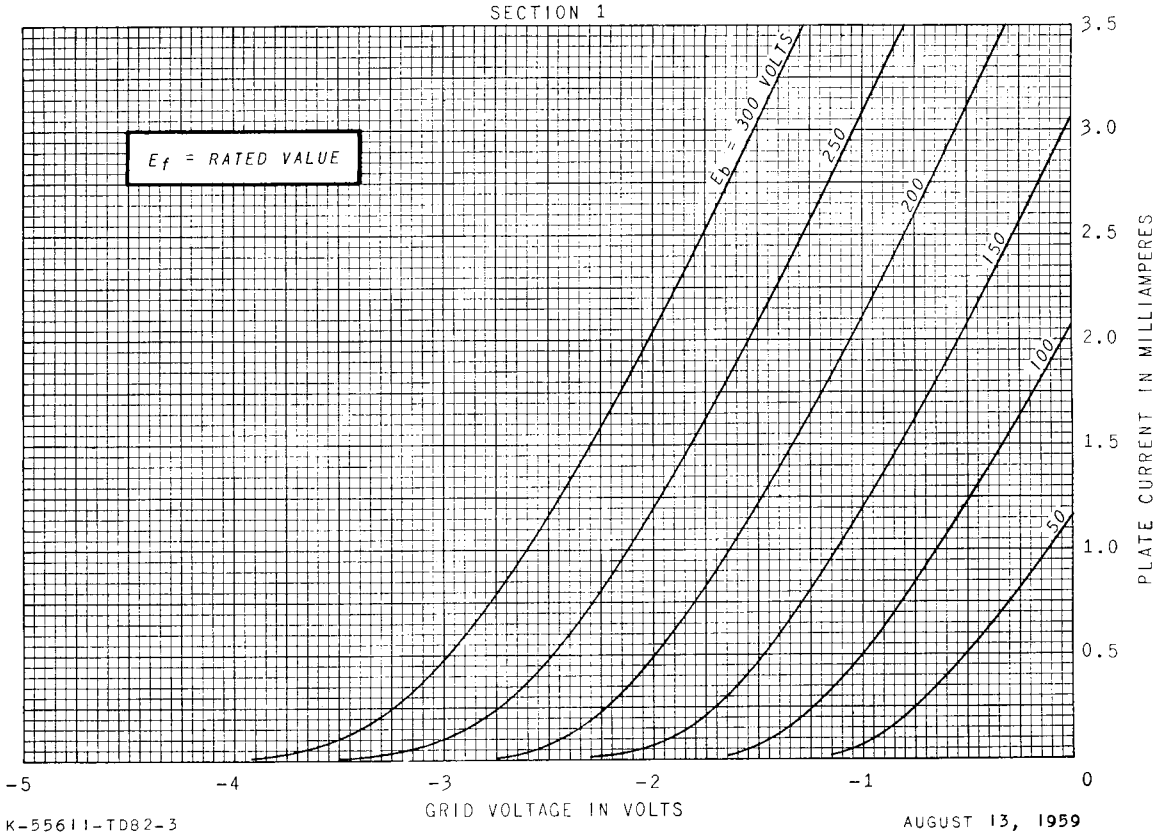


K-55611-TD82-2

AUGUST 13, 1959

AVERAGE TRANSFER CHARACTERISTICS

SECTION 1

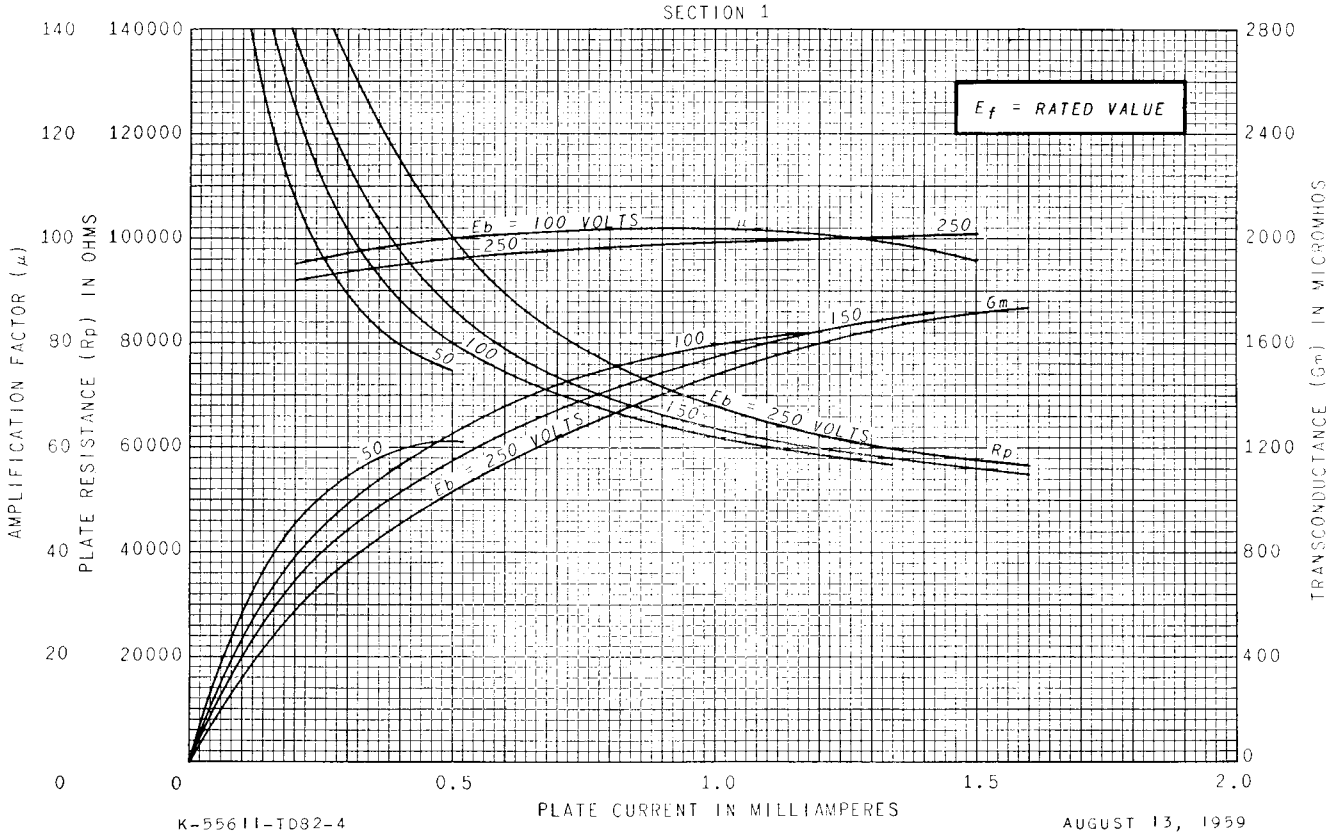


K-55611-TD82-3

AUGUST 13, 1959

AVERAGE CHARACTERISTICS

SECTION 1

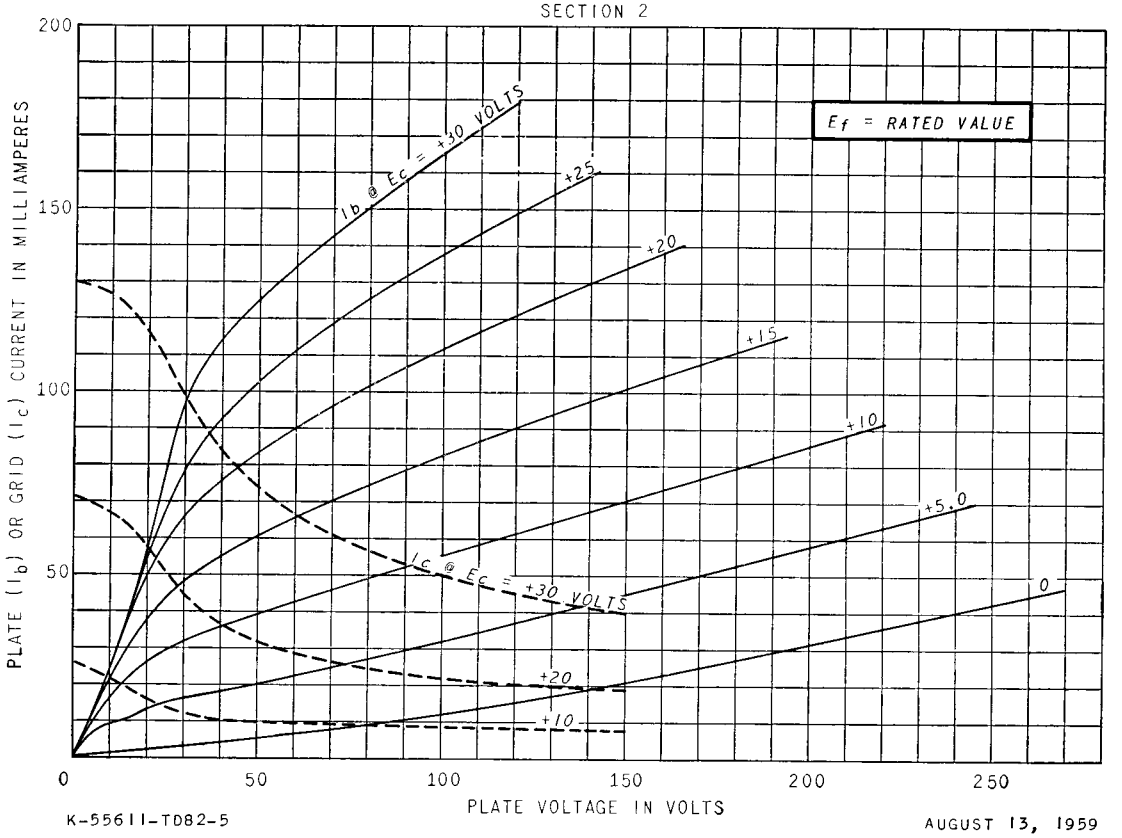


K-55611-TD82-4

AUGUST 13, 1959

AVERAGE PLATE CHARACTERISTICS

SECTION 2

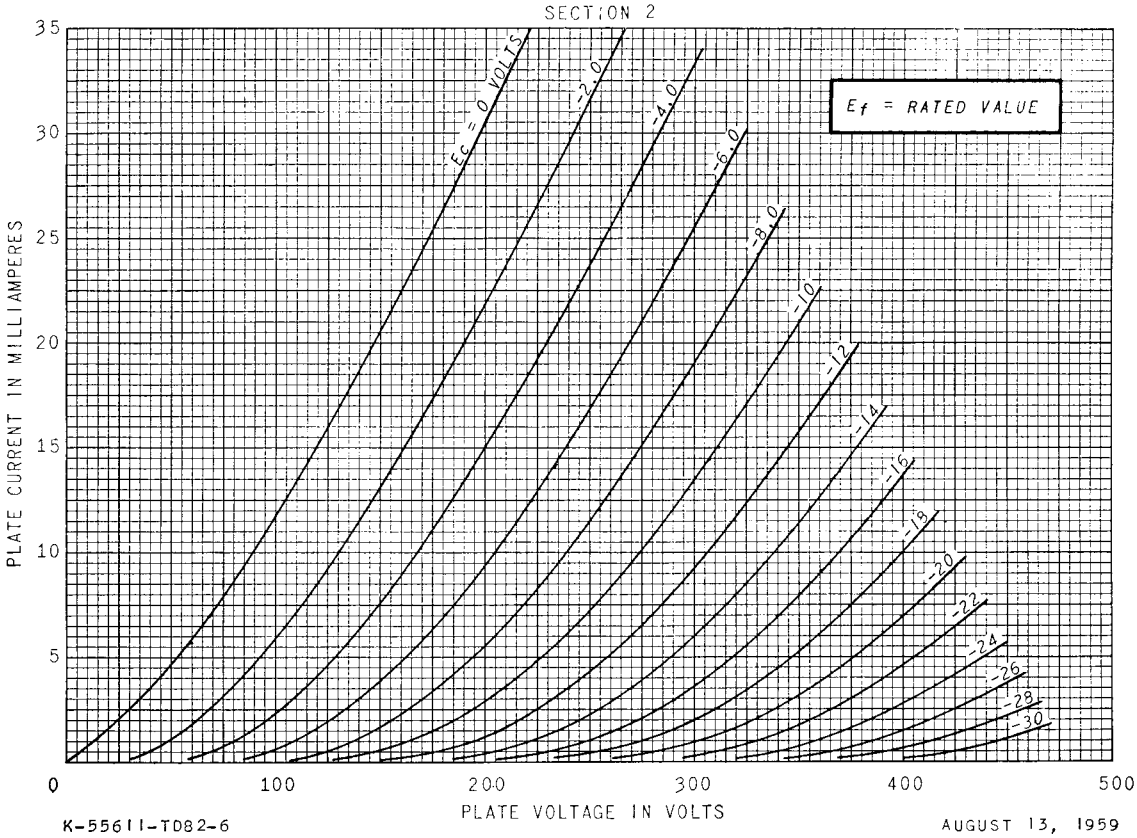


K-55611-TD82-5

AUGUST 13, 1959

AVERAGE PLATE CHARACTERISTICS

SECTION 2

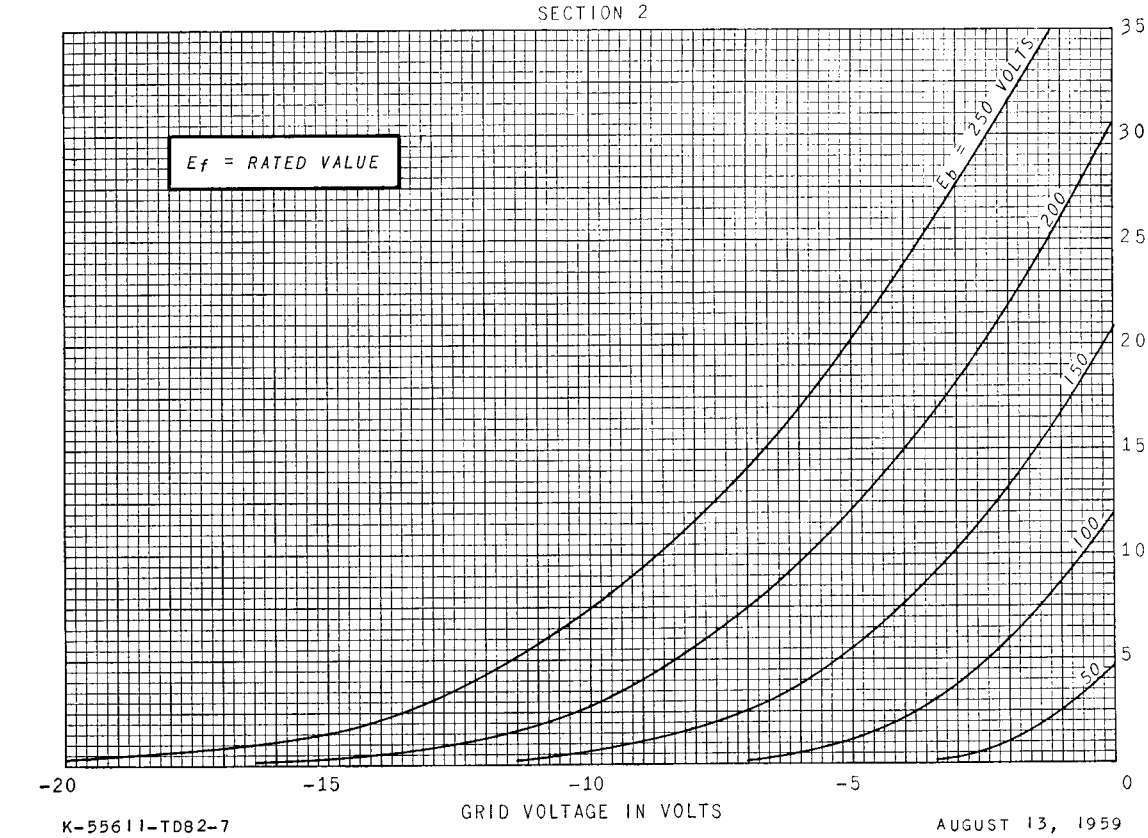


K-55611-TD82-6

AUGUST 13, 1959

AVERAGE TRANSFER CHARACTERISTICS

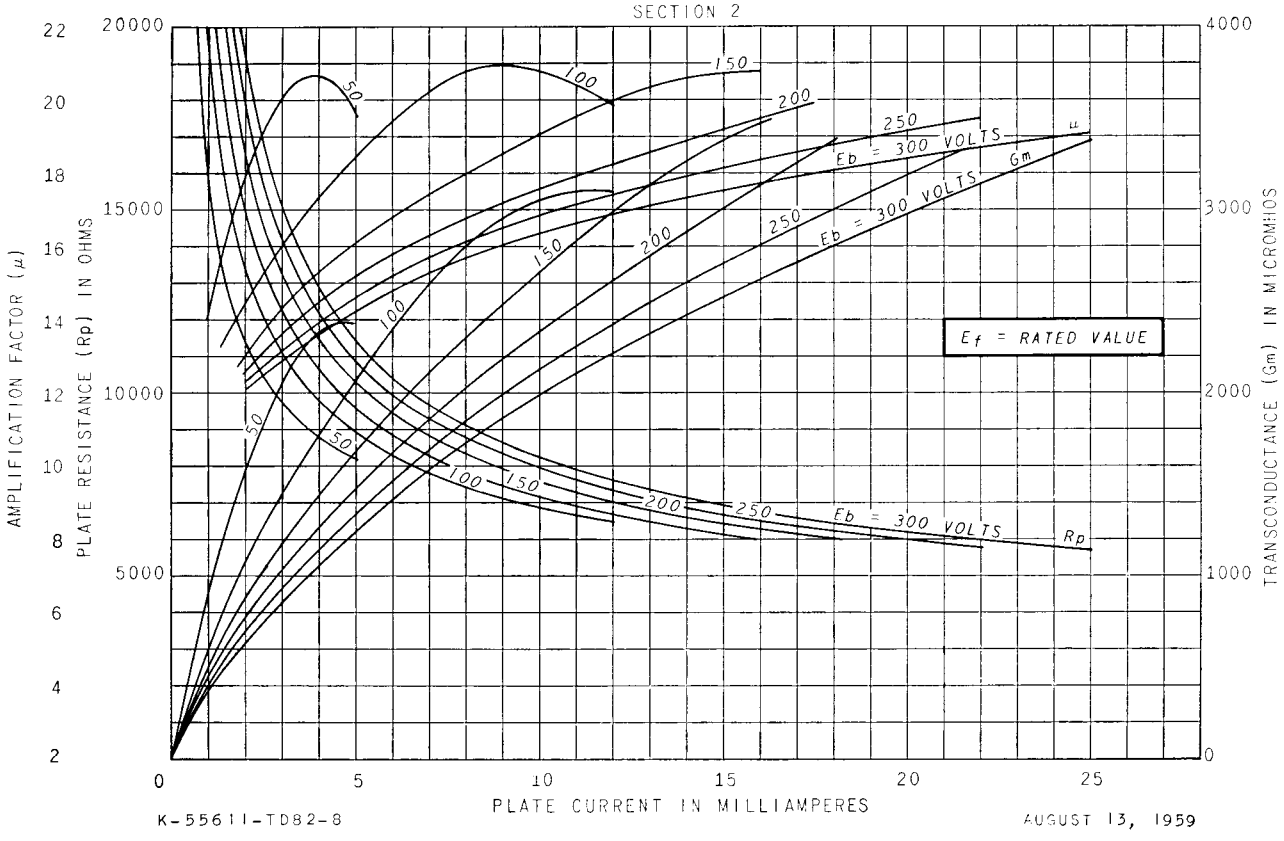
SECTION 2



K-55611-TD82-7

AUGUST 13, 1959

AVERAGE CHARACTERISTICS

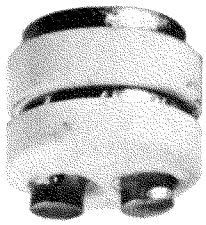


RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

METAL-CERAMIC DIODE



DESCRIPTION AND RATING

The 7266 is a cathode-type diode of ceramic-and-metal planar construction. It is intended for detector, high-frequency instrument probe, and low-current rectifier applications. The 7266 is especially suited for use where unfavorable conditions of mechanical shock, mechanical vibration, and nuclear radiation are encountered.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.3	Volts
Heater Current†	0.215	Amperes

Direct Interelectrode Capacitances‡

Plate to Cathode: (p to k)	1.0	pf
Heater to Cathode: (h to k)	1.3	pf

MECHANICAL

Mounting Position—Any

See Outline Drawing on page 3 for dimensions and electrical connections

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Peak Inverse Plate Voltage	600	Volts
Steady-State Peak Plate Current	11	Milliamperes
DC Output Current	2.2	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point§	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 1.0 Milliamperes DC	1.0	Volts

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AVERAGE CHARACTERISTICS (Continued)

FOOTNOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.
† Heater current of a bogey tube at Ef = 6.3 volts.
‡ Measured using a grounded adapter that provides shielding between external terminals of tube.
§ Operation below the rated maximum envelope temperature is recommended for applications requiring the longest possible tube life. The 7266 is also capable of operation at envelope temperatures much higher than the rated maximum values. For specific recommendations concerning higher temperature operation, contact your General Electric tube sales representative.

INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
Ef = 6.3 volts	198	215	232	Milliamperes
Tube Voltage Drop				
Ef = 6.3 volts, Eb adjusted for Ib = 1.0 ma	0.4	1.0	2.0	Volts
Tube Voltage Drop at Reduced Heater Voltage				
Ef = 5.7 volts, Eb adjusted for Ib = 1.0 ma	...	...	2.3	Volts
Emission				
Ef = 6.3 volts, Eb = 9 volts d-c	10	...	...	Milliamperes
Plate Current				
Ef = 6.3 volts, Ebb = 0 volts, R_L = 40000 ohms	2	8	16	Microamperes
Interelectrode Capacitances				
Plate to Cathode: (p to k)	0.7	1.0	1.3	Picofarads
Heater to Cathode: (h to k)	0.9	1.3	1.7	Picofarads
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	...	...	20	Microamperes
Heater Negative with Respect to Cathode	...	...	20	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode omission results.				
Plate to All at 500 volts d-c	10000	...	...	Megohms

SPECIAL PERFORMANCE TESTS

Low Pressure Voltage Breakdown Test
Statistical sample tested for voltage breakdown at a pressure of 8mm Hg, to simulate an altitude of 100000 feet. Tubes shall not give visual evidence of flashover or corona when 300 volts RMS, 60 cps, is applied between the plate and cathode terminals.

DEGRADATION RATE TESTS

Fatigue

Statistical sample vibrated for a total of six hours, three hours in each of two planes, at a peak acceleration of 10G. Frequency is continuously varied from 30 cps to 2000 cps and back to 30 cps, with a period of ten minutes. Tubes are operated during the test with Ef = 6.3 volts and Ehk = +100 volts. Following the test, tubes are evaluated for heater-cathode leakage and heater current.

Shock

Statistical sample subjected to 5 impact accelerations of approximately 450G in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine using a 30° hammer angle. Tubes are operated during the test with Ef = 6.3 volts and Ehk = +100 volts. Following the test, tubes are evaluated for heater-cathode leakage and heater current.

Survival Rate Life Test

The combined statistical samples subjected to the Intermittent and Standby Life Tests are evaluated for shorted and open elements and tube voltage drop following approximately 100 hours of life test.

Intermittent Life Test

Statistical sample operated for 1000 hours under the following conditions: Ef = 6.3 volts (cycled—on 1¾ hours, off ¼ hour), Ebb = 220 volts RMS, Ehk = −70 volts d-c, R_L = 0.13 meg, C_L = 1.0 μf, and Rs = 1300 ohms. Tubes are evaluated, following 500 and 1000 hours of life test, for shorted or open elements, heater current, tube voltage drop, heater-cathode leakage, interelectrode leakage resistance, and emission.

Standby Life Test

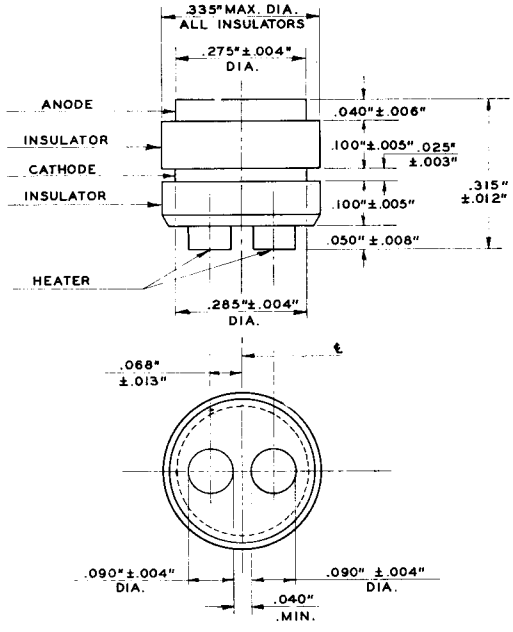
Statistical sample operated for 1000 hours under the following conditions: Ef = 6.3 volts (cycled—on 1¾ hours, off ¼ hour) no other voltages applied. Tubes are evaluated, following 500 and 1000 hours of life test, for shorted or open elements, heater current, tube voltage drop, heater-cathode leakage, interelectrode leakage resistance, and emission.

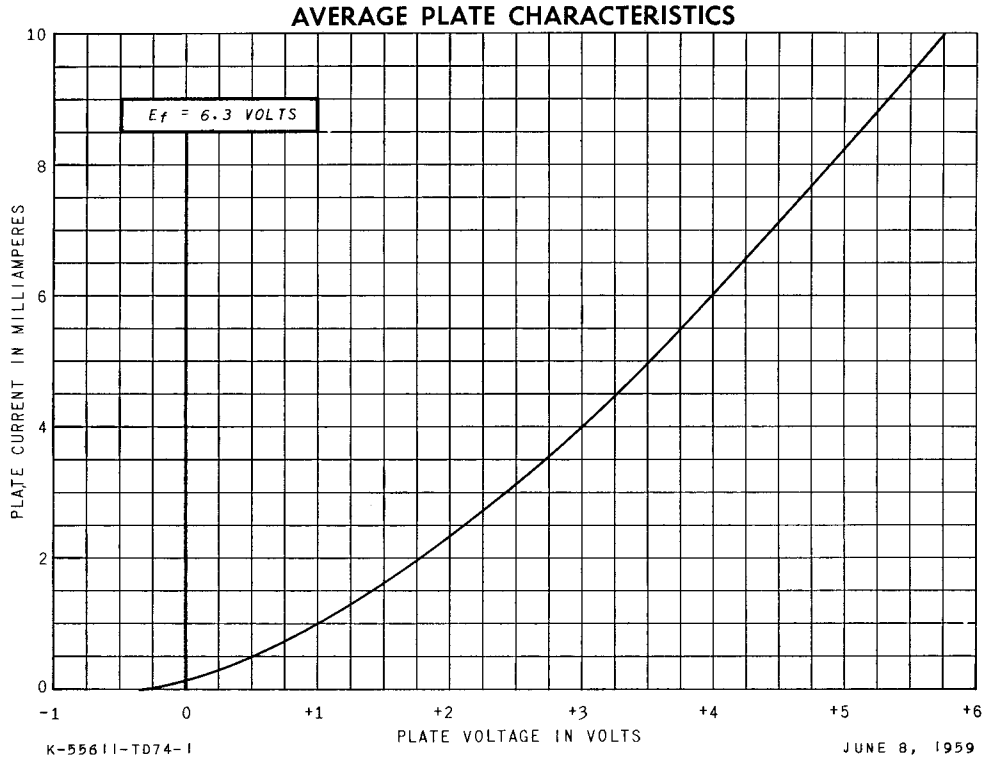
Heater-Cycling Life Test

Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.0 volts cycled for one minute on and one minute off, Eb = 0 volts, and Ehk = 70 volts with heater positive with respect to cathode. Following this test, tubes are evaluated for open heaters, heater-cathode shorts, and heater-cathode leakage current.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable operating conditions.

OUTLINE DRAWING





RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

PLANAR TRIODE



DESCRIPTION AND RATING

FOR GROUNDED-GRID OSCILLATOR, AMPLIFIER, AND FREQUENCY MULTIPLIER SERVICE

Metal and Ceramic — Pulse Rated
High Transconductance — Shock Resistant
100 Watts Plate Dissipation

The 7289 is a metal-and-ceramic, high-mu triode designed for use as a grounded-grid CW oscillator, amplifier, or frequency multiplier at frequencies as high as 2500 megacycles. In addition, it may be used as a plate-pulsed oscillator or amplifier at frequencies as high as 3000 megacycles.

Features of the 7289 include planar electrode construction, high plate dissipation capability, excellent electrode isolation, low radio-frequency losses, high transconductance, and low interelectrode capacitances.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC	*	Volts
Heater Current at Ef = 6.0 volts	1.0†	Amperes
Cathode Heating Time, minimum	60	Seconds
Direct Interelectrode Capacitances‡		
Grid to Plate: (g to p)	2.0	pf
Grid to Cathode: (g to k)	6.3	pf
Plate to Cathode: (p to k), maximum	0.035	pf

MECHANICAL

Mounting Position—Any—Only Plate Flange to be Used as a Socket Stop and Clamp

Net Weight, approximate	2.5	Ounces

Cooling

Plate and Plate Seal—Conduction and Forced Air
Grid and Cathode Seals—Conduction and Forced Air
Recommended Air Flow Cowling—157-JAN

Recommended Air Flow on Plate Radiator at Sea Level Incoming Air Temperature 25C, Plate Dissipation 100 Watts	12.5	Cu.Ft.PerMin.

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key-Down Conditions Per Tube Without Amplitude Modulation§

Heater Voltage*	4.5 to 5.7	Volts
Frequency	2500	Megacycles
DC Plate Voltage	1000	Volts
Negative DC Grid Voltage	150	Volts
Peak Positive RF Grid Voltage	30	Volts
Peak Negative RF Grid Voltage	400	Volts
DC Grid Current	50	Milliamperes
DC Cathode Current	125	Milliamperes
Plate Dissipation	100	Watts
Grid Dissipation	2.0	Watts
Envelope Temperature at Hottest Point	300	C

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEPHONY

Carrier Conditions Per Tube For Use With a Maximum Modulation Factor of 1.0

Heater Voltage*	4.5 to 5.7	Volts
Frequency	2500	Megacycles
DC Plate Voltage¶	600	Volts
Negative DC Grid Voltage	150	Volts
Peak Positive RF Grid Voltage	30	Volts
Peak Negative RF Grid Voltage	400	Volts
DC Grid Current	50	Milliamperes
DC Cathode Current	100	Milliamperes
Plate Dissipation	70	Watts
Grid Dissipation	2.0	Watts
Envelope Temperature at Hottest Point	300	C

PLATE-PULSED OSCILLATOR OR AMPLIFIER

Heater Voltage*	5.7 to 6.0	Volts
Frequency	3000	Megacycles
Peak Positive-Pulse Plate Supply Voltage	3500	Volts
Duty Factor of Plate Pulse ⁂ △	0.0025	
Pulse Duration	3.0	Microseconds
Plate Current Average During Plate Pulse △**	3.0	Amperes
Negative Grid Voltage Average During Plate Pulse††	150	Volts
Grid Current Average During Plate Pulse	1.8	Amperes
Plate Dissipation △	27	Watts
Grid Dissipation △	2.0	Watts
Envelope Temperature at Hottest Point	300	C

GENERAL ELECTRIC

⊕ *Supersedes pages 1 and 2 of D & R sheet for 7289 dated 12-61*

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Heater Voltage	6.0	Volts
Plate Voltage	600	Volts
Grid Voltage§§		Volts
Amplification Factor	100	
Transconductance	25000	Micromhos
Plate Current	70	Milliamperes

RADIO-FREQUENCY POWER AMPLIFIER

Frequency	500	Megacycles
DC Plate Voltage	900	Volts
DC Grid Voltage	−40	Volts
DC Plate Current	90	Milliamperes
DC Grid Current, approximate	30	Milliamperes
Driving Power, approximate	6	Watts
Useful Power Output	40	Watts

RADIO-FREQUENCY OSCILLATOR

Frequency	2500	Megacycles
DC Plate Voltage	1000	Volts
DC Grid Voltage, approximate	−22	Volts
DC Plate Current	90	Milliamperes
DC Grid Current	10	Milliamperes
Useful Power Output	17	Watts

PLATE-PULSED OSCILLATOR

Frequency	3000	Megacycles
Heater Voltage	5.8	Volts
Duty Factor	0.0025	
Pulse Duration	3.0	Microseconds
Peak Positive-Pulse Plate-Supply Voltage	3500	Volts
Plate Current Average During Plate Pulse	3.0	Amperes
Grid Current Average During Plate Pulse	1.8	Amperes
Useful Power Output Average During Plate Pulse	1.6	Kilowatts

* The equipment designer should design the equipment so that heater voltage is centered at some value within the range of 4.5 to 5.7 volts for CW operation, or 5.7 to 6.0 volts for pulse operation. Heater voltage variations about the center value should be kept as small as practical and should not, in any case, exceed ±5%. The optimum center value of heater voltage depends on the cathode current and on other parameters of circuit design and operation. For specific recommendations, contact your General Electric tube sales representative.

† Heater current of a bogey tube at Ef = 6.0 volts.

‡ Measured in a special shielded socket.

§ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

¶ For modulation factors less than 1.0, a higher d-c plate voltage may be used if the sum of the peak positive audio voltage and the d-c plate voltage does not exceed 1200 volts.

⁂ Applications with a duty factor greater than 0.0025 should be referred to your General Electric tube sales representative for recommendations.

△ In any 5000-microsecond interval.

** The regulation and/or series plate-supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 30 amperes.

†† The maximum instantaneous value should be within the range of +250 to −750 volts.

§§ Adjusted for Ib = 70 milliamperes.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

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INITIAL CHARACTERISTICS LIMITS

	Min.	Max.	
Heater Current			
Ef = 6.0 volts	0.90	1.05	Amperes
Grid Voltage			
Ef = 6.0 volts, Eb = 1000 volts, Ib = 100 ma	−2.0	−7.0	Volts
Grid Voltage			
Ef = 6.0 volts, Eb = 1000 volts, Ib = 1.0 ma	....	−25	Volts
Negative Grid Current			
Ef = 6.0 volts, Eb = 1000 volts, Ec adjusted for Ib = 100 ma	....	8.0	Microamperes
Interelectrode Leakage Resistance			
Ef = 6.0 volts, Polarity of applied d-c interelectrode voltage is such that no cathode emission results			
Grid to Cathode at 500 volts d-c	50	....	Megohms
Interelectrode Capacitances			
Grid to Plate: (g to p)	1.95	2.15	Picofarads
Grid to Cathode: (g to k)	5.6	7.0	Picofarads
Plate to Cathode: (p to k)	....	0.035	Picofarads

SPECIAL PERFORMANCE TESTS

	Min.	Max.	
Oscillator Power Output			
Tubes are tested for power output as an oscillator under the following conditions: Ef = 5.0 volts; F = 2500 MC, min.; Eb = 1000 volts; Ib = 90 ma	15	....	Watts
Pulsed-Oscillator Power Output			
Tubes are tested for power output as an oscillator under the following conditions: Ef = 5.8 volts; F = 3000 MC, min.; epy = 3500 volts; tp = 3.0 μsec. ±10%; Du = 0.0025 ±5%; Rg adjusted for Ib = 7.5 ma; Ec = −1.5 volts, max.; Ic = 4.5 ma, max.	4.0	....	Watts
Low Pressure Voltage Breakdown Test			
Statistical sample tested for voltage breakdown at a pressure of 54 mm Hg. Tubes shall not give visual evidence of flashover when 1000 volts RMS, 60 cps, is applied between the plate and grid terminals.			

DEGRADATION RATE TESTS

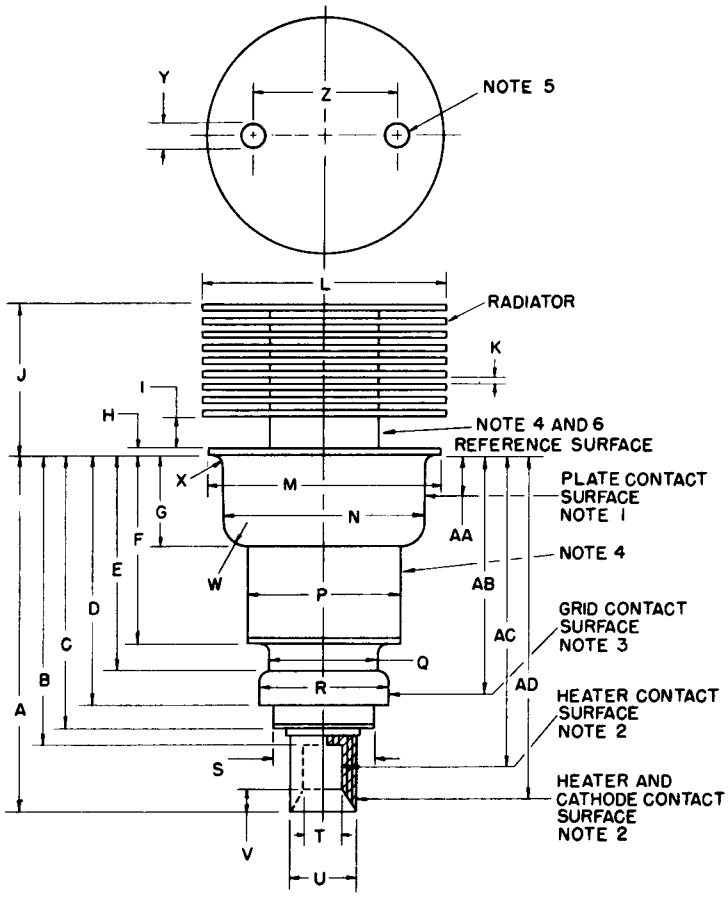
Shock

Statistical sample subjected to 5 impact accelerations of approximately 400 G and 0.5 milliseconds duration in each of three positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine.

500-Hour Life Test

Statistical sample operated for 500 hours as an oscillator to evaluate changes in power output with life.

PHYSICAL DIMENSIONS



DIMENSIONS FOR OUTLINE (INCHES)

Ref.	Minimum	Maximum
A	1.815	1.875
B	....	1.534
C	....	1.475
D	1.289	1.329
E	1.085	1.135
F	.880	.920
G	.462	.477
H	....	.040
I	.125	.185
J	.766	.826
K	.025	.046
L	1.234	1.264
M	1.180	1.195
N	1.025	1.035
P	.772	.792
Q	.541	.561
R	.655	.665
S	....	.545
T	.213	.223
U	.315	.325
V	....	.086
W	....	.100
X	....	.035
Y	.105	.145
Z	.650	.850

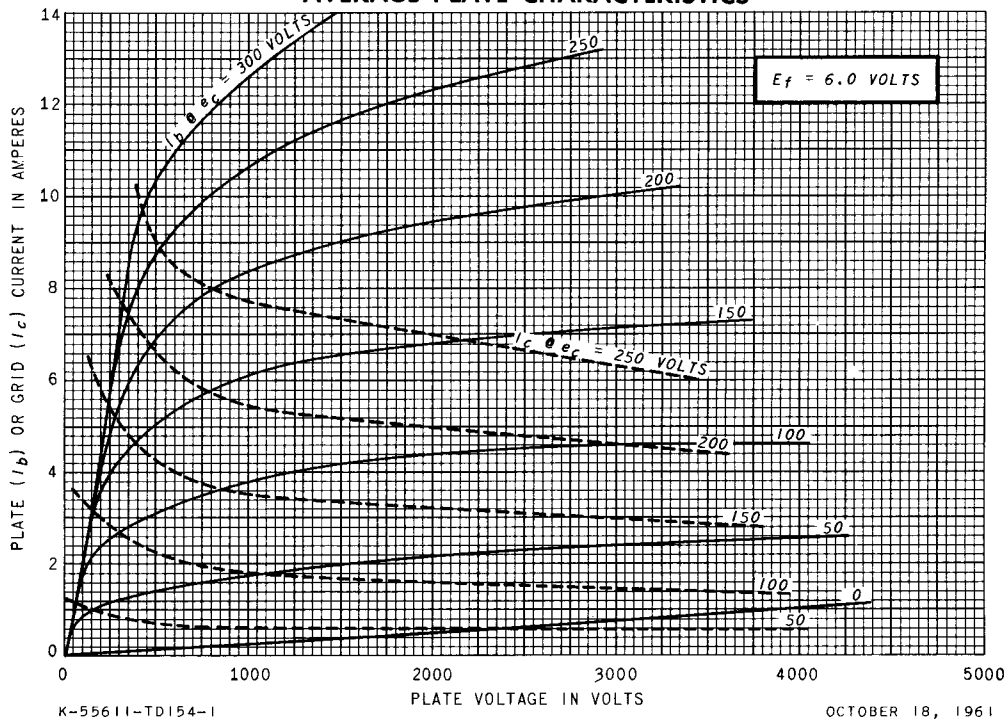
DIMENSIONS FOR ELECTRODE CONTACT AREA (INCHES)

Ref.	Dimension	Contact
AA	.198 ± .163	Plate
AB	1.225 ± .040	Grid
AC	1.631 ± .097	Heater
AD	1.645 ± .170	Cathode

NOTES

1. The total indicated runout of the plate contact surface with respect to the cathode contact surfaces will not exceed .020 inch.
2. The total indicated runout of the cathode contact surface with respect to the heater contact surfaces will not exceed .012 inch.
3. The total indicated runout of the grid contact surface with respect to the cathode contact surface will not exceed .020 inch.
4. Do not clamp or locate on this surface.
5. Hole provided for tube extractor through the top fin only.
6. Measure plate shank temperature on this surface.

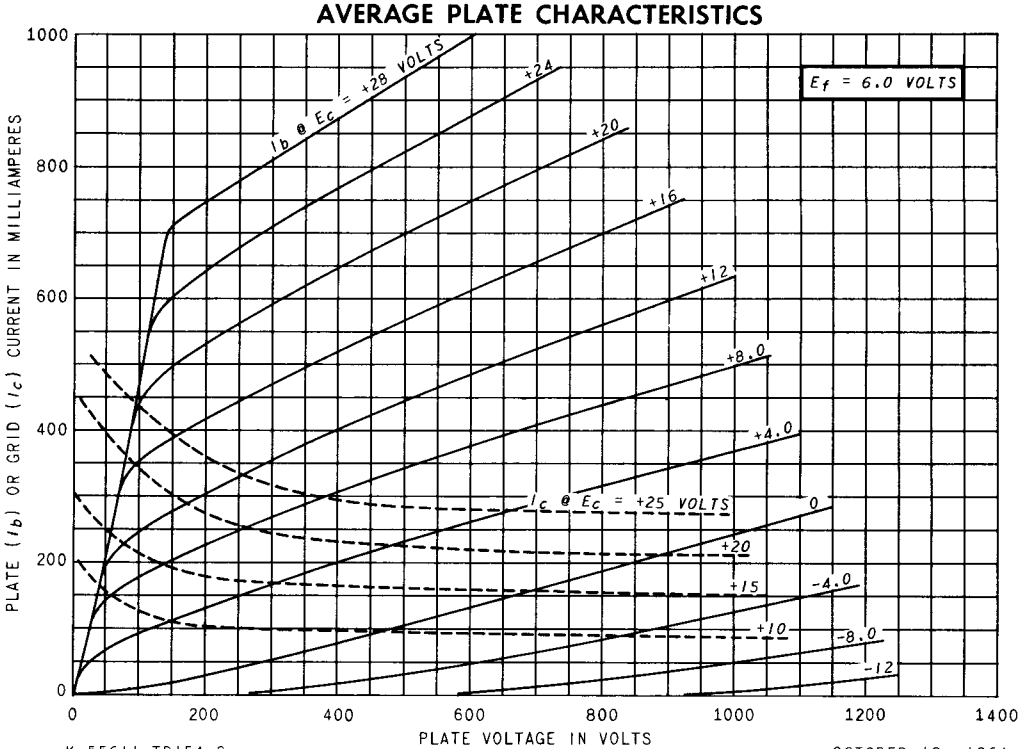
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD154-1

OCTOBER 18, 1961

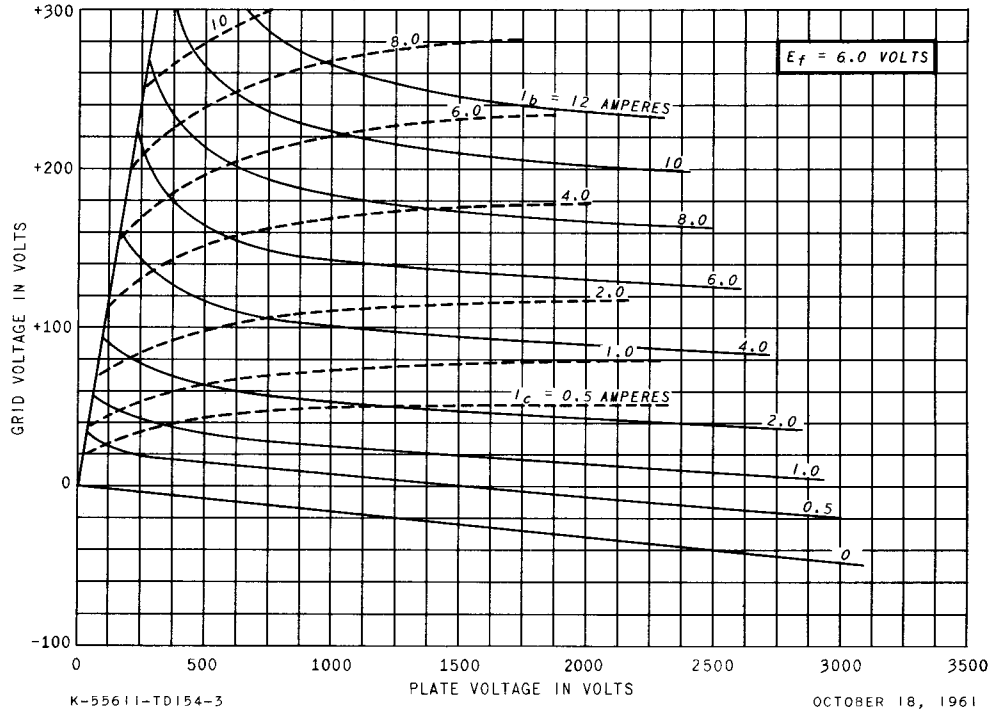
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD154-2

OCTOBER 18, 1961

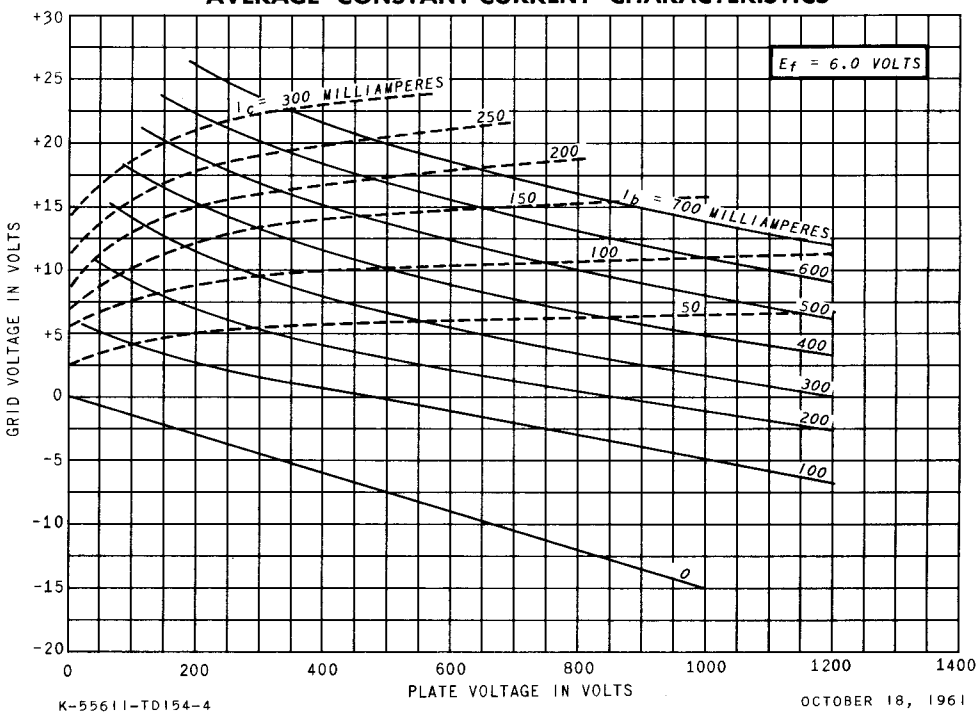
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



K-5561I-TD154-3

OCTOBER 18, 1961

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



K-5561I-TD154-4

OCTOBER 18, 1961

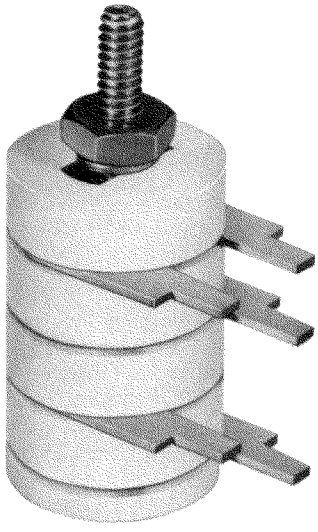
RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

7296

METAL-CERAMIC TRIODE



DESCRIPTION AND RATING

FOR VHF OSCILLATOR AND AMPLIFIER APPLICATIONS

The 7296 is a high-mu triode of ceramic-and-metal planar construction primarily intended for use as an oscillator, broadband radio-frequency amplifier, or VHF power amplifier. The 7296 is especially suited for use where unfavorable conditions of mechanical shock, mechanical vibration, and nuclear radiation are encountered.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential		
Heater Voltage, AC or DC *	6.3±0.3	Volts
Heater Current +	0.4	Amperes
Direct Interelectrode Capacitances ‡		
Grid to Plate: (g to p)	2.2	pf
Input: g to (h + k)	5.0	pf
Output: p to (h + k)	0.075	pf
Heater to Cathode: (h to k)	2.8	pf

MECHANICAL

Mounting Position—Any §

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	5.5	Watts
DC Grid Current	10	Milliamperes
DC Cathode Current	30	Milliamperes
Peak Cathode Current	120	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.18	Megohms
Envelope Temperature at Hottest Point ※		
Plate Dissipation not over 3.3 Watts	300	C
Plate Dissipation up to 5.5 Watts	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

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CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	200	Volts
Cathode-Bias Resistor	68	Ohms
Amplification Factor	90	
Plate Resistance, approximate	5450	Ohms
Transconductance	16500	Micromhos
Plate Current	17	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes	−5.5	Volts

* The equipment designer should design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ One method of mounting the 7296 is to use a stainless-steel "T" bolt (see drawing) to attach the mounting base of the tube to a chassis or circuit board. The "T" bolt should be inserted in the slot in the base of the tube, turned 90 degrees, and attached to the chassis or circuit board with a 4-40 nut and lock washer. Torque used to tighten the nut should not exceed 3 inch-pounds.

⁂ Operation below the rated maximum envelope temperatures is recommended for applications requiring the longest possible tube life. The 7296 is also capable of operation at envelope temperatures much higher than the rated maximum values. For specific recommendations concerning higher temperature operation, contact your General Electric tube sales representative.

INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
Ef = 6.3 volts	370	400	430	Milliamperes
Plate Current				
Ef = 6.3 volts, Eb = 200 volts, Rk = 68 ohms (bypassed)	10	17	24	Milliamperes
Transconductance				
Ef = 6.3 volts, Eb = 200 volts, Rk = 68 ohms (bypassed)	13000	16500	20000	Micromhos
Amplification Factor				
Ef = 6.3 volts, Eb = 100 volts, Rk = 68 ohms (bypassed)	65	90	115	
Zero-Bias Transconductance				
Ef = 6.3 volts, Eb = 100 volts, Ec = 0 volts	13000	20000	.....	Micromhos
Grid Voltage Cutoff				
Ef = 6.3 volts, Eb = 200 volts, Ib = 10 μa	.....	−5.5	−9.5	Volts
Interelectrode Capacitances				
Grid to Plate (g to p)	1.9	2.2	2.5	pf
Input: g to (h + k)	3.7	5.0	6.3	pf
Output: p to (h + k)	0.05	0.075	0.1	pf
Heater to Cathode: (h to k)	2.1	2.8	3.5	pf
Negative Grid Current				
Ef = 6.3 volts, Eb = 200 volts, Ecc = −1.0 volts, Rk = 68 ohms (bypassed), Rg = 0.18 meg	.....	.....	0.5	Microamperes
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	.....	.....	20	Microamperes
Heater Negative with Respect to Cathode	.....	.....	20	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid to All at 100 volts d-c	100	.....	.....	Megohms
Plate to All at 300 volts d-c	100	.....	.....	Megohms
Grid Emission Current				
Ef = 7.0 volts, Eb = 200 volts, Ecc = −15 volts, Rg = 0.18 meg	.....	.....	2.0	Microamperes

SPECIAL PERFORMANCE TESTS

	Min.	Bogey	Max.	
400 Megacycle Oscillator Power Output	1.6	2.0	.....	Watts

Tubes are tested for power output as an oscillator under the following conditions: F = 400 mc, Ef = 6.3 volts, Eb = 300 volts, Rg = 1400 ohms, Ib = 20 ma maximum, Ic = 6.0–9.0 ma.

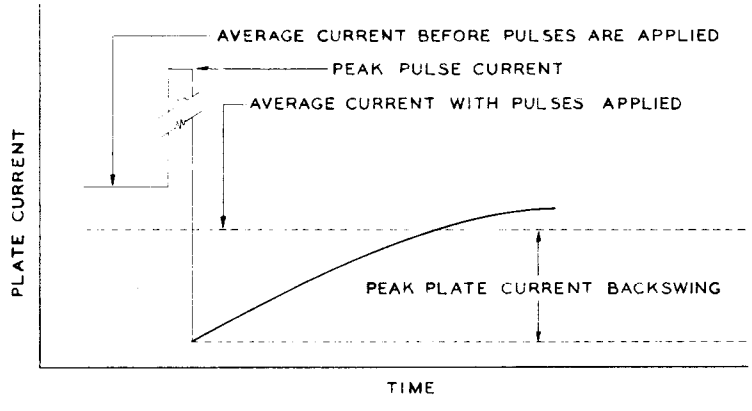
Pulse Emission	320	.....	.....	Milliamperes

Tubes are tested for pulse emission under the following conditions: Ef = 6.3 volts, Eb = 200 volts, Ec = −20 volts, egk = +12 volts, prr = 1000 pps, duty cycle 1%. Pulse cathode current is measured.

Grid Recovery — Change in Average Plate Current	.....	.....	1.0	Milliamperes
Peak Plate Current Backswing	.....	.....	2.0	Milliamperes

Tubes with poor grid recovery affect circuit operation, when the grid is driven positive by a pulse of signal or noise, somewhat as if a parallel RC circuit were in series with the grid. This effect may occur in tubes of any type, but is unimportant in many applications. In the majority of 7296 tubes the effect is negligible, but to eliminate the few in which it may be excessive, tubes are tested under the following conditions: Ef = 6.3 volts, Ebb = 250 volts, R_L = 0.01 meg. Ec is adjusted for Ib = 10 ma.

Upon application to the grid of a pulse driving it 3 volts positive with respect to cathode (prr = 60 pps, duty cycle = 0.12%) the change in average plate current is noted, and the peak plate current backswing is measured. The following diagram shows qualitatively the plate current—time relationship for a tube (with poor grid recovery) subjected to this test:



Low Frequency Vibrational Output	.....	.....	15	Millivolts RMS

Statistical sample is subjected to vibration in each of two planes at 40 cps, with peak acceleration 15 G. Tube is operated with Ef = 6.3 volts, Ebb = 200 volts, Rk = 68 ohms (bypassed), R_L = 2000 ohms.

Variable Frequency Vibrational Output

The tube is designed to be free of vibrational outputs in excess of 100 mv RMS at any frequency within the range 100–2000 cps, when vibrated in either of two planes at 10 G peak acceleration. Electrical conditions for this test are the same as for Low Frequency Vibrational Output.

Low Pressure Voltage Breakdown Test

Statistical sample tested for voltage breakdown at a pressure of 8 mm Hg, to simulate an altitude of 100,000 feet. Tubes shall not give visual evidence of flashover or corona when 300 volts RMS, 60 cps, is applied between the plate and grid terminals.

DEGRADATION RATE TESTS

Fatigue

Statistical sample vibrated for a total of six hours, three hours in each of two planes, at a peak acceleration of 10 G. Frequency is continuously varied from 30 cps to 2000 cps and back to 30 cps, with a period of ten minutes. Tubes are operated during the test with Ef = 6.3 volts, Eb = 200 volts, and Rk = 68 ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, heater current, and transconductance.

Shock

Statistical sample subjected to 5 impact accelerations of approximately 600 G in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine using a 42° hammer angle. Tubes are mounted by T-bolt with 3 inch-pounds torque, and operated during the test with Ef = 6.3 volts, Eb = 200 volts, Ehk = +100 volts, Rg = 0.1 Meg, and Rk = 68 ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, heater current, and transconductance.

Stability Life Test

The statistical sample subjected to the Dynamic Life Test is evaluated for percent change in zero-bias transconductance of individual tubes, from the initial reading to readings following 2 hours and 20 hours of the life test.

Survival Rate Life Test

The combined statistical samples subjected to the Dynamic and Pulse Life Tests are evaluated for shorted and open elements following approximately 100 hours of life test.

Dynamic Life Test

Statistical sample operated, with a 60 cps grid signal, at maximum rated DC grid current and cathode current for a period of 1000 hours. Heater voltage is cycled (on 1¾ hours, off ¼ hour). Tubes are evaluated, following 500 and 1000 hours of life test, for shorted or open elements, heater current, zero-bias transconductance, oscillator power output, and heater-cathode leakage.

Pulse Life Test

Statistical sample operated with 400 ma peak cathode current, 1% duty cycle, for 1000 hours. Heater voltage is cycled (on 1¾ hours, off ¼ hour). Tubes are evaluated, following 500 and 1000 hours of life test, for shorted or open elements, heater current, pulse emission, and heater-cathode leakage.

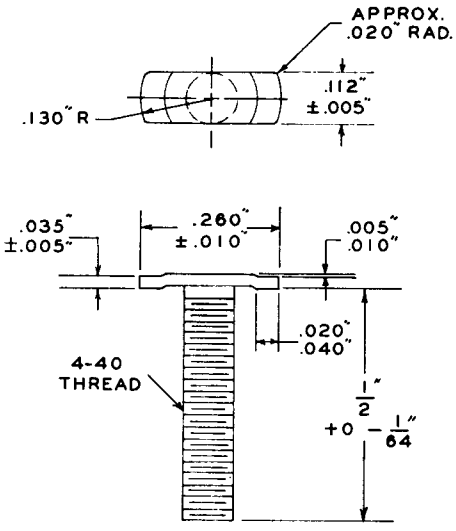
Interface Life Test

Statistical sample operated for 1000 hours with Ef = 6.6 volts, no other voltages applied, and evaluated for cathode interface resistance following the life test.

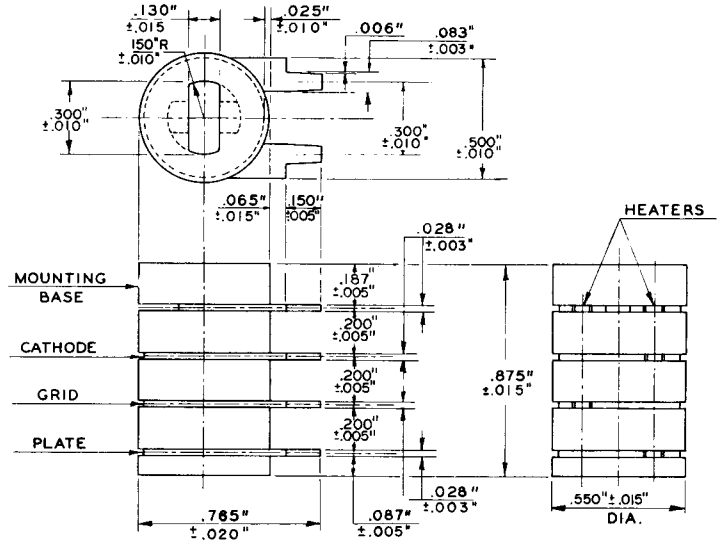
Heater-Cycling Life Test

Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.5 volts cycled for one minute on and one minute off, Eb = Ec = 0 volts, and Ehk = 70 volts with heater positive with respect to cathode. Following this test tubes are evaluated for open heaters, heater-cathode shorts, and heater-cathode leakage current.

MOUNTING BOLT

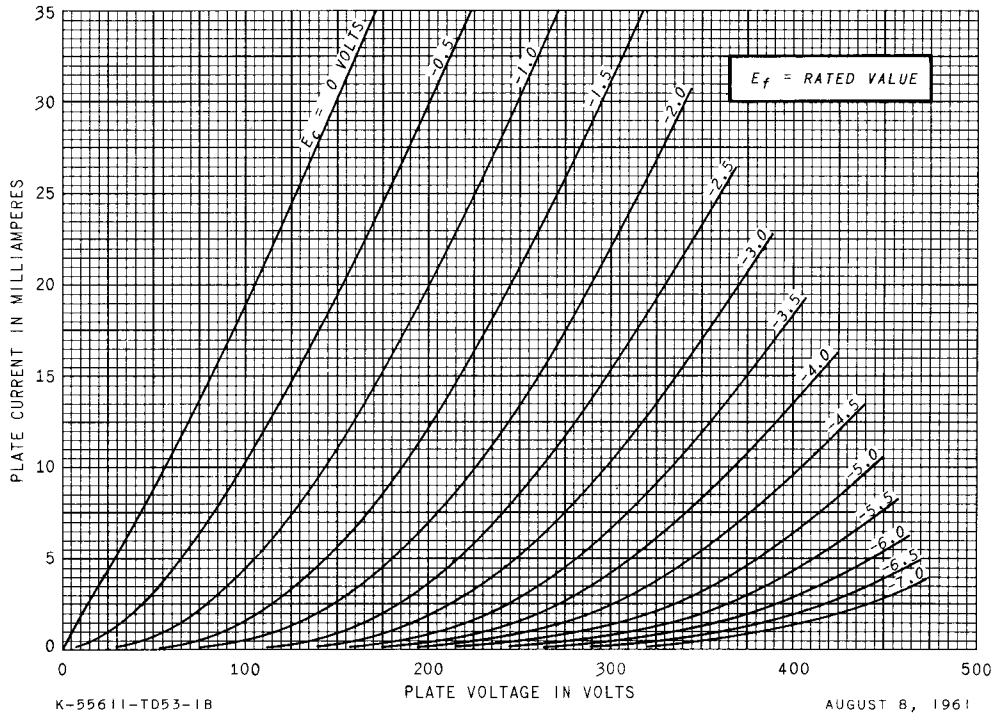


PHYSICAL DIMENSIONS

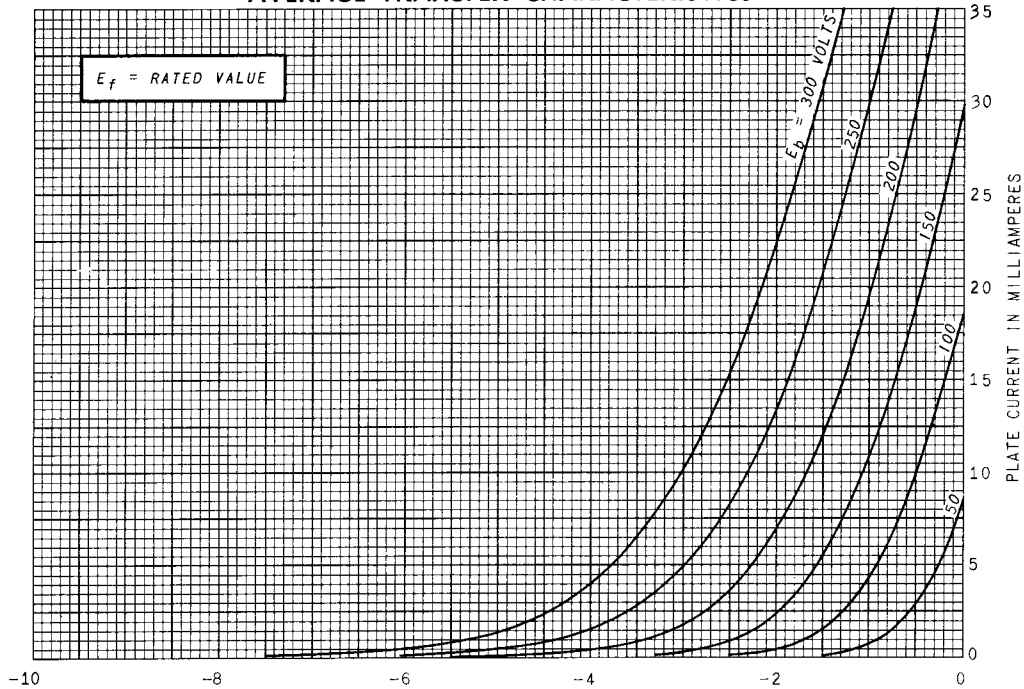


Maximum eccentricity of insulators 0.015 in. from center line.

AVERAGE PLATE CHARACTERISTICS



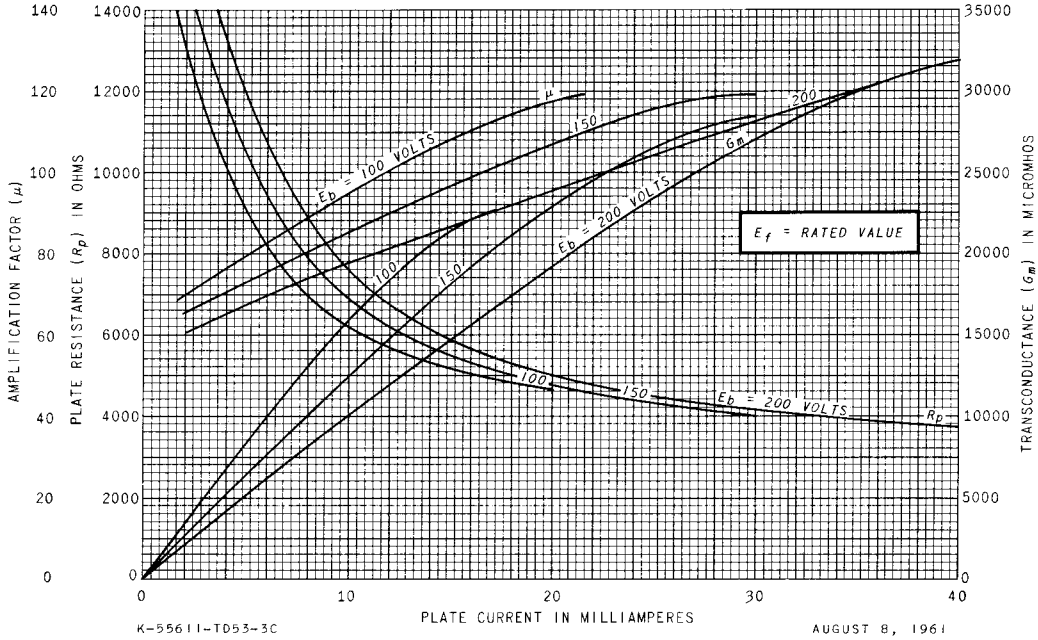
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD53-2B

AUGUST 8, 1961

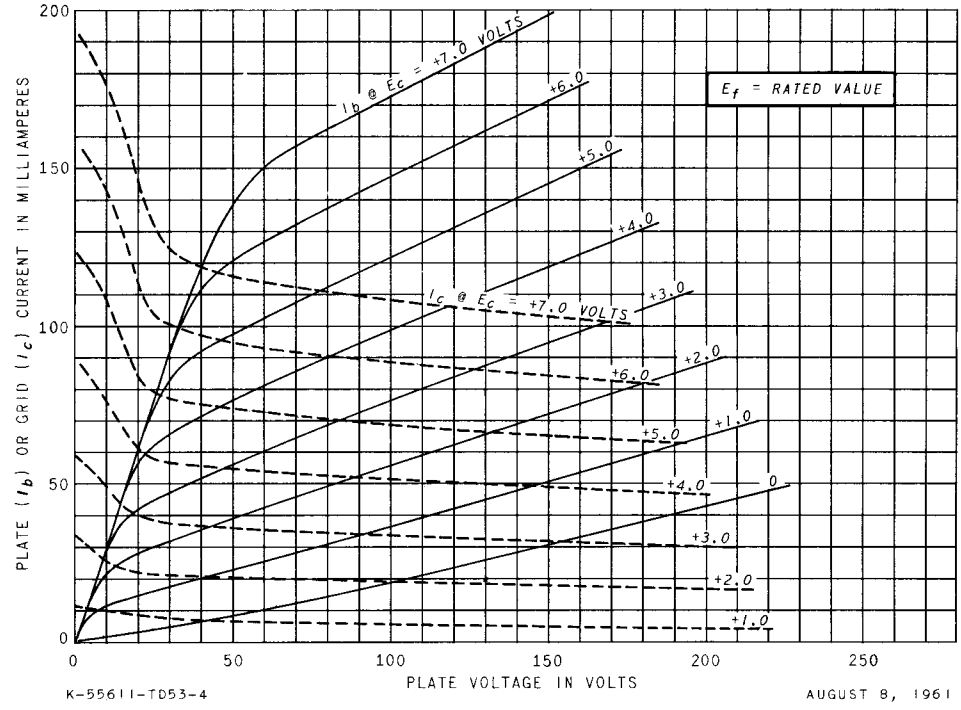
AVERAGE CHARACTERISTICS



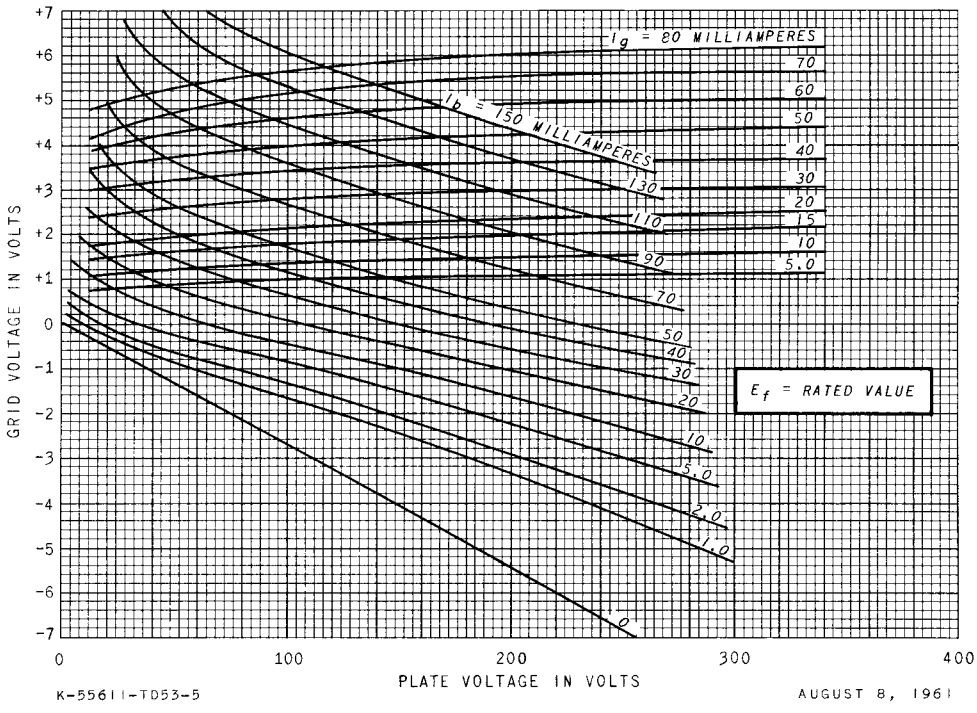
K-55611-TD53-3C

AUGUST 8, 1961

AVERAGE PLATE CHARACTERISTICS



AVERAGE CONSTANT-CURRENT CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

BEAM PENTODE

FOR AF POWER AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The *7355* is a beam-power pentode primarily designed for use in the power-output stage of high-fidelity audio-frequency amplifier systems.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.8	Amperes
Direct Interelectrode Capacitances, approximate‡		
Grid-Number 1 to Plate: (g1 to p)	0.5	pf
Input: g1 to (h+k+g2+b.p.)	13	pf
Output: p to (h+k+g2+b.p.)	6.0	pf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B6-229, Intermediate-Shell Octal 6-Pin with external barriers

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	500	Volts
Screen Voltage	400	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate Dissipation	18	Watts
Screen Dissipation (Continuous)	3.5	Watts
Screen Dissipation (Peaks of Speech and Music)	7.0	Watts
DC Cathode Current	100	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.3	Megohms
With Cathode Bias	1.0	Megohms

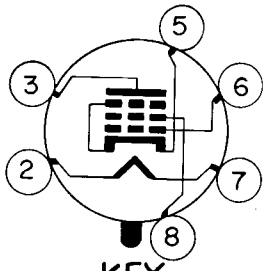
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The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

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BASING DIAGRAM

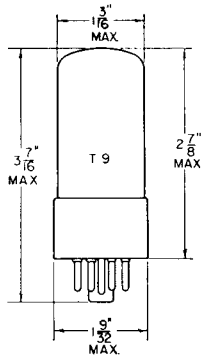


EIA 8KN

TERMINAL CONNECTIONS

Pin 2—Heater
Pin 3—Plate
Pin 5—Cathode and Beam Plates
Pin 6—Grid Number 1
Pin 7—Heater
Pin 8—Grid Number 2 (Screen)

PHYSICAL DIMENSIONS



EIA 9-15

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

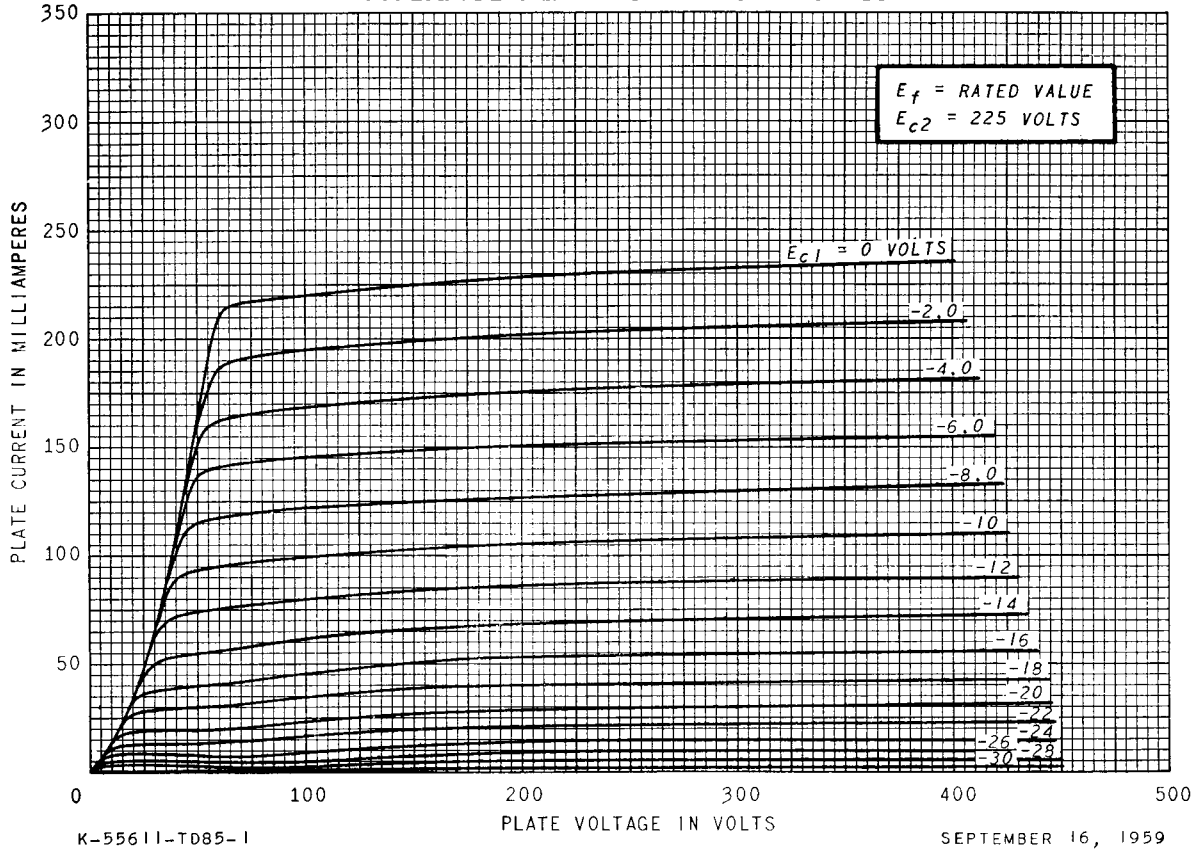
Plate Voltage	250	Volts
Screen Voltage	225	Volts
Grid-Number 1 Voltage	−15	Volts
Peak AF Grid-Number 1 Voltage	15	Volts
Plate Resistance, approximate	42000	Ohms
Transconductance	7600	Micromhos
Zero-Signal Plate Current	62	Milliamperes
Maximum-Signal Plate Current	74	Milliamperes
Zero-Signal Screen Current	3.2	Milliamperes
Maximum-Signal Screen Current	16.5	Milliamperes
Load Resistance	2500	Ohms
Total Harmonic Distortion, approximate	15	Percent
Maximum-Signal Power Output	9.0	Watts
Grid-Number 1 Voltage, approximate Ib = 500 Microamperes	−35	Volts

PUSH-PULL CLASS AB_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	300	400	Volts
Screen Voltage	250	300	Volts
Grid-Number 1 Voltage	−21	−34	Volts
Peak AF Grid-to-Grid Voltage	42	60	Volts
Zero-Signal Plate Current	100	56	Milliamperes
Maximum-Signal Plate Current	185	175	Milliamperes
Zero-Signal Screen Current	5.5	3.5	Milliamperes
Maximum-Signal Screen Current	24	24	Milliamperes
Effective Load Resistance, Plate-to-Plate	4000	5000	Ohms
Total Harmonic Distortion	2.0	6.0	Percent
Maximum-Signal Power Output	28.5	40	Watts

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.
† Heater current of a bogey tube at Ef = 6.3 volts.
‡ Without external shield.

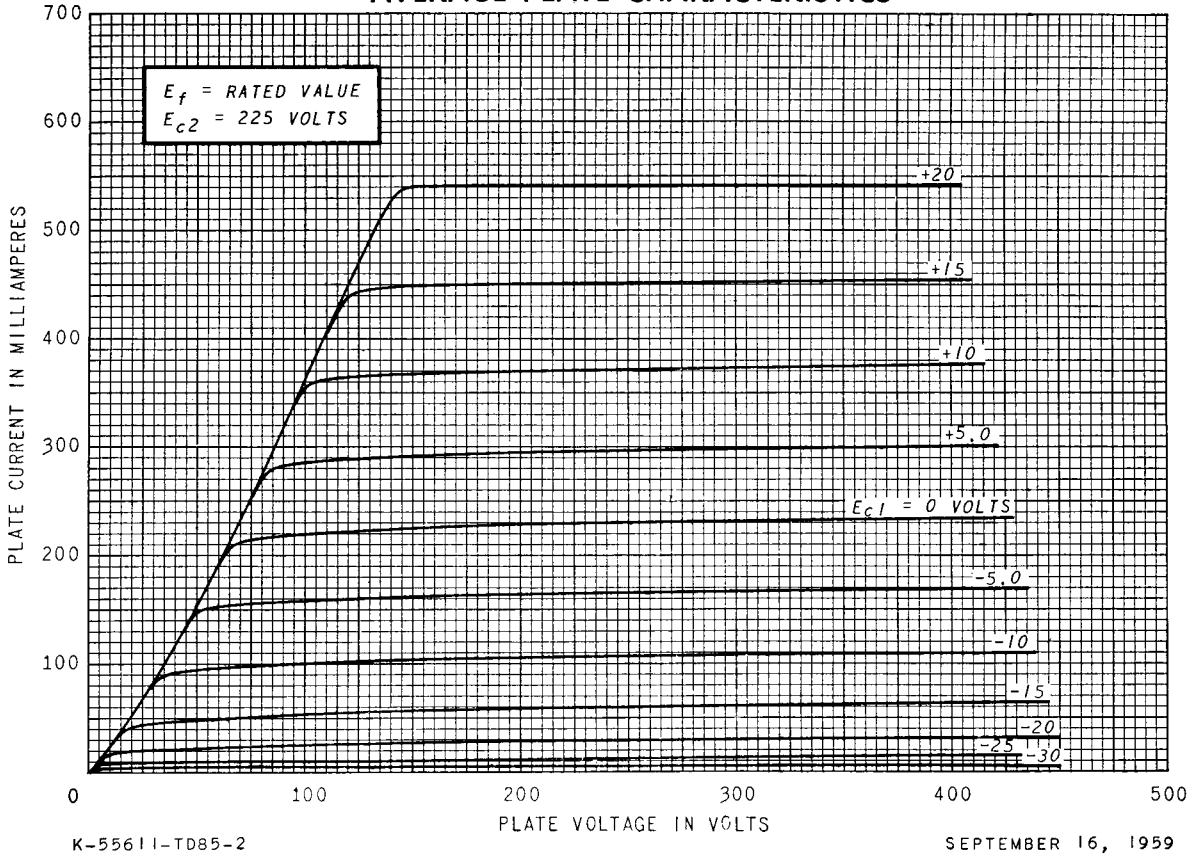
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD85-1

SEPTEMBER 16, 1959

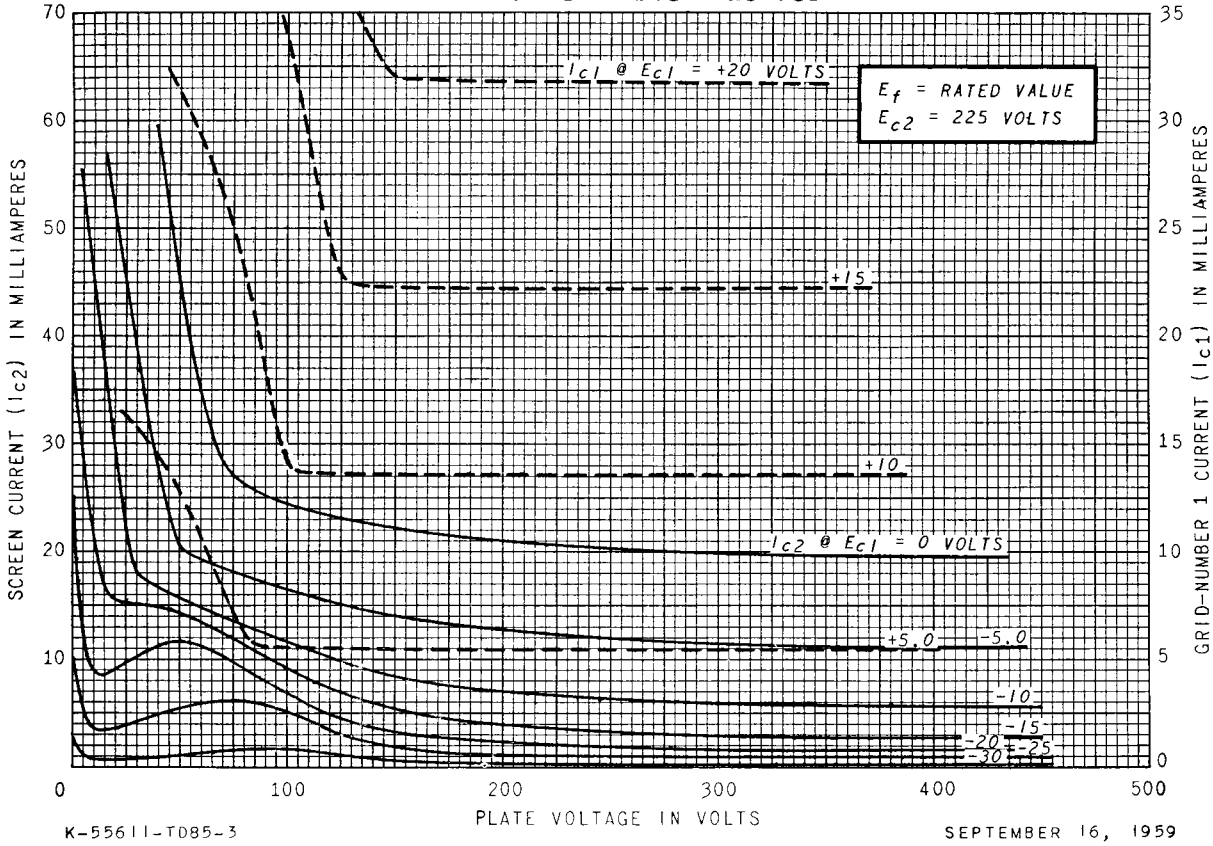
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD85-2

SEPTEMBER 16, 1959

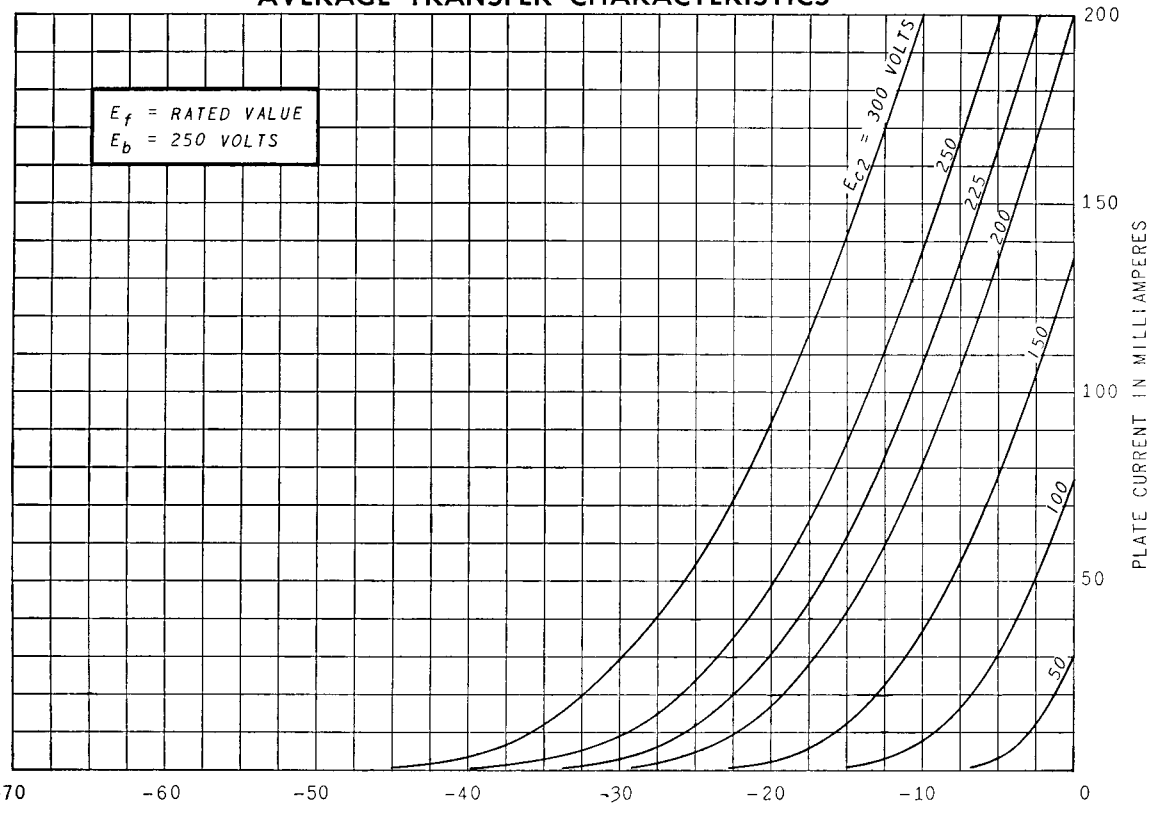
AVERAGE CHARACTERISTICS



K-55611-TD85-3

SEPTEMBER 16, 1959

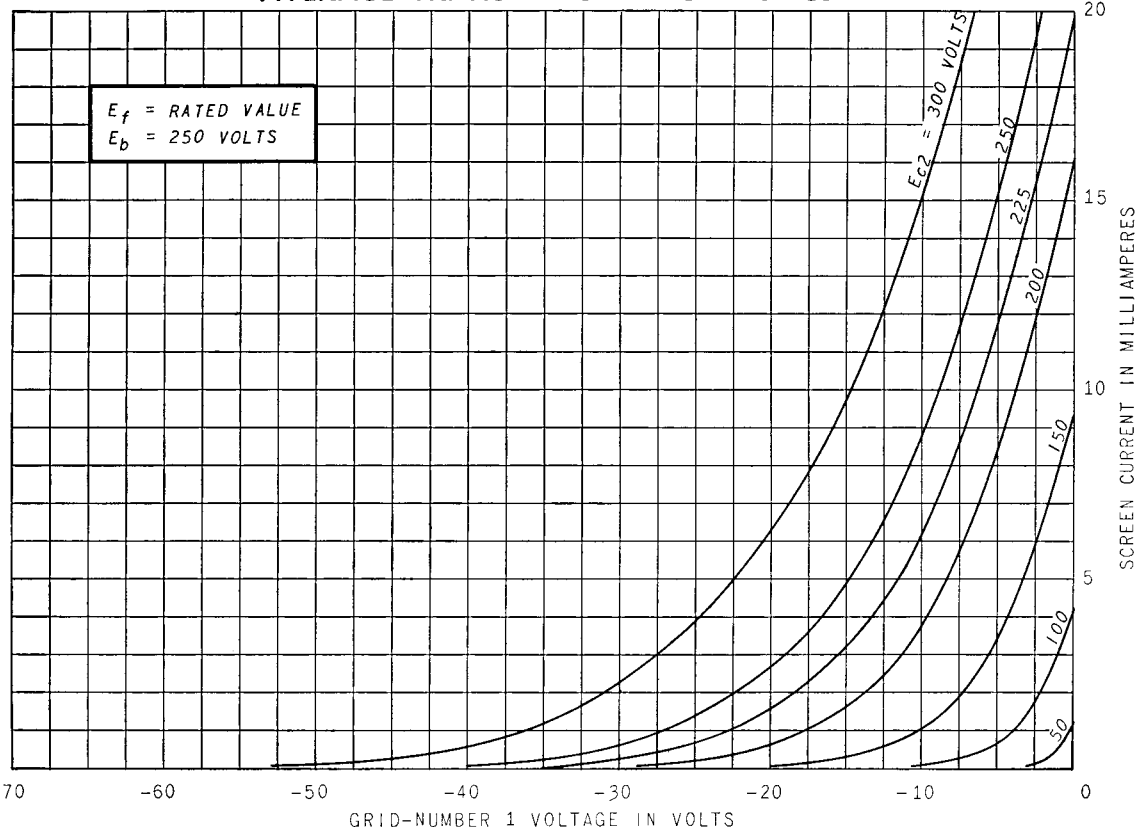
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD85-4

SEPTEMBER 16, 1959

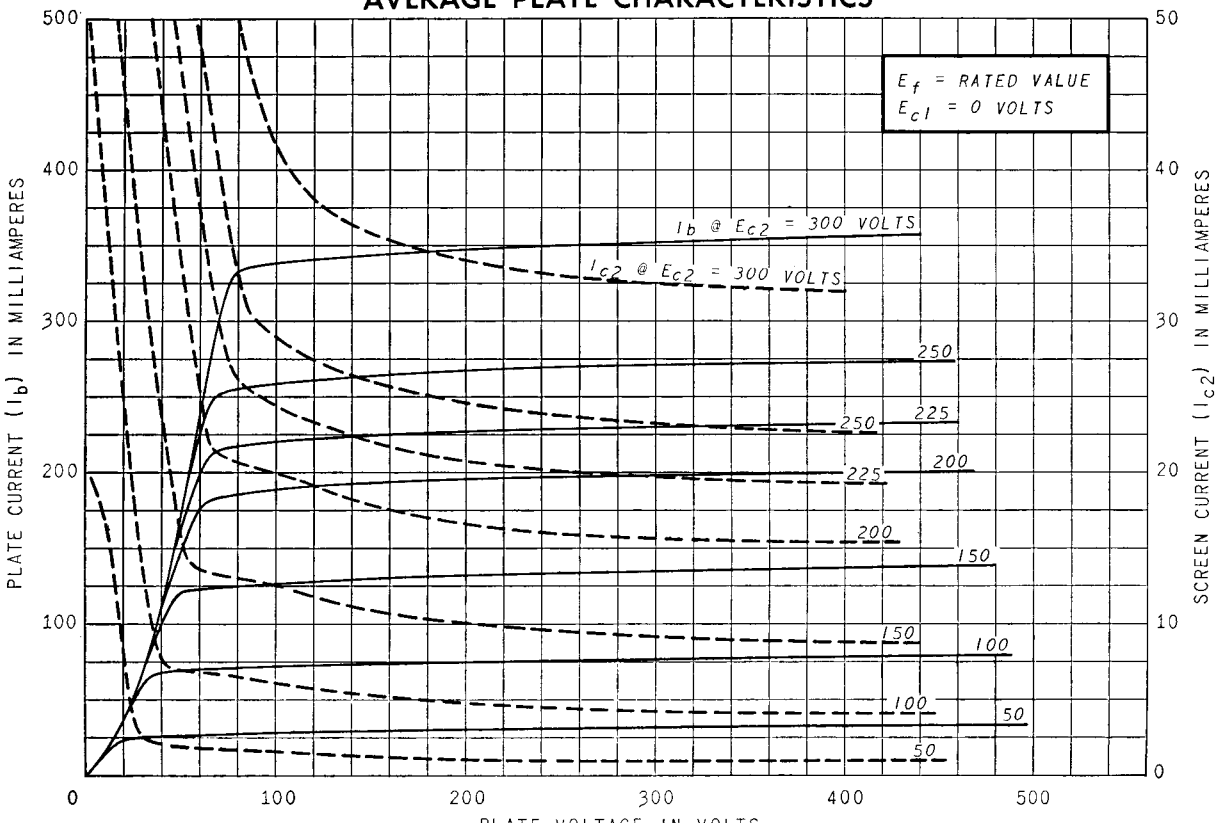
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD85-5

SEPTEMBER 16, 1959

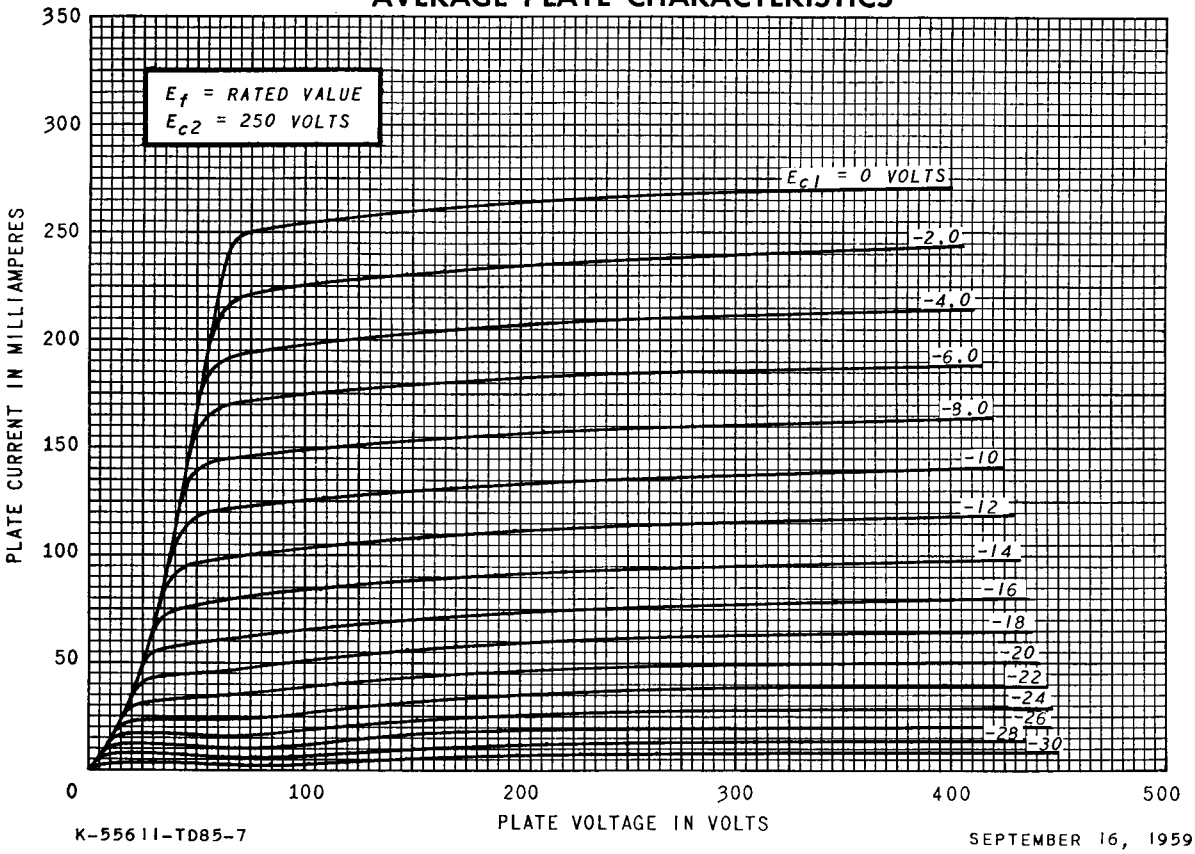
AVERAGE PLATE CHARACTERISTICS



K-55611-TD85-6

SEPTEMBER 16, 1959

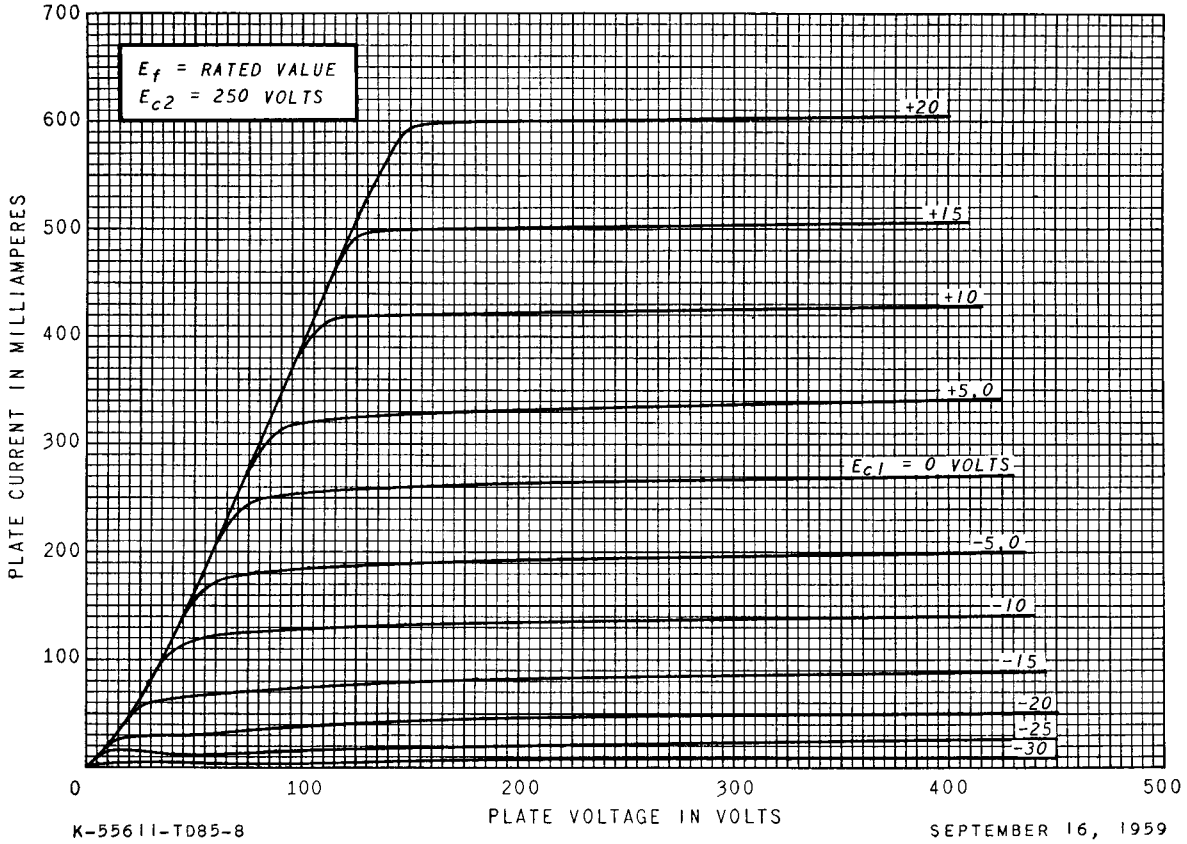
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD85-7

SEPTEMBER 16, 1959

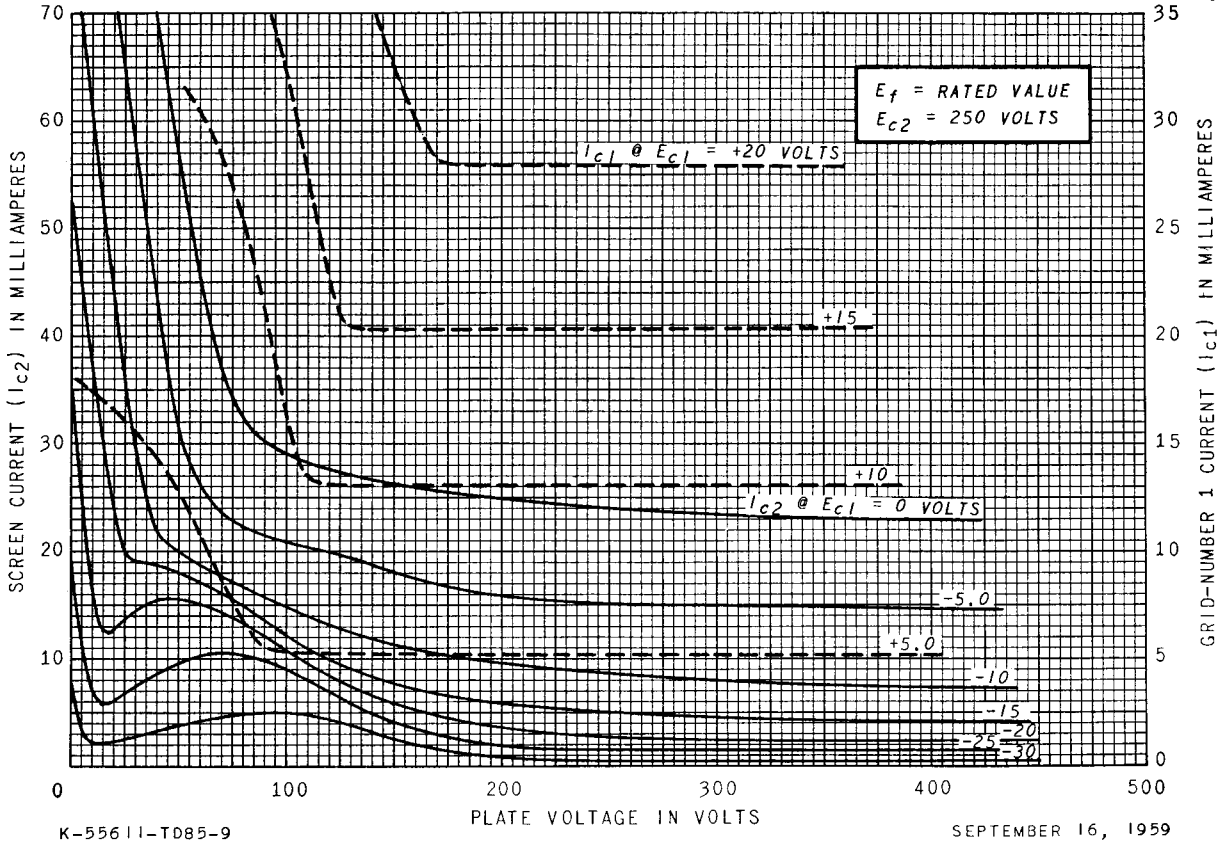
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD85-8

SEPTEMBER 16, 1959

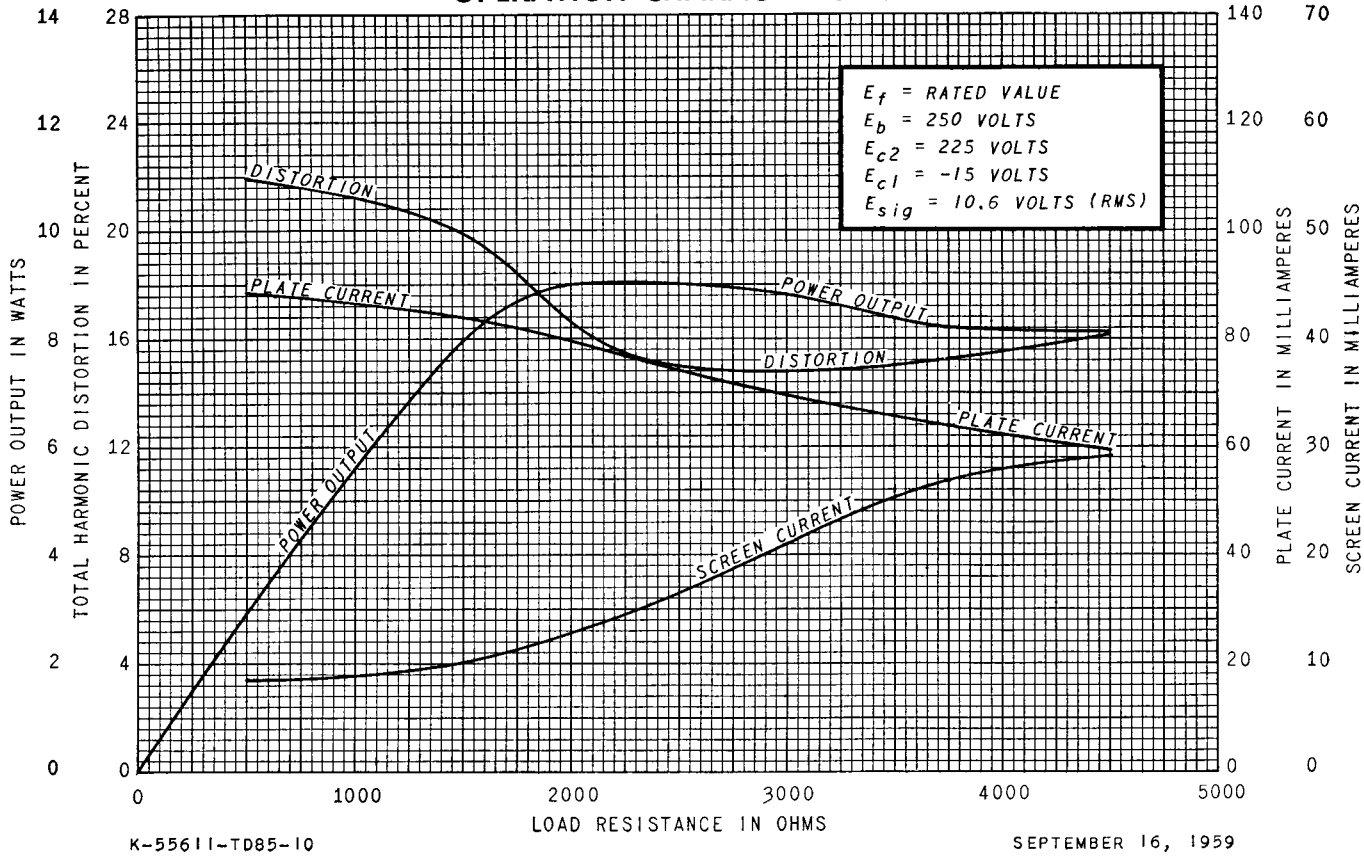
AVERAGE CHARACTERISTICS



K-55611-TD85-9

SEPTEMBER 16, 1959

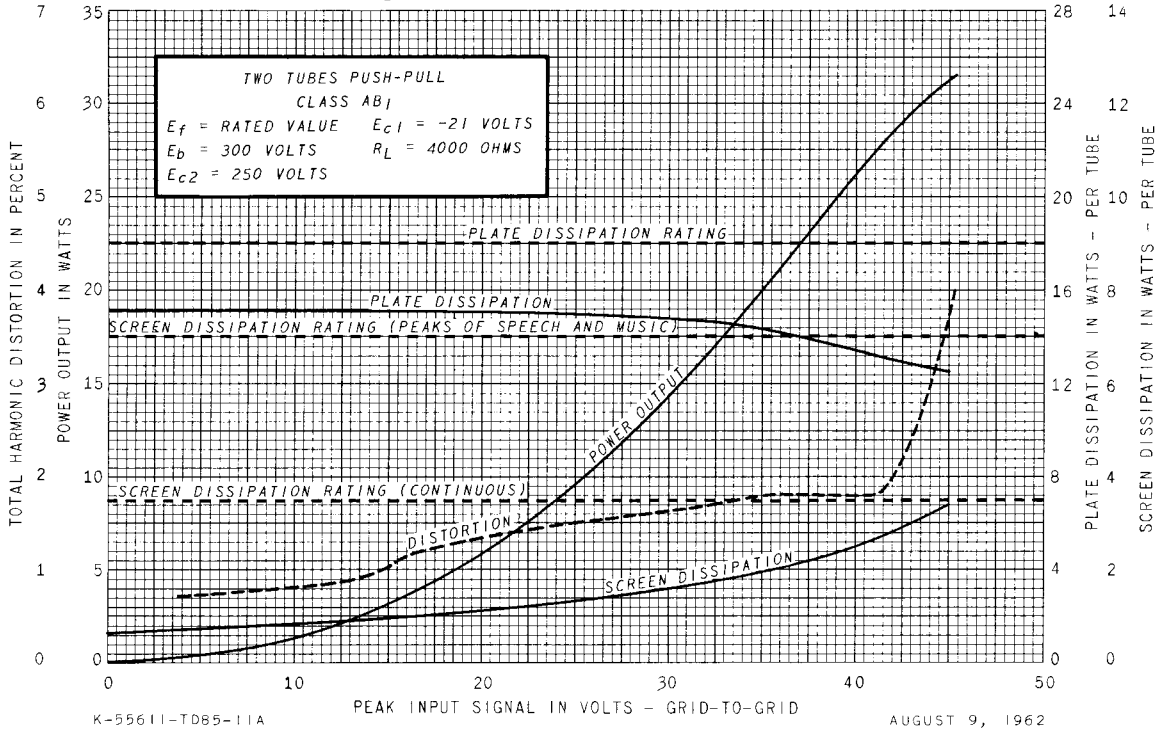
OPERATION CHARACTERISTICS



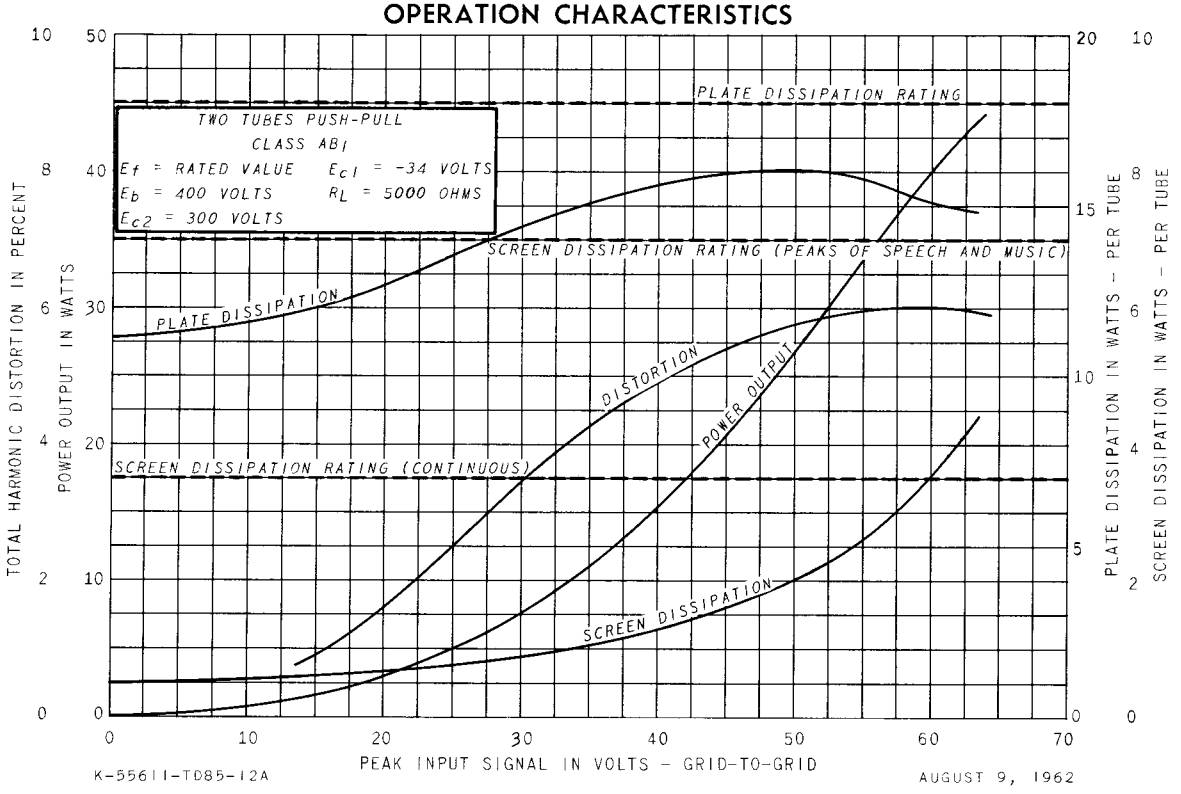
K-55611-TD85-10

SEPTEMBER 16, 1959

OPERATION CHARACTERISTICS



OPERATION CHARACTERISTICS



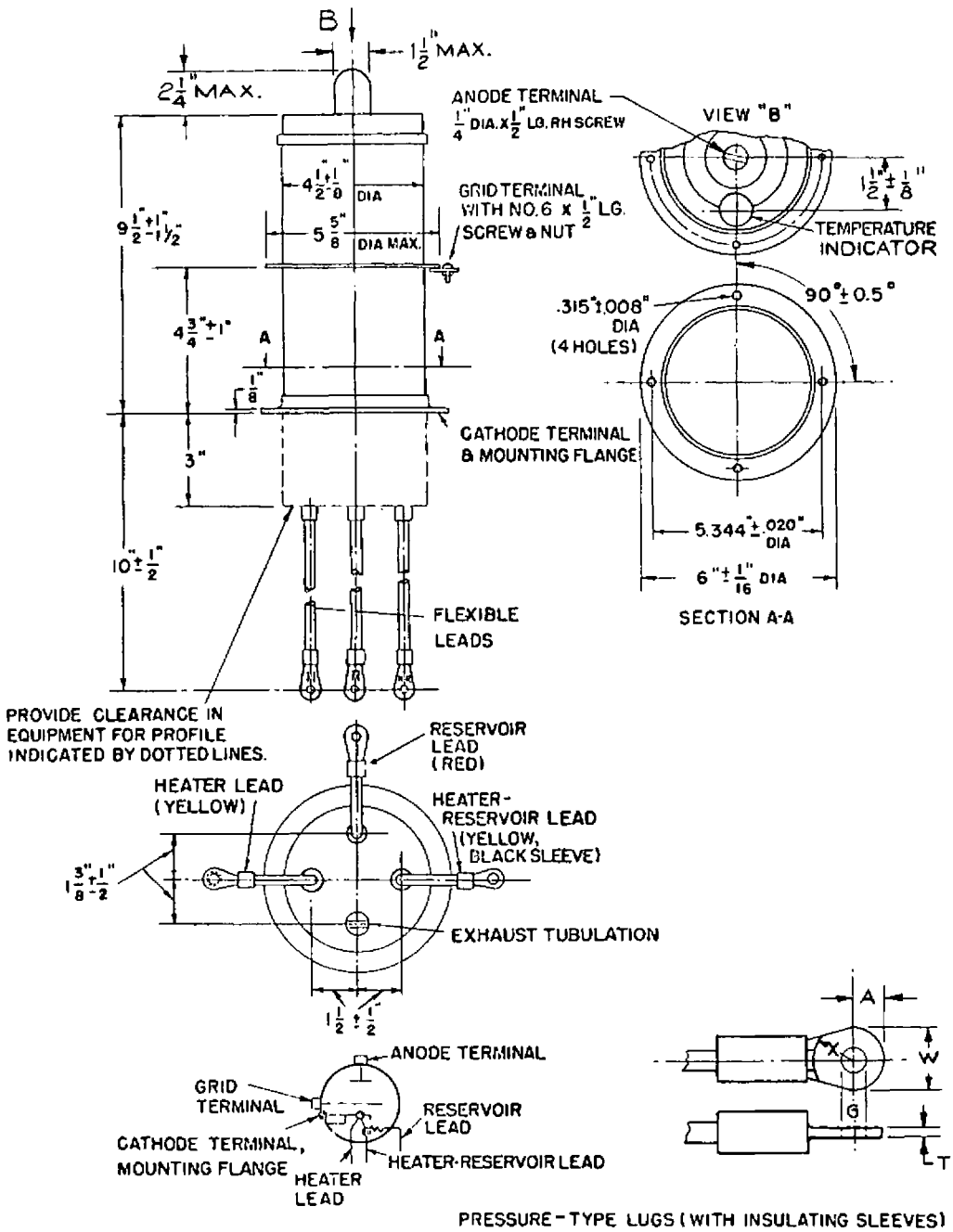
RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

from JEDEC release #3065,
Dec. 12, 1960
Electrically the same as 7390,
release #2520.

7390-A
HYDROGEN THYRATRON



PRESSURE-TYPE LUGS (WITH INSULATING SLEEVES)

LEADS	LUG DESIGNATION	"G" INCHES	"W" INCHES	"A" INCHES	"X" INCHES	"T" INCHES
RESERVOIR	# 10	.187 TO .207	.395 MAX.	.200 MAX.	.275 MIN.	.060 MAX.
HEATER-RESERVOIR	¼"	.260 TO .313	.605 MAX.	.305 MAX.	.380 MIN.	.060 MAX.
HEATER	¼"	.260 TO .313	.605 MAX.	.305 MAX.	.380 MIN.	.060 MAX.

NOTE: THERE SHALL BE NO OBSTRUCTION WITHIN THE DISTANCE OF "X" FROM THE CENTER OF THE LUG SCREW HOLE.

Planar Triode

7391

FOR GROUNDED-GRID CLASS C OSCILLATOR APPLICATIONS

The 7391 is a high-mu, metal-and-ceramic triode intended for operation as a grounded-grid, Class C oscillator at frequencies as high as 6000 megacycles.

Features of the tube include small size, planar electrode construction with close spacing, inherent rigidity, and an envelope structure convenient for coaxial circuit applications.

The physical appearance and dimensions of the 7391 are identical to those of the 6299.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.3	Volts
Heater Current‡	0.38	Amperes
Cathode Heating Time, minimum	60	Seconds
Direct Interelectrode Capacitances§		
Grid to Plate: (g to p)	1.58	pf
Grid to Cathode and Heater:		
g to (h + k)	3.25	pf
Plate to Cathode and Heater:		
p to (h + k)	0.0158	pf

MECHANICAL

Operating Position - Any

Net Weight, approximate	1/6	Ounce

Cooling - Conduction¶

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Plate Voltage	200	Volts
Negative DC Grid Voltage	15	Volts
Plate Dissipation	2.25	Watts
DC Plate Current	15	Milliamperes
DC Grid Current	3.0	Milliamperes
DC Cathode Current	15	Milliamperes
Envelope Temperature at Hottest Point	150	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	175	Volts
Grid Voltage	-1.5	Volts
Amplification Factor	62	
Transconductance	11000	Micromhos
Plate Current	10	Milliamperes

CLASS C CW OSCILLATOR—GROUNDED-GRID COAXIAL-TYPE CIRCUIT

Frequency	500	1000	5400	Megacycles
Plate Voltage	150	150	150	Volts
Plate Current	12	12	12	Milliamperes
Grid Current	3.0	3.0	3.0	Milliamperes
Power Output	500	250	65	Milliwatts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ The electrical connections to the plate and cathode must provide good thermal conductivity from these electrodes. The plate contact must be sufficiently flexible to keep the lateral force on the plate terminal at a minimum.

INITIAL CHARACTERISTICS LIMITS

	Minimum	Bogey	Maximum	
Heater Current				
Ef = 6.3 volts	360	380	400	Milliamperes
Grid Voltage				
Ef = 6.3 volts, Eb = 175 volts, Ib = 10 ma	-0.7	-1.5	-2.55	Volts
Transconductance				
Ef = 6.3 volts, Eb = 175 volts, Ec adjusted for Ib = 10 ma.	8000	11000	13500	Micromhos
Amplification Factor				
Ef = 6.3 volts, Eb = 175 volts, Ec adjusted for Ib = 10 ma.	46	62	80	
Grid Voltage Cutoff				
Ef = 6.3 volts, Eb = 175 volts, Ib = 100 μa.	-2.4	-4.2	-7.0	Volts
Interelectrode Leakage Resistance				
Ef = 6.3 volts, Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid to Cathode and Heater at 45 volts d-c	0.25	---	---	Megohms
Grid to Plate at 500 volts d-c	5.0	---	---	Megohms
Interelectrode Capacitances				
Grid to Plate: (g to p)	1.40	1.58	1.80	pf
Grid to Cathode and Heater: g to (h + k)	2.60	3.25	3.95	pf
Plate to Cathode and Heater: p to (h + k)	0.010	0.0158	0.023	pf

SPECIAL PERFORMANCE TESTS

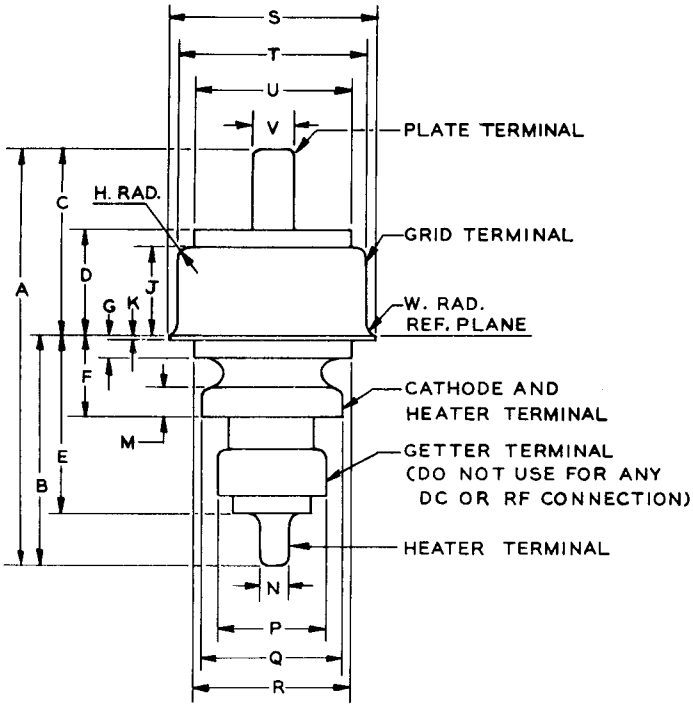
5400 Megacycle Oscillator Power Output				
Ef = 6.3 volts, Eb = 150 volts, Rg = 2000 ohms, Ib = 15±0.5 ma, F = 5400 MC, min.	30	65	---	Milliwatts

DEGRADATION RATE TESTS

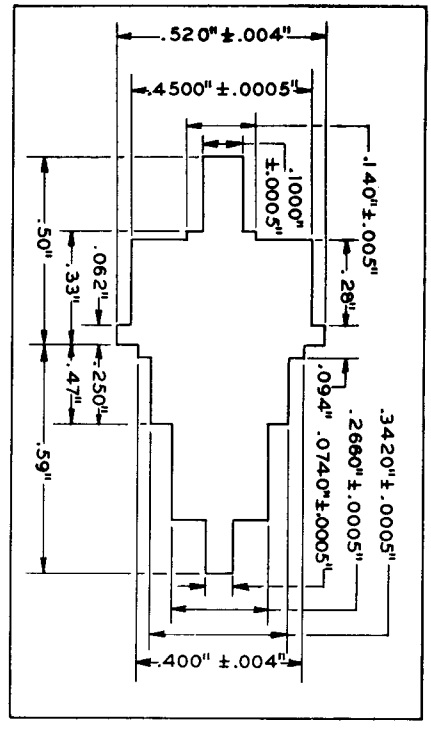
500-Hour Life

Statistical sample operated for 500 hours to evaluate changes in power output and transconductance with life.

PHYSICAL DIMENSIONS

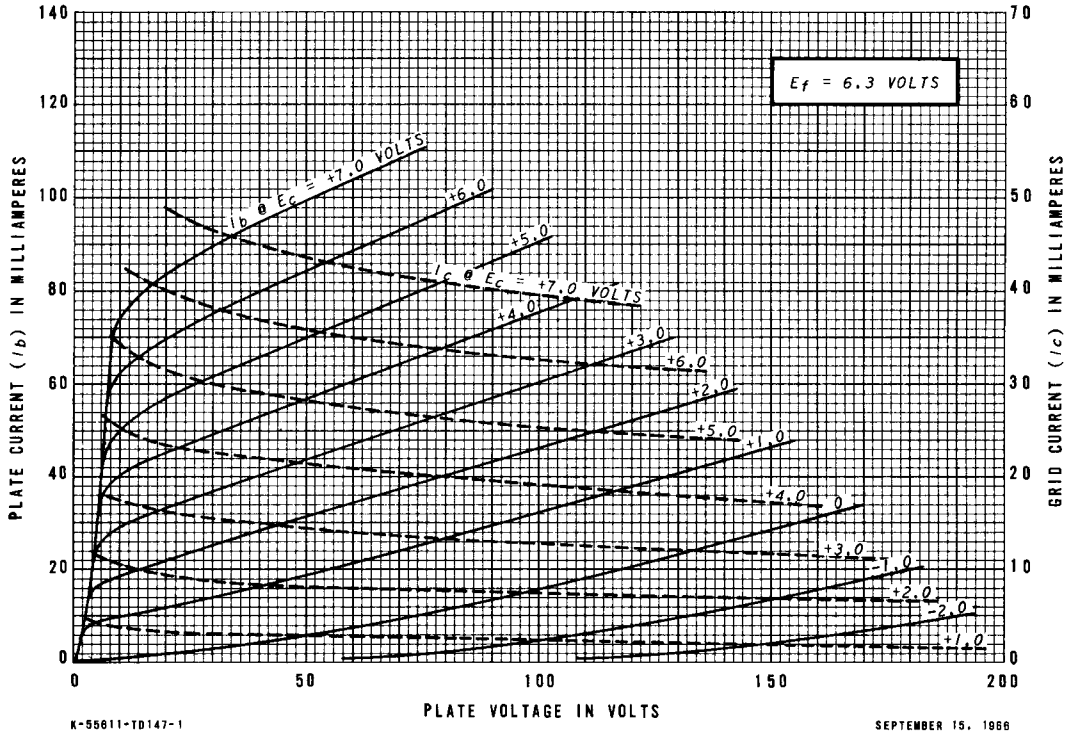


ALIGNMENT GAUGE



Ref.	INCHES		MILLIMETERS	
	Minimum	Maximum	Minimum	Maximum
A	0.960	1.040	24.38	26.42
B	0.530	0.590	13.46	14.99
C	0.410	0.470	10.41	11.94
D	---	0.272	---	6.91
E	---	0.475	---	12.07
F	0.163	0.193	4.14	4.90
G	---	0.060	---	1.52
H	---	0.030	---	0.76
J	0.190	0.210	4.83	5.33
K	0.009	0.015	0.23	0.38
M	0.040	0.070	1.02	1.78
N	0.059	0.065	1.50	1.65
P	---	0.257	---	6.53
Q	0.326	0.334	8.28	8.48
R	---	0.385	---	9.78
S	0.483	0.497	12.27	12.62
T	0.435	0.445	11.05	11.30
U	---	0.385	---	9.78
V	0.088	0.094	2.24	2.39
W	---	0.008	---	0.20

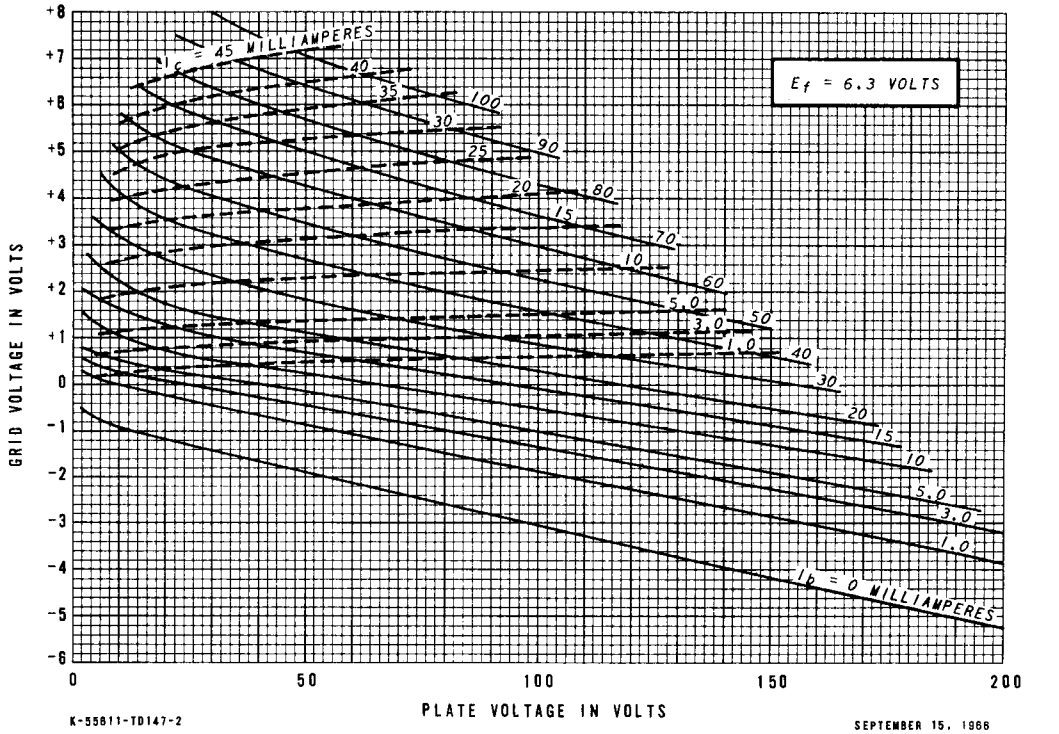
AVERAGE PLATE CHARACTERISTICS



K-55611-TD147-1

SEPTEMBER 15, 1966

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



K-55611-TD147-2

SEPTEMBER 15, 1966

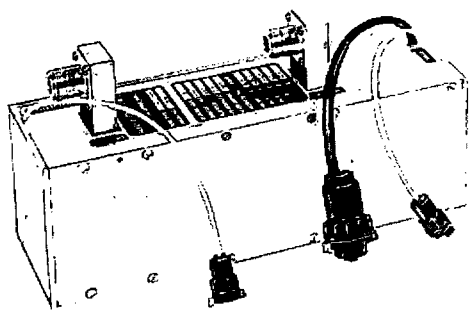
TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

GL-7393

TRAVELING-WAVE TUBE



LESS THAN 10 DB NOISE FIGURE **4000-8000 MEGACYCLES**

25 DB GAIN **METAL-CERAMIC**

LOW NOISE

The GL-7393 is a ruggedized, low-noise, broadband traveling-wave tube for use in the 4000-to-8000-megacycle frequency range. It has a noise figure of less than 10 decibels across the entire band with a power output of five milliwatts.

The tube is of metal-and-ceramic construction and is supplied as a complete packaged assembly which includes the focusing magnets, connectors, and housing. The entire assembly weighs approximately 11.5 pounds.

The broad bandwidth, low-noise, high gain, freedom from tuning adjustments, and rugged construction make this tube particularly useful in military systems. As the input tube for radar receivers, it has the decided advantages of low noise and protection to the crystal mixer. Other applications include electronic countermeasures equipment, microwave relay systems, and radiometry.

Electrical

Frequency	4000–8000	Megacycles
Heater		
Voltage	6.3	Volts
Current, nominal	0.3	Ampere
A heater-voltage regulation of ±2 percent is recommended to realize optimum gain and noise figure.		
Focusing Method—Permanent Magnet		
Noise Figure*, maximum	10	Decibels
Small-Signal Gain, minimum	25	Decibels
Saturated Power Output, nominal	5.0	Milliwatts
Collector Dissipation	1.0	Watt
Impedance, Coaxial	50	Ohms
Input VSWR	Less than 2.5 to 1	
Output VSWR	Less than 3.5 to 1	

Mechanical

Mounting Position—Any

Connectors

- DC Socket—Winchester PM6P-LS (or equivalent)
- Helix—Winchester PM1P-LS (or equivalent)
- Collector—Winchester PM1P-LS (or equivalent)
- RF Connectors, Coaxial
  - Input—Type N, UG-58/U
  - Output—Type N, UG-58/U

Over-all Dimensions		
Length	9.25	Inches
Width	4.525	Inches
Height	2.914	Inches
Weight, Tube and Magnet, approximate	11.5	Pounds
Shock	50	G
Vibration	15	G
Altitude, operating	100,000	Feet Mean Sea Level

Thermal

Cooling—Convection		
Operating Temperature, Ambient	−20 to +70	C

TYPICAL OPERATING CONDITIONS**

Electrode-No. 1 Voltage, Grid	−20 to −25	Volts
Electrode-No. 2 Voltage, Anode	25 to 50	Volts
Electrode-No. 3 Voltage	30 to 100	Volts
Electrode-No. 4 Voltage	150 to 300	Volts
Helix		
Voltage	400 to 500	Volts
Current, maximum	50	Microamperes
Collector voltage	550 to 750	Volts
Beam Current	500 to 850	Microamperes
Magnetic Field Strength, approximate	600	Gausses

*Over band with the same operating voltages that provide minimum gain variation.

**All voltages may be isolated from ground; i.e., it is not necessary to operate the cathode, helix, collector, or any other electrode at ground potential. Voltages shown are measured with respect to cathode. For minimum noise and optimum gain characteristics, voltages should be adjusted to values specified by instructions accompanying each tube.

PERFORMANCE ASSURANCE SPECIFICATIONS

Shock (energized)	30 G for 11 milliseconds on each of three mutually perpendicular axes.
Vibration (operating)	0.031 inches double amplitude from 5 to 55 cycles per second and 5 G from 55 to 1500 cycles per second with sweep over 5 to 1500 cycles per second for 100 minutes on each of three mutually perpendicular axes.
Humidity (non-operating)	MIL-E-5272 C, Paragraph 4.4.1 (Procedure I); i.e., non-operating tube in 95 percent relative humidity atmosphere for 10 days with temperature cycled slowly from approximately 30 C to 71 C each day.
Acoustic noise (operating)	135 decibels, 25 to 12,000 cycles per second random noise.

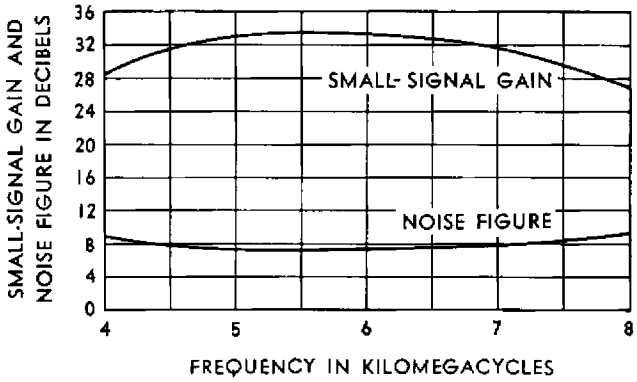
PERMANENT-MAGNET PRECAUTIONS

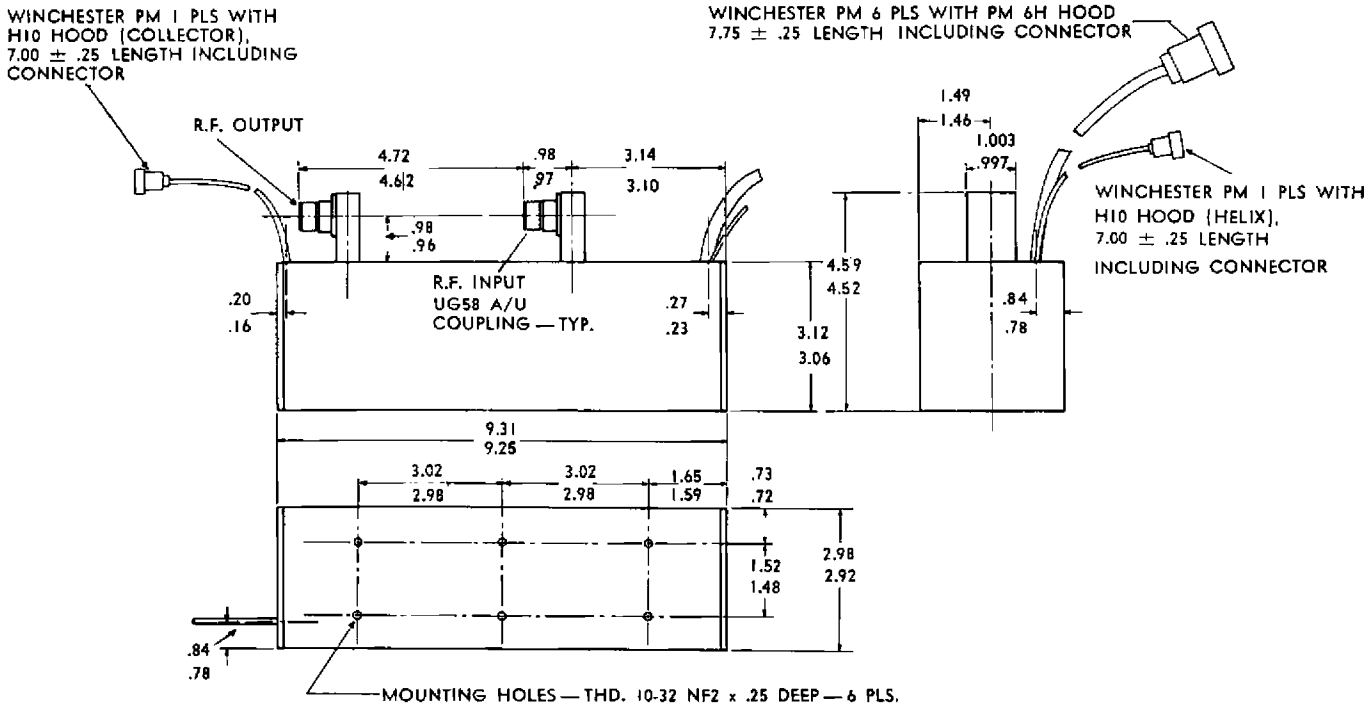
This tube uses a uniform-field permanent magnet as the focusing structure. A label on the tube specifies a nominal lower limit of two inches on magnetic-material proximity. It must be realized that strong external magnets or large amounts of magnetic material at this distance may permanently damage the tube. A small screwdriver will not, while a large a-c transformer or a large sheet of steel at this distance may cause damage by defocusing the tube.

In addition, a related caution is important and must be remembered whenever handling a uniform-field tube. The permanent magnets of these tubes cause a large attractive force between the tube and magnetic material. Unless one is always careful to hold the tube and/or magnetic objects near the tube firmly, the result is sudden direct contact. The magnetic object may cause tube damage due to violations of the minimum spacing requirement.

For small steel hand tools, a two-inch limit is sufficient. For large magnetic objects with magnetic fields of their own, the lower minimum distance should be determined accurately by testing. To accomplish this, the tube may be secured to a suitable three-foot-long dielectric support and the tube case grounded. With the tube operating and its helix current being measured, the tube may be moved slowly by the dielectric support toward the magnetic object. (CAUTION: Appropriate electrical safety procedures should be followed at all times.) The minimum distance for which there is no degradation in r-f performance is the point at which the helix current starts to increase. If a slight degradation in noise figure can be accepted, the helix current may be allowed to increase somewhat as long as it stays below its operating maximum.

NOISE FIGURE AND SMALL-SIGNAL GAIN VS. FREQUENCY

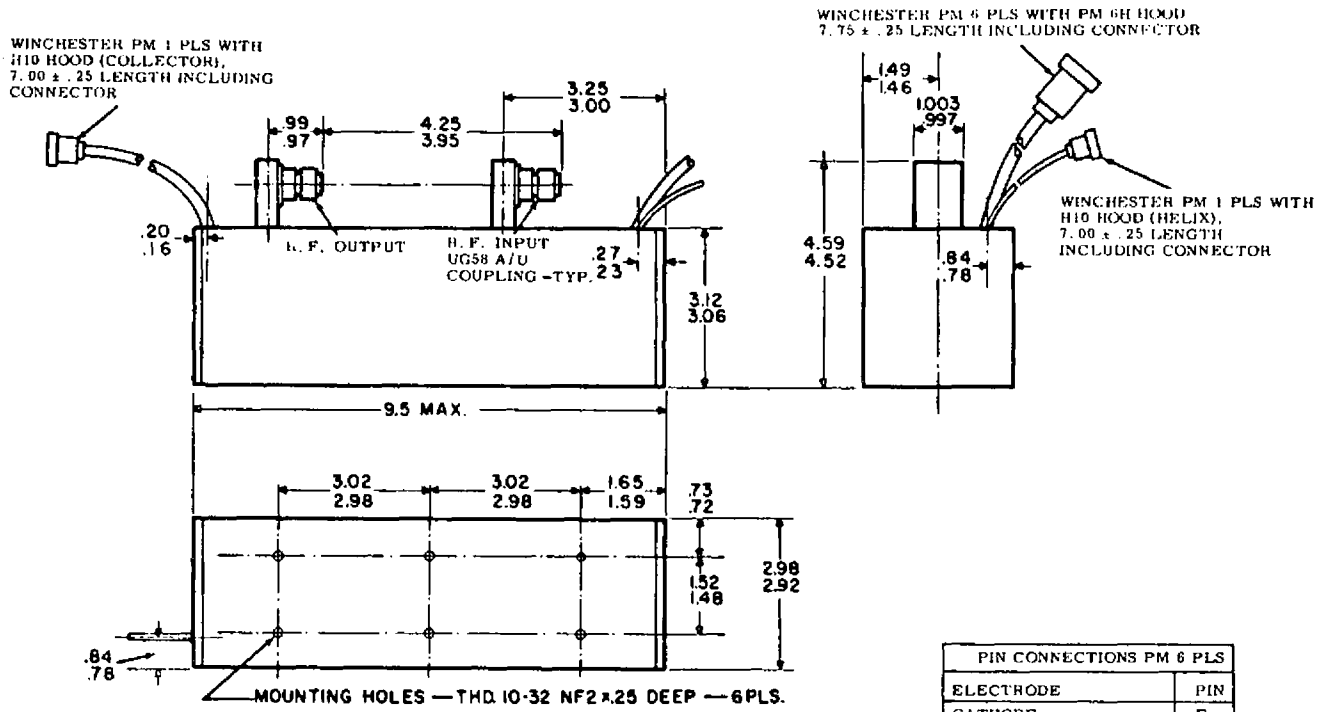




PIN CONNECTIONS PM 6 PLS	
ELECTRODE	PIN
CATHODE	F
HEATER	A
NO. 1, GRID	B
NO. 2, ANODE	C
NO. 3, FOCUS	D
NO. 4, FOCUS	E

GL-7393

OUTLINE



ALL DIMENSIONS ARE IN INCHES

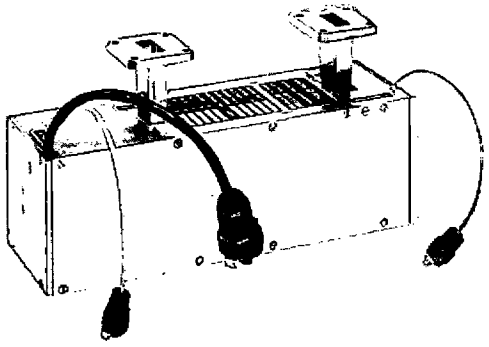
PIN CONNECTIONS PM 6 PLS	
ELECTRODE	PIN
CATHODE	F
HEATER	A
NO. 1, GRID	B
NO. 2, ANODE	C
NO. 3, FOCUS	D
NO. 4, FOCUS	E

2/15/63

from JEDEC release #3442B, March 4, 1963

GL-7394

TRAVELING-WAVE TUBE



LESS THAN 10 DB NOISE FIGURE **8000-12,000 MEGACYCLES**

25 DB GAIN **METAL-CERAMIC**

LOW NOISE

The GL-7394 is a ruggedized, low-noise, broadband traveling-wave tube for use in the 8000-to-12,000 megacycle frequency range. It has a noise figure of less than 10 decibels across the entire band with a power output of 5 milliwatts.

The tube is of metal-and-ceramic construction and is supplied as a complete packaged assembly which includes permanent focusing magnets, connectors, and housing. The entire assembly weighs approximately 11.5 pounds.

The broad bandwidth, low-noise, high gain, freedom from tuning adjustments, and rugged construction make this tube particularly useful in military systems. As the input tube for radar receivers, it has the decided advantages of low noise and protection to the crystal mixer. Other applications include electronic countermeasures equipment, microwave relay systems, and radiometry.

Electrical

Frequency	8000 to 12,000	Megacycles
Heater		
Voltage	6.3	Volts
Current, nominal	0.3	Ampere
A heater-voltage regulation of ±2 percent is recommended to realize optimum gain and noise figure.		
Focusing Method—Permanent Magnet		
Noise Figure*, maximum	10	Decibels
Small-Signal Gain, minimum	25	Decibels
Saturated Power Output, nominal	5.0	Milliwatts
Collector Dissipation	1.0	Watt
Waveguide VSWR		
Input	Less than 2.5 to 1	
Output	Less than 3.5 to 1	

Mechanical

Mounting Position—Any

Connectors

DC Socket—Winchester PM6P-LS (or equivalent)
Helix—Winchester PM1P-LS (or equivalent)
Collector—Winchester PM1P-LS (or equivalent)
RF Connectors, Waveguide
Input—UG-39/U
Output—UG-39/U

Over-all Dimensions		
Length	9.25	Inches
Width	4.6	Inches
Height	3.0	Inches
Weight, Tube and Magnet, approximate	11.5	Pounds
Shock	50	G
Vibration	15	G
Altitude	100,000	Feet Mean Sea Level

Thermal

Cooling—Convection

Operating Temperature		
Ambient	—20 to +70	C

TYPICAL OPERATING CONDITIONS**

Electrode-No. 1 Voltage, Grid	—10 to —25	Volts
Electrode-No. 2 Voltage, Anode	30 to 60	Volts
Electrode-No. 3 Voltage	40 to 150	Volts
Electrode-No. 4 Voltage	250 to 450	Volts
Helix		
Voltage	700 to 850	Volts
Current, maximum	50	Microamperes
Collector Voltage	900 to 1000	Volts
Beam Current	400 to 700	Microamperes
Magnetic Field Strength, approximate	600	Gausses

*Over band with the same operating voltages that provide minimum gain variation.

**All voltages may be isolated from ground; i.e., it is not necessary to operate the cathode, helix, collector, or any other electrode at ground potential. Voltages shown are measured with respect to cathode. For minimum noise and optimum gain characteristics, voltages should be adjusted to values specified by instructions accompanying each tube.

PERFORMANCE ASSURANCE SPECIFICATIONS

Shock (energized)	30 G for 11 milliseconds on each of three mutually perpendicular axes.
Vibration (operating)	0.031 inches double amplitude from 5 to 55 cycles per second and 5 G from 55 to 1500 cycles per second with sweep over 5 to 1500 cycles per second for 100 minutes on each of three mutually perpendicular axes.
Humidity (non-operating)	MIL-E-5272 C, Paragraph 4.4.1 (Procedure I); i.e., non-operating tube in 95 percent relative humidity atmosphere for 10 days with temperature cycled slowly from approximately 30 C to 71 C each day.
Acoustic noise (operating)	135 decibels, 25 to 12,000 cycles per second random noise.

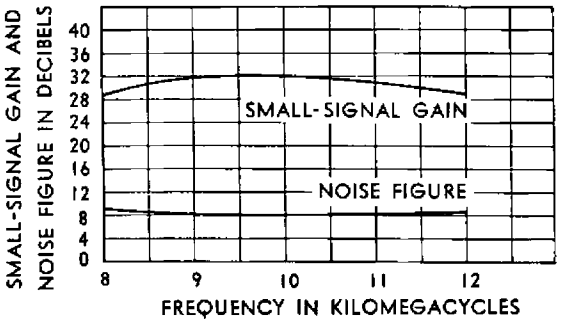
PERMANENT-MAGNET PRECAUTIONS

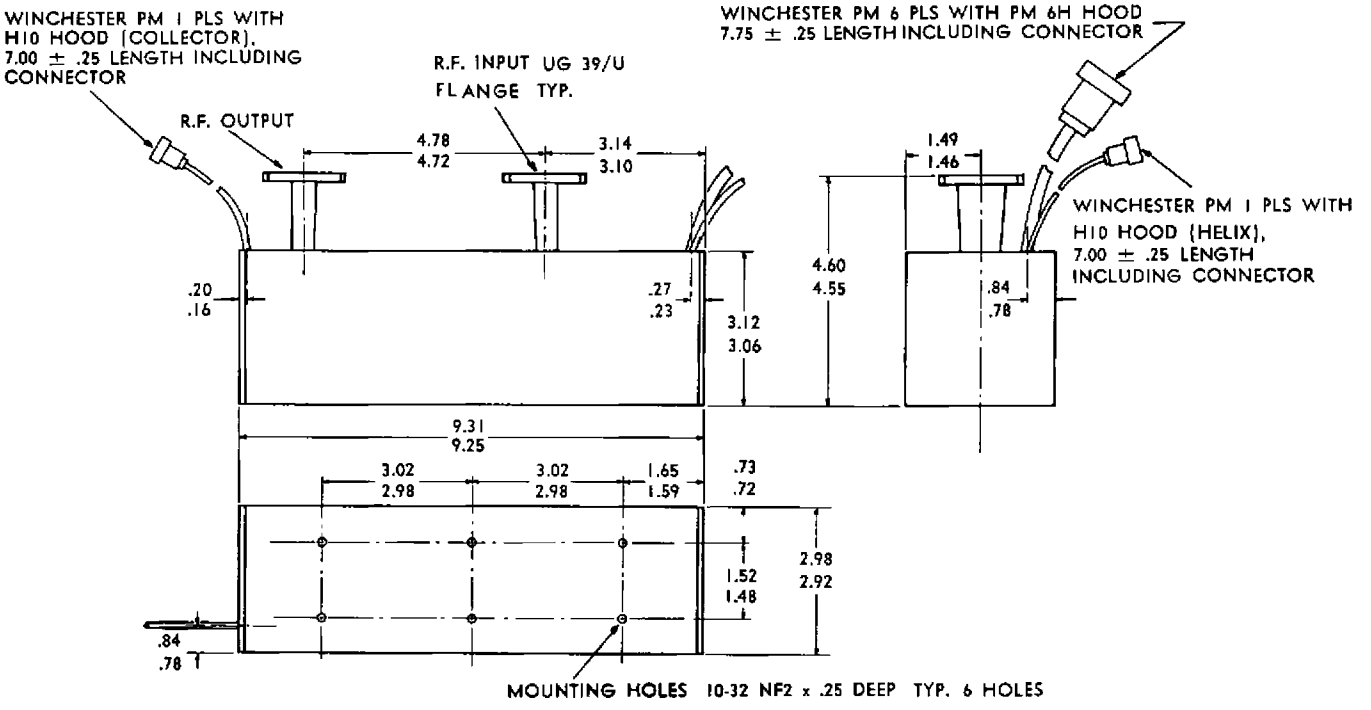
This tube uses a uniform-field permanent magnet as the focusing structure. A label on the tube specifies a nominal lower limit of two inches on magnetic-material proximity. It must be realized that strong external magnets or large amounts of magnetic material at this distance may permanently damage the tube. A small screwdriver will not, while a large a-c transformer or a large sheet of steel at this distance may cause damage by defocusing the tube.

In addition, a related caution is important and must be remembered whenever handling a uniform-field tube. The permanent magnets of these tubes cause a large attractive force between the tube and magnetic material. Unless one is always careful to hold the tube and/or magnetic objects near the tube firmly, the result is sudden direct contact. The magnetic object may cause tube damage due to violations of the minimum spacing requirement.

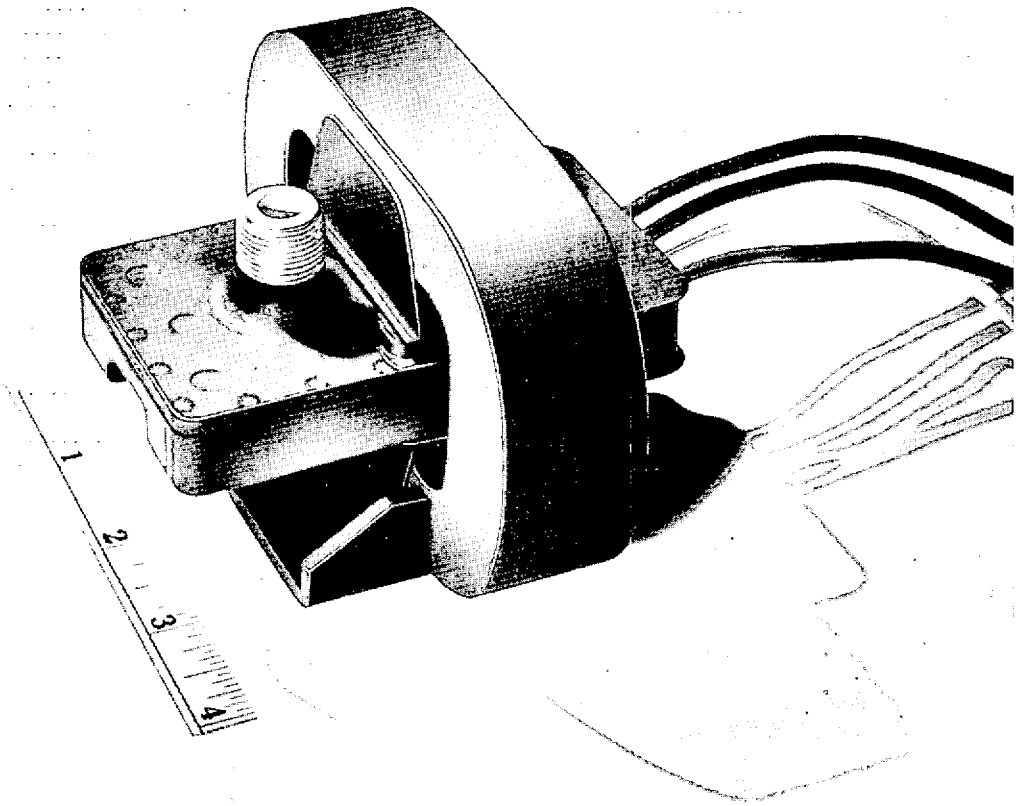
For small steel hand tools, a two-inch limit is sufficient. For large magnetic objects with magnetic fields of their own, the lower minimum distance should be determined accurately by testing. To accomplish this, the tube may be secured to a suitable three-foot-long dielectric support and the tube case grounded. With the tube operating and its helix current being measured, the tube may be moved slowly by the dielectric support toward the magnetic object. (CAUTION: Appropriate electrical safety procedures should be followed at all times.) The minimum distance for which there is no degradation in r-f performance is the point at which the helix current starts to increase. If a slight degradation in noise figure can be accepted, the helix current may be allowed to increase somewhat as long as it stays below its operating maximum.

NOISE FIGURE AND SMALL-SIGNAL GAIN VS. FREQUENCY





PIN CONNECTIONS PM 6 PLS	
ELECTRODE	PIN
CATHODE	F
HEATER	A
NO. 1, GRID	B
NO. 2, ANODE	C
NO. 3, FOCUS	D
NO. 4, FOCUS	E



PACKAGED VOLTAGE-TUNABLE MAGNETRON

2200-3850 MEGACYCLES **2 WATTS CW OUTPUT**

The GL-7398 is a packaged voltage-tunable magnetron designed for voltage-tunable operation in the 2200 to 3850-megacycle frequency range. It is a complete r-f power source package requiring only input power connections and an r-f power output connection and has a minimum CW power output of two watts across the entire frequency range. The tube may be voltage-tuned over a portion or all of the frequency range for which it is designed or operated at a fixed frequency. The voltage-frequency relationship is essentially linear.

TECHNICAL INFORMATION

GENERAL

	Minimum	Bogey	Maximum	
Electrical				
Cathode—Directly Heated				
Filament Voltage*	2.2	2.5	2.7	Volts
Filament Current	—	3.0	—	Amperes
Mechanical				
Mounting Position—Any				
Net Weight			3.5	Pounds
Thermal				
Type of Cooling—Forced Air				
Air Flow			30	Cubic Feet per Minute
Ambient Air Temperature			50	C

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Absolute Values

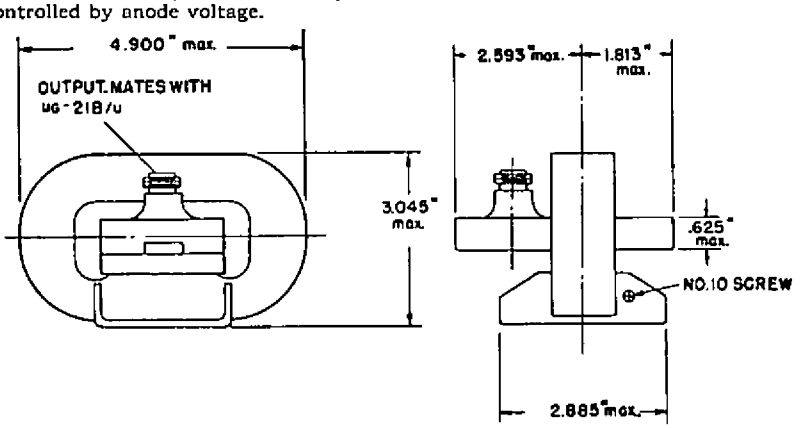
Anode Voltage	2000	Volts
Anode Current	30	Milliamperes
Power Input, with forced-air cooling	45	Watts
Injection Electrode Voltage	700	Volts
Injection Electrode Current	1.0	Milliamperes
Filament Current	3.2	Amperes
Voltage Standing Wave Ratio	1.5	

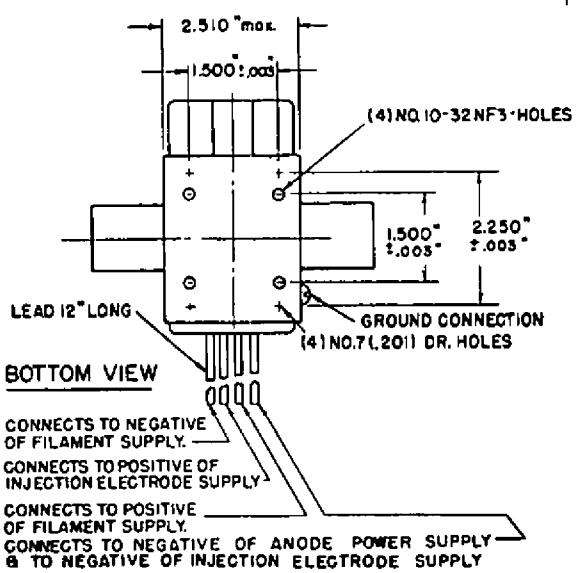
Typical Operating Conditions

Operation with 60-cycle Sweep Voltage in Wide-Band Circuit

Filament Voltage*, approximate	2.50	Volts
Filament Current	3.0	Amperes
Tunable Range†	2200—3850	Megacycles
Tuning Rate, approximate	3.0	Megacycles per Volt
Anode Voltage at 3 Kilomegacycles	1250	Volts
Anode Current, average	10 to 20	Milliamperes
Injection Electrode Voltage, positive with respect to cathode	300 to 600	Volts
Injection Electrode Current	0.1	Milliamperes
Voltage Standing Wave Ratio of Load	1.3	
Power Output, minimum	2.0	Watts
Variation over Band	Less than 4:1	

* Filament current should be adjusted to 3.0 amperes.
† Frequency controlled by anode voltage.



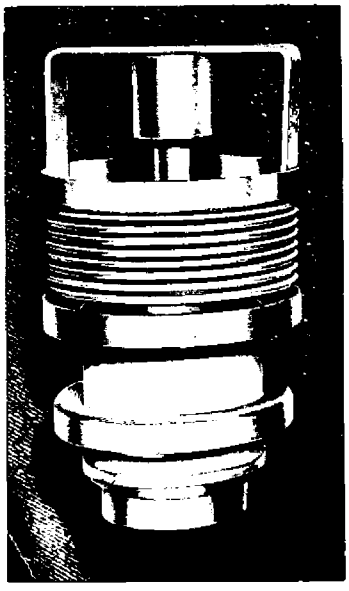


K-69087-72A870 6-8-59

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.



GL-7399

TETRODE

PULSED SERVICE
GROUNDED-GRID OPERATION

FORCED-AIR COOLED
METAL AND CERAMIC

INTEGRAL RADIATOR

The GL-7399 is a small-size, four-electrode transmitting tube especially designed for pulsed-amplifier or -oscillator service at L-band frequencies. This tetrode is particularly well suited for use in airborne or ground-based radar equipment.

The tube is capable of providing useful output at frequencies up to approximately 1500 megacycles.

Features of the GL-7399 include long life and reliability, long pulse width, high peak power and high gain, broad-banding capability, and resistance to shock and vibration.

These together with such design factors as an oxide-coated cathode, coaxial elements, and metal-ceramic construction make the tube well adapted to application in modern systems where performance and reliability are important.

Electrical

	Minimum	Bogey	Maximum	
Heater Voltage	6.0	6.3	6.8	Volts
Heater Current	....	5.6	....	Amperes
Amplification				
Factor, G_2 to G_1	....	10.5	....	
E_{c2} = 275 Volts DC, E_b = 1000 Volts DC, I_b = 200 Milliamperes DC				
Cathode Heating Time	1	....	....	Minute
Direct Interelectrode Capacitances*				
Cathode to Plate†	....	0.012	....	$\mu\mu f$
Input	....	21.5	....	$\mu\mu f$
Output	....	9.3	....	$\mu\mu f$

Mechanical

Mounting Position—Any

Net Weight	....	1.0	....	Pounds

Thermal

Cooling— Forced Air‡

Radiator§				
Plate Dissipation	300	240	180	Watts
Air Flow, 45 C incoming air temperature	15	10	5	Min Cubic Feet per Minute
Static Pressure, anode at room temperature¶	0.60	0.30	0.10	Inches-Water
Radiator Hub Temperature▲			180	Max C
Seals				
Screen and Control Grid, approximate			1	Cubic Foot per Minute
Heater and Cathode, approximate			1	Cubic Foot per Minute
Ceramic Temperature at any Point			200	Max C

MAXIMUM RATINGS AT 500 MEGACYCLES

Radio-Frequency Power Amplifier—Plate and Screen Grid Pulsed

DC Plate Voltage, during pulse	10	Kilovolts	
DC Plate Current, during pulse	10	Amperes	
DC Screen Voltage, during pulse	2000	Volts	
DC Screen Input♣	15	Watts	
Plate Dissipation♣	300	Watts	
DC Grid-No. 1 Voltage, not pulsed	−175	Volts	
DC Grid-No. 1 Current, during pulse	2.5	Amperes	
Pulse Width♥♦	15	Microseconds	
Duty Factor♥ϕ	0.0012		

TYPICAL OPERATION AT 500 MEGACYCLES

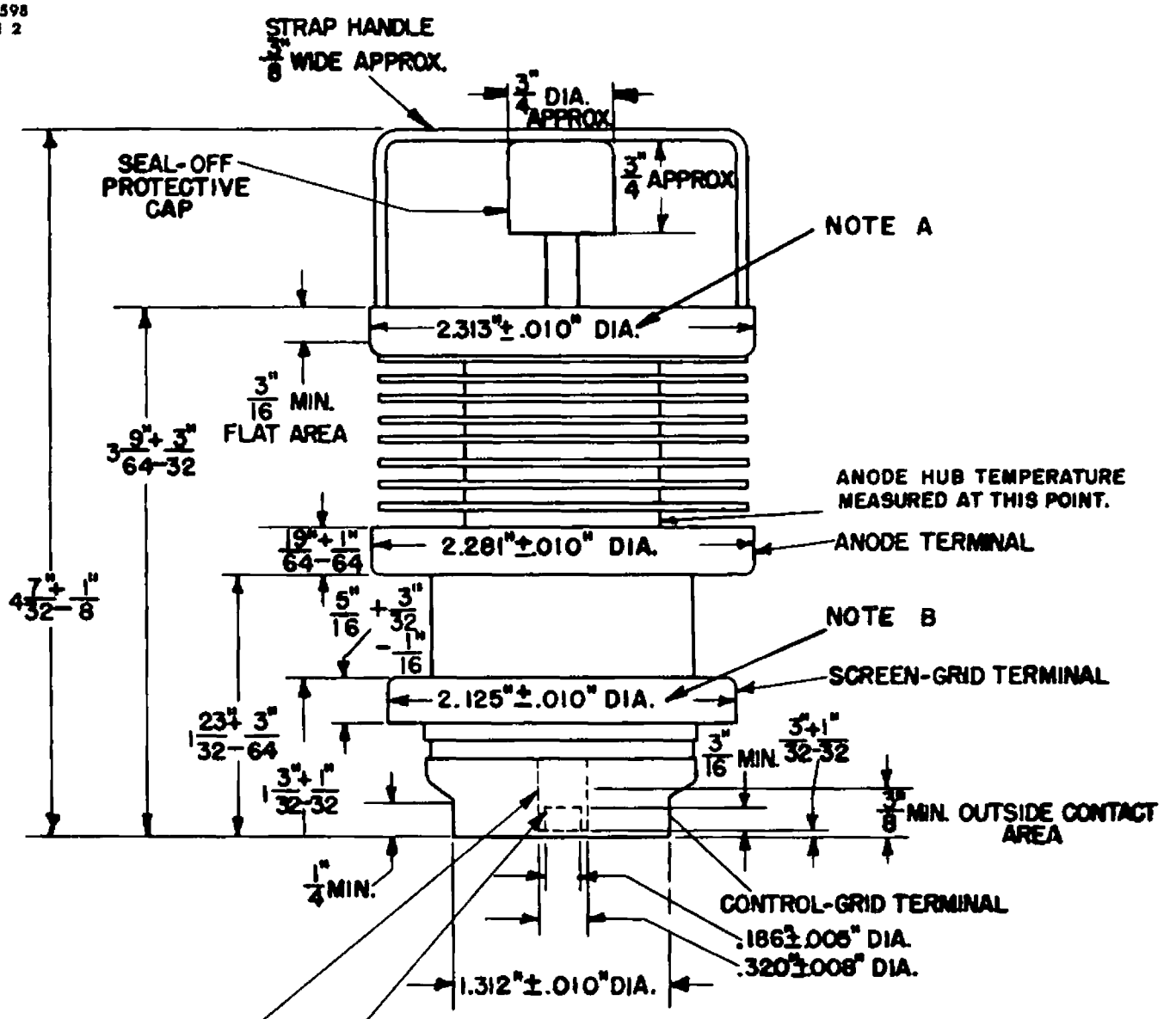
Class B, Grounded-Grid Service

DC Plate Voltage, during pulse	9	Kilovolts	
DC Grid-No. 2 Voltage, during pulse	1400	Volts	
DC Grid-No. 1 Voltage, not pulsed	−125	Volts	
Peak RF Plate Voltage	7000	Volts	
Peak RF Grid Voltage	300	Volts	
DC Plate Current, during pulse	9.2	Amperes	
DC Grid-No. 1 Current, during pulse	1.1	Amperes	
DC Grid-No. 2 Current, during pulse	0.47	Amperes	
Driving Power at Tube, during pulse	2.6	Kilowatts	
Power Output, during pulse	52	Kilowatts	
Pulse Width♦	15	Microseconds	
Duty Factorϕ	0.001		

* Control grid connected directly to screen grid.
† Complete external shielding between cathode and plate.
‡ Forced air cooling should be applied during the application of any voltages.
§ Provision must be made for unobstructed passage of cooling air between radiator fins, and the anode terminal and adjacent fins.
¶ With anode temperature at 180 C a 10-percent increase in back pressure occurs for the specified air flow.
▲ Measured at the base of the fin adjacent to the plate terminal. See outline drawing on page 2.
♣ Maximum average value.
♥ For applications that require longer pulses or higher duty refer to the tube manufacturer for recommendations.
♦ Pulse duration measured between points at 70 percent of peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.
ϕ Maximum ratio of on time to elapsed time during any one millisecond period.

GENERAL ELECTRIC

from JEDEC release #2815, May 23, 1960



NOTES:

1. BOTTOM OF CUP MUST NOT BE USED AS A SOCKET STOP.

(A) MAX. ECCENTRICITY 0.015 INCHES
(B) MAX. ECCENTRICITY 0.008 INCHES
(C) MAX. ECCENTRICITY 0.018 INCHES
(D) MAX. ECCENTRICITY 0.021 INCHES
WITH RESPECT TO CENTERLINE DETERMINED BY CENTERS OF ANODE & CONTROL GRID TERMINALS.

K-5933-72A578

ELECTRONIC COMPONENTS DIVISION

3-8-60

GENERAL ELECTRIC

Schenectady 5, N. Y.

BEAM PENTODE

FOR AF POWER-AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 7408 is a beam-power pentode primarily designed for use in audio-frequency power-amplifier applications. The tube is a direct replacement for the 6V6-GT, but features additional controlled zero-bias characteristics.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.45	Amperes
Direct Interelectrode Capacitances†		
Grid-Number 1 to Plate: (g1 to p)	0.7	pf
Input: g1 to (h+k+g2+b.p.)	9.0	pf
Output: p to (h+k+g2+b.p.)	7.5	pf

MECHANICAL

Mounting Position—Any
Envelope—T-9, Glass
Base—B7-7, Intermediate-Shell Octal 7-Pin or
B7-59, Short Intermediate-Shell Octal 7-Pin with carriers

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate Voltage	350	Volts
Screen Voltage	315	Volts
Plate Dissipation	14	Watts
Screen Dissipation	2.2	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.5	Megohms

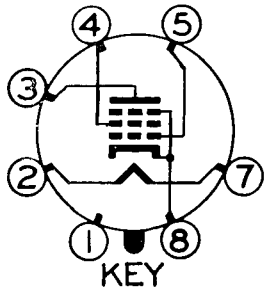
Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

BASING DIAGRAM

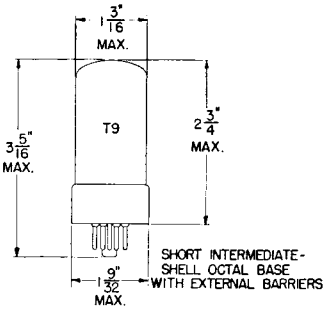


EIA 7AC

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Heater
Pin 3—Plate
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates

PHYSICAL DIMENSIONS



EIA 9-41

GENERAL ELECTRIC

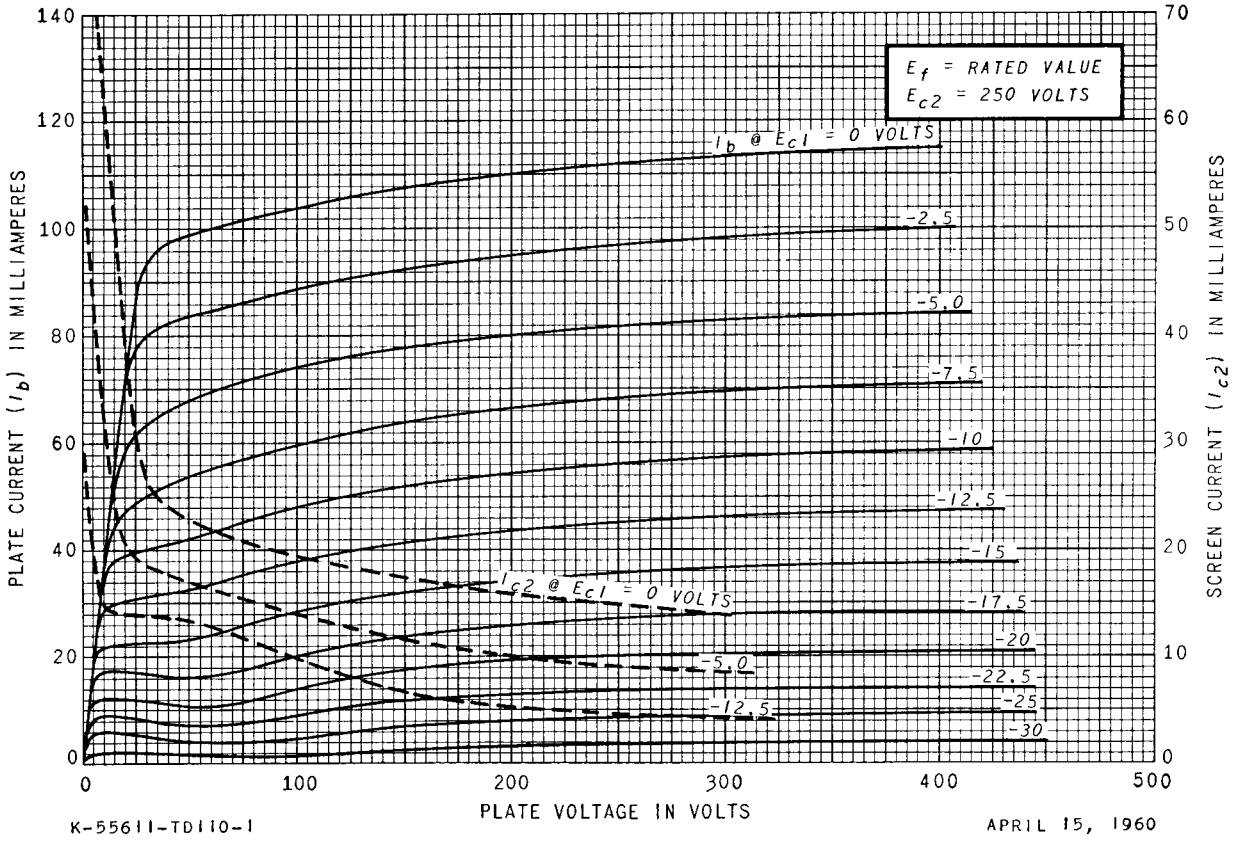
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

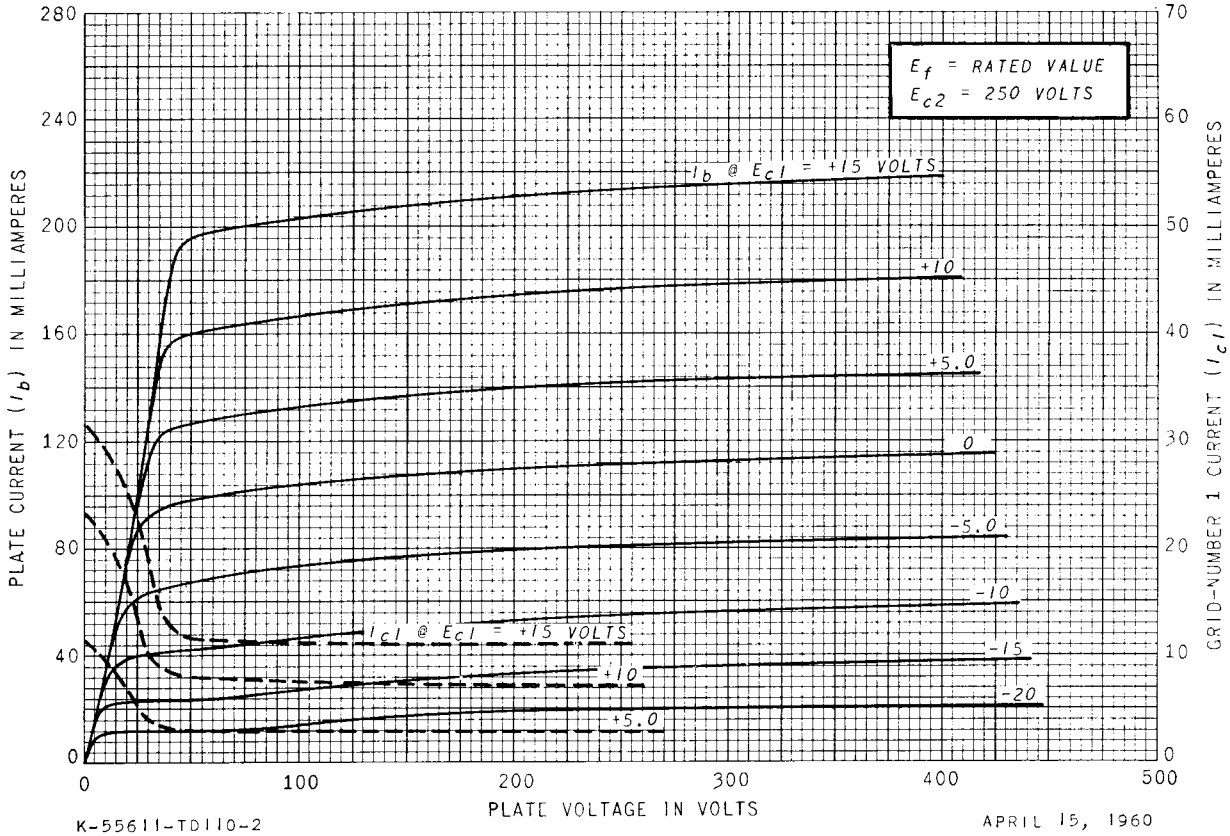
Plate Voltage	60	250	Volts
Screen Voltage	250	250	Volts
Grid-Number 1 Voltage	0	−12.5	Volts
Peak AF Grid-Number 1 Voltage	—	12.5	Volts
Plate Resistance, approximate	—	50,000	Ohms
Transconductance	—	4100	Micromhos
Zero-Signal Plate Current	100	45	Milliamperes
Maximum-Signal Plate Current	—	47	Milliamperes
Zero-Signal Screen Current	22	4.5	Milliamperes
Maximum-Signal Screen Current	—	7.0	Milliamperes
Load Resistance	—	5000	Ohms
Total Harmonic Distortion, approximate	—	7	Percent
Maximum-Signal Power Output	—	4.5	Watts

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.
† Heater current of a bogey tube at Ef = 6.3 volts.
‡ Without external shield.

AVERAGE PLATE CHARACTERISTICS



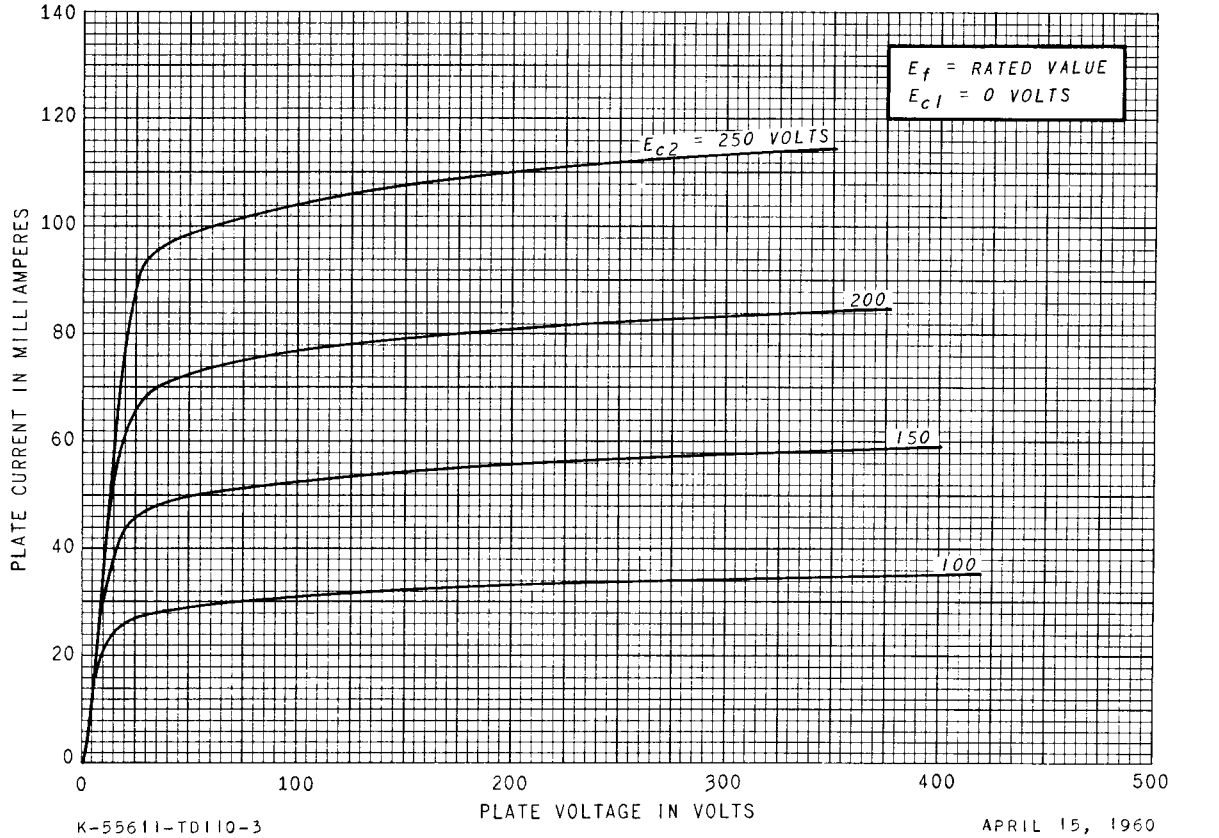
AVERAGE PLATE CHARACTERISTICS



K-55611-TD110-2

APRIL 15, 1960

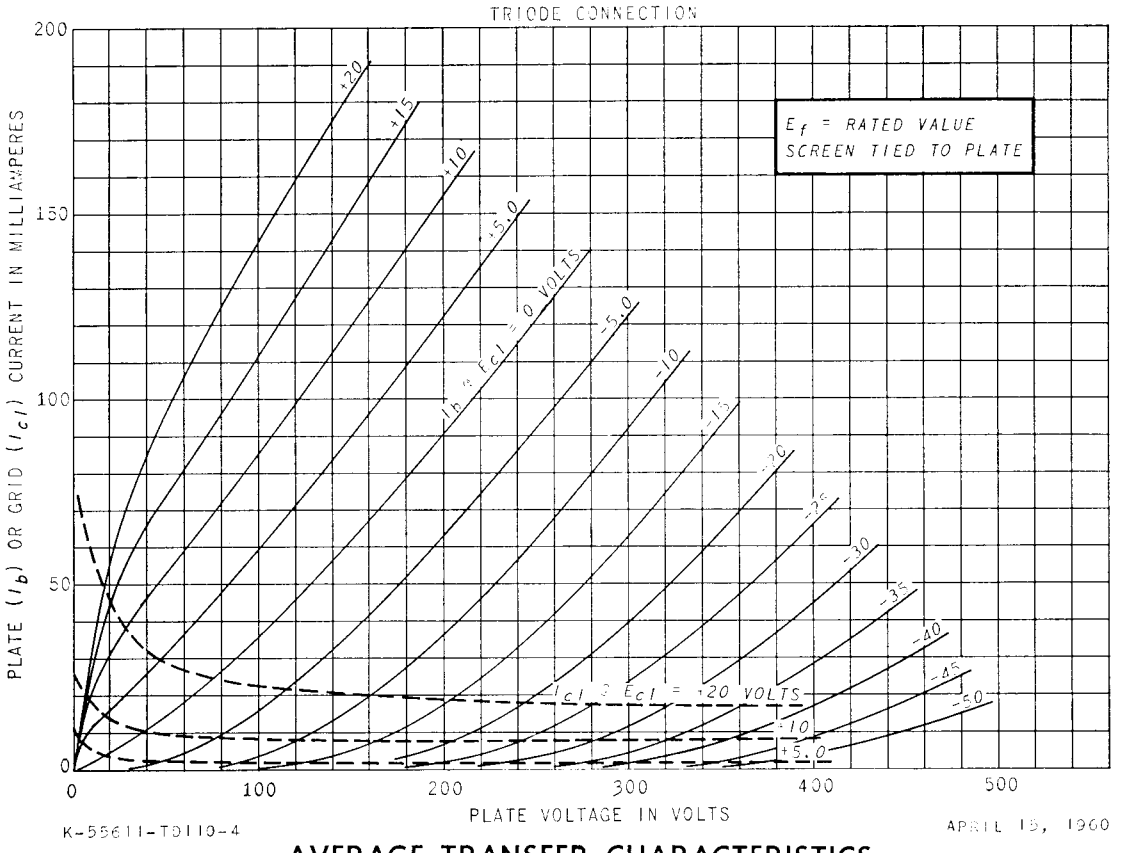
AVERAGE PLATE CHARACTERISTICS



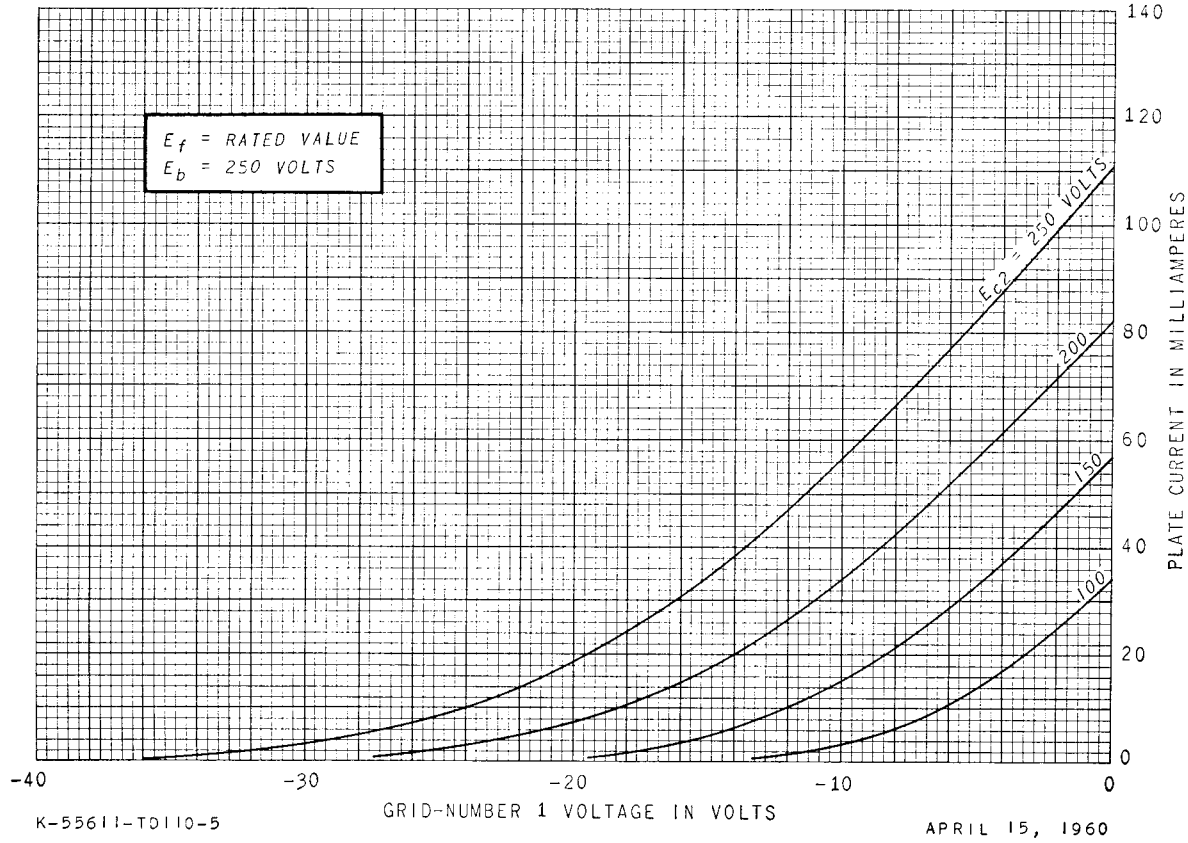
K-55611-TD110-3

APRIL 15, 1960

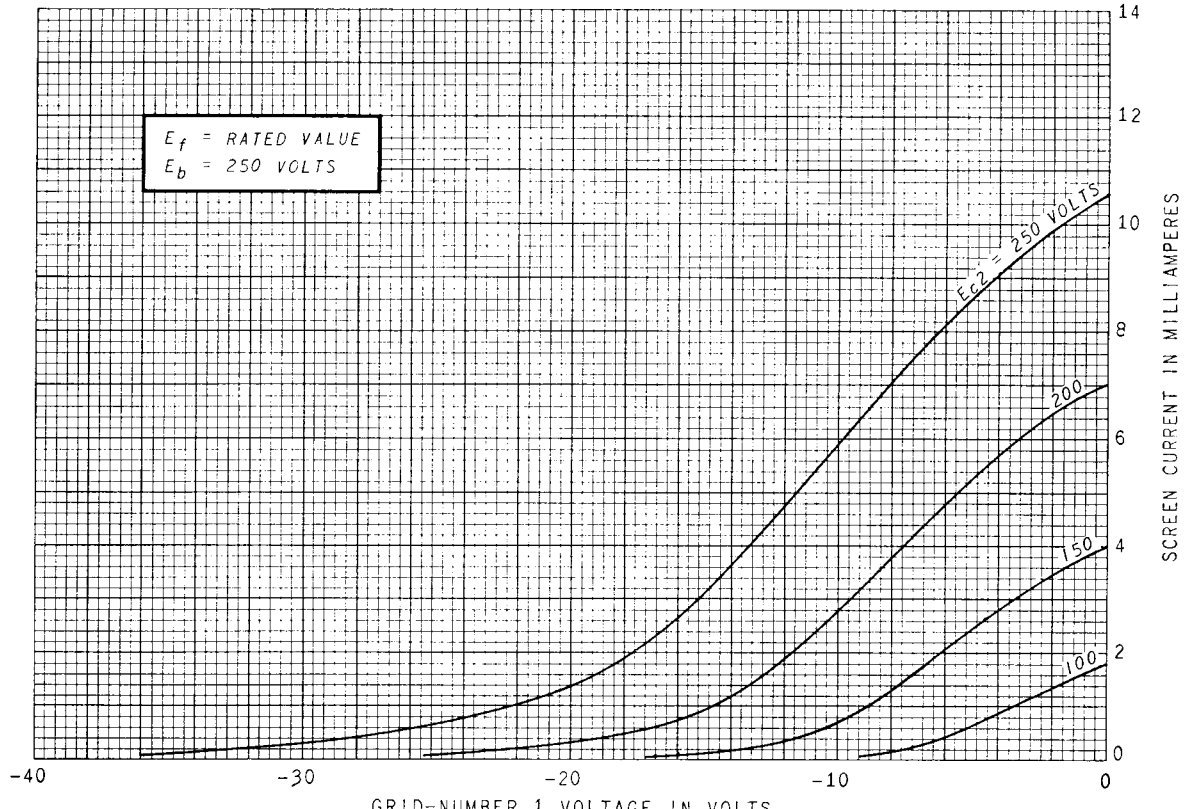
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



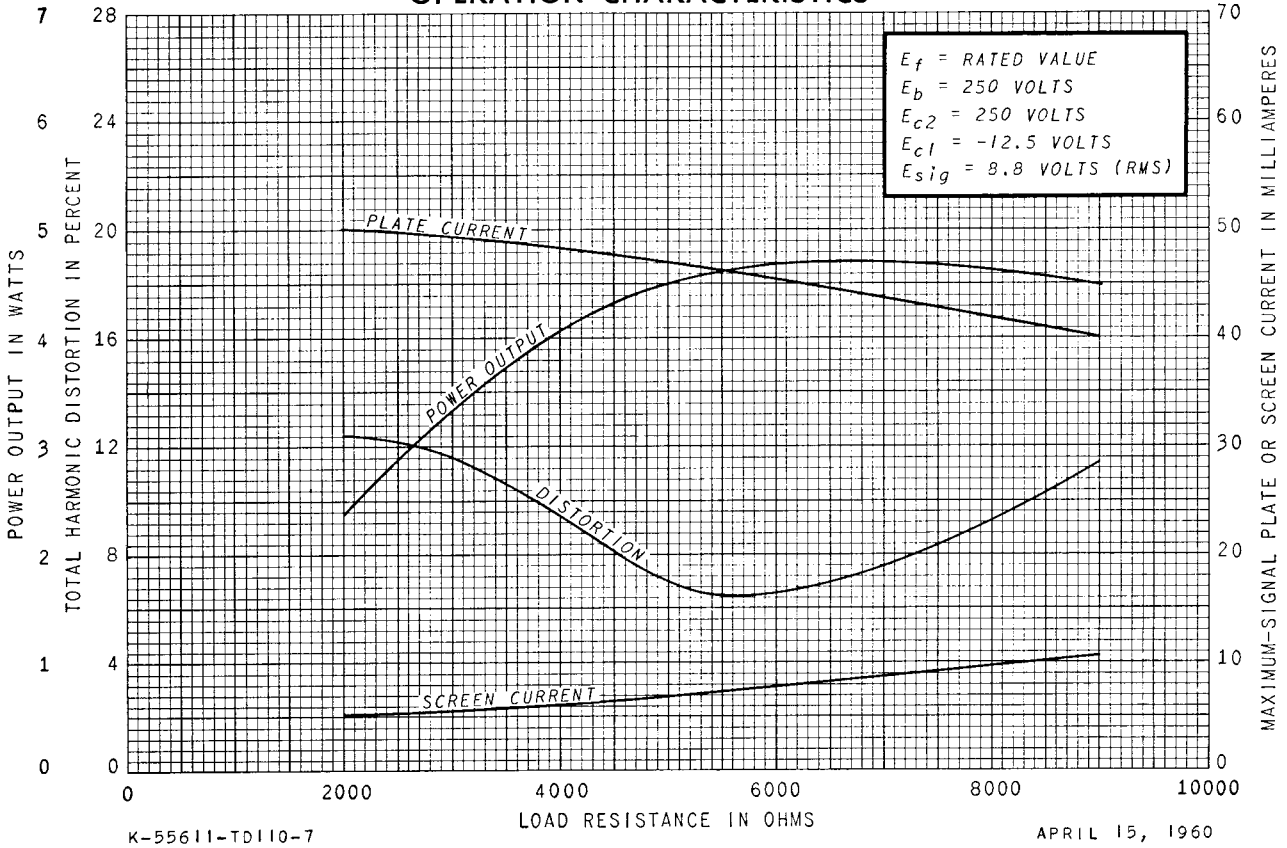
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD110-6

APRIL 15, 1960

OPERATION CHARACTERISTICS



K-55611-TD110-7

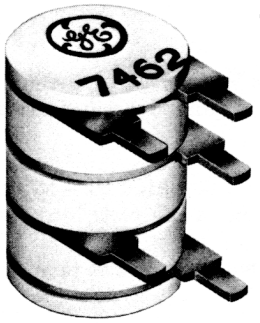
APRIL 15, 1960

ELECTRONIC INNOVATIONS IN ACTION

TUBES

7462

METAL-CERAMIC TRIODE



DESCRIPTION AND RATING

The 7462 is a high-mu triode of ceramic-and-metal planar construction primarily intended for radio-frequency amplifier service from low frequencies into the ultra-high-frequency range. It is similar to the 7077 in characteristics but differs in having terminal lugs for use in print-board circuits.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.3	Volts
Heater Current†	0.24	Amperes

Direct Interelectrode Capacitances‡

Grid to Plate: (g to p)	1.25	pf
Input: g to (h+k)	1.8	pf
Output: p to (h+k)	0.032	pf
Heater to Cathode (h to k)	1.5	pf

MECHANICAL

Mounting Position—Any

See Outline Drawing on page 2 for dimensions and electrical connections.

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Plate Voltage	250	Volts
Positive Peak and DC Grid Voltage	0	Volts
Negative Peak and DC Grid Voltage	50	Volts
Plate Dissipation	1.1	Watts
DC Cathode Current	11	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid-Circuit Resistance, with Fixed Bias§	0.01	Megohms
Bulb Temperature at Hottest Point¶	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

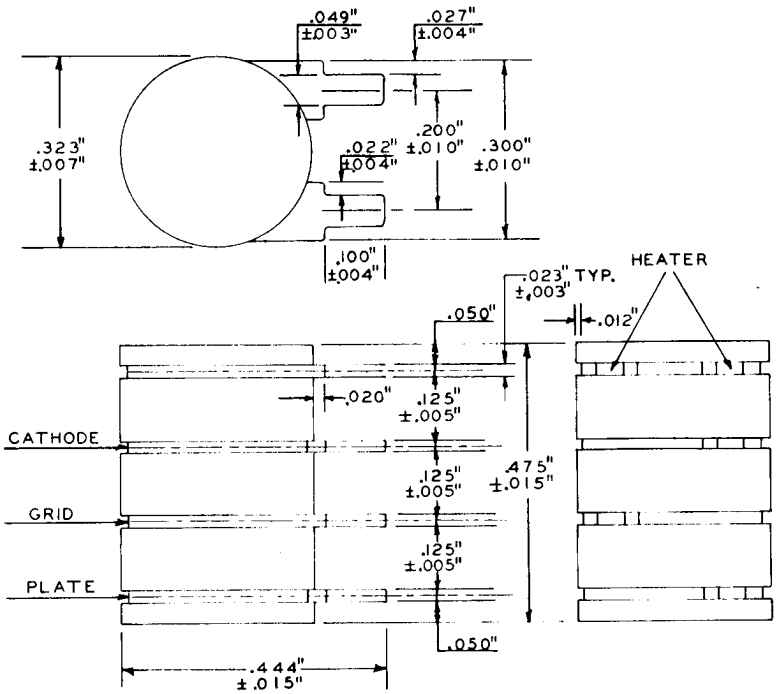
Plate Voltage	150	Volts
Grid Voltage	+6.0	Volts
Cathode-Bias Resistor	910	Ohms
Amplification Factor	94	
Plate Resistance, approximate	9000	Ohms
Transconductance	10500	Micromhos
Plate Current	7.2	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes	−2.4	Volts

GENERAL ELECTRIC

Supersedes 7462 D & R sheet ET-T1540A, dated 2-60

FOOTNOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.
† Heater current of a bogey tube at Ef = 6.3 volts.
‡ Without external shield.
§ If a cathode bias resistor is used, the grid-circuit resistance may be as high as (10,000 + 100 Rk + R_L) ohms, where Rk is the value of the cathode-bias resistor in ohms and R_L is the value of the plate-load resistor in ohms.
¶ For applications where long life is a primary consideration, it is recommended that the envelope temperature be maintained below 175 C.



NOTE: Maximum eccentricity of insulators 0.010 in. from center line.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
Ef = 6.3 volts	222	240	258	Milliamperes
Plate Current				
Ef = 6.3 volts, Eb = 150 volts, Rk = 82 ohms (bypassed)	4.5	7.5	11	Milliamperes
Transconductance				
Ef = 6.3 volts, Eb = 150 volts, Ec = +6 volts, Rk = 910 ohms (bypassed)	8000	10500	13000	Micromhos
Amplification Factor				
Ef = 6.3 volts, Eb = 150 volts, Ec = +6 volts, Rk = 910 ohms (bypassed)	65	94	115	

INITIAL CHARACTERISTICS LIMITS (Continued)

	Min.	Bogey	Max.	
Transconductance Change with Heater Voltage				
Difference between transconductance at Ef = 6.3 volts and transconductance at Ef = 6.0 volts (other conditions the same) expressed as a percentage of transconductance at Ef = 6.3 volts	.....	.....	15	Percent
Grid Voltage Cutoff				
Ef = 6.3 volts, Eb = 150 volts, Ib = 100 μa	.....	−2.4	−4.5	Volts
Interelectrode Capacitances				
Grid to Plate: (g to p)	1.05	1.25	1.45	pf
Input: g to (h+k)	1.25	1.8	2.25	pf
Output: p to (h+k)	0.013	0.032	0.045	pf
Heater to Cathode: (h to k)	1.1	1.5	1.9	pf
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	.....	.....	20	Microamperes
Heater Negative with Respect to Cathode	.....	.....	20	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid to All of 100 volts d-c	100	.....	.....	Megohms
Plate to All at 300 volts d-c	100	.....	.....	Megohms
Grid Emission Current				
Ef = 7.0 volts, Eb = 100 volts, Ecc = −10 volts, Rg = 0.1 meg	.....	.....	2.0	Microamperes

SPECIAL PERFORMANCE TESTS

Low Frequency Vibrational Output				
Statistical sample is subjected to vibration in each of two planes at 40 cps, with peak acceleration 15 G. Tube is operated with Ef = 6.3 volts, Ebb = 150 volts, Rk = 82 ohms (bypassed), R_L = 10000 ohms	.....	.....	10	Millivolts RMS
Variable Frequency Vibrational Output				
Statistical sample is subjected to vibration according to the procedure given below. Tube is operated with Ef = 6.3 volts, Ebb = 150 volts, Rk = 82 ohms (bypassed) R_L = 10000 ohms	.....	.....	15	Millivolts RMS

The variable-frequency vibration test shall be performed as follows:

1. The frequency shall be increased from 100 to 2000 cps with approximately logarithmic progression in 3 ± 1 minutes. The return sweep (2000 to 100 cps) is not required.
2. The tube shall be vibrated with simple harmonic motion in each of two planes: first, parallel to the cylindrical axis; second, perpendicular to the cylindrical axis and parallel to a line through the major axis of a terminal lug. At all frequencies from 100 to 2000 cps, the total harmonic distortion of the acceleration waveform shall be less than 5%.
3. The peak acceleration shall be maintained at 10 ± 1.0 G throughout the test.
4. The value of the alternating voltage produced across the load resistor (R_L), as a result of the vibration, shall be measured with a suitable device having a response to the RMS value of the voltage to within ±0.5 db of the response at 400 cps for the frequency range of 100 to 3000 cps, and having a band-pass filter with an attenuation rate of 24 db per octave below the low frequency cutoff point of 50 cps and above the high frequency cutoff point of 5000 cps. The meter shall have a dynamic response characteristic equivalent to or faster than a VU meter (operated in accordance with ASA Standard No. C16.5-1954).

Low Pressure Voltage Breakdown Test
Statistical sample tested for voltage breakdown at a pressure of 8 mm Hg, to simulate an altitude of 100,000 feet. Tubes shall not give visual evidence of flashover or corona when 300 volts RMS, 60 cps, is applied between the plate and grid terminals.

DEGRADATION RATE TESTS

Fatigue

Statistical sample vibrated for a total of six hours, three hours in each of two planes, at a peak acceleration of 10 G. Frequency is continuously varied from 30 cps to 2000 cps and back to 30 cps, with a period of ten minutes. Tubes are operated during the test with Ef = 6.3 volts, Eb = 150 volts, and Rk = 82 ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, heater current, and transconductance.

Shock

Statistical sample subjected to 5 impact accelerations of approximately 450 G in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine using a 30° hammer angle. Tubes are operated during the test with Ef = 6.3 volts, Eb = 150 volts, Ehk = +100 volts, Rg = 0.1 meg, and Rk = 82 ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, heater current, and transconductance.

Stability Life Test

The statistical sample subjected to the Intermittent Life Test is evaluated for percent change in transconductance of individual tubes, from the initial reading to readings following 2 hours and 20 hours of the life test.

Survival Rate Life Test

The statistical sample subjected to the Intermittent Life Test is evaluated for shorted and open elements, and transconductance, following approximately 100 hours of life test.

Intermittent Life Test

Statistical sample operated 1000 hours under the following conditions: Ef = 6.3 volts, Eb = 150 volts, Ecc = +6 volts, Ehk = −70 volts, Rk = 910 ohms, Rg = 0.1 meg. Heater voltage is cycled (on 1¾ hours, off ¼ hour). Tubes are evaluated, following 500 and 1000 hours of life test, for shorted or open elements, heater current, transconductance, heater-cathode leakage, and interelectrode leakage resistance.

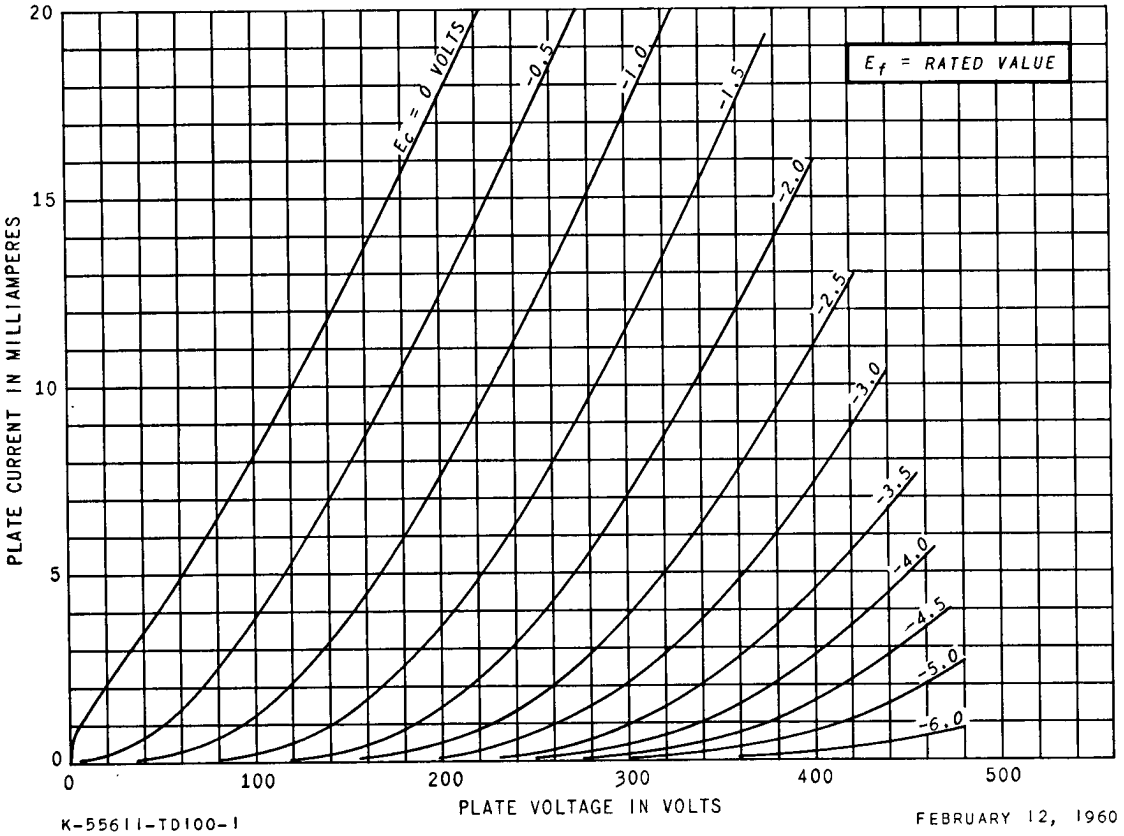
Interface Life Test

Statistical sample operated for 500 hours with Ef = 6.6 volts, no other voltages applied, and evaluated for cathode interface resistance following the life test.

Heater-Cycling Life Test

Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.0 volts cycled for one minute on and one minute off, Eb = Ec = 0 volts, and Ehk = 70 volts with heater positive with respect to cathode. Following the test, tubes are evaluated for open heaters, heater-cathode shorts, and heater-cathode leakage.

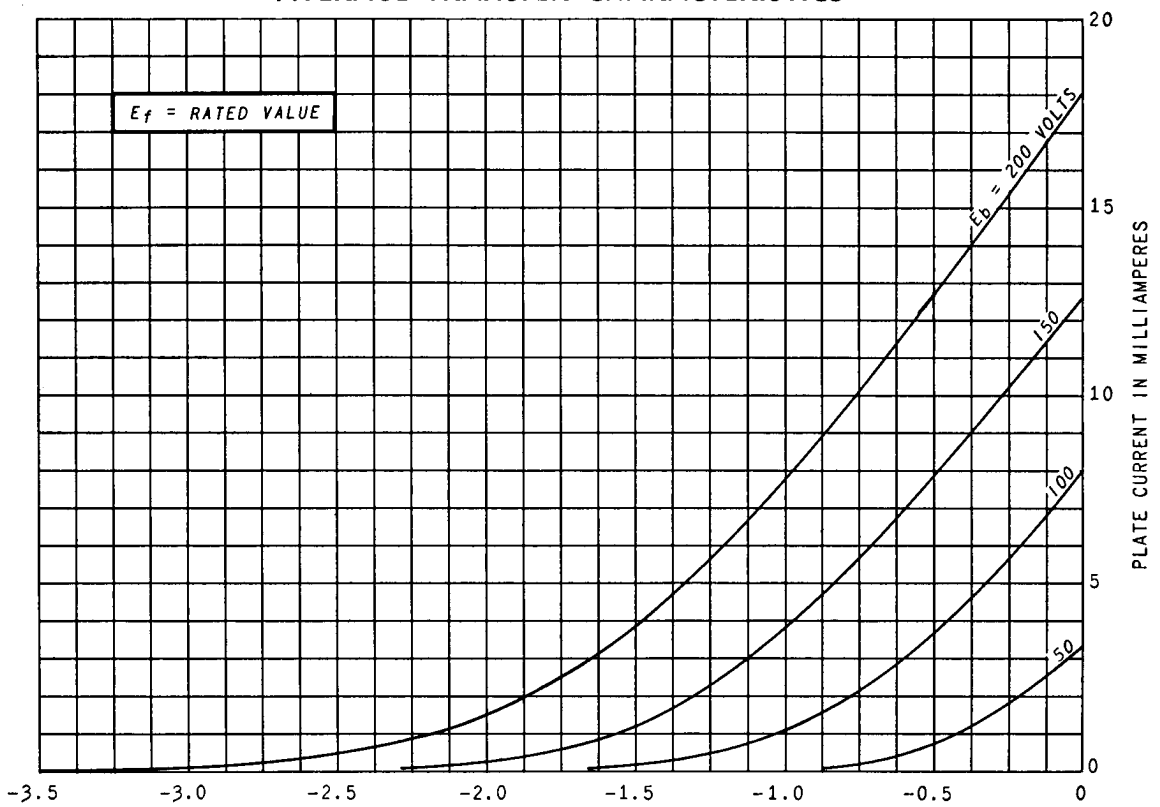
AVERAGE PLATE CHARACTERISTICS



K-55611-TD100-1

FEBRUARY 12, 1960

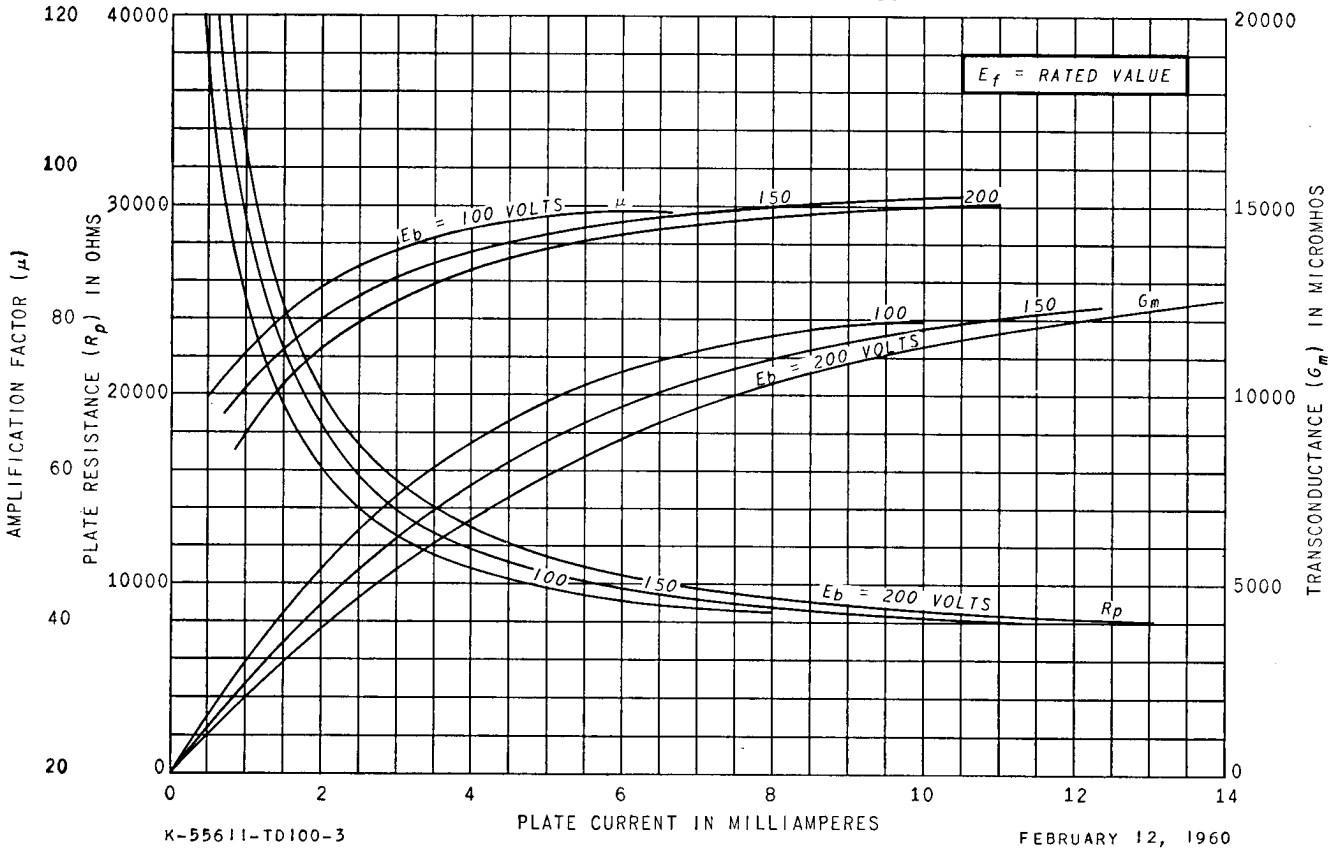
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD100-2

FEBRUARY 12, 1960

AVERAGE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONIC INNOVATIONS IN ACTION

TUBES

7486

METAL-CERAMIC TRIODE

FOR UHF OSCILLATOR AND POWER AMPLIFIER APPLICATIONS



DESCRIPTION AND RATING

The 7486 is a high-mu triode of ceramic-and-metal planar construction intended for use as an oscillator or radio-frequency power amplifier in the ultra-high-frequency range. The 7486 is especially suited for use where unfavorable conditions of mechanical shock, mechanical vibration, and nuclear radiation are encountered.

GENERAL

ELECTRICAL

Cathode--Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.3	Volts
Heater Current	0.24	Amperes

Direct Interelectrode Capacitances‡

Grid to Plate: (g to p)	1.0	pf
Input: g to (h+k)	1.7	pf
Output: p to (h+k)	0.01	pf
Heater to Cathode: (h to k)	1.1	pf

MECHANICAL

Mounting Position—Any

See Outline Drawing on page 3 for dimensions and electrical connections

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Plate Voltage	250	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	1.0	Watts
DC Grid Current	2.2	Milliamperes
DC Cathode Current	11	Milliamperes
Peak Cathode Current	40	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance	10000	Ohms
Envelope Temperature at Hottest Point§	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

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CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	100	150	Volts
Grid Voltage	0	.....	Volts
Cathode-Bias Resistor	.....	82	Ohms
Amplification Factor	.....	90	
Transconductance	11500	10500	Micromhos
Plate Current	8.0	7.5	Milliamperes
UHF Oscillator Service			
Plate Voltage	150	150	Volts
Grid Resistor	1000	1000	Ohms
Plate Current	8.0	8.0	Milliamperes
Grid Current	2.0	2.0	Milliamperes
Frequency	450	1200	Megacycles
Power Output, approximate	450	300	Milliwatts
Class C RF Amplifier			
Plate Voltage		150	Volts
Grid Resistor		3000	Ohms
Plate Current		5.0	Milliamperes
Grid Current		1.0	Milliamperes
Frequency		450	Megacycles
Power Output, approximate		300	Milliwatts

FOOTNOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Measured using a grounded adapter that provides shielding between external terminals of tube.

§ Operation below the rated maximum envelope temperature is recommended for applications requiring the longest possible tube life. The 7486 is also capable of operation at envelope temperatures much higher than the rated maximum values. For specific recommendations concerning higher temperature operation, contact your General Electric tube sales representative.

INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current Ef = 6.3 volts	222	240	258	Milliamperes
Plate Current Ef = 6.3 volts, Eb = 150 volts, Rk = 82 ohms (bypassed)	4.5	.....	11	Milliamperes
Zero-Bias Transconductance Ef = 6.3 volts, Eb = 100 volts, Ec = 0 volts	8000	11500	.....	Micromhos
Transconductance Change with Heater Voltage Difference between Zero-Bias Transconductance measured at Ef = 6.3 volts and Ef = 6.0 volts (other conditions the same) expressed as a percentage	.....	.....	20	Percent
Amplification Factor Ef = 6.3 volts, Eb = 150 volts, Rk = 82 ohms (bypassed)	65	90	115	
Grid Voltage Cutoff Ef = 6.3 volts, Eb = 150 volts, Ib = 100 μa	.....	−2.4	−4.5	Volts
Interelectrode Capacitances				
Grid to Plate: (g to p)	0.84	1.00	1.16	Picofarads
Input: g to (h+k)	1.25	1.70	2.15	Picofarads
Output: p to (h+k)	0.004	0.010	0.016	Picofarads
Heater to Cathode: (h to k)	0.80	1.10	1.40	Picofarads

INITIAL CHARACTERISTICS LIMITS (Continued)

	Min.	Bogey	Max.	
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	.....	.....	20	Microamperes
Heater Negative with Respect to Cathode	.....	.....	20	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid to All at 100 volts d-c	100	.....	.....	Megohms
Plate to All at 300 volts d-c	100	.....	.....	Megohms
Grid Emission Current				
Ef = 7.0 volts, Eb = 150 volts, Ecc = −20 volts, Rg = 0.1 meg	.....	.....	2.0	Microamperes

SPECIAL PERFORMANCE TESTS

	Min.	Bogey	Max.	
1200 Megacycle Oscillator Power Output	200	.....	.....	Milliwatts

Tubes are tested for power output as an oscillator under the following conditions: F = 1200 mc ± 50 mc, Ef = 6.3 volts, Eb = 150 volts, Rg = 1000 ohms, Ib = 8.0 ma maximum, Ic = 1.6 − 2.0 ma

Pulse Emission	90	.....	.....	Milliamperes

Tubes are tested for pulse emission under the following conditions: Ef = 6.3 volts, Eb = 150 volts, Ec = −10 volts, egk = +7 V, prr = 1000 pps, duty factor = 0.01. Pulse cathode current is measured

Grid Recovery				
Change in Average Plate Current	.....	.....	0.6	Milliamperes
Peak Plate Current Backswing	.....	.....	1.0	Milliamperes

Tubes with poor grid recovery affect circuit operation, when the grid is driven positive by a pulse of signal or noise, somewhat as if a parallel RC circuit were in series with the grid. This effect may occur in tubes of any type, but is unimportant in many applications. In the majority of 7486 tubes the effect is negligible, but to eliminate the few in which it may be excessive, tubes are tested under the following conditions: Ef = 6.3 volts, Ebb = 250 volts, R_L = 0.01 meg. Ec is adjusted for Ib = 3.0 ma.

Upon application to the grid of a 5-volt positive pulse (prr = 60 pps, duty factor = 0.0012) the change in average plate current is noted, and the peak plate current backswing is measured. The following diagram shows qualitatively the plate current-time relationship for a tube (with poor grid recovery) subjected to this test.

OUTLINE DRAWING

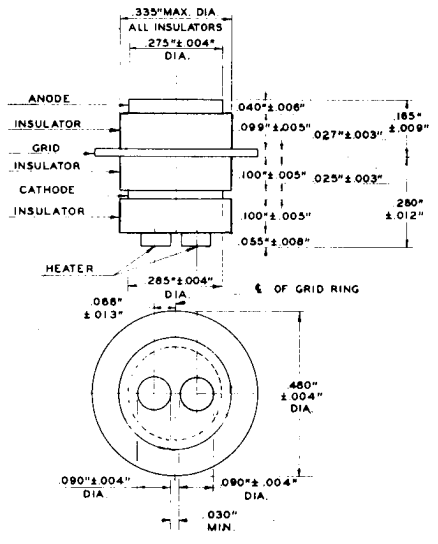
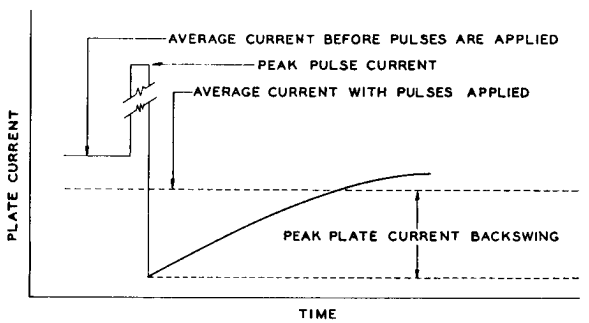


PLATE CURRENT VS TIME— GRID RECOVERY TEST



1—Maximum eccentricity of anode, grid, and cathode 0.005" from center line.

2—Maximum eccentricity of insulators 0.010" from center line.

3—Center line of grid ring used as reference line for horizontal tolerances.

4—Bottom surface of grid ring used as reference line for vertical tolerances.

SPECIAL PERFORMANCE TESTS (Continued)

	Min.	Bogey	Max.	
Low Frequency Vibrational Output				10 Millivolts RMS

Statistical sample is subjected to vibration in each of two planes at 40 cps, with peak acceleration 15G. Tube is operated with Ef = 6.3 volts, Ebb = 150 volts, Rk = 82 ohms (bypassed), R_L = 10000 ohms.

Variable Frequency Vibrational Output

The tube is designed to be free of vibrational outputs in excess of 15 mv RMS at any frequency within the range 100–2000 cps, when vibrated in either of two planes at 10G peak acceleration. Electrical conditions for this test are the same as for Low Frequency Vibrational Output.

Low Pressure Voltage Breakdown Test

Statistical sample tested for voltage breakdown at a pressure of 8 mm Hg, to simulate an altitude of 100,000 feet. Tubes shall not give visual evidence of flashover or corona when 300 volts RMS, 60 cps, is applied between the plate and grid terminals.

DEGRADATION RATE TESTS

Fatigue

Statistical sample vibrated for a total of six hours, three hours in each of two planes, at a peak acceleration of 10G. Frequency is continuously varied from 30 cps to 2000 cps and back to 30 cps, with a period of ten minutes. Tubes are operated during the test with Ef = 6.3 volts, Eb = 150 volts, and Rk = 82 ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, and heater current.

Shock

Statistical sample subjected to 5 impact accelerations of approximately 450G in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine using a 30° hammer angle. Tubes are operated during the test with Ef = 6.3 volts, Eb = 150 volts, Ehk = +100 volts, and Rk = 82 ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, and heater current.

Stability Life Test

The statistical sample subjected to the Dynamic Life Test is evaluated for percent change in zero-bias transconductance of individual tubes, from the initial reading to readings following 2 hours and 20 hours of the life test.

Survival Rate Life Test

The combined statistical samples subjected to the Dynamic and Pulse Life Tests are evaluated for shorted and open elements following approximately 100 hours of life test.

Dynamic Life Test

Statistical sample operated, with a 60 cps grid signal, at maximum rated DC grid current and cathode current for a period of 1000 hours. Heater voltage is cycled (on 1¾ hours, off ¼ hour). Tubes are evaluated, following 500 and 1000 hours of life test, for shorted or open elements, heater current, oscillator power output, zero-bias transconductance, heater-cathode leakage, and interelectrode leakage resistance.

Pulse Life Test

Statistical sample operated with 120 ma peak cathode current, 0.01 duty factor, for 1000 hours. Heater voltage is cycled (on 1¾ hours, off ¼ hour). Tubes are evaluated, following 500 and 1000 hours of life test, for shorted or open elements, heater current, pulse cathode current, heater-cathode leakage, and interelectrode leakage resistance.

Interface Life Test

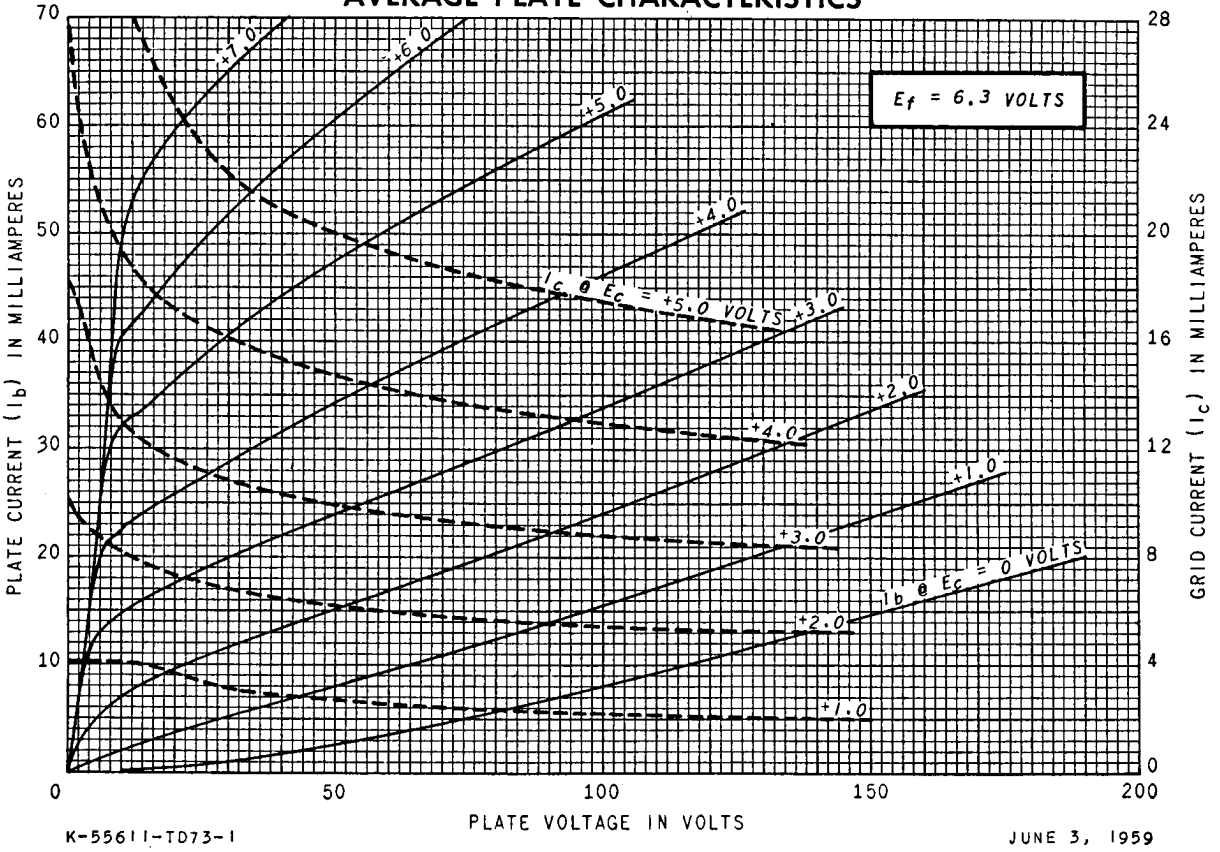
Statistical sample operated for 1000 hours with Ef = 6.6 volts, no other voltages applied, and evaluated for cathode interface resistance following the life test.

Heater-Cycling Life Test

Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.0 volts cycled for one minute on and one minute off, Eb = Ec = 0 volts, and Ehk = 70 volts with heater positive with respect to cathode. Following this test, tubes are evaluated for open heaters, heater-cathode shorts, and heater-cathode leakage current.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

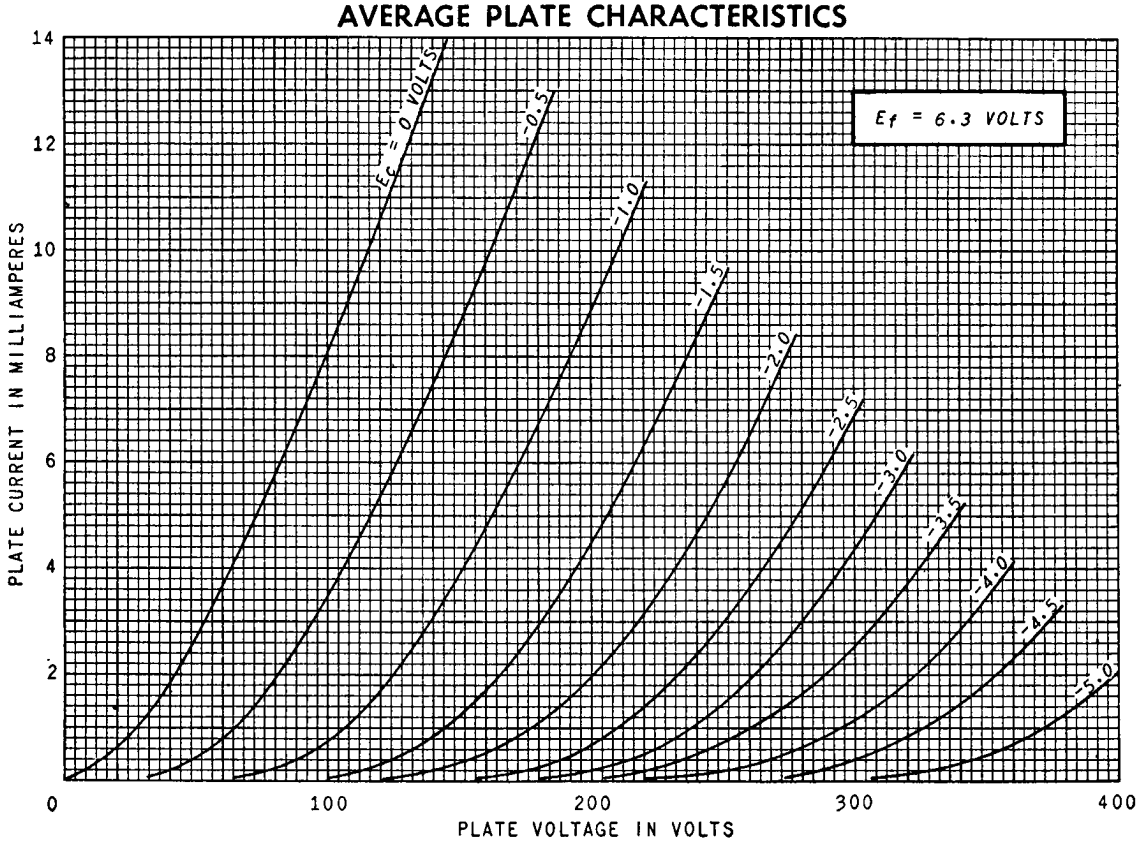
AVERAGE PLATE CHARACTERISTICS



K-55611-TD73-1

JUNE 3, 1959

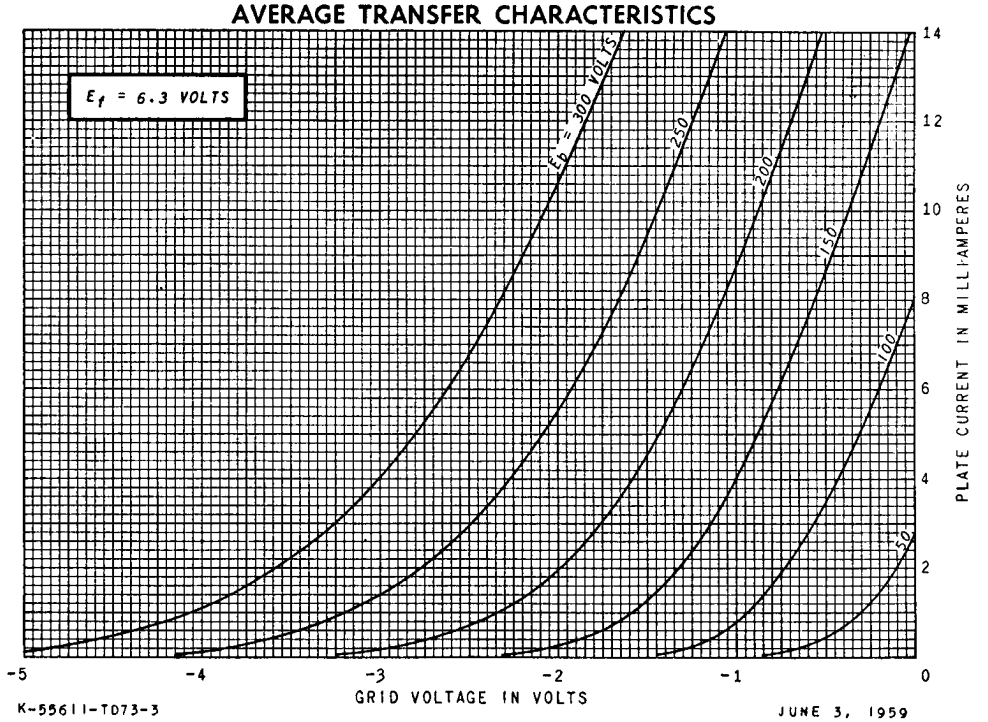
AVERAGE PLATE CHARACTERISTICS



K-55611-TD73-2

JUNE 3, 1959

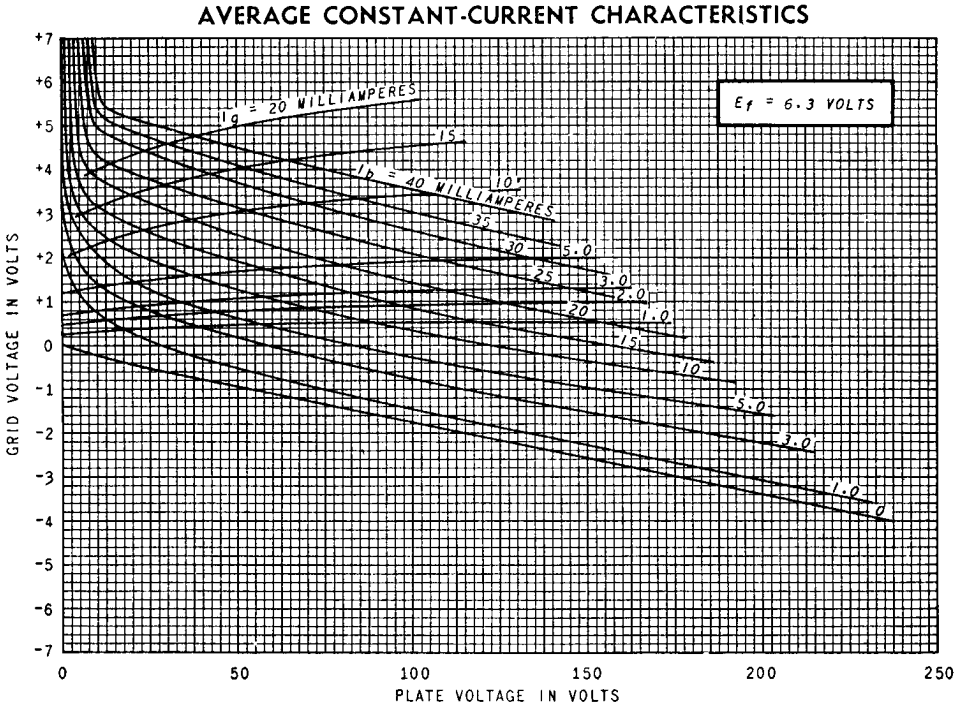
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD73-3

JUNE 3, 1959

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



K-55611-TD73-4

CONSTANT-CURRENT CURVES

JUNE 3, 1959

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

BEAM PENTODE

FOR AF POWER-AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 7581-A is a beam-power pentode primarily designed for use in audio-frequency power-amplifier applications. The 7581-A is unilaterally interchangeable with the 7581 and the 6L6-GC.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.9	Amperes

Direct Interelectrode Capacitances, approximate‡

Grid-Number 1 to Plate: (g1 to p)	0.6	pf
Input: g1 to (h+k+b.p.+g2)	10	pf
Output: p to (h+k+b.p.+g2)	6.5	pf

MECHANICAL

Operating Position—Any

Envelope—T-12, Glass

Base—B6-148, Short Medium-Shell Octal 6-Pin Micanol

Outline Drawing—EIA 12-15

Maximum Diameter	$1\frac{9}{16}$	Inches
Maximum Over-all Length	$4\frac{1}{4}$	Inches
Maximum Seated Height	$3\frac{11}{16}$	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

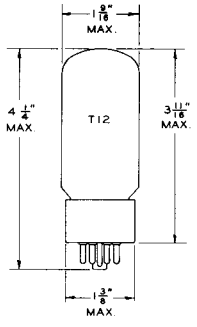
	Pentode Connection	Triode§ Connection	
Plate Voltage	500	450	Volts
Screen Voltage	450¶	...	Volts
Plate Dissipation	35	35	Watts
Screen Dissipation	5.0	...	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode	200	200	Volts
Heater Negative with Respect to Cathode	200	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	0.1	Megohms
With Cathode Bias	0.5	0.5	Megohms

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

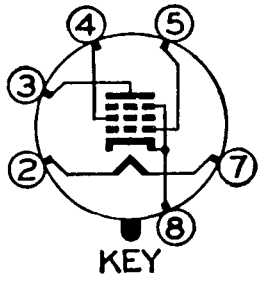


EIA 12-15

TERMINAL CONNECTIONS

Pin 2—Heater
Pin 3—Plate
Pin 4—Grid Number 2 (Screen)
Pin 5—Grid Number 1
Pin 7—Heater
Pin 8—Cathode and Beam Plates

BASING DIAGRAM



EIA 7AC

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	70	250	Volts
Screen Voltage	300	250	Volts
Grid-Number 1 Voltage	0△	−14	Volts
Plate Resistance, approximate	—	22500	Ohms
Transconductance	—	6000	Micromhos
Plate Current	210	72	Milliamperes
Screen Current	25	5.0	Milliamperes

CLASS A_1 AMPLIFIER, TRIODE CONNECTION‡

Plate Voltage	250	Volts
Grid-Number 1 Voltage	−20	Volts
Peak AF Grid-Number 1 Voltage	20	Volts
Amplification Factor	8	
Plate Resistance, approximate	1700	Ohms
Transconductance	4700	Micromhos
Zero-Signal Plate Current	40	Milliamperes
Maximum-Signal Plate Current	44	Milliamperes
Load Resistance	5000	Ohms
Total Harmonic Distortion, approximate	5	Percent
Maximum-Signal Power Output	1.4	Watts

CLASS A_1 AMPLIFIER, PENTODE CONNECTION

Plate Voltage	250	300	350	Volts
Screen Voltage	250	200	250	Volts
Grid-Number 1 Voltage	−14	−12.5	−18	Volts
Peak AF Grid-Number 1 Voltage	14	12.5	18	Volts
Plate Resistance, approximate	22500	35000	33000	Ohms
Transconductance	6000	5300	5200	Micromhos
Zero-Signal Plate Current	72	48	54	Milliamperes
Maximum-Signal Plate Current	79	55	66	Milliamperes
Zero-Signal Screen Current	5.0	2.5	2.5	Milliamperes
Maximum-Signal Screen Current	7.3	4.7	7.0	Milliamperes
Load Resistance	2500	4500	4200	Ohms
Total Harmonic Distortion, approximate	10	11	15	Percent
Maximum-Signal Power Output	6.5	6.5	10.8	Watts

PUSH-PULL CLASS A_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	250	270	Volts
Screen Voltage	250	270	Volts
Grid-Number 1 Voltage	−16	−17.5	Volts
Peak AF Grid-to-Grid Voltage	32	35	Volts
Zero-Signal Plate Current	120	134	Milliamperes
Maximum-Signal Plate Current	140	155	Milliamperes
Zero-Signal Screen Current	10	11	Milliamperes
Maximum-Signal Screen Current	16	17	Milliamperes
Effective Load Resistance, Plate-to-Plate	5000	5000	Ohms
Total Harmonic Distortion	2	2	Percent
Maximum-Signal Power Output	14.5	17.5	Watts

CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

PUSH-PULL CLASS AB_1 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	360	360	450	Volts
Screen Voltage	270	270	400	Volts
Grid-Number 1 Voltage	−22.5	−22.5	−37	Volts
Peak AF Grid-to-Grid Voltage	45	45	70	Volts
Zero-Signal Plate Current	88	88	116	Milliamperes
Maximum-Signal Plate Current	132	140	210	Milliamperes
Zero-Signal Screen Current	5.0	5.0	5.6	Milliamperes
Maximum-Signal Screen Current	15	11	22	Milliamperes
Effective Load Resistance, Plate-to-Plate	6600	3800	5600	Ohms
Total Harmonic Distortion	2	2	1.8	Percent
Maximum-Signal Power Output	26.5	18	55	Watts

PUSH-PULL CLASS AB_2 AMPLIFIER, VALUES FOR TWO TUBES

Plate Voltage	360	360	Volts
Screen Voltage	225	270	Volts
Grid-Number 1 Voltage	−18	−22.5	Volts
Peak AF Grid-to-Grid Voltage	52	72	Volts
Zero-Signal Plate Current	78	88	Milliamperes
Maximum-Signal Plate Current	142	205	Milliamperes
Zero-Signal Screen Current	3.5	5.0	Milliamperes
Maximum-Signal Screen Current	11	16	Milliamperes
Effective Load Resistance, Plate-to-Plate	6000	3800	Ohms
Total Harmonic Distortion	2	2	Percent
Maximum-Signal Power Output	31	47	Watts

NOTES

* The equipment designer should design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ With screen connected to plate.

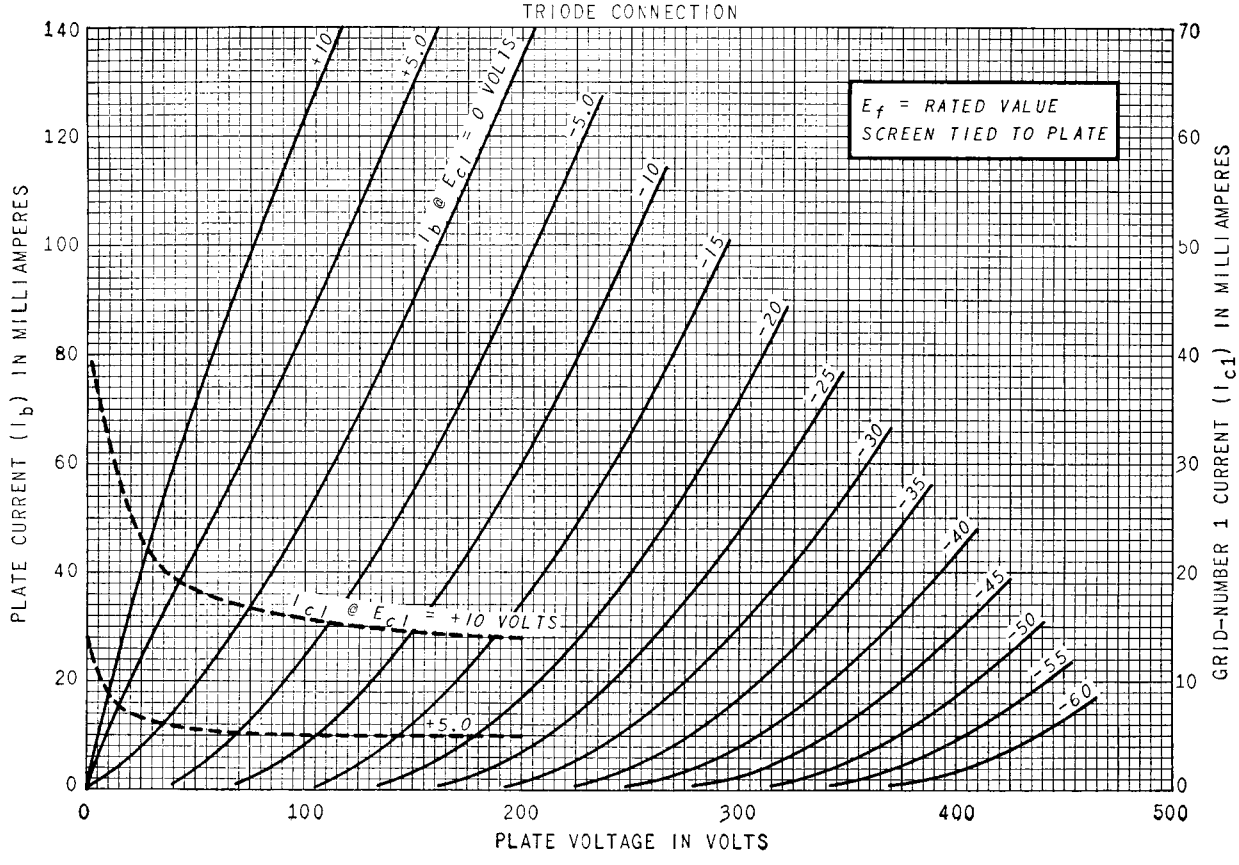
¶ The maximum screen voltage rating is 500 volts in push-pull circuits where the screen of each tube is connected to a tap on the plate winding of the output transformer.

△Applied for short interval (two seconds maximum) so as not to damage tube.

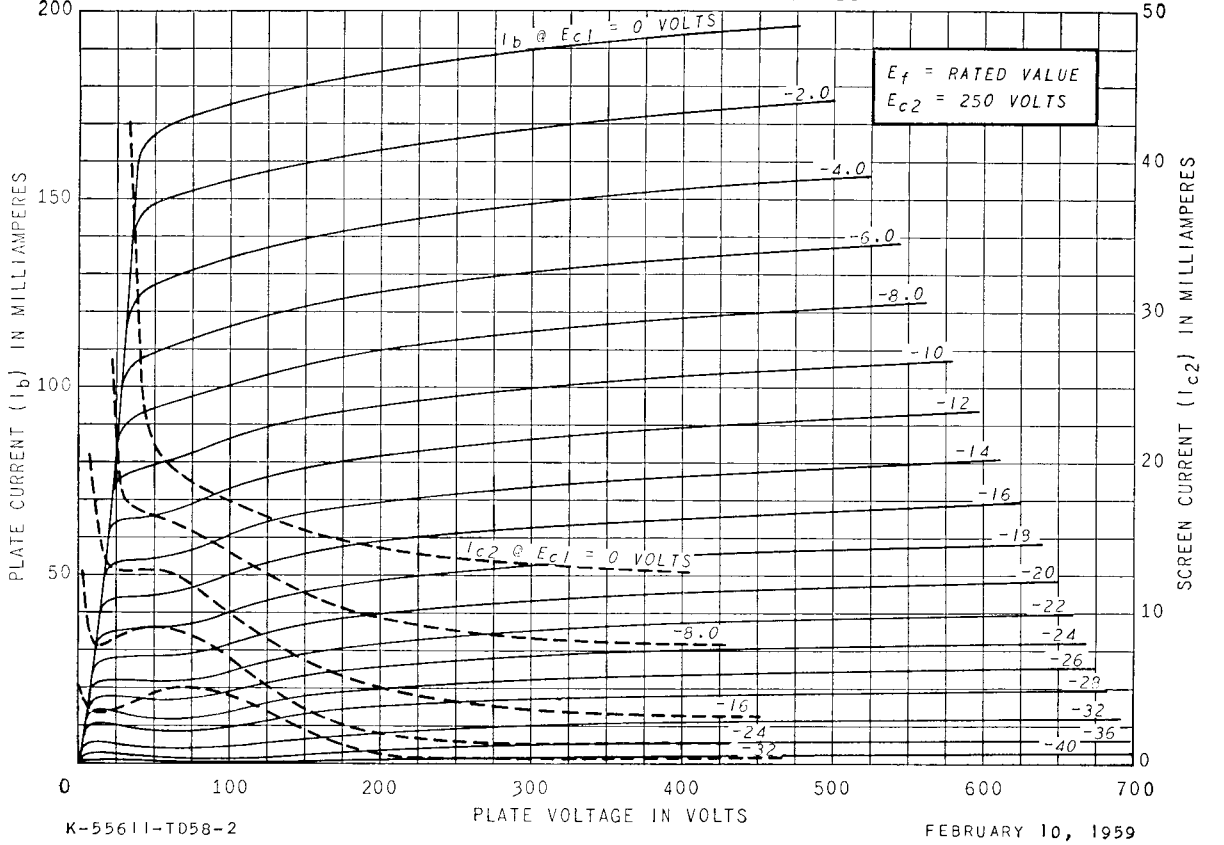
The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS

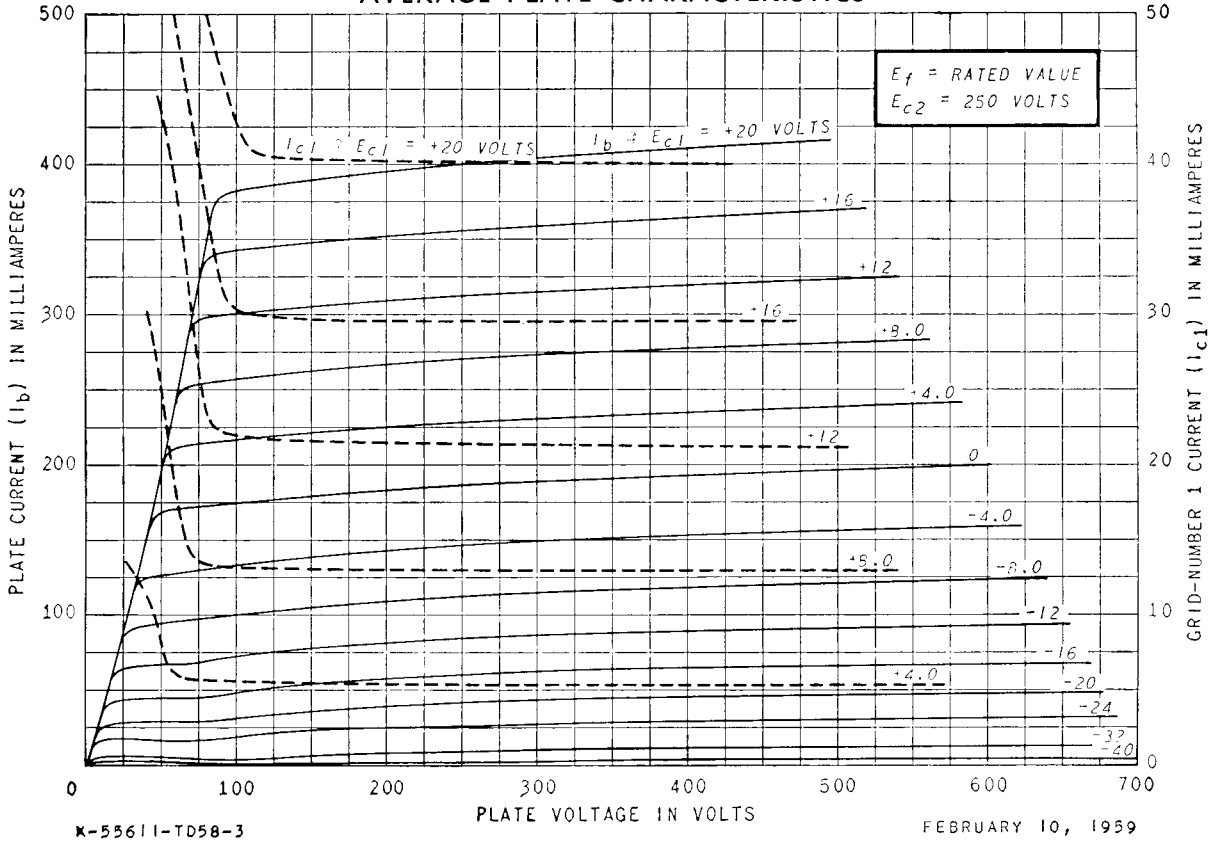
TRIODE CONNECTION



AVERAGE PLATE CHARACTERISTICS



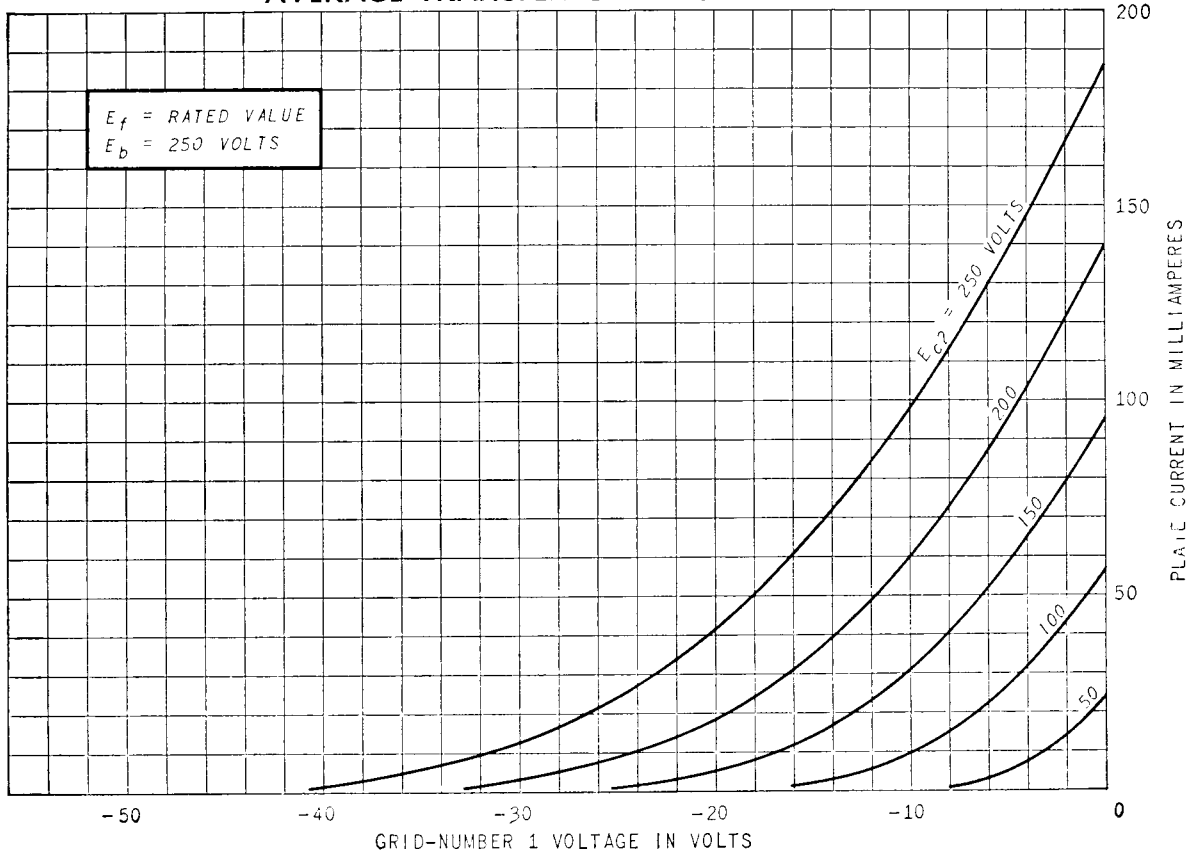
AVERAGE PLATE CHARACTERISTICS



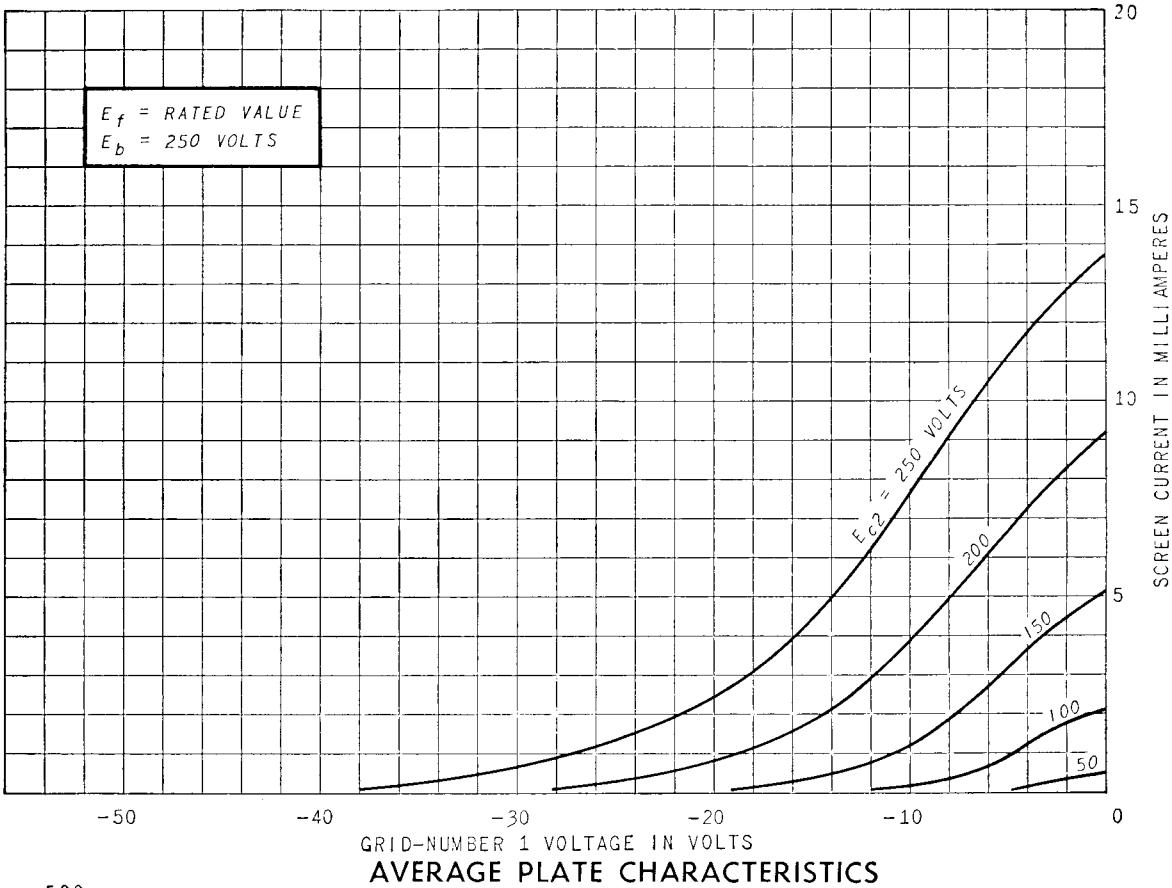
K-55611-TD58-3

FEBRUARY 10, 1959

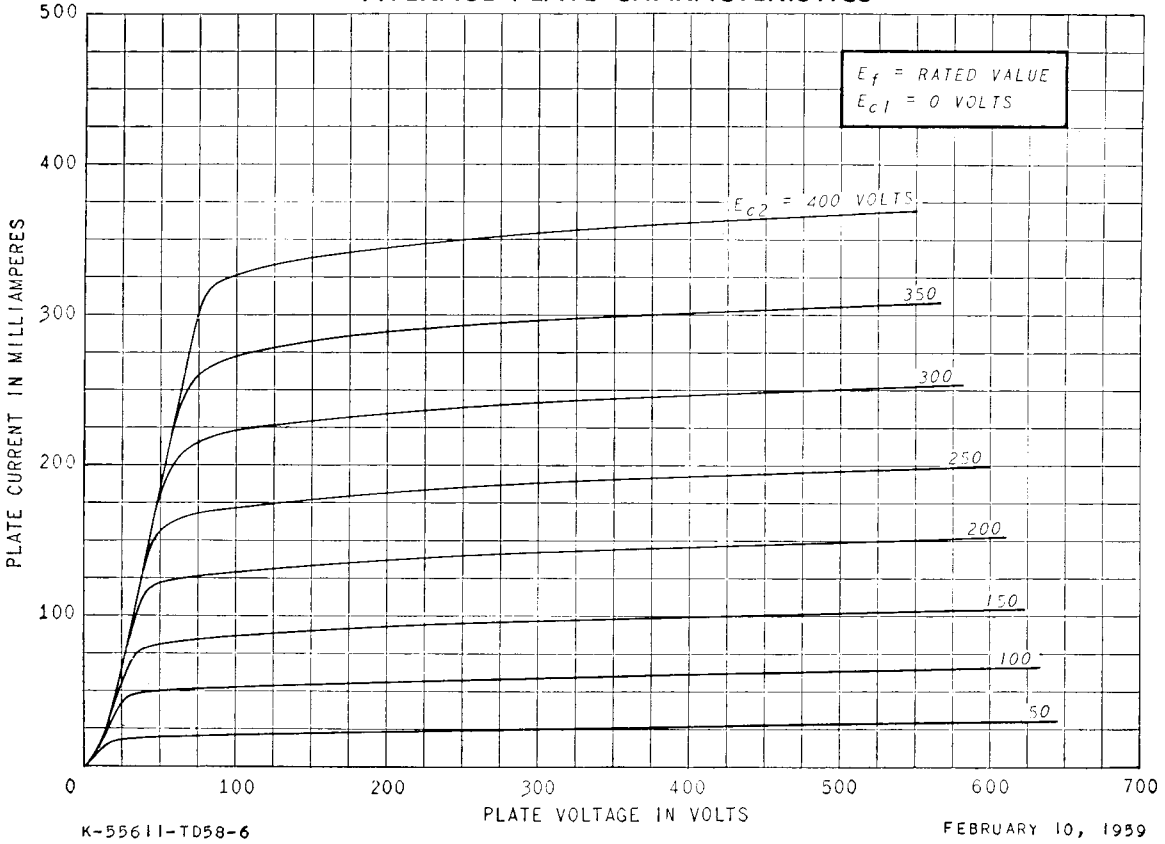
AVERAGE TRANSFER CHARACTERISTICS



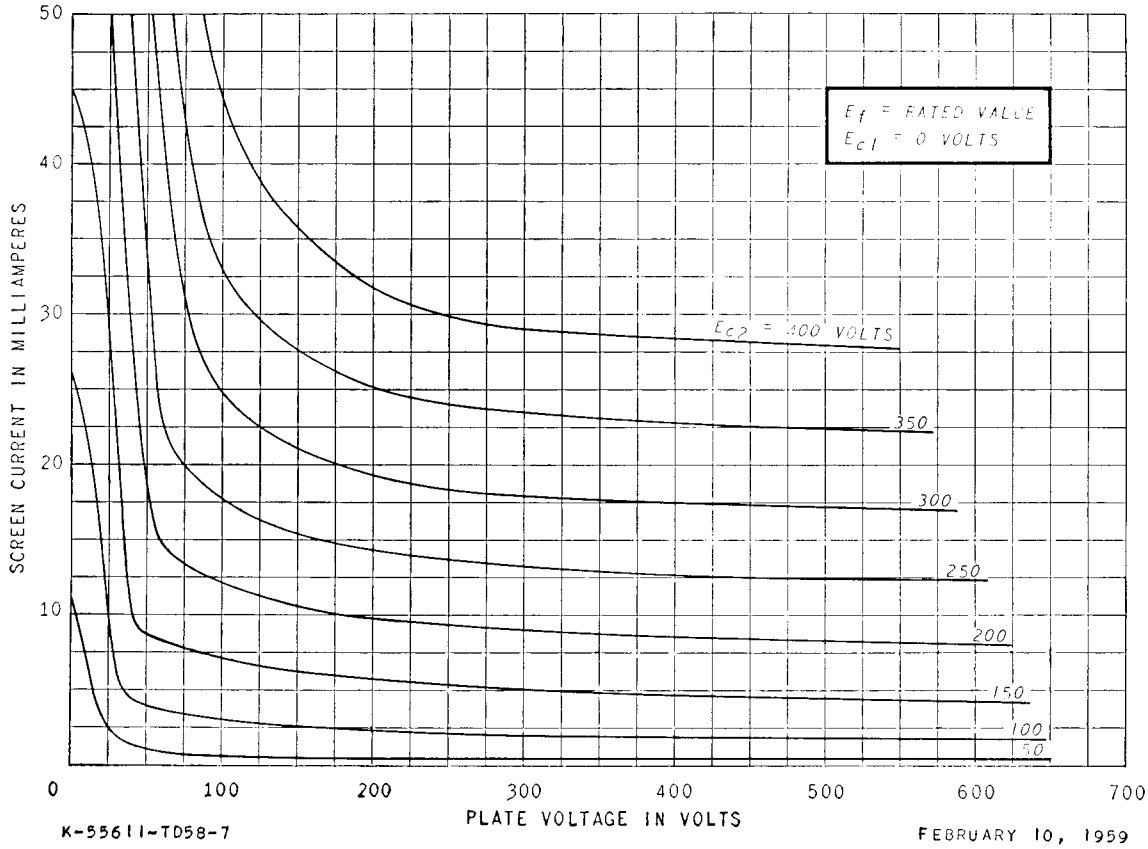
AVERAGE TRANSFER CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



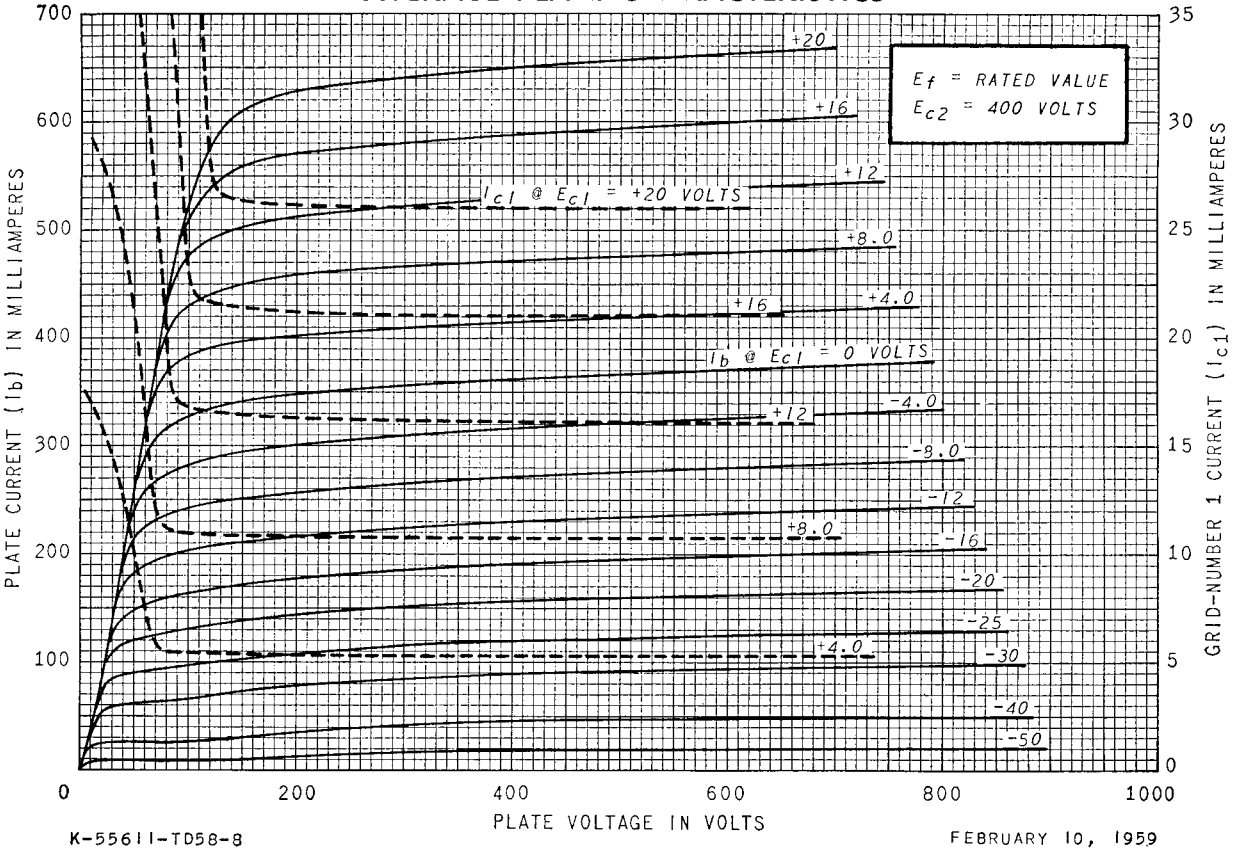
AVERAGE SCREEN CHARACTERISTICS



K-5561I-TD58-7

FEBRUARY 10, 1959

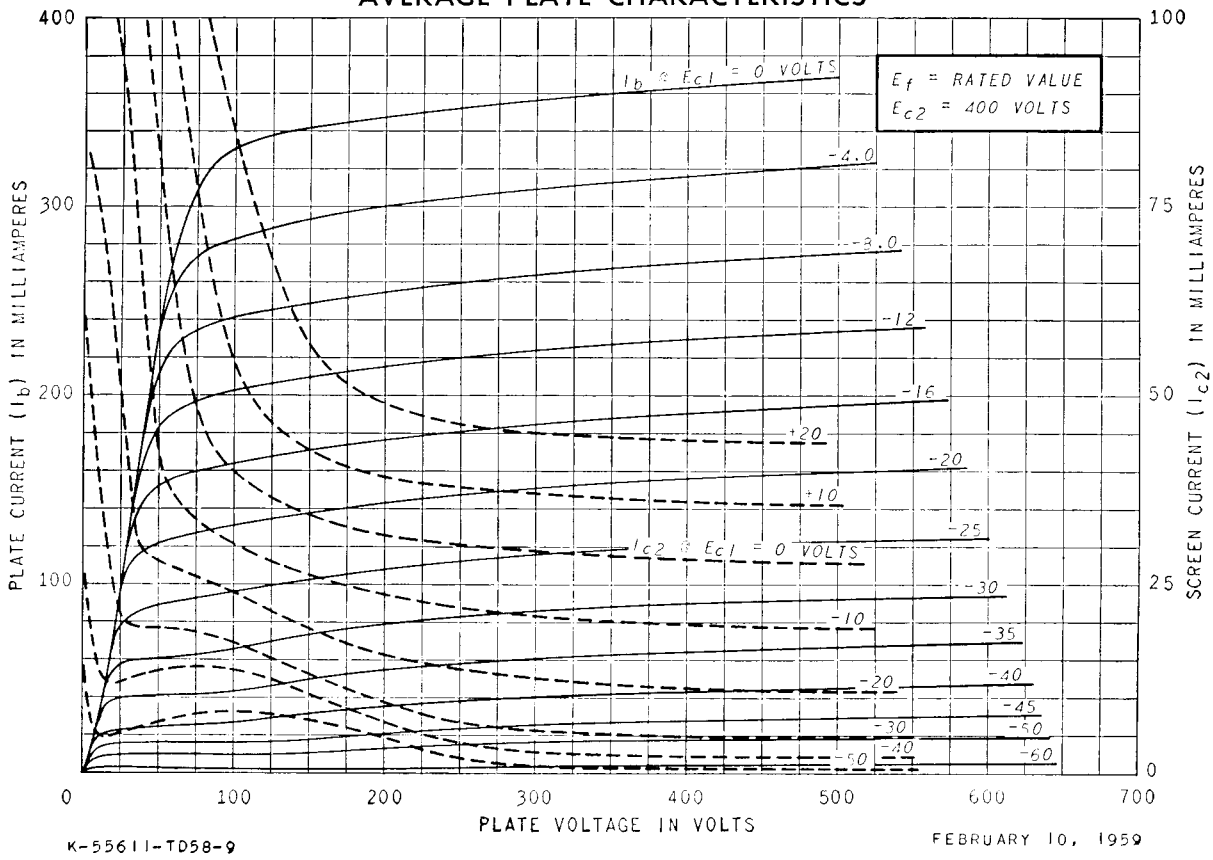
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD58-8

FEBRUARY 10, 1959

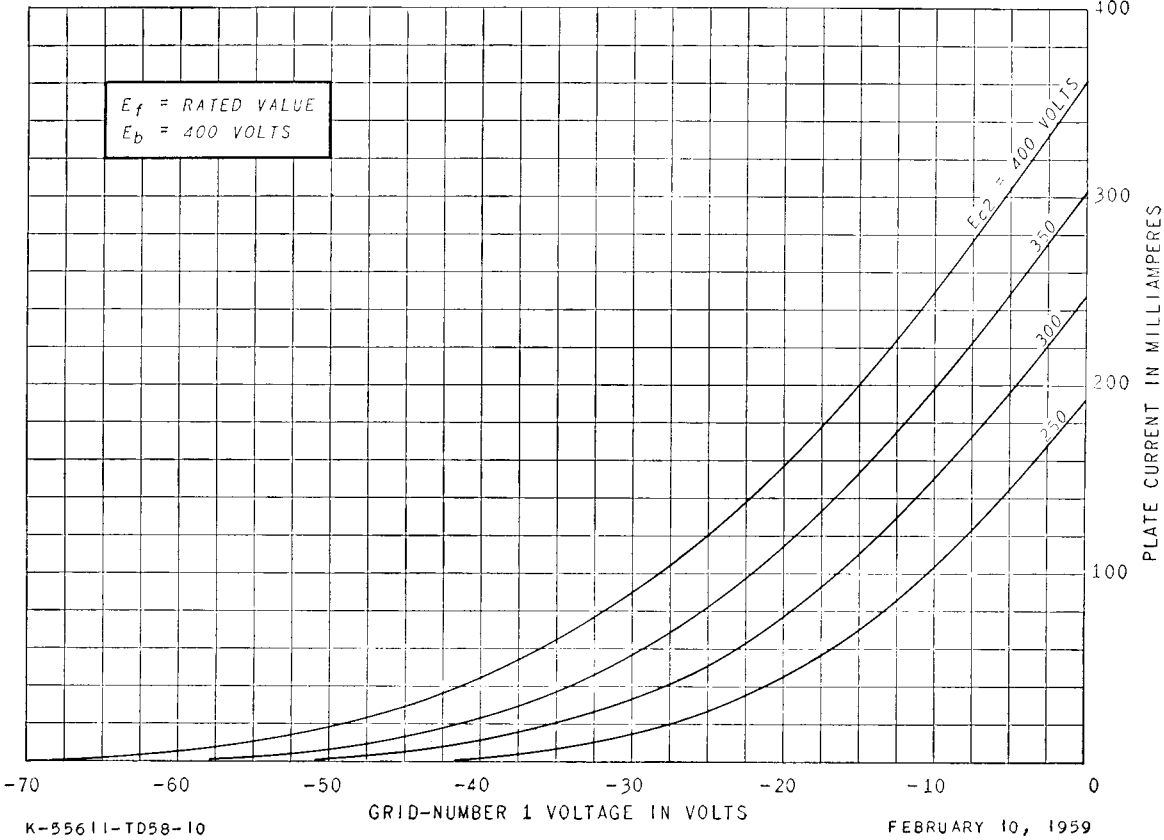
AVERAGE PLATE CHARACTERISTICS



K-55611-TD58-9

FEBRUARY 10, 1959

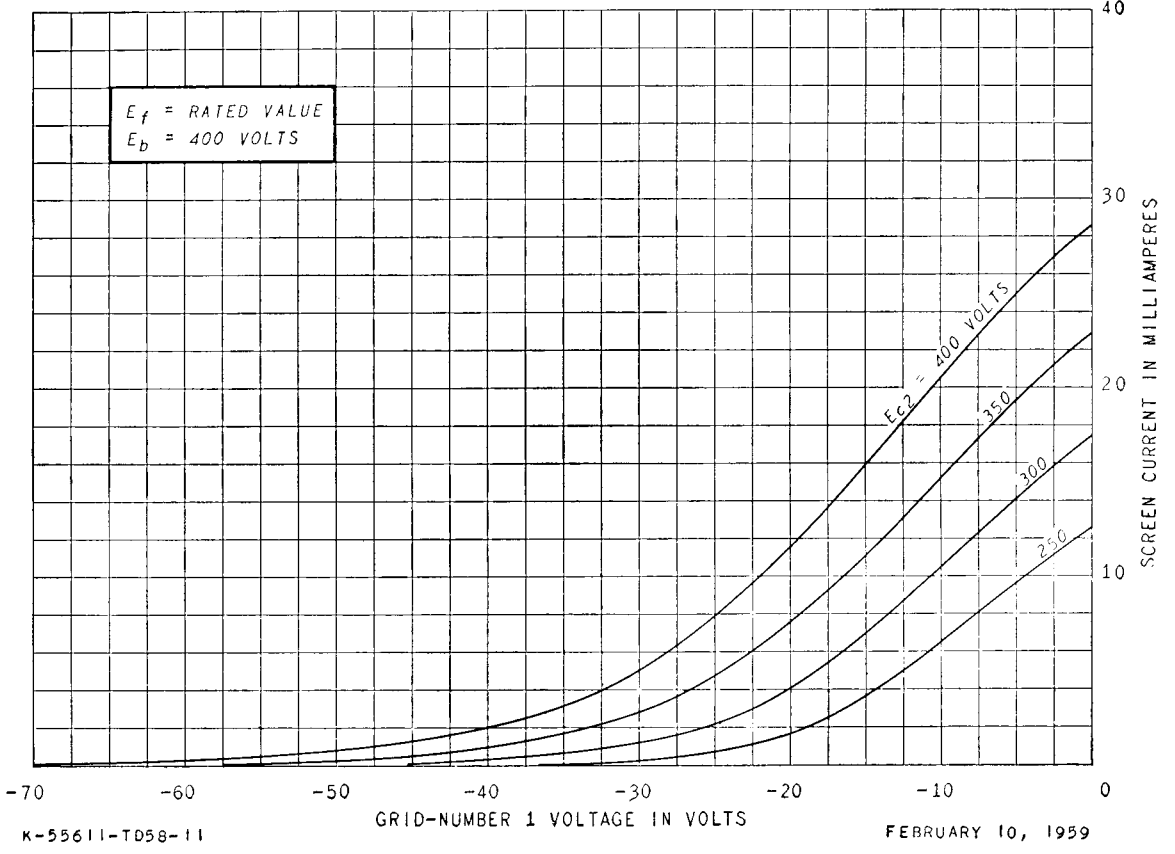
AVERAGE TRANSFER CHARACTERISTICS



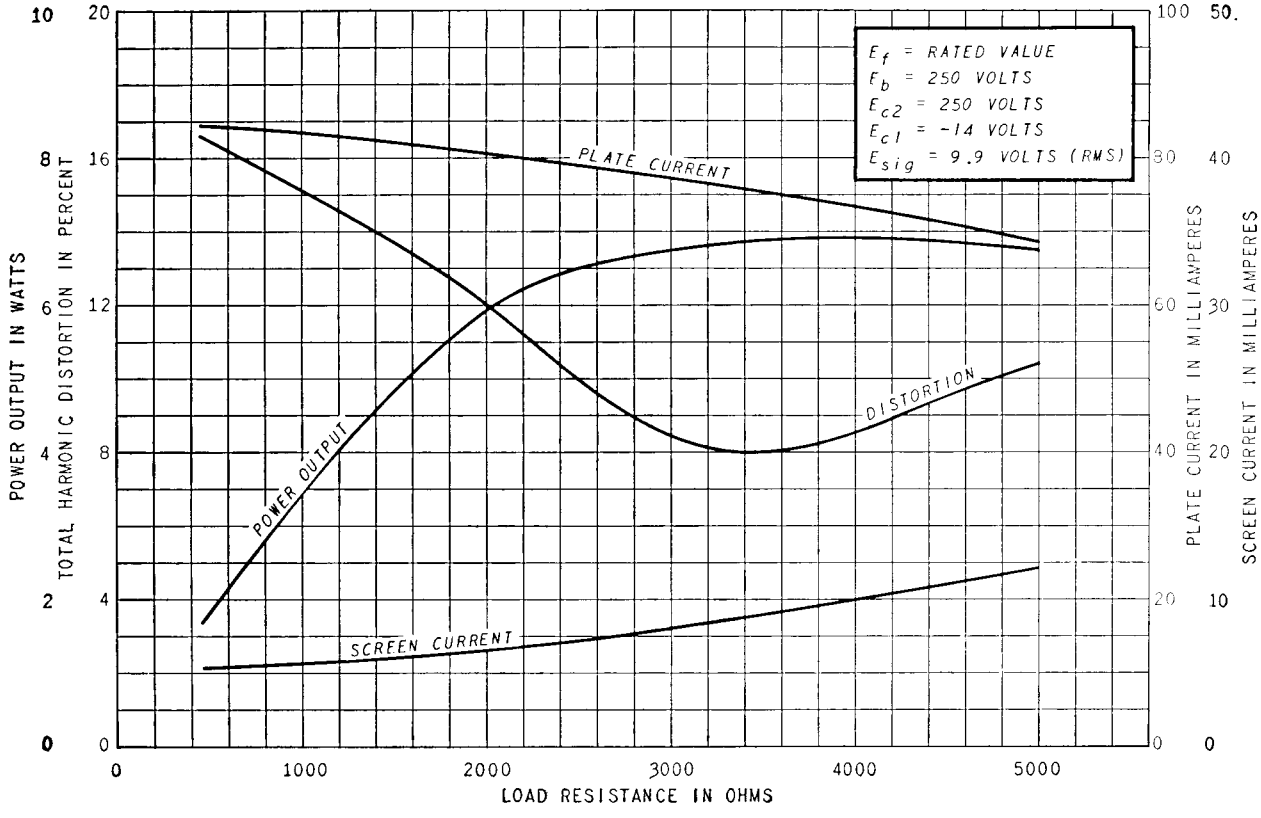
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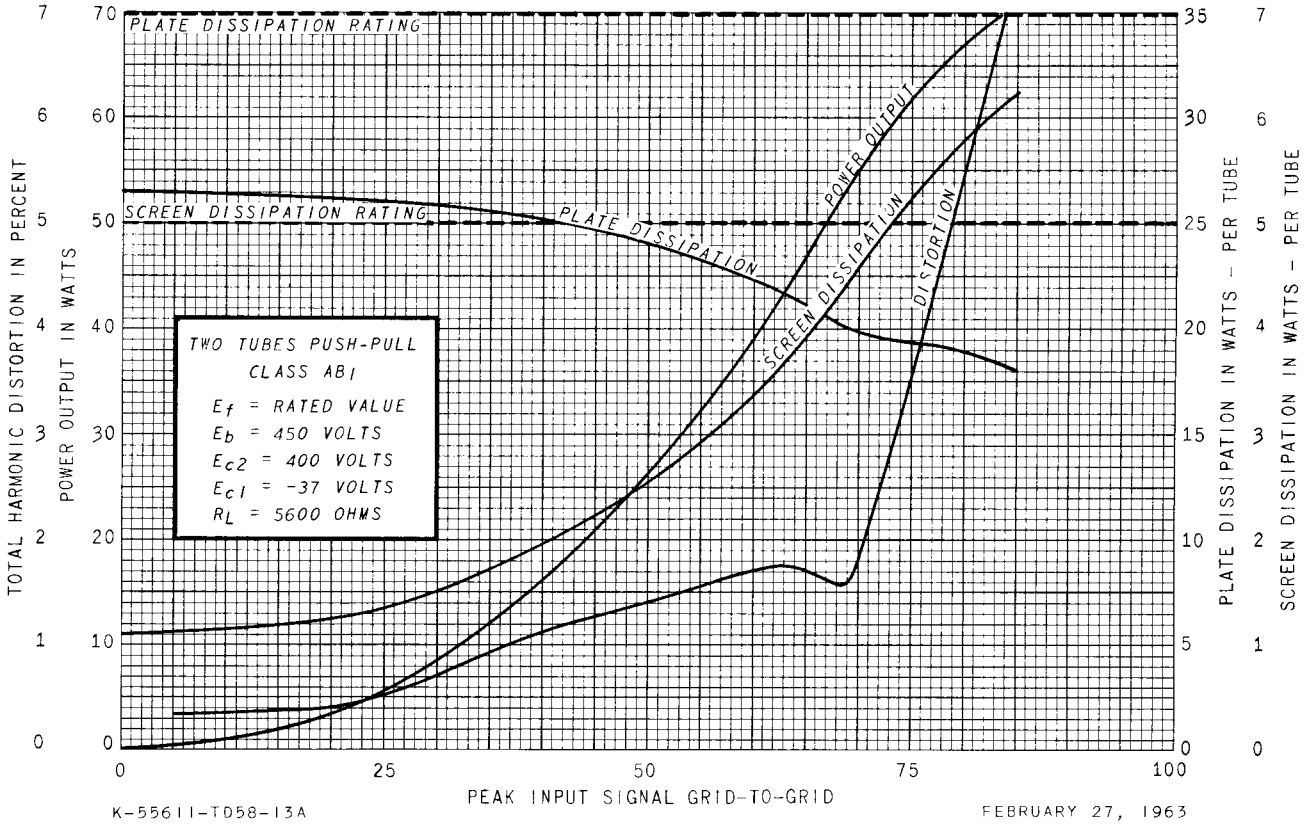
AVERAGE TRANSFER CHARACTERISTICS



OPERATION CHARACTERISTICS



OPERATION CHARACTERISTICS



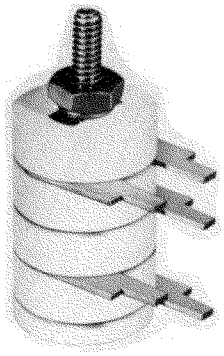
RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

7588

METAL-CERAMIC TRIODE



DESCRIPTION AND RATING

The 7588 is a high-mu triode of ceramic-and-metal planar construction. The tube is intended for use as a broadband radio-frequency amplifier at frequencies up to 500 megacycles.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.3	Volts
Heater Current†	0.4	Amperes

Direct Interelectrode Capacitances‡

Grid to Plate: (g to p)	2.8	pf
Input: g to (h+k)	6.5	pf
Output: p to (h+k)	0.075	pf
Heater to Cathode: (h to k)	2.6	pf

MECHANICAL

Mounting Position—Any§
See Physical Dimensions on page 4 for dimensions and electrical connections.

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Plate Voltage	300 Volts
Positive DC Grid-to-Cathode Voltage	0 Volts
Negative DC Grid Voltage	50 Volts
Plate Dissipation	5.5 Watts
DC Cathode Current	30 Milliamperes
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	50 Volts
Heater Negative with Respect to Cathode	50 Volts
Grid Circuit Resistance	
With Fixed Bias	0.025 Megohms
With Cathode Bias	0.1 Megohms
Envelope Temperature at Hottest Point	250 C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	200 Volts
Positive Grid Voltage	6.0 Volts
Cathode-Bias Resistor	270 Ohms
Amplification Factor	175
Plate Resistance, approximate	3900 Ohms
Transconductance	45000 Micromhos
Plate Current	24 Milliamperes
Grid Voltage, approximate	
Ib = 100 Microamperes	−5 Volts
Noise Figure¶	3.0 Decibels

GENERAL ELECTRIC

Supersedes 7588 D & R Sheet ET-T1620, dated 6-60

FOOTNOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ One method of mounting the 7588 is to use a stainless-steel "T" bolt (see drawing) to attach the mounting base of the tube to a chassis or circuit board. The "T" bolt should be inserted in the slot in the base of the tube, turned 90 degrees, and attached to the chassis or circuit board with a 4-40 nut and lock washer. Torque used to tighten the nut should not exceed 3 inch-pounds.

¶ Measured at 200 megacycles in a grounded-grid amplifier and corrected for second-stage noise figure and diode temperature.

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INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
Ef = 6.3 volts	370	400	430	Milliamperes
Plate Current				
Ef = 6.3 volts, Eb = 200 volts, Rk = 22 ohms	17	25	33	Milliamperes
Transconductance				
Ef = 6.3 volts, Eb = 200 volts, Ec = +6 volts, Rk = 270 ohms (bypassed)	35000	45000	55000	Micromhos
Amplification Factor				
Ef = 6.3 volts, Eb = 200 volts, Ec = +6 volts, Rk = 270 Ohms (bypassed)	140	175	210	
Transconductance Change with Heater Voltage				
Difference between transconductance at Ef = 6.3 volts and transconductance at Ef = 5.7 volts (other conditions the same) expressed as a percentage of transconductance at Ef = 6.3 volts	.....	.....	20	Percent
Grid Voltage Cutoff				
Ef = 6.3 volts, Eb = 200 volts, Ib = 100 μa	.....	−5.0	−8.0	Volts
Noise Figure				
Ef = 6.3 volts, Ebb = 265 volts, Ec = 0 volts, R_L = 3300 ohms, (bypassed), Rk = 22 ohms, F = 200 ± 10 MC	.....	3.0	4.8	Decibels
Interelectrode Capacitances				
Grid to Plate: (g to p)	2.1	2.8	3.5	pf
Input: g to (h+k)	5.1	6.7	8.3	pf
Output: p to (h+k)	0.05	0.075	0.1	pf
Heater to Cathode: (h to k)	1.9	2.6	3.3	pf
Negative Grid Current				
Ef = 6.3 volts, Eb = 200 volts, Ecc = −1.0 volts, Rk = 22 ohms (bypassed), Rg = 0.1 meg	.....	.....	0.5	Microamperes
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	.....	.....	20	Microamperes
Heater Negative with Respect to Cathode	.....	.....	20	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid to All at 100 volts d-c	50	.....	.....	Megohms
Plate to All at 300 volts d-c	50	.....	.....	Megohms
Grid Emission Current				
Ef = 7.0 volts, Eb = 200 volts, Ecc = −15 volts, Rg = 0.1 meg	.....	.....	2.0	Microamperes

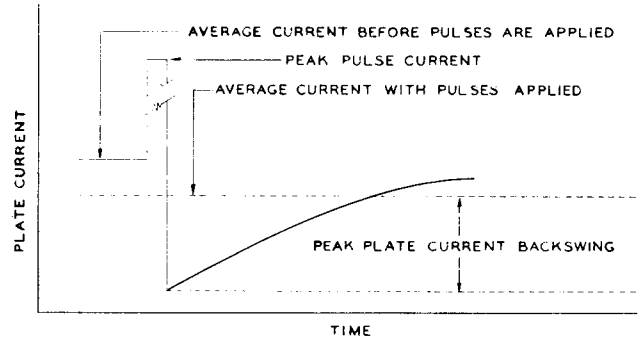
SPECIAL PERFORMANCE TESTS

	Min.	Bogey	Max.	
Grid Recovery				
Change in Average Plate Current	....	....	1.0	Milliamperes
Peak Plate Current Backswing	....	....	2.0	Milliamperes

Tubes with poor grid recovery affect circuit operation when the grid is driven positive by a pulse of signal or noise, somewhat as if a parallel RC circuit were in series with the grid. This effect may occur in tubes of any type but is unimportant in many applications. In the majority of 7588 tubes the effect is negligible, but to eliminate the few in which it may be excessive, tubes are tested under the following conditions: Ef = 6.3 volts, Ebb = 250 volts, R_L = 0.01 meg. EC is adjusted for Ib = 10 ma.

Upon application to the grid of a pulse driving it 3 volts positive with respect to cathode (prr = 60 pps, duty cycle = 0.12%) the change in average plate current is noted, and the peak plate current backswing is measured. The following diagram shows qualitatively the plate current-time relationship for a tube (with poor grid recovery) subjected to this test:

PLATE CURRENT VS TIME —GRID RECOVERY TEST



	Min.	Bogey	Max.	
Low Frequency Vibrational Output Statistical sample is subjected to vibration in each of two planes at 40 cps, with peak acceleration 15G. Tube is operated with Ef = 6.3 volts, Ebb = 250 volts, Rk = 68 ohms (bypassed), R_L = 2000 ohms	....	.....	25	Millivolts RMS
Variable Frequency Vibrational Output Statistical sample is subjected to vibration according to the procedure given below. Tube is operated with Ef = 6.3 volts, Ebb = 250 volts, Rk = 68 ohms (bypassed), R_L = 2000 ohms	....	.....	75	Millivolts RMS

The variable-frequency vibration test shall be performed as follows:

1. The frequency shall be increased from 100 to 2000 cps with approximately logarithmic progression in 3 ± 1 minutes. The return sweep (2000 to 100 cps) is not required.
2. The tube shall be vibrated with simple harmonic motion in each of two planes: first, parallel to the cylindrical axis; second, perpendicular to the cylindrical axis and parallel to a line through the major axis of a terminal lug. At all frequencies from 100 to 2000 cps, the total harmonic distortion of the acceleration wave form shall be less than 5%.
3. The peak acceleration shall be maintained at 10 ± 1.0 G throughout the test.
4. The value of the alternating voltage produced across the load resistor (R_L), as a result of the vibration, shall be measured with a suitable device having a response to the RMS value of the voltage to within ±0.5 db of the response at 400 cps for the frequency range of 100 to 3000 cps, and having a band-pass filter with an attenuation rate of 24 db per octave below the low frequency cutoff point of 50 cps and above the high frequency cutoff point of 5000 cps. The meter shall have a dynamic response characteristic equivalent to or faster than a VU meter (operated in accordance with ASA Standard No. C16.5–1954).

Low Pressure Voltage Breakdown Test

Statistical sample tested for voltage breakdown at a pressure of 8mm Hg, to simulate an altitude of 100,000 feet. Tubes shall not give visual evidence of flashover or corona when 300 volts RMS, 60 cps, is applied between the plate and grid terminals.

DEGRADATION RATE TESTS

Fatigue

Statistical sample vibrated for a total of six hours, three hours in each of two planes, at a peak acceleration of 10 G. Frequency is continuously varied from 30 cps to 2000 cps and back to 30 cps, with a period of ten minutes. Tubes are operated during the test with Ef = 6.3 volts, Eb = 250 volts, and Rk = 68 ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, heater current, and transconductance.

DEGRADATION RATE TESTS (Continued)

Shock

Statistical sample subjected to 5 impact accelerations of approximately 450 G in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine using a 30° hammer angle. Tubes are mounted by T-bolt with 3 inch-pounds torque, and operated during the test with Ef = 6.3 volts, Eb = 250 volts, Ehk = +100 volts, Rg = 0.1 meg, and Rk = 68 ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, heater current, and transconductance.

Stability Life Test

The statistical sample subjected to the Intermittent Life Test is evaluated for percent change in transconductance of individual tubes, from the initial reading to readings following 2 hours and 20 hours of the life test.

Survival Rate Life Test

The statistical sample subjected to the Intermittent Life Test is evaluated for shorted and open elements, and transconductance, following approximately 100 hours of life test.

Intermittent Life Test

Statistical sample operated 1000 hours under the following conditions: Ef = 6.3 volts, Eb = 200 volts, Ecc = +6 volts, Ehk = −70 volts, Rk = 270 ohms, Rg = 0.1 meg. Heater voltage is cycled (on 1¾ hours, off ¼ hour). Tubes are evaluated, following 500 and 1000 hours of life test, for shorted or open elements, heater current, transconductance, negative grid current, noise figure, heater-cathode leakage, and interelectrode leakage resistance.

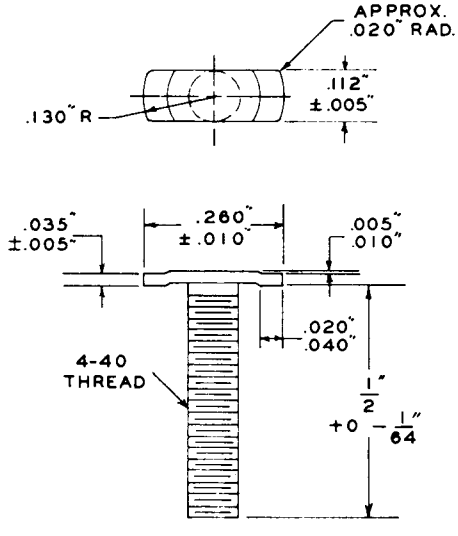
Interface Life Test

Statistical sample operated for 1000 hours with Ef = 6.6 volts, no other voltages applied, and evaluated for cathode interface resistance following the life test.

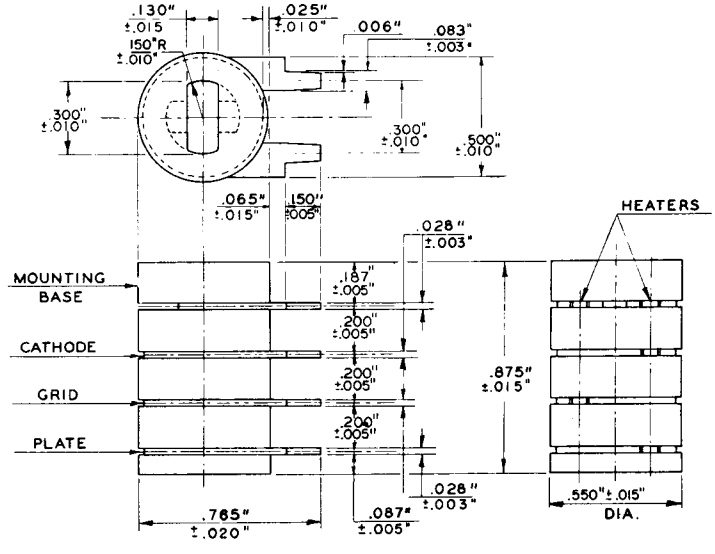
Heater-Cycling Life Test

Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.5 volts cycled for one minute on and one minute off, Eb = Ec = 0 volts, and Ehk = 70 volts with heater positive with respect to cathode. Following this test, tubes are evaluated for open heaters, heater-cathode shorts, and heater-cathode leakage current.

MOUNTING BOLT

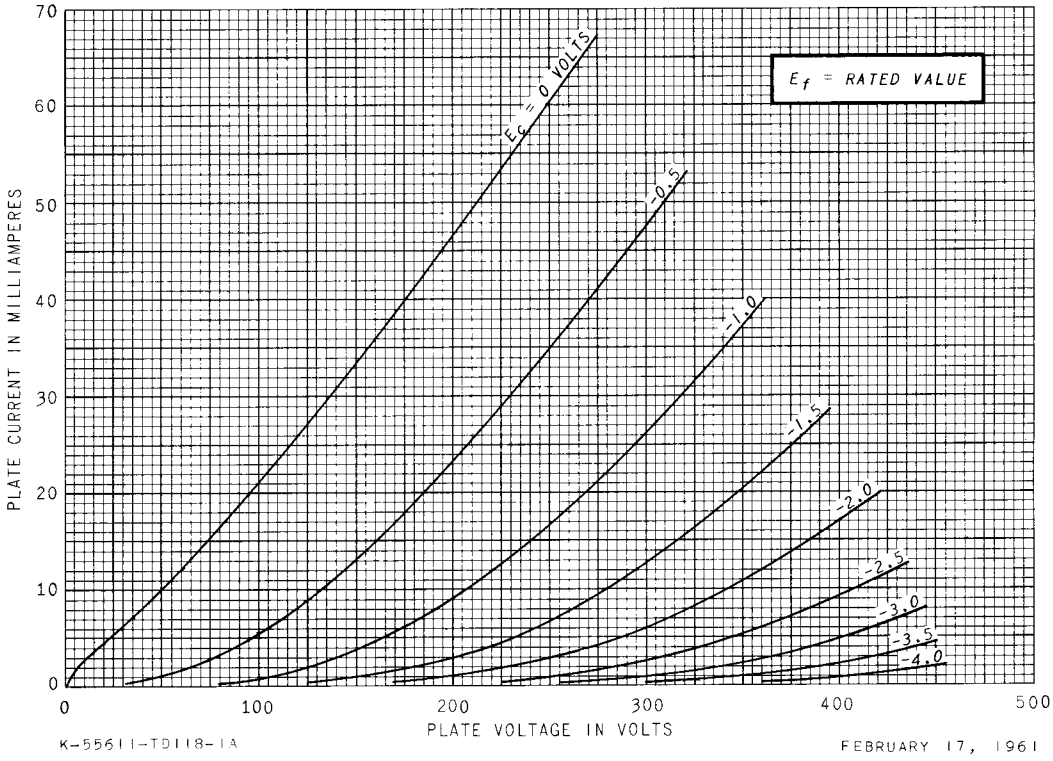


PHYSICAL DIMENSIONS



Maximum eccentricity of insulators 0.015 in. from center line.

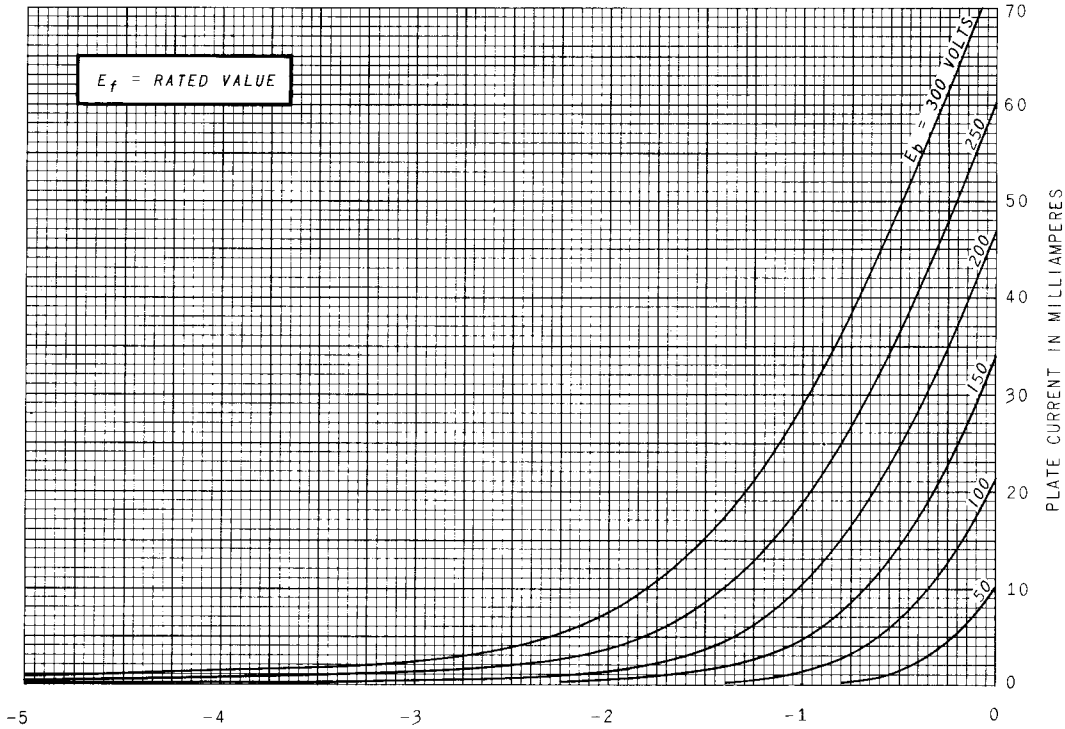
AVERAGE PLATE CHARACTERISTICS



K-5561I-TDII8-IA

FEBRUARY 17, 1961

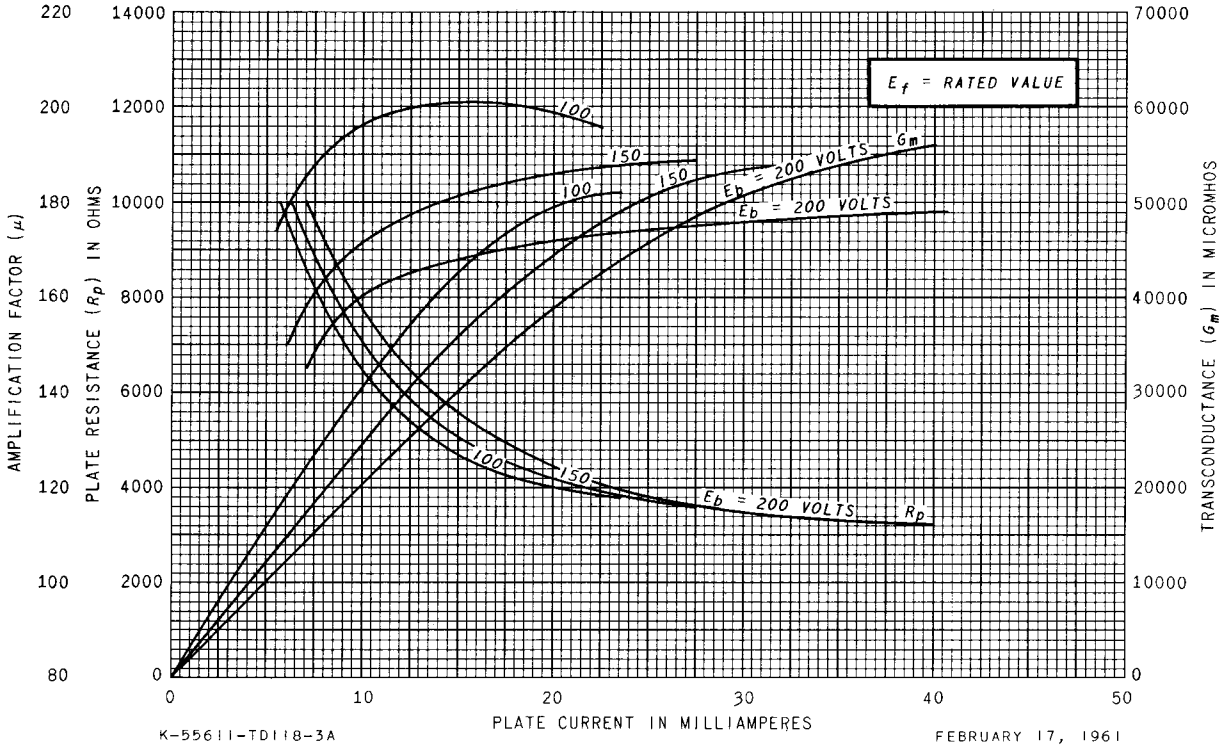
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TDII8-2A

FEBRUARY 17, 1961

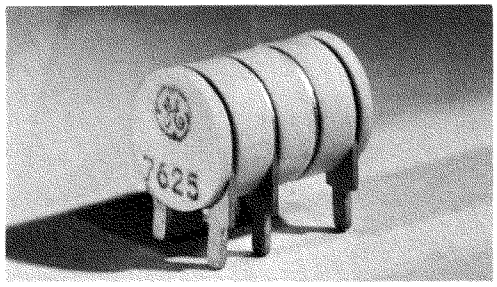
AVERAGE PLATE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky



METAL-CERAMIC TRIODE

DESCRIPTION AND RATING

The 7625 is a high-mu triode of ceramic-and-metal planar construction primarily intended for low-level audio-frequency amplification.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.3	Volts
Heater Current†	0.215	Amperes

Direct Interelectrode Capacitances‡

Grid to Plate: (g to p)	1.3	pf
Input: g to (h+k)	1.5	pf
Output: p to (h+k)	0.03	pf
Heater to Cathode: (h to k)	1.5	pf

MECHANICAL

Mounting Position—Any

See Outline Drawing on page 3 for dimensions and electrical connections

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

DC Plate Voltage	275	Volts
Peak Plate Voltage	400	Volts
Positive Peak and DC Grid Voltage	0	Volts
Negative Peak and DC Grid Voltage	50	Volts
Plate Dissipation	0.85	Watts
DC Cathode Current	3.8	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance, with Fixed Bias§	0.2	Megohms
Envelope Temperature at Hottest Point¶	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	150	Volts
Cathode-Bias Resistor	1000	Ohms
Amplification Factor	80	
Plate Resistance, approximate	57000	Ohms
Transconductance	1400	Micromhos
Plate Current	0.95	Milliamperes
Grid Voltage, approximate Ib = 10 Microamperes, Eb = 250 Volts	−4.6	Volts

FOOTNOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ If resistance is used in the cathode or plate circuits, the grid-circuit resistance may be high as (200,000 + 500 RK + 10 RL) ohms, where RK is the cathode-bias resistance in ohms, and RL is the DC plate load resistance in ohms.

¶ Operation below the rated maximum envelope temperature is recommended for applications requiring the longest possible tube life. The 7625 is also capable of operation at envelope temperatures much higher than the rated maximum values. For specific recommendations concerning higher temperature operation, contact your General Electric tube sales representative.

SPECIAL PERFORMANCE TESTS

	Maximum	
Variable-Frequency Vibration Ef = 6.3 volts, Ebb = 150 volts, Ec = 0 volts d-c, Rk = 1000 ohms (bypassed), R_L = 10000 ohms; Note 1	15	Millivolts peak to peak
Low-Frequency Vibration Ef = 6.3 volts, Ebb = 150 volts, Ec = 0 volts d-c, Rk = 1000 ohms (bypassed), R_L = 10000 ohms, G = 15, F = 40 cps; Note 2	0.75	Millivolts RMS

Low Pressure Voltage Breakdown Test
Statistical sample tested for voltage breakdown at a pressure of 8mm Hg, to simulate an altitude of 100,000 feet. Tubes shall not give visual evidence of flashover or corona when 300 volts RMS, 60 cps, is applied between the plate and grid terminals.

Note 1: The variable-frequency vibration test shall be performed as follows:
- a. The frequency shall be increased from 100 to 2000 cps with approximately logarithmic progression in 3 ± 1 minutes. The return sweep (2000 to 100 cps) is not required.
- b. The tube shall be vibrated with simple harmonic motion in each of two planes; first, parallel to the cylindrical axis; second, perpendicular to the cylindrical axis and parallel to a line through the major axis of a terminal lug.
- c. The peak acceleration shall be maintained at 10 ± 1 G throughout the test.
- d. The vibrational output produced across R_L as a result of the vibration shall be coupled to a low-pass filter that has the following characteristics:
  - (1) A response within ± 1 db of the response at 1000 cps over the frequency range of 100 to 17000 cps.
  - (2) The response shall be down at least 1.5 db at 20000 cps and have a cut-off rate of at least 18 db per octave above 20000 cps.

Note 2: The tube shall be vibrated with harmonic motion in each of two planes, (1) parallel to the cylindrical axis and (2) perpendicular to the cyclindrical axis and perpendicular to a line through the major axis of a terminal lug.

DEGRADATION RATE TESTS

Fatigue
Statistical sample vibrated for a total of six hours, three hours in each of two planes, at a peak acceleration of 10 G. Frequency is continuously varied from 30 cps to 2000 cps and back to 30 cps, with a period of ten minutes. Tubes are operated during the test with Ef = 6.3 volts, Eb = 150 volts, and Rk = 82 ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, transconductance, and negative grid current.

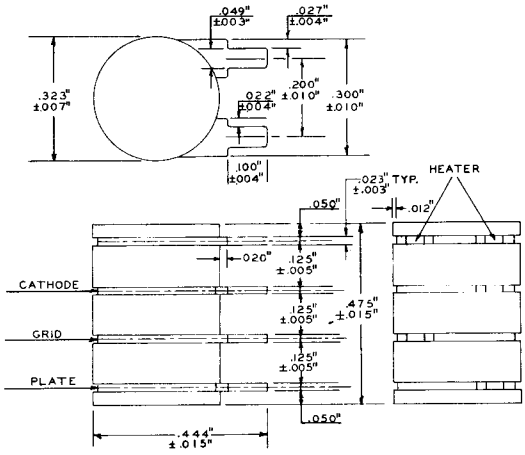
Shock
Statistical sample subjected to 5 impact accelerations of approximately 450 G in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine using a 30° hammer angle. Tubes are operated during the test with Ef = 6.3 volts, Eb = 150 volts, Ehk = +100 volts, Rg = 0.1 Meg, and Rk = 82 ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, transconductance, and negative grid current.

Stability Life Test
The statistical sample subjected to the Intermittent Life Test is evaluated for percent change in transconductance of individual tubes, from the initial readings to readings following 2 hours and 20 hours of the life test.

Survival Rate Life Test
The statistical sample subjected to the Intermittent Life Test is evaluated for shorted and open elements and transconductance following approximately 100 hours of life test.

Intermittent Life Test
Statistical sample operated for 1000 hours under the following conditions: Ef = 6.3 volts (cycled—on 1¾ hours, off ¼ hour), Ebb = 300 volts, Ehk = +70 volts d-c, Rk = 82 ohms, R_L = 18000 ohms, and Rg = 0.1 meg. Tubes are evaluated, following 500 and 1000 hours of life test, for shorted or open elements, heater current, grid current, transconductance, heater-cathode leakage, and interelectrode leakage resistance.

DEGRADATION RATE TESTS (Continued)



Maximum eccentricity of insulators 0.010 in. from center line.

Interface Life Test

Statistical sample operated for 1000 hours with Ef = 6.6 volts, no other voltages applied, and evaluated for cathode interface resistance following the life test.

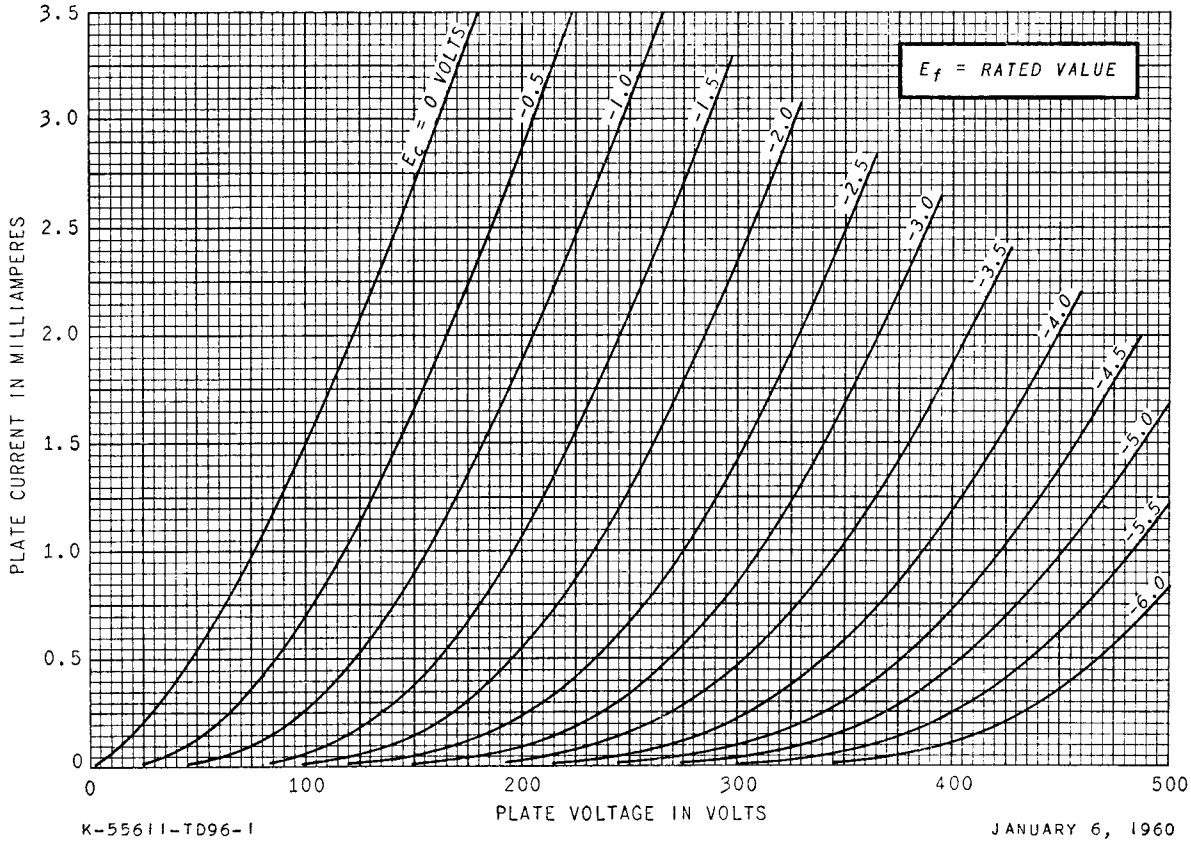
Heater-Cycling Life Test

Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.0 volts cycled for one minute on and one minute off, Eb = Ec = 0 volts, and Ehk = 70 volts with heater positive with respect to cathode. Following this test, tubes are evaluated for open heaters, heater-cathode shorts, and heater-cathode leakage current.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

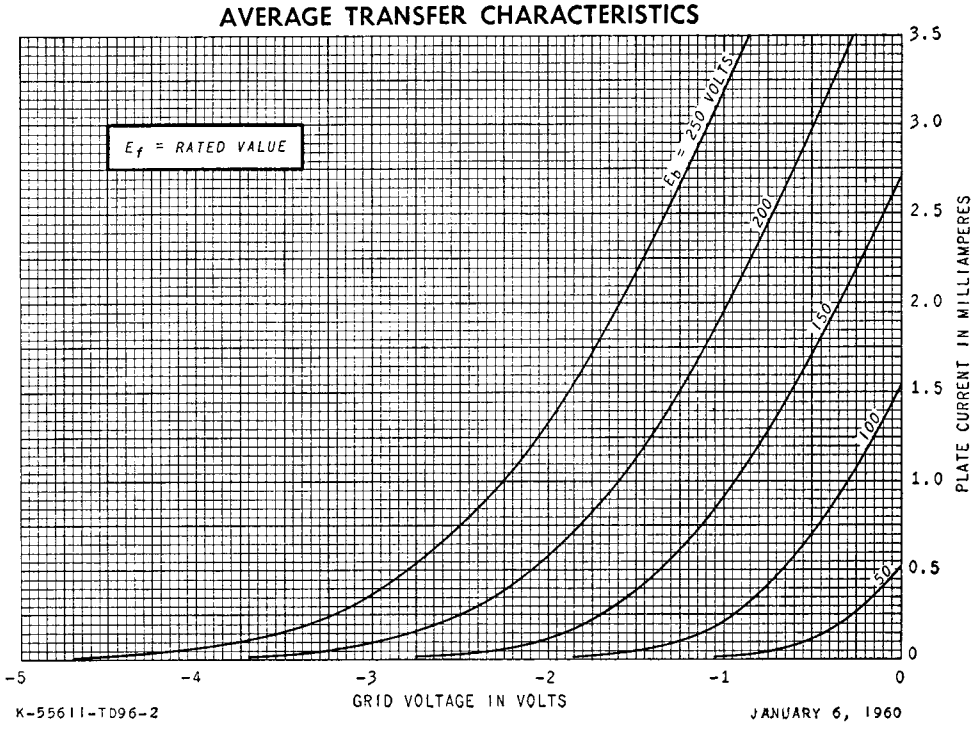
AVERAGE PLATE CHARACTERISTICS



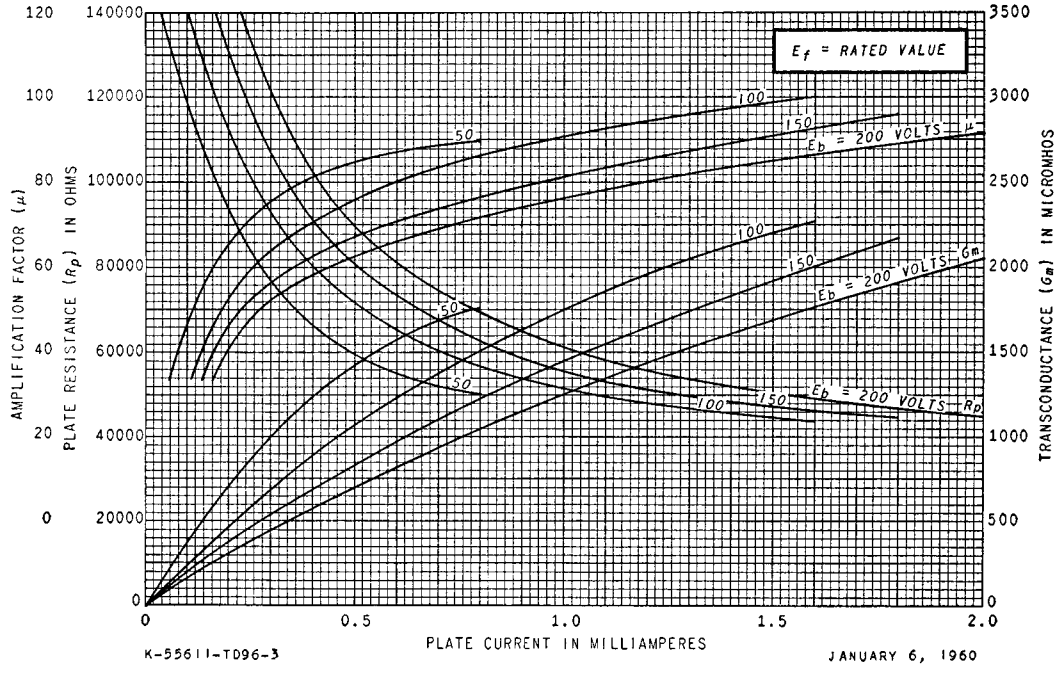
K-5561I-TD96-I

JANUARY 6, 1960

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

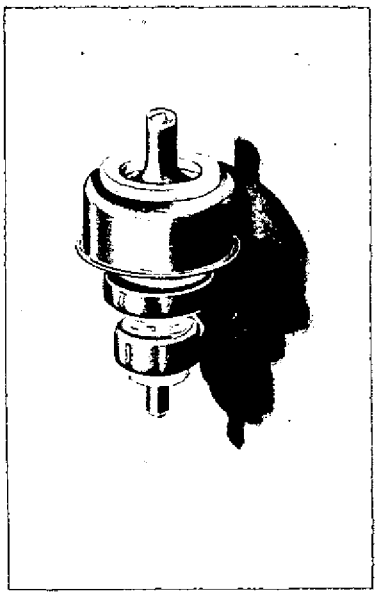
GENERAL ELECTRIC

Owensboro, Kentucky

from JEDEC release #2755,
March 14, 1960

GL-7644

UHF TRIODE



LOW POWER
GROUNDED-GRID CIRCUIT

VERY SMALL SIZE

METAL AND CERAMIC
CONDUCTION COOLED

The GL-7644 is a miniature metal-and-ceramic triode for use in UHF grounded-grid amplifier applications under high pulse-power input conditions at a frequency of up to 3000 megacycles. The physical appearance and dimensions of this tube are identical to those of the GL-6299.

Electrical

Heater Voltage	6.3 ± 2%	Volts
Heater Current at 6.3 volts	300	Milliamperes
Direct Interelectrode Capacitances, approximate		
Grid to Anode	1.75	μμf
Grid to Cathode	3.65	μμf
Cathode to Anode, maximum	0.020	μμf
Characteristics, Eb = 175 v d-c, Ib = 10 ma d-c, Ec adjusted		
Transconductance	15,000	Micromhos
Amplification Factor	110	

Mechanical

Mounting Position—Any

Net Weight, approximate	1/6	Ounces

Thermal

Type of Cooling—Conduction*

Seal Temperature, maximum	150	C

MAXIMUM RATINGS—ABSOLUTE VALUES

DC Plate Voltage	200	Volts	Duty Cycle	0.0011	
DC Plate Current	12	Milliamperes	Pulse Width	15	Microseconds
Plate Dissipation	2	Watts	Peak RF Grid Voltage	7	Volts
Negative DC Grid Voltage	15	Volts			

TYPICAL OPERATION

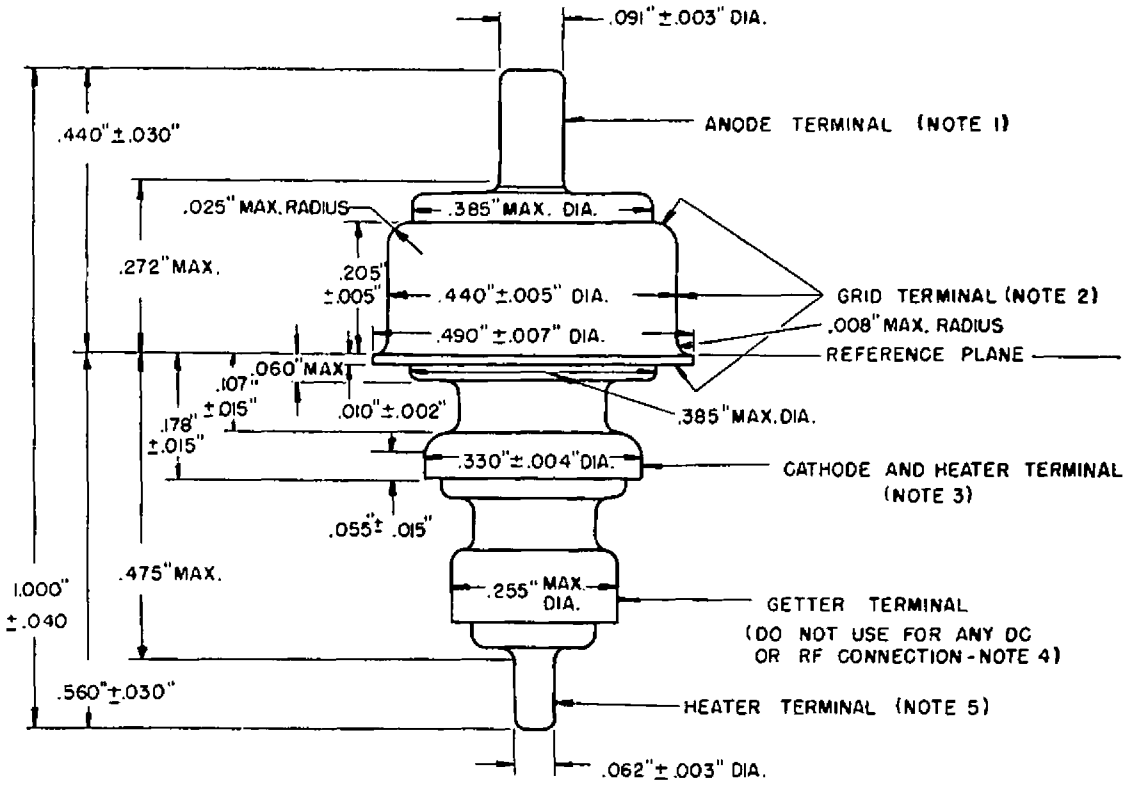
Class A_1 RF Amplifier

Grounded-grid Coaxial-type Circuit

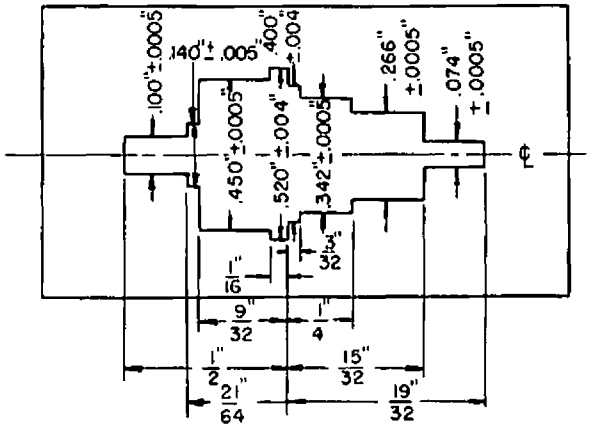
Frequency	450	Megacycles	Duty Cycle	0.0011	
Heater Voltage	6.3	Volts	Pulse Width	15	Microseconds
DC Plate Voltage, adjust for specified plate current	180	Volts	Noise Figure, power matched	4.5	Decibels
DC Plate Current	10	Milliamperes	Gain, 10 megacycle bandwidth	17.5	Decibels

*The electrical connections to the anode and cathode must provide good thermal conductivity from these electrodes. The anode contact must be sufficiently flexible to keep the lateral force on the anode terminal at a minimum.

GENERAL ELECTRIC



GAGE



FRACTIONAL TOLERANCES
1/4" OR LESS ± .008" OVER 1/4" ± .015"

NOTES:

1. MAXIMUM ECCENTRICITY 0.007" (RUNOUT 0.014")
2. MAXIMUM ECCENTRICITY 0.008" (RUNOUT 0.016")
3. MAXIMUM ECCENTRICITY 0.010" (RUNOUT 0.020")
4. MAXIMUM ECCENTRICITY 0.015" (RUNOUT 0.030")
5. MAXIMUM ECCENTRICITY 0.010" (RUNOUT 0.020")

ECCENTRICITIES MEASURED WITH RESPECT TO CENTER LINE THROUGH GAGE. TUBE SHALL BE ROTATED 360° IN GAGE WITHOUT BINDING.

K-69087-72A627

2-21-56

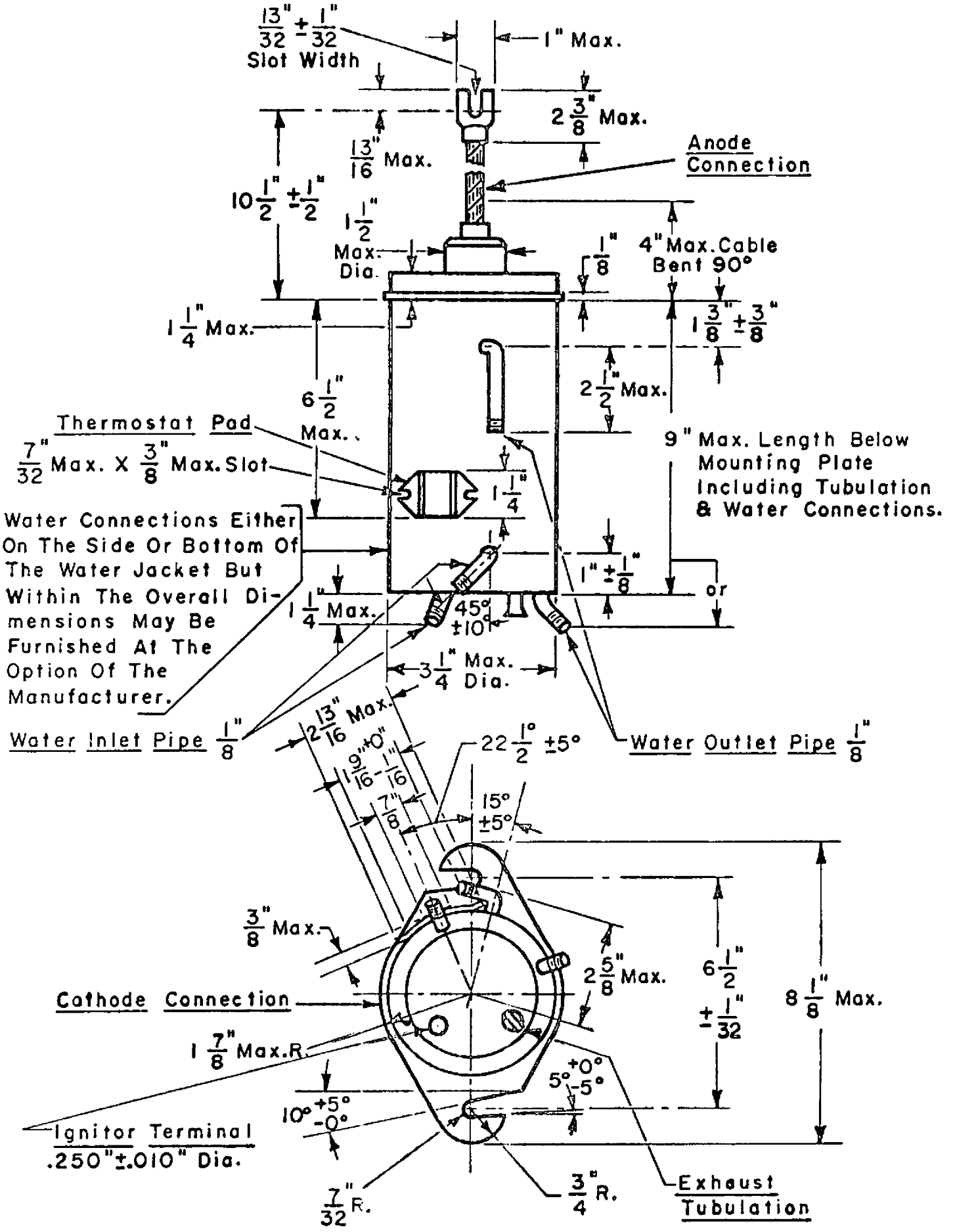
ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

from JEDEC release #2967B, Sept. 24, 1962
sponsor: General ELectric Co.
This tube is electrically identical with type 5551A

Tube Type: 7669

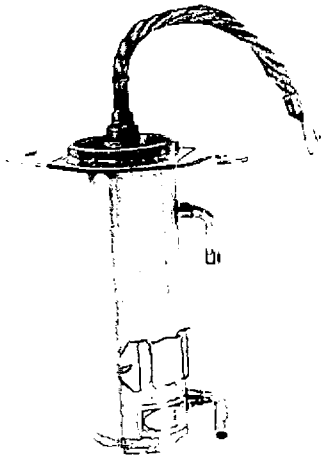


from JEDEC release #2972, Sept. 26, 1960

GL-7670

IGNITRON
Coaxial

PULSE-WELDER SERVICE—2000 AMPERES PEAK



ADAPTED TO WATER-FLOW CONTROL

The GL-7670 is a sealed, stainless-steel-jacketed, water-cooled ignitron designed to control the high-current, short-duration power pulses required in pulse-welding service. In such use two tubes in inverse-parallel connection will control 2000 amperes peak at voltages up to 2500 volts peak at a frequency of 60 cycles. The tube is also useful in other high-peak-current applications such as capacitor-discharge circuits.

The 7670 features a new coaxial construction in which current flows through the tube from anode to cathode, then up the tube wall to a coaxial cathode terminal at the top. This coaxial current flow provides a magnetic shield to eliminate the arc deflection which the high peak currents of this tube might cause in standard design ignitrons.

ADAPTED TO TEMPERATURE CONTROL

A slotted mounting plate permits convenient mounting of a thermostat to provide control of the water flow or over-temperature protection.

Electrical

Cathode Excitation—Cyclic	
Cathode Spot Starting—Ignitor	
Number of Electrodes	
Main Anodes	1
Main Cathodes	1
Ignitors	1
Arc Drop at 2500 Peak Amperes	25 Volts
Arc Drop at 150 Amperes	13 Volts

Mechanical

Envelope Material—Stainless Steel	
Net Weight	3.6 Pounds

Thermal

Type of Cooling—Water	
Inlet Water Temperature, minimum	10 C
Inlet Water Temperature, maximum	30 C
Outlet Water Temperature, maximum	35 C
Water Flow, minimum, solenoid water-valve open	1.0 Gallons per Minute
Characteristics for Water Cooling at Rated Minimum Flow	
Water Temperature Rise, maximum	4 C
Pressure Drop at 1 Gallon per Minute	1.8 Pounds per Square Inch

MAXIMUM RATINGS—PULSE WELDER SERVICE

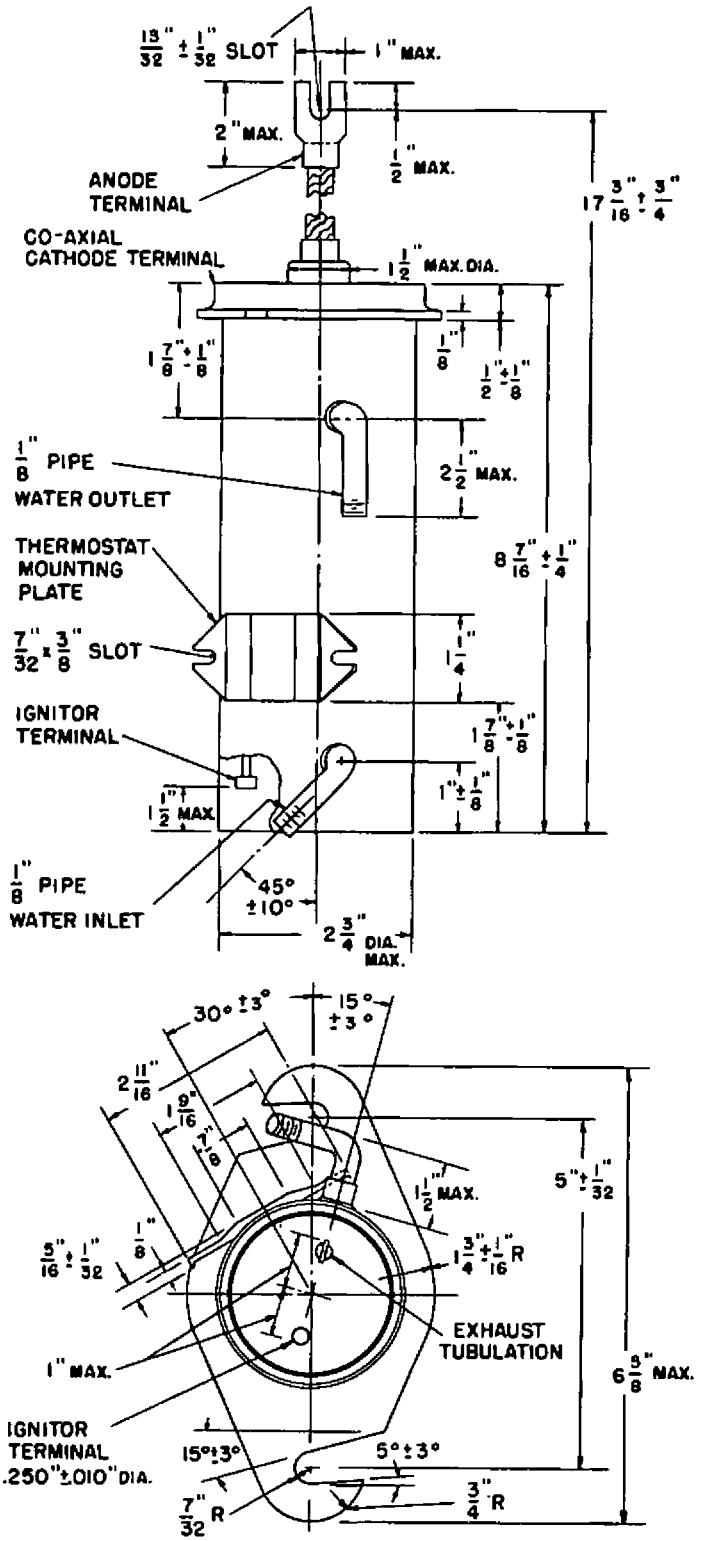
Peak Forward Anode Voltage	2500 Volts
Peak Inverse Anode Voltage	2500 Volts
Initial Inverse Voltage*	1250 Volts
Peak Anode Current	2000 Amperes
Average Anode Current	10 Amperes
Averaging Time	2 Seconds
Anode Current Repetition Rate	60 Pulses per Second
Anode Current Pulse Width	1000 Microseconds

Cathode Excitation Requirements

Ignitor Voltage Required to Fire	200 Volts
Ignitor Current Required to Fire	30 Amperes
Starting time at Required Voltage or Current	100 Microseconds
Ignitor	
Maximum Voltage	
Positive—Anode Voltage	
Negative	5 Volts
Maximum Current	
Peak	100 Amperes
Root Mean Square	10 Amperes
Average	1 Ampere
Maximum Averaging Time	5 Seconds

* Initial inverse voltage is the negative voltage applied to the anode immediately after anode current conduction.

GENERAL ELECTRIC



K-69087-72A970

ELECTRONIC COMPONENTS DIVISION

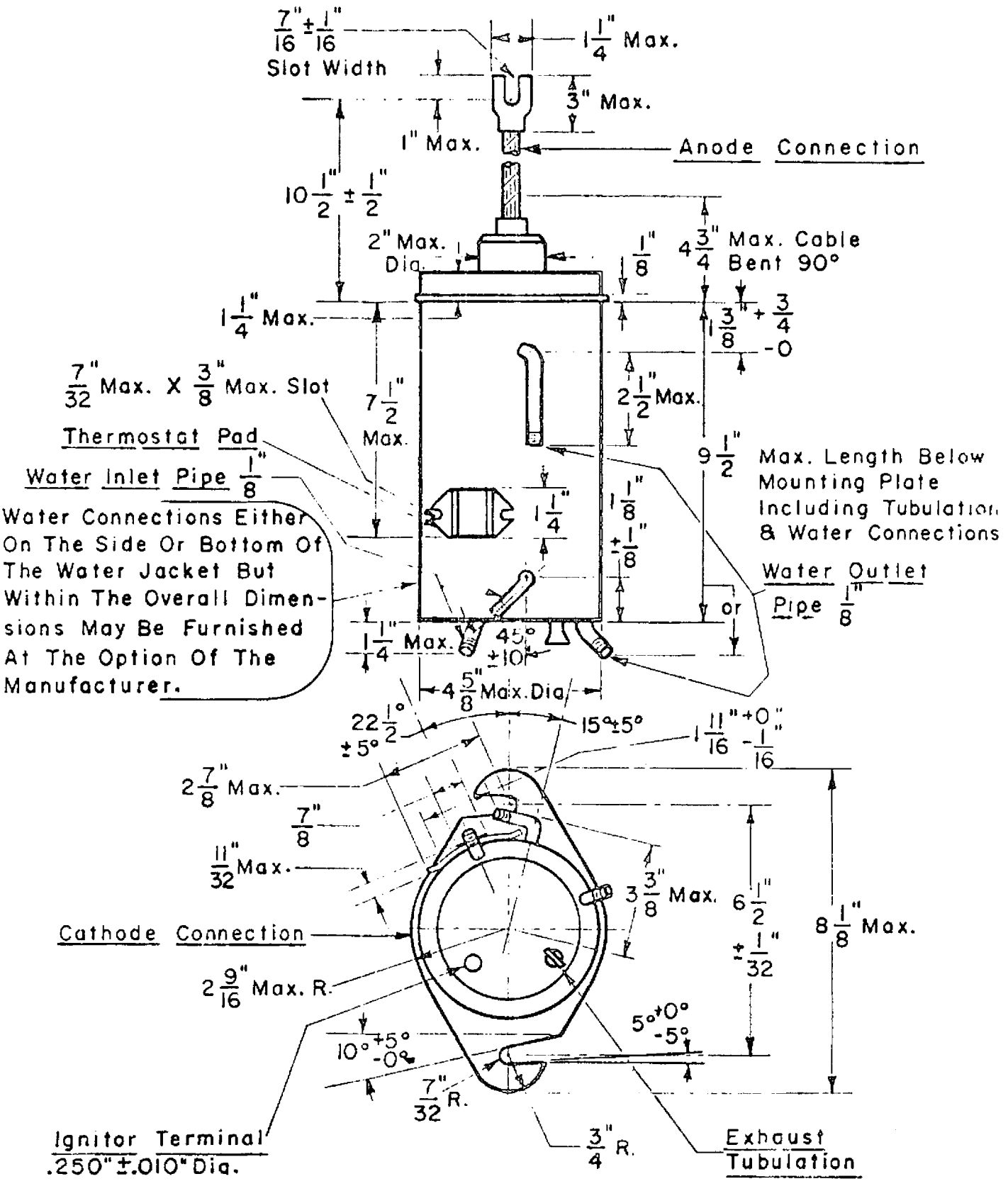
GENERAL ELECTRIC

Schenectady 5, N. Y.

8-60

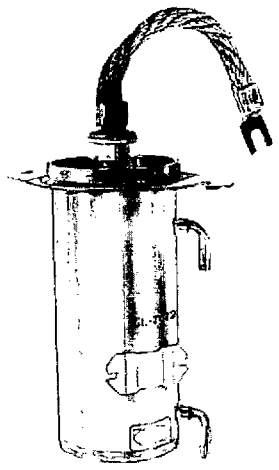
from JEDEC release #2935B, Sept. 24, 1962
Sponsor: General Electric Co.
Electrically the same as type 5552A.

Tube Type: 7671



IGNITRON
Coaxial

FREQUENCY-CHANGER WELDER SERVICE—1500 AMPERES PEAK



ADAPTED TO WATER-FLOW CONTROL

ADAPTED TO TEMPERATURE CONTROL

The GL-7672 is a sealed, stainless-steel-jacketed, water-cooled ignitron for use in frequency-changer welder service. In such use two tubes in inverse-parallel connection will control 1500 amperes peak at voltages up to 1200 volts peak at a frequency of 60 cycles. The tube is also useful in other high-peak-current applications such as capacitor-discharge circuits.

The 7672 features a new coaxial construction in which current flows through the tube from anode to cathode, then up the tube wall to a coaxial cathode terminal at the top. This coaxial current flow provides a magnetic shield to eliminate the arc deflection which the high peak currents of this tube might cause in standard design ignitrons.

A slotted mounting plate permits convenient mounting of a thermostat to provide control of the water flow or over-temperature protection.

Electrical

Cathode Excitation—Cyclic	
Cathode Spot Starting—Ignitor	
Number of Electrodes	
Main Anodes	1
Main Cathodes	1
Ignitors	1
Arc Drop at 1500 Amperes Peak	25 Volts

Mechanical

Envelope Material—Stainless Steel	
Net Weight	8.25 Pounds

Thermal

Type of Cooling—Water	
Inlet Water Temperature, minimum	10 C
Inlet Water Temperature, maximum	30 C
Outlet Water Temperature, maximum	35 C
Water Flow, minimum, solenoid water-valve open	
At Continuous Rated Average Current	1.5 Gallons per Minute
At No Load	0.5 Gallons per Minute
Characteristics for Water Cooling at Rated Minimum Flow	
Water Temperature Rise, maximum	6 C
Pressure Drop at 1.5 Gallons per Minute	5 Pounds per Square Inch

MAXIMUM RATINGS—FREQUENCY-CHANGER WELDER SERVICE

Ratings are for zero-phase-control angle (See curve K69087-72A316 on Page 3 for details).

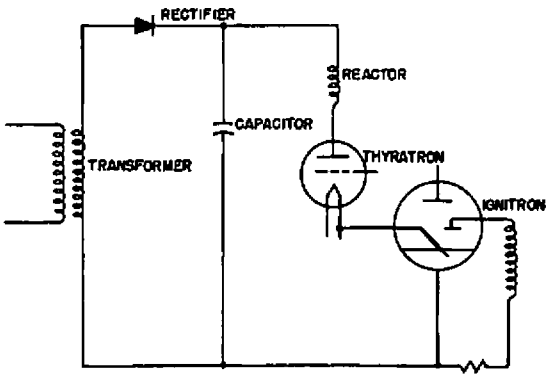
Peak Anode Voltage			
Forward	1200	1500	Volts
Inverse	1200	1500	Volts
Peak Anode Current*	1500	1200	Amperes
Corresponding Average	20	16	Amperes
Average Anode Current	70	56	Amperes
Corresponding Peak	420	336	Amperes
Maximum Averaging Time	6.25	6.25	Seconds
Ratio of Average to Peak Current	0.166	0.166	
Maximum Averaging Time	0.2	0.2	Seconds
Ratio of Fault to Maximum Peak Current	12.5	12.5	
Maximum Duration of Fault Current	0.15	0.15	Seconds
Frequency Range	50–60	50–60	Cycles per Second

Cathode Excitation Requirements

Ignitor Voltage Required to Fire	200	Volts
Ignitor Current Required to Fire	30	Amperes
Starting time at Required Voltage or Current	100	Microseconds
Ignitor		
Maximum Voltage		
Positive—Anode Voltage		
Negative	5	Volts
Maximum Current		
Peak	100	Amperes
Root Mean Square	10	Amperes
Average	1	Ampere
Maximum Averaging Time	5	Seconds

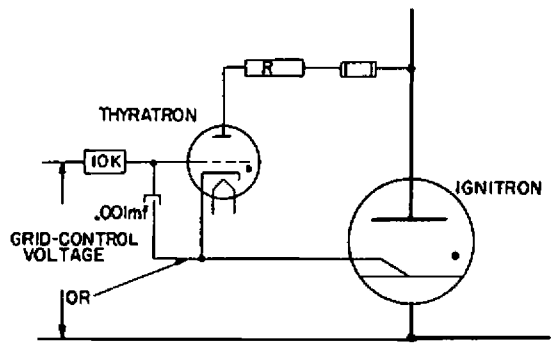
* Straight line interpolation on log-log paper is allowed between corresponding points.

GENERAL ELECTRIC



ELEMENTARY CIRCUIT FOR CAPACITOR FIRING

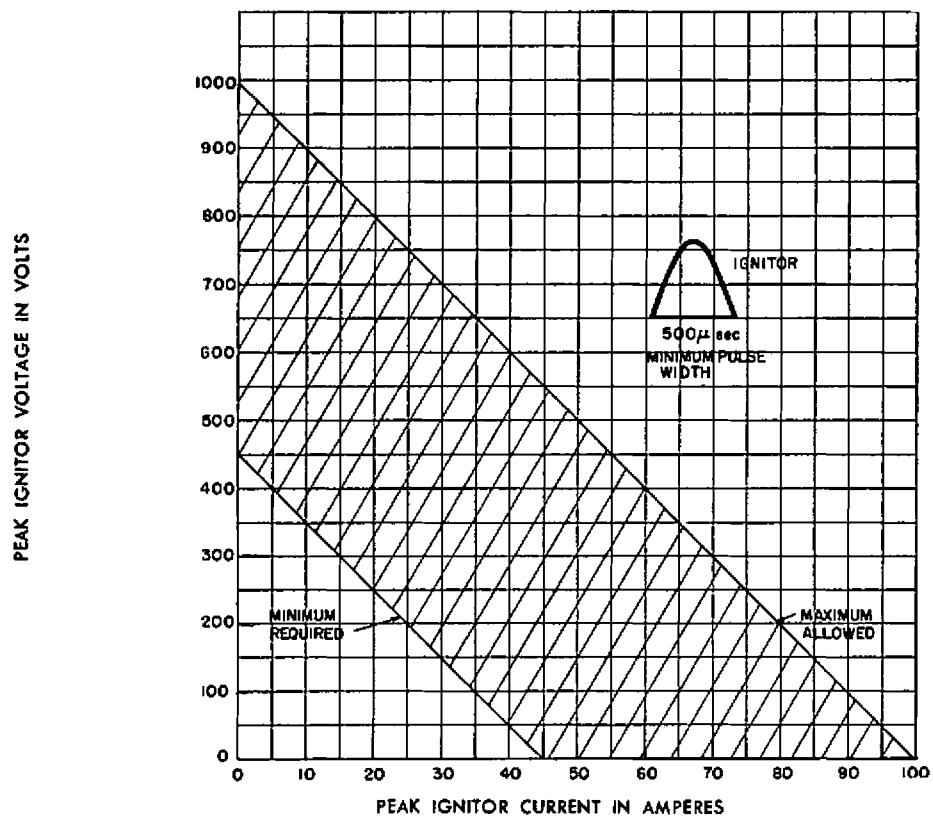
K-9033525 5-54



SELF OR ANODE EXCITATION IN WHICH A PART OF THE LOAD CURRENT IS DIVERTED THROUGH THE IGNITOR

K-9033542 9-60

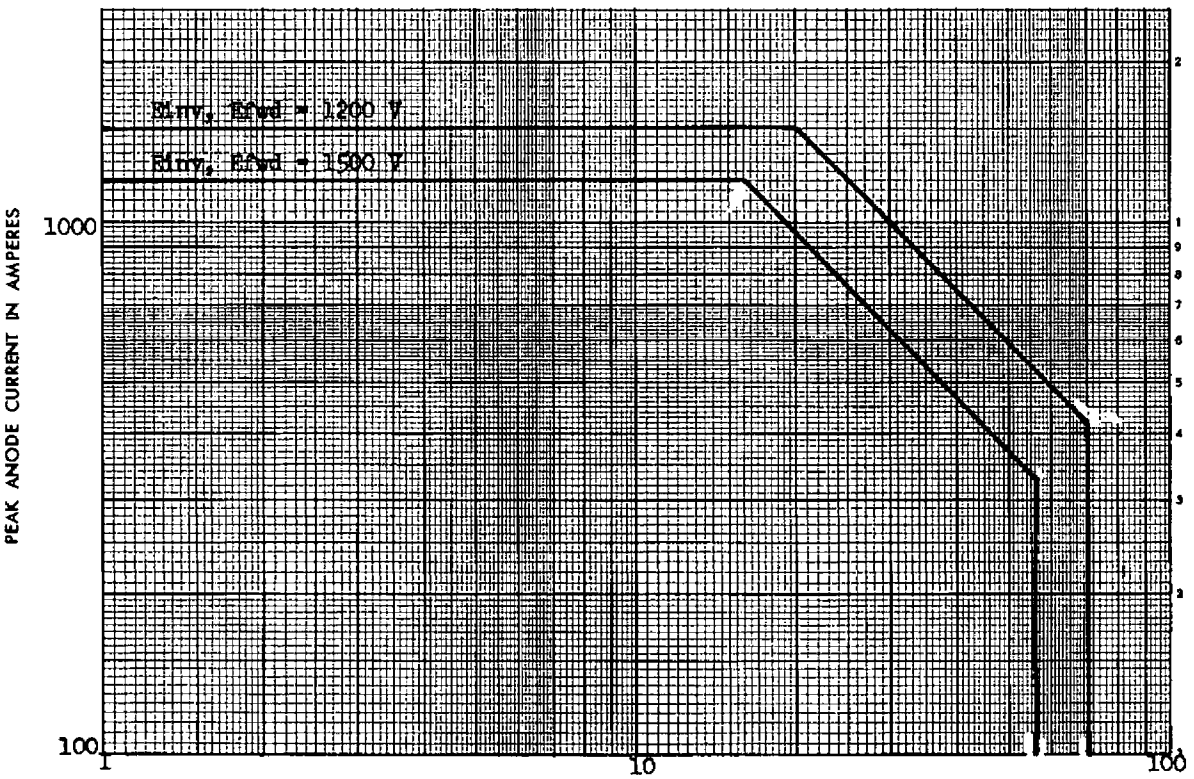
IGNITOR VOLT-AMPERE REQUIREMENTS FOR SEPARATE EXCITATION SEALED-IGNITRON RECTIFIERS



THE IGNITOR FIRING CIRCUIT SHOULD BE DESIGNED TO OPERATE WITHIN THE SHADED AREA

K-69087 72A982 9-60

FREQUENCY-CHANGER RESISTANCE-WELDING SERVICE



K-69087-72A316

9-56

MAXIMUM AVERAGING TIME = 6.25 SECONDS

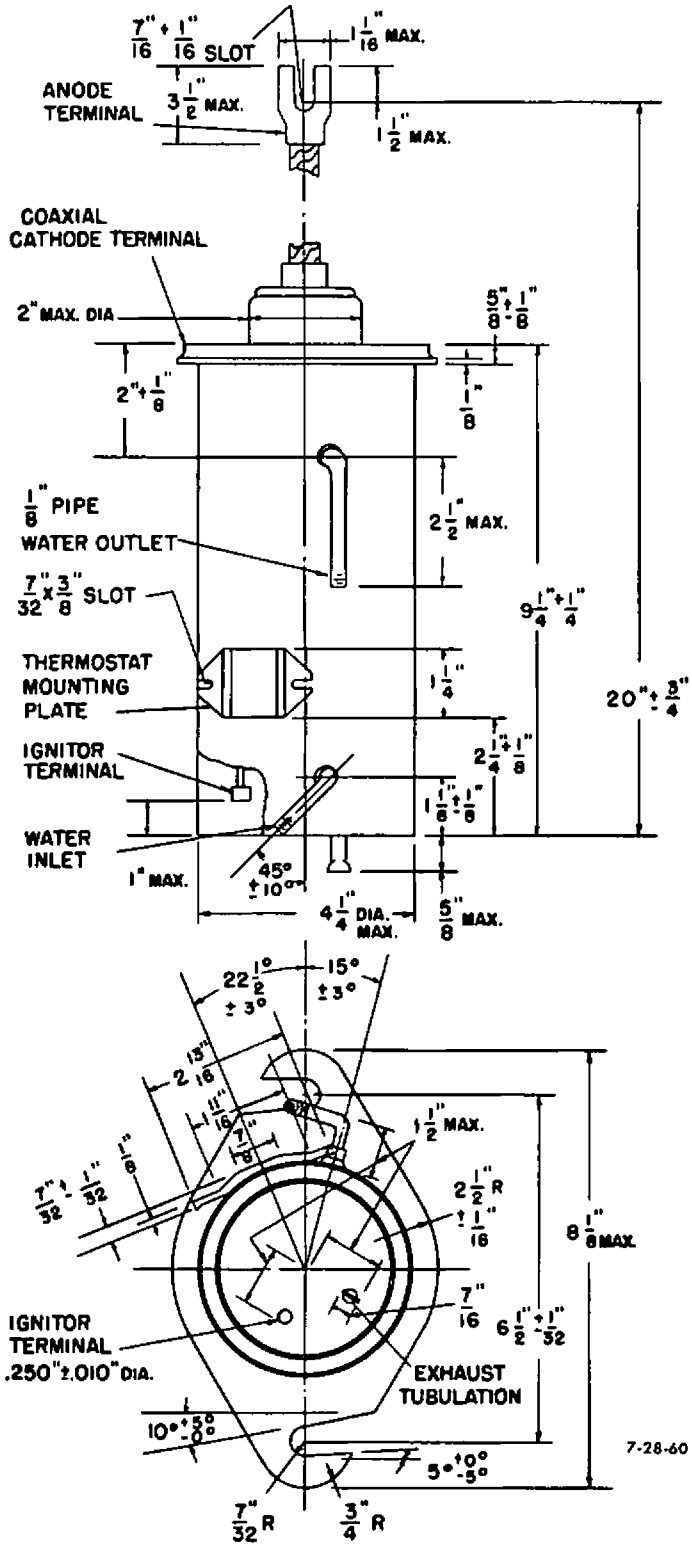
$\frac{\text{AVERAGE CURRENT}}{\text{PEAK CURRENT}}$ MAXIMUM AVERAGING TIME 0.2 SECOND = 0.166 MAXIMUM

$\frac{\text{SURGE CURRENT}}{\text{PEAK CURRENT}}$ MAXIMUM DURATION OF FAULT CURRENT 0.15 SECOND = 12.5 MAXIMUM

Control thermostats, with mounting brackets, are available through regular tube supply channels under the following catalog numbers:

AC Control Service
- Flying-Lead Type
  - Water-Control Thermostat—N15272AA
  - Over-Temperature Thermostat—N15273AA
- Terminal-Block Type
  - Water-Control Thermostat—N15286AA
  - Over-Temperature Thermostat—N15287AA

See Ignitron Accessories publication in front of Ignitron section for details.



K-69087-72A968

7-28-60

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

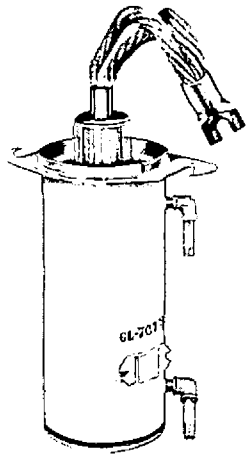
Schenectady 5, N. Y.

from JEDEC releases #3274, May 22, 1961 and #3274A, Sept. 23, 1963

GL-7673

IGNITRON
Coaxial

RECTIFIER SERVICE—190 AMPERES
AC CONTROL SERVICE—355 AMPERES



ADAPTED TO WATER-FLOW CONTROL

The GL-7673 is a sealed, stainless-steel-jacketed, water-cooled ignitron for a-c control service. In such application two tubes in inverse-parallel connection will control 2400 kilovolt-amperes at voltages of 250 to 600 over a frequency range of 25 to 60 cycles.

The 7673 features a new coaxial construction in which current flows through the tube from anode to cathode, then up the tube wall to a coaxial cathode terminal at the top. This coaxial current flow provides a magnetic shield to eliminate the arc deflection which the high peak currents of this tube might cause in standard design ignitrons.

ADAPTED TO TEMPERATURE CONTROL

A slotted mounting plate permits convenient mounting of a thermostat to provide control of the water flow or over-temperature protection.

Advantages of the control feature include reduction of condensation on the tube walls during hot weather, protection against overloads, elimination of water supply as a limiting factor in equipment location, and appreciable savings in water consumption.

Electrical

Cathode Excitation—Cyclic	
Cathode Spot Starting—Ignitor	
Number of Electrodes	
Main Anodes	1
Main Cathodes	1
Ignitors	1
Arc Drop at 13,600 Amperes Peak	36 Volts
Arc Drop at 1115 Amperes Peak	17 Volts

Mechanical

Envelope Material—Stainless Steel	
Net Weight	21 Pounds

Thermal

Type of Cooling—Water	
Inlet Water Temperature, minimum	0 C
Inlet Water Temperature, maximum	30 C
Outlet Water Temperature, maximum	40 C
Water Flow, minimum, solenoid water valve open	3.0 Gallons per Minute
Characteristics for Water Cooling at Rated Minimum Flow	
Water Temperature Rise, maximum	9 C
Pressure Drop at 3 Gallons per Minute, maximum	5.1 Pounds per Square Inch

MAXIMUM RATINGS

Power-Rectifier Service, Intermittent Duty

Ratings are for Zero-Phase-Control Angle
(See Curves K-69087-72A513 and K-69087-72A630 on Page 2 for Details)
Ratings Apply Only at Inlet Water Temperatures Up to 40 C

Maximum Peak Anode Voltage				
Inverse	600	1200	1500	Volts
Forward	600	1200	1500	Volts
Maximum Anode Current				
Peak	4000	3000	2400	Amperes
Corresponding Average	54	40	32	Amperes
Average	190	140	112	Amperes
Corresponding Peak	1140	840	672	Amperes
Maximum Averaging Time	6.23	6.25	6.25	Seconds
Ratio of Average to Peak Current, maximum Averaging Time 0.2 Second	0.166	0.166	0.166	
Ratio of Fault to Maximum Peak Current	12.5	12.5	12.5	
Maximum Duration of Fault Current	0.15	0.15	0.15	Seconds
Frequency Range	50–60	50–60	50–60	Cycles per Second

AC Control Service*

Two Tubes in Inverse Parallel, Ratings per Tube
(See Curves K-69087-72A723 and K-69087-72A724 on Page 3 for Details)

Voltage	250 to 600 Volts RMS
Maximum Demand	2400 Kilovolt-Amperes
Average Current at Maximum Demand	192 Amperes
Maximum Average Current	355 Amperes
Demand at Maximum Average Current	800 Kilovolt-Amperes
Maximum Averaging Time at 250 Volts RMS	11.0 Seconds
Maximum Averaging Time at 600 Volts RMS	4.6 Seconds
Maximum Peak Fault-Current at 250 Volts	27,000 Amperes
Maximum Peak Fault Current at 600 Volts	11,200 Amperes
Frequency Range	25–60 Cycles per Second

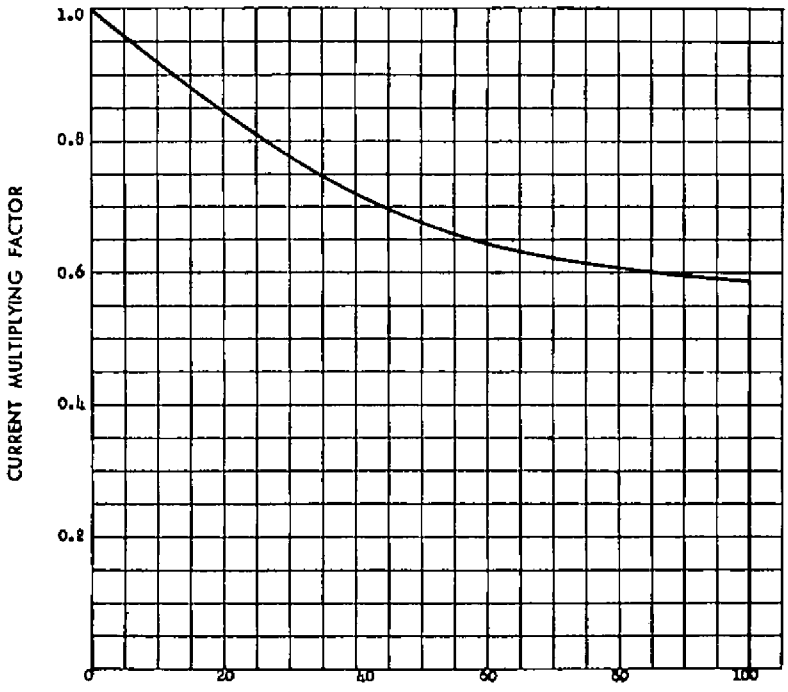
Cathode Excitation Requirements

Ignitor Voltage Required to Fire	200 Volts
Ignitor Current Required to Fire	30 Amperes
(See Cuvre K-69087-72A982 on Page 4 for Ignitor Circuit Requirements)	
Starting Time at Required Voltage or Current	100 Microseconds
Ignitor	
Maximum Voltage	
Positive—Anode Voltage	
Negative	5 Volts
Maximum Current	
Peak	100 Amperes
Root Mean Square	10 Amperes
Average	1 Ampere
Maximum Averaging Time	5 Seconds

* RMS demand voltage, current, and kilovolt-ampere demand are all on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used. For voltages below the minimum, the minimum-voltage current rating applies. With the use of log-log paper straight-line interpolation between tabulated points may be used for other detailed ratings of: Demand kva vs average anode current, and maximum averaging time vs anode voltage.

GENERAL ELECTRIC

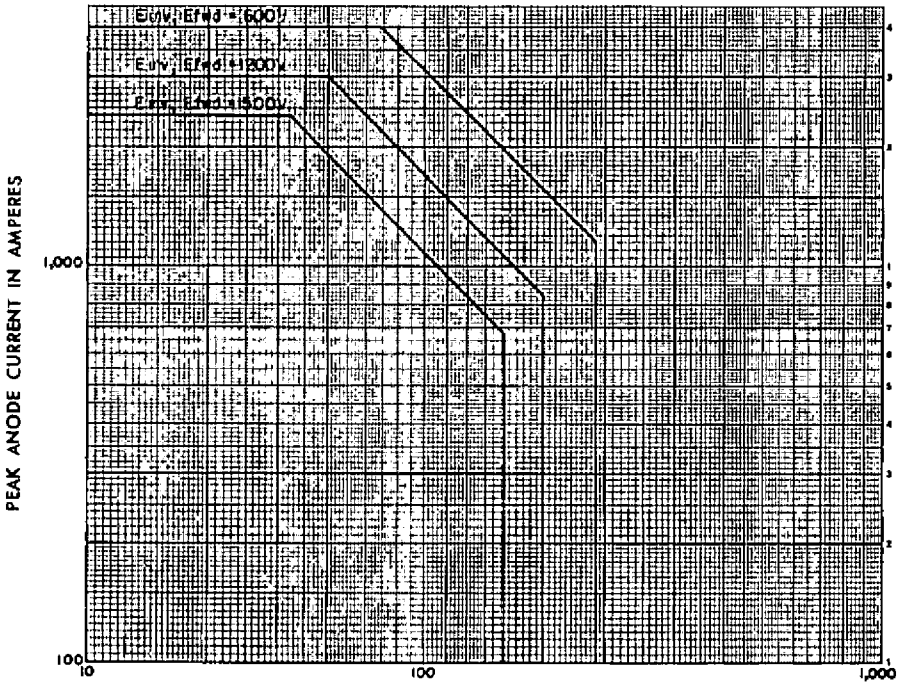
PHASE CONTROL
THREE-PHASE SINGLE-WAY
DOUBLE-WAY CIRCUITS



K-69087-72A513

8-21-53

POWER-RECTIFIER RATING—INTERMITTENT DUTY



K-69087-72A630

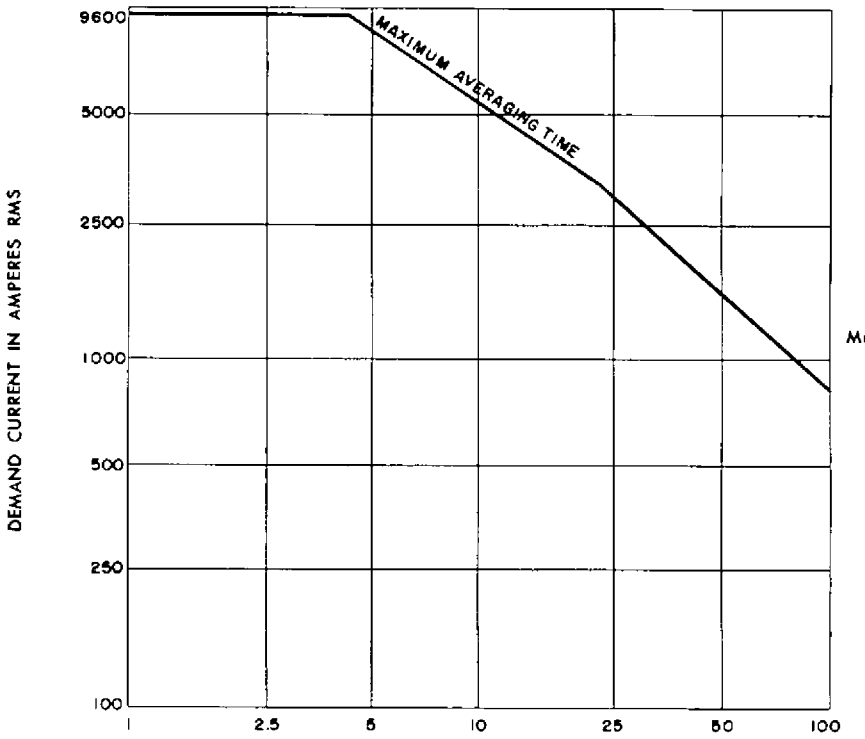
9-21-55

MAXIMUM AVERAGING TIME = 6.25 SECONDS

$\frac{I\ AVERAGE}{I\ PEAK}$ MAXIMUM AVERAGING TIME 0.2 SECONDS = 0.166 MAXIMUM

$\frac{I\ FAULT}{I\ PEAK\ MAX.}$ MAXIMUM DURATION OF FAULT CURRENT 0.15 SECONDS = 12.5 MAXIMUM

DEMAND CURRENT VS PERCENTAGE DUTY AT 220 TO 250 VOLTS RMS



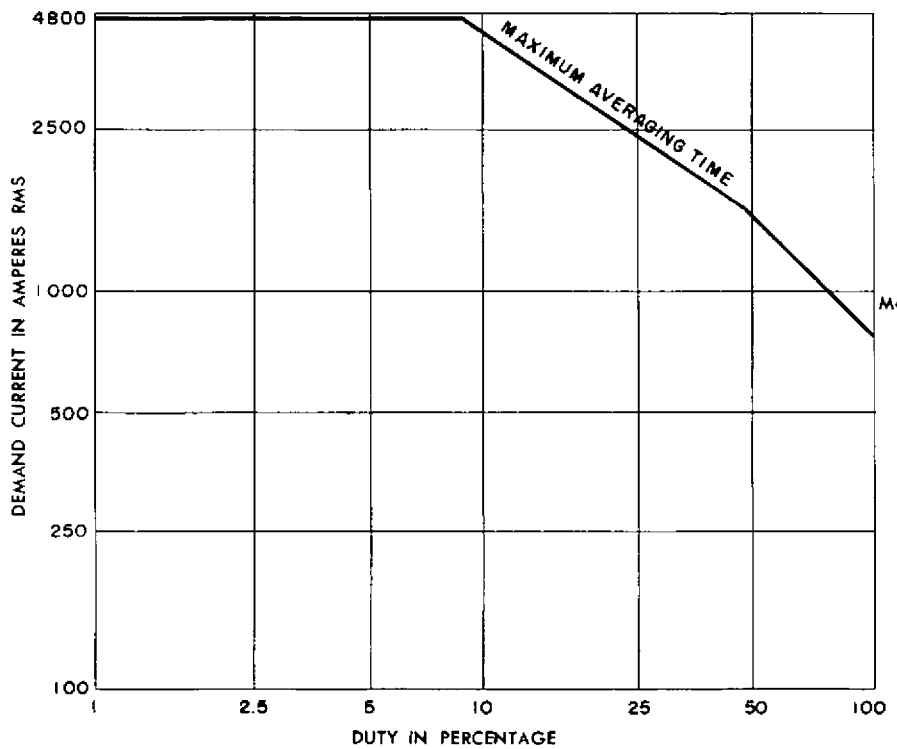
Maximum Averaging Time:

At 220 Volts = 12.5 Seconds
At 250 Volts = 11.0 Seconds

K-69087-72A723

4-61

DEMAND CURRENT VS PERCENTAGE DUTY AT 440 TO 600 VOLTS RMS



Maximum Averaging Time:

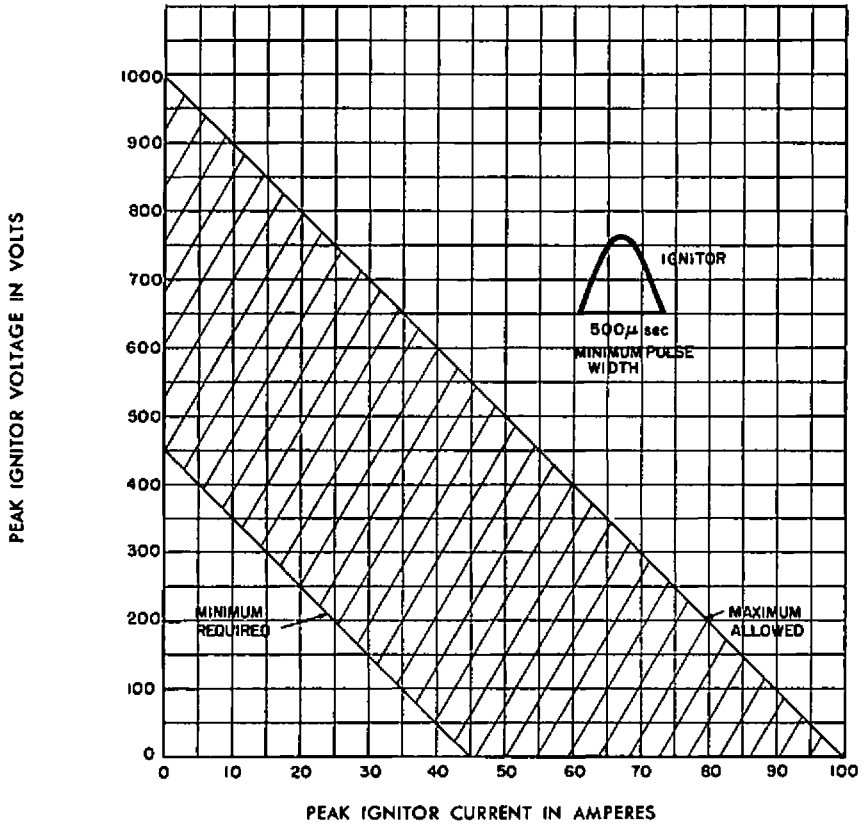
At 440 Volts = 6.4 Seconds
At 500 Volts = 5.6 Seconds
At 600 Volts = 4.6 Seconds

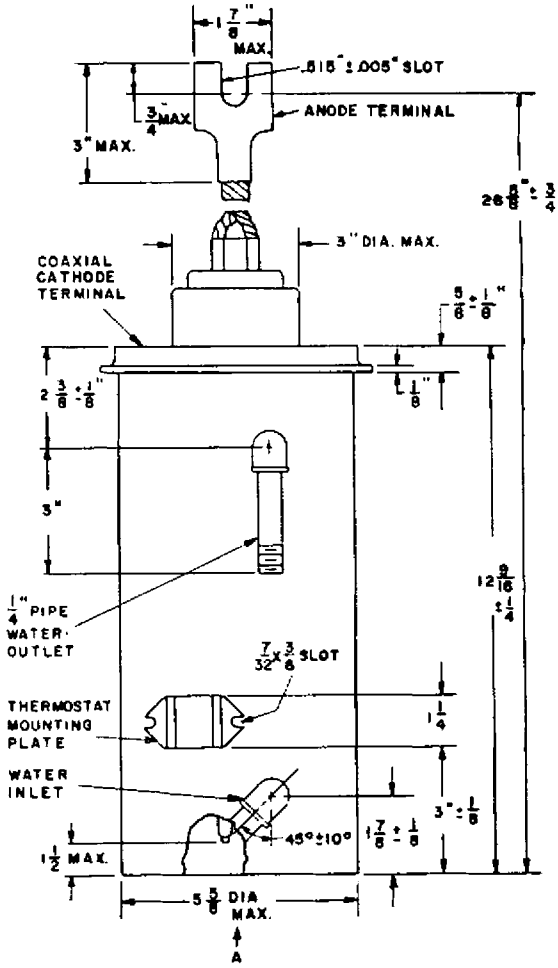
K-69087-72A724

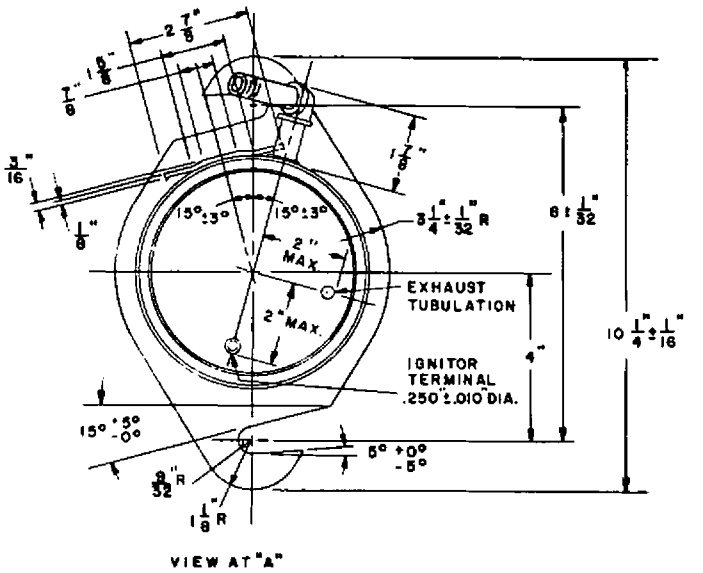
4-61

IGNITOR VOLT-AMPERE REQUIREMENTS FOR SEPARATE EXCITATION SEALED-IGNITRON RECTIFIERS

THE IGNITOR FIRING CIRCUIT SHOULD BE DESIGNED TO OPERATE WITHIN THE SHADED AREA







VIEW AT "A"

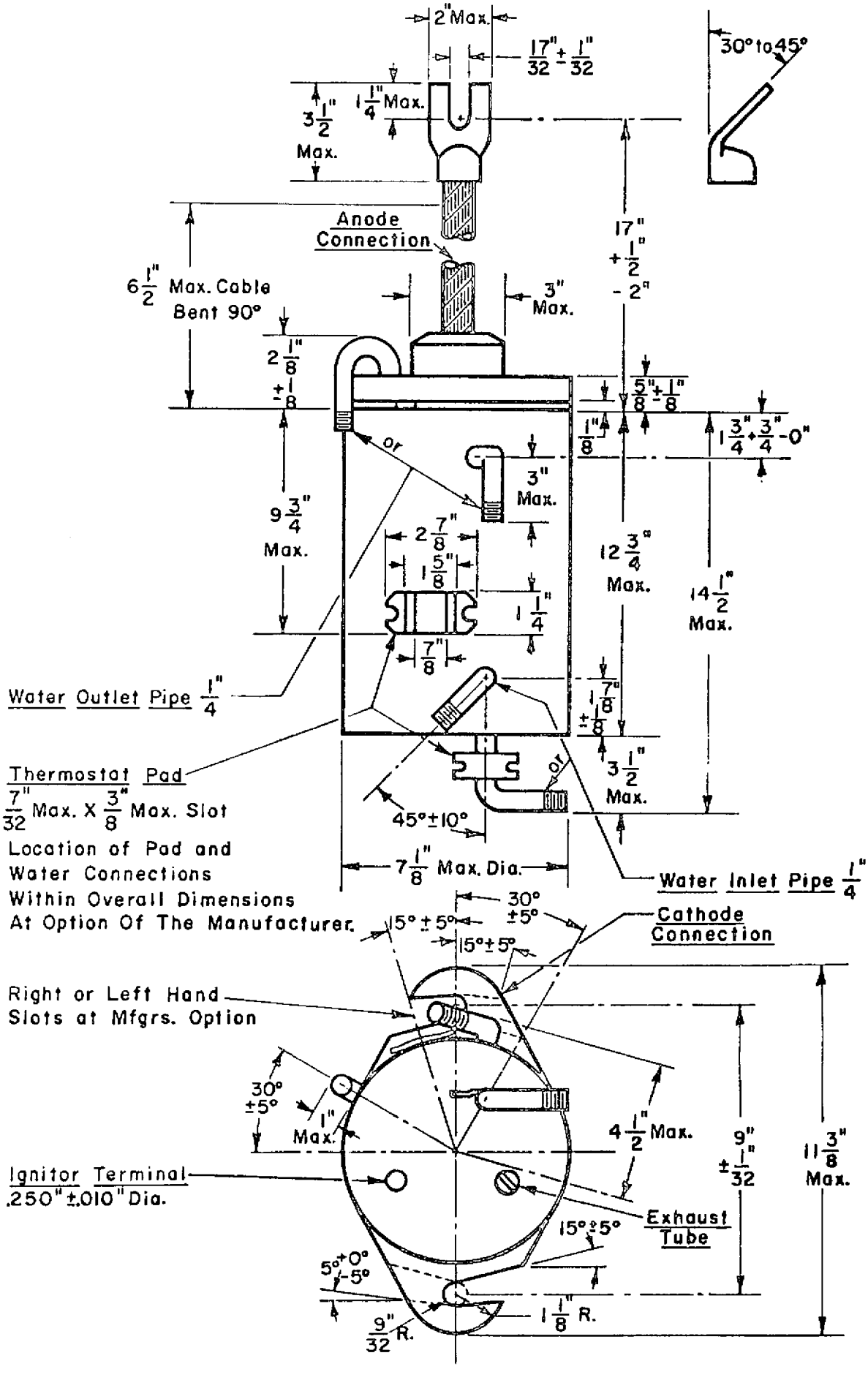
Control thermostats, with mounting brackets, are available through regular tube supply channels under the following catalog numbers:

AC Control Service
- Flying-Lead Type
  - Water-Control Thermostat—N15272AA
  - Over-Temperature Thermostat—N15273AA
- Terminal-Block Type
  - Water-Control Thermostat—N15286AA
  - Over-Temperature Thermostat—N15287AA

See Ignitron Accessories publication in front of Ignitron section for details.

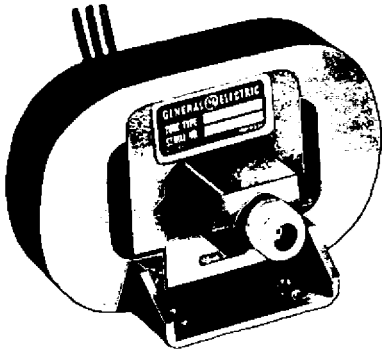
7673

from JEDEC release #3274A,
Sept. 23, 1963



GL-7680

PACKAGED VOLTAGE-TUNABLE MAGNETRON



1000–2300 MEGACYCLES **1 WATT CW OUTPUT**

The GL-7680 is a packaged voltage-tunable magnetron for voltage-tunable operation in the 1000-to-2300-megacycle frequency range. It is a complete r-f power source package requiring only input power connections and an r-f power output connection and has a minimum CW power output of one watt across the entire frequency range. The tube may be voltage-tuned over a portion or all of the frequency range for which it is designed or operated at a fixed frequency. The voltage-frequency relationship is essentially linear.

Electrical

	Minimum	Bogey	Maximum	
Cathode—Directly Heated				
Filament Voltage*	2.3	2.6	2.8	Volts
Filament Current	—	3.0	—	Amperes

Mechanical

Mounting Position—Any		
Net Weight	3.5	Pounds

Thermal

Type of Cooling—Forced Air		
Air Flow	5	Cubic Feet Per Minute
Ambient Air Temperature, Maximum	50	C

MAXIMUM RATINGS—ABSOLUTE VALUES

Anode Voltage	2000	Volts	
Anode Current	20	Milliamperes	
Power Input, with forced-air cooling	45	Watts	
Injection Electrode Voltage	500	Volts	
Injection Electrode Current	1.0	Milliamperes	
Filament Current	3.2	Amperes	
Voltage Standing Wave Ratio	1.5		

TYPICAL OPERATION

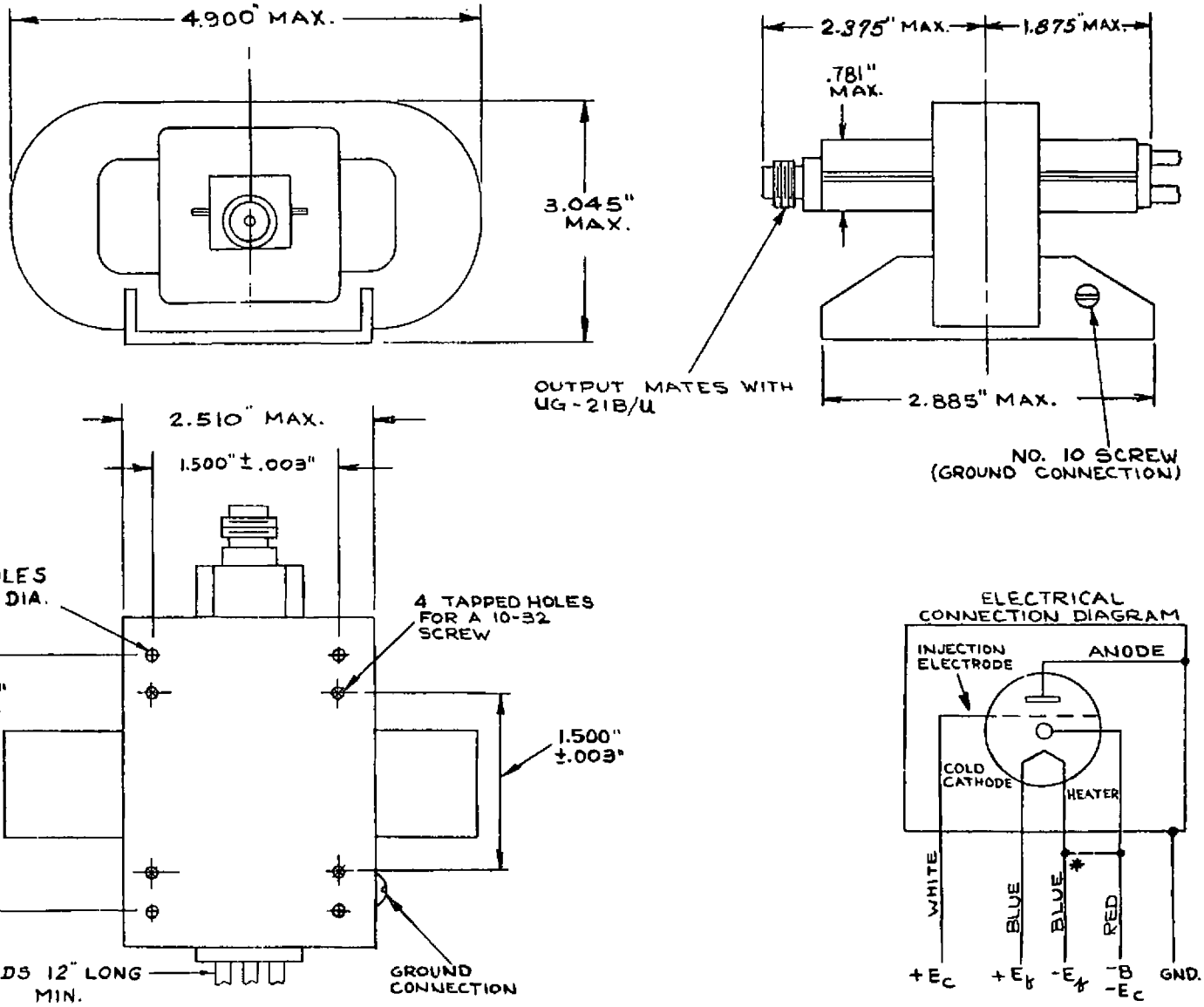
Operation with 60-cycle Sweep Voltage in Wide-Band Circuit		
Filament Voltage*, approximate	2.60	Volts
Filament Current	3.0	Amperes
Tunable Range†	1000-2300	Megacycles
Tuning Sensitivity, approximate	1.2	Megacycles per Volt
Anode Voltage at 1.6 Kilomegacycles	1400	Volts
Anode Current, average	5 to 15	Milliamperes
Injection Electrode Voltage, positive with respect to cathode	200 to 400	Volts
Injection Electrode Current	0.1	Milliamperes
Voltage Standing Wave Ratio of Load	1.3	
Power Output, minimum	1.0	Watts
Variation over Band	Less than 4:1	

* Filament current should be adjusted to 3.0 amperes.
† Frequency controlled by anode voltage.

CAUTION: A clearance of nine inches between ferromagnetic materials and the tube will prevent any serious change of the operating characteristics.

GENERAL ELECTRIC

from JEDEC release #4054, Dec. 31, 1962



K69087-72A903

12-62

*Note: An external connection is required between the cold cathode lead and one of the heater leads.

GENERAL ELECTRIC
POWER TUBE DEPARTMENT
Schenectady 5, N. Y.

from JEDEC release #2949, Sept. 5, 1960

GL-7681
IGNITRON

FREQUENCY-CHANGER WELDER SERVICE

The GL-7681 is a sealed, stainless-steel-jacketed, water-cooled, mercury-pool tube for use in electronic-contactor and resistance-welding-control service, both single-phase and three-phase.

In AC-control service two tubes in an inverse-parallel connection will control 1800 kilovoltamperes at 440 to 600 volts RMS, 25 to 60 cycles. Six tubes will control 2250 amperes peak at 1200 volts inverse in frequency-changer welder service.

AC-CONTROL SERVICE

A thermostat mounting plate, thermally coupled to the mercury-condensing surface of the tube, provides protection against excessive temperature or temperature control through regulation of the water flow.

Electrical

Electrodes		
Anodes	1	
Cathodes	1	
Ignitors	1	
Deionization Baffles	1	
Arc Drop		
At 5000 Amperes Peak	30	Volts
At 500 Amperes Peak	16	Volts

Mechanical

Water Jackets—Stainless Steel		
Mounting—Vertical, Cathode Terminal Down		
Net Weight, approximate	15	Pounds

Thermal

Cooling—Liquid. If other than water is used, correct for conductivity, specific heat and viscosity.		
Inlet Water Temperature, minimum	6	C
Outlet Water Temperature, maximum	45	C
Water Flow, minimum		
At Continuous Rated Average Current	2.0	Gallons per Minute
At No Load	0	
Note: Flow at intermediate loads may be decreased to an amount proportional to load. Water flow should be continued for 30 minutes after load.		
Characteristics for Water Cooling at Rated Minimum Flow		
Water Temperature Rise at Maximum Current.	9	C
Water Pressure Drop at 2.0 Gallons per Minute, Maximum	5	pounds per square inch

MAXIMUM RATINGS AND TYPICAL OPERATION

AC-Control Service*

(Two Tubes in Inverse Parallel, Ratings per Tube)

Voltage	500–600	Volts RMS
Maximum Demand	1800†	Kilovoltamperes
Average Current at Maximum Demand	113.5	Amperes
Maximum Average Current	210	Amperes
Demand at Maximum Average Current	600	Kilovoltamperes
Maximum Averaging Time		
At 250 Volts RMS	9.5	Seconds
At 500 Volts RMS	7.1	Seconds
Maximum Peak Fault Current		
At 250 Volts	20,040	Amperes
At 600 Volts	8400	Amperes
Frequency Range	25–60	Cycles per second

Frequency-Changer-Welder Service

(Ratings are for zero phase-control angle.)

Maximum Peak Anode Voltage			
Inverse and Forward	1200	1500	Volts
Maximum Anode Current			
Peak	2250	1800	Amperes
Corresponding Average	30	24	Amperes
Average	105	84	Amperes
Corresponding Peak	630	502	Amperes
Maximum Averaging Time	6.25	6.25	Seconds
Ratio of Average to Peak Current	0.166	0.166	
Maximum Averaging Time	0.2	0.2	Seconds
Ratio of Fault to Maximum Peak Current	12.5	12.5	
Maximum Duration of Fault Current	0.15	0.15	Seconds
Frequency Range	50–60	50–60	Cycles per second

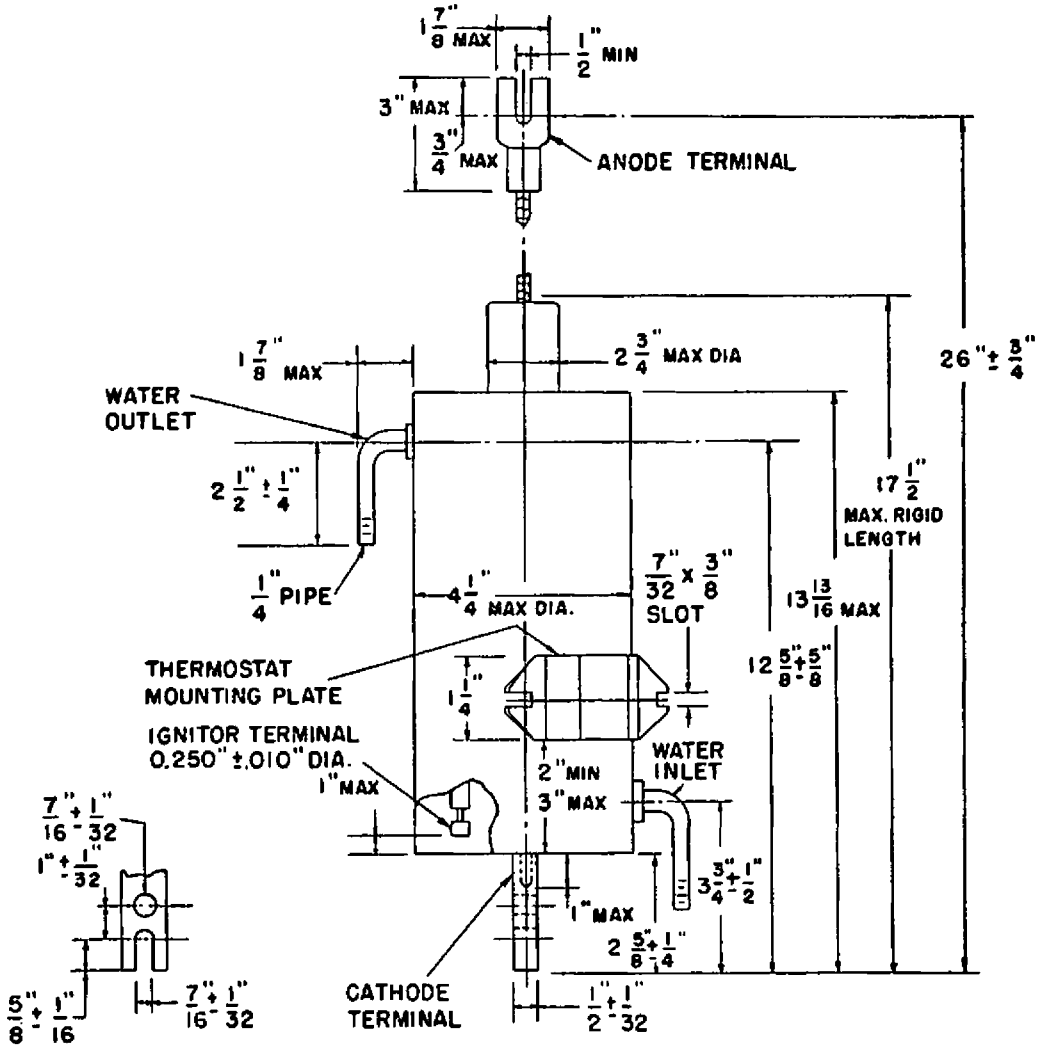
Cathode Excitation Requirements

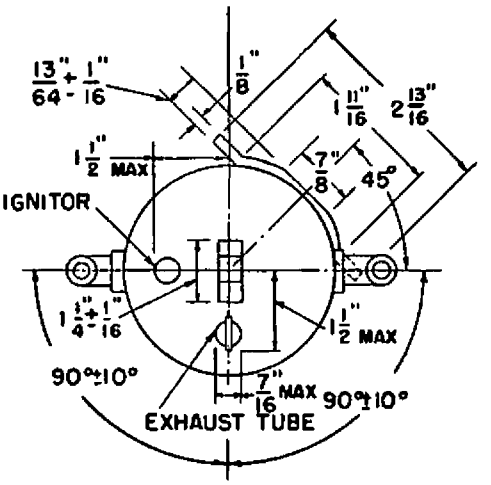
Ignitor Voltage Required to Fire	200	Volts
Ignitor Current Required to Fire	30	Amperes
Starting Time at Required Voltage or Current	100	Microseconds
Ignitor		
Maximum Voltage		
Positive—Anode Voltage		
Negative	5	Volts
Maximum Current		
Peak	100	Amperes
RMS	10	Amperes
Average	1	Ampere
Maximum Averaging Time	5	Seconds

* RMS demand voltage, current, and kilovolt-ampere demand are all on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used. Straight-line interpolation on log-log paper is allowed between corresponding points.

† Maximum demand current for 250 volts RMS is 4800 amperes. For voltages between 250 and 500 use proportional values between 4800 and 3600 amperes.

GENERAL ELECTRIC





NOTE: ENVELOPE IS AT CATHODE POTENTIAL

K-69087-72A969

7-60

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

BEAM PENTODE

FOR RF CLASS C APPLICATIONS

DESCRIPTION AND RATING

The 7701 is a miniature beam-power pentode suitable for Class C radio-frequency power-amplifier and frequency-multiplier service.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	13.6*	Volts
Heater Current	0.16	Amperes

Direct Interelectrode Capacitances†

Grid-Number 1 to Plate: (g1 to P)	0.15	μμf
Input: g1 to (H+K+g2+BP)	7.0	μμf
Output: P to (H+K+g2+BP)	3.6	μμf

MECHANICAL

Mounting Position—Any

Envelope—T-6½, Glass

Base—E9-1, Small Button 9-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Class C Radio-Frequency Amplifier Service up to 175 Megacycles

Plate Voltage	350	Volts
Screen Voltage	300	Volts
Negative DC Grid-Number 1 Voltage	150	Volts
Plate Dissipation	9	Watts
Screen Dissipation	3.5	Watts
DC Plate Current	45	Milliamperes
DC Screen Current	17	Milliamperes
DC Grid-Number 1 Current	3.3	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	100	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

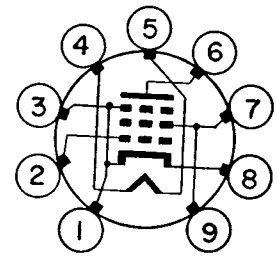
The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other tubes in the equipment, equipment control adjustment, load variation, signal variation, and environmental conditions.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

GENERAL ELECTRIC

Supersedes ET-T1608 dated 4-60

BASING DIAGRAM

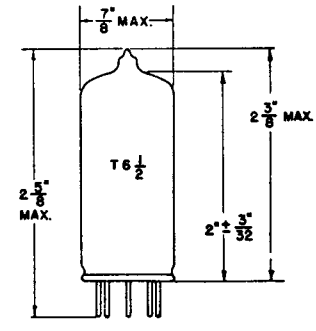


EIA 9MS

TERMINAL CONNECTIONS

Pin 1—Cathode and Beam Plates
Pin 2—Grid Number 1
Pin 3—Cathode and Beam Plates
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate
Pin 7—Grid Number 2 (Screen)
Pin 8—Cathode and Beam Plates
Pin 9—Grid Number 2 (Screen)

PHYSICAL DIMENSIONS



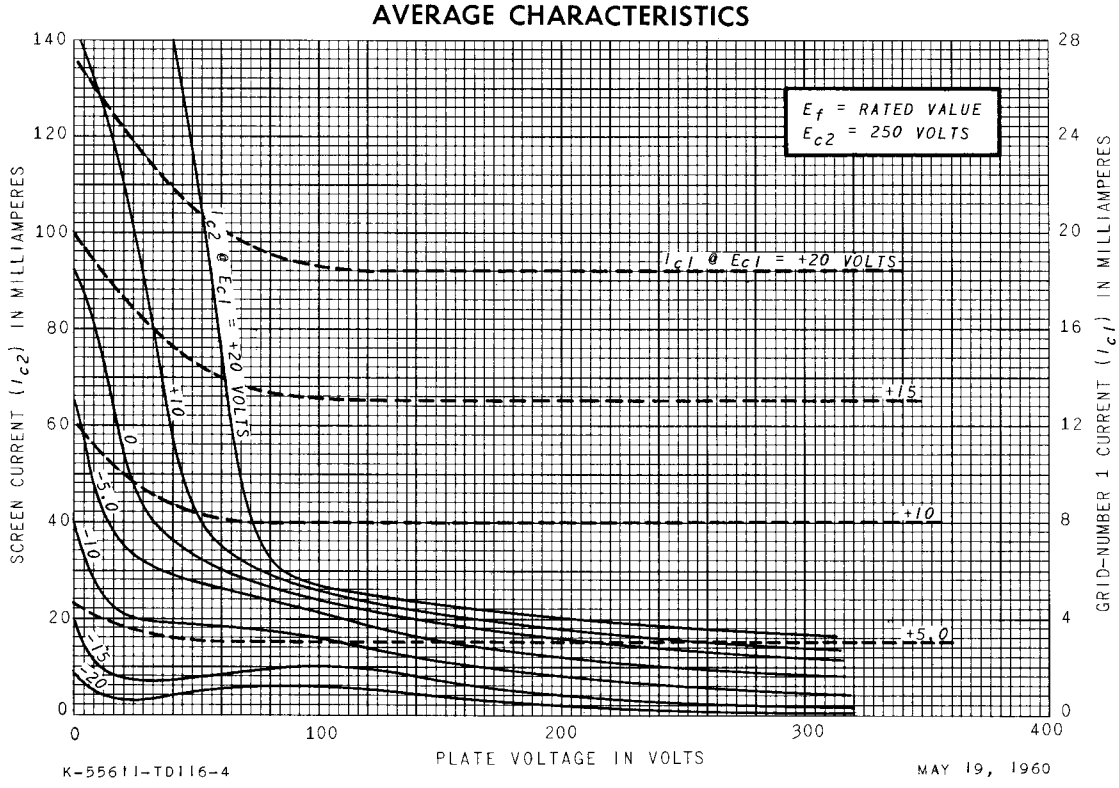
EIA 6-2

CHARACTERISTICS AND TYPICAL OPERATION

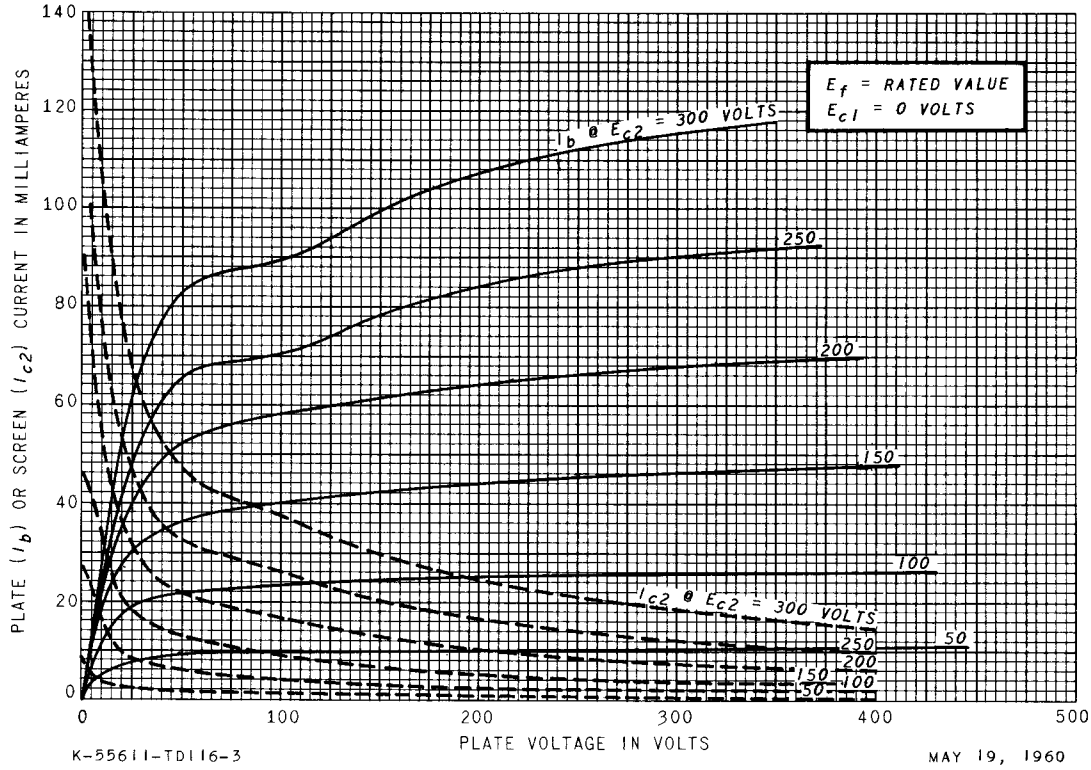
AVERAGE CHARACTERISTICS

Plate Voltage	250	Volts
Screen Voltage	250	Volts
Grid-Number 1 Voltage	−12.5	Volts
Plate Resistance, approximate	31000	Ohms
Transconductance	3600	Micromhos
Plate Current	28	Milliamperes
Screen Current	3.1	Milliamperes

* The allowable limits of heater voltage for satisfactory operation are 12 volts minimum and 15 volts maximum.
† Without external shield.



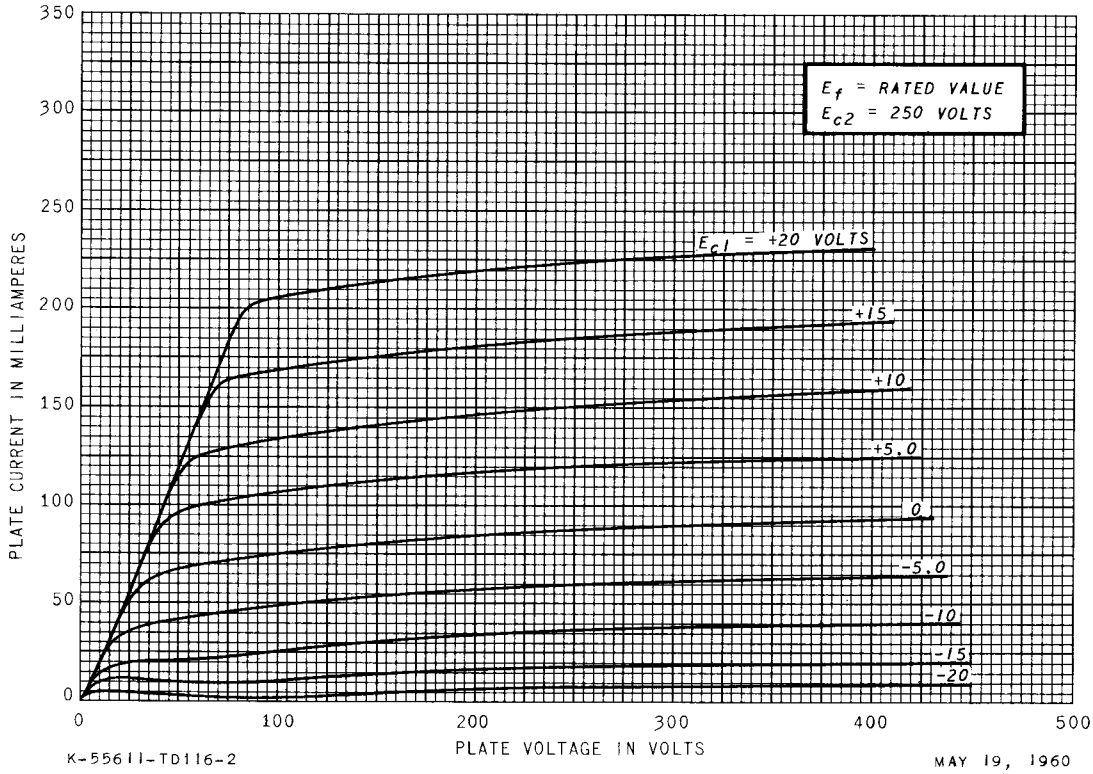
AVERAGE PLATE CHARACTERISTICS



K-55611-TD116-3

MAY 19, 1960

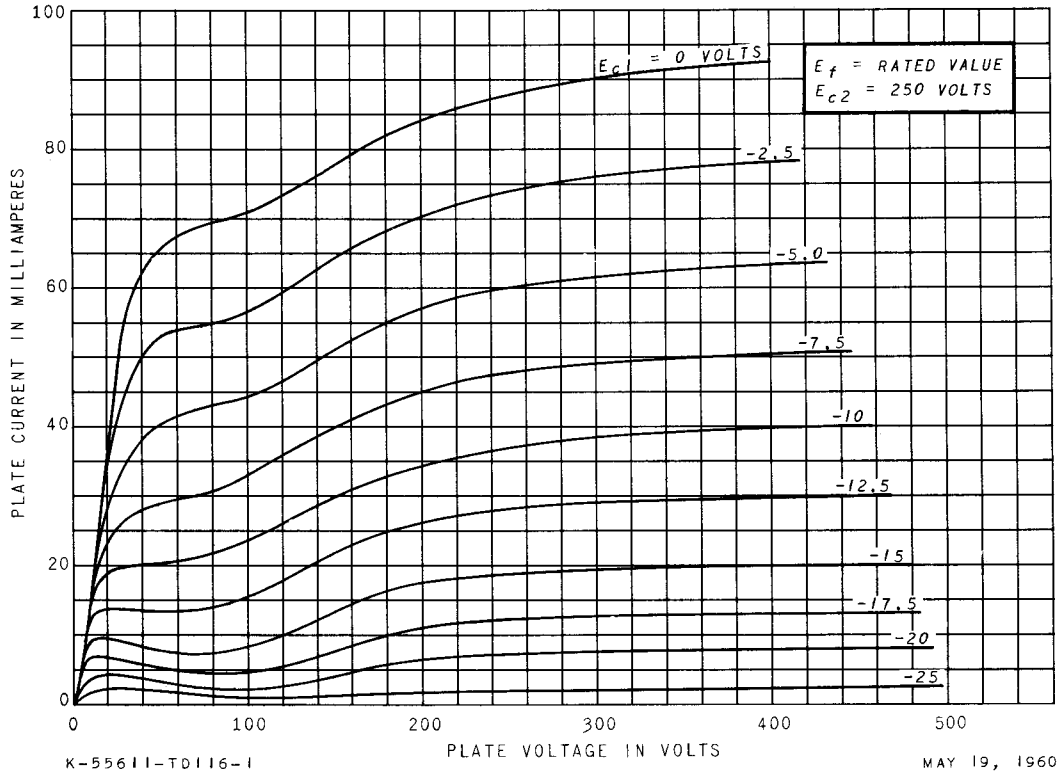
AVERAGE PLATE CHARACTERISTICS



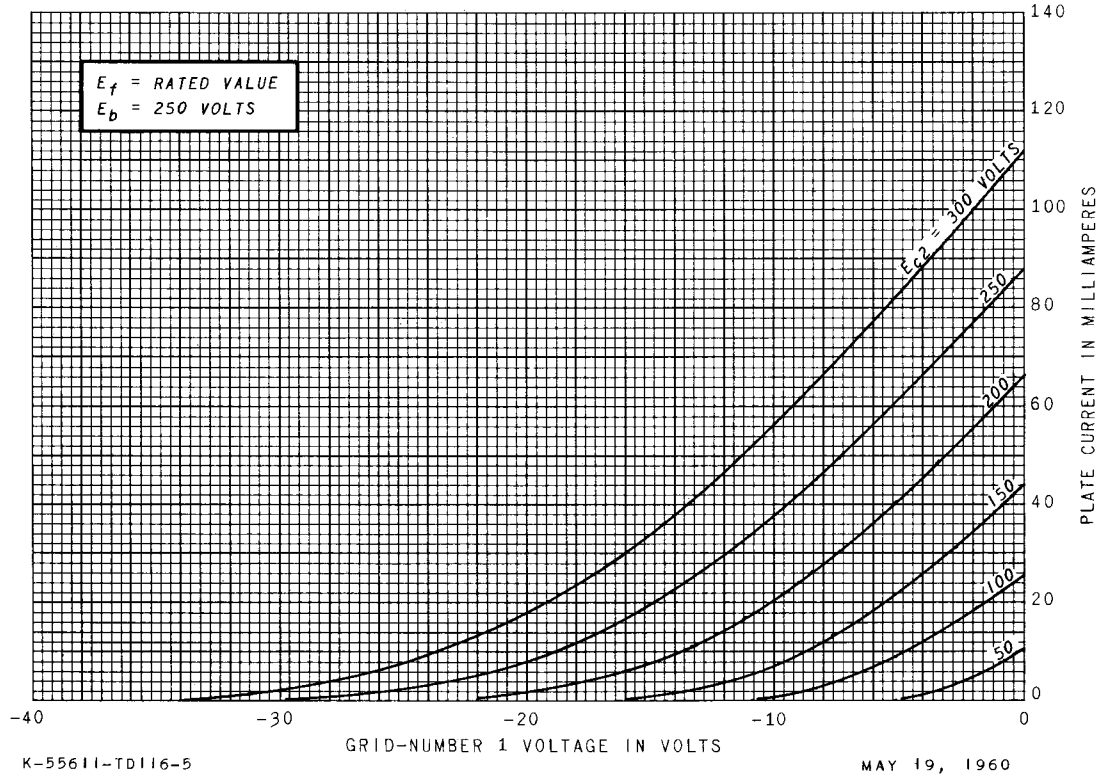
K-55611-TD116-2

MAY 19, 1960

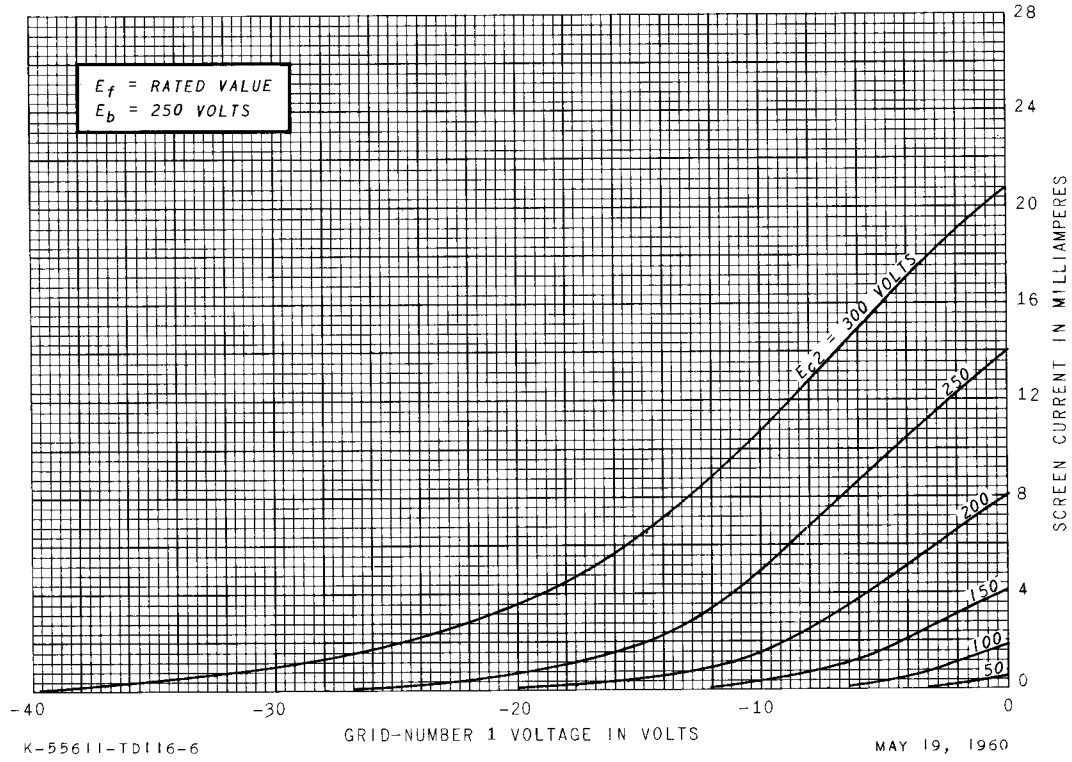
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



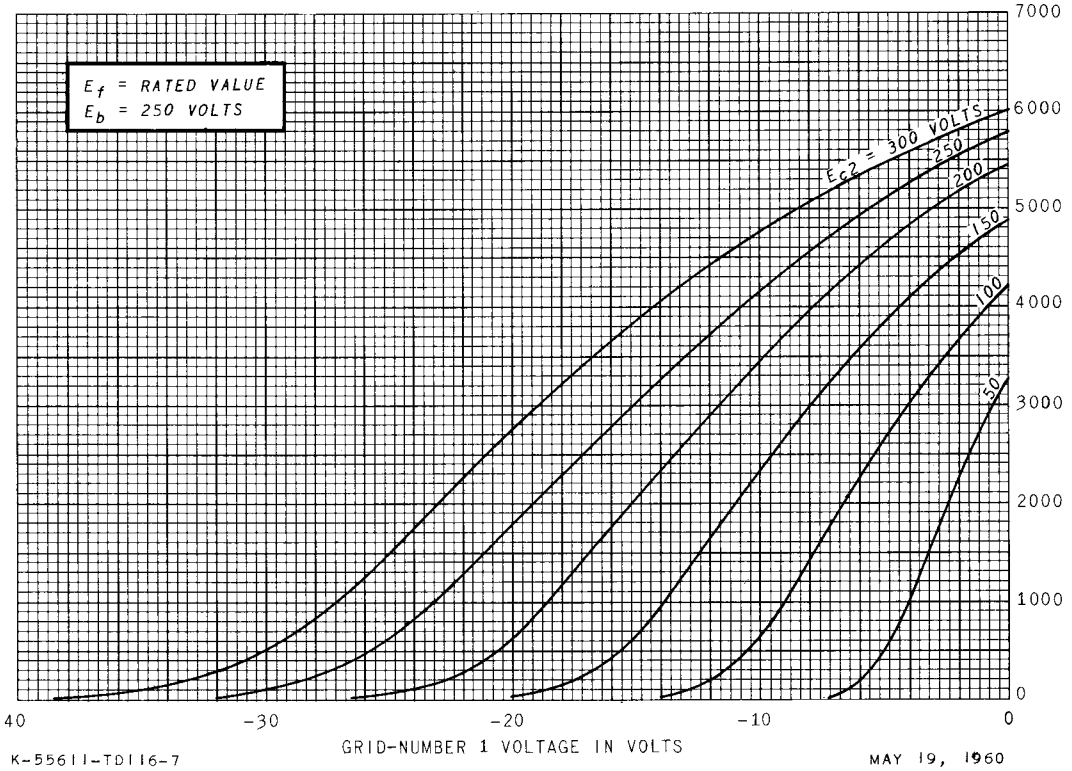
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD1116-6

MAY 19, 1960

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD1116-7

MAY 19, 1960

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

GL-7703
IGNITRON

CAPACITOR-DISCHARGE SERVICE — 20,000 VOLTS PEAK
DC SHORT-CIRCUITING-SWITCH SERVICE — 100,000 AMPERES PEAK

The GL-7703 is a sealed, stainless-steel-jacketed ignitron for use as a switch in capacitor-discharge circuits operating up to 20,000 volts. In this service the tube will carry peak currents up to 100,000 amperes. The anode seal is enclosed in an insulating compound to prevent external voltage flashover.

Electrical
- Cathode Excitation - Cyclic
- Cathode Spot Starting - Ignitor
- Number of Electrodes
  - Main Anodes..... 1
  - Main Cathodes..... 1
  - Ignitors..... 1

Mechanical
- Envelope - Stainless Steel
- Mounting Position - Axis Vertical, Anode Terminal Up
- Net Weight..... 2 Pounds

Thermal
- Type of Cooling - Air or Liquid, by clamp around lower portion of tube
- Clamp Temperature..... 10 to 30 C
- Cathode Temperature, maximum..... 35 C
- Anode Insulating-Compound Temperature*, maximum.... 70 C

MAXIMUM RATINGS

Capacitor-Discharge Service, Intermittent Pulse Duty, Sinusoidal Current †
- Peak Anode Voltage ‡
  - Forward..... 20,000 Volts
  - Inverse..... 20,000 Volts
- Critical Anode Starting Voltage, minimum..... 100 Volts
- Anode Current ¶
  - Peak, for 1/2 cycle of 120 microseconds..... 60,000 Amperes
  - Peak, for 1/2 cycle of 20 microseconds..... 100,000 Amperes
- Maximum Discharge Rate..... 2 Per Minute
- Rate of Rise of Current§, tube inductance 0.04 microhenrys, approx.
- Ionization Time..... 0.5 Microseconds

GENERAL ELECTRIC COMPANY
Power Tube Department
Schenectady 5, New York

from JEDEC release #2883, July 18, 1960

DC Short-Circuiting-Switch Service

Peak Anode Voltage ‡	
Forward	20,000 Volts
Inverse	20,000 Volts
Critical Anode Starting Voltage, minimum	100 Volts
Anode Current	
Peak	35,000 Amperes
Average	0.25 Amperes
Maximum Averaging Time	1 Cycle
Rate of Rise of Current §, tube inductance 0.04 microhenrys, approx.	
Ionization Time	0.5 Microseconds

Ignitor Ratings	Minimum	Maximum	
Separate Excitation			
Ignitor Voltage			
Forward Open Circuit	1500	3000	Volts
Inverse, maximum	—	5	Volts
Ignitor Short-Circuit Current	200	250	Amperes
Length of Firing Pulse, sine wave	5	10	Microseconds
Anode Firing			
Ignitor Voltage			
Forward, maximum	—	3000	Volts
Inverse, maximum	—	5	Volts
Peak Ignitor Current	200	250	Amperes

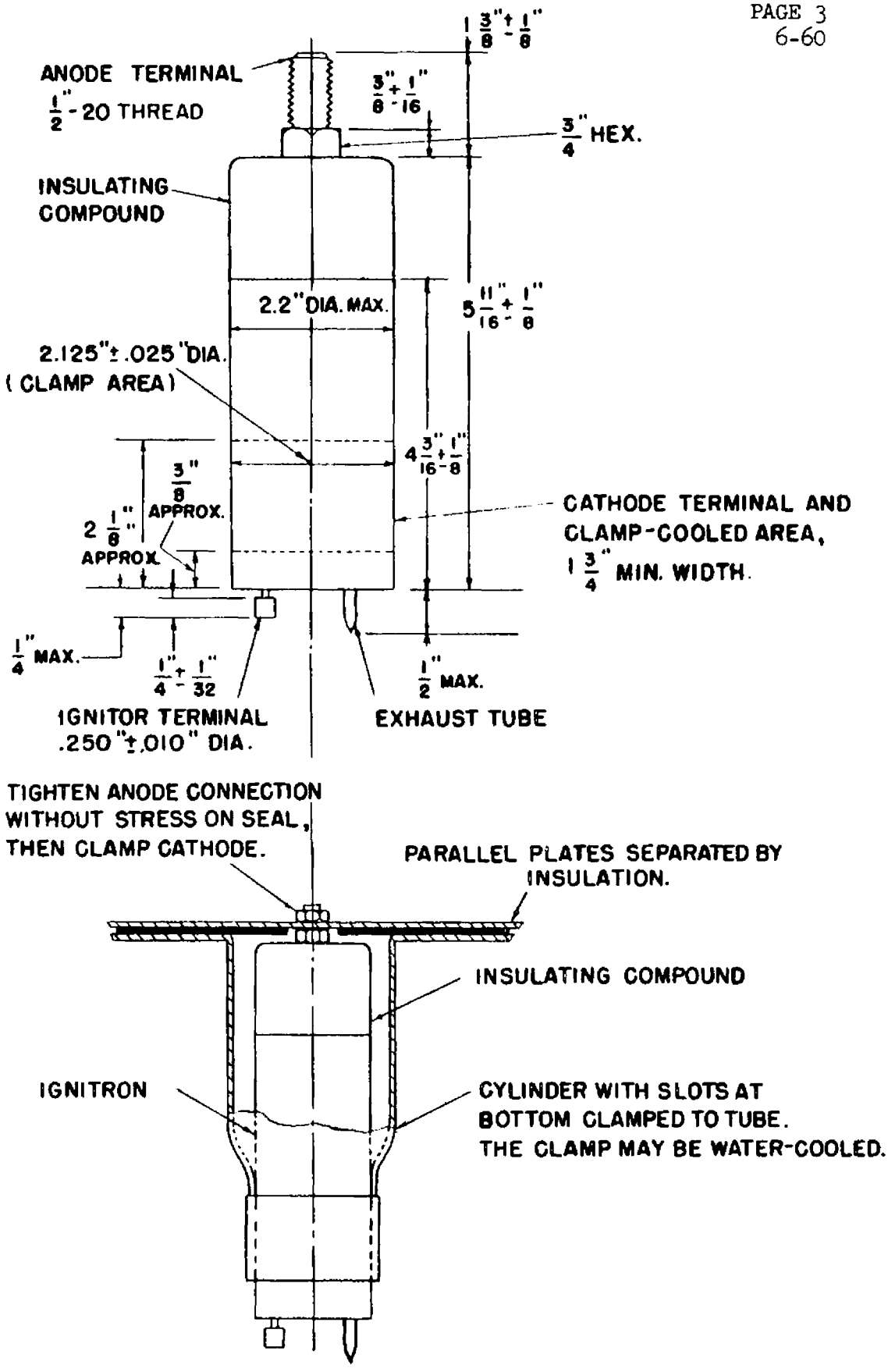
*Anode-seal, insulating-compound temperature must always be higher than the cathode temperature to prevent mercury condensation on the anode and anode seal. Before tube operation, the anode seals must be heated long enough to vaporize all mercury from the seal area.

†The tube may become a closed switch (does not open) carrying current in both directions until the current dampens out.

‡The tube cannot hold off this voltage immediately after conduction. A 1-to-10-second delay may be required before reapplication of voltage.

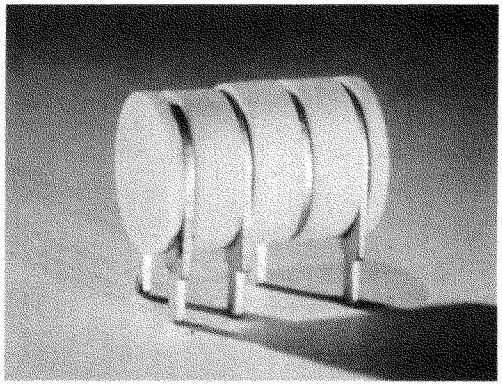
¶Dampened oscillations are permissible provided the oscillating cycles do not exceed 20. The peak current value for one-half cycle must not be exceeded.

§Rate of rise depends on circuit.



CO-AXIAL TUBE MOUNT

METAL-CERAMIC TRIODE



DESCRIPTION AND RATING

The 7720 is a high-mu triode of ceramic-and-metal planar construction primarily intended for use as an oscillator in the ultra-high-frequency range.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.3	Volts
Heater Current†	0.24	Amperes
Direct Interelectrode Capacitances§		
Grid to Plate: (g to p)	1.3	pf
Input: g to (h+k)	1.8	pf
Output: p to (h+k)	0.032	pf
Heater to Cathode: (h to k)	1.5	pf

MECHANICAL

Mounting Position—Any
See outline drawing on page 2 for dimensions and electrical connections.

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES

Plate Voltage	250	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Peak Negative Grid Voltage	50	Volts
Plate Dissipation	1.0	Watt
DC Grid Current	2.2	Milliamperes
DC Cathode Current	11	Milliamperes
Peak Cathode Current	40	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid-Circuit Resistance	10,000	Ohms
Bulb Temperature at Hottest Point**	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

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CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	100	150	Volts
Grid Voltage	0	—	Volts
Cathode-Bias Resistor	—	82	Ohms
Amplification Factor	—	90	
Transconductance	11,500	10,500	Micromhos
Plate Current	9.0	7.5	Milliamperes

UHF OSCILLATOR SERVICE

Plate Voltage	150	Volts
Grid Resistor	7000	Ohms
Plate Current	4.0	Milliamperes
Frequency	450	Megacycles
Grid Current	0.5	Milliamperes
Power Output, approximate	100	Milliwatts

FOOTNOTES

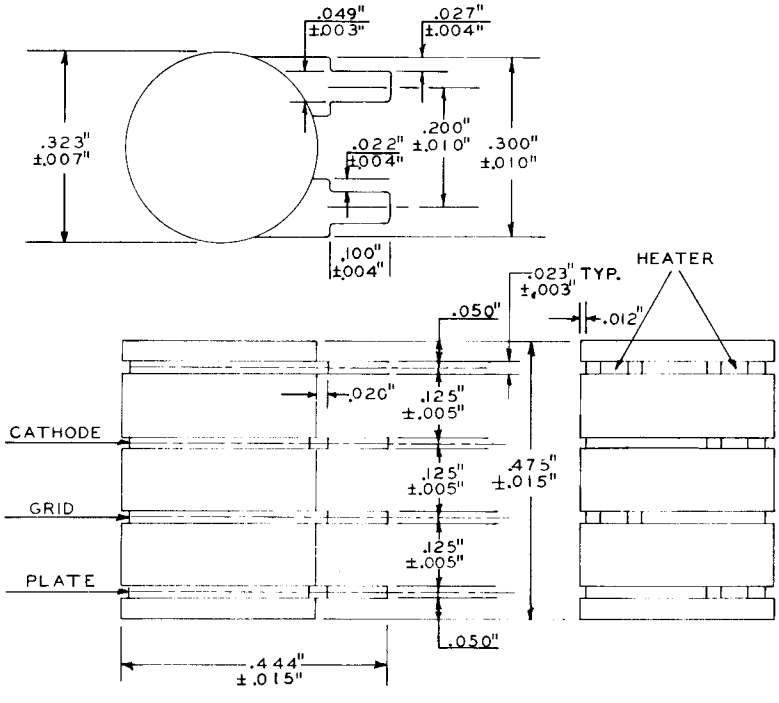
* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

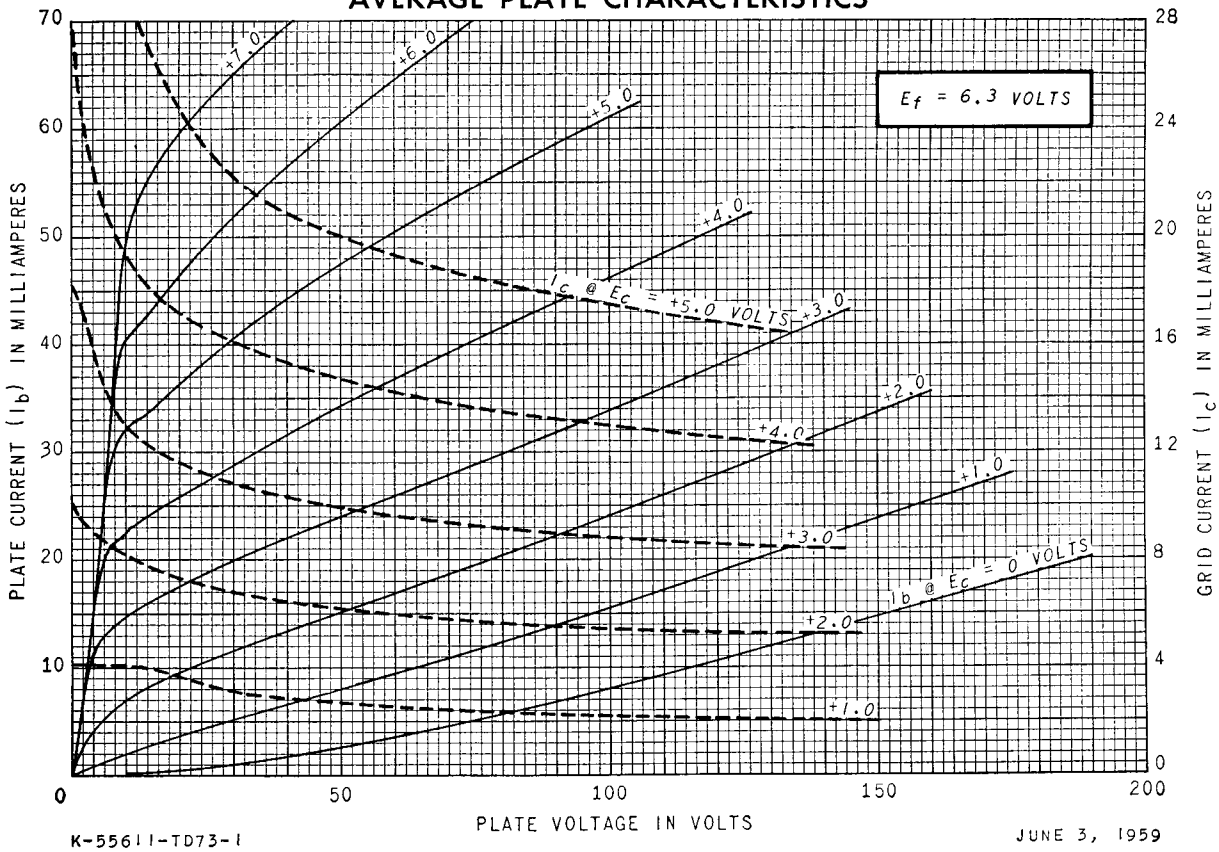
**For applications where long life is a primary consideration, it is recommended that the envelope temperature be maintained below 175 C.

OUTLINE DRAWING



NOTE: Maximum eccentricity of insulators 0.010 in. from center line.

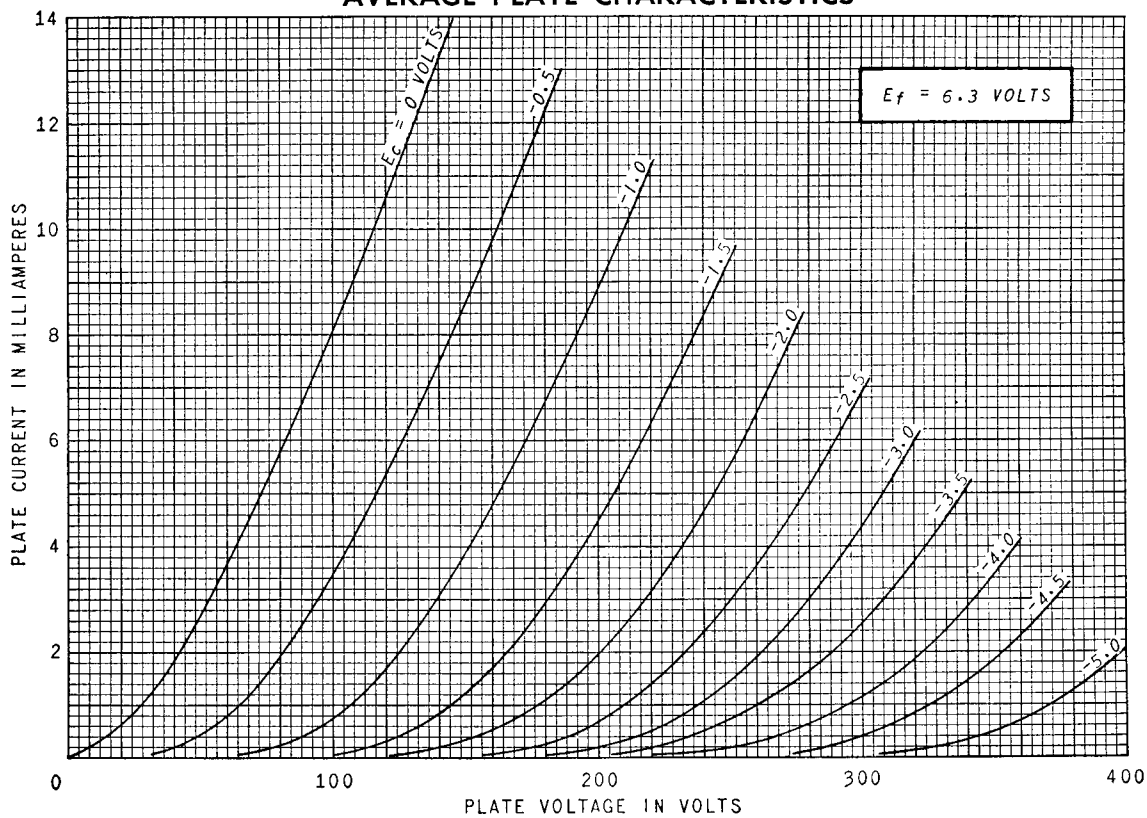
AVERAGE PLATE CHARACTERISTICS



K-55611-TD73-1

JUNE 3, 1959

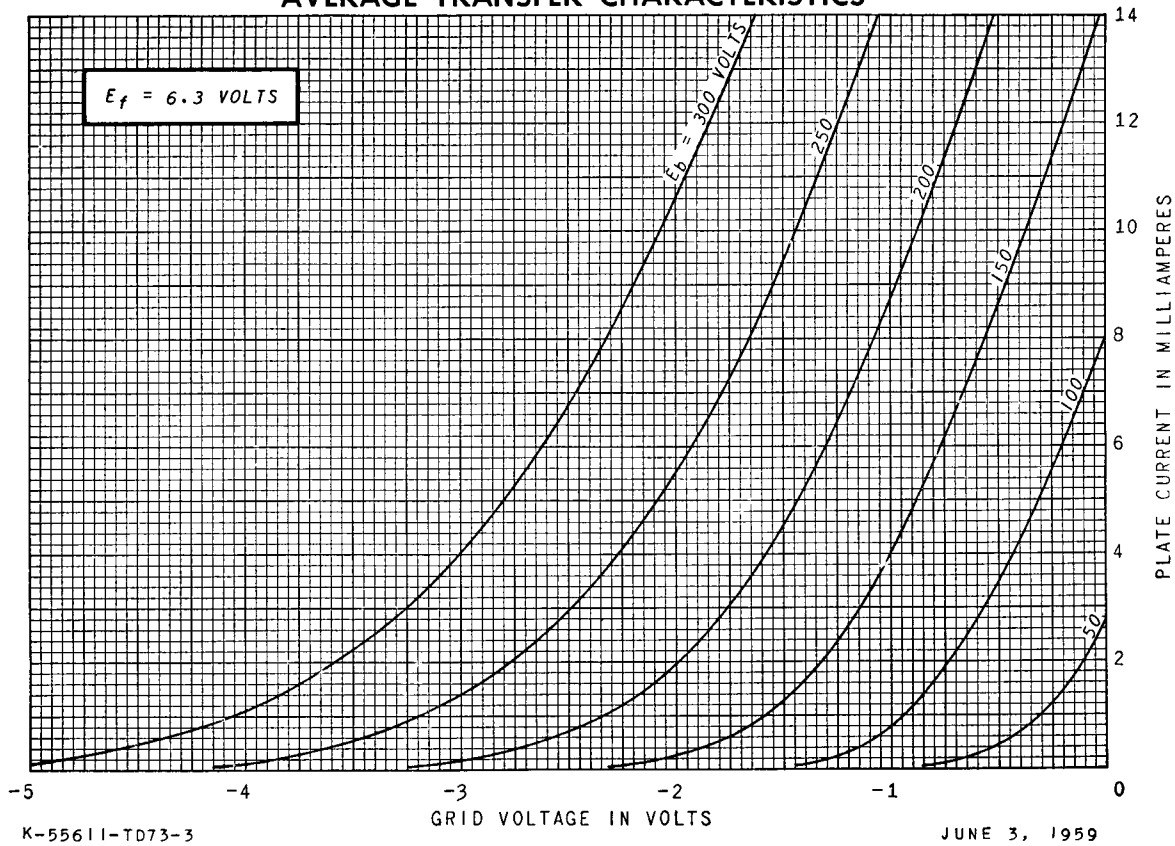
AVERAGE PLATE CHARACTERISTICS



K-55611-TD73-2

JUNE 3, 1959

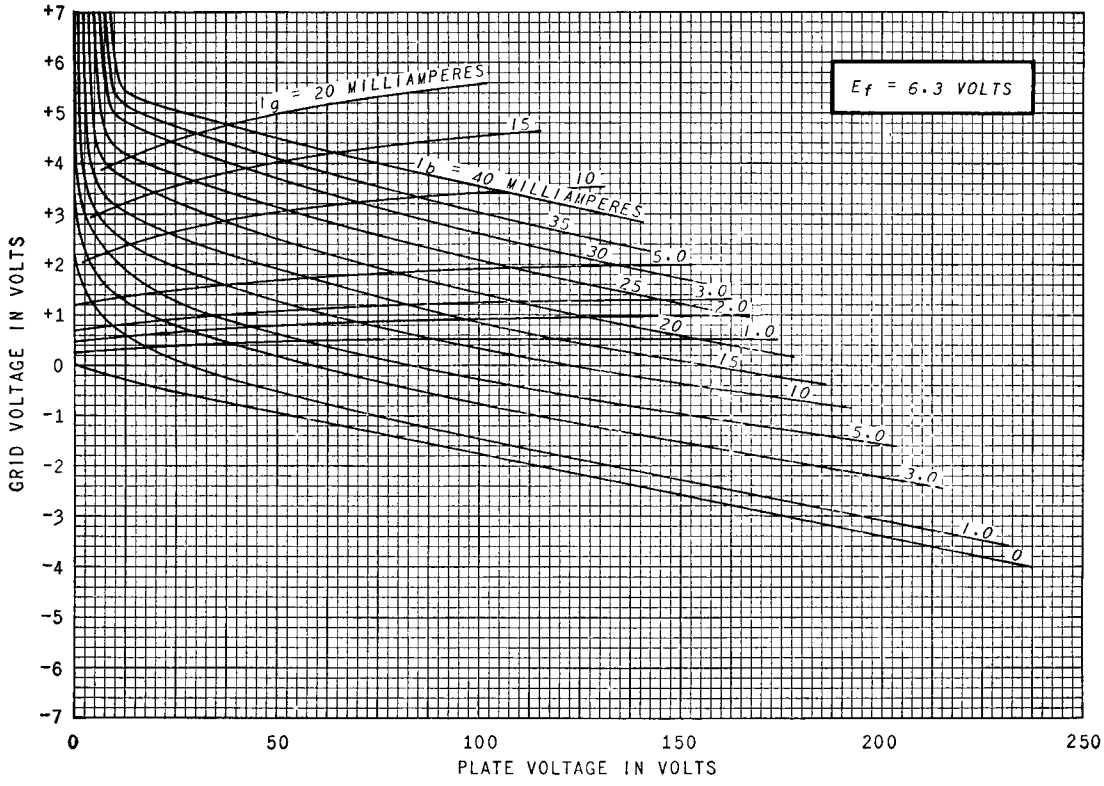
AVERAGE TRANSFER CHARACTERISTICS



K-5561I-TD73-3

JUNE 3, 1959

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



K-5561I-TD73-4

RECEIVING TUBE DEPARTMENT

JUNE 3, 1959

GENERAL ELECTRIC

Owensboro, Kentucky

from JEDEC release #2935, Aug. 22, 1960

GL-7736
IGNITRON

RECTIFIER SERVICE - 400 AMPERES
AC CONTROL SERVICE - 4800 KILOVOLT-AMPERES

AUXILIARY ANODE
TWO IGNITORS

GENERAL		
Electrical		
Cathode-Excitation - Cyclic		
Cathode Spot Starting - Ignitor		
Number of Electrodes		
Main Anodes	1	
Main Cathodes	1	
Auxiliary Anodes	1	
Ignitors	2	
Control Grids	1	
Arc Drop at 1200 Peak Amperes	18.2±0.1	Volts
Arc Drop at 8000 Peak Amperes	35±0.1	Volts
Mechanical		
Envelope Material - Stainless Steel		
Net Weight, approximate	90	pounds
Thermal		
Type of Cooling - Water		
Inlet Water Temperature*, minimum	35	C
Outlet Water Temperature, maximum		
Power-Rectifier Service		
Peak Inverse Anode Voltage=900 Volts	60	C
Peak Inverse Anode Voltage=2100 Volts	50	C
AC Control Service		
Voltage=250 Volts RMS	45	C
Voltage=600 Volts RMS	45	C
Voltage=2400 Volts RMS	45	C
Water Flow, minimum		
At No Load	2	Gallons per Minute
At Continuous Rated Average Current	6	Gallons per Minute
Characteristics for Water Cooling at Rated Minimum Flow		
Water Temperature Rise, maximum	19	C
Pressure Drop at 6 Gallons per Minute, maximum	1	Pound per Square Inch

MAXIMUM RATINGS AND TYPICAL OPERATION

Power-Rectifier Service, Continuous Duty			
(Ratings are for Zero-Phase-Control Angle)			
Maximum Peak Anode Voltage			
Inverse	900	2100	Volts
Forward	900	2100	Volts
Maximum Anode Current			
Peak	3600	2400	Amperes

Cont'd. on Page 2

GENERAL ELECTRIC COMPANY
Power Tube Department
Schenectady 5, New York

MAXIMUM RATINGS AND TYPICAL OPERATION (Cont'd.)

Average		
Continuous	400	300 Amperes
Two-Hours- Averaged Over Any Two-Minute Interval	600	450 Amperes
One-Minute - Averaged Over Any One-Minute Interval	800	600 Amperes
Fault	15,000	15,000 Amperes
Maximum Duration of Fault Current	0.15	0.15 Seconds
Frequency Range	25-60	25-60 Cycles per Second
Grid Requirements+		
Minimum Voltage to Establish Conduction		50 Volts
Minimum Voltage to Prevent Conduction		100 Volts
Positive Current to Establish Conduction		0.1 Amperes
AC Control Service ‡		
(Two Tubes in Inverse Parallel, Ratings per Tube)		
Voltage		2400 Volts RMS
Maximum Demand		4800 Kilovolt-Amperes
Average Current at Maximum Demand		270 Amperes
Maximum Average Current		414 Amperes
Demand at Maximum Average Current		2210 Kilovolt-Amperes
Maximum Average Time		1.66 Seconds
Maximum Peak Fault Current		12,000 Amperes
Frequency Range		25-60 Cycles per Second
Cathode Excitation Requirements		
Ignitor Voltage Required to Fire		450 Volts
Ignitor Current Required to Fire		45 Amperes
Starting Time at Required Voltage or Current		100 Microseconds
Peak Excitation Arc Current Required, minimum		6 Amperes
Excitation Arc-Drop Voltage		12 Volts
Ignitor		
Maximum Voltage		
Positive - Anode Voltage		
Negative		5 Volts
Maximum Current		
Peak		100 Amperes
Root Mean Square		15 Amperes
Average		2 Amperes
Maximum Averaging Time		10 Seconds

Typical Resistance Added to Ignitor Circuit for Anode Firing

Anode Voltage	Resistance
600 Volts or less	4 Ohms
601 - 1000 Volts	10 Ohms
1001 - 1500 Volts	20 Ohms
1501 - 2000 Volts	35 Ohms
2001 - 2400 Volts	50 Ohms

Cont'd. on Page 3

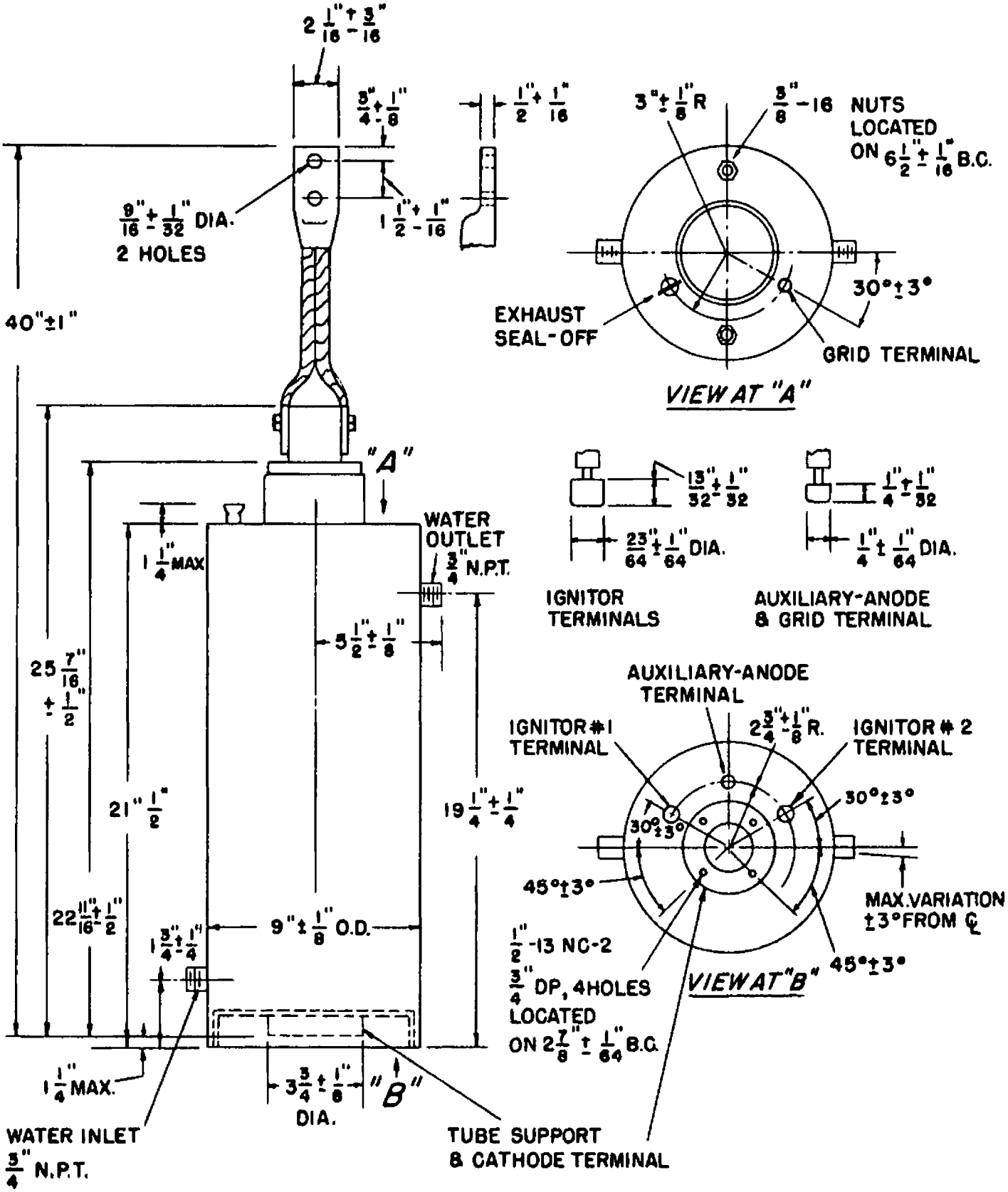
MAXIMUM RATINGS AND TYPICAL OPERATION (Cont'd.)

Auxiliary-Anode	
Maximum Peak Forward Voltage	160 Volts
Maximum Peak Inverse Voltage	
Main Anode Conducting	25 Volts
Main Anode Not Conducting	160 Volts
Maximum Current	
Peak	30 Amperes
Average	9 Amperes
Maximum Averaging Time	10 Seconds
Root Mean Square	15 Seconds
Grid+	
Maximum Peak Forward Voltage	250 Volts
Maximum Peak Inverse Voltage	300 Volts
Maximum Grid-Current	
Peak Positive	1.5 Amperes
Peak Negative	0.5 Amperes
Average	0.5 Amperes
Root Mean Square	1.0 Amperes

* Dependent upon load conditions. For substantially constant load 0 C is satisfactory. For widely fluctuating loads 25 C is required.

+ At main anode voltages of 500 volts and over, the grid circuit should provide a negative d-c bias of 100 volts and a suitable turn-on voltage to swing the grid positive at the time the ignitor is fired. At lower anode voltages, it is sufficient to connect the grid to the main anode through a resistor. In either case, the grid circuit resistance should be 500 to 1000 ohms.

‡ RMS demand voltage, current, and kilovolt-ampere demand are all on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used. For voltages below the minimum, the minimum-voltage current rating applies. With the use of log-log paper straight-line interpolation between tabulated points may be used for other detailed ratings of: Demand kva vs average anode current, and maximum averaging time vs anode voltage.


2 1/16" ± 3/16"
3/4" ± 1/8"
1/2" ± 1/16"
9/16" ± 1/32" DIA.
2 HOLES
1 1/2" ± 1/16"
40" ± 1"
"A"
1 1/4" MAX
WATER OUTLET
3/4" N.P.T.
5 1/2" ± 1/8"
25 7/16" ± 1/2"
21" 1/2
19 1/4" ± 1/4"
22 11/16" ± 1/2"
1 3/4" ± 1/4"
9" ± 1/8" O.D.
1 1/4" MAX.
3 3/4" ± 1/8" DIA.
"B"
WATER INLET
3/4" N.P.T.
TUBE SUPPORT
& CATHODE TERMINAL
3" ± 1/8" R
3/8"-16 NUTS
LOCATED
ON 6 1/2" ± 1/16" B.C.
30° ± 3°
EXHAUST
SEAL-OFF
GRID TERMINAL
VIEW AT "A"
13/32" ± 1/32"
23/64" ± 1/64" DIA.
IGNITOR
TERMINALS
1/4" ± 1/32"
1/4" ± 1/64" DIA.
AUXILIARY-ANODE
& GRID TERMINAL
AUXILIARY-ANODE
TERMINAL
IGNITOR #1
TERMINAL
2 3/4" ± 1/8" R.
IGNITOR # 2
TERMINAL
30° ± 3°
30° ± 3°
45° ± 3°
MAX. VARIATION
± 3° FROM ℄
1/2"-13 NC-2
3/4" DP, 4 HOLES
LOCATED
ON 2 7/8" ± 1/64" B.C.
45° ± 3°
VIEW AT "B"

7763

from JEDEC release #3285A,
March 5, 1962

SHEET-BEAM TUBE

Five-Star Tube

★ ★ ★ ★ ★

FOR INTERMEDIATE-FREQUENCY AMPLIFIER AND LIMITER APPLICATIONS

The 7763 is a miniature double-plate sheet-beam tube which incorporates a pair of balanced deflectors to direct the electron beam to either of the two plates. It is especially suited for service as an intermediate-frequency amplifier and limiter in systems that require constant phase-shift over a wide range of input signal amplitudes.

The 7763 is a special-quality tube intended for use in critical industrial and military applications in which operational dependability is of primary importance. Features of the tube include a high degree of mechanical strength and a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation.

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current+	0.3	Amperes

Direct Interlectrode Capacitances, approximate

	With Shield‡	Without Shield	
Deflector-Number 1 to All	2.8	2.6	pf
Deflector-Number 2 to All	2.8	2.6	pf
Deflector-Number 1 to Plate Number 1	0.008	0.01	pf
Deflector-Number 2 to Plate Number 2	0.008	0.01	pf
Plate-Number 1 to All	2.4	2.2	pf
Plate-Number 2 to All	2.4	2.2	pf
Focus Electrode to All	4.0	4.0	pf
Accelerator and Screen to All	6.5	6.5	pf
→ Plate-Number 1 to Plate-Number 2	0.055	0.055	pf
→ Deflector-Number 1 to Deflector-Number 2	0.8	0.8	pf

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Mechanical

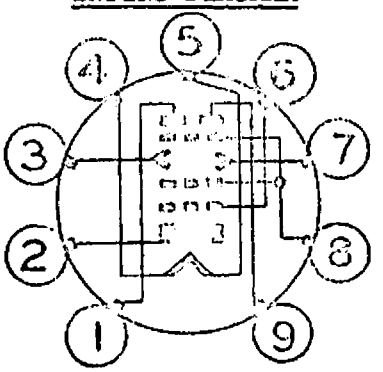
Mounting Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-3

Maximum Diameter	7/8	Inches
Maximum Over-all Length	2 5/8	Inches
Maximum Seated Height	2 3/8	Inches

TERMINAL CONNECTIONS

Pin 1 - Plate Number 2
Pin 2 - Cathode and Internal Shield
Pin 3 - Deflector Number 2
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Focus Electrode
Pin 7 - Deflector Number 1
Pin 8 - Accelerator and Screen
Pin 9 - Plate Number 1

BASING DIAGRAM



EIA 9NF

MAXIMUM RATINGS

Absolute-Maximum Values

Plate Voltage, Each Plate	330	Volts
Accelerator and Screen Voltage	330	Volts
→ Peak Positive Deflector Voltage, Each Deflector	250	Volts
Plate Dissipation, Each Plate	0.75	Watts
Accelerator and Screen Dissipation	1.5	Watts
Peak Negative Focus-Electrode Voltage	30	Volts
DC Cathode Current	12	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	100	Volts
Heater Negative with Respect to Cathode	100	Volts
Deflector Circuit Resistance	39000	Ohms

Absolute-maximum ratings are limiting values of operating and environmental conditions applicable to any tube of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions. The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other tubes in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the tube under consideration and of all other tubes in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics

→	Plate-Number 1 Voltage	135	Volts
→	Plate-Number 2 Voltage	135	Volts
→	Accelerator and Screen Voltage	300	Volts
→	Deflector-Number 1 Voltage	135	Volts
→	Deflector-Number 2 Voltage	135	Volts
	Focus-Electrode Voltage	0	Volts
	Deflector-Number 1 to Plate-Number 1 Transconductance	1000	Micromhos
	Deflector-Number 2 to Plate-Number 2 Transconductance	1000	Micromhos
→	Plate Resistance, Each Plate	0.85	Megohms

Dynamic Characteristics

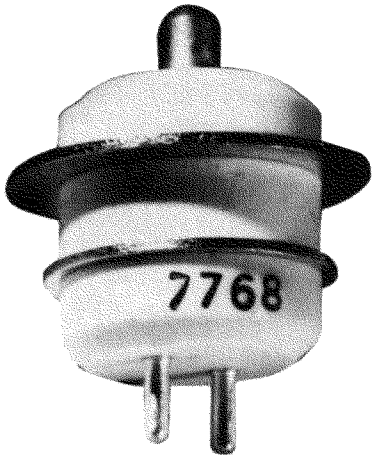
→	Plate-Number 1 Voltage	135	Volts
→	Plate-Number 2 Voltage	135	Volts
→	Accelerator and Screen Voltage	300	Volts
→	Deflector-Number 1 Voltage	135	Volts
→	Deflector-Number 2 Voltage	135	Volts
	AC Deflector-to-Deflector Voltage, RMS	10	Volts
	Focus-Electrode Voltage	0	Volts
	Total Plate Current	4.2	Milliamperes
→	Accelerator and Screen Current	4.0	Milliamperes

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

\+ Heater current of a bogey tube at Ef = 6.3 volts.

‡ With external shield (EIA 315) connected to pin 2.

1/29/62 (F)
Supersedes 4/19/61 (F)



METAL-CERAMIC TRIODE

DESCRIPTION AND RATING

FOR BROADBAND RADIO-FREQUENCY AMPLIFIER APPLICATIONS

The 7768 is a high-mu triode of ceramic-and-metal planar construction primarily intended for use as a broadband radio-frequency amplifier. The 7768 is especially suited for use where unfavorable conditions of mechanical shock, mechanical vibration, and nuclear radiation are encountered.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.3	Volts
Heater Current†	0.4	Amperes

Direct Interelectrode Capacitances‡

Grid to Plate: (g to p)	1.7	pf
Input: g to (h+k)	6.0	pf
Output: p to (h+k)	0.018	pf
Heater to Cathode: (h to k)	2.4	pf

MECHANICAL

Mounting Position—Any

See Outline Drawing on page 3 for dimensions and electrical connections

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	5.5	Watts
DC Cathode Current	30	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance With Cathode Bias	0.01	Megohms
Envelope Temperature at Hottest Point§	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

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CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	200	Volts	Transconductance	50000	Micromhos
Grid Voltage	+6.0	Volts	Plate Current	24	Milliamperes
Cathode-Bias Resistor	270	Ohms	Grid Voltage, approximate		
Amplification Factor	225		Ib = 100 Microamperes	−3	Volts
Plate Resistance, approximate	4500	Ohms			

FOOTNOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

§ Operation below the rated maximum envelope temperature is recommended for applications requiring the longest possible tube life.

INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
Ef = 6.3 volts	370	400	430	Milliamperes
Plate Current				
Ef = 6.3 volts, Eb = 200 volts, Rk = 22 ohms (bypassed)	14	22	30	Milliamperes
Transconductance				
Ef = 6.3 volts, Eb = 200 volts, Rk = 22 ohms (bypassed)	40000	50000	60000	Micromhos
Amplification Factor				
Ef = 6.3 volts, Eb = 200 volts, Rk = 22 ohms (bypassed)	170	225	280	
Grid Voltage Cutoff				
Ef = 6.3 volts, Eb = 200 volts, Ib = 100 μa	.....	−3.0	−5.0	Volts
Noise Figure				
Ef = 6.3 volts, Ebb = 280 volts, R_L = 3300 ohms, Rk = 22 ohms (bypassed), F = 200 MC ± 10 mc	.....	3.0	4.8	Decibels
Interelectrode Capacitances				
Grid to Plate: (g to p)	1.3	1.7	2.1	pf
Input: g to (h+k)	4.5	6.0	7.5	pf
Output: p to (h+k)	0.01	0.018	0.026	pf
Heater to Cathode: (h to k)	1.5	2.4	3.3	pf
Negative Grid Current				
Ef = 6.3 volts, Eb = 200 volts, Ecc = −1.0 volts, Rk = 22 ohms (bypassed), Rg = 0.1 meg	.....	.....	0.5	Microamperes
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	.....	.....	20	Microamperes
Heater Negative with Respect to Cathode	.....	.....	20	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid to A11 at 100 volts d-c	50	.....	.....	Megohms
Plate to A11 at 300 volts d-c	50	.....	.....	Megohms
Grid Emission Current				
Ef = 7.0 volts, Eb = 200 volts, Ecc = −15 volts, Rg = 0.1 meg	.....	.....	2.0	Microamperes

SPECIAL PERFORMANCE TESTS

	Min.	Bogey	Max.	
Grid Recovery				
Change in Average Plate Current	.....	.....	1.0	Milliamperes
Peak Plate Current Backswing	.....	.....	2.0	Milliamperes

Tubes with poor grid recovery affect circuit operation when the grid is driven positive by a pulse of signal or noise, somewhat as if a parallel RC circuit were in series with the grid. This effect may occur in tubes of any type, but is unimportant in many applications. In the majority of 7768 tubes the effect is negligible, but to eliminate the few in which it may be excessive, tubes are tested under the following conditions: Ef = 6.3 volts, Ebb = 250 volts, R_L = 0.01 meg. Ec is adjusted for Ib = 10 ma.

Upon application to the grid of a 3 volt positive pulse (prr = 60 pps, duty factor = 0.0012) the change in average plate current is noted, and the peak plate current backswing is measured. The following diagram shows qualitatively the plate current-time relationship for a tube (with poor grid recovery) subjected to this test.

Low Frequency Vibrational Output	.....	.....	50	Millivolts RMS

Statistical sample is subjected to vibration in each of two planes at 40 cps, with peak acceleration 15G. Tube is operated with Ef = 6.3 volts, Ebb = 250 volts, Rk = 68 ohms (bypassed), R_L = 2000 ohms

Low Pressure Voltage Breakdown Test

Statistical sample tested for voltage breakdown at a pressure of 8mm Hg, to simulate an altitude of 100,000 feet. Tubes shall not give visual evidence of flashover or corona when 300 volts RMS, 60 cps, is applied between the plate and grid terminals.

OUTLINE DRAWING

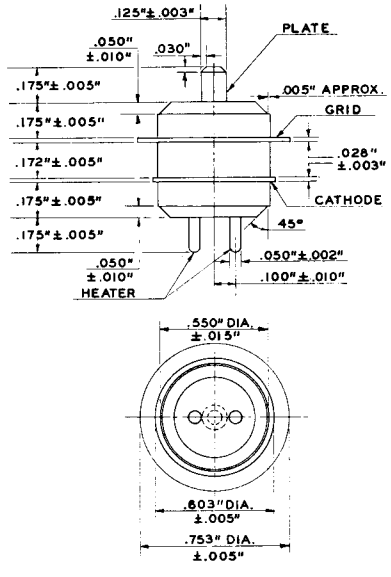
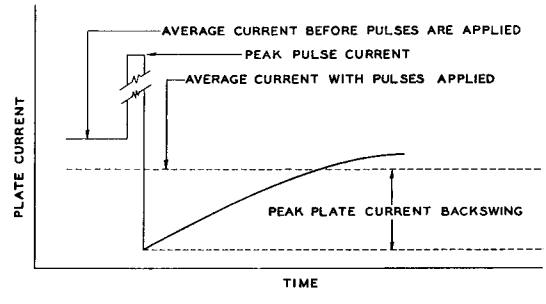


PLATE CURRENT VS. TIME —GRID RECOVERY TEST



DEGRADATION RATE TESTS

Fatigue

Statistical sample vibrated for a total of six hours, three hours in each of two planes, at a peak acceleration of 10G. Frequency is continuously varied from 30 cps to 2000 cps and back to 30 cps, with a period of ten minutes. Tubes are operated during the test with Ef = 6.3 volts, Eb = 250 volts, and Rk = 68 ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, heater current, and transconductance.

Shock

Statistical sample subjected to 5 impact accelerations of approximately 450G in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine using a 30° hammer angle. Tubes are operated during the test with Ef = 6.3 volts, Eb = 250 volts, Ehk = +100 volts, and Rk = 68 ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, heater current, and transconductance.

Stability Life Test

The statistical sample subjected to the Intermittent Life Test is evaluated for percent change in zero-bias transconductance of individual tubes, from the initial reading to readings following 2 hours and 20 hours of the life test.

Survival Rate Life Test

The statistical sample subjected to the Intermittent Life Test is evaluated for shorted and open elements and transconductance following approximately 100 hours of life test.

Intermittent Life Test

Statistical sample operated for 1000 hours under the following conditions: Ef = 6.3 volts (cycled—on 1¾ hours, off ¼ hour), Eb = 200 volts, Ecc = +7 volts, Ehk = −70 volts d-c, Rk = 270 ohms, and Rg = 0.01 meg. Tubes are evaluated, following 500 and 1000 hours of life test, for shorted or open elements, heater current, grid current, transconductance, noise figure, heater-cathode leakage, and interelectrode leakage resistance.

Interface Life Test

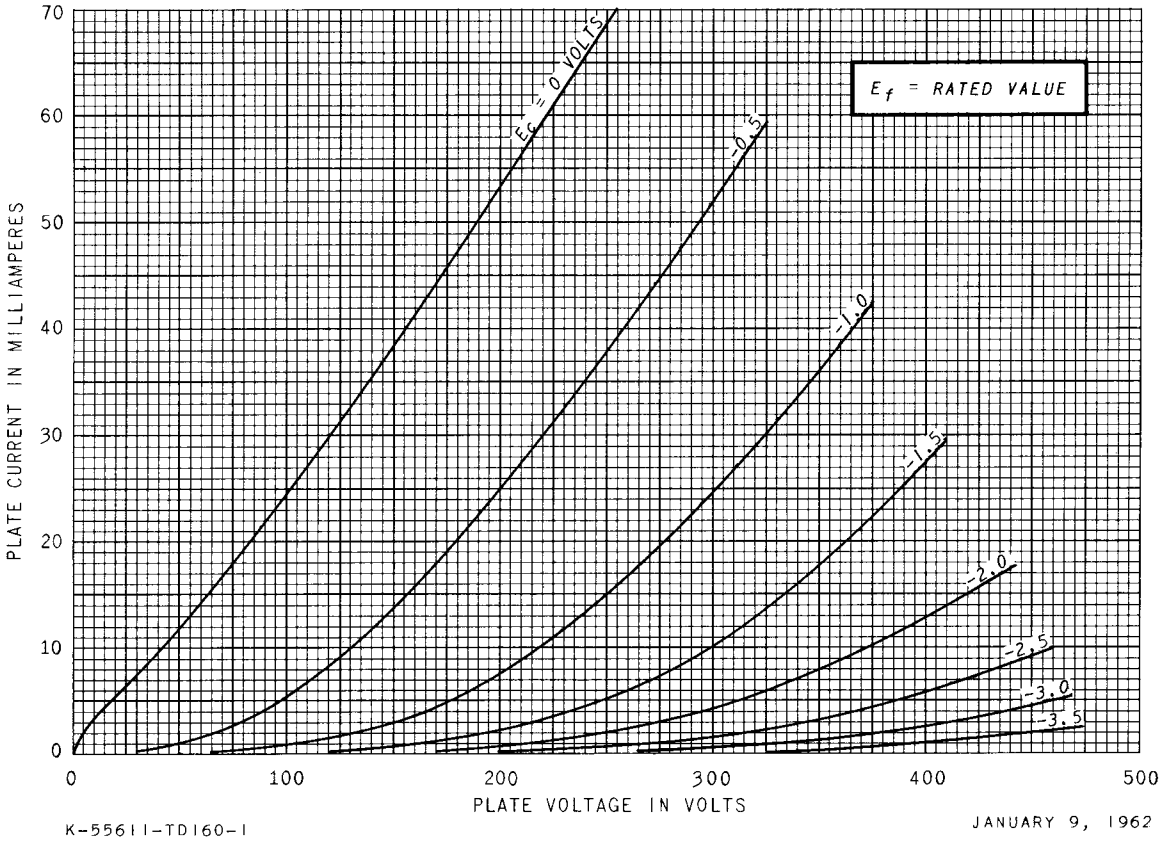
Statistical sample operated for 1000 hours with Ef = 6.6 volts, no other voltages applied, and evaluated for cathode interface resistance following the life test.

Heater-Cycling Life Test

Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.5 volts cycled for one minute on and one minute off, Eb = Ec = 0 volts, and Ehk = 70 volts with heater positive with respect to cathode. Following this test, tubes are evaluated for open heaters, heater-cathode shorts, and heater-cathode leakage current.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

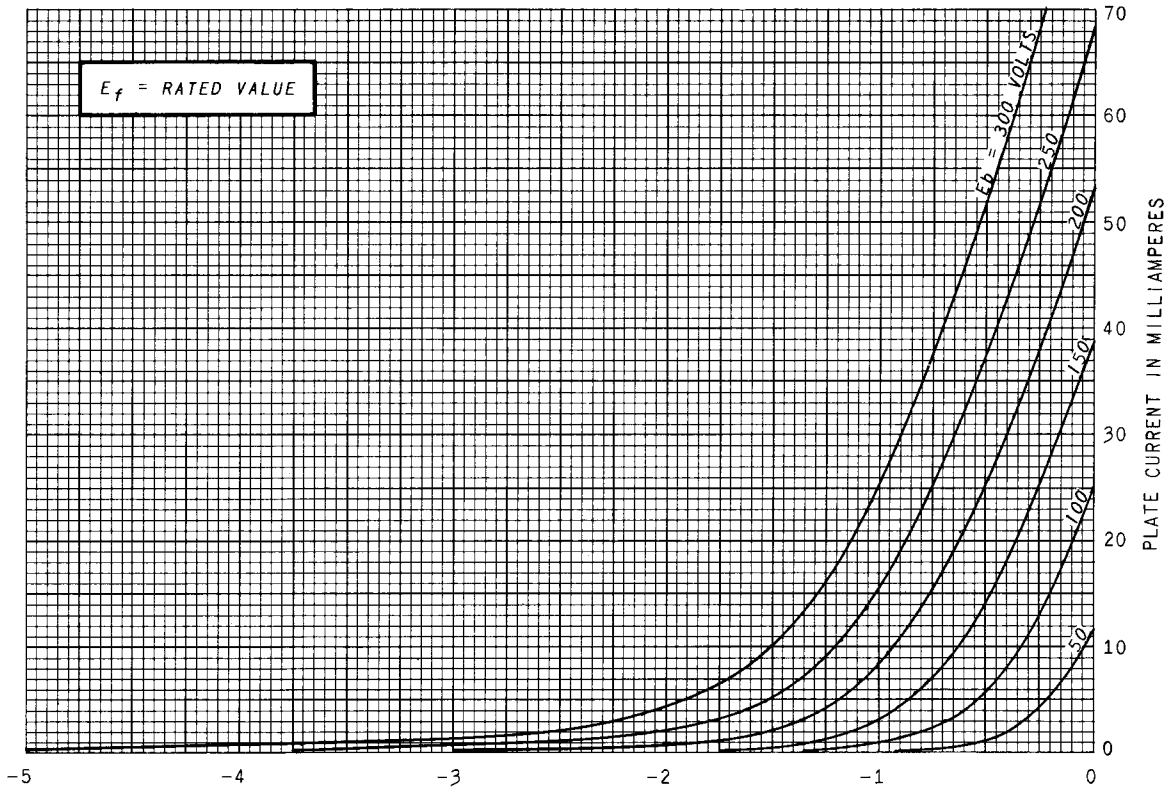
AVERAGE PLATE CHARACTERISTICS



K-55611-TD160-1

JANUARY 9, 1962

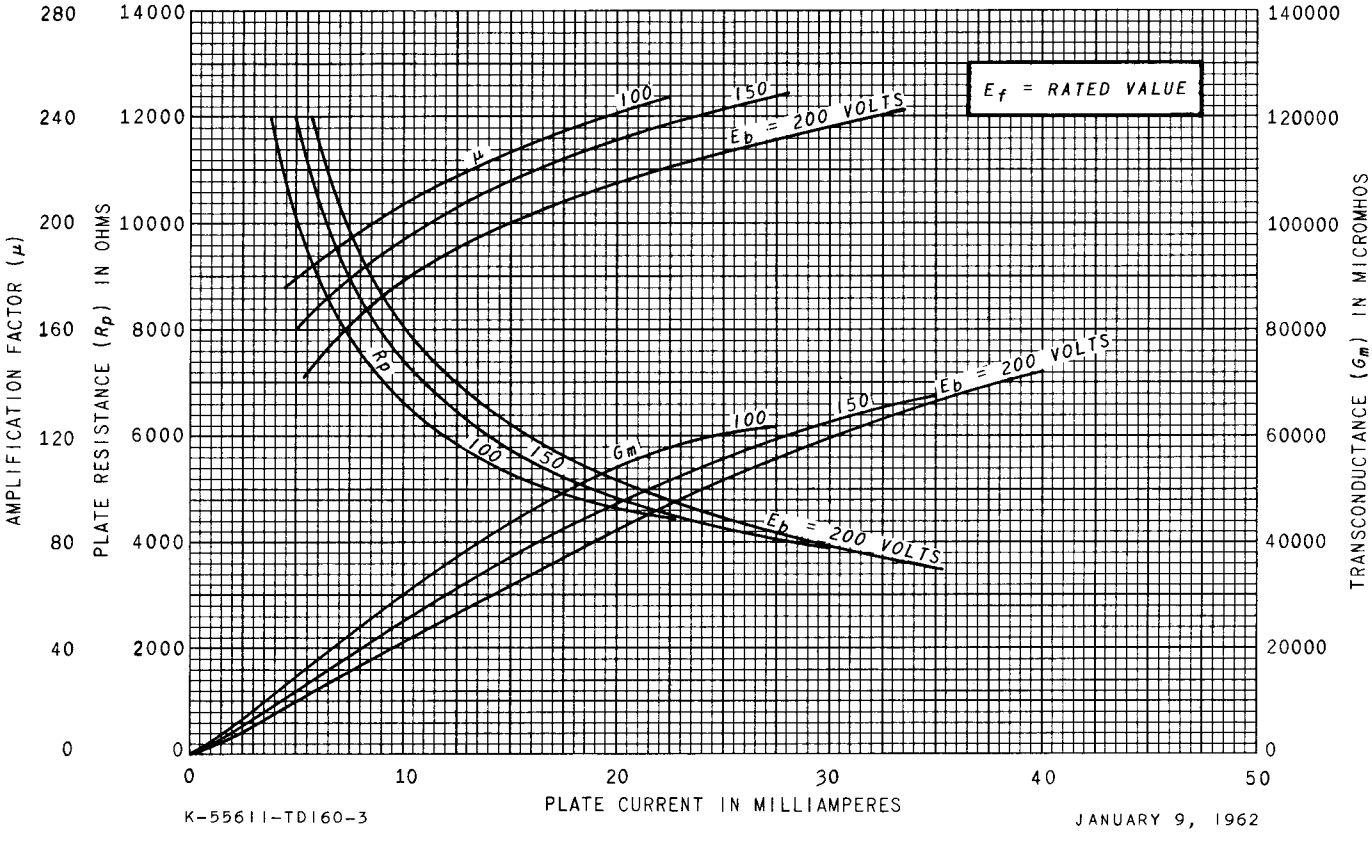
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD160-2

JANUARY 9, 1962

AVERAGE CHARACTERISTICS



K-5561I-TD160-3

JANUARY 9, 1962

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

Planar Triode

7784

FOR GROUNDED-GRID CLASS A UHF AMPLIFIER APPLICATIONS

The 7784 is a high-mu, metal-and-ceramic triode intended for operation as a grounded-grid, Class A radio-frequency amplifier at frequencies as high as 3000 megacycles.

Features of the tube include small size, planar electrode construction with close spacing, inherent rigidity, and an envelope structure convenient for coaxial circuit applications.

At 1200 megacycles a noise figure of less than 8.5 decibels may be obtained when the 7784 is used in a grounded-grid coaxial circuit.

The 7784 differs from the 6299 only in having an isolated heater.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.3	Volts
Heater Current‡	0.3	Amperes

Direct Interelectrode Capacitances§

Grid to Plate: (g to p)	1.75	pf
Grid to Cathode and Heater:		
g to (h + k)	3.65	pf
Plate to Cathode and Heater:		
p to (h + k)	0.015	pf

MECHANICAL

Operating Position - Any

Net Weight	1/6	Ounce

Cooling - Conduction¶

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Plate Voltage	200	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	15	Volts
Plate Dissipation	2.0	Watts
DC Plate Current	12	Milliamperes
DC Grid Current#	0Δ	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point	150	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	175	Volts
Grid Voltage¢	---	Volts
Amplification Factor	110	
Plate Resistance, approximate	7300	Ohms
Transconductance	15000	Micromhos
Plate Current	10	Milliamperes
Plate Voltage, approximate Ib = 10 Milliamperes, Ec = 0 Volts	125	Volts

CLASS A$_1$ RF AMPLIFIER—GROUNDED-GRID, COAXIAL-TYPE CIRCUIT

Frequency	450	1200	1200	1200	3000	Megacycles
Plate Voltage	**	---	**	175	**	Volts
Plate-Supply Voltage‡‡	---	300	---	---	---	Volts
Resistor in Plate Circuit (bypassed)	---	17500	---	---	---	Ohms
Grid Voltage§§	0	0	0	¶¶	0	Volts
Plate Current	10	10	10	10	10	Milliamperes
Bandwidth, min	9	10	10	10	10	Megacycles
Gain	17.5	17	17	17	11	Decibels
Noise Figure, Power Matched	4.5	8.2	8.0	8.5	13.2	Decibels

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ The electrical connections to the plate and cathode must provide good thermal conductivity from these electrodes. The plate contact must be sufficiently flexible to keep the lateral force on the plate terminal at a minimum.

The 7784 is rated only for Class A amplifier service.

Δ Does not apply to initial-emission-velocity current

¢ Adjusted for Ib = 10 milliamperes.

** Adjust for Ib = 10 milliamperes; range must be variable from 75 to 200 volts.

‡‡ Supply should be regulated.

§§ For operation above 1000 megacycles, the minimum noise figure will generally be obtained by operation at zero bias. For operation below 1000 megacycles, the use of a cathode resistor or grid bias should be evaluated for the particular application.

¶¶ Adjusted for Ib = 10 milliamperes; 200-ohm variable cathode resistor recommended.

INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
Ef = 6.3 volts.	280	300	320	Milliamperes
Plate Voltage				
Ef = 6.3 volts, Ec = 0 volts, Eb adjusted for Ib = 10 ma.	75	125	175	Volts
Transconductance				
Ef = 6.3 volts, Eb = 175 volts, Ec adjusted for Ib = 10 ma	11500	15000	---	Micromhos
Amplification Factor				
Ef = 6.3 volts, Eb = 175 volts, Ec adjusted for Ib = 10 ma	85	110	140	
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 50 volts				
Heater Positive with Respect to Cathode	---	---	20	Microamperes
Heater Negative with Respect to Cathode	---	---	20	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts, Polarity of applied d-c interelectrode voltage is such that no cathode emission results				
Grid to Cathode at 45 volts d-c	0.25	---	---	Megohms
Grid to Plate at 500 volts d-c	5.0	---	---	Megohms
Interelectrode Capacitances				
Grid to Plate: (g to p)	1.5	1.75	2.0	Picofarads
Grid to Cathode and Heater: g to (h + k)	3.0	3.65	5.0	Picofarads
Plate to Cathode and Heater: p to (h + k)	---	0.015	0.025	Picofarads

SPECIAL PERFORMANCE TESTS

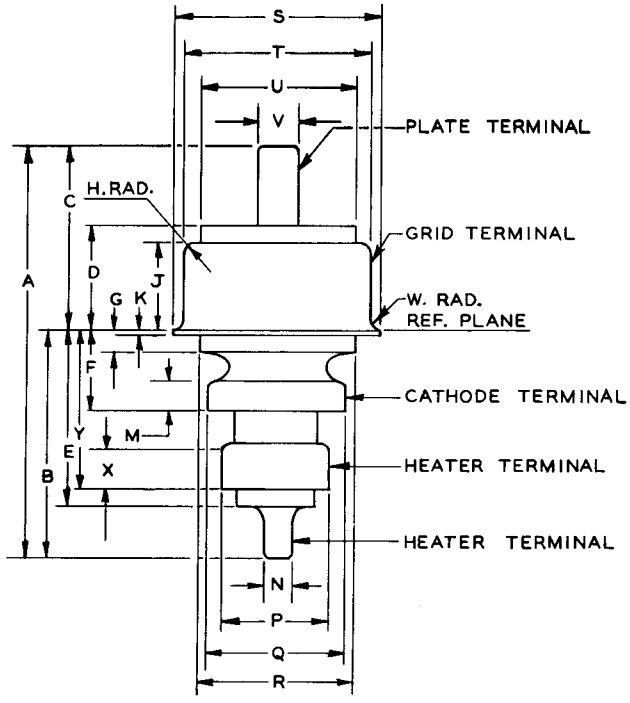
	Min.	Max.	
Noise Figure - 450 MC			
Ef = 6.3 volts, Ec = 0 volts, Eb adjusted for Ib = 10 ma, F = 450±5 MC	---	5.0	Decibels
Noise Figure - 1200 MC			
Ef = 6.3 volts, Ec = 0 volts, Eb adjusted for Ib = 10 ma, F = 1200±5 MC	---	8.5	Decibels
Power Gain - 450 MC			
Ef = 6.3 volts, Ec = 0 volts, Eb adjusted for Ib = 10 ma, F = 450±5 MC, Bandwidth = 9 MC, min.	15	---	Decibels
Power Gain - 1200 MC			
Ef = 6.3 volts, Ec = 0 volts, Eb adjusted for Ib = 10 ma, F = 1200±5 MC, Bandwidth = 10 MC, min	15	---	Decibels

DEGRADATION RATE TESTS

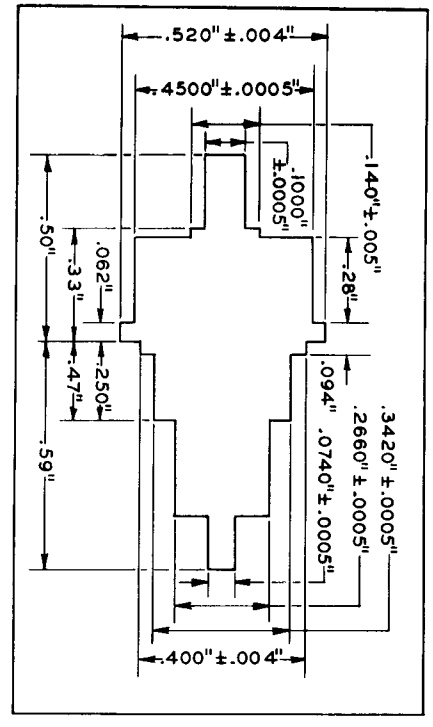
1000-Hour Life

Statistical sample operated for 1000 hours to evaluate changes in transconductance and noise figure with life.

PHYSICAL DIMENSIONS

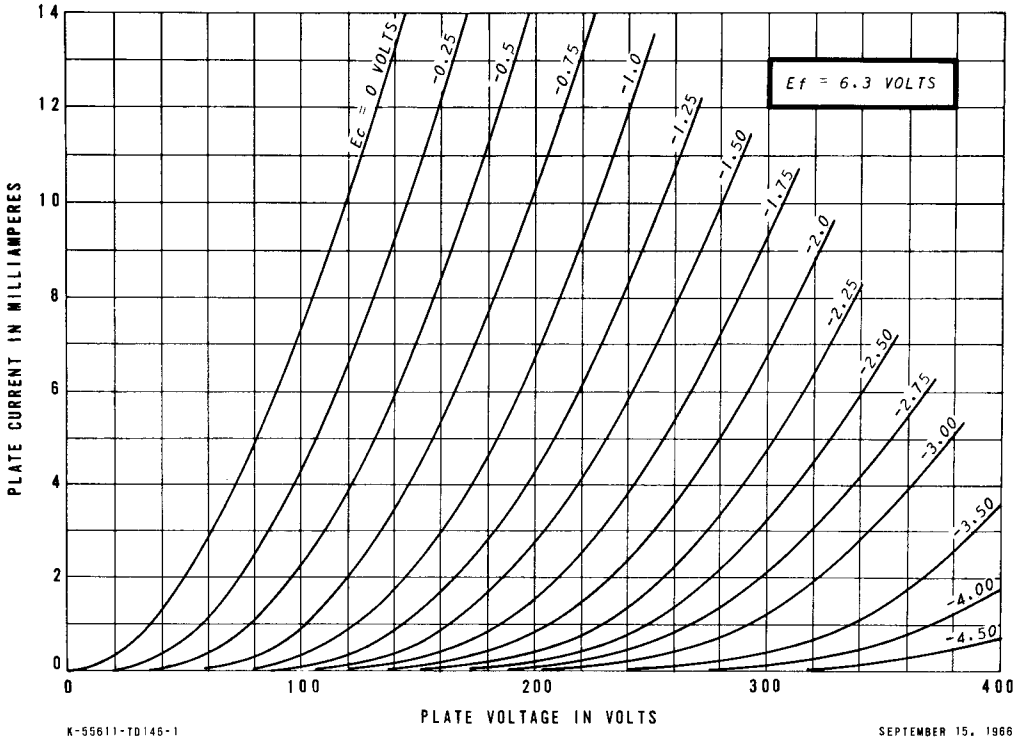


ALIGNMENT GAUGE



Ref.	INCHES		MILLIMETERS	
	Minimum	Maximum	Minimum	Maximum
A	0.960	1.040	24.38	26.42
B	0.530	0.590	13.46	14.99
C	0.410	0.470	10.41	11.94
D	---	0.272	---	6.91
E	---	0.475	---	12.07
F	0.163	0.193	4.14	4.90
G	---	0.060	---	1.52
H	---	0.030	---	0.76
J	0.190	0.210	4.83	5.33
K	0.009	0.015	0.23	0.38
M	0.040	0.070	1.02	1.78
N	0.059	0.065	1.50	1.65
P	0.247	0.257	6.27	6.53
Q	0.326	0.334	8.28	8.48
R	---	0.385	---	9.78
S	0.483	0.497	12.27	12.62
T	0.435	0.445	11.05	11.30
U	---	0.385	---	9.78
V	0.088	0.094	2.24	2.39
W	---	0.008	---	0.20
X	0.070	0.100	1.78	2.54
Y	0.355	0.395	9.02	10.05

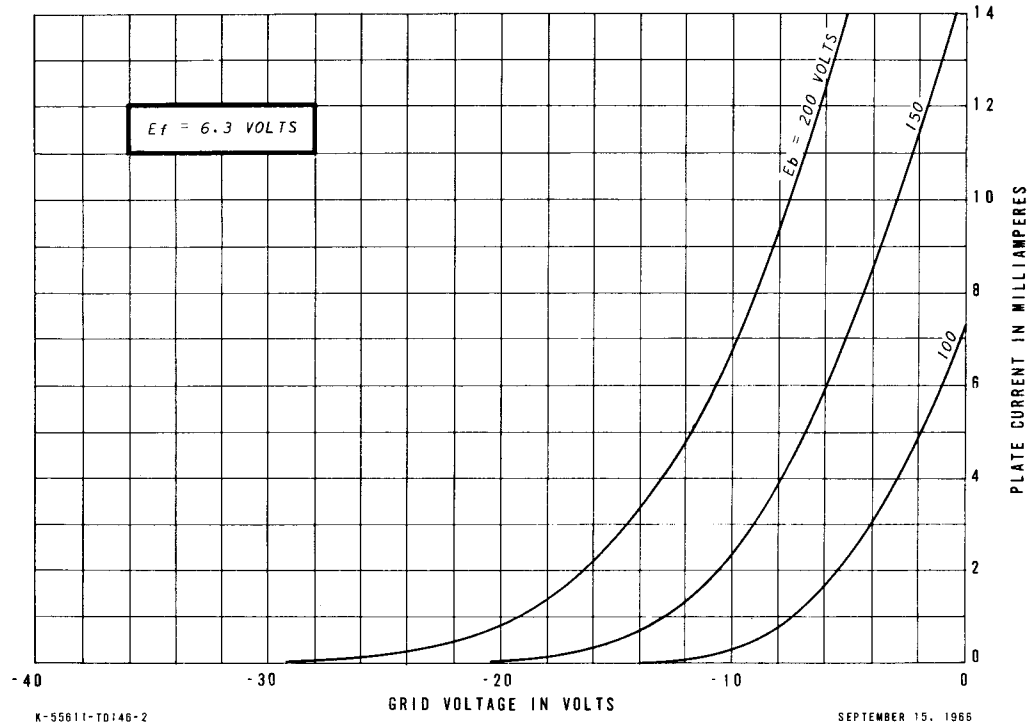
AVERAGE PLATE CHARACTERISTICS



K-55611-TD146-1

SEPTEMBER 15, 1966

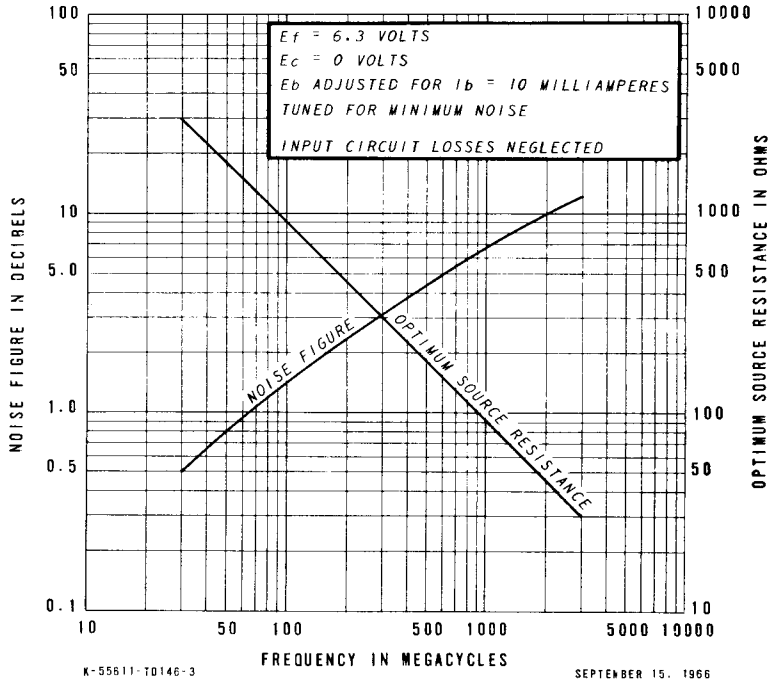
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD146-2

SEPTEMBER 15, 1966

PREDICATED NOISE PERFORMANCE



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

7815

Planar Triode

The 7815 is a high-mu, ceramic-and-metal, planar triode designed for use as a grid-pulsed or plate-pulsed oscillator, frequency multiplier, or power amplifier at frequencies up to 3000 megacycles.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC	*	Volts
Heater Current‡	1.0	Amperes
Direct Interelectrode Capacitances§		
Grid to Plate: (g to p)	2.05	pf
Grid to Cathode: (g to k)	6.3	pf
Plate to Cathode: (p to k), Maximum	0.035	pf

MECHANICAL

Operating Position - Any
Cooling - Conduction and Convection

Net Weight, approximate	1.7	Ounces
Maximum Anode Temperature	250	C

MAXIMUM RATINGS AND TYPICAL OPERATION

PLATE-PULSED OSCILLATOR OR AMPLIFIER—CLASS C

MAXIMUM RATINGS—ABSOLUTE-MAXIMUM VALUES

Peak Pulse Plate-Supply Voltage	3500	Volts
Pulse Length	6	Microseconds
Duty Factor	0.0033	
Negative DC Grid Voltage	150	Volts
Positive Peak Grid Voltage	250	Volts
Negative Peak Grid Voltage	750	Volts
Plate Dissipation	10	Watts
Grid Dissipation	2.0	Watts
Average Plate Current	10	Milliamperes
Peak Plate Current	3.0	Amperes
Average Grid Current	5.0	Milliamperes
Frequency	3000	Megacycles

TYPICAL OPERATION—OSCILLATOR AT 2500 MEGACYCLES

Heater Voltage	5.8	Volts
Peak Plate-Supply Voltage	3500	Volts
Pulse Length	5	Microseconds
Duty Factor	0.0030	
Peak Plate Current	3.0	Amperes
Average Plate Current	9.0	Milliamperes
Average Grid Current	3.0	Milliamperes
Peak Useful Power Output, approximate	2000	Watts

The devices and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of devices by General Electric Company conveys any license under patent claims covering combinations of these devices with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of these devices with other devices or elements by any purchaser or others.

MAXIMUM RATINGS AND TYPICAL OPERATION (Continued)

GRID-PULSED OSCILLATOR OR AMPLIFIER—CLASS C

MAXIMUM RATINGS—ABSOLUTE-MAXIMUM VALUES

DC Plate Voltage	2000	Volts
Pulse Length	6	Microseconds
Duty Factor	0.0033	
Negative DC Grid Voltage	150	Volts
Positive Peak Grid Voltage	250	Volts
Negative Peak Grid Voltage	750	Volts
Plate Dissipation	10	Watts
Grid Dissipation	2.0	Watts
Average Plate Current	10	Milliamperes
Peak Plate Current	3.0	Amperes
Average Grid Current	5.0	Milliamperes
Frequency	3000	Megacycles

TYPICAL OPERATION—AMPLIFIER AT 1100 MEGACYCLES

Heater Voltage	6.0	Volts
DC Plate Voltage	1700	Volts
DC Grid Voltage	-45	Volts
Pulse Length	3.5	Microseconds
Duty Factor	0.001	
Peak Plate Current	1.9	Amperes
Peak Grid Current	1.1	Amperes
Driving Power during Pulse, approximate	400	Watts
Peak Useful Power Output, approximate	1500	Watts

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

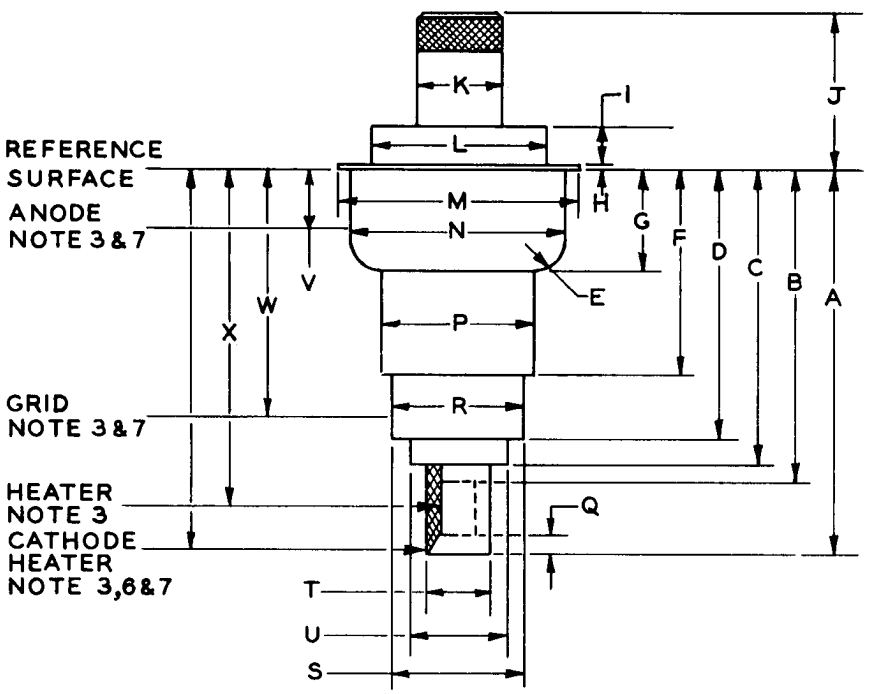
The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at some value within the range of 5.0 to 6.0 volts. Heater voltage variations about the center value should be kept as small as practical and should not, in any case, exceed ±5%. The optimum center value of heater voltage depends on the cathode current and on other parameters of circuit design and operation. For specific recommendations, contact your General Electric tube sales representative.

‡ Heater Current of a bogey tube at Ef = 6.0 volts.

§ Measured without heater voltage.



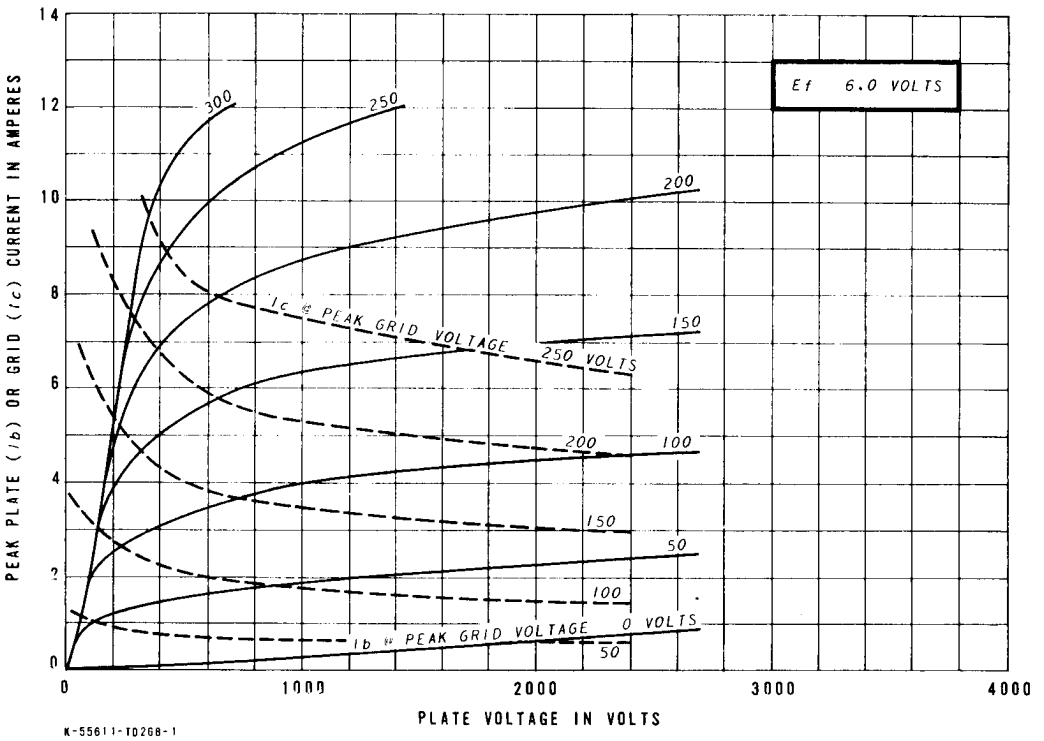
DIMENSIONS FOR OUTLINE (INCHES)

Ref.	Inches	
	Minimum	Maximum
A	1.815	1.875
B	---	1.534
C	---	1.475
D	1.289	1.329
E	---	0.100
F	0.970	1.010
G	0.462	0.477
H	---	0.040
I	---	0.185
J	0.766	0.826
K	0.427	0.447
L	0.840	0.860
M	1.180	1.195
N	1.025	1.035
P	0.752	0.792
Q	---	0.086
R	0.655	0.665
S	---	0.545
T	0.213	0.223
U	0.315	0.325

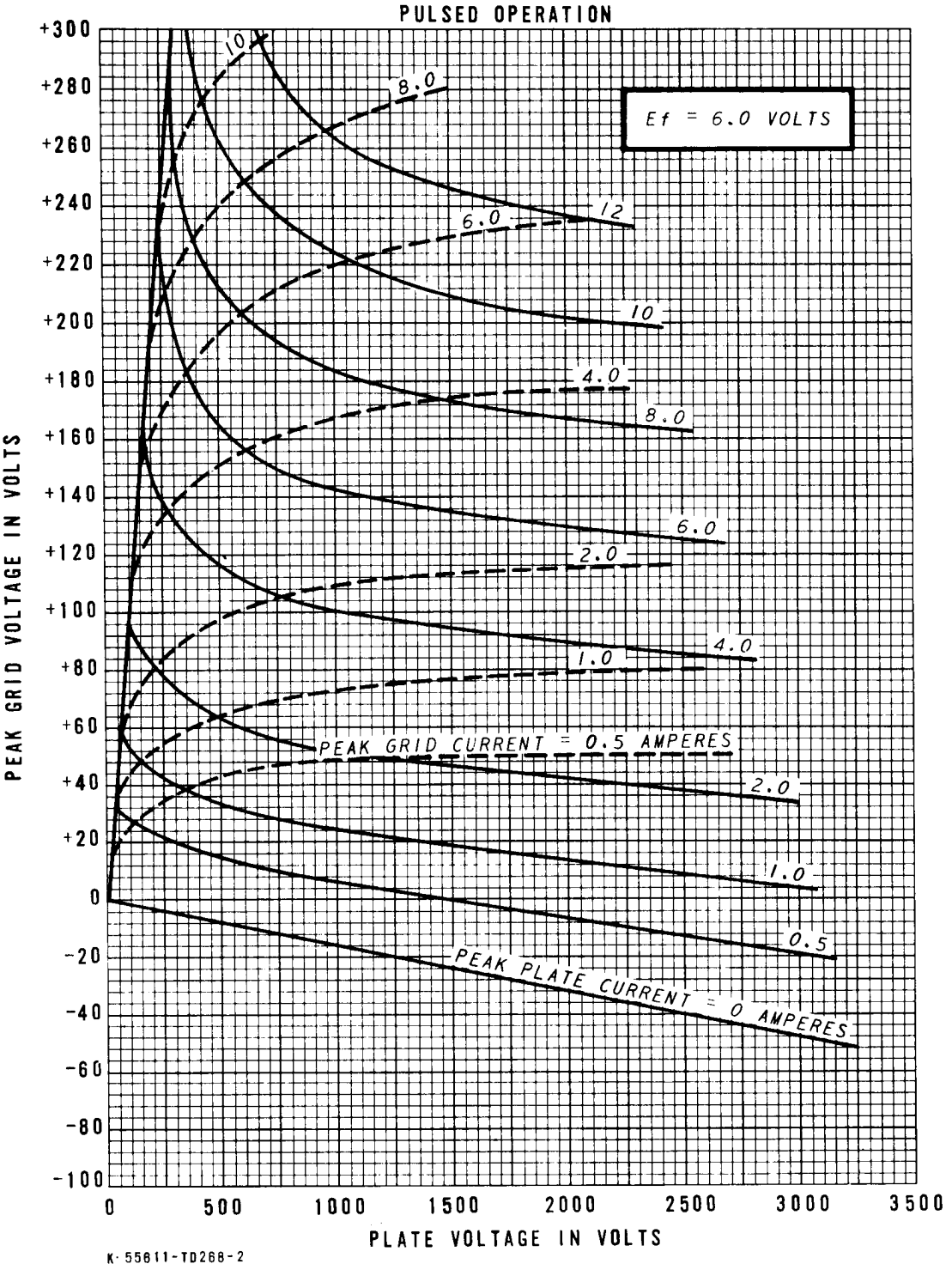
DIMENSIONS FOR ELECTRODE CONTACT AREA (INCHES)

Ref.	Dimension	Contact
V	0.198±0.163	Anode
W	1.225±0.040	Grid
X	1.631±0.097	Heater
Y	1.645±0.170	Cathode

AVERAGE PLATE CHARACTERISTICS



AVERAGE CONSTANT-CURRENT CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Planar Triode

7815R

The 7815R is a high-mu, ceramic-and-metal, planar triode designed for use as a grid-pulsed or plate-pulsed oscillator, frequency multiplier, or power amplifier at frequencies up to 3000 megacycles.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC	*	Volts
Heater Current‡	1.0	Amperes
Direct Interelectrode Capacitances§		
Grid to Plate: (g to p)	2.05	pf
Grid to Cathode: (g to k)	6.3	pf
Plate to Cathode: (p to k), Maximum	0.035	pf

MECHANICAL

Operating Position - Any
Cooling - Conduction and Convection

Net Weight, approximate	2.5	Ounces
Maximum Anode Temperature	250	C

MAXIMUM RATINGS AND TYPICAL OPERATION

PLATE-PULSED OSCILLATOR OR AMPLIFIER—CLASS C

MAXIMUM RATINGS—ABSOLUTE-MAXIMUM VALUES

Peak Pulse Plate-Supply Voltage	3500	Volts
Pulse Length	6	Microseconds
Duty Factor	0.0033	
Negative DC Grid Voltage	150	Volts
Positive Peak Grid Voltage	250	Volts
Negative Peak Grid Voltage	750	Volts
Plate Dissipation	10¶	Watts
Grid Dissipation	2.0	Watts
Average Plate Current	10	Milliamperes
Peak Plate Current	3.0	Amperes
Average Grid Current	5.0	Milliamperes
Frequency	3000	Megacycles

TYPICAL OPERATION—OSCILLATOR AT 2500 MEGACYCLES

Heater Voltage	5.8	Volts
Peak Plate-Supply Voltage	3500	Volts
Pulse Length	5	Microseconds
Duty Factor	0.0030	
Peak Plate Current	3.0	Amperes
Average Plate Current	9.0	Milliamperes
Average Grid Current	3.0	Milliamperes
Peak Useful Power Output, approximate	2000	Watts

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MAXIMUM RATINGS AND TYPICAL OPERATION (Continued)

GRID-PULSED OSCILLATOR OR AMPLIFIER—CLASS C

MAXIMUM RATINGS—ABSOLUTE-MAXIMUM VALUES

DC Plate Voltage	2000	Volts
Pulse Length	6	Microseconds
Duty Factor	0.0033	
Negative DC Grid Voltage	150	Volts
Positive Peak Grid Voltage	250	Volts
Negative Peak Grid Voltage	750	Volts
Plate Dissipation	10¶	Watts
Grid Dissipation	2.0	Watts
Average Plate Current	10	Milliamperes
Peak Plate Current	3.0	Amperes
Average Grid Current	5.0	Milliamperes
Frequency	3000	Megacycles

TYPICAL OPERATION—AMPLIFIER AT 1100 MEGACYCLES

Heater Voltage	6.0	Volts
DC Plate Voltage	1700	Volts
DC Grid Voltage	-45	Volts
Pulse Length	3.5	Microseconds
Duty Factor	0.001	
Peak Plate Current	1.9	Amperes
Peak Grid Current	1.1	Amperes
Driving Power during Pulse, approximate	400	Watts
Peak Useful Power Output, approximate	1500	Watts

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

NOTES

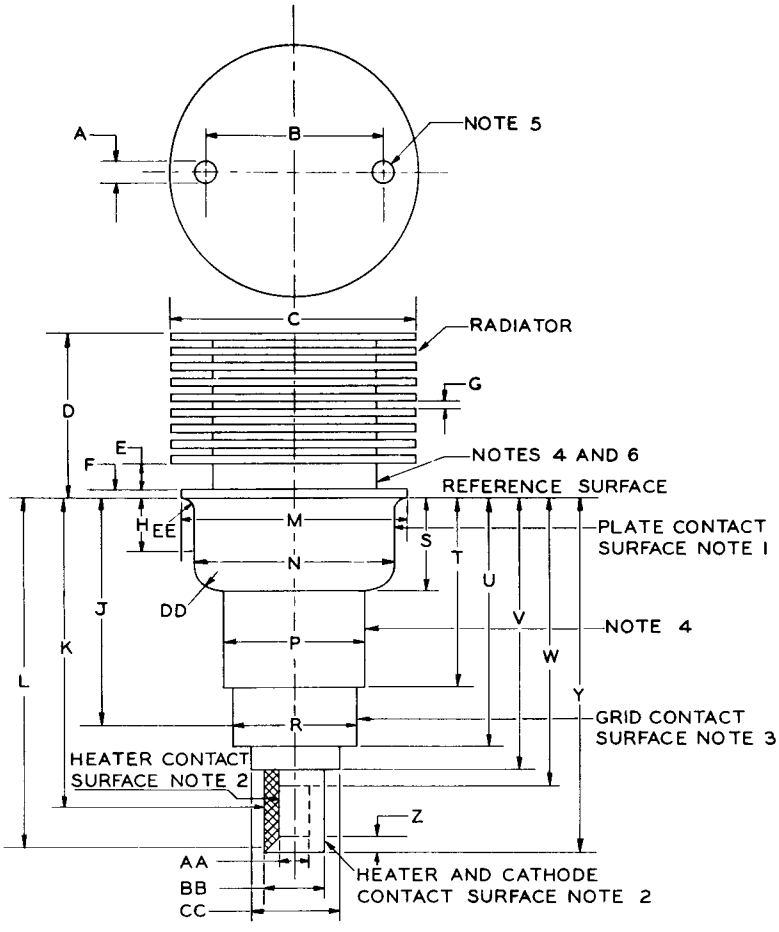
* The equipment designer should design the equipment so that heater voltage is centered at some value within the range of 5.0 to 6.0 volts. Heater voltage variations about the center value should be kept as small as practical and should not, in any case, exceed ±5%. The optimum center value of heater voltage depends on the cathode current and on other parameters of circuit design and operation. For specific recommendations, contact your General Electric tube sales representative.

‡ Heater current of a bogey tube at Ef = 6.0 volts.

§ Measured without heater voltage.

¶ Plate dissipation of 100 watts is permissible with forced-air cooling.

PHYSICAL DIMENSIONS



DIMENSIONS FOR OUTLINE (INCHES)

Ref.	Inches	
	Minimum	Maximum
A	0.105	0.145
B	0.650	0.850
C	1.234	1.264
D	0.766	0.826
E	0.125	0.185
F	---	0.040
G	0.025	0.046
M	1.180	1.195
N	1.025	1.035
P	0.752	0.792
R	0.655	0.665
S	0.462	0.477
T	0.970	1.010
U	1.289	1.329
V	---	1.475
W	---	1.534
Y	1.815	1.875
Z	---	0.086
AA	0.213	0.223
BB	0.315	0.325
CC	---	0.545

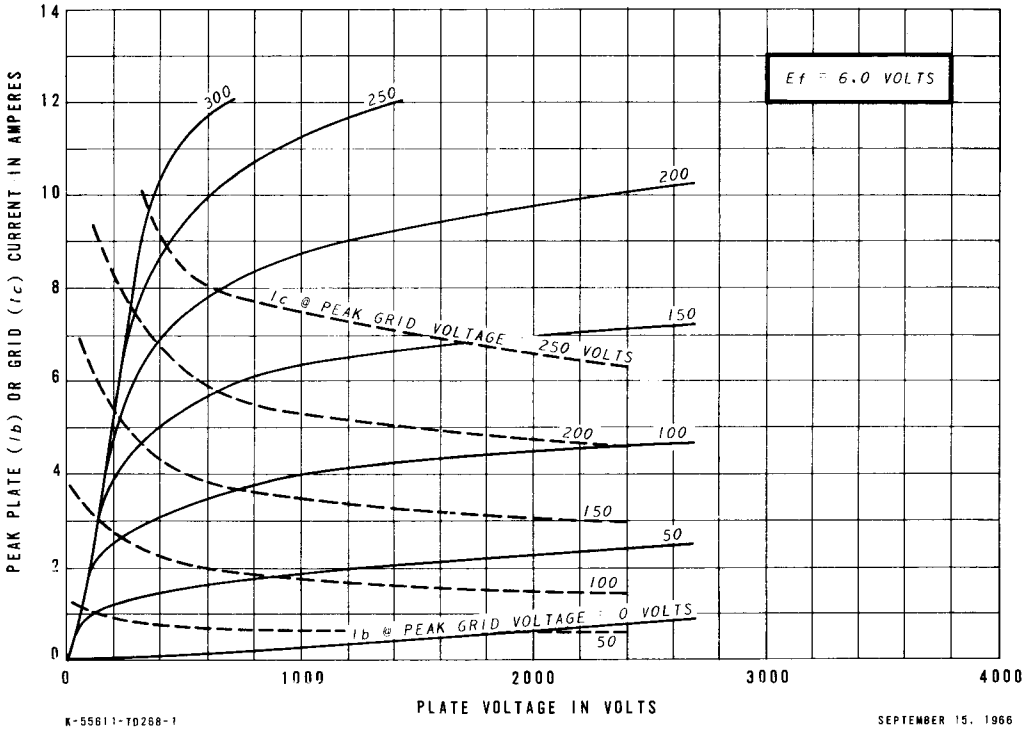
DIMENSIONS FOR ELECTRODE CONTACT AREA (INCHES)

Ref.	Dimension	Contact
H	0.198±0.163	Plate
J	1.225±0.040	Grid
K	1.631±0.097	Heater
L	1.645±0.170	Cathode

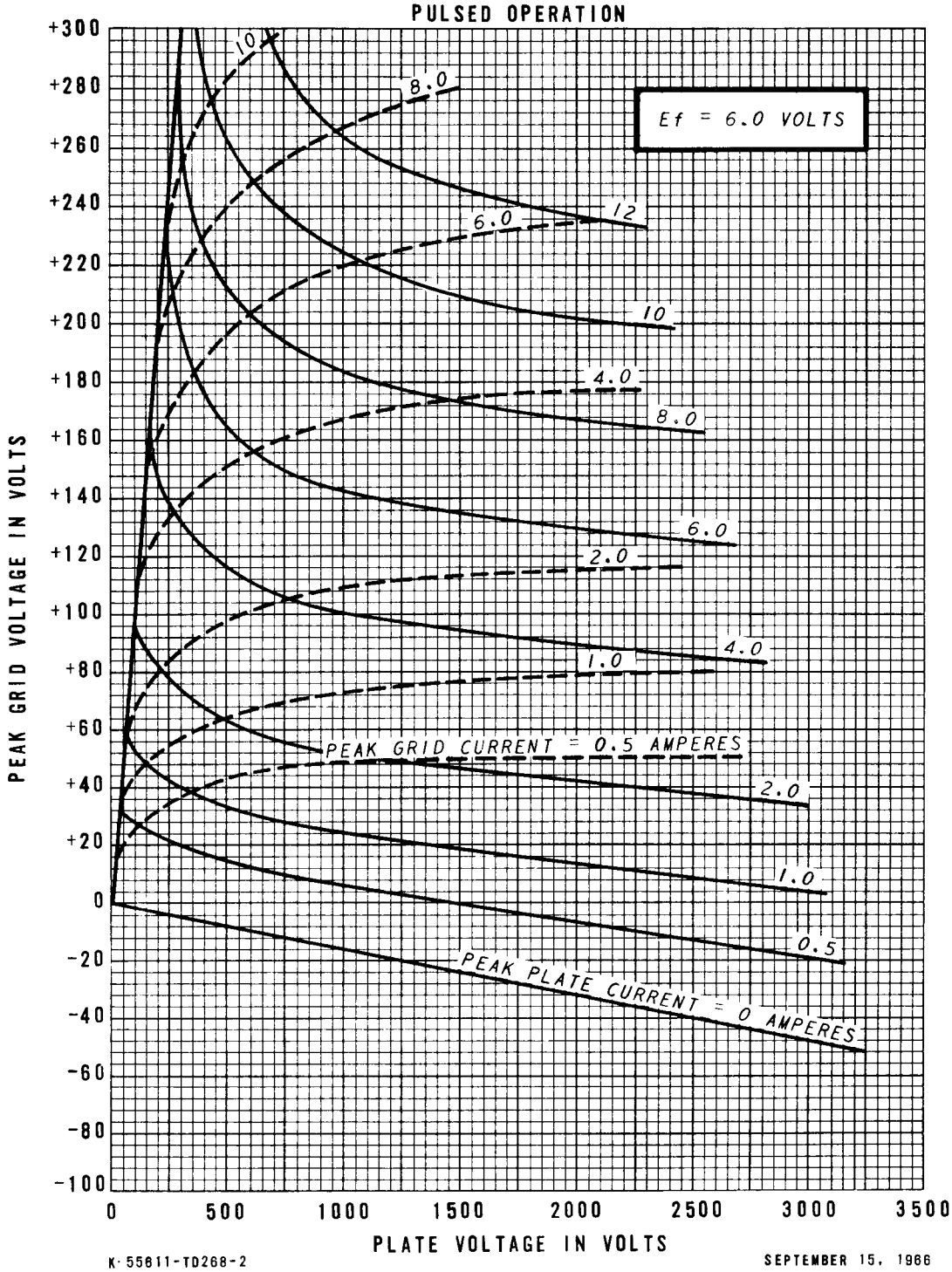
NOTES

1. The total indicated runout of the plate contact surface with respect to the cathode contact surfaces will not exceed 0.020 inch.
2. The total indicated runout of the cathode contact surface with respect to the heater contact surfaces will not exceed 0.012 inch.
3. The total indicated runout of the grid contact surface with respect to the cathode contact surface will not exceed 0.020 inch.
4. Do not clamp or locate on this surface.
5. Hole provided for tube extractor through the top fin only.
6. Measure plate shank temperature on this surface.

AVERAGE PLATE CHARACTERISTICS



AVERAGE CONSTANT-CURRENT CHARACTERISTICS



K-55611-TD268-2

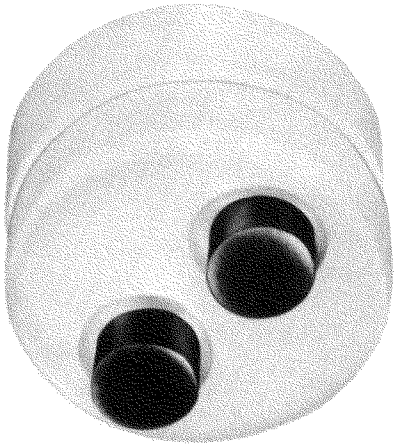
SEPTEMBER 15, 1966

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

7841
METAL-CERAMIC DIODE



DESCRIPTION AND RATING

The 7841 is a cathode-type diode of ceramic-and-metal planar construction intended for detector and low-current rectifier applications.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.3	Volts
Heater Current†	0.215	Amperes
Direct Interelectrode Capacitances§		
Plate to Cathode: (p to k)	1.1	pf
Heater to Cathode: (h to k)	1.2	pf

MECHANICAL

Mounting Position—Any

See outline drawing on page 2 for dimensions and electrical connections.

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES

Peak Inverse Plate Voltage	350	Volts
Steady-State Peak Plate Current	22	Milliamperes
DC Output Current	55	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point**	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 5.0 Milliamperes DC	2.6	Volts

FOOTNOTES

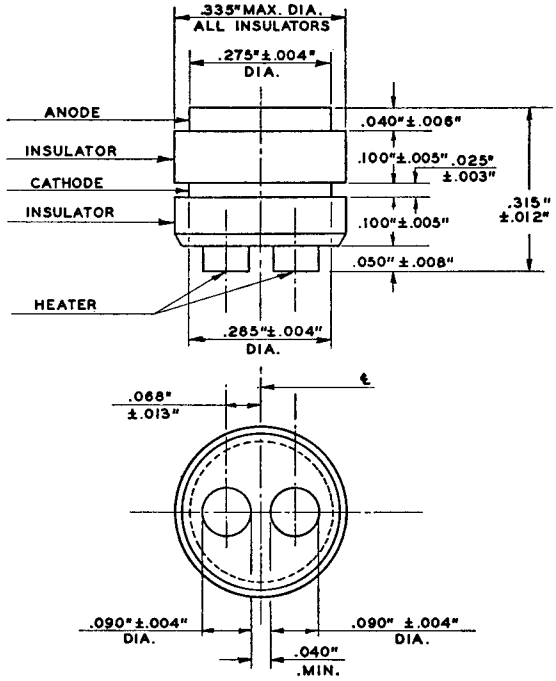
* The equipment designer should design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

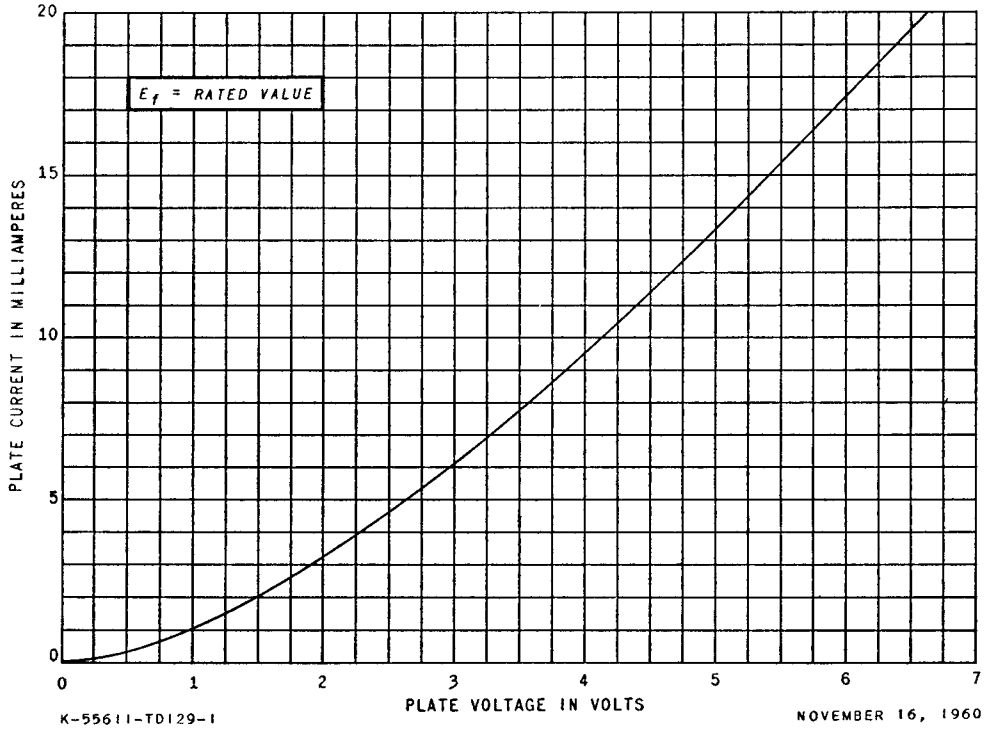
§ Measured using a grounded adapter that provides shielding between external terminals of tube.

**For applications where long life is a primary consideration, it is recommended that the envelope temperature be maintained below 175 C.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.



AVERAGE PLATE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

7910

The 7910 is a triode of ceramic-and-metal planar construction primarily intended for use as a plate-pulsed oscillator or amplifier at frequencies up to 7500 megahertz.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	Eg V	Rk Ohms
Heater Voltage, AC or DC ★	6.0	6.3	6.6	Volts					
Heater Current	268	290	312	Milliamperes	6.3	---	---	---	---
Plate Current	7	12	18	Milliamperes	6.3	125	---	---	82
Amplification Factor	50	75	100		6.3	125	---	---	82
Transconductance	12000	16000	20000	Micromhos	6.3	125	---	---	82
Grid Voltage, Cutoff	---	-3.5	-6	Volts	6.3	125	0.1	---	---
Direct Interelectrode Capacitances ●									
Grid to Plate: (g to p)	0.85	1.05	1.25	pf					
Input: g to (h+k)	1.5	2.1	2.7	pf					
Output: p to (h+k)	---	0.018	0.026	pf					
Cathode Heating Time	60	---	---	Seconds					

PLATE-PULSED OSCILLATOR SERVICE

Frequency	5900	Megahertz
Duty Factor	0.001	
Pulse Duration	1	Microseconds
Pulse Repetition Rate	1000	Pulses Per Second
Peak Positive - Pulse Supply Voltage	1000	Volts
Plate Current: Average During Pulse	0.6	Amperes
Grid Current: Average During Pulse	0.2	Amperes
Power Output: Average During Pulse	100	Watts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. In some applications, longer tube life may be obtained at reduced heater voltage. For specific recommendations, contact your General Electric sales representative.

● Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

GENERAL ELECTRIC

Supersedes PI Sheet dated 7-64

ABSOLUTE-MAXIMUM RATINGS

PLATE-PULSED OSCILLATOR SERVICE

Peak Positive-Pulse Plate Supply Voltage		
1 Microsecond Pulse Duration	1200	Volts
4 Microsecond Pulse Duration	800	Volts
Duty Factor of Plate Pulse	0.001	
Plate Current: Average During Pulse#	0.6	Amperes
Negative Grid Voltage: Average During Pulse	50	Volts
Grid Current: Average During Pulse	0.2	Amperes
Plate Dissipation	1.5	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point▲	250	°C
Temperature Differential Between Two Adjacent Electrodes♦	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	10	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

NOTES

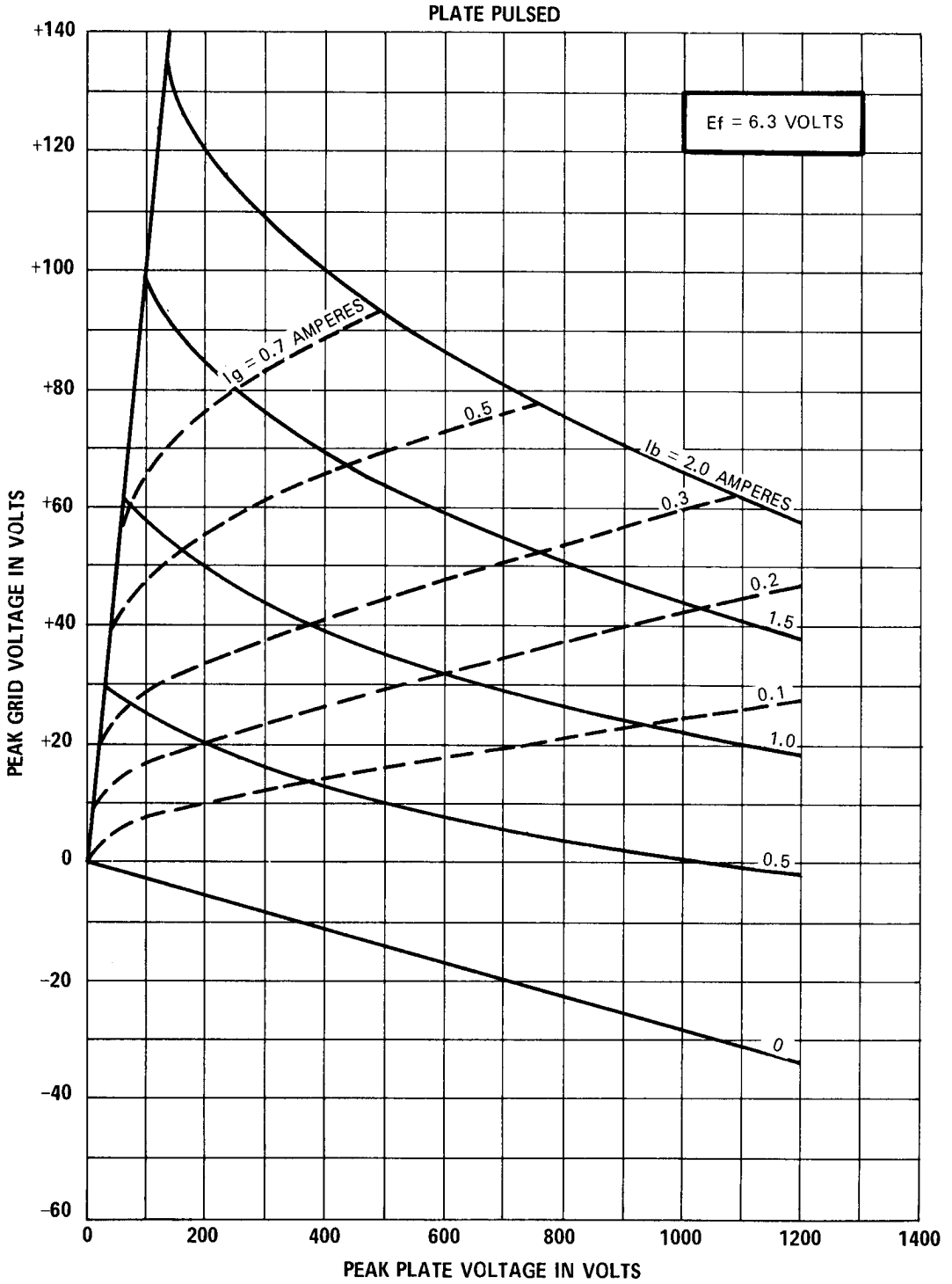
\# The regulation and/or series plate supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 10 times the maximum plate current rating.

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

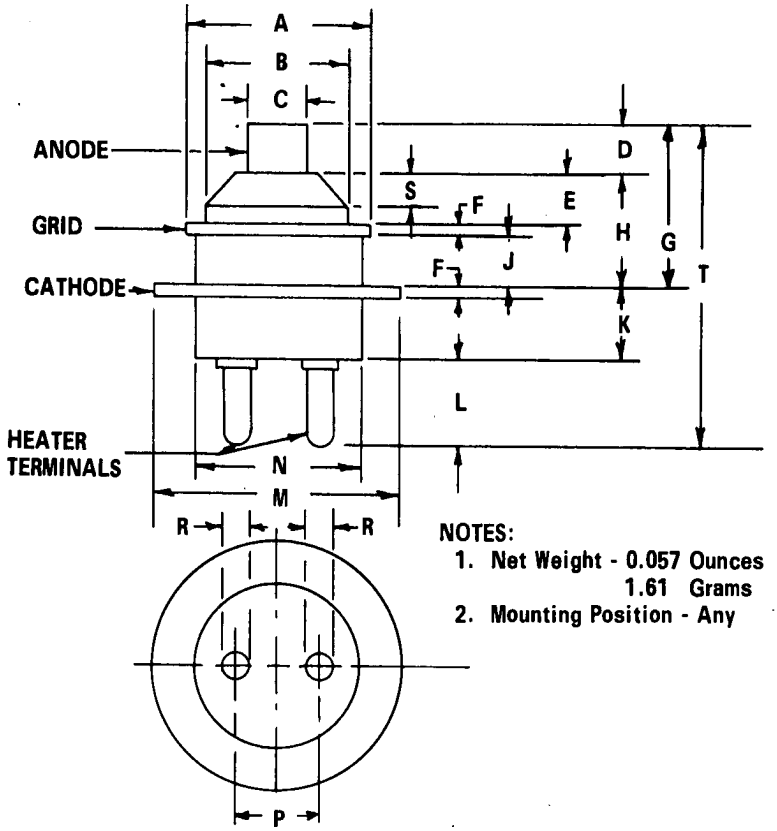
♦ This assumes no thermal heat sinking to any insulator.

The devices and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of devices by General Electric Company conveys any license under patent claims covering combinations of these devices with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of these devices with other devices or elements by any purchaser or others.

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



NOTES:
1. Net Weight - 0.057 Ounces
   1.61 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.357	0.360	0.363	9.068	9.144	9.220
B	---	---	0.285	---	---	7.239
C	0.108	0.110	0.112	2.743	2.794	2.845
D	0.095	0.100	0.105	2.413	2.540	2.667
E	0.095	0.100	0.105	2.413	2.540	2.667
F	0.025	0.028	0.031	0.635	0.711	0.787
G	0.315	0.325	0.335	8.001	8.225	8.509
H	0.216	0.224	0.232	5.486	5.690	5.893
J	0.094	0.098	0.102	2.388	2.489	2.591
K	0.143	0.150	0.157	3.632	3.810	3.988
L	0.165	0.175	0.185	4.191	4.445	4.699
M	0.476	0.480	0.484	12.09	12.19	12.29
N	---	---	0.330	---	---	8.458
P	0.130	0.136	0.142	3.302	3.454	3.607
R	0.048	0.051	0.054	1.219	1.295	1.372
S	---	0.060	---	---	1.524	---
T	0.623	0.650	0.677	15.82	16.51	17.20

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

7911

FOR PLATE-PULSED OSCILLATOR OR AMPLIFIER APPLICATIONS

The 7911 is a high-mu triode of ceramic and metal planar construction intended for use as a plate-pulsed oscillator or amplifier at frequencies up to 6000 megahertz.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC★	6.3 ± 0.3	Volts
Heater Current●	0.55	Amperes
Direct Interelectrode Capacitances♦		
Grid to Plate: (g to p)	1.4	pf
Input: g to (h + k)	5.0	pf
Output: p to (h + k)	0.05	pf

MECHANICAL

Operating Position - Any

See Outline Drawing on page 3 for dimensions and electrical connections

MAXIMUM RATINGS

PLATE-PULSED OSCILLATOR OR AMPLIFIER SERVICE—ABSOLUTE-MAXIMUM VALUES

Cathode Heating Time, minimum	60	Seconds
Peak Positive-Pulse Plate Supply Voltage	3000	Volts
Duty Factor of Plate Pulse■▲	0.001	
Pulse Duration	2.0	Microseconds
Plate Current		
Average▲	2.5	Milliamperes
Average During Plate Pulse□	2.5	Amperes
Negative Grid Voltage		
Average During Plate Pulse	100	Volts
Grid Current		
Average▲	1.0	Milliamperes
Average During Plate Pulse	1.0	Amperes
Cathode Current		
Average▲	3.0	Milliamperes
Average During Plate Pulse□	3.0	Amperes
Plate Dissipation▲	6.5	Watts
Peak Heater-Cathode Voltage		
Heater Positive with respect to Cathode	50	Volts
Heater Negative with respect to Cathode	50	Volts
Envelope Temperature at Hottest Point	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

GENERAL ELECTRIC

Supersedes PI Sheet dated 12-68

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	200	Volts
Cathode-Bias Resistor	100	Ohms
Amplification Factor	58	
Plate Resistance, approximate	2300	Ohms
Transconductance	25000	Micromhos
Plate Current	23	Milliamperes
Grid Voltage, approximate		
Ib = 100 Microamperes	-5	Volts

PLATE-PULSED OSCILLATOR SERVICE

Frequency	4100	MHz
Heater Voltage	6.3	Volts
Duty Factor	0.001	
Pulse Duration	1.0	Microseconds
Pulse Repetition Rate	1000	Pulses per Second
Peak Positive-Pulse Supply Voltage	3000	Volts
Plate Current		
Average	2.5	Milliamperes
Average During Plate Pulse	2.5	Amperes
Grid Current		
Average	0.3	Milliamperes
Average During Plate Pulse	0.3	Amperes
Useful Power Output		
Average	2.2	Watts
Average During Plate Pulse	2.2	Kilowatts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

♦ Measured using a grounded adapter that provides shielding between external terminals of the tube.

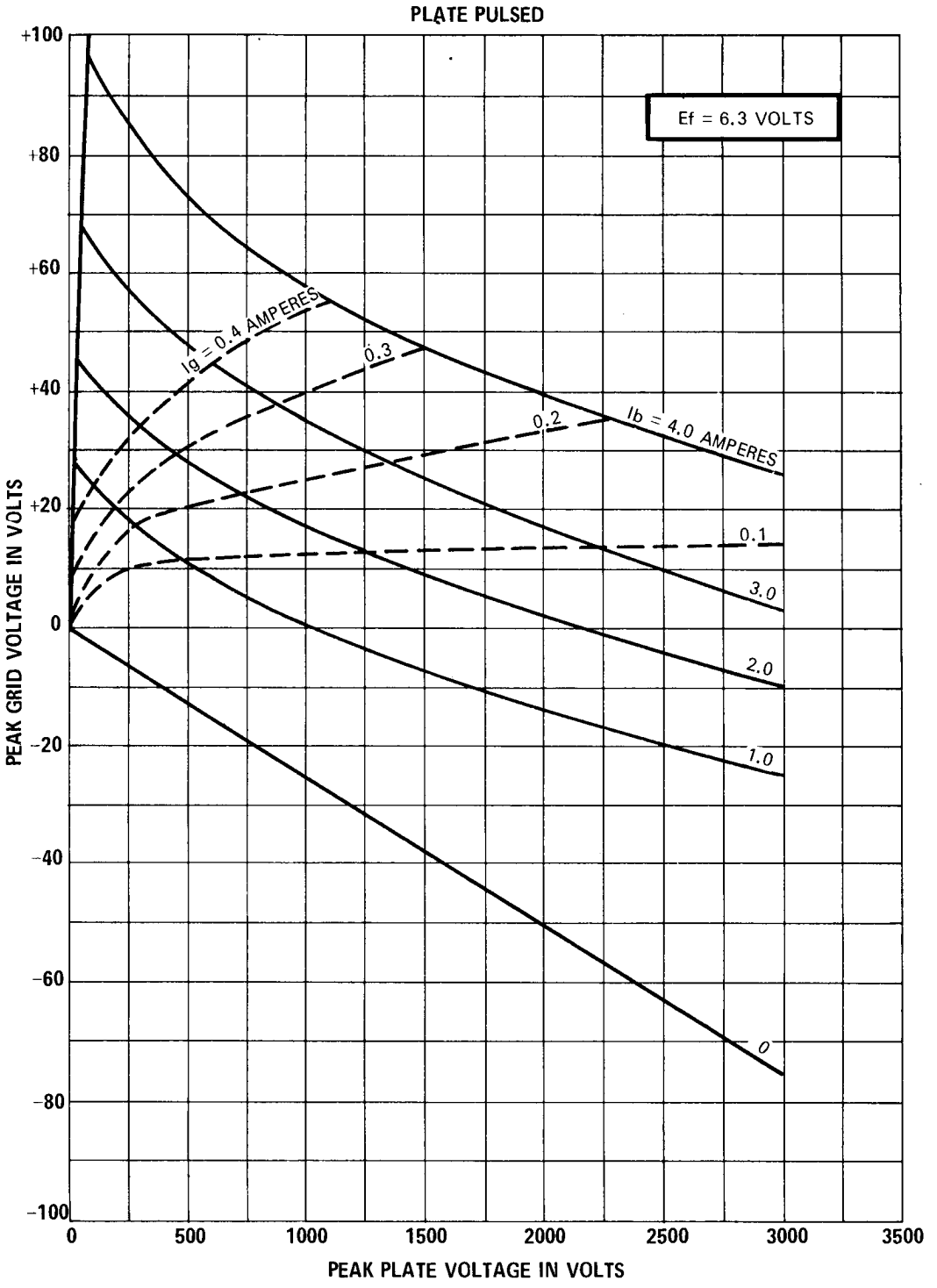
■ Applications with a duty factor greater than 0.001 should be referred to your General Electric tube sales representative for recommendation.

▲ In any 5000 microsecond interval.

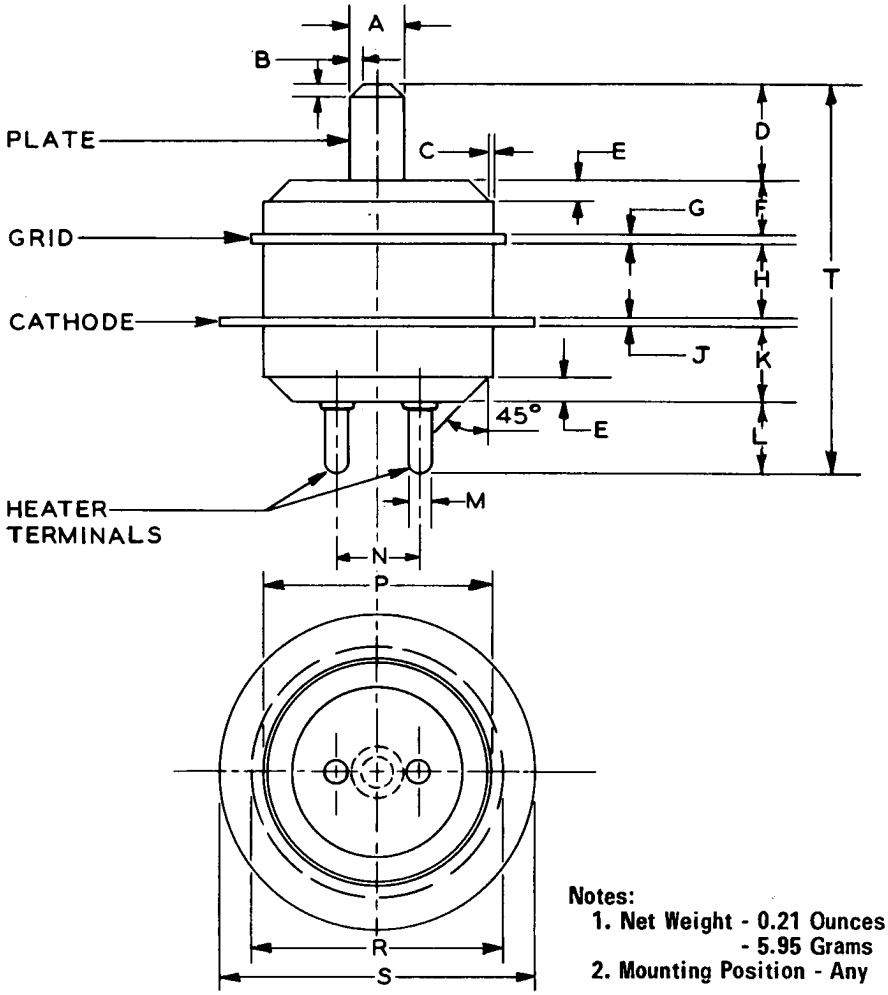
□ The regulation and/or series plate-supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 25 amperes.

The devices and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of devices by General Electric Company conveys any license under patent claims covering combinations of these devices with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of these devices with other devices or elements by any purchaser or others.

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



Notes:
1. Net Weight - 0.21 Ounces
- 5.95 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.122	0.125	0.128	3.099	3.175	3.251
B	---	0.030	---	---	0.762	---
C	---	0.005	---	---	0.127	---
D	0.220	0.225	0.230	5.588	5.715	5.842
E	0.040	0.050	0.060	1.016	1.270	1.524
F	0.120	0.125	0.130	3.048	3.175	3.302
G	0.025	0.028	0.031	0.635	0.711	0.787
H	0.167	0.172	0.177	4.242	4.369	4.496
J	0.025	0.028	0.031	0.635	0.711	0.787
K	0.170	0.175	0.180	4.318	4.445	4.572
L	0.170	0.175	0.180	4.318	4.445	4.572
M	0.047	0.050	0.053	1.194	1.270	1.346
N	0.185	0.200	0.215	4.699	5.080	5.461
P	0.535	0.550	0.565	13.59	13.97	14.35
R	0.598	0.603	0.608	15.19	15.32	15.44
S	0.748	0.753	0.758	19.00	19.13	19.25
T	0.897	0.928	0.959	22.78	23.57	24.36

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONICS

7913

METAL-CERAMIC TRIODE

DESCRIPTION AND RATING

The 7913 is a high-mu triode of ceramic-and-metal planar construction primarily intended for use as an oscillator or radio-frequency power amplifier.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.3	Volts
Heater Current‡	0.4	Amperes
Direct Interelectrode Capacitances§		
Grid to Plate: (g to p)	2.4	pf
Input: g to (h + k)	6.0	pf
Output: p to (h + k)	0.03	pf
Heater to Cathode: (h to k)	2.4	pf

MECHANICAL

Operating Position - Any

See Outline Drawing on page 3 for dimensions and electrical connections.

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Plate Voltage	330	Volts
Plate Dissipation	5.5	Watts
DC Grid Current	10	Milliamperes
DC Cathode Current	30	Milliamperes
Peak Cathode Current	120	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid-Circuit Resistance		
With Fixed Bias	0.025	Megohms
With Cathode Bias	0.1	Megohms
Envelope Temperature at Hottest Point	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

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The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

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CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	200	Volts
Cathode-Bias Resistor	47	Ohms
Amplification Factor	100	
Plate Resistance, approximate	2500	Ohms
Transconductance	40000	Micromhos
Plate Current	25	Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes	-4.5	Volts

UHF OSCILLATOR SERVICE

Frequency	400	Megacycles
Plate Voltage	300	Volts
Grid Resistor	1500	Ohms
Plate Current	25	Milliamperes
Grid Current, approximate	5	Milliamperes
Power Output, approximate	4	Watts

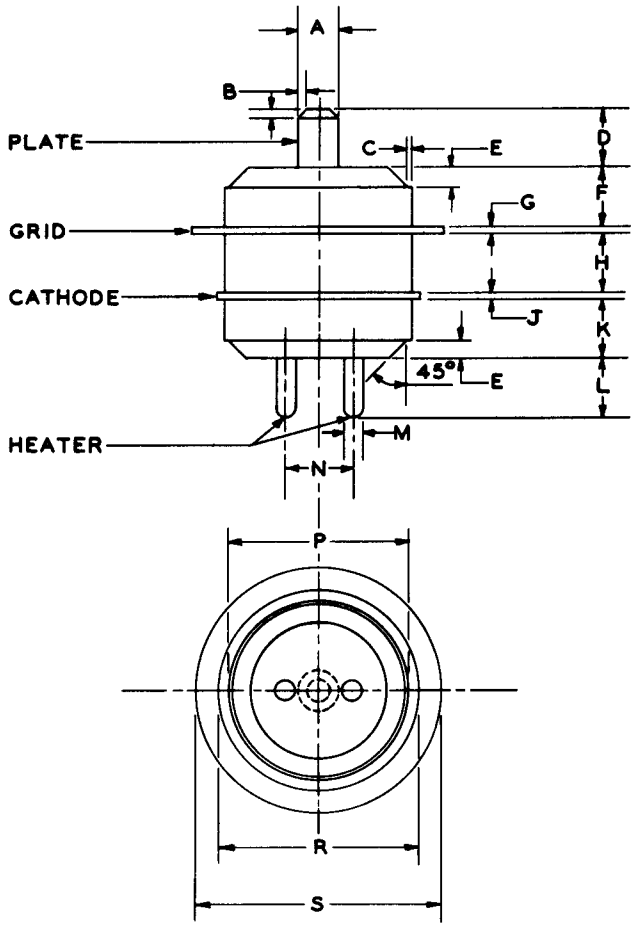
NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

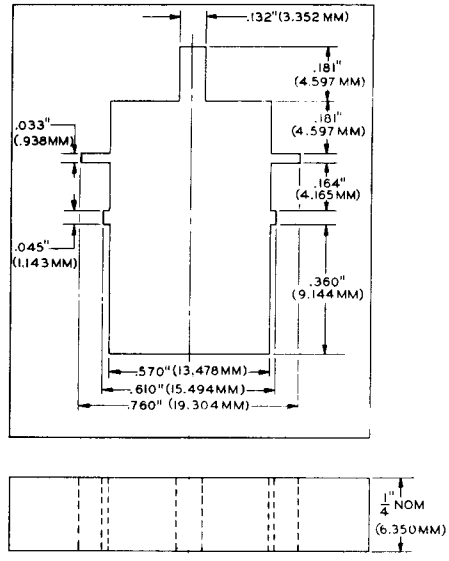
‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

PHYSICAL DIMENSIONS



ALIGNMENT GAUGE

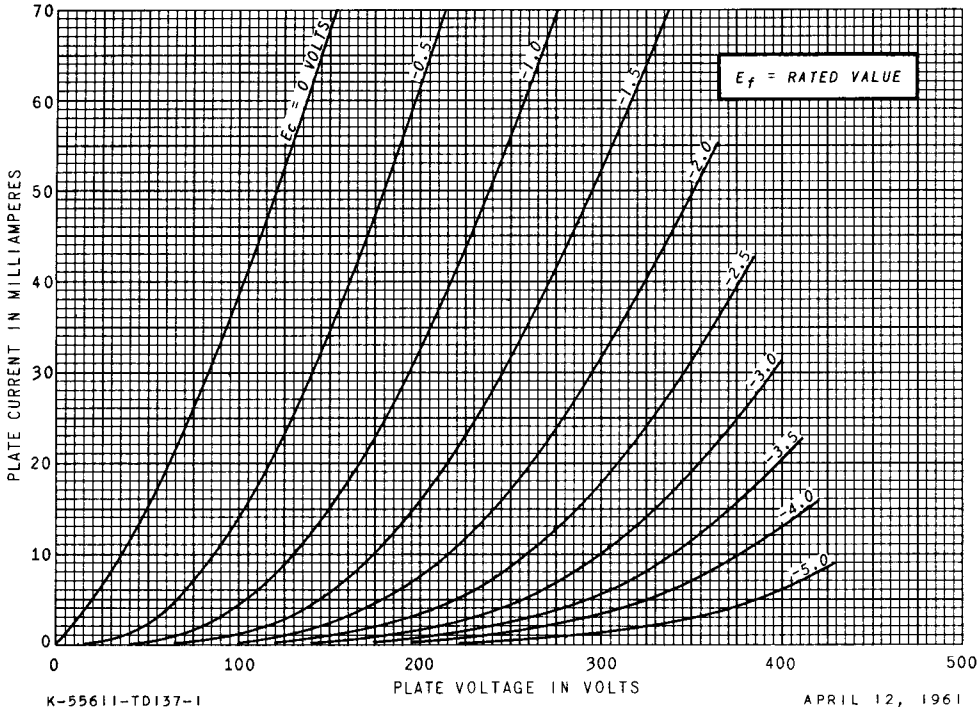


Note: Tolerances are ±0.001 inches or ±0.025 millimeters, unless otherwise indicated.

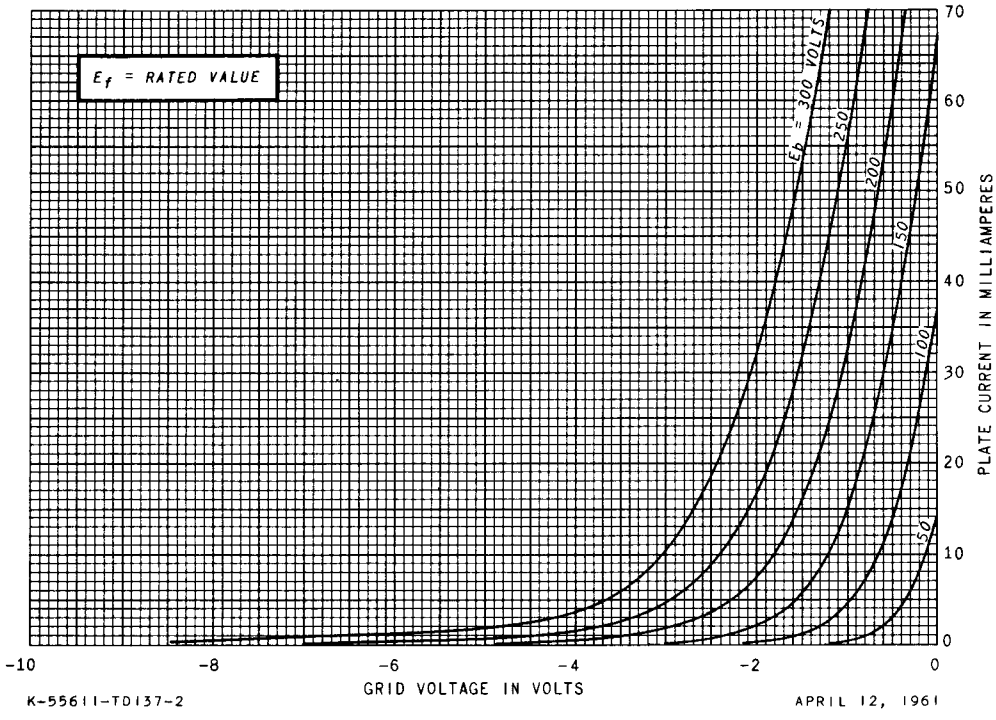
Ref.	INCHES			MILLIMETERS		
	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
A	0.122		0.128	3.099		3.251
B		0.030			0.76	
C		0.005			0.13	
D	0.170		0.180	4.32		4.57
E	0.040		0.060	1.02		1.52
F	0.165		0.175	4.19		4.45
G	0.025		0.031	0.635		0.787
H	0.167		0.177	4.24		4.50
J	0.025		0.031	0.635		0.787
K	0.170		0.180	4.32		4.57
L	0.170		0.180	4.32		4.57
M	0.047		0.053	1.194		1.346
N	0.185		0.215	4.70		5.46
P	0.535		0.565	13.59		14.35
R	0.598		0.608	15.19		15.44
S	0.748		0.758	19.00		19.25

Note: The millimeter dimensions are derived from the original inch dimensions.

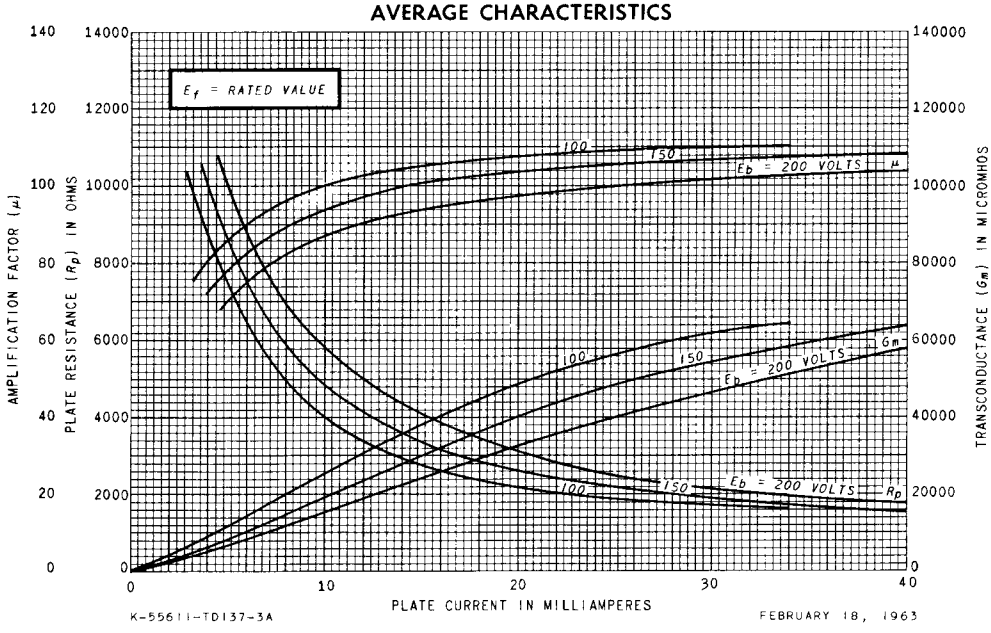
AVERAGE PLATE CHARACTERISTICS



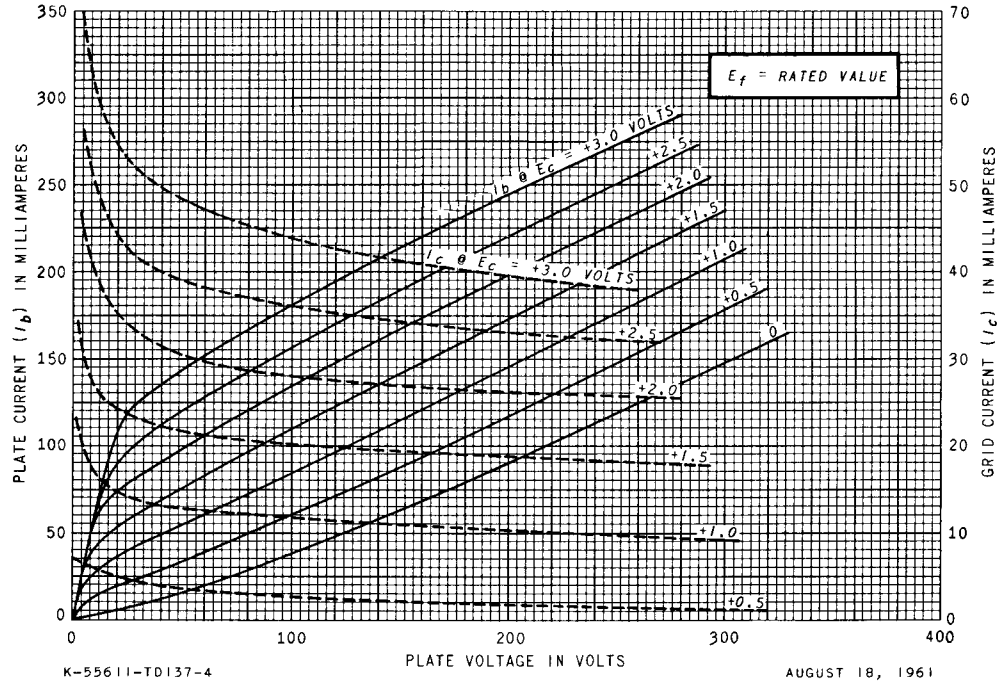
AVERAGE TRANSFER CHARACTERISTICS



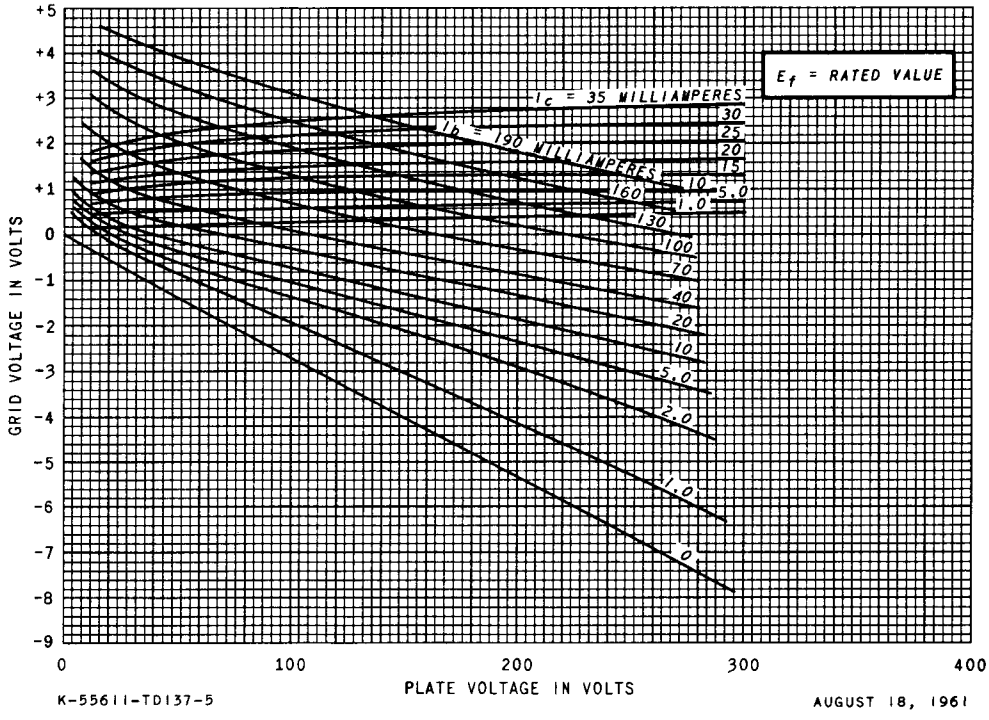
AVERAGE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



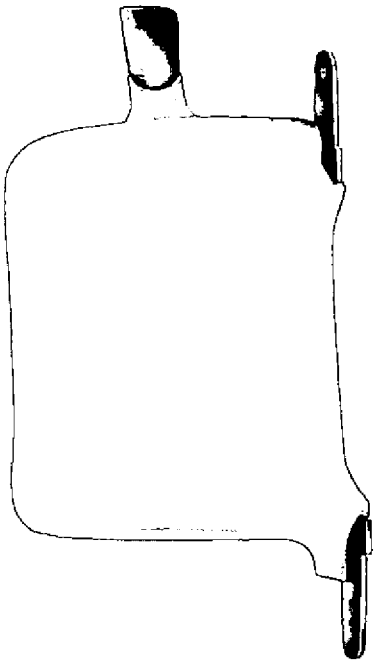
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky



GL-7964

TRIGGERED SPARK GAP

MINIATURE SWITCHING DEVICE **3 KILOVOLTS**

18 JOULES

The GL-7964 is a small, cold cathode, gaseous, triggered spark gap capable of switching 18 joules of energy at high voltages. Since the device does not require external energy to initiate the discharge its use permits both equipment cost reduction and savings in space through component elimination.

Mechanical features include rugged metal-ceramic construction, ability to withstand high shock and vibration conditions, and reliable operation over temperatures ranging from as low as −80 to as high as +200 F.

The GL-7964 is especially designed to deliver short rapid pulses of current with minimum delay and jitter in applications where high hold-off voltages and low leakage currents exist.

Applications include switching single stored electrical energy systems into low impedance loads, or energy storage capacitors into resistive or inductive loads.

Electrical

Heater Voltage	None Required

Mechanical

Mounting Position	Any
Net Weight	0.3 Ounces

Thermal

Ambient Temperature Range	−80 to +200 F

MAXIMUM RATINGS

Interelectrode Leakage Resistance	10,000	Megohms
Main Gap		
Operating Voltage	2.0 to 2.6	Kilovolts
Hold-off Voltage		
Indefinite	3	Kilovolts
10 Minutes	3.6	Kilovolts
Peak Current		
Ringing*, maximum	1500	Amperes
Unidirectional Pulse, maximum	4000	Amperes
Pulse Duration, maximum	10	Microseconds
Dissipation, approximate	60	Volts
Delay Time† @ V_{APP} 2600 volts	1.5	Microseconds
Jitter‡	0.5	Microseconds

Trigger		
Firing Voltage, minimum§	5000	Volts
Peak Firing Current, maximum	5	Amperes
Firing Pulse Duration, maximum**	10	Microseconds

* 1500 amperes for the first half cycle of a 10–12 kc ringing frequency, circuit should be sufficiently damped to pass only 5–6 cycles.

† Main gap delay time is defined as the interval of time between application of ½ maximum trigger voltage and initiation of ½ maximum current conduction.

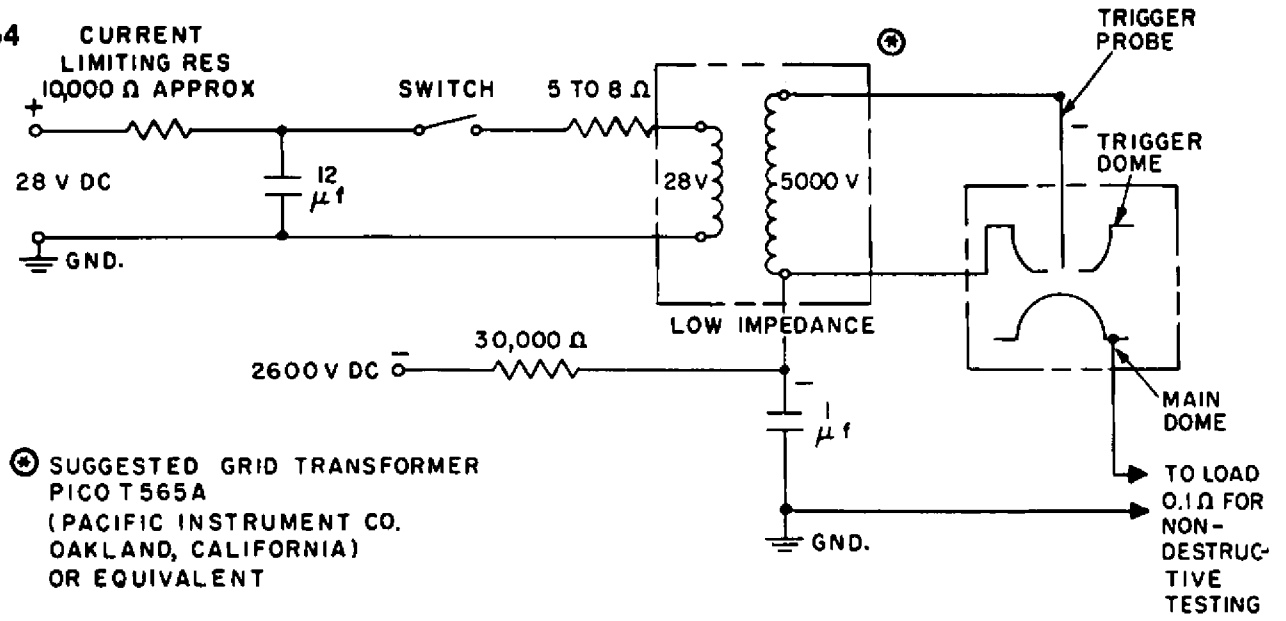
‡ Main gap jitter is defined as the variation in main-gap delay time.

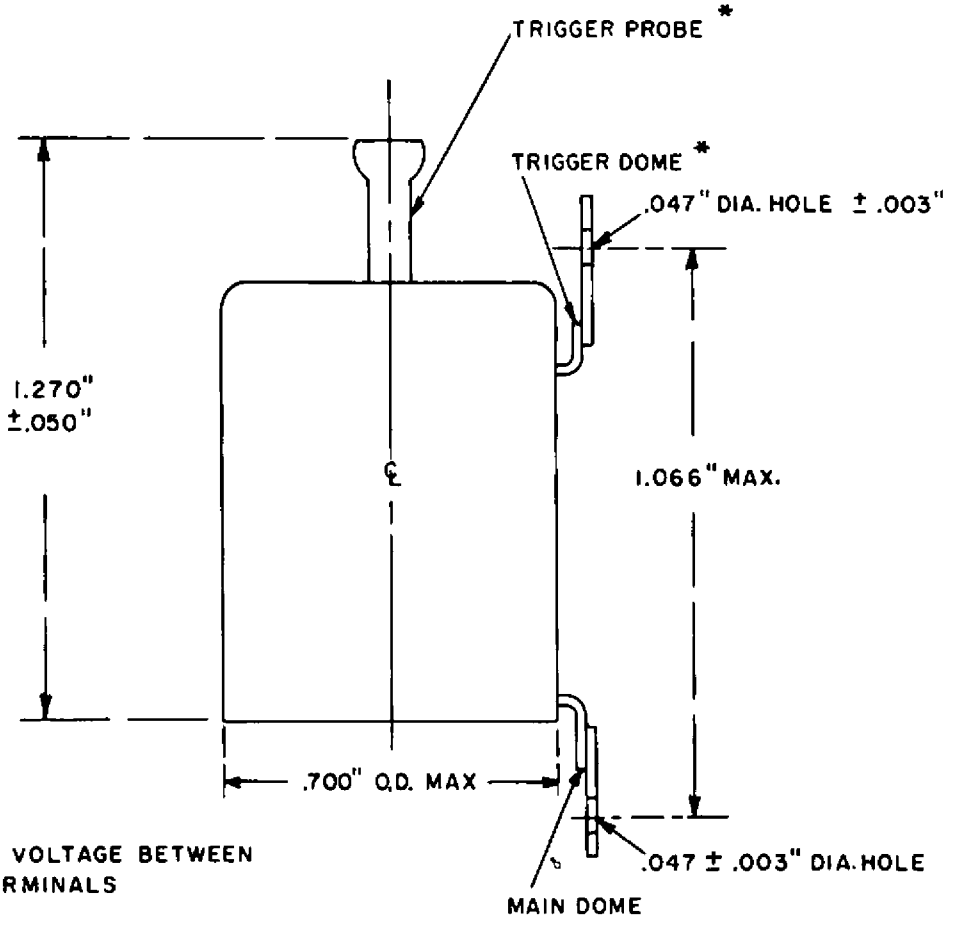
§ Breakdown to occur on leading edge of pulse having a rise time of 0.5 microseconds where rise time is defined as the interval of time between 10 percent and 90 percent of the trigger voltage pulse.

**Measured at a point between 10 to 90 percent of initial rise to a point 90 percent of current maximum on trailing edge of pulse.

from JEDEC release #3178, March 6, 1961

GENERAL ELECTRIC





ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.

ELECTRONICS

7984

COMPACTRON BEAM PENTODE

FOR RADIO-FREQUENCY POWER AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 7984 is a compactron beam pentode designed for use as a radio-frequency power amplifier in mobile communications equipment. In this service, it is capable of delivering a power output of 46 watts* at 175 megacycles.

Features of the 7984 include a single-ended construction, low seated height, short internal leads, multiple cathode and screen connections, and low driving-power requirements.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC‡	13.5±1.5	Volts
Heater Current§	0.58	Amperes

Direct Interelectrode Capacitances¶

Grid-Number 1 to Plate: (g1 to p)	0.16	pf
Input: g1 to (h + k + g2 + b.p.)	16	pf
Output: p to (h + k + g2 + b.p.)	6.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - E12-74, Button 12-Pin
Outline Drawing - EIA 12-56

Maximum Diameter	1.563	Inches
Maximum Over-all Length	2.875	Inches
Maximum Seated Height	2.500	Inches

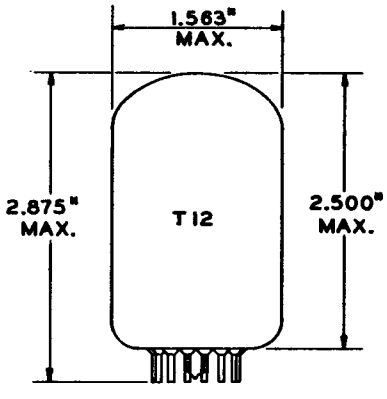
MAXIMUM RATINGS

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

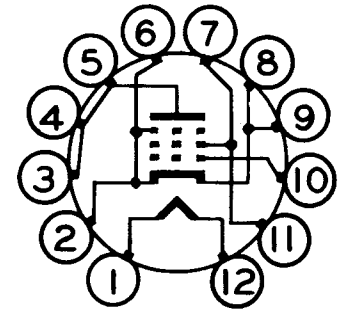


EIA 12-56

TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode and Beam Plates
‡‡Pin 3 - Plate
‡‡Pin 4 - Plate
‡‡Pin 5 - Plate
Pin 6 - Cathode and Beam Plates
Pin 7 - Grid Number 2 (Screen)
Pin 8 - Cathode and Beam Plates
Pin 9 - Cathode and Beam Plates
Pin 10 - Grid Number 1
Pin 11 - Grid Number 2 (Screen)
Pin 12 - Heater

BASING DIAGRAM



EIA 12EU

MAXIMUM RATINGS (Cont'd)

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY AND RADIO-FREQUENCY POWER AMPLIFIER—CLASS C FM TELEPHONY

ABSOLUTE-MAXIMUM VALUES

	CCS#	ICAS△	IMS**	
DC Plate Voltage	600	750	750	Volts
DC Screen Voltage	250	250	250	Volts
DC Grid-Number 1 Voltage	-100	-100	-100	Volts
DC Plate Current	150	150	180	Milliamperes
DC Grid-Number 1 Current	6.0	6.0	6.0	Milliamperes
Screen Input	3.0	3.0	3.0	Watts
Plate Dissipation	20	25	35	Watts
Peak Heater-Cathode Voltage				
Heater Positive with Respect to Cathode	100	100	100	Volts
Heater Negative with Respect to Cathode	100	100	100	Volts
Bulb Temperature at Hottest Point	220	220	220	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	200	Volts
Screen Voltage	125	Volts
Grid-Number 1 Voltage	-7.5	Volts
Plate Current	125	Milliamperes
Screen Current	4.5	Milliamperes
Transconductance	13500	Micromhos

TYPICAL OPERATION AS CLASS C AMPLIFIER

	CCS#	ICAS△	IMS**	
Frequency	175	175	175	Megacycles
DC Plate Voltage	315	375	450	Volts
DC Screen Voltage	165	160	200	Volts
DC Grid-Number 1 Voltage, approximate	-74	-80	-60	Volts
Grid-Number 1 Resistor	20000	20000	15000	Ohms
DC Plate Current	150	150	180	Milliamperes
DC Screen Current	8.5	8.5	12	Milliamperes
DC Grid-Number 1 Current, approximate	3.7	4	4	Milliamperes
Driving Power, approximate	2	2	2	Watts
Power Output, approximate*	26.5	32	46	Watts

NOTES

* This is the power output of the tube. Power output measured at the load will be less because of tank-circuit losses.

‡ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

§ Heater current of a bogey tube at Ef = 13.5 volts.

¶ Without external shield.

\# Continuous Commercial Service (CCS) is defined as that type of service in which normal tube life and reliability of performance under continuous operating conditions are the prime consideration.

△ Intermittent Commercial and Amateur Service (ICAS) is defined to include the many applications where the transmitter design factors of minimum size, light weight, and considerably increased power output are more important than long tube life. In this service, life expectancy may be one-half that obtained in Continuous Commercial Service.

Under the ICAS classification are such applications as the use of tubes in amateur transmitters, and the use of tubes in equipment where transmissions are of intermittent nature. The term "intermittent" is used to identify operation conditions in all applications other than amateur in which no operating or "on" period exceeds 5 minutes and every "on" period is followed by an "off" or standby period of at least the same or greater duration.

NOTES (Cont'd)

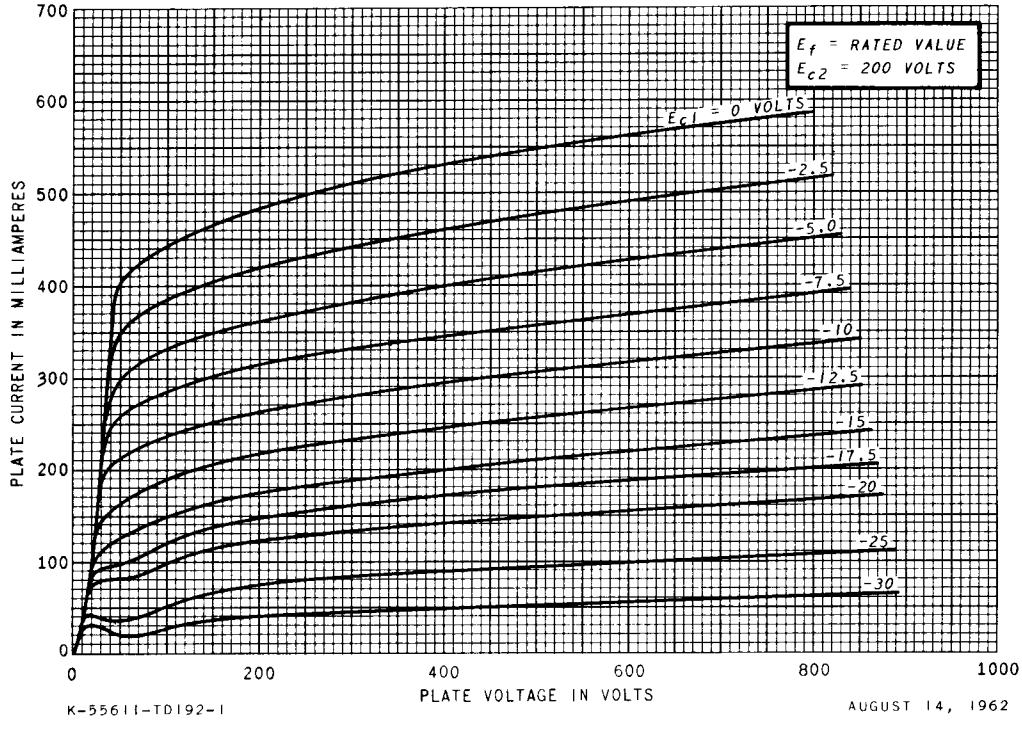
** Intermittent Mobile Service (IMS) is defined to include those applications, such as aircraft, where the transmitter design factors of minimum size, light weight, and exceedingly high power output for short intervals are the primary requirements, even though the average life expectancy of tubes used in such transmitters is reduced. Tube ratings for IMS service are established on the basis that the transmissions have maximum "on" periods of 15 seconds followed by "off" periods of at least 60 seconds, except that it is permissible to make equipment tests with maximum "on" periods of 5 minutes followed by "off" periods of at least 5 minutes provided the total "on" time of such periods does not exceed 10 hours during the life of any tube.

Although the use of tubes under IMS ratings involve great reduction in tube life, such use can be justified as economical practice in applications where high power is intermittently desired for small tubes.

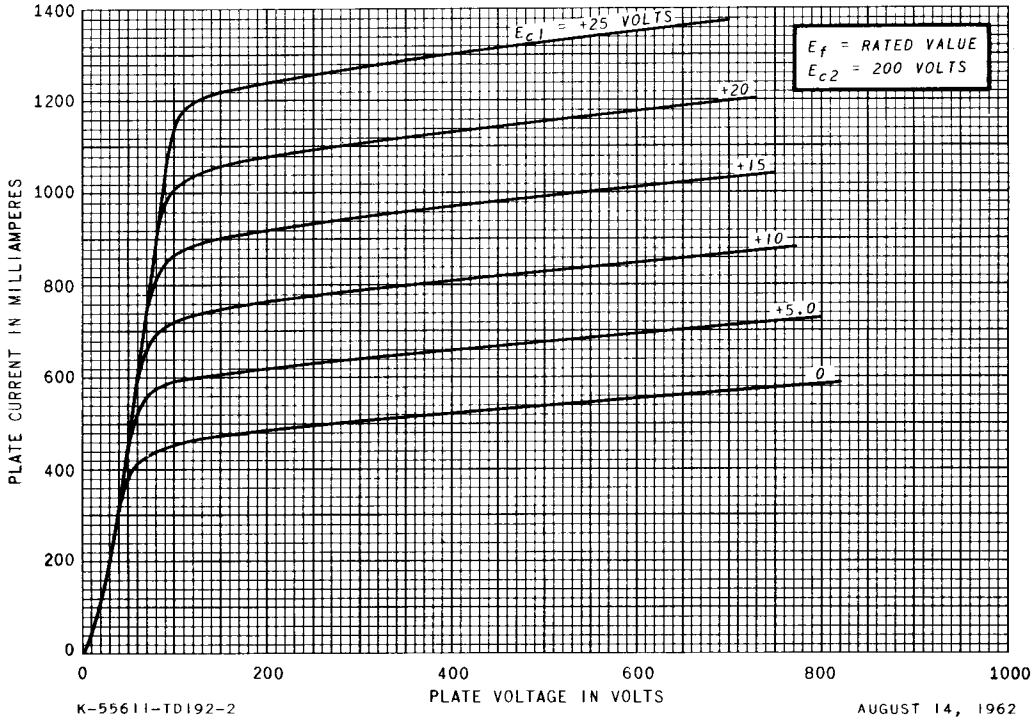
‡‡ Socket contacts for these three pins should be connected together.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

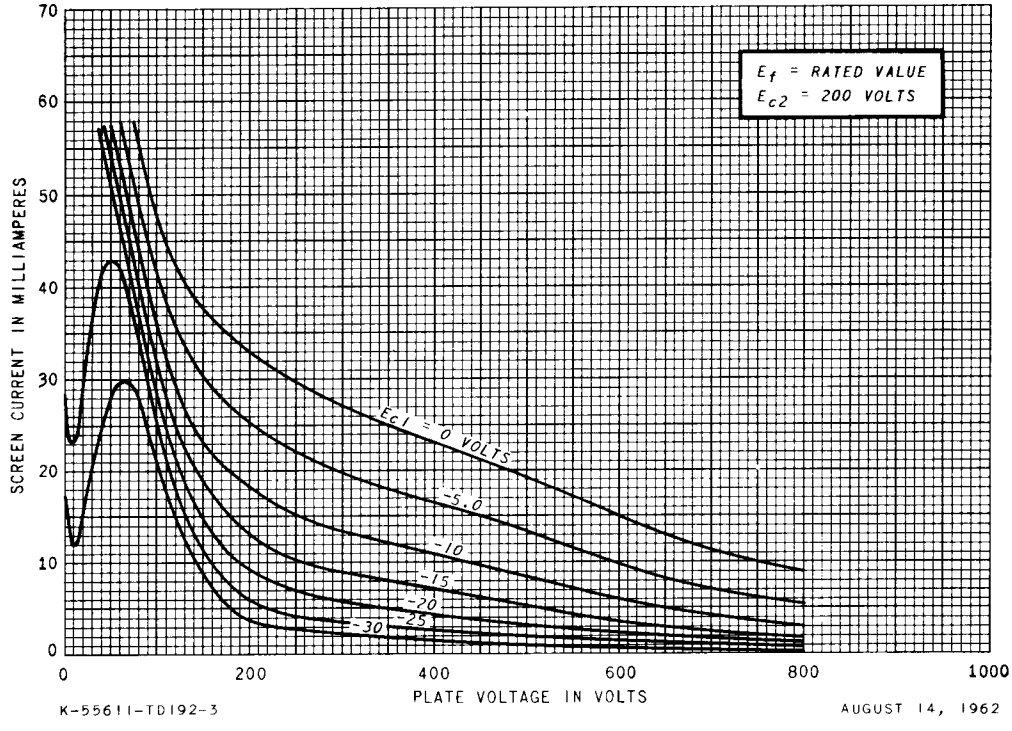
AVERAGE PLATE CHARACTERISTICS



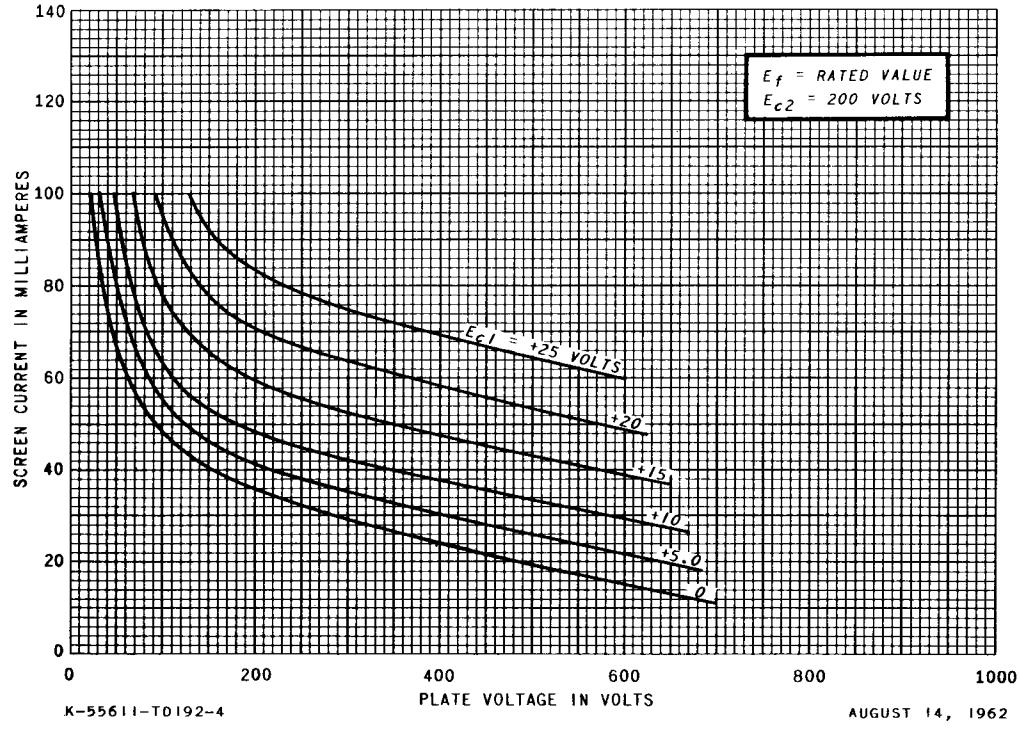
AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



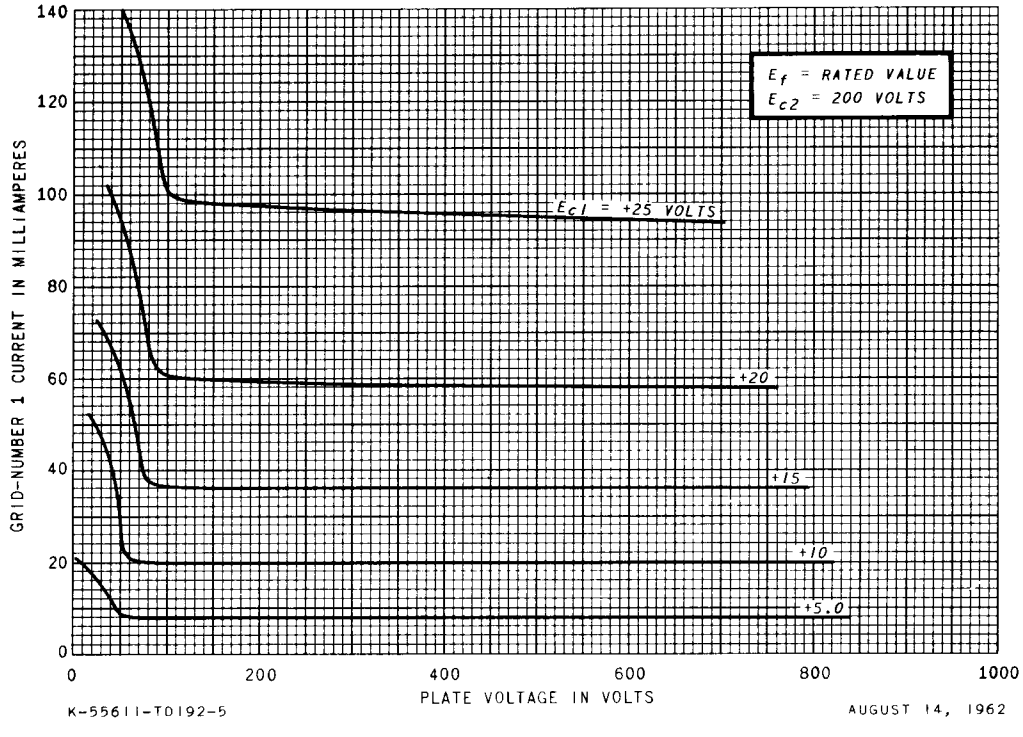
AVERAGE CHARACTERISTICS



K-55611-TD192-4

AUGUST 14, 1962

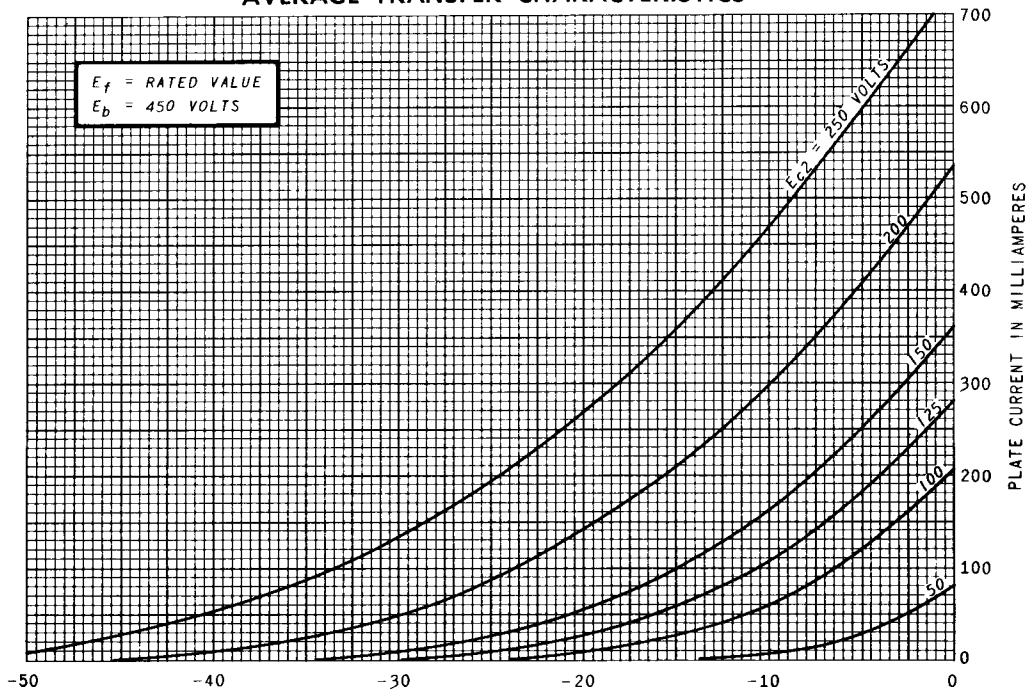
AVERAGE CHARACTERISTICS



K-55611-TD192-5

AUGUST 14, 1962

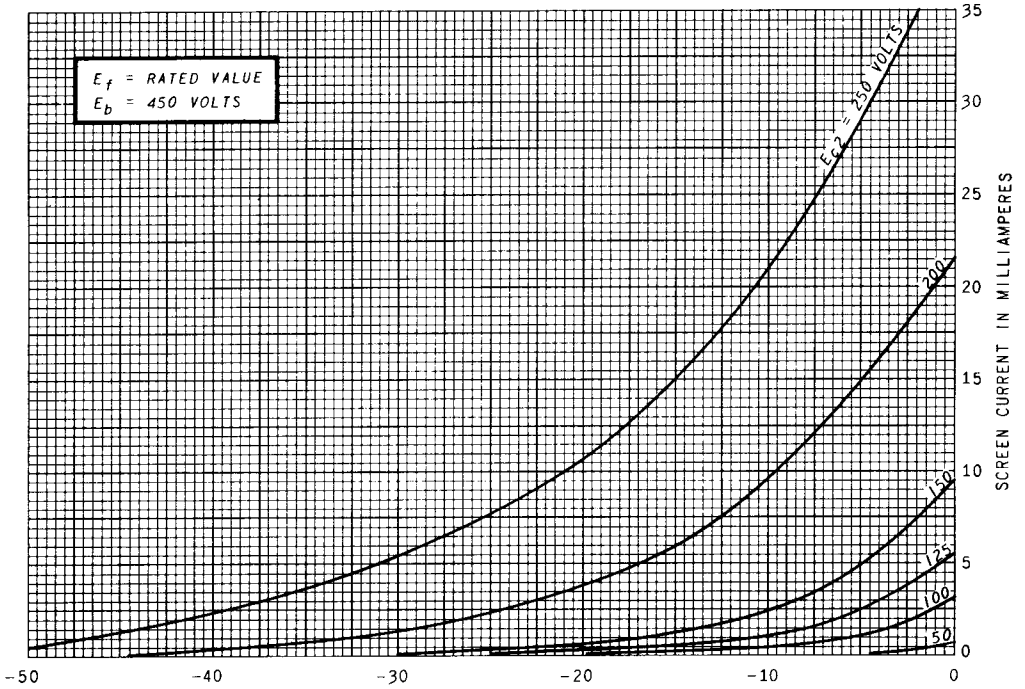
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD192-6

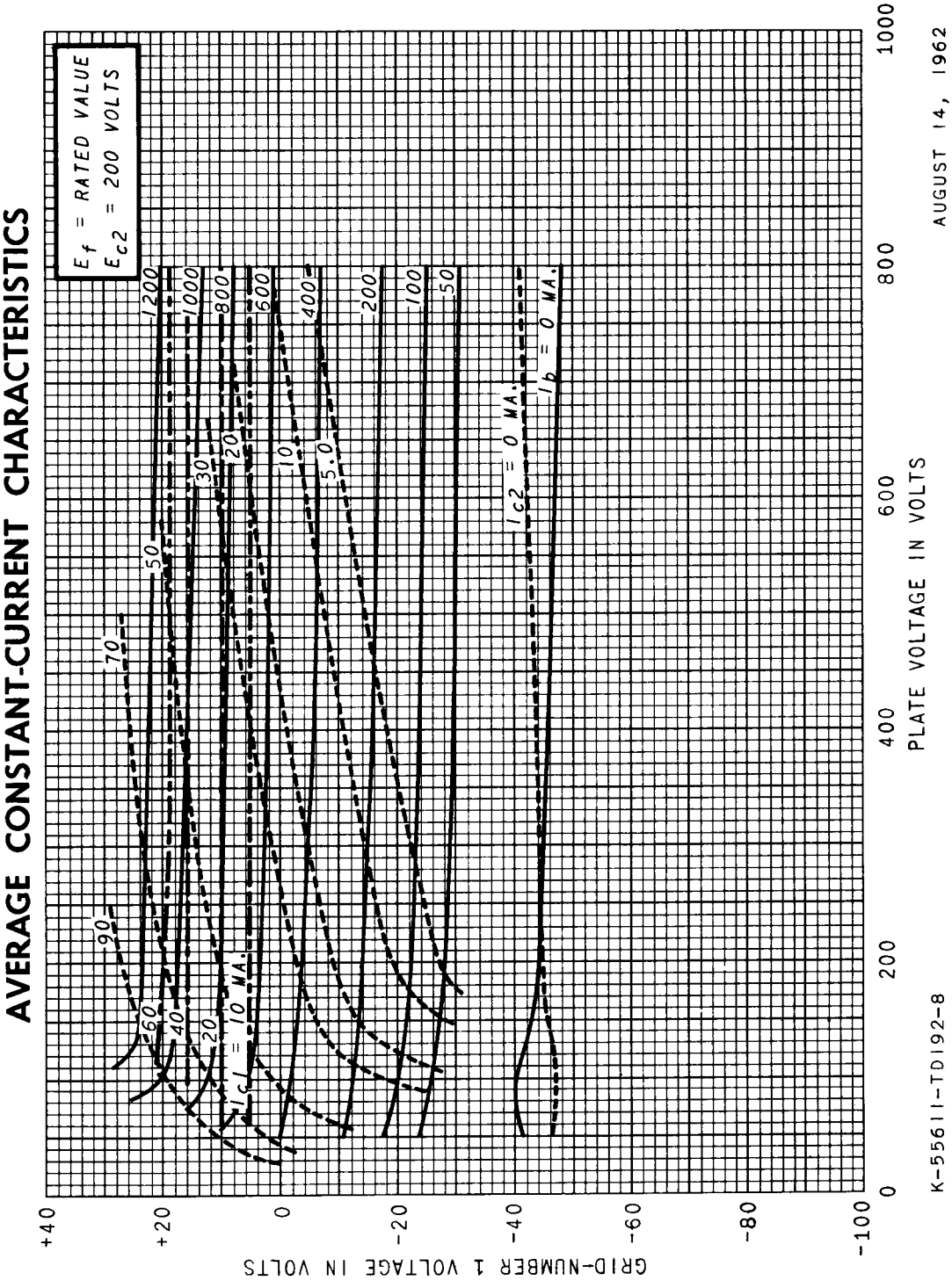
AUGUST 14, 1962

AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD192-7

AUGUST 14, 1962


AVERAGE CONSTANT-CURRENT CHARACTERISTICS
E_f = RATED VALUE
E_{c2} = 200 VOLTS
I_{c1} = 10 MA.
I_{c2} = 0 MA.
I_b = 0 MA.
90
70
60
50
40
30
20
10
5.0
1200
1000
800
600
400
200
100
50
+40
+20
0
-20
-40
-60
-80
-100
GRID-NUMBER 1 VOLTAGE IN VOLTS
0
200
400
600
800
1000
PLATE VOLTAGE IN VOLTS
K-5561I-TD192-8
AUGUST 14, 1962

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

from JEDEC release #3769, June 18, 1962

GL-7998
COAXIAL IGNITRON

FREQUENCY-CHANGER WELDER SERVICE
2250 AMPERES PEAK

The GL-7998 is a sealed, stainless-steel-jacketed, water-cooled ignitron for use in electronic-contactor and resistance-welding-control service, both single-phase and three-phase. It is a coaxial-design version of the GL-7681.

In AC-control service two tubes in an inverse-parallel connection will control 1800 kilovolt-amperes at 440 to 600 volts RMS, 25 to 60 cycles. In frequency-changer welder service six tubes will control 2250 amperes peak at 1200 volts inverse.

In the coaxial construction current flows through the tube from anode to cathode, then up the tube wall to a coaxial cathode terminal at the top. This current flow provides a magnetic shield which eliminates the arc deflection that the high peak currents possible with this tube might cause in standard design ignitrons.

AC-CONTROL SERVICE
1800 KILOVOLT-AMPERES

A thermostat mounting plate thermally coupled to the mercury-condensing surface of the tube facilitates attachment of a thermostat to provide either protection against excessive temperature or temperature control through regulation of the water flow.

Electrical

Electrodes		
Anodes	1	
Cathodes	1	
Ignitors	1	
Deionization Baffles	1	
Arc Drop		
At 5000 Amperes Peak	30	Volts
At 500 Amperes Peak	16	Volts

Mechanical

Envelope—Stainless Steel		
Mounting—Vertical, Anode Terminal Up		
Net Weight, approximate	15	Pounds

Thermal

Cooling—Liquid. If other than water is used, correct for conductivity, specific heat and viscosity.

Inlet Water Temperature, minimum	6	C
Outlet Water Temperature, maximum	45	C
Water Flow, minimum		
At Continuous Rated Average Current	2.0	Gallons per Minute
At no Load	0	

Note: Flow at intermediate loads may be decreased to an amount proportional to load. Water flow should be continued for 30 minutes after load is removed.

Water Cooling Characteristics at Rated Minimum Flow		
Water Temperature Rise at Maximum Current	9	C
Water Pressure Drop, maximum. 5 Pounds per Square Inch		

AC-Control Service*

Two Tubes in Inverse Parallel, Ratings per Tube

Voltage	440–600	Volts RMS
Maximum Demand	1800†	Kilovolt-Amperes
Corresponding Average Current	113.5	Amperes
Maximum Average Current	210	Amperes
Corresponding Demand	600	Kilovolt-Amperes
Maximum Averaging Time		
At 250 Volts RMS	9.5	Seconds
At 500 Volts RMS	7.1	Seconds
Maximum Peak Fault Current		
At 250 Volts	20,040	Amperes
At 600 Volts	8400	Amperes
Frequency Range	25–60	Cycles per second

Frequency-Changer-Welder Service

Ratings are for zero phase-control angle

Maximum Peak Anode Voltage			
Inverse and Forward	1200	1500	Volts
Maximum Anode Current			
Peak	2250	1800	Amperes
Corresponding Average	30	24	Amperes
Average	105	84	Amperes
Corresponding Peak	630	502	Amperes
Maximum Averaging Time	6.25	6.25	Seconds

Ratio of Average to Peak			
Current	0.166	0.166	
Maximum Average Time	0.2	0.2	Seconds
Ratio of Fault to Maximum Peak			
Current	12.5	12.5	
Maximum Duration of Fault			
Current	0.15	0.15	Seconds
Frequency Range	50–60	50–60	Cycles per second

Cathode Excitation Requirements

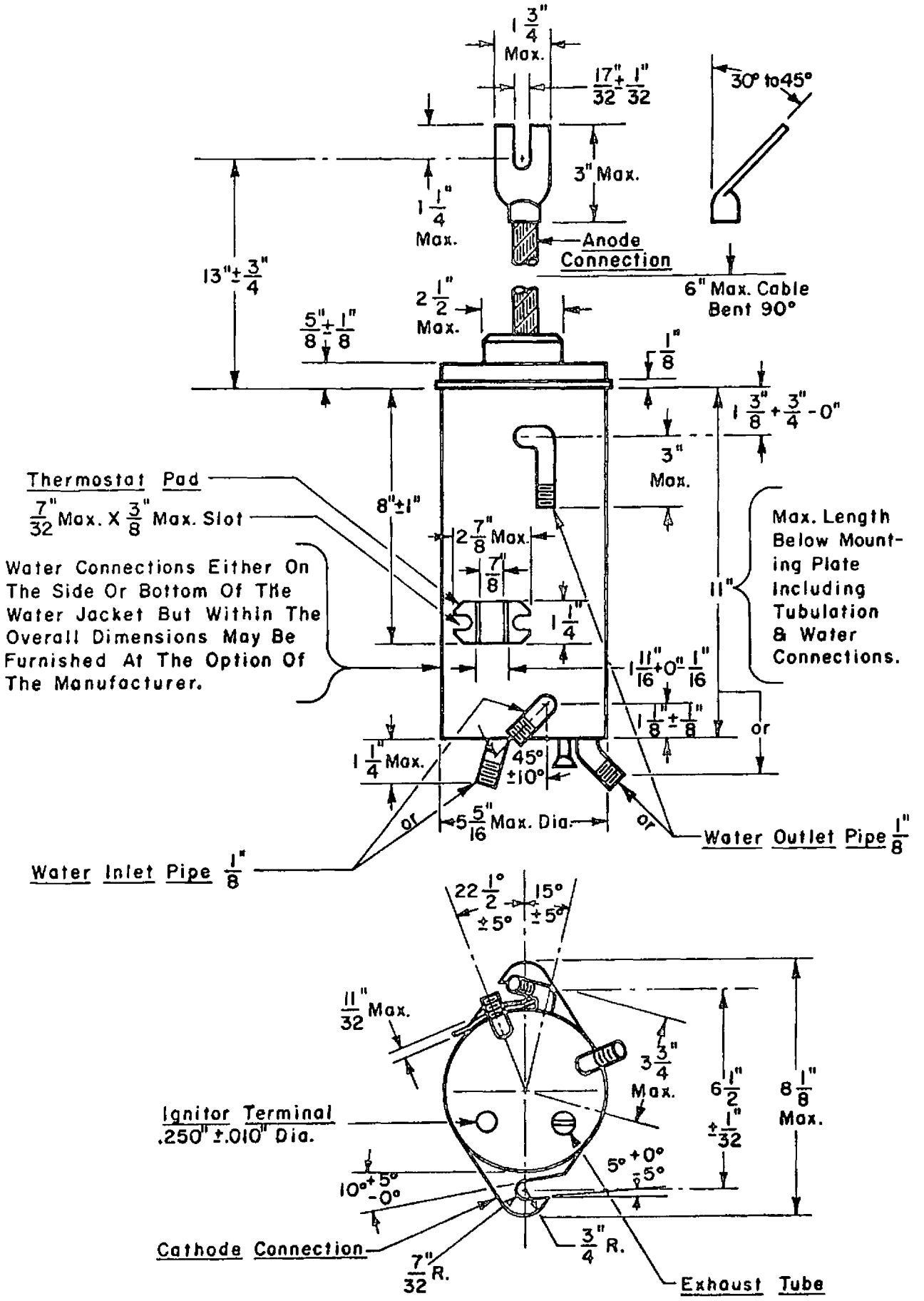
Ignitor Voltage Required to Fire	200	Volts
Ignitor Current Required to Fire	30	Amperes
Starting Time at Required Voltage or Current	100	Microseconds
Ignitor		
Maximum Voltage		
Positive—Anode Voltage		
Negative	5	Volts
Maximum Current		
Peak	100	Amperes
RMS	10	Amperes
Average	1	Ampere
Maximum Averaging Time	5	Seconds

* RMS demand voltage, current, and kilovolt-ampere demand are all on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used. Straight-line interpolation on log-log paper is allowed between corresponding points.

† Maximum demand current for 250 volts RMS is 4800 amperes. For voltages between 250 and 500 use proportional values between 4800 and 3600 amperes.

GENERAL ELECTRIC

from JEDEC release #3769A,
Sept. 23, 1963



8068
BEAM PENTODE

DESCRIPTION AND RATING

The 8068 is a beam pentode designed for use as a series regulator in high-voltage power supplies.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3 ± 0.6	Volts
Heater Current†	0.9	Amperes
Direct Interelectrode Capacitances‡		
Grid to Plate: (g to p)	0.6	pf
Input: g to (h + k + g2 + b.p.)	10.0	pf
Output: p to (h + k + g2 + b.p.)	5.5	pf

MECHANICAL

Mounting Position—Any
Envelope—T12, Glass
Base—B5-149, Octal 8-Pin
Top Cap—C1-1, Small
Outline Drawing—EIA 12-20

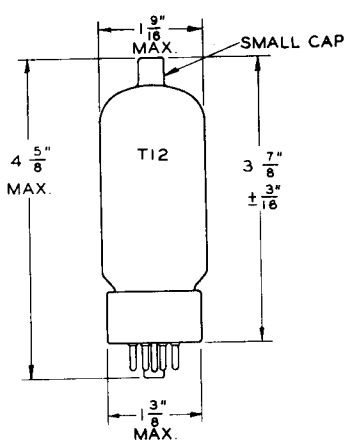
Maximum Diameter	$1\frac{9}{16}$	Inches
Maximum Over-all Length	$4\frac{5}{8}$	Inches
Maximum Seated Height	$4\frac{1}{16}$	Inches
Minimum Seated Height	$3\frac{11}{16}$	Inches

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Plate Voltage	3500	Volts
Screen Voltage	250	Volts
Plate Dissipation	35	Watts
Screen Dissipation	1.0	Watts
DC Cathode Current	100	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	200	Volts
Heater Negative with Respect to Cathode	200	Volts
Grid-Number 1 Circuit Resistance	0.1	Megohms

PHYSICAL DIMENSIONS

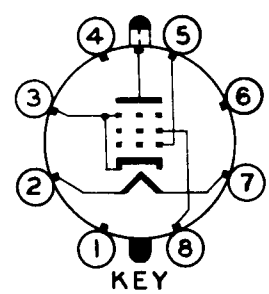


EIA 12-20

TERMINAL CONNECTIONS

Pin 1—No Connection
Pin 2—Heater
Pin 3—Cathode and Beam Plates
Pin 4—No Connection
Pin 5—Grid Number 1
Pin 6—No Connection
Pin 7—Heater
Pin 8—Grid Number 2 (Screen)
Cap—Plate

BASING DIAGRAM



EIA 8LC

AVERAGE CHARACTERISTICS

Plate Voltage	3500	600	Volts
Screen Voltage	100	125	Volts
Grid-Number 1 Voltage	−30	−7.5	Volts
Plate Resistance, approximate		54500	Ohms
Transconductance		5200	Micromhos
Plate Current	1.0	36	Milliamperes
Screen Current		1.0	Milliamperes

* The equipment designer should design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Without external shield.

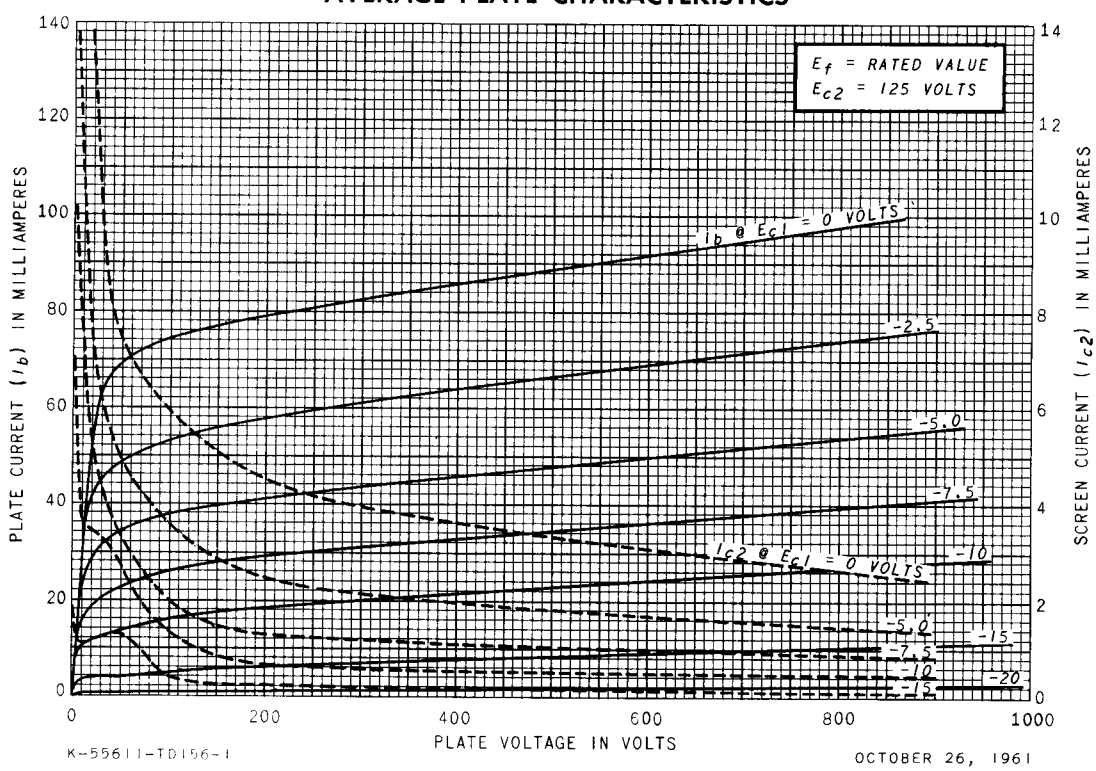
Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

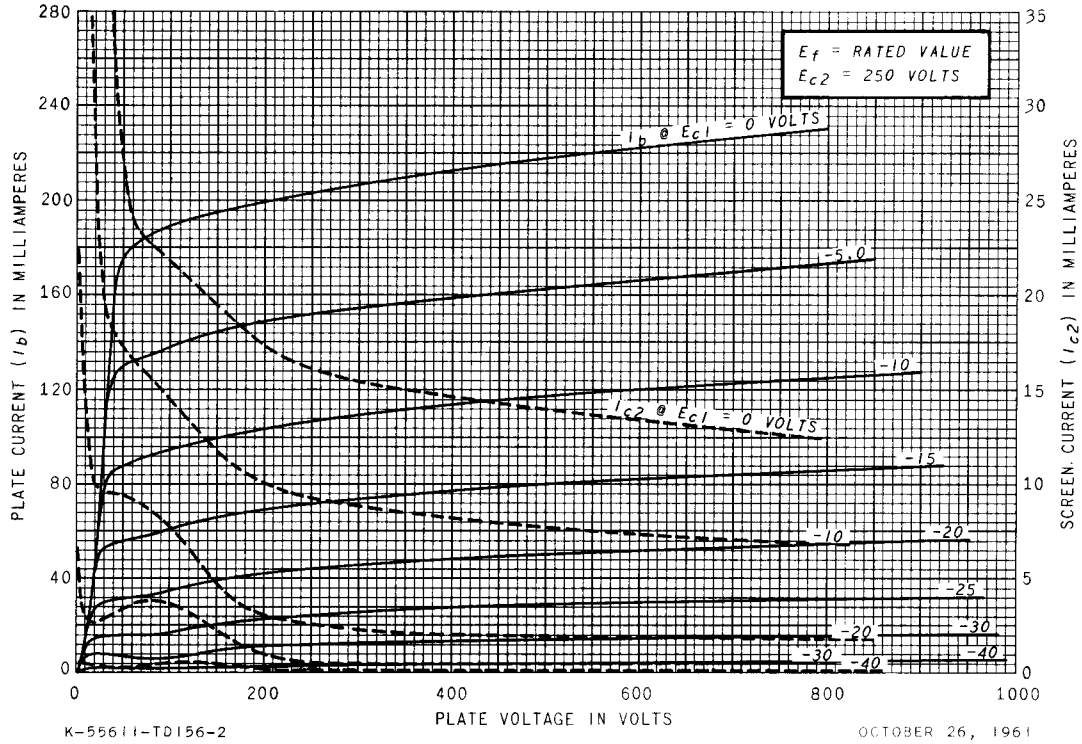
The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

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AVERAGE PLATE CHARACTERISTICS



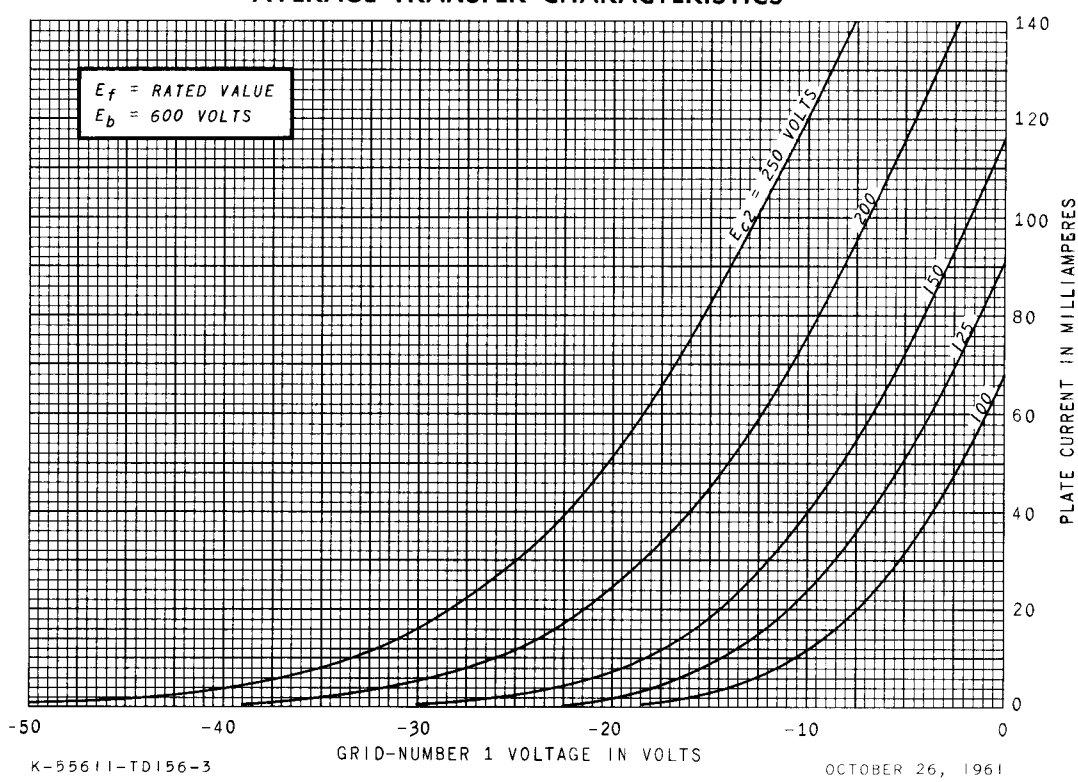
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD156-2

OCTOBER 26, 1961

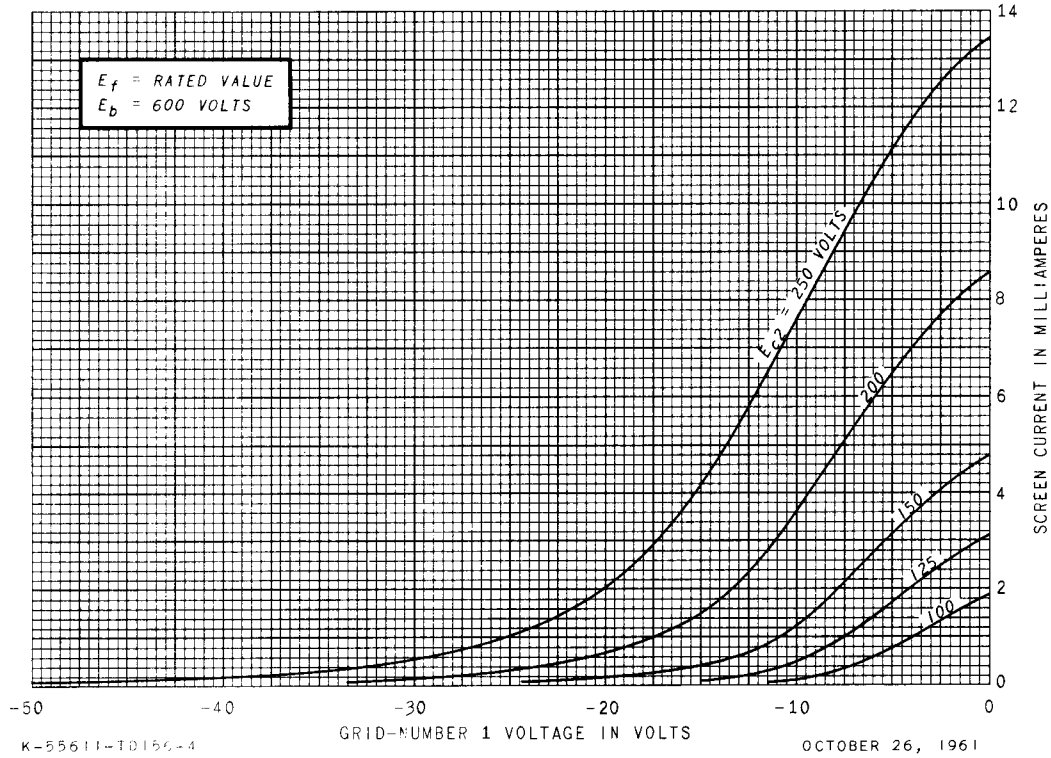
AVERAGE TRANSFER CHARACTERISTICS



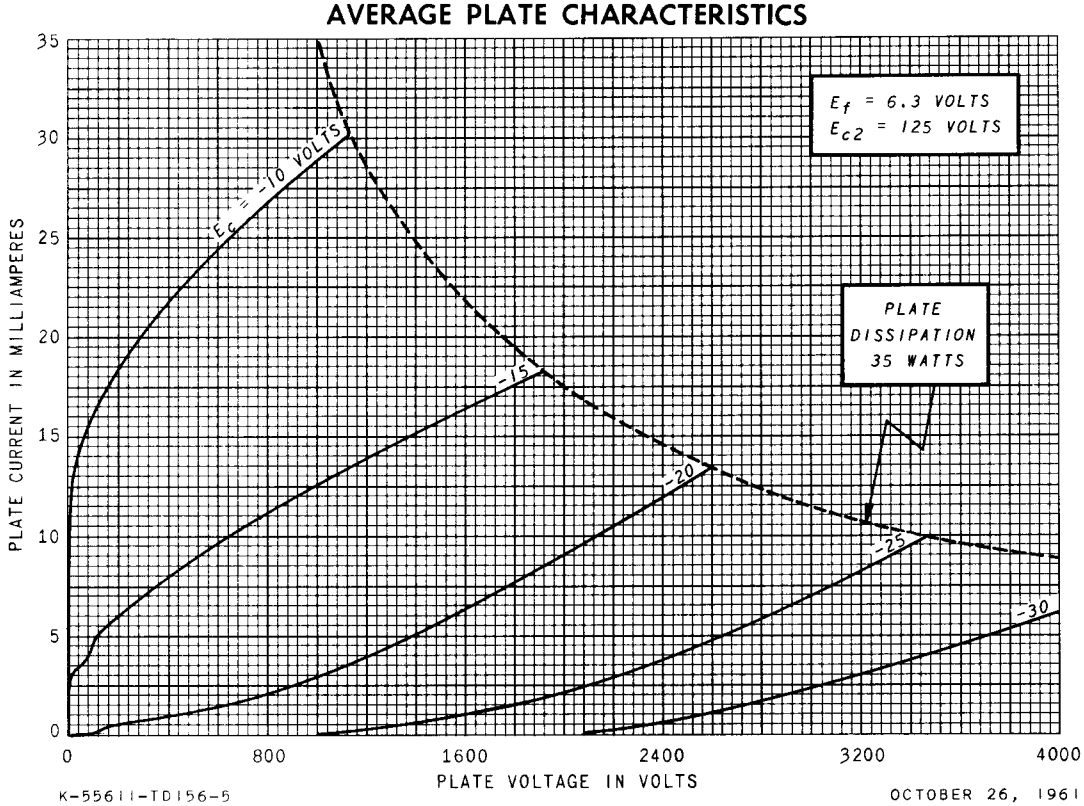
K-5561I-TD156-3

OCTOBER 26, 1961

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

8081

TRIODE

The 8081 is a high-mu triode of ceramic-and-metal planar construction primarily intended for low-level audio-frequency amplification.

GENERAL

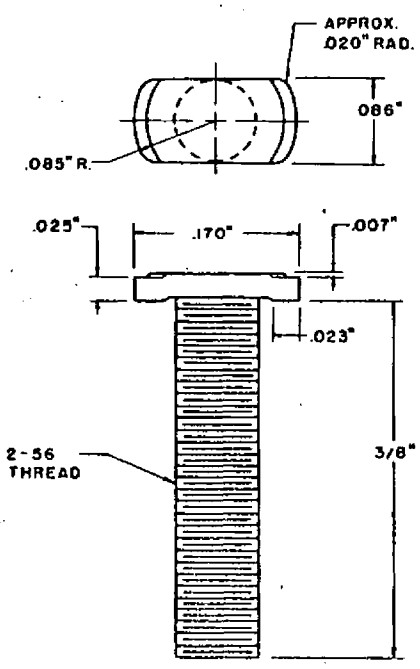
Electrical

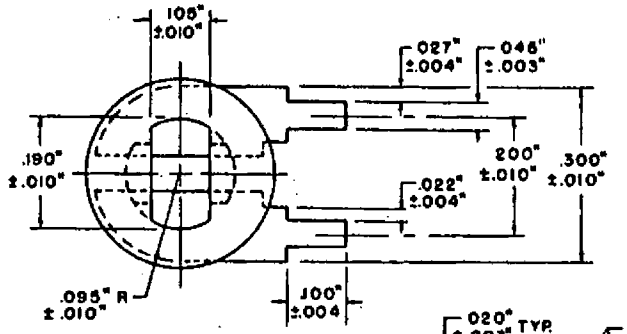
Cathode - Coated Unipotential

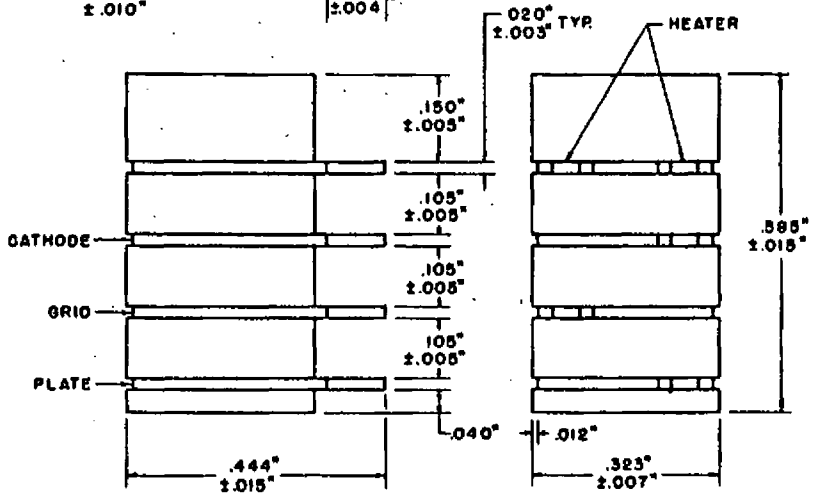
Heater Characteristics and Ratings		
Heater Voltage, AC or DC+	6.3±0.3	Volts
Heater Current‡	0.22	Amperes
Direct Interelectrode Capacitances§		
Grid to Plate: (g to p)	1.0	pf
Grid to Heater and Cathode: g to (h + k)	1.5	pf
Plate to Heater and Cathode: p to (h + k)	0.03	pf
Heater to Cathode: (h to k)	1.5	pf

Mechanical

Mounting Position - Any¶







ETR-2186

from JEDEC release #3406, Sept. 4, 1961

MAXIMUM RATINGS

Absolute-Maximum Values

DC Plate Voltage	275	Volts
Peak Plate Voltage	400	Volts
Positive Peak and DC Grid Voltage	0	Volts
Negative Peak and DC Grid Voltage	50	Volts
Plate Dissipation	0.85	Watts
DC Cathode Current	3.8	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance, with Fixed BiasΔ	0.2	Megohms
Envelope Temperature at Hottest Point#	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics

Plate Voltage	150	Volts
Cathode-Bias Resistor	1000	Ohms
Amplification Factor	80	
Plate Resistance, approximate	57000	Ohms
Transconductance	1400	Micromhos
Plate Current	0.95	Milliamperes
Grid Voltage, approximate		
Ib = 10 Microamperes, Eb = 250 Volts	-4.7	Volts

+ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ One method of mounting the 8081 is to use a stainless-steel "T" bolt (see drawing) to attach the mounting base of the tube to a chassis or circuit board. The "T" bolt should be inserted in the slot in the base of the tube, turned 90 degrees, and attached to the chassis or circuit board with a 2-56 nut and lock washer. Torque used to tighten the nut should not exceed 3 inch-pounds.

Δ If resistance is used in the cathode or plate circuits, the grid-circuit resistance may be as high as (200000 + 500 RK + 10RL) ohms, where RK is the cathode-bias resistance in ohms, and RL is the DC plate load resistance in ohms.

Operation below the rated maximum envelope temperature is recommended for applications requiring the longest possible tube life.

8/18/61 (E)

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

TECHNICAL DATA
Electronic Tubes

from JEDEC release #3406, Sept. 4, 1961

8082

TRIODE

The 8082 is a high-mu triode of ceramic-and-metal planar construction primarily intended for use as an oscillator in the ultra-high-frequency range.

GENERAL

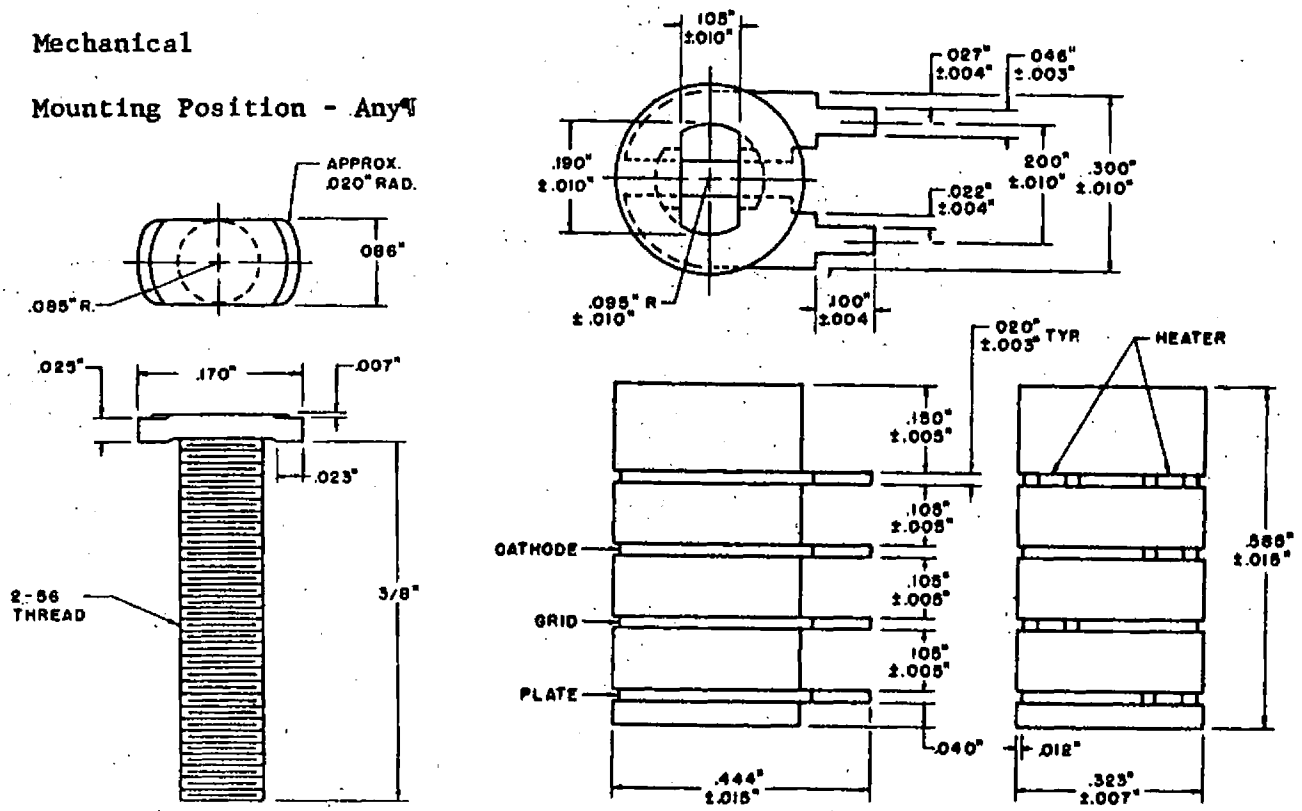
Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC+	6.3±0.3	Volts
Heater Current‡	0.24	Amperes
Direct Interelectrode Capacitances§		
Grid to Plate: (g to p)	1.3	pf
Grid to Heater and Cathode: g to (h + k)	1.8	pf
Plate to Heater and Cathode: p to (h + k)	0.032	pf
Heater to Cathode: (h to k)	1.5	pf

Mechanical

Mounting Position - Any¶



ETR-2186

MAXIMUM RATINGS

Absolute-Maximum Values

Plate Voltage	250	Volts
Positive DC Grid Voltage	0	Volts
Negative Grid Voltage	50	Volts
Peak Negative Grid Voltage	50	Volts
Plate Dissipation	1.0	Watt
DC Grid Current	2.2	Milliamperes
DC Cathode Current	11	Milliamperes
Peak Cathode Current	40	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid-Circuit Resistance	10000	Ohms
Envelope Temperature at Hottest Point#	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

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CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics

Plate Voltage	100	150	Volts
Grid Voltage	0	---	Volts
Cathode-Bias Resistor	---	82	Ohms
Amplification Factor	---	90	
Transconductance	11500	10500	Micromhos
Plate Current	9.0	7.5	Milliamperes

UHF Oscillator Service

Plate Voltage	150	Volts
Grid Resistor	7000	Ohms
Plate Current	4.0	Milliamperes
Frequency	450	Megacycles
Grid Current	0.5	Milliamperes
Power Output, approximate	100	Milliwatts

+ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ One method of mounting the 8082 is to use a stainless-steel "T" bolt (see drawing) to attach the mounting base of the tube to a chassis or circuit board. The "T" bolt should be inserted in the slot in the base of the tube, turned 90 degrees, and attached to the chassis or circuit board with a 2-56 nut and lock washer. Torque used to tighten the nut should not exceed 3 inch-pounds.

Operation below the rated maximum envelope temperature is recommended for applications requiring the longest possible tube life.

8/18/61 (E)

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from JEDEC release #3406, Sept. 4, 1961

8083

TRIODE

The 8083 is a high-mu triode of ceramic-and-metal planar construction primarily intended for radio-frequency amplifier service from low frequencies into the ultra-high frequency range.

GENERAL

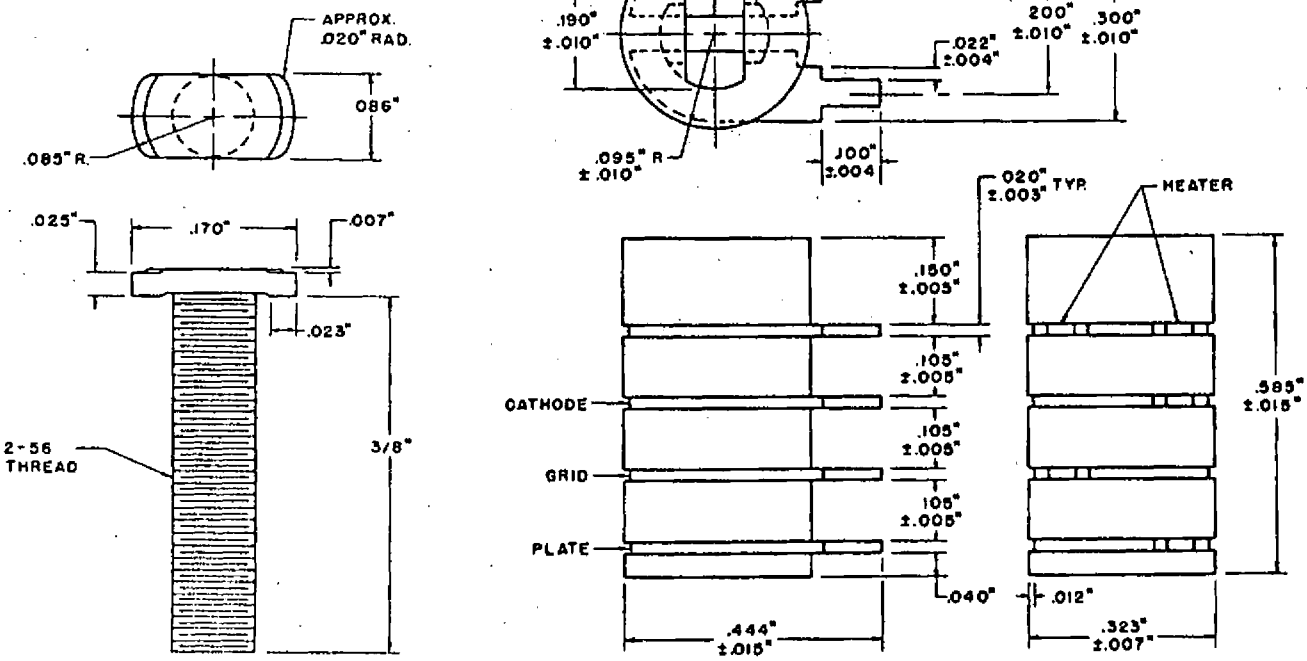
Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC+	6.3±0.3	Volts
Heater Current‡	0.24	Amperes
Direct Interelectrode Capacitances§		
Grid to Plate: (g to p)	1.2	pf
Grid to Heater and Cathode: g to (h + k)	1.8	pf
Plate to Heater and Cathode: p to (h + k)	0.032	pf
Heater to Cathode: (h to k)	1.5	pf

Mechanical

Mounting Position - Any¶



ETR-2186

MAXIMUM RATINGS

Absolute-Maximum Values

Plate Voltage	250	Volts
Peak Plate Voltage	400	Volts
Positive Peak and DC Grid-to-Cathode Voltage	0	Volts
Negative Peak and DC Grid-to-Cathode Voltage	50	Volts
Plate Dissipation	1.1	Watts
DC Cathode Current	11	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid-Circuit Resistance, with Fixed BiasΔ	0.01	Megohms
Envelope Temperature at Hottest Point#	250	C

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CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics

Plate Voltage	150	Volts
Grid Voltage	+6.0	Volts
Cathode-Bias Resistor	910	Ohms
Amplification Factor	94	
Plate Resistance, approximate	9000	Ohms
Transconductance	10500	Micromhos
Plate Current	7.2	Milliamperes
Grid Voltage, approximate		
Ib = 100 Microamperes	-2.2	Volts

+ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ One method of mounting the 8083 is to use a stainless-steel "T" bolt (see drawing) to attach the mounting base of the tube to a chassis or circuit board. The "T" bolt should be inserted in the slot in the base of the tube, turned 90 degrees, and attached to the chassis or circuit board with a 2-56 nut and lock washer. Torque used to tighten the nut should not exceed 3 inch-pounds.

Δ If resistance is used in the cathode or plate circuits, the grid-circuit resistance may be as high as (10000 + 100 RK + 10RL) ohms, where RK is the cathode-bias resistance in ohms, and RL is the DC plate load resistance in ohms.

Operation below the rated maximum envelope temperature is recommended for applications requiring the longest possible tube life.

8/18/61 (E)

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from JEDEC release #3417, Sept. 11, 1961

GL-8092

IMAGE ORTHICON



EXCEPTIONAL SENSITIVITY 3 IN. DIAMETER, MAXIMUM LONG LIFE

MAGNETIC FOCUS AND DEFLECTION COLOR AND BLACK-AND-WHITE FIELD MESH

The GL-8092 is a television camera tube primarily intended for live color-pickup service where normal lighting conditions are not available. This includes the range of applications from most remotes to black-and-white illuminated studios.

The tube features a high-gain, thin-film semiconductor target, which results in extremely high sensitivity and ability to handle wide ranges of scene illumination. The tube will produce color pictures of good quality at a scene illumination of approximately 40 foot-candles, and black-and-white pictures at light levels of approximately 1 foot-candle.

Particularly important for color service is the addition of a field mesh in the scanning section which provides an excellent landing, shading, and dynamic match in color cameras utilizing three image orthicons for the simultaneous method of pickup.

Other significant advantages of the thin-film semiconductor target include excellent resolution and high amplitude response, elimination of stickiness throughout life, greatly reduced susceptibility to permanent burn-in damage, stable operation during life and elimination of target raster burns.

A photocathode with a spectral response close to that of the eye provides accurate color rendition of scenes by assuring gray-scale reproduction of colors in nearly their true tonal gradation.

The GL-8092 is interchangeable with the GL-7629, -7293, -5820 and 7513.

Electrical

Cathode—Unipotential		
Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.6	Amperes
Photocathode—Semi-transparent		
Response—S-10		
Rectangular Image, 4 by 3 aspect ratio		
Useful Size, maximum diagonal	1.8	Inches
Orientation—Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the faceplate and pin No. 7 of the shoulder base.		
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Direct Interelectrode Capacitance		
Anode to All Other Electrodes	12	μμf

Mechanical

Over-all Length	15.20 ± 0.25	Inches
Greatest Diameter of Bulb	3.00 ± 0.06	Inches
Minimum Deflection Coil Inside Diameter	2⅜	Inches
Deflecting Coil Length	5	Inches
Focusing Coil Length	10	Inches
Alignment-Coil Length	15/16	Inch
Photocathode Distance Inside End of Focusing Coil	½	Inch
Weight, approximate	1.4	Pounds

Operating Position—Any, except with diheptal base up and the tube axis at an angle of less than 20 degrees from vertical.

Thermal

Operating Temperature of Any Part of Bulb	55	C
Operating Temperature of Bulb at Large End of Tube, target section, minimum	0	C
Temperature Difference Between Target Section and Any Part of Bulb Hotter than Target Section	5	C

MAXIMUM RATINGS—ABSOLUTE VALUES

Photocathode Voltage	−550	Volts
Photocathode Illumination	50	Foot-Candles
Anode Supply Voltage*	1350	Volts
Grid-No. 1 Voltage		
Negative Bias Value	125	Volts
Positive Bias Value	0	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	350	Volts
Grid-No. 3 Voltage	400	Volts
Grid-No. 4 Voltage	300	Volts
Grid-No. 5 Voltage	150	Volts
Grid-No. 6 Voltage	−550	Volts
Voltage per Multiplier Stage	350	Volts
Target Voltage		
Above Target Cutoff, positive direction	6	Volts
Negative Value	10	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125	Volts
Heater Positive with Respect to Cathode	10	Volts

GENERAL ELECTRIC

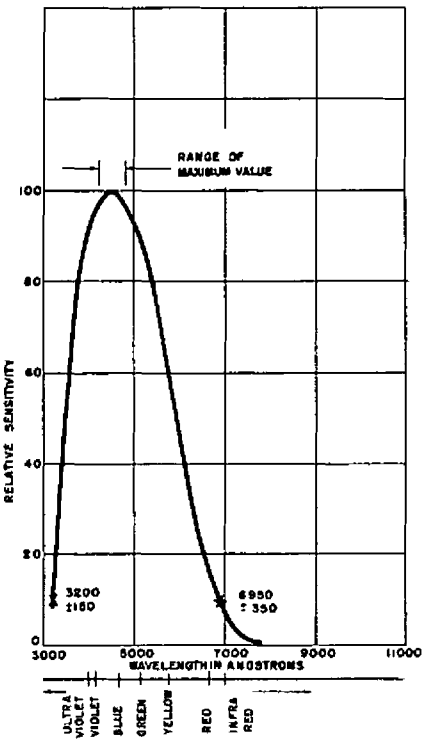
TYPICAL OPERATION

Photocathode Voltage, image focus	−400 to −540	Volts
Grid-No. 1 Voltage for Picture Cutoff, beam	−45 to −115	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	300	Volts
Grid-No. 3 Voltage†, multiplier focus	225 to 330	Volts
Grid-No. 4 Voltage, beam focus	140 to 180	Volts
Grid-No. 5 Voltage, decelerator	0 to 125	Volts
Grid-No. 6 Voltage, accelerator —75 percent of Photocathode Voltage, approximate	−300 to −405	Volts
Dynode-No. 2 Voltage	600	Volts
Dynode-No. 3 Voltage	800	Volts
Dynode-No. 4 Voltage	1000	Volts
Dynode-No. 5 Voltage	1200	Volts
Anode Voltage	1250	Volts
DC Anode Current, average	30	Microamperes
Signal Output Current, peak-to-peak—See Light Transfer Characteristic Curve, page 3.		
Target Voltage‡		
Target Cutoff Voltage.‡	−3 to +1	Volts
Target Temperature Range	15 to 50	C
Ratio of Peak-to-Peak Highlight Video Signal Current to RMS Noise Current:		
Minimum	29	
Average	34	
Photocathode illumination at 2870°K Required to Reach the Knee of Light Transfer Characteristic, approximate	0.0035	Foot-Candles
Peak-to-Peak Blanking Voltage	5 to 20	Volts
Field Strength at Center of Focusing Coil§	75	Gausses
Field Strength of Alignment Coil, approximate	0 to 3	Gausses

* Ratio of dynode voltages is shown under Typical Operation.
† Adjust to give the most uniformly shaded picture near maximum signal.
‡ The target supply voltage should be adjustable from −3 to +5 volts with blanking voltage off. Recommended target voltage is +2 volts above cutoff. At marginally low light levels, a slight increase in target voltage may help sensitivity. Slight readjustment, usually only a small fraction of a volt, may be necessary to minimize microphonics.
§ Direction of current should be such that a north-seeking pole is attracted to the image and of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

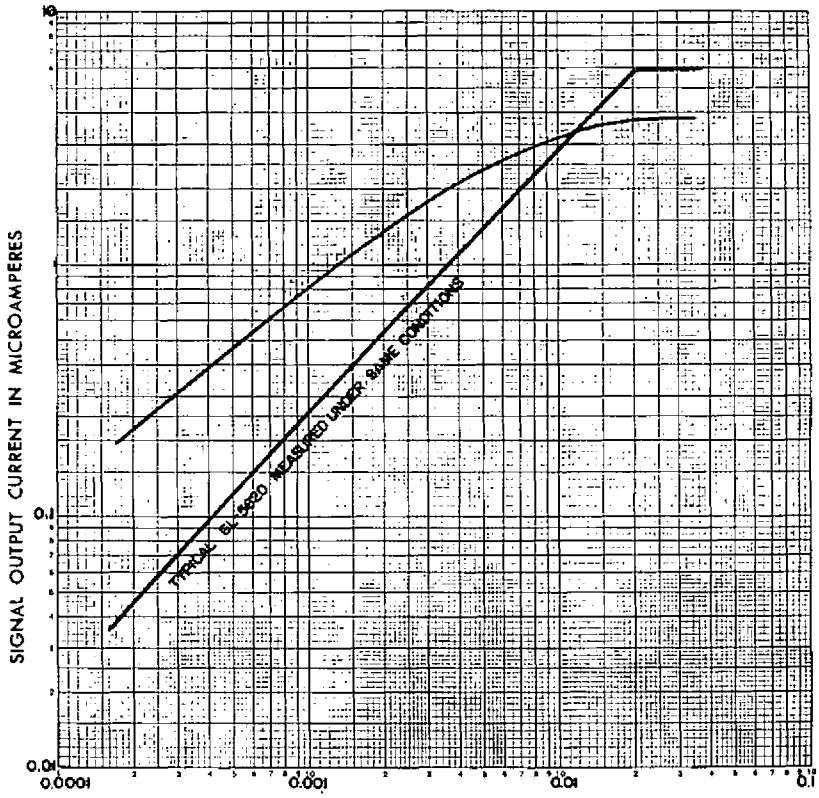
SPECTRAL-SENSITIVITY CHARACTERISTIC—S-10 RESPONSE

For Equal Values of Radiant Flux at All Wavelengths



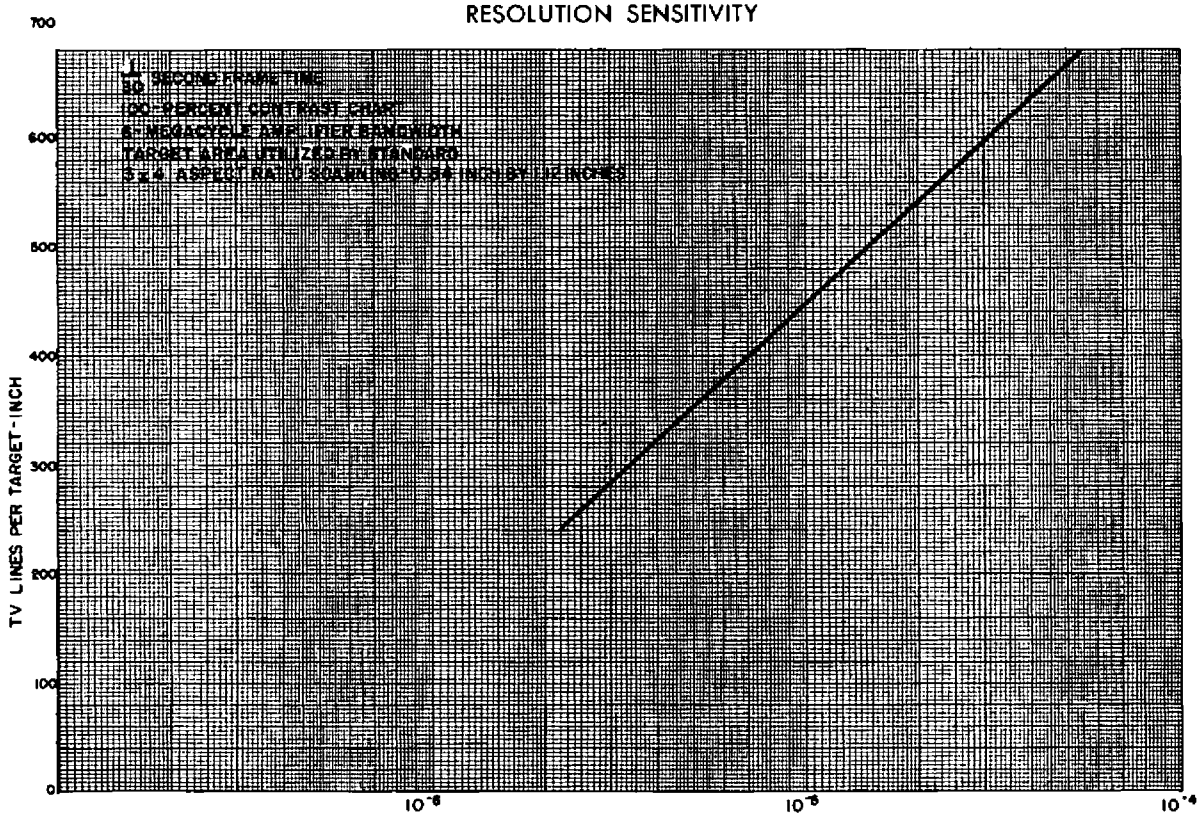
"X"- POINTS REPRESENT 10 PERCENT OF MAXIMUM RESPONSE.

LIGHT TRANSFER CHARACTERISTIC

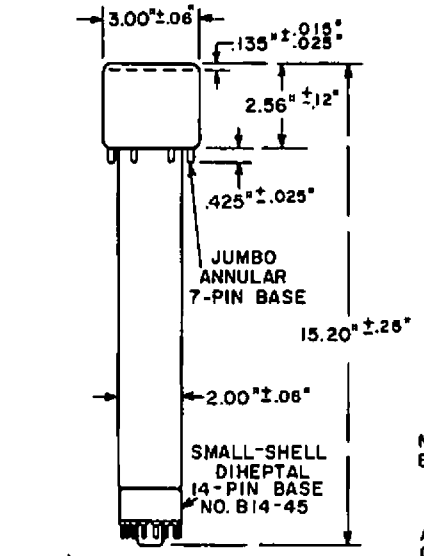


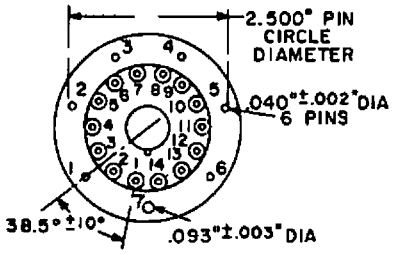
K-69087-72A908 HIGHLIGHT ILLUMINATION ON PHOTOCATHODE IN FOOT-CANDLES 11-30-59

RESOLUTION SENSITIVITY

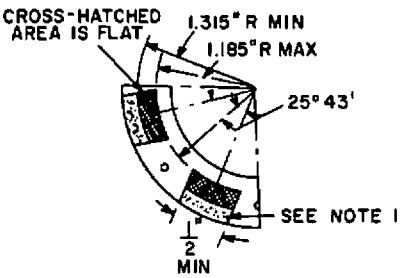


K-69087-72A909 PHOTOCATHODE ILLUMINATION IN FOOT-CANDLES 11-30-59





ENLARGED BOTTOM VIEW



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

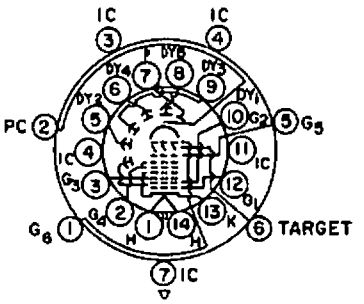
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b. SEVEN STOPS HAVING HEIGHT OF 0.187"±0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT OF A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126"±0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200"±0.001".

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE



WHITE INDEX LINE ON FACE

BOTTOM VIEW

BASING DIAGRAM

SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
PIN 2: GRID NO.4 & FIELD MESH
PIN 3: GRID NO. 3
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: DYNODE NO. 2
PIN 6: DYNODE NO. 4
PIN 7: ANODE
PIN 8: DYNODE NO.5
PIN 9: DYNODE NO.3
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PIN 11: INTERNAL CONNECTION-DO NOT USE
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PIN 13: CATHODE AND SUPPRESSOR GRID
PIN 14: HEATER

NOTE: IN THE TUBE SYMBOL, THE SUPPRESSOR GRID CONNECTED TO THE CATHODE, AND THE FIELD-MESH GRID CONNECTED TO GRID NO.4, ARE INTENTIONALLY WITHOUT NUMBERS TO AVOID UPSETTING INDUSTRY PRACTICE OF ASSOCIATING FUNCTIONAL CAMERA CONTROL KNOBS WITH SPECIFIC GRID NUMBERS. FOR EXAMPLE, BEAM-FOCUS CONTROL IS GENERALLY ASSOCIATED WITH KNOB IDENTIFIED AS G_4 (GRID NO.4).

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO. 6
PIN 2: PHOTOCATHODE
PIN 3: INTERNAL CONNECTION-DO NOT USE
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: GRID NO. 5
PIN 6: TARGET
PIN 7: INTERNAL CONNECTION-DO NOT USE

GENERAL ELECTRIC

CATHODE RAY TUBE DEPARTMENT

Syracuse, N. Y.



GL-8093

IMAGE ORTHICON

FIELD MESH **3 IN. DIAMETER, MAXIMUM**

MAGNETIC FOCUS AND DEFLECTION

The GL-8093 is a television camera tube for studio pickup service where high quality of performance is required and lighting can be controlled.

The construction of the target-mesh assembly assures a high signal-to-noise ratio, particularly desirable for video-taping requirements. The GL-8093 also features a field mesh in the scanning section which enhances picture quality by providing sharp transition from black to white without spurious effect (white edges) and by improving flatness of field and corner resolution.

A suppressor grid maintains high signal-to-noise ratio by preventing field-mesh secondary electrons from entering the electron multiplier.

A photocathode with a spectral response close to that of the eye permits portrayal of scenes in nearly their true tonal gradation.

In operation alignment is performed with the lens open on a chart or scene since dynode aperatures are not visible with the lens capped.

The tube is interchangeable with the GL-5820, -7293 and 7513.

Electrical

Cathode—Unipotential		
Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.6	Ampere
Photocathode—Semi-transparent		
Response—S-10		
Rectangular Image, 4 by 3 aspect ratio		
Useful Size, maximum diagonal	1.8	Inches
Orientation—Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the faceplate and pin No. 7 of the shoulder base.		
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Direct Interelectrode Capacitance		
Anode to All Other Electrodes	12	μμf

Mechanical

Over-all Length	15.20 ± 0.25	Inches
Greatest Diameter of Bulb	3.00 ± 0.06	Inches
Minimum Deflecting-Coil Inside Diameter	2⅜	Inches
Deflecting-Coil Length	5	Inches
Focusing-Coil Length	10	Inches
Alignment-Coil Length	1.5/16	Inch
Photocathode Distance Inside End of Focusing Coil	½	Inch
Weight, approximate	1.4	Pounds

Operating Position—Any, except with diheptal base up and the tube axis at an angle of less than 20 degrees from vertical.

Thermal

Operating Temperature of Any Part of Bulb	50	C
Operating Temperature of Bulb at Large End of Tube, Target Section, Minimum	35	C
Temperature Difference Between Target Section and Any Part of Bulb Hotter than Target Section	5	C

MAXIMUM RATINGS—ABSOLUTE VALUES

Photocathode Voltage	−550	Volts
Photocathode Illumination	50	Foot-Candles
Anode Supply Voltage*	1350	Volts
Grid-No. 1 Voltage		
Negative-Bias Value	125	Volts
Positive-Bias Value	0	Volt
Grid-No. 2 and Dynode-No. 1 Voltage	350	Volts
Grid-No. 3 Voltage	400	Volts
Grid-No. 4 Voltage	300	Volts
Grid-No. 5 Voltage	150	Volts
Grid-No. 6 Voltage	−550	Volts
Voltage per Multiplier Stage		Its
Target Voltage		
Positive Value	10	Volts
Negative Value	10	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125	Volts
Heater Positive with Respect to Cathode	10	Volts

from JEDEC release #3417, Sept. 11, 1961

GENERAL ELECTRIC

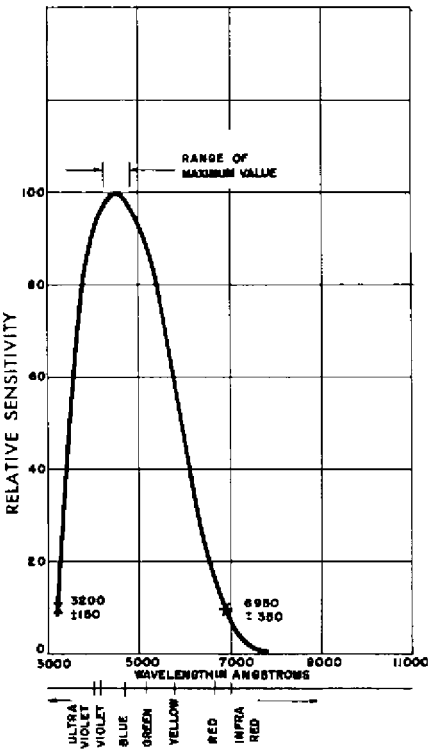
TYPICAL OPERATION

Photocathode Voltage, image focus	−400 to −540	Volts
Grid-No. 1 Voltage for Picture Cutoff, beam	−45 to −115	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	300	Volts
Grid-No. 3 Voltage†, multiplier focus	225 to 330	Volts
Grid-No. 4 Voltage, beam focus	140 to 180	Volts
Grid-No. 5 Voltage, decelerator	0 to 125	Volts
Grid-No. 6 Voltage, accelerator—75 percent of Photocathode Voltage, approximate	−300 to −405	Volts
Dynode-No. 2 Voltage	600	Volts
Dynode-No. 3 Voltage	800	Volts
Dynode-No. 4 Voltage	1000	Volts
Dynode-No. 5 Voltage	1200	Volts
Anode Voltage	1250	Volts
DC Anode Current, average	30	Microamperes
Signal Output Current, peak-to-peak	5 to 30	Microamperes
Target Voltage‡		
Target Cutoff Voltage‡	−3 to +1	Volts
Target Temperature Range	35 to 45	C
Ratio of Peak-to-Peak Highlight Video Signal Current to RMS Noise Current:		
Minimum	38	
Average	50	
Photocathode Illumination at 2870°K Required to Reach Knee of Light Transfer Characteristic, approximate	0.018	Foot-Candle
Minimum Peak-to-Peak Blanking Voltage	5	Volts
Field Strength at Center of Focusing Coils§	75	Gausses
Field Strength of Alignment Coil** approximate	0 to 3	Gausses

* Ratio of dynode voltages is shown under Typical Operation.
† Adjust to give maximum signal.
‡ Adjustable from −3 to +5 volts with blanking voltage off. Normal setting of target voltage is +2 volts from target cutoff.
§ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.
**Adjusted to produce flattest field with maximum response. Alignment is correct when the center of the picture merely goes through focus and does not rotate when beam focus (Grid-No. 4) is varied.

SPECTRAL-SENSITIVITY CHARACTERISTIC—S-10 RESPONSE

For Equal Values of Radiant Flux at All Wavelengths



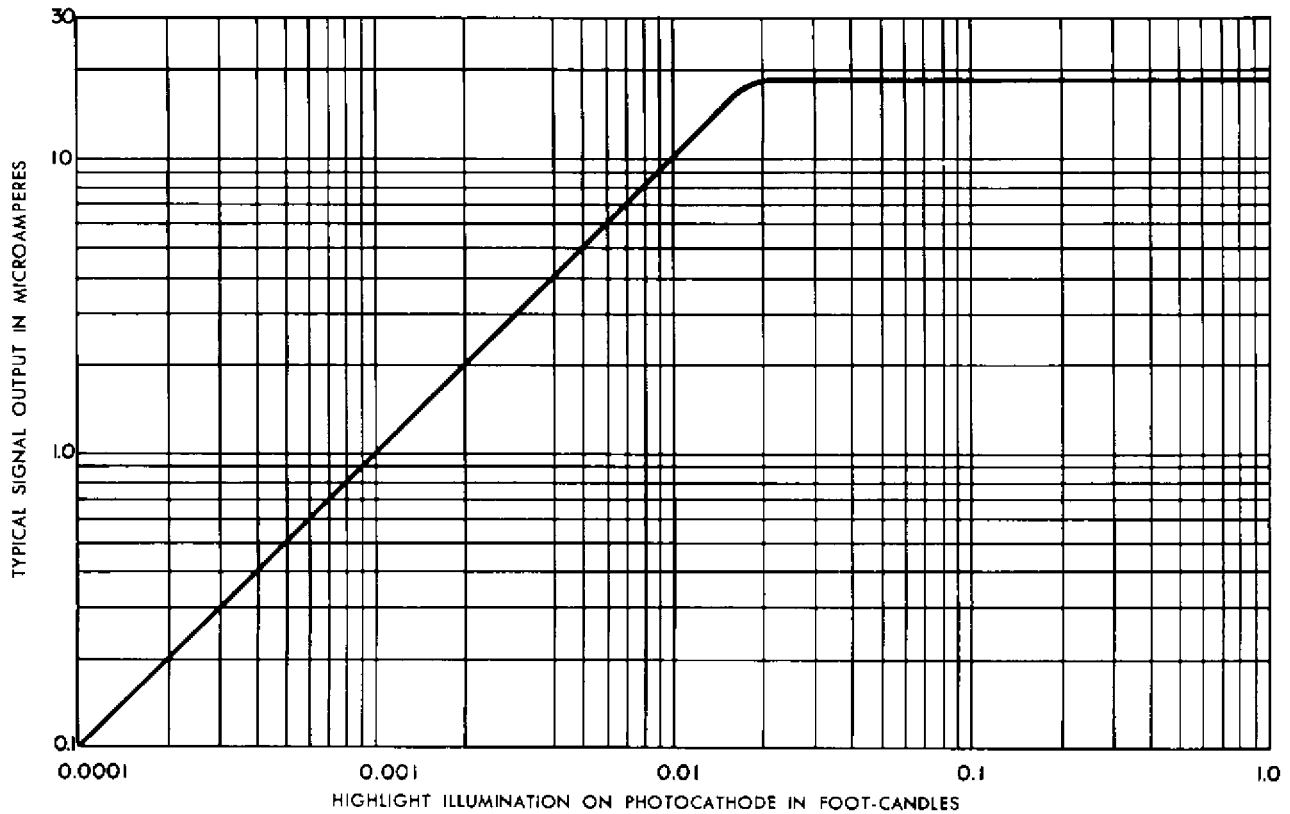
K-69087-72A923

"X"- POINTS REPRESENT 10 PERCENT OF MAXIMUM RESPONSE.

4-26-60

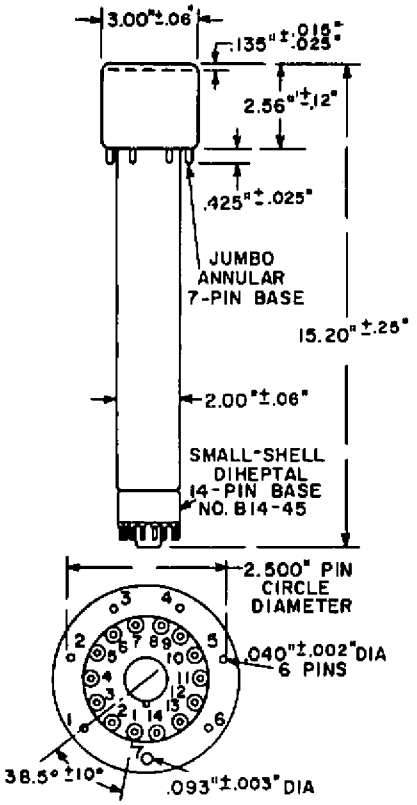
TYPICAL SIGNAL OUTPUT

SCENE: BLACK AND WHITE BALANCED TUNGSTEN, DAYLIGHT OR WHITE FLUORESCENT LIGHT

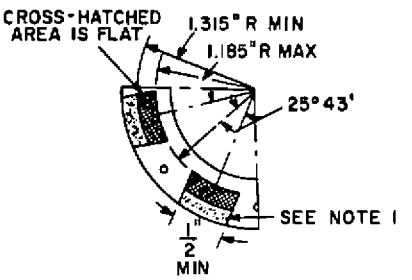


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5-61



ENLARGED BOTTOM VIEW



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

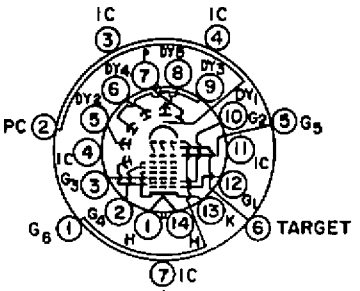
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BOTTOM VIEW

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GENERAL ELECTRIC
CATHODE RAY TUBE DEPARTMENT
Syracuse, N. Y.

ELECTRONICS

8136

PENTODE

DESCRIPTION AND RATING

The 8136 is a miniature sharp-cutoff pentode intended primarily for use as a wide band intermediate-frequency amplifier in industrial applications. Similar to the 6DK6, it features additional controls over the development of interface during operation under regular life-test conditions, providing increased assurance of satisfactory long-life service.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.3	Amperes
Direct Interelectrode Capacitances§		
Grid-Number 1 to Plate: (g1 to p)	0.02	pf
Input: g1 to (h + k + g2 + g3 + i.s.)	7.0	pf
Output: p to (h + k + g2 + g3 + i.s.)	2.2	pf

MECHANICAL

Operating Position - Any
Envelope - T-5 1/2, Glass
Base - E7-1, Miniature Button 7-Pin
Outline Drawing - EIA 5-2

Maximum Diameter	0.750	Inches
Maximum Over-all Length	2.125	Inches
Maximum Seated Height	1.875	Inches

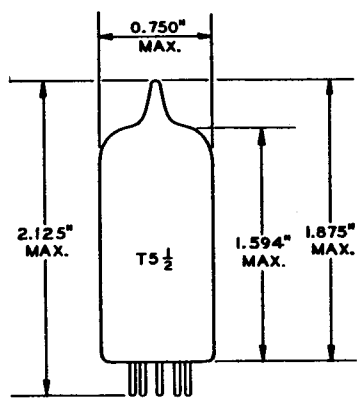
MAXIMUM RATINGS

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

PHYSICAL DIMENSIONS

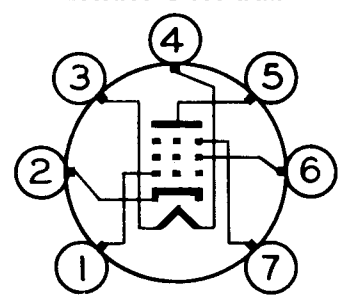


EIA 5-2

TERMINAL CONNECTIONS

Pin 1 - Grid Number 1
Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Grid Number 3 (Suppressor) and Internal Shield

BASING DIAGRAM



EIA 7CM

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

ABSOLUTE-MAXIMUM VALUES

Plate Voltage	330	Volts
Screen Voltage	165	Volts
Plate Dissipation	2.2	Watts
Screen Dissipation	0.65	Watts
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	300	Volts

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	125	Volts
Suppressor, Connected to Cathode at Socket		
Screen Voltage	125	Volts
Cathode-Bias Resistor	56	Ohms
Transconductance	9800	Micromhos
Plate Current	10.8	Milliamperes
Screen Current	2.9	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 20 Microamperes	-6.5	Volts

SPECIAL TESTS AND RATINGS

Cathode-Interface Impedance		
500 Hour Life-Test End Point, maximum¶	5	Ohms

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

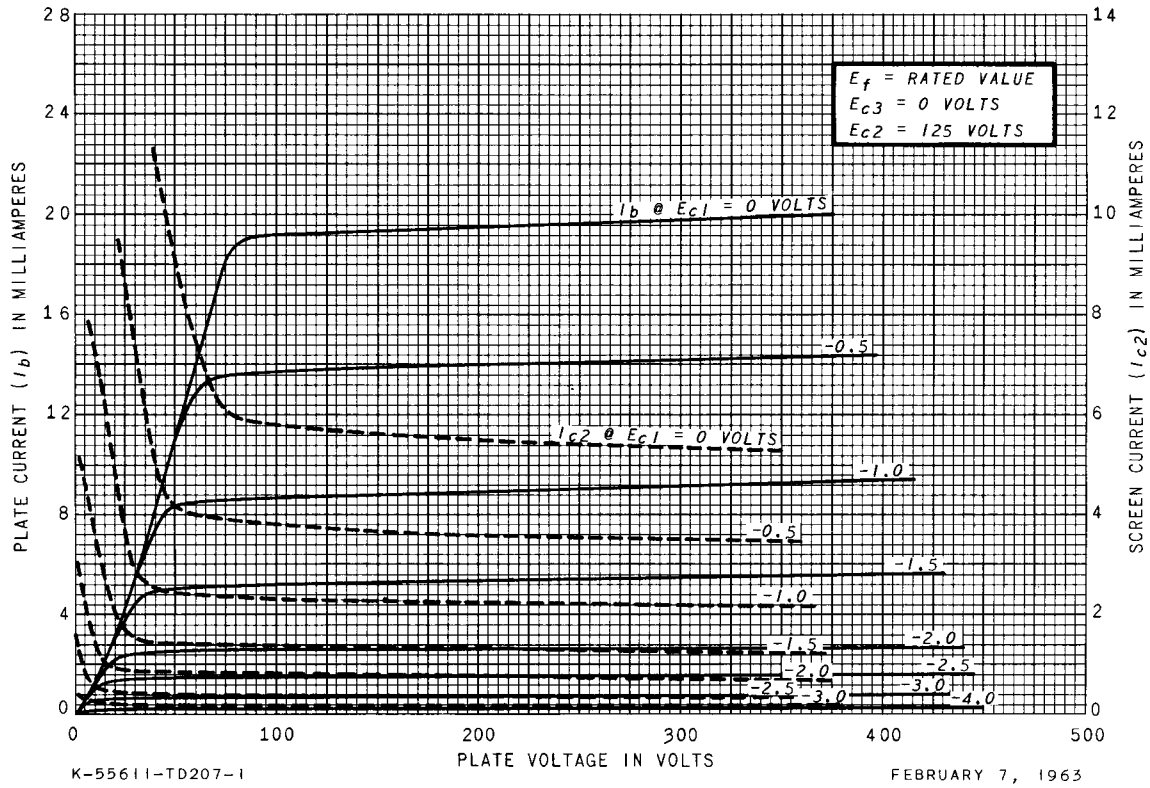
‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ Statistical sample operated for 500 hours (extended periodically to 2000 hours and 5000 hours) under the following conditions: Ef = 6.6 volts, Eb = 150 volts, Eg2 = 150 volts, Eg3 = 0 volts, Rk = 55 ohms, Rg1 = 250000 ohms, Ehk = -180 volts. Cathode-interface impedance measured under the following conditions: Ef = 5.7 volts, Eb = 80 volts, G2 and G3 tied to plate, Ec1 adjusted for Ib = 2.5 milliamperes.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

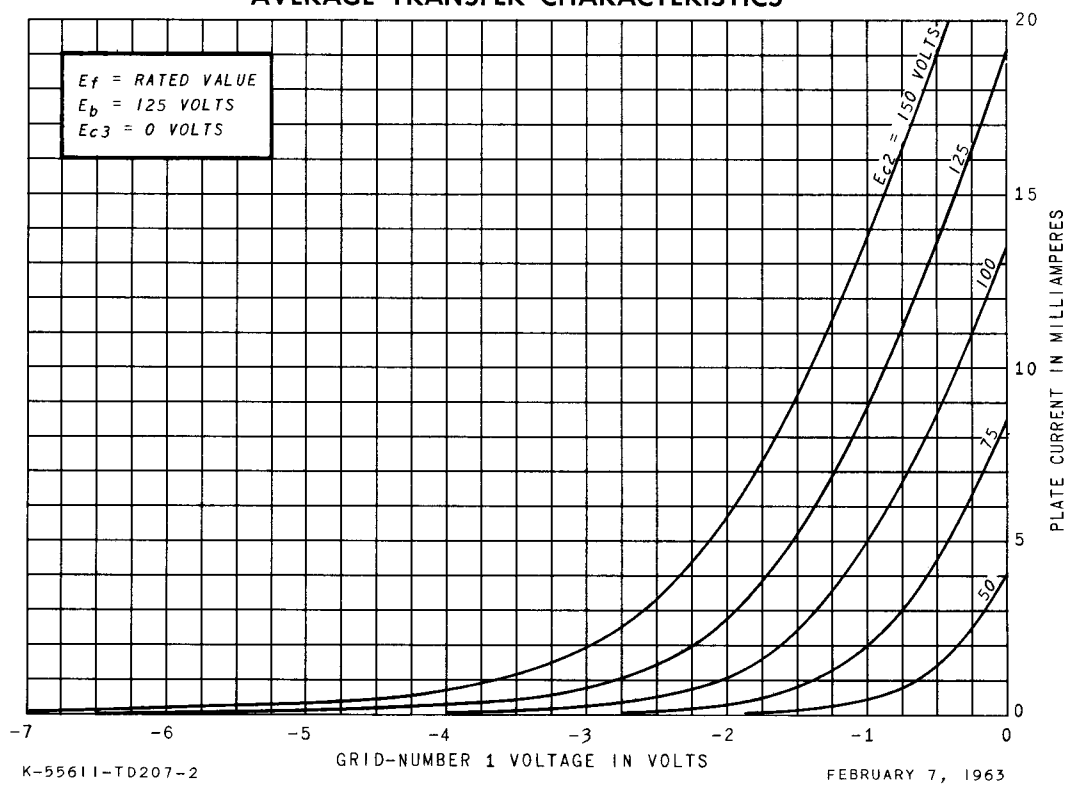
AVERAGE PLATE CHARACTERISTICS



K-55611-TD207-1

FEBRUARY 7, 1963

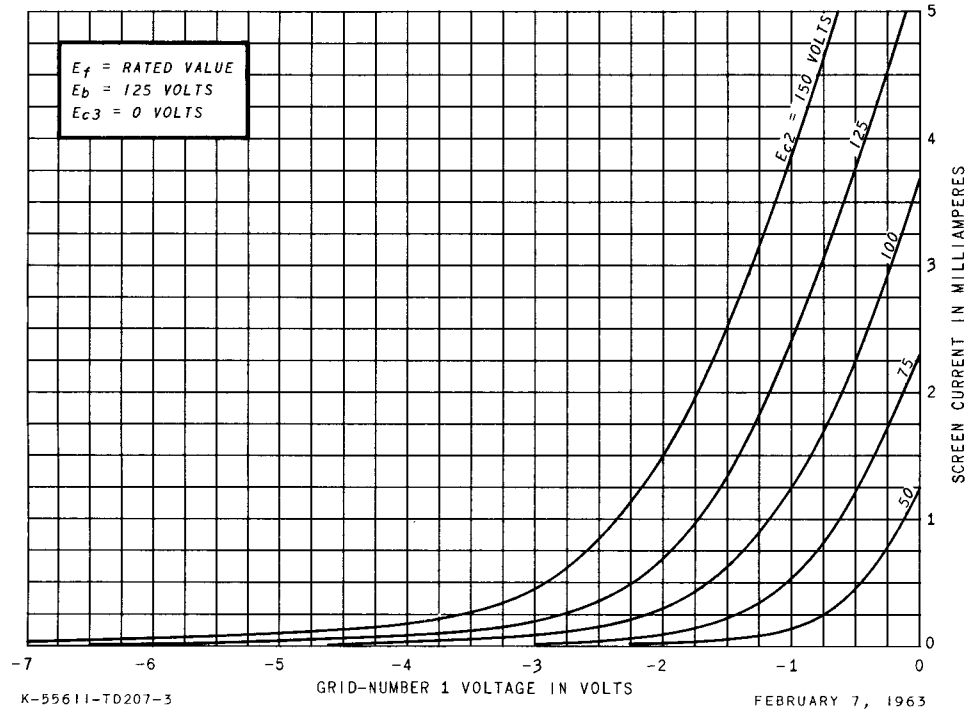
AVERAGE TRANSFER CHARACTERISTICS



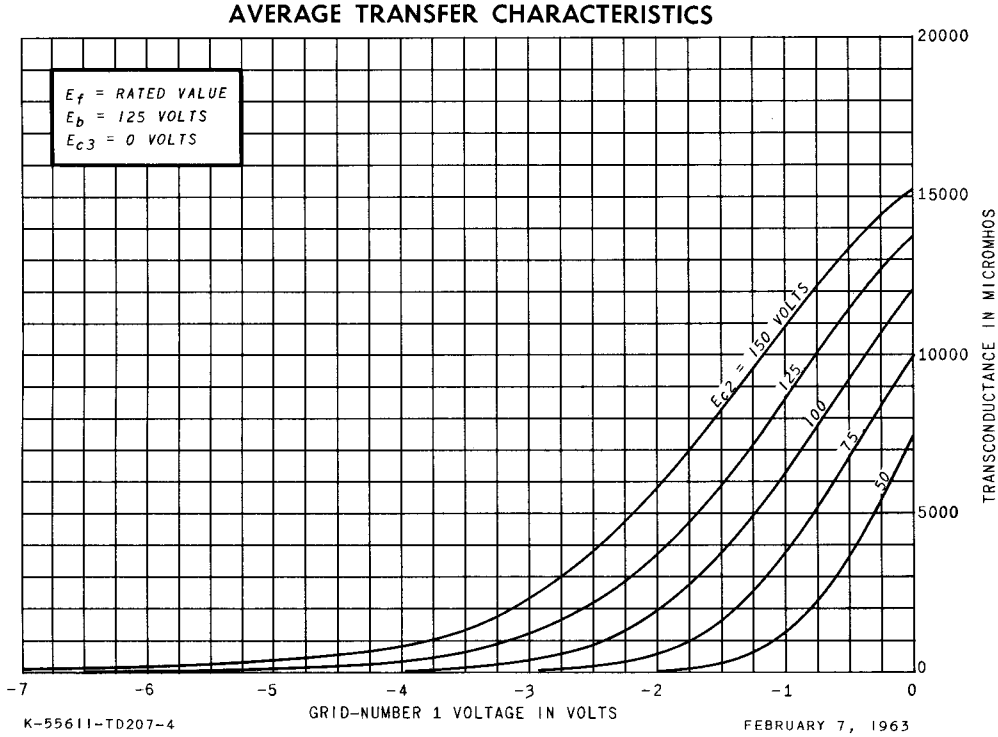
K-55611-TD207-2

FEBRUARY 7, 1963

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

GL-8138

TRIGGERED SPARK GAP

MINIATURE SWITCHING DEVICE **3 KILOVOLTS**

18 JOULES

The GL-8138 is a small, cold cathode, gaseous, triggered spark gap capable of switching 18 joules at high voltages. Since the device does not require such external sources of energy as "keep-alive" circuits to initiate the discharge, its use permits both equipment cost reduction and savings in space through component elimination.

Mechanical features include rugged metal-ceramic construction, gold-plated terminals to resist corrosion, ability to withstand high shock and vibration conditions, and reliable operation over temperatures ranging from as low as −80 to as high as +300 F.

The GL-8138 is especially designed to deliver short rapid pulses of current with minimum delay and jitter in applications where high hold-off voltages and low leakage currents exist.

Applications include switching single-stored electrical-energy systems into low-impedance loads, or energy-storage capacitors into resistive or inductive loads.

Electrical

Heater Voltage ..... None Required

Mechanical

Mounting Position—Any
Net Weight ..... 0.4 Ounces

Thermal

Ambient Temperature Range ..... −80 to +300 F

MAXIMUM RATINGS

Interelectrode Leakage Resistance ..... 10,000 Megohms
Main Gap
- Operating Voltage ..... 2.0 to 2.6 Kilovolts
- Hold-off Voltage, minimum—Terminal No. 1 Positive, Terminal No. 2 Negative
  - 1.0 Minute ..... 4.0 Kilovolts
  - 10 Minutes ..... 3.6 Kilovolts
  - 30 Minutes ..... 3.0 Kilovolts
- Static Breakdown Voltage
  - Minimum ..... 4.25 Kilovolts
  - Maximum ..... 5.2 Kilovolts
- Peak Current
  - Unidirectional Pulse, maximum ..... 4000 Amperes
  - Pulse Duration, maximum ..... 10 Microseconds
  - Ringing*, maximum ..... 1500 Amperes
- Arc Drop, approximate ..... 60 Volts
- Delay Time†, Vapp 2400 DC ..... 2.5 Microseconds
- Jitter‡ ..... 0.5 Microseconds

Trigger Gap
- Hold-off Voltage, minimum—Terminal No. 2 Positive, Terminal No. 3 Negative
  - 1.0 Minute ..... 1.2 Kilovolts
- Static Breakdown Voltage
  - Minimum ..... 1.5 Kilovolts
  - Maximum ..... 2.8 Kilovolts
- Trigger Firing Voltage§, minimum ..... 3.0 Kilovolts
- Trigger Firing Current ..... 5.0 Amperes
- Duration of Trigger Firing Pulse—Sinusoidal Pulse, 5.0 Kilovolts Peak Voltage, 18 Microseconds to Peak

* 1500 amperes for the first half-cycle of a 10 to 12-kilocycle ringing frequency. Circuit should be damped sufficiently to pass only 5 to 6 cycles.

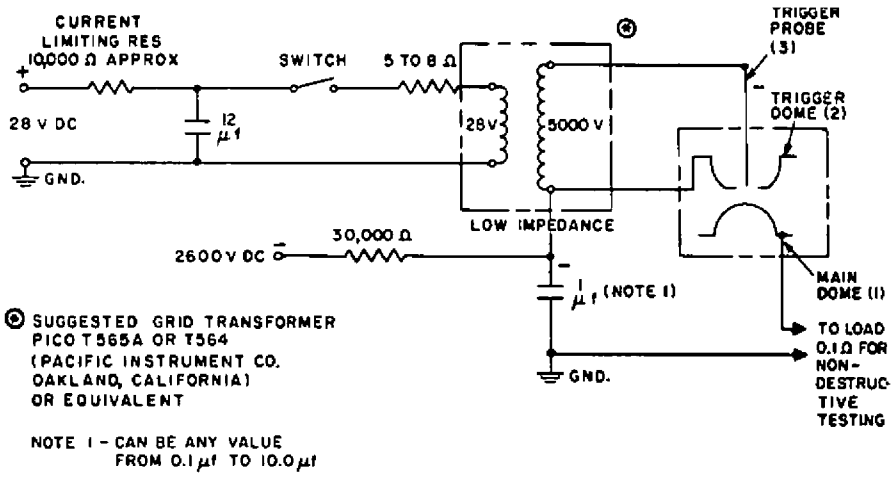
† From trigger-gap breakdown to main-gap breakdown.

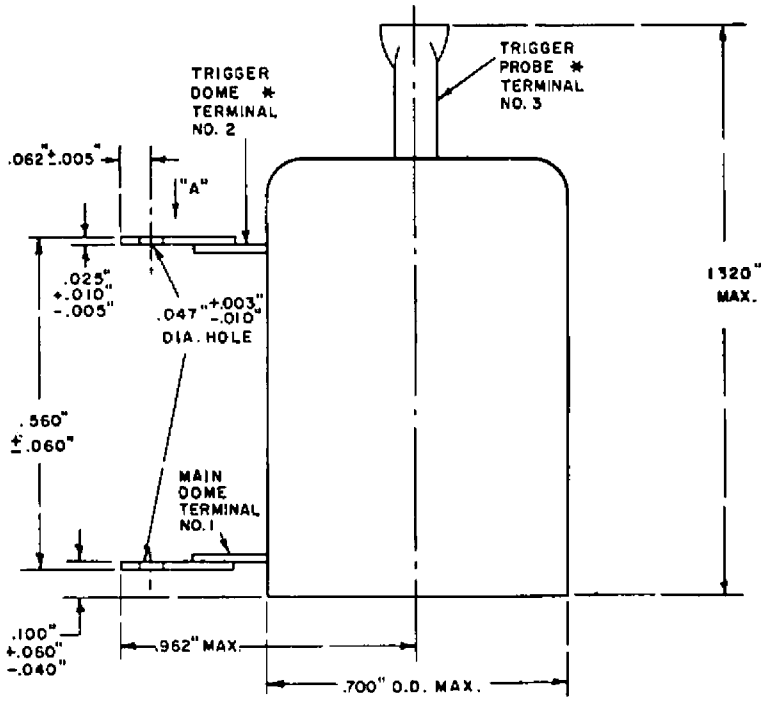
‡ Main-gap jitter is defined as the variation in main-gap delay time.

§ Breakdown to occur on leading edge of pulse having a rise time of 8 microseconds where rise time is defined as the interval of time between 10 percent and 90 percent of the trigger voltage pulse.

GENERAL ELECTRIC

from JEDEC release #3876, Sept. 10, 1962





* APPLY TRIGGER VOLTAGE BETWEEN THESE TWO TERMINALS.

TERMINALS GOLD-PLATED ON GL-8138

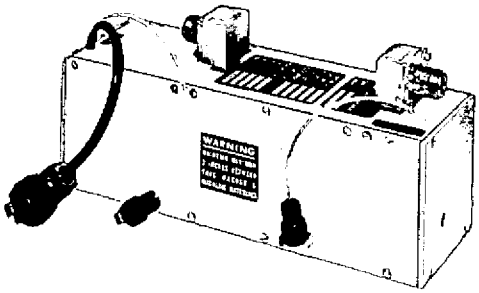
GENERAL ELECTRIC
POWER TUBE DEPARTMENT
Schenectady 5, N. Y.

from JEDEC release #3571, Jan. 22, 1962

GL-8154

TRAVELING-WAVE TUBE

LESS THAN 10 DB NOISE FIGURE **7000–11,000 MEGACYCLES**
25 DB GAIN **METAL-CERAMIC**
LOW NOISE



The GL-8154 is a ruggedized, low-noise, broadband traveling-wave tube for use in the 7000-to-11,000 megacycle frequency range. It has a noise figure of less than 10 decibels across the entire band with a power output of 5 milliwatts.

The tube is of metal-and-ceramic construction and is supplied as a complete packaged assembly which includes permanent focusing magnets, connectors, and housing. The entire assembly weighs approximately 11.5 pounds.

The broad bandwidth, low-noise, high gain, freedom from tuning adjustments, and rugged construction make this tube particularly useful in military systems. As the input tube for radar receivers, it has the decided advantages of low noise and protection to the crystal mixer. Other applications include electronic countermeasures equipment, microwave relay systems, and radiometry.

ELECTRICAL

Frequency	7000 to 11,000	Megacycles
Heater		
Voltage	6.3	Volts
Current, nominal	0.3	Ampere
A heater-voltage regulation of ±2 percent is recommended to realize optimum gain and noise figure.		
Focusing Method—Permanent Magnet		
Noise Figure*†, maximum	10	Decibels
Small-Signal Gain, minimum	25	Decibels
Saturated Power Output, nominal	5.0	Milliwatts
Collector Dissipation	1.0	Watt
Impedance, Coaxial		
Input, VSWR	Less than 2.5 to 1	
Output, VSWR	Less than 3.5 to 1	

MECHANICAL

Mounting Position—Any
Connectors
- DC Socket—Winchester PM6P-LS (or equivalent)
- Helix—Winchester PM1P-LS (or equivalent)
- Collector—Winchester PM1P-LS (or equivalent)
- RF Connectors, Coaxial
  - Input—Type N, UG-58/U
  - Output—Type N, UG-58/U

Over-all Dimensions		
Length	9.31	Inches
Width	2.98	Inches
Height	4.38	Inches
Weight (Complete Assembly), approximate	11.5	Pounds

THERMAL

Cooling—Convection

ENVIRONMENTAL

Shock (energized)	30 G for 11 milliseconds on each of three mutually perpendicular axes.
Vibration (operating)	0.031 inches double amplitude from 5 to 55 cycles per second and 5 G from 55 to 1500 cycles per second with sweep over 5 to 1500 cycles per second for 100 minutes on each of three mutually perpendicular axes.
Humidity (non-operating)	MIL-E-5272 C, Paragraph 4.4.1 (Procedure I); i.e., non-operating tube in 95 percent relative humidity atmosphere for 10 days with temperature cycled slowly from approximately 30 C to 71 C each day.
Acoustic noise (operating)	135 decibels, 25 to 12,000 cycles per second random noise.
Altitude (operating)	100,000 feet mean sea level.
Operating temperature, ambient	−20 to +70 C

TYPICAL OPERATING CONDITIONS**

Electrode-No. 1 Voltage, Grid	−10 to −25	Volts
Electrode-No. 2 Voltage, Anode	30 to 60	Volts
Electrode-No. 3 Voltage	40 to 150	Volts
Electrode-No. 4 Voltage	250 to 450	Volts
Helix		
Voltage	700 to 850	Volts
Current, maximum	50	Microamperes
Collector Voltage	900 to 1000	Volts
Beam Current	400 to 700	Microamperes
Magnetic Field Strength, approximate	600	Gausses

* Over band with the same operating voltages that provide minimum gain variation.
† An improved noise figure is possible when this tube is optimized for a narrow frequency band. If requirements exist for an improved noise figure over a narrow band, consult the nearest Power Tube Department sales office.
**All voltages may be isolated from ground; i.e., it is not necessary to operate the cathode, helix, collector, or any other electrode at ground potential. Voltages shown are measured with respect to cathode. For minimum noise and optimum gain characteristics, voltages should be adjusted within ranges specified by instructions accompanying each tube.

GENERAL ELECTRIC

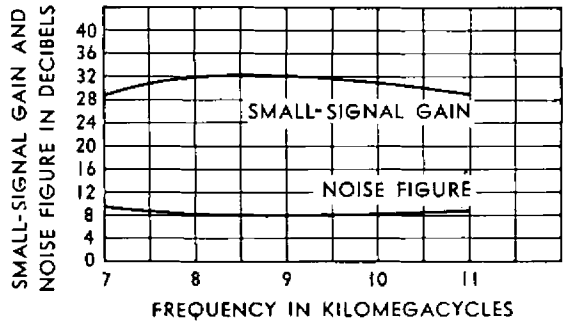
PERMANENT-MAGNET PRECAUTIONS

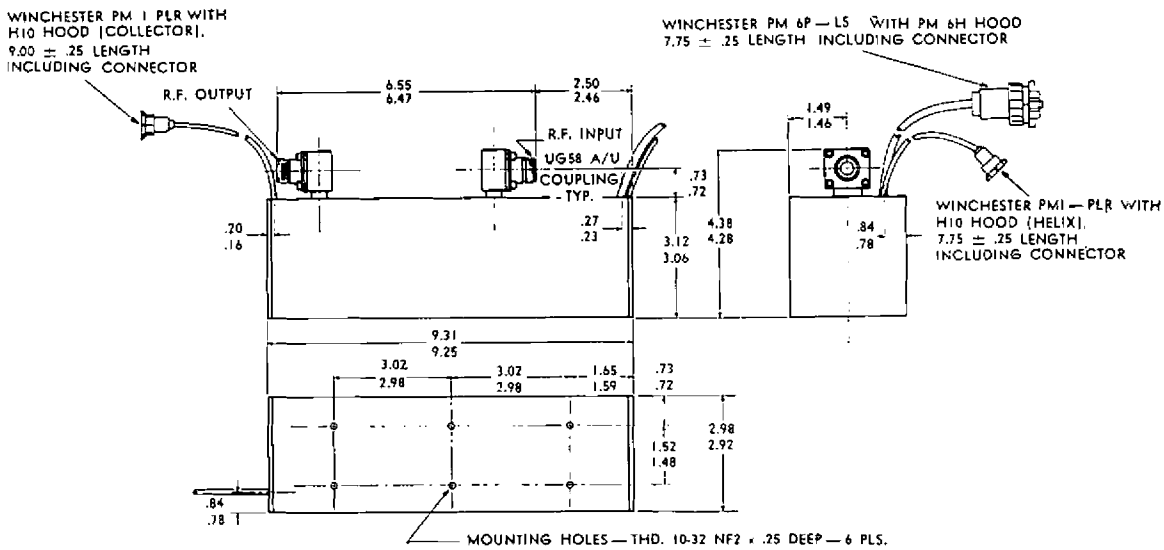
This tube uses a uniform-field permanent magnet as the focusing structure. A label on the tube specifies a nominal lower limit of two inches on magnetic-material proximity. It must be realized that strong external magnets or large amounts of magnetic material at this distance may permanently damage the tube. A small screwdriver will not, while a large a-c transformer or a large sheet of steel at this distance may cause damage by defocusing the tube.

In addition, a related caution is important and must be remembered whenever handling a uniform-field tube. The permanent magnets of these tubes cause a large attractive force between the tube and magnetic material. Unless one is always careful to hold the tube and/or magnetic objects near the tube firmly, the result is sudden direct contact. The magnetic object may cause tube damage due to violations of the minimum spacing requirement.

For small steel hand tools, a two-inch limit is sufficient. For large magnetic objects with magnetic fields of their own, the lower minimum distance should be determined accurately by testing. To accomplish this, the tube may be secured to a suitable three-foot-long dielectric support and the tube case grounded. With the tube operating and its helix current being measured, the tube may be moved slowly by the dielectric support toward the magnetic object. (CAUTION: Appropriate electrical safety procedures should be followed at all times.) The minimum distance for which there is no degradation in r-f performance is the point at which the helix current starts to increase. If a slight degradation in noise figure can be accepted, the helix current may be allowed to increase somewhat as long as it stays below its operating maximum.

NOISE FIGURE AND SMALL-SIGNAL GAIN VS. FREQUENCY





PIN CONNECTIONS PM6P-LS	
ELECTRODE	PIN
CATHODE	F
HEATER	A
NO. 1, GRID	B
NO. 2, ANODE	C
NO. 3, FOCUS	D
NO. 4, FOCUS	E

ELECTRONICS

8156

COMPACTRON BEAM PENTODE

FOR RADIO-FREQUENCY POWER AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING

The 8156 is a compactron beam pentode designed for use as a radio-frequency power amplifier in mobile equipment.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	13.5±1.5	Volts
Heater Current‡	0.3	Amperes
Direct Interelectrode Capacitances§		
Grid-Number 1 to Plate: (g1 to p)	0.07	pf
Input: g1 to (h + k + g2 + b.p.)	11	pf
Output: p to (h + k + g2 + b.p.)	5.0	pf

MECHANICAL

Operating Position - Any
Envelope - T-9, Glass
Base - E12-70, Button 12-Pin
Outline Drawing

Maximum Diameter	1.188	Inches
Maximum Over-all Length	2.313	Inches
Maximum Seated Height	1.938	Inches

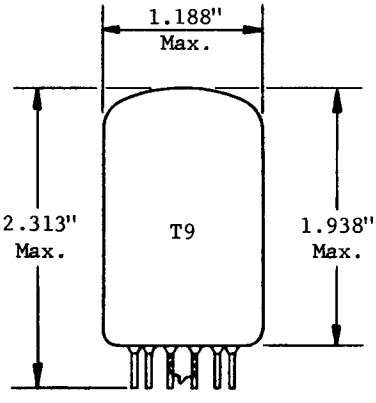
MAXIMUM RATINGS

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

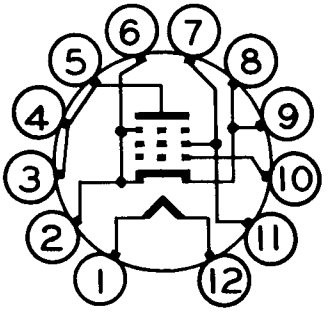
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

Pin 1 - Heater
Pin 2 - Cathode and Beam Plates
**Pin 3 - Plate
**Pin 4 - Plate
**Pin 5 - Plate
Pin 6 - Cathode and Beam Plates
Pin 7 - Grid Number 2 (Screen)
Pin 8 - Cathode and Beam Plates
Pin 9 - Cathode and Beam Plates
Pin 10 - Grid Number 1
Pin 11 - Grid Number 2 (Screen)
Pin 12 - Heater

BASING DIAGRAM



EIA 12EU

MAXIMUM RATINGS (Cont'd)

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY AND RADIO-FREQUENCY POWER AMPLIFIER—CLASS C FM TELEPHONY

ABSOLUTE-MAXIMUM VALUES

	CCS¶	ICAS#	IMS△	
DC Plate Voltage	500	600	600	Volts
DC Screen Voltage	250	250	250	Volts
DC Grid-Number 1 Voltage	-100	-100	-150	Volts
DC Grid-Number 1 Current	5.0	5.0	5.0	Milliamperes
DC Plate Current	100	100	100	Milliamperes
Plate Dissipation	11	13	15	Watts
Screen Dissipation	2.5	2.5	2.5	Watts
Peak Heater-Cathode Voltage				
Heater Positive with Respect to Cathode	100	100	100	Volts
Heater Negative with Respect to Cathode	100	100	100	Volts
Bulb Temperature at Hottest Point	220	220	220	C

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	200	Volts
Screen Voltage	125	Volts
Grid-Number 1 Voltage	-9.0	Volts
Plate Current	75	Milliamperes
Screen Current	3.5	Milliamperes
Transconductance	7600	Micromhos
Grid-Number 1 Voltage, approximate		
Ib = 100 Microamperes	-45	Volts

TYPICAL OPERATION AS CLASS C AMPLIFIER

	CCS¶	ICAS#	IMS△	
Frequency	175	175	175	Megacycles
DC Plate Voltage	250	300	400	Volts
DC Screen Voltage	185	180	170	Volts
DC Grid-Number 1 Voltage, approximate	-70	-80	-60	Volts
Grid-Number 1 Resistor	20000	20000	20000	Ohms
DC Plate Current	100	95	90	Milliamperes
DC Screen Current	11	10	10	Milliamperes
DC Grid-Number 1 Current, approximate	3.5	4	3	Milliamperes
Driving Power, approximate	1	1	1	Watts
Useful Power Output, approximate	14	15.5	21	Watts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 13.5 volts.

§ Without external shield

¶ Continuous Commercial Service (CCS) is defined as that type of service in which normal tube life and reliability of performance under continuous operating conditions are the prime consideration.

\# Intermittent Commercial and Amateur Service (ICAS) is defined to include the many applications where the transmitter design factors of minimum size, light weight, and considerably increased power output are more important than long tube life. In this service, life expectancy may be one-half that obtained in Continuous Commercial Service.

Under the ICAS classification are such applications as the use of tubes in amateur transmitters, and the use of tubes in equipment where transmissions are of an intermittent nature. The term "intermittent" is used to identify operation conditions in all applications other than amateur in which no operating or "on" period exceeds 5 minutes and every "on" period is followed by an "off" or standby period of at least the same or greater duration.

NOTES (Cont'd)

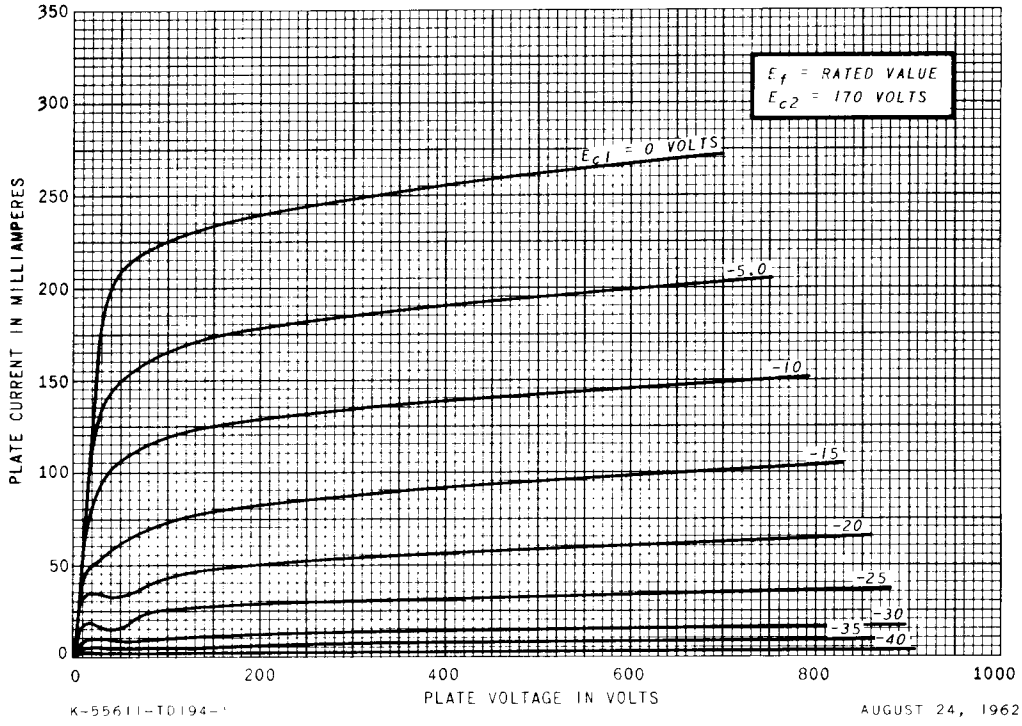
Δ Intermittent Mobile Service (IMS) is defined to include those applications, such as aircraft, where the transmitter design factors of minimum size, light weight, and exceedingly high power output for short intervals are the primary requirements even though the average life expectancy of tubes used in such transmitters is reduced. Tube ratings for IMS service are established on the basis that the transmissions have maximum "on" periods of 15 seconds followed by "off" periods of at least 60 seconds, except that it is permissible to make equipment tests with maximum "on" periods of 5 minutes followed by "off" periods of at least 5 minutes provided the total "on" time of such periods does not exceed 10 hours during the life of any tube.

Although the use of tubes under IMS ratings involve great reduction in tube life, such use can be justified as economical practice in applications where high power is intermittently desired from small tubes.

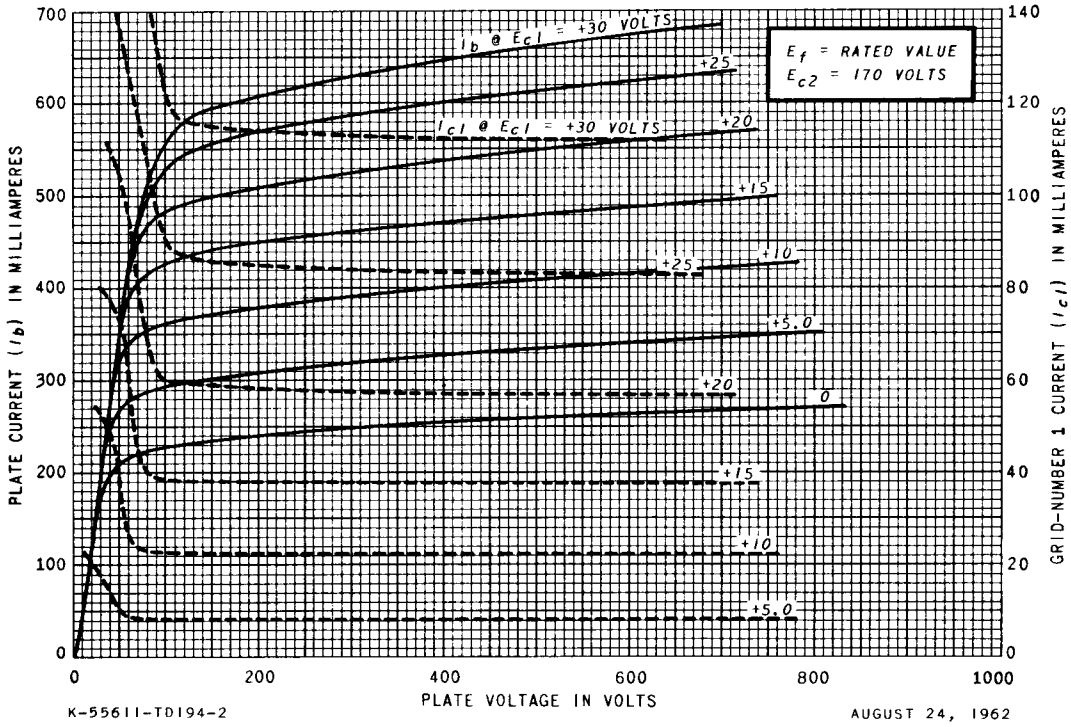
** Socket contacts for these three pins should be connected together.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



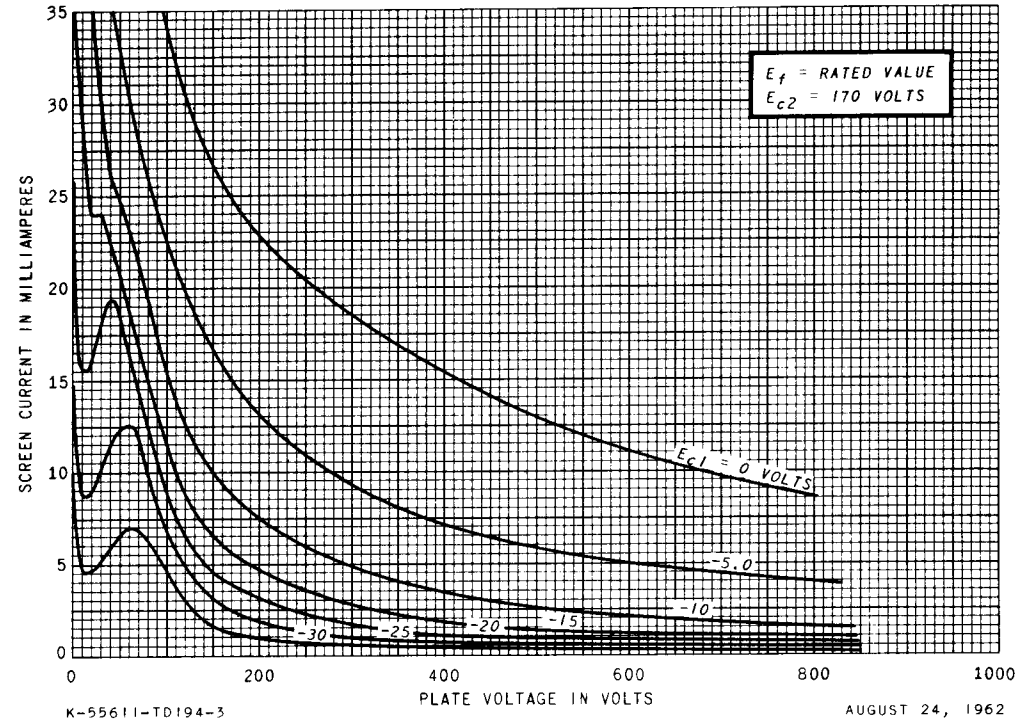
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD194-2

AUGUST 24, 1962

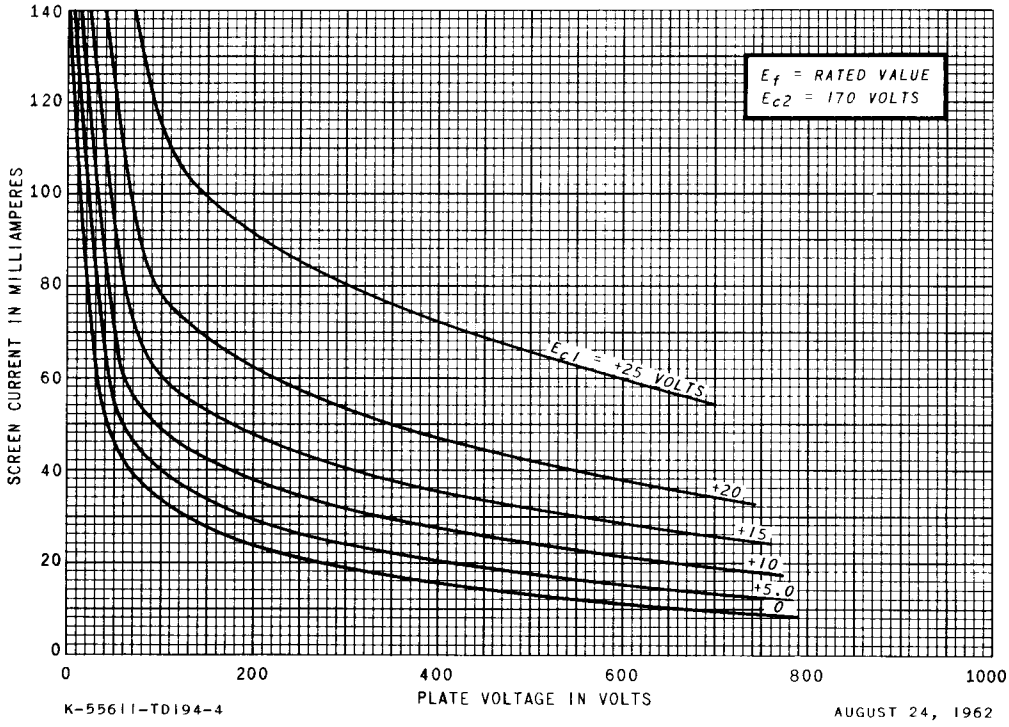
AVERAGE CHARACTERISTICS



K-5561I-TD194-3

AUGUST 24, 1962

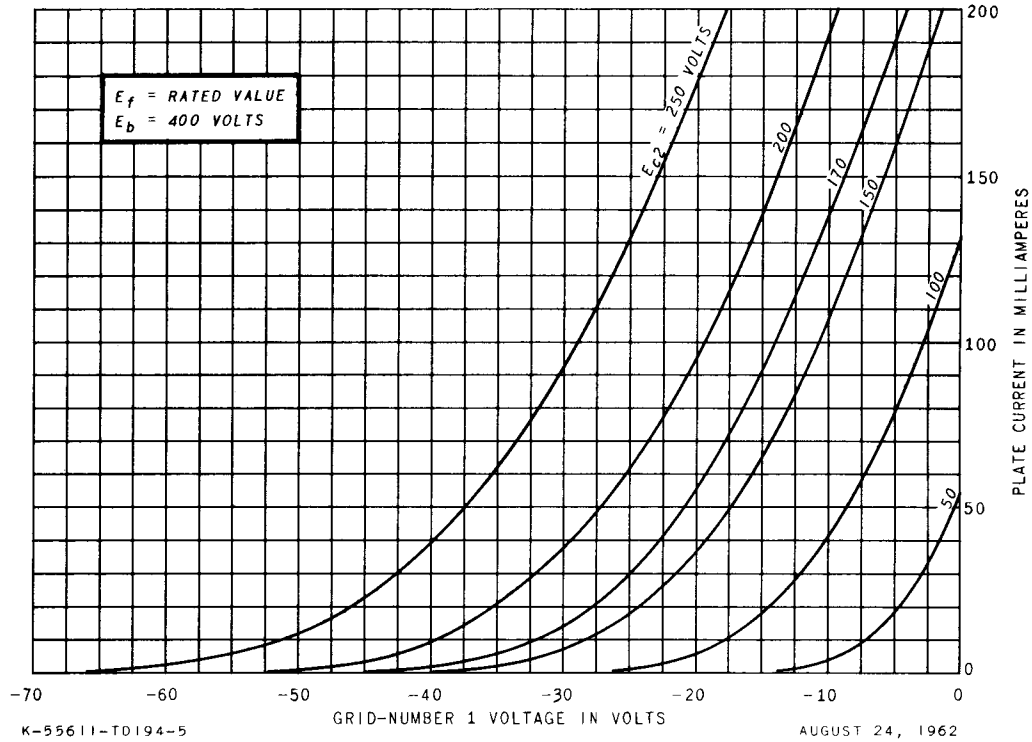
AVERAGE CHARACTERISTICS



K-55611-TD194-4

AUGUST 24, 1962

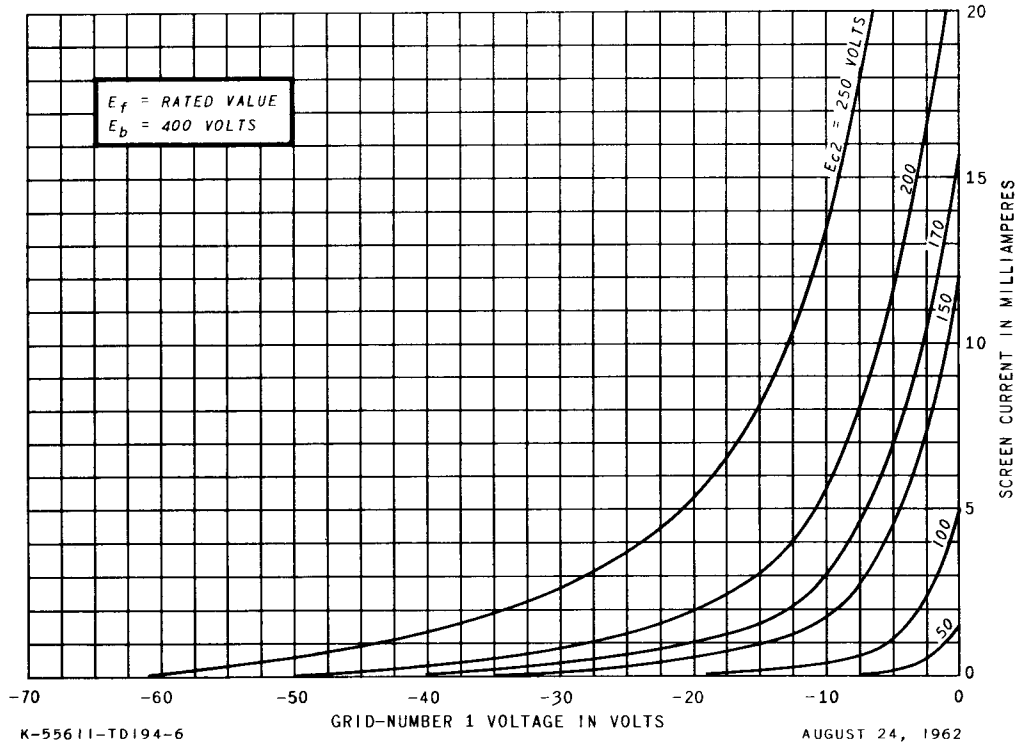
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD194-5

AUGUST 24, 1962

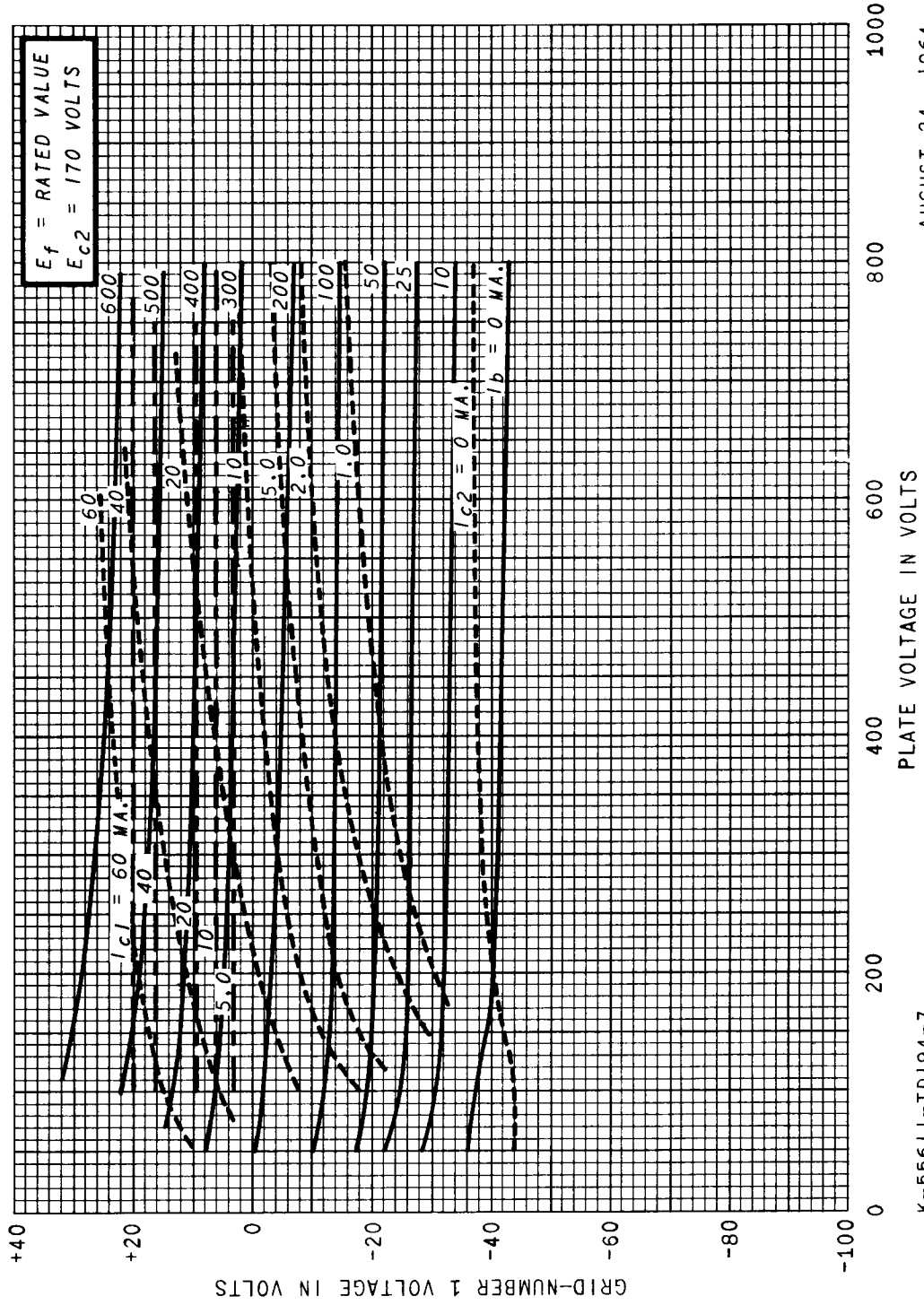
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD194-6

AUGUST 24, 1962

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



K-5561I-TD194-7

AUGUST 24, 1964

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

from JEDEC release #3769, June 18, 1962

GL-8205
COAXIAL IGNITRON

AC-CONTROL SERVICE

4800 KILOVOLT-AMPERES

HIGH EFFICIENCY COOLING

The GL-8205 is a sealed, stainless-steel-jacketed ignitron for a-c control welder service. It is a coaxial-design version of the GL-7151.

Two tubes in an inverse-parallel connection will control 4800 kilovolt-amperes at 250 to 600 volts RMS, 25 to 60 cycles.

In the coaxial construction, current flows through the tube from anode to cathode, then up the tube wall to a coaxial cathode terminal at the top. This current flow provides a magnetic shield which eliminates the arc deflection that the high peak currents possible with this tube might cause in standard-design ignitrons.

Other features of the 8205 include a specially designed water-cooling chamber that provides high-efficiency cooling at the bottom of the tube without increasing the water-pressure drop of the cooling jacket. A thermostat mounting plate, thermally coupled to the mercury-condensing surface of the tube, facilitates attachment of a thermostat to provide either protection against excessive temperature or temperature control through regulation of the water flow.

Electrical

Electrodes		
Main Anodes	1	
Main Cathodes	1	
Ignitors	1	
Arc Drop		
At 9600 Amperes Peak	31	Volts
At 1000 Amperes Peak	20	Volts

Mechanical

Envelope Material—Stainless Steel		
Mounting Position—Vertical, Anode Terminal Up		
Net Weight	70	Pounds

Thermal

Cooling—Water		
Inlet Water Temperature, minimum	0	C
Outlet Water Temperature, maximum	40	C
Water Flow, minimum	10	Gallons per Minute
Water flow should be continued for at least one hour after removal of anode power.		
Maximum Working Water Pressure, Non-Shock	100	Pounds per Square Inch
Water-Cooling Characteristics at Rated Minimum Flow		
Water Temperature Rise at Maximum Current	8	C
Water Pressure Drop, maximum	1.5	Pounds per Square Inch

AC-Control Service*

Two Tubes in Inverse Parallel, Ratings per Tube

Voltage	250 to 600	Volts RMS
Maximum Demand	4800	Kilovolt-Amperes
Corresponding Average Current*	486	Amperes
Maximum Average Current*	900	Amperes
Corresponding Demand	1600	Kilovolt-Amperes
Maximum Demand Current Below 500 Volts	9600	Amperes RMS
Maximum Averaging Time		
At 250 Volts RMS	8.9	Seconds
At 500 Volts RMS	4.5	Seconds
Maximum Peak Fault Current		
At 250 Volts	54,000	Amperes
At 600 Volts	22,400	Amperes
Frequency Range	25-60	Cycles per second

Cathode Excitation Requirements

Anode Firing		
Ignitor Voltage Required to Fire	200	Volts
Ignitor Current Required to Fire	30	Amperes
Starting Time at Required Voltage or Current	100	Microseconds
Separate Excitation		
Pulse Width		
Recommended	500	Microseconds
Maximum	4000	Microseconds
When the average anode current is greater than 20 amperes the pulse width must not fall below 150 microseconds.		
Maximum Rate of Rise of Ignitor Current	2.5	Amperes per Microsecond

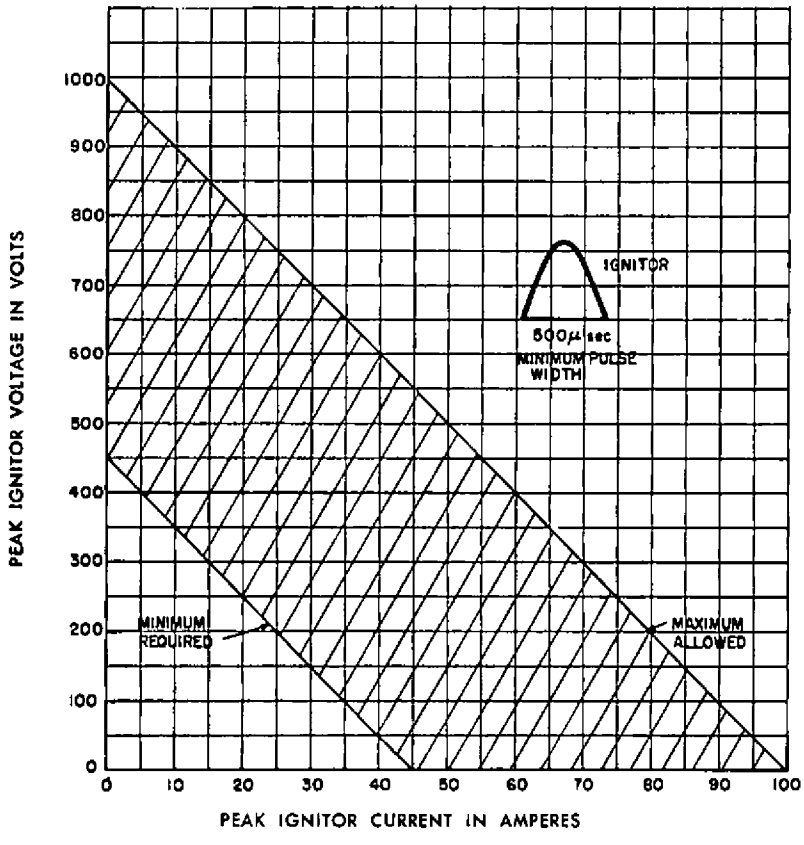
Ignitor†		
Maximum Voltage		
Positive—Anode Voltage Negative	5	Volts
Maximum Current		
Peak	100	Amperes
RMS	10	Amperes
Average	1	Ampere
Maximum Averaging Time	5	Seconds

* RMS demand voltage, current, and kilovolt-ampere demand are all on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used. Straight-line interpolation on log-log paper is allowed between corresponding points.

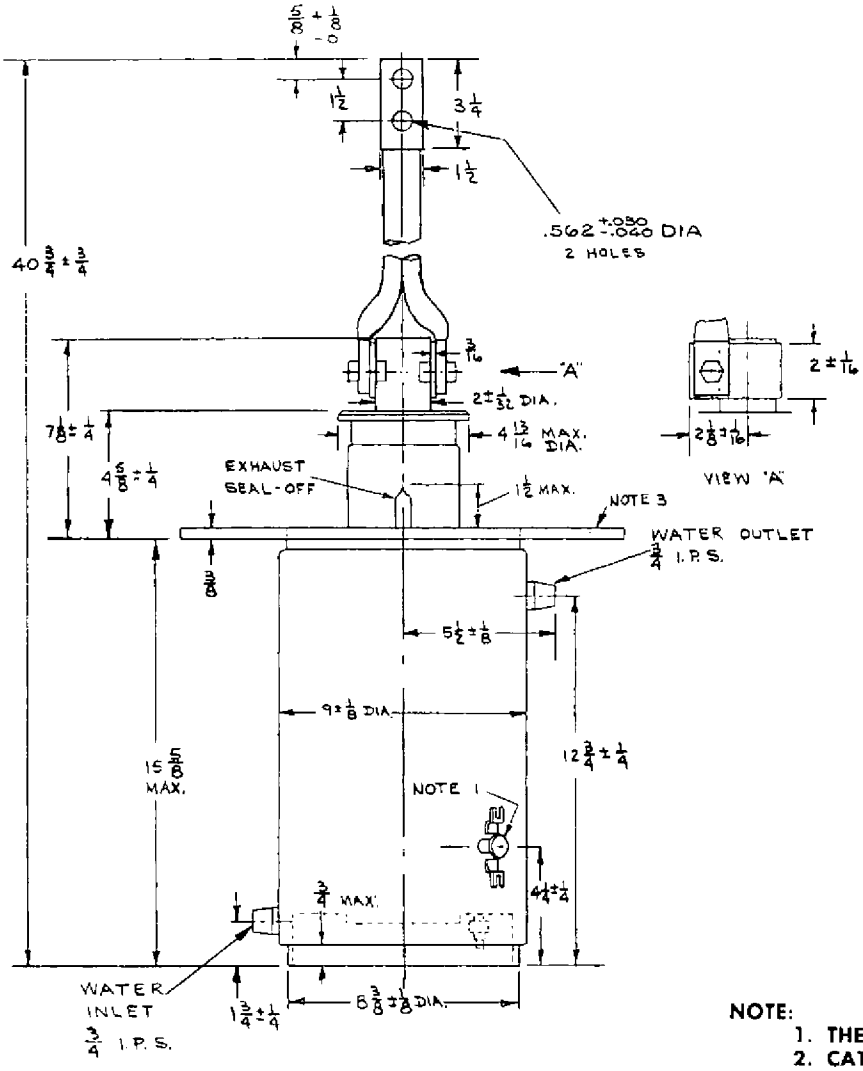
† These ratings apply only when anode firing of the ignitor is employed. See curve K69087-72A982 on page 2 for values when separate excitation is used.

GENERAL ELECTRIC

IGNITOR VOLT-AMPERE REQUIREMENTS FOR SEPARATE EXCITATION

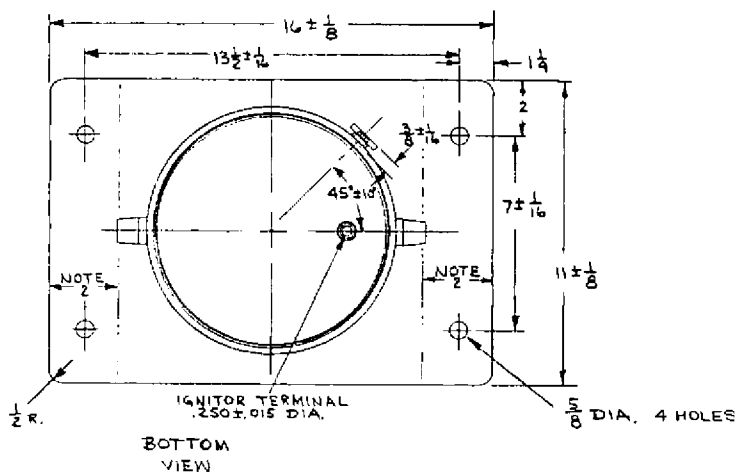


THE IGNITOR FIRING CIRCUIT SHOULD BE DESIGNED TO OPERATE WITHIN THE SHADED AREA



NOTE:

1. THERMOSTAT CONTACT AREA
2. CATHODE CONTACT AREA, 2½ WIDE
3. TUBE SUPPORT & CATHODE TERMINAL





GL-8326

HYDROGEN THYRATRON

33 KILOVOLTS PEAK
100 KILOWATTS AVERAGE POWER

CERAMIC ENVELOPE
EXTERNAL ELECTRODES

The GL-8326 is a hydrogen thyratron for radar-modulating and other pulsing applications. It is capable of switching an average power of 100 kilowatts.

Mechanically, the tube features a heavy-duty ceramic envelope and external electrodes to improve heat dissipation.

The high peak power rating of this tube and its mechanical design features assure reliable service under the stringent operating conditions encountered in high-power pulse equipment.

Electrical

	Minimum	Bogey	Maximum	
Cathode—Indirectly Heated				
Cathode is Tied to Heater Midpoint				
Heater Voltage	6.0	6.3	6.6	Volts
Heater Current, Ef = 6.3 volts	35	—	55	Amperes
Reservoir				
Heater Voltage	3.5	4.5	5.5	Volts
Heater Current	—	—	24	Amperes
Heating Time	15	—	—	Minutes
Direct Interelectrode Capacitances				
Anode to Grid	—	40	—	μμf
Grid to Cathode	—	40	—	μμf
Anode Current Time Jitter	—	0.005	0.01	Microseconds
Anode Delay Time*	—	—	1	Microcesond
Delay Time Drift†	—	—	0.1	Microsecond
Anode Voltage Drop	—	—	400	Volts
Grid Drive‡				

Mechanical

Mounting Position—Vertical with Base Down		
Altitude, maximum	10,000	Feet
Net Weight, approximate	15	Pounds

Thermal

Ambient Temperature Limits	—55 to +75	C
Type of Cooling—Forced Air		
Air Flow Rate, at 40 C Inlet Temperature	160	Cubic Feet Per Minute
Velocity, minimum	2000	Feet per Minute

At higher inlet temperatures increased air flow may be required.

MAXIMUM RATINGS—ABSOLUTE VALUES

Maximum Peak Anode Voltage		
Inverse (See OPERATING NOTES, Electrical)		
Forward, minimum supply voltage = 3500 volts d-c	33,000	Volts
Maximum Cathode Current		
Peak	4000	Amperes
Average	7.0	Amperes
Maximum Averaging Time	1	Cycle
RMS¶	100	Amperes
Anode Dissipation Factor§	55 x 10^9	
Maximum Negative Control-Grid Voltage before Conduction	650	Volts
Maximum Rate of Rise of Anode Current	10,000	Amperes per Microsecond

* The time interval between the point on the rising portion of the grid pulse which is 26 percent of the peak unloaded pulse amplitude and the start of the anode current pulse.

† Change in anode delay time relative to the delay time observed after two minutes of operation.

‡ Driver pulse measured at the tube socket with thyratron grid disconnected; amplitude = 1300 volts minimum, 2500 volts maximum, above 0; time of rise = 0.35 microsecond maximum, measured from 26 percent to 70 percent of peak value; grid pulse duration = 2 microseconds minimum, measured between 70 percent of peak on rising side to 70 percent of peak on falling side; impedance of drive circuit = 10 to 25 ohms.

¶ The RMS current of hydrogen thyratrons is the square root of the product of the average and peak currents.

§ Highest rating to which tube has been tested. This is not necessarily maximum tube capability.

GENERAL ELECTRIC

from JEDEC release #3970, Nov. 12, 1962

OPERATING NOTES

Thermal

The optimum reservoir voltage for operation under artificial-cooling conditions at maximum tube voltage, maximum peak and average tube currents, and at a repetition corresponding to an anode dissipation factor of 50 x 10^9 is inscribed on the base of the tube and must be held within ±5 percent. Applications involving operation at other conditions may necessitate a redetermination of the optimum reservoir range.

Electrical

In switching and line-type modulator circuits the minimum inverse anode voltage permissible is 5 percent of the peak forward voltage, and the maximum is 5000 volts during the first 25 microseconds following the anode pulse, exclusive of a spike of 0.05 microsecond maximum duration.

If the forward anode voltage is applied instantaneously, it should be limited to a maximum of 22 kilovolts peak. The power-supply filter should be designed to limit the rate of application of this voltage to 550,000 volts per second.

X-RAY WARNING NOTICE

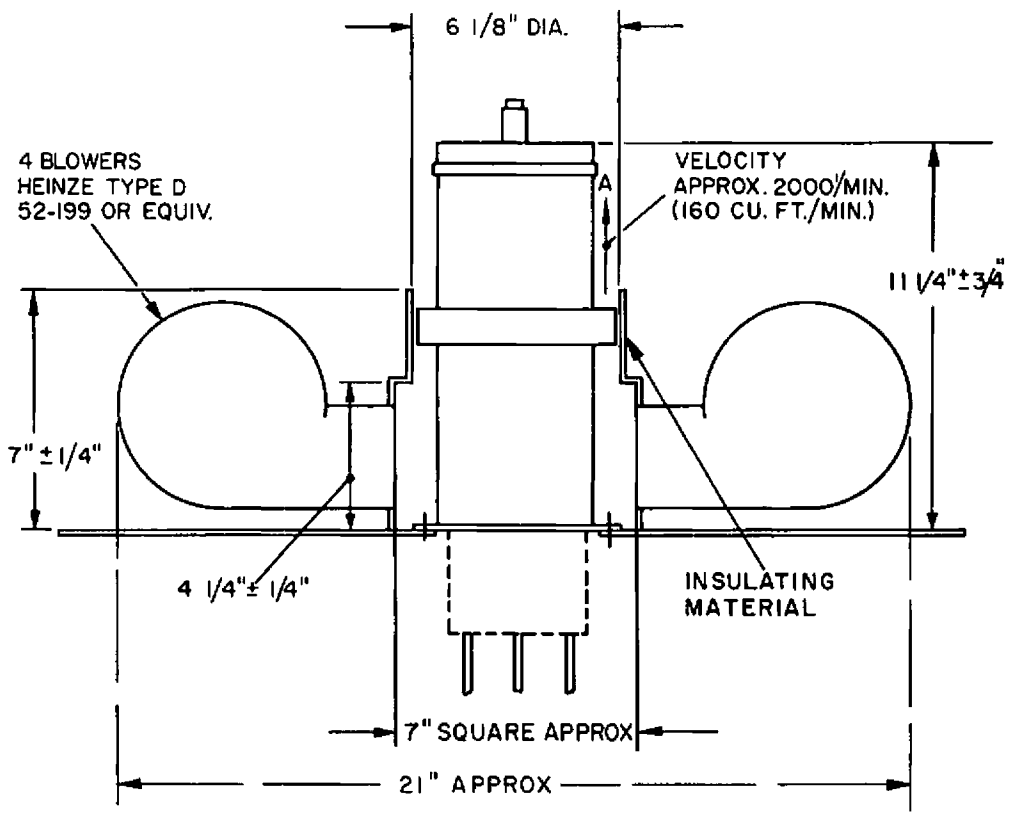
If the GL-8326 is operated at anode voltages in excess of 16 kilovolts, X-ray radiation shielding may be necessary to protect the user against possible danger of personal injury from prolonged exposure at close range. For further information consult the following references or other standard texts on the subject:

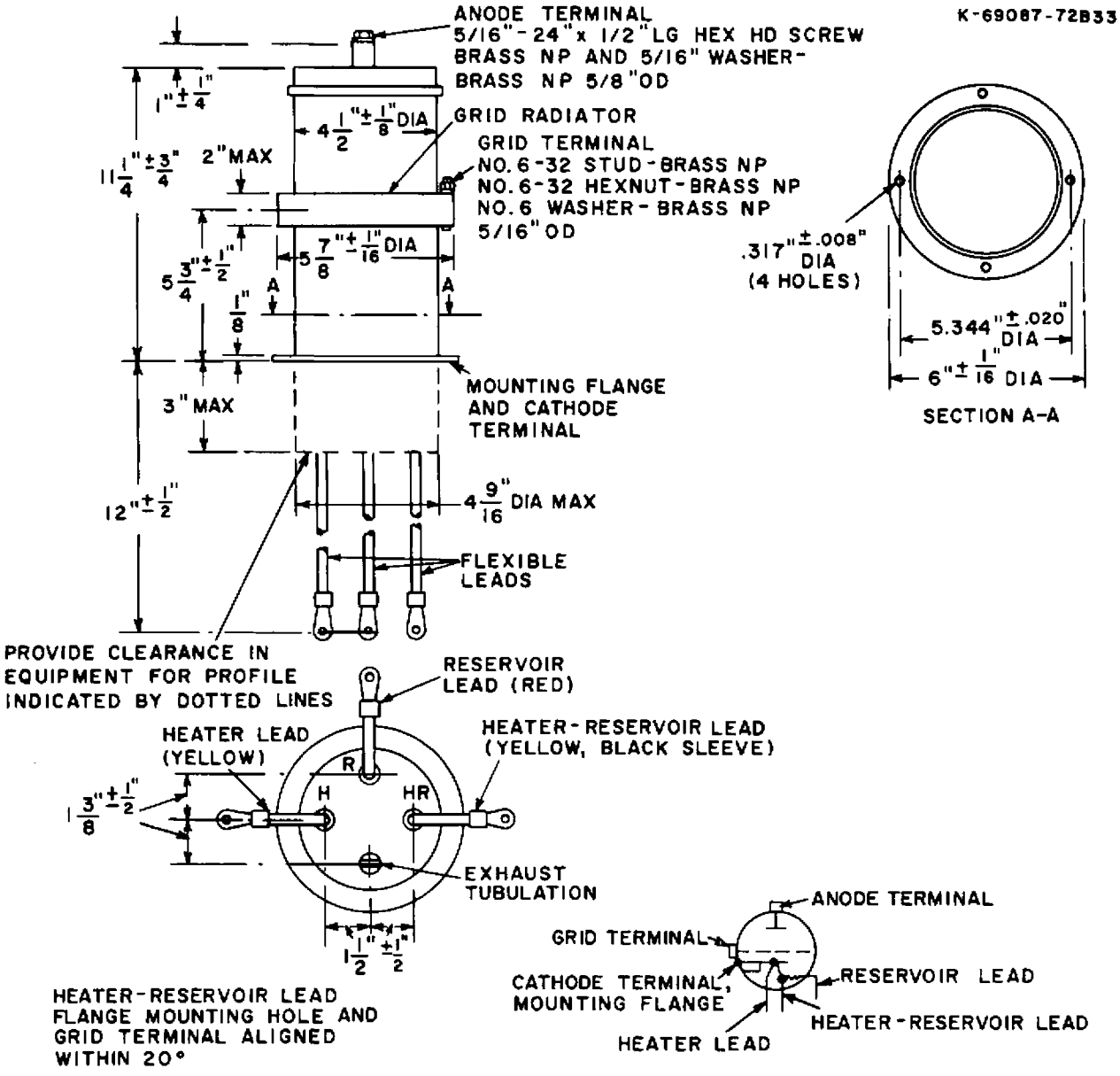
(a) X-RAY PROTECTION DESIGN, Handbook No. 50. National Bureau of Standards, Washington, D. C.

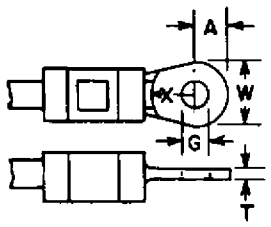
(b) X-RAY PROTECTION, Handbook No. 60. National Bureau of Standards, Washington, D. C.
The above references are available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

(c) SAFETY CODE FOR THE INDUSTRIAL USE OF X-RAYS, Bulletin No. Z54-1. American Standards Association, New York 17, N. Y.

(d) Schneider, S. and Reich, B., "X-Ray Emission from High-Voltage Hydrogen Thyratrons," PROC. IRE, Vol. 43, No. 6, June, 1955.







PRESSURE-TYPE LUGS WITH INSULATING SLEEVES

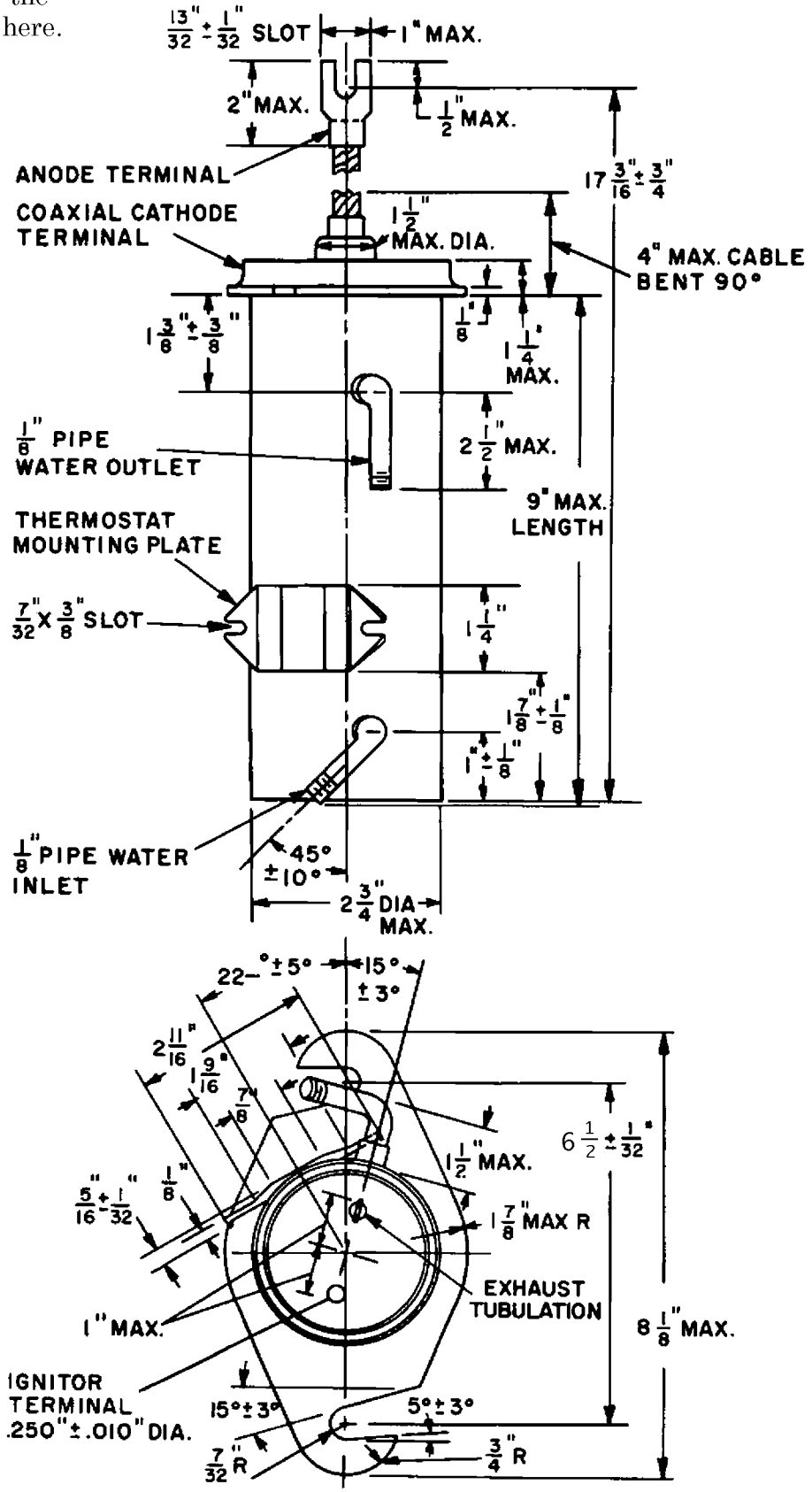
LEADS	LUG DESIGNATION	"G" INCHES	"W" INCHES	"A" INCHES	"X" INCHES	"T" INCHES
RESERVOIR	NO. 10	.187 TO .207	.395 MAX	.200 MAX	.275 MIN	.060 MAX
HEATER-RESERVOIR	1/4"	.260 TO .313	.605 MAX	.305 MAX	.380 MIN	.060 MAX
HEATER	1/4"	.260 TO .313	.605 MAX	.305 MAX	.380 MIN	.060 MAX

NOTE: THERE SHALL BE NO OBSTRUCTION WITHIN THE DISTANCE OF "X" FROM THE CENTER OF THE LUG SCREWHOLE

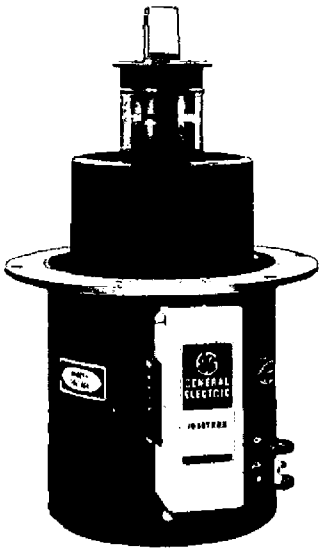
from JEDEC releases:
#3909, Oct. 1, 1962,
#3909A, April 1, 1963.

The 8360 is the same as the 7670 except for the dimensions shown here.

GL-8360
COAXIAL IGNITRON



GENERAL ELECTRIC



GL-8420

COAXIAL IGNITRON

INTEGRAL CONTROL THERMOSTAT FORCED-AIR COOLED

ELECTRONIC CONTACTOR SERVICE 1000 AMPERES

The GL-8420 is a forced-air-cooled ignitron for use in railroad locomotive service as an electronic contactor. In such application two tubes in an inverse-parallel connection control the a-c voltage input to a semiconductor rectifier.

Features include a coaxial construction in which current flows from anode to cathode, then up the tube wall to a coaxial cathode terminal. Coaxial current flow provides a magnetic shield to eliminate arc deflection caused by high peak currents. An integral thermostat provides protection against excessive temperature and loss of cooling air. An ignitor terminal block on the periphery of the tube facilitates connecting to the ignitor.

Electrical

Cathode Excitation—Cyclic		
Cathode Spot Starting—Ignitor		
Number of Electrodes		
Main Anodes	1	
Main Cathodes	1	
Ignitors	1	
Arc Drop, at 1100 Amperes Peak	19	Volts

Mechanical

Envelope Material—Steel		
Net Weight	130	Pounds
Mounting Position—Vertical, Anode Terminal Up		

Thermal

Type of Cooling—Forced Air		
Cooling Air Temperature		
Maximum	45	C
Minimum	10	C
Air Flow at Rated Load, minimum	600	Cubic Feet per Minute
Static Incoming Air Pressure at Minimum Flow	3.9	Inches—Water
Incoming Air Enters Beneath Tube—(See Outline Drawing)		

MAXIMUM RATINGS—AC CONTACTOR SERVICE
(Two Tubes in Inverse Parallel, Ratings per Tube)

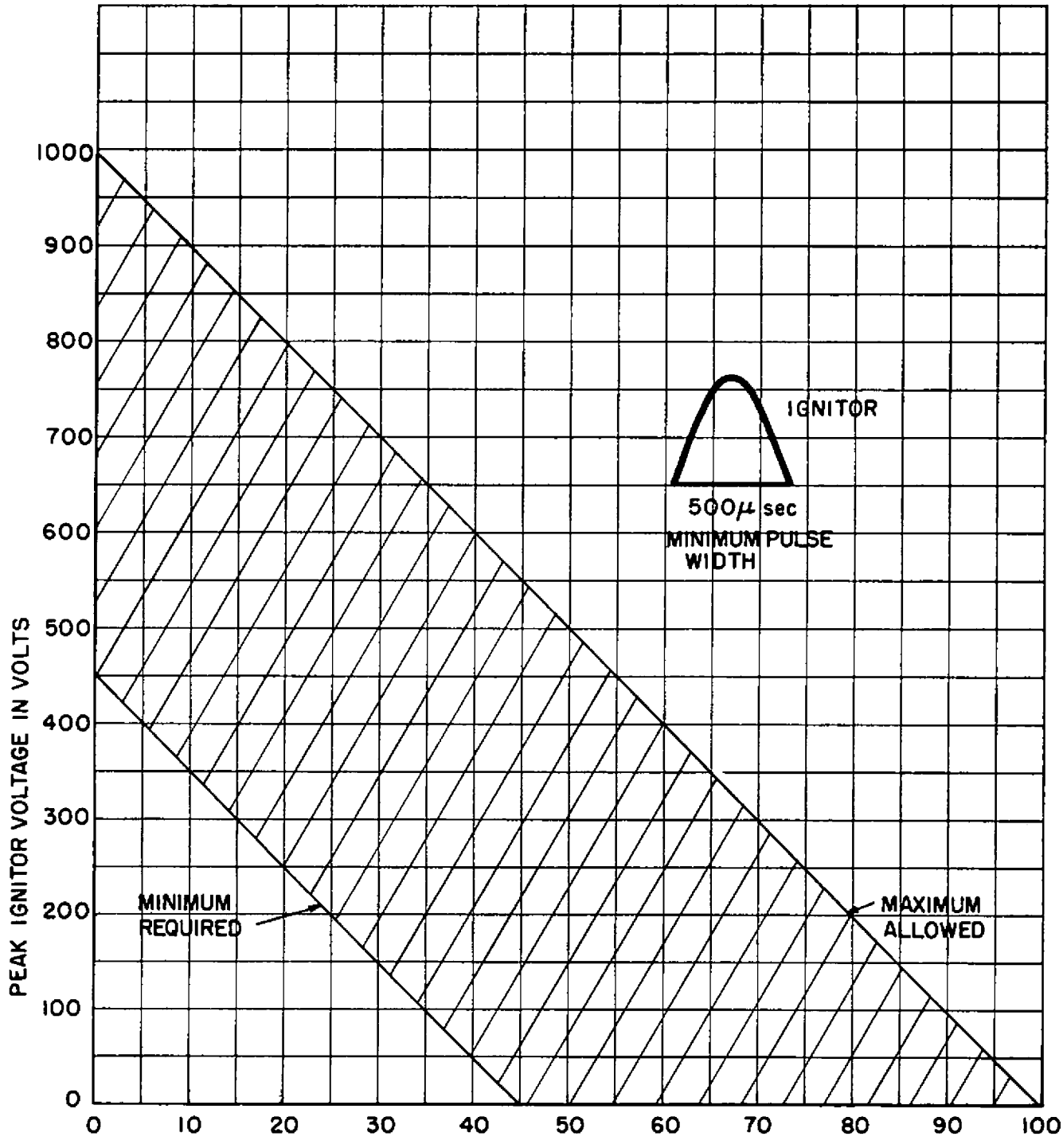
Peak Foward and Inverse Anode Voltage	1000	Volts
Average Anode Current		
5 Cycles	1000	Amperes
2 Minutes	130	Amperes
Frequency Range	25-60	Cycles per Second

Ignitor Requirements		
Maximum Voltage		
Positive—Anode Voltage		
Negative	5	Volts
Maximum Current		
Peak	100	Amperes
Root Mean Square	15	Amperes
Average	2	Amperes
Maximum Averaging Time	10	Seconds
Volt-Ampere Time Requirements—See Curve K-69087-72A982		
Temperature-Control-Switch Ratings		
Maximum Current, at 32 Volts DC	1	Ampere
Maximum Peak Potential Difference Between Tube Cylinder and Switch Current	1500	Volts

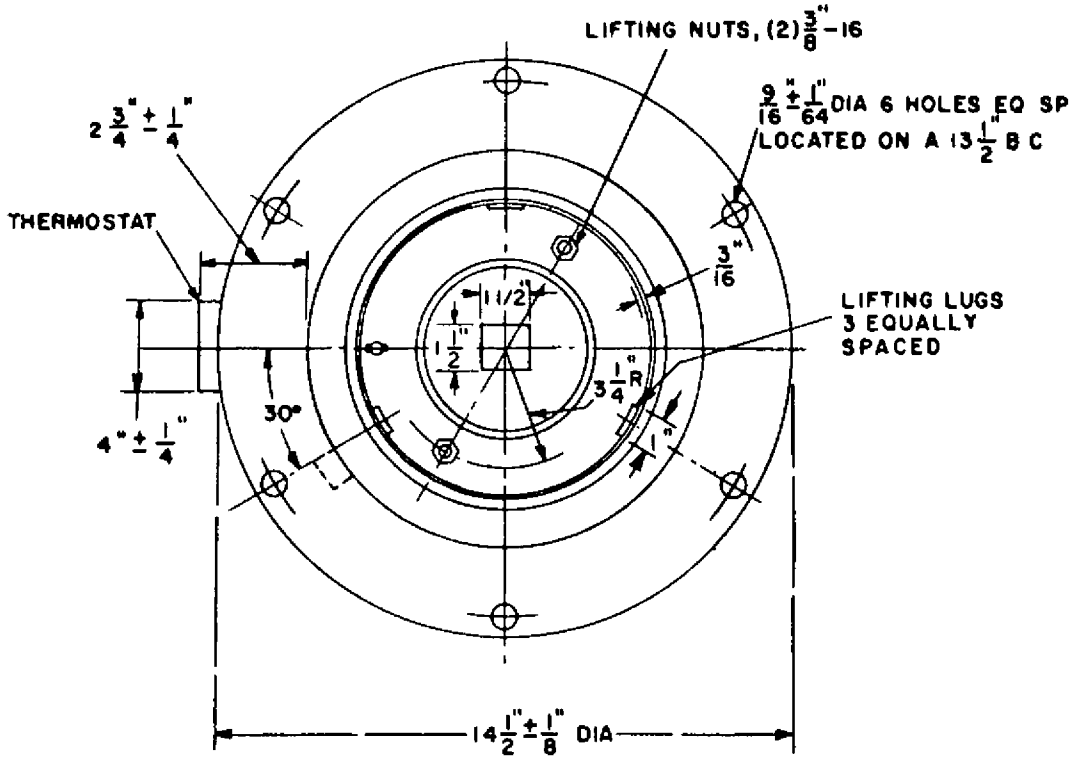
GENERAL ELECTRIC

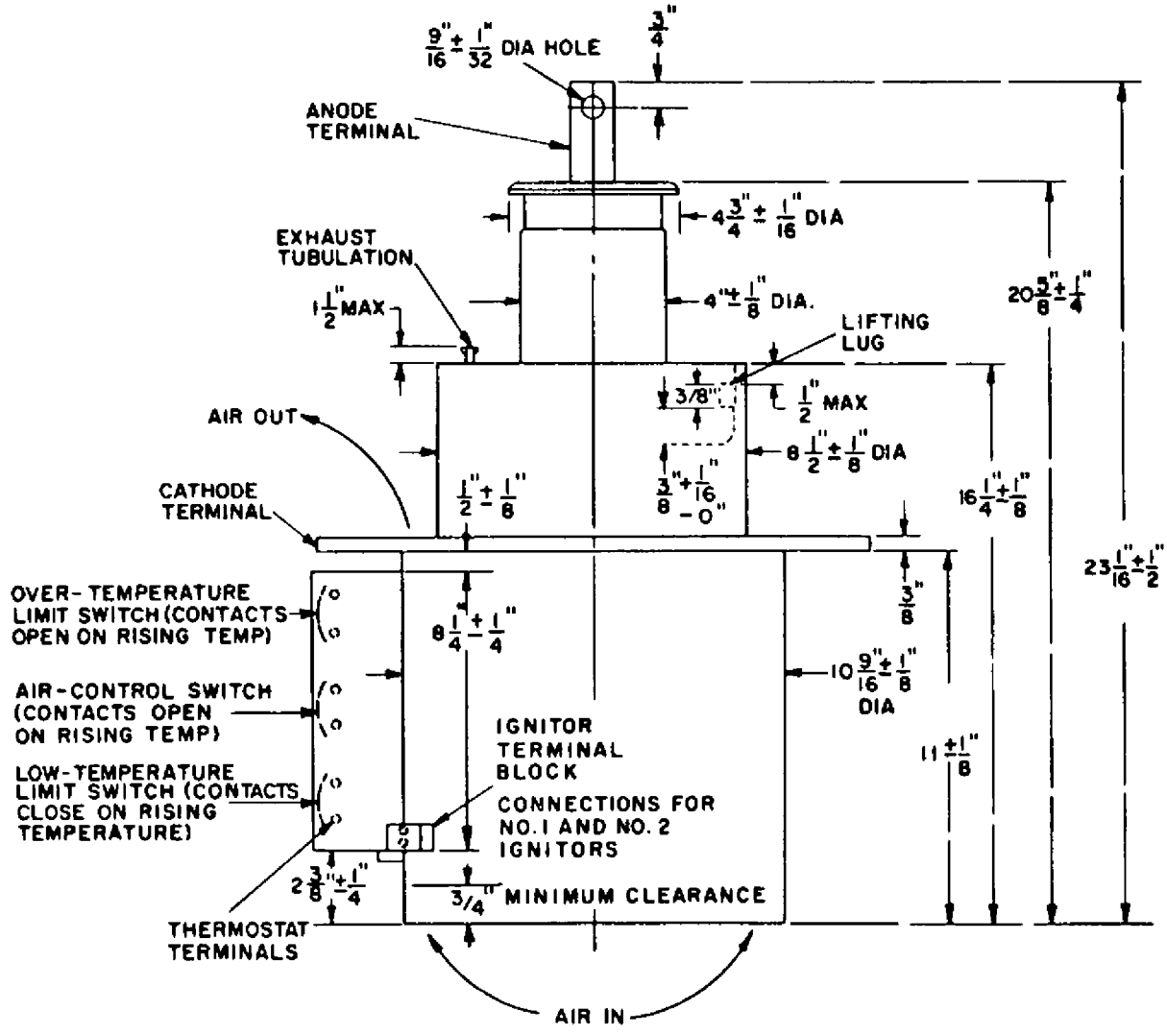
from JEDEC release #4173, March 4, 1963

IGNITOR VOLT-AMPERE REQUIREMENTS FOR SEPARATE EXCITATION



THE IGNITOR FIRING CIRCUIT SHOULD BE DESIGNED TO OPERATE WITHIN THE SHADED AREA


LIFTING NUTS, (2) 3/8"-16
9/16" ± 1/64" DIA 6 HOLES EQ SP
LOCATED ON A 13 1/2" B C
2 3/4" ± 1/4"
THERMOSTAT
3/16"
1 1/2"
1 1/2"
LIFTING LUGS
3 EQUALLY
SPACED
3 1/4" R
30°
4" ± 1/4"
1"
14 1/2" ± 1/8" DIA


9/16" ± 1/32" DIA HOLE
3/4"
ANODE
TERMINAL
4 3/4" ± 1/16" DIA
EXHAUST
TUBULATION
1 1/2" MAX
4" ± 1/8" DIA.
20 5/8" ± 1/4"
LIFTING
LUG
3/8"
1/2" MAX
AIR OUT
8 1/2" ± 1/8" DIA
1/2" ± 1/8"
3/8" + 1/16" - 0"
16 1/4" ± 1/8"
CATHODE
TERMINAL
23 1/16" ± 1/2"
3/8"
OVER-TEMPERATURE
LIMIT SWITCH (CONTACTS
OPEN ON RISING TEMP)
8 1/4" ± 1/4"
10 9/16" ± 1/8"
DIA
AIR-CONTROL SWITCH
(CONTACTS OPEN
ON RISING TEMP)
IGNITOR
TERMINAL
BLOCK
11 ± 1/8"
LOW-TEMPERATURE
LIMIT SWITCH (CONTACTS
CLOSE ON RISING
TEMPERATURE)
CONNECTIONS FOR
NO. 1 AND NO. 2
IGNITORS
2 3/8" ± 1/4"
3/4" MINIMUM CLEARANCE
THERMOSTAT
TERMINALS
AIR IN

ELECTRONICS

8425-A
PENTODE

DESCRIPTION AND RATING

The 8425-A is a miniature sharp-cutoff pentode intended for various industrial applications. It is unilaterally interchangeable with the 8425.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.3±0.6	Volts
Heater Current‡	0.3	Amperes

Direct Interelectrode Capacitances§

Pentode Connection

Grid-Number 1 to Plate: (g1 to p), maximum.	0.003	pf
Input: g1 to (h + k + g2 + g3 + i.s.)	5.9	pf
Output: p to (h + k + g2 + g3 + i.s.)	5.1	pf

Triode Connection¶

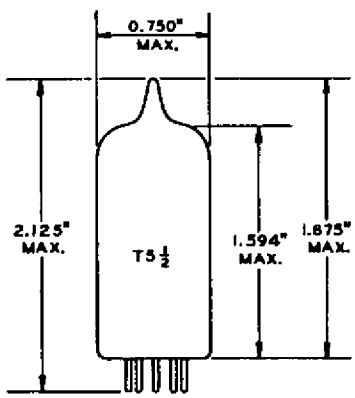
Grid-Number 1 to Plate: g1 to (p + g2 + g3 + i.s.).	2.5	pf
Input: g1 to (h + k).	3.6	pf
Output: (p + g2 + g3 + i.s.) to (h + k)	1.1	pf

MECHANICAL

Operating Position - Any
Envelope - T-5 1/2, Glass
Base - E7-1, Miniature Button 7-Pin
Outline Drawing - EIA 5-2

Maximum Diameter	0.750	Inches
Maximum Over-all Length.	2.125	Inches
Maximum Seated Height	1.875	Inches

PHYSICAL DIMENSIONS

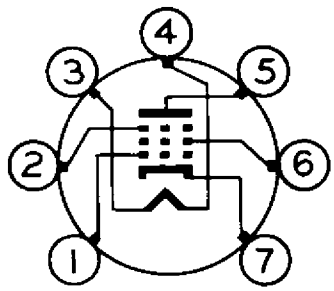


EIA 5-2

TERMINAL CONNECTIONS

Pin 1 - Grid Number 1
Pin 2 - Grid Number 3 (Suppressor) and Internal Shield
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Cathode

BASING DIAGRAM



EIA 7BK

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

	Pentode Connection	Triode Connection¶	
Plate Voltage	330	275	Volts
Screen-Supply Voltage	330	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.5	3.5	Watts
Screen Dissipation	0.75	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

	Pentode Connection			Triode Connection¶	
Plate Voltage	100	250	250	250	Volts
Suppressor - Connected to Cathode at Socket					
Screen Voltage	100	125	150	---	Volts
Cathode-Bias Resistor	150	100	68	330	Ohms
Amplification Factor	---	---	---	41	
Plate Resistance, approximate	0.6	1.3	1.1	---	Megohms
Transconductance	4500	5500	6200	6000	Micromhos
Plate Current	4.8	7.4	10.5	11.2	Milliamperes
Screen Current	1.9	2.8	4.1	---	Milliamperes
Grid-Number 1 Voltage, approximate					
Ib = 10 Microamperes	-4.1	-4.9	-5.8	---	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ With screen and suppressor connected to plate.

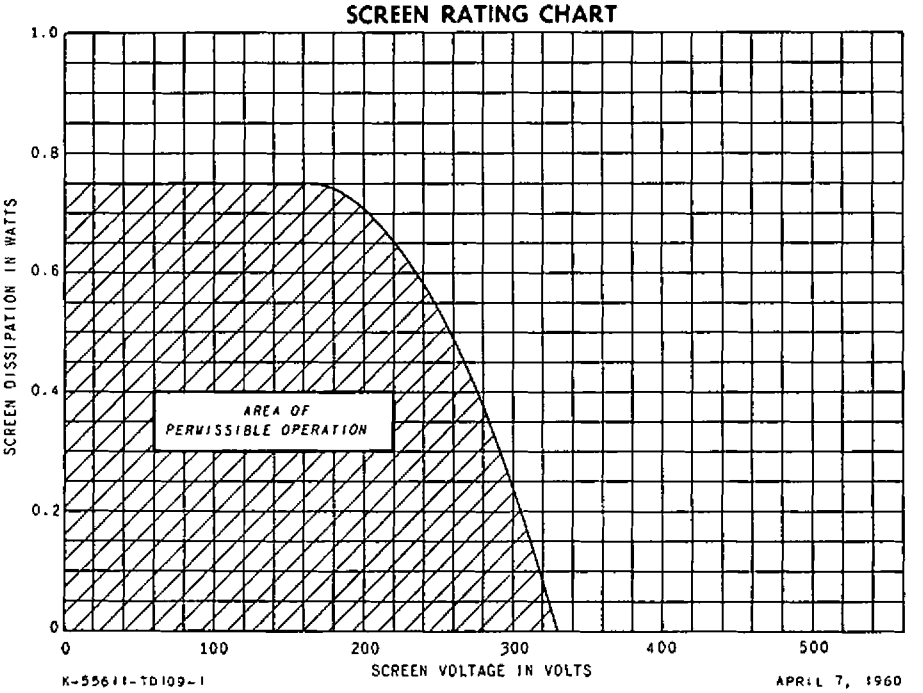
SPECIAL TESTS AND RATINGS

Screen Voltage for Zero Grid-Number 1 Current . . . . . Ef = 6.3 volts, Eb = 95 volts, Ec1 = 0 volts, G3 tied to cathode, cathode tied through variable Rk to -150 volts, Rk varied for Ik = 3.2 ma, Ec2 varied for zero grid-number 1 current.	95	Volts
Noise and Microphonics . . . . . Ef = 6.3 volts, Ebb = 300 volts, Ec3 = 0 volts, Ecc2 = 300 volts, Ec1 = 0 volts, R_L = 0.22 meg, Rg2 = 0.5 meg, Rk = 1000 ohms (bypassed).	500	Millivolts, RMS, Maximum

DEGRADATION RATE TESTS

Cathode-Interface Impedance 1000 Hour Life-Test End Point, maximum.	5	Ohms

SCREEN RATING CHART



ELECTRONICS

8426-A

PENTODE

DESCRIPTION AND RATING

The 8426-A is a miniature sharp-cutoff pentode intended for various industrial applications. It is unilaterally interchangeable with the 8426.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*. . .	12.6±1.3	Volts
Heater Current‡	0.15	Amperes

Direct Interelectrode Capacitances§

Pentode Connection

Grid-Number 1 to Plate: (g1 to p), maximum	0.003	pf
Input: g1 to (h + k + g2 + g3 + i.s.).	5.9	pf
Output: p to (h + k + g2 + g3 + i.s.).	5.1	pf

Triode Connection¶

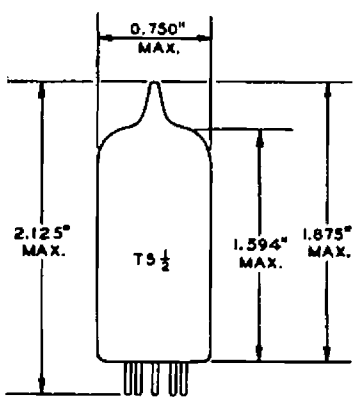
Grid-Number 1 to Plate: g1 to (p + g2 + g3 + i.s.) . . .	2.5	pf
Input: g1 to (h + k)	3.6	pf
Output: (p + g2 + g3 + i.s.) to (h + k).	1.1	pf

MECHANICAL

Operating Position - Any
Envelope - T-5 1/2, Glass
Base - E7-1, Miniature Button 7-Pin
Outline Drawing - EIA 5-2

Maximum Diameter.	0.750	Inches
Maximum Over-all Length . . .	2.125	Inches
Maximum Seated Height	1.875	Inches

PHYSICAL DIMENSIONS

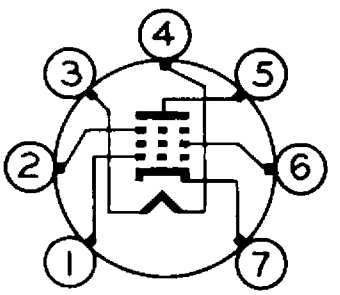


EIA 5-2

TERMINAL CONNECTIONS

Pin 1 - Grid Number 1
Pin 2 - Grid Number 3 (Suppressor) and Internal Shield
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Grid Number 2 (Screen)
Pin 7 - Cathode

BASING DIAGRAM



EIA 7BK

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES	Pentode Connection	Triode Connection¶	
Plate Voltage	330	275	Volts
Screen-Supply Voltage	330	---	Volts
Screen Voltage - See Screen Rating Chart			
Positive DC Grid-Number 1 Voltage	0	0	Volts
Plate Dissipation	3.5	3.5	Watts
Screen Dissipation	0.75	---	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode			
DC Component	100	100	Volts
Total DC and Peak	200	200	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	200	Volts

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER	Pentode Connection			Triode Connection¶	
Plate Voltage	100	250	250	250	Volts
Suppressor - Connected to Cathode at Socket					
Screen Voltage	100	125	150	---	Volts
Cathode-Bias Resistor	150	100	68	330	Ohms
Amplification Factor	---	---	---	41	
Plate Resistance, approximate	0.6	1.3	1.1	---	Megohms
Transconductance	4500	5500	6200	6000	Micromhos
Plate Current	4.8	7.4	10.5	11.2	Milliamperes
Screen Current	1.9	2.8	4.1	---	Milliamperes
Grid-Number 1 Voltage, approximate					
Ib = 10 Microamperes	-4.1	-4.9	-5.8	---	Volts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 12.6 volts.

§ Without external shield.

¶ With screen and suppressor connected to plate.

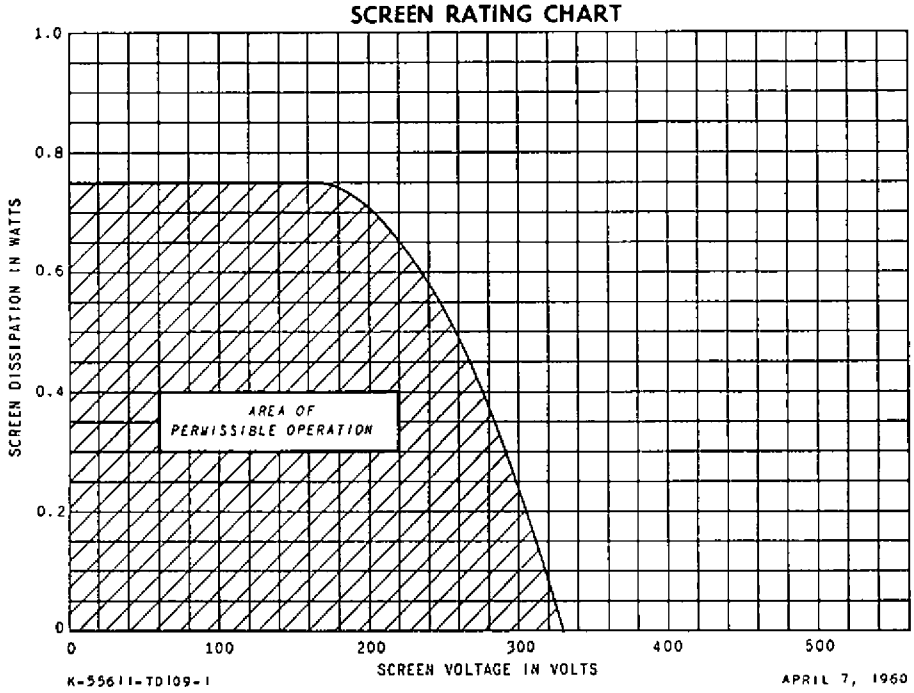
SPECIAL TESTS AND RATINGS

Screen Voltage for Zero Grid-Number 1 Current Ef = 12.6 volts, Eb = 95 volts, Ec1 = 0 volts, G3 tied to cathode, cathode tied through variable Rk to -150 volts, Rk varied for Ik = 3.2 ma, Ec2 varied for zero grid-number 1 current.	95	Volts
Noise and Microphonics Ef = 12.6 volts, Ebb = 300 volts, Ec3 = 0 volts, Ecc2 = 300 volts, Ec1 = 0 volts, R_L = 0.22 meg, Rg2 = 0.5 meg, Rk = 1000 ohms (bypassed).	500	Millivolts, RMS, Maximum

DEGRADATION RATE TESTS

Cathode-Interface Impedance 1000 Hour Life-Test End Point, maximum.	5	Ohms

SCREEN RATING CHART



8426A

OBJECTIVE FOR DEVELOPMENTAL TYPE

Y-1066-d*

The Y-1066-d is a miniature sharp-cutoff pentode intended for various industrial applications. It is unilaterally interchangeable with the 8426 and differs in having grid-current controls.

SPECIAL TEST AND RATINGS

	Minimum	Bogey	Maximum	
Grid Current Ef = 12.6 volts, Eb = 30 volts, Ec2 = 72 volts, Ec1 = 0 volts, G3 tied to cathode. Rk connected to -150 volts DC and varied for Ik = 1.0 milliamperes	-0.3	0	+0.3	Nanoamperes

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

8/20/63 (B)

ELECTRONIC INNOVATIONS IN ACTION

TUBES

PRELIMINARY

—PRODUCT INFORMATION—

BEAM PENTODE

8950

LINEAR AMPLIFIER AND RF PO APPLICATIONS

■ 400 MA DC CATHODE CURRENT ■ 33 WATTS PLATE DISSIPATION ■ 1.4 AMP PEAK CATHODE CURRENT

The 8950 is a compactron beam power pentode primarily designed for RF Power Output applications. Features of the 8950 are dual cathode and grid connections for lower lead inductance, and a 13.0 volt heater. The 8950 is suitable for mobile and marine equipment applications having 12 volt battery supplies.

GENERAL

ELECTRICAL

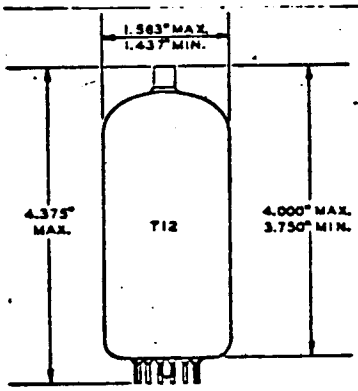
Cathode Coated Unipotential

Heater Characteristics and Ratings
Heater Voltage, AC or DC . . . . . 13.0 Volts
Heater Current . . . . . 1.1 Amperes
Direct Interelectrode Capacitances, approximate
Grid No. 1 to Plate: (g1 to p) . . . . 0.6 pf
Input: . . . . . 36 pf
Output: . . . . . 18 pf

MECHANICAL

Operating Position Any
Envelope T-12
Top Cap C1-1, Small
Base E12-74
Outline Drawing
Maximum Diameter 1.563"
Maximum Over all Length 4.375"
Maximum Seated Height 4.000"

PHYSICAL DIMENSIONS

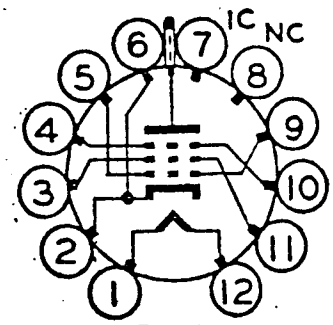


EIA 12-90

TERMINAL CONNECTIONS

Pin 1 – Heater
Pin 2 – Cathode
Pin 3 – Grid 2
Pin 4 – Grid 3 (Beam Plate)
Pin 5 – Grid 1
Pin 6 – Cathode
Pin 7 – Internal Connection (Do not use)
Pin 8 – No Connection
Pin 9 – Grid 1
Pin 10 – Grid 3 (Beam Plate)
Pin 11 – Grid 2
Pin 12 – Heater
Cap – Plate

BASING DIAGRAM



MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

DC Plate Voltage	800	Volts
Peak Positive Pulse Plate Voltage	6500	Volts
Screen Voltage	250	Volts
Peak Negative Grid-Number 1 Voltage	250	Volts
Plate Dissipation	33	Watts
Screen Dissipation	5	Watts
DC Cathode Current	400	Milliamperes
Peak Cathode Current	1400	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid-Number 1 Circuit Resistance ▲		
With Fixed Bias	0.1	Megohm
With Cathode Bias	Not Recommended	
Bulb Temperature at Hottest Point ♦	240	°C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Plate Voltage	175	Volts
Beam Plates-Connected to Cathode at Socket		
Screen Voltage	110	Volts
Grid Number 1 Voltage	-21	Volts
Plate Resistance, approximate	□	Ohms
Transconductance	16000	Micromhos
Plate Current	120	Milliamperes
Screen Current	2.0	Milliamperes
Grid-Number 1 Voltage, approximate		
Ib = 1.0 Milliamperes	-42	Volts
Triode Amplification Factor	□	

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef= 13.0 volts.

▲ The type of input coupling network used should not introduce too much resistance in the grid-number 1 circuit. Transformer or impedance coupling devices are recommended.

♦ Measured with an infrared thermometer, Ircon Model 700 BC or equivalent.

□ To be determined.

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A-0897

PLANAR TRIODE

DESCRIPTION AND RATING

For Grounded-Grid Oscillator And Amplifier Service

The A-0897 is a metal-and-ceramic, high-mu triode designed for use as a grounded-grid oscillator or amplifier at frequencies as high as 2500 megacycles.

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC	*	Volts
Heater Current at Ef = 6.3 volts	1.03‡	Amperes
Direct Interelectrode Capacitances§		
Grid to Plate: (g to p)	2.01	pf
Grid to Cathode: (g to k)	6.5	pf
Plate to Cathode: (p to k)	0.023	pf

Mechanical

Operating Position - Any

Net Weight, approximate	2	Ounces

MAXIMUM RATINGS

Absolute-Maximum Values

Radio-Frequency Power Amplifier and Oscillator - Class C Telegraphy

Key-down Conditions per Tube Without Amplitude Modulation¶		
Heater Voltage*	4.5 to 6.3	Volts
DC Plate Voltage	1000	Volts
Negative DC Grid Voltage	150	Volts
Peak Positive RF Grid Voltage	30	Volts
Peak Negative RF Grid Voltage	400	Volts
DC Grid Current	50	Milliamperes
DC Cathode Current	125	Milliamperes
Plate Dissipation#	10	Watts
Grid Dissipation	2.0	Watts
Envelope Temperature at Hottest Point‡‡	250	C

MAXIMUM RATINGS (Continued)

Radio-Frequency Power Amplifier and Oscillator - Class C Telephony

Carrier Conditions per Tube for Use With a Maximum Modulation Factor of 1.0		
Heater Voltage*	4.5 to 6.3	Volts
DC Plate Voltage**	600	Volts
Negative DC Grid Voltage	150	Volts
Peak Positive RF Grid Voltage	30	Volts
Peak Negative RF Grid Voltage	400	Volts
DC Grid Current	50	Milliamperes
DC Cathode Current	100	Milliamperes
Plate DissipationΔ	7.0	Watts
Grid Dissipation	2.0	Watts
Envelope Temperature at Hottest Point‡‡	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics§§

Heater Voltage	6.3	Volts
Plate Voltage	600	Volts
Grid Voltage¶¶	---	Volts
Amplification Factor	95	
Transconductance	24800	Micromhos
Plate Current	75	Milliamperes

Radio-Frequency Oscillator - Class C§§

Frequency	500	2500	Megacycles
Heater Voltage	6.0	5.0	Volts
DC Plate Voltage	900	900	Volts
DC Plate Current	90	90	Milliamperes
DC Grid Current	30	27	Milliamperes
DC Grid Voltage	-40	-22	Volts
Useful Power Output	40	17	Watts

A-0897

INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
Ef = 6.3 volts	950	1030	1100	Milliamperes
Grid Voltage				
Ef = 6.3 volts, Eb = 600 volts, Ib = 75 ma	-1.3	-2.5	-3.5	Volts
Grid Voltage				
Ef = 6.3 volts, Eb = 600 volts, Ib = 1.0 ma	-7.0	-9.5	-15	Volts
Transconductance				
Ef = 6.3 volts, Eb = 600 volts, Ec adjusted for Ib = 75 ma	22000	24800	27500	Micromhos
Amplification Factor				
Ef = 6.3 volts, Eb = 600 volts, Ec adjusted for Ib = 75 ma	75	95	115	
Negative Grid Current				
Ef = 6.3 volts, Eb = 600 volts, Ec adjusted for Ib = 75 ma	---	---	3.0	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts, Polarity of applied d-c interelectrode voltage is such that no cathode emission results				
Grid to Cathode at 500 volts d-c	50	---	---	Megohms
Interelectrode Capacitances				
Grid to Plate: (g to p)	1.89	2.01	2.13	Picofarads
Grid to Cathode: (g to k)	6.0	6.5	7.0	Picofarads
Plate to Cathode: (p to k)	0.018	0.023	0.029	Picofarads

SPECIAL PERFORMANCE TESTS

	Min.	Max.	
Oscillator Power Output			
Tubes are tested for power output as an oscillator under the following conditions: Ef = 5.0 volts; F = 2500 MC, min; Eb = 1000 volts; Ib = 90 ma	15	---	Watts
Low Pressure Voltage Breakdown Test			
Statistical sample tested for voltage breakdown at a pressure of 27 mm Hg. Tubes shall not give visual evidence of flashover when 1000 volts RMS, 60 cps, is applied between the plate and grid terminals			

* The equipment designer should design the equipment so that heater voltage is centered at some value within the range of 4.5 to 6.3 volts. Heater voltage variations about the center value should be kept as small as practical and should not, in any case, exceed ±5%. The optimum center value of heater voltage depends on the cathode current and on other parameters of circuit design and operation. For specific recommendations, contact your General Electric tube sales representative.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Measured in a special shielded socket.

¶ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier conditions.

With an adequate heat sink, the maximum dissipation rating is 100 watts.

Δ With an adequate heat sink, the maximum dissipation rating is 70 watts.

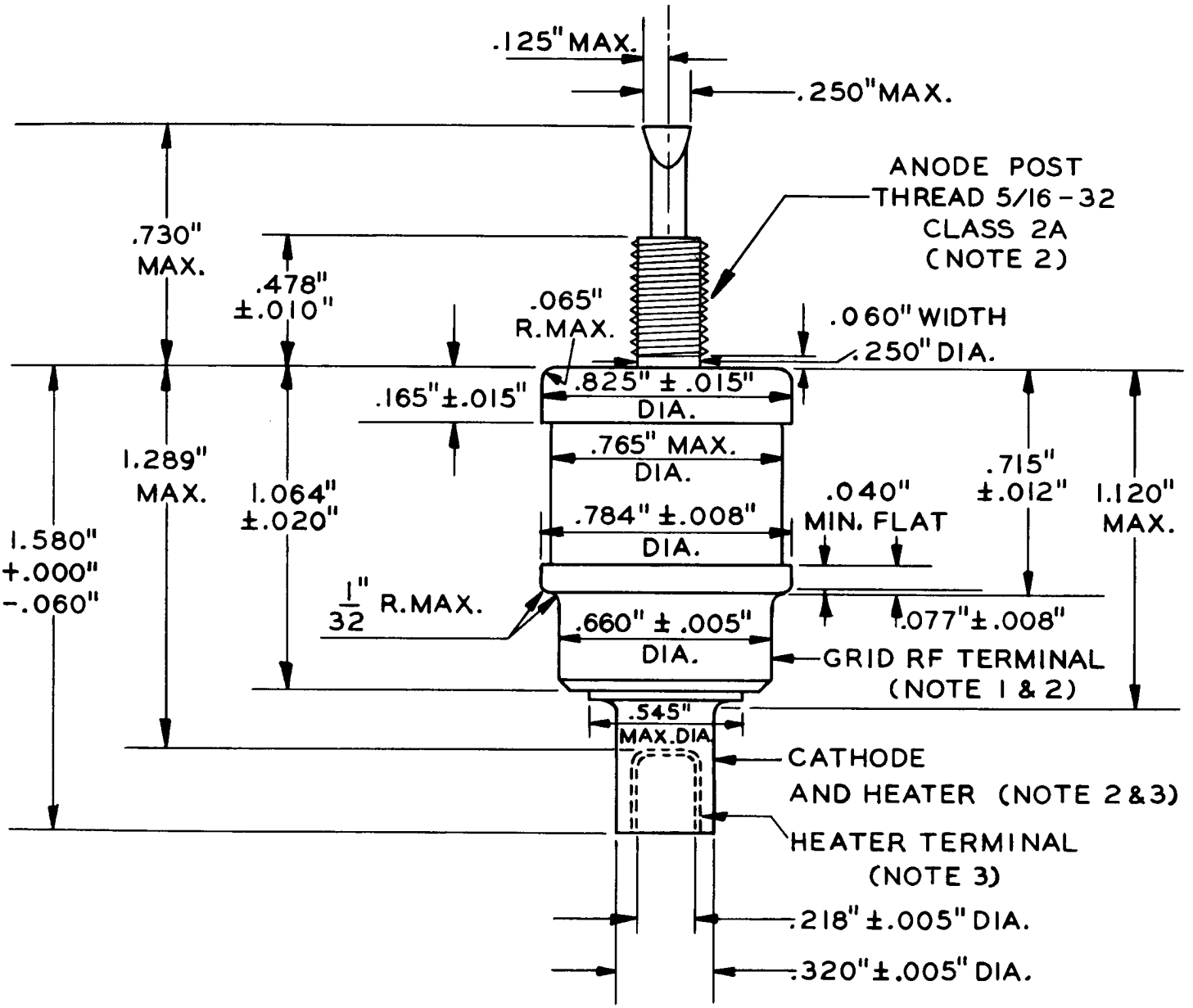
§§ An adequate heat sink must be provided.

‡‡ Where long life and reliable operation are important, lower envelope temperatures should be used.

** For modulation factors less than 1.0, a higher d-c plate voltage may be used if the sum of the peak positive audio voltage and the d-c plate voltage does not exceed 1200 volts.

¶¶ Adjusted for Ib = 75 milliamperes.

OUTLINE
A-0897



NOTES:

1. Solder not to extend radially beyond grid RF terminal.
2. Axis of threaded section shall be concentric with surface of Cathode-Fil. and Grid to within .020" T.I.R.. T.I.R. to be measured on cathode and grid contact areas within ±.040" of center of each area.
3. Total indicated runout of the heater-contact surface with respect to the cathode-contact surface shall not exceed 0.012".

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

G.E.C. VALVES

VHF/UHF TRIODE

A1714

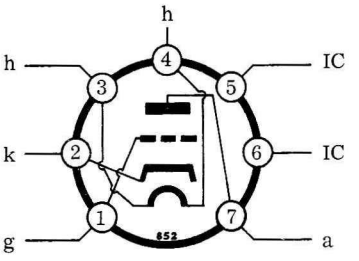
ISSUE 4

A triode with planar electrodes for use as an RF oscillator at frequencies up to 1000 Mc/s or as a low noise amplifier at frequencies up to about 300 Mc/s.

The A1714 is a commercial equivalent of CV408.

In many applications the A1714 may be replaced by the A2975 with improved performance.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base

Base: B7G
Bulb: Tubular

Max. overall length:	54	mm.
Max. seated length:	47·5	mm.
Max. diameter:	19	mm.

HEATER

V_h	6.3	V
I_h	0·49 (approx)	A

MAXIMUM RATINGS (Design centre)

V_a	250	V
p_a	2.5	W
I_k	45	mA
$i_{k(pk)}$	150	mA
V_g	−30	V
p_g	0.1	W
I_g	10	mA
$V_{h-k(pk)}$	90	V

CAPACITANCES (of unscreened valve)

*c_{a-g}	0.9 pF
*c_a—all less g	1.3 pF
†c_g—all less a	3.0 pF

*Measured on a cold valve.
†Measured at 1 Mc/s, with V_a = 150, I_a = 10mA.

THE M-O VALVE CO. LTD . BROOK GREEN WORKS . LONDON . W.6
a subsidiary of THE GENERAL ELECTRIC CO. LTD. OF ENGLAND

AUGUST 1965

A1714

CHARACTERISTICS

V_a	150	V
I_a	10	mA
V_g	−2.2 (approx)	V
g_m	8.5	mA/V
μ	45	
r_{eq} noise ref g	500	Ω
*r_{in} (45 Mc/s)	40	kΩ
*c_{g-all} (45 Mc/s)	5	pF
Noise factor (45 Mc/s)	1.9	dB

*Measured with anode decoupled to cathode.

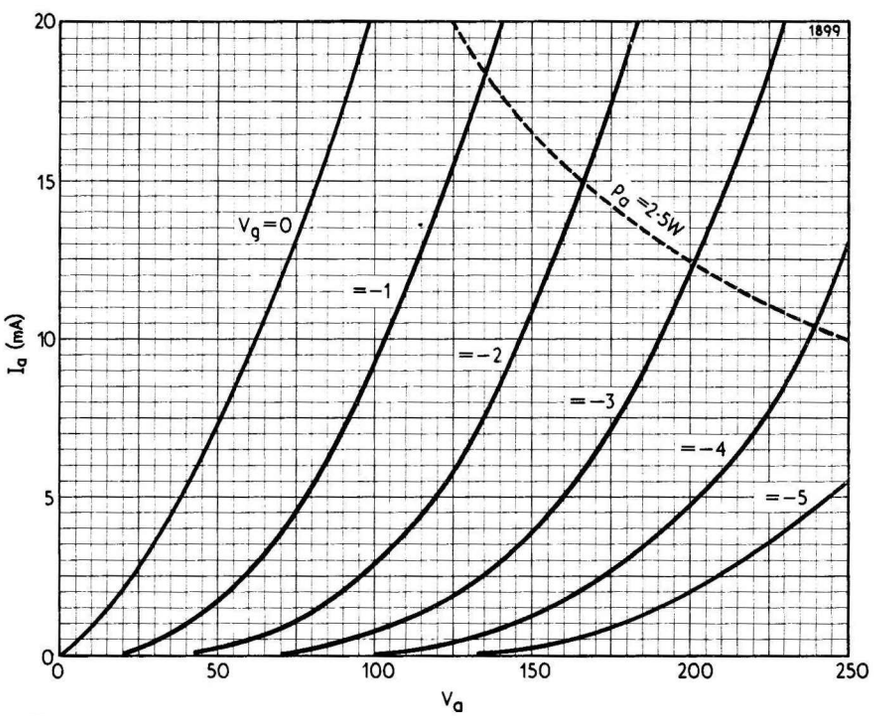
INSTALLATION

The valve may be mounted in any position.

A separate screening can should be used when the application demands.

Free air circulation around the bulb is preferable.

The temperature of the hottest part of the bulb must not exceed 220°C.



Printed in England

THE M-O VALVE
COMPANY LIMITED

A2087

GEC

VHF
NOISE GENERATOR DIODE

BRIEF DATA

A VHF noise generator diode with a tungsten filament. The A2087 is a commercial equivalent of the CV2171.

FILAMENT

*Filament voltage range	0 – 4.3	V
Filament current (approx at V_f = 4.3 V)	0.6	A

*The saturated anode current is regulated by variation of the filament voltage. With a 6.3 V filament supply, a variable series resistor of 10 Ω max. will be suitable for most purposes.

MAXIMUM RATINGS

Anode voltage	200	V
Anode current	20	mA
Anode dissipation	2	W
Filament voltage	4.8	V

CHARACTERISTICS

Anode voltage	40	V
Saturated anode current (approx)	7	mA
Filament voltage (approx)	3.7	V

CAPACITANCES (measured on a cold valve fitted with external shield)

Anode to filament (approx)	1.35	pF
*Anode to all (approx)	2.7	pF

*Includes capacitance to filament, pins 2 & 7 and external shield.

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April 1977
Issue 3
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TYPICAL OPERATION

Noise Diode for use up to 220 MHz

Anode voltage	100	100	100	V
Saturated anode current range	0–20	0–20	0–20	mA
Filament voltage range (approx)	0–4.3	0–4.3	0–4.3	V
*Source resistance	50	70	300	Ω
*Noise factor measurement range (approx)	0–13	0–14.5	0–20.8	dB

*When measuring receiver noise factor, using with the diode a source resistance R_s (to match the receiver input) and the technique of setting the value of $I_{a(sat)}$ to double the noise output power to the receiver detector, the range of noise factor that can be measured with a given value of R_s is as shown.

Then, noise factor = $10 \log_{10} (20 I_a R_s)$ dB,
where I_a is the diode saturated anode current in amperes and R_s is the source resistance in ohms.

INSTALLATION

The valve can be mounted in any position.

A screening canister, which also serves as a retainer, is necessary.

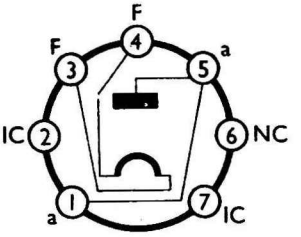
Free air circulation around the canister is preferable. The temperature of the hottest part of the bulb must not exceed 200 °C.

This valve has been designed to give a life of 1,000–2,000 hours operating at a saturated current of 5 mA. With a saturated current of 20 mA the life is approximately 100 hours.

No correction of the noise factor for electron transit time when measured as above is necessary for use up to 220 MHz.

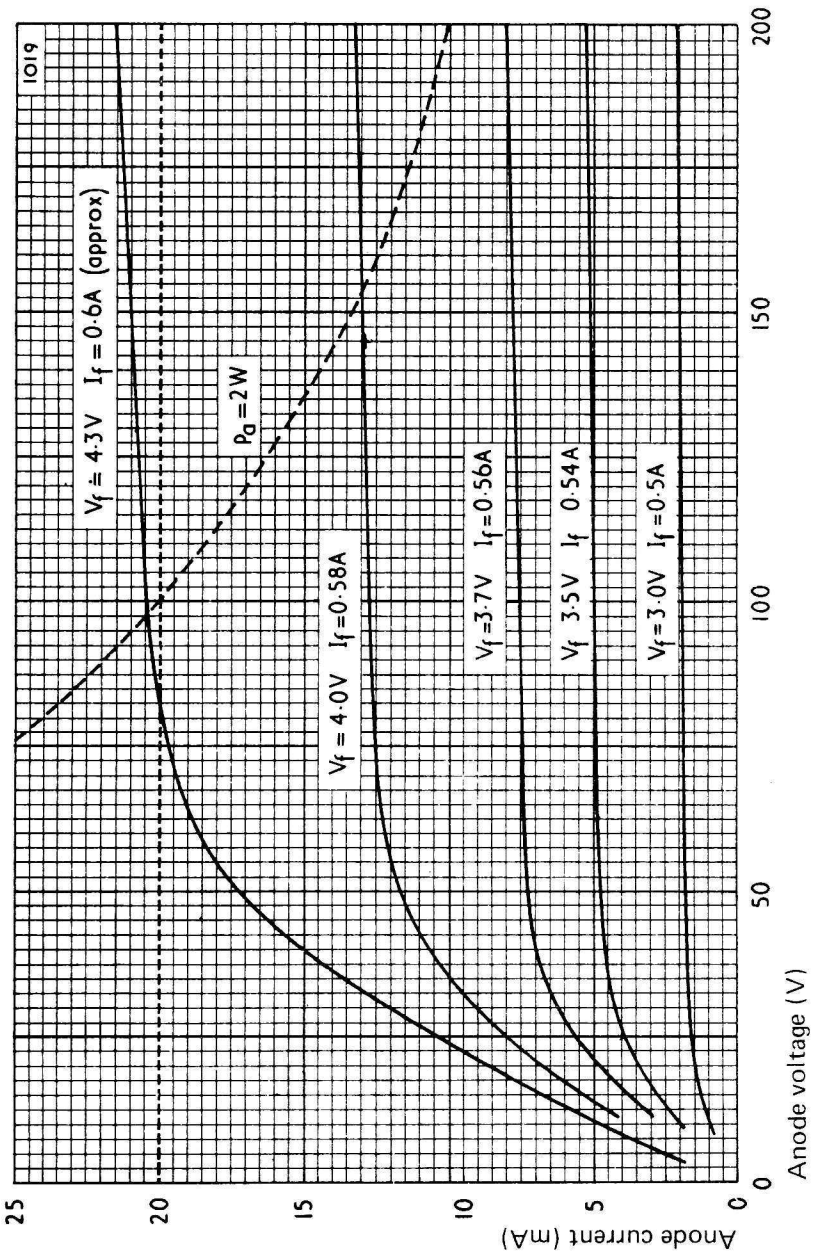
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BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base	:	B7G
Bulb	:	Tubular
Max. overall length	:	55 mm
Max. seated length	:	49 mm
Max. diameter	:	19 mm


1019
V_f = 4·3V I_f = 0·6A (approx)
P_a = 2W
V_f = 4·0V I_f = 0·58A
V_f = 3·7V I_f = 0·56A
V_f 3·5V I_f 0·54A
V_f = 3·0V I_f = 0·5A
Anode current (mA)
25
20
15
10
5
0
0
50
100
150
200
Anode voltage (V)

G.E.C.

Valves for Voltage Stabilisation

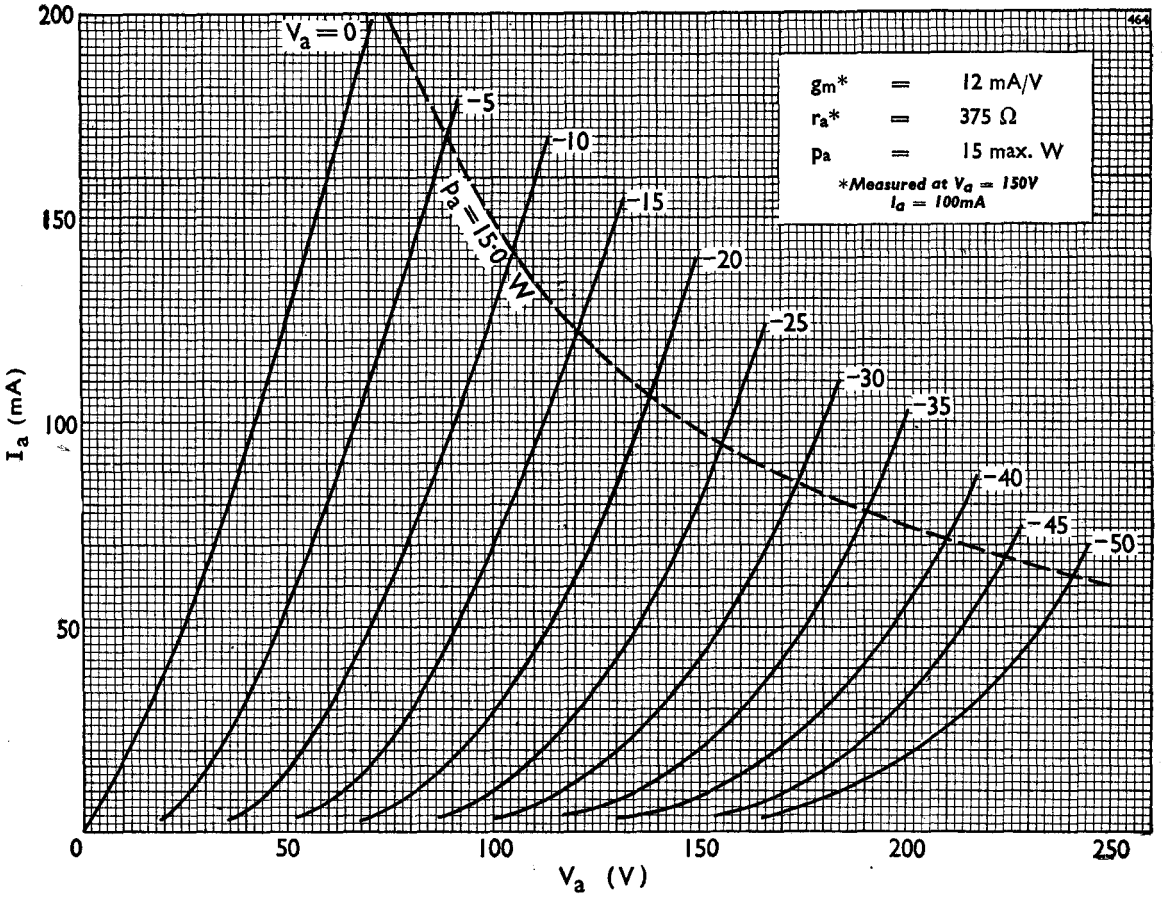
A 2 2 9 3



THE A2293 is a new low impedance triode particularly suitable as the series valve in stabilised power packs. List price 27/-.

RATINGS

V_h	6.3	V
I_h	0.95	A
V_a	300 max.	V
I_a	120 max.	mA
Base	B9A	



For further details write to the G.E.C. Valve & Electronics Dept.

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

THE M-O VALVE
COMPANY LIMITED

A2521

GEC

UHF
GROUNDED GRID TRIODE

BRIEF DATA

A uhf triode for use in grounded grid circuits as a low noise amplifier, small power amplifier or frequency multiplier at frequencies up to 1250 MHz. The A2521 is a commercial version of the CV2453, except for the heater current rating.

HEATER

Heater voltage	6.3	V
Heater current (approx) - A2521	0.3	A
Heater current (approx) - CV2453	0.37	A

MAXIMUM RATINGS

DC anode voltage	250	V
Peak anode voltage	1000	V
Anode dissipation	2.5	W
DC grid current	6	mA
DC cathode current	25	mA
Peak cathode current (pulse duration $< 2\,\mu s$)	700	mA
Negative dc grid voltage	20	V
Peak heater-cathode voltage	100	V
Bulb temperature	200	°C

CAPACITANCES (Measured on a cold unscreened valve)

Cathode plus heater to grid	3.5	pF
Anode to grid	1.6	pF
Cathode plus heater to anode	0.06	pF

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December 1977
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Issue 5

CHARACTERISTICS

DC anode voltage	130	V
DC anode current	16	mA
Negative dc grid voltage (approx)	1	V
Mutual conductance (approx)	15	mA/V
Amplification factor	60	–

OPERATING DATA

CLASS A GROUNDED GRID AMPLIFIER
Typical Operation

Frequency	1250	900	400	200	MHz
V_b	180	180	180	180	V
R_a	3.3	3.3	3.3	3.3	kΩ
R_k	68	68	68	68	Ω
I_a	16	16	16	16	mA
*Δf (to 3 dB)	20	50	6	4	MHz
†Power gain	9	10	17	14.5	dB
†‡Noise factor	11.1	9.5	6.7	4.6	dB

*Bandwidth and power gain may be adjusted by altering the coupling between the anode circuit and the output line.

†With input circuit adjusted for minimum noise factor.

‡Using a gas discharge noise source.

CLASS C GROUNDED GRID UHF POWER AMPLIFIER AND FREQUENCY MULTIPLIER
Maximum Permissible Conditions

DC anode voltage	250	V
Anode dissipation	2.5	W
Peak anode current	100	mA
DC grid current	6	mA
Positive dc cathode to grid voltage	20	V

Typical Operation as Amplifier

Frequency	400	900	MHz
DC anode voltage	250	150	V
Anode dissipation	2	2.4	W
*DC anode current	18	20	mA
DC grid current	4.5	2.5	mA
Positive dc cathode to grid voltage	10.5	5.0	V
Driving power	0.3	0.45	W
Load power (approx)	2.6	0.9	W

*Set by adjustment of cathode resistance.

Typical Operation as Frequency Multiplier

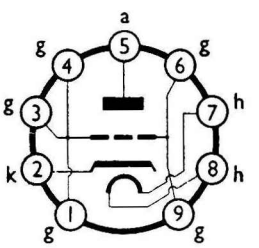
Frequency-in	200	133.3	450	300	416.6	MHz
Frequency-out	400	400	900	900	1250	MHz
V_a	200	200	140	90	130	V
p_a	2.4	2.5	2.4	2.5	2.4	W
$*I_a$	20	15	20	20	18.5	mA
I_g	3.5	1.5	3.5	3.0	1.5	mA
$+V_{k-g}$	20	20	15	10	10.5	V
p_{dr}	0.6	0.55	0.6	1.2	0.22	W
P_L (approx)	1.8	0.75	0.7	0.3	0.05	W

*Set by adjustment of R_k.

INSTALLATION

The valve may be mounted in any position.
If a screening can is used it should be blackened inside and out.
Free air cirulation around the bulb or the screening can is desirable.
A detailed Application Report is available upon request.

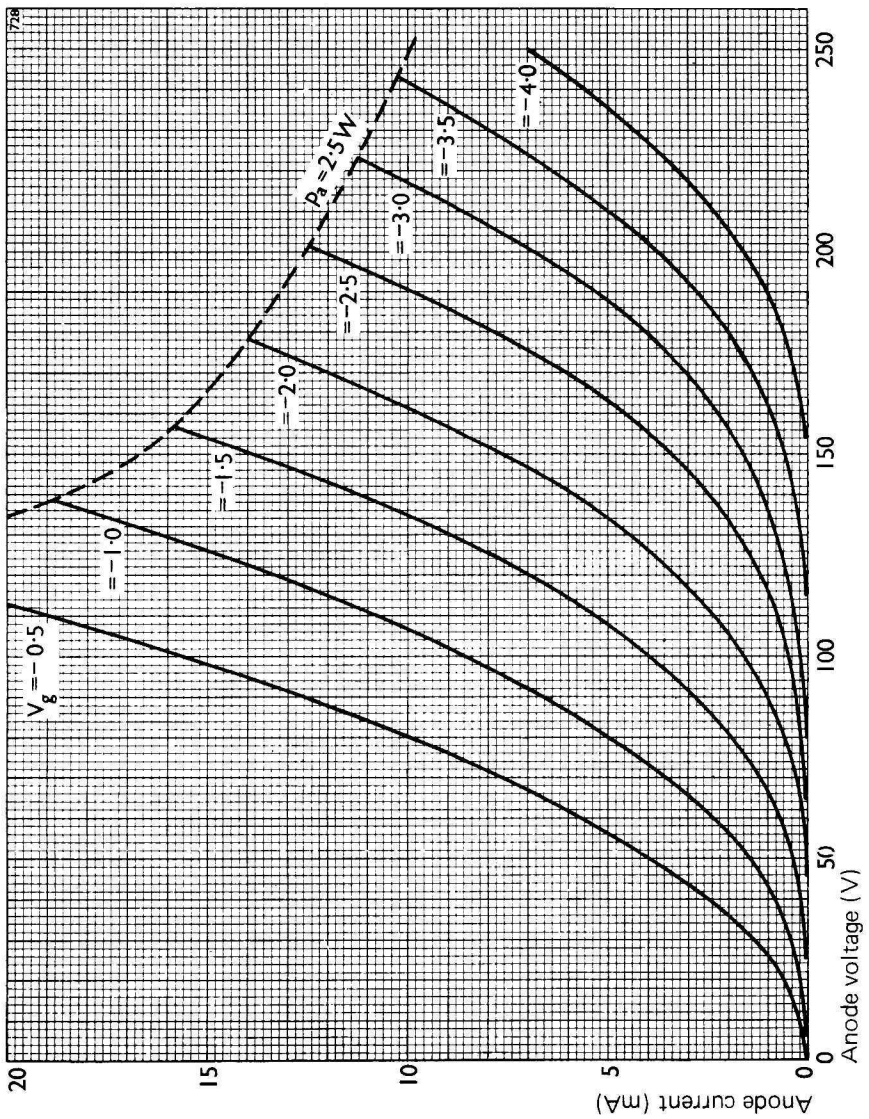
BASE CONNECTIONS AND VALVE DIMENSIONS

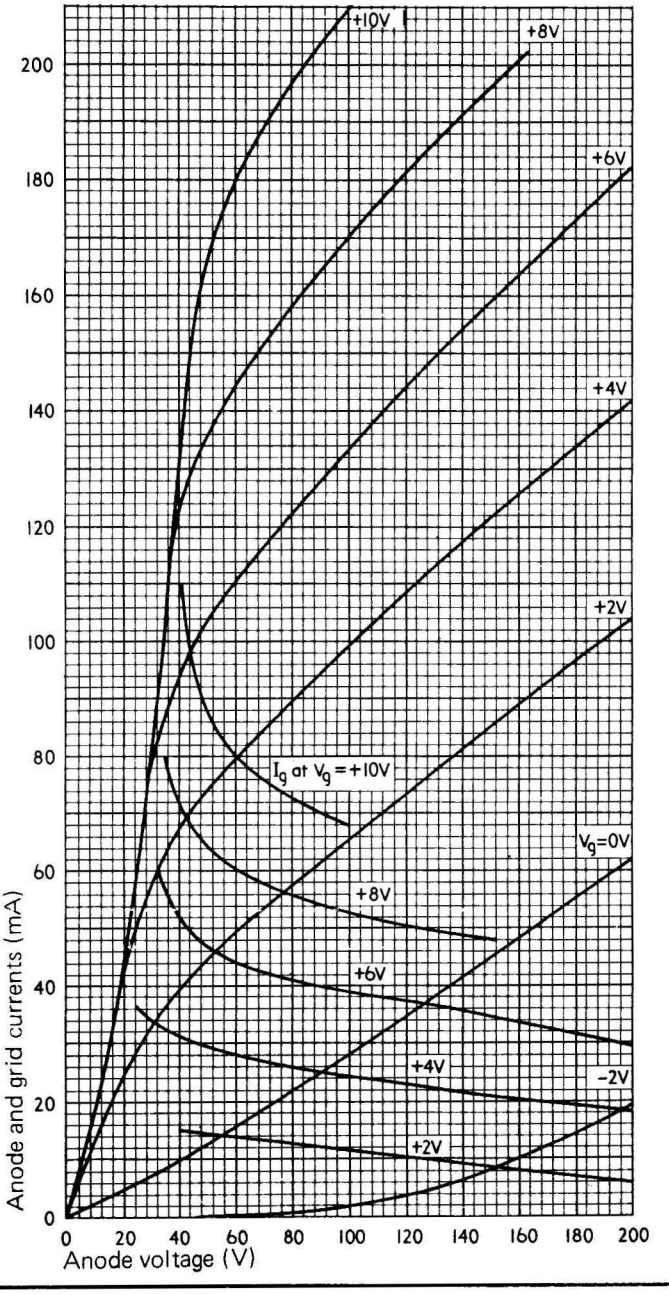


View from underside of base.

Base:	B9A
Bulb:	Tubular
Max. overall length:	56 mm
Max. seated length:	49 mm
Max. diameter:	22.2 mm

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728
$V_g = -0{\cdot}5$
$= -1{\cdot}0$
$= -1{\cdot}5$
$= -2{\cdot}0$
$= -2{\cdot}5$
$= -3{\cdot}0$
$= -3{\cdot}5$
$= -4{\cdot}0$
$P_a = 2{\cdot}5W$
Anode current (mA)
0
5
10
15
20
0
50
100
150
200
250
Anode voltage (V)



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Brook Green Works, London W6 7PE

Printed in England

G.E.C. VALVES

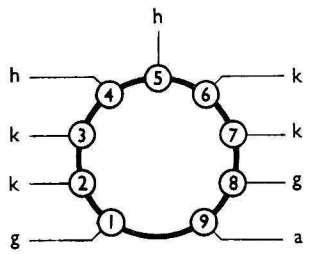
LOW NOISE VHF TRIODE

A2599

ISSUE 2

The A2599 is a low noise v.h.f. triode for grounded-cathode use. It is a commercial version of the CV5242.

BASE CONNECTIONS AND VALVE DIMENSIONS



Viewed from underside of base.

Base: B9A
Bulb: Tubular.
Max. overall length: 56 mm.
Max. seated length: 49 mm.
Max. diameter: 22·2 mm.

HEATER

V_h	6·3	V
I_h	0·3 (approx)	A

MAXIMUM RATINGS (Absolute)

V_a	250	V
p_a	2·5	W
I_k	20	mA
$-V_g$	20	V
$v_{h\text{-}k(pk)}$	100	V
T_{bulb}	200	°C

CAPACITANCES (Measured on a cold screened valve)

$c_{g\text{-all, less a}}$: 3·5pF; $c_{a\text{-all, less g}}$: 0·7pF; $c_{g\text{-a}}$: 1·1pF.

CHARACTERISTICS

V_a	130	V
I_a	16	mA
V_g	−1 (approx)	V
g_m	15	mA/V
μ	60	—
$*c_{in(w)}$	6 (approx)	pF
$*r_{in(w)}$	30 (approx)	kΩ

*Measured hot at 45Mc/s with anode decoupled to cathode.

A2599

TYPICAL OPERATION

Class A. Low Noise Amplifier. Grounded Cathode Connection.

Used in the first stage of a cascode amplifier, followed by an A2521 triode, operated in grounded-grid connection, as shown in figs. 1, 2 and 3.

$V_{a(b)}$	180	250	V
R_a	3·3	—	kΩ
R_k	68	68	Ω
I_a	15·5	14·5	mA
Frequency	45	200	Mc/s
*Noise factor (average)	1·5	6·8	dB
†Noise factor (average)	1·3	4·7	dB
‡Power gain (approx)	30	20	dB
Optimum source resistance (approx)	1300	290	Ω

*Input circuit tuned.
†Input circuit adjusted for lowest noise factor.
‡For the cascode amplifier.

INSTALLATION

The valve may be mounted in any position. The use of a retaining device is recommended.

If a screening can is used it should be blackened inside and out.

Free air circulation around the bulb or the outside of the screening can should be provided.

Provision of circuit information in this publication does not imply a right to use any invention which may be involved and which is the subject of patents by whomsoever owned.

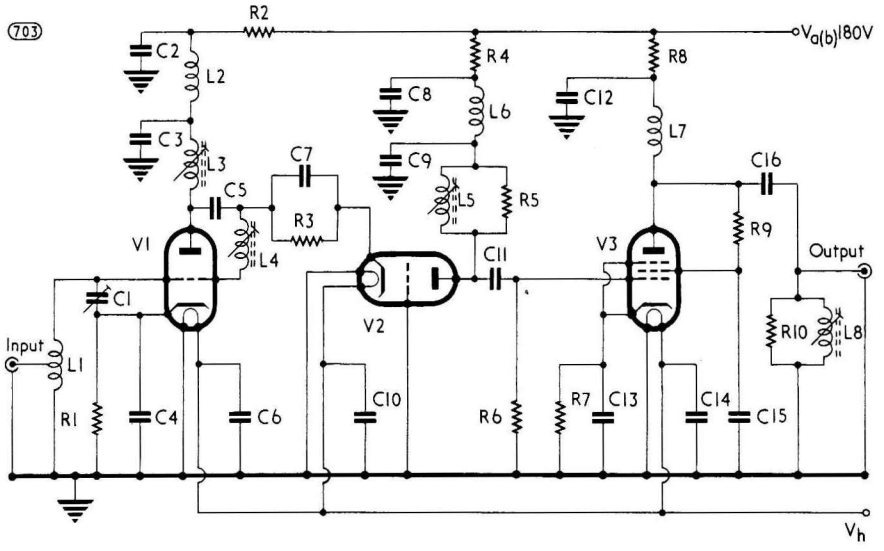


Fig. 1. Circuit of 45Mc/s cascode amplifier.

COMPONENT VALUES FOR FIG. 1.

Valves		Resistors		
V1 A2599		R1, R3	68Ω	0·25W
V2 A2521		R2, R4, R8	3·3kΩ	1W
V3 Z77		R5	4·7kΩ	0·25W
Capacitors		R6	1·0MΩ	0·25W
C1	2-8pF	R7	150Ω	0·25W
C2 to C14, C 16	1000pF	R9	22kΩ	0·25W
C15	470pF	R10	100Ω	0·25W

Inductances

All coils of enamelled copper wire wound on $\frac{1}{4}$ in. dia. former.

	Turns	s.w.g.
L1	9	18
L2, L6, L7	80	34
*L3	12	20
*L4	35	30
*L5	10	20
*L8	12	20

*Core is of the type recommended for use up to 100 Mc/s.

A2599

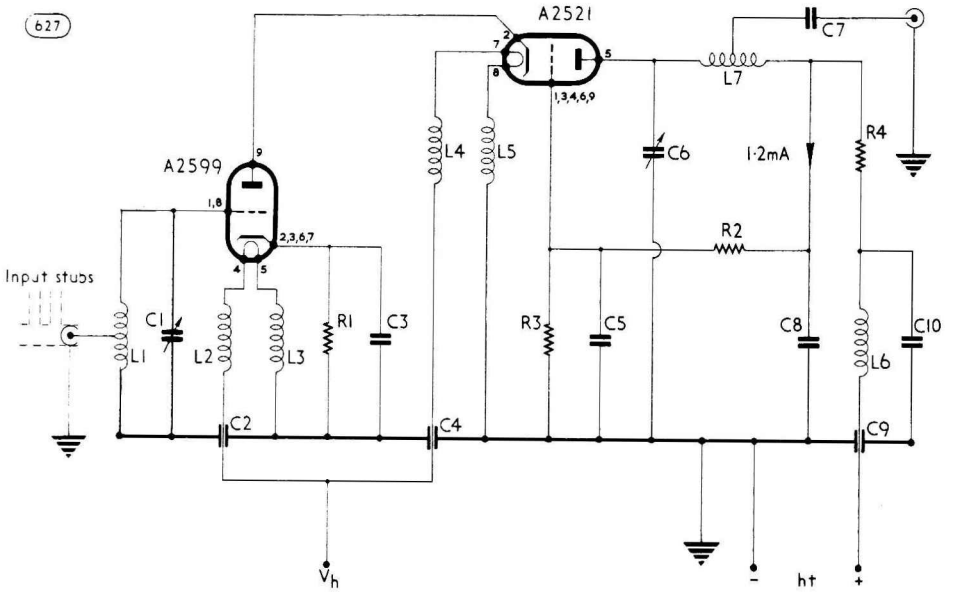


Fig. 2. Circuit of 200Mc/s cascode amplifier.

COMPONENT VALUES FOR FIGS. 2 AND 3

Resistors		Capacitors	
R1	68Ω.	C1, C6	3-30pF ceramic trimmer.
R2–R3	100kΩ.	C2, C4, C9	4700pF feedthrough.
R4	1kΩ.	C3, C7, C10	1000pF.
		C5, C8	2000pF.

Inductances

L1	$1\frac{3}{4}$ turns 14 s.w.g. copper wire $\frac{3}{8}$in. i.d. tapped at 1 turn from earthy end.
L2 to L6	$20\frac{1}{2}$in. of 26 s.w.g. enamelled copper wire close-wound $\frac{3}{16}$in. i.d. air-cored coil.
L7	$1\frac{1}{2}$ turns 14 s.w.g. copper wire $\frac{1}{2}$in. i.d. tapped at $\frac{1}{2}$ turn from earthy end.

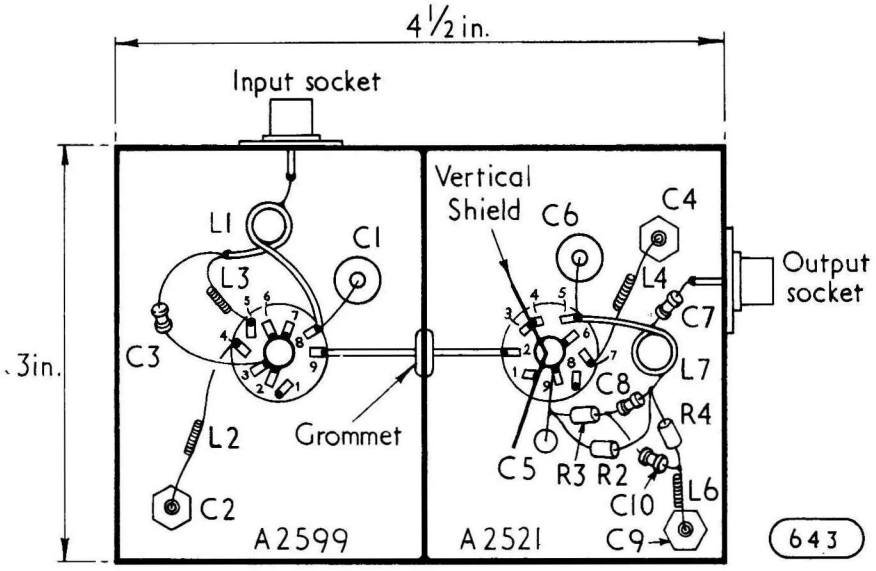


Fig. 3. Layout of 200Mc/s cascode amplifier.

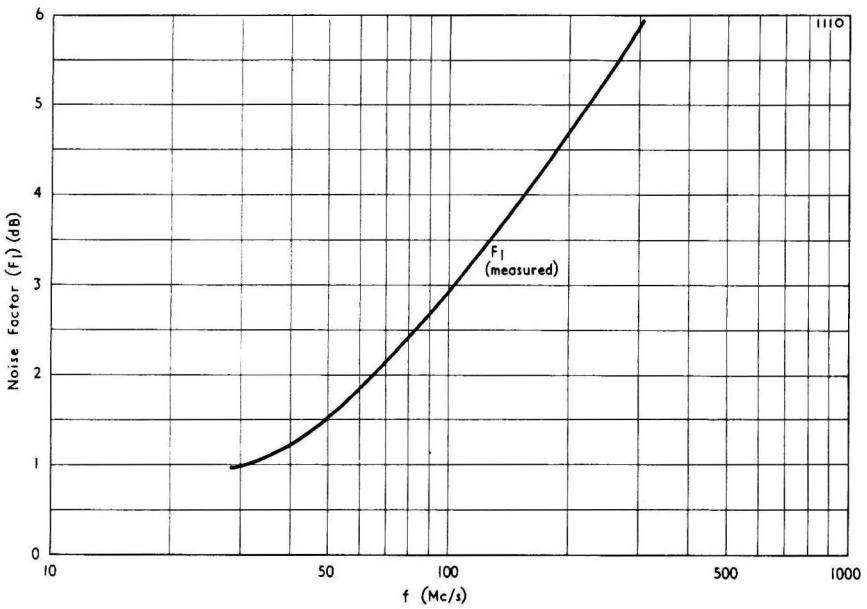


Fig. 4. Variation in average minimum noise factor against frequency for A2599-A2521 cascode amplifiers. (F_1 measured using a noise diode).

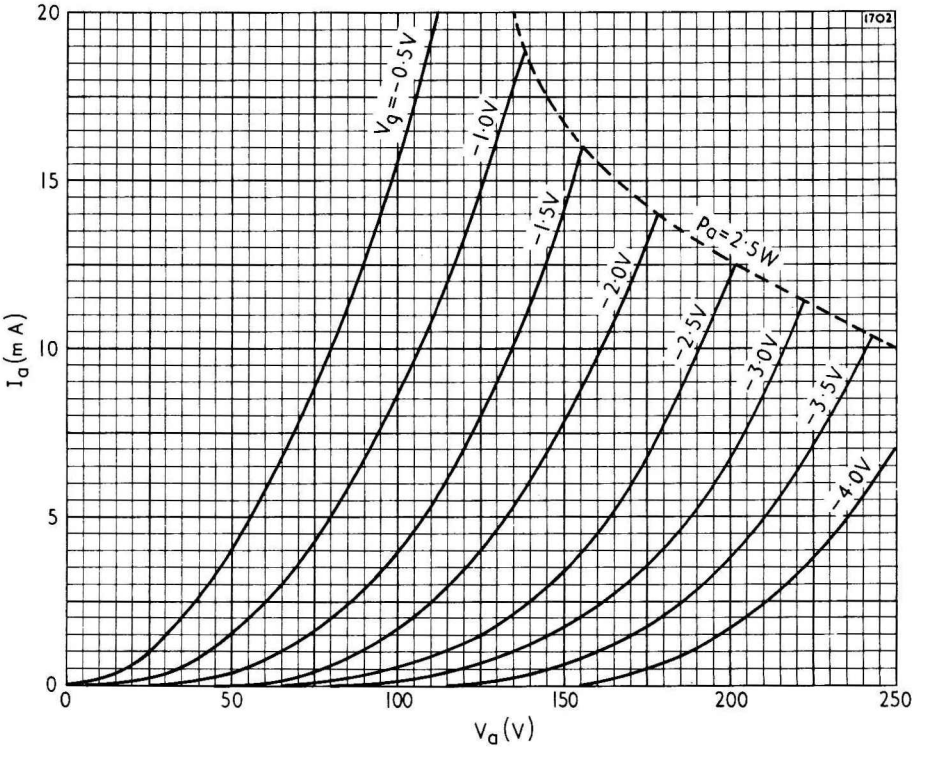

1702
20
15
10
5
0
0
50
100
150
200
250
I_a (mA)
V_a (V)
V_g = −0·5V
−1·0V
−1·5V
−2·0V
−2·5V
−3·0V
−3·5V
−4·0V
P_a = 2·5W

Fig 5.

A2599

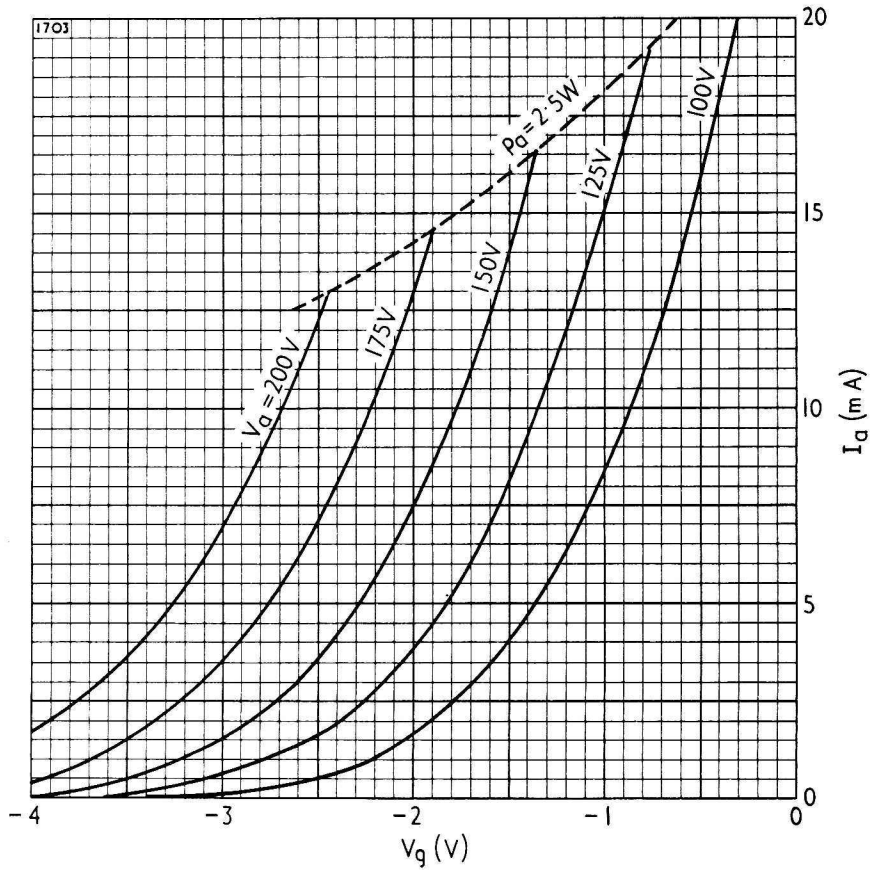


Fig. 6.

Printed in England – K-C.

G.E.C. VALVES

R.F. PENTODE

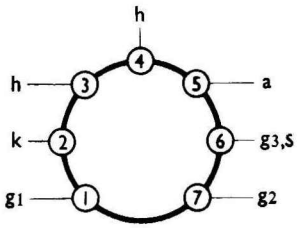
A3064

ISSUE 1

An r.f. pentode suitable for use in applications where long life and close control of characteristics are required.

The A3064 will replace the CV138, CV4014 and Z77 in most applications.

BASE CONNECTIONS AND VALVE DIMENSIONS



Viewed from underside of base.

Base :	Small-button miniature (B7G)
Bulb :	Tubular
Max. overall length :	54.5mm
Max. seated length :	47.5mm
Max. diameter :	19mm

HEATER

V_h	6.3	V
I_h	0.3	A

MAXIMUM RATINGS (Absolute)

$V_{a(o)}$	550	V
V_a	300	V
p_a	2.5	W
$V_{g2(o)}$	450	V
V_{g2}	300	V
p_{g2}	0.8	W
R_{g1-k}	0.5	MΩ
V_{h-k} (heater positive)	100	V
$-V_{h-k}$ (heater negative)	250	V
T_{bulb}	200	°C

CAPACITANCES (Measured on a cold screened valve)

$c_{g1\text{-all less a}}$: 6.5—8.7pF $c_{a\text{-all less g1}}$: 2.75—3.75pF

c_{a-g1}: 0.01pF (max)

A3064

CHARACTERISTIC SPREAD

Measured at :

V_a	250	V
V_{g2}	250	V
V_{g1}	0	V
R_k	160	Ω

	Min.	Mean	Max.	
*I_a	8.7	9.85	11.0	mA
I_{g2}	1.8	2.6	3.4	mA
*g_m	6.8	7.62	8.43	mA/V
$-I_g$			0.5	μA
I_a (at $-V_{g1}$ = 8V)			100	μA
*μ	60	75	89	-
*$-V_{g3}$ (at $-V_{g1}$ = 3.5V, I_a = 50μA)	70	95	120	V
I_h	275	300	325	mA

*These tests are performed on a sample basis only, and the figures given are of the average spread.

LIFE PERFORMANCE

The average life expectancy of the A3064 is at least 10,000 hours. In order to obtain maximum life, the valve must be operated within the ratings given on page 1. The environment must be a static one and the valve must not be switched more than 12 times in 24 hours. The life expectancy may be reduced if conditions other than those specified are imposed on the valve, and will be reduced appreciably if the absolute maximum ratings are exceeded. Both reliability and performance will be jeopardised if heater voltage ratings are exceeded. Life and reliability are directly related to the degree to which regulation of heater voltage is maintained at its centre rated value. Attention should also be paid to the recommendations of the British Standard Code of Practice CP1005 "The Use of Electronic Valves".

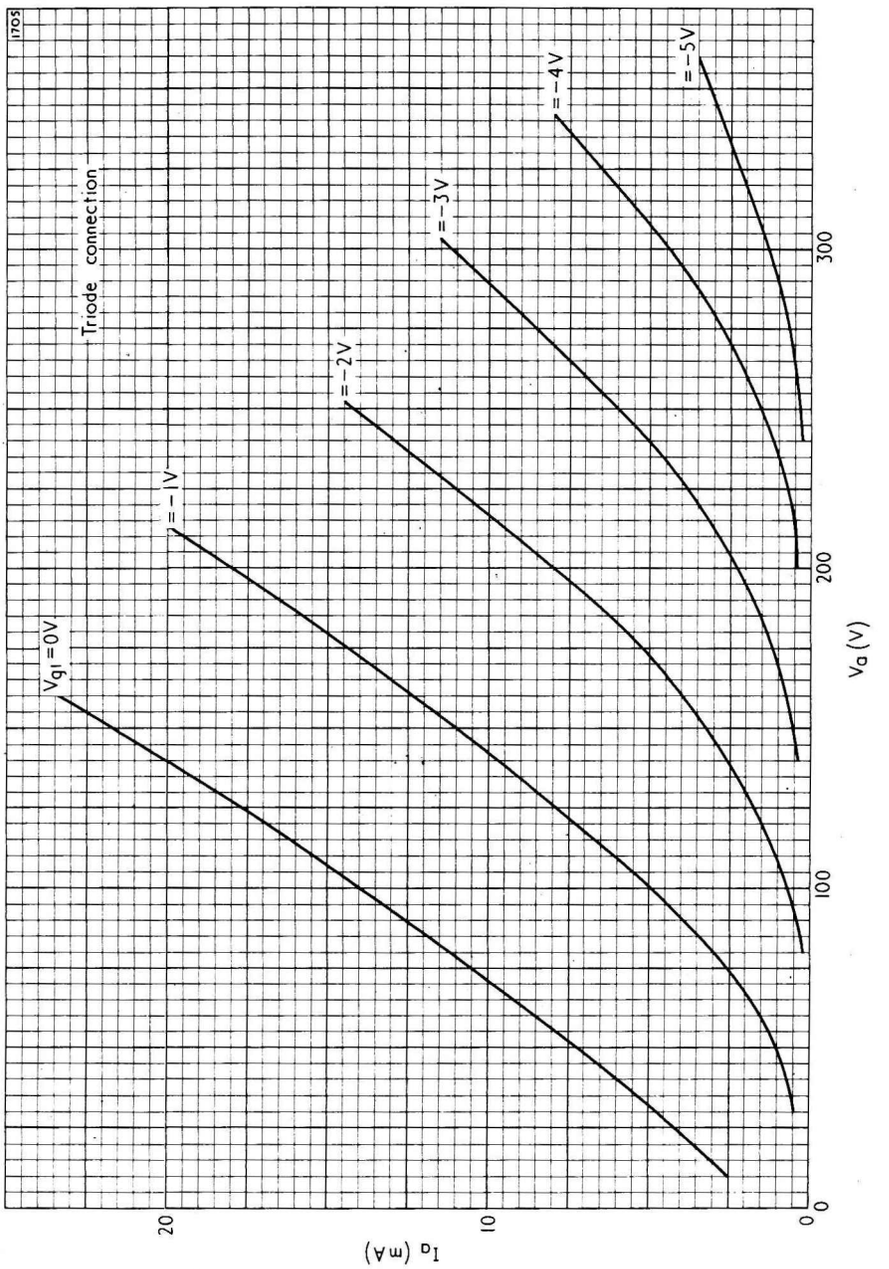
A valve is considered to have reached the end of life when it is either inoperative, or one or more of its characteristics has reached the following values :

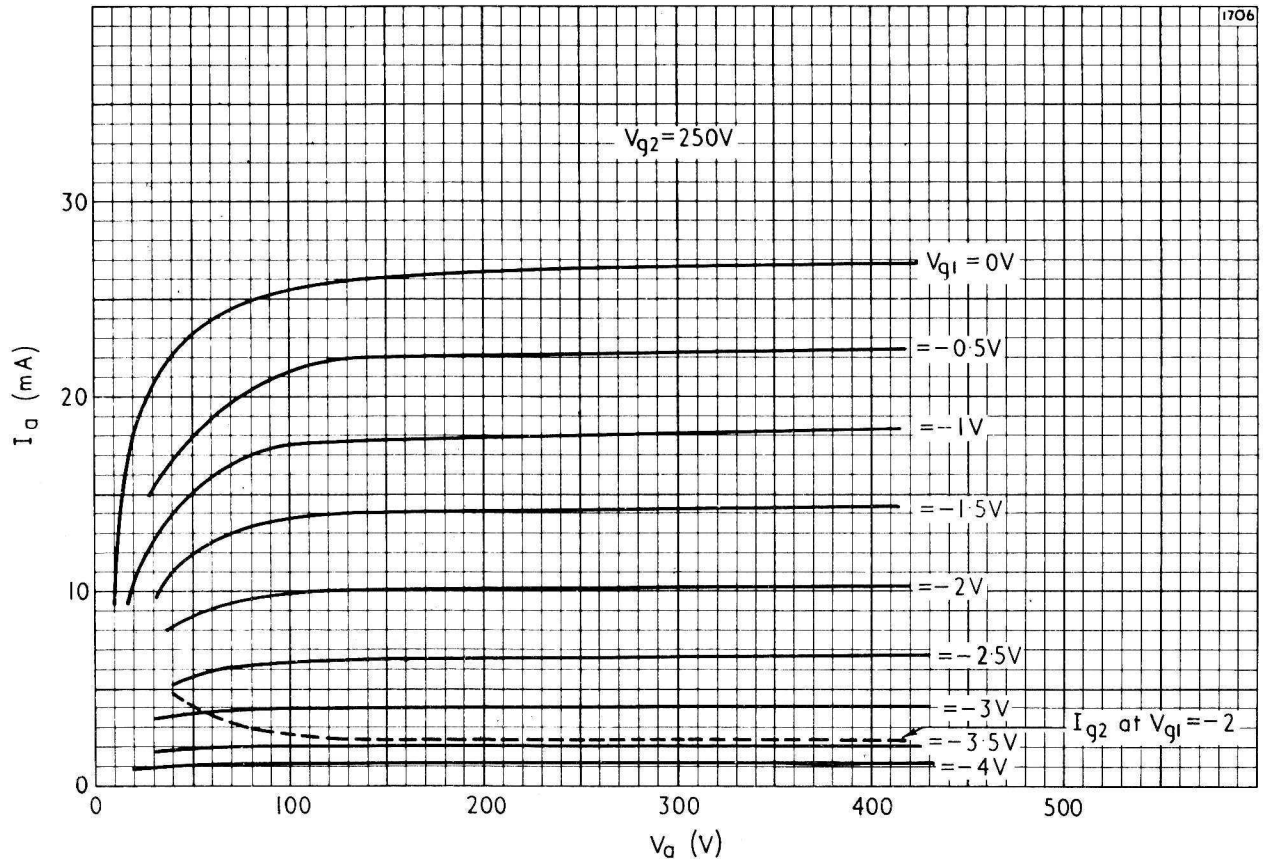
I_a	5.25	mA
g_m	4.9	mA/V
$-I_{g1}$	3.0	μA
I_{hk} (V_{hk} ±100)	20	μA

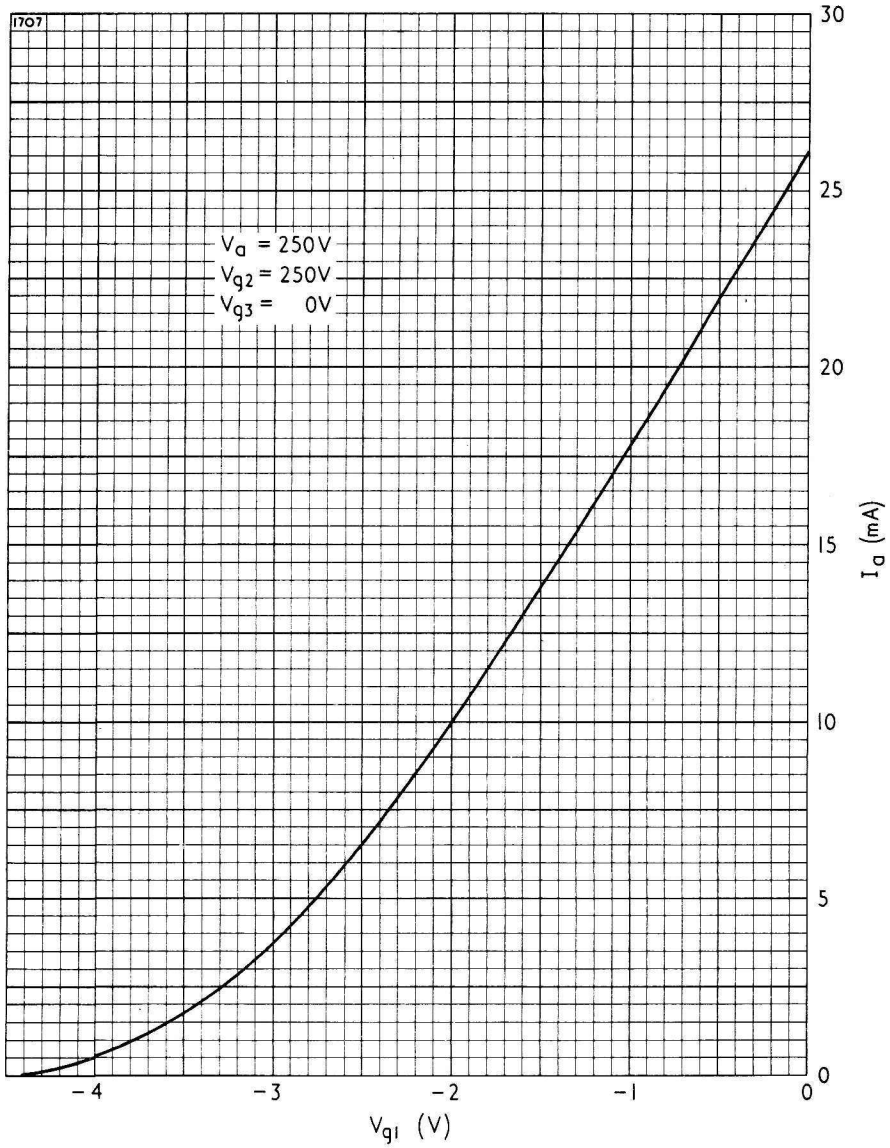
measured as "Characteristic Spread".

INSTALLATION

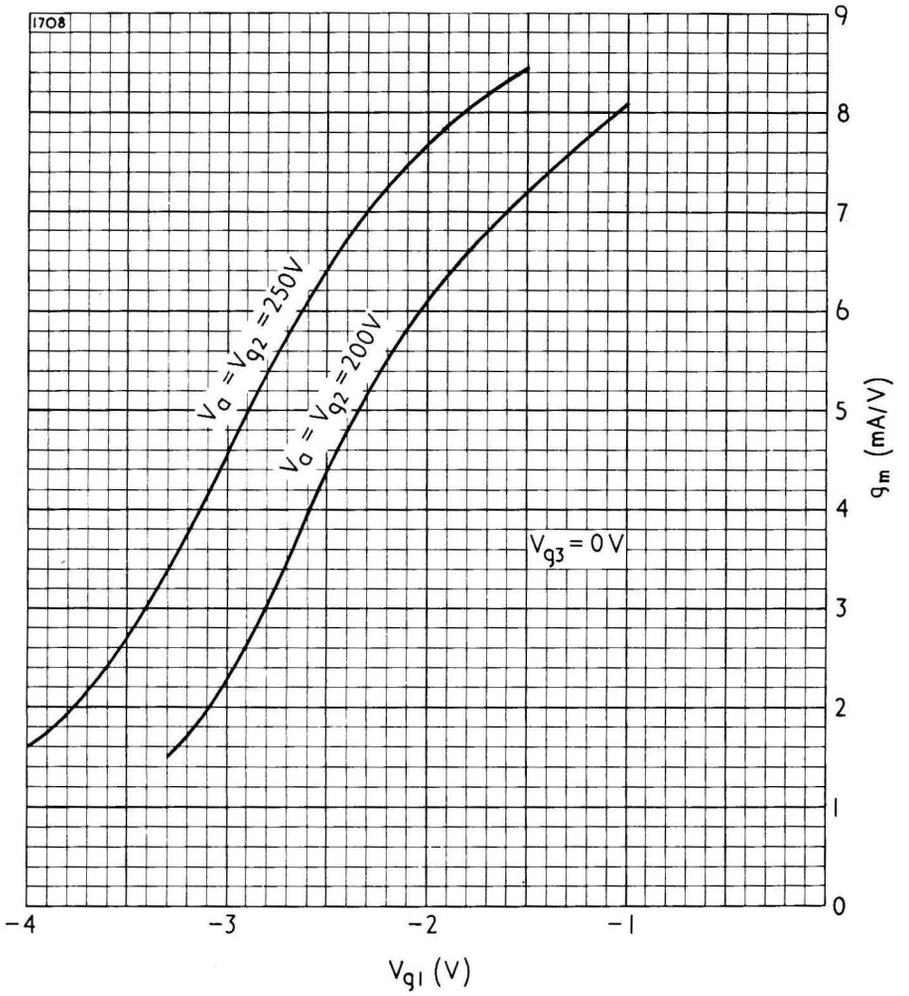
The valve may be mounted in any position.

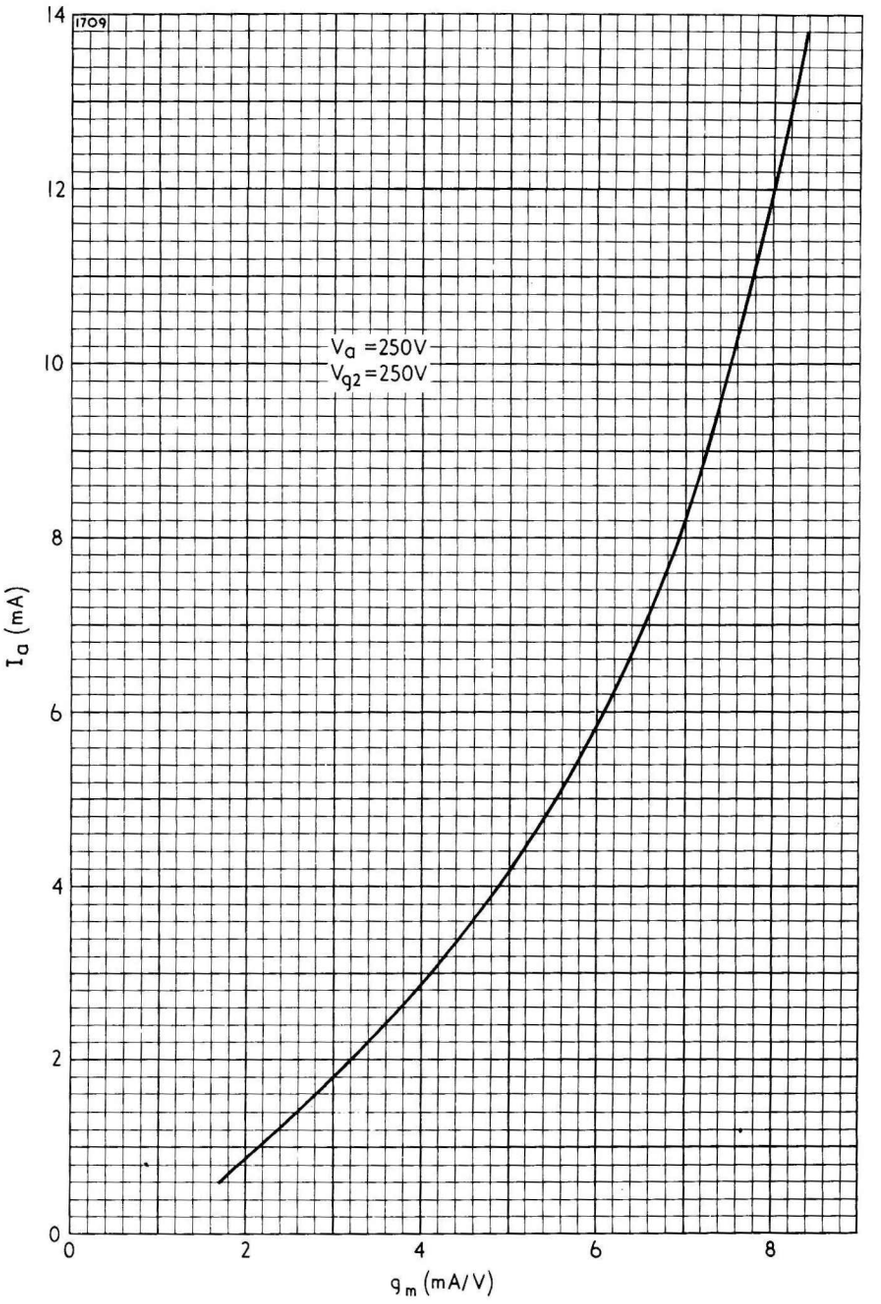

1705
Triode connection
V_{g1} = 0V
= −1V
= −2V
= −3V
= −4V
= −5V
I_a (mA)
20
10
0
0
100
200
300
V_a (V)


1706
V_{g2}=250V
V_{g1} = 0V
=−0·5V
=−1V
=−1·5V
=−2V
=−2·5V
=−3V
=−3·5V
=−4V
I_{g2} at V_{g1}=−2
I_a (mA)
V_a (V)
0
10
20
30
100
200
300
400
500

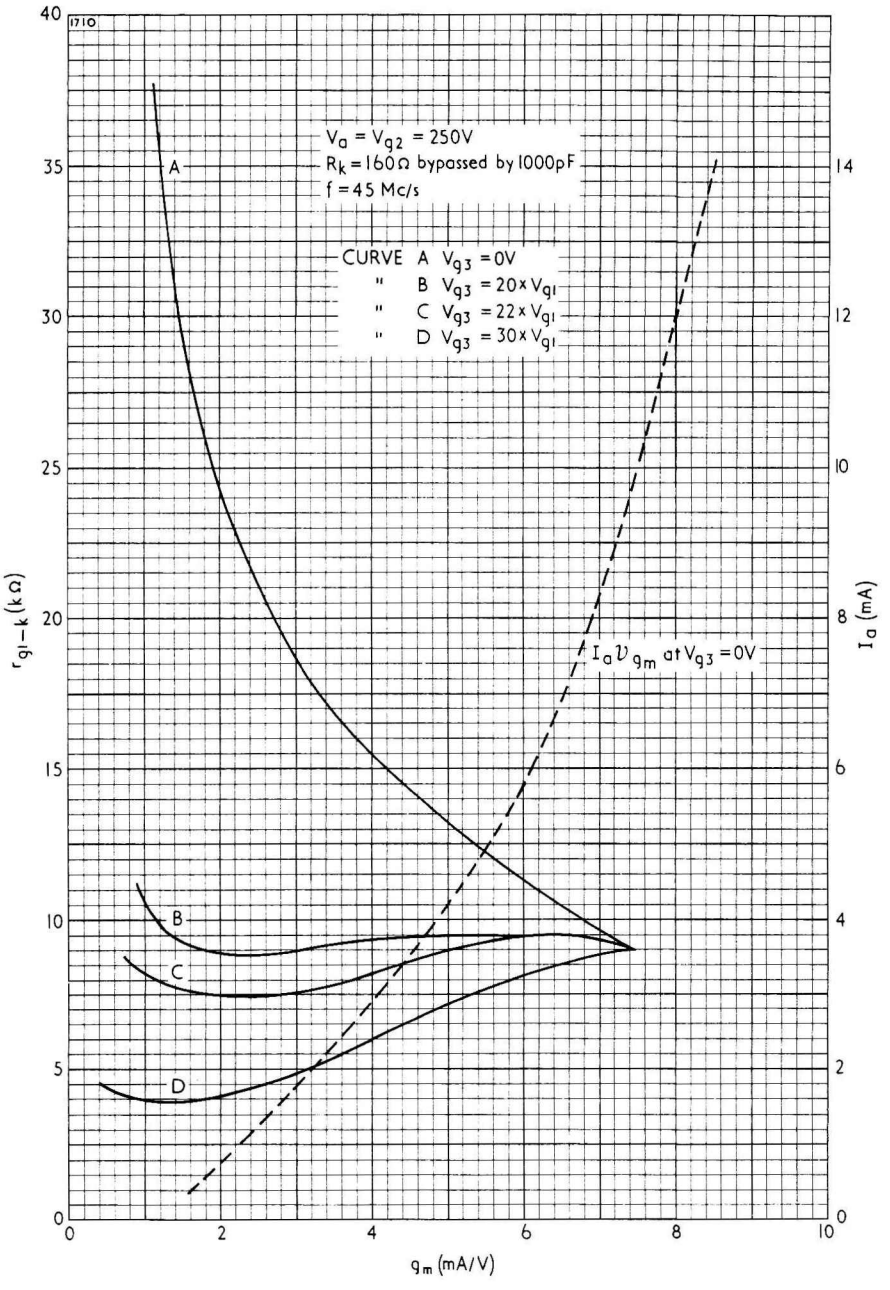

1707
V_a = 250V
V_{g2} = 250V
V_{g3} = 0V
30
25
20
15
10
5
0
I_a (mA)
−4
−3
−2
−1
0
V_{g1} (V)

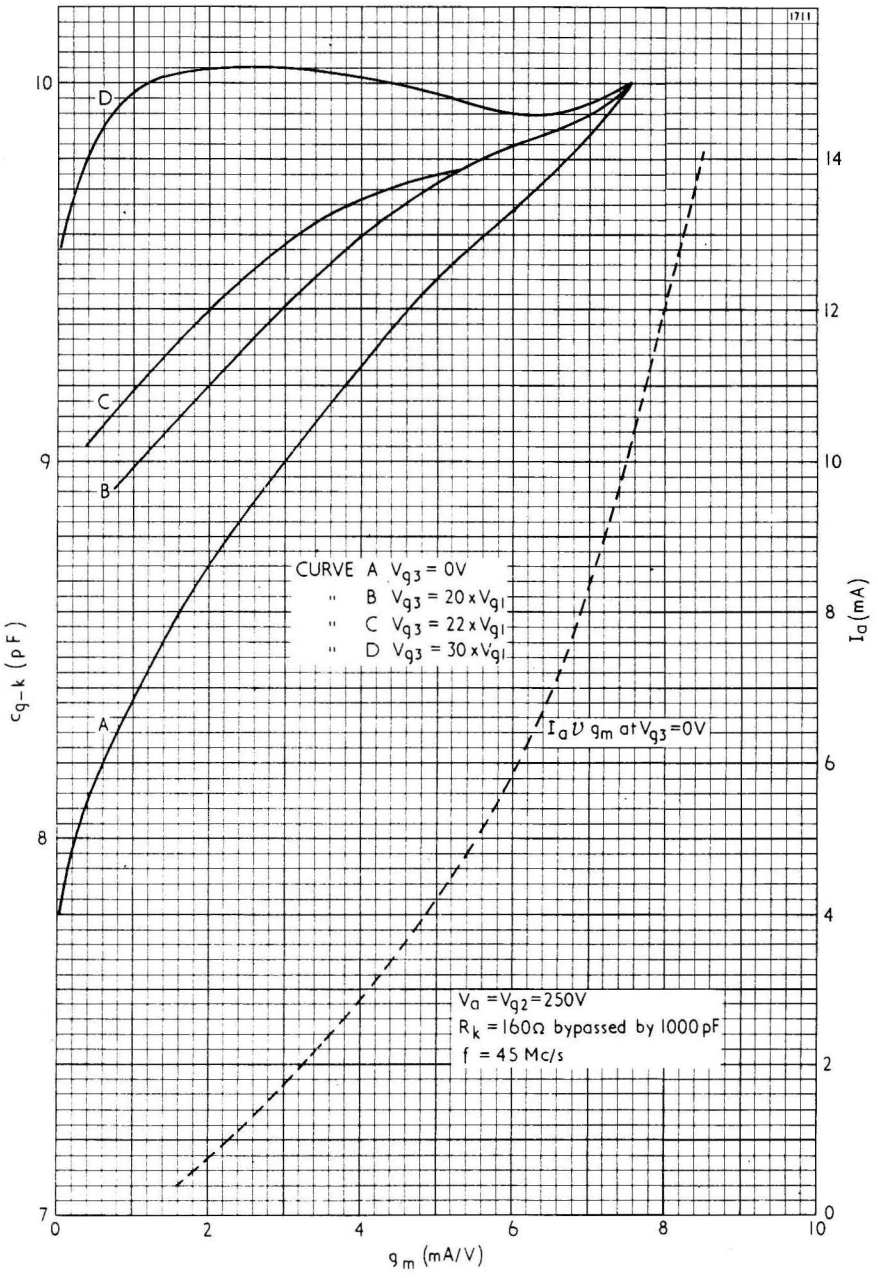
A3064


1708
$V_a = V_{g2} = 250V$
$V_a = V_{g2} = 200V$
$V_{g3} = 0\,V$
9
8
7
6
5
4
3
2
1
0
g_m (mA/V)
−4
−3
−2
−1
V_{g1} (V)

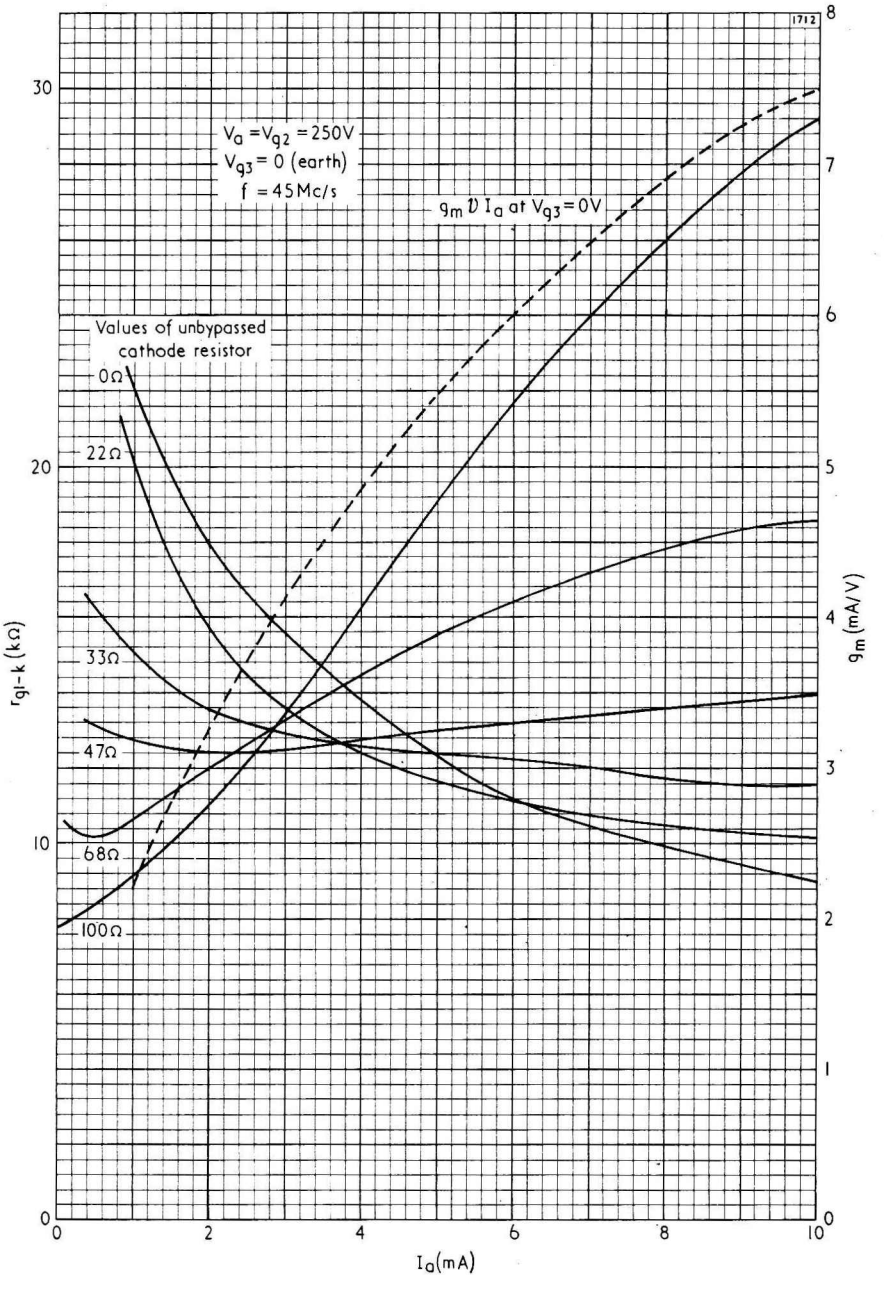

1709
V_a =250V
V_{g2}=250V
I_a (mA)
g_m (mA/V)
0
2
4
6
8
10
12
14

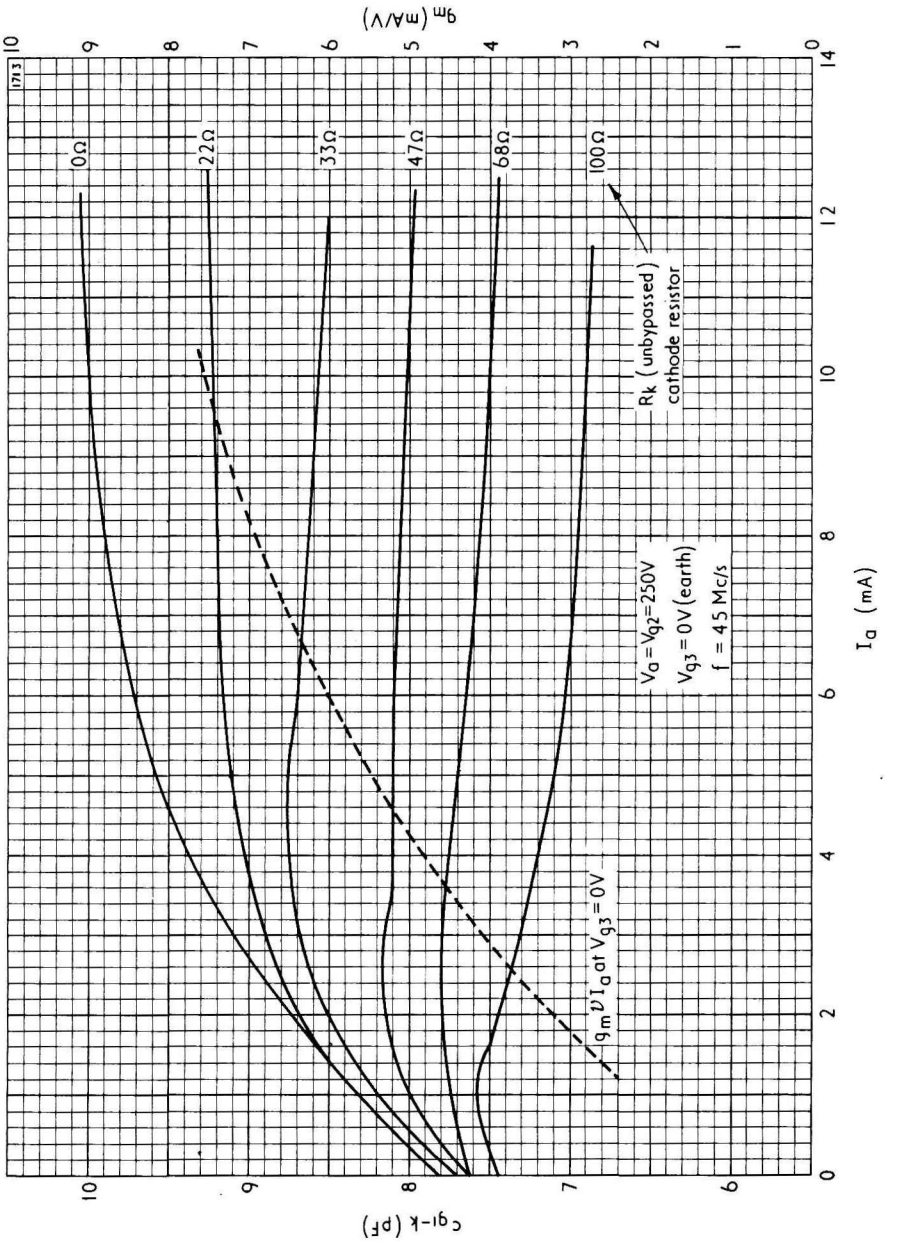
A3064


1710
$V_a = V_{g2} = 250V$
$R_k = 160\Omega$ bypassed by 1000pF
f = 45 Mc/s
CURVE A $V_{g3} = 0V$
" B $V_{g3} = 20 \times V_{g1}$
" C $V_{g3} = 22 \times V_{g1}$
" D $V_{g3} = 30 \times V_{g1}$
A
B
C
D
I_a & g_m at $V_{g3} = 0V$
r_{g1-k} (kΩ)
I_a (mA)
g_m (mA/V)
0
5
10
15
20
25
30
35
40
2
4
6
8
12
14


1711
D
C
B
A
CURVE A V_{g3} = 0V
" B V_{g3} = 20 x V_{g1}
" C V_{g3} = 22 x V_{g1}
" D V_{g3} = 30 x V_{g1}
I_a v g_m at V_{g3} = 0V
V_a = V_{g2} = 250V
R_k = 160Ω bypassed by 1000 pF
f = 45 Mc/s
c_{g-k} (pF)
I_a (mA)
g_m (mA/V)
10
9
8
7
14
12
10
8
6
4
2
0
0
2
4
6
8
10

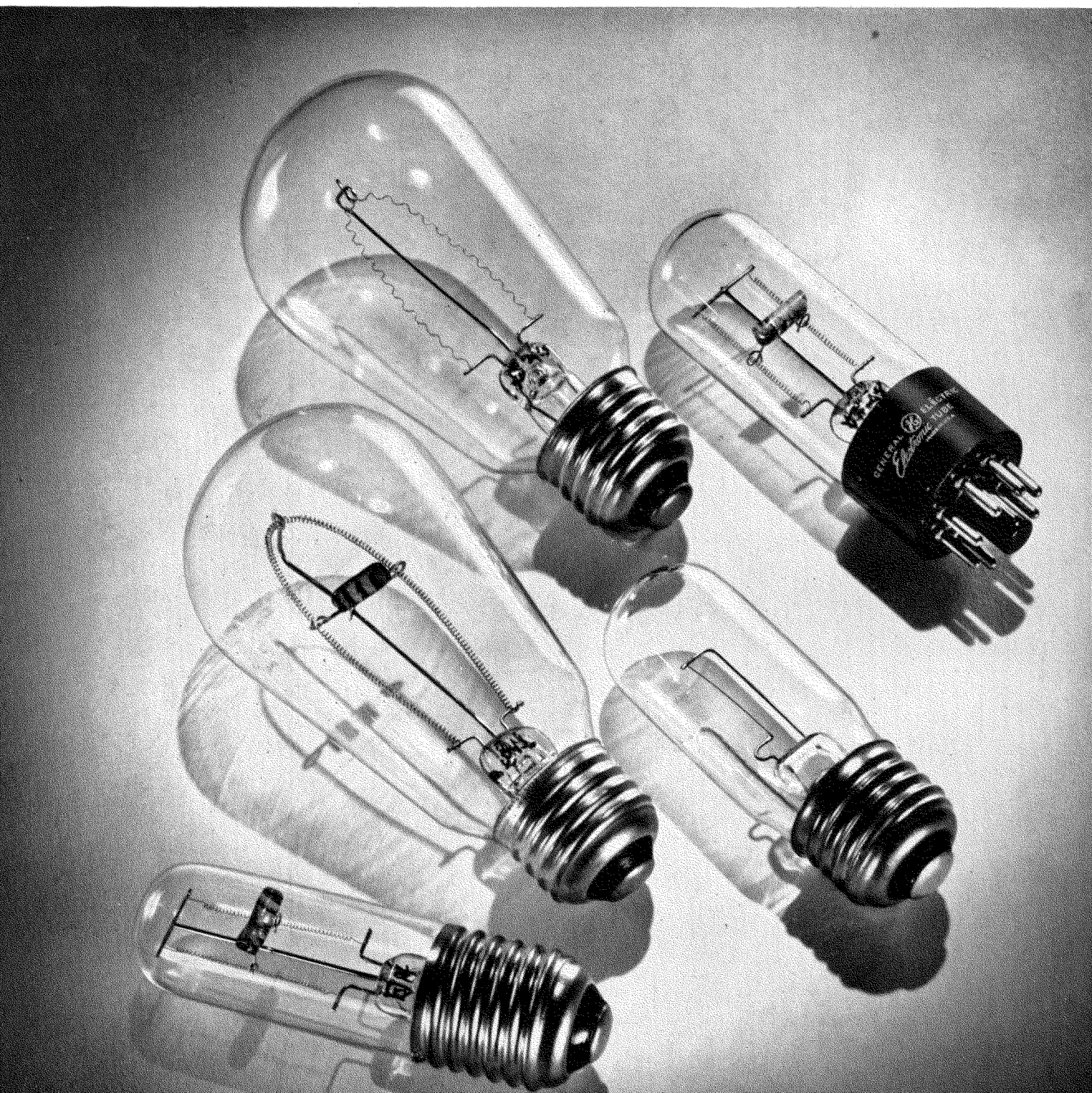
A3064


1712
$V_a = V_{g2} = 250V$
$V_{g3} = 0$ (earth)
f = 45Mc/s
g_m & I_a at $V_{g3} = 0V$
Values of unbypassed cathode resistor
0Ω
22Ω
33Ω
47Ω
68Ω
100Ω
r_{g1-k} (kΩ)
g_m (mA/V)
I_a(mA)
0
2
4
6
8
10
20
30
1
3
5
7


g_m (mA/V)
c_{g1-k} (pF)
I_a (mA)
0Ω
22Ω
33Ω
47Ω
68Ω
100Ω
R_k (unbypassed) cathode resistor
$V_a = V_{g2} = 250V$
$V_{g3} = 0V$ (earth)
f = 45 Mc/s
g_m v I_a at $V_{g3} = 0V$

GENERAL ELECTRIC

BALLAST TUBES



DESCRIPTION

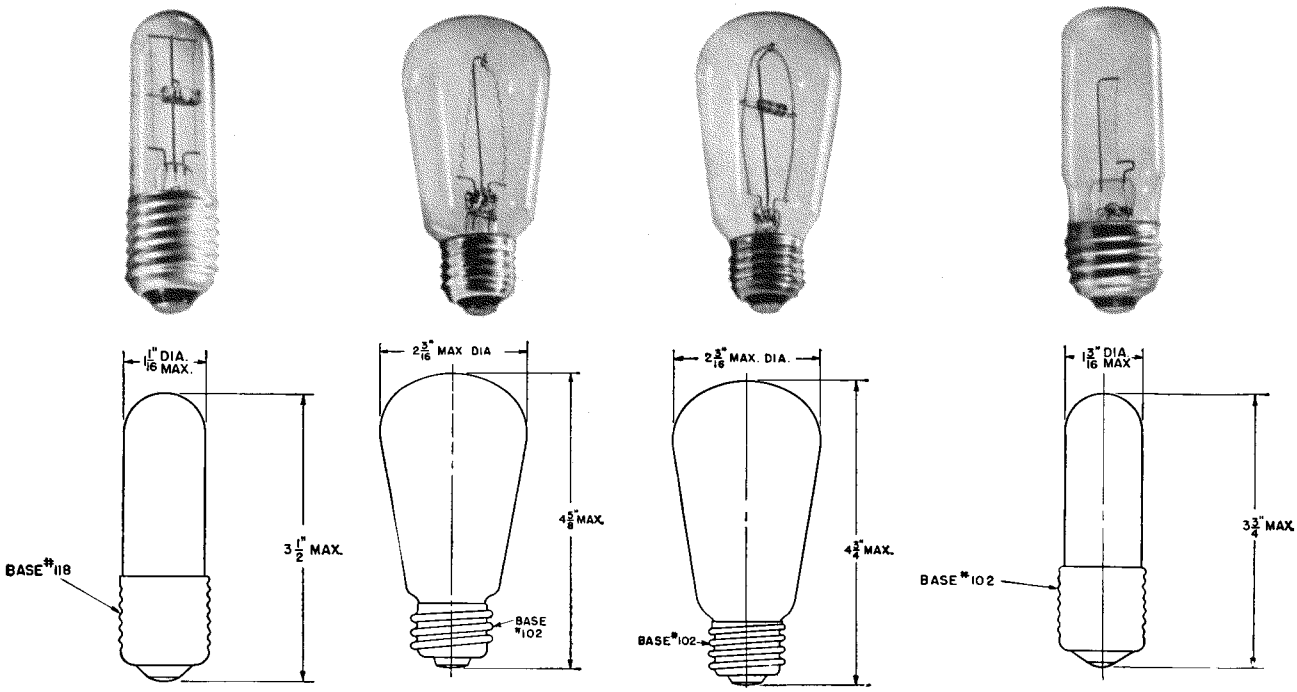
A ballast tube is essentially a constant-current device. It is a resistor whose resistance, at a certain critical temperature, varies with temperature so rapidly that, as the voltage across the tube varies, the current remains practically constant. The operation is the same on either alternating or direct current. Its function is to maintain a constant average current.

All ballast tubes now manufactured have been designed for a specific application and, as a result have non-uniform ratings. Because of the wide range of voltage and current ratings possible, no attempt has been made to manufacture a standard line. Ballast tubes may, however, be used in parallel or with shunting resistors across the load to increase or decrease the current rating, or with series resistors to increase the voltage rating. These methods are described under the section titled "Operation."

RATINGS AND DATA

In rating a ballast tube, the voltage range over which the current is nearly constant is given together with a maximum and minimum current. The upper limit of the voltage range is to be considered the maximum voltage at which the tube may be operated. Over the voltage range the current may vary two per cent above or below its average value. The average current of individual tubes may be as much as two per cent above or below the average current of the entire production. Therefore, considering change of current with life and any other factors which may enter, the variation of current in a circuit using ballast tubes may be as much as five per cent above or below the average. The limits given in the tube ratings cover these factors.

TUBE TYPE NO.	VOLTAGE RANGE IN VOLTS		CURRENT IN AMPERES	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
B-6	15	21	0.95	1.01
B-25	7	16	1.07	1.16
B-46	8	18	2.70	3.25
B-47	8	18	2.05	2.35
FB-50	5	8	0.225	0.275



Outline
B-6 Ballast Tube
K-5182058 7-1-44

Outline
B-25 Ballast Tube
K-4955995 7-1-44

Outline
B-46, B-47 Ballast Tube
K-5185216 8-10-44

Outline
FB-50 Ballast Tube
K-8639322 7-1-44

INSTALLATION

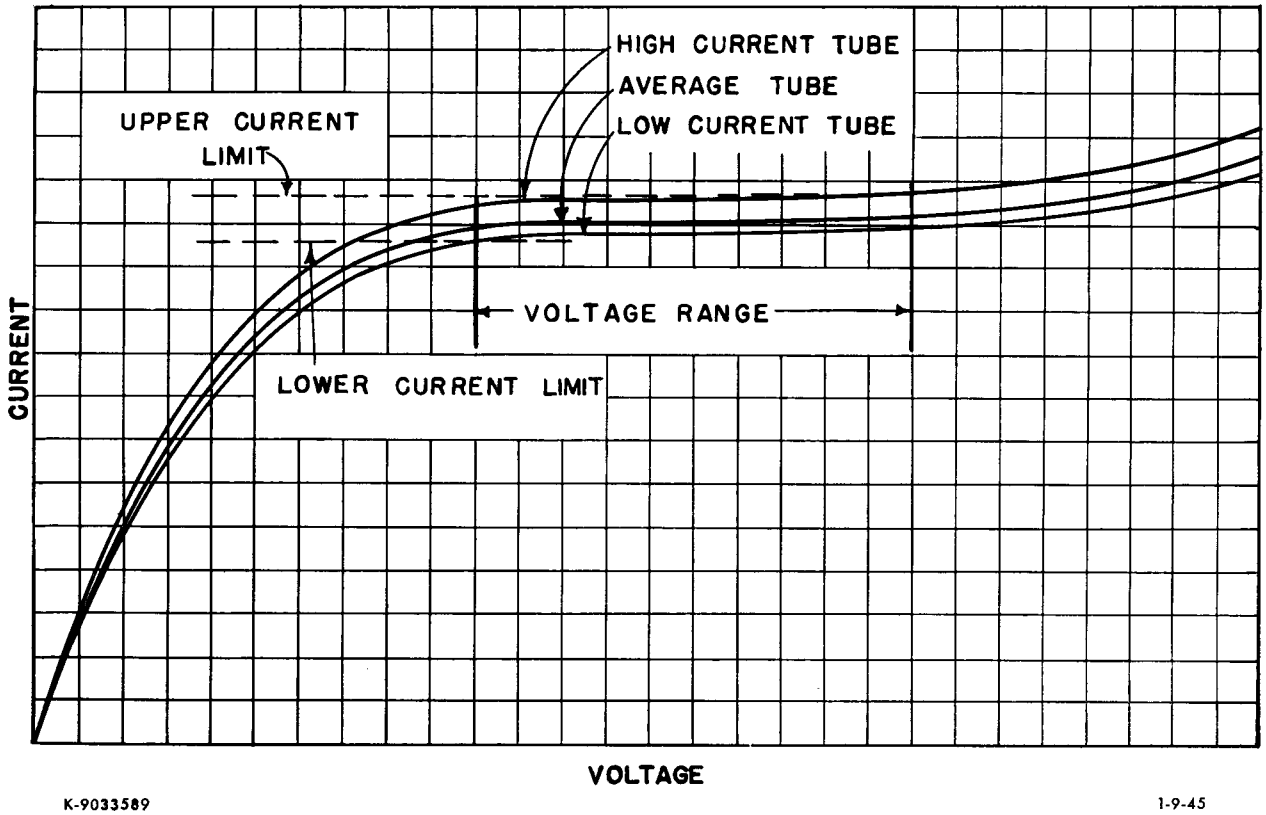
The ballast tube should be mounted, with the base down, in an enclosure rigid enough to stop flying glass since, should the tube develop an air leak, the mixture of oxygen with the hydrogen contained in the tube might become of the right proportion to explode. The envelope becomes quite hot during operation, and free circulation of air must be allowed in order to keep the temperature of the air near the tube below 150 F. Marked changes in envelope temperature will cause a change in the current. Since the entire load current must pass through the ballast tube, the socket and connections to it must be clean and make good contact to prevent heating at these points.

OPERATION

The operation of the tube is shown by the characteristic curves in Fig. 1. As the voltage across the filament rises from zero, the resistance of the tube increases slowly in the same manner as most metals. As the lower end of the operating range is reached, the resistance of the filament increases quite rapidly with temperature, so that further increase in voltage causes practically no further increase in current. As the upper end of the operating range is reached, the resistance again becomes nearly constant. A still further increase in voltage causes an almost proportional increase in current as illustrated in the curves of Fig. 1.

This operation of the tube can be seen by observing the filament. As the voltage across the tube is increased from zero and approaches the lower end of the operating range, a small section in the middle of the filament will become red hot. As the voltage is increased further, the length of this red-hot section increases until the entire filament is visibly hot. This represents the end of the operating range and any increase in voltage will overheat and damage the tube. Operating the tube above the upper limit of voltage will result in excessive expansion and contraction of the filament as the voltage varies; this will cause the wire to stretch out the coils of the filament or to knot, which will increase the current and speed up the destructive process already started, resulting, shortly, in filament burn-out.

If a steady voltage of a value in the middle of the operating range is applied to the tube continuously, its life will be tens of thousands of hours. Opening and closing the circuit with the resulting lengthen-



K-9033589 1-9-45

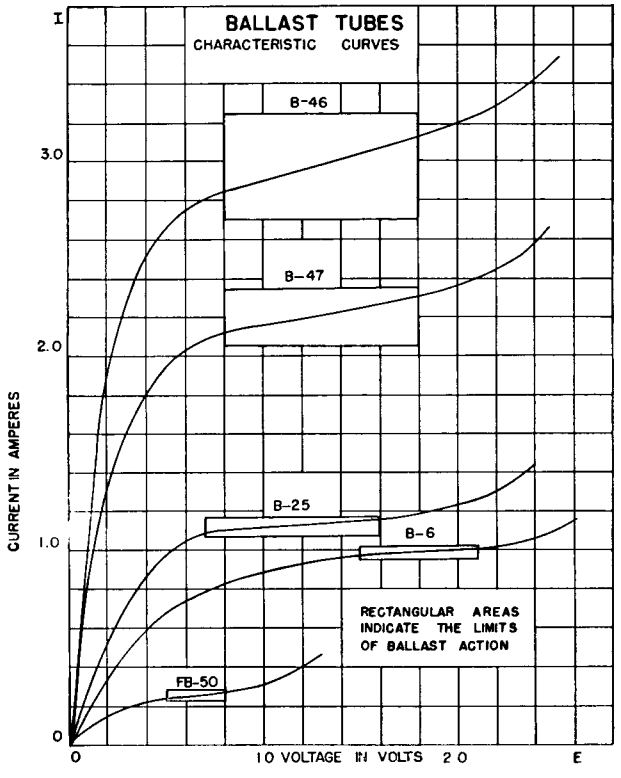
Fig. 1—Typical Ballast Tube Characteristics

ing and shortening of the filament greatly reduces the life of the tube. If full voltage is applied to the tube, the circuit may be opened and closed only a few hundred times before the current is outside the limits or the filament is burned out. Thus the life of the tube will be determined entirely by its duty cycle.

Because of the large thermal inertia of the tube, the temperature does not reach its final value immediately when the circuit is closed or when the voltage changes. Since the cold resistance of the filament is quite low, when the circuit is first closed the initial current may be several times the final value.

After a few seconds, however, the current will have fallen to within 25 per cent of the final value, and from 15 seconds to several minutes, depending upon the size of the tube, will be required for the current to reach a steady state. The real function of a ballast tube is to maintain a constant average current.

In Fig. 1 three curves are given to show the variation to be expected between tubes of a given rating. By choosing the proper coordinates, these curves are approximate for any ballast tube. Individual tubes may maintain the current to less than the range shown, but in any particular application variations up to plus or minus five per cent of the average may be expected. Typical characteristic curves indicating the limits of ballast action for the various types of ballast tubes are shown in Fig. 1A at the right.



K-9033550 12-30-44

Fig. 1A

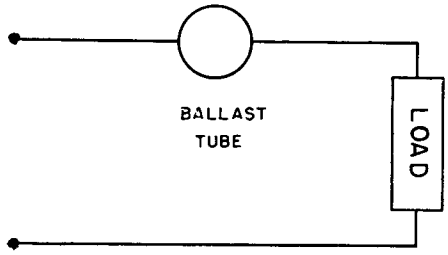
APPLICATION CIRCUITS#

The commonest use of the ballast tube is to place it directly in series with the load as shown in Fig. 2 and Fig. 3.

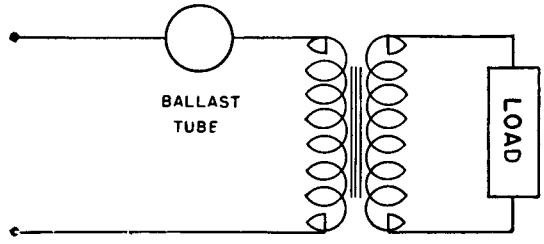
The graphical representation of the current and voltages in the circuit is shown in Fig. 4.

When voltage is applied, the current which flows is determined by the intersection of the load characteristic and the tube characteristic. As the supply voltage varies the current remains practically constant. The load voltage remains practically constant because the tube voltage varies by an amount proportional to the supply-voltage variation. The tube used should have a voltage range equal to the variation in supply voltage.

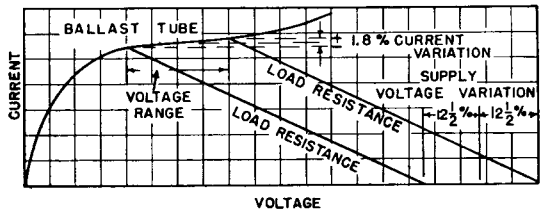
#Circuits shown in ETI-194 are examples of possible tube applications and the description and illustration of them does not convey to the purchase of tubes any license under patent rights of General Electric Company



K-9033575 Fig. 2—Connection for A-c or D-c Circuit 12-30-44

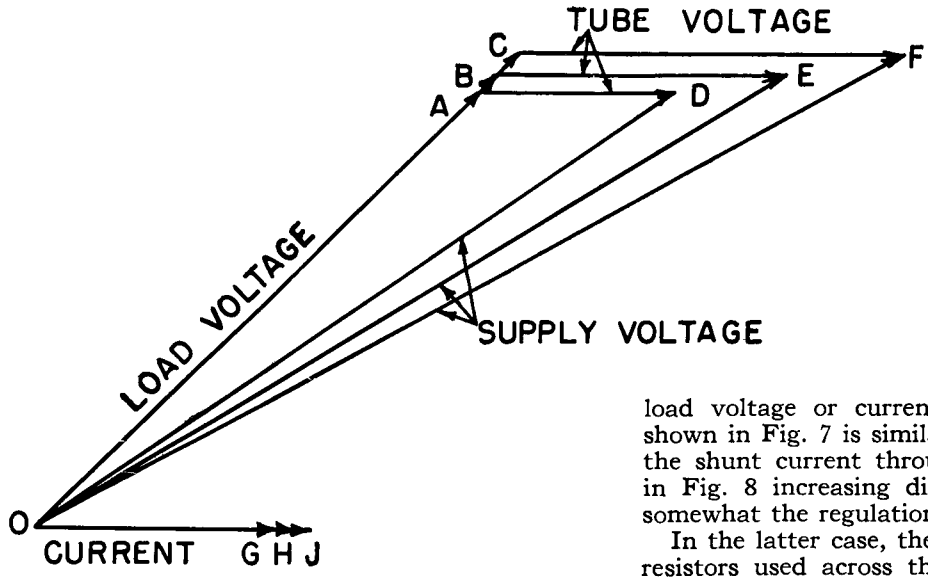


K-9033578 Fig. 3—Connection Using a Transformer 1-1-45



K-9033579 1-1-45

Fig. 4—Ballast Tube in Series with Load



K-9033580 1-1-45

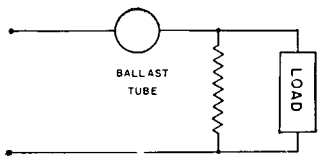
Fig. 5—Vector Diagram For Inductive Load

A ballast tube may be used with inductive loads as well as with pure-resistance loads. Fig. 5 shows the vector diagram for such a load. The vector *OE* represents the normal supply voltage, while the vectors *OB* and *BE* represent the normal load and ballast-tube voltages, respectively. *OH* is the normal current. As the supply voltage decreases to *OD* or increases to *OF*, the ballast-tube voltage decreases to AD or increases to CF. This maintains the load voltage between OA and OC and the current between OG and OJ.

If it is necessary to use a tube whose current rating is too high or too low, either the load or the tube, as the case may be, may be bridged with a resistor to carry the excess or additional current. Figs. 6 and 7 show these two connections.

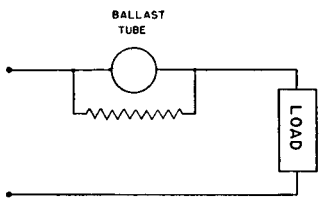
The operation of the circuit shown in Fig. 6 is identical with that shown in Fig. 2, the resistor being considered part of the load. This circuit is also recommended where close adjustment of the load voltage or current is required. The circuit shown in Fig. 7 is similar in operation except that the shunt current through the resistor, as shown in Fig. 8 increasing directly with voltage, spoils somewhat the regulation of the tube.

In the latter case, the higher the value of shunt resistors used across the ballast tube, the better the regulation. This connection is not recommended except in cases where close regulation is unnecessary.



K-9033577 12-30-44

Fig. 6—Circuit Using Tube with Too Large a Current



K-9033576 12-30-44

Fig. 7—Circuit Using Tube with Too Small a Current
(Not recommended)

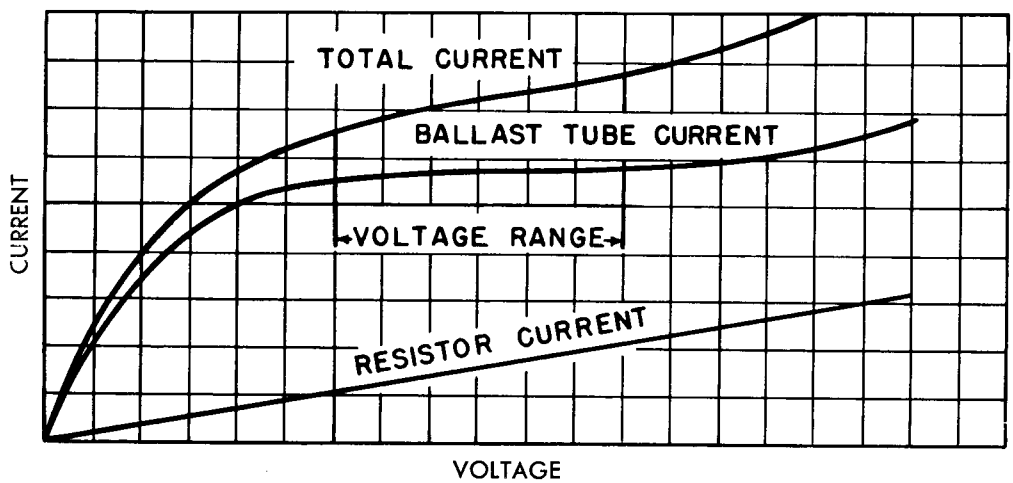


Fig. 8—Resistor Across Ballast Tube

K-9033581 1-1-45

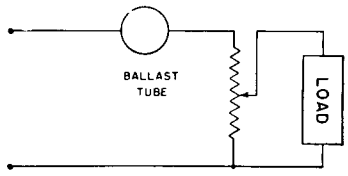
APPLICATION CIRCUITS (Contd.)

The ballast tube may be used to maintain constant current in a circuit requiring variation of the load. A suggested circuit is shown in Fig. 9.

Since the voltage across the ballast tube will vary with both the line voltage and load resistance (the potentiometer being considered part of the load) a greater voltage range will be required, and the ballast tube will use a greater percentage of power See Fig. 10 below.

The minimum voltage across the ballast tube will occur with minimum supply voltage and with the load adjusted to the minimum point on the potentiometer. The maximum voltage across the ballast tube will occur with the maximum supply voltage and with the load adjusted to the maximum point on the potentiometer. Since this circuit draws a constant current from the line, varying the potentiometer will not cause a variation in supply voltage to other apparatus on the line.

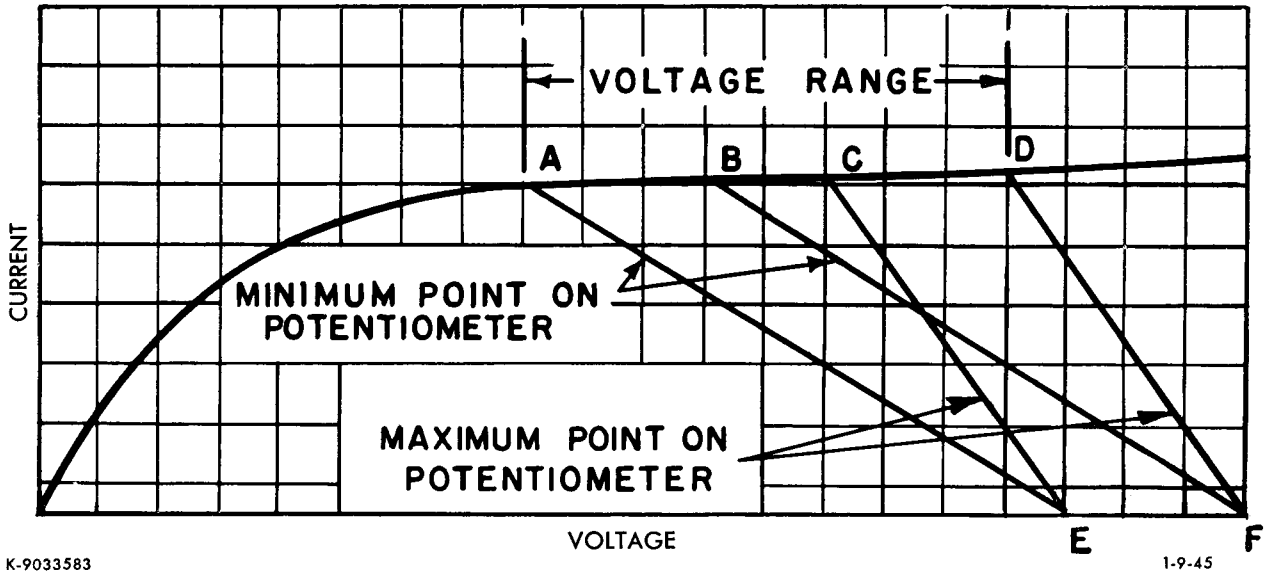
Ballast tubes may be used in parallel provided their voltage ranges are equal or nearly so. If their voltage ranges are unequal, good ballasting will occur only over that part of the voltage range which is included by both tubes. The current for any voltage will be the sum of the currents in both tubes at that voltage.



K-9033582 1-9-45

Fig. 9—Circuit for Varying Load Voltage

Ballast tubes cannot be used in series unless their current-voltage characteristics are identical. This can be shown by referring to Fig. 1. If two tubes, one having the maximum current and one the minimum for a particular rating, are used in series the current will be the same in both tubes at all times. At the value at which the higher-current tube starts to ballast, the lower-current tube is operating above its ballasting range and hence is over-loaded. Thus, the safe operating range of the combination is only that of the lower current tube.



K-9033583 1-9-45

Fig. 10—Ballast Tube in Series with Potentiometer, Load Across Potentiometer

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850

G.E.C. VALVES

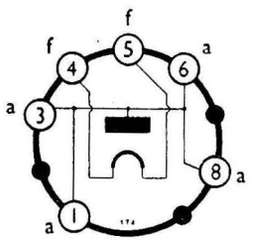
DIODE
NOISE GENERATOR
TUNGSTEN FILAMENT

CV2398

ISSUE 1

A diode noise generator with a flexible lead Noval base. Suitable for use up to 500 Mc/s.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A/F
Bulb : Tubular
Max. bulb length : 49 mm
Max. diameter : 22 mm
Min. lead length : 35 mm

FILAMENT

V_f (range)	0—6	V
I_f (at V_f=6V)	1·15 (approx)	A

The value of the saturated anode current is regulated by variation of the filament voltage.

MAXIMUM RATINGS (Absolute)

V_a	200	V
I_a	85	mA
p_a	3·5	W
V_f	6	V

CAPACITANCES (Measured on a cold unscreened valve)

$c_{a-f(max)}$	3	pF

CHARACTERISTICS

V_a	50	V
$I_{a(sat)}$ (approx)	50	mA
V_f (approx)	5·6	V

TYPICAL OPERATION

Noise diode for use up to 220 Mc/s

When measuring receiver noise factor using with the diode a source resistance R_{source} (to match the receiver input) and the technique of setting the value of $I_{a(sat)}$ to double the noise output power from the receiver detector, the range of noise factor that can be measured with a given value of R_{source} is as shown.

Then, noise factor = 10 $\log_{10}$ ($I_{a(sat)} \times R_{source}$) db.

No correction of noise factor measured is necessary up to 220 Mc/s.

V_a	50	50	50	V
$I_{a(sat)}$ (range)	0—70	0—70	0—70	mA
V_f (range) (approx)	0—6	0—6	0—6	V
R_{source}	50	70	300	Ω
Noise Factor Measurement (range) (approx)	18·4	19·9	26·2	db

THE GENERAL ELECTRIC CO. LTD. OF ENGLAND
Head Office : Magnet House . Kingsway . London . W.C. 2

AUGUST, 1958

CV2398

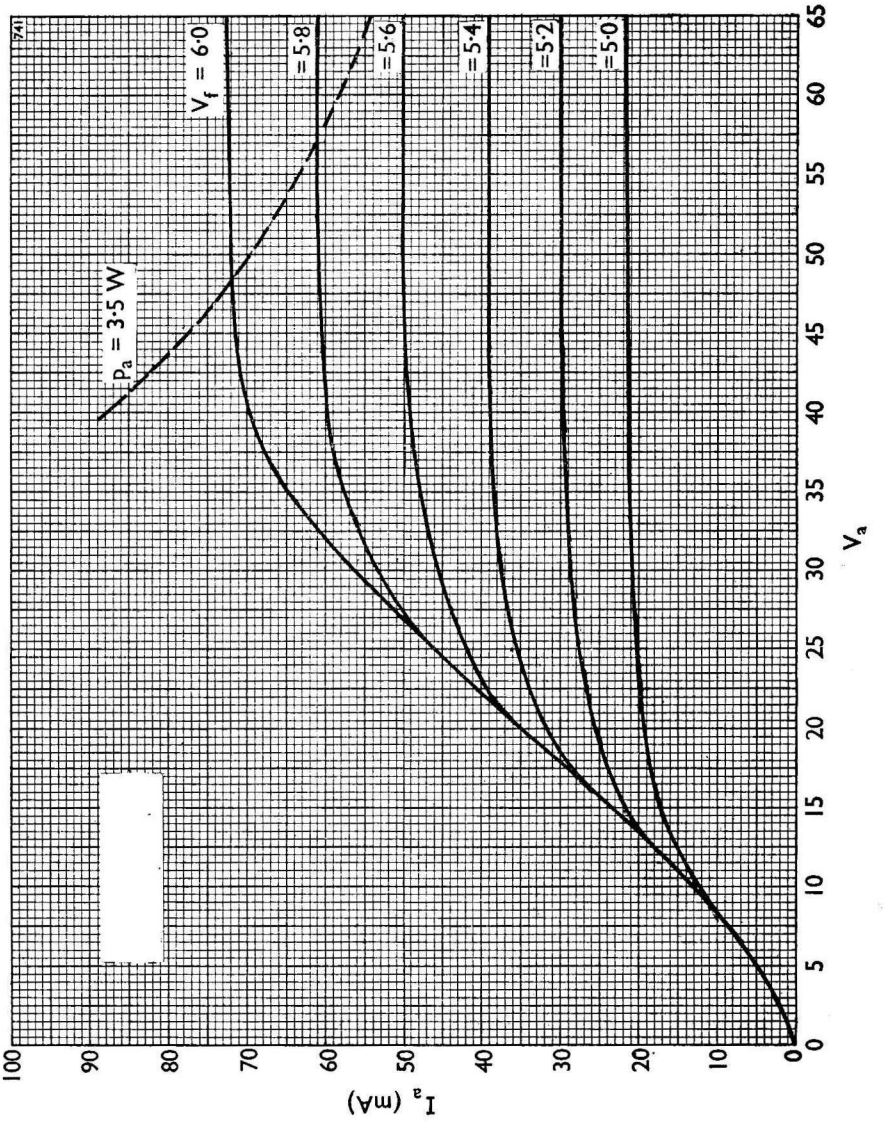
INSTALLATION

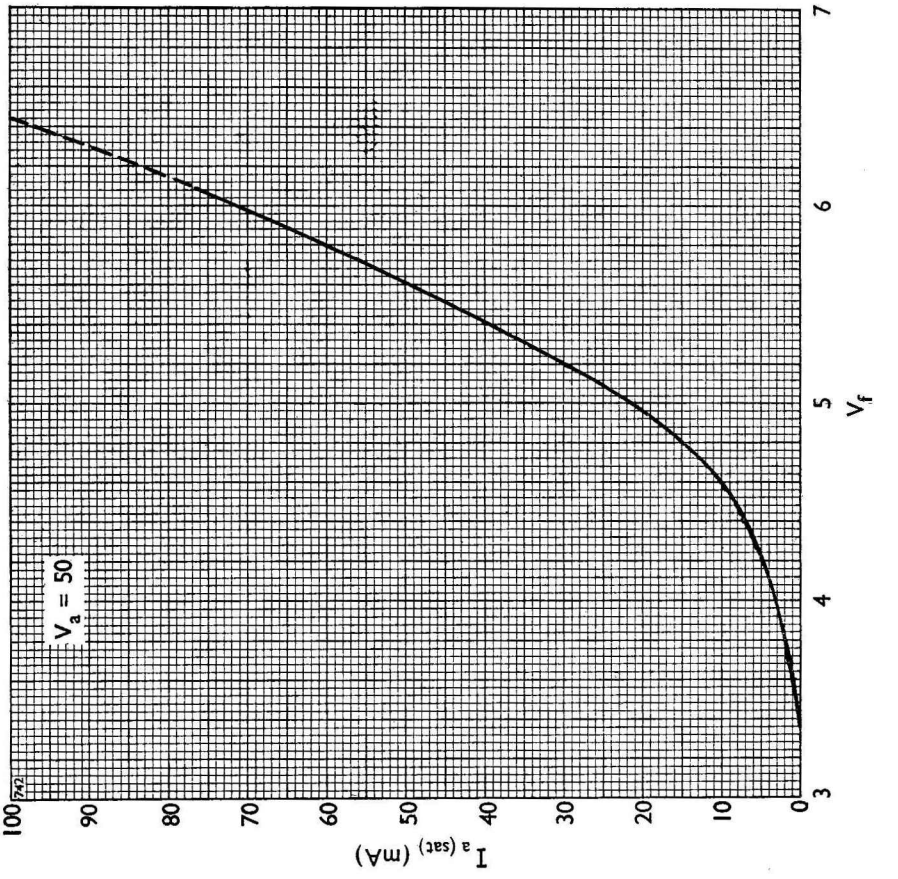
The valve can be mounted in any position.

A screening can, which also serves as a retainer, is necessary.

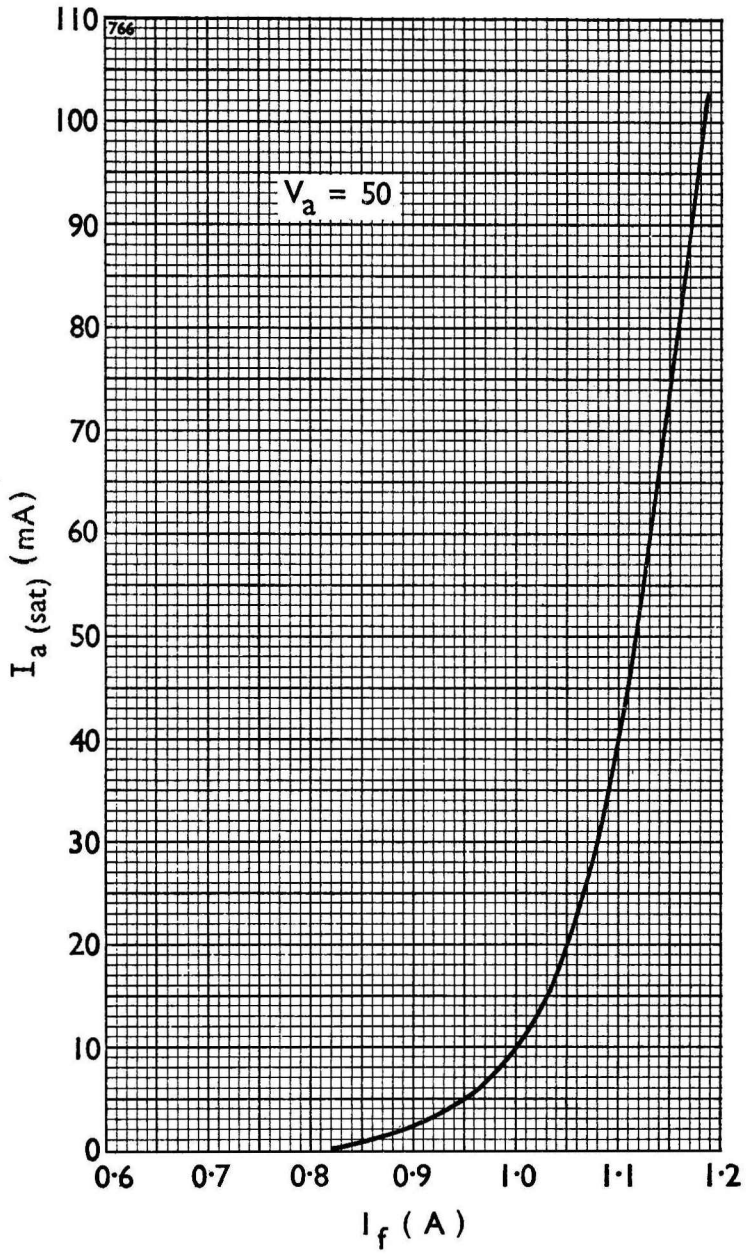
Free air circulation around the can is preferable. The temperature of the hottest part of the bulb must not exceed 200°C.

Leads should not be soldered or bent less than 3 mm from the base.




V_a = 50
$I_{a\,(sat)}$ (mA)
100
90
80
70
60
50
40
30
20
10
0
3
4
5
6
7
V_f
7472

CV2398



Printed in England. C.

THE M-O VALVE
COMPANY LIMITED

CV4085

GEC

RUGGED LOW NOISE
AF PENTODE

BRIEF DATA

A pentode with low hum and microphony output, suitable for use in low level, low frequency amplifiers, under conditions of abnormal shock and vibration or where statistically controlled major electrical characteristics are required.

HEATER

Heater voltage	6.3	V
Heater current	0.2 (±7.5%)	A

MAXIMUM RATINGS (Absolute)

DC anode supply voltage	550	V
DC anode voltage	300	V
Anode dissipation	1.0	W
DC screen supply voltage	550	V
DC screen voltage	250	V
Screen dissipation	0.2	W
DC cathode current	6.0	mA
DC heater-cathode voltage	100	V
External grid cathode resistor ($p_a > 0.2$ W)	3.0	MΩ
External grid cathode resistor ($p_a < 0.2$ W)	10	MΩ
Bulb temperature	165	°C
Acceleration (continuous vibration)	2.5	g
Shock (short duration)	500	g

CAPACITANCES (Measured on a cold externally unscreened valve)

Grid to anode (max)	0.05	pF
Grid to all less anode	3.8	pF
Anode to all less grid	5.1	pF

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CHARACTERISTICS

Pentode Connection

	Min	Mean	Max	
DC anode voltage	–	250	–	V
DC screen voltage	–	140	–	V
DC suppressor voltage	–	0	–	V
Negative dc grid voltage	–	2.0	–	V
*DC anode current	2.15	3.0	3.85	mA
*DC screen current	–	0.60	0.85	mA
†DC grid current	–	0.05	0.40	μA
*Mutual conductance	1.55	2.00	2.45	mA/V
Internal anode resistance	–	2.5	–	MΩ
‡Inner amplification factor	34	38	42	
*§Grid hum	–	–	8	μV
*§Cathode hum	–	–	60	μV
*§Hiss	–	–	5	μV

*Approximately 99% of all samples lie within these limits.

†All samples lie within these limits.

‡Approximately 94% of all samples lie within these limits.

§These values refer to the equivalent rms voltage at g_1 and are measured in an amplifier specified by the Government Authority.

Triode Connection

DC anode, screen & suppressor voltage	250	V
Negative dc grid voltage (approx)	5	V
DC cathode current	4	mA
DC grid current	0.06	μA
Mutual conductance	2.0	mA/V
Internal anode resistance	16.5	kΩ
Amplification factor	33	

TYPICAL OPERATION

AF Amplifier. Pentode Connection

DC anode supply voltage	200	300	400	200	300	400	V
External anode load resistor	100	100	100	220	220	220	kΩ
DC cathode current	1.65	2.45	3.30	0.75	1.10	1.55	mA
External screen resistor	0.39	0.39	0.39	1.0	1.0	1.0	MΩ
External cathode bias resistor	1.0	1.0	1.0	2.2	2.2	2.2	kΩ
External grid resistor (max)	80	36	22	100	80	44	MΩ
Gain	106	116	124	170	188	200	
*Output voltage	40	64	87	36	54	73	V
*Total distortion	5	5	5	5	5	5	%
Following valve grid resistor	330	330	330	680	680	680	kΩ

*V_{out} and distortion at the start of positive grid current. At lower output values, the distortion is approximately proportional to the input voltage.

AF Amplifier. Triode Connection

$V_{a(b)}$	200	300	400	200	300	400	200	300	400	V
R_a	47	47	47	100	100	100	220	220	220	kΩ
I_a	1.85	2.70	3.70	1.0	1.5	2.0	0.50	0.80	1.05	mA
R_k	1.2	1.2	1.2	2.2	2.2	2.2	3.9	3.9	3.9	kΩ
R_{g1} (max)	33	9	4	72	21	9	100	60	24	MΩ
Gain	23.5	24.0	24.5	27.5	28.5	28.5	30.5	31.0	32.0	
*V_{out}	22	43	64	27.5	50	73	28	51	74	V
*D_{tot}	3.1	3.8	4.5	3.3	3.8	4.0	3.1	3.7	3.8	%
†R_g	150	150	150	330	330	330	680	680	680	kΩ

*V_{out} and distortion at the start of positive grid current. At lower output values, the distortion is approximately proportional to the input voltage.
†Following valve grid resistor.

INSTALLATION

The valve may be mounted in any position. The use of a retaining device is recommended. The valve is internally screened.

TESTING

These valves are manufactured in discrete lots, under carefully controlled conditions. Each lot is very comprehensively tested for electrical and mechanical properties in a manner specified by the relevant Government Authority.

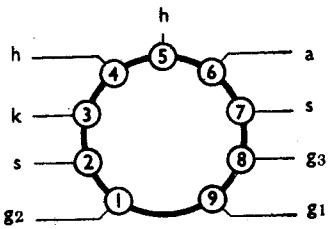
The limits imposed in the electrical tests are usually closer than those used in normal domestic or commercial valve testing, and include control on the spread of characteristic parameters.

Random samples are also taken from each lot, and subjected to specified destructive and electrical and mechanical life tests.

The lot is only released if it passes all the above tests, including the life tests.

The careful control of manufacture and the comprehensive testing and lot release system are designed to reduce microphony, the spread in electrical properties and the incidence of early failures, and to provide known life performance within the specified electrical and mechanical maximum ratings.

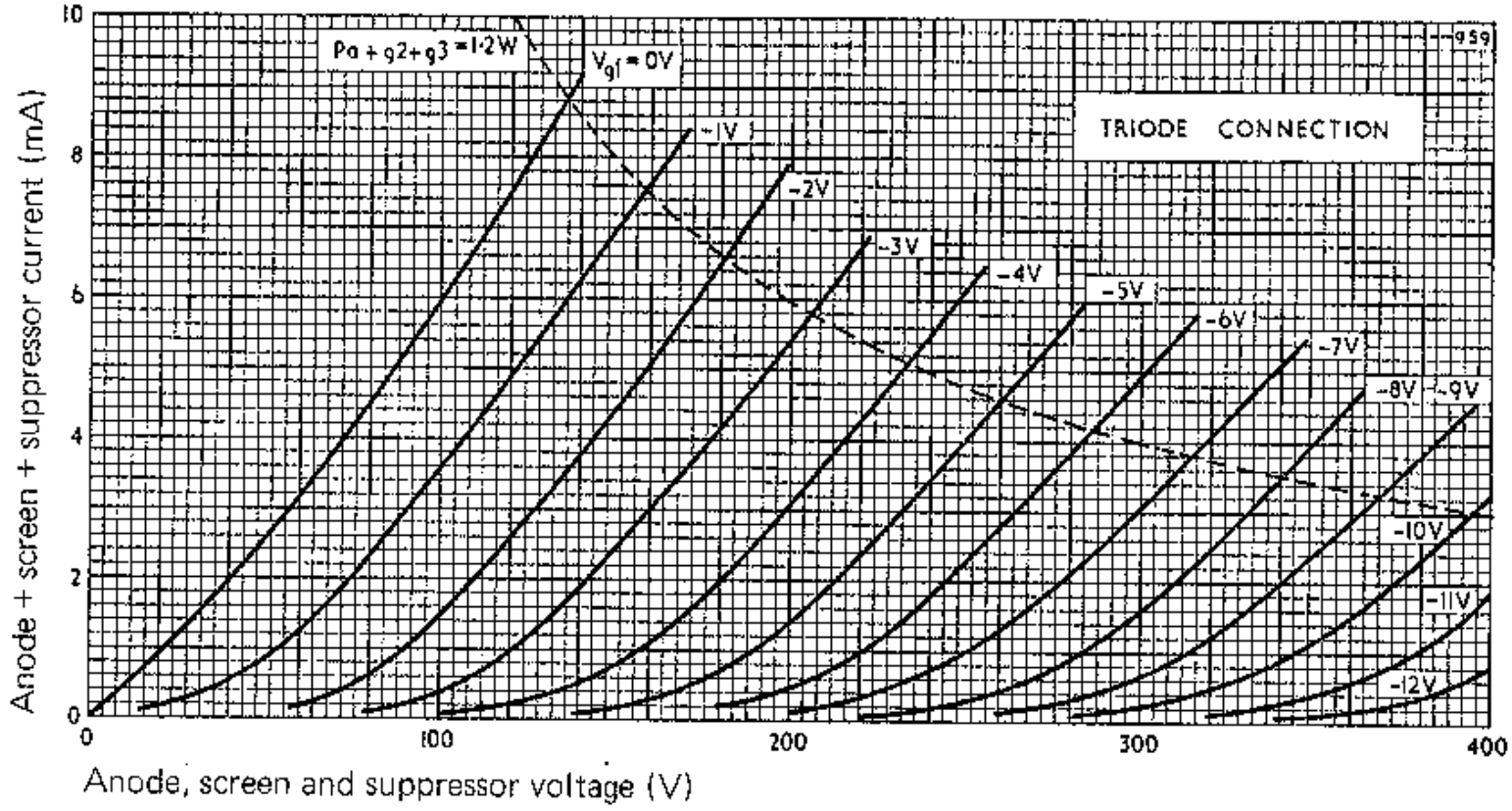
BASE CONNECTIONS AND VALVE DIMENSIONS

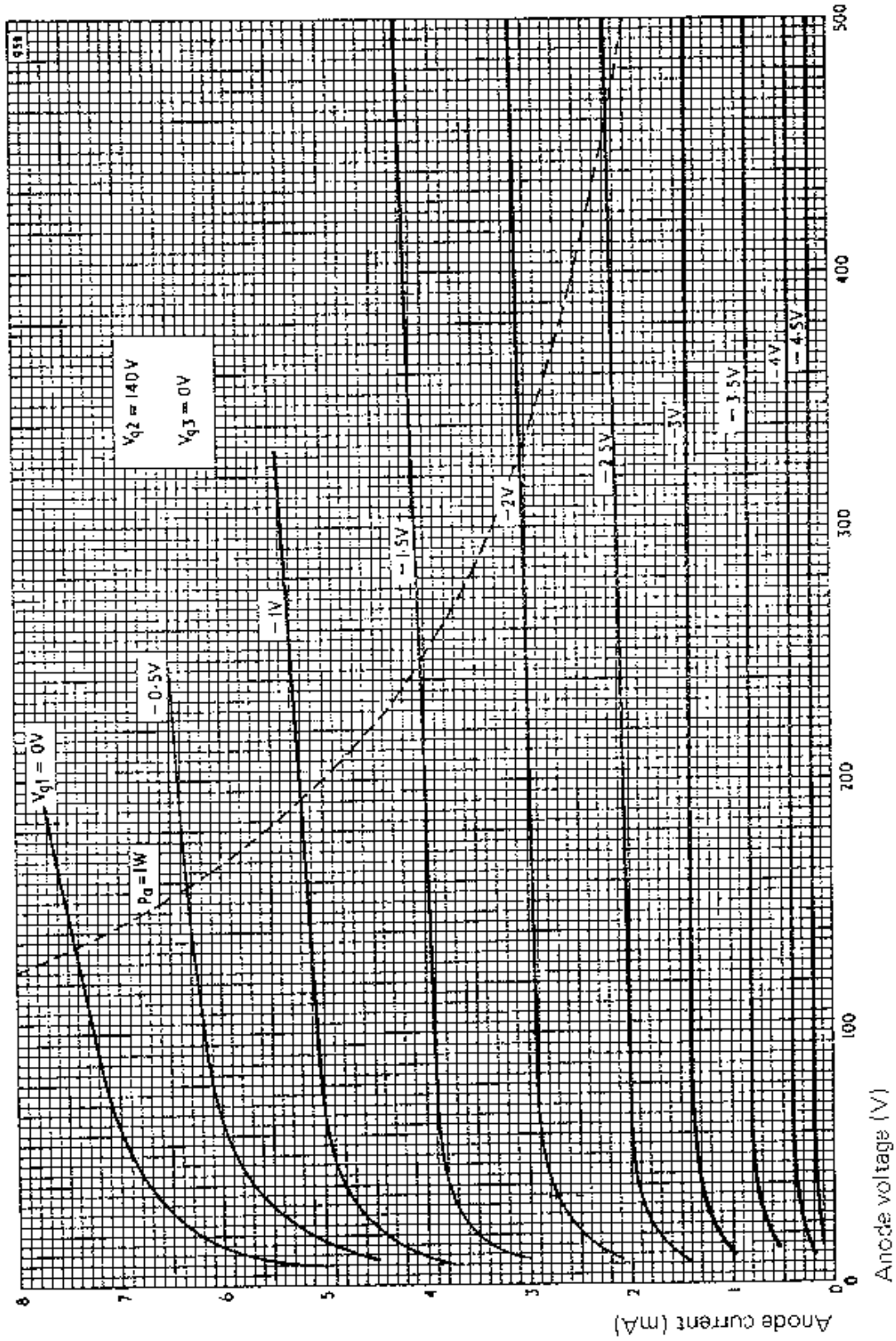


View from underside of base.

Base :	B9A
Bulb :	Tubular
Max overall length :	56 mm
Max seated length :	49 mm
Max diameter :	22.2 mm

Whilst M-OV has taken care to ensure the accuracy of the information contained herein it accepts no responsibility for the consequences of any use thereof and also reserves the right to change the specification of goods without notice.
M-OV accepts no liability beyond that set out in its standard conditions of sale in respect of infringement of third party patents arising from the use of tubes or other devices in accordance with information contained herein.


Pa + g2 + g3 = 1·2W
V_{g1} = 0V
-1V
-2V
-3V
-4V
-5V
-6V
-7V
-8V
-9V
-10V
-11V
-12V
TRIODE CONNECTION
959
Anode + screen + suppressor current (mA)
Anode, screen and suppressor voltage (V)
0
2
4
6
8
10
100
200
300
400


V_{g2} = 140 V
V_{g3} = 0 V
V_{g1} = 0 V
P_a = 1 W
−0·5 V
−1 V
−1·5 V
−2 V
−2·5 V
−3 V
−3·5 V
−4 V
−4·5 V
Anode current (mA)
Anode voltage (V)
0
100
200
300
400
500
1
2
3
4
5
6
7
8

G.E.C. **Advance Technical Information**

CV4520

LOW IMPEDANCE TRIODE
6.3V INDIRECTLY HEATED

ISSUE 2
MAY 1963

The CV4520 is an indirectly heated triode designed for use as a low impedance stabiliser valve in environments of extreme shock and vibration.

BASE CONNECTIONS AND VALVE DIMENSIONS

1.	a	5.	h	Base :	B9A/F
2.	k	6.	g	Bulb :	Tubular
3.	a	7.	IC		
4.	h	8.	a	Max. seated length :	66mm
		9.	a	Max. diameter :	22.2mm
				Min. lead length :	38mm

HEATER

V_h	6.3 ±5%	V
*I_h	1.1 ±0.1	A

*This test is performed on an agreed sample basis.

MAXIMUM RATINGS (Absolute)

$V_{a(b)}$	500	V
V_a	300	V
$-V_g$	100	V
p_a	15	W
I_k	125	mA
R_{g-k} (fixed bias)	100	kΩ
R_{g-k} (cathode bias)	500	kΩ
*V_{h-k} (cathode positive)	250	V
*V_{h-k} (cathode negative)	100	V
T_{bulb}	225	°C
Acceleration (continuous operation)		
†100 hours duration :	5.0	g
† 10 mins. duration :	20.0	g
Shock (short duration) :	500	g
Operating pressure (min) :	55	mm of Hg
Ambient storage temperature range :	-60 to +85	°C

*For maximum reliability V_{h-k} should not exceed 10V.

†When the vibration components are varying continuously over the spectrum 10 to 1000c/s in a random manner.

CAPACITANCES (Measured on a cold screened valve *)

†$c_{g\text{-all less a}}$: 7.1pF ±1.4pF †$c_{a\text{-all less g}}$: 6.0pF ±1.2pF

†$c_{g\text{-a}}$: 9.5pF ±1.75pF

*Measured at 1Mc/s in an approved manner.

†These tests are performed on an agreed sample basis.

CHARACTERISTICS

(i)	V_a	150	100	V
	I_a	100	2.0	mA
	$-V_g$	21.5 ±4.5†	35 (max)‡	V
	*g_m	11.0 ±2.0‡	-	mA/V
	I_g (R_{g-k} = 500kΩ)	2.0 (max)†	-	μA
	μ	4.5 ±1.0‡	-	-
	*§Δg_m	8.0 (max)‡	-	%

(ii)	V_a	170	V
	R_k (R_{g-k} = 0)	170	Ω
	I_a	100	mA
	//t_{hk}	40 (max)‡	s

(iii)	V_a	200	200	V
	R_a	1.0	1.0	kΩ
	R_k (c_k ≥1000μF)	200	200	Ω
	f	50	1000 to 2500	c/s
	Acceleration(pk)	20 (min)	5.0 (min)	g
	$V_{out(rms)}$	120 (max)†	350 (max)†	mV

(iv)	V_h	6.3	6.3	6.3	V
	$V_{a\text{-all}}$	-300	-	-	V
	$V_{g\text{-all}}$	-	-100	-	V
	$V_{h\text{-k}}$	-	-	±250	V
	R (insulation)	100 (min)†	100 (min)†	-	MΩ
	$I_{h\text{-k}}$	-	-	20 (max)‡	μA

(v)	V_h	6.3	Running conditions for 1000 hours life test‡	V
	V_a	120		V
	I_a	125		mA
	$V_{h\text{-k(rms)}}$ (50c/s)	200		V

Cont'd.....

CHARACTERISTICS (Continued)

After 1000 hours operation:-

V_a	150	V
I_a	100	mA
$-V_g$	15.5 (min)‡	V
$-V_g$	26.0 (max)‡	V
I_g (R_{g-k} = 500kΩ)	3.0 (max)‡	μA
V_{h-k}	±250	V
I_{h-k}	30 (max)‡	μA

*Measured in an approved manner.

†Every valve tested.

‡These tests are performed on an agreed sample basis.

§ Δg_m is defined here as:-

$$\Delta g_m = \frac{(g_m \text{ at } V_h = 6.3V) - (g_m \text{ at } V_h = 5.7V)}{(g_m \text{ at } V_h = 6.3V)} \times 100\%$$

// t_{hk} is defined here as the time taken for I_a to rise to 100mA, from switching on the heater of a valve whose heater has not been operated for at least two hours. The impedance of the heater voltage supply must be low enough to ensure that V_h = 6.3V throughout the heating time.

INSTALLATION

The valve may be mounted in any position.

TESTING

These valves are manufactured in discrete lots, under carefully controlled conditions. Each lot is very comprehensively tested for electrical and mechanical properties in a manner specified by the relevant Government Authority.

The limits imposed in the electrical tests are usually closer than those used in normal domestic or commercial valve testing and include control on the spread of characteristic parameters.

Random samples are also taken from each lot and subjected to specified destructive electrical and mechanical life test.

The lot is only released if it passes all the above tests, including the life test.

The careful control of manufacture and the comprehensive testing and lot release system are designed to reduce microphony, the spread in electrical properties, the incidence of early failures and provide known life performance within the specified electrical and mechanical maximum ratings. An article in British Communications and Electronics (April 1958) by R. Brewer of the G.E.C. Research Laboratories entitled "The Life Test Contribution to the Improvement of Valve Reliability" discusses these points more fully. Reprints can be supplied on request.

Printed in England — KC. R1305

G.E.C. VALVES

PACKAGED X-BAND PULSED MAGNETRONS

CV6034
CV6035
CV6036

ISSUE 1

The CV6034, 5 and 6 are forced air cooled packaged magnetrons with indirectly heated cathodes and waveguide outputs. They differ only in frequency range as follows:

CV6034	9500 - 9590	Mc/s
CV6035	9555 - 9645	Mc/s
CV6036	9610 - 9700	Mc/s

HEATER

V_h	2.0	V
I_h	10.5 (approx)	A

For a mean anode input power greater than 50W the heater voltage must be reduced in accordance with the formula:

$$V_h = 2\ (1 - \frac{\text{mean power input}}{300}) \pm 0.2V$$

MAXIMUM RATINGS (Absolute)

v_a (pk)	18.0	kV
i_a (pk)	20.0	A
t_p (max)	1.0	μs
t_p (min)	0.25	μs
DF	0.001	-
*Rate of rise of voltage (max)	250	kV/μs
*Rate of rise of voltage (min)	100	kV/μs
$t_{h,k}$ (min)	3.0	minutes
VSWR (load)	1.5 : 1	-
P_{in} (mean)	360	W
P_{in} (pk) (for $t_p = 0.25\mu s$)	360	kW
(for $t_p = 1.0\mu s$)	200	kW
Output waveguide pressurising	40	lb/in^2
$T_{anode\ block}$ (max)	150	°C
$T_{anode\ block}$ (min)	-55	°C
$T_{cathode\ connector}$ (max)	165	°C
$T_{cathode\ connector}$ (min)	-55	°C
Altitude	10,000	ft

*Rate of rise of applied voltage is defined here as the value of $\frac{dv_a}{dt}$ between 80% and 100% of the peak amplitude of the voltage pulse.

CHARACTERISTICS

Pulling figure (max) (VSWR = 1.5 : 1)	15	Mc/s
Efficiency into matched load (min)	30	%
$c_{h,k-a}$	12	pF

TYPICAL OPERATION FOR CV6035

f	9600	9600	Mc/s
t_p	0.25	1.0	μs
PRF	4000	1000	p/s
$i_{a\,(pk)}$	20	12	A
$v_{a\,(pk)}$ (approx)	17.2	16.7	kV
*Rate of rise of voltage	250	250	kV/μs
$P_{out\,(pk)}$	130	75	kW
Efficiency (approx)	38	38	%
Bandwidth (to $\frac{1}{4}$ power points)	5.5	1.4	Mc/s
Stability (missing pulses)	0.1	0.1	%
Minor lobes	-12	-10	dB
Pushing figure	0.2	0.2	$Mc/s(A)^{-1}$

*Rate of rise of applied voltage is defined here as the value of $\frac{dv_a}{dt}$ between 80% and 100% of the peak amplitude of the voltage pulse.

INSTALLATION

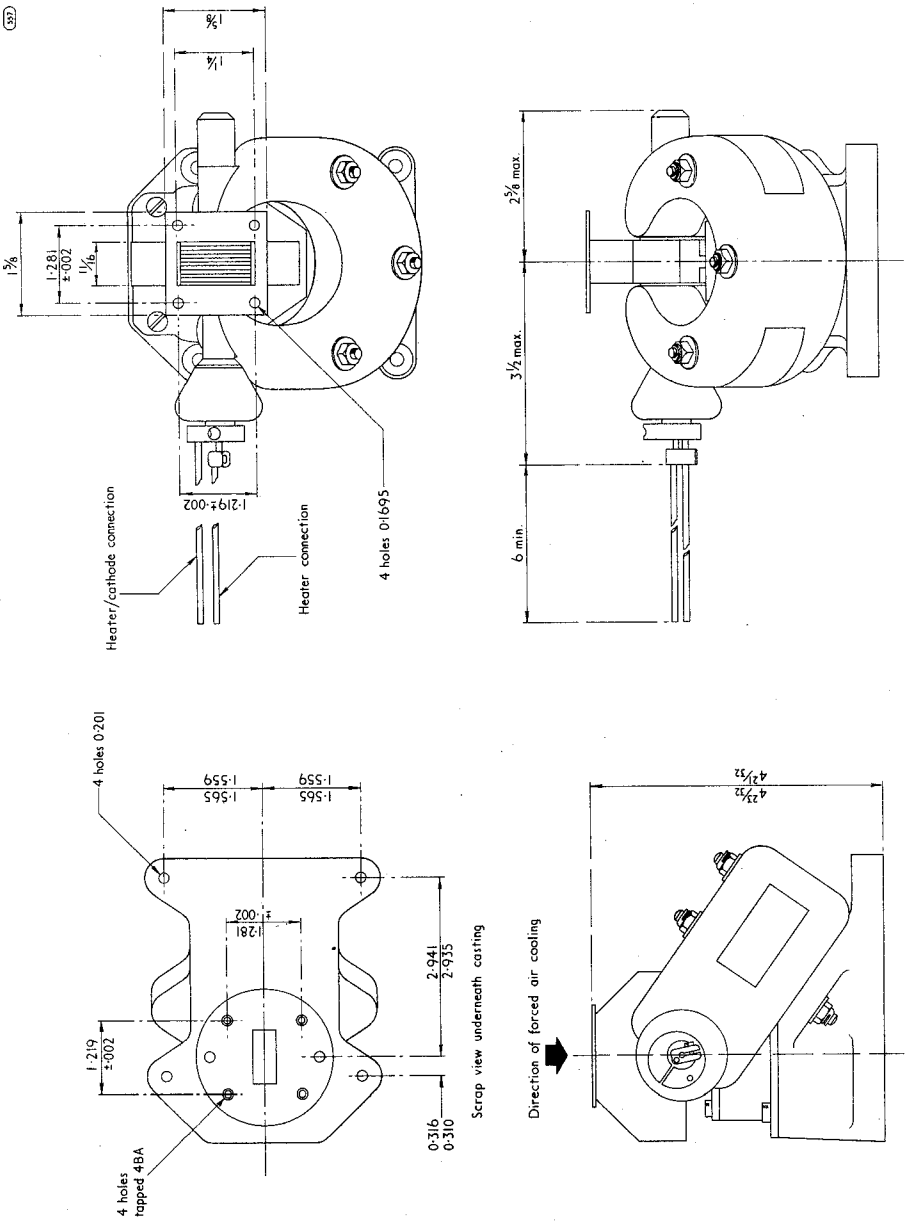
The valve may be mounted in any position.

The r.f. output is by standard waveguide WG16 (0.4 x 0.9 in. i.d.) to connect to a suitable square choke flange.

The valve must be forced air cooled at 15 c.f.m. through the cooling duct, so that the maximum temperature ratings are not exceeded.

The total weight of the valve is about $7\frac{1}{2}$ lb.

As there is a strong magnetic field in the vicinity of the valve, care must be taken to keep magnetic materials at least two inches away from it.



All dimensions are in inches

G.E.C. VALVES

FORCED AIR COOLED UHF DISC SEAL PULSE TRIODE OXIDE COATED CATHODE

CV6055

ISSUE 1

The CV6055 is a pulse version of the ACT22 (CV257) primarily intended for use as a pulsed oscillator or amplifier at frequencies up to 1000Mc/s.

HEATER

V_h	6·3	V
I_h	4 (approx)	A

MAXIMUM RATINGS (Absolute)

V_a	4·5	kV
V_{a-g}	4·5	kV
$-V_g$	400	V
$+v_{g(pk)}$	750	V
p_a	75	W
p_g	2·0	W
$i_{k(pk)}$	40	A
I_k	400	mA
$*I_{k(pulse)}$	10	A
†T_{seal}	140	°C

*$I_{k(pulse)}$ is the mean cathode current during the pulse. In all cases where this exceeds the d.c. cathode current (I_k) rating, the total charge drawn from the cathode in one pulse should not exceed 100 microcoulombs.

†See " Cooling ".

CAPACITANCES (Measured at 1Mc/s on a cold unscreened valve)

c_{g-k} : 10·5pF ; c_{a-k} : 0·3pF ; c_{g-a} : 6·5pF

CHARACTERISTICS

V_a	500	V
I_a	100	mA
$-V_g$	12 (approx)	V
g_m	16	mA/V
μ	22	—

TYPICAL OPERATION

Pulsed R.F. Power Amplifier

f	500	1000	Mc/s
η	60	40	%
Gain	11	8	dB

THE M-O VALVE CO. LTD. · BROOK GREEN · LONDON · W.6
a subsidiary of
THE GENERAL ELECTRIC CO. LTD. OF ENGLAND

JANUARY, 1961

CIRCUIT DESIGN

The CV6055 is designed for use in coaxial circuits in which the anode is connected to the inner line. The performance data given was obtained with an anode/grid line of 59Ω characteristic impedance. The dimensions of the anode line and the line lengths required for a range of wavelengths are shown in fig. 3.

COOLING

For full rated anode dissipation in ambient temperatures up to 30°C, the air flow to the anode must be 5 cu. ft./min minimum at about 2 in. static water gauge.

The temperature of the glass to metal seals must not exceed 140°C. An air flow may be required to ensure this. The temperature may be checked with " Tempilac " paint, obtainable from J. M. Steel & Co. Ltd., 36 Kingsway, London, W.C.2.

INSTALLATION

The valve may be mounted in any position. Rigid connections must not be made to more than one electrode.

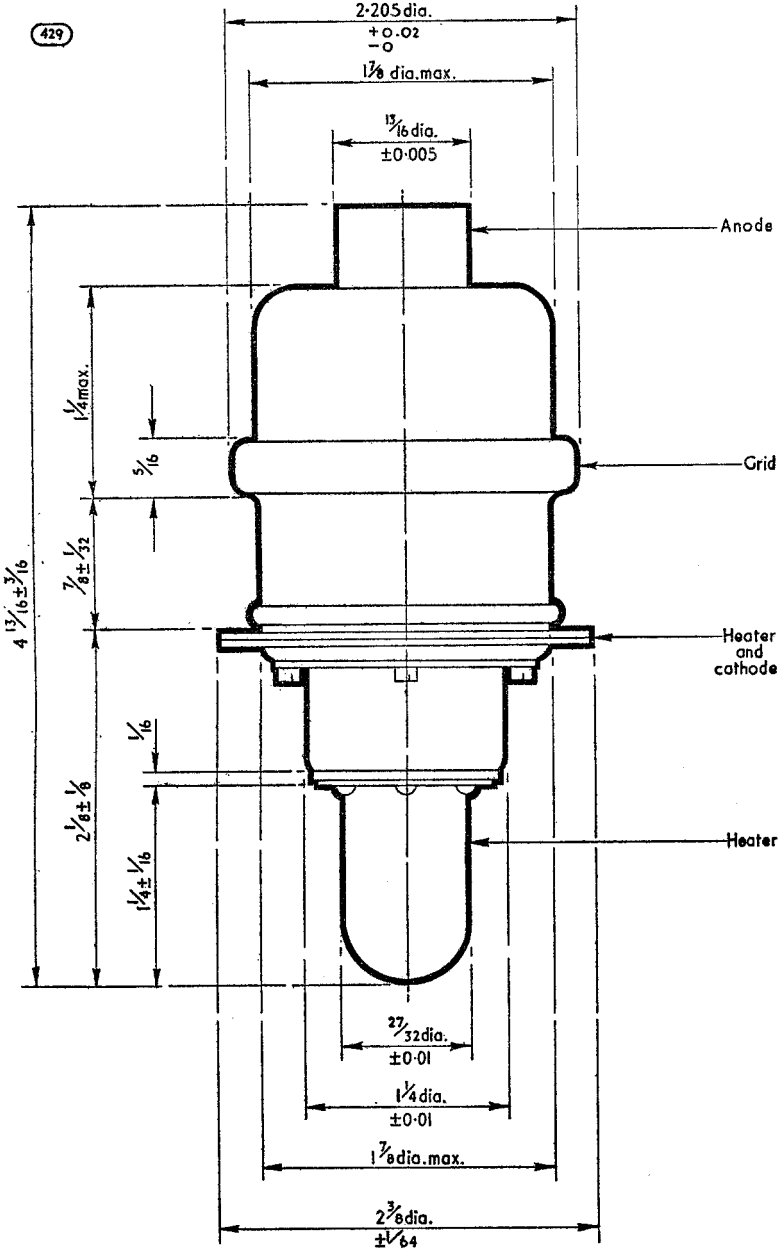


Fig. 1.

Dimensions in inches.

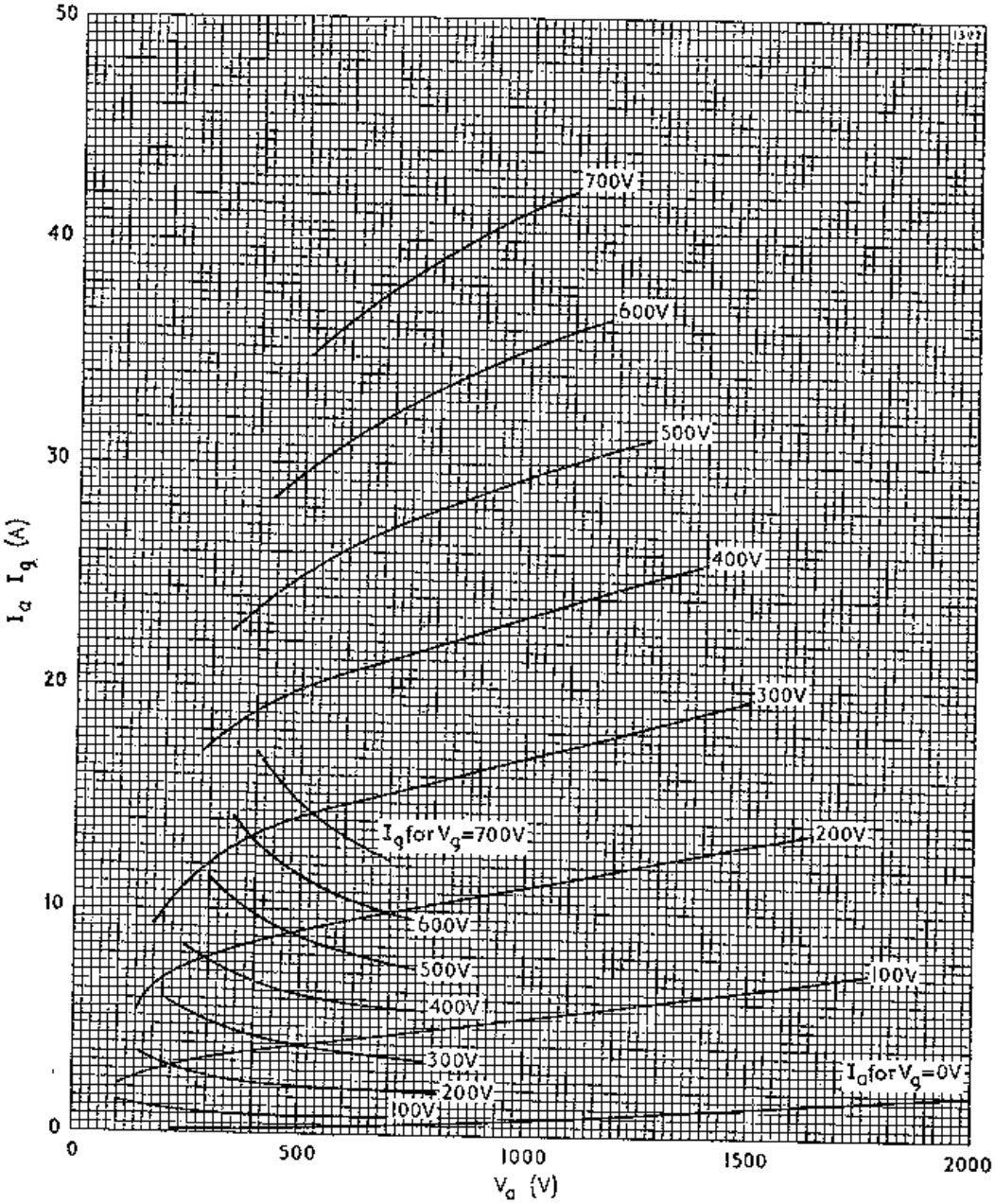

50
40
30
20
10
0
0
500
1000
1500
2000
I_a I_g (A)
V_a (V)
700V
600V
500V
400V
300V
200V
100V
I_g for V_g=700V
600V
500V
400V
300V
200V
100V
I_a for V_g=0V

Fig. 2.

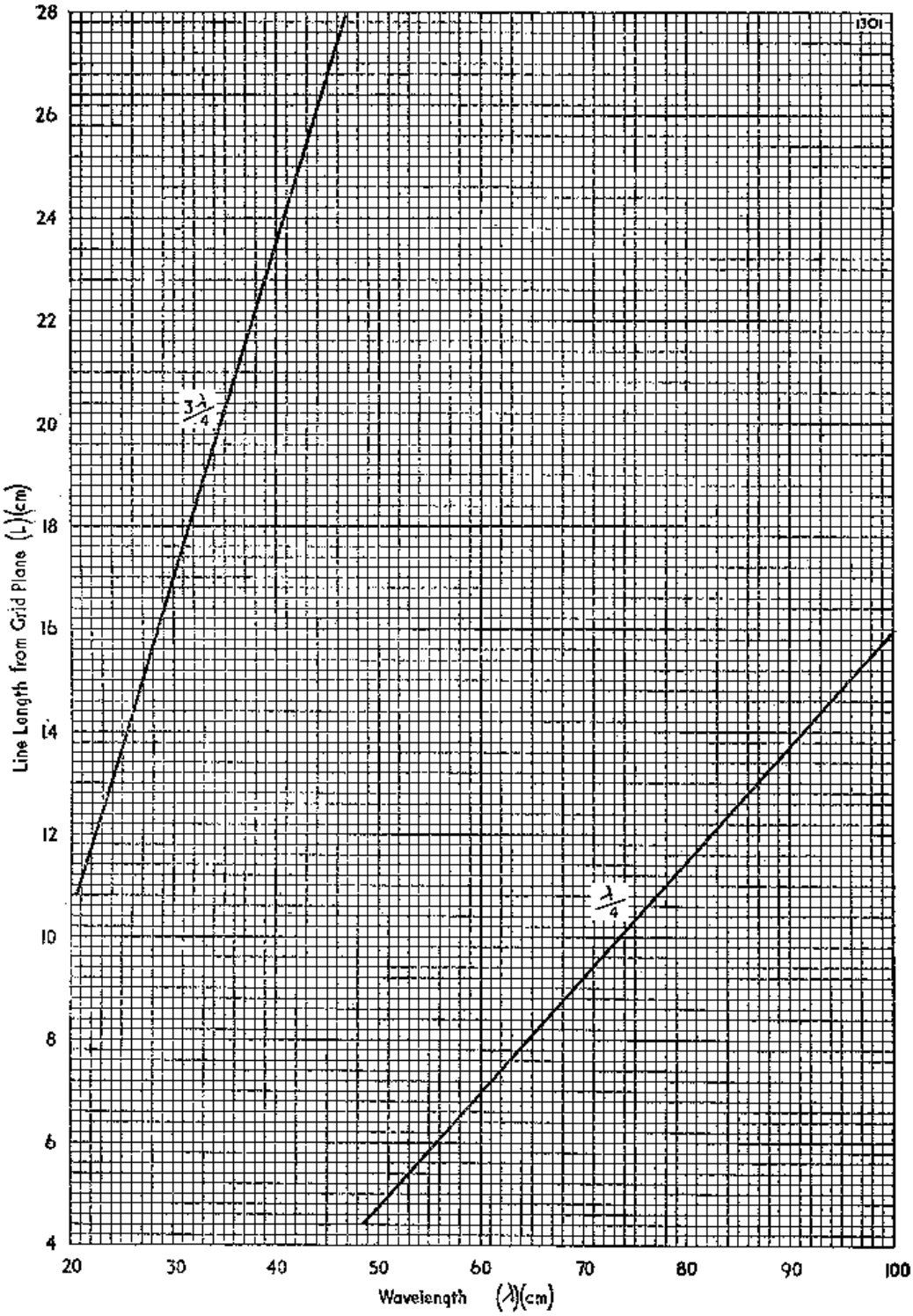


Fig. 3. Grid-anode line lengths for unloaded circuit.

$Z_o = 59\Omega$; grid line : 2 in. i.d. ; anode line : 0·74 in. o.d.

THE M-O VALVE
COMPANY LIMITED

D10-280GH

improved 900W/D10-210 Brimar

GEC

INSTRUMENT
CATHODE RAY TUBE

5y 4.2
5x 13.0

BRIEF DATA

A short 10cm diagonal (4 in.) flat faced rectangular instrument tube with mesh p.d.a. This tube is intended for use in general purpose and portable oscilloscopes. 250 mm long

HEATER

Heater voltage	11	V
Heater current	68	mA

SCREEN

Fluorescence	Green
Phosphorescence	Green
Persistence	1–5ms
E.I.A. phosphor code	P31
Pro Electron phosphor code	GH
GEC phosphor code	24

Other screens are available to special order (see data sheet 'CRT Screens').

RATINGS (Absolute)

		Max	Min	
Fourth anode voltage	V_{a4}	7.0	2.0	kV
Third anode voltage	V_{a3}	1.0	0.5	kV
Ratio	V_{a4}/V_{a3}	10	2.0	
Focus voltage	V_{a2}	600	—	V
First anode voltage + mesh	$V_{a1 + mesh}$	1.0	0.5	kV
Control grid voltage	$-V_{g1}$	200	1.0	V
Y plate to third anode voltage	$V_{y\text{-}a3}$	500	—	V
X plate to third anode voltage	$V_{x\text{-}a3}$	500	—	V
Grid to cathode circuit resistance	$R_{g1\text{-}k}$	1.0	—	MΩ
Y deflector plate circuit resistance	$R_{y\text{-}a3}$	100	—	kΩ
X deflector plate circuit resistance	$R_{x\text{-}a3}$	250	—	kΩ

Voltage ratings are to cathode unless otherwise shown.

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July 1976
Issue 1

CAPACITANCES (Typical)

Control grid to all other electrodes	9.3	pF
Deflector plates y1 to y2	2.0	pF
Deflector plates y1 to all electrodes except y2	5.0	pF
Deflector plates y2 to all electrodes except y1	5.0	pF
Deflector plates x1 to x2	2.5	pF
Deflector plates x1 to all electrodes except x2	7.0	pF
Deflector plates x2 to all electrodes except x1	7.0	pF

EQUIPMENT DESIGN RANGE

		Max	Min	
Focus voltage	V_{a2}	400	233	V/kV_{a3}
Control grid voltage for spot cut-off	$-V_{g1}$	140	50	V/kV_{a1}
Y deflection factor	D_y	7.0	5.0	$V/cm/kV_{a3}$
X deflection factor	D_x	21.7	17	$V/cm/kV_{a3}$
Astigmatism correction voltage	$V_{a3\text{-}y\ mean}$	+83	−83	V/kV_{a3}
Pattern correction voltage	$V_{s\text{-}x\ mean}$	+83	−83	V/kV_{a3}

TYPICAL OPERATION (All operating potentials are with respect to cathode)

Fourth anode voltage	V_{a4}	6.0	kV
Third anode voltage	V_{a3}	600	V
Focus voltage	V_{a2}	140–250	V
First anode voltage + mesh	$V_{a1\ +\ mesh}$	580	V
Control grid voltage for spot cut-off	$-V_{g1}$	30–84	V
Nominal geometry correction voltage	V_s	600	V
Maximum y deflection factor	D_y	4.2	V/cm
Maximum x deflection factor	D_x	13.0	V/cm
Line width (typical) 24 screen		0.4	mm

Measured by means of a shrinking raster at $I_b = 5\mu A$

DISPLAY CHARACTERISTICS (Typical Operation)

Pattern Distortion

With pattern correction applied to s, the edges of a test raster will lie between two concentric rectangles of 70mm x 50mm and 68mm x 48mm. The angle between x and y axes will be 90° ± 1° measured at face centre.

X Deflection Linearity

The deflection factor for a deflection of less than 75% of the useful scan will be equal to that for a deflection of 25% within approx 3%.

Spot Position

The focused and undeflected spot will fall within a square 10mm x 10mm centred at the geometric centre of the faceplate.

Orientation

Looking at the screen with pins 1 and 12 uppermost, a positive voltage applied to x1 will deflect the beam to the left and a positive voltage applied to y1 will deflect the beam upwards.

Minimum Scanned Area

x major axis	7.0	cm
y minor axis	5.0	cm

This area will be centred on a point which is within 3mm of the major and minor axes of the tube face.

Axis Alignment

The electrical x axis of the tube will lie within ±5° of the major axis of the faceplate, and may be aligned with this axis by means of the field from an axial coil placed about the cone of the tube in the region shown in the outline drawing. The maximum ampere turns required for axis alignment will be given by $11\sqrt{kV_{a4}}$.

MOUNTING

The tube may be mounted in any position but should not be supported by the base alone. It should preferably be held in a suitable rubber mask at the screen and by a clamp around the magnetic shield near the base. The socket should have sufficient freedom of movement to accommodate the maximum overall tube length and base orientation tolerances.

WEIGHT

The weight of the tube alone is 500gm (approx).

BASE CONNECTIONS

Base: B12F

Pin 1:	g1	Pin 7:	x2
2:	k + h	8:	s (geometry)/IPS
3:	h	9:	y2
4:	IC	10:	a1 + Mesh
5:	a2 (focus)	11:	y1
6:	x1	12:	a3 (astigmatism)

Pins 4 and 10 must be connected externally.
Side contact (CT8): a4

ACCESSORIES

Base socket	The M-O Valve Co. Ltd.	
CT8 connector	The M-O Valve Co. Ltd.	(cover) 12/426 (clip) 10/425
Magnet shield a twist coil	Magnetic Shields Ltd., Headcorn Road, Staplehurst, Tonbridge, Kent.	

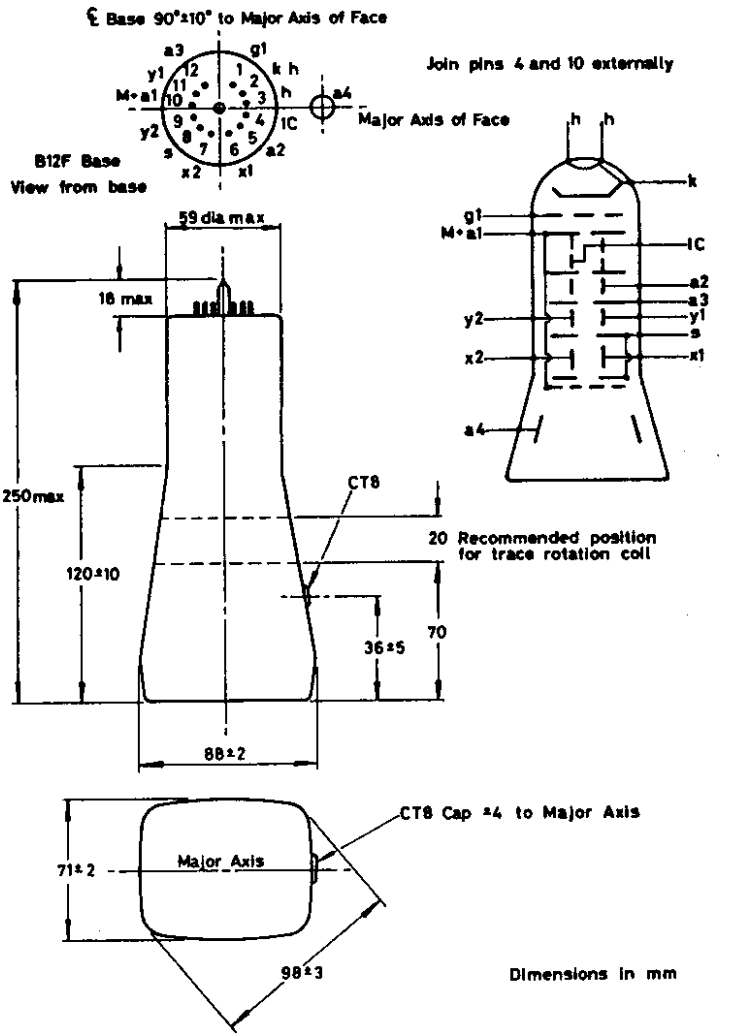
WARNING

Care should be taken not to expose the tube to strong magnetic fields either in use or during storage.

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OUTLINE

1144



Dimensions in mm

THE M-O VALVE
COMPANY LIMITED

DET24

GEC

UHF DISC SEAL TRIODE

BRIEF DATA

The DET24 is a conduction cooled UHF disc seal triode. It is a commercial equivalent of CV397.

HEATER

Heater voltage	6.3	V
Heater current (approx)	1.0	A

MAXIMUM RATINGS

DC anode voltage	400	V
DC anode current	120	mA
Peak anode current	600	mA
Anode dissipation	20	W
Grid dissipation	1	W
Negative dc grid voltage	50	V
Anode seal temperature	140	°C

CAPACITANCES

Anode to grid	2.2	pF
Anode to cathode	0.04	pF
Grid to cathode	4.8	pF

CHARACTERISTICS

DC anode voltage	400	V
DC anode current	50	mA
Mutual conductance	12	mA/V
Amplification factor	28	–

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December 1977
Issue 4

TYPICAL OPERATION (in coaxial oscillator as shown in fig. 4)

Frequency	500	MHz
DC anode voltage	300	V
DC anode current	100	mA
DC grid current	40	mA
Negative dc grid voltage	15	V
Load power	14	W

CIRCUIT DESIGN

The performance of the DET24 as an oscillator and an amplifier is shown in the curves of figs. 9 and 10. The circuits used to obtain this data are given in figs. 4 and 5 for the oscillator and amplifier respectively. In both cases the circuit elements consist of coaxial lines with the grid line common to input and output cavities.

The anode-grid and grid-cathode cavities are both tuned by means of movable bridges; if contact bridges are used, it is important that good contact is made with the tubes on which they slide. In order that bias may be used, a grid-cathode contact bridge must incorporate a capacitor. Both the need for this capacitor and the difficulties of reliable sliding contacts are avoided if non-contact bridges are used.

In the oscillator the position of the feedback probe depends upon the required wavelength and on the mode of operation of the tuned circuits. Probe positions are shown in fig. 4 for a wide range of wavelengths. The amount of feedback is controlled by the capacitance of the probe to the cathode line. Even when a circuit is intended to operate only at one frequency it is desirable to provide control of feedback to compensate for variations between valves.

If the circuit dimensions given in fig. 3 are used, the line lengths for several modes of operation and wavelengths are shown by the curves of fig. 8.

The performance curves for the DET24 as an amplifier are shown for two values of driving power (fig. 10). As the driving power is the power actually delivered to the amplifier, the driver stage should provide significantly greater power to allow for losses in the coupling system.

At frequencies below 500 MHz satisfactory performance may be obtained using lumped instead of distributed circuit elements. Application Report No. 10 describes an amplifier designed in this manner.

INSTALLATION

The valve may be mounted in any position but rigid connection must be made to the anode flange only.

The rate of rise of temperature of the metal at the glass-to-metal seals must not exceed 25° C per minute. The maximum temperature must not exceed 140° C.

In order to limit the rate of change of temperature of the anode seal, it is necessary for the mass of metal in close thermal contact with the anode disc to have a thermal capacity of not less than 11 cal/°C. 120 gm of brass or 52 gm of aluminium are suitable.

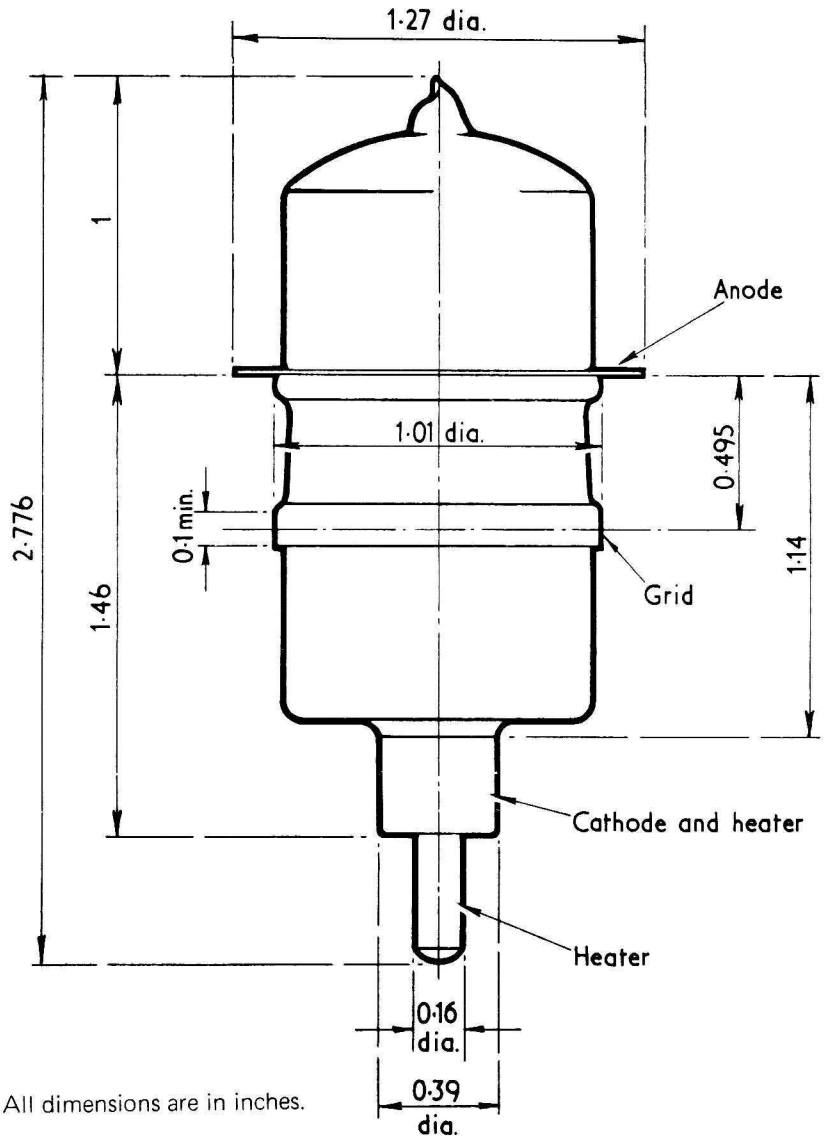
In order to limit the maximum temperature of the anode seal, the loss of heat from the metal in contact with the seal must be adequate. The seal temperature may be conveniently measured with a temperature sensitive paint.

Provision of circuit information in this publication does not imply a right to use any invention which may be involved and which is the subject of patents by whomsoever owned.

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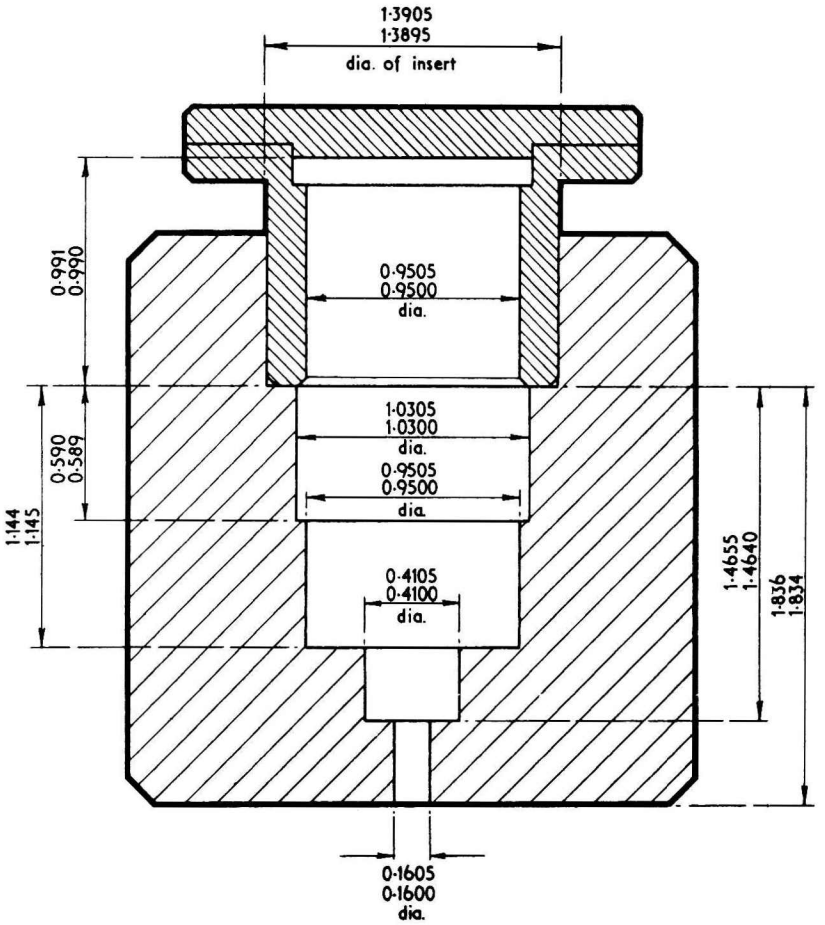
Fig. 1 OUTLINE

Dimensions are maximum unless otherwise stated. This drawing should not be used for circuit design: see figs. 2 and 3.



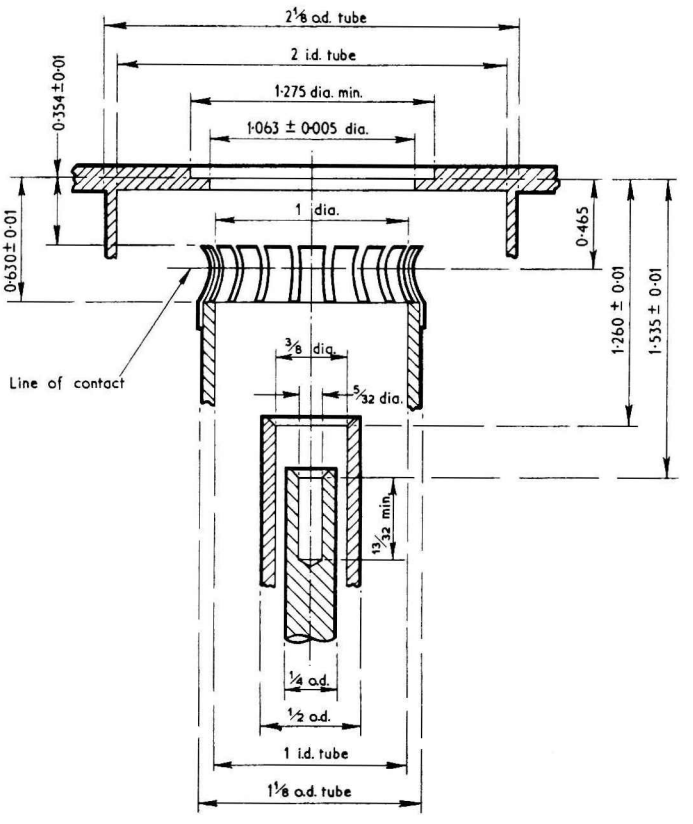
All dimensions are in inches.

Fig. 2
To assist in circuit design, this drawing gives the important dimensions of the gauge into which every valve is required to fit before leaving the factory.



All dimensions are in inches.

Fig. 3
Circuit elements made to this drawing were used to obtain the various modes of operation and wavelengths shown graphically in fig. 8.



All dimensions are in inches.

Fig. 4 OSCILLATOR CIRCUIT

The ranges of wavelength obtained with the feedback probe at two different distances from the anode plane are as follows:-

'A'	Range of λ
3.5 cm	25 – 90 cm
7.0 cm	15 – 30 cm

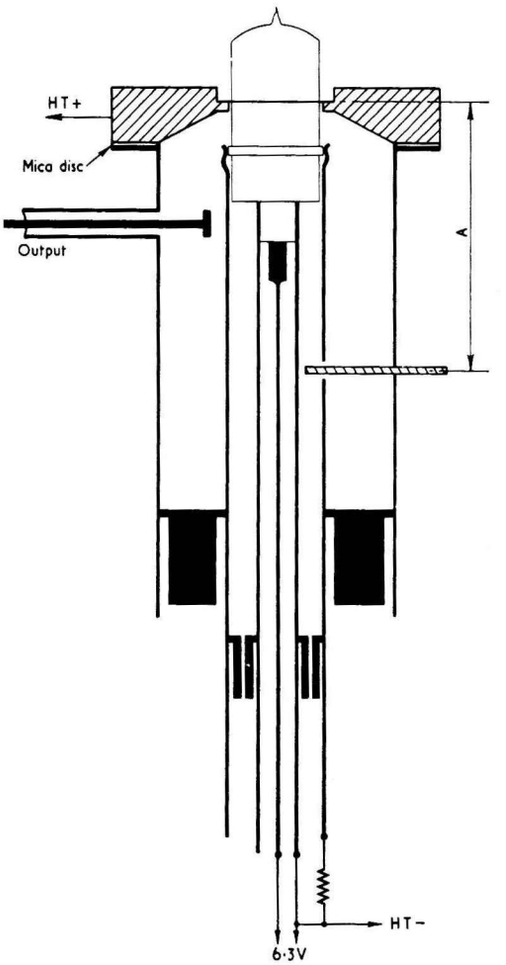


Fig. 5 **AMPLIFIER CIRCUIT**

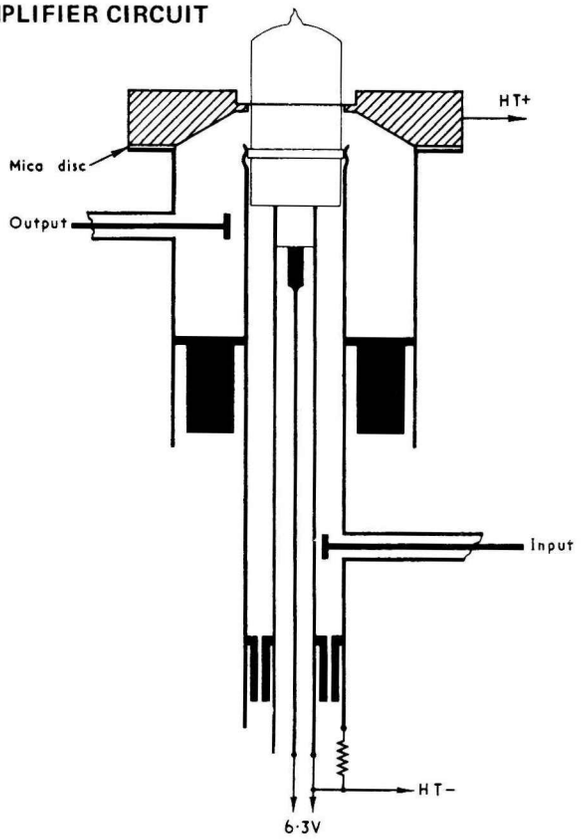


Fig. 6 **The Circuits of Figs. 4 and 5 Modified for Cathode Bias**

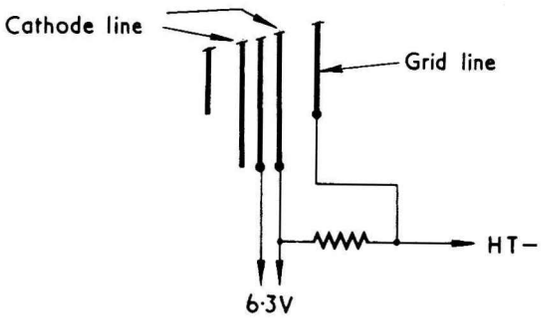


Fig. 7

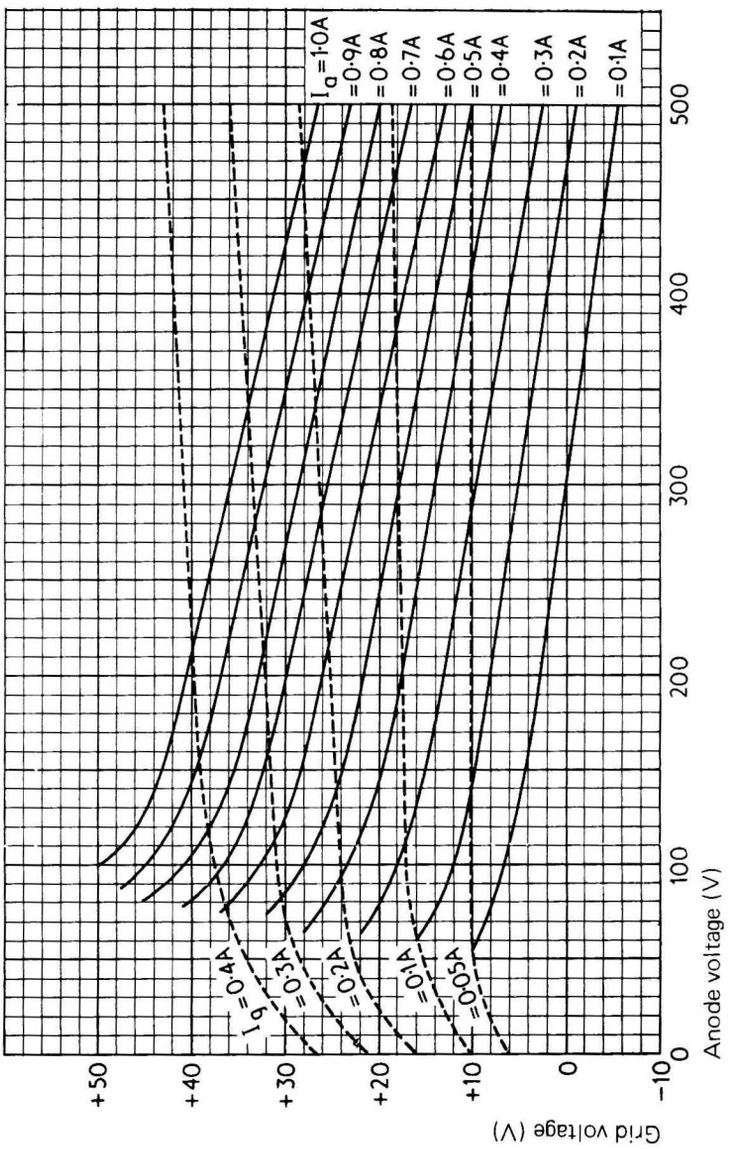

I_a=1·0A
=0·9A
=0·8A
=0·7A
=0·6A
=0·5A
=0·4A
=0·3A
=0·2A
=0·1A
I_g=0·4A
=0·3A
=0·2A
=0·1A
=0·05A
0
100
200
300
400
500
Anode voltage (V)
+50
+40
+30
+20
+10
0
−10
Grid voltage (V)

Fig. 8 Typical Line Lengths For An Unloaded Self-Oscillator Having The Circuit Dimensions Shown In Fig. 3.

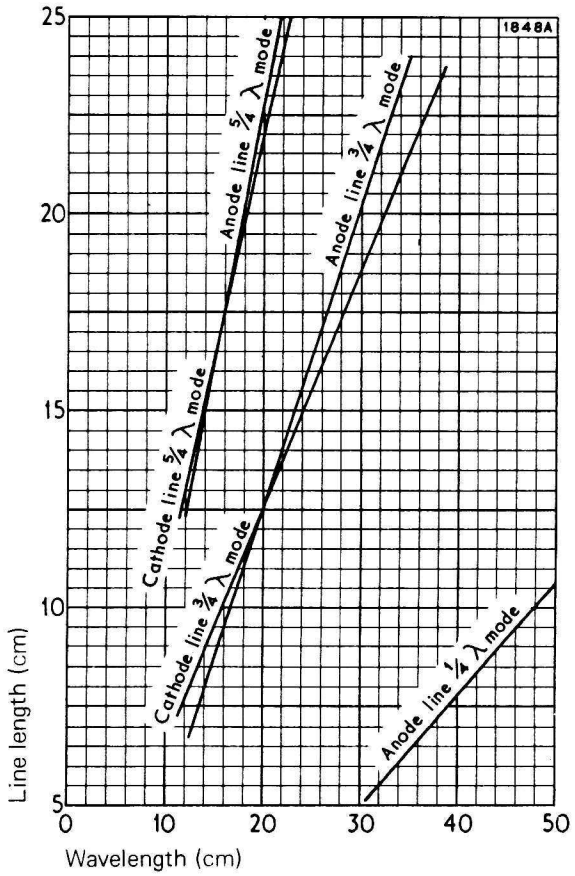


Fig. 9 Performance As A Common Grid Oscillator

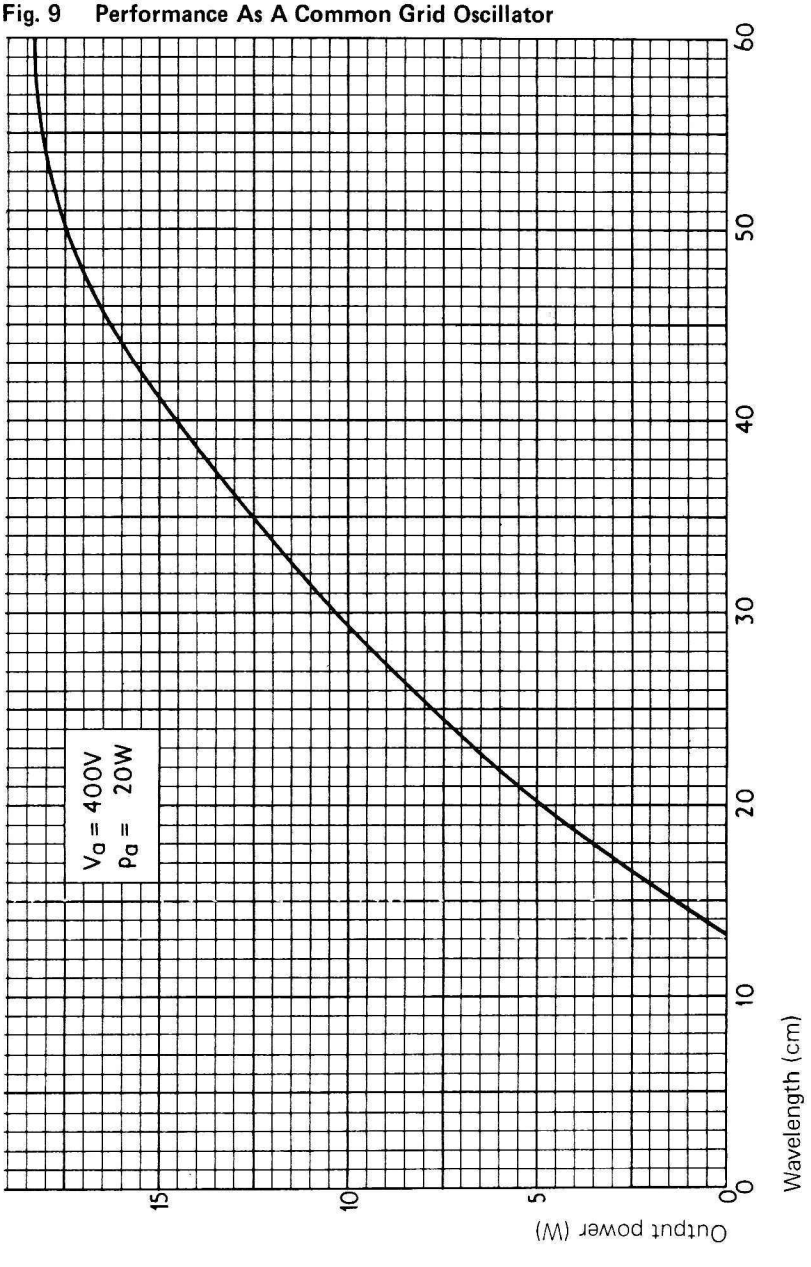
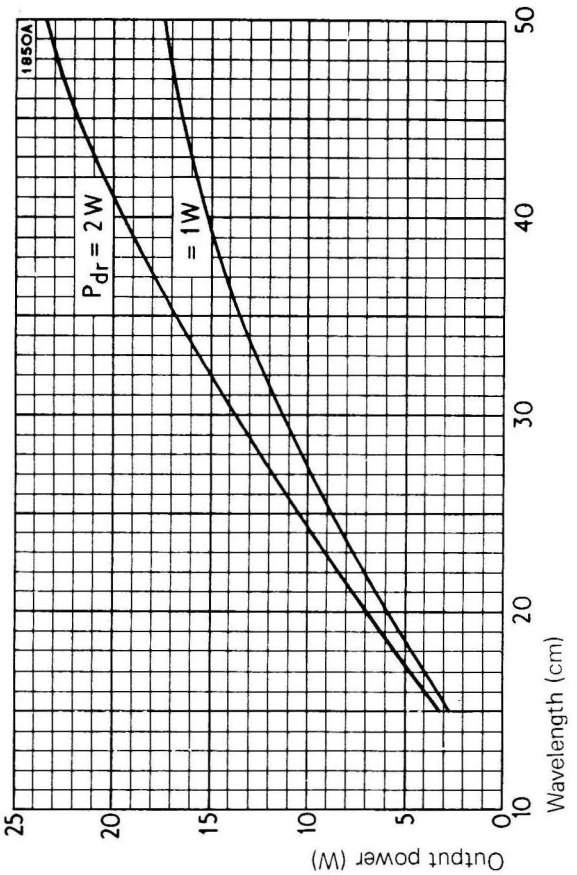


Fig. 10 Performance As A Common Grid Amplifier



THE M-O VALVE
COMPANY LIMITED

CV8108

DHM9-11

similar Etel 3A2P31

Mullard DHM9-11

G.E.C.

INSTRUMENT CATHODE RAY TUBE

used in Solartron CT436 & CD1014

BRIEF DATA

A 9cm (3½ inch) diameter flat faced double gun, oscilloscope tube.

Final anode voltage	1.5	kV
Useful scan (each beam)	5 x 7.7	cm
D_y (max)	18.3	V/cm
D_x (max)	27.3	V/cm

HEATER

V_h	6.3	V
I_h (approx. both guns)	0.6	A

PREFERRED TYPE

Tubes normally supplied with 24 phosphor as DHM9–11 (CV8108).	P31
Also available with 08 phosphor as DBM9–11 (CV5966)	P11
25 phosphor as DNM9–11 (CV5883)	P2
46 phosphor as DPM9–11 (CV8109)	P7

SCREEN (Preferred)

Fluorescence	Green
Phosphorescence	Green
Persistence	Medium-short
E.I.A. phosphor code	P31
GEC phosphor code	24

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May 1972
Issue 1

Maintenance type 1975

RATINGS (Absolute)(Each Gun)

	Max	Min	
V_{a1+a3}	1.8	1.0	kV
V_{a2}	600	–	V
$-V_g$	200	1.0	V
$V_{x-a1+a3}$	300	–	V
$V_{y-a1+a3}$	300	–	V
$R_{x-a1+a3}$	2.0	–	MΩ
$R_{y-a1+a3}$	2.0	–	MΩ
R_{g-k}	1.0	–	MΩ
v_{h-k} (pk)	+150	–150	V

CAPACITANCES

	Gun'		Gun''		
	Min	Max	Min	Max	
c_{g-all}	3.7	6.4	3.7	6.4	pF
c_{k-all}	2.1	4.2	2.1	4.2	pF
c_{x1-all} (x2 earthed)	4.0	6.5	4.0	6.5	pF
c_{x2-all} (x1 earthed)	4.0	7.0	4.0	7.0	pF
c_{y1-all} (y2 earthed)	1.0	3.0	2.0	4.0	pF
c_{y2-all} (y1 earthed)	2.0	4.0	1.0	3.0	pF
c_{x1-x2}	–	1.7	–	1.7	pF
c_{y1-y2}	1.6	2.6	1.6	2.6	pF
$c_{x1+x2-y1+y2}$	–	200	–	200	mpF

$c_{x1'+x2'-x1''+x2''}$ (max)	1.6	pF
$c_{y1'+y2'-y1''+y2''}$ (max)	600	mpF

EQUIPMENT DESIGN RANGE

	Max	Min	
V_{a2}	300	160	V/kV_{a3}
$-V_{g1}$	63	28	V/kV_{a1}
D_x	18.2	13.8	$V/cm/kV_{a3}$
D_y	12.2	9.1	$V/cm/kV_{a3}$

TYPICAL OPERATING CONDITIONS (Each Gun)

V_{a1+a3}	1.5	kV
V_{a2}	250 to 450	V
V_g for visual cut-off	−42 to −95	V
*I_{a2} max	150	μA
D_y	15	V/cm
D_x	23	V/cm

*With V_{a2} set for focus, and V_g = −1.0V.

D_y, D_x and V_g for visual cut-off are proportional to V_{a1+a3}.

LINE WIDTH (measured with 24 phosphor)

A value for line width under d.c. conditions is given below.

V_{a1+a3}	1.5	kV
V_{a2}	adjusted for focus	
I_t	1.0	μA
Raster — circle diameter	50	mm
Maximum line width	0.7	mm

EQUALITY OF SENSITIVITIES

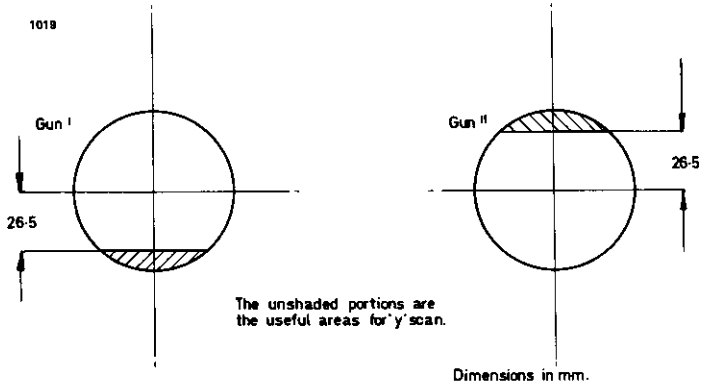
Sensitivity variations between the two guns will not differ by more than 5%, calculated as follows:

$$\text{Difference in sensitivities} = 100 - \frac{\text{lower x sensitivity}}{\text{higher x sensitivity}} \times 100$$

MINIMUM SCANNED AREA

x (Full screen)	7.7	cm
y	See Fig. 1	

FIGURE 1



DISPLAY CHARACTERISTICS

Both x and y plates are intended for symmetrical operation. The tube may be operated asymmetrically, but focus quality will deteriorate and trapezium distortion will be introduced.
The data for raster distortion and line-width will therefore not apply.
In general, the deflection plates should be at the same average potential as a1+a3. However, it may be necessary to adjust the potential of the deflection plates to obtain optimum focus.

Pattern Distortion

Centred at the screen centre, a nominally square raster from either gun may be inserted into the frame bounded by the squares 48.75mm and 51.25mm.

Angle between x and y deflection (each gun)	$90^\circ \pm 1.5^\circ$
Maximum angle between the two x deflections	1.5°
*Maximum angle between the two y deflections	2.5°

*The distance between the two electrical y axes at the geometric screen centre is 3.5mm max.

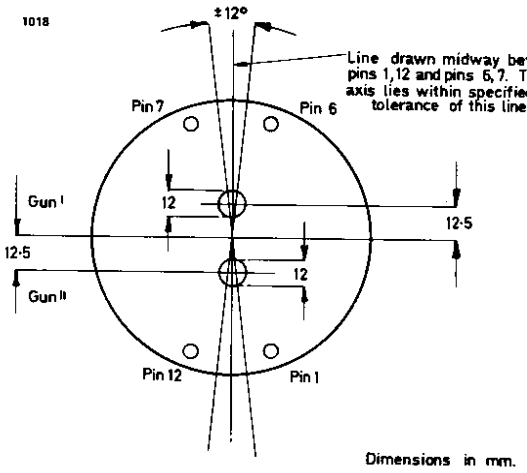
Pattern Alignment

When two nominally square rasters, whose edges coincide at their centres are superimposed at the screen centre, and when the rasters are simultaneously adjusted in size, the edges will fall within the frame bounded by the squares 48mm and 52mm, giving a total raster misalignment of ±4%.

Spot Position

With the tube magnetically shielded, the undeflected spot of each gun will fall within the appropriate 12mm diameter circle shown in Fig. 2.

FIGURE 2



MOUNTING POSITION

The tube may be mounted in any position but under no circumstances should the socket be used to support the tube.

WEIGHT

510g.

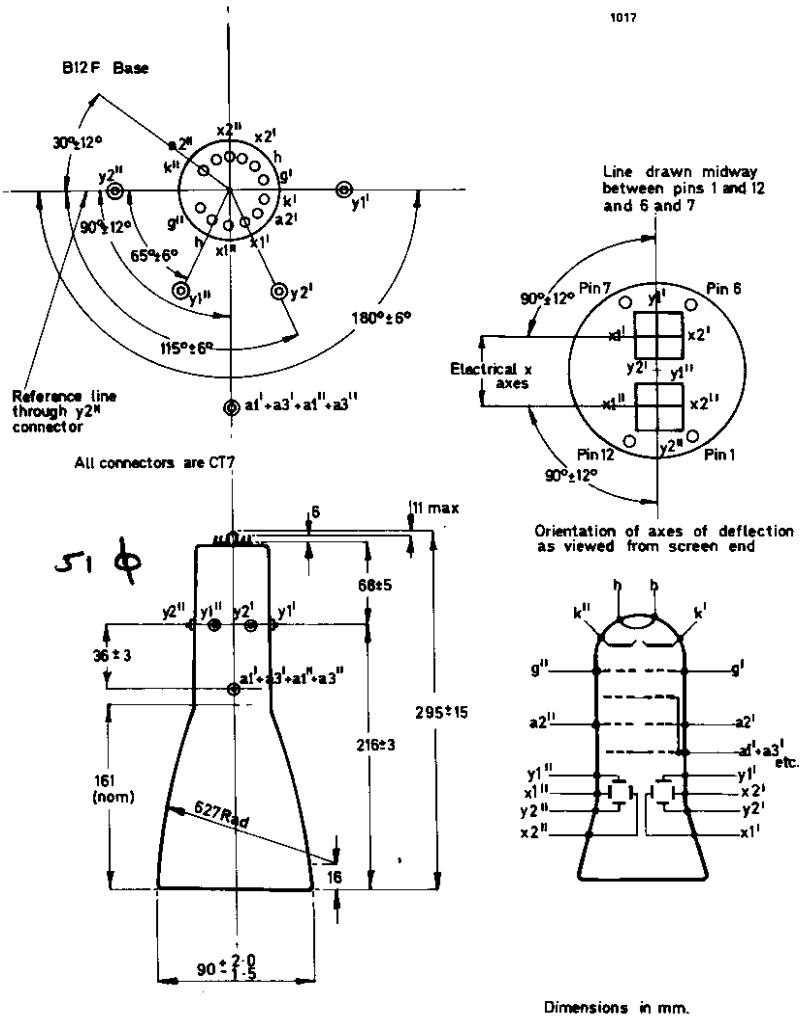
BASE CONNECTIONS

See drawing.

WARNING

Care should be taken not to expose the tube to strong magnetic fields either in use or during storage.

OUTLINE


1017
B12F Base
30°±12°
90°±12°
65°±6°
115°±6°
180°±6°
Reference line through y2" connector
a1'+a3'+a1"+a3"
Line drawn midway between pins 1 and 12 and 6 and 7
Pin 7
Pin 6
Pin 12
Pin 1
Electrical x axes
Orientation of axes of deflection as viewed from screen end
All connectors are CT7
6
11 max
68±5
36±3
295±15
216±3
161 (nom)
627Rad
16
90 +2·0 -1·5
etc.
Dimensions in mm.

THE M-O VALVE
COMPANY LIMITED

E14-110GM

GEC

DOUBLE GUN
CATHODE RAY TUBE

BRIEF DATA

10x8 cm

A high sensitivity double gun oscilloscope tube with a 14cm (5½ inch) diagonal rectangular faceplate, mesh post deflection acceleration, aluminium backed screen and compensated deflection blanking system. The two identical electron guns have completely independent horizontal and vertical deflection systems.

length 391 mm

Final anode voltage (p.d.a.)	8.0	kV
Display area (each beam)	4 x 10	cm
Overlap	2.0	cm
Y deflection factor (Dy)(max)	5.0	V/cm
X deflection factor (Dx)(max)	12	V/cm

HEATER

V_h	6.3	V
I_h (approx. both guns)	1.2	A

SCREEN

Fluorescence	Bluish-White
Phosphorescence	Yellow
Persistence	10–60 sec
E.I.A. phosphor code	P7
GEC phosphor code	96
Pro-Electron phosphor code	GM

EQUIPMENT DESIGN RANGE

	Max	Min	
V_{a2} (for focus)	400	150	V/kV_{a3}
$-V_{g1}$ (for cut-off)	100	30	V/kV_{a1}
$\pm V_{g2}$ (for blanking)(w.r.t. a1)	80	–	V/kV_{a1}
Dy (at $V_{a4}/V_{a3} = 8$)	5.0	–	$V/cm/kV_{a3}$
Dx (at $V_{a4}/V_{a3} = 8$)	12	–	$V/cm/kV_{a3}$
p.d.a. spiral current	10	–	$\mu A/kV_{a3\text{-}a4}$

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November 1974
Issue 1

RATINGS (Absolute)

	Max	Min	
V_{a4}	10	6.0	kV
V_{a3}	2.0	0.9	kV
Ratio (V_{a4}/V_{a3})	8.0	–	
V_{a2}	1.5	0	kV
V_{a1}	2.0	0.9	kV
$-V_{g1}$	200	1.0	V
$V_{y\text{-}a3}$	200	–	V
$V_{x\text{-}a3}$	500	–	V
$V_{h\text{-}k}$	±150	–	V
$R_{h\text{-}k}$	0.1	–	MΩ
$R_{y\text{-}a3}$	0.1	–	MΩ
$R_{x\text{-}a3}$	0.5	–	MΩ
$R_{g1\text{-}k}$	1.0	–	MΩ
V_{g2}	2.0	0.9	kV
$V_{(neck,\ box)}$	2.0	0.9	kV
$V_{(igs,\ ogs,\ lips)}$	2.0	0.9	kV
$V_{(mesh)}$	2.0	0.9	kV

Voltage ratings are with respect to cathode, unless otherwise indicated.

CAPACITANCES (each gun) typical

	Gun'	Gun''	
$C_{k\text{-}all}$	4.0	4.0	pF
$C_{g1\text{-}all}$	12.5	12.5	pF
$C_{g2\text{-}all}$	5.6	5.6	pF
$C_{y1\text{-}y2}$	2.5	2.5	pF
$C_{y1\text{-}all\ less\ y2}$	3.0	5.0	pF
$C_{y2\text{-}all\ less\ y1}$	5.0	3.0	pF
$C_{x1\text{-}x2}$	4.2	4.2	pF
$C_{x1\text{-}all\ less\ x2}$	3.5	3.5	pF
$C_{x2\text{-}all\ less\ x1}$	3.5	3.5	pF

TYPICAL OPERATION

V_{a4}	8.0	kV
V_{a3}	1.0	kV
V_{a2} (for focus)	150–380	V
V_{a1}	1.0	kV
$-V_{g1}$ (for cut-off)(max)	100	V

V_{g2} (nom)	1.0	kV
V_s (neck, box)	1.0	kV
V_s (igs, lips)	1000 (−50/+50)	V
V_s (ogs)	1000 (−50/+150)	V
V_s (mesh)	980	V
Dy (max)	5.0	V/cm
Dx (max)	12	V/cm
*Typical line width (for type 96 phosphor)	0.44	mm

*Measured by means of a shrinking raster at the geometric centre of the faceplate at 5.0μA beam current.

Minimum Scanned Area

x (each gun)	10	cm
x (overlap)	10	cm
y (each gun)	4	cm
y (overlap)	2	cm

Gun' fills +30 to −10mm and gun'' fills +10 to −30mm about the geometric major axis of the screen.

Beam Blanking

A potential of $-80V/kV_{a1}$ (preferable) or $+100V/kV_{a1}$ with respect to V_{a1} applied to either or both of the blanking electrodes (g2' and g2'') will completely cut-off either or both beams. Blanking electrodes should not be used as brightness controls.

Astigmatism Correction

Adjustment of the potential on a3 relative to the y deflection plate mean potential may be used for the purpose of astigmatism correction. A range of adjustment of $\pm 50V/kV_{a3}$ should be allowed for this purpose.

Pattern Correction

Barrel or pincushion distortion may be minimised by the application of appropriate potentials to the s electrodes relative to the x plate mean potential. Ranges of adjustment (see Typical Operation) should be allowed for this purpose. Astigmatism and pattern correction potentials are quoted for the condition where the x plate mean potential is equal to the y plate mean potential. If, in any application, a difference between x and y plate mean potentials is unavoidable, it is recommended that this difference should be kept to a minimum.

Axis Alignment

The electrical x axis of the tube will lie within ±5° of the major axis of the face plate and may be aligned with this axis by means of the field from an axial coil placed about the cone of the tube.

DISPLAY CHARACTERISTICS

Pattern Distortion

For each beam, with pattern correction applied, the edges of a test raster will lie between two concentric rectangles of 100 x 40 and 94 x 36mm. The angle between x and y axes (each beam) will be 90° ± 1.5° max.
The angle between y axes at screen centre 1.5° max.
The angle between x axes at screen centre 1.5° max.

Deflection Defocusing

The ratio of line width, measured at the centre of a vertical line placed at the centre of the screen, to the corresponding line width measured at edge of the horizontal window will not exceed 2.5:1.

Deflection Linearity

The deflection factor for a deflection of less than 75% of the useful scan will not differ from that for a deflection of 25% by more than 2%.

Spot Position

The focused and undeflected spots will fall within two 15mm squares whose centres lie on the geometric y axis and ±7.5mm from the geometric centre of the faceplate. Gun' spot falls in upper square and gun'' in lower square.

Orientation

Looking at the screen with pins 3 and 4 of the base uppermost a positive potential applied to x1' or x1'' will deflect the appropriate beam to the left and a positive potential applied to y1' or y1'' will deflect the appropriate beam upwards.

MOUNTING

The tube may be mounted in any position but must not be supported by the base alone. It is recommended that the tube should be held by a rubber mask at the screen and a clamp around the magnetic shield near the base, a resilient packing being located between the shield and the tube. The socket should have sufficient freedom of movement to accommodate the maximum overall tube length and base orientation tolerances.

BASE CONNECTIONS

Base: B12F		Side contact (CT8): a4	
Pin 1:	g1'	Pin 7:	g2''
2:	k'	8:	a2''
3:	h	9:	a1'
4:	h	10:	a1''
5:	a2'	11:	k''
6:	g2'	12:	g1''

WEIGHT

The weight of the tube is 2.0kg (approx).

ACCESSORIES

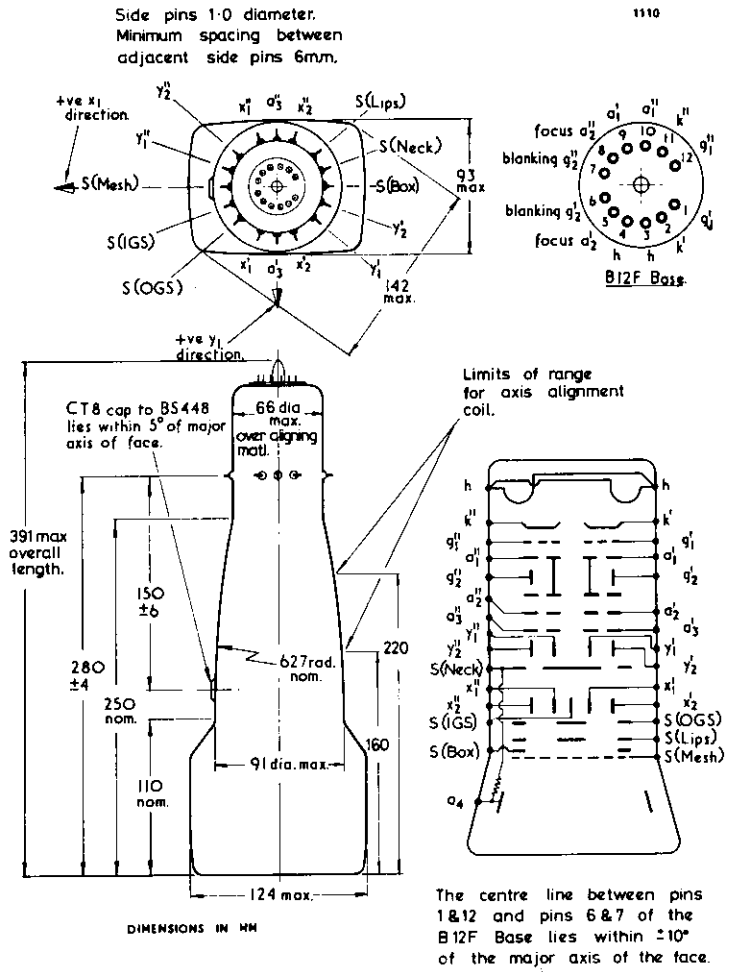
Part	Manufacturer	Type No.
Base sockets	Carr Fastener Co. Ltd., Stapleford, Notts.	77/842
CT8 connector	Pressac Ltd., Leopold Street, Long Eaton, Nottingham. NG10 4QL.	(cover) 12/426 (clip) 10/425
Side pin connectors	Auto Precision Ltd., Glendere Street, Bristol 5.	WS1
Magnetic shield	Magnetic Shields Ltd., Headcorne Road, Staplehurst, Tonbridge, Kent. Q-Fab Ltd., Milnathort, Kinross, Scotland. KY13 7XB.	

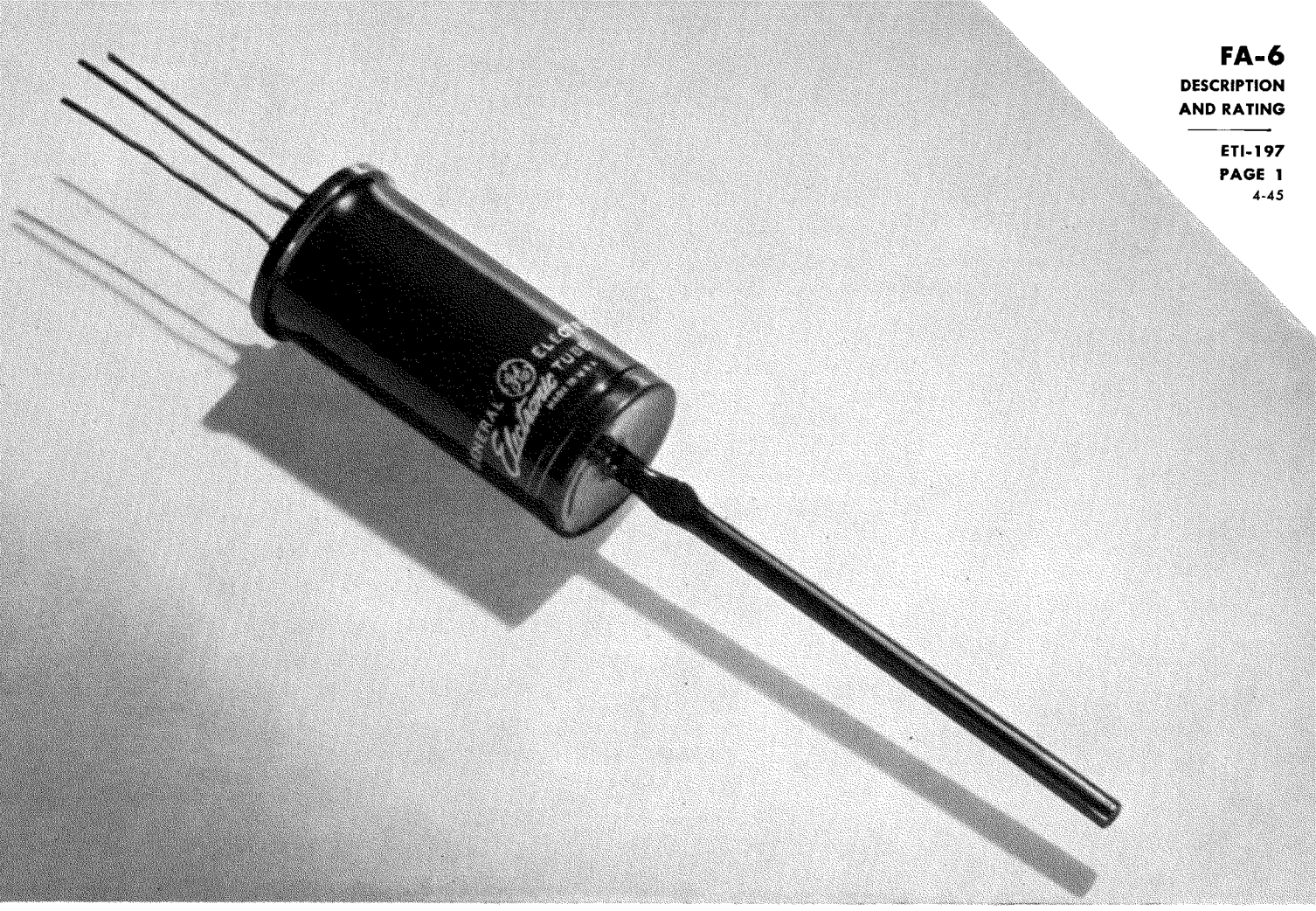
WARNING

Care should be taken not to expose the tube to stray magnetic fields either in use or during storage.

Whilst M-OV has taken care to ensure the accuracy of the information contained herein it accepts no responsibility for the consequences of any use thereof and also reserves the right to change the specification of goods without notice.
M-OV accepts no liability beyond that set out in its standard conditions of sale in respect of infringement of third party patents arising from the use of tubes or other devices in accordance with information contained herein.

OUTLINE


Side pins 1·0 diameter.
Minimum spacing between adjacent side pins 6mm.
1110
+ve x1 direction.
S(Lips)
S(Neck)
S(Mesh)
S(Box)
S(IGS)
S(OGS)
93 max
142 max.
+ve y1 direction.
focus a'2
blanking g''2
blanking g'2
focus a2
B12F Base.
CT8 cap to BS448 lies within 5° of major axis of face.
66 dia max. over aligning matl.
Limits of range for axis alignment coil.
391 max overall length.
150 ±6
280 ±4
250 nom.
110 nom.
627 rad. nom.
220
160
91 dia. max.
124 max.
DIMENSIONS IN MM
The centre line between pins 1 & 12 and pins 6 & 7 of the B12F Base lies within ±10° of the major axis of the face.



VACUUM SWITCH

DESCRIPTION

The FA-6 is a mechanically actuated, single-pole, double-throw vacuum switch designed to perform switching operations at high speed with low operating pressure and long contact life.

Operation of the FA-6 vacuum switch is unaffected by atmospheric conditions, contacts are free from contamination, and resistance remains low. The construction minimizes arcing at the contacts.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Electrical

Interrupting current rating, a-c rms, resistive load

For total life of 1000 operations		
at 550 volts, a-c rms	10	amperes
For total life of 1,000,000 operations		
at 550 volts, a-c rms	2	amperes
For total life of 500,000,000 operations		
at 550 volts, a-c rms	0.1	ampere

GE Electronic TUBE

GENERAL ELECTRIC

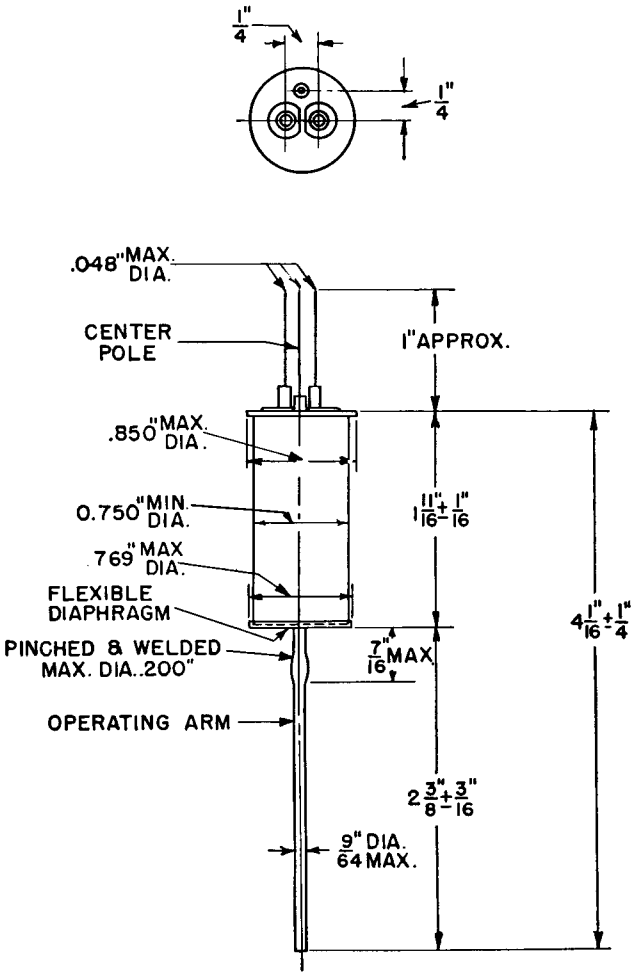
TECHNICAL INFORMATION (CONT'D)

Mechanical

Net weight, approximate	1½	ounces
Shipping weight, approximate	3	pounds
Mounting position	any	
Maximum over-all length (not including leads)	$4\frac{5}{16}$	inches
Maximum over-all width	$\frac{17}{20}$	inch

MAXIMUM RATINGS

Internal hold-off voltage, rms	550	volts
Maximum continuous current, rms	15	amperes
Ambient temperature range	−40 to +100	centigrade
Maximum allowable force on operating arm	500	grams



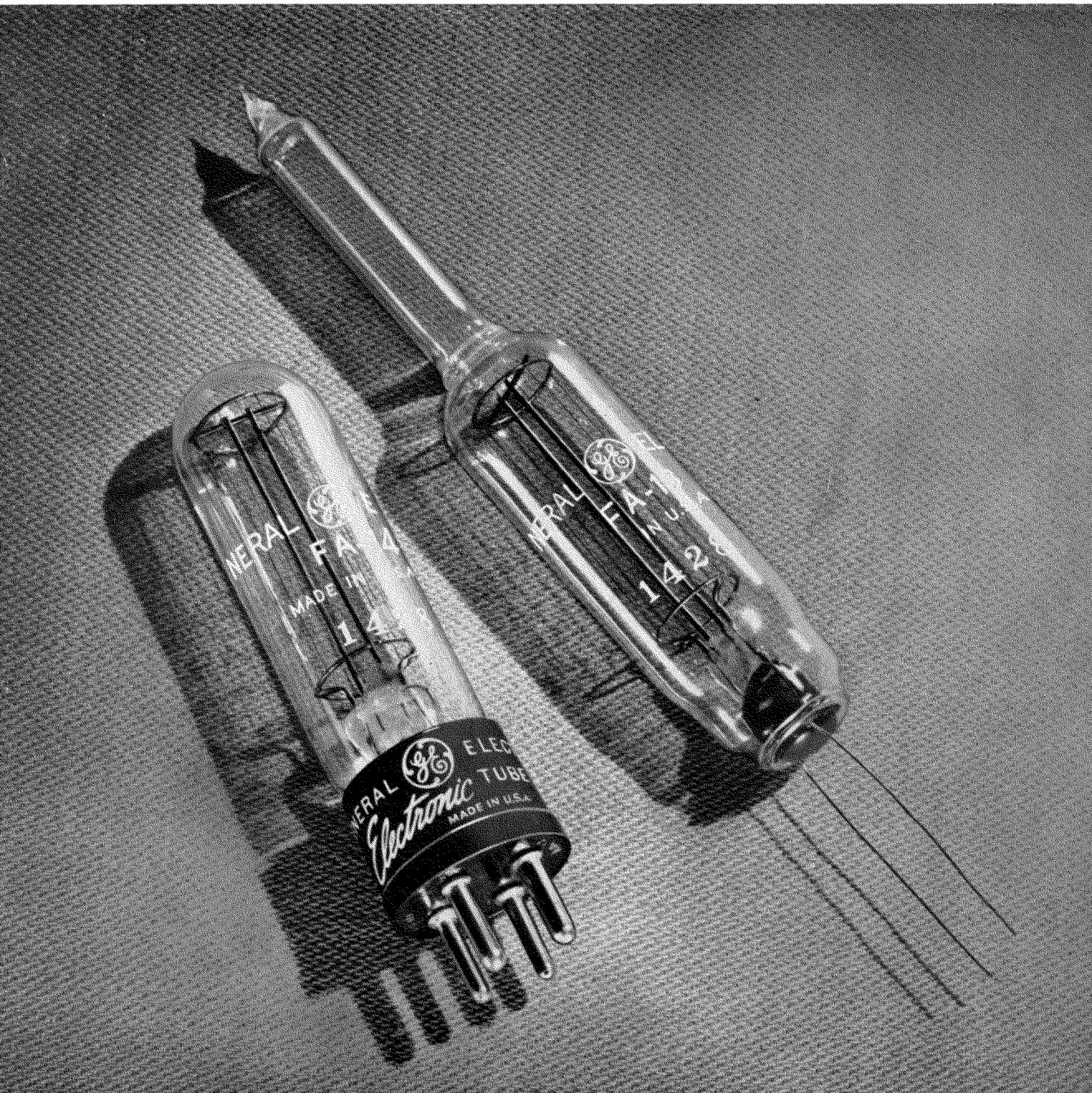
OUTLINE
FA-6 VACUUM SWITCH

K-5188108 7-1-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

GENERAL ELECTRIC

RESISTANCE VACUUM GAGES



DESCRIPTION

The FA-13 and 14, used in a resistance vacuum gage possess features especially useful in providing a convenient method for measuring low gas pressures. With suitable associated apparatus, these tubes will provide a fast, continuous, direct reading. As the vacuum system is pumped down, a meter in the bridge circuit reads the unbalancing of the bridge, thus providing an uninterrupted and instantaneous reading and enabling the observer to determine at all times the exact conditions in the system.

The resistance vacuum gage differs from the McLeod gage in that it gives an electrical, rather than mechanical, indication. Unlike the McLeod gage, it is also possible with this gage to take readings of condensable vapor, such as water vapor.

These tubes should be used in pairs since in combination they provide a much more stable and reliable reading than if the FA-13 is used alone.

TECHNICAL INFORMATION

GENERAL CHARACTERISTICS (Indicator Tube FA-13*)

Number of Electrodes	1

Electrical

Recommended range	0–600 microns
Maximum d-c voltage	6 volts
Resistance of average tube at 25 C	7 ohms

Characteristics of an average tube at 3 volts—25 C, ambient temperature:

0 microns pressure, dry air	180 milliamperes
75 microns pressure, dry air	226 milliamperes
195 microns pressure, dry air	271 milliamperes
1000 microns pressure, dry air	327 milliamperes
Atmospheric pressure	353 milliamperes

Mechanical

Splice tubing	3/8 inches diam. lime glass
Net weight, approx.	1 ounce
Shipping weight, approx.	3 pounds

**It is recommended that this tube be used in a bridge circuit in combinations with the FA-14 Compensator Tube.*

GENERAL CHARACTERISTICS (Compensator Tube FA-14)

Number of Electrodes	1

Electrical

Maximum d-c voltage	6 volts
Resistance of average tube at 25 C	7 ohms

Characteristics of an average tube at 25 C, ambient temperature:

1 Volt	90 milliamperes
2 Volts	140 milliamperes
3 Volts	180 milliamperes
4 Volts	218 milliamperes

Mechanical

Base	4101
Net weight, approx.	1 ounce
Shipping weight, approx.	3 pounds

OPERATING NOTES

The FA-13 is used to measure the gas pressure. The FA-14, which has a filament identical with that of the FA-13, is sealed off under very high vacuum and is used to compensate for temperature and voltage changes.

The FA-13 and FA-14 are usually sold in matched pairs since there is some variation from time to time in manufacture. For this reason single tubes purchased separately and at different times may not match.

With the FA-13 the pressure indication is obtained as a function of the change in resistance of a heated tungsten filament caused by the cooling, by convection current, of the gas being measured. Since different gases have different factors for convection cooling, the calibration of the gage will not be the same for all gases. For example, the gage is much more sensitive to hydrogen than to nitrogen. Since the response of the gage is a current change, it may be used for recording and for control—to start and stop a pump—as well as for indication.

INSTALLATION

The FA-13 and FA-14 may be mounted in any position, but should be protected from excessive shock or vibration. It is recommended that the connection to the base of the FA-14 be clamped solidly or soldered to avoid difficulty with contact resistance. The FA-13 is provided with connection leads instead of a base and glass connection tubing for splicing to the exhaust system. This connection may be cemented on, or sealed to, another glass tube.

Greater stability will be obtained if tubes are protected from heat and direct light rays. If used in pairs it is advisable to place the tubes together so that their temperatures will vary simultaneously.

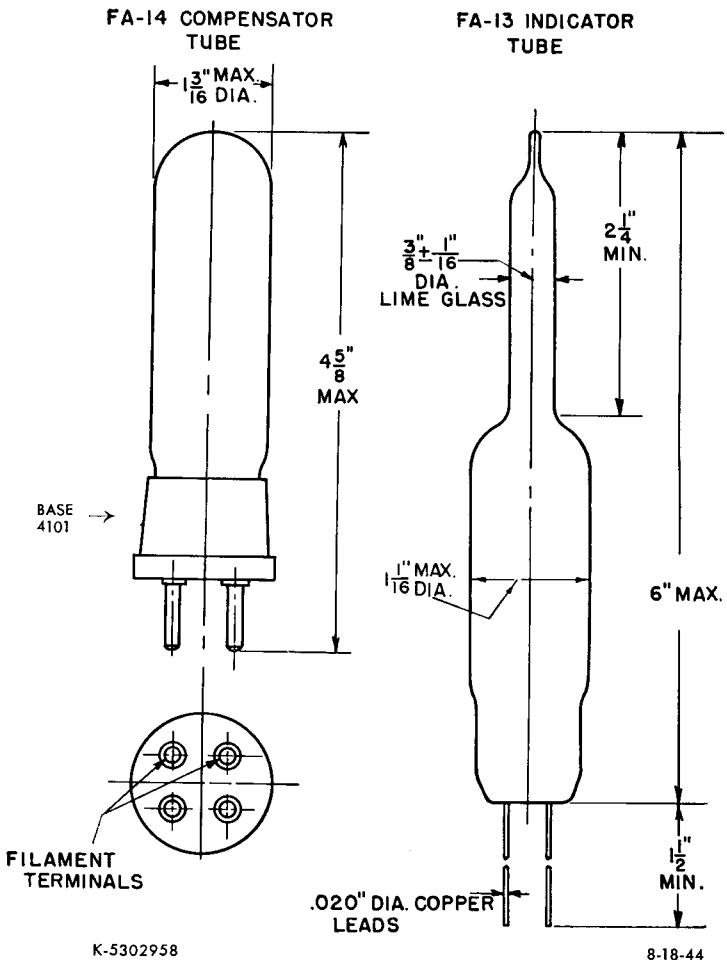
OPERATION

Although the FA-13 connected in series with a milliameter, may be used for rough measurements, it is recommended that an ordinary bridge circuit be provided with the FA-13 in one arm, the FA-14 compensator tube in the opposite arm, and variable resistances in the two adjacent arms. The bridge arrangement gives greater sensitivity than the FA-13 alone and the use of a compensator tube results in substantial independence from ordinary voltage variation.

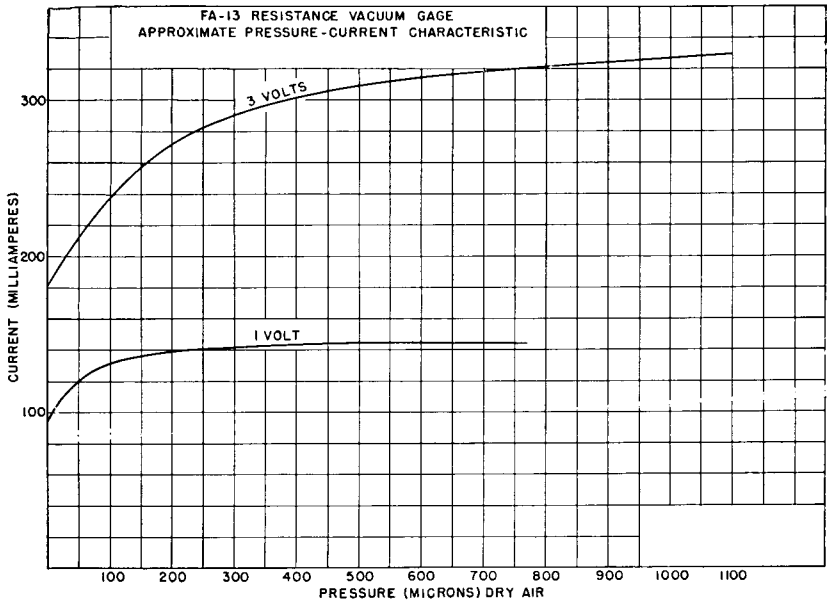
The characteristics shown by the curves are approximate. Where a high degree of accuracy is required, the individual gage must be calibrated against a standard. In Fig. 2, of page 4, the dotted curves are the compensator characteristics plotted in reverse. The distance between the origins represents the total voltage on the bridge; the intersections give the voltage division for various pressures.

With the bridge balanced at zero pressure, the horizontal distances between the zero intersection and the intersection for other pressures furnishes a rough calibration for corresponding measurement taken on the bridge with a high-resistance voltmeter.

These curves supply a convenient method for estimating the bridge sensitivity at various voltages. The calibration may change with wide variations in ambient temperature. Fig. 1 on page 4 illustrates the variation in current with pressure for two different voltages.



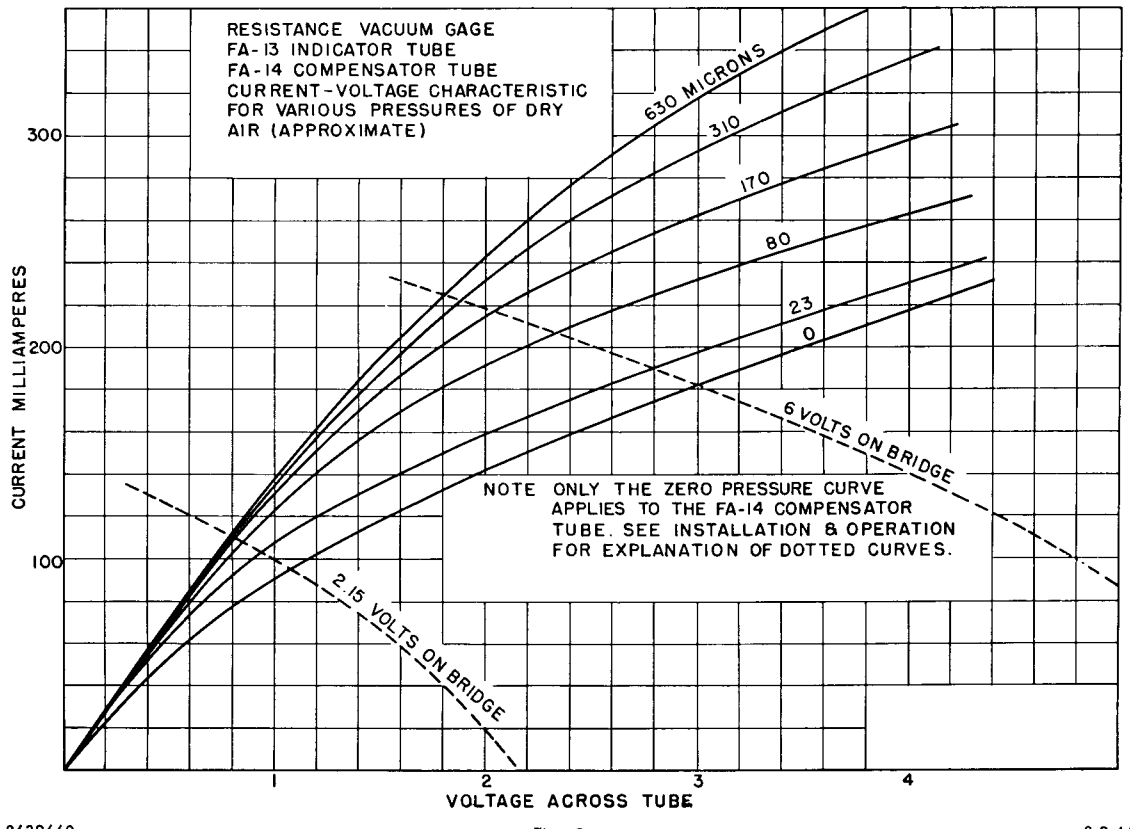
OUTLINE RESISTANCE VACUUM GAGES FA-13, FA-14



K-8639661

Fig. 1

8-9-44



K-8639660

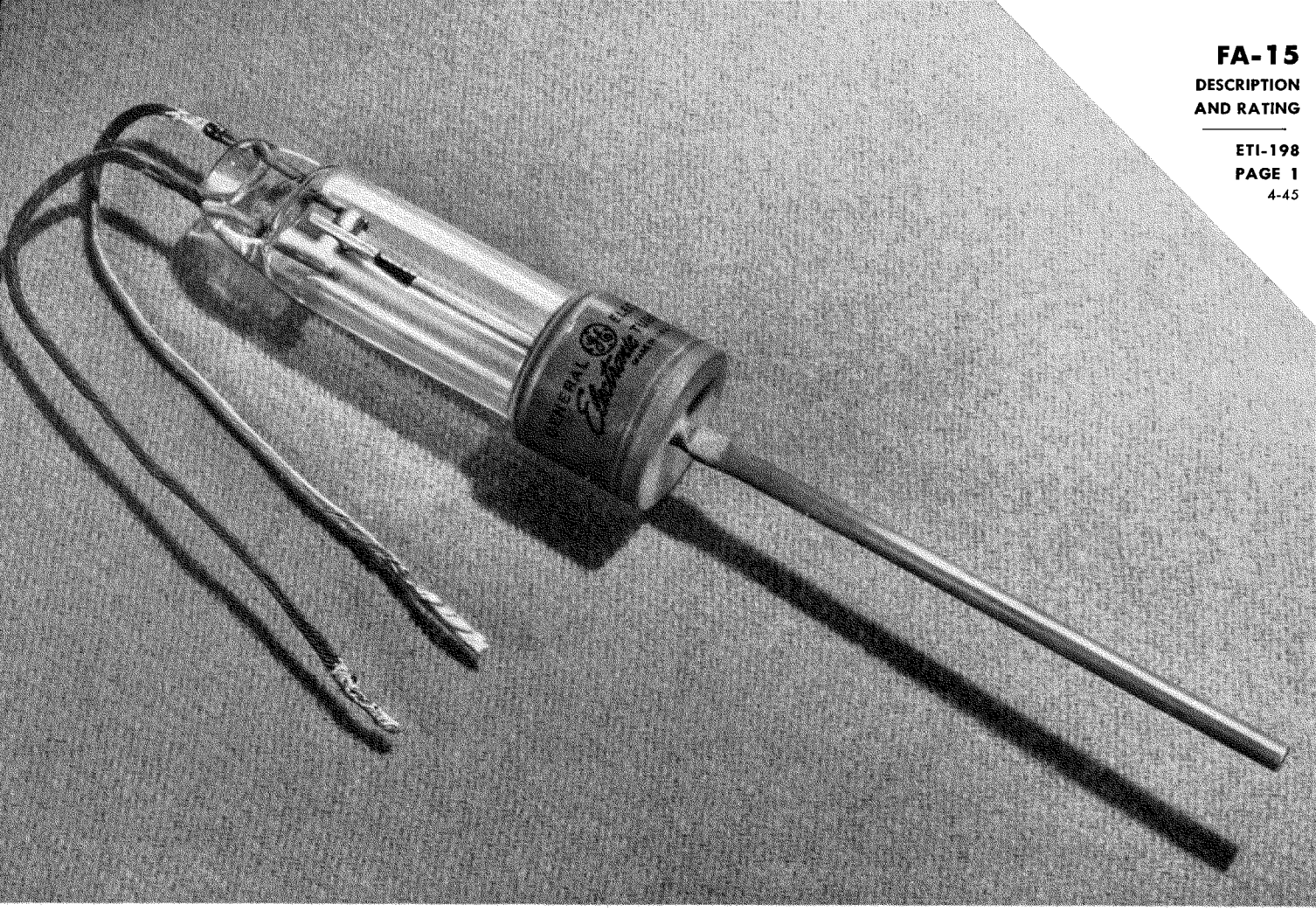
Fig. 2

8-9-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



VACUUM SWITCH

DESCRIPTION

The FA-15 single-pole double-throw vacuum switch is designed for operation in high-speed relay construction, in d-c circuits involving high inductance, and in installations that require the circuit to be opened by a slow movement.

Since the switch is enclosed in a vacuum, its operation is unaffected by atmospheric conditions, contacts are free from contamination, and resistance remains low. The construction minimizes arcing at the contacts. Only a few thousandths of an inch movement is required to interrupt rated current. This feature coupled with low operating pressure and light weight of the moving parts enables the FA-15 to be operated by a small amount of power.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Electrical

Interrupting current rating, a-c rms, resistive load current

For total life of 1000 operations at 3000 volts, a-c rms	10 amperes
For total life of 100,000 operations at 3000 volts, a-c rms	3 amperes
For total life of 1,000,000 operations at 3000 volts, a-c rms	1 ampere
For total life of 500,000,000 operations at 3000 volts, a-c rms	0.1 ampere

GE Electronic TUBE

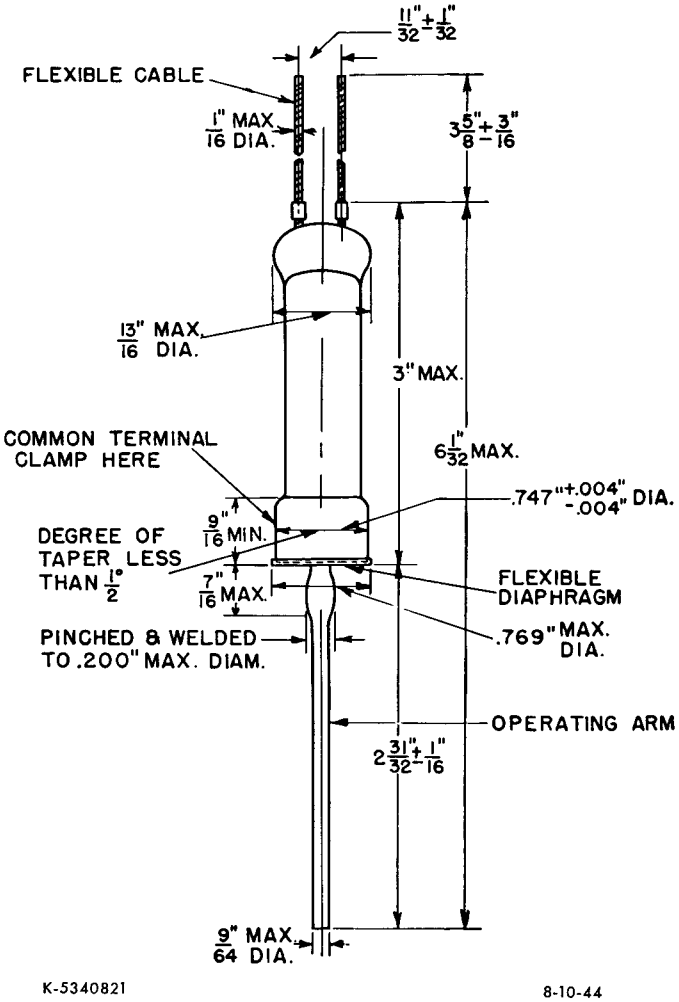
TECHNICAL INFORMATION (CONT'D)

Mechanical

Net weight, approximate	1	ounce
Shipping weight, approximate	3	pounds
Mounting position	any	
Maximum over-all length (not including leads)	$6\frac{1}{32}$	inches
Maximum over-all width	$\frac{13}{16}$	inch
Maximum over-all thickness	$\frac{25}{32}$	inch

MAXIMUM RATINGS

Internal hold-off voltage, rms	3000	volts
Maximum continuous current, rms	15	amperes
Ambient temperature range	−40 to +100	centigrade
Maximum allowable force on operating arm	500	grams



OUTLINE
FA-15 VACUUM SWITCH

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



THYRATRON

DESCRIPTION

The FG-17 thyratron is a negative-control mercury-vapor tube for use where it is desired to actuate the tube with a change in negative grid voltage. It requires relatively little grid power and is suitable for use in relay circuits where current flow is desired in the absence of grid excitation.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes			3	
Electrical				
Cathode—Filamentary type				
Filament voltage			2.5	volts
Filament current, approx.			5.0	amperes
Filament heating time, typical			5	seconds
Peak voltage drop, typical			16	volts
Approximate control characteristics				
Anode voltage	50	100	1000	volts
Grid voltage	0	−2.25	−6.50	volts
Anode to grid capacitance, approx			4.4	micromicrofarads
Ionization time, approx			10	microseconds
Deionization time, approx.			1000	microseconds
Mechanical				
Net weight, approx.			3	ounces
Shipping weight, approx.			4	pounds
Mounting position				vertical, base down

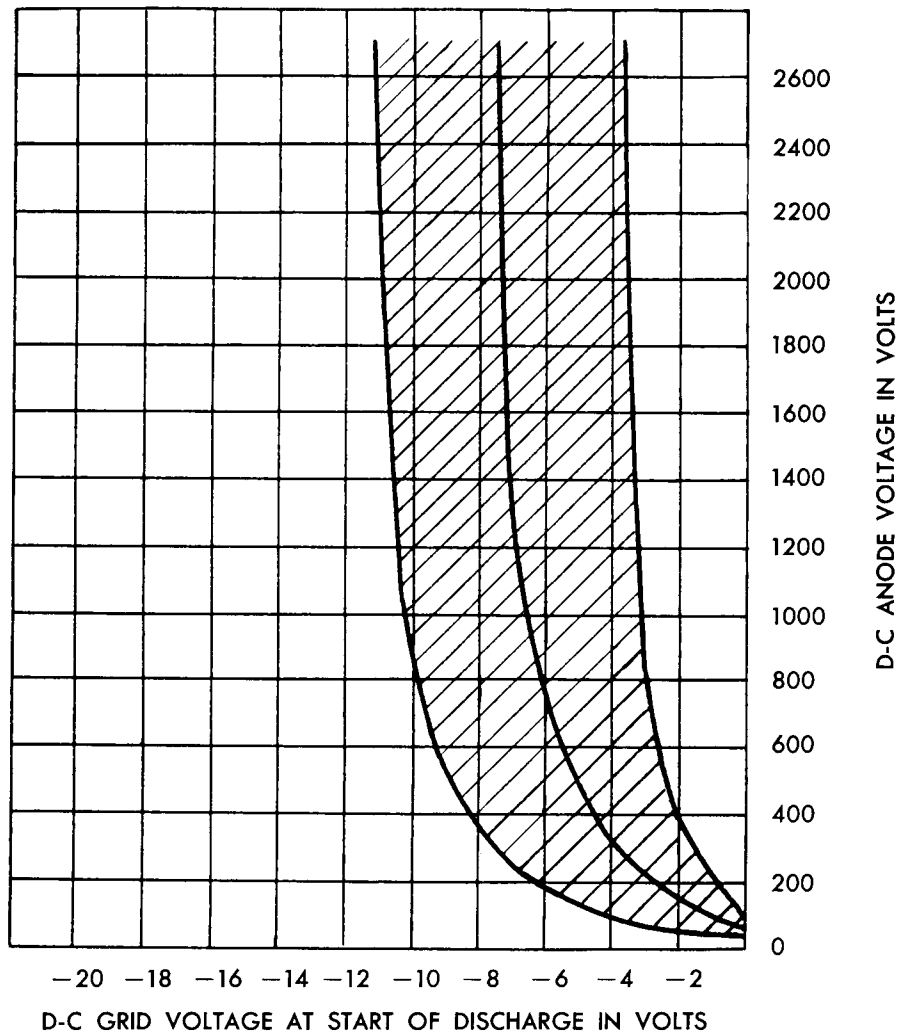
Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

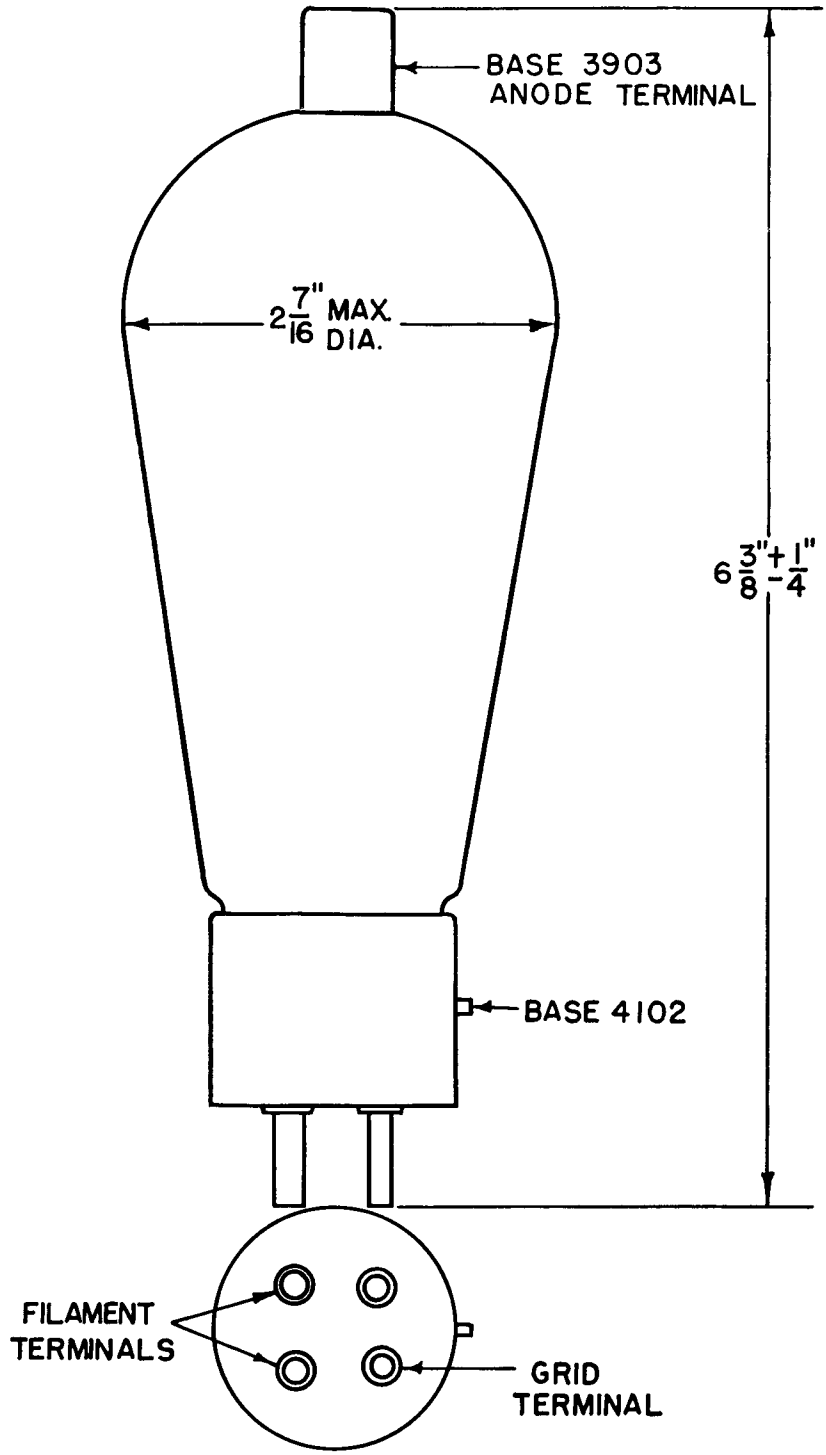
MAXIMUM RATINGS

Maximum peak anode voltage		
Inverse	5000	volts
Forward	2500	volts
Maximum negative grid voltage		
Before conduction	500	volts
During conduction	10	volts
Maximum anode current		
Instantaneous, 25 cycles and above	2.0	amperes
Instantaneous, below 25 cycles	1.0	ampere
Average	0.5	ampere
Surge, for design only	40	amperes
Duration of surge current	0.1	second
Maximum grid current		
Instantaneous	0.25	ampere
Average	0.05	ampere
Maximum time of averaging current	15	seconds
Temperature limits, condensed mercury	+40 to +80	centigrade
Recommended temperature, condensed mercury	+40	centigrade



K-8639302 7-29-43

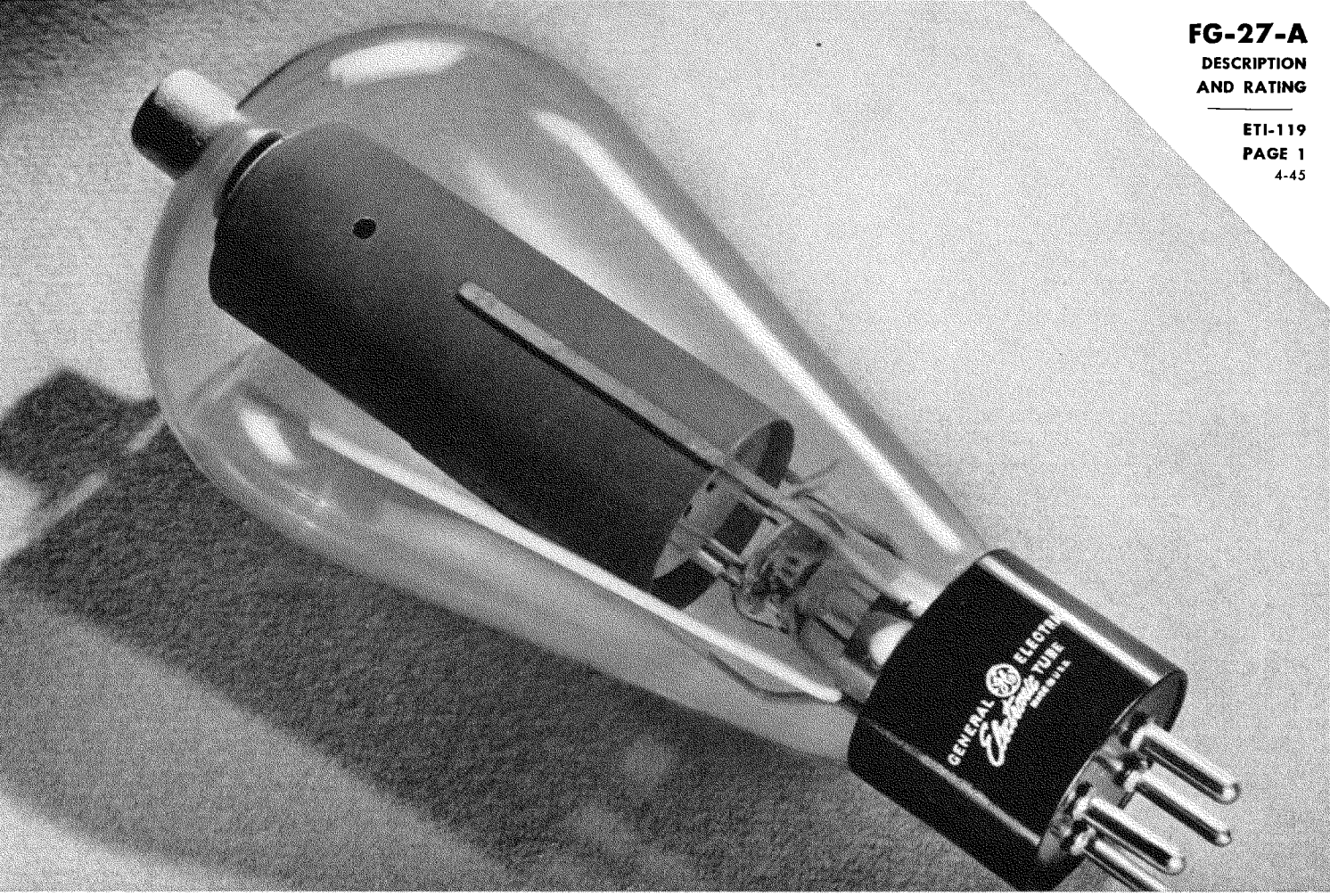
THYRATRON FG-17
TYPICAL CONTROL CHARACTERISTIC
SHADED AREA SHOWS RANGE OF CHARACTERISTICS
CONDENSED MERCURY TEMPERATURE 40 C



OUTLINE
FG-17 THYRATRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The FG-27-A is a negative-control mercury-vapor tube for use where it is desired to actuate the tube with a change in negative grid voltage. It requires relatively little grid power and is suitable for use in relay circuits where current flow is desired in the absence of grid excitation.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes			3	
Electrical				
Cathode—Filamentary type				
Filament voltage			5.0	volts
Filament current, approx			4.5	amperes
Filament heating time, typical			60	seconds
Peak voltage drop, typical			16	volts
Approximate control characteristics				
Anode voltage	70	100	1000	volts
Grid voltage	0	−2.25	−8.0	volts
Anode to grid capacitance, approx			4.4	micromicrofarads
Ionization time, approx			10	microseconds
Deionization time, approx			1000	microseconds

GE Electronic TUBE

GENERAL ELECTRIC

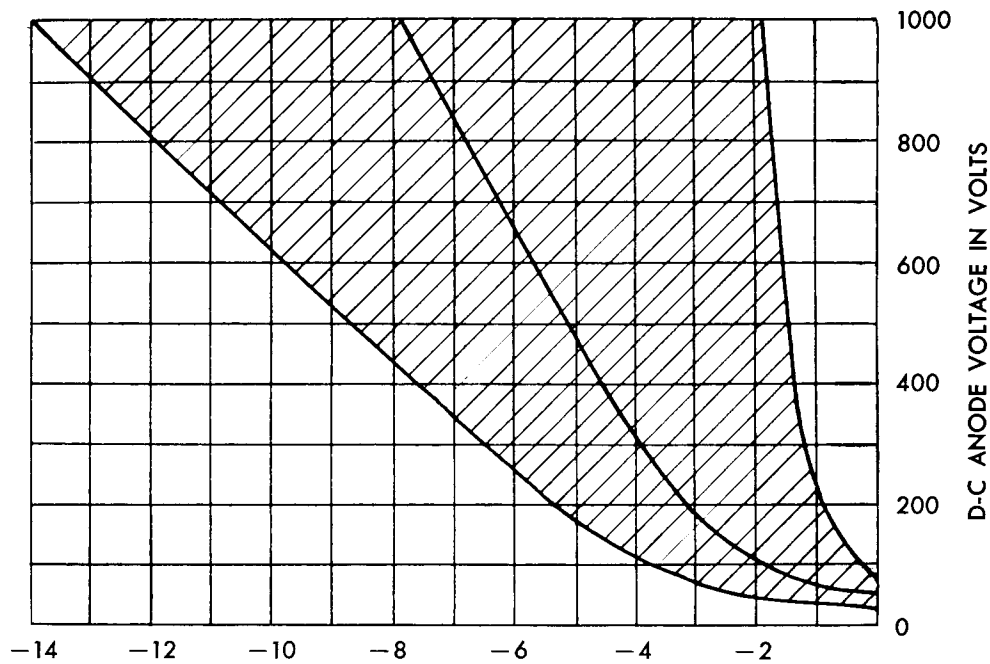
TECHNICAL INFORMATION (CONT'D)

Mechanical

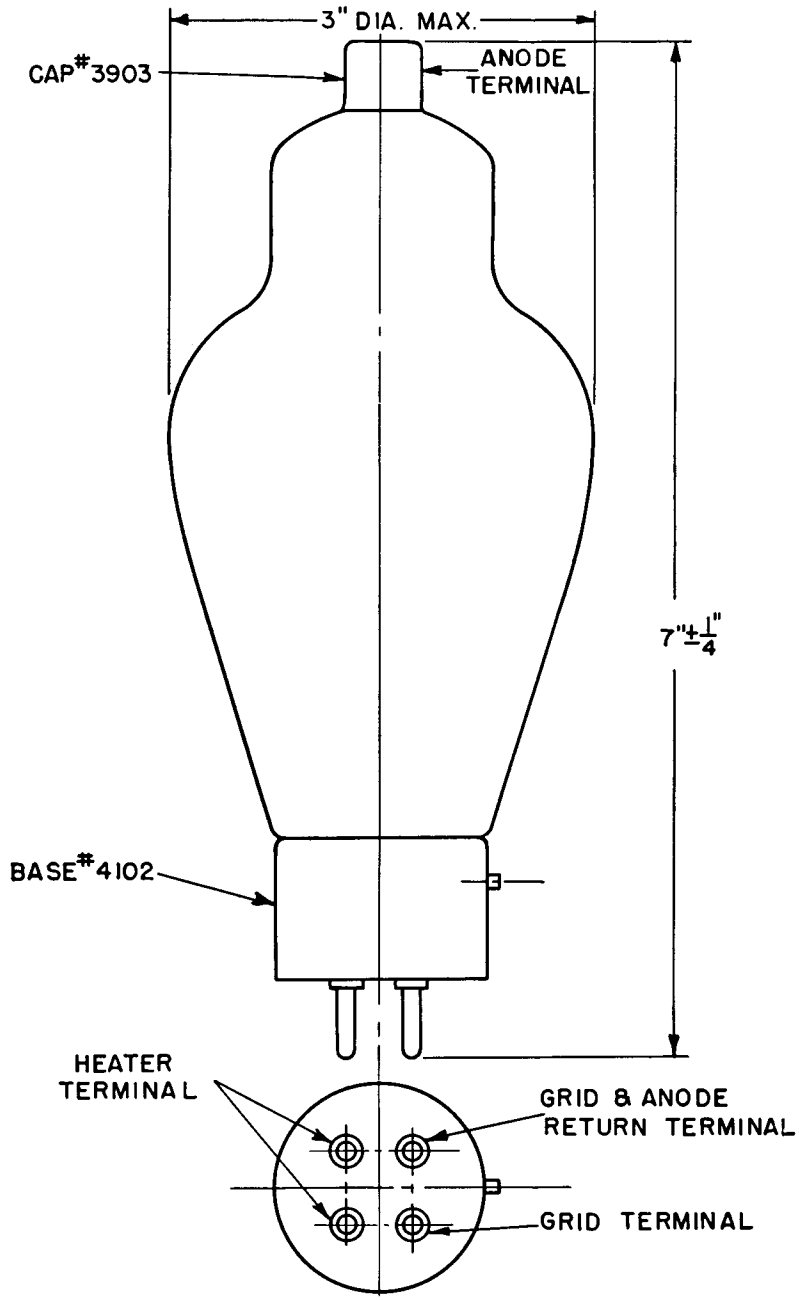
Net weight, approx	4	ounces
Shipping weight, approx	7	pounds
Mounting position		vertical, base down

MAXIMUM RATINGS

Maximum peak anode voltage		
Inverse	1000	volts
Forward	1000	volts
Maximum negative grid voltage		
Before conduction	500	volts
During conduction	10	volts
Maximum anode current		
Instantaneous, 25 cycles and above	10.0	amperes
Instantaneous, below 25 cycles	5.0	amperes
Average	2.5	amperes
Surge, for design only	180	amperes
Duration of surge current	0.1	second
Maximum grid current		
Instantaneous	1.0	ampere
Average	0.25	ampere
Maximum time of averaging current	15	seconds
Temperature limits, condensed mercury	+40 to +80	centigrade
Recommended temperature, condensed mercury	+40	centigrade



THYRATRON FG-27-A
TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS
CONDENSED MERCURY TEMPERATURE 40 C



OUTLINE

THYRATRON FG-27-A

K-4909071

8-18-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PHANOTRON

DESCRIPTION

The FG-32 is a half-wave, mercury-vapor rectifier for converting alternating current to direct current. It is adapted to applications where rectification of higher currents at lower frequencies and voltages is desired than is possible with high-vacuum tubes. In comparison with high-vacuum tubes the FG-32 has a relatively low and constant voltage drop which is an advantage in low-voltage rectifier applications as it allows more efficient utilization of power and results in lower circuit losses.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Cathode—Indirectly heated type		
Heater voltage	5.0	volts
Heater current, approx	4.5	amperes
Heating time, typical	5	minutes
Peak voltage drop, typical	12	volts
Mechanical		
Net weight, approx	4	ounces
Shipping weight, approx	3	pounds
Mounting position		vertical, base down

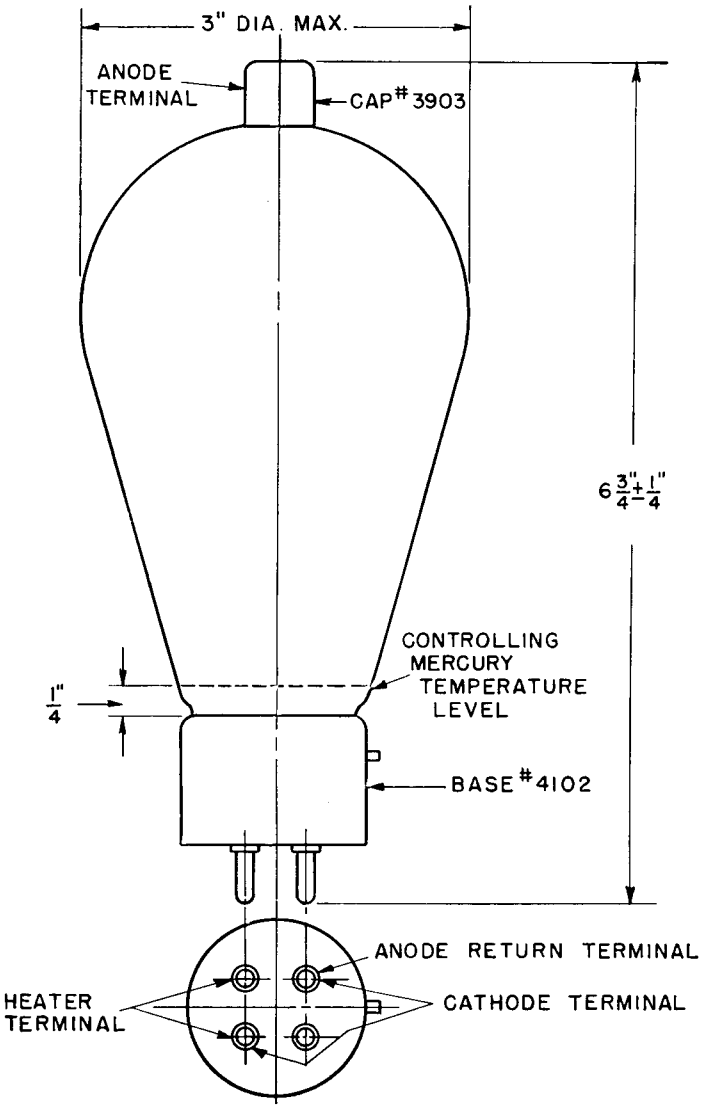
GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

Maximum peak inverse anode voltage	1000	volts
Maximum anode current		
Instantaneous, 25 cycles and above	15	amperes
Instantaneous, below 25 cycles	5	amperes
Average	2.5	amperes
Surge, for design only	200	amperes
Duration of surge current	0.1	second
Maximum time of averaging current	15	seconds
Temperature limits, condensed mercury	+30 to +80	centigrade
Recommended temperature, condensed mercury	40	centigrade



OUTLINE
FG-32 PHANOTRON

K-4373333 8-10-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



THYRATRON

DESCRIPTION

The FG-33 is a mercury-vapor thyratron with a positive control characteristic. This offers the advantage of a tube that will operate only with a positive voltage on the grid and is ideally suited for applications which require that no current flow in the absence of grid excitation.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes			3
Electrical			
Cathode—Indirectly heated type			
Voltage			5.0 volts
Current, approx			4.5 amperes
Heating time, typical			5 minutes
Peak voltage drop, typical			16 volts
Approximate control characteristics			
Anode voltage	100	1000	volts
Grid voltage	+10	+10	volts
Anode to grid capacitance, approx			2.7 micromicrofarads
Ionization time, approx			10 microseconds
Deionization time, approx			1000 microseconds

GE Electronic TUBE

GENERAL ELECTRIC

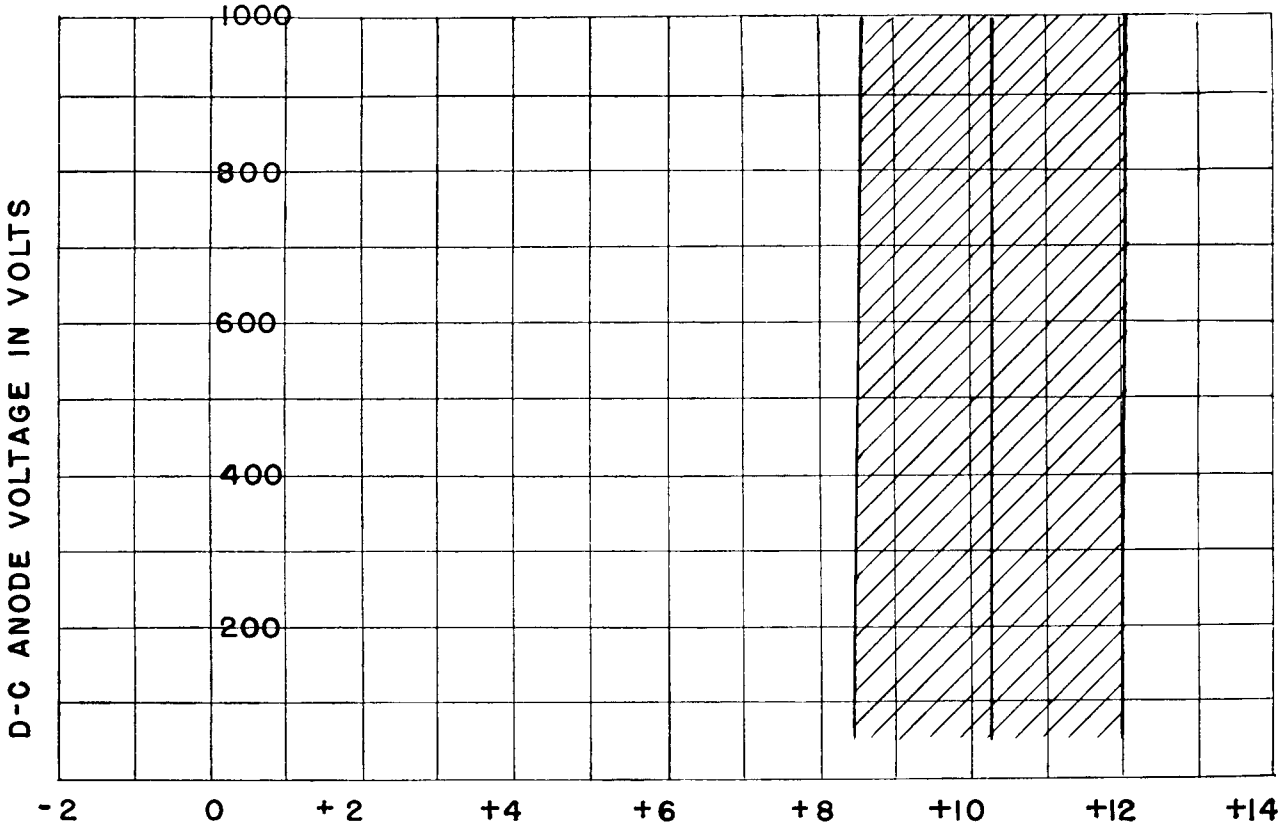
TECHNICAL INFORMATION (CONT'D)

Mechanical

Net weight, approx	5	ounces
Shipping weight, approx	7	pounds
Mounting position		vertical, base down

MAXIMUM RATINGS

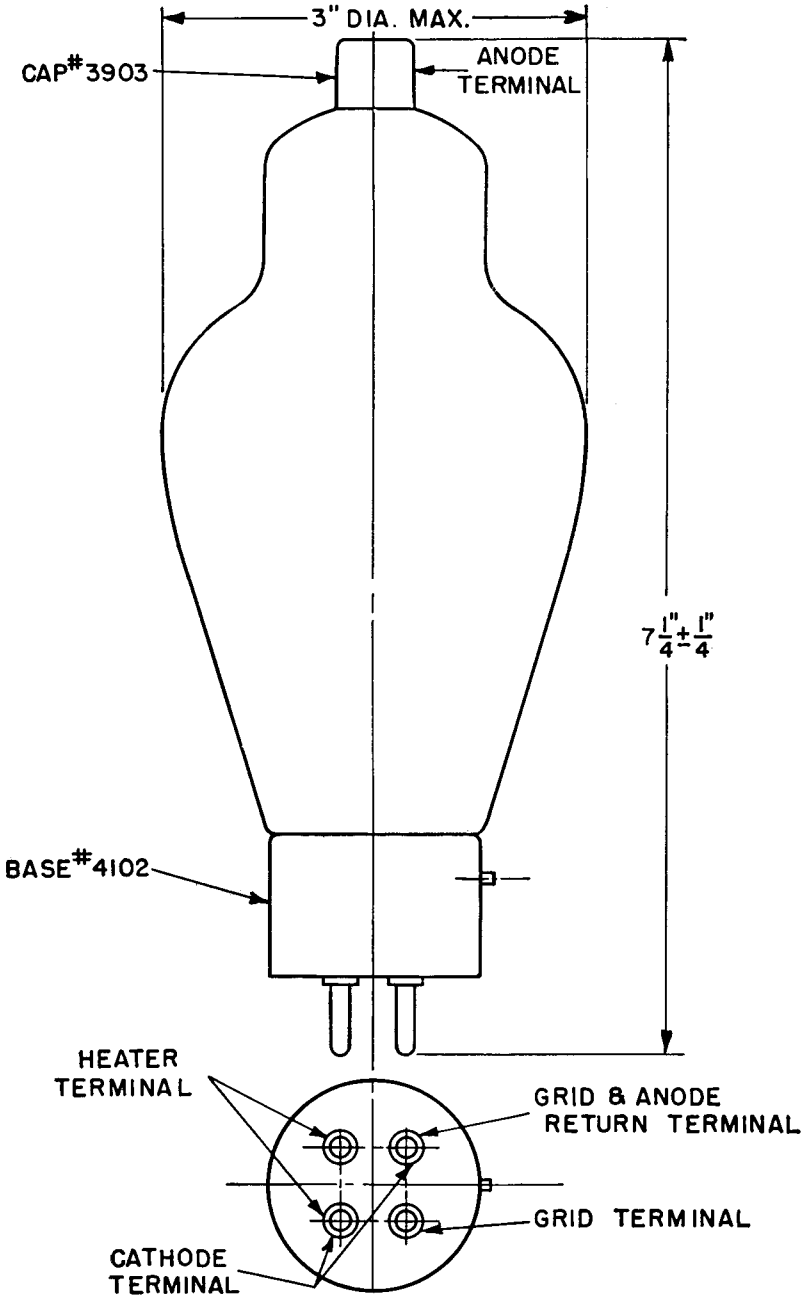
Maximum peak anode voltage		
Inverse	1000	volts
Forward	1000	volts
Maximum negative grid voltage		
Before conduction	500	volts
During conduction	10	volts
Maximum anode current		
Instantaneous, 25 cycles and above	15	amperes
Instantaneous, below 25 cycles	5.0	amperes
Average	2.5	amperes
Surge, for design only	200	amperes
Duration of surge current	0.1	second
Maximum grid current		
Instantaneous	1.0	ampere
Average	0.25	ampere
Maximum time of averaging current	15	seconds
Temperature limits, condensed mercury	+35 to +80	centigrade
Recommended temperature, condensed mercury	+40	centigrade



K-8639644

6-6-44

FG-33 TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS
CONDENSED-MERCURY TEMPERATURE 40 C



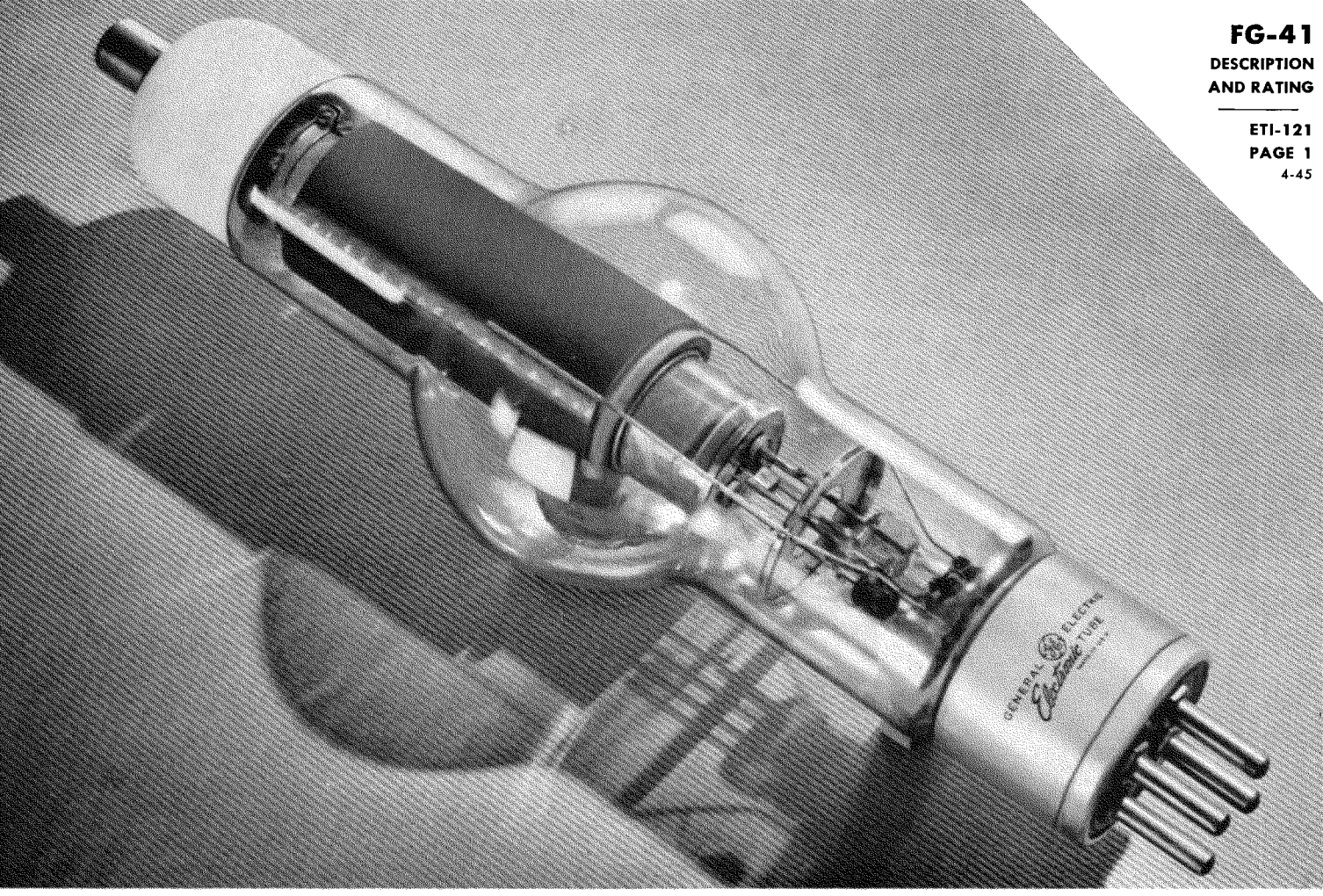
OUTLINE
THYRATRON FG-33

K-4373360

8-18-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The FG-41 is a mercury-vapor thyratron. This tube has a negative control characteristic which enables it to be used in applications where current flow is required in the absence of grid excitation.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes				3
Electrical				
Cathode—Indirectly heated type				
Voltage				5.0 volts
Current, approx				20.0 amperes
Heating time, typical				5 minutes
Peak voltage drop, typical				16 volts
Approximate control characteristics				
Anode voltage	250	1000	10,000	volts
Grid voltage	0	+1.5	−6.0	volts
Anode to grid capacitance, approx				0.05 micromicrofarad
Ionization time, approx				20 microseconds
Deionization time, approx				100 microseconds

GE Electronic TUBE

GENERAL ELECTRIC

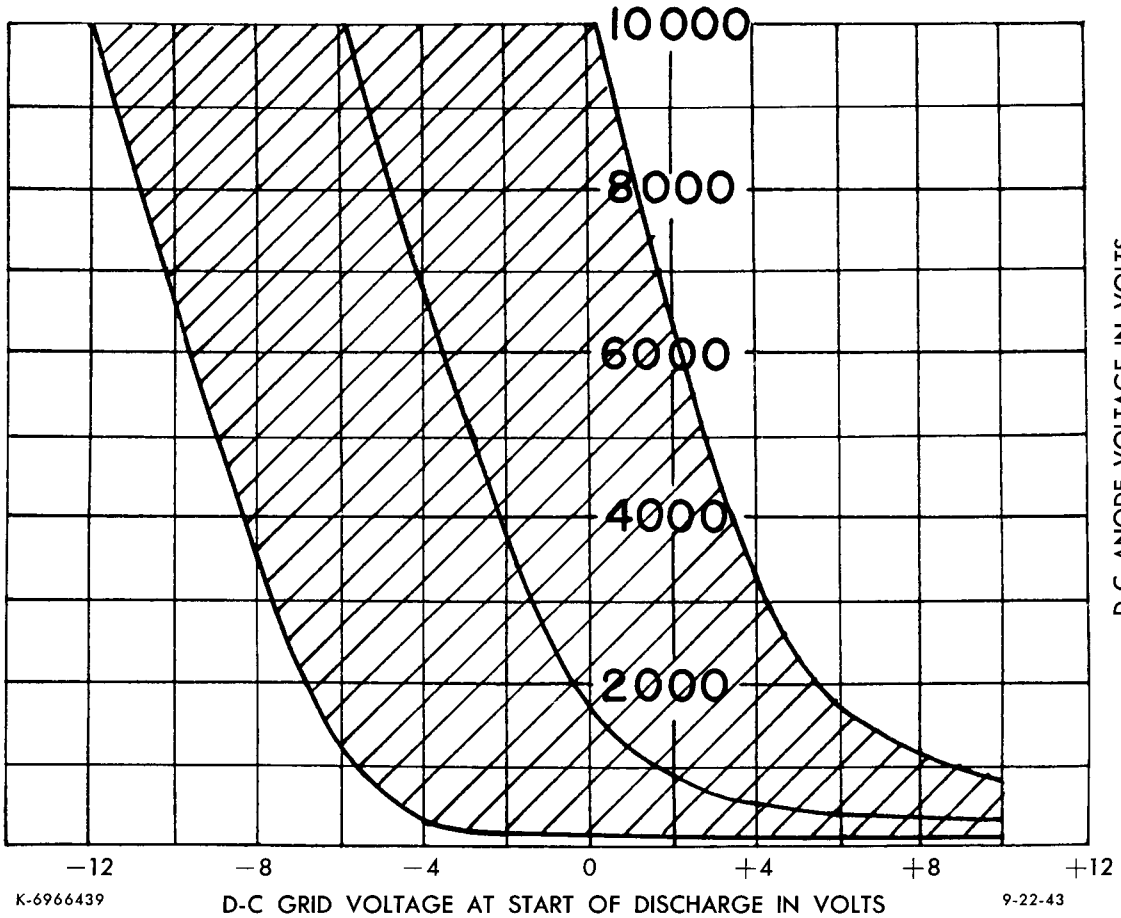
TECHNICAL INFORMATION (CONT'D)

Mechanical

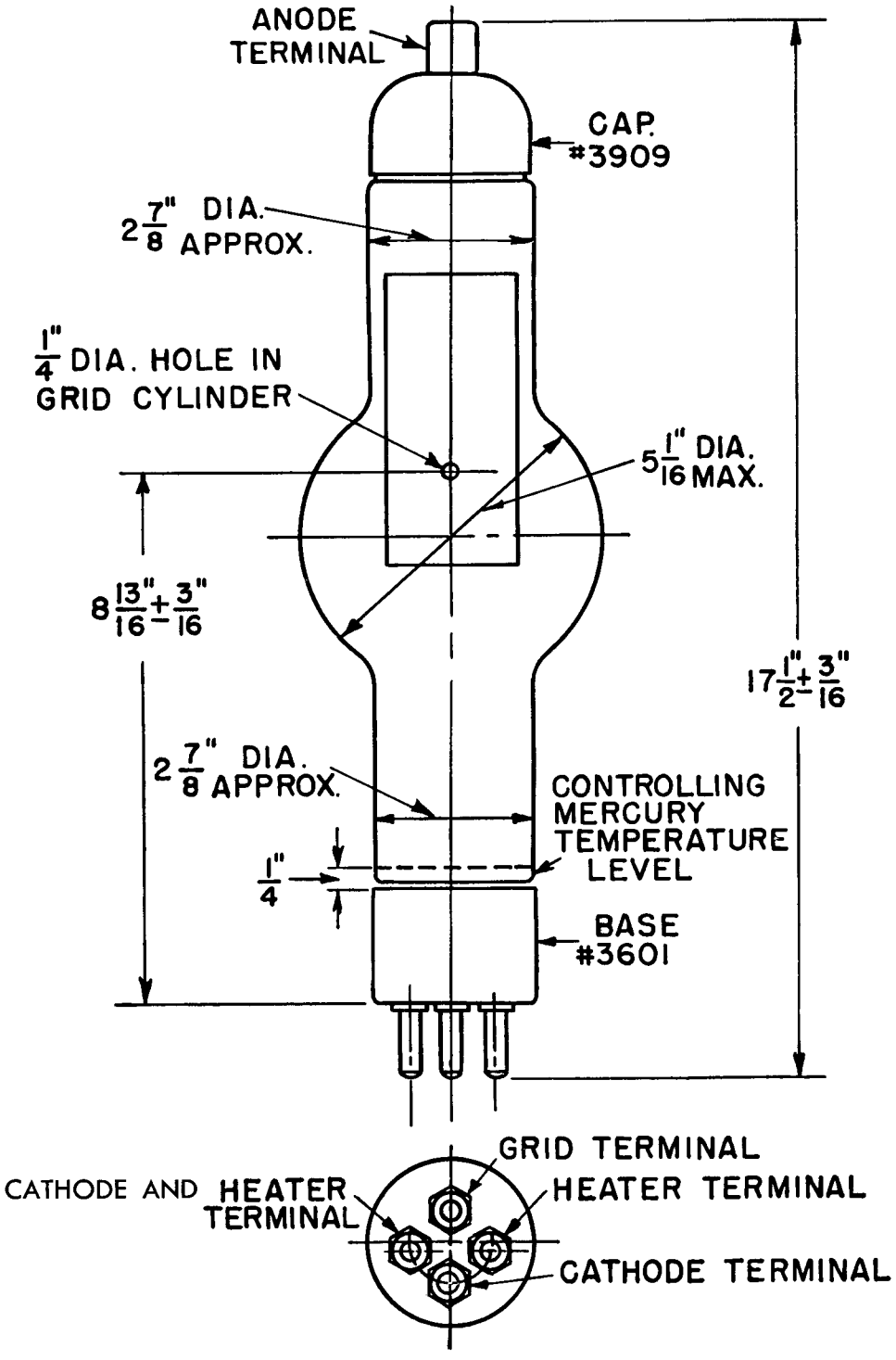
Net weight, approx	2	pounds
Shipping weight, approx	8	pounds
Mounting position		vertical, base down

MAXIMUM RATINGS

Maximum peak anode voltage		
Inverse	10,000	volts
Forward	10,000	volts
Maximum negative grid voltage		
Before conduction	1000	volts
During conduction	15	volts
Maximum anode current		
Instantaneous, 25 cycles and above	75	amperes
Instantaneous, below 25 cycles	25	amperes
Average	12.5	amperes
Surge, for design only	1500	amperes
Duration of surge current	0.1	second
Maximum grid current		
Instantaneous	5.0	amperes
Average	1.0	ampere
Maximum time of averaging current	30	seconds
Temperature limits, condensed mercury	+40 to +65	centigrade
Recommended temperature, condensed mercury	+40	centigrade



THYRATRON FG-41 TYPICAL CONTROL CHARACTERISTIC
SHADED AREA SHOWS RANGE OF CHARACTERISTICS
CONDENSED HG TEMPERATURE 40 C

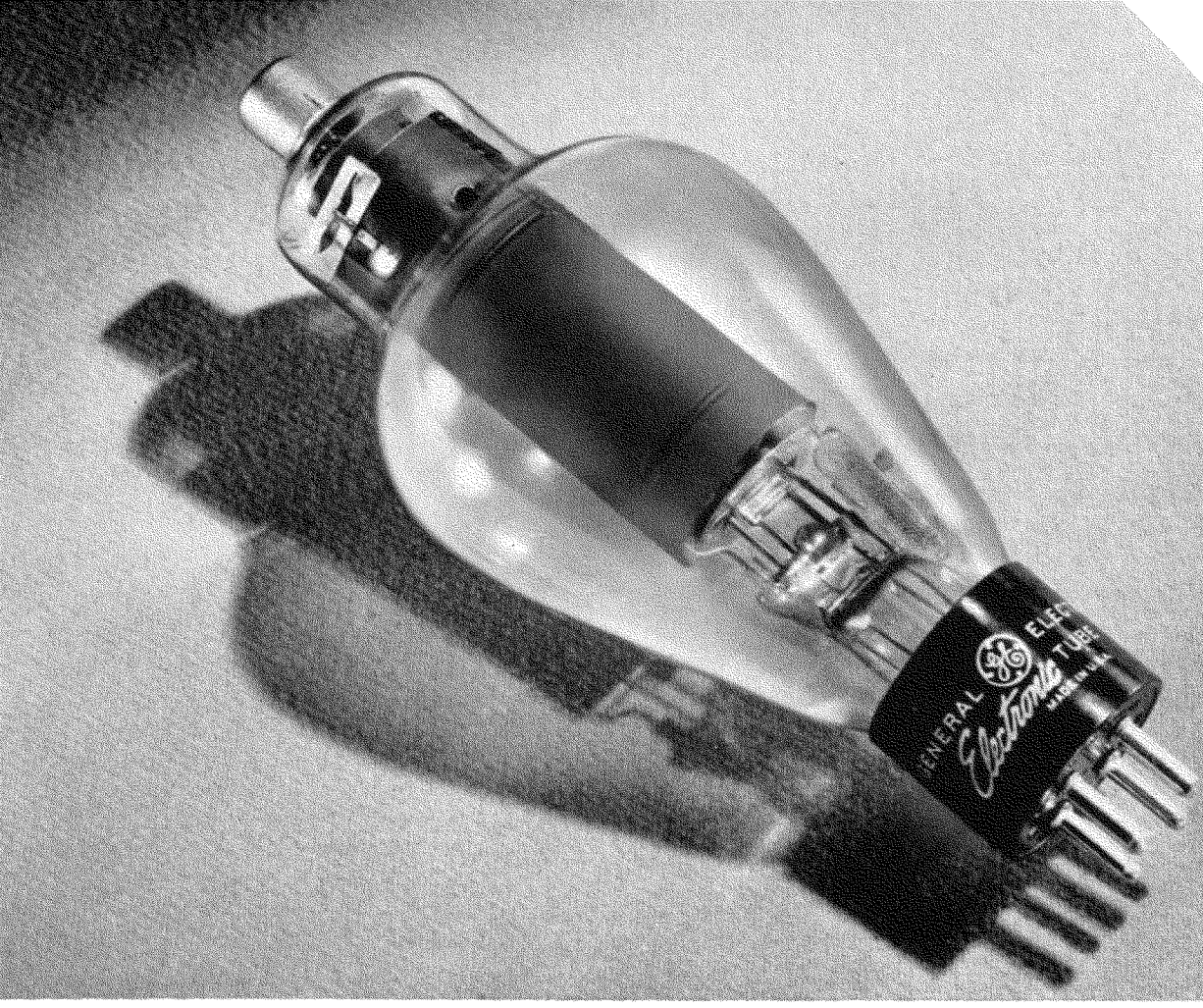


K-5182056 2-24-45

OUTLINE
FG-41 THYRATRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The FG-57 is a negative-control mercury-vapor tube for use where it is desired to actuate the tube with a change in negative grid voltage. It requires relatively little grid power and is suitable for use in relay circuits where current flow is desired in the absence of grid excitation.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes				3
Electrical				
Cathode—Indirectly heated type				
Voltage				5.0 volts
Current, approx				4.5 amperes
Heating time, typical				5 minutes
Peak voltage drop, typical				16 volts
Approximate control characteristics				
Anode voltage	60	100	1000	volts
Grid voltage	0	−1.75	−6.5	volts
Anode to grid capacitance, approx				4.4 micromicrofarads
Ionization time, approx				10 microseconds
Deionization time, approx				1000 microseconds

GE Electronic TUBE

GENERAL ELECTRIC

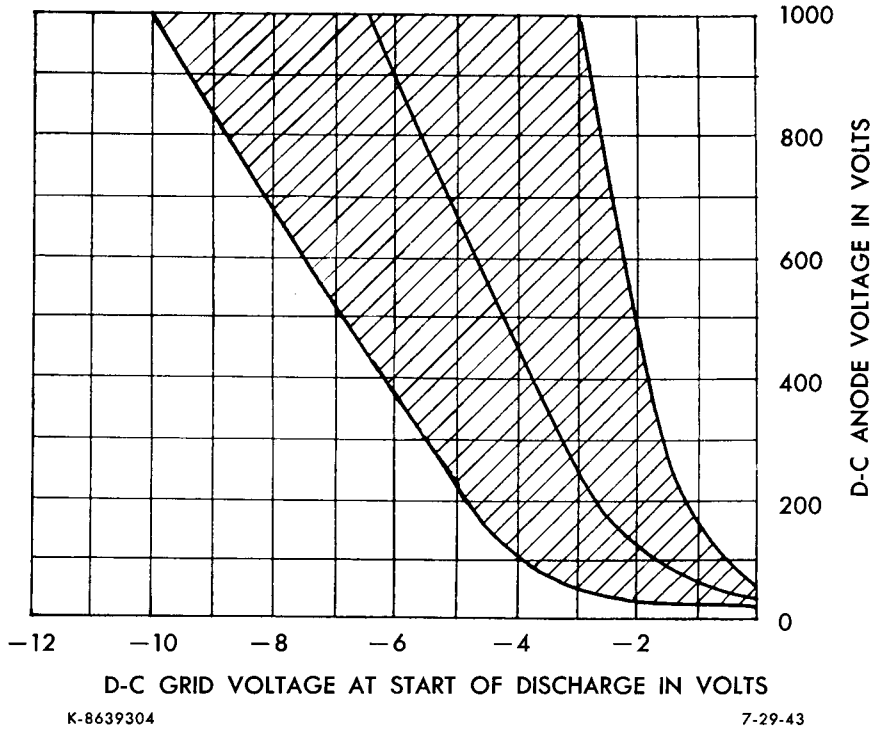
TECHNICAL INFORMATION (CONT'D)

Mechanical

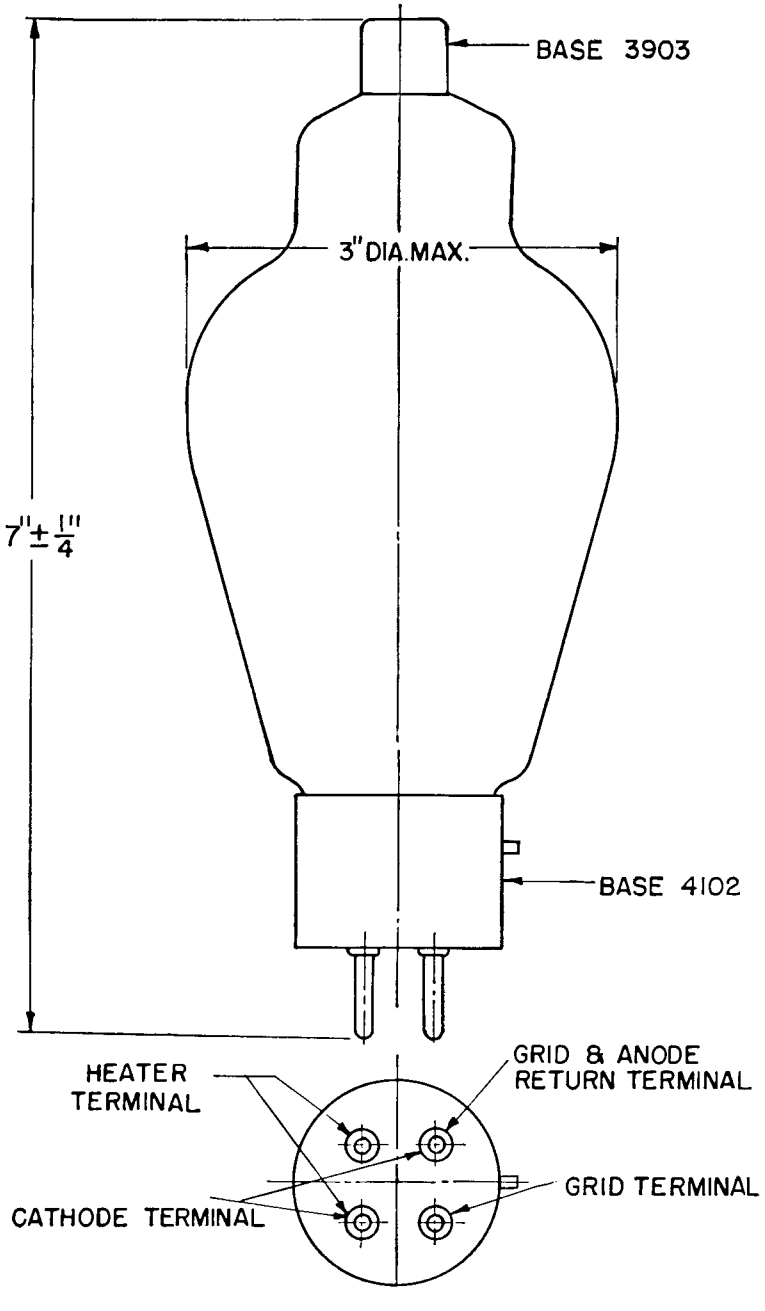
Net weight, approx	4	ounces
Shipping weight, approx	7	pounds
Mounting position		vertical, base down

MAXIMUM RATINGS

Maximum peak anode voltage		
Inverse	1000	volts
Forward	1000	volts
Maximum negative grid voltage		
Before conduction	500	volts
During conduction	10	volts
Maximum anode current		
Instantaneous, 25 cycles and above	15.0	amperes
Instantaneous, below 25 cycles	5.0	amperes
Average	2.5	amperes
Surge, for design only	200	amperes
Duration of surge current	0.1	second
Maximum grid current		
Instantaneous	1.0	ampere
Average	0.25	ampere
Maximum time of averaging current	15	seconds
Temperature limits, condensed mercury	+40 to +80	centigrade
Recommended temperature, condensed mercury	+40	centigrade



THYRATRON FG-57
TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS
CONDENSED MERCURY TEMPERATURE 40 C



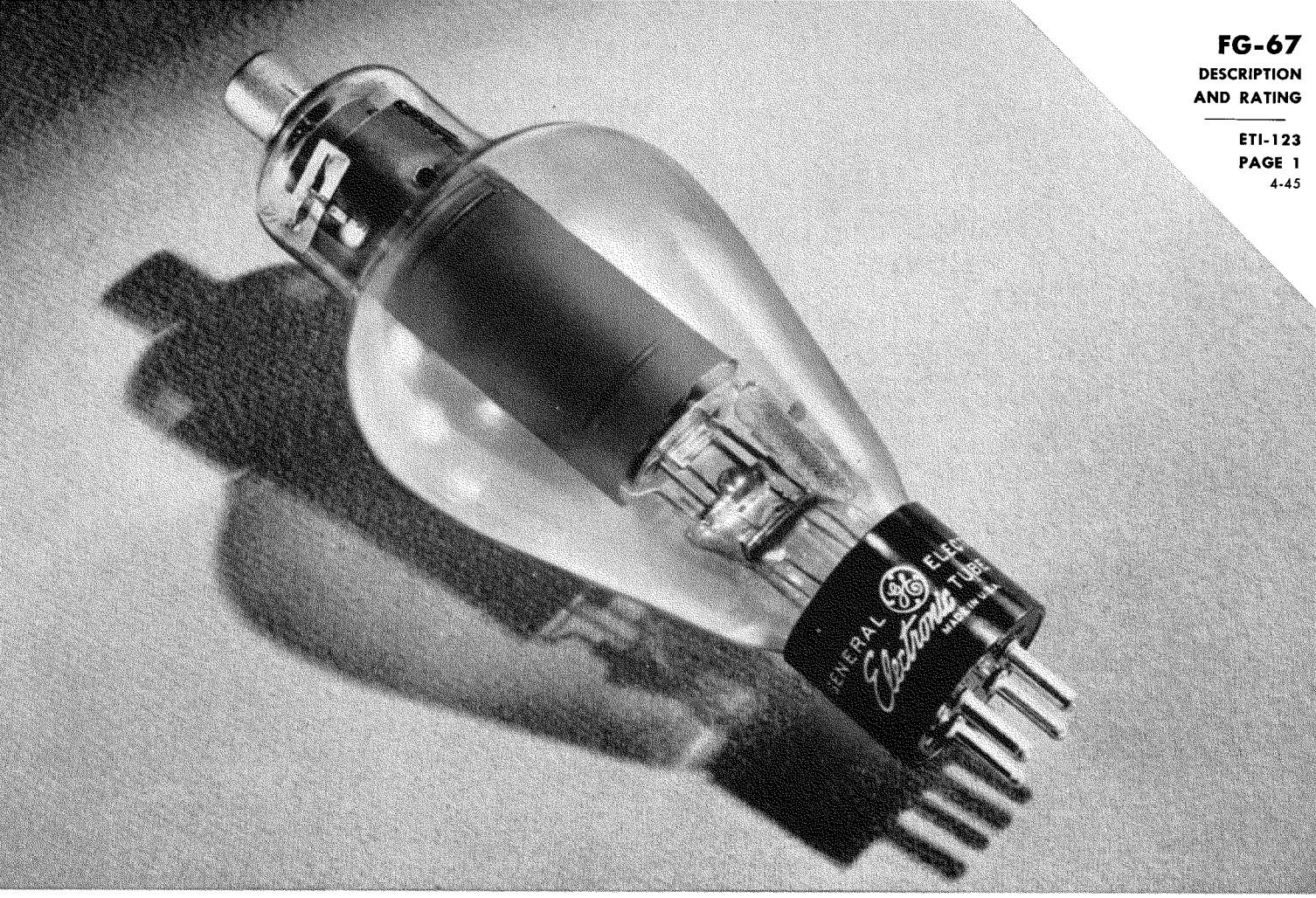
OUTLINE
FG-57 THYRATRON

K-4373343

12-11-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The FG-67 is a mercury-vapor thyratron with an intermediate control characteristic. This tube is particularly designed for use in inverter circuits where a short deionization time is required.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes			3
Electrical			
Cathode—Indirectly heated type			
Voltage			5.0 volts
Current, approx			4.5 amperes
Heating time, typical			5 minutes
Peak voltage drop, typical			16 volts
Approximate control characteristics			
Anode voltage	100	1000	volts
Grid voltage	+3.0	−0.5	volts
Anode to grid capacitance, approx			6.5 micromicrofarads
Ionization time, approx			20 microseconds
Deionization time, approx			100 microseconds

GE Electronic TUBE

GENERAL ELECTRIC

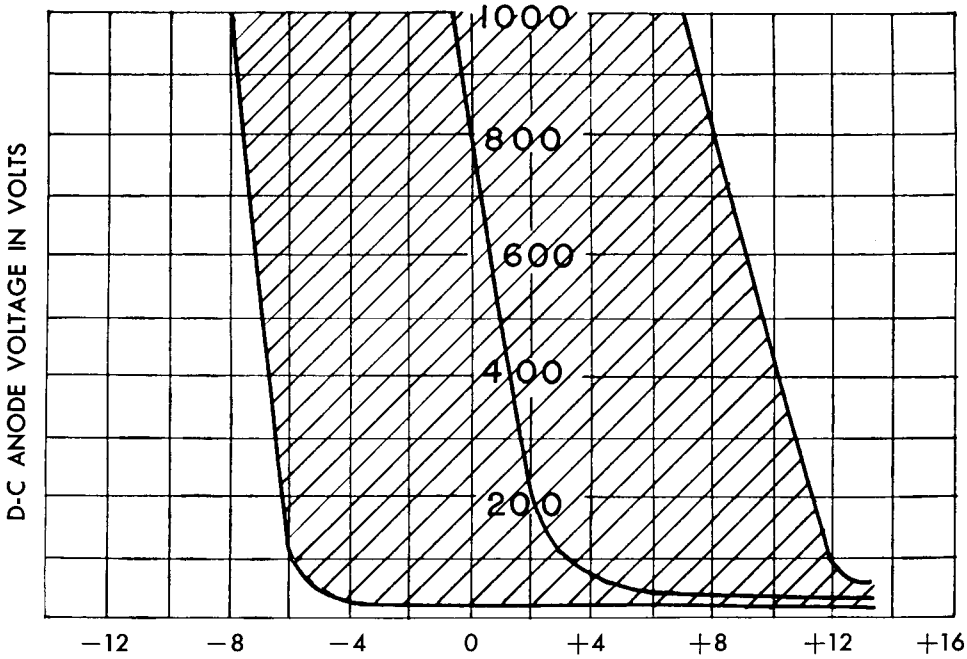
TECHNICAL INFORMATION (CONT'D)

Mechanical

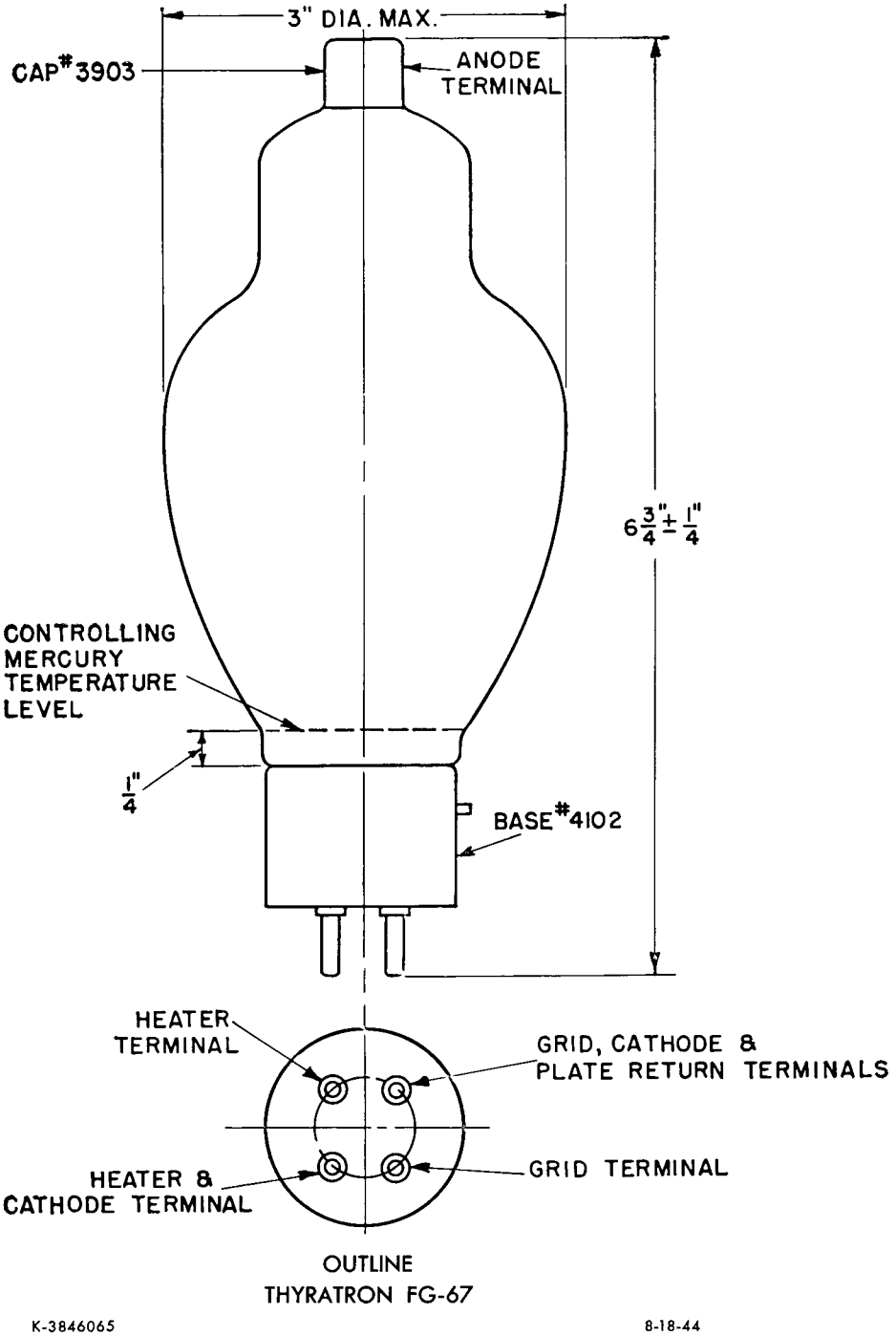
Net weight, approx	4	ounces
Shipping weight, approx	3	pounds
Mounting position		vertical, base down

MAXIMUM RATINGS

Maximum peak anode voltage		
Inverse	1000	volts
Forward	1000	volts
Maximum negative grid voltage		
Before conduction	500	volts
During conduction	5	volts
Maximum anode current		
Instantaneous, 25 cycles and above	15	amperes
Instantaneous, below 25 cycles	5.0	amperes
Average	2.5	amperes
Surge, for design only	200	amperes
Duration of surge current	0.1	second
Maximum grid current		
Instantaneous	1.0	ampere
Average	0.25	ampere
Maximum time of averaging current	15	seconds
Temperature limits, condensed mercury	+40 to +80	centigrade
Recommended temperature, condensed mercury	+40	centigrade



THYRATRON FG-67
TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS
CONDENSED HG TEMPERATURE 40 C



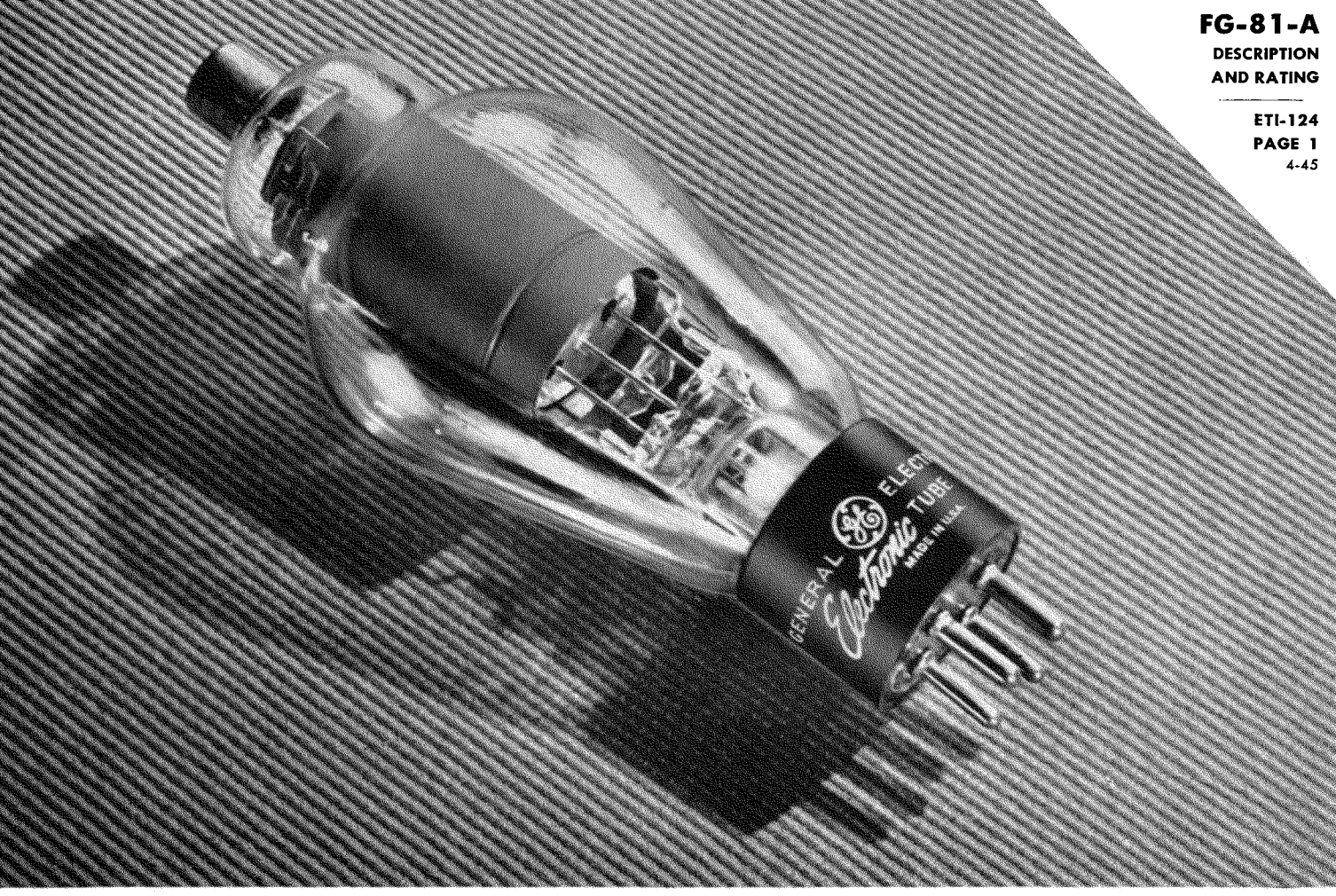
OUTLINE
THYRATRON FG-67

K-3846065

8-18-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The FG-81-A is an inert-gas-filled thyratron with a negative control characteristic.

Although inert-gas-filled tubes can be operated in much lower ambient temperatures than mercury-vapor types, they are not rated at as high voltages as mercury tubes of comparable size.

This tube is particularly adapted to applications where it is desired to have current flow in the absence of grid excitation, where constancy of characteristic is required with large variations in ambient temperature and where the tube is subjected to intermittent operation.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes				3
Electrical				
Cathode—Filamentary type				
Filament voltage				2.5 volts
Filament current, approx				5.0 amperes
Filament heating time, typical				5 seconds
Peak voltage drop, typical				16 volts
Approximate control characteristics				
Anode voltage	25	100	500	volts
Grid voltage	0	−3.0	−5.25	volts
Anode to grid capacitance, approx				4.4 micromicrofarads
Ionization time, approx				10 microseconds
Deionization time, approx				1000 microseconds

GE Electronic TUBE

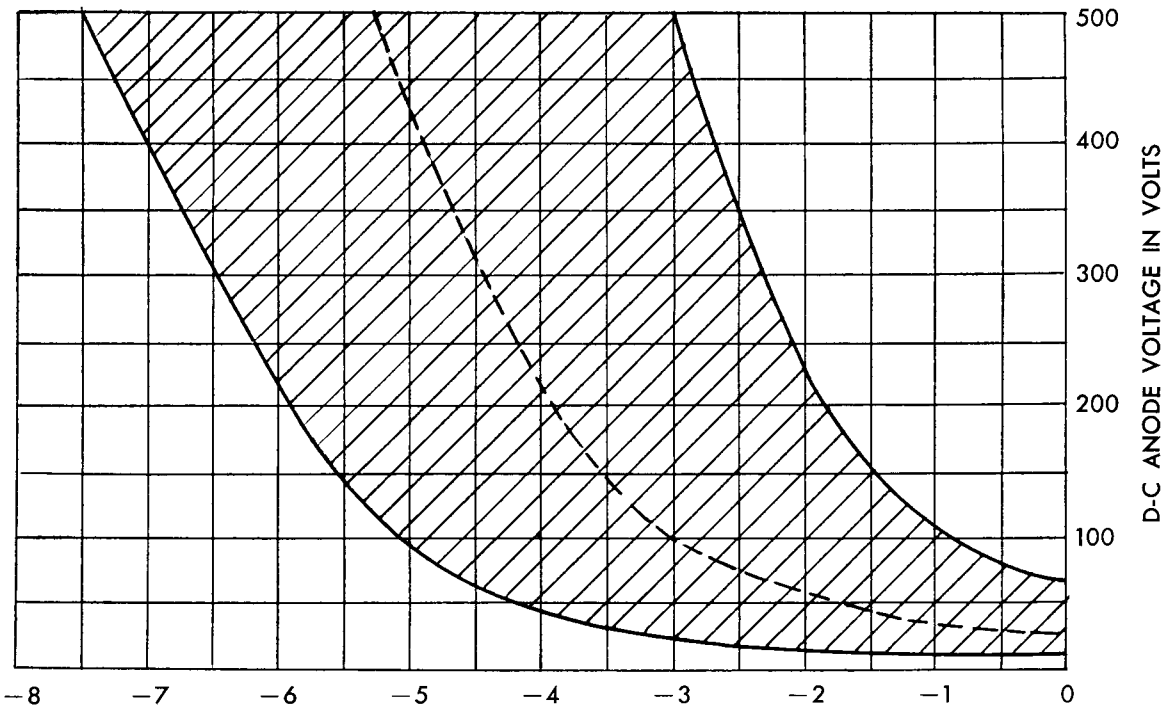
TECHNICAL INFORMATION (CONT'D)

Mechanical

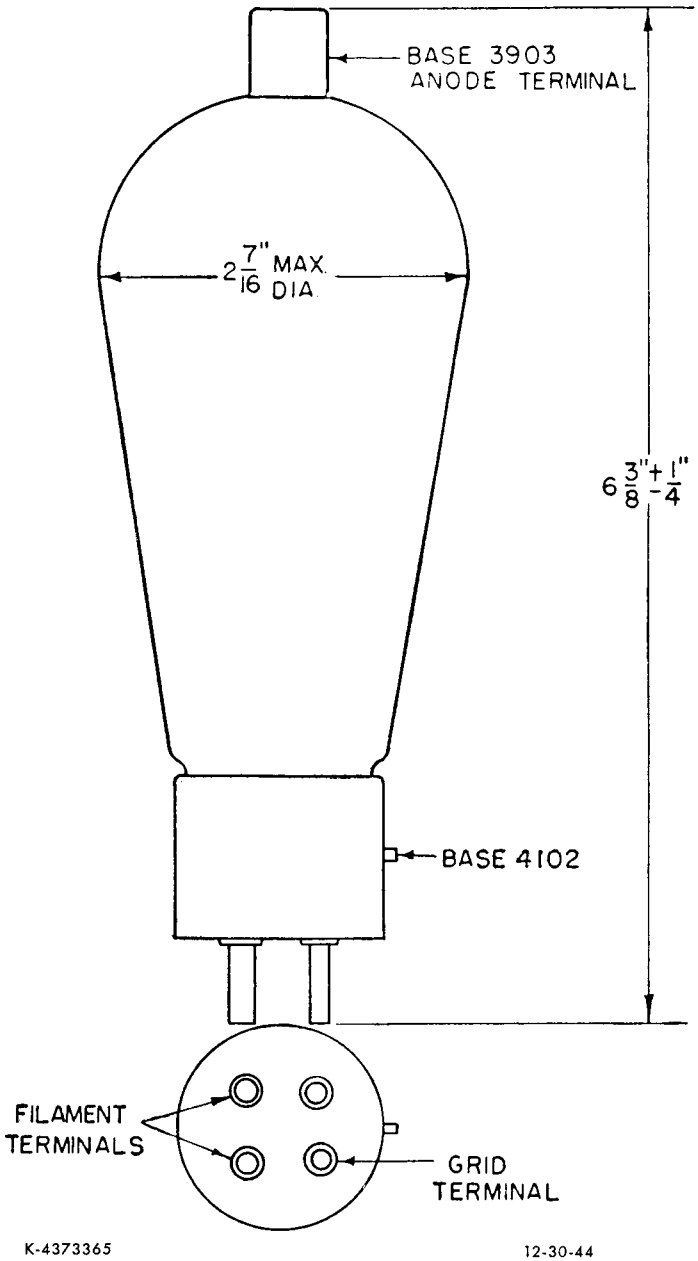
Net weight, approx	4 ounces
Shipping weight, approx	2 pounds
Mounting position	vertical, base down

MAXIMUM RATINGS

Maximum peak anode voltage	
Inverse	500 volts
Forward	500 volts
Maximum negative grid voltage	
Before conduction	70 volts
During conduction	10 volts
Maximum anode current	
Instantaneous, 25 cycles and above	2.0 amperes
Instantaneous, below 25 cycles	1.0 ampere
Average	0.5 ampere
Surge, for design only	40 amperes
Duration of surge current	0.1 second
Maximum grid current	
Instantaneous	0.25 ampere
Average	0.05 ampere
Maximum time of averaging current	15 seconds
Ambient temperature limits	−20 to +50 centigrade



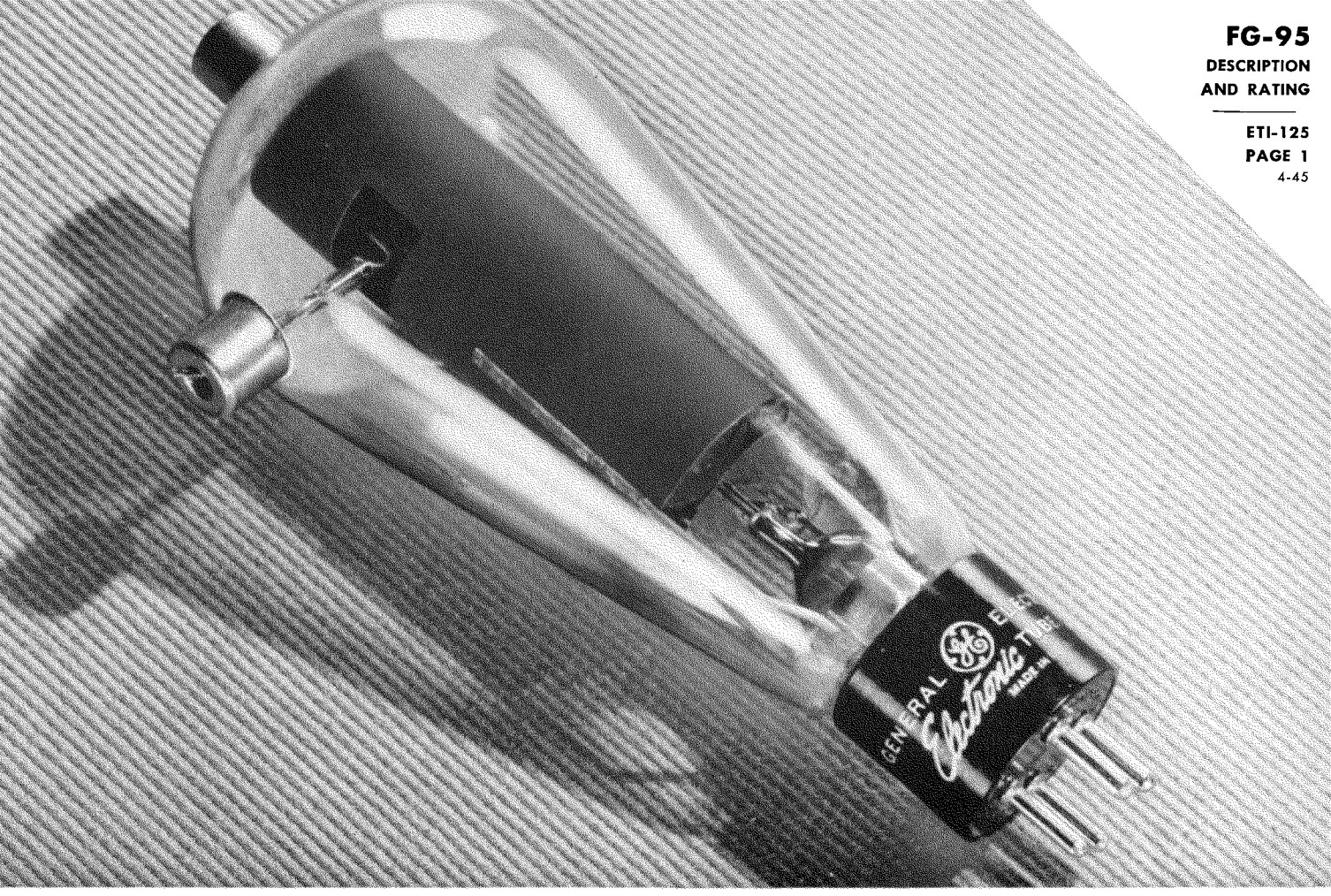
THYRATRON FG-81-A
TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS



OUTLINE
FG-81-A THYRATRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The FG-95 is a double-grid mercury-vapor thyratron for use in applications where the available grid power is very small and where it is desired to actuate the grid from a high-impedance source. It may be used in applications where the tube temperature can be maintained relatively constant.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes		4	
Electrical			
Cathode—Indirectly heated type			
Voltage	5.5*	5.0	volts
Current, approx	5.0*	4.5	amperes
Heating time, typical		5	minutes
Peak voltage drop, typical		16	volts
Approximate control characteristics			
Anode voltage	100	1000	volts
Shield-grid voltage	0	0	volts
Control-grid voltage	+1.0	−9.0	volts
Anode to control grid capacitance, approx		0.2	micromicrofarad
Ionization time, approx		10	microseconds
Deionization time, approx		1000	microseconds

**These ratings apply only when the tube is used for ignitor firing.*

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

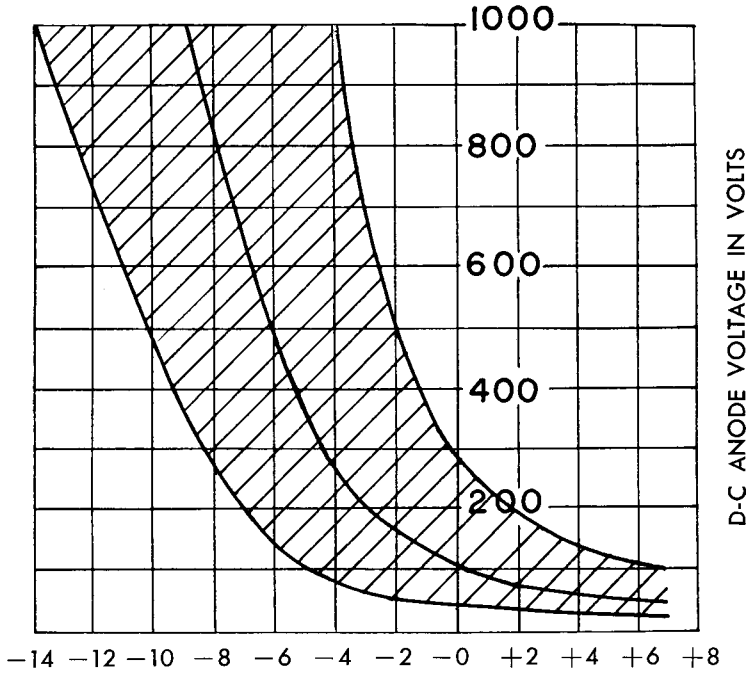
Mechanical

Net weight, approx	5	ounces
Shipping weight, approx	7	pounds
Operating position		vertical, base down

MAXIMUM RATINGS

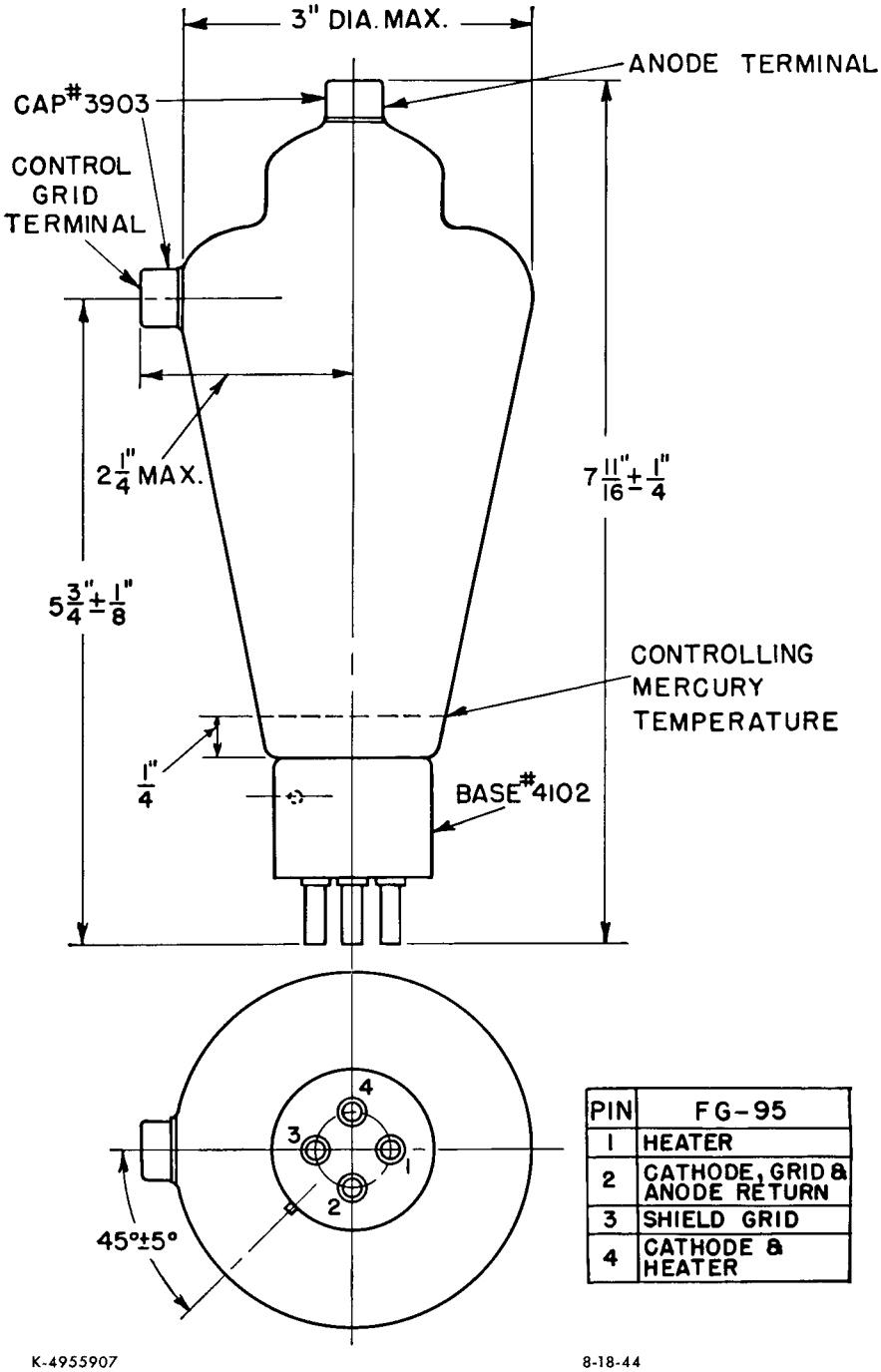
Maximum peak anode voltage			
Inverse		1000	volts
Forward		1000	volts
Maximum negative control-grid voltage			
Before conduction		1000	volts
During conduction		10	volts
Maximum negative shield-grid voltage			
Before conduction		300	volts
During conduction		5	volts
Maximum anode current			
Instantaneous, 25 cycles and above	30*	15	amperes
Instantaneous, below 25 cycles		5.0	amperes
Average	0.5*	2.5	amperes
Surge, for design only		200	amperes
Duration of surge current		0.1	second
Maximum control-grid current			
Instantaneous		1.0	ampere
Average		0.25	ampere
Maximum shield-grid current			
Instantaneous		1.0	ampere
Average		0.25	ampere
Maximum time of averaging current		15	seconds
Temperature limits, condensed mercury		+40 to +80	centigrade
Recommended temperature, condensed mercury		40	centigrade

**These ratings apply only when the FG-95 is used for ignitor firing.*



THYRATRON FG-95 TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS
CONDENSED MERCURY TEMPERATURE 40 C
SHIELD-GRID VOLTAGE ZERO

K-8639318 9-22-43



PIN	FG-95
1	HEATER
2	CATHODE, GRID & ANODE RETURN
3	SHIELD GRID
4	CATHODE & HEATER

OUTLINE
FG-95 THYRATRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The FG-97 is a mercury-vapor double-grid thyratron designed for applications where the available grid power is very small and where it is desired to actuate the grid from a high-impedance source. It may be used in applications where the tube temperature can be maintained relatively constant.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes			4
Electrical			
Cathode—Filamentary type			
Filament voltage			2.5 volts
Filament current, approx			5.0 amperes
Filament heating time, typical			5 seconds
Peak voltage drop, typical			16 volts
Approximate control characteristics			
Anode voltage	100	1000	volts
Shield-grid voltage	0	0	volts
Control-grid voltage	+0.5	−13.0	volts
Anode to control-grid capacitance, approx			0.3 micromicrofarad
Ionization time, approx			10 microseconds
Deionization time, approx			1000 microseconds

GE Electronic TUBE

GENERAL ELECTRIC

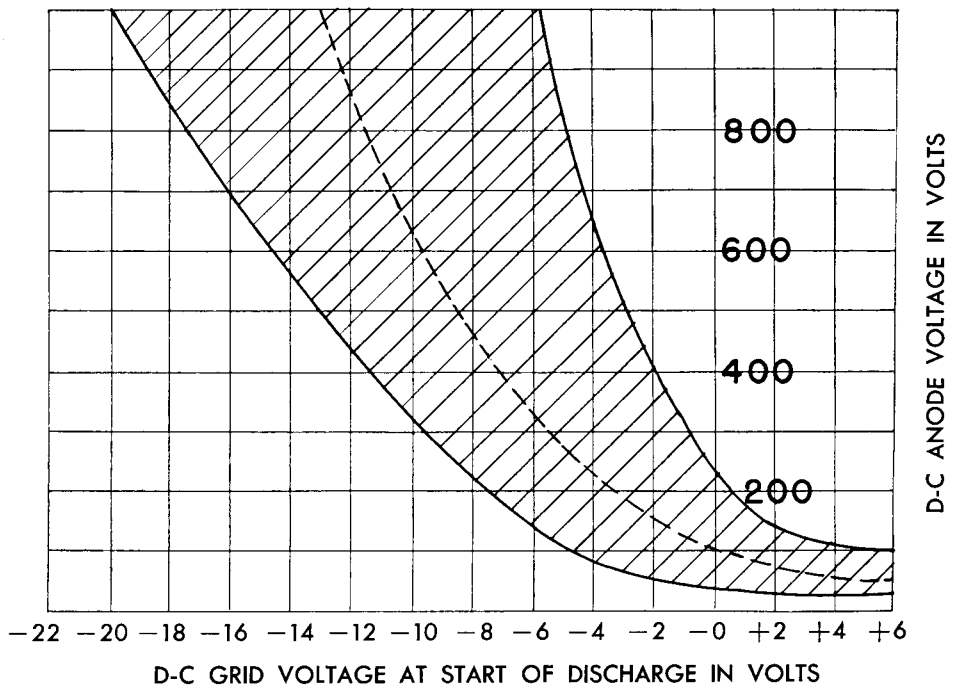
TECHNICAL INFORMATION (CONT'D)

Mechanical

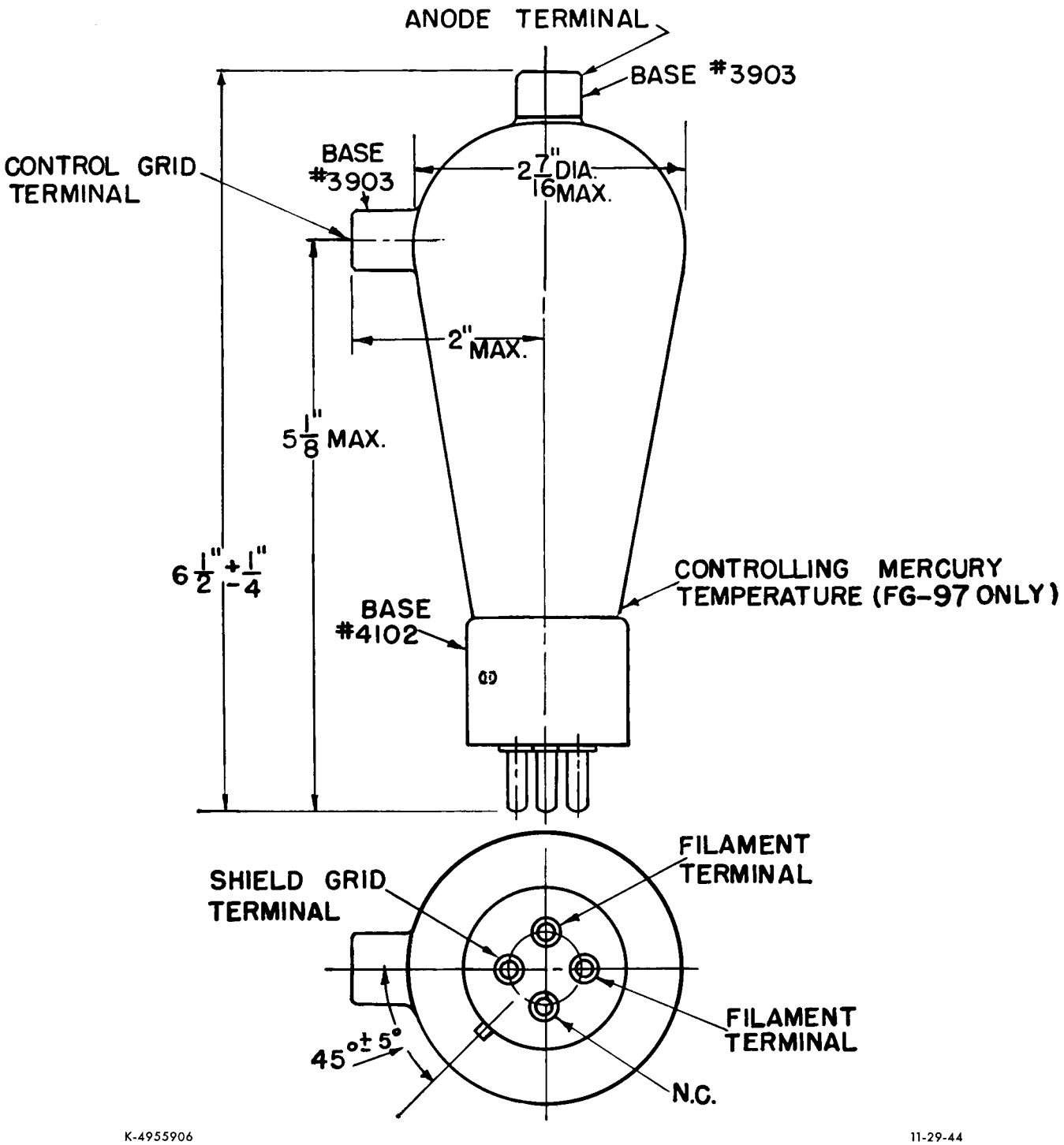
Net weight, approx	5 ounces
Shipping weight, approx	4 pounds
Operating position	vertical, base down

MAXIMUM RATINGS

Maximum peak anode voltage	
Inverse	1000 volts
Forward	1000 volts
Maximum negative control-grid voltage	
Before conduction	1000 volts
During conduction	10 volts
Maximum negative shield-grid voltage	
Before conduction	300 volts
During conduction	5 volts
Maximum anode current	
Instantaneous, 25 cycles and above	2.0 amperes
Instantaneous, below 25 cycles	1.0 ampere
Average	0.5 ampere
Surge, for design only	40 amperes
Duration of surge current	0.1 second
Maximum control-grid current	
Instantaneous	0.25 ampere
Average	0.05 ampere
Maximum shield-grid current	
Instantaneous	0.25 ampere
Average	0.05 ampere
Maximum time of averaging current	15 seconds
Temperature limits, condensed mercury	+40 to +80 centigrade
Recommended temperature, condensed mercury	40 centigrade



THYRATRON FG-97
TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS
CONDENSED MERCURY TEMPERATURE 40 C
SHIELD GRID VOLTAGE ZERO



OUTLINE
FG-97 THYRATRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The FG-98-A is a double-grid inert-gas-filled thyratron designed for applications where the available grid power is very small and where it is desired to actuate the grid from a high-impedance source. It is also used in applications where wide variations in ambient temperature will be encountered.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes			4	
Electrical				
Cathode—Filamentary type				
Filament voltage			2.5	volts
Filament current, approx			5.0	amperes
Filament heating time, typical			5	seconds
Peak voltage drop, typical			16	volts
Approximate control characteristics				
Anode voltage	35	100	500	volts
Shield-grid voltage	0	0	0	volts
Control-grid voltage	0	−5.0	−11.0	volts
Anode to control-grid capacitance, approx			0.5	micromicrofarad
Ionization time, approx			10	microseconds
Deionization time, approx			1000	microseconds

GE Electronic TUBE

GENERAL ELECTRIC

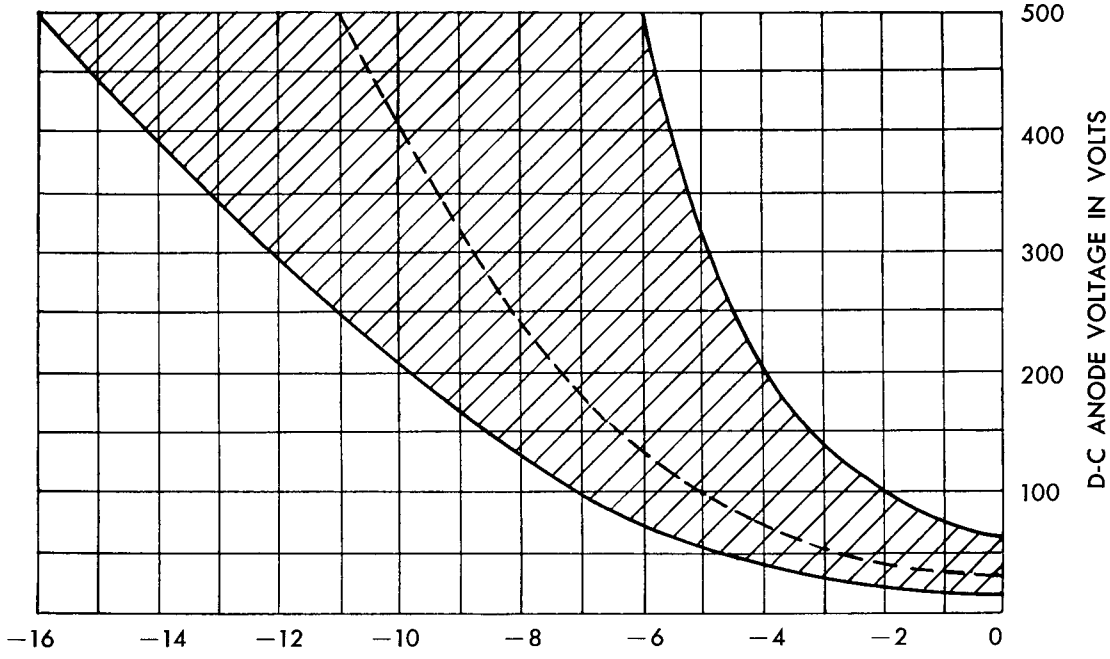
TECHNICAL INFORMATION (CONT'D)

Mechanical

Net weight, approx	5	ounces
Shipping weight, approx	4	pounds
Operating position	Vertical, base down	

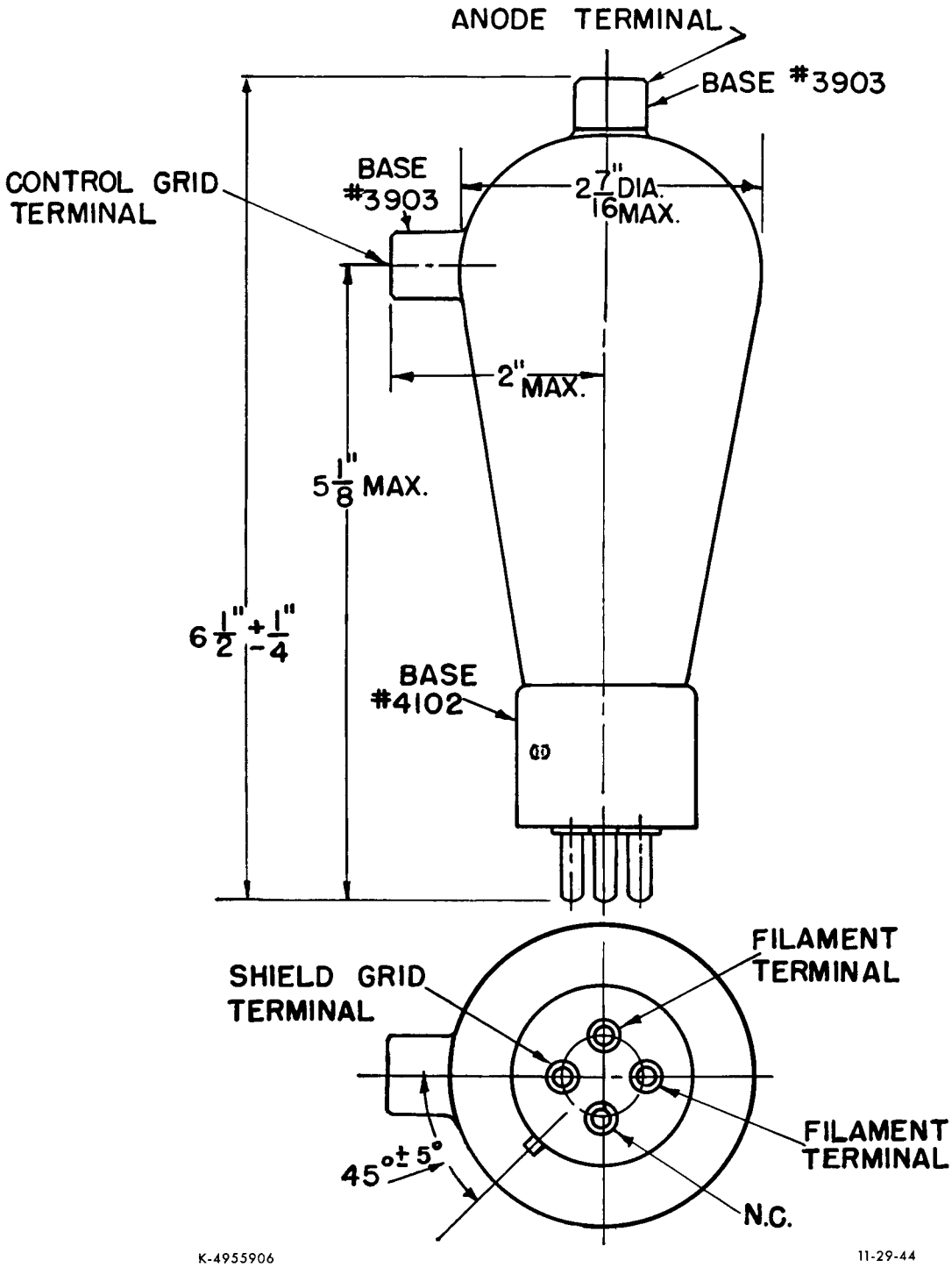
MAXIMUM RATINGS

Maximum peak anode voltage		
Inverse	500	volts
Forward	500	volts
Maximum negative control-grid voltage		
Before conduction	70	volts
During conduction	10	volts
Maximum negative shield-grid voltage		
Before conduction	50	volts
During conduction	5	volts
Maximum anode current		
Instantaneous, 25 cycles and above	2.0	amperes
Instantaneous, below 25 cycles	1.0	ampere
Average	0.5	ampere
Surge, for design only	40	amperes
Duration of surge current	0.1	second
Maximum control-grid current		
Instantaneous	0.25	ampere
Average	0.05	ampere
Maximum shield-grid current		
Instantaneous	0.25	ampere
Average	0.05	ampere
Maximum time of averaging current	15	seconds
Ambient temperature limits	−20 to +50	centigrade



K-6917473 8-20-43

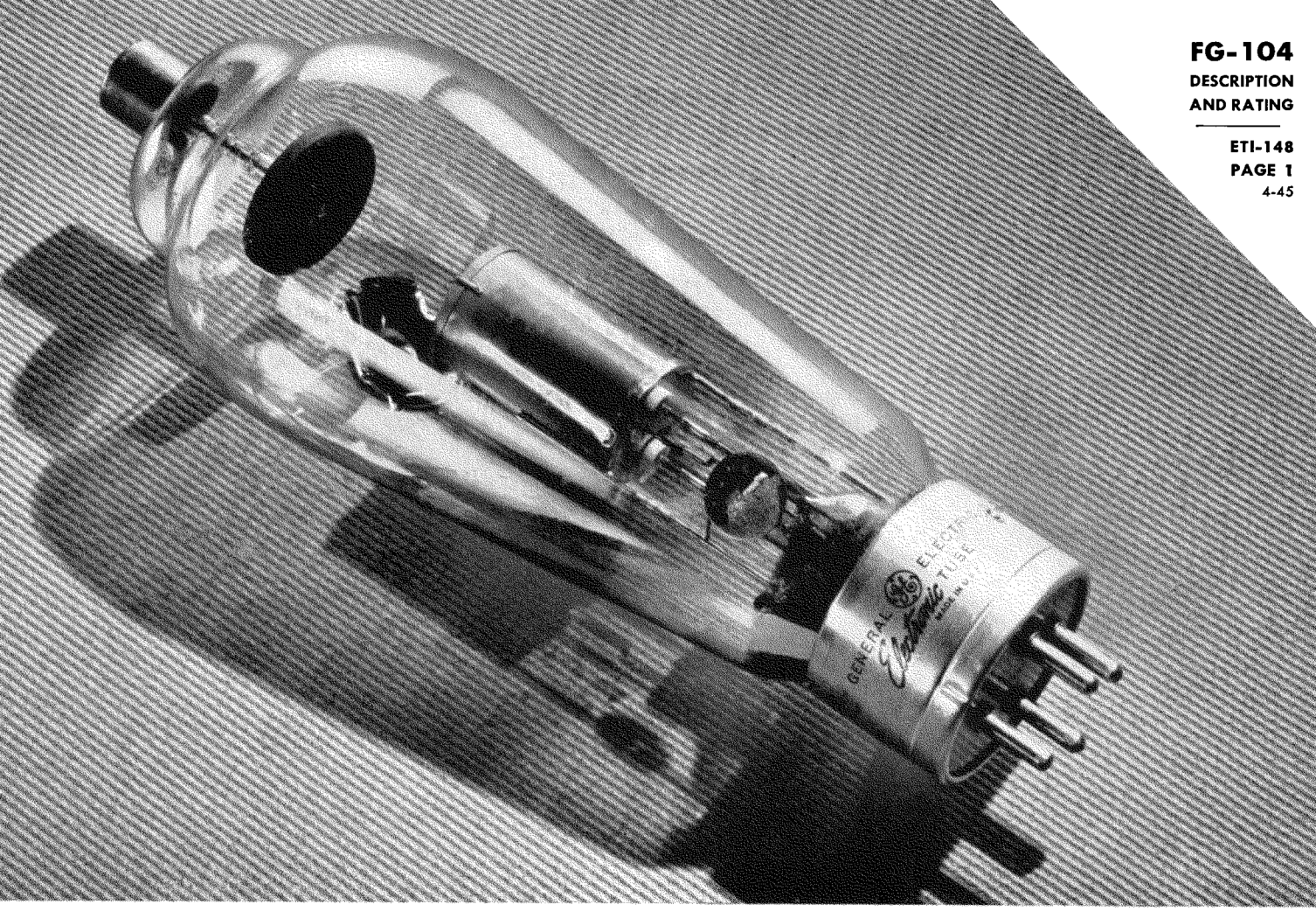
THYRATRON FG-98-A
TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS
SHIELD GRID VOLTAGE ZERO



OUTLINE
FG-98-A THYRATRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PHANOTRON

DESCRIPTION

The FG-104 is a half-wave, mercury-vapor rectifier for converting alternating current to direct current. It is suitable for applications where rectification of higher currents at lower frequencies and voltages is desired than is possible with high-vacuum tubes. In comparison with high-vacuum tubes, the FG-104 has a low and constant voltage drop which is an advantage in low-voltage rectifier applications since it allows more efficient utilization of power and results in lower circuit losses.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

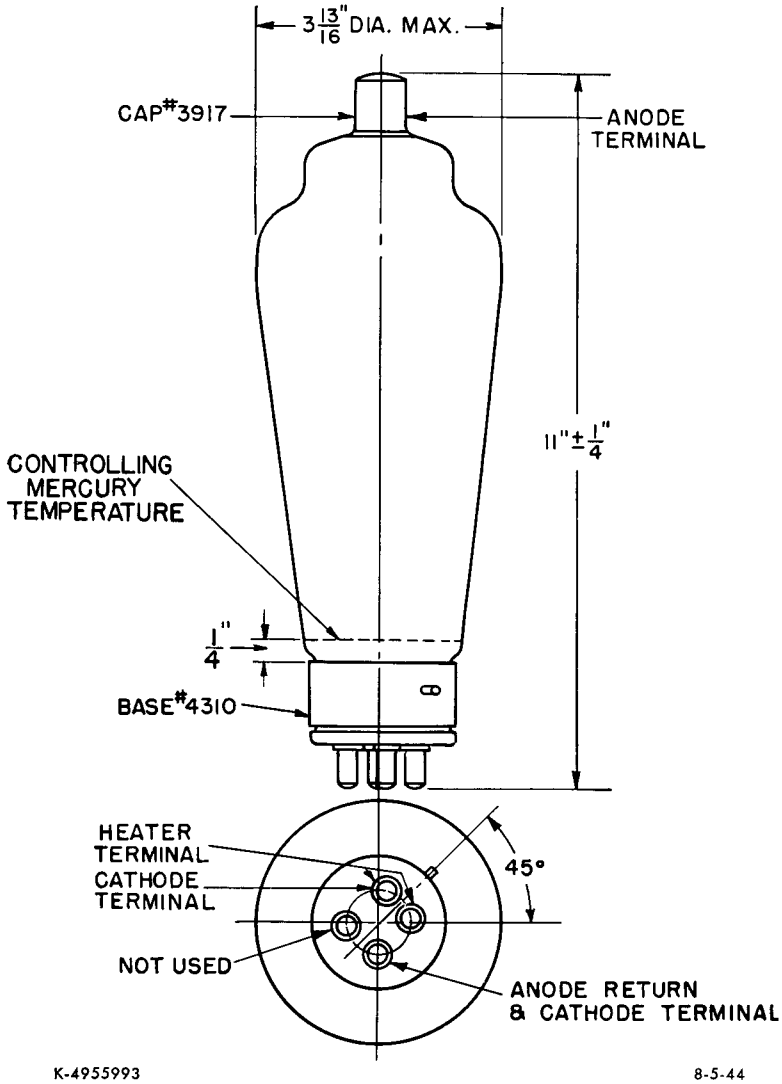
Number of electrodes	2	
Electrical		
Cathode—Indirectly heated type		
Heater voltage	5.0	volts
Heater current, approx.	10.0	amperes
Heating time, typical	5	minutes
Peak voltage drop, typical	15	volts
Mechanical		
Net weight, approx	12	ounces
Shipping weight, approx.	3	pounds
Mounting position	vertical, with base down	

Electronic TUBE

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

	Continuous Service	Welder-Control Service	
Maximum peak inverse anode voltage	3000	10,000	volts
Maximum anode current			
Instantaneous			
25 cycles and above	40	16	amperes
Below 25 cycles	12.8	8	amperes
Average anode current	6.4	4	amperes
Surge anode current, for design only	200	80	amperes
Duration of surge current	0.1	0.1	seconds
Maximum time of averaging current	15	15	seconds
Temperature limits, condensed mercury	+40 +80	+25 +50	centigrade
Recommended temperature, condensed mercury	40	40	centigrade

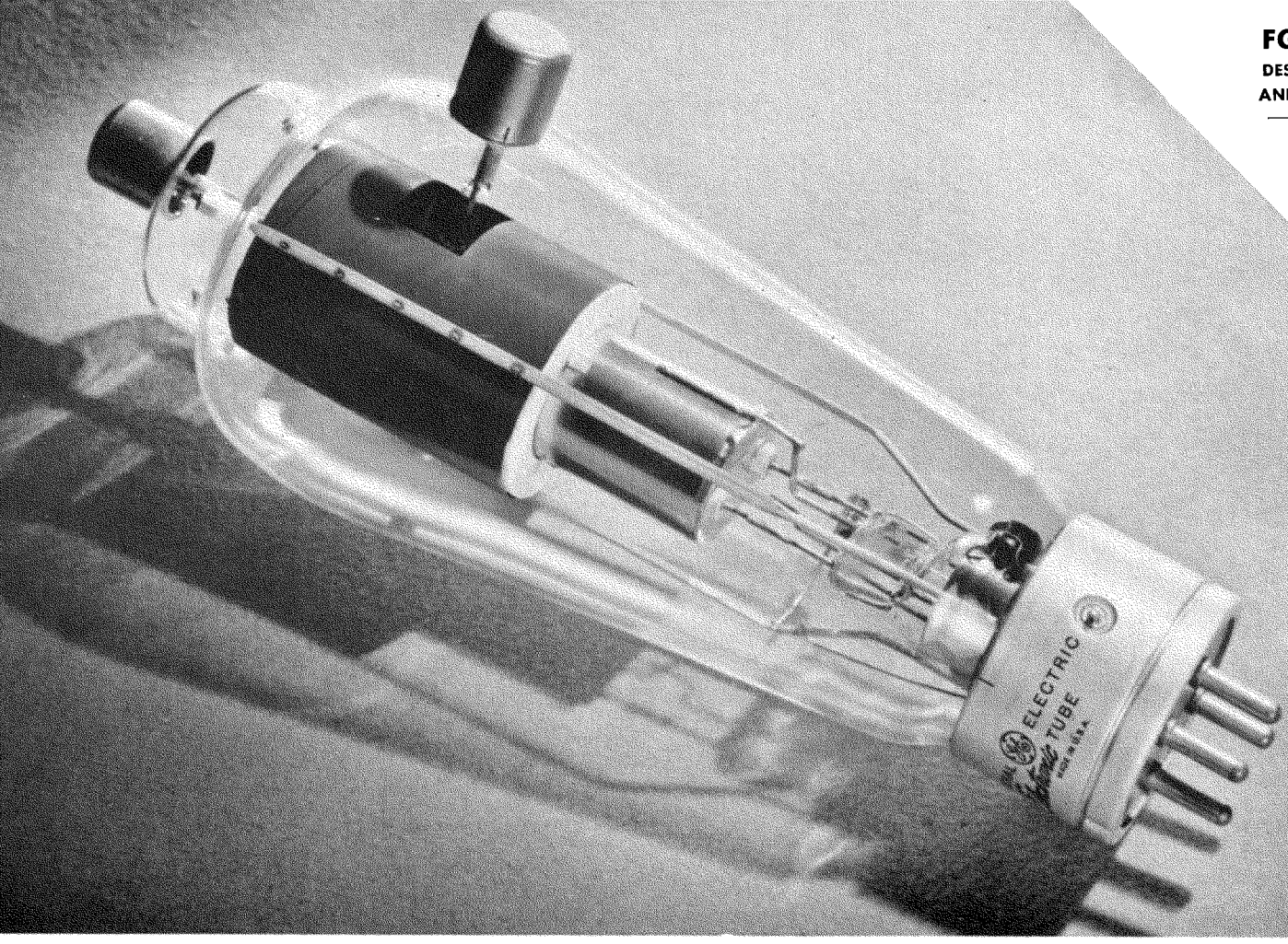


OUTLINE FG-104

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



THYRATRON

DESCRIPTION

The FG-105 is a double-grid, mercury-vapor thyratron. Double-grid tubes are designed for applications where the grid is actuated from a high-impedance source and where available grid power is small.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes 4

Electrical	Continuous Service		Intermittent Service		
Cathode—Indirectly heated type					
Voltage	5.0		5.5	5.0	volts
Current, approx	10.0		11.0	10.0	amperes
Heating time, typical	5		5	5	minutes
Peak voltage drop, typical	16		16	16	volts
Approximate control characteristics					
Anode voltage	100	1000	100	1000	volts
Shield-grid voltage	0	0	0	0	volts
Control-grid voltage	+1.0	−9.0	+1.0	−9.0	volts
Anode-to-control grid capacitance, approx	0.3		0.3	0.3	micromicrofarad
Ionization time, approx	10		10	10	microseconds
Deionization time, approx	1000		1000	1000	microseconds

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

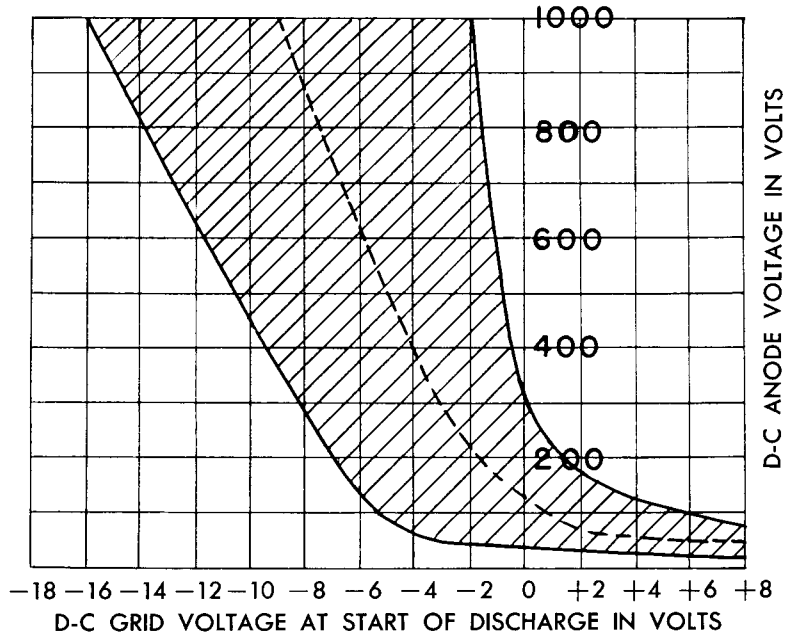
Net weight, approx	22 ounces
Shipping weight, approx	7 pounds
Mounting position	vertical, base down

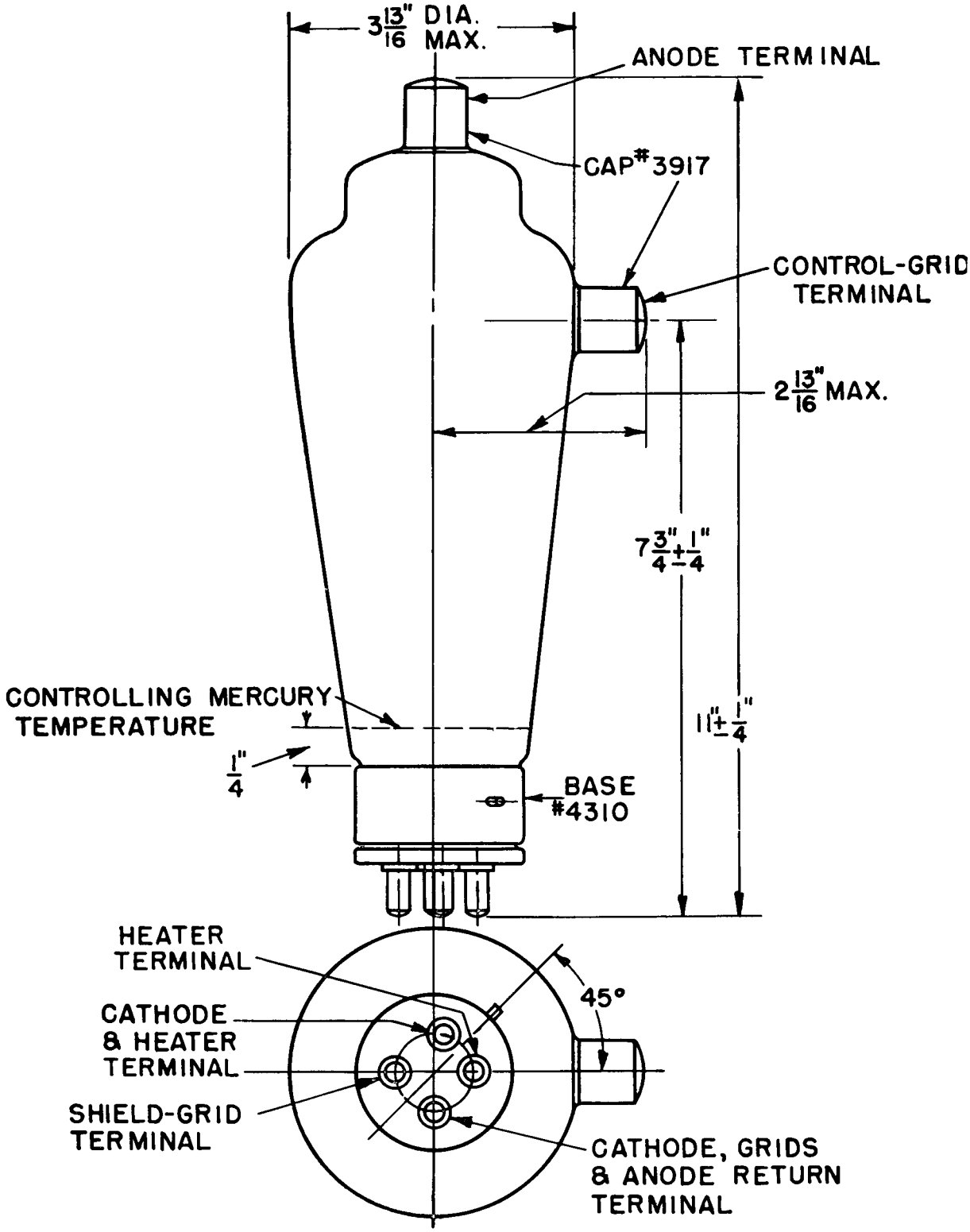
MAXIMUM RATINGS

	Continuous Service	Intermittent* Service		
Maximum peak anode voltage				
Inverse	2500	750	10,000	volts
Forward	2500	750	10,000	volts
Maximum negative control-grid voltage				
Before conduction	1000	1000	1000	volts
During conduction	10	10	10	volts
Maximum negative shield-grid voltage				
Before conduction	500	500	500	volts
During conduction	10	10	10	volts
Maximum anode current				
Instantaneous, 25 cycles and above	40	77	16	amperes
Instantaneous, below 25 cycles	12.8	5.0	8.0	amperes
Average	6.4	2.5	4.0	amperes
Surge, for design only	400	400	160	amperes
Duration of surge current	0.1	0.1	0.1	second
Maximum control-grid current				
Instantaneous	1.0	1.0	1.0	ampere
Average	0.25	0.25	0.25	ampere
Maximum shield-grid current				
Instantaneous	2.0	2.0	2.0	amperes
Average	0.50	0.50	0.50	ampere
Maximum time of averaging current	15	5	15	seconds
Temperature limits, condensed mercury	+40 to +80	+30 to +95	+25 to +50	centigrade
Recommended temperature, condensed mercury	40	40	40	centigrade

**Interpolate linearly for values of anode current and temperature for operation at voltages between 2500 and 10,000 volts.*

THYRATRON FG-105 TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS
CONDENSED H_G TEMPERATURE 40C
SHIELD GRID VOLTAGE ZERO





OUTLINE
FG-105 THYRATRON

K-4955972

8-10-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The FG-154 is a double-grid inert-gas-filled thyratron for use in applications where the available grid power is very small and where the grid must be actuated from a high-impedance source. It is also used in applications where wide variations in ambient temperature will be encountered.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes			4	
Electrical				
Cathode—Filamentary type				
Filament voltage			5.0	volts
Filament current, approx			7.0	amperes
Filament heating time, typical			10	seconds
Peak voltage drop, typical			16	volts
Approximate control characteristics				
Anode voltage	60	100	500	volts
Shield-grid voltage	0	0	0	volts
Control-grid voltage	0	−3.5	−9.0	volts
Anode to control-grid capacitance, approx			0.3	micromicrofarad
Ionization time, approx			10	microseconds
Deionization time, approx			1000	microseconds

GE Electronic TUBE

GENERAL ELECTRIC

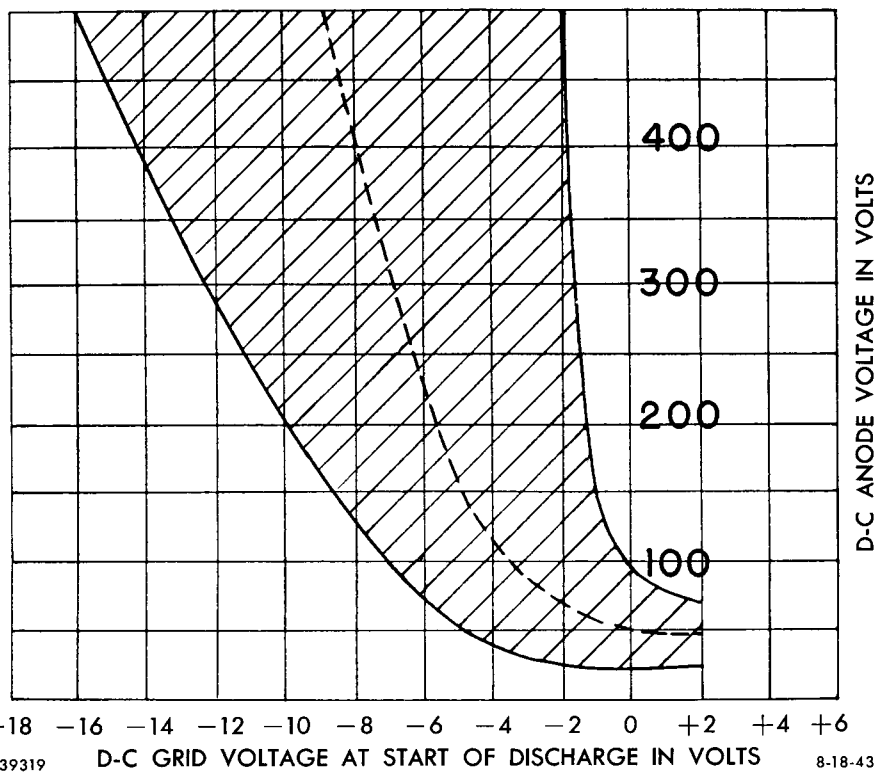
TECHNICAL INFORMATION (CONT'D)

Mechanical

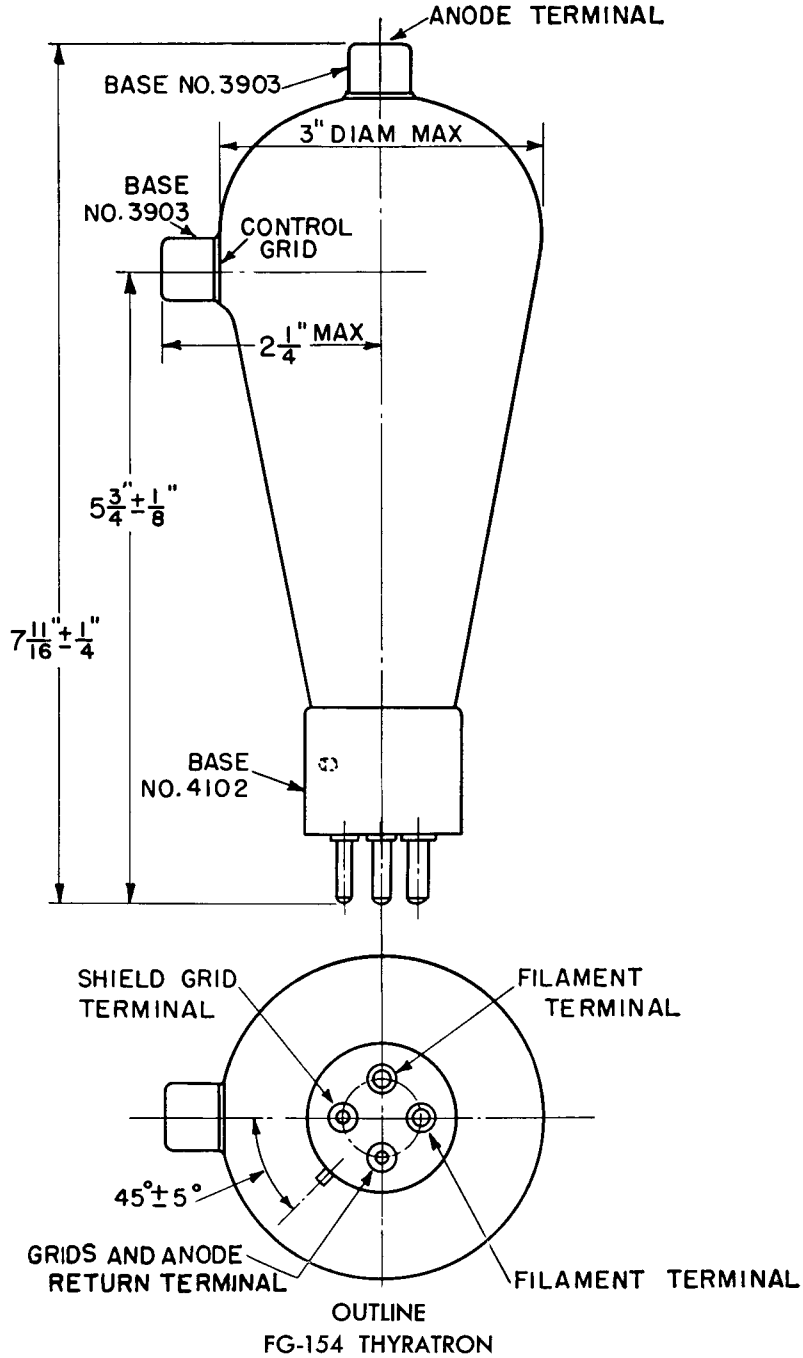
Net weight, approx	5	ounces
Shipping weight, approx	7	pounds
Operating position		vertical, base down

MAXIMUM RATINGS

Maximum peak anode voltage		
Inverse	500	volts
Forward	500	volts
Maximum negative control-grid voltage		
Before conduction	300	volts
During conduction	10	volts
Maximum negative shield-grid voltage		
Before conduction	50	volts
During conduction	5	volts
Maximum anode current		
Instantaneous, 25 cycles and above	10.0	amperes
Instantaneous, below 25 cycles	5.0	amperes
Average	2.5	amperes
Surge, for design only	160	amperes
Duration of surge current	0.1	second
Maximum control-grid current		
Instantaneous	1.0	amperes
Average	0.25	ampere
Maximum shield-grid current		
Instantaneous	1.0	amperes
Average	0.25	ampere
Maximum time of averaging current	15	seconds
Ambient temperature limits	−20 to +50	centigrade



THYRATRON FG-154
TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS
SHIELD GRID VOLTAGE ZERO

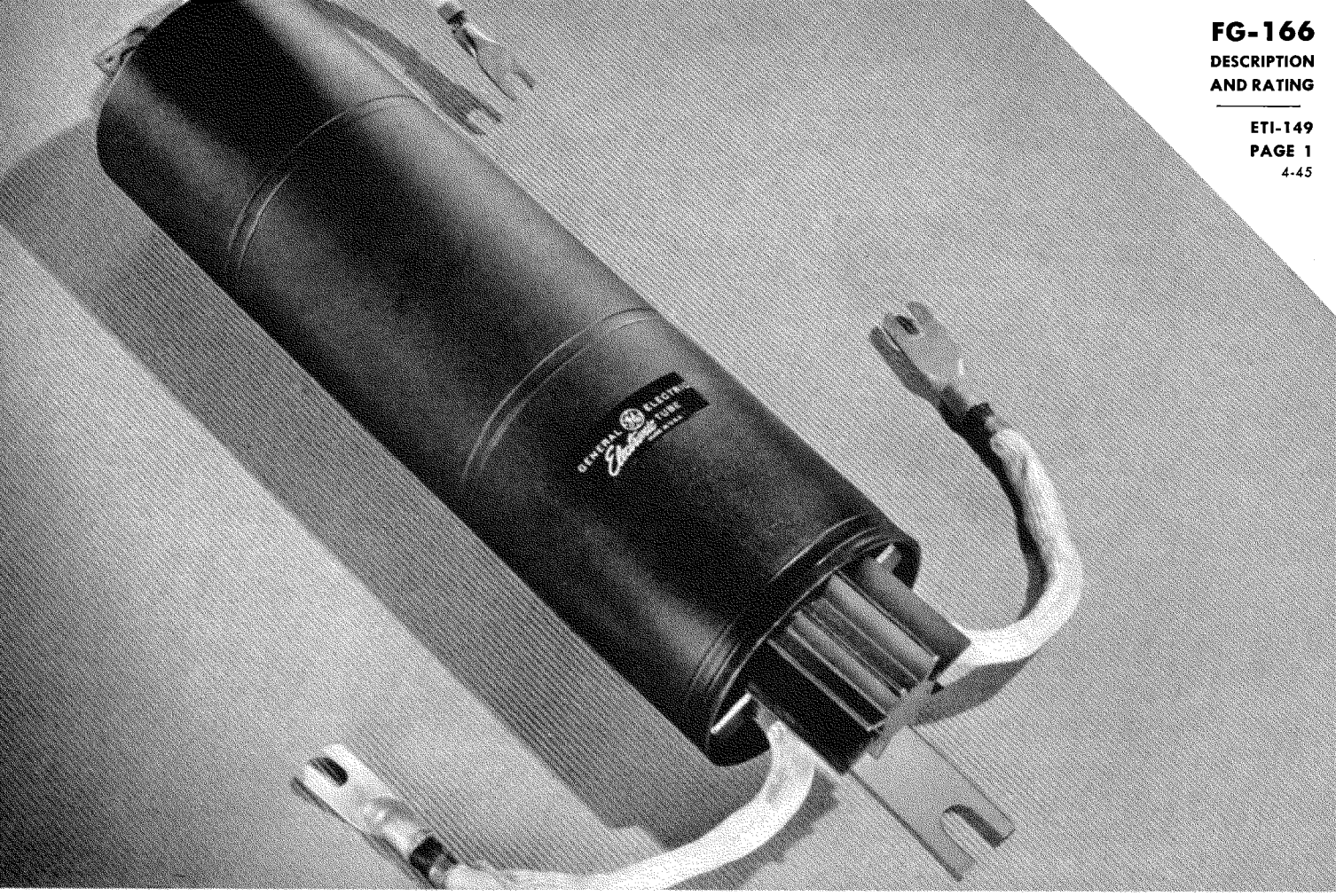


OUTLINE
FG-154 THYRATRON

K-5182026 8-18-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PHANOTRON

DESCRIPTION

The FG-166 half-wave, all-metal mercury-vapor rectifier is capable of carrying peak currents as high as 75 amperes. It is suitable for rectifiers that supply 125 or 250 to 600 volts in capacities of 15 to 50 kilowatts. The sturdy all-metal construction combines mechanical strength with simplicity of design.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Cathode—Filamentary type		
Filament voltage	2.5	volts
Filament current, approx	100	amperes
Filament heating time, typical	2	minutes
Optimum phase of filament voltage with respect to anode voltage	90	degrees
Peak voltage drop	9	volts
Rise of tube temperature above ambient without forced-air circulation		
Average anode current 0 amperes		
Condensed mercury temperature	30	centigrade
Temperature of side of tube	100	centigrade
Average anode current 20 amperes		
Condensed mercury temperature	35	centigrade
Temperature of side of tube	150	centigrade

GE Electronic TUBE

GENERAL ELECTRIC

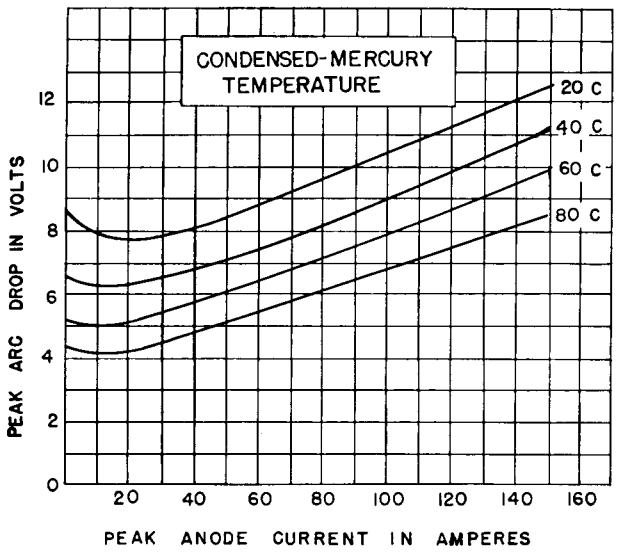
TECHNICAL INFORMATION (CONT'D)

Mechanical

Net weight, approx.	5.5	pounds
Shipping weight, approx.	14	pounds
Mounting position		vertical, with radiator down

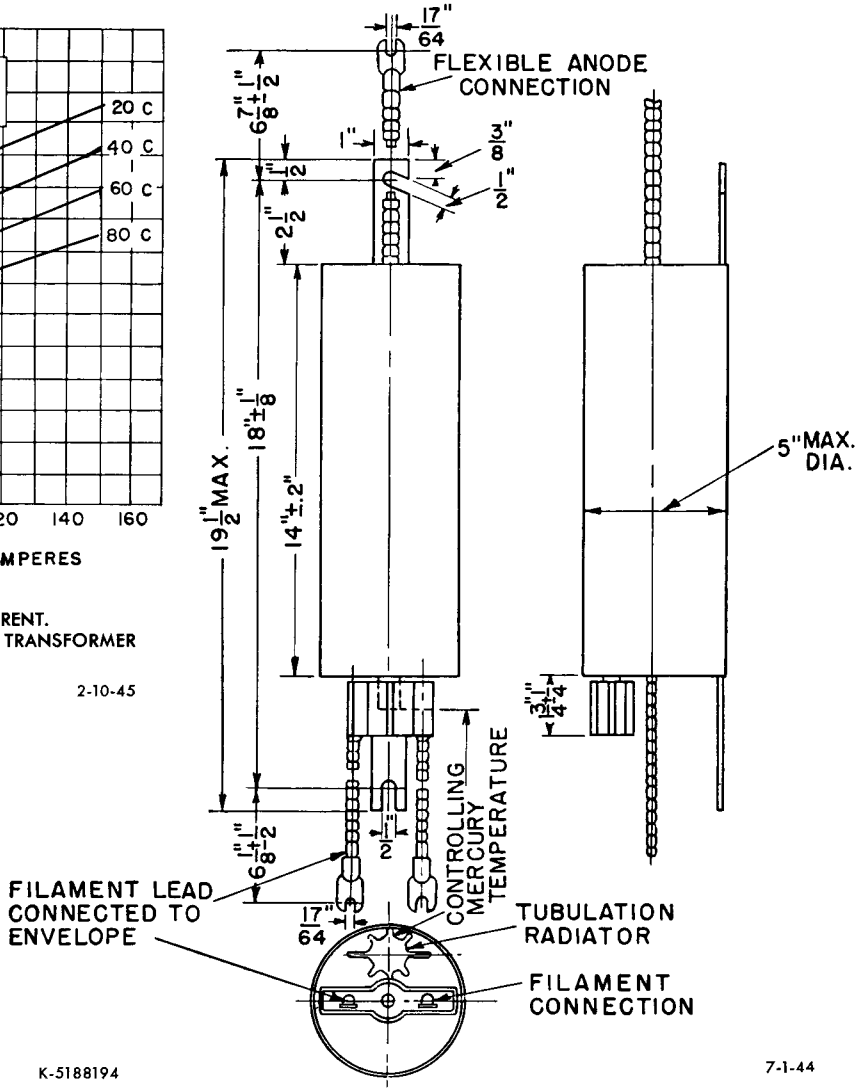
MAXIMUM RATINGS

Maximum peak anode voltage		
20 to 60 C condensed mercury	1500	volts
20 to 70 C condensed mercury	800	volts
Maximum anode current		
Instantaneous	75	amperes
Average	20	amperes
Surge, for design only	750	amperes
Maximum time of averaging current	30	seconds
Temperature limits, condensed mercury	+40 to +60	centigrade



FG-166 PHANOTRON
PEAK DROP VS PEAK ANODE CURRENT.
AVERAGE VALUES MEASURED FROM FILAMENT TRANSFORMER MIDTAP TO ANODE

K-6917484 2-10-45



K-5188194 7-1-44

OUTLINE
PHANOTRON FG-166

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



THYRATRON

DESCRIPTION

The FG-172 is a double-grid, mercury-vapor thyratron. Double-grid tubes are designed for applications where the grid is actuated from a high-impedance source and where the available grid power is very small. The all-metal construction results in a sturdy tube for industrial applications.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes 4

Electrical	Continuous Service		Welder-Control Service		
Cathode—Indirectly heated type					
Voltage	5.0		5.5		volts
Current, approx	10.0		11.0		amperes
Heating time, typical	5		5		minutes
Peak voltage drop, typical	16		16		volts
Approximate control characteristics					
Anode voltage	100	2000	100	2000	volts
Shield-grid voltage	0	0	0	0	volts
Control-grid voltage	+1.0	−14	+1.0	−14	volts
Anode to grid capacitance, approx	0.07			0.07	micromicrofarad
Ionization time, approx	10			10	microseconds
Deionization time, approx	1000			1000	microseconds

GE Electronic TUBE

TECHNICAL INFORMATION (CONT'D)

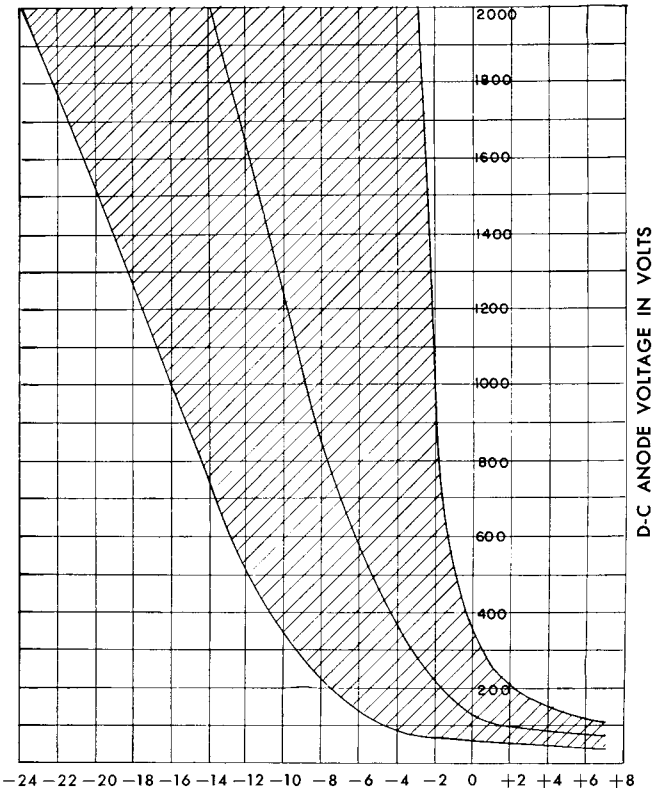
Mechanical

Net weight, approx	22 ounces
Shipping weight, approx	7 pounds
Mounting position	vertical, radiator down

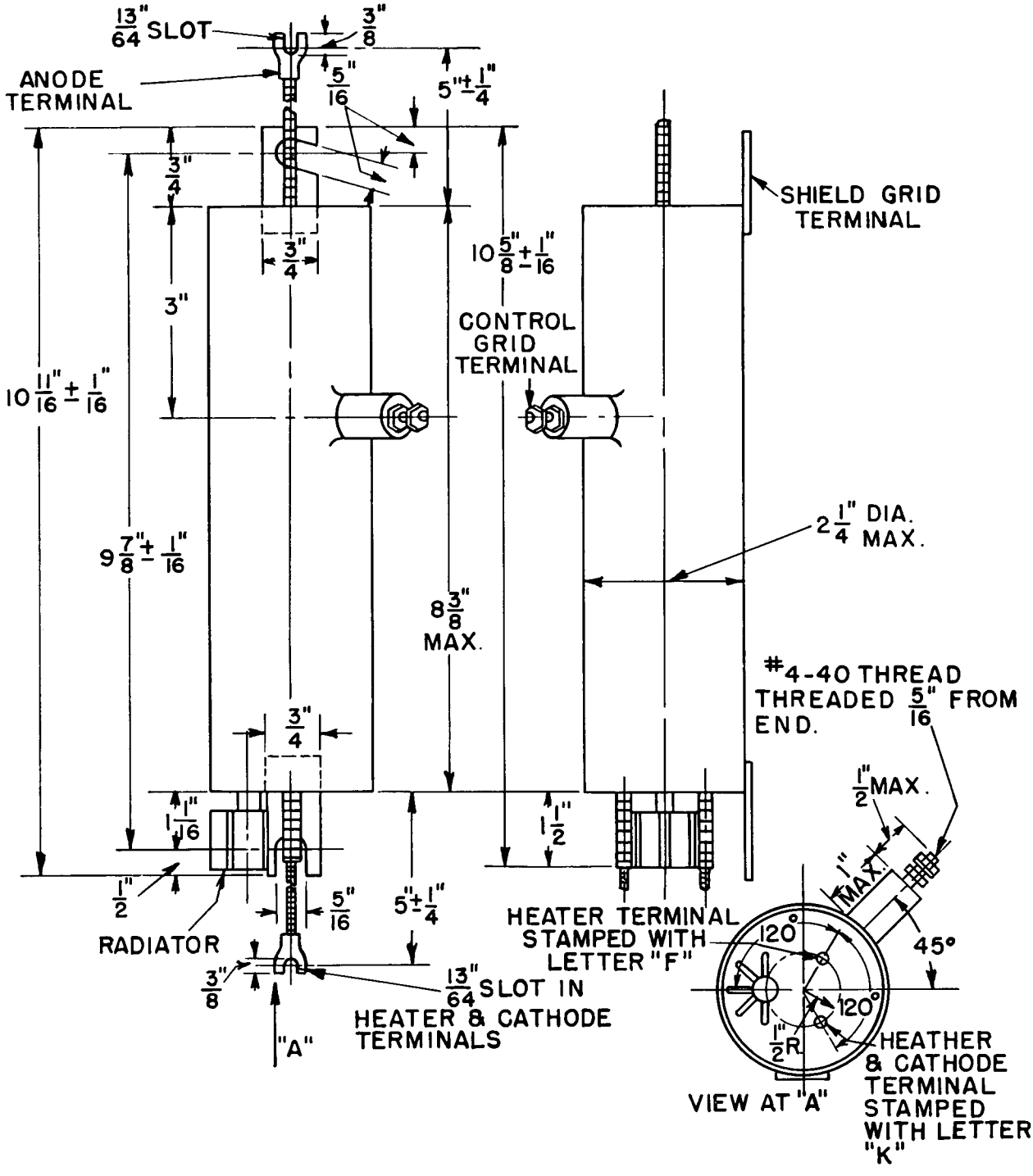
MAXIMUM RATINGS

	Continuous Service	Welder-Control Service	
Maximum peak anode voltage			
Inverse	2000	750	volts
Forward	2000	750	volts
Maximum negative control-grid voltage			
Before conduction	1000	1000	volts
During conduction	10	10	volts
Maximum negative shield-grid voltage			
Before conduction	300	300	volts
During conduction	5.0	5.0	volts
Maximum anode current			
Instantaneous, 25 cycles and above	40	77	amperes
Instantaneous, below 25 cycles	13.0	13.0	amperes
Average	6.4	2.5	amperes
Surge, for design only	400	400	amperes
Duration of surge current	0.1	0.1	second
Maximum control-grid current			
Instantaneous	1.0	1.0	ampere
Average	0.25	0.25	ampere
Maximum shield-grid current			
Instantaneous	2.0	2.0	amperes
Average	0.50	0.50	ampere
Maximum time of averaging current	15	15	seconds
Temperature limits, condensed mercury	+40 to +80	+30 to +95	centigrade
Recommended temperature, condensed mercury	40	40	centigrade

FG-172 TYPICAL CONTROL CHARACTERISTIC
SHADED AREA SHOWS RANGE OF CHARACTERISTIC
CONDENSED-MERCURY TEMP 40 C, SHIELD GRID CONNECTED TO CATHODE



K-8639645 6-27-44



OUTLINE
FG-172 THYRATRON

K-5185243

8-10-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The FG-178-A is an inert-gas-filled thyratron with a negative control characteristic.

Although inert-gas-filled tubes can be operated in much lower ambient temperatures than the mercury-vapor types, they are not rated at as high voltages as mercury tubes of comparable size.

This tube is particularly adapted to applications where it is desired to have current flow in the absence of grid excitation, where constancy of characteristic is required with large variations in ambient temperature, and where the tube is subjected to intermittent operation.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes			3	
Electrical				
Cathode—Filamentary type				
Filament voltage			2.5	volts
Filament current, approx			2.25	amperes
Filament heating time, typical			6	seconds
Peak voltage drop, approx.			16	volts
Approximate control characteristics				
Anode voltage	25	100	500	volts
Grid voltage	0	−3.0	−7.0	volts
Anode to grid capacitance, approx.			2.5	micromicrofarads
Ionization time, approx.			10	microseconds
Deionization time, approx.			1000	microseconds

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

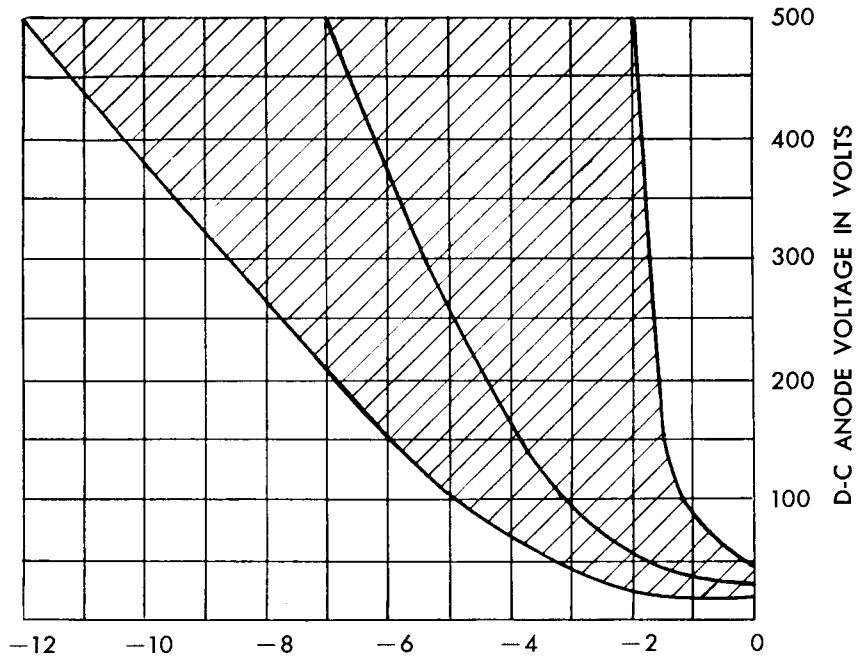
Mechanical

Net weight, approx.	2	ounces
Shipping weight, approx.	2	pounds
Mounting position	vertical,	base down

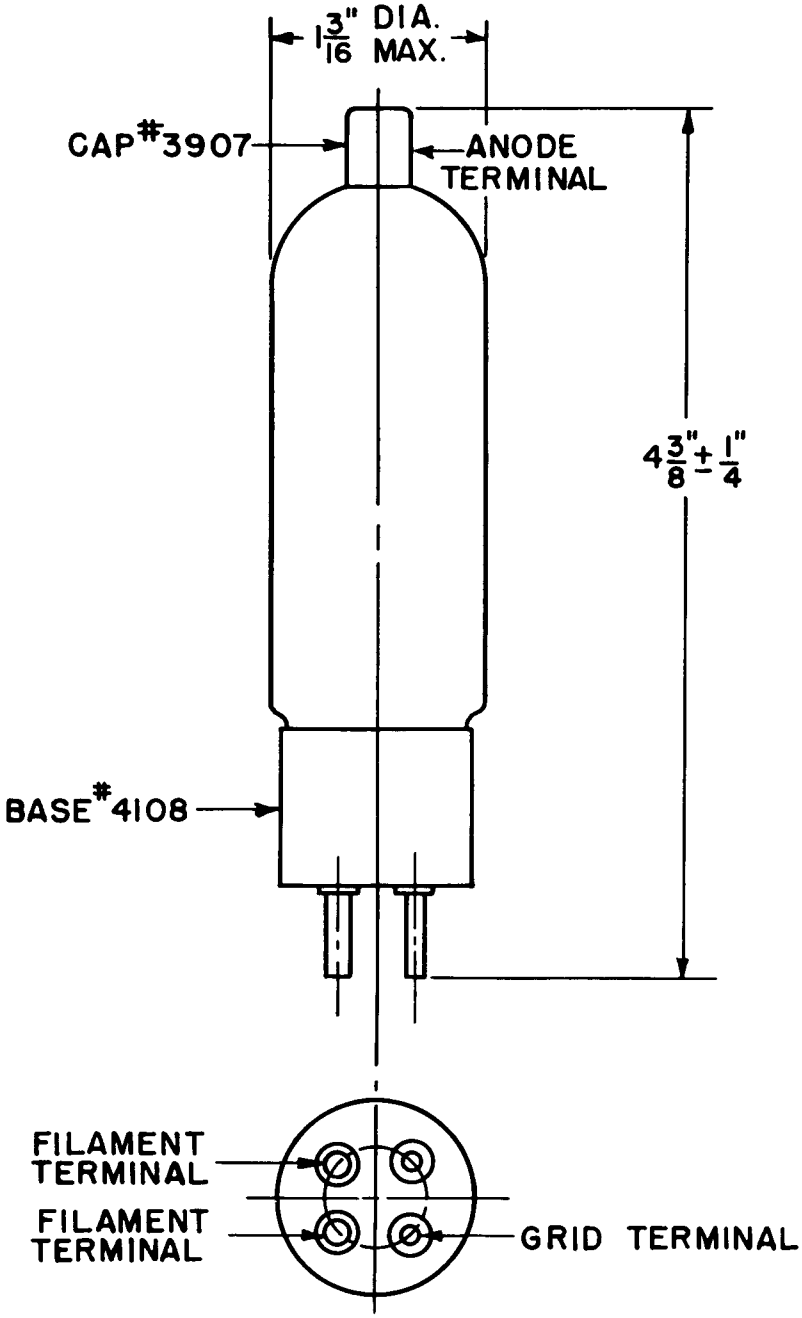
MAXIMUM RATINGS

Maximum peak anode voltage		
Inverse	500	volts
Forward	500	volts
Maximum negative grid voltage		
Before conduction	70	volts
During conduction	10	volts
Maximum anode current		
Instantaneous, 25 cycles and above	0.500	ampere
Instantaneous, below 25 cycles	0.250	ampere
Average	0.125	ampere
Surge, for design only	20.0	ampere
Duration of surge current	0.1	second
Maximum grid current		
Instantaneous	0.020	ampere
Average	0.005	ampere
Maximum time of averaging current	15	seconds
Ambient temperature limits	−20 to +50	centigrade

THYRATRON FG-178-A
TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS



K-6917470 9-22-43



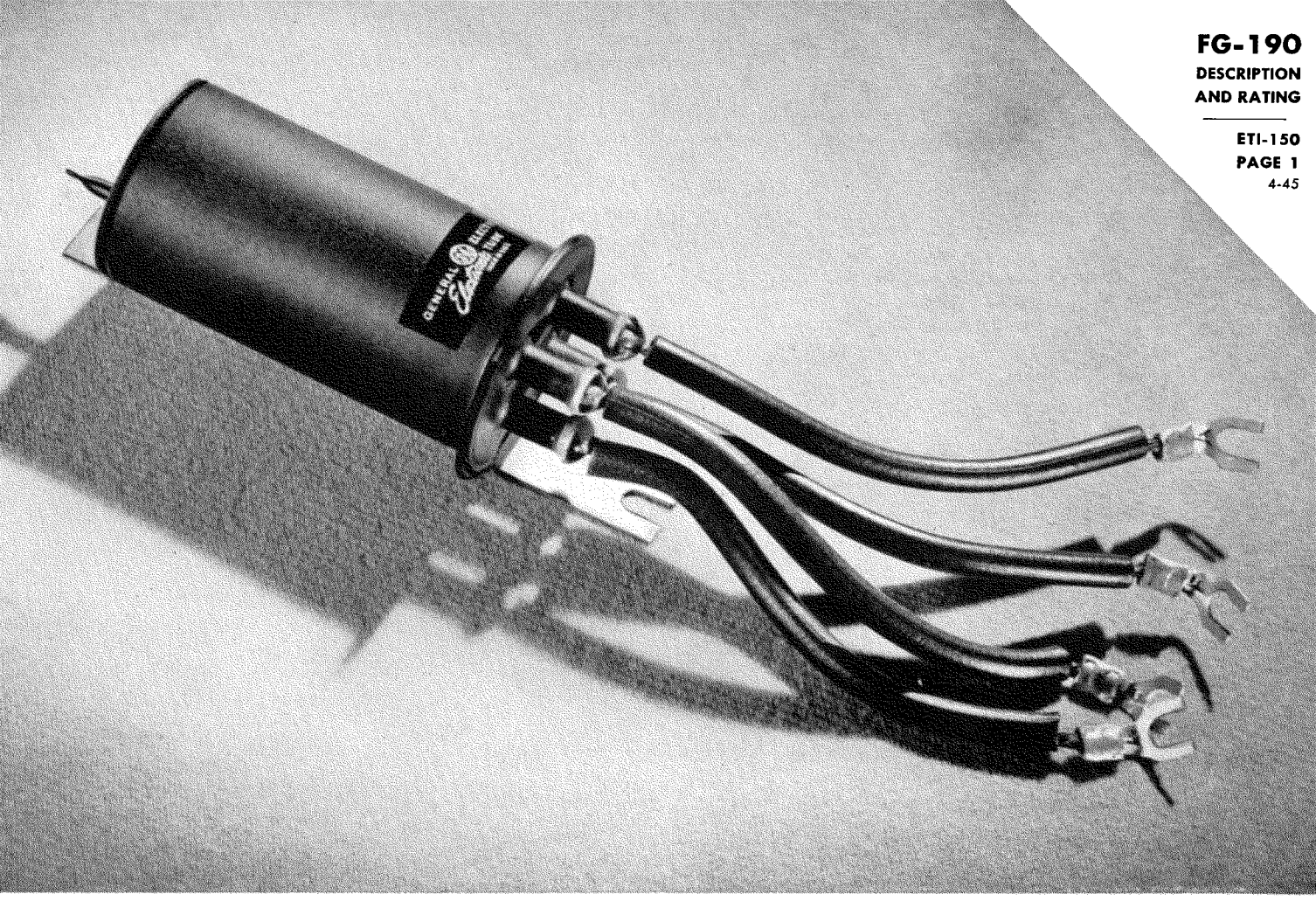
OUTLINE
FG-178-A THYRATRON

K-4903506

8-10-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PHANOTRON

DESCRIPTION

The FG-190 is a gas-filled all-metal tube for use as a full-wave rectifier at low voltages. The use of gas imposes a voltage limitation and tubes of this type will not carry as high a voltage as mercury tubes of comparable size. They can, however, be operated in much lower ambient temperatures.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	

Electrical

Cathode—Filamentary type		
Heater voltage	2.5	volts
Heater current, approx	12	amperes
Heating time, typical	5	seconds
Voltage drop, typical	8	volts
Pick-up voltage, either anode, typical	14	volts

Mechanical

Net weight, approx	6	ounces
Shipping weight, approx	4	pounds
Mounting position		vertical, with leads down

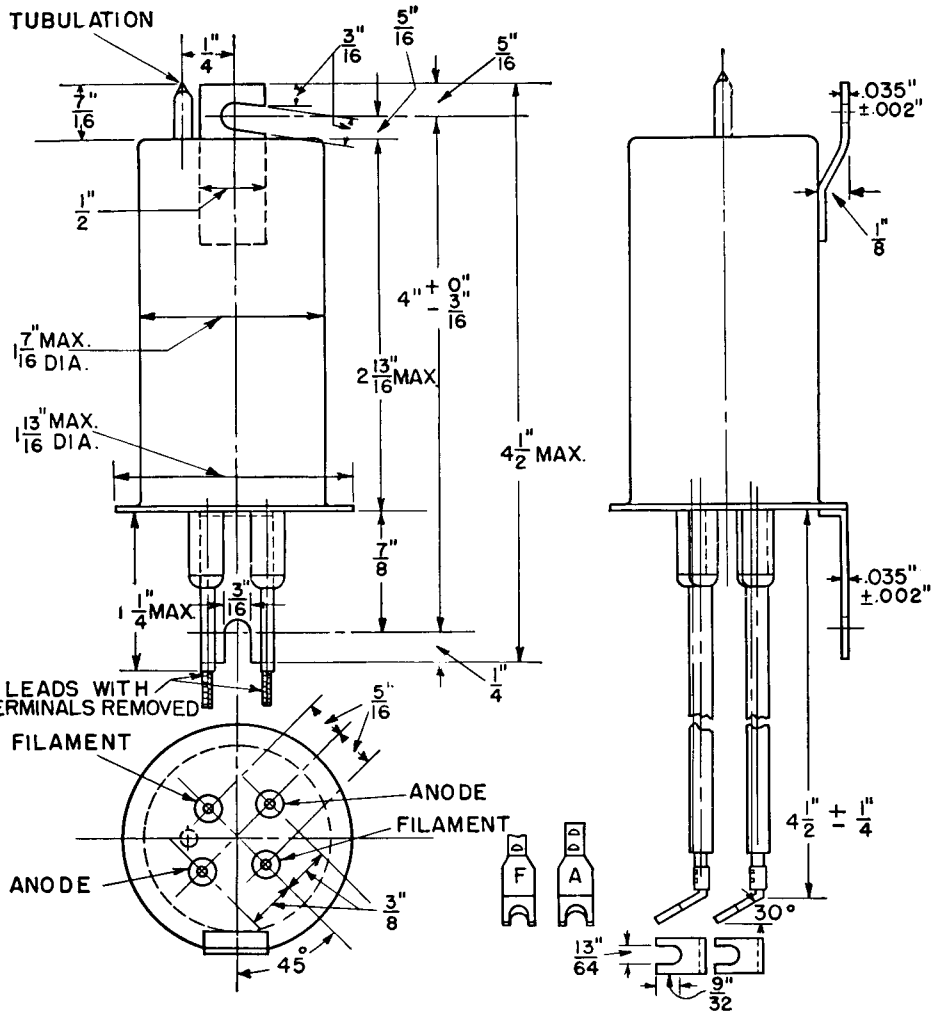
Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

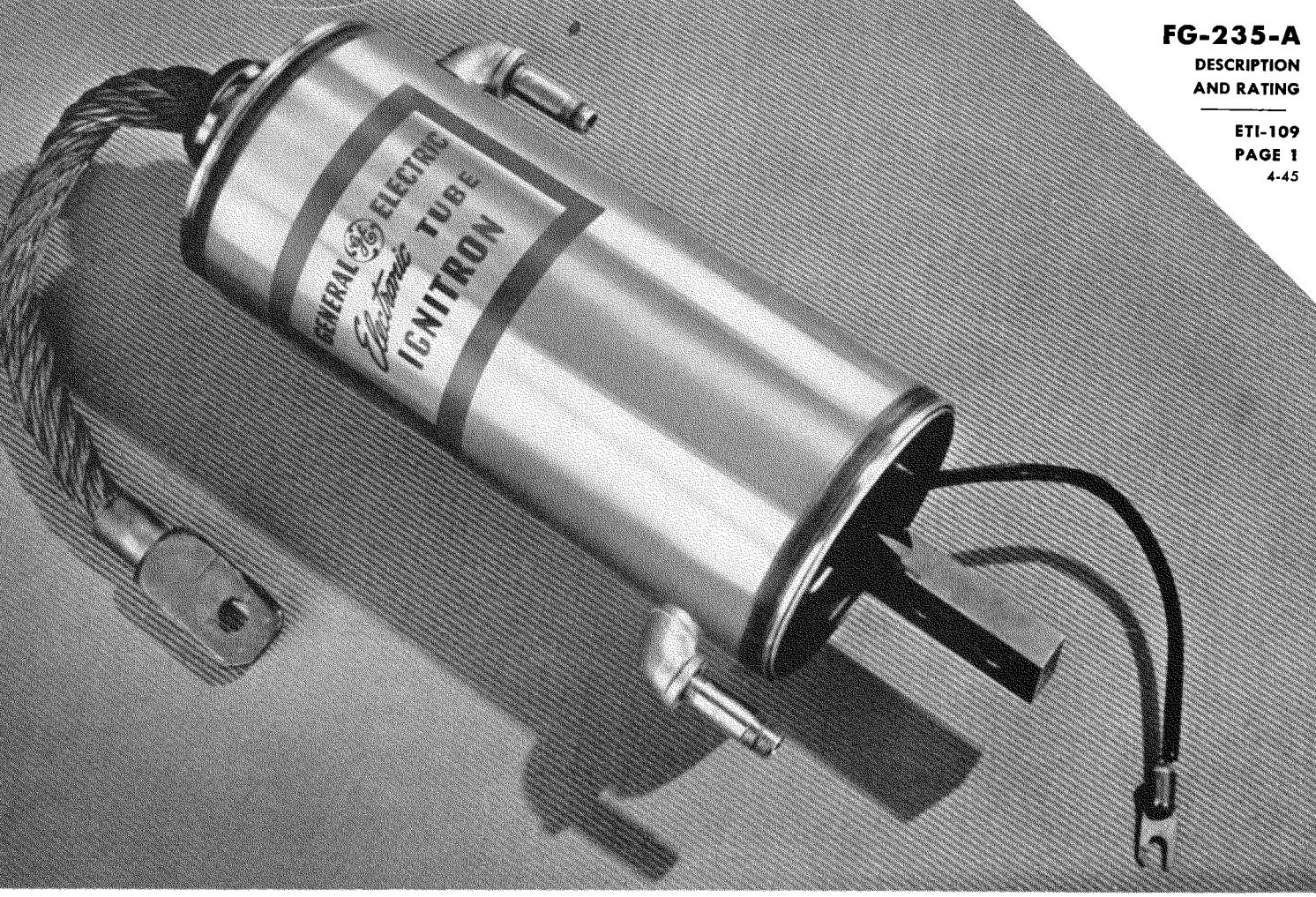
Maximum peak inverse anode voltage	175	volts
Maximum instantaneous anode current		
25 cycles and above	5	amperes
Below 25 cycles	2.50	amperes
Average anode current	1.25	amperes
Surge anode current, for design only	20	amperes
Duration of surge current	0.1	second
Maximum time of averaging current	15	seconds
Ambient temperature limits	−20 to +50	centigrade



OUTLINE
FG-190 PHANOTRON

K-5300039 7-13-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



IGNITRON

SPECIAL DESIGN FEATURES

1. Stainless-steel, seam-welded construction
2. Uniform water cooling
3. Strong, compact design
4. Easy to install
5. Copper terminals
6. Flexible anode lead
7. Mercury-pool cathode allows extremely high instantaneous currents to be passed through the tube without damage.

DESCRIPTION

The ability of this tube to carry very high peak currents for short periods makes it especially suited to welder-control service. It may also be used for conversion in low-power circuits and for intermittent rectifier service.

Ease of installation, economical use of space, and reliability of operation are assured by design features inherent in the steel-jacketed construction.

The FG-235-A is similar to the FG-258-A and the FG-271. All of these tubes can be used for a wide range of applications where welds are made infrequently or in rapid succession.

The current range required for the welding operation determines which tube to use. Another factor, of course, is the nature of the material to be welded. Low-resistance materials, such as the aluminum alloys, require more current than such high-resistance metals as stainless steel.

The FG-235-A ignitron is equivalent to a 600-ampere magnetic contactor.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Peak voltage drop, approx.	12	volts
Net weight, approx.	9	pounds
Shipping weight, approx.	17	pounds
Type of cooling		water
Maximum outlet water temperature	40	centigrade
Minimum flow	1.5	gallons per minute
Minimum inlet water temperature	10	centigrade
Pressure drop per tube at minimum flow	4.1	pounds per square inch
Temperature rise at minimum flow, approx. (Average current 100 amperes per anode)	3	centigrade

MAXIMUM RATINGS

A-C Welder-Control Service—Frequencies From 25 to 60 Cycles—Ratings Are For Any Voltage From 250 to 600 Volts Rms*†

Maximum demand	1200	kva
Corresponding average anode current	75.6	amperes
Maximum average anode current	140	amperes
Corresponding demand	400	kva
Maximum time of averaging anode current*		
At 500 volts rms	7.1	seconds
At 250 volts rms	14	seconds
Maximum surge current, peak amperes	280	per cent of maximum rms demand current

Intermittent Rectifier Service‡—Frequencies From 25 to 60 Cycles

Maximum peak anode voltage		
Inverse	500	volts
Forward	500	volts
Maximum anode current		
Instantaneous	1600	amperes
Average, per tube	100	amperes
Averaging time	3	seconds
Surge, peak amperes, averaging time 0.15 second	6000	amperes
Ignitor ratings same as for welder-control service		

Ignition Requirements (same for both classes of service)

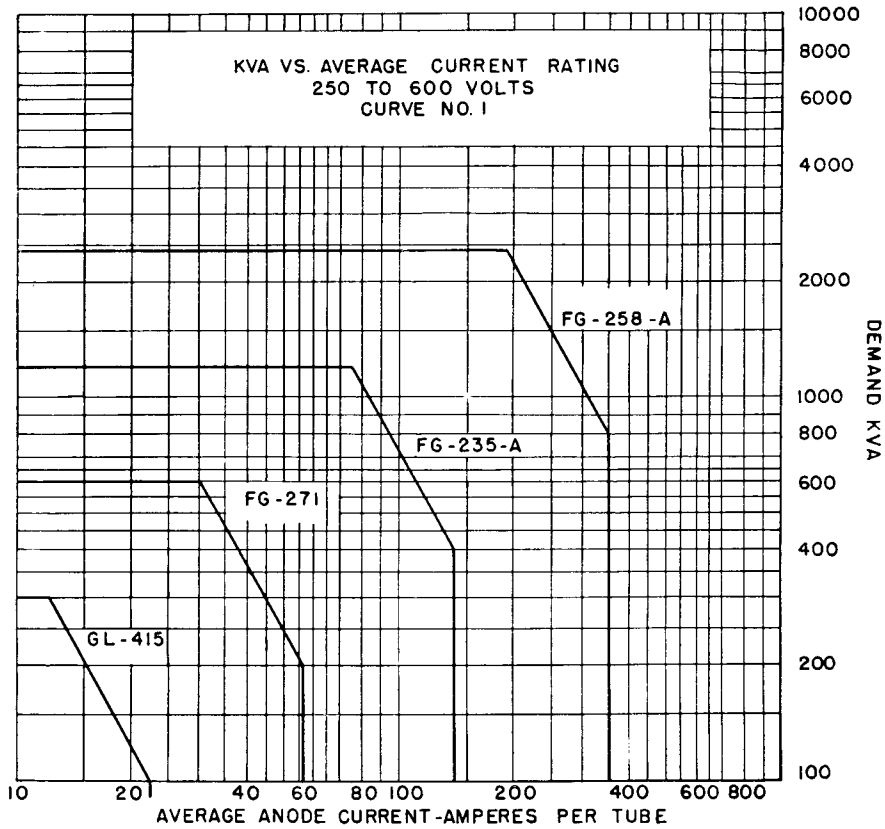
Ignitor voltage		
Maximum instantaneous allowed, ignitor positive	900	volts
Maximum instantaneous required, ignitor positive	200	volts
Maximum instantaneous allowed, ignitor negative	5	volts
Ignitor current		
Maximum instantaneous allowed	100	amperes
Maximum instantaneous required§	30	amperes
Maximum average allowed	1	ampere
Ignitor ignition time, maximum§	100	microseconds
Ignitor current averaging time	5	seconds

* With the use of log-log paper, straight line interpolation between the two points tabulated may be used to determine other detailed ratings.

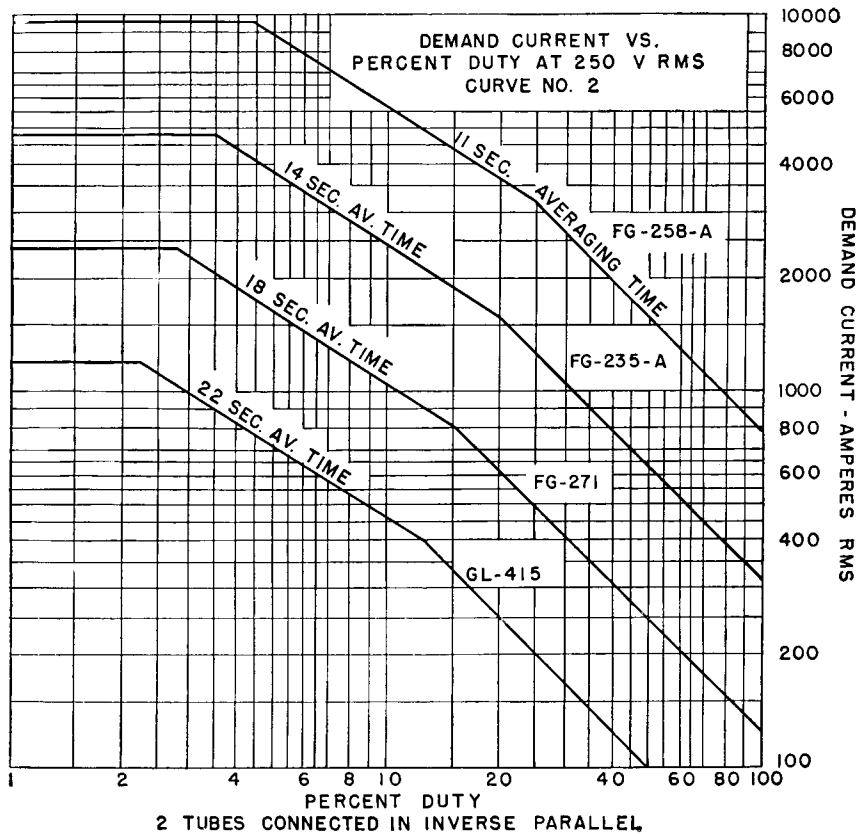
† Rms demand voltage, current, and kva are all on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used. For voltages below 250 volts, use the 250-volt rating.

§ Ignition will occur if either maximum required instantaneous positive potential is applied or maximum required instantaneous current flows for the rated maximum ignitor ignitron time.

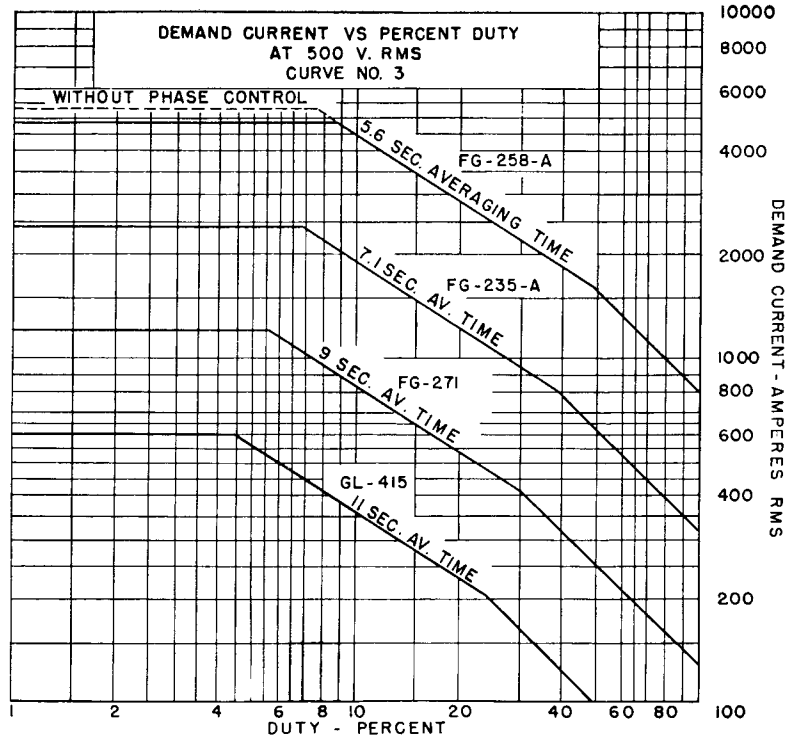
‡ Curves of Figures 1, 2, and 3 must not be used for intermittent rectifier service.



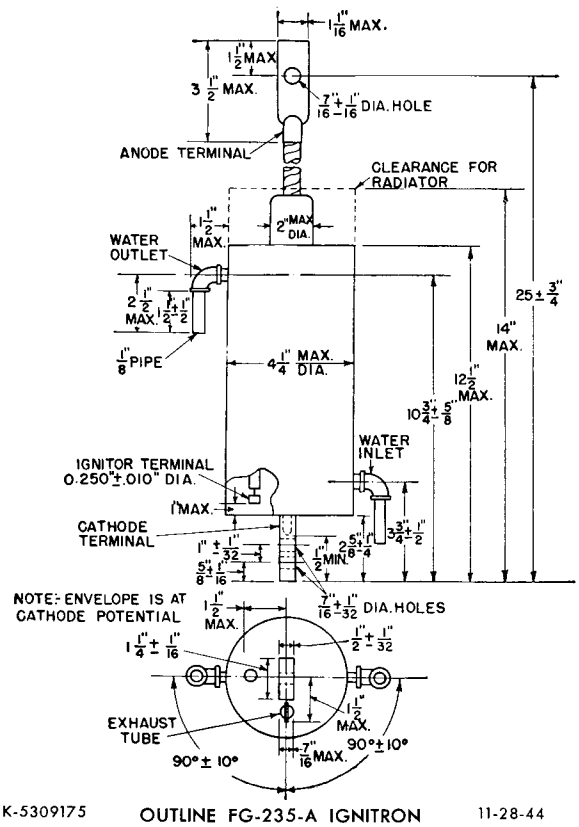
K-6966431 FIG. 1 7-1-44



K-6966432 FIG. 2 7-1-44



K-6966433 FIG. 3 8-25-44

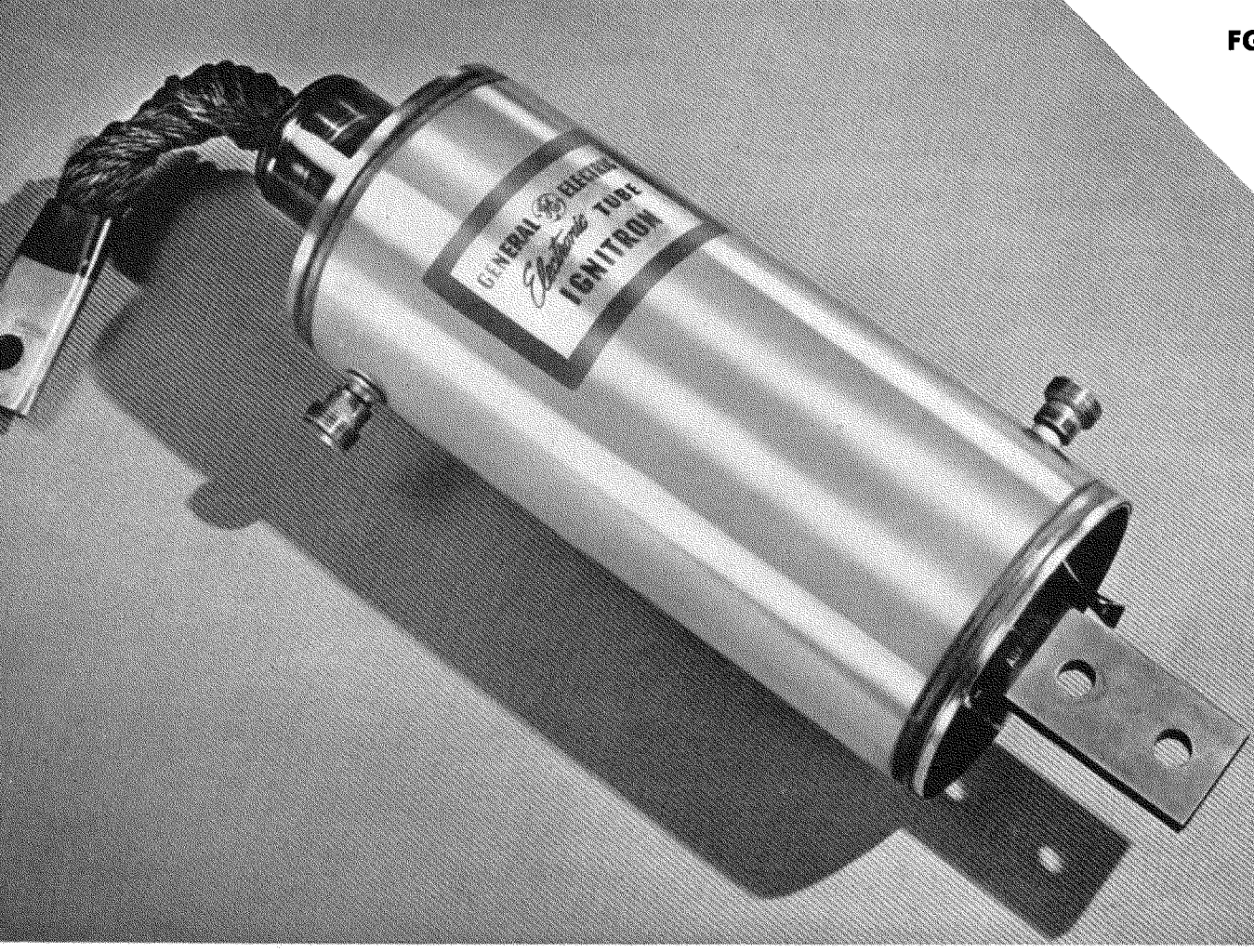


K-5309175 OUTLINE FG-235-A IGNITRON 11-28-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



IGNITRON

SPECIAL DESIGN FEATURES

1. Stainless-steel, seam-welded construction
2. Uniform water cooling
3. Strong, compact design
4. Easy to install
5. Copper terminals
6. Flexible anode lead
7. Mercury-pool cathode allows extremely high instantaneous currents to be passed through the tube without damage.

DESCRIPTION

This steel-jacketed ignitron is designed for rectifier service in the 125-, 250-, 600-, and 900-volt d-c power fields. The FG-238-B is used for rectifiers rated up to 1000 kilowatts depending on the number of ignitrons used, the output voltage, and the circuit.

The FG-238-B is also rated for 2400-volt resistance-welder-control service and has a capacity of 2400 kilovolt-amperes in this service. The FG-238-B has a continuous average current rating of 200 amperes per tube for use in rectifiers rated up to 1000 kilowatts.

Arc losses are low. Phase control of the ignitron impulses permits voltage control of the rectified output. Excitation of the small auxiliary anode stabilizes the cathode spot for very small anode currents. Two ignitors, only one of which is used at a time, assure long life.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Electrical

Voltage drop		
At 100 amperes instantaneous anode current	12.6	volts
At 300 amperes instantaneous anode current	14.1	volts
At 600 amperes instantaneous anode current	16.2	volts
At 1200 amperes instantaneous anode current	19.1	volts

Mechanical

Cathode		pool type
Number of ignitors	2	
Number of main anodes	1	
Number of auxiliary anodes	1	
Type of cooling		water
Typical flow	3 to 5	gallons per minute
Pressure drop at above flow	3 to 8	pounds per square inch
Temperature rise with lower rate of flow 300 amperes per anode	7	centigrade
Net weight, approx	25	pounds
Shipping weight, approx	35	pounds

MAXIMUM RATINGS

Rectifier Service—For Power Supply—Frequency of 25 to 60 Cycles, Phase Retard = 0

Maximum inverse and forward anode voltage	900	volts	2100	volts
Maximum anode current				
Instantaneous	1800	amperes	1200	amperes
Average continuous current	200	amperes	150	amperes
2-hour-average current over any 2-minute period	300	amperes	225	amperes
1-minute-average current over any 1-minute period	400	amperes	300	amperes
Surge current, maximum duration 0.15 second	12000	amperes	9000	amperes
Maximum outlet water temperature	60	centigrade	45	centigrade
Minimum inlet water temperature	6	centigrade	6	centigrade
Minimum water flow				
At continuous average anode current	3	gallons per minute	3	gallons per minute
At no load*	1.0	gallon per minute	1.0	gallon per minute

**For Systems in which the flow of water is controlled by the Load.*

Welder—Control Service—Ratings are for 2400 Volts Rms, Frequency of 25 to 60 Cycles

Maximum demand	2400	kva
Corresponding average anode current	135	amperes
Maximum average anode current	207	amperes
Corresponding demand	1105	kva
Maximum time of averaging anode current at 2400 volts, rms	1.66	seconds
Minimum water flow	3.0	gallons per minute
Maximum outlet water temperature	30	centigrade
Maximum surge current	6000	amperes
Maximum duration of surge current	0.15	second

Ignition Requirements (Ratings are the same for both Welder and Rectifier Service)

Ignitor voltage		
Maximum allowed, ignitor positive—same as anode voltage		
Maximum instantaneous allowed, ignitor negative	5	volts
Ignitor current		
Maximum instantaneous allowed	100	amperes
Maximum average allowed	2.0	amperes
Time of averaging current	10	seconds
Maximum ignition time	100	microseconds

TECHNICAL INFORMATION (CONT'D)

Anode firing (see elementary circuit K-9033528)

Maximum instantaneous ignitor potential required	150	volts
Maximum instantaneous ignitor current required	40	amperes
Typical resistance added to ignitor circuit for anode firing		
At anode voltage of 600 volts or less	4	ohms
At anode voltage of 601 volts to 1000 volts	10	ohms
At anode voltage of 1001 volts to 1500 volts	20	ohms
At anode voltage of 1501 volts to 2000 volts	35	ohms
At anode voltage of 2001 volts to 2400 volts	50	ohms
Separate excitation (see elementary circuit K-9033525)		
Minimum volt-ampere requirements for separate excitation		
Firing systems are shown on K-9033529		

Auxiliary Anode Requirements (Ratings are the same for both Welder and Rectifier Service)

Maximum average current	5	amperes
Maximum inverse voltage		
With main anode conducting	25	volts
With main anode not conducting	150	volts

FG-238-B

MINIMUM VOLT-AMPERE REQUIREMENTS FOR SEPARATE-EXCITATION FIRING SYSTEMS

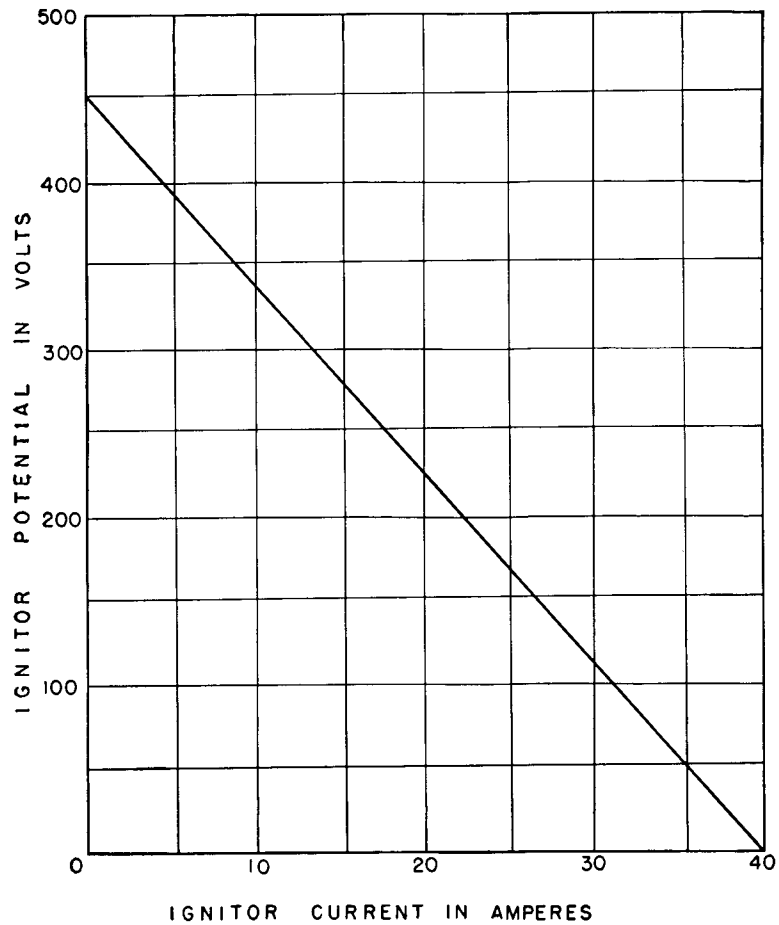


FIG. 2

K-9033529 11-15-44

FG-238-B

ELEMENTARY CIRCUIT FOR CAPACITOR FIRING

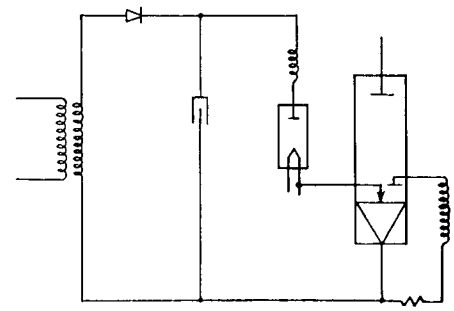


FIG. 1

K-9033525 11-15-44

FG-238-B

ELEMENTARY CIRCUIT FOR ANODE FIRING

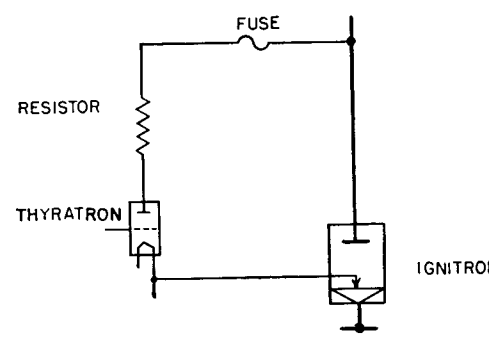
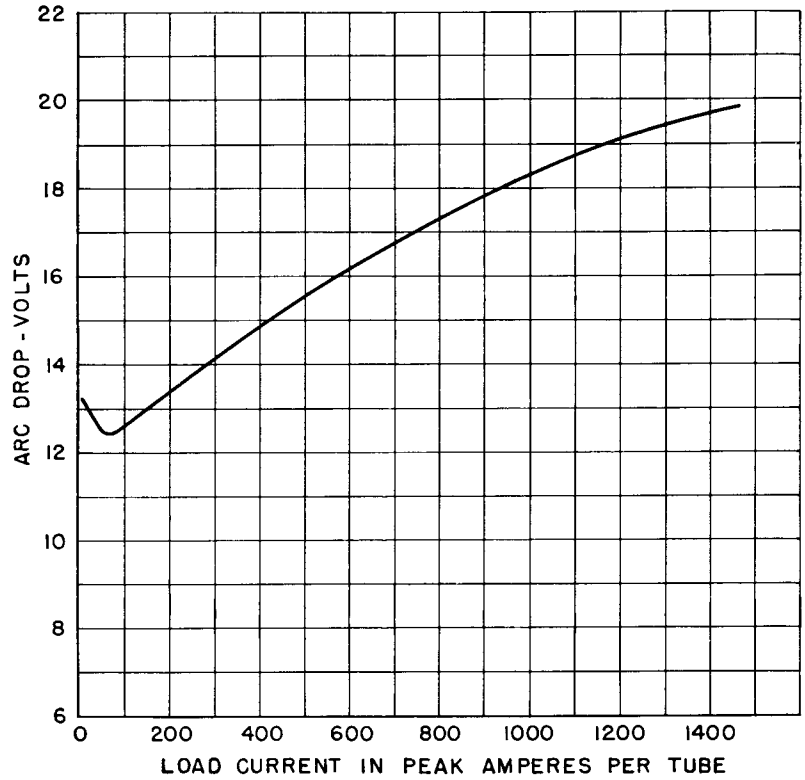


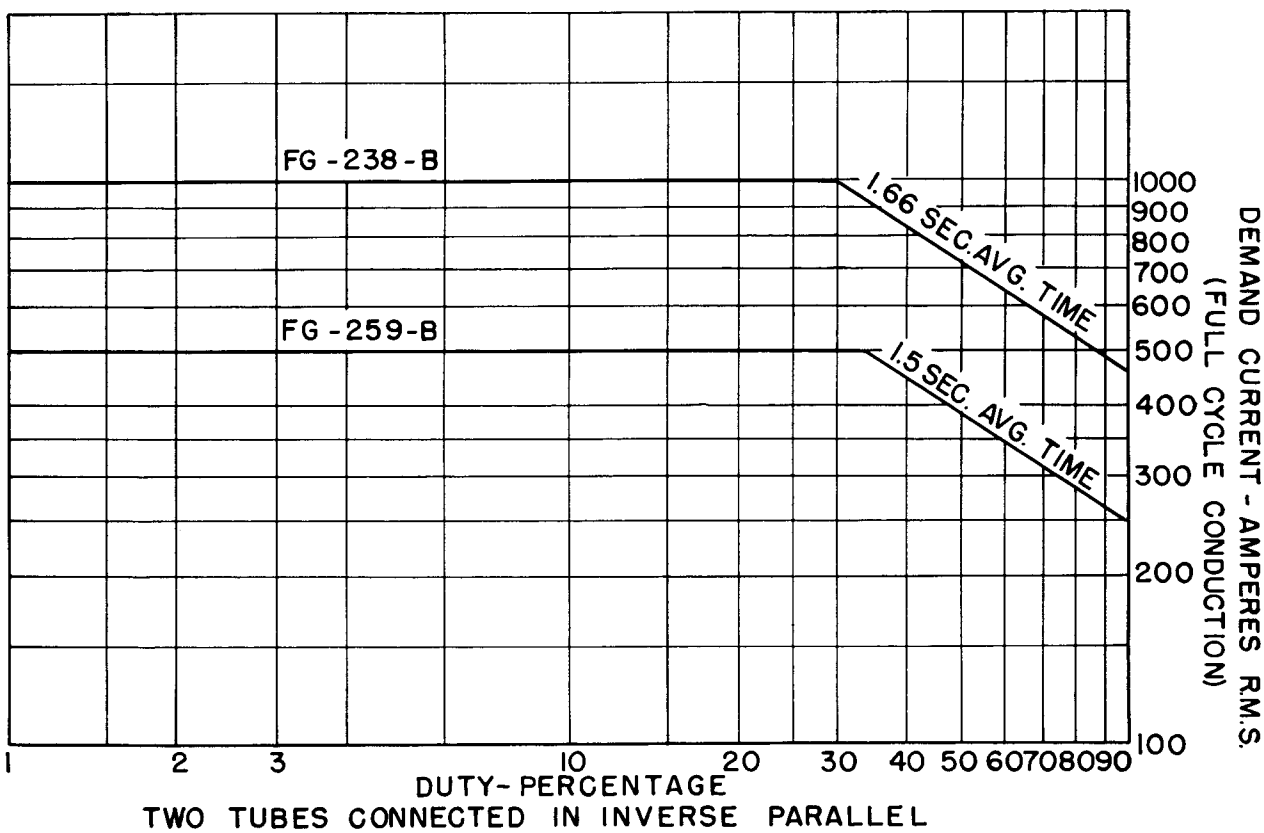
FIG. 3

K-9033528 12-16-44



FG-238-B ARC DROP, OUTLET WATER TEMPERATURE—40 C TO 60 C, WATER FLOW—3 GPM

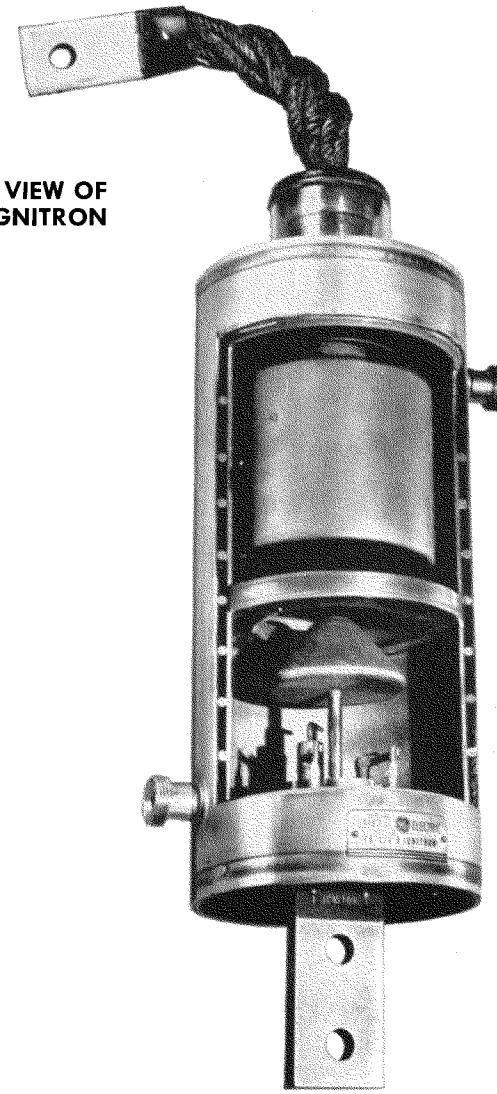
K-6917495 FIG. 4 8-25-44

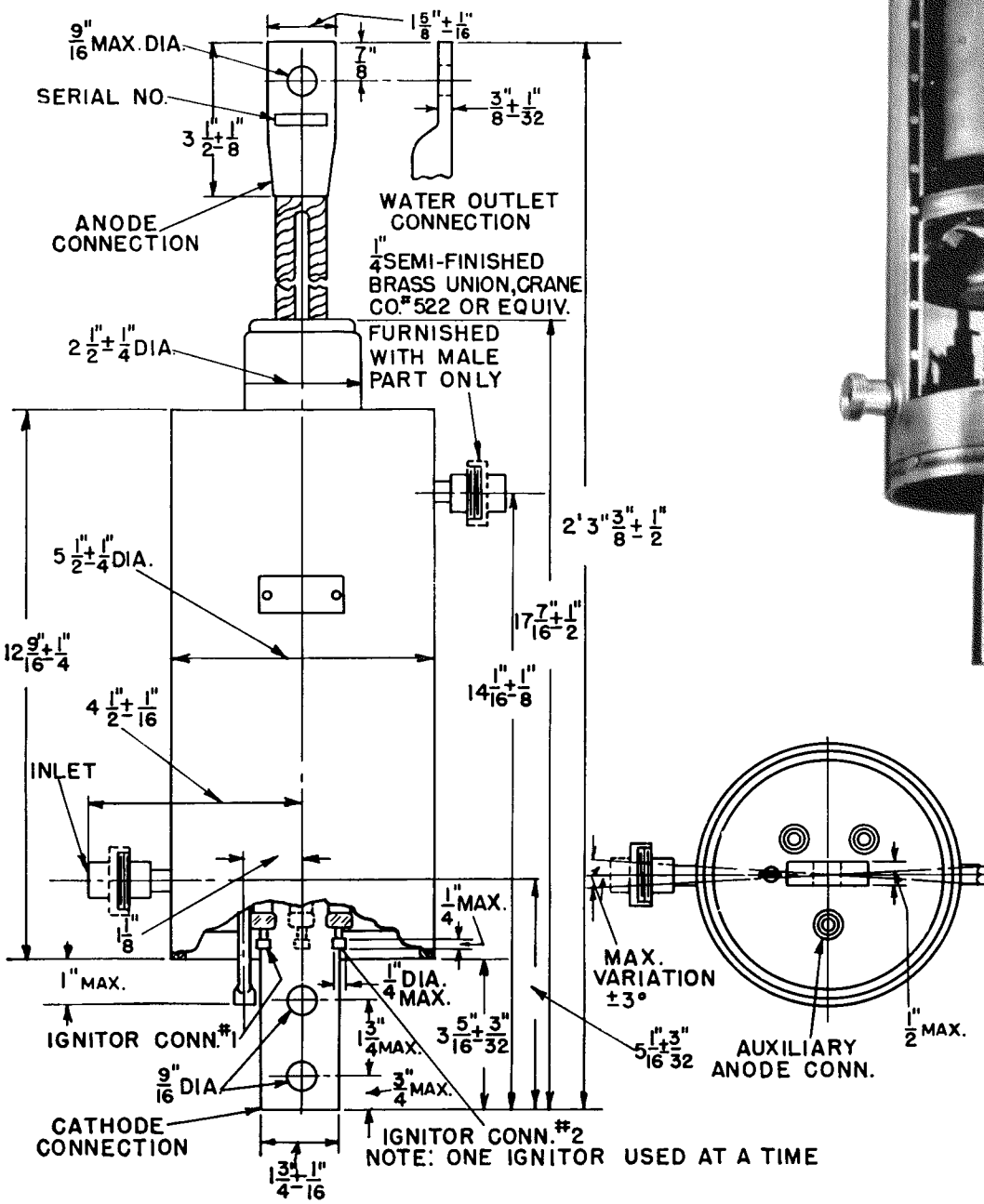


FG-238-B IGNITRON; DEMAND CURRENT VS PERCENTAGE DUTY AT 2400 VOLTS RMS, MAX. OUTLET WATER TEMP 30 C, MIN WATER RATE 3 GAL/MIN, WELDER CONTROL SERVICE

K-8074661 FIG. 5 9-26-44

CUT-AWAY VIEW OF
FG-238-B IGNITRON





K-5344658 OUTLINE FG-238-B IGNITRON 8-10-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



IGNITRON

SPECIAL DESIGN FEATURES

1. Stainless-steel, seam-welded construction
2. Uniform water cooling
3. Strong, compact design
4. Easy to install
5. Copper terminals
6. Flexible anode lead
7. Mercury-pool cathode allows extremely high instantaneous currents to be passed through the tube without damage.

DESCRIPTION

The ability of this tube to carry very high peak currents for short periods makes it especially suited to welder-control service. It may also be used for conversion in low-power circuits.

Ease of installation, economical use of space, and reliability of operation are assured by design and construction features inherent in the steel-jacketed construction.

The FG-258-A is similar to the FG-235-A and the FG-271. All of these tubes can be used for a wide range of applications where welds are made infrequently or in rapid succession.

The current range required for the welding operation determines which tube to use. Another factor, of course, is the nature of the material to be welded. Low-resistance materials, such as aluminum alloys, require more current than such high-resistance metals as stainless steel.

The FG-258-A ignitron is equivalent to a 1200-ampere magnetic contactor.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Peak voltage drop, approx	12	volts
Net weight, approx	20	pounds
Shipping weight, approx	41	pounds
Type of cooling		water
Maximum outlet water temperature	40	centigrade
Minimum flow	3	gallons per minute
Minimum inlet water temperature	10	centigrade
Pressure drop per tube at minimum flow	5.1	pounds per square inch
Temperature rise at minimum flow, approx (Average current 200 amperes per anode)	5	centigrade

MAXIMUM RATINGS

A-C Welder-Control Service—Frequencies from 25 to 60 Cycles—Ratings are for any Voltage from 250 to 600 Volts Rms* †

Maximum demand	2400	kva
Corresponding average anode current	192	amperes
Maximum average anode current	355	amperes
Corresponding demand	800	kva
Maximum time of averaging anode current*		
At 500 volts, rms	5.6	seconds
At 250 volts, rms	11	seconds
Maximum surge current, peak amperes	280	per cent of maximum rms demand current

Ignition Requirements

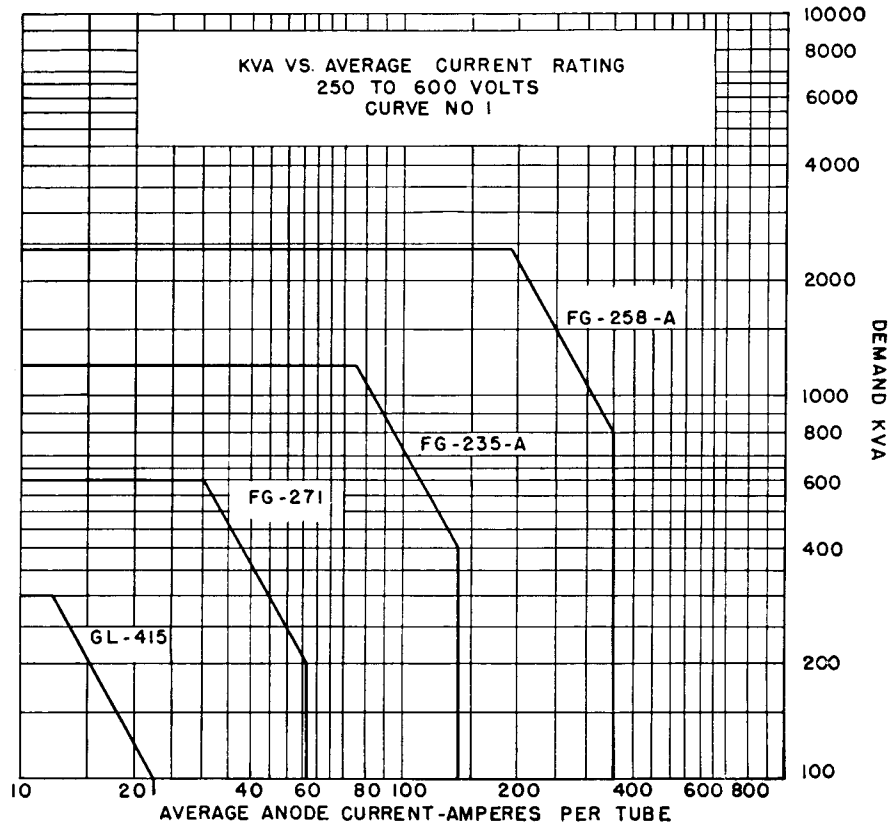
Ignitor voltage		
Maximum instantaneous allowed, ignitor positive	900	volts
Maximum instantaneous required, ignitor positive §	200	volts
Maximum instantaneous allowed, ignitor negative	5	volts
Ignitor current		
Maximum instantaneous allowed	100	amperes
Maximum instantaneous required §	30	amperes
Maximum average allowed	1	ampere
Ignitor ignition time, maximum §	100	microseconds
Ignitor current averaging time	5	seconds

* With the use of log-log paper, straight line interpolation between the two points tabulated may be used to determine other detailed ratings.

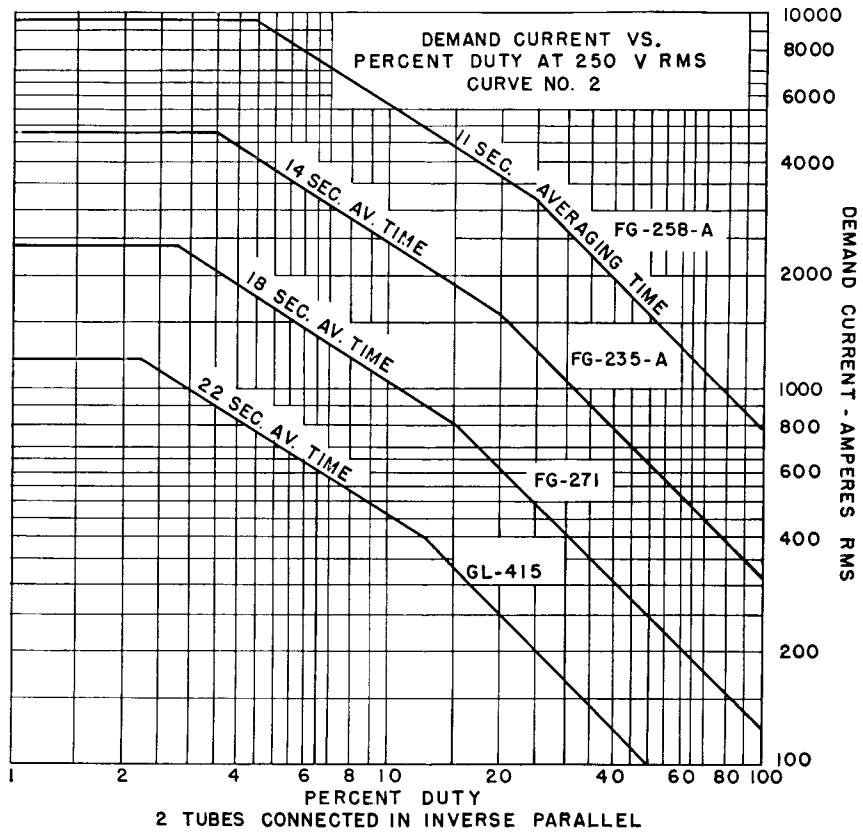
† Rms demand voltage, current, and kva are all on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used. For voltages below 250 volts, use the 250-volt rating.

§ Ignition will occur if either maximum required instantaneous positive potential is applied or maximum required instantaneous current flows for the rated maximum ignition time.

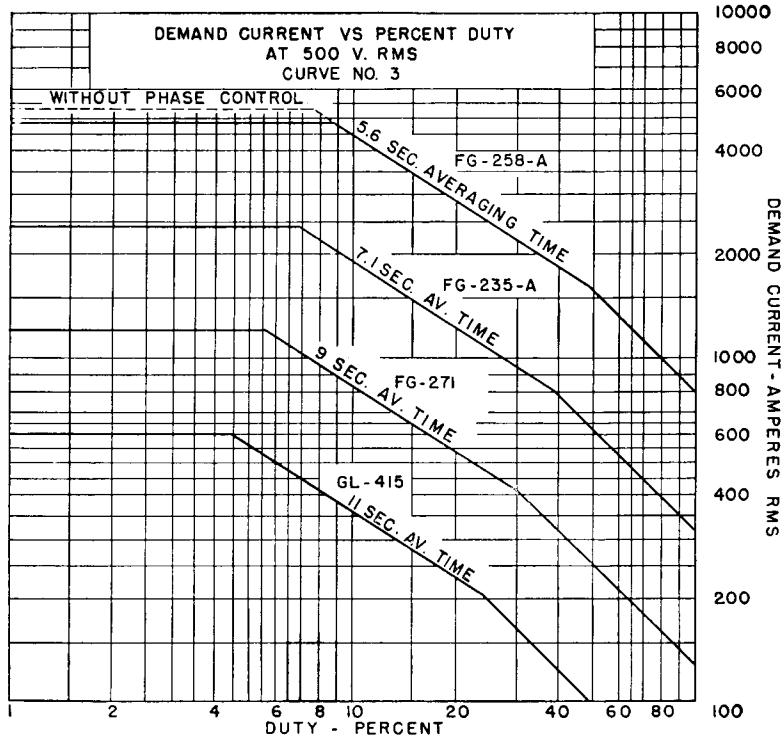
Note for Curves of Figures 1, 2, and 3.
In the case of 258-A, a special allowance up to 5300 amperes at voltages below 600 volts is made for panels which fire the ignitor synchronously and with a zero phase delay.



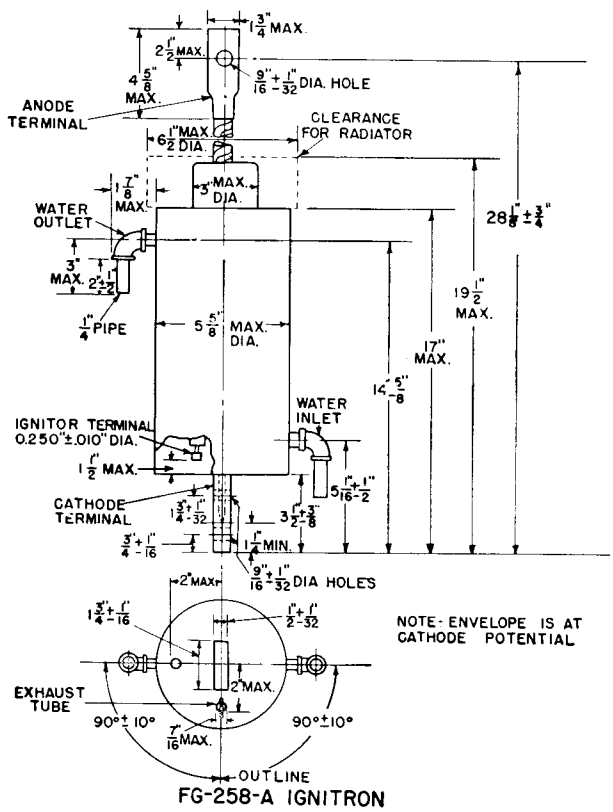
K-6966431 Fig. 1 7-1-44



K-6966432 Fig. 2 7-1-44



K-6966433 Fig. 3 8-25-44



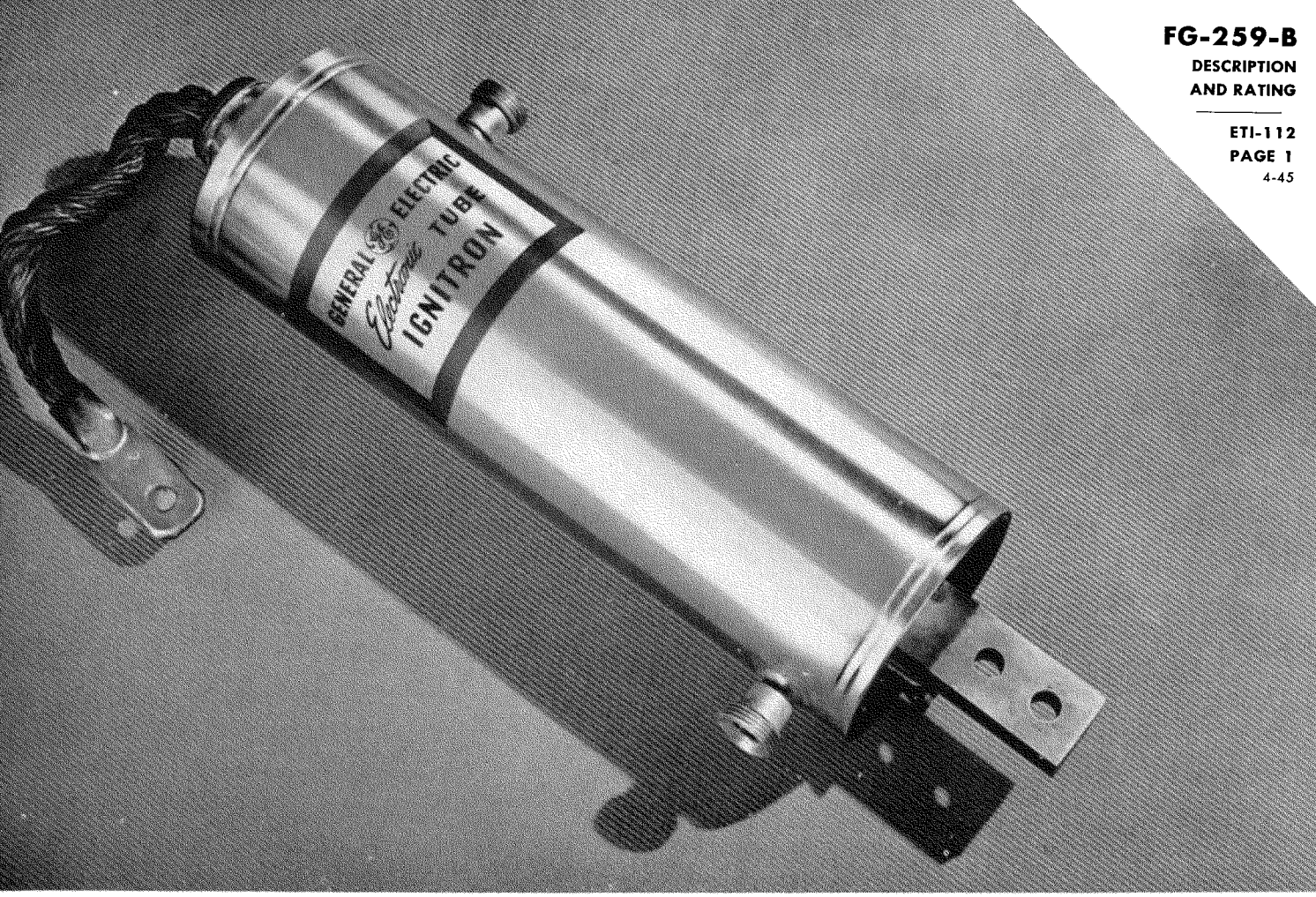
FG-258-A IGNITRON

K-5340877 10-5-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



IGNITRON

SPECIAL DESIGN FEATURES

1. Stainless-steel, seam-welded construction
2. Uniform water cooling
3. Strong, compact design
4. Easy to install
5. Copper terminals
6. Flexible anode lead
7. Mercury-pool cathode allows extremely high instantaneous currents to be passed through the tube without damage.

DESCRIPTION

This steel-jacketed ignitron is designed, as is the FG-238-B, for rectifier service in the 125-, 250-, 600-, and 900-volt d-c power fields. The FG-259-B is used for rectifiers rated up to 200 kilowatts depending on the number of ignitrons used, the output voltage, and the circuit.

The FG-259-B is also rated for 2400-volt resistance-welder-control service and has a capacity of 1200 kilovolt-amperes in this service. The FG-259-B has a continuous average current rating of 100 amperes per tube for use in rectifiers rated up to 200 kilowatts.

Arc losses are low. Phase control of the ignitron impulses permits voltage control of the rectified output. Excitation of the small auxiliary anode stabilizes the cathode spot for very small anode currents. Two ignitors, only one of which is used at a time, assure long life.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Electrical

Voltage drop		
At 100 amperes instantaneous anode current	12.6	volts
At 300 amperes instantaneous anode current	14.4	volts
At 600 amperes instantaneous anode current	17.3	volts

Mechanical

Cathode		pool type
Number of ignitors	2	
Number of main anodes	1	
Number of auxiliary anodes	1	
Type of cooling		water
Typical flow	1.5 to 3	gallons per minute
Pressure drop at above flow	2 to 5	pounds per square inch
Temperature rise with lower rate of flow		
150 amperes per anode	6	centigrade
Net weight, approx.	13.5	pounds
Shipping weight, approx.	22	pounds

MAXIMUM RATINGS

Rectifier Service—For Power Supply-Frequency 25 to 60 Cycles, Phase Retard = 0

Maximum inverse and forward anode voltage	900	volts	2100	volts
Maximum anode current				
Instantaneous	900	amperes	600	amperes
Average continuous current	100	amperes	75	amperes
2-hour-average current over any 2-minute period	150	amperes	112.5	amperes
1-minute-average current over any 1-minute period	200	amperes	150	amperes
Surge current, maximum duration 0.15 second	6000	amperes	4500	amperes
Maximum outlet water temperature	60	centigrade	45	centigrade
Minimum inlet water temperature	6	centigrade	6	centigrade
Minimum water flow				
At continuous average anode current	1.5	gallons per minute	1.5	gallons per minute
At no load*	0.5	gallon per minute	0.5	gallon per minute

**For systems in which the flow of water is controlled by the load.*

Welder-Control Service—Ratings are for 2400 Volts Rms, Frequency 25 to 60 Cycles

Maximum demand	1200	kva
Corresponding average anode current	75	amperes
Maximum average anode current	113	amperes
Corresponding demand	600	kva
Maximum time of averaging anode current at 2400 volts, rms	1.50	seconds
Minimum water flow	1.5	gallons per minute
Maximum outlet water temperature	30	centigrade
Maximum surge current	3000	amperes
Maximum duration of surge current	0.15	second

Ignition Requirements (Ratings are the same for both Welder and Rectifier Service)

Ignitor voltage		
Maximum instantaneous allowed, ignitor positive—same as anode voltage		
Maximum instantaneous allowed, ignitor negative	5	volts
Ignitor current		
Maximum instantaneous allowed	100	amperes
Maximum average allowed	2.0	amperes
Time of averaging current	10	seconds
Maximum ignition time	100	microseconds

TECHNICAL INFORMATION (CONT'D)

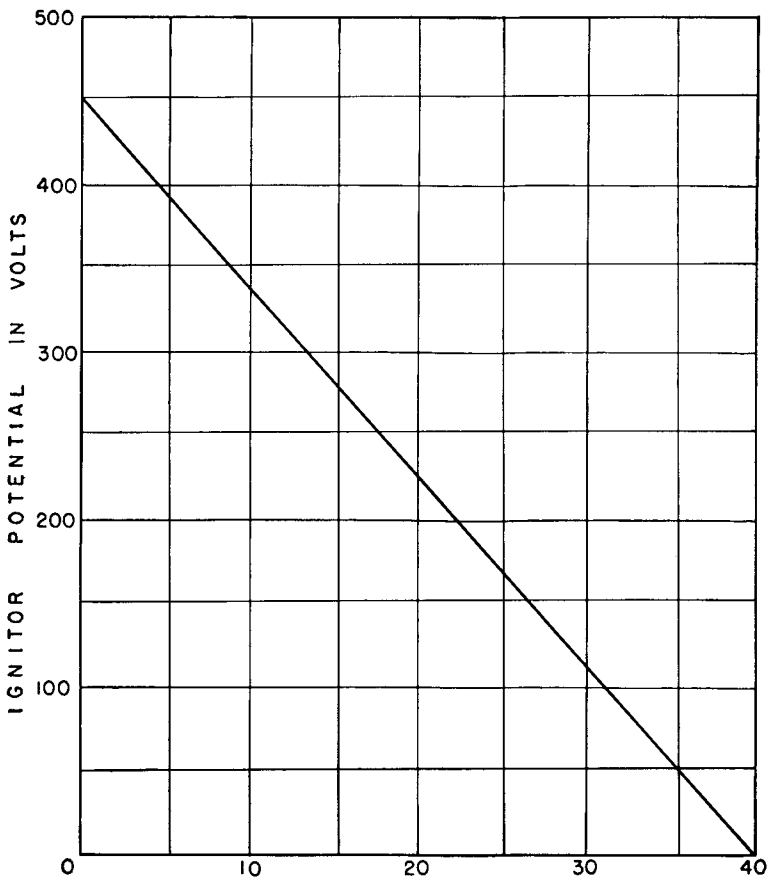
Anode firing (See elementary circuit K-9033528)

Maximum instantaneous ignitor potential required	150	volts
Maximum instantaneous ignitor current required	40	amperes
Typical resistance added to ignitor circuit for anode firing		
At anode voltage of 600 volts or less	4	ohms
At anode voltage of 601 volts to 1000 volts	10	ohms
At anode voltage of 1001 volts to 1500 volts	20	ohms
At anode voltage of 1501 volts to 2000 volts	35	ohms
At anode voltage of 2001 volts to 2400 volts	50	ohms
Separate excitation (See elementary circuit K-9033525)		
Minimum volt-ampere requirements for separate excitation		
Firing systems are shown on K-9033529		

Auxiliary Anode Requirements (Ratings are the same for both Welder and Rectifier Service)

Maximum average current	5	amperes
Maximum inverse voltage		
With main anode conducting	25	volts
With main anode not conducting	150	volts

FG-259-B
MINIMUM VOLT-AMPERE REQUIREMENTS FOR SEPARATE-EXCITATION FIRING SYSTEMS



K-9033529 FIG. 2 11-15-44

FG-259-B
ELEMENTARY CIRCUIT FOR CAPACITOR FIRING

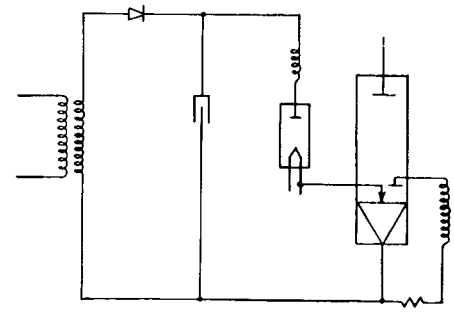


FIG. 1

K-9033525 11-15-44

FG-259-B
ELEMENTARY CIRCUIT FOR ANODE FIRING

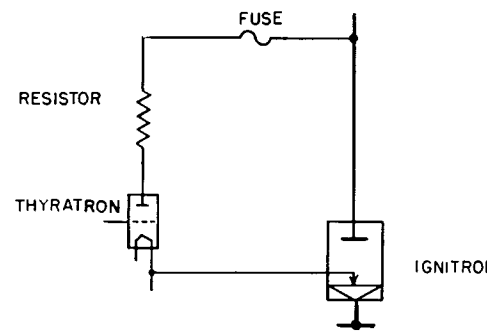
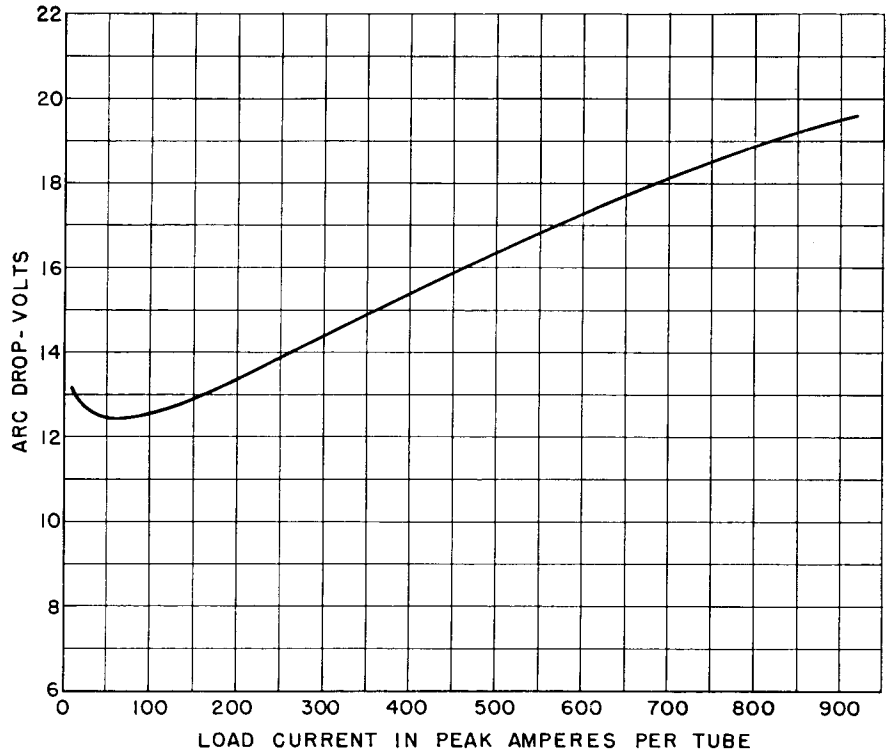


FIG. 3

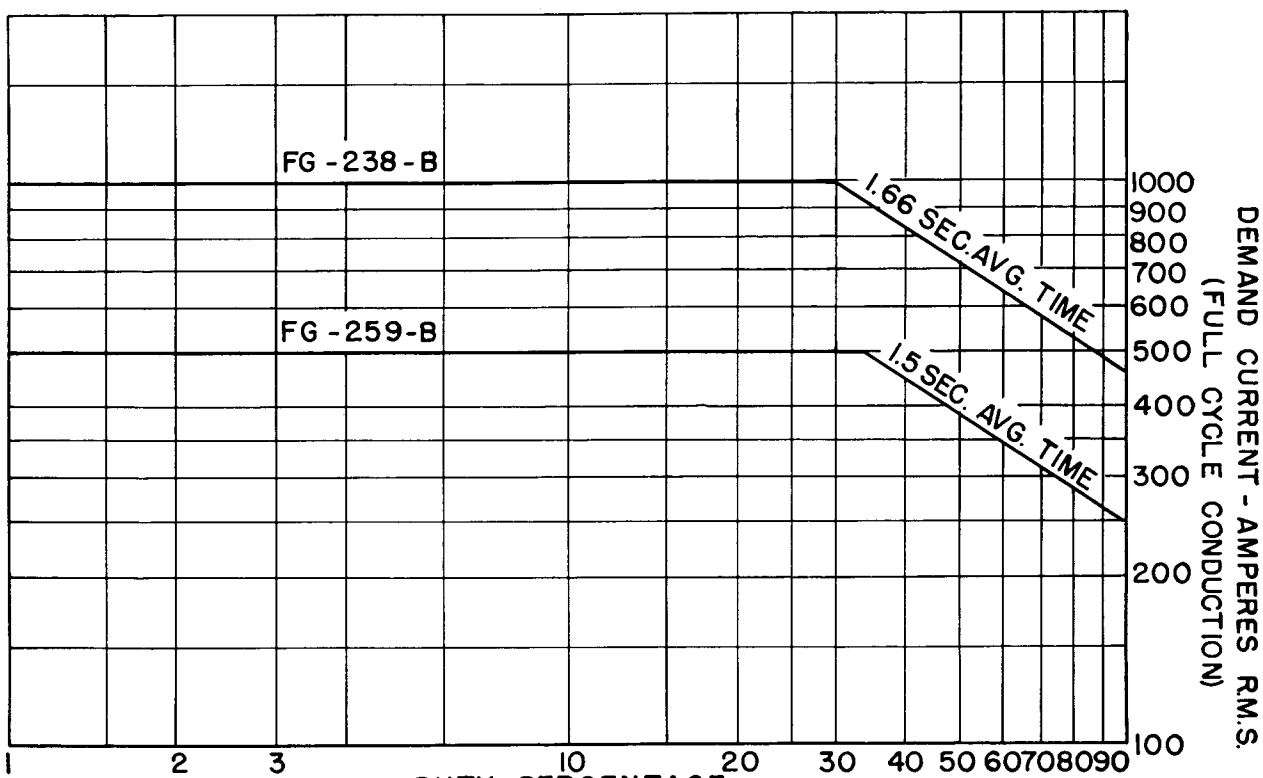
K-9033528 12-16-44



FG-259-B ARC DROP, OUTLET WATER
TEMPERATURE—40 TO 60 C, WATER FLOW—1.5 GPM

K-6917493 7-1-44

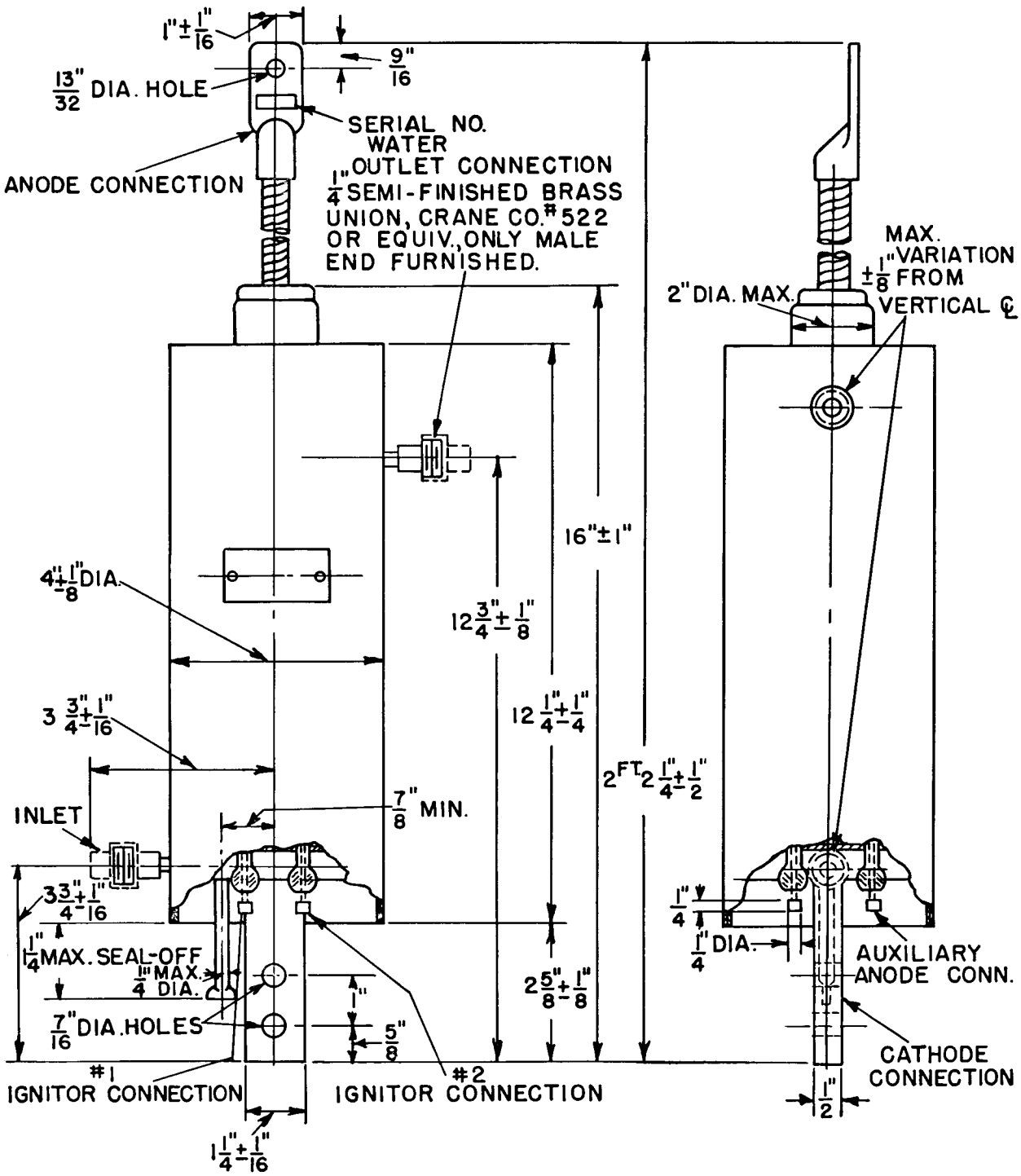
FIG. 4



FG-259-B IGNITRON; DEMAND CURRENT VS PERCENTAGE DUTY AT 2400 VOLTS RMS, MAX OUTLET WATER TEMP 30 C, MIN WATER RATE 1.5 GAL/MIN, WELDER CONTROL SERVICE

K-8074661 9-26-44

FIG. 5



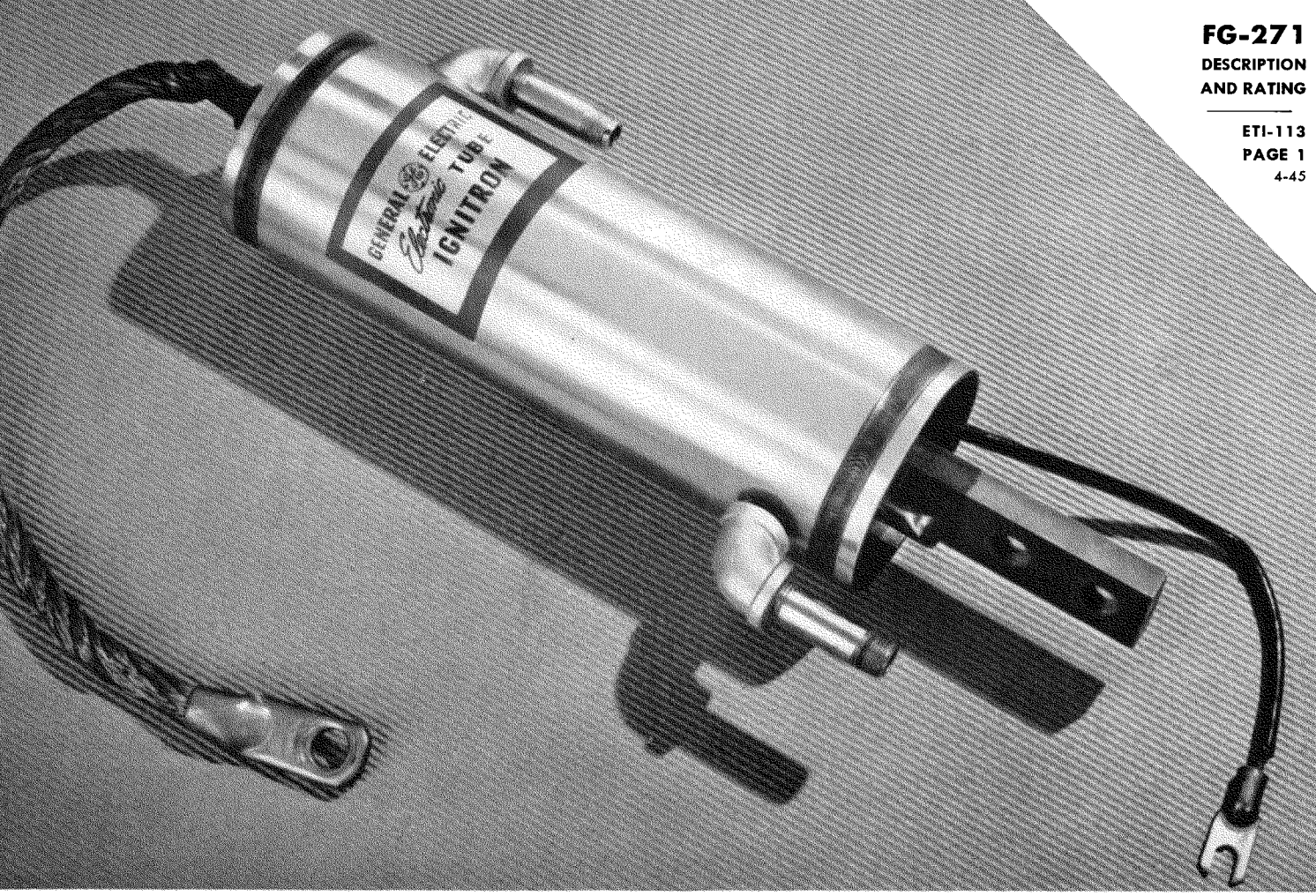
OUTLINE
FG-259-B IGNITRON

K-5344767

8-10-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



IGNITRON

SPECIAL DESIGN FEATURES

1. Stainless-steel, seam-welded construction
2. Uniform water cooling
3. Strong, compact design
4. Easy to install
5. Copper terminals
6. Flexible anode lead
7. Mercury-pool cathode allows extremely high instantaneous currents to be passed through the tube without damage.

DESCRIPTION

The ability of this tube to carry very high peak currents for short periods makes it especially suited to welder-control service. It may also be used for conversion in low-power circuits and for intermittent rectifier service.

Ease of installation, economical use of space, and reliability of operation are assured by design features inherent in the steel-jacketed construction.

The FG-271 is similar to the FG-235-A and the FG-258-A. All of these tubes can be used for a wide range of applications where welds are made infrequently or in rapid succession.

The current range required for the welding operation determines which tube to use. Another factor, of course, is the nature of the material to be welded. Low-resistance materials, such as aluminum alloys, require more current than such high-resistance metals as stainless steel.

The FG-271 ignitron is equivalent to a 300-ampere magnetic contactor.

TECHNICAL INFORMATION

These data are for reference only. For design information, refer to specifications.

GENERAL CHARACTERISTICS

Peak voltage drop, approx	12	volts
Net weight, approx	4	pounds
Shipping weight, approx	12	pounds
Type of cooling		Water
Maximum outlet water temperature	40	centigrade
Minimum flow	1	gallon per minute
Minimum inlet water temperature	10	centigrade
Pressure drop per tube at minimum flow	1.6	pounds per square inch
Temperature rise at minimum flow, approx (Average current 40 amperes per anode)	2	centigrade

MAXIMUM RATINGS

A-C Welder-Control Service-Frequencies from 25 to 60 Cycles; Ratings are for any Voltage from 250–600 Volts, Rms*†

Maximum demand	600	kva
Corresponding average anode current	30.2	amperes
Maximum average anode current	56	amperes
Corresponding demand	200	kva
Maximum time of averaging anode current*		
At 500 volts, rms	9	seconds
At 250 volts, rms	18	seconds
Maximum surge current, peak amperes	280	per cent of maximum rms demand current

Intermittent Rectifier Service‡. Frequencies from 25 to 60 Cycles

Maximum peak anode voltage		
Inverse	500	volts
Forward	500	volts
Maximum anode current		
Instantaneous	700	amperes
Average, per tube	40	amperes
Averaging time	3	seconds
Surge, peak amperes, averaging time 0.15 second	8000	amperes
Ignitor ratings same as for welder-control service		

Ignition Requirements (same for both classes of service)

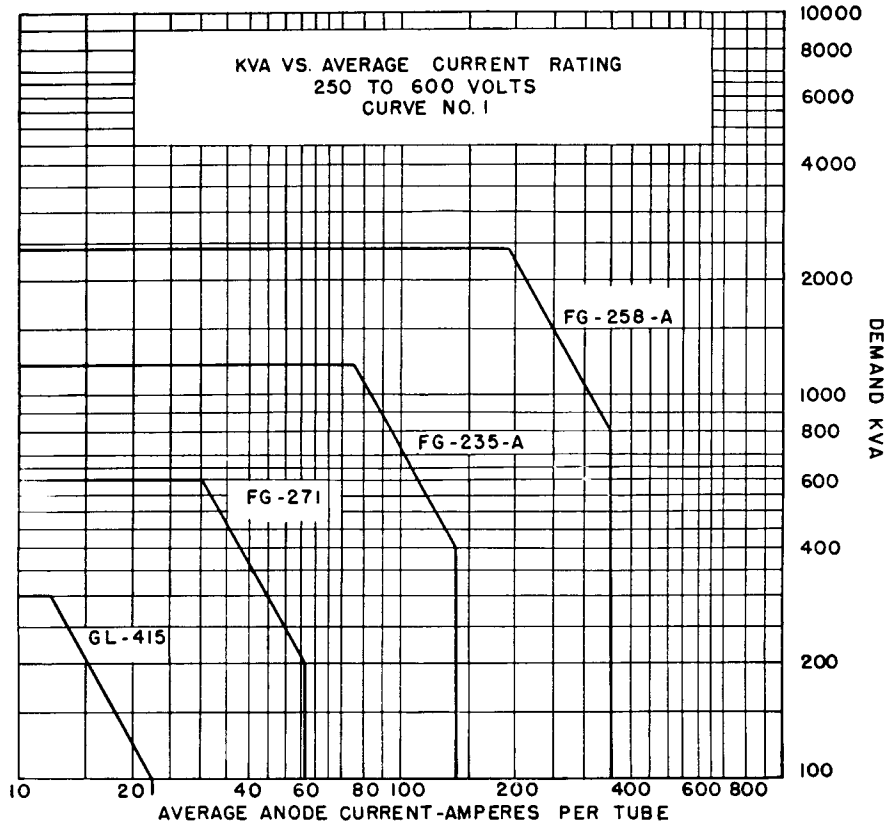
Ignitor voltage		
Maximum instantaneous allowed, ignitor positive	900	volts
Maximum instantaneous required, ignitor positive§	200	volts
Maximum instantaneous allowed, ignitor negative	5	volts
Ignitor current		
Maximum instantaneous allowed	100	amperes
Maximum instantaneous required§	30	amperes
Maximum average allowed	1	ampere
Ignitor ignition time, maximum§	100	microseconds
Ignitor current, averaging time	5	seconds

* With the use of log-log paper, straight line interpolation between the two points tabulated may be used to determine other detailed ratings.

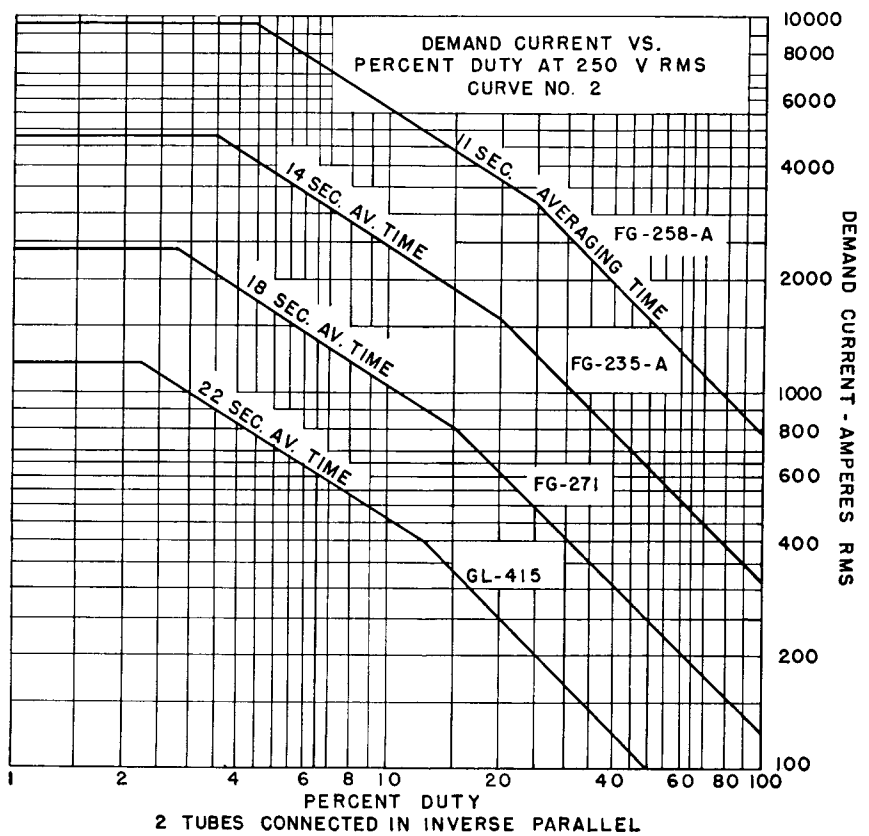
† Rms demand voltage, current, and kva are all on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used. For voltages below 250 volts, use the 250-volt rating.

§ Ignition will occur if either maximum required instantaneous positive potential is applied, or maximum required instantaneous current flows for the rated maximum ignitor ignition time.

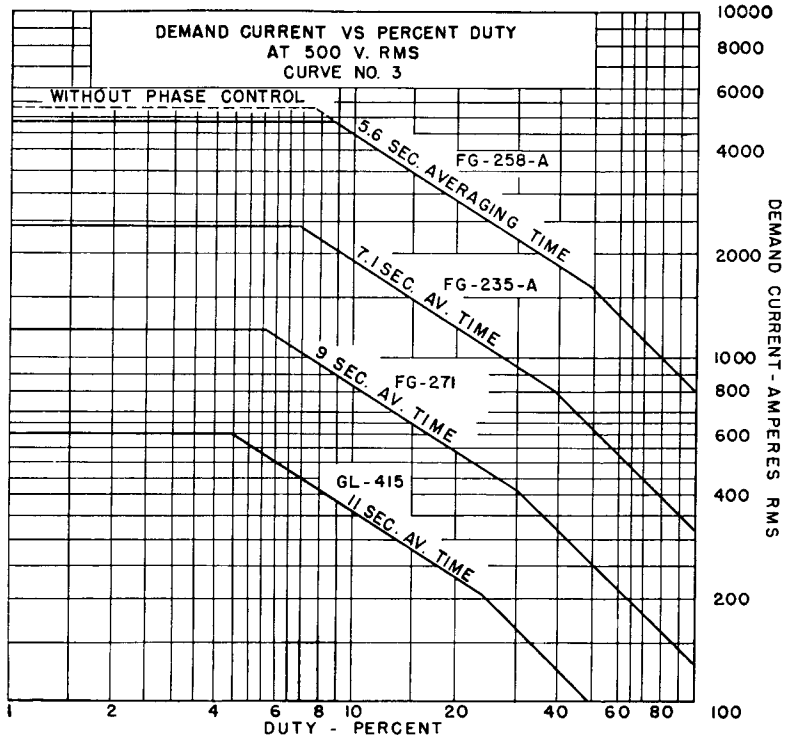
‡ The curves K-6966431, K-6966432 and K-6966433 (Figs. 1, 2, and 3) must not be used for intermittent rectifier service.



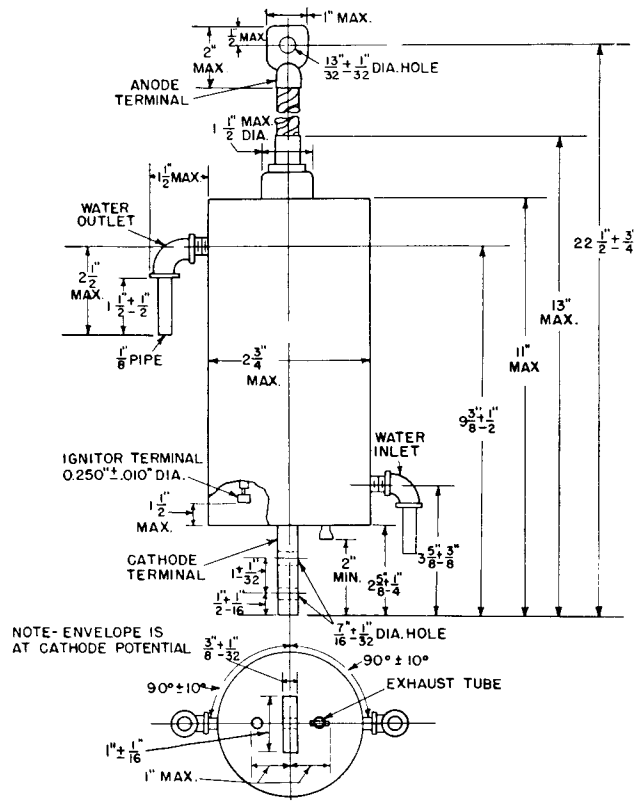
K-6966431 Fig. 1 7-1-44



K-6966432 Fig. 2 7-1-44



K-6966433 FIG. 3 8-25-44

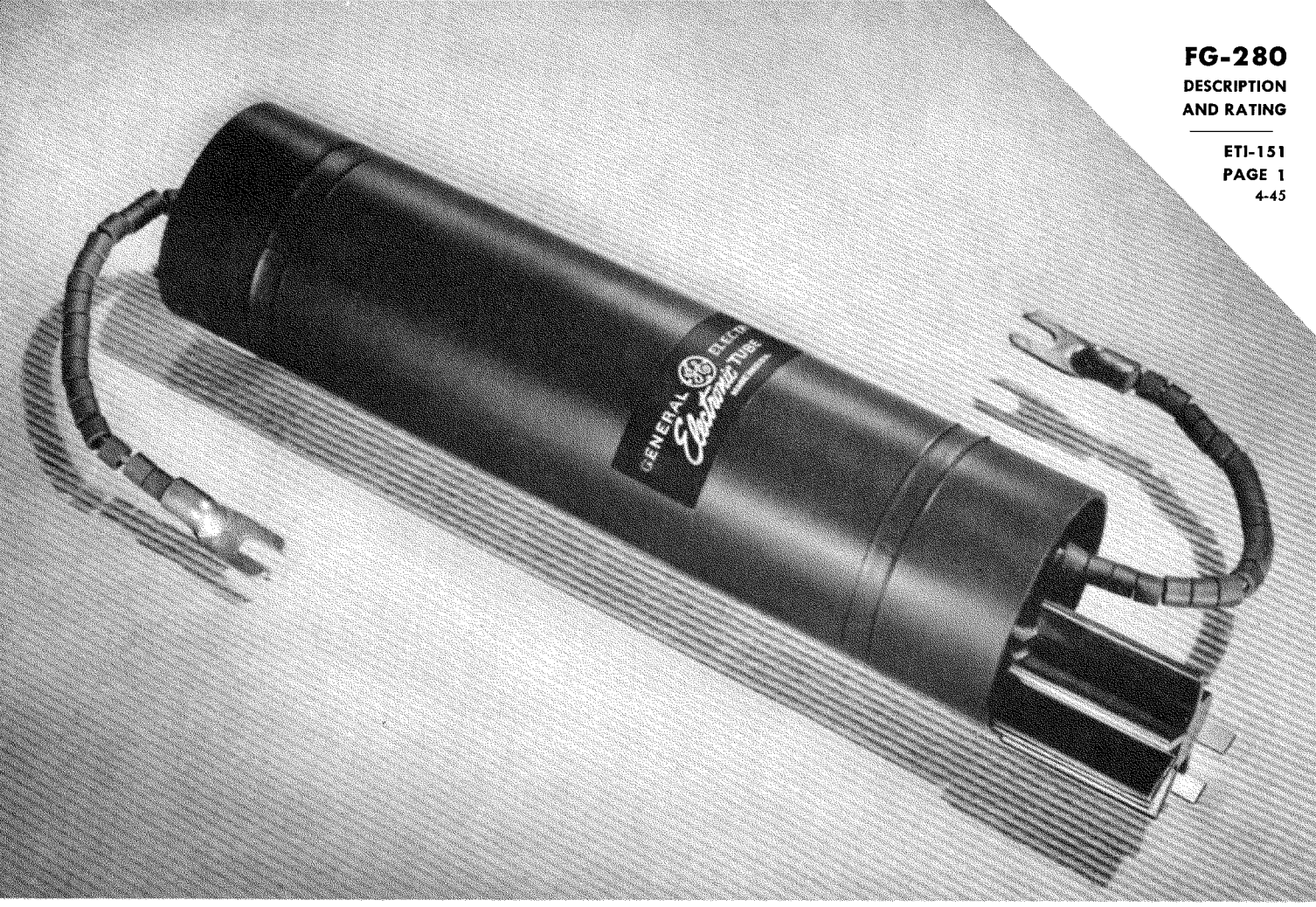


OUTLINE
K-5344676 FG-271 IGNITRON 10-5-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PHANOTRON

DESCRIPTION

The FG-280 is a half-wave, all metal, mercury-vapor rectifier for converting alternating current to direct current. It is adapted to applications where rectification of higher currents at lower frequencies and voltages is desired than is possible with high-vacuum tubes. In comparison with high-vacuum tubes, the FG-280 has a low and constant voltage drop which is an advantage in low-voltage rectifier applications as it allows more efficient utilization of power and results in lower circuit losses.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

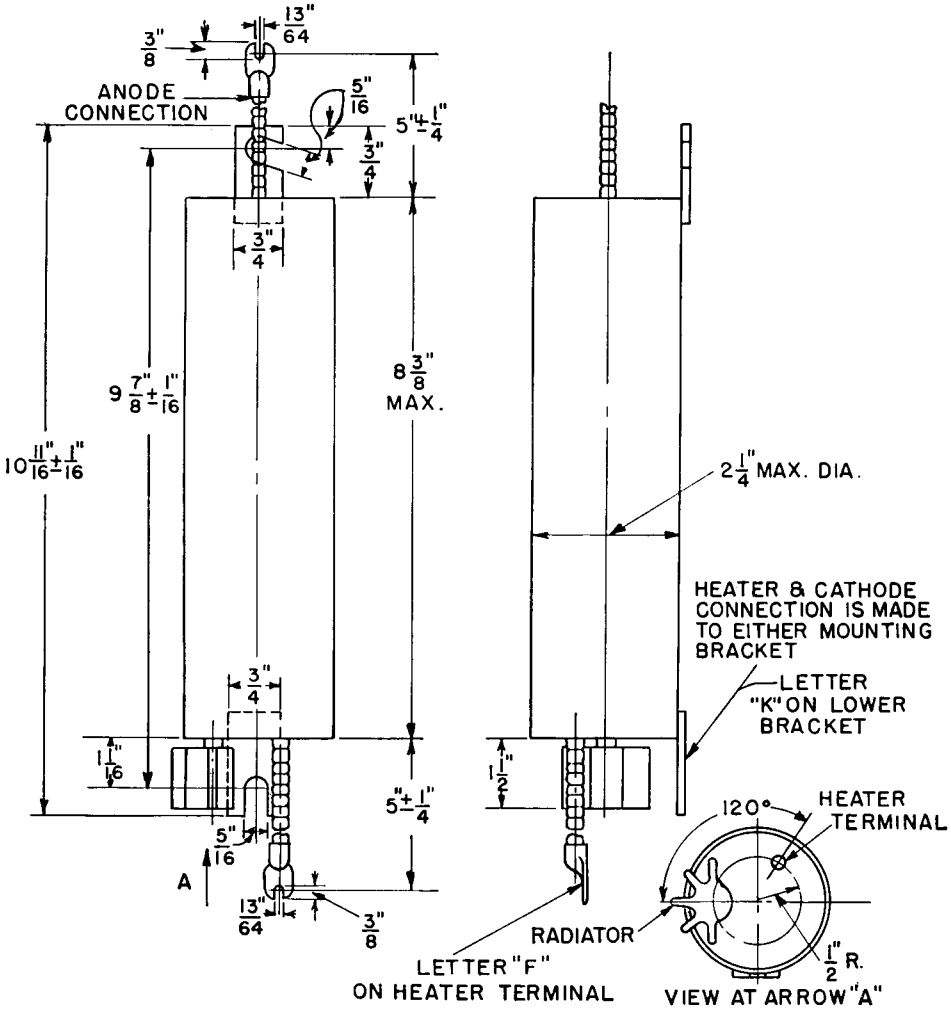
Number of electrodes	2	
Electrical		
Cathode—indirectly heated type		
Heater voltage	5.0	volts
Heater current, approx.	10.0	amperes
Heating time, typical	5	minutes
Peak voltage drop, typical	15	volts
Mechanical		
Net weight, approx.	22	ounces
Shipping weight, approx.	3	pounds
Mounting position		vertical, with radiator end down

GE Electronic TUBE

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

Maximum peak inverse anode voltage	2000	volts
Maximum instantaneous anode current		
25 cycles and above	40	amperes
Below 25 cycles	12.8	amperes
Average anode current	6.4	amperes
Surge anode current, for design only	200	amperes
Duration of surge current	0.1	second
Maximum time of averaging current	15	seconds
Temperature limits, condensed mercury	+40 +80	centigrade
Recommended temperature, condensed mercury	40	centigrade

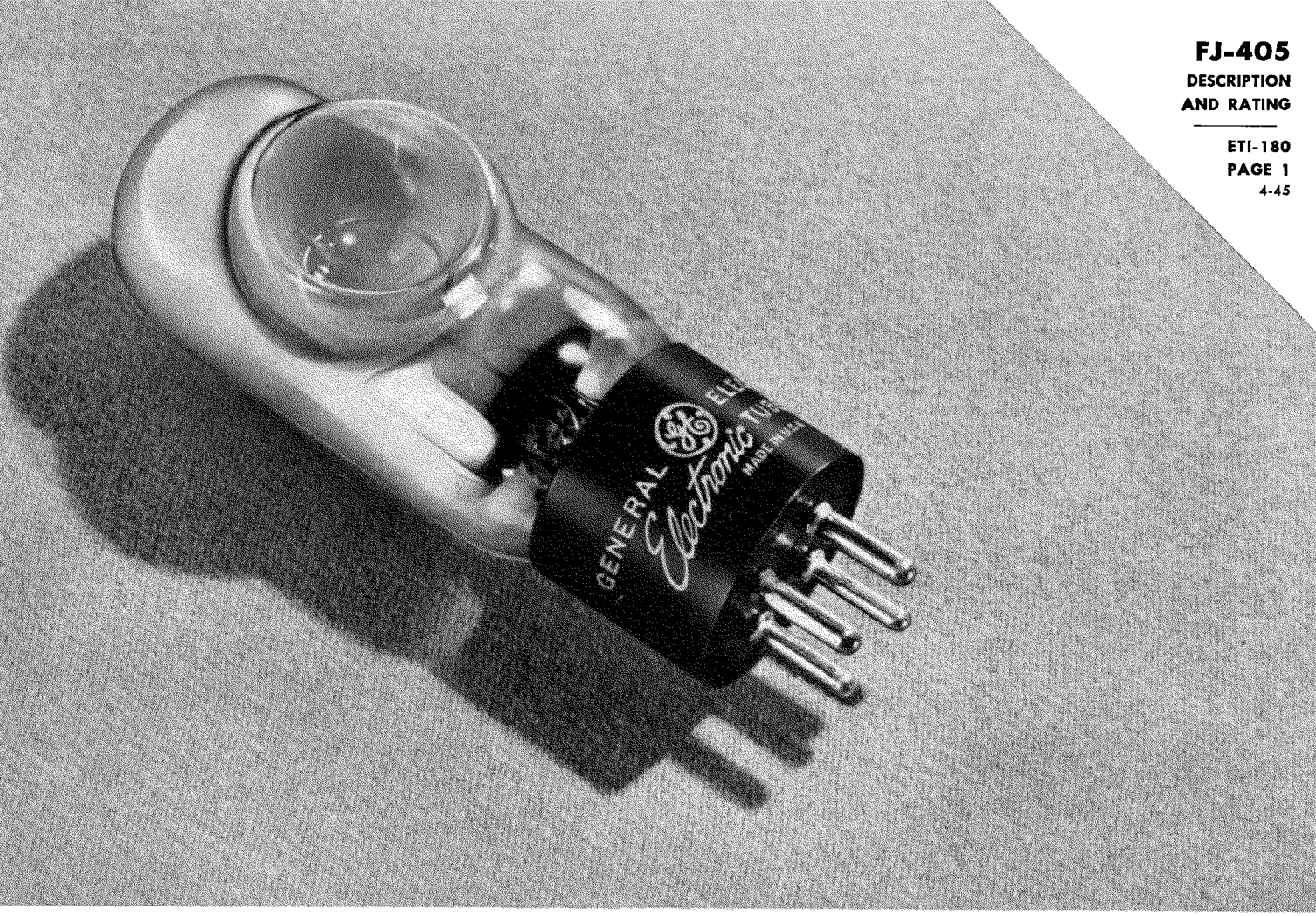


OUTLINE
FG-280 PHANOTRON

K-5344712

8-10-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



PHOTOTUBE

DESCRIPTION

The FJ-405 is a two-electrode high-vacuum phototube which is highly responsive to ultraviolet radiation between 2000 and 4000 angstroms. This phototube is a precise tool for measurement of ultraviolet radiation in the laboratory. One industrial application is to provide an accurate means of checking the radiation of ultraviolet lamps during manufacture.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Spectral response	S-6	
*Luminous sensitivity at 67.5 volts, 0 cycles	12	microamperes per lumen
Maximum gas amplification	1.2	
Interelectrode capacitance	5.0	micromicrofarads
Maximum dark current at 90 volts	0.1	microampere
Wavelength of maximum response	2800	angstroms

* With tube 25 inches from quartz uviarc burner operating at 320 watts

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

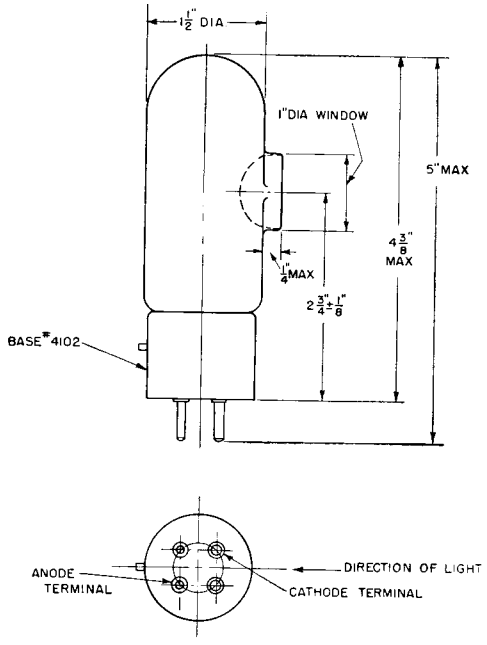
Mechanical

†Window dimensions	1	inch diameter
Seated height to center of useful cathode area	$2\frac{3}{4} \pm \frac{1}{8}$	inches
Maximum over-all height	5	inches
Maximum seated height	$4\frac{3}{8}$	inches
Maximum diameter	$1\frac{1}{2}$	inches
Base	4102	
Net weight, approx	$\frac{3}{4}$	ounce
Shipping weight, approx	3	pounds
Mounting position	Any	

† The window is very thin and should not be touched.

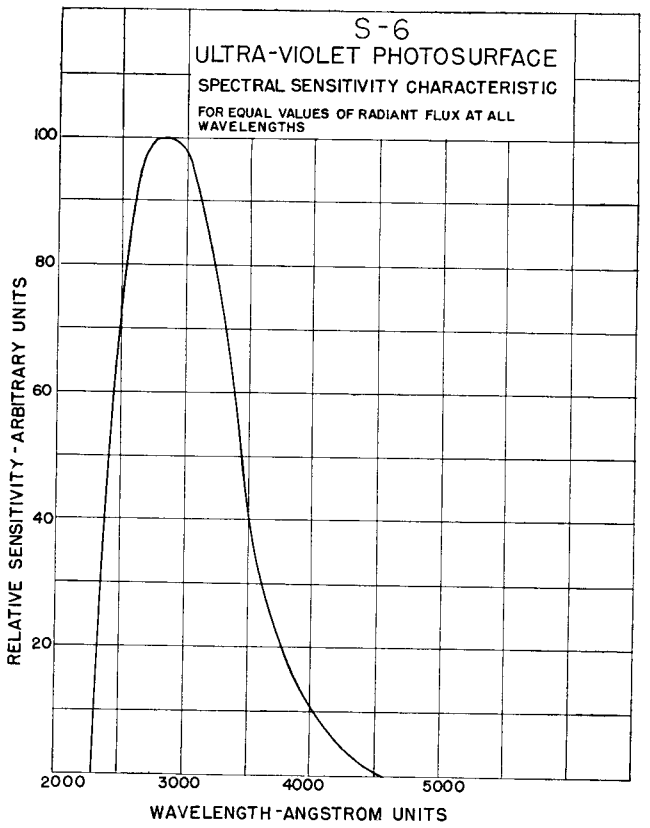
MAXIMUM RATINGS

Anode voltage, d-c or peak a-c	200	volts
Cathode current density	62	microamperes per square inch
Ambient temperature	50	centigrade



OUTLINE
FJ-405 PHOTOTUBE

K-5965349 8-18-44

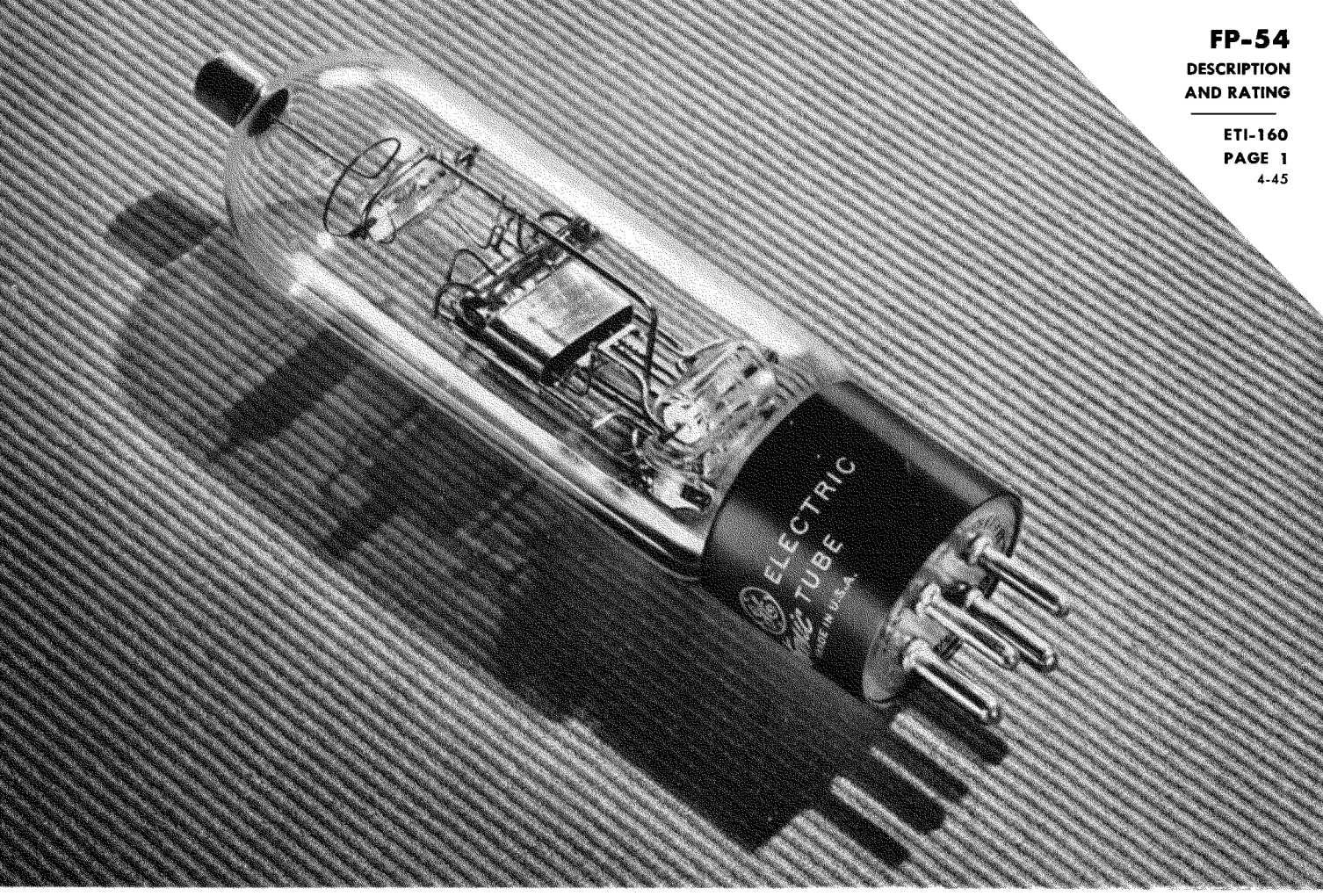


K-8639627 3-23-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PLIOTRON

DESCRIPTION

The FP-54 space-charge-grid tube is designed to have a very high input resistance and a very low grid current. It is designed particularly for amplification of direct currents smaller than about 10^{-9} amperes and has been found capable of measuring currents as small as 5×10^{-18} amperes.

This tube will give the maximum benefits when used to measure very small currents or voltages in very high-resistance circuits. Using a single tube with an input resistor of 10^{10} ohms resistance, the current amplification factor will be 250,000. Since the tube has a voltage amplification factor of less than unity, it should be used in this capacity only as a coupling tube between a high-resistance circuit and another tube which will accomplish the actual amplification. Used in the capacity of an electrometer, with a galvanometer having a sensitivity of 10^{-10} amperes per millimeter connected in the plate circuit, a sensitivity of 250,000 millimeters per volt will be obtained. The FP-54 can be easily installed and operated in a suitable circuit to detect currents as low as 10^{-17} amperes—about sixty electrons per second.

The FP-54 is a convenient and sturdy substitute for a sensitive galvanometer or electrometer in any standard circuit involving the measurement and detection of small currents.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	4	
Electrical		
Filament voltage	2.5	volts
Filament current	0.09	ampere
Approximate direct interelectrode capacitance		
Control-grid-to-plate-to-space-charge-grid	6	micromicrofarads
Mechanical		
Base		medium 4-prong bayonet
Net weight, approx.	3	ounces
Shipping weight, approx.	6	pounds

TYPICAL OPERATING CONDITIONS

Normal operating voltages		
Plate	6	volts
Control grid	−4	volts
Space-charge grid	4	volts
Average characteristics values at normal operating conditions		
Plate current	60	microamperes
Control-grid current, approx.	10^{-15}	amperes
Input resistance, approx.	10^{16}	ohms
Amplification factor	0.9	
Plate resistance	45,000	ohms
Control-grid plate transconductance	20	micromhos

INSTALLATION

The FP-54 is designed for use with a standard, 0.640-inch pin-circle diameter, four-contact socket. A spring connector should be used for connecting to the top cap. If an attempt is made to solder to the cap, the cement may loosen, causing the lead through the glass to break off. This pliotron may be mounted in any position. The tube must not be subjected to excessive vibration or sudden shock.

For measurements of very small currents, a steady high-resistance unit is required to obtain sufficient voltage drop to operate the tube. A sensitive galvanometer, with an arrangement for balancing out the initial plate current, is required for measurement of plate-current changes.

The surface of the bulb must be kept free from all sources of surface leakage. Remove all traces of foreign matter which might form a conducting path from the control grid to ground.

The air in contact with the bulb must be kept free from moisture. A drier, such as phosphorous pentoxide, placed in the compartment with the tube is satisfactory.

Because of the high leakage resistance of the tube, any change in the total capacitance of the control-grid circuit to ground, such as might be caused by stray capacitive effects, will cause a marked change in the potential of the control grid. Appreciable time will be required for the potential to return to its original value. Since the magnitudes of the plate current deflections measured are quite small, any stray magnetic effects picked up in the associated wiring will cause appreciable deflection. Because of the reasons mentioned above, tube apparatus, including all wiring, meters, controls, and batteries, must be built into a shielded compartment or operated in a shielded room. The tube must also be shielded from air. A metal box will serve both as a shield from air and as an electrostatic shield. If there are large magnetic fields in the vicinity, the shielding must be of iron.

The FP-54 has been designed to minimize all sources of leakage and great care must be taken in its installation not to introduce external sources of leakage. The grid lead and all connections in the grid circuit above ground should be run as directly as possible without any insulators. Should it be necessary to run a lead through the shield, a piece of quartz tubing will make a satisfactory bushing.

Since very small changes in current are measured, the supply voltage must be as nearly constant as possible. Storage batteries of large capacity have proved to be the best source of voltage. Special care must be taken to see that all connections are secure and that controls, such as rheostats and switches, make positive contact and are not subjected to variation by vibration or jar.

OPERATION

Careful handling and conservative operation of this tube will be amply repaid by the longer and more uniform tube life which will be obtained.

During handling, the surface of the bulb will pick up charges, a part of which will leak off through the control grid circuit, appreciably increasing the grid current. Measurements should not be made at any operating conditions without first allowing the tube to run at these conditions for some time. Half an hour will usually suffice for most of these charges to leak off. It may be found advantageous to coat the outside of the bulb with some conductor, such as aquadag, to within an inch or two of the control grid connection. Connecting this con-

ductor to a source of potential equal to that of the grid will facilitate dissipation of the charges on the bulb.

All of the recommended voltages can be varied somewhat without injury to the tube. Operating at higher voltages, however, will tend to increase the grid current. Operating at lower voltages, especially on the filament, will tend to decrease it. It is not advisable to operate with more than 2.5 volts on the filament, more than 6 volts on the space-charge grid, more than 10 volts on the plate, or with less than 3 volts negative on the control grid. When operating with a high-resistance grid leak, if a high input resistance is to be maintained, sufficient grid bias must be applied so that the voltage drop through the grid leak, caused by the grid current, does not cause the actual grid voltage to fall below the recommended minimum value. If sufficient grid bias is not applied the tube will bias itself in the region where the input resistance is low. At the point where the grid current passes through zero in changing from a negative to a positive value, the input resistance is approximately 10^{14} ohms.

In operation, the changes in grid voltage are measured by the changes in plate current. As mentioned above, this may be accomplished with a sensitive galvanometer with the initial plate current balanced out. With this method it is possible to obtain an over-all sensitivity of 250,000 millimeters per volt. Another method is to use an amplifying tube with a high mutual conductance in place of the galvanometer. The plate current of the amplifying tube can then be measured with a less sensitive galvanometer. If the supply voltages are held constant the plate current will remain constant with no tendency to drift.

The following circuits are suggested for use with the FP-54. With slight modifications these circuits may be adapted to any ordinary measurements.

I. Simple one-tube circuit

The simple circuit shown in Fig. 1 is recommended for measurements of currents as small as 10^{-14} amperes. It requires only a 12-volt storage battery and a 1.5-volt dry cell.

The method of operation is as follows:

With the filament voltage set at its rated value (2.5 volts) and V reading zero, the galvanometer is made to read zero by adjusting R_1 and R_3. The input current, i, will then produce a change in grid potential, e, equal to $R_g i$ and the change in plate current will cause a deflection of the galvanometer. By adjusting R_2 the galvanometer is brought back to zero. The meter V then reads the value of e, from which i is computed if R_g is known. The sensitivity of the amplifier depends upon the value of R_g and on the sensitivity of the galvanometer. Thus, if g_m is the grid-plate transconductance of the tube

$$g_m = \frac{di_p}{deg} = \frac{I_G}{R_g i} = \frac{kd}{R_g i}$$

where k is the galvanometer sensitivity, i_G the galvanometer current, and d the galvanometer deflection for the input current i.

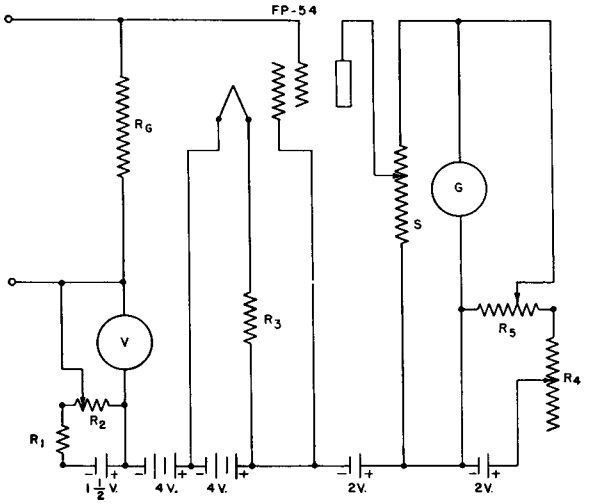
For the FP-54, g_m is equal to about 20 micro-amperes per volt. Hence, for example, if $k = 10^{-9}$ ampere per millimeter, $r_g = 10^{10}$ ohms, then d will be 1 millimeter, for $i = 5 \times 10^{-15}$ amperes. The current amplification factor is

$$A = \frac{i_G}{i} = R_g g_m$$

and hence in this example $A = 20 \times 10^4$.

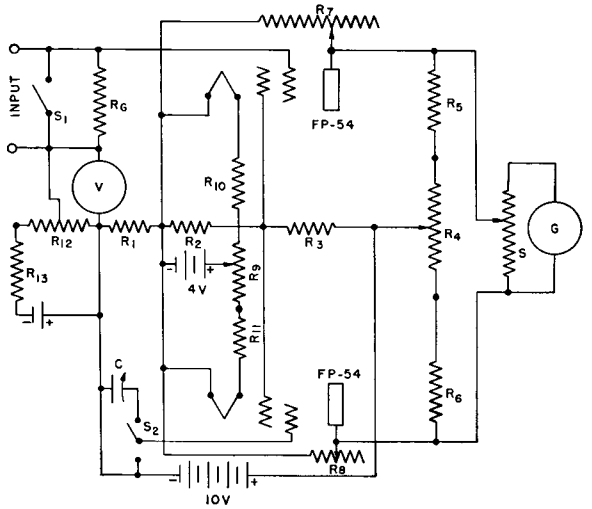
II. Two-tube balanced circuit

For currents smaller than 10^{-14} amperes, the circuit shown in Fig. 2 is recommended. The circuit is balanced by adjusting R_4, R_7, and R_8 so that variations in plate supply voltage will cause no



R_1 = 1000-ohm Resistor
R_2 = 400-ohm Potentiometer
R_3 = 17-ohm Resistor
R_4 = 400-ohm Rheostat
R_5 = 10,000-ohm Potentiometer
S = 10,000-ohm Potentiometer
V = 0-200-mv Millivoltmeter
G = Sensitive Galvanometer
R_g = 10^7- to 10^{12}-ohm Resistor

K-8639665 Fig. 1—One-tube Circuit 8-18-44



R_1 = 3000-ohm Resistor
R_2 = 5000-ohm Resistor
R_3 = 2000-ohm Resistor
R_4 = 10,000-ohm Potentiometer
R_5 & R_6 = 5000-ohm Resistors
R_7 & R_8 = 0.1—10-megohm Resistors
R_g = 10^{10}- to 10^{14}-ohm Resistor
C = 15-$\mu\mu f$ Quartz-insulated Variable Condenser
S_1 & S_2 = Quartz—or Air-insulated Switches
G = Sensitive Galvanometer
R_9 = 10-ohm Potentiometer
R_{10} & R_{11} = 15-ohm Resistor
R_{12} = 400-ohm Potentiometer
R_{13} = 1000-ohm Resistor
S = 10,000-ohm Potentiometer
V = 0-200-mv Millivoltmeter

K-8639664 Fig. 2—Two-tube balanced Circuit 8-18-44

change in the galvanometer reading. The effect of R_7 and R_8 is to make the change in current with plate supply voltage in the two circuits equal. An adjustment of R_9 can be found which will make the galvanometer reading independent of filament supply voltage as well. The circuit is then extremely stable and a galvanometer with a sensitivity of 10^{-10} ampere/millimeter may be used, together with a grid resistance of 10^{11} ohms. The ideal sensitivity then will be about 5×10^{-17} amperes per millimeter but, because of the bridge arrangement, the real sensitivity will be half as great, or 10^{-16} ampere/millimeter. The actual amplification factor will be about 10^6.

A still greater sensitivity may be obtained by floating the two control grids—that is, by making R_g infinite and switching S_2 to the condenser C. The potential of each grid will then slowly reduce due to the residual grid current of 10^{-15} amperes. If they reduce at the same rate the galvanometer will still read zero. They may be made to reduce at the same rate by adjustment of the variable 15 micromicrofarad condenser.

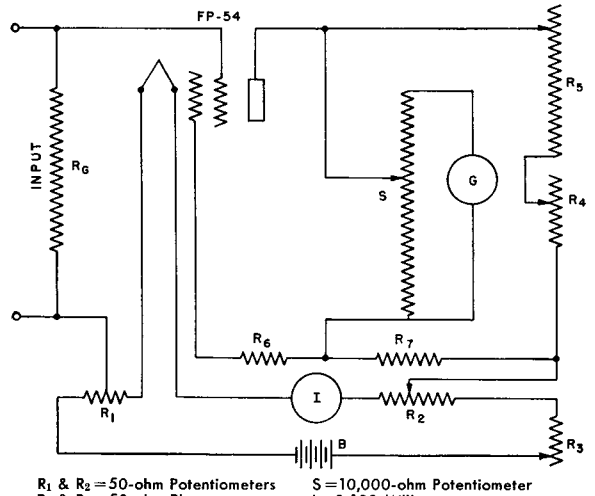
The input current i will now cause the potential of the grid of tube *No. 1* to reduce faster, and this will produce a steady drift of the galvanometer, which may be timed with a stop watch. (The circuit is thus simply a vacuum tube electrometer.) The current is then determined from

$$\frac{di_G}{dt} = g_m \frac{de_g}{dt} = g_m \frac{i}{C}$$

where C is the grid capacitance, and is about 6 micromicrofarads for the FP-54. For a galvanometer sensitivity of 10^{-10} amperes per millimeter, a drift of 1 millimeter per second will correspond to an input current of

$$i = \frac{10^{-10} \times 6 \times 10^{-12}}{20 \times 10^{-0}} = 3 \times 10^{-17} \text{ amp}$$

In actual practice such a circuit has been found capable of detecting currents of 5×10^{-18} amperes (about 30 electrons per second).



R_1 & R_2 = 50-ohm Potentiometers
R_3 & R_4 = 50-ohm Rheostats
R_5 = 10,000-ohm Rheostat
R_6 = 6000-ohm Resistor
R_7 = 2000-ohm Resistor
S = 10,000-ohm Potentiometer
I = 0-100 Milliammeter
G = Sensitive Galvanometer
R_g = 10^7- to 10^{11}-ohm Resistor
B = 12-volt Storage Battery

K-8639662 Fig. 3—Stabilized One-tube Circuit 8-18-44

The galvanometer deflection is calibrated in terms of input voltage using the millivoltmeter V.

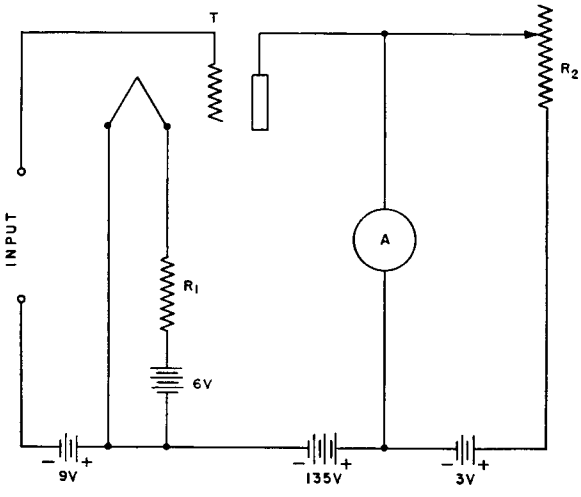
III. Stabilized one-tube circuit

In order to obtain the greatest sensitivity using one tube and for making measurements over a long period of time, the circuit shown in *Fig. 3* is recommended.* This circuit can be adjusted so that changes in battery voltage as well as drift in plate current have no effect on the balance of the galvanometer. Adjust the circuit by setting the filament current (I) to obtain approximately the rated filament potential, and bring the galvanometer to zero by varying R_3 and R_4. Then by varying R_2 a point should be found where the rate of change of galvanometer deflection with filament current is zero. If this point cannot be found within a range of plus or minus 3 or 4 per cent of filament current, change the setting of R_2 and repeat. Then balance the galvanometer to zero with R_4 and R_5. After operating for 20 or 30 minutes it may be necessary to readjust R_4 and R_5 for zero balance.

The operation of this circuit is identical with that shown in *Fig. 1* and the same equations for sensitivity and current amplification will apply.

IV. Two-stage amplifier

When it is desired to measure currents of 10^{-9} to 10^{-14} amperes with a very sturdy galvanometer or microammeter, the circuit of *Fig. 4* has been found useful. The first stage may be any of the



R_1 = 4-ohm Resistor
R_2 = 400-ohm Rheostat
A = Microammeter
T = 112-A or Equivalent

K-8639663 Fig. 4—Two-stage Amplifier 8-18-44

circuits previously described but having the input terminals of this second stage connected in place of the galvanometer. The second stage is balanced by adjustment of R_2.

With a microammeter of given range, the sensitivity of the amplifier may be varied by changing the grid resistance R_g. The over-all sensitivity of this circuit connected to the circuit shown in *Fig. 1* or *Fig. 3* is approximately

* *Lee A. DuBridge, and Hart Brown—Review of Scientific Instruments, Vol. IV, No. 10, pages 532–536, October 1933.*

$$\frac{i_A}{i} = \frac{\mu 1\, R_s}{r_p + R_s} \times gm_2 R_g$$

where i_A = *microammeter current*
i = *input current*
r_p = *internal plate resistance of first tube*
$\mu 1$ = *voltage amplification factor of first tube*
gm_2 = *grid-plate transconductance of second tube*
R_s = *resistance of S in Fig. 1 or 3.*

For the FP-54, $\mu 1 = 0.9$ and $r_p = 45{,}000$ ohms, and for the second tube, gm_2 may equal 1500 micromicroamperes per volt. Hence if $r_g = 10^{11}$ ohms and $r_s = 10{,}000$ ohms, an output current i_A of 1 microampere will be obtained for $i = 4 \times 10^{-14}$ ampere (approx) and the current amplification is 2.5×10^7.

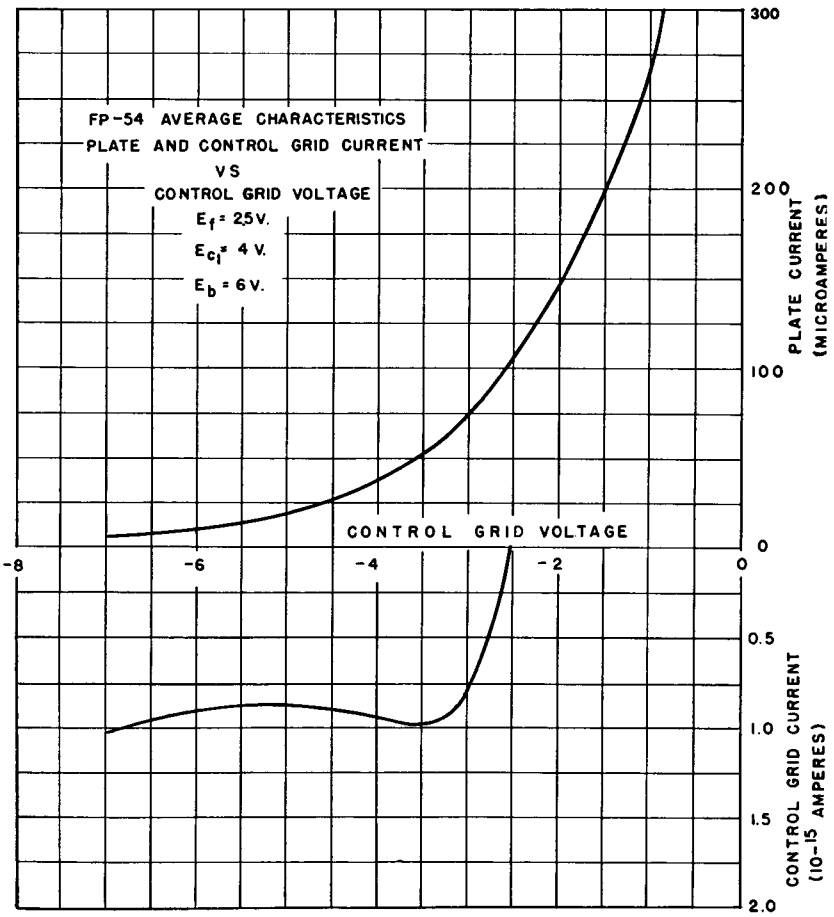
It has been found that i_A is a linear function of i for input voltages ($= R_g i$) less than about 0.5 volt. For larger input voltages, up to 5 volts, a null method should be used to prevent the FP-54 grid voltage becoming low enough to draw a high grid current.

High Resistance

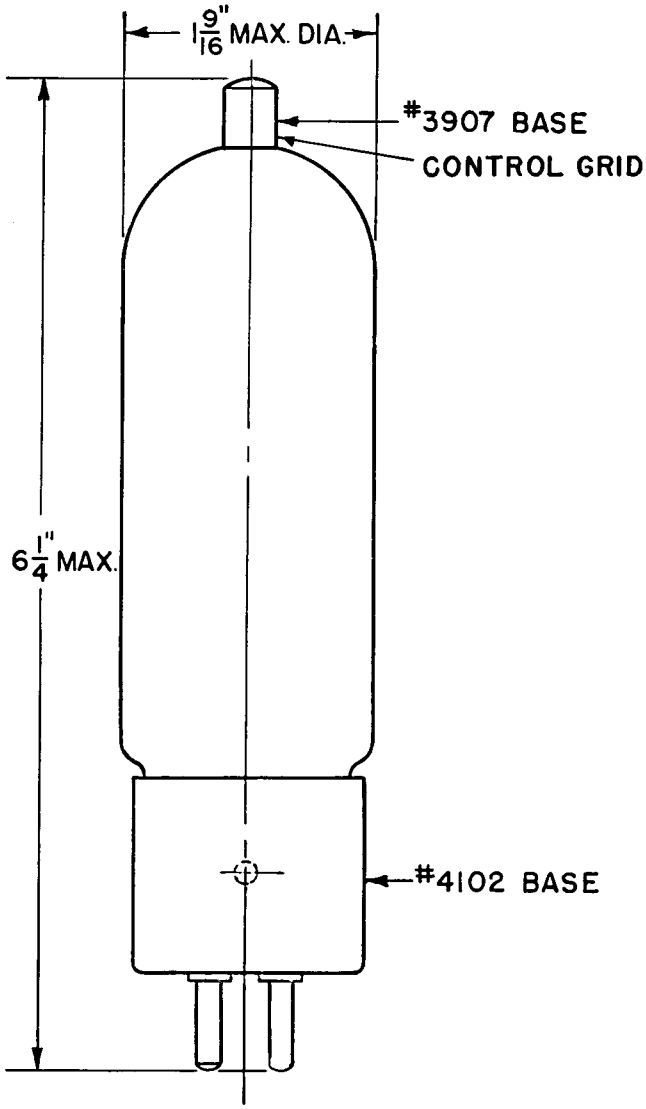
Metallic grid-leak resistors may now be obtained up to 100 megohms and composition resistors up to 10^{14} ohms. Resistances up to a thousand megohms may be made by ruling India ink marks on drawing paper or hard rubber or amber, and inclosing in a drying tube. Still higher resistances may be made by evaporating or sputtering thin metal films onto a glass or quartz rod, keeping the rod in paraffin or in vacuum.

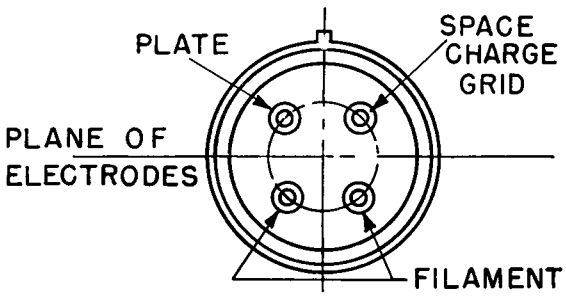
PRECAUTIONARY OPERATING NOTES

1. The whole circuit, including batteries, should be shielded carefully from external electrostatic fields by an earthed metal shield.
2. The tubes should be kept dry. It has been found satisfactory to inclose circuit and tubes in a metal-lined box in which a drying agent is kept.
3. Only the best insulation, such as quartz or amber, should be used in the control-grid circuit. The connections should be self-supporting as much as possible.
4. Rheostat slides should make firm positive contact. Cleaning with sandpaper is advised.
5. The switches S_1 and S_2 used in the circuit of *Fig. 2* should be of small capacitance and without contact potentials.
6. The output current is a linear function of input voltage over only a limited range. The amplifier must be calibrated if a direct deflection rather than a null method is to be used.
7. Keep all batteries in good condition.



K-9033584 FIG. 5 1-13-45





OUTLINE FP-54 PLIOTRON

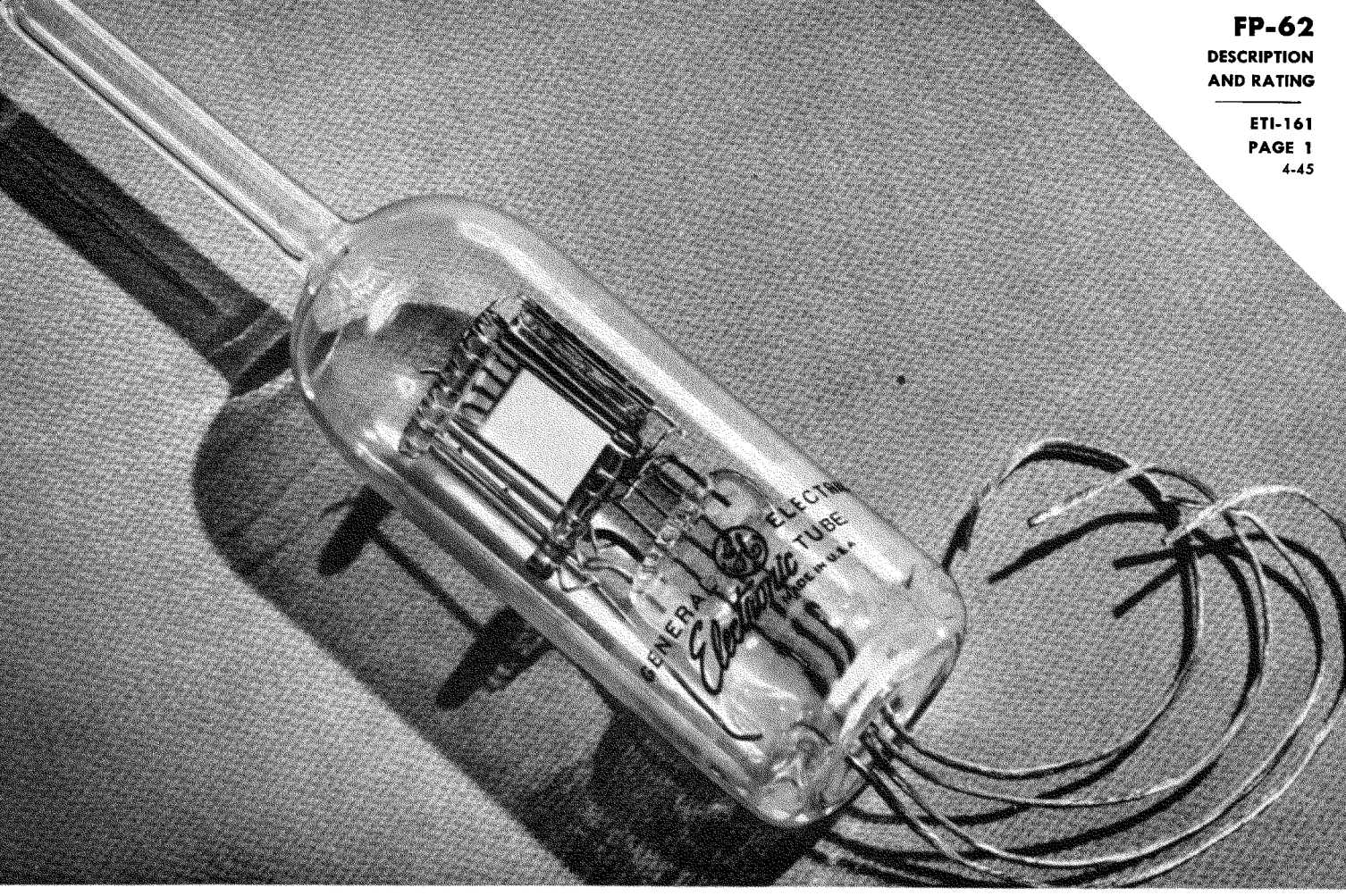
K-4903522

6-9-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PLIOTRON

DESCRIPTION

The FP-62 ionization gage embodies several unique design features which make this tube an efficient and reliable device for the measurement of gas pressures.

Stem leakage is entirely eliminated by mounting the plate, which serves as the positive ion collector, on glass beads and by bringing the plate lead out through the side of the stem. The grid, which serves as the "anode," and the filament, are mounted in the usual manner with the grid between the collector and the filament. The measurement of the small ionization currents associated with low pressures is made possible because of design features which result in high insulation resistance of the collector circuit. Since both the plate and the grid are made of molybdenum and have smooth surfaces, they may be heated to a temperature high enough to drive out all occluded gas within a reasonable time and can readily be heated by bombardment, in case high-frequency heating equipment is not available.

Freedom of the filament from contamination by ordinary gases is assured by its pure tungsten composition. To withstand the effects of flexing in service, the leads to the electrodes are made of a special stranded cable.

For most measurements, where up to twenty per cent error may be tolerated, the sensitivity figures given below may be used. For more accurate measurements, however, the gage should be calibrated with a McLeod gage each time it is installed.

The FP-62 will accurately and conveniently measure gas pressures over a range of 100 microns to as low as 0.001 micron. Not only is it sufficiently sturdy for general use, but it is also sensitive enough for the most delicate measurements.

This gage has a high sensitivity characteristic and, since the parts are rigidly mounted, it will hold its calibration to a very close degree.

TECHNICAL INFORMATION

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Filament—pure tungsten		
Normal voltage, approx.	4.5	volts
Normal current, approx.	1.48	amperes
Maximum current	1.68	amperes
Normal operating conditions		
Collector voltage	−22.5	volts
Grid voltage	112.5	volts
Grid current	10	milliamperes
Average sensitivity (collector current per micron of pressure of dry air at normal operating conditions) approx	40	microamperes
Mechanical		
Bulb material		hard glass
Maximum "bake-out" temperature	500	centigrade

TYPICAL CALIBRATION

Grid voltage	112½	volts
Collector or plate voltage	−22½	volts
Grid current	10	milliamperes

Gas	Collector Current in Microamperes per Micron Pressure
Helium	5.6
Neon	9.0
*Nitrogen	39.5
Argon	54.0

* The value given for nitrogen is correct for dry air since the oxygen cleans up when the filament is lighted.

INSTALLATION AND OPERATION

INSTALLATION: The FP-62 is of hard glass and may be used on either hard- or soft-glass systems. When it is sealed to a soft-glass system a graded seal must be used. The gage is furnished exhausted and sealed off and with a tubulation for sealing it into the system. The gage should be kept in this form until it is ready to be used. The end of the tubulation is then cut off and the gage sealed into the system, care being taken that no constriction is formed between the bulb and the system. For accurate results, the gage should be placed as near as possible to the point at which the pressure is to be measured. The gage should be mounted with its axis vertical. The stem may be either up or down, whichever is more convenient. Since, in sealing the gage into the system, the end of the tubulation is cut off and air is let in, it is necessary to exhaust and degas the gage before it can be used. For this reason the gage is furnished unbased to permit its being baked out.

Where high voltages are used in the system and where there is a possibility of a gaseous discharge to the electrodes of the gage, a wire or guard ring should be inserted in the seal when sealing to the system. This wire or guard ring should then be well grounded.

Care should be taken against shorting the leads while anyone is working around the system. The entire collector circuit should be well insulated to prevent the introduction of external sources of leakage. The glass around the collector lead should be clean so that there will be no leakage at that point.

For working at low pressures it is necessary to degas the gage thoroughly. At these low pressures the gas occluded from the metal parts and from the glass may cause the gage to read higher than the actual pressure in the system. Before the gage is used, it should be degassed as follows:

1. Bake out with the rest of the system (do not exceed 500 C).
2. Connect the grid and plate leads to the positive 500-volt d-c supply.
3. Bombard at 1000 C plate temperature for 20 minutes. This is accomplished by regulating the filament voltage to give approximately 40 to 80 milliamperes total current.

Note: Only a d-c voltage supply should be used in this operation.

OPERATION: Measurements are taken with the gage by placing a positive voltage on the grid and a negative voltage on the collector. The filament voltage is increased until the grid current reaches the desired value. The negative current to the collector is then a measure of the gas pressure.

The calibration curve of the gage is nearly a straight line, especially at pressures below one micron. By checking a few points of collector current and gas pressure against a McLeod gage, the curve can be plotted and extrapolated down to

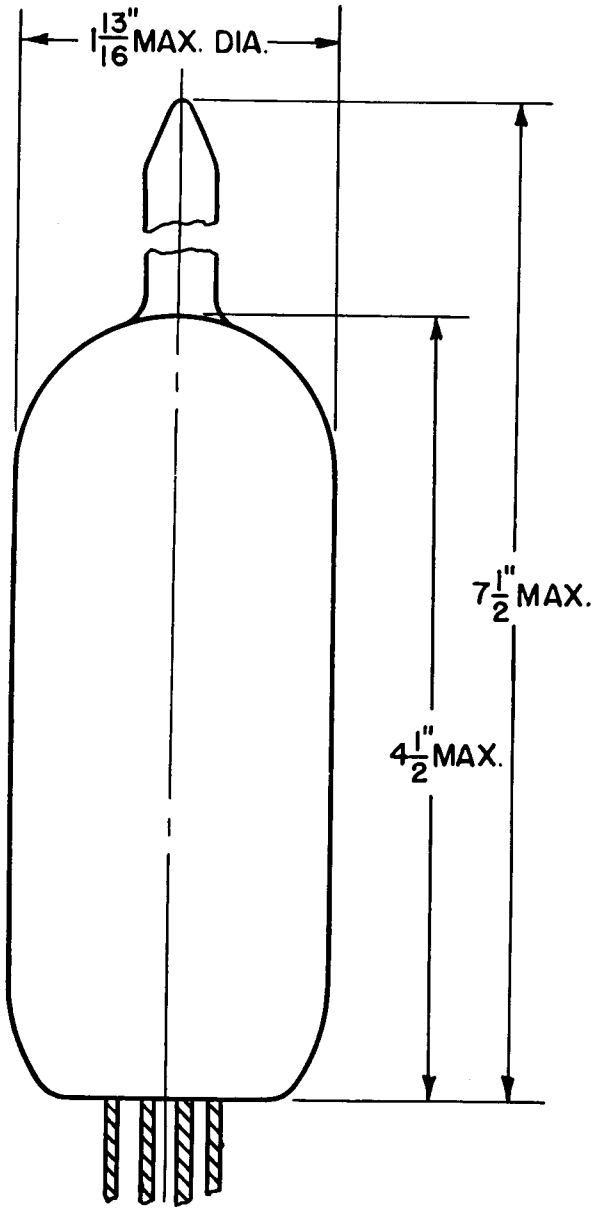
zero current at zero pressure. Typical calibrations for various gases are shown on page 2.

It can reasonably be expected that, as long as the arrangement of the electrodes of the gage remains unchanged, the calibration will also remain constant. Excessive overheating during degassing or rough handling may warp or change the relative positions of the electrodes. Leakage arising in the collector circuit can also cause a change in the calibration. This, however, can be detected by looking for a residual leakage current with the filament cold.

OPERATING NOTES

The filament should not be lighted until the pressure has been reduced to a low value. Care should be taken during bombardment that the gas evolved does not cause the current to increase steadily until the filament burns out or the electrodes are warped. A series resistor will be found satisfactory for avoiding such trouble. As a further precaution, bombardment should not begin until the pressure is below one micron.

In taking readings at extremely low pressures, there are two sources of inaccuracy which may be present. The gage will clean up the gas slowly and give too low a reading. Furthermore, the rate of flow, or rather drift of gas, at low pressure is slow and the gage may read high or low depending on which way the pressure is changing. For best results it is recommended that the filament be turned off and the system allowed to equalize for several minutes. Following this period of equalization the filament should again be lighted and a reading taken as soon as possible.



OUTLINE
FP-62 PLIOTRON

K-4903555

6-9-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



KENOTRON

DESCRIPTION

The FP-85-A is a high-vacuum rectifier that may be used at voltages as high as 20,000 volts peak inverse. This tube is particularly useful in applications which require high voltage and low current.

RECOMMENDED FOR REPLACEMENT ONLY—USE GL-8020 FOR NEW APPLICATIONS

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Cathode—Filamentary type, pure tungsten		
Filament voltage	10.0	volts
Filament current	5.0	amperes
Voltage drop ($I_b = 20$ milliamperes)	90	volts
Interelectrode capacitance, plate-filament	1.8	micromicrofarads
Mechanical		
Base	4102	
Maximum over-all dimensions		
Length	8	inches
Diameter	$2\frac{5}{16}$	inches
Net weight, approx.	$3\frac{1}{2}$	ounces
Shipping weight, approx.	3	pounds
Mounting position		vertical, with base down

Electronic TUBE

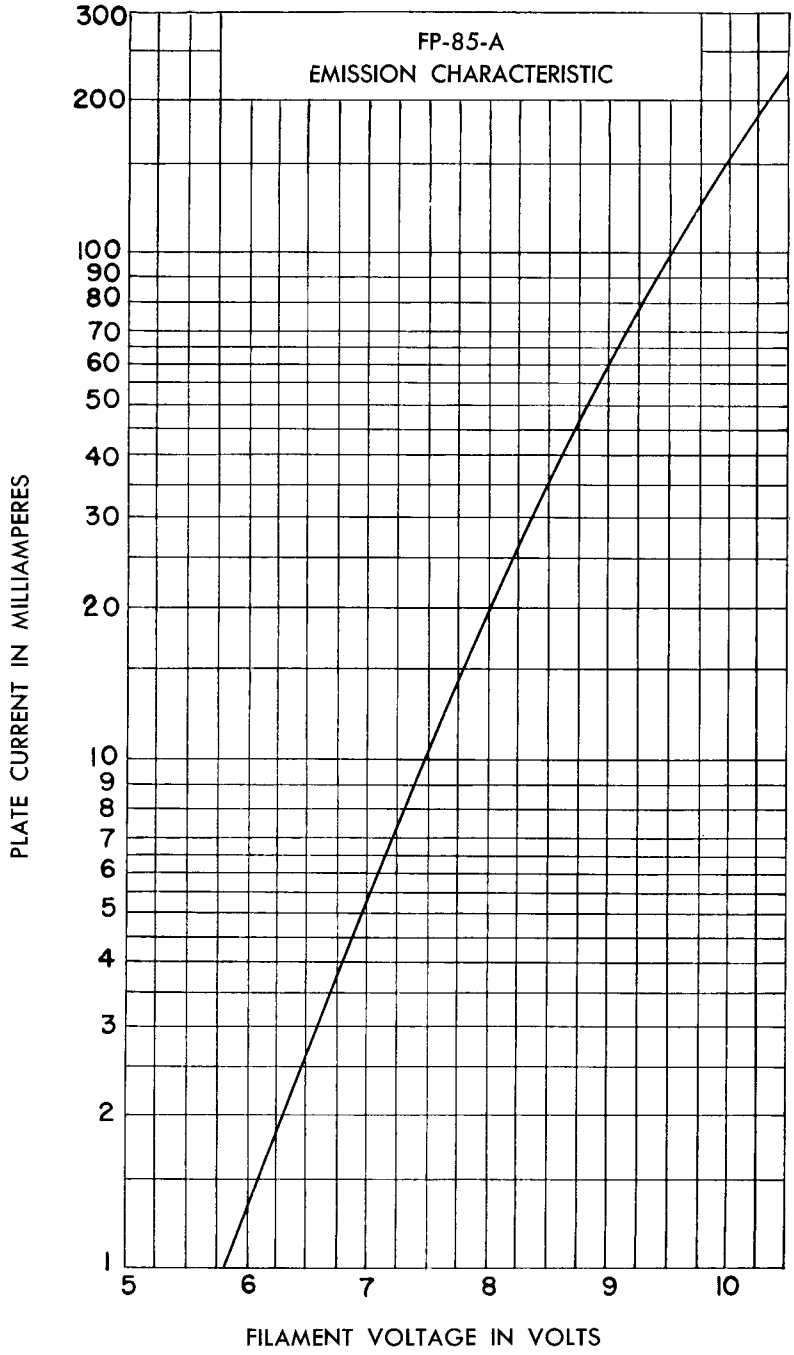
GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

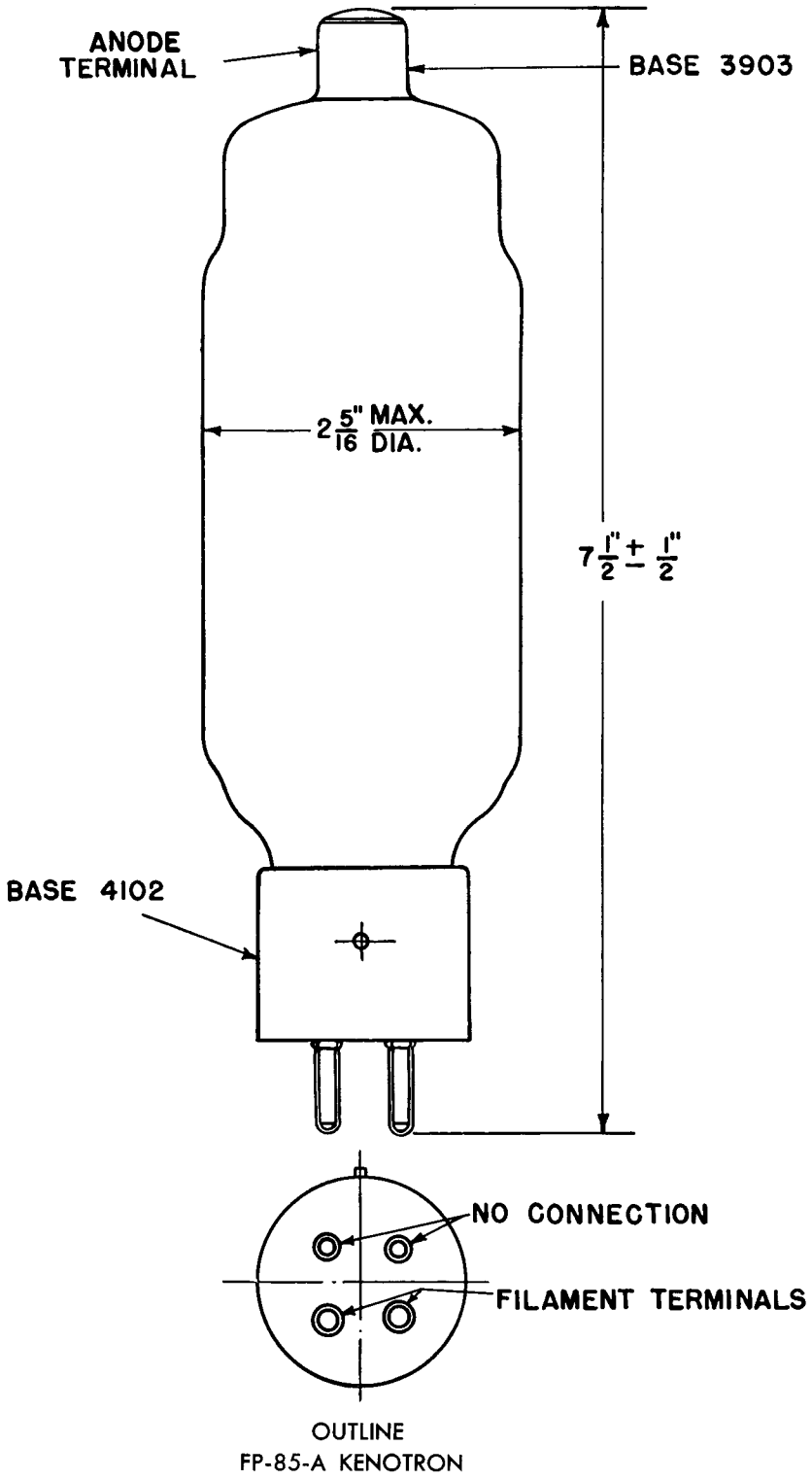
For Rectifier Service

Maximum peak inverse voltage	20,000	volts
Maximum peak anode current	100	milliamperes
Average anode current	20	milliamperes
Maximum ambient temperature	60	centigrade



K-6917414

2-6-45



OUTLINE
FP-85-A KENOTRON

K-6979168

9-23-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850

PLIOTRON FP-146

PRELIMINARY TECHNICAL INFORMATION SHEET

GENERAL

Main Use - Class B Power Amplifier		
Number of Electrodes	3	
Filament Voltage	10	Volts
Current	3.25	Amperes
Type - Thoriated Tungsten		
Average Characteristic Calues Calculated at Eb = 1250, Ib = .090 amp., Ef = 10 v. direct		
Grid Voltage	+22	Volts
Amplification Factor	78	
Plate Resistance	20,000	Ohms
Mutual Conductance	3,900	Micromhos
Average Direct Interelectrode Capacitances:		
Plate to Grid	9.2	mmf.
Grid to Filament	7.2	"
Plate to Filament	3.9	"
Maximum Overall Dimensions:		
Length	9-1/2	Inches
Diameter	2-3/4	"
Base Type Numbers	3917 & 4310	
Type of Cooling - Air		

MAXIMUM RATINGS & TYPICAL OPERATING CONDITIONS

Class B Audio Frequency Power Amplifier	Max. Rating	Typical Operation		
Plate Voltage	1500	1250	1000	Volts Direct
Grid "		0	0	" "
Fil. "		10	10	" "
Plate Current - No Signal		.017	.010	Amp. "
" " Max. Signal	.175*	.160	.160	" "
" Input - " "	250*	200	160	Watts
" Dissipation	125*	75	60	"
Output - approx. - Max. Signal	[illegible]	125	100	"
Load Resistance per Tube		2100	1750	Ohms

* Averaged over any audio-frequency cycle

Class B Radio Frequency Power Amplifier (Carrier conditions to which a mod. factor up to 1.0 can be applied)				
Plate Voltage	1500	1250	1000	Volts Direct
Grid "		0	0	" "
Fil. "		10	10	" "
Plate Current	.175	.132	.150	Amp. "
" Input	200	165	150	Watts
" Dissipation	125	110	105	"
Output - approx.		55	45	"

April 26, 1934

H-4997150

GENERAL ELECTRIC

General Installation and Operation of Pliotron Tubes

Installation

MECHANICAL

Pliotron mountings must be of good quality and should be so installed as to minimize danger from impact. If the set is subject to vibration, a shock-absorbing suspension must be employed.

COOLING

All apparatus should be arranged to allow free circulation of air around the pliotron. The bulb becomes very hot during operation and, therefore, should neither come in contact with any metallic object nor be subjected to drops or spray of liquid.

Sets using more than one tube should provide adequate spacing between tubes so that adjacent portions of the bulbs do not operate appreciably hotter than the other sections.

ELECTRICAL

To avoid danger of corona discharge, all wires and connections should be made to allow several inches of free space around the pliotron. For tubes using a metal base, the metal shell must not be connected to any part of the circuit.

The filament is of the thoriated-tungsten type, and should be operated preferably from an a-c source, although a d-c supply may be used. A voltmeter should be connected permanently across the filament circuit at the socket terminals so that the filament voltage can be maintained at the ⌀rated value. The filament supply should be designed to allow operation at rated filament voltage. Unless otherwise specified by the manufacturer, any variations which may occur should permit operation of the filament at voltages within the range; namely, rated voltage to five per cent above rated voltage. The filament transformer shall have good regulation and should be designed for at least thirty per cent above rated filament wattage. During "stand-by" periods, the filament voltage should be maintained at rated voltage. If the "stand-by" periods exceed two hours in duration, the filament current should be shut off.

Overheating by severe overload may decrease filament emission. Unless the overload has liberated a large amount of gas, the activity of the filament usually can be restored by operating the filament at rated voltage for ten minutes or more with no voltage on the plate or grid. This process may be accelerated by increasing the filament voltage to 20 per cent above the ⌀normal value (not higher) for a few minutes.

The grid-circuit and plate-circuit return leads should be connected to the center tap of the filament-transformer secondary. When d-c filament excitation is used, the return leads from the grid and plate circuits should be connected to the negative filament terminal.

To prevent parasitic oscillations when pliotrons are operated in parallel, a noninductive resistance of 10 to 100 ohms should be placed in series with each control-grid lead as near as possible to the grid terminal.

An ammeter in the plate circuit of each tube should be connected so that the direct-plate current may be checked regularly.

The plate circuit should be provided with a protective device such as a fuse or relay in order to prevent overheating caused by improper circuit adjustments or overloading. This device should remove the plate voltage instantly if the direct-plate current reaches a value 50 per cent above ⌀normal.

In rating pliotrons, certain values are given as maximum; that is, the values beyond which it is unsafe to go from the viewpoint of life and performance. In order not to exceed the ⌀maximum ratings, changes in plate and filament voltage caused by line-voltage fluctuation, load variation, and manufacturing variation of the associated apparatus must be determined. Then, an average value of plate voltage should be chosen so that under the usual operating conditions the maximum ratings will not be exceeded.

IN TRYING OUT A NEW CIRCUIT OR WHEN ADJUSTMENTS ARE BEING MADE, THE PLATE VOLTAGE SHOULD BE REDUCED IN ORDER TO PREVENT DAMAGE TO THE PLIOTRON OR ASSOCIATED APPARATUS IN CASE THE ADJUSTMENTS ARE INCORRECT.

Operation

GENERAL

Maximum ratings and typical operating conditions for each recommended class of service are given on the Description and

⌀Note: The ratings and characteristics of a particular pliotron are given on the Description and Rating Sheet for that tube.

*Supersedes GEH-980B

Rating Sheet covering the individual type of pliotron. The typical values given must not be considered as ratings, because the tube may be used at any suitable conditions within the maximum ratings.

CLASS A AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Grid bias for this type of service may be obtained from a separate voltage source or by means of a self-biasing resistor shunted by a filter network to avoid degenerative effects at the low audio-frequencies. When several tubes are operated in parallel, it is necessary to make provision for individual adjustment of grid bias to insure that the plate dissipation of any tube does not exceed the ⌀maximum value. This may be accomplished by means of a tapped "C" battery or, if self bias is used, by means of a variable cathode resistor for each tube. When the self-biasing method is used, separate filament supplies are necessary for each tube.

An output device such as a choke or transformer should be used to transfer power efficiently from the pliotron to the load.

CLASS B AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

In this type of service two tubes are used in a "balanced" circuit, each tube conducting only half the time. The plate loss becomes maximum at a signal slightly less than 1, depending on the circuit conditions, and therefore the plate dissipation must be limited so that at this value of sustained signal, the plate loss will not exceed the ⌀maximum rating.

The input transformer should be designed to give good frequency response when operated into an open circuit, such as that represented by the grid circuit of the Class B stage when the signal amplitude is small. It should be designed also to handle the required input power for maximum signal conditions.

The output transformer should be designed so that the resistance presented by the load is reflected as the proper plate-to-plate loading in the Class B stage. For example, if the load is a modulated Class C amplifier operating at 2000 volts and 500 milliamperes, the ratio of the output transformer to provide a plate-to-plate loading of 10,000 ohms would be $\sqrt{10000 \div 4000}$, or 1.58 to 1, step-down. The transformer should be designed with a core large enough to avoid saturation effects, which would impair the quality of the output. If the secondary is to carry the direct plate current of the modulated amplifier, the core should be made larger and should include an air gap.

CLASS B RADIO-FREQUENCY AMPLIFIER

In Class B radio-frequency service, the plate is supplied with unmodulated direct voltage, and the grid is excited by modulated r-f. voltage. It is important to note that in this service the plate dissipation is greatest when the carrier is unmodulated. Therefore, the circuit should be adjusted so that, without modulation, the plate loss will not exceed the ⌀maximum rating.

Grid bias for Class B a-f. or r-f. service should be obtained from a battery or other d-c source of good regulation. It should not be obtained from a high-resistance supply such as a grid leak.

CLASS C RADIO-FREQUENCY POWER AMPLIFIER -- PLATE MODULATED

In this type of service, the plate supply voltage is modulated so that the tube output is modulated radio frequency. Assuming a value, P, of plate input to be modulated, the amount of audio-frequency power to be supplied is equal to $\frac{m^2P}{2}$, where m is the modulation factor.

The maximum ratings and typical operating conditions given in the ⌀Technical Information are such that a modulation factor up to 1.0 may be used. When a lower value of modulation is used, the plate dissipation allowed may be increased, but should be limited so that with the modulation sustained at its peak value, m, the plate loss will not exceed a value $\frac{3}{2+m^2}$ times the plate dissipation rating.

Grid bias for this service may be obtained from a grid leak or from a combination of grid leak and generator, rectifier, or cathode-bias resistor, suitably by-passed for audio- and radio-frequencies. The combination method is desirable because distortion effects may be minimized.

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

In telegraph service, the plate input power is keyed, i.e., is on and off alternately in accordance with the characters of some code. During the "key-down" periods, the tube functions as an unmodulated radio-frequency power amplifier. The tube may be used also as an amplifier or oscillator without keying. In both types of service, the ratings given are for "key-down" conditions.

Certain methods of modulation may be applied to this class of service provided

⌀Note: The ratings and characteristics of a particular pliotron are given on the Description and Rating Sheet for that tube.

the modulation is essentially negative, and the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

Grid bias for Class C service may be obtained from a grid leak, from a battery, from a rectifier of good regulation, or from a self-biasing resistor by-passed with a suitable capacitor. With the grid-leak method, the grid excitation must not be removed without also removing the plate voltage. Grid-bias values are not particularly critical, and correct circuit adjustment may be obtained with widely different values.

INSTRUCTIONS

Complete instructions are packed with each shipment of tubes. Additional copies can be secured from the nearest office of the General Electric Company.

General Electric tubes are warranted to be of the kind and quality described in the manufacturer's specifications. Before leaving the factory, each tube is subjected to rigid tests and inspections. Performance will depend, to a large extent, upon the application, and upon the care with which the tubes are handled. In case of doubt as to proper operating conditions, information should be secured from the General Electric Office through which the purchase was made.

To assure satisfactory operation, it is recommended that each tube be tested upon receipt by the customer, in the equipment in which it is to be used. If spare tubes are to be stocked for long periods, a check test should be made every three months. The conditions of test and operation should not be more severe than the conditions described in the specifications.

If any failure of the tubes to comply with the specifications appears during the initial test or subsequently during the life warranty under which the tubes were purchased, the General Electric Office through which the purchase was made will advise the purchaser regarding the correct procedure for returning tubes believed to be defective.

Should the package be received in damaged condition, observance of the procedure described on the tag affixed to the container will enable the General Electric Company to assist the customer in filing a claim for tubes damaged in transit.

Tubes returned for credit adjustment should be packed as carefully as when originally received, for damage sustained in return shipment will make a thorough examination impossible.

LICENSE NOTICE

In connection with this device, the General Electric Company has rights under patents having claims (a) on the device itself and (b) on combinations of the device with other devices or elements, as for example in various circuits and hook-ups.

The sale does not carry a license under the patent claims of (b) except for installation and legitimate renewals and repairs in apparatus and systems already licensed for use under such patent claims on combinations.

Service Report Form

This service sheet is furnished for the convenience of the customer in applying for adjustment if the quality of the tube does not meet the specification and warranty under which the tube was sold. It is essential that the customer, in making application for adjustment, fill out this sheet and return it, with the tube, to the commercial agency from which the tube was purchased.

In returning a vacuum tube for test and examination, the customer gives permission to the General Electric Company to break the glass bulb and to dissect the structure of the tube, in case such procedure is considered necessary for a complete examination of the tube, to determine whether or not the failure was caused by a manufacturing defect.

Type of Tube.....Serial Number.....Date Tested.....Date Put In Service.....Result of Initial Test (Good) (Defective).....

Manufacturer of Equipment in Which Tube Was Used
(Include Manufacturer's Designation or Catalog No.) .....

Service, with Cathode Operating, Hours ..... Service, with Anode Operating, Hours .....

Hours Service Per Day .....Hours Service Per Week .....Date Rejected .....

Reason Rejected .....

Description of Equipment .....

Remarks (Include Service Conditions) .....

.....

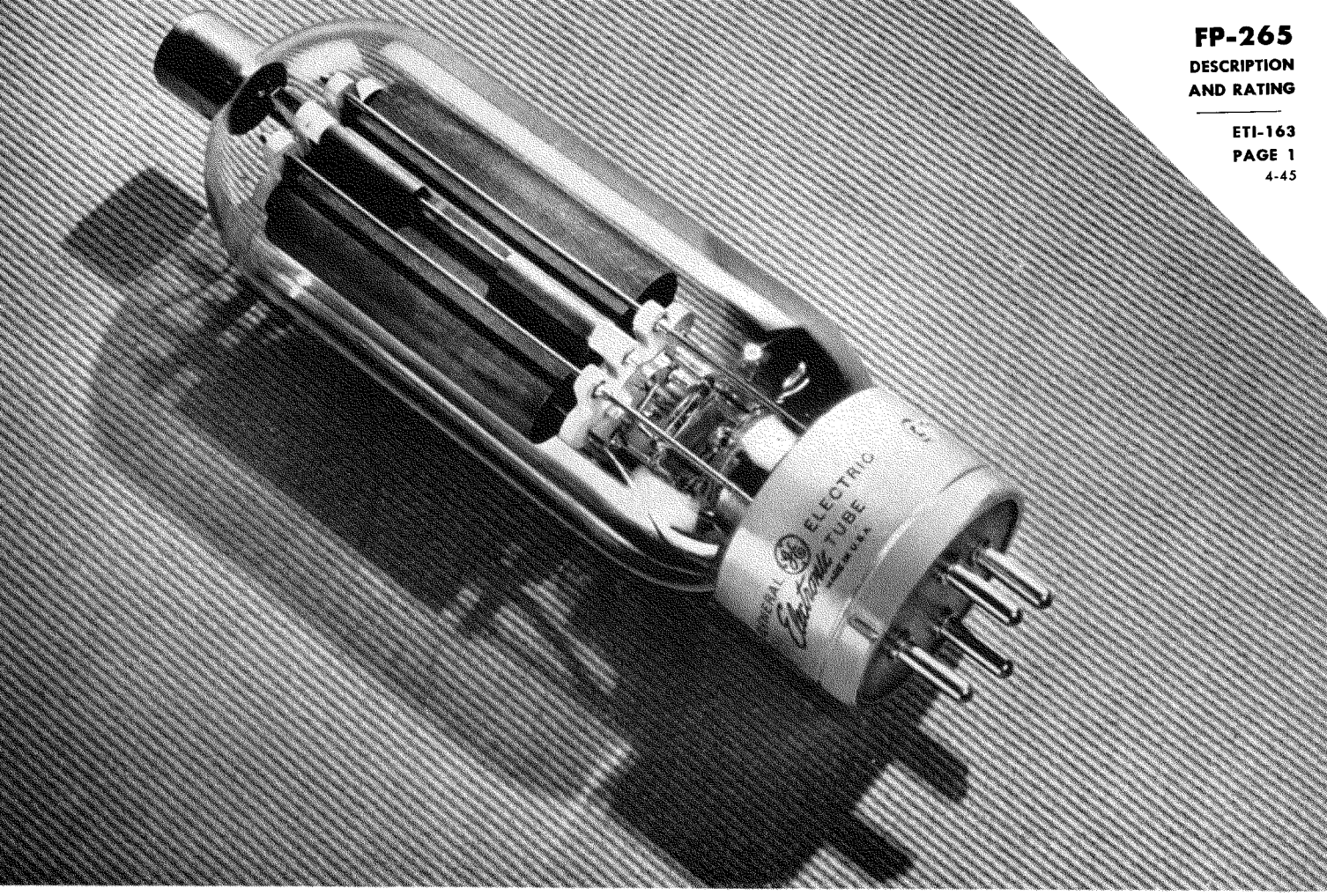
Conditions of Operation
(Voltages, Currents, Temperatures, Circuits, etc.) .....

.....

Signature .....Date .....

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

2-37 (10M) Filing No. B8850



PLIOTRON

DESCRIPTION

The FP-265 is a high-vacuum tube designed for use as an oscillator and radio-frequency amplifier in high-frequency circuits.

The plate lead is brought out the top of the bulb, and the grid lead is brought out through the side wall of the stem tube to the cathode base. The mount is supported by a special insulator so that the clamp and supports are not connected to the plate.

The filament of the FP-265 is designed to provide ample emission for operation in circuits utilizing half-wave alternating current. In designing the filament transformer, conditions should be chosen so that the filament voltage is never less than 10 volts nor more than 10.5 volts for continuous operation. For less than one hour of operation, a filament voltage up to 11 volts is permissible.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Filament—thoriated tungsten		
Voltage	10	volts
Current	5.2	amperes
Average characteristics, $I_b = 0.090$ amperes		
Amplification factor	75	
Grid-plate transconductance	6000	micromhos

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Direct interelectrode capacitance

Grid-plate	11	micromicrofarads
Grid-filament	7.8	micromicrofarads
Plate-filament	3.8	micromicrofarads

Mechanical

Base	Super-jumbo 4-pin
Net weight, approx	14 ounces
Shipping weight, approx	6 pounds
Operating position	vertical or horizontal with plane of electrodes vertical

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Key-down conditions per tube without modulation. Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

	Typical Operation	Maximum Ratings	
D-c plate voltage, filtered or pulsating	....	1500	volts
A-c plate voltage, rms	1800	1800	volts
D-c grid voltage	−100	−400	volts
D-c plate current	200	200	milliamperes
D-c grid current	30	60	milliamperes
R-f grid current	....	10	amperes
Plate input	....	350	watts
Plate dissipation	130	160	watts
Plate power output	200	....	watts

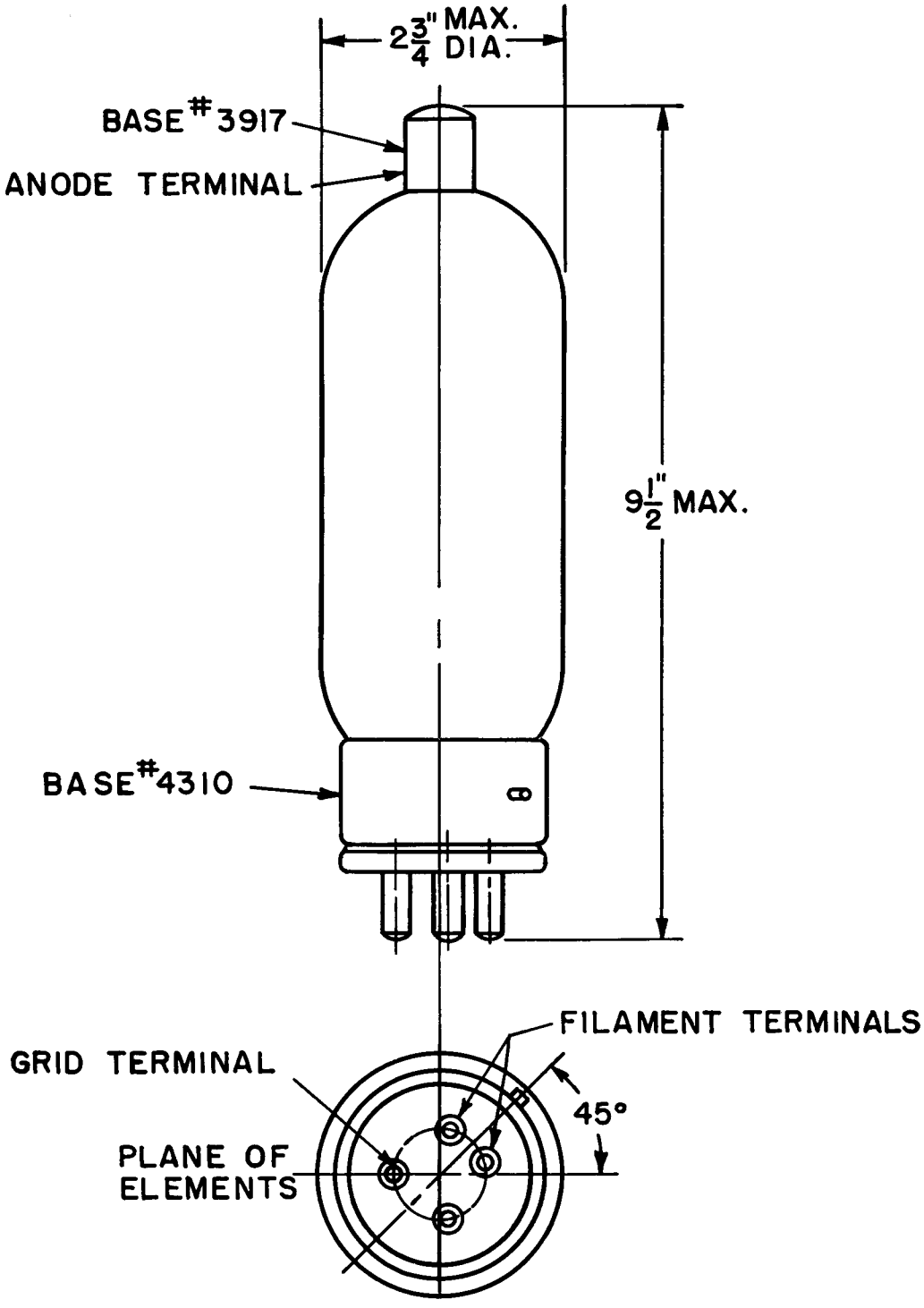
APPLICATION NOTES

The normal value of grid leak, when the tube is used as an oscillator or r-f power amplifier (Class c), is in the neighborhood of 3000 ohms, although this may be replaced by a suitable fixed bias. If self-bias is used, the cathode resistor should be approximately 500 ohms. In some cases, to minimize the danger of overloads, a combination of grid leak and partial self-bais may be desirable. The values should be chosen so that the plate loss at the worst condition is limited to the maximum rating.

The maximum ratings apply only at frequencies below 15 megacycles. For operation at higher frequencies adequate ventilation and normal ambient temperatures must be maintained, and the plate voltage must be reduced as indicated.

Frequency	15	30	40	megacycles
Percentage of maximum rated Plate voltage and plate input	100	75	50	per cent

With the grid connected to the plate through the shortest possible connection, the resonant frequency of the grid-plate circuit is approximately 100 megacycles.



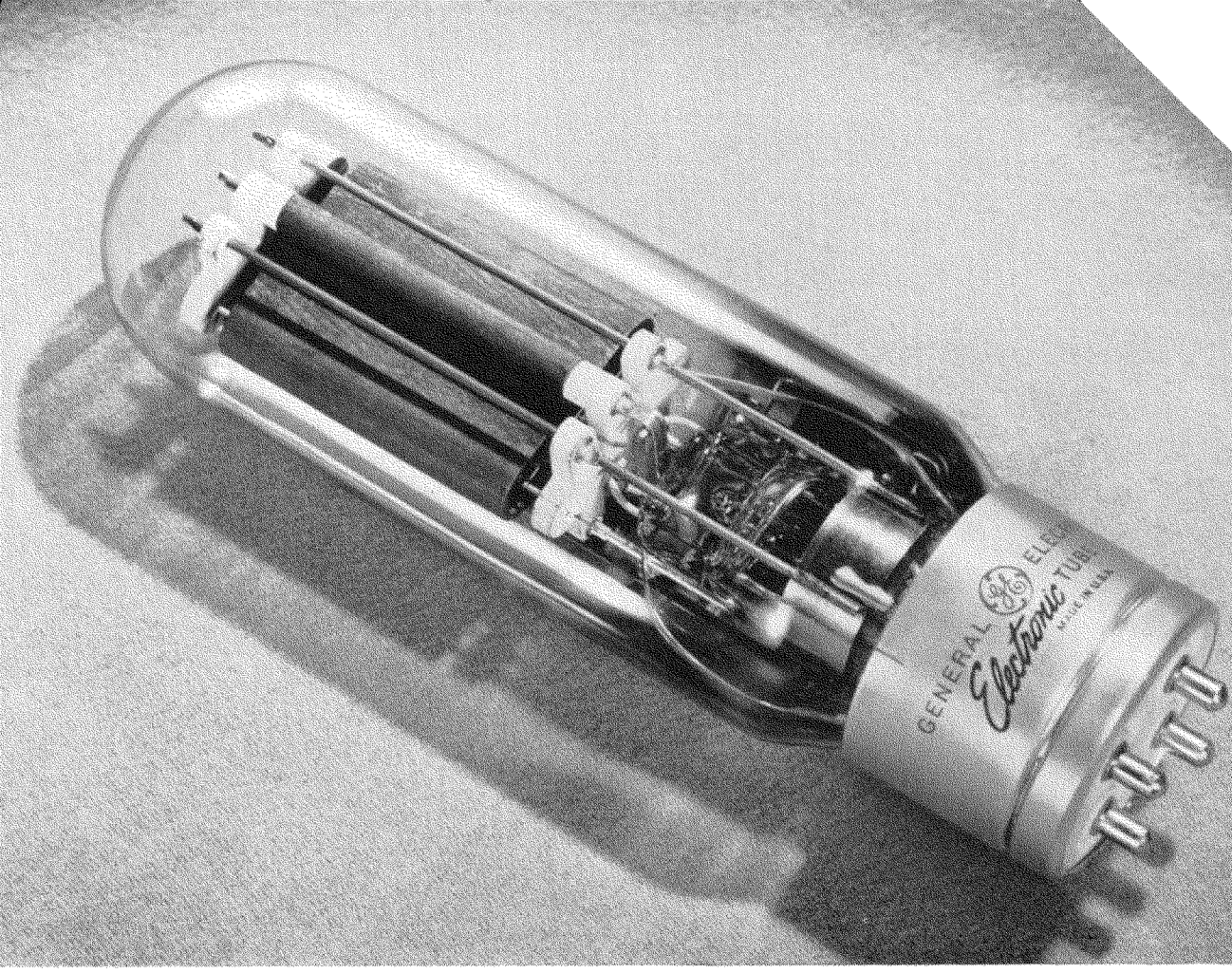
K-5182000

6-9-44

OUTLINE FP-265 PLIOTRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PLIOTRON

DESCRIPTION

The FP-285 is a high-vacuum tube suitable for use as an oscillator and radio-frequency amplifier in high-frequency circuits.

This tube is especially satisfactory when used to generate the ultra-high frequencies required in short-wave therapy equipment. The hazard of stem puncture, a common fault in some tubes used in such applications, has been eliminated by bringing the plate and grid leads out through the side wall of the cathode stem. Low plate-to-filament capacitance and good insulation, especially important features in tubes for high-frequency service, are assured by the use of a special insulator which supports the mount and holds the clamp and supports away from the plate.

These, together with the other design features inherent in pliotrons of this type, result in economical, dependable operation and long life.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Filament—thoriated tungsten		
Voltage	10	volts
Current	3.25	amperes
Average characteristics, $I_b = 0.072$ ampere		
Amplification factor	12	
Grid-plate transconductance	4000	micromhos

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Direct interelectrode capacitance		
Grid-plate	13.5	micromicrofarads
Grid-filament	6	micromicrofarads
Plate-filament	5	micromicrofarads
Frequency for maximum ratings	20	megacycles

Mechanical

Base		jumbo, large 4-pin
Net weight, approx	8	ounces
Shipping weight, approx	3	pounds
Operating position		vertical or horizontal with plane of electrodes vertical

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Key-down conditions per tube without modulation.
Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

	Typical Operation			Maximum Ratings	
A-c plate voltage, rms				1500	volts
D-c plate voltage, filtered or pulsating	750	1000	1250	1350	volts
D-c grid voltage	−100	−150	−200	−400	volts
D-c plate current	200	200	200	200	milliamperes
D-c grid current	30	30	30	50	milliamperes
Plate input				270	watts
Plate dissipation				100	watts
Plate power output	100	140	180		watts

APPLICATION NOTES

The tube may be mounted either vertically, with base up or down, or horizontally, with the filament in a vertical plane. The metal shell must not be connected to any part of the circuit.

The normal value of grid leak, when the tube is used as an oscillator or r-f power amplifier (Class C), is in the neighborhood of 5000 ohms, although this may be replaced by a suitable fixed bias. If self-bias is used, the cathode resistor should be approximately 1000 ohms. In some cases, to minimize the danger of overloads, a combination of grid leak and partial self-bias may be desirable. The values should be chosen so that the plate loss at the worst condition is limited to the maximum rating.

The maximum ratings apply only at frequencies below 20 megacycles. For operation at higher frequencies adequate ventilation and normal ambient temperatures must be maintained, and the plate voltage must be reduced as indicated.

Frequency	20	50	80	megacycles
Percentage of maximum rated plate voltage and plate input	100	75	50	per cent

The following table indicates the tube output obtainable at various wavelengths when the tube is operated within the maximum allowable conditions in a properly designed circuit.

Wavelength		A-c Plate Voltage, Volts	Minimum Plate Output, Watts	Maximum Plate Output, Approx Watts
Meters	Megacycles			
15	20	1500	170	200
10	30	1350	150	180
7.5	40	1250	140	160
6	50	1150	110	130
5	60	1000	80	100
4	75	750	40	60

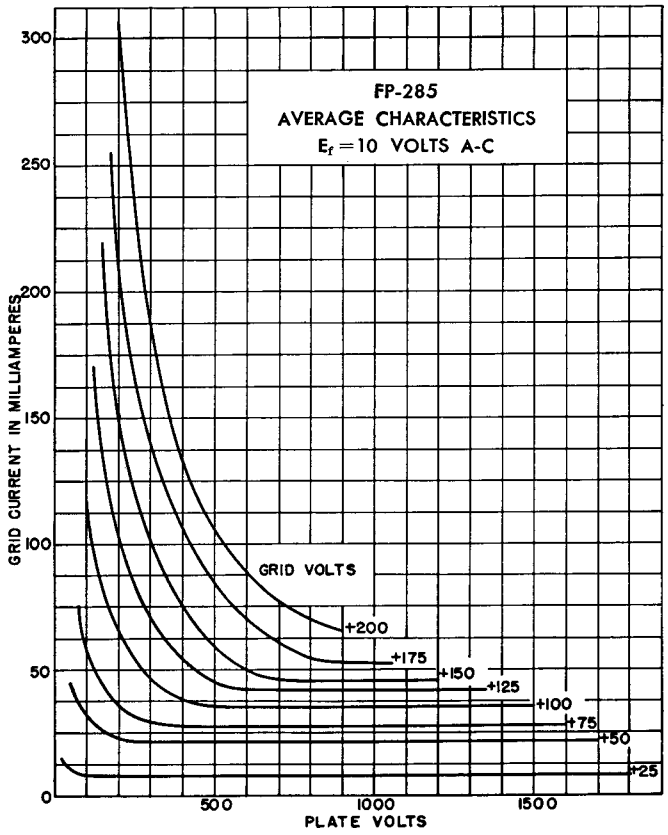

FP-285
AVERAGE CHARACTERISTICS
$E_f = 10$ VOLTS A-C
GRID CURRENT IN MILLIAMPERES
PLATE VOLTS
GRID VOLTS
+200
+175
+150
+125
+100
+75
+50
+25
300
250
200
150
100
50
0
500
1000
1500
K-6917435
9-26-44

Fig. 1

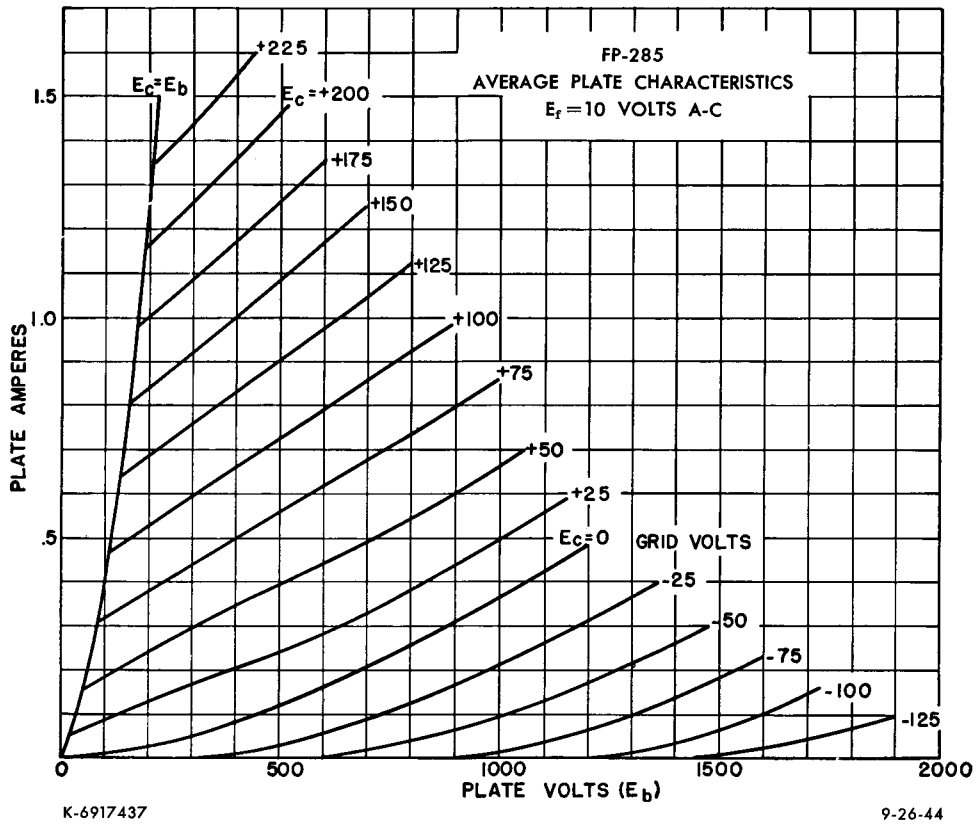
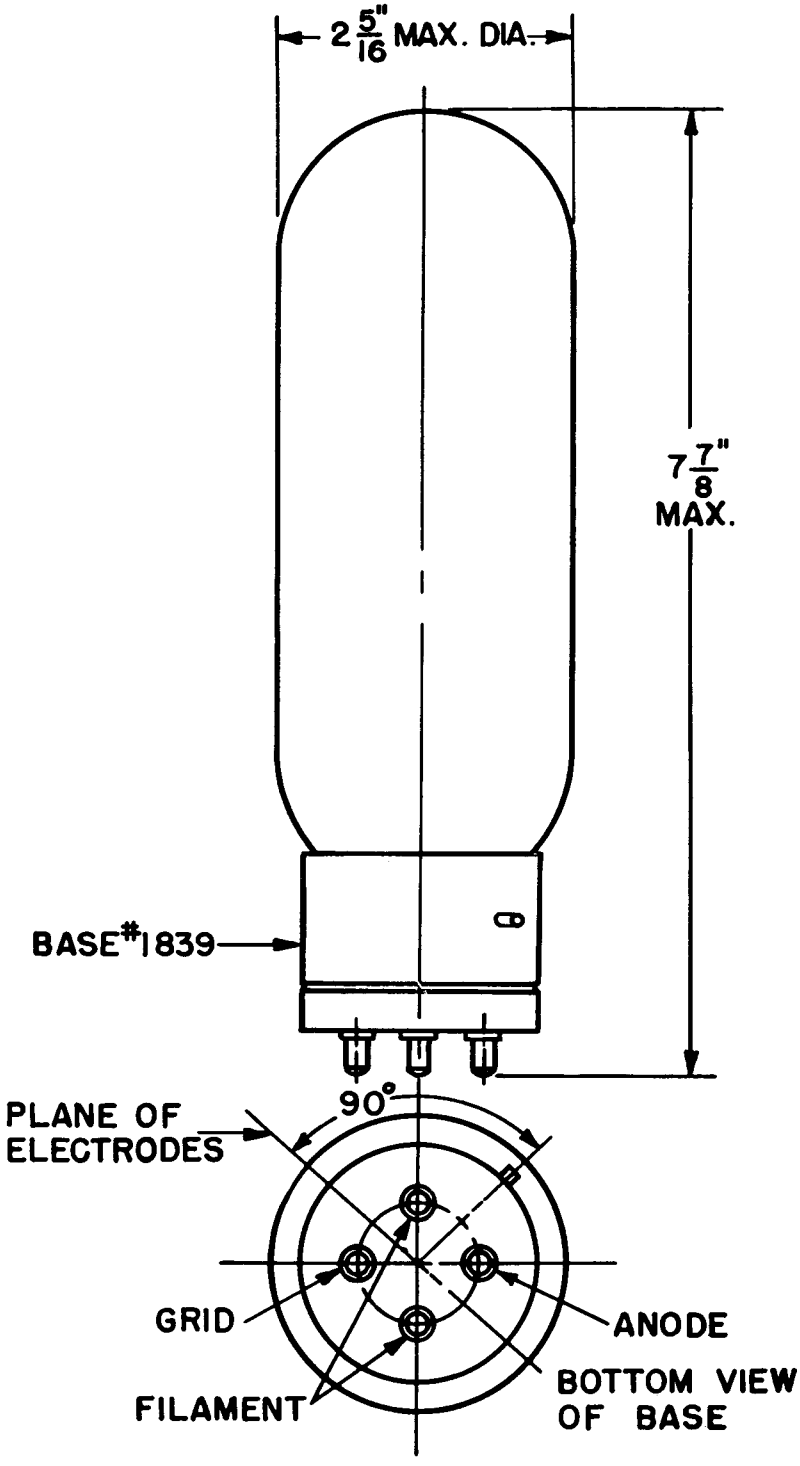
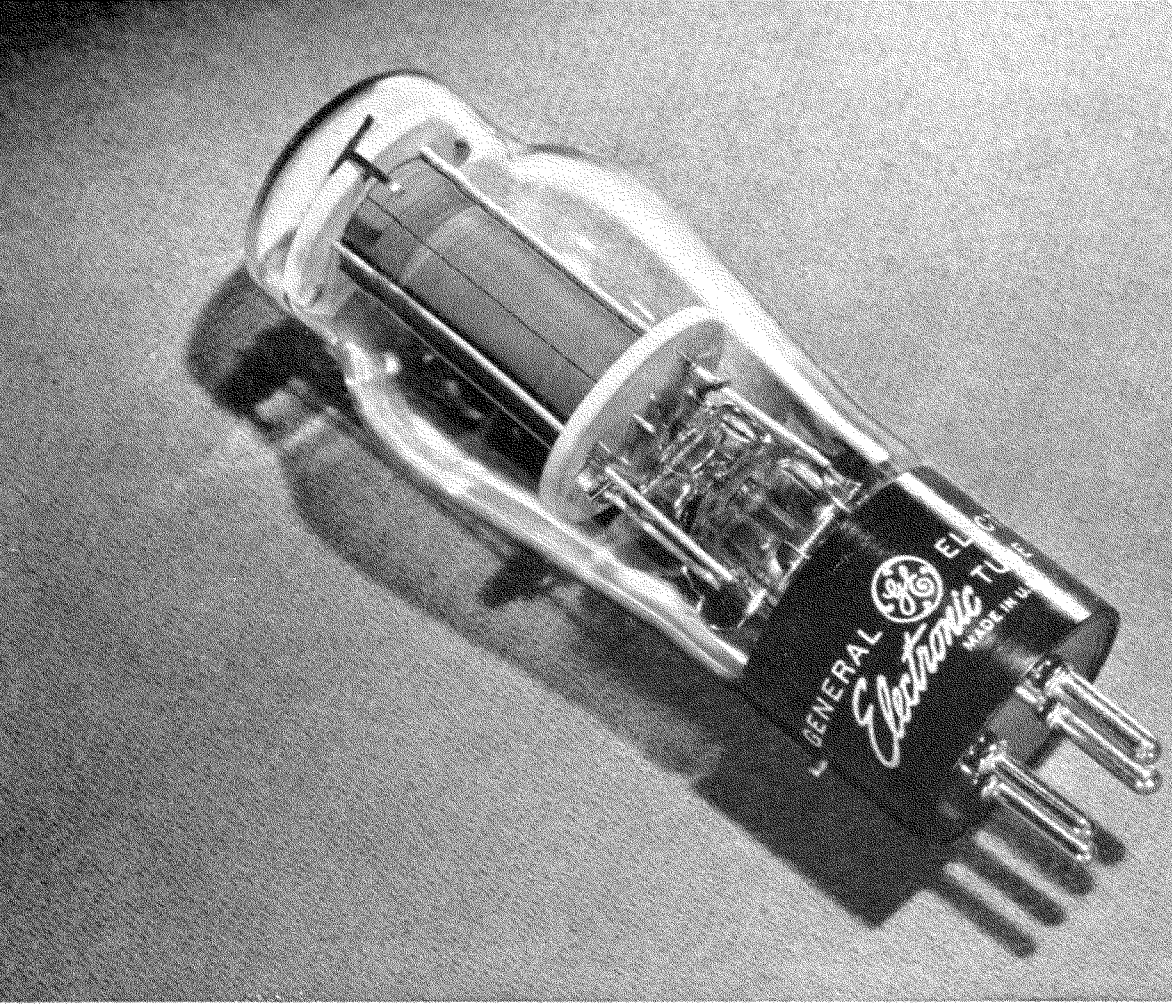

FP-285
AVERAGE PLATE CHARACTERISTICS
$E_f = 10$ VOLTS A-C
PLATE AMPERES
PLATE VOLTS (E_b)
$E_c = E_b$
E_c = +200
+225
+175
+150
+125
+100
+75
+50
+25
E_c = 0
GRID VOLTS
-25
-50
-75
-100
-125
1.5
1.0
.5
0
500
1000
1500
2000
K-6917437
9-26-44

Fig. 2



OUTLINE
FP-285 PLIOTRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



KENOTRON

DESCRIPTION

The FP-400 is a diode designed to be used in the study of electrical discharges in high vacuum. It contains a pure-tungsten filament, located axially in a cylindrical zirconium-coated-nickel anode. It is particularly well adapted to the following studies of fundamental electronic phenomena:

1. The limitation of current by space charge
2. The relation between temperature and electron emission
3. The effect of magnetic fields on electron currents

The pure tungsten filament used renders this tube especially advantageous for emission studies.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

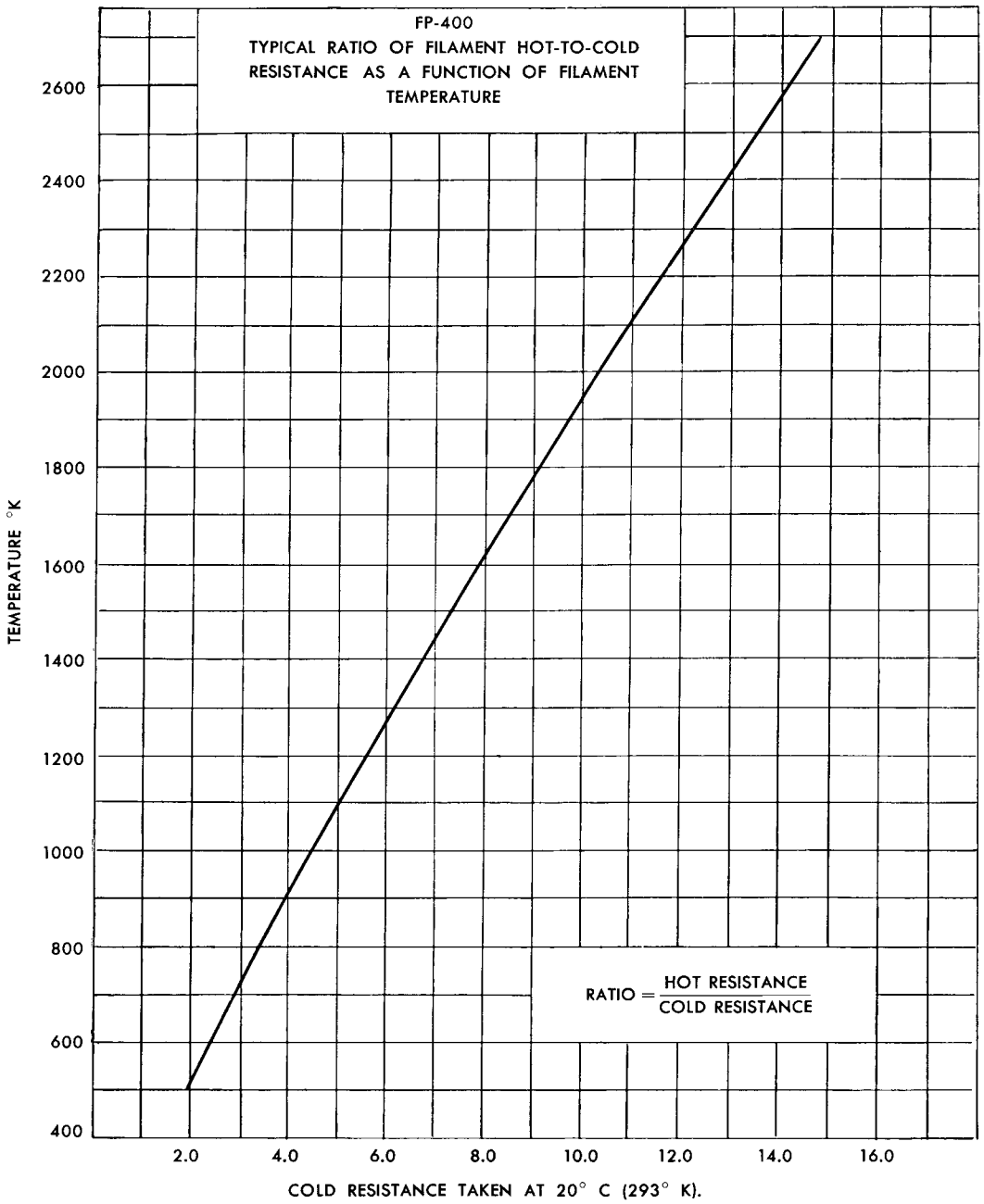
Number of electrodes	2	
Electrical		
Filament—Pure tungsten		
Voltage	4.0	volts
Current	2.25	amperes
Average filament lead resistance, excluding filament	0.08	ohm
Mechanical		
Maximum over-all dimensions		
Length (free length of filament)	1.25	inches
Diameter	0.005	inch
Anode, zirconium-coated-nickel, inside diameter	0.620	inch
Base		Medium 4-prong bayonet
Mounting position		Vertical or horizontal

GE Electronic TUBE

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

	Typical Operation	Maximum Ratings
Filament voltage	4.0	4.75 volts
Filament current	2.25	— amperes
Anode voltage	100	125 volts
Anode current	0.025	— amperes
Anode dissipation	—	15 watts
Magnetron characteristics		
Magnetic field for anode voltage = 80 volts		
At normal anode current	Below 80 gauss	
At minimum anode current	Above 130 gauss	

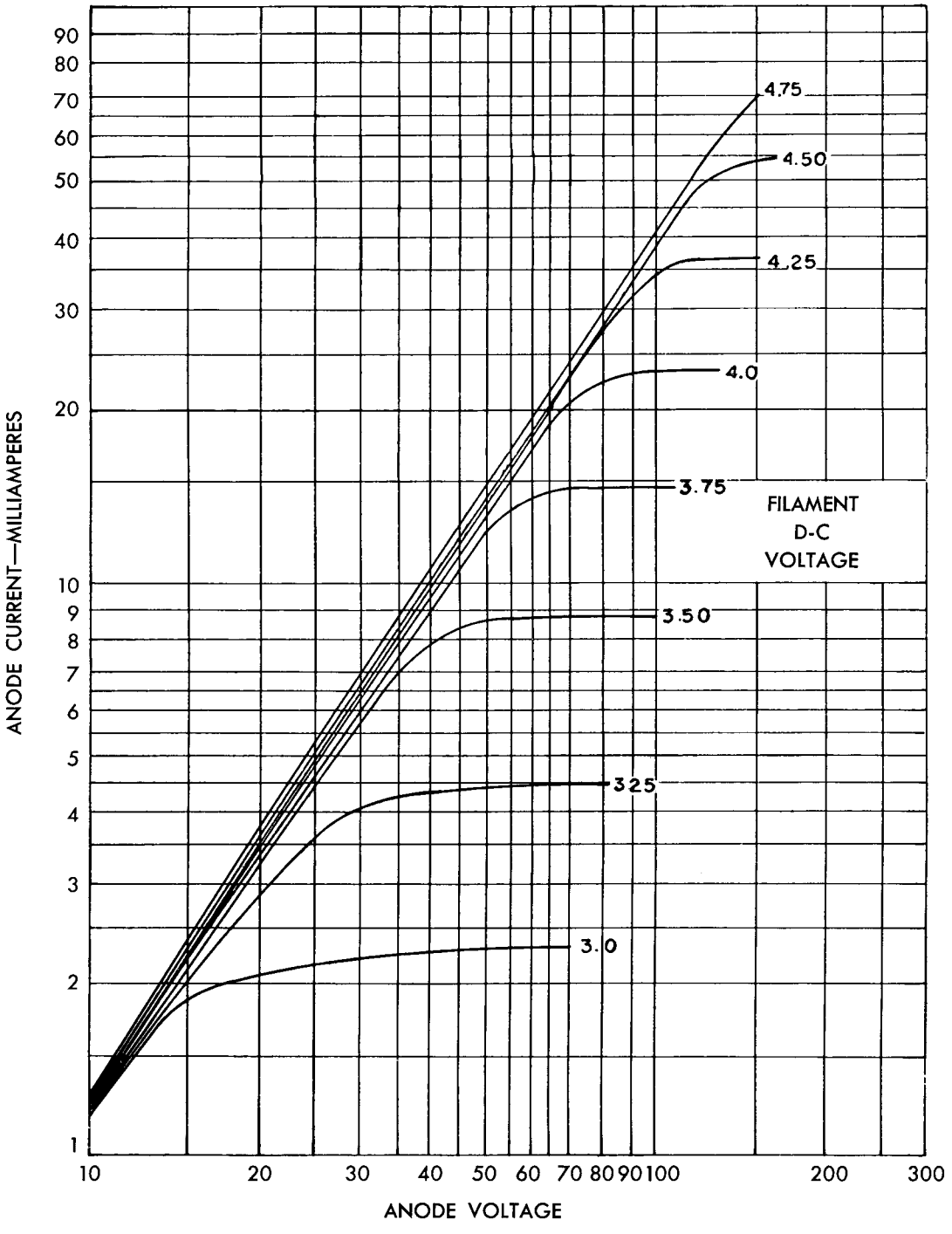


K-8639680

8-30-44

FIG. 1

FP-400 ANODE CURRENT CHARACTERISTICS



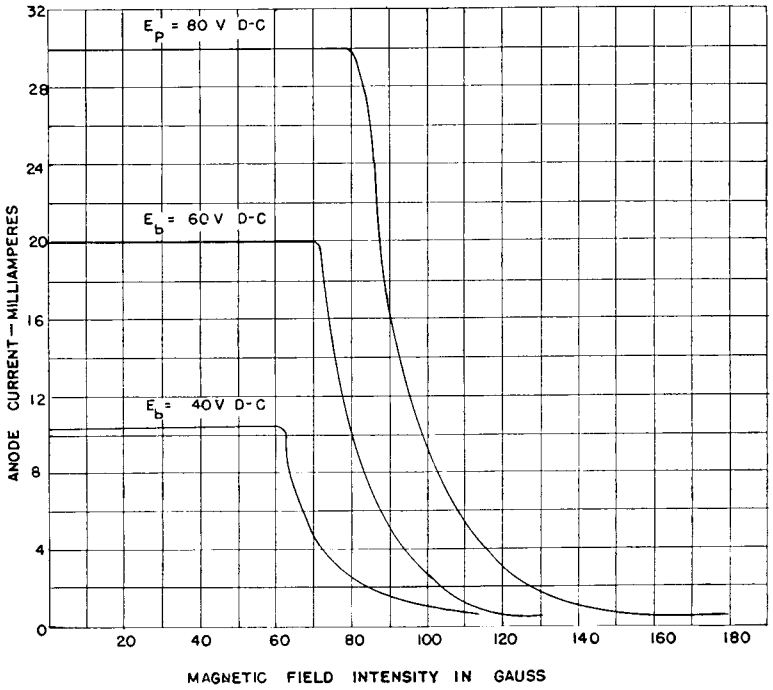
K-8639677

8-30-44

FIG. 2

FP-400

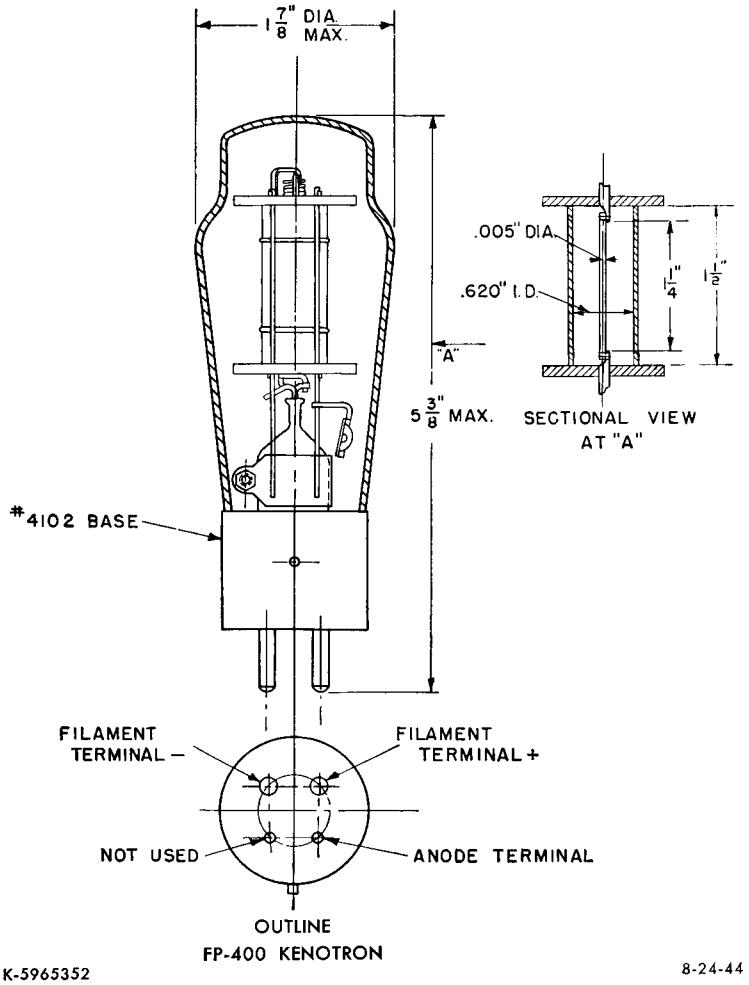
TYPICAL MAGNETIC CONTROL CHARACTERISTICS



K-8639678

FIG. 3

8-30-44



K-5965352

8-24-44

INSTALLATION

Mechanical

Mountings should minimize danger from vibration and impact. Special attention should be given the socket to assure firm, low-resistance contact with the filament terminals of the base.

Cooling

All apparatus should be arranged to allow free circulation of air around the bulb which becomes very hot during operation and, therefore, should neither come in contact with any metallic object nor be subjected to drops or spray of liquid.

Electrical

The filament may be operated from either an a-c or a d-c source. For accurate measurements of filament voltage and current, a d-c source is preferable. The voltage rating of the filament makes the use of a six-volt battery convenient.

The anode-circuit return lead should be connected to the negative filament terminal when d-c filament supply is used. The negative filament terminal of the base (see outline) is connected in the tube through the lowest possible lead resistance to the end of the filament.

OPERATION

Maximum ratings and typical operating conditions are given above. It should be recognized that the life of a tungsten filament decreases with increased temperature, and that at temperatures above about 2600 K, the length of life of tungsten filaments under tension is difficult to predict due to the possibility of rupture caused by accelerated crystallization.

The theoretical space-charge equation for concentric cylinders is,

$$I = 14.65 \times 10^{-\frac{6V^{3/2}}{rB^2}}$$ amperes per centimeter length of filament

Where V = anode voltage and
r = anode radius (centimeters)

B^2 is a function of the ratio of the anode radius to cathode radius. The derivation of this equation, and values of B^2 may be found in the references (1) and (2).

The space-charge equation may be applied without major discrepancies to practical cases, particularly where the variation of current with voltage is desired. Where an actual filament is used as the emitter, and it is desired to obtain the anode current for a given anode voltage, some correction must be made to allow for the fact that the filament is cool at each end. For the FP-400, satisfactory results are obtained by basing the calculations on a filament length of one inch. A more accurate correction for each filament temperature may be obtained by using the theory of end losses (3).

For a study of space-charge, curves similar to those shown may be plotted from data taken in the laboratory. (For use in the study of emission, it is convenient to measure the saturated emission currents at different filament voltage levels while obtaining these data. At each filament voltage level, the filament current should be measured accurately.)

These curves may be checked as to slope (the exponent in the space-charge equation) by plotting slightly to one side a straight line representing the equation, $I = KE\ 3/2$ where K is arbitrarily chosen to make the line fall near the curves.

The several causes for the deviation of the curves from a straight line before saturation occurs form an interesting field for qualitative studies.

The Relation between Temperature and Electron Emission

The data necessary for this study may be obtained while making measurements of the space-charge limited currents, as described above.

Dushman's equation (4) for thermionic emission is,

$$I = AT^2\ E^{-\frac{b_o}{T}}$$ amperes per square centimeter

Where T = absolute temperature of the emitter
$A = 60.2$
$b_o = 52{,}400$ for pure tungsten

Observed values of the properties of tungsten have been recorded by H. A. Jones and I. Langmuir (5).

The saturated emission currents measured may be checked against the corresponding filament temperature, using the Dushman equation or the observed properties of tungsten. Actual filaments, however, always vary in temperature from the center to each end, due to the cooling effect of the leads. A temperature may be found by means of the hot-to-cold resistance ratio.

The cold resistance is measured at room temperature. If the room temperature is appreciably different from 20 C, a correction on the measured value may be used. This measurement will include the filament resistance, and the resistance of the filament leads. The resistance of the filament alone may be found from the known length and diameter of the filament and the properties of tungsten (5). In this way, the resistance of the leads may be found.

The hot resistance of the filament circuit is found by measurements of voltage and current. The usual precautions regarding voltmeter current should be observed when making such measurements. The hot resistance may then be corrected for the resistance of the leads, and the ratio of hot-to-cold resistance found.

The temperature determined in this way will obviously be an average value, less than the center

See Footnotes 1, 2, 3, 4, 5 and 6 on page 6.

temperature of the filament, and greater than the temperatures.

It will also be subject to major errors because of the errors of measurement in finding the cold resistance. The emission determined by use of this temperature will usually be far below that measured, because of the exponential increase of emission with temperature.

The temperature at the center of the filament may be discovered with a high degree of accuracy by determining the function, A' (amp/(cm)3/2) and arriving at the corresponding temperature (5). Then, the emission to be expected from the entire length of filament running at this maximum temperature may be corrected by means of the factor obtained from the theory of end losses; (3), (5):

$$f = \frac{V + 2\triangle V}{V + 2\triangle V - 2\triangle V_H}$$

Where V is the filament voltage

$\triangle V$ is a function of the maximum temperature and the filament-to-lead-junction temperature

$\triangle V_H$ is a function of the exponent (with respect to temperature) at which the property (emission) increases, and the temperature

The lead-junction temperature of the FP-400 filament may be considered one-quarter the maximum temperature. The leads connected to the filament are molybdenum, 0.030 inch in diameter. Another method of arriving at a temperature, in this case too low, is to measure the input to the filament, in watts, and use the function W' (watts/length $\times$ diameter) to find the temperature (5). On the chart, "Specific Characteristics of Ideal Tungsten Filaments" (5), the function I' (amperes/length $\times$ diameter) may be found directly, if desired.

When the Dushman equation is used to check the variation of emission with temperature against the measured values, it will be found that the value of A given in the emission equation will not apply to the experimnetal results; the discrepancy depends on whether an average temperature or the maximum temperature of the filament has been found. If the maximum temperature has been found, the factor, f (a function of temperature), mentioned above may be used to correct the value of A in the Dushman equation for the effect of end losses (5). If the value of A in the Dushman equation is corrected for one of the points taken, so that the calculated emission agrees with that actually obtained, the other points will agree quite well with the equation.

The Effect of Magnetic Fields on Electron Currents

The FP-400 is designed to demonstrate the influence of a magnetic field on a moving stream of electrons. The theoretical and actual performances of magnetrons are discussed in the references (1), (6).

The tube may be surrounded by an air-cooled field coil which will produce flux parallel with the filament. The flux produced by this coil should be measured. Data may then be taken for curves showing the cut-off characteristics of the tube. The critical value or cut-off value of flux is given by the relation—

$$H = \frac{6.72\sqrt{V}}{r} \text{ gauss}$$

Where V is the anode potential in volts and r is the anode radius in centimeters the effect of a non-parallel field may be observed. Once the FP-400 has been "calibrated," it may be used to explore other unknown magnetic fields.

Footnotes: (1) *Electrical Discharges in Gases—Review of Modern Physics,* pp. 191-257 Vol. 3, No. 2 April, 1931.
(2) *Space-charge Between Coaxial Cylinders—Physical Review*—October, 1923.
(3) *Effects of End Losses on the Characteristics of Filaments of Tungsten and Other Materials—Physical Review* —pp. 478-503, Vol. 35, No. 5, March 1, 1930.
(4) *Thermionic Emission—Review of Modern Physics,* pp. 381-476, Vol. 2, No. 4, October 1930.
(5) *The Characteristics of Tungsten Filaments as Functions of Temperature, General Electric Review*—pp. 310-319, June, 1927; pp. 334-361, July 1927; pp. 408-412, August, 1927.
(6) *The Magnetron-Journal AIEE,* September, 1931.

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PHOTOTUBE

DESCRIPTION

This gas-filled, two-electrode phototube is useful in photoelectric control apparatus where a high degree of output per unit of light flux is required. The GL-1P29/FJ-401 has a high sensitivity in the visible range of the spectrum and reaches its maximum output in the blue portion.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	

Electrical

Spectral response	S-3	
Maximum gas amplification	9.0	
Interelectrode capacitance	2.5	micromicrofarads
Maximum dark current at 90 volts	0.1	microampere
Wavelength of maximum response	4200	angstroms
Sensitivity at maximum response	0.010	microampere per microwatt

GE Electronic TUBE

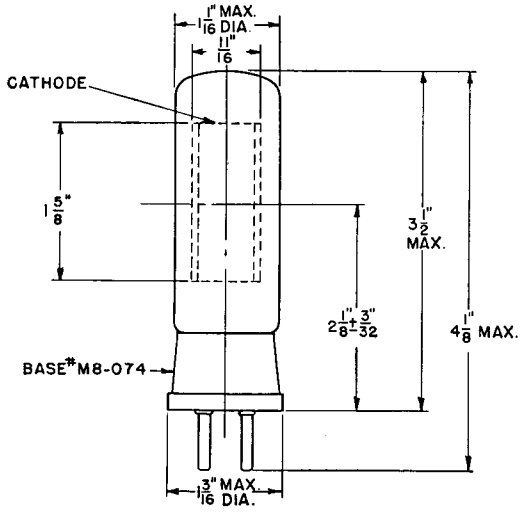
TECHNICAL INFORMATION (CONT'D)

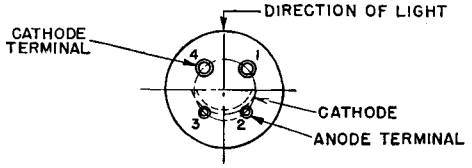
Mechanical

Window dimensions	$\frac{11}{16}$ x $1\frac{5}{8}$	inches
Seated height to center of useful cathode area	$2\frac{1}{8} \pm \frac{3}{32}$	inches
Maximum over-all height	$4\frac{1}{8}$	inches
Maximum seated height	$3\frac{1}{2}$	inches
Maximum diameter	$1\frac{3}{16}$	inches
Base	M8-074	
Mounting position	Any	
Net weight, approx	$\frac{1}{2}$	ounce

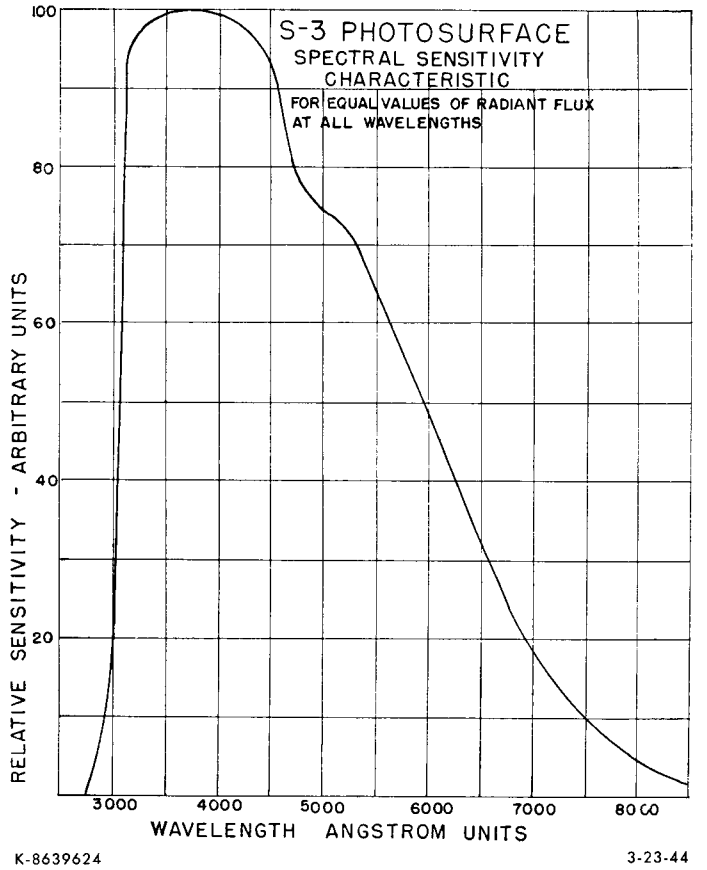
MAXIMUM RATINGS

Anode voltage, d-c or peak a-c	100	volts
Cathode current density	152	microamperes per square inch
Ambient temperature	100	centigrade





OUTLINE
GL-1P29/FJ-401 PHOTOTUBE
K-8639391 8-10-44

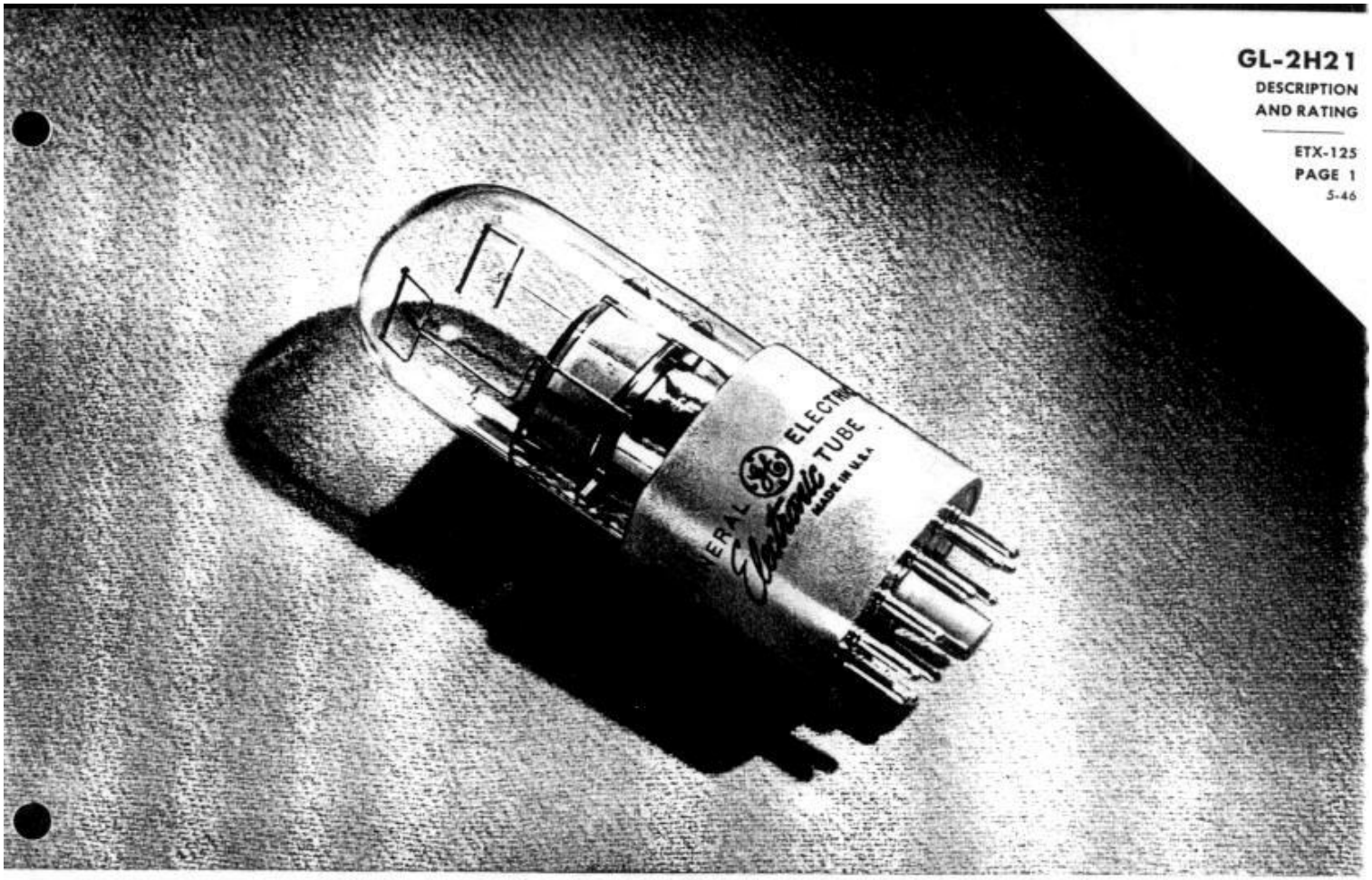


K-8639624 3-23-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PHASITRON

DESCRIPTION

The GL-2H21 is a phase-modulator tube for use in FM transmitters. It is intended for operation up to 500 kilocycles. As a modulator tube, the GL-2H21 makes possible the introduction of comparatively wide-phase excursions at audio-frequency rates in a crystal-controlled, radio-frequency carrier. The modulating circuit audio response is such that the tube has a wide-swing, frequency-modulated output.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	10	
Electrical		
Cathode—indirectly heated		
Heater voltage	6.3	volts
Heater current	0.3	ampere
Direct interelectrode capacitance, approx		
Deflectors to plate 1	0.08	micromicrofarad
Plate 1 to plate 2	4.0	micromicrofarad
Frequency for maximum ratings	500	kilocycles
Mechanical		
Net weight, approx	3	ounces
Shipping weight, approx	1	pound
Mounting position	Any	

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

Plate No. 1 voltage	300	volts
Plate No. 2 voltage	300	volts
Deflectors No. 1, 2 and 3 voltage	100	volts
Deflector No. 4 voltage	100	volts
Grid No. 1 voltage	25	volts
Grid No. 2 voltage	150	volts
Cathode current	6	milliamperes

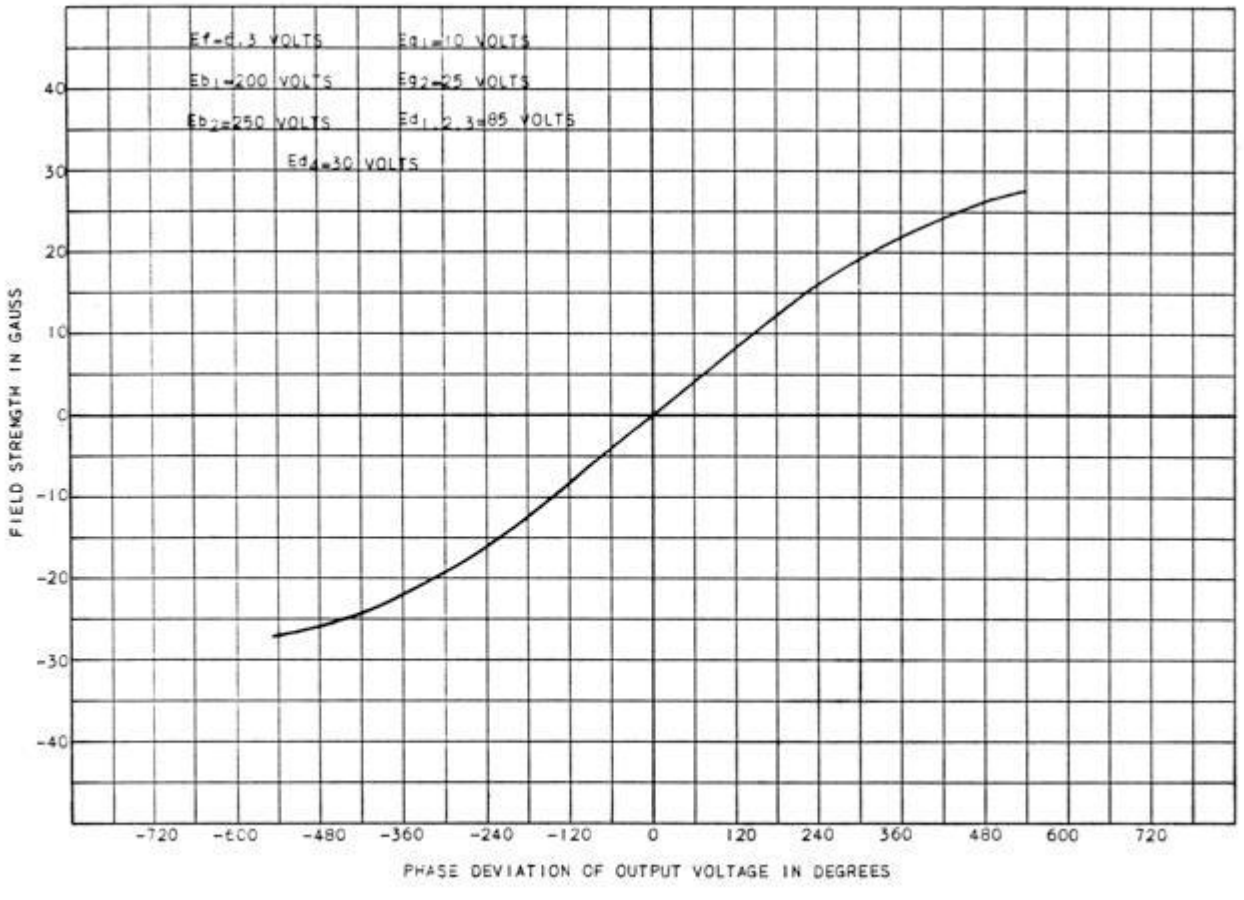
CHARACTERISTICS AND TYPICAL OPERATION

Phase modulator*

Plate No. 1 voltage	200	volts
Plate No. 2 voltage	250	volts
Deflectors No. 1, 2 and 3 voltage	85	volts
Deflector No. 4 voltage	60	volts
Grid No. 1 voltage	10	volts
Grid No. 2 voltage	25	volts
Cathode current	4	milliamperes
Radio-frequency driving voltage, phase to neutral	35	volts rms
Audio-modulating power for ±180° phase shift, approximate	50	milliwatts
Radio-frequency output voltage	4	volts rms
Distortion at ±180° phase shift	1.4	per cent

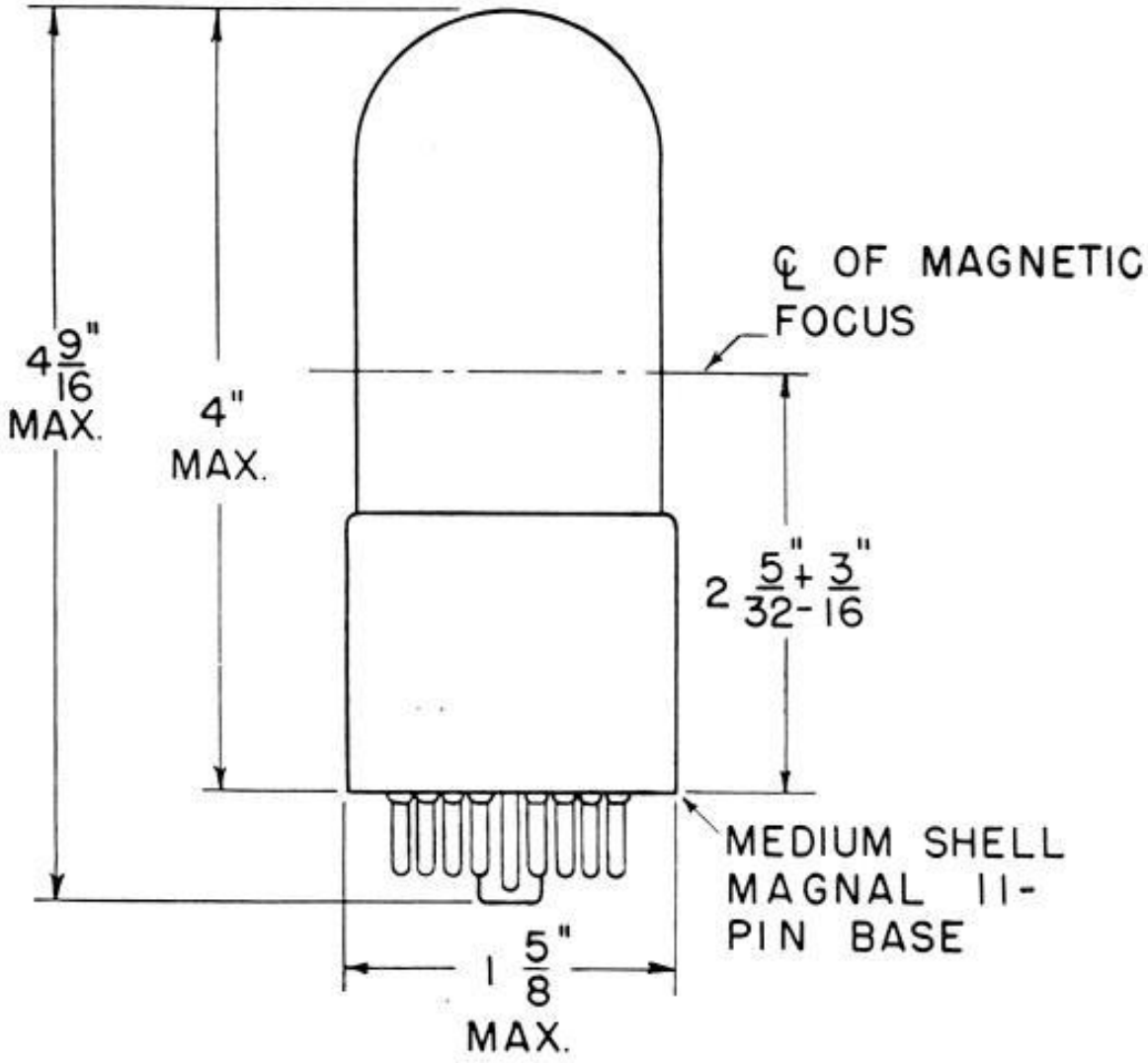
*Refer to ETX-109, application data for circuit.

GL-2H21
MODULATION CHARACTERISTIC



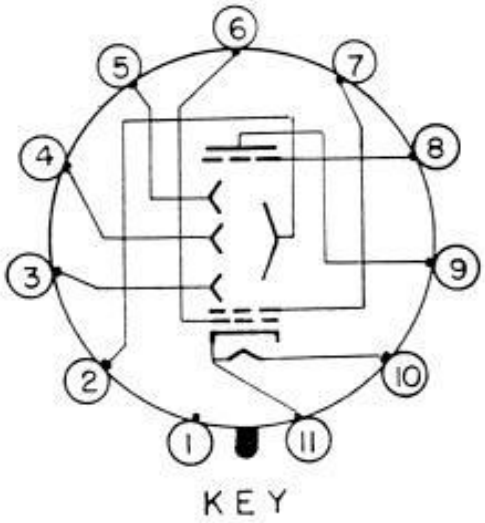
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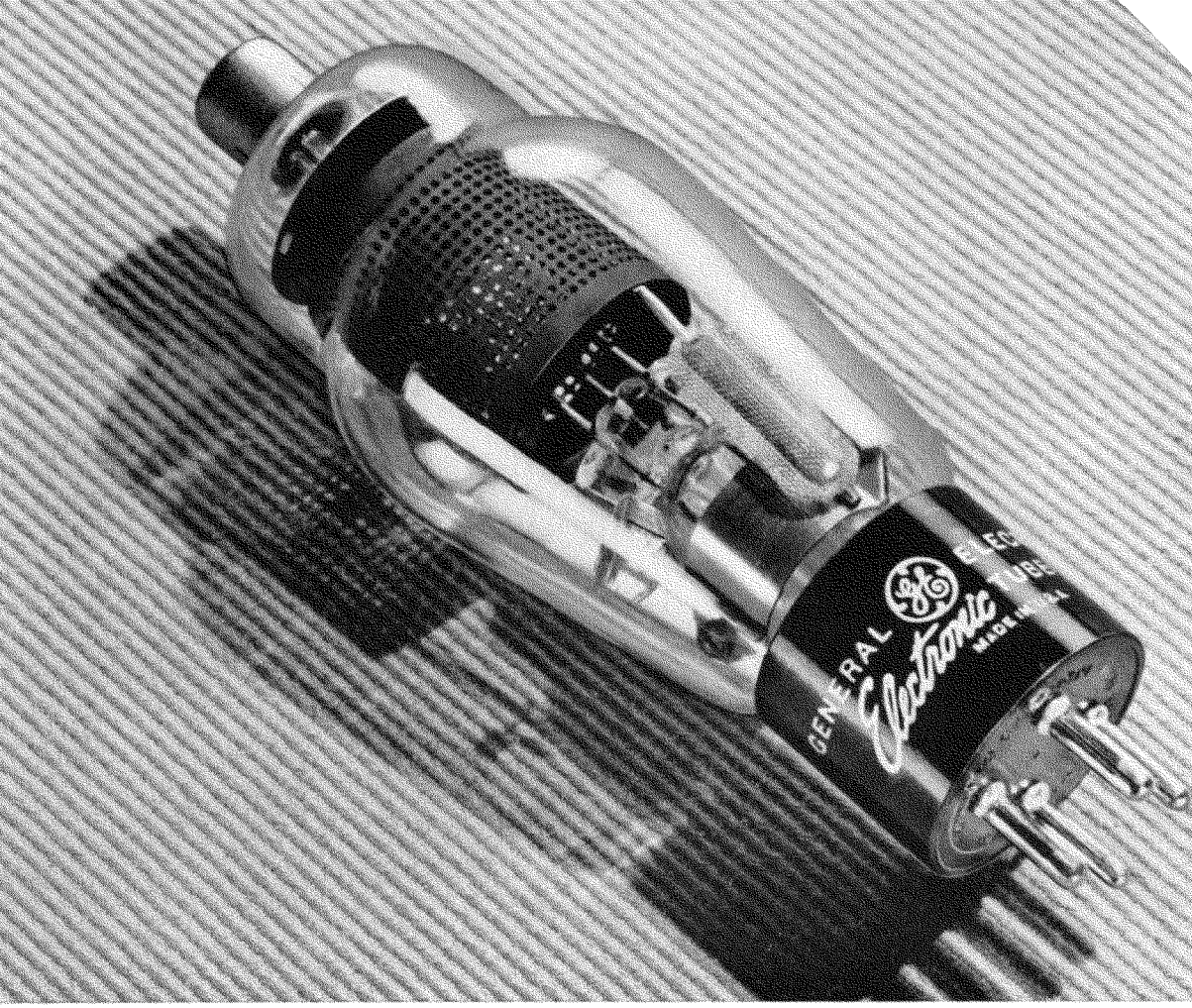
GL-2H21 OUTLINE

N-51066AZ 11-1-45



N-15066AZ-1 11-1-45

TERMINAL CONNECTIONS			
PIN	CONNECTION	PIN	CONNECTION
1	INTERNAL CONNECTION	6	GRID NO. 1
		7	GRID NO. 2
2	DEFLECTOR NO. 4	8	PLATE NO. 1
3	DEFLECTOR NO. 1	9	PLATE NO. 2
4	DEFLECTOR NO. 2	10	HEATER
5	DEFLECTOR NO. 3	11	HEATER AND CATHODE



THYRATRON

DESCRIPTION

The GL-3C23 is a negative-control thyratron for use in regulated-rectifier circuits. The mixture of inert-gas and mercury vapor provides constancy of characteristic within wide temperature limits. The construction, however, enables the tube to withstand higher voltages than many gas-filled types.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes				3
Electrical				
Cathode—Filamentary type				
Filament voltage				2.5 volts
Filament current, approx				7.0 amperes
Filament heating time, typical				15 seconds
Peak voltage drop, typical				16 volts
Approximate control characteristics				
Anode voltage	25	100	500	volts
Grid voltage	0	−2.5	−4.5	volts
Anode-to-grid capacitance, approx				1.8 micromicrofarad
Ionization time, approx.				10 microseconds
Deionization time, approx.				1000 microseconds
Mechanical				
Net weight, approx.				3 ounces
Shipping weight, approx.				3 pounds
Mounting position				vertical, base down

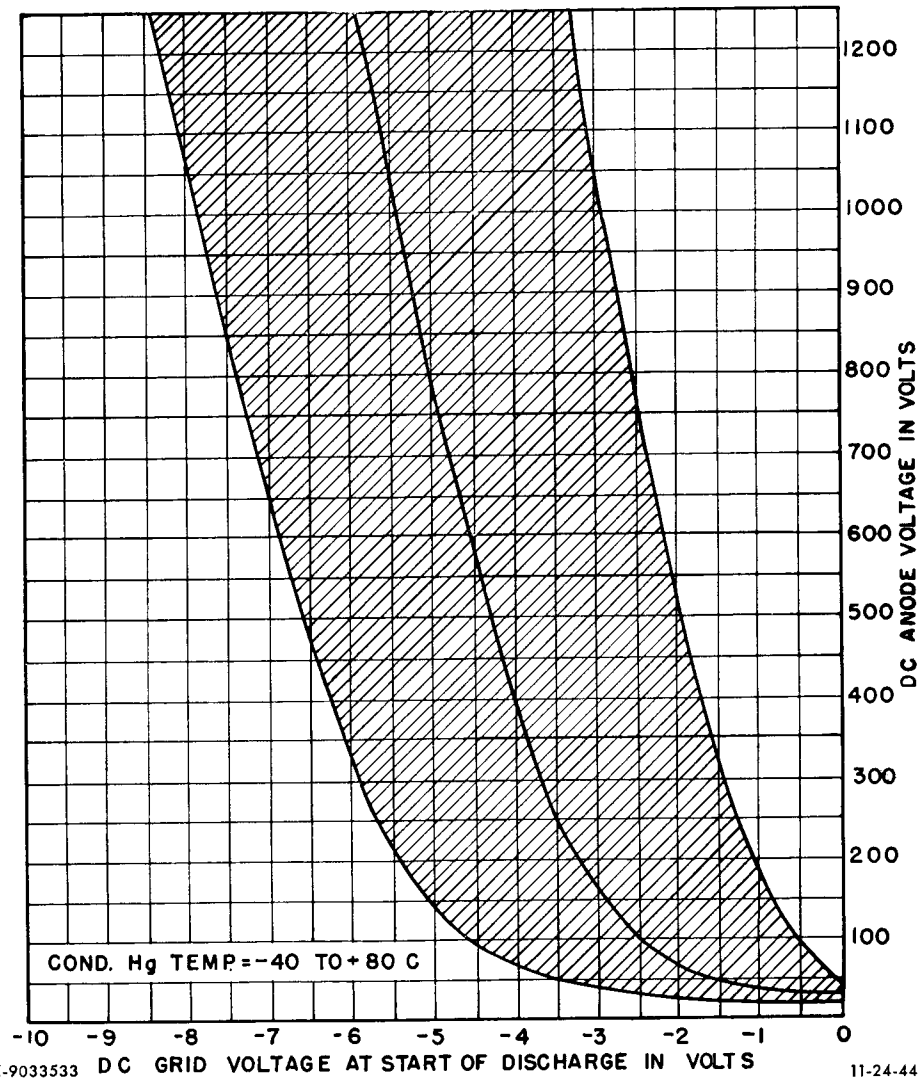
GE Electronic TUBE

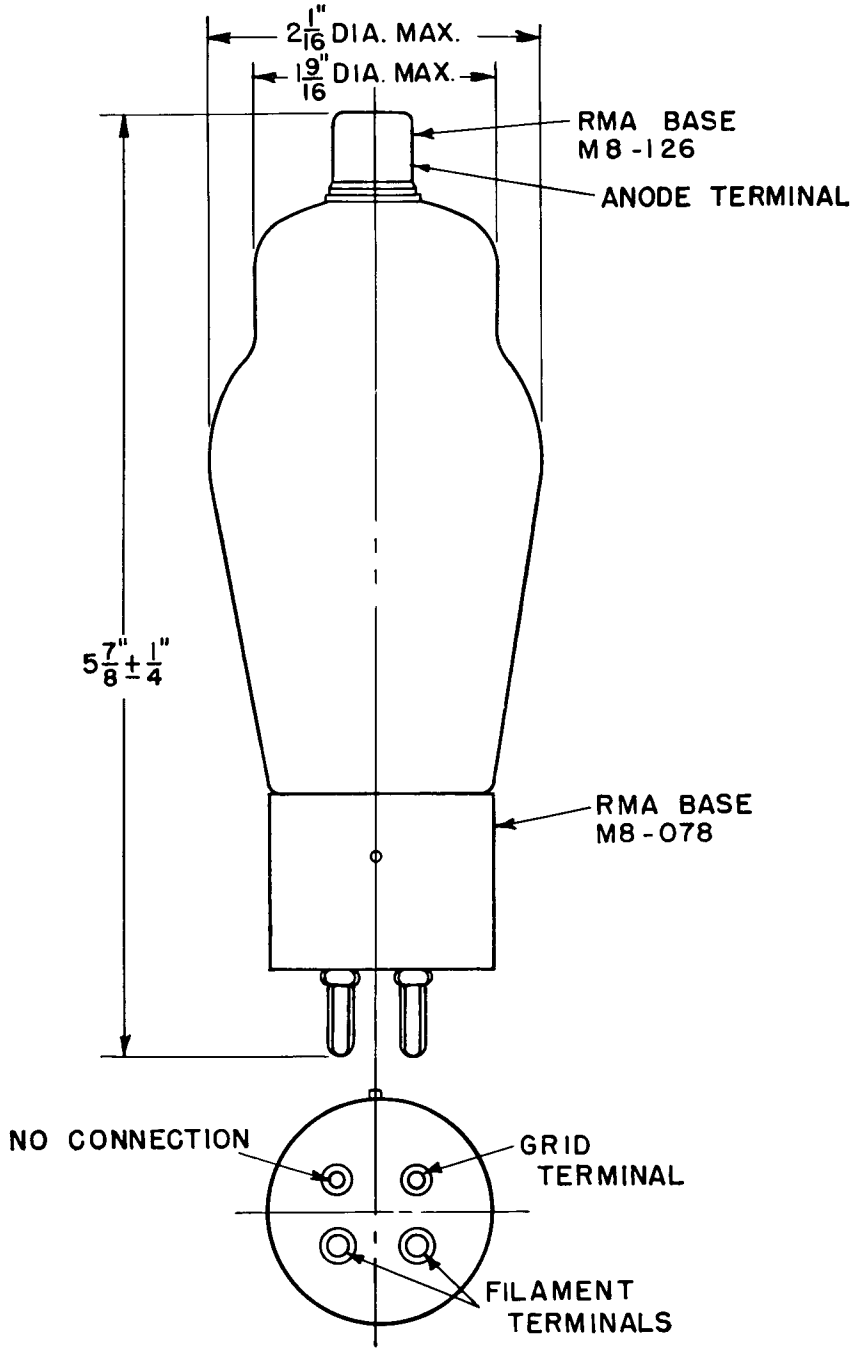
TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

Maximum peak anode voltage		
Inverse	1250	volts
Forward	1250	volts
Maximum negative grid voltage		
Before conduction	500	volts
During conduction	10	volts
Maximum anode current		
Instantaneous, 25 cycles and above	6.0	amperes
Instantaneous, below 25 cycles	3.0	amperes
Average, 210 to 400 cycles	1.0	ampere
Average, below 210 cycles	1.5	ampere
Surge, for design only	120	amperes
Duration of surge current	0.1	second
Maximum grid current		
Instantaneous	0.050	ampere
Average	0.010	ampere
Maximum time of averaging current	5	seconds
Temperature limits, condensed mercury	−40 to +80	centigrade
Recommended temperature, condensed mercury	+40	centigrade

THYRATRON GL-3C23
TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTIC





OUTLINE

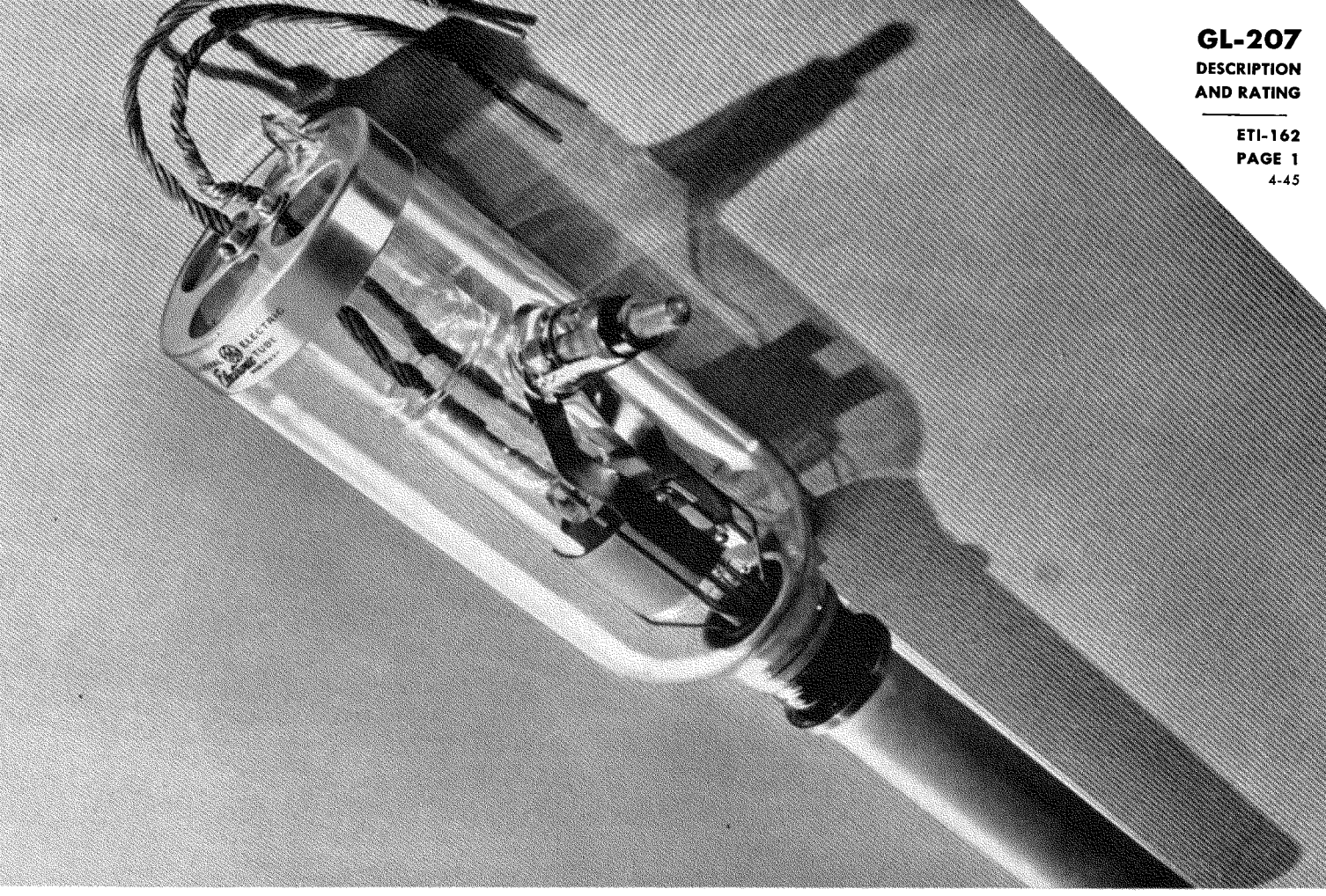
GL-3C23 THYRATRON

K-8639392

6-9-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PLIOTRON

DESCRIPTION

The GL-207 is a three-electrode vacuum tube designed for use as a radio-frequency power amplifier, oscillator, or Class B modulator. The plate is water-cooled and is capable of dissipating 6.6 to 10 kilowatts, depending on the service in which the tube is used.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Electrical

Filament		tungsten
Voltage	22	volts
Current	51	amperes
Average characteristics, $E_b = 10{,}000$, $I_b = 750$ ma, $E_f = 22$		
Grid voltage	−310	volts
Amplification factor	20	
Grid-plate transconductance, $I_b = 750$ ma	5700	micromhos
Direct interelectrode capacitances		
Grid-plate	27	micromicrofarads
Input	18	micromicrofarads
Output	2.0	micromicrofarads
Frequency for maximum tarings	1.5	megacycles

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

Type of cooling	water
Water flow	3–8 gallons per minute
Maximum outlet temperature	70 centigrade
Base	3906
Gasket	Cat. No. 5182028P3
Maximum over-all dimensions	
Length	20¼ inches
Radius	6½ inches
Net weight, approximate	3 pounds
Shipping weight, approximate	10 pounds
Mounting position	vertical, anode down

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS B AUDIO-FREQUENCY POWER AMPLIFIER, TWO TUBES

	Typical Operation			Maximum Ratings	
D-c plate voltage	6000	10000	12500	15000	volts
Maximum signal plate current, per tube*				2.0	amperes
D-c maximum signal plate input, per tube*				20	kilowatts
Plate dissipation, per tube*				7.5	kilowatts
D-c grid voltage	−210	−410	−575		volts
Peak a-f grid input voltage	1520	2140	2300		volts
Zero signal plate current	0.5	0.5	0.4		ampere
Maximum signal plate current	2.5	3.2	2.8		amperes
Maximum signal driving power, approx.	190	380	400		watts
Effective load, plate-to-plate	4200	6400	10000		ohms
Maximum signal plate power output	8	20	22.5		kilowatts

* Averaged over any audio-frequency cycle.

CLASS B RADIO-FREQUENCY POWER AMPLIFIER

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D-c plate voltage	6000	10000	14000	15000	volts
D-c grid voltage	−225	−440	−650		volts
D-c plate current	0.62	0.93	1.0	1.0	ampere
Plate input				15	kilowatts
Plate dissipation				10	kilowatts
Peak r-f grid input voltage	400	600	730		volts
Driving power #, approx.	72	16	0		watts
Plate power output	1	2.5	4		kilowatts

\# At crest of audio-frequency cycle.

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR, PLATE MODULATED

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D-c plate voltage	6000	8000	10000	10000	volts
D-c grid voltage	−1200	−1600	−2000	−3000	volts
D-c plate current	0.76	0.78	0.75	1.0	ampere
D-c grid current, approximate	0.15	0.14	0.07	0.20	ampere
Plate input				10	kilowatts
Plate dissipation				6.6	kilowatts
Peak r-f grid input voltage, approx.	1860	2300	2660		volts
Driving power, approx.	280	325	185		watts
Plate power output	3.5	5	6		kilowatts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Key-down conditions per tube without modulation.##

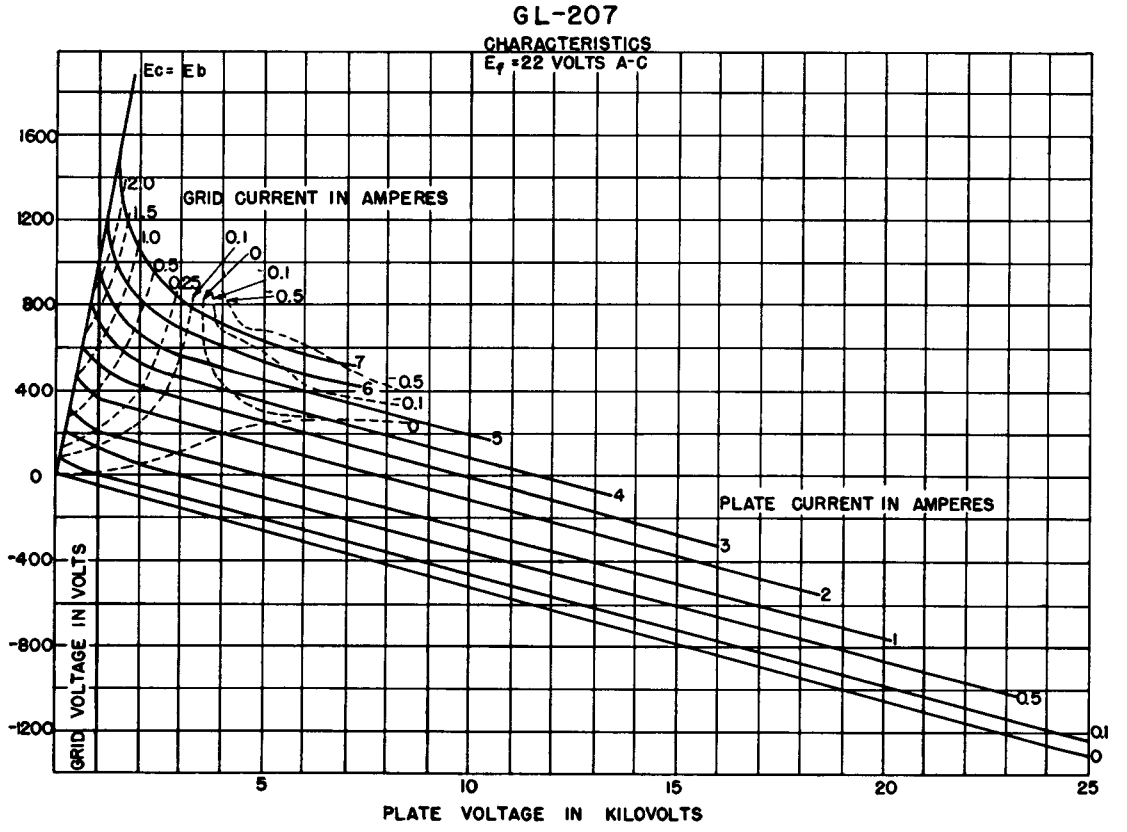
D-c plate voltage	8000	10000	12000	15000	volts
D-c grid voltage	−1000	−1200	−1600	−3000	volts
D-c plate current	1.1	1.33	1.67	2.0	amperes
D-c grid current, approx.	0.17	0.12	0.09	0.2	ampere
Plate input				30	kilowatts
Plate dissipation				10	kilowatts
Peak r-f grid input voltage	1730	2050	2650		volts
Driving power, approx.	295	245	235		watts
Plate power output	6.5	10	15		kilowatts

\#\# Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed the 115 per cent of the carrier conditions.

APPLICATION NOTES

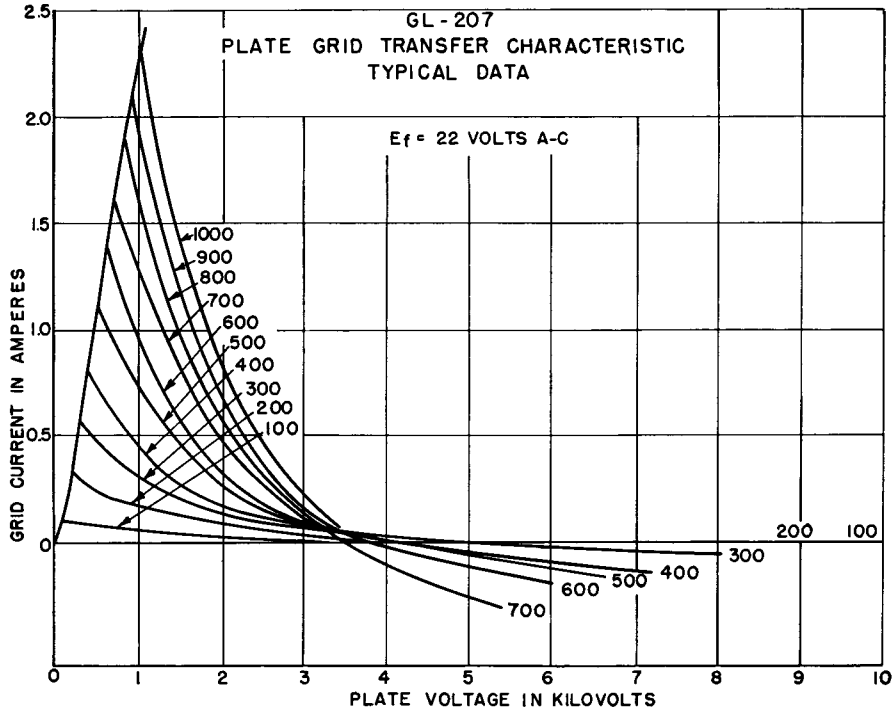
The GL-207 can be operated at frequencies as high as 1.5 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised (other maximum ratings are the same as shown under TECHNICAL INFORMATION). The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used up to 20 megacycles for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency				1.5	7.5	20	megacycles
Percentage of maximum rated plate voltage and plate input							
Class B				100	85	76	per cent
Class C plate modulated				100	75	50	per cent
Class C unmodulated				100	75	50	per cent
Plate series protective resistors							
Series resistor	25	50	200	250	275	300	ohms
Maximum power output of rectifier	16	40	100	250	640	1600	kilowatts

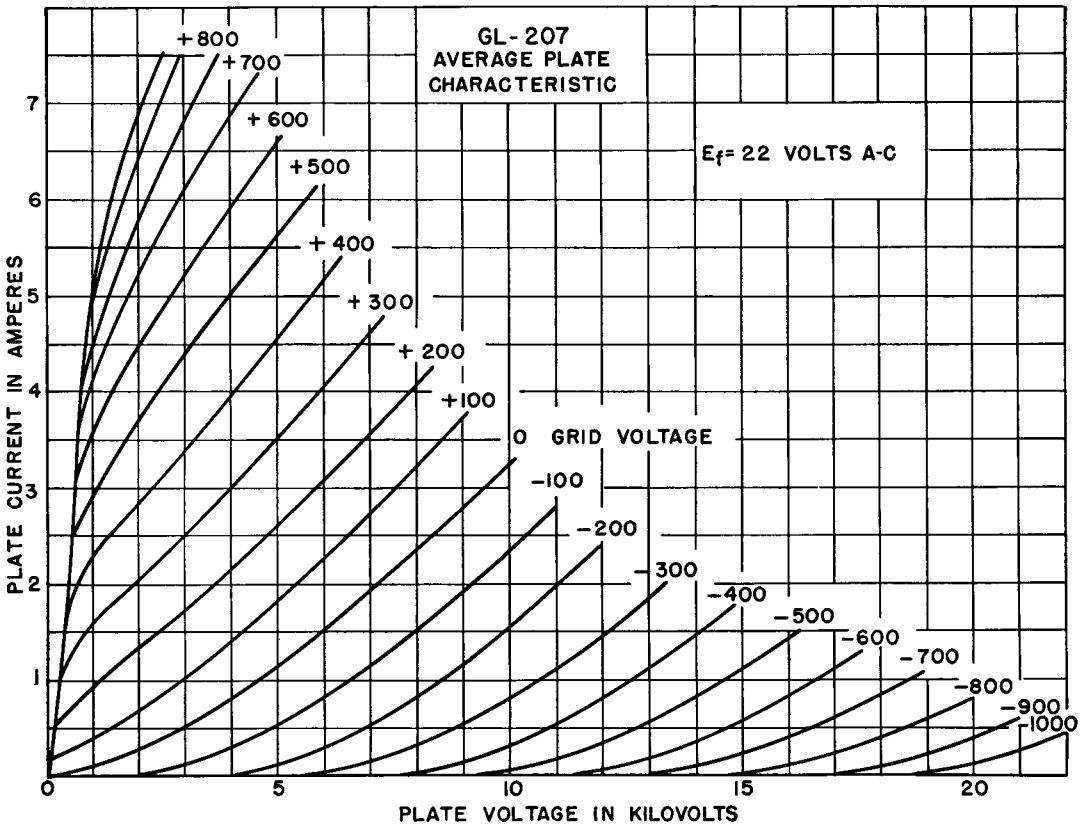


K-6966464

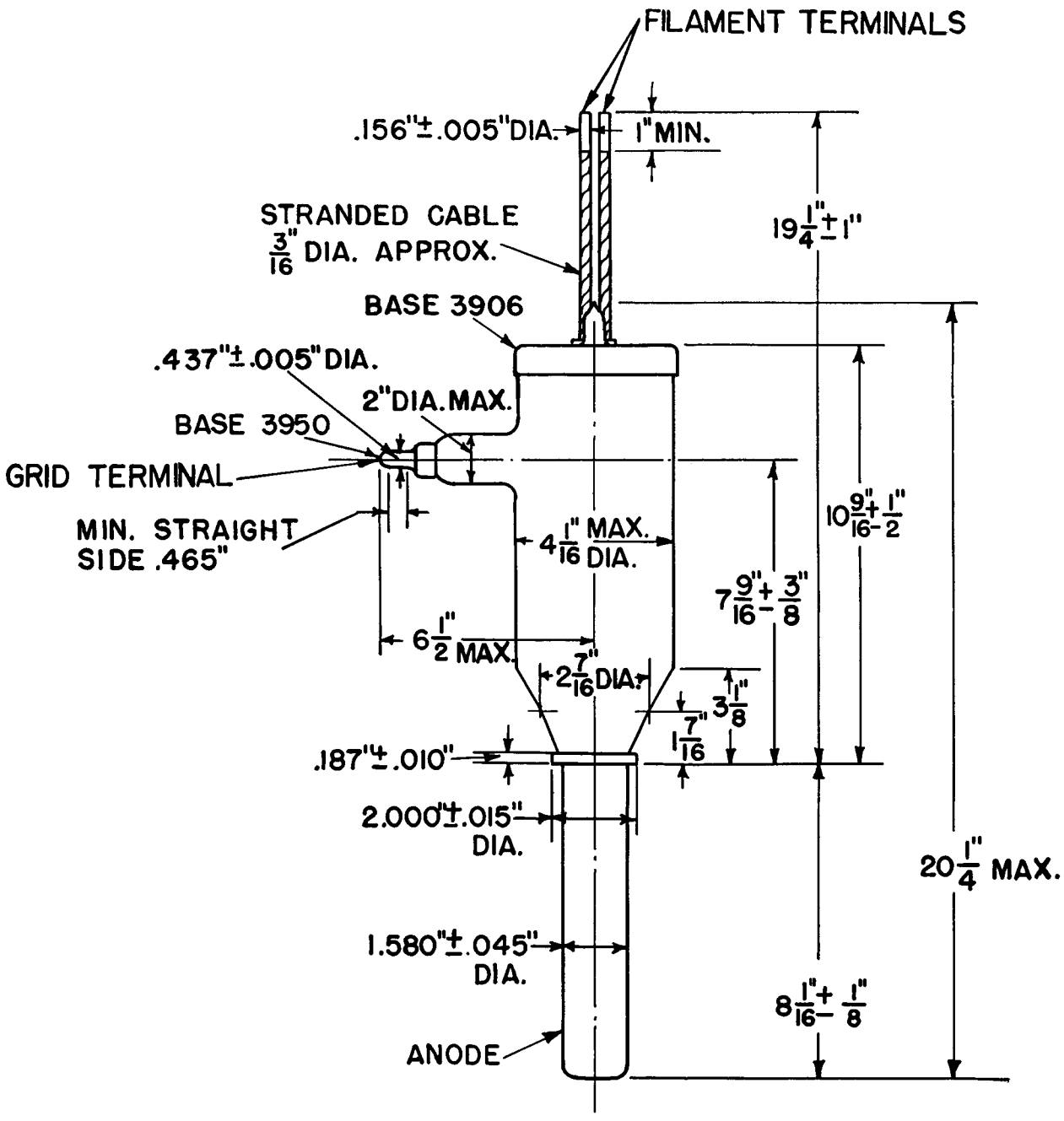
11-2-44



K-6966465 9-26-44



K-6966463 9-26-44



OUTLINE
GL-207 PLIOTRON

K-5182095

9-23-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The GL-393-A thyratron is designed for regulated-rectifier circuits. The use of a gas mixture of argon and mercury vapor provides constancy of characteristics within wide temperature limits. The construction, however, enables the tube to withstand higher voltages than many gas-filled types.

RECOMMENDED FOR REPLACEMENT ONLY

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes			3	
Electrical				
Cathode—Filamentary type				
Filament voltage			2.5	volts
Filament current, approx.			7.0	amperes
Filament heating time, typical			15	seconds
Peak voltage drop, approx.			15	volts
Approximate starting characteristics				
Anode voltage	25	100	500	volts
Grid voltage	0	−2.5	−4.5	volts
Deionization time, approx.			1000	microseconds
Mechanical				
Net weight, approx.			3	ounces
Shipping weight, approx.			3	pounds
Mounting position				vertical, base down

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

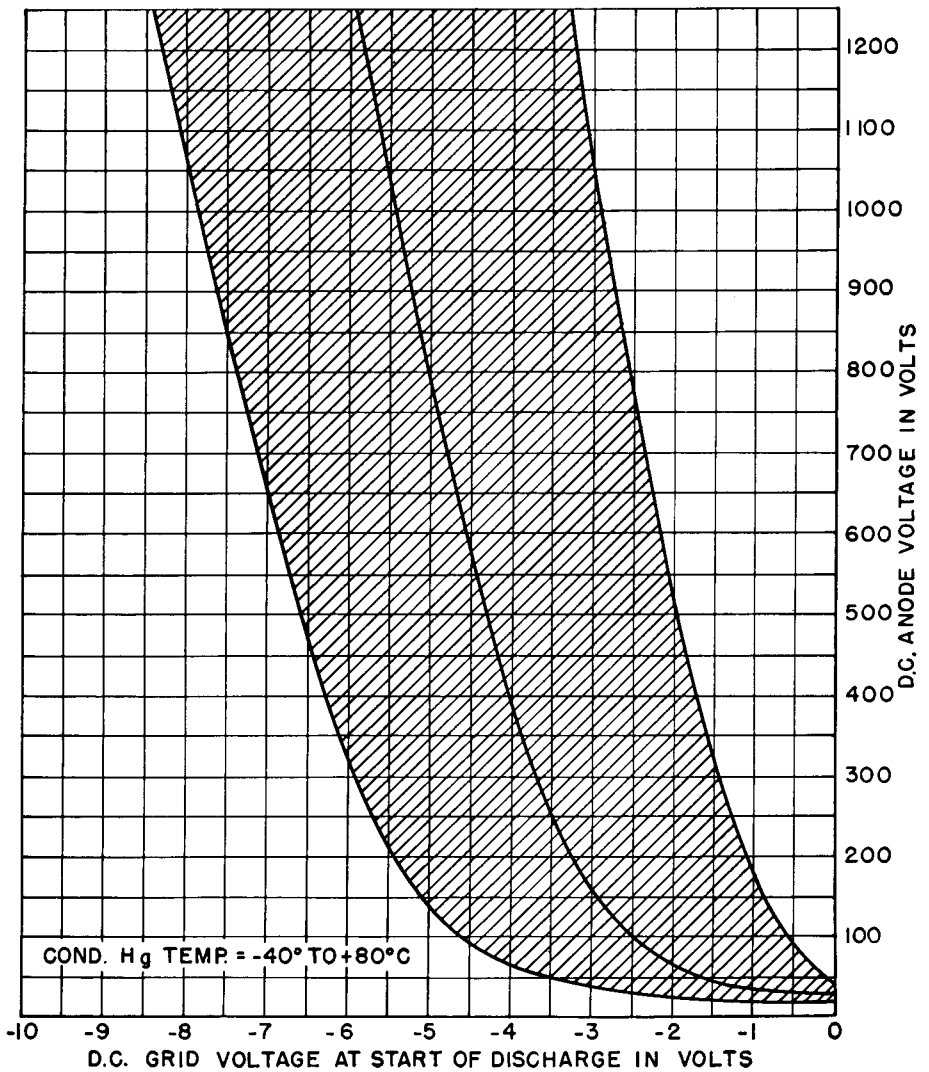
MAXIMUM RATINGS

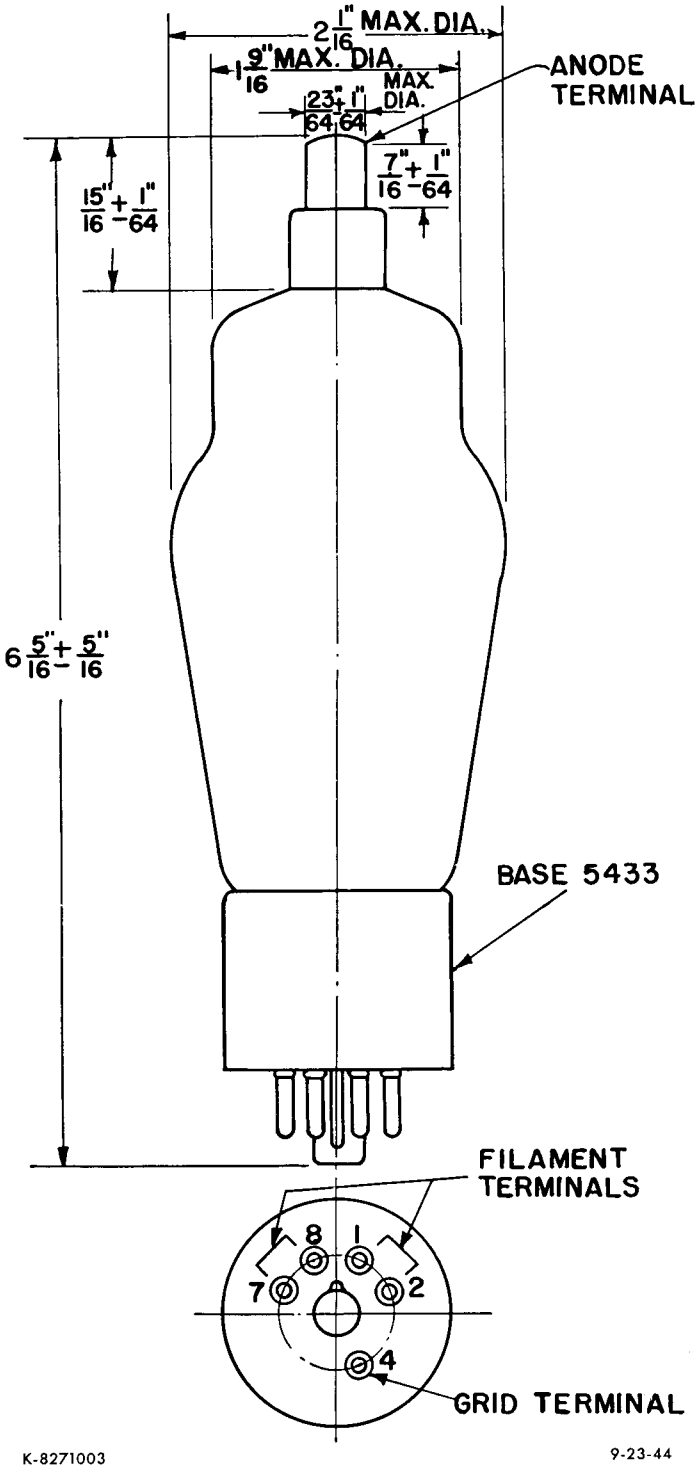
Maximum peak anode voltage		
Inverse	1250	volts
Forward	1250	volts
Maximum negative grid voltage		
Before conduction	500	volts
During conduction	10	volts
Maximum anode current		
Instantaneous, 25 cycles and above	6.0	amperes
Instantaneous, below 25 cycles	3.0	amperes
Average	1.5	amperes
Surge, for design only	55	amperes
Maximum grid current		
Instantaneous	0.050	ampere
Average	0.010	ampere
Maximum time of averaging current	5	seconds
Temperature limits	−40 to +80	centigrade

THYRATRON GL-393-A

TYPICAL CONTROL CHARACTERISTICS

SHADED AREA SHOWS RANGE OF CHARACTERISTIC

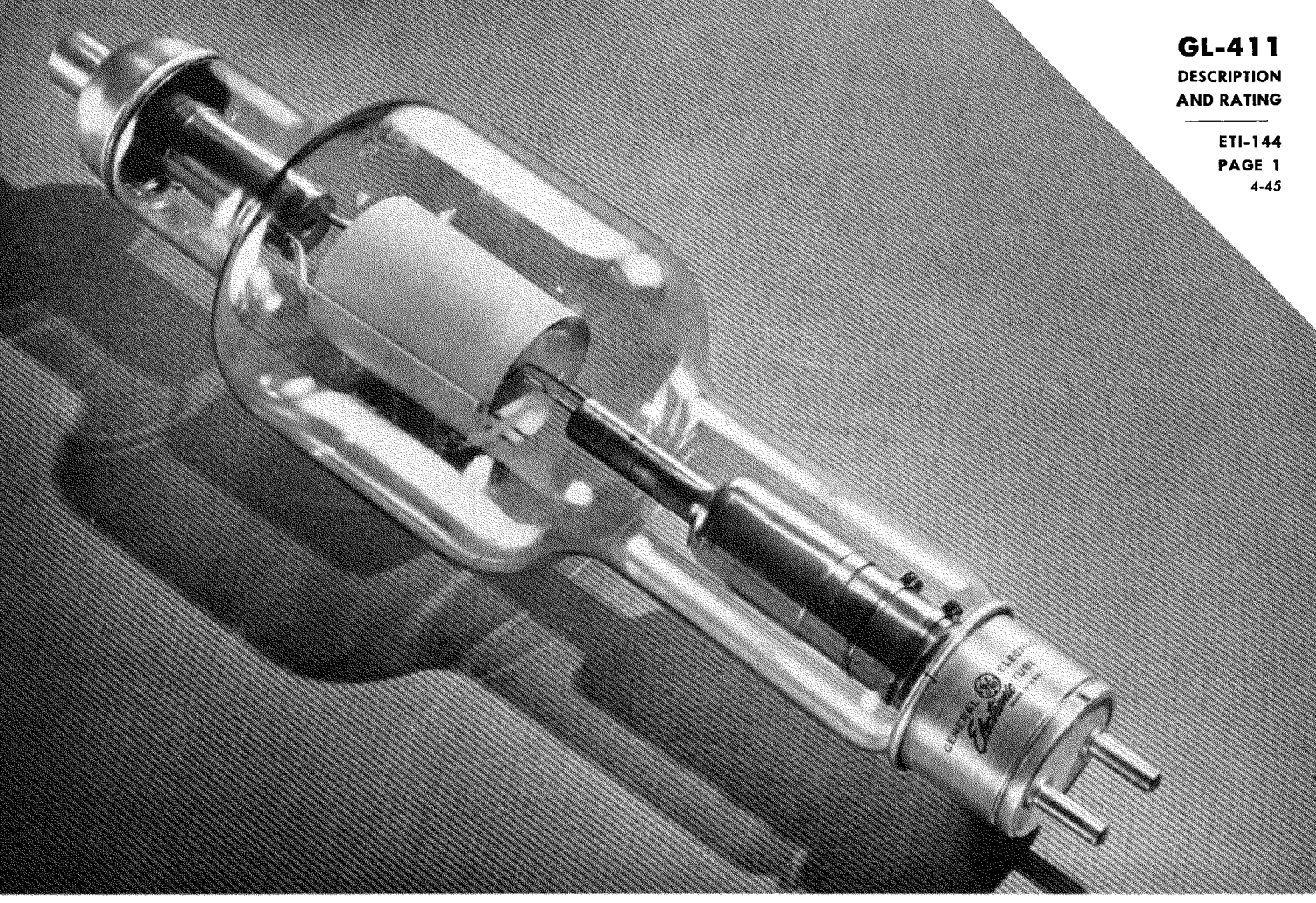




OUTLINE
GL-393-A THYRATRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



KENOTRON

DESCRIPTION

The GL-411 is a high-vacuum rectifier designed for high-voltage applications requiring low current —such as cable testing and smoke precipitation, where voltages up to 150,000 volts are required.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes 2

Electrical

Cathode—filamentary type

Filament voltage	10	volts
Filament current, approx.	14.5	amperes

Mechanical

Net weight, approx.	1⅞	pounds
Shipping weight, approx.	9	pounds
Mounting position		vertical, with base down

GE Electronic TUBE

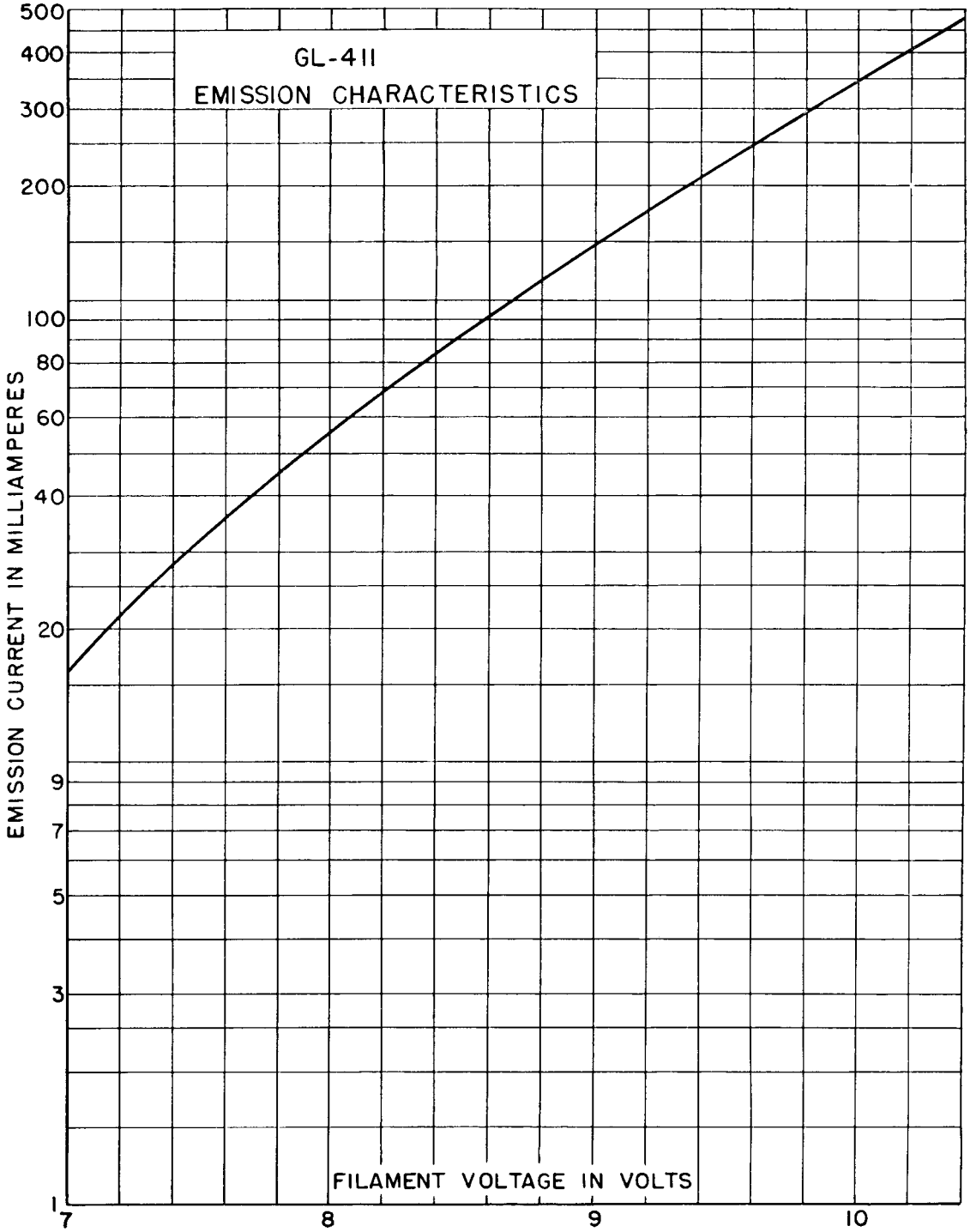
GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

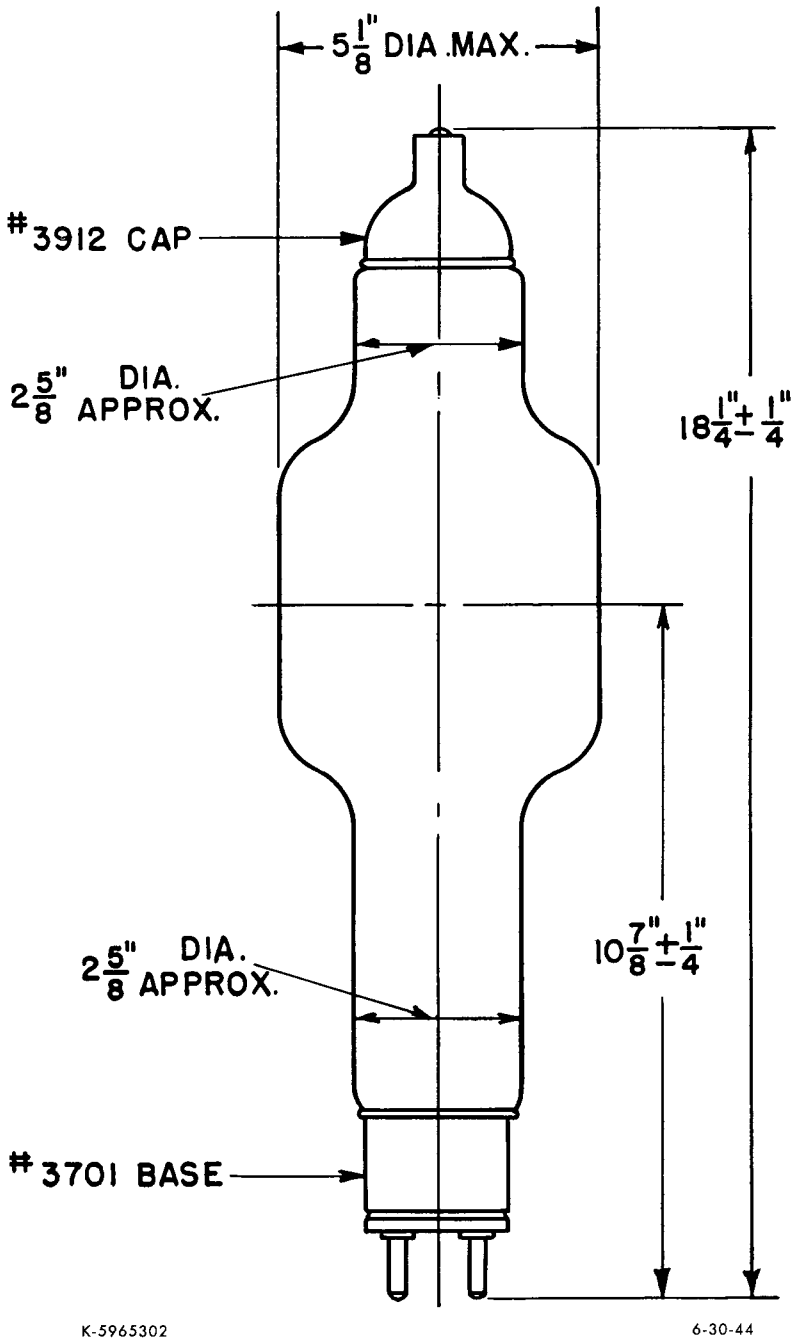
For Rectifier Service

Maximum peak inverse voltage		
In air	100,000	volts
In oil	150,000	volts
Maximum peak anode current	0.3	ampere
Maximum anode dissipation	500	watts



K-6917401

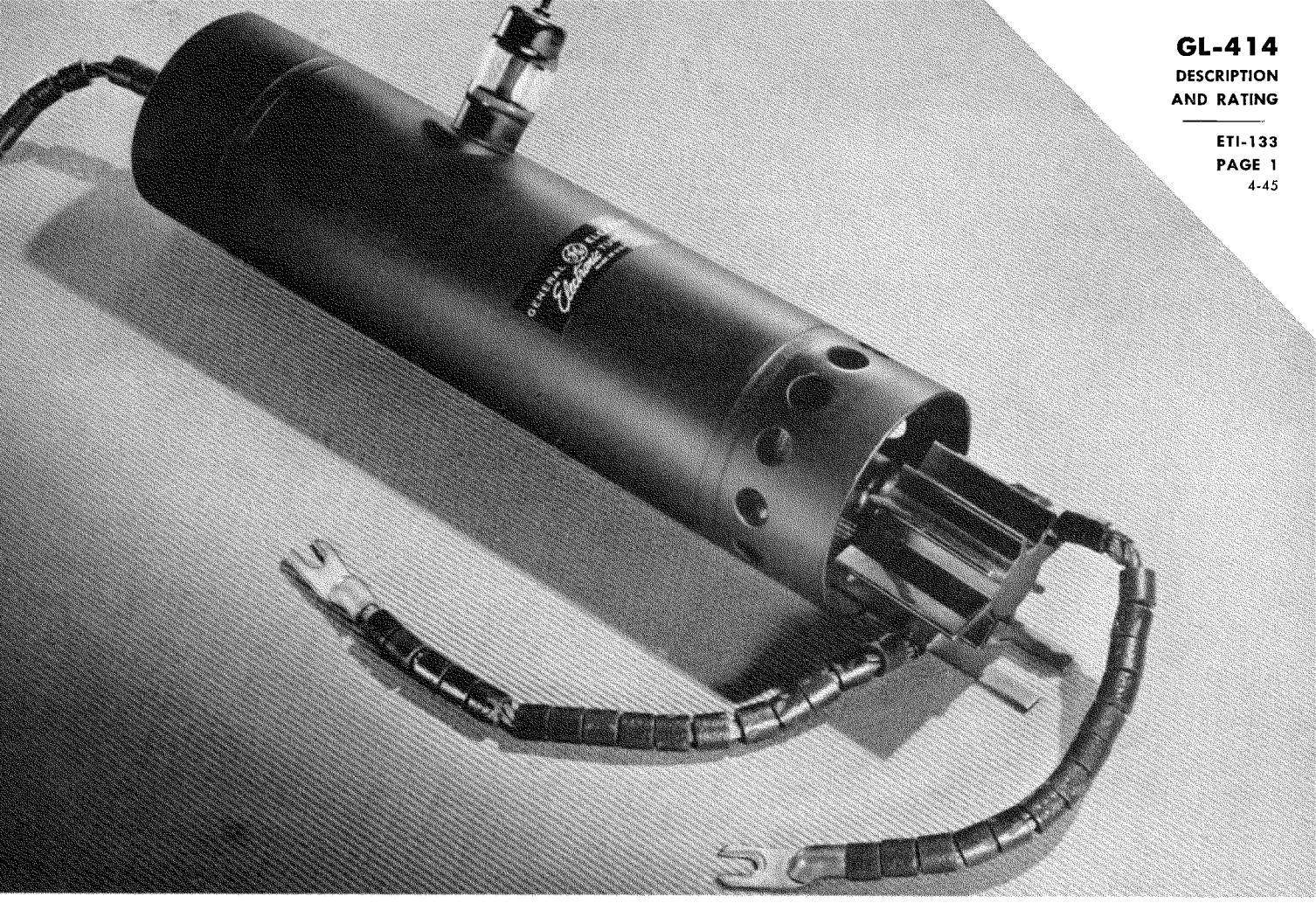
7-1-44



OUTLINE
GL-411 KENOTRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The GL-414 is a hot-cathode, mercury-vapor all-metal thyratron.

The low voltage-drop characteristic and high efficiency of mercury tubes are combined in the GL-414 with the mechanical strength and ease of installation inherent in the all-metal design. These features result in a tube especially satisfactory for industrial applications.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes		4	
Electrical			
Cathode—Indirectly heated type			
Heater voltage		5.0	volts
Heater current, approx		20.0	amperes
Heating time, typical		10	minutes
Peak voltage drop, typical		16	volts
Approximate starting characteristics			
Anode voltage	100	2000	volts
Control-grid voltage	−1.0	−14.0	volts
Anode to control-grid capacitance		0.07	micromicrofarad
Ionization time, approx		10	microseconds
Deionization time, approx		1000	microseconds

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

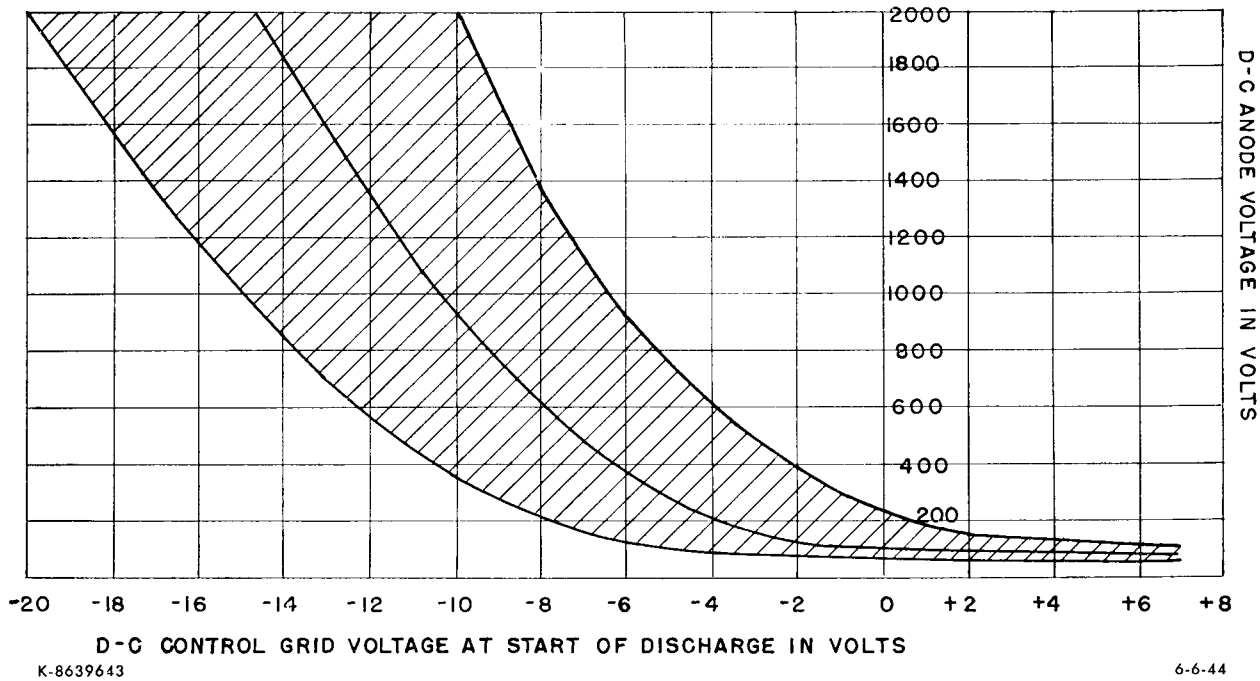
Mechanical

Net weight, approx	4	pounds
Shipping weight, approx	9	pounds
Mounting position		vertical

MAXIMUM RATINGS

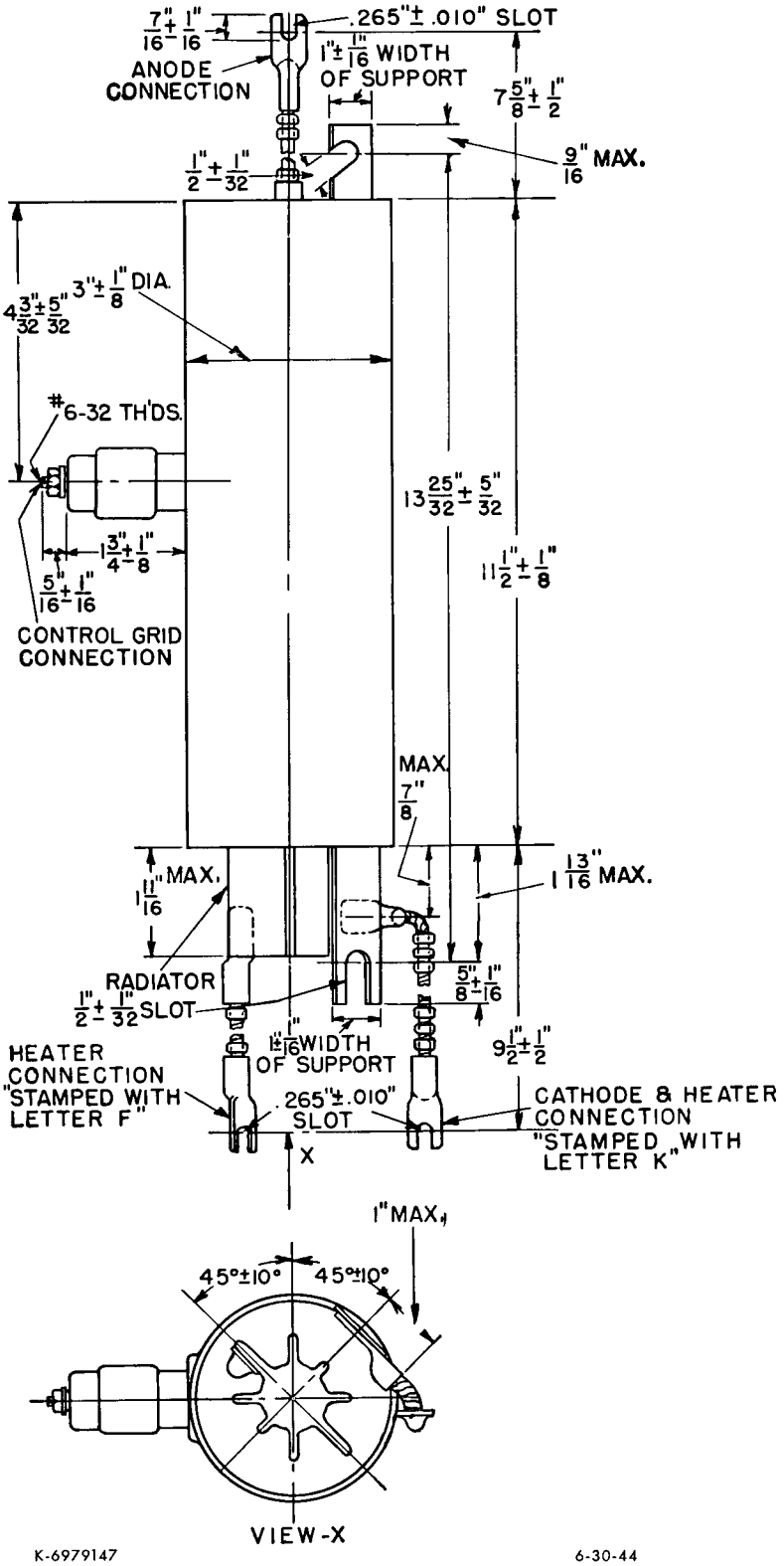
Maximum peak anode voltage		
Inverse	2000	volts
Forward	2000	volts
Maximum negative control-grid voltage		
Before conduction	1000	volts
During conduction	10	volts
Maximum anode current		
Instantaneous, 25 cycles and above	100	amperes
Instantaneous, below 25 cycles	25	amperes
Average	12.5	amperes
Surge, for design only	1500	amperes
Maximum control-grid current		
Instantaneous	5.0	amperes
Average	1.0	ampere
Maximum time of averaging current	30	seconds
Temperature limits, condensed mercury	+40 to +80	centigrade
Recommended temperature, condensed mercury	+40	centigrade

TYPICAL CONTROL CHARACTERISTIC
SHADED AREA SHOWS RANGE OF CHARACTERISTIC
CONDENSED-MERCURY TEMPERATURE 40 C
SHIELD GRID CONNECTED TO CATHODE



K-8639643

6-6-44



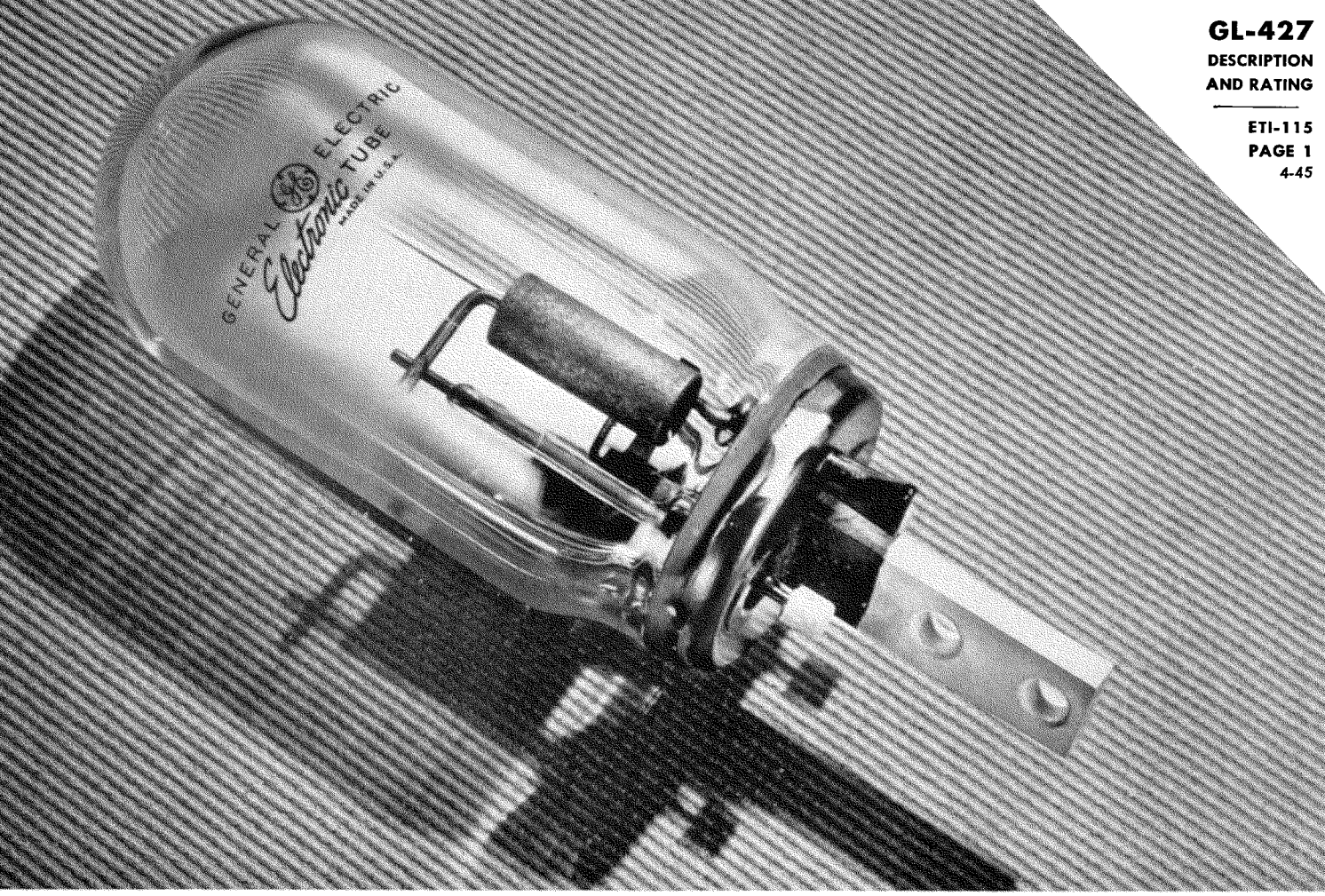
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6-30-44

OUTLINE
GL-414 THYRATRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



IGNITRON

DESCRIPTION

The GL-427 is a small glass, air-cooled ignitron tube which combines the advantages of simple construction and visibility of operation. It is designed primarily for demonstrating the unique and interesting characteristics of ignitors used to initiate a cathode spot. The sturdy construction makes it particularly applicable to classroom demonstrations or student experiments. A red glass filter will be found to be a convenient aid in observing ignitor operation.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Typical arc drop	10–15	volts
Type of cooling		
Free-air circulation		
Average anode current	5	amperes
Ambient temperature	25	centigrade
Condensed mercury temperature	100	centigrade
Forced-air circulation†		
Average anode current	10	amperes
Ambient temperature	25	centigrade
Condensed mercury temperature	100	centigrade

†An ordinary desk fan will provide sufficient cooling for most uses.

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

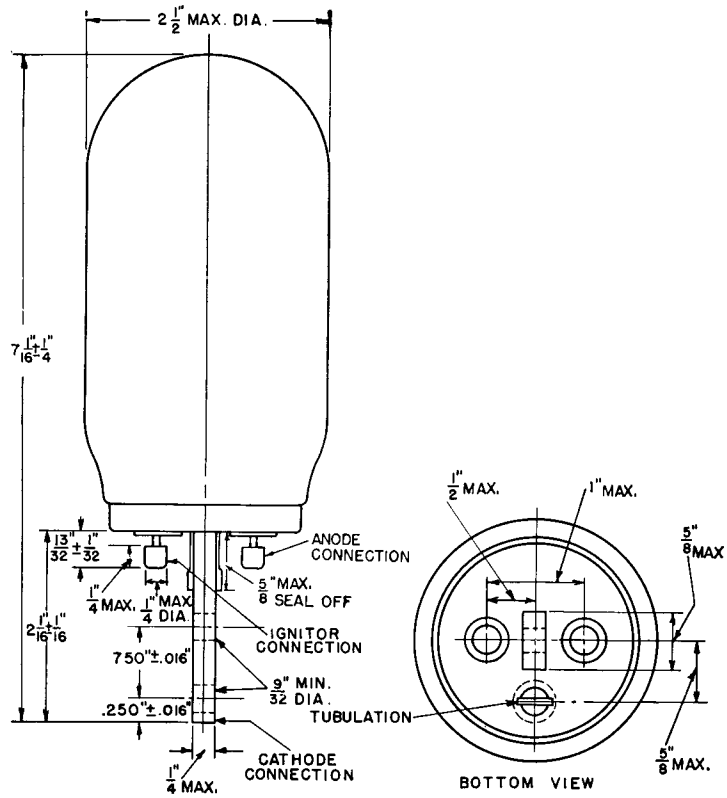
Mechanical

Net weight, approx	1.5	pounds
Shipping weight, approx	3	pounds

MAXIMUM RATINGS

Anode voltage, maximum inverse and forward	350	volts
Anode current		
Maximum instantaneous	30	amperes
Maximum average, free-air circulation	5	amperes
Maximum average, forced-air circulation	10	amperes
Maximum temperature, condensed mercury	100	centigrade
Ignitron voltage		
Maximum instantaneous allowed, ignitor positive	350	volts
Maximum instantaneous required, ignitor positive*	150	volts
Maximum instantaneous allowed, ignitor negative	5	volts
Ignitor current		
Maximum instantaneous allowed	100	amperes
Maximum instantaneous required*	30	amperes
Maximum average allowed	2	amperes
Maximum averaging time	10	seconds
Maximum ignition time*	100	microseconds

*Application of either the maximum required ignitor voltage or current will provide a cathode spot in maximum ignition time.



OUTLINE
GL-427 IGNITRON

K-6966951 6-30-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



PHOTOTUBE

DESCRIPTION

The GL-441 is a high-vacuum, two-electrode phototube which has high sensitivity to light sources predominating in blue radiation. Because of its excellent stability, and high sensitivity, it is particularly suitable for measurement and relay applications.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Spectral response	S-4	
Luminous sensitivity at 250 volts, 0 cycles	45	microamperes per lumen
Maximum gas amplification	1.2	
Interelectrode capacitance	3.0	micromicrofarads
Maximum dark current at 250 volts	0.1	microampere
Wavelength of maximum response	4000	angstroms
Sensitivity at maximum response	0.040	microampere per microwatt

Electronic TUBE

GENERAL ELECTRIC

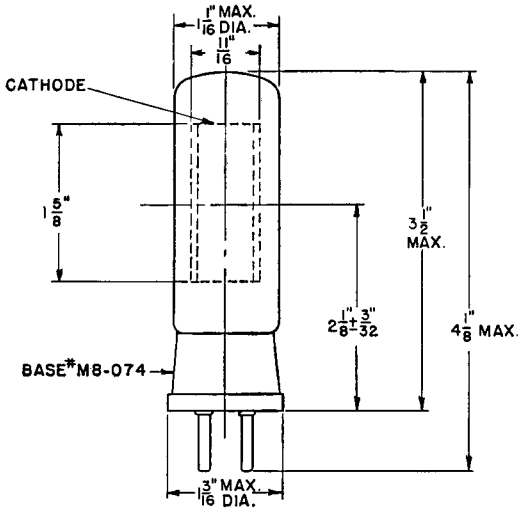
TECHNICAL INFORMATION (CONT'D)

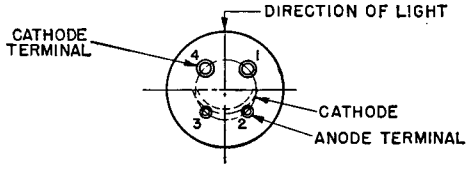
Mechanical

Window dimensions	$\frac{11}{16}$ x $1\frac{5}{8}$	inches
Seated height to center of useful area	$2\frac{1}{8}$ $\pm\frac{3}{32}$	inches
Maximum over-all height	$4\frac{1}{8}$	inches
Maximum seated height	$3\frac{1}{2}$	inches
Maximum diameter	$1\frac{3}{16}$	inches
Base	M8-074	
Mounting position	Any	
Net weight, approx	$\frac{1}{2}$	ounce
Shipping weight, approx	3	pounds

MAXIMUM RATINGS

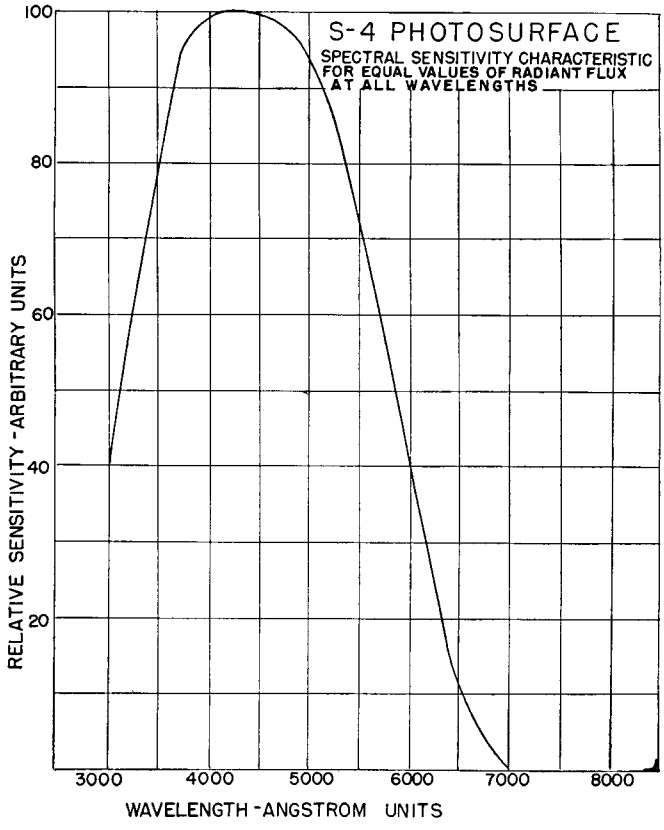
Anode voltage, d-c or peak a-c	250	volts
Cathode current density	102	microamperes per square inch
Ambient temperature	50	centigrade





OUTLINE
PHOTOTUBE GL-441

K-8639391 8-10-44



K-8639625 4-27-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



THYRATRON

DESCRIPTION

The GL-502-A is an inert-gas-filled, double-grid thyratron with negative control characteristics. The control characteristic of this tube is independent of ambient temperature over a wide range. It has high sensitivity characteristics because the grid current is low enough to permit the use of a high resistance in the grid circuit. Because of its low grid-anode capacitance, the GL-502-A is relatively unaffected by line-voltage surges. The small size and weight of this thyratron are features which adapt it to applications where space and weight are important factors.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	4			
Electrical				
Cathode—Indirectly heated type				
Voltage	6.3			volts
Current, approx	0.6			ampere
Heating time, typical	10			seconds
Peak voltage drop, typical	11			volts
Approximate control characteristics. (0.1-megohm grid resistance)				
Anode voltage	30	100	650	volts
Control-grid voltage	0	−1.5	−3.75	volts
Shield-grid voltage	0	0	0	volts
Anode to control-grid capacitance, approx	0.2			micromicrofarad
Ionization time, approx	5			microseconds
Deionization time, approx	1000			microseconds

GE Electronic TUBE

GENERAL ELECTRIC

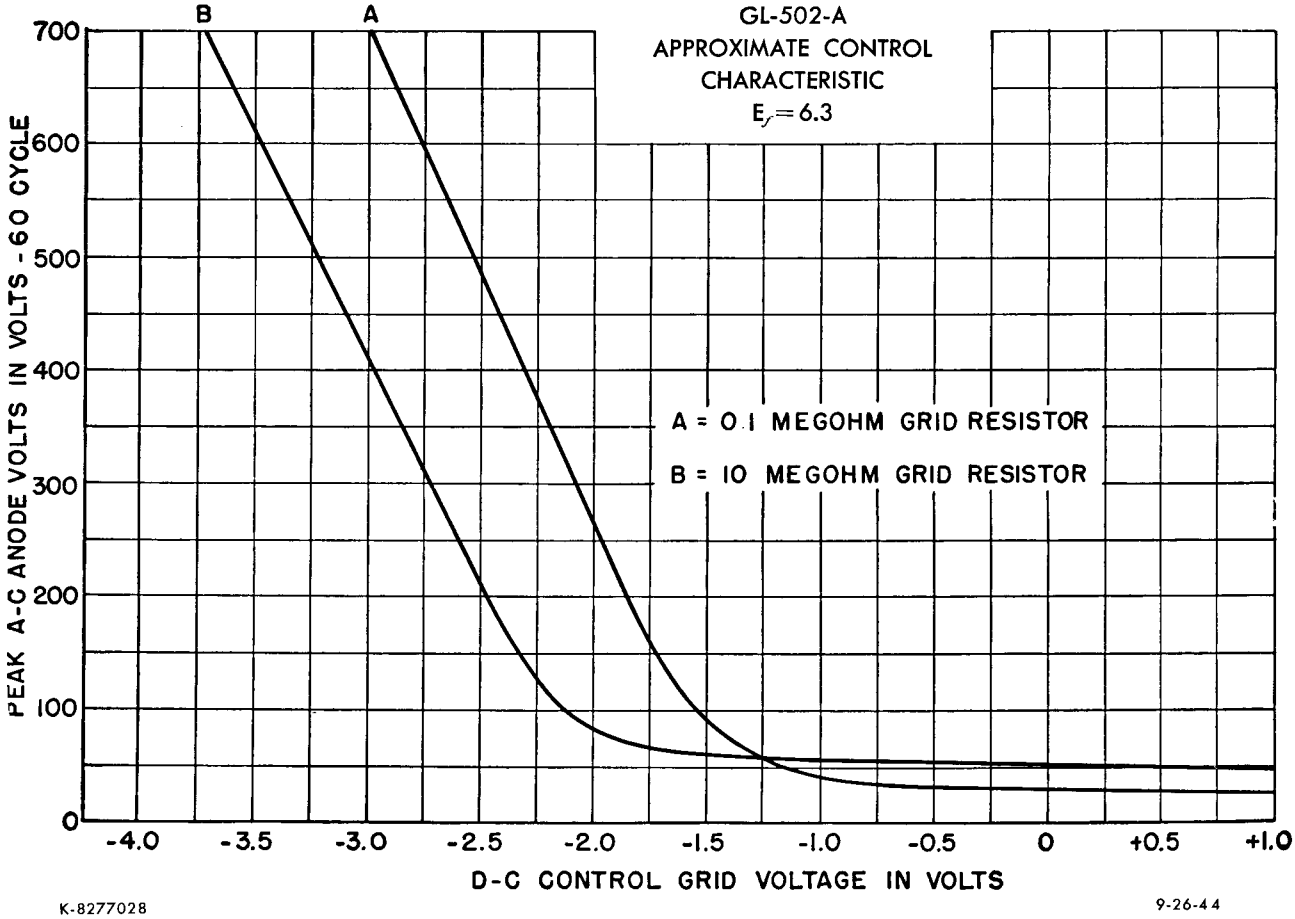
TECHNICAL INFORMATION (CONT'D)

Mechanical

Net weight, approx	2	ounces
Shipping weight, approx	3	pounds
Operating position		vertical or horizontal

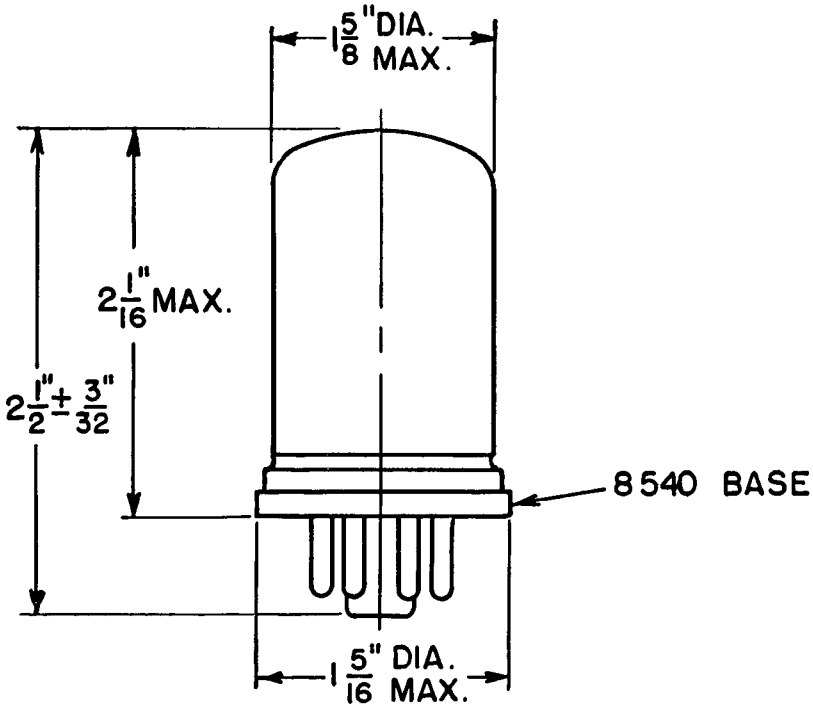
MAXIMUM RATINGS

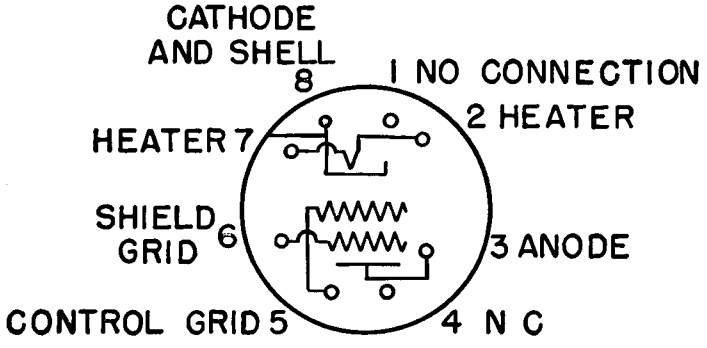
Maximum peak anode voltage		
Inverse	1300	volts
Forward	650	volts
Maximum negative control-grid voltage		
Before conduction	200	volts
During conduction	10	volts
Maximum negative shield-grid voltage		
Before conduction	100	volts
During conduction	5	volts
Maximum anode current		
Instantaneous	500	milliamperes
Average	100	milliamperes
Surge, for design only	10	amperes
Maximum control-grid current		
Instantaneous	50	milliamperes
Average	10	milliamperes
Maximum shield-grid current		
Instantaneous	50	milliamperes
Average	10	milliamperes
Maximum time of averaging anode current	30	seconds
Ambient temperature limits	−55 to +90	centigrade



K-8277028

9-26-44





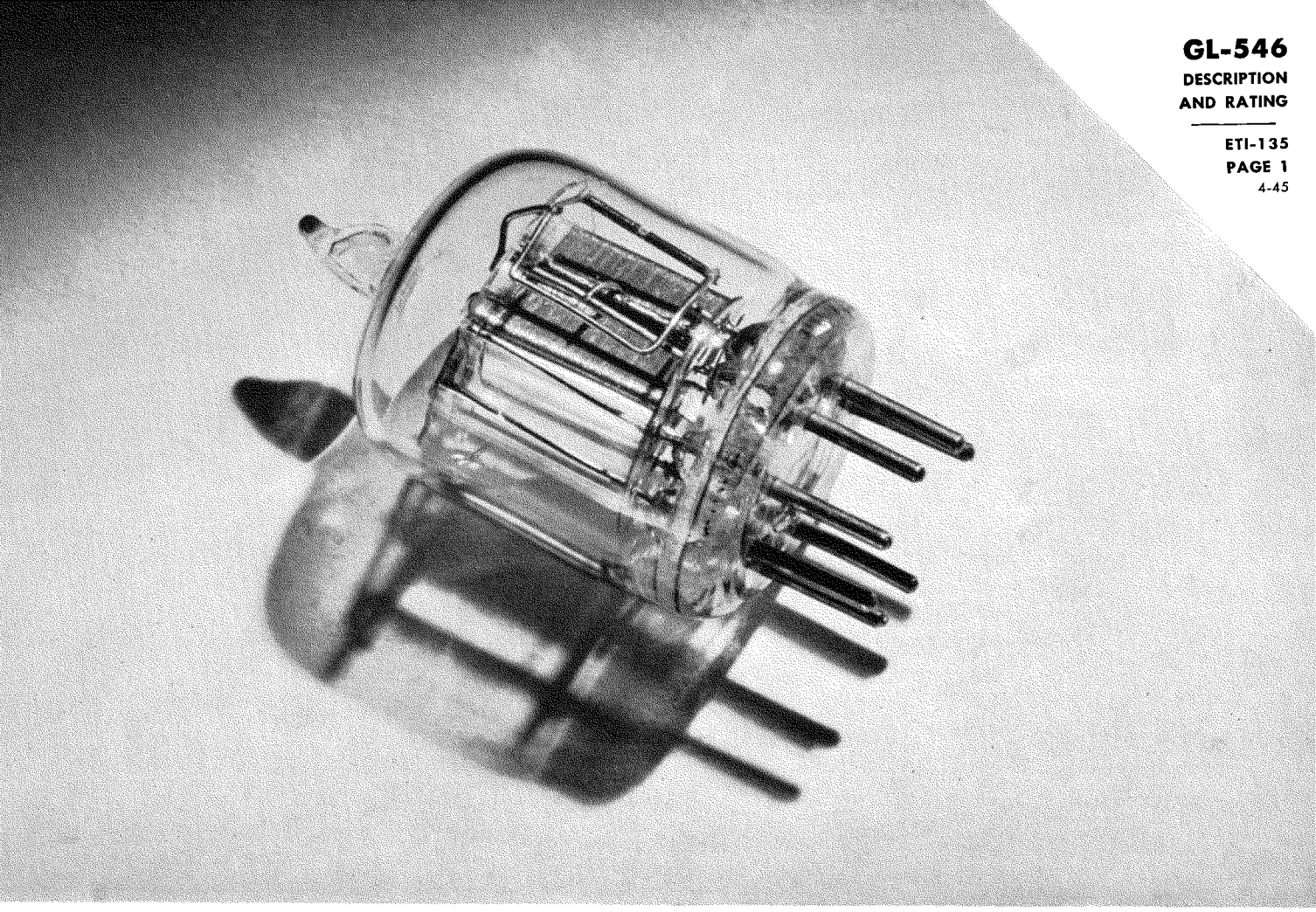
BOTTOM VIEW OF
SOCKET CONNECTIONS

OUTLINE

GL-502-A THYRATRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The GL-546 is an inert-gas-filled thyratron designed with a shield grid. The control characteristic of the GL-546 is independent of ambient temperature over a wide range. The small size and lightweight construction are features which especially adapt it to many control and relay applications where compactness and weight are important factors.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	4	
Electrical		
Cathode—Indirectly heated type		
Voltage	6.3	volts
Current, approx	0.15	ampere
Heating time, minimum	10	seconds
Tube voltage drop, approx	14–16	volts
Average anode to control-grid capacitance	0.1	micromicrofarad
Grid resistor		
Minimum	0.01	megohm*
Maximum	10	megohms*
Ambient temperature	−40 to +80	centigrade

When the tube is operated with an a-c anode voltage and a high value of grid-circuit resistance, the grid-anode capacitance should be made as small as possible by placing the grid resistor directly at the socket terminal.

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

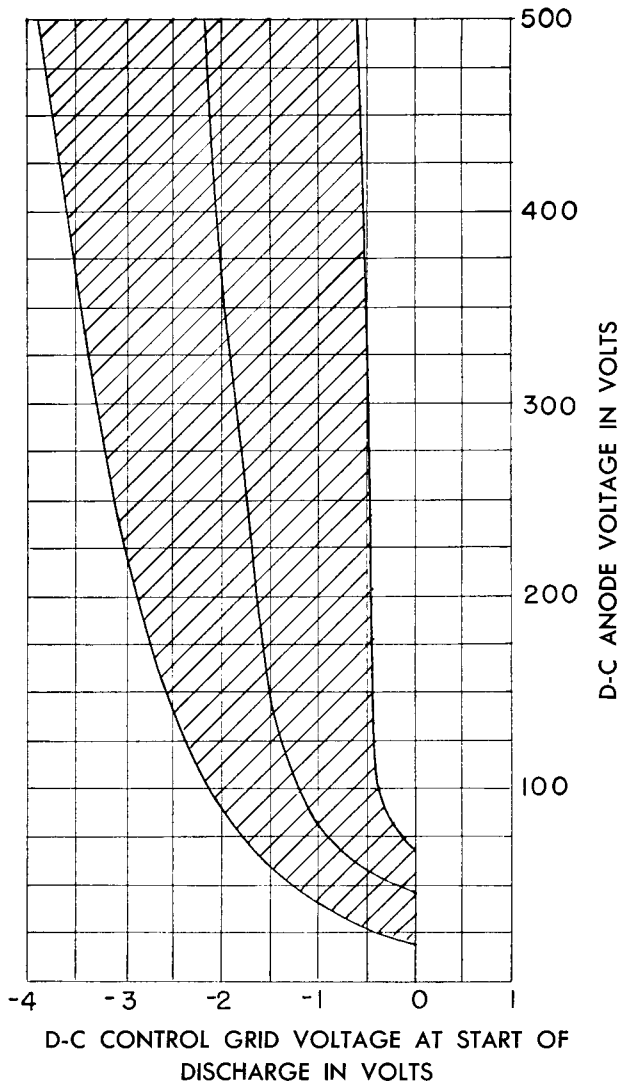
Mechanical

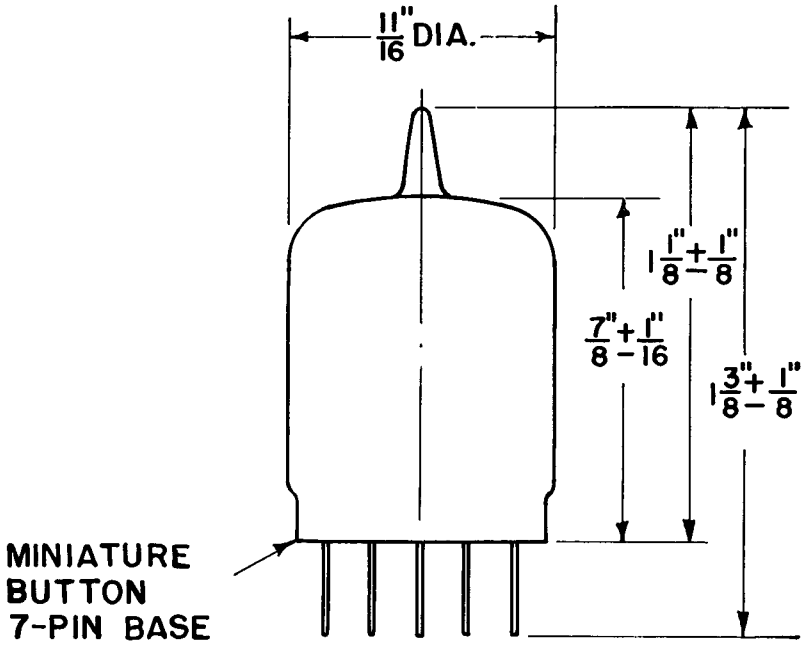
Net weight, approx.	1/3	ounce
Shipping weight, approx.	3	pounds

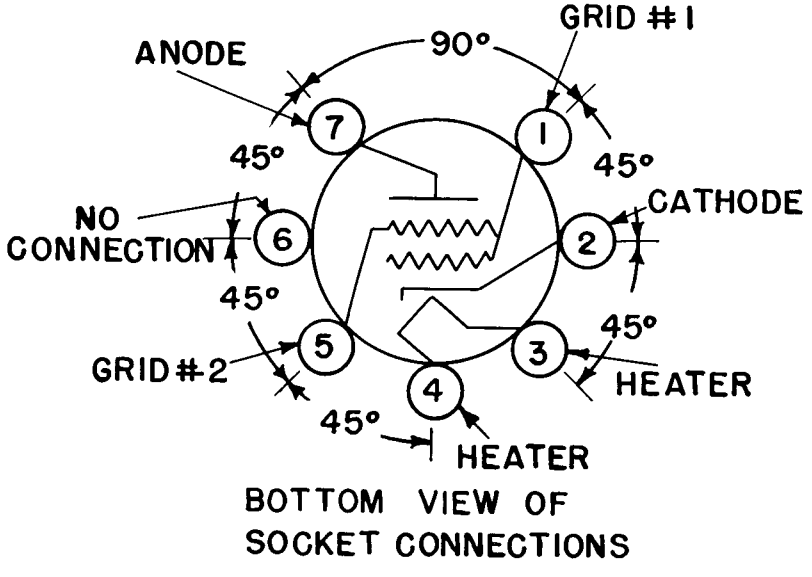
MAXIMUM RATINGS

Maximum peak anode voltage		
Inverse	500	volts
Forward	500	volts
Maximum anode current		
Instantaneous	100	milliamperes
Average	20	milliamperes
Maximum time of averaging anode current	15	seconds

GL-546 THYRATRON
TYPICAL CONTROL CHARACTERISTICS
$E_{G2} = 0$
SHADED AREA SHOWS RANGE OF CHARACTERISTIC







K-8639362 9-23-44

OUTLINE
GL-546 THYRATRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PLIOTRON

DESCRIPTION

The 807 is a beam power transmitting tube of the heater-cathode type having a maximum plate dissipation rating of 30 watts (ICAS). The high power sensitivity of this tube makes it especially useful in frequency-multiplier service where high harmonic output is essential. The 807 may also be used as a crystal oscillator and buffer amplifier in medium-power transmitters using up to a half-kilowatt input. Neutralization is generally unnecessary in adequately shielded circuits.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	5	
Electrical		
Filament voltage ¶	6.3	volts
Filament current	0.9	ampere
Average characteristics		
Grid-plate transconductance, $I_b = 72$ ma	6000	micromhos
Grid-screen amplification factor	8	
Direct interelectrode capacitance		
Grid-plate, with external shielding	0.2	micromicrofarads
Input	11	micromicrofarads
Output	7	micromicrofarads

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

Base description	medium 5-pin
Net weight, approx	3 ounces
Shipping weight, approx	3 pounds
Mounting position	vertical or horizontal

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS AB_2* AUDIO-FREQUENCY POWER AMPLIFIER (TWO TUBES)

	Typical Operation				Maximum Ratings		
	CCS			ICAS	CCS	ICAS	
D-c plate voltage	400	500	600	750	600	750	volts
Max signal plate current (per tube)†					120	120	milliamperes
D-c max signal plate input (per tube)†					60	90	watts
Plate dissipation (per tube)†					25	30	watts
D-c grid voltage	−25	−25	−30	−32			volts
Positive d-c grid voltage	300	300	300	300	300	300	volts
Peak a-f grid input voltage (grid to grid)	78	78	78	92			volts
Zero signal plate current	100	100	60	60			milliamperes
Max signal plate current	240	240	200	240			milliamperes
Max signal screen grid current	10	10	10	10			milliamperes
Screen grid input†					3.5	3.5	watts
Peak grid input power‡	0.35	0.6	0.4	0.5			watt
Load resistance (per tube)	800	1060	1600	1740			ohms
Effective load (plate to plate)	3200	4240	6400	6960			ohms
Max signal plate power output§	55	75	80	120			watts

CLASS B RADIO-FREQUENCY POWER AMPLIFIER

(Carrier conditions per tube for use with a max modulation factor of 1.0)

	CCS			ICAS	CCS	ICAS	
D-c plate voltage	400	500	600	750	600	750	volts
D-c grid voltage	−25	−25	−25	−35			volts
D-c screen grid voltage	250	250	250	300	300	300	volts
D-c grid current	0	0	0	0			milliampere
D-c plate current	75	75	62.5	60	80	90	milliamperes
D-c screen grid current	4	4	3	3			milliamperes
Plate input					37.5	45	watts
Screen grid input					2.5	2.5	watts
Plate dissipation					25	30	watts
Peak r-f grid input voltage	30	30	20	27			volts
Driving power◆, approx	0.25	0.25	0.2	0.12			watt
Plate power output	9	12.5	12.5	15			watts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—PLATE MODULATED

(Carrier conditions per tube for use with a max modulation factor of 1.0)

	CCS			ICAS	CCS	ICAS	
D-c plate voltage	325	400	475	600	475	600	volts
D-c grid voltage	−75	−80	−85	−90	−200	−200	volts
From a grid resistor of	25000	22800	21300	22500			ohms
D-c screen voltage	225	225	225	275	300	300	volts
From a series resistor of△	20000	30000	50000	50000			ohms
D-c plate current	80	80	83	100	83	100	milliamperes
D-c grid current, approx.	3	3.5	4	4	5	5	milliamperes
D-c screen grid current	5	5.75	5	6.5			milliamperes
Plate input					40	60	watts
Screen grid input					2.5	2.5	watts
Plate dissipation					16.5	25	watts
Peak r-f grid input voltage, approx.	90	95	110	115			volts
Driving power, approx	0.25	0.3	0.4	0.4			watts
Plate power output	17.5	22.5	27.5	42.5			watts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

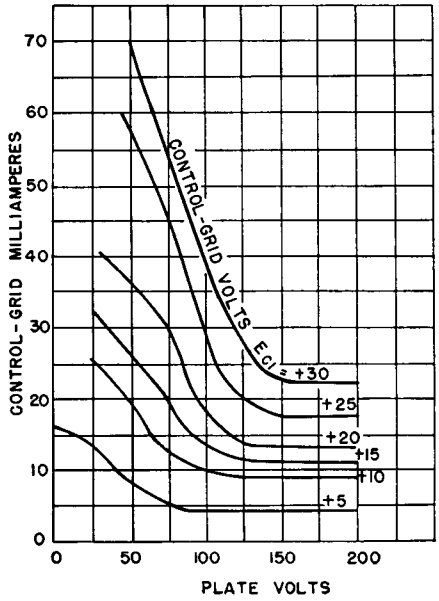
(Key down conditions per tube without modulation) +	CCS			ICAS	CCS	ICAS	
D-c plate voltage	400	500	600	750	600	750	volts
D-c grid voltage					−200	−200	volts
From a fixed supply of	−45	−45	−45	−45			volts
From a cathode resistor of	410	410	410	410			ohms
From a grid resistor of	12800	12800	12800	12800			ohms
D-c screen grid voltage					300	300	volts
From a fixed supply of	250	250	250	250			volts
From a series resistor of	20000	42000	50000	85000			ohms
D-c plate current	100	100	100	100	100	100	milliamperes
D-c grid current, approx	3.5	3.5	3.5	3.5	5	5	milliamperes
D-c screen grid current	7.5	6	7	6			milliamperes
Plate input					60	75	watts
Plate dissipation					25	30	watts
Screen grid input					3.5	3.5	watts
Peak r-f grid input voltage, approx.	65	65	65	65			volts
Driving power, approx	0.2	0.2	0.2	0.2			watt
Plate power output	25	30	40	50			watts

†Averaged over any audio-frequency cycle of sine-wave form.
+Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.
ϕ Subscript (2) indicates that grid current flows during some part of input cycle.
¶ Heater voltage fluctuations should not exceed +10 or −5 per cent from the rated value.
‡Driver stage should be capable of supplying the grids of the Class AB_2 stage with the specified peak values at low distortion. The effective resistance per grid circuit of the Class AB_2 stage should be kept below 500 ohms and the effective impedance of the highest desired response frequency should not exceed 700 ohms.
§With zero-impedance driver and perfect regulation, plate circuit distortion does not exceed 2 per cent. In practice, plate-voltage regulation, positive grid voltage regulation, and grid bias regulation should not be greater than 5 per cent, 5 per cent, and 3 per cent, respectively.
◆At crest of a-f cycle with modulation factor of 1.0.
△Connected to modulated plate-voltage supply.

APPLICATION NOTES

The GL-807 can be operated at frequencies as high as 60 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised. (Other maximum ratings are the same as shown under TECHNICAL INFORMATION.) The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used up to 125 megacycles for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency	60	80	125	megacycles
Max permissible percentage of maximum rated plate voltage and plate input				
Class B, r-f	100	90	75	per cent
Class C, plate-modulated	100	80	55	per cent
Class C, telegraphy	100	80	55	per cent

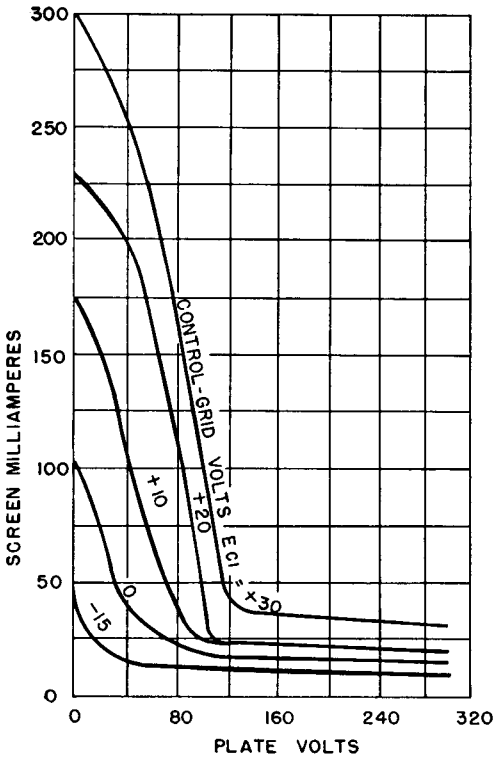


K-8639688 9-28-44

GL-807 TYPICAL CHARACTERISTICS (E_f = 6.3 VOLTS, SCREEN VOLTS = 300)

GL-807 AVERAGE CHARACTERISTICS

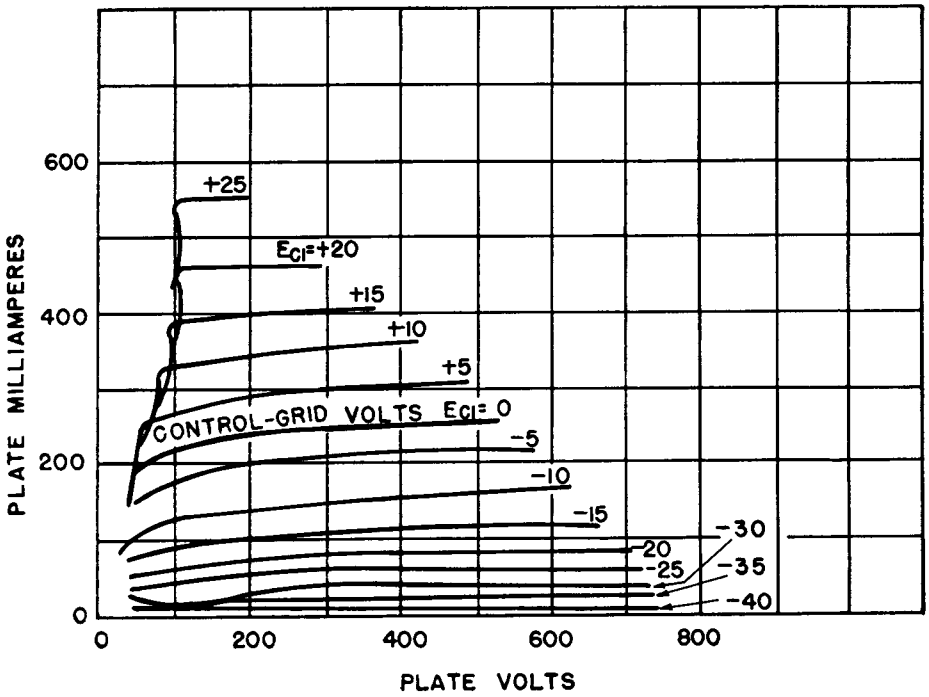
($E_f = 6.3$ VOLTS, SCREEN VOLTS = 300)



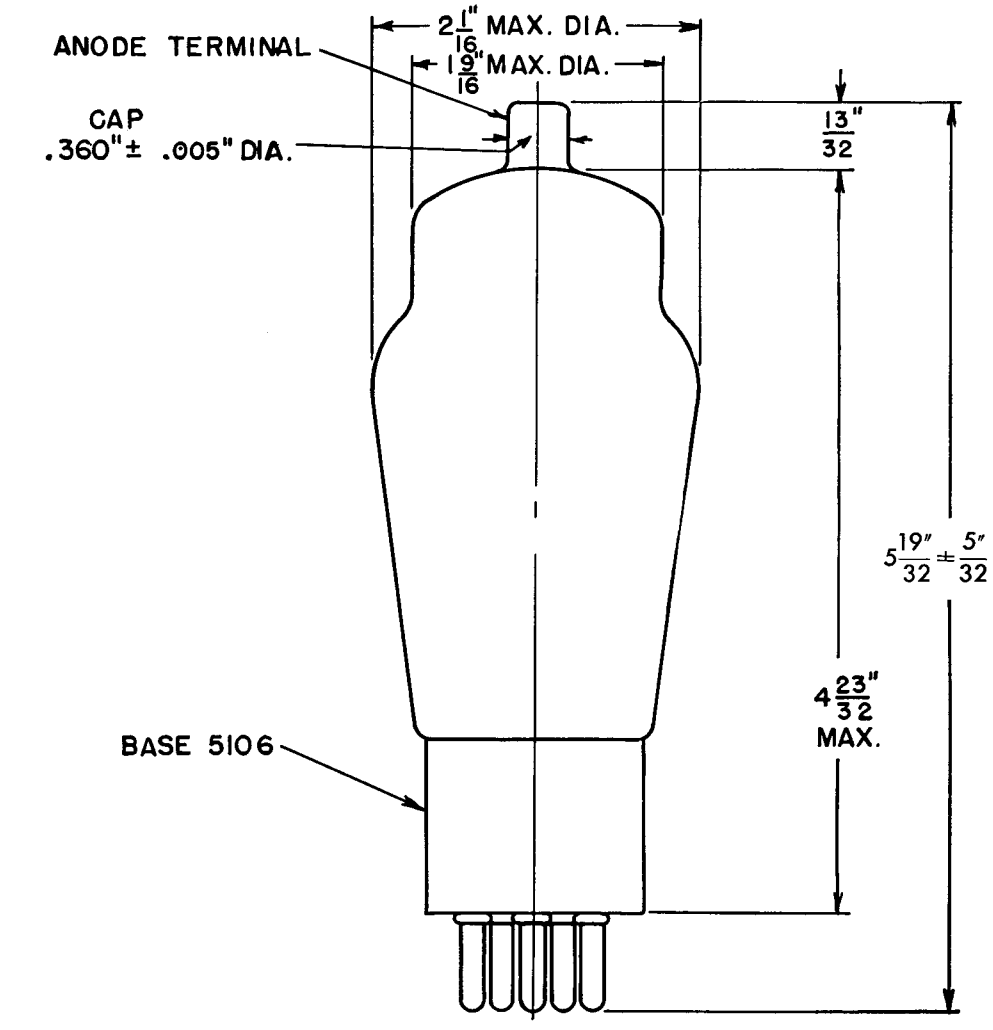
K-8639690 9-28-44

GL-807 AVERAGE PLATE CHARACTERISTICS WITH E_{C1} AS VARIABLE

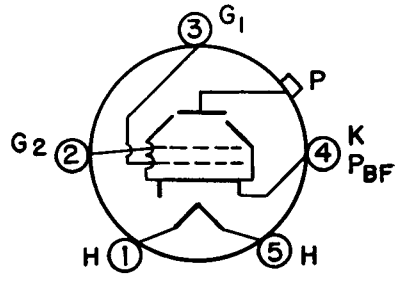
($E_f = 6.3$ VOLTS, SCREEN VOLTS = 300)



K-8639689 9-28-44



P = ANODE
G_2 = SCREEN
G_1 = GRID
K = CATHODE
H = HEATER
P_{BF} = BEAM-FORMING PLATES



BOTTOM VIEW OF
SOCKET CONN.

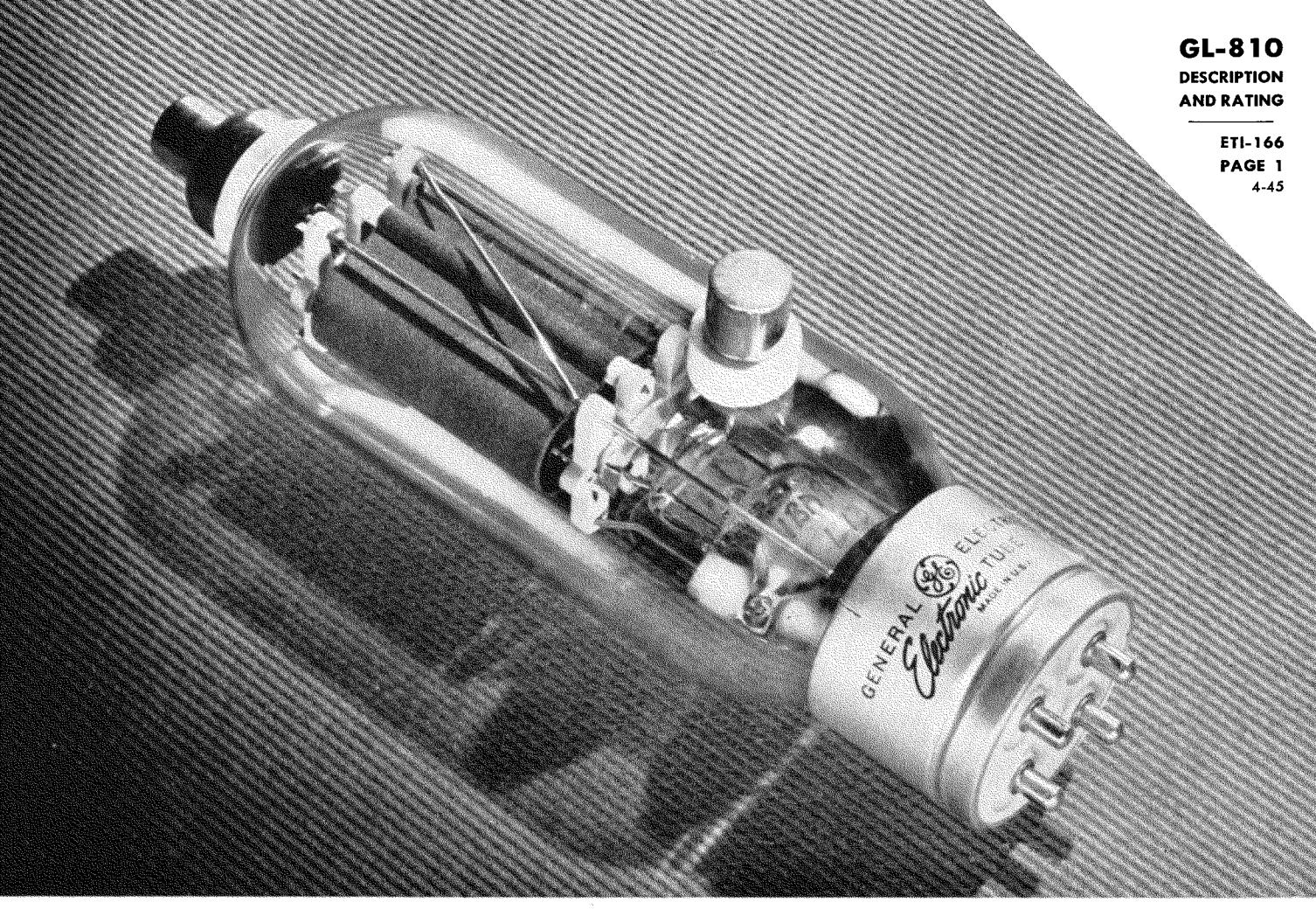
K-8639602

9-23-44

OUTLINE
GL-807 PLIOTRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PLIOTRON

DESCRIPTION

The GL-810 is a high-mu tube with a typical power output of 475 watts (ICAS) for Class C telegraph service. Because of its high perveance the tube can be operated at high plate efficiency with low driving power and relatively low plate voltage. The heavy duty filament, shielded at each end conserves input power by eliminating bulb bombardment and stray electrons. The plate and grid leads are brought out to terminals at the top and side of the bulb respectively—a design which provides very short internal leads, low internal lead inductance, and permits compact high-frequency circuits.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Filament voltage	10	volts
Filament current	4.5	amperes
Average characteristics		
Amplification factor	36	
Direct interelectrode capacitance		
Grid-plate	4.8	micromicrofarads
Grid-cathode	8.7	micromicrofarads
Plate-cathode	12	micromicrofarads
Frequency for maximum ratings	30	megacycles

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

Type of cooling	convection
Maximum ambient temperature	60 centigrade
Net weight, approx	8 ounces
Shipping weight, approx	1 pound
Mounting position	Vertical, base down: horizontal—plane of electrodes vertical

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS B AUDIO-FREQUENCY POWER AMPLIFIER (TWO TUBES)

	Typical Operation			Maximum Ratings		
	CCS		ICAS	CCS	ICAS	
D-c plate voltage	1500	2000	2250	2000	2250	volts
Max signal plate current (per tube)†				250	250	milliamperes
D-c max signal plate input (per tube)†				425	510	watts
Plate dissipation (per tube)†				125	150	watts
D-c grid voltage	−30	−50	−60			volts
Peak a-f grid input voltage	345	345	380			volts
Zero signal plate current	80	60	70			milliamperes
Max signal plate current	500	420	450			milliamperes
Max signal driving power, approx	12	10	13			watts
Effective load (plate to plate)	6600	11000	11600			ohms
Max signal plate power output	510	590	725			watts

CLASS B RADIO-FREQUENCY POWER AMPLIFIER

Carrier conditions per tube for use with a max modulation factor of 1.0

D-c plate voltage	1500	2000	2250	2000	2250	volts
D-c grid voltage	−50	−65	−70			volts
D-c plate current	115	93	100	185	185	milliamperes
Plate input				185	225	watts
D-c grid current	2	2	2			milliamperes
Plate dissipation				125	150	watts
Peak r-f grid input voltage	110	100	100			volts
Driving power, approx‡	6	4	4			watts
Plate power output	60	60	75			watts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—GRID-MODULATED

Carrier conditions per tube for use with a max modulation factor of 1.0

D-c plate voltage	1500	2000	2250	2000	2250	volts
D-c grid voltage	−140	−140	−140	−500	−500	volts
D-c plate current	110	92	100	185	185	milliamperes
D-c grid current, approx	2	2	2			milliamperes
Plate input				185	225	watts
Plate dissipation				125	150	watts
Peak r-f grid input voltage, approx	175	160	180			volts
Driving power‡, approx	5	4	4			watts
Plate power output	60	60	75			watts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—PLATE-MODULATED

Carrier conditions per tube for use with a max modulation factor of 1.0

D-c plate voltage	1250	1600	1800	1600	1800	volts
D-c grid voltage§	−200	−200	−200	−500	−500	volts
	4000	4000	4000			ohms
D-c plate current	210	210	250	210	250	milliamperes
D-c grid current, approx	50	50	50	70	70	milliamperes
Plate input				335	450	watts
Plate dissipation				85	125	watts
Peak r-f grid input voltage, approx	370	370	370			volts
Driving power, approx	17	17	17			watts
Plate power output	180	250	335			watts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

(Key-down conditions per tube without modulation)‖

	Typical Operation			Maximum Ratings		
	CCS		ICAS	CCS	ICAS	
D-c plate voltage	1500	2000	2250	2000	2250	volts
D-c grid voltage ¶	−120	−160	−160	−500	−500	volts
	3000	4000	4000			ohms
	415	550	510			ohms
D-c plate current	250	250	275	250	275	milliamperes
D-c grid current	40	40	40	70	70	milliamperes
Plate input				500	620	watts
Plate dissipation				125	150	watts
Peak r-f grid input voltage, approx.	280	330	330			volts
Driving power, approx	10	12	12			watts
Plate power output	275	375	475			watts

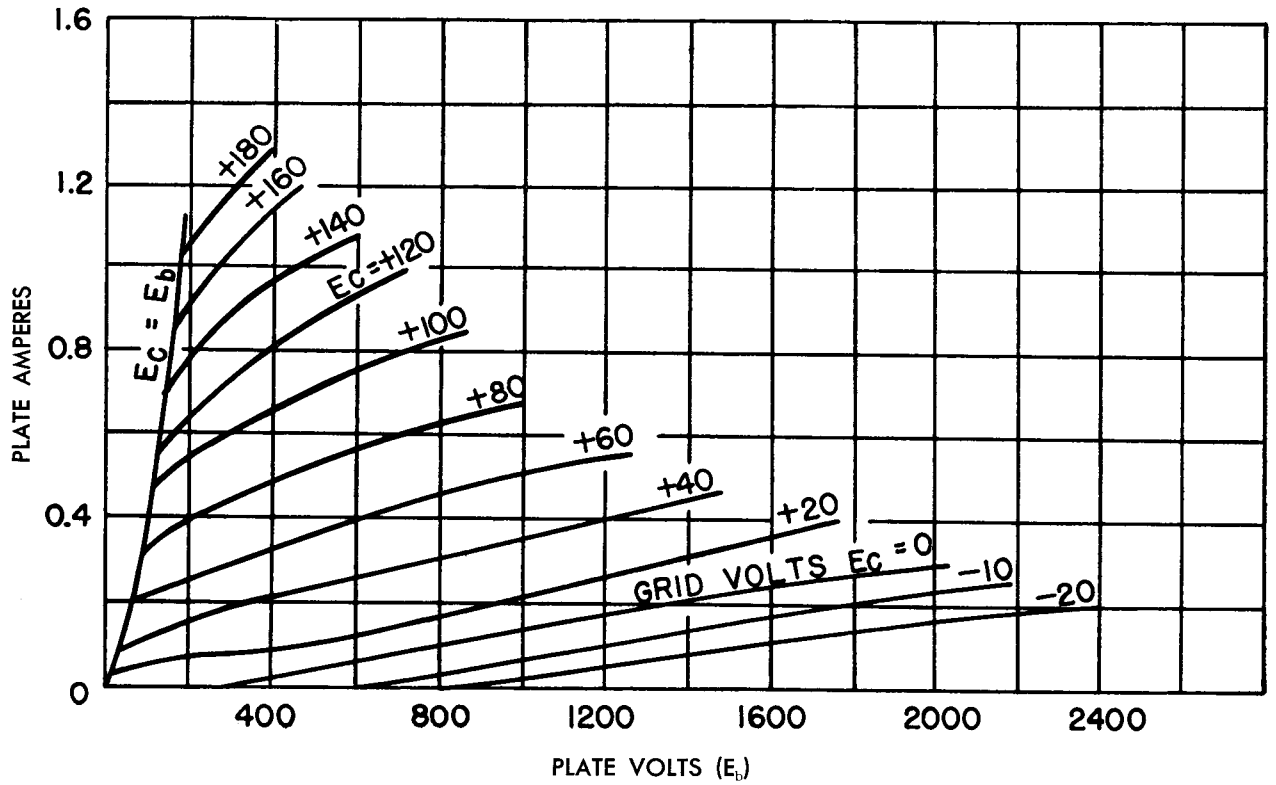
†Averaged over any audio-frequency cycle.
‡At crest of audio-frequency cycle.
§Obtained by grid-resistor of value shown or by partial self-bias methods.
‖Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.
¶Obtained from fixed supply, by grid resistor (3000, 4000), or by cathode resistor (415, 550, 510).

APPLICATION NOTES

*The GL-810 can be operated at frequencies as high as 30 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised (other maximum ratings are the same as shown above). The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used up to 100 megacycles for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

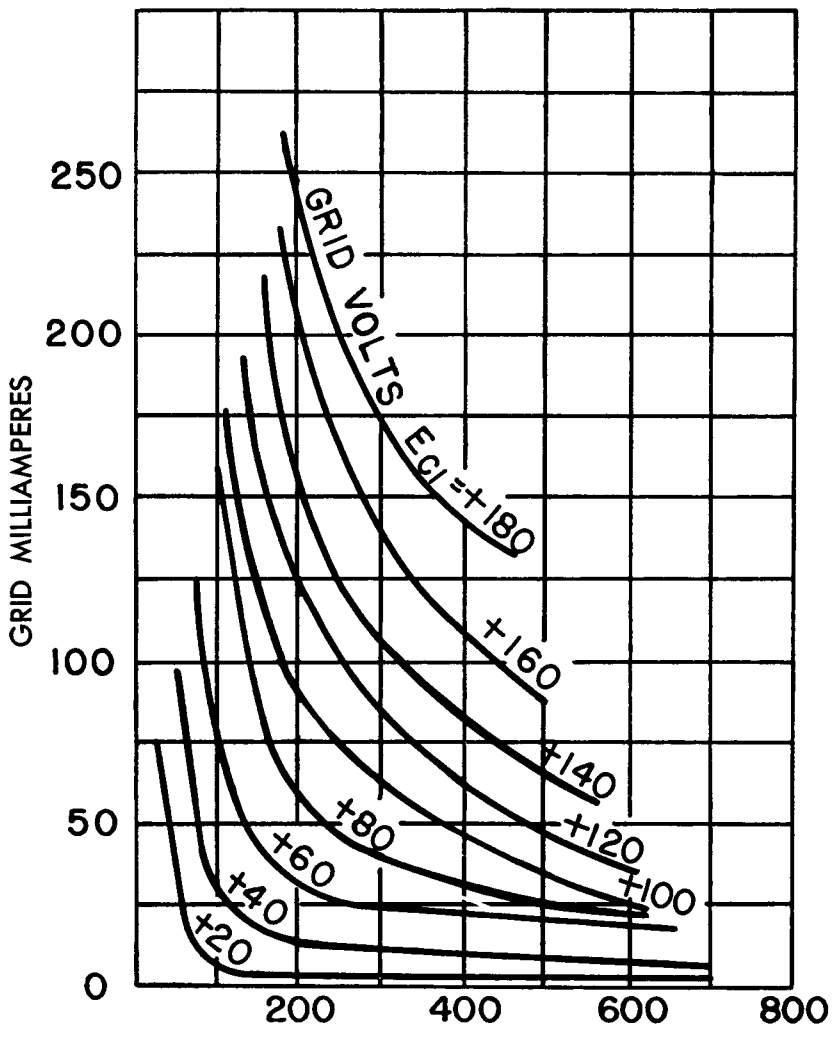
Frequency	30	60	100	megacycles
Max permissible percentage of max rated				
Plate voltage and plate input, Class B	100	88	80	per cent
Class C, grid-modulated	100	88	80	per cent
Class C, plate-modulated	100	70	50	per cent
Class C, telegraphy	100	70	50	per cent

GL-810 AVERAGE PLATE CHARACTERISTICS (E_f = 10 VOLTS D-C)



K-8639693

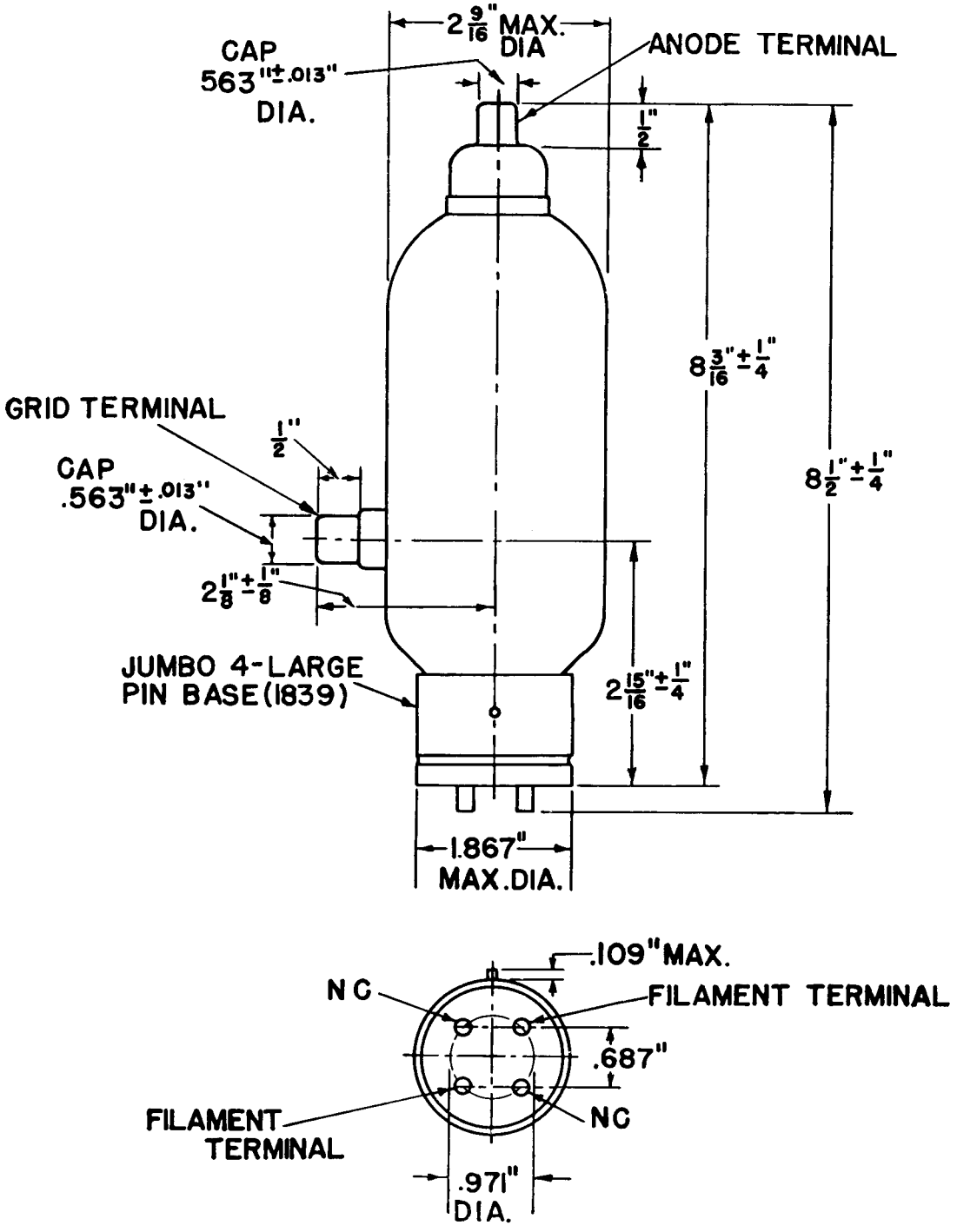
9-28-44



GL-810 TYPICAL CHARACTERISTICS (E_f = 10 VOLTS D-C)

K-8639692

9-28-44



OUTLINE
GL-810 PLIOTRON

K-9033819

2-22-45

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PLIOTRON

DESCRIPTION

GL-833-A is a three-electrode transmitting tube of the high-mu type for use as a radio-frequency amplifier, oscillator, and Class B modulator. Because of its high perveance, the 833-A can be operated at high plate efficiency with low driving power.

Designed in a new way with post terminals which provide a sturdy structure and make bases unnecessary, the 833-A has a minimum amount of insulation within the tube. The anode is supported directly from its post terminal at the top of the tube. Short, heavy-current leads are used to connect the anode and the grid to their respective terminals in order to carry the high circulating r-f current at the high frequencies and to minimize internal lead inductance.

As a result of its construction, the 833-A provides exceptional efficiency at high frequencies. It can be operated in Class C telegraph service with maximum input of 2000 watts at frequencies as high as 30 megacycles, and with reduced input at frequencies as high as 75 megacycles.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Filament voltage	10	volts
Filament current	10	amperes

GE Electronic TUBE

TECHNICAL INFORMATION (CONT'D)

Average characteristics

Amplification factor	35	
Direct interelectrode capacitances		
Grid-plate	6.3	micromicrofarads
Grid-filament	12.3	micromicrofarads
Plate-filament	8.5	micromicrofarads
Frequency for maximum ratings	30	megacycles

Mechanical

Type of cooling	Convection or forced air	
Maximum ambient temperature, convection-cooled	60	centigrade
Net weight, approx	1	pound
Shipping weight, approx	3	pounds
Operating position	Vertical with filament terminals down or horziontal with plane of electrodes vertical.	

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS B AUDIO-FREQUENCY POWER AMPLIFIER (TWO TUBES)

	Typical Operation			Maximum Ratings			
	CCS	*	ICAS *	CCS	*	ICAS *	
D-c plate voltage	3000	4000	4000	3000	4000	4000	volts
Max signal plate current, per tube†				500	500	500	milliamperes
D-c max signal plate input, per tube†				1125	1600	1800	watts
Plate dissipation†				300	400	450	watts
D-c grid voltage‡	−70	−100	−100				volts
Peak a-f grid input voltage	400	480	510				volts
Zero signal plate current	100	100	100				milliamperes
Max signal plate current	750	800	900				milliamperes
Max signal driving power, approx	20	29	38				watts
Effective load, plate to plate	9500	12000	11000				ohms
Maximum signal plate power output, approx	1650	2400	2700				watts
Load resistance, per tube	2375	3000	2750				ohms

CLASS B RADIO-FREQUENCY POWER AMPLIFIER

Carrier conditions per tube for use with a max modulation factor of 1.0		*	*		*	*	
D-c plate voltage	3000	4000	4000	3000	4000	4000	volts
D-c grid voltage‡	−70	−120	−120				volts
D-c plate current	150	150	150	300	300	300	milliamperes
Plate input				450	600	675	watts
Plate dissipation				300	400	450	watts
Peak r-f grid input voltage	90	120	130				volts
Driving power§△, approx.	10	14	21				watts
Plate power output, approx	150	225	250				watts
D-c grid current, approx△	2	2	3				milliamperes

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—PLATE-MODULATED

Carrier conditions per tube for use with a max modulation factor of 1.0		*	*		*	*	
D-c plate voltage	2500	3000	4000	2500	3000	4000	volts
D-c grid voltage π	−300	−300	−325	−500	−500	−500	volts
	4000	3600	3600				ohms
D-c plate current	335	415	450	400	450	450	milliamperes
D-c grid current, approx	75△	85△	90△	100	100	100	milliamperes
Plate input				835	1250	1800	watts
Plate dissipation				200	270	350	watts
Driving power△, approx	30	37	42				watts
Plate power output, approx	635	1000	1500				watts
Peak r-f grid voltage	460	490	520				volts

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS (CONT'D)

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Key-down conditions per tube without modulation □

	Typical Operation			Maximum Ratings			
	CCS	*	ICAS *	CCS	*	CAS *	
D-c plate voltage	3000	4000	4000	3000	4000	4000	volts
D-c grid voltage #	−200	−200	−225	−500	−500	−500	volts
	3500	2650	2400				ohms
	425	380	380				ohms
D-c plate current	415	450	500	500	500	500	milliamperes
D-c grid current, approx	55△	75△	95△	100	100	100	milliamperes
Plate input				1250	1800	2000	watts
Plate dissipation				300	400	450	watts
Peak r-f grid input voltage, approx	360	375	415				volts
Driving power△, approx	20	26	35				watts
Plate power output, approx	1000	1440	1600				watts

*Forced-air cooling required at these conditions of operation. When forced-air cooling is required an air flow of 40 cfm from a two-inch diameter nozzle directed vertically downward on bulb between grid and plate seals is required. Bulb temperature between grid and plate seals must not exceed 145 C. For conditions of operation where forced-air cooling is not required, adequate free circulation of air around the tube is necessary for satisfactory operation.

†Averaged over any audio-frequency cycle of sine-wave form.

‡For a-c filament supply.

§At crest of audio-frequency cycle.

△Subject to wide variations depending on the impedance of the load circuit. High-impedance load circuits require more grid current and driving power to obtain the desired output. Low-impedance circuits need less grid current and driving power, but plate circuit efficiency is sacrificed. The driving stage should have a tank circuit of good regulation and should be capable of delivering considerably more than the required driving power.

πObtained by grid resistor of value shown or by partial self-bias methods.

□Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

#Obtained from fixed supply, by grid resistor (3500, 2650, 2400), or by cathode resistor (425, 380, 380).

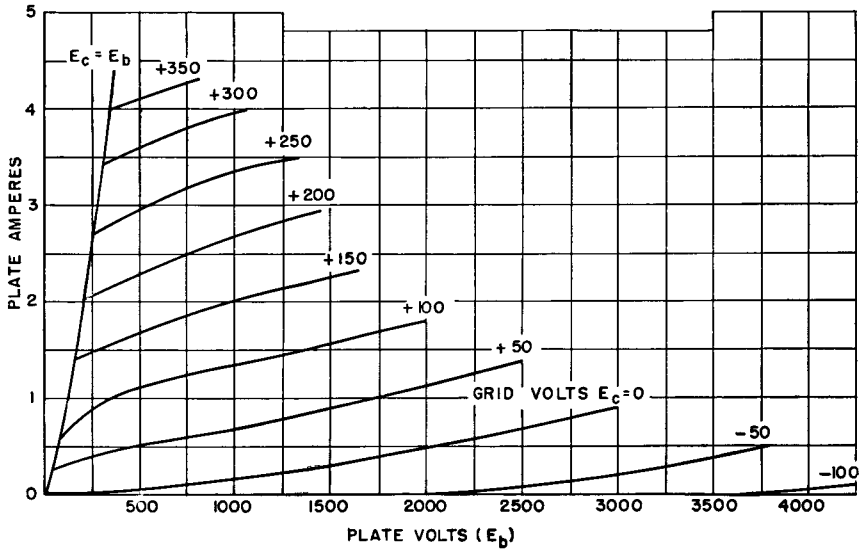
APPLICATION NOTES

The GL-833-A can be operated at frequencies as high as 30 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised (other maximum ratings are the same as shown above). The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used up to 100 megacycles for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

	Natural Cooling			Forced-air Cooling			
Frequency	30	50	75	20	50	75	megacycles
Maximum permissible percentage of maximum rated plate voltage and plate input							
Class B, r-f	100	98	94	100	97	93	per cent
Class C, plate-modulated	100	90	72	100	83	65	per cent
Class C	100	90	72	100	83	65	per cent

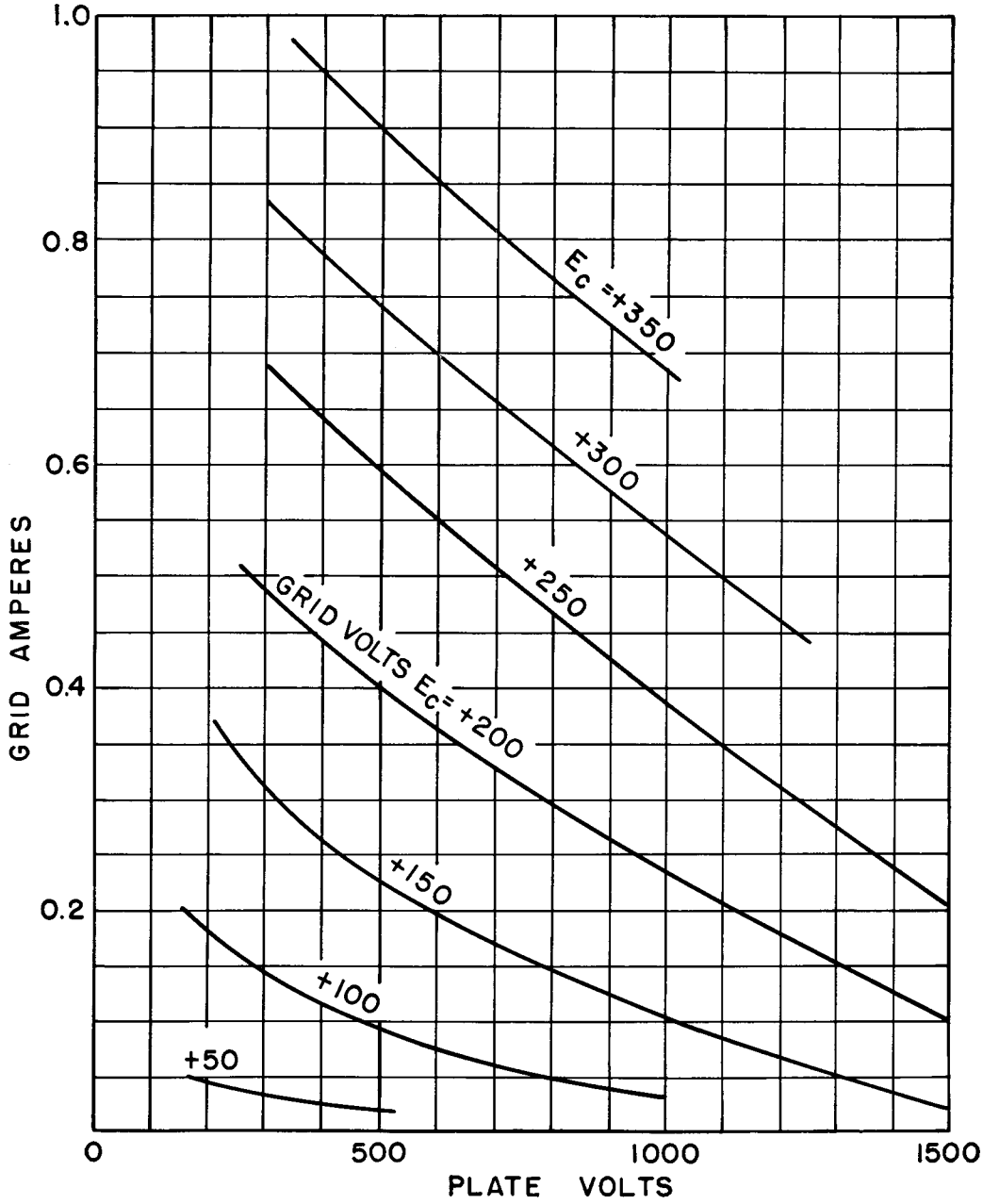
GL-833-A

AVERAGE PLATE CHARACTERISTICS, E_f = 10.0 VOLTS A-C



K-6966408

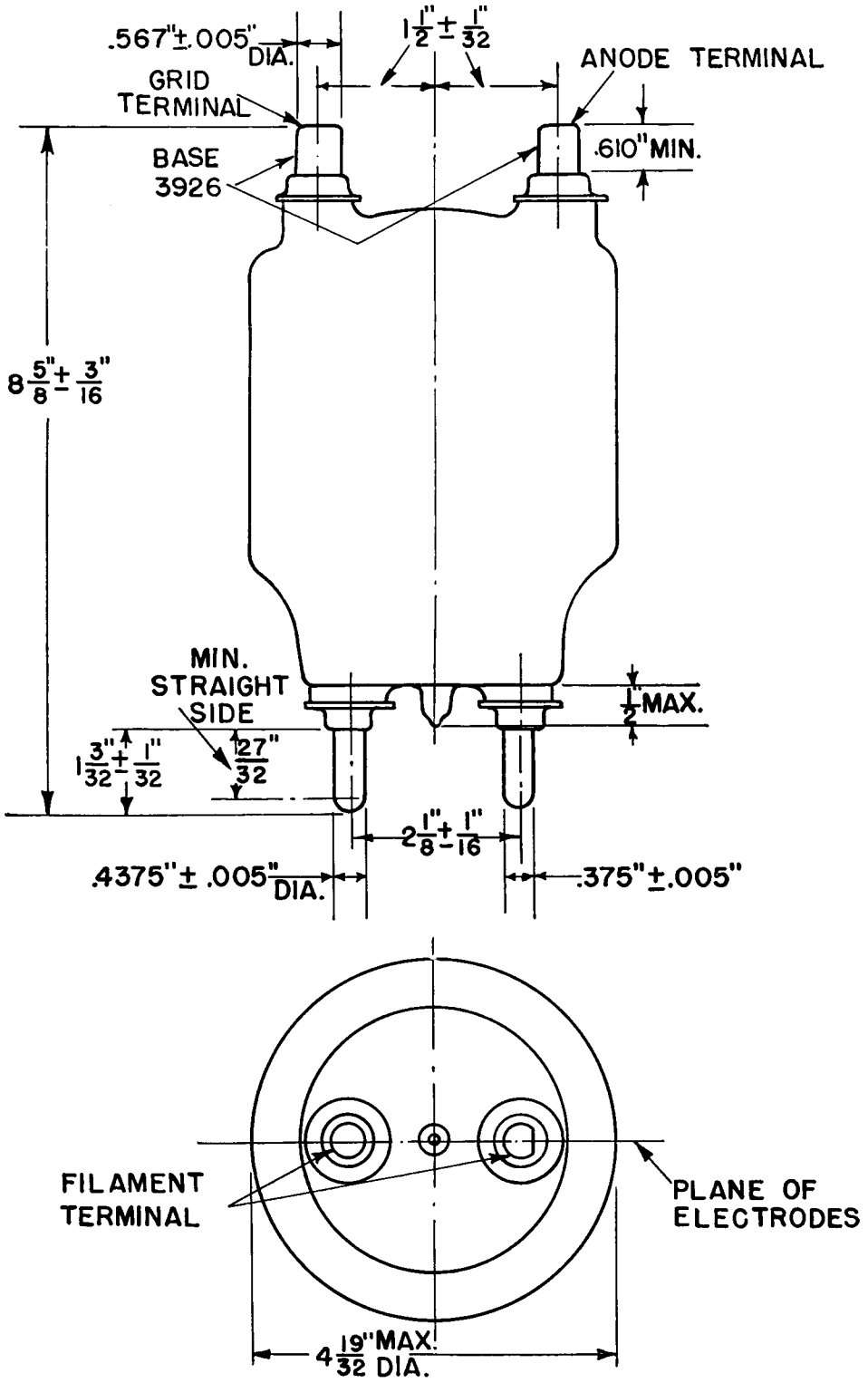
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GL-833-A TYPICAL CHARACTERISTICS (E_f = 10 VOLTS A-C)

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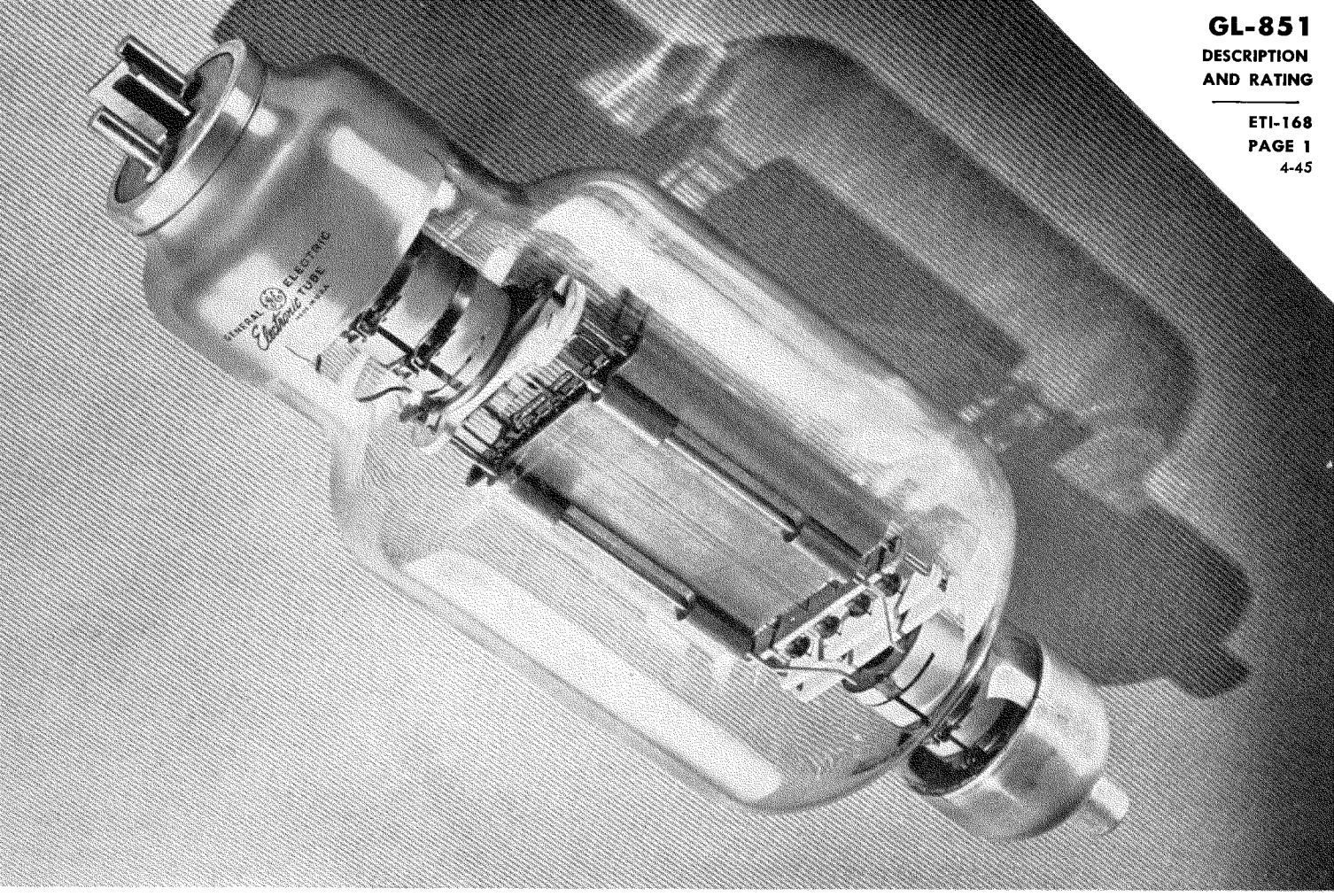


OUTLINE
GL-833-A PLIOTRON

NOTE: THE HORIZONTAL ANGLE BETWEEN THE PLANE DETERMINED BY THE AXIS OF THE FILAMENT TERMINALS AND THE PLANE DETERMINED BY THE AXIS OF THE GRID AND ANODE CAPS IS NOT MORE THAN 5 DEGREES

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PLIOTRON

DESCRIPTION

The GL-851 is a three-electrode, general purpose tube designed for use as a radio-frequency amplifier, oscillator, or Class B modulator. The plate of this tube is capable of dissipating 500 to 750 watts.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Filament voltage	11	volts
Filament current	15.5	amperes
Average characteristics		
Amplification factor, $I_b = 300$ ma	20.5	
Grid-plate transconductance	15000	micromhos
Direct interelectrode capacitances		
Grid plate	47	micromicrofarads
Input	25.5	micromicrofarads
Output	4.5	micromicrofarads
Frequency for maximum ratings	3	megacycles
Mechanical		
Type of cooling		convection
Maximum ambient temperature	60	centigrade
Net weight, approx.	3	pounds
Mounting position	vertical, filament base (large) up or horizontal, filament in vertical plane (on edge)	
Shipping weight, approx.	9	pounds

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

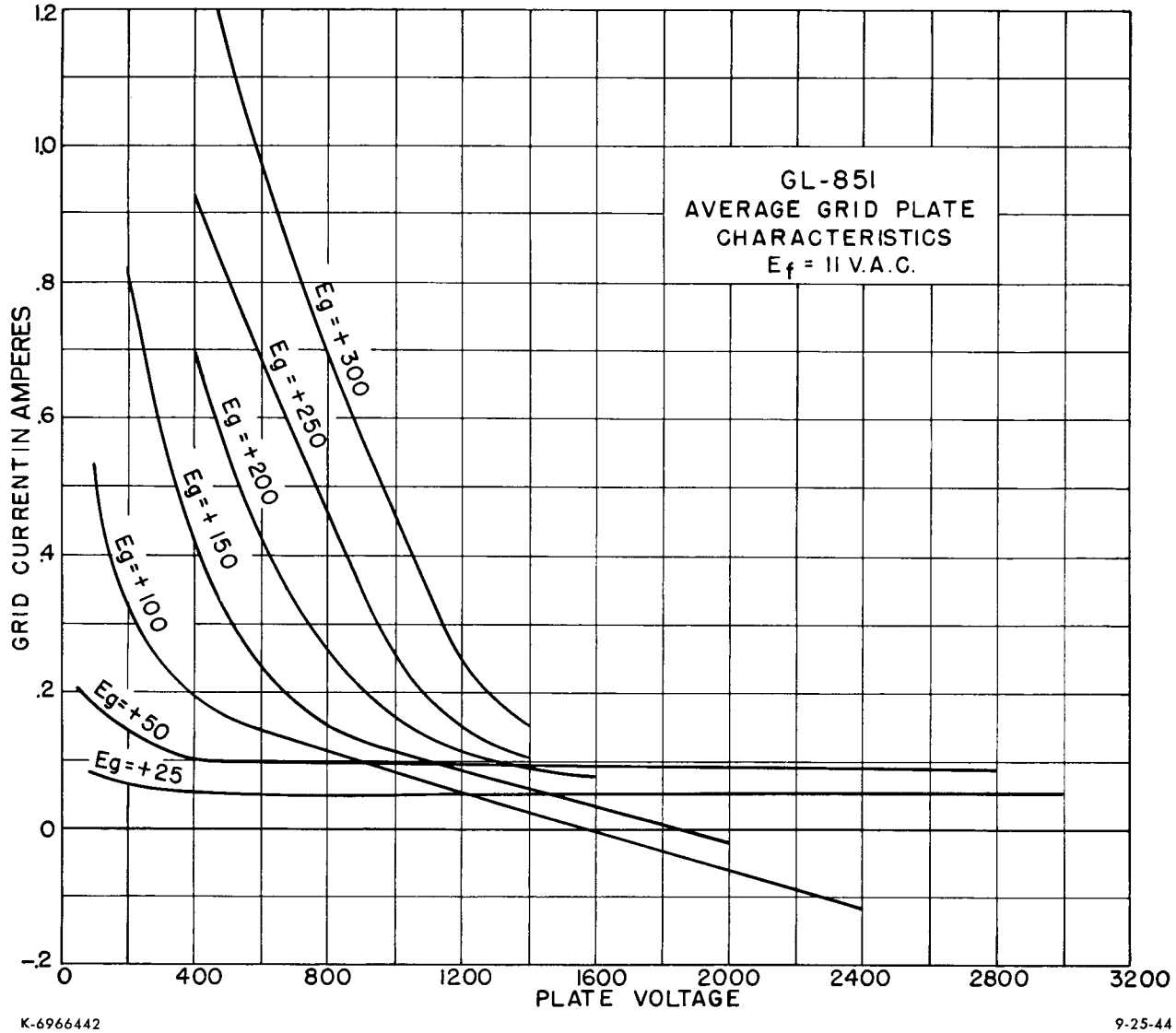
	Typical Operation			Maximum Ratings	
CLASS A AUDIO-FREQUENCY AMPLIFIER AND MODULATOR					
D-c plate voltage	1500	2000	2500	2500	volts
Plate dissipation				600	watts
D-c grid voltage	−49	−65	−92		volts
Peak grid swing, approx.	44	60	87		volts
D-c plate current	0.175	0.270	0.240		ampere
Plate resistance	1800	1500	1600		ohms
Load resistance	3700	3100	5000		ohms
Plate power output, 5 per cent second harmonic	46	100	160		watts
CLASS B AUDIO-FREQUENCY POWER AMPLIFIER (TWO TUBES)					
D-c plate voltage	2000	2500	3000	3000	volts
Max signal plate current, per tube*				1	ampere
D-c max signal plate input, per tube*				2250	watts
Plate dissipation, per tube*				750	watts
D-c grid voltage	−85	−111	−135		volts
Peak a-f grid input voltage	250	245	245		volts
Zero signal plate current	0.12	0.12	0.11		ampere
Max signal plate current	1.7	1.4	1.2		amperes
Max signal plate input*	3400	3500	3600		watts
Max signal driving power, approx.	20	12	6		watts
Effective load resistance, plate-to-plate	2600	4000	5600		ohms
Max signal plate power output	2200	2300	2400		watts
CLASS B RADIO-FREQUENCY POWER AMPLIFIER					
Carrier conditions per tube for use with a max modulation factor of 1.0					
D-c plate voltage	1500	2000	2500	2500	volts
D-c grid voltage	−60	−85	−110		volts
D-c plate current	0.62	0.475	0.39	0.750	ampere
Plate input				1100	watts
Plate dissipation				750	watts
Peak r-f grid input voltage	300	280	270		volts
Driving power, approx†	40	25	20		watts
Plate power output	275	300	325		watts
CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—PLATE-MODULATED					
Carrier conditions per tube for use with a max modulation factor of 1.0					
D-c plate voltage		1500	2000	2000	volts
D-c grid voltage		−250	−300	−500	volts
D-c plate current		0.9	0.85	1	ampere
D-c grid current, approx.		0.15	0.125	0.200	ampere
Plate input				1800	watts
Plate dissipation				500	watts
Peak r-f grid input voltage, approx.		475	525		volts
Driving power, approx.		75	65		volts
Plate power output		900	1250		watts
CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR					
Key-down conditions per tube without modulation‡					
D-c plate voltage	1500	2000	2500	2500	volts
D-c grid voltage	−150	−200	−250	−500	volts
D-c plate current	0.9	0.9	0.9	1	ampere
D-c grid current, approx.	0.15	0.12	0.1	0.200	ampere
Plate input				2500	watts
Plate dissipation				750	watts
Peak r-f grid input voltage, approx.	375	425	450		volts
Driving power, approx.	55	50	45		watts
Plate power output	900	1250	1700		watts

* Averaged over any audio-frequency cycle.
† At crest of audio-frequency cycle.
‡ Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

APPLICATION NOTES

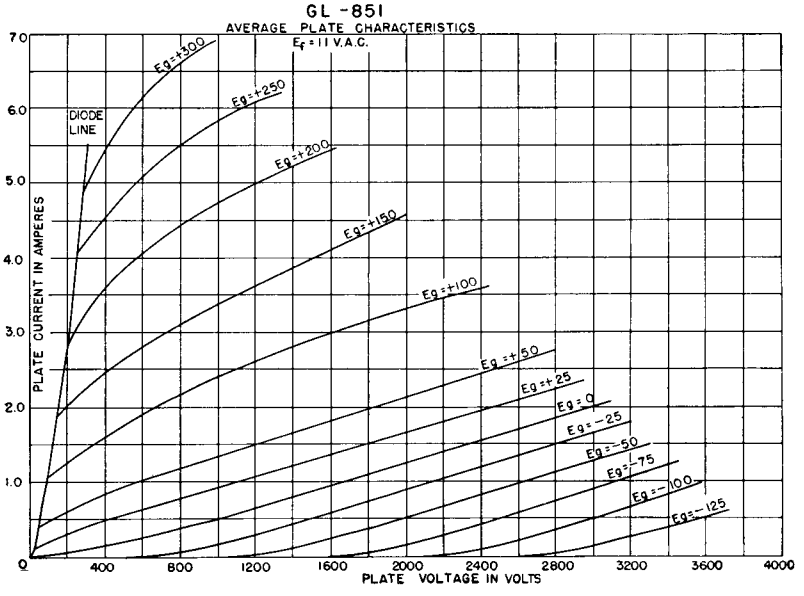
GL-851 can be operated at maximum ratings in all classes of service at frequencies as high as 3 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised. (Other maximum ratings are the same as shown under TECHNICAL INFORMATION.) The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used up to 15 mc for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency	3	7	15 megacycles
Maximum permissible percentage of maximum rated plate voltage and plate input:			
Class B telephony	100	88	76 per cent
Class C telephony, plate-modulated	100	75	50 per cent
Class C telegraphy, plate-modulated	100	75	50 per cent

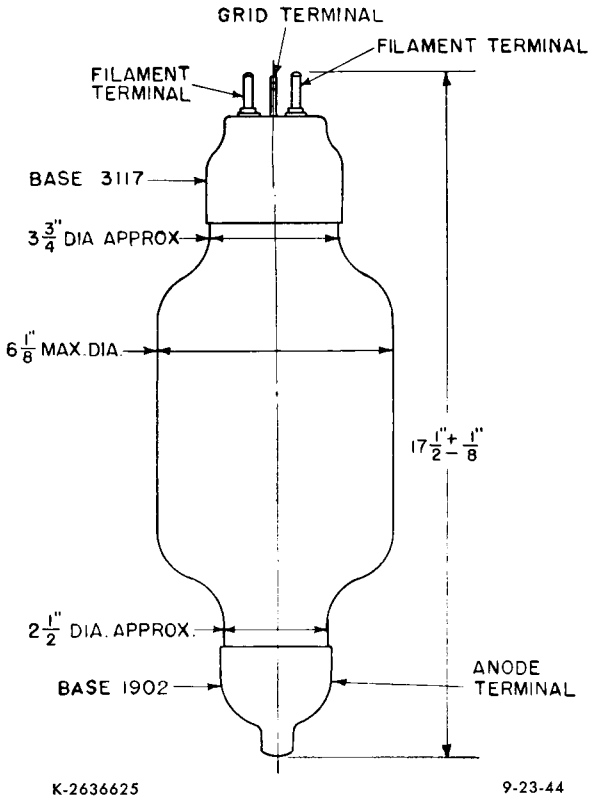


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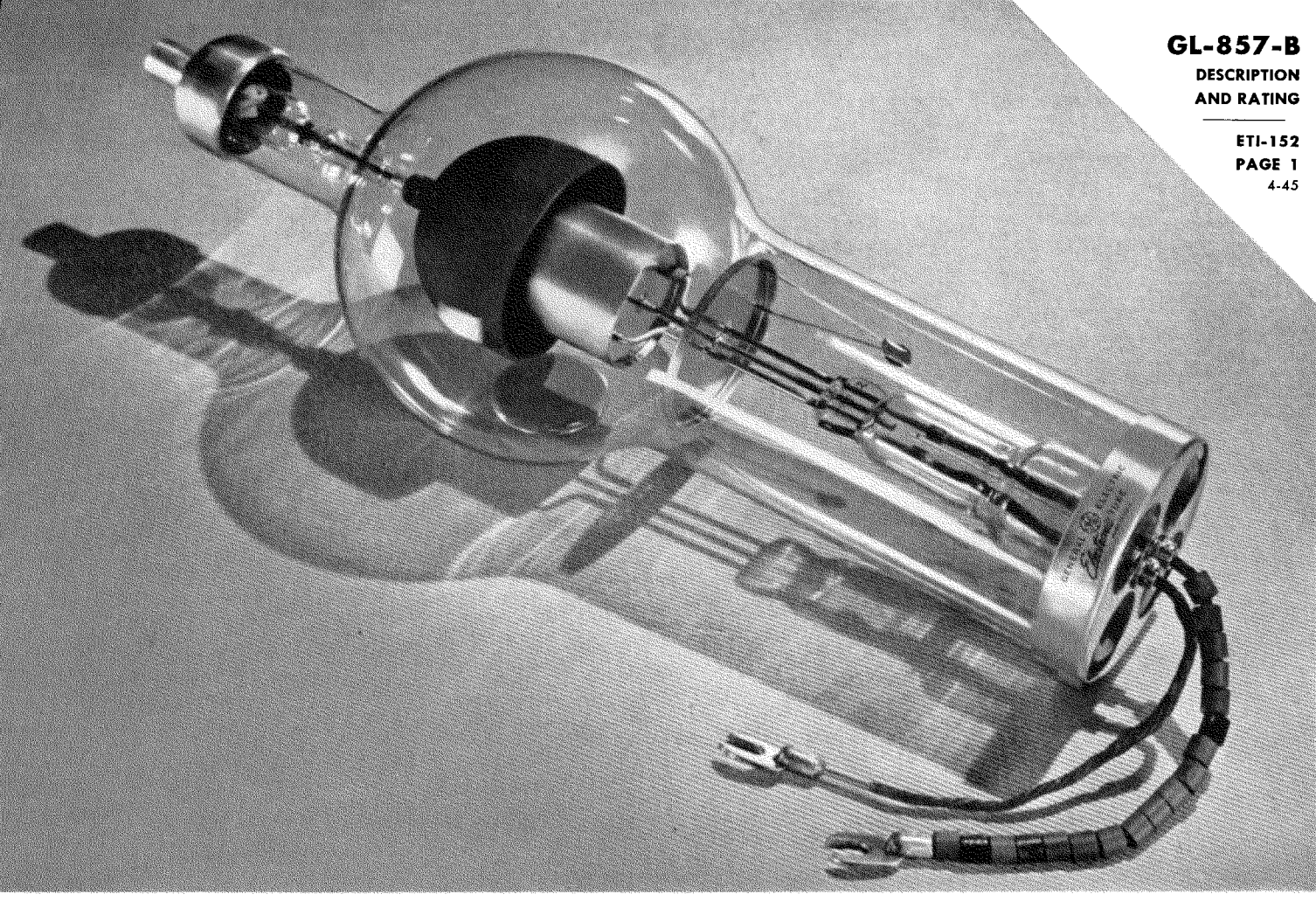
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K-2636625 9-23-44

OUTLINE
GL-851 PLIOTRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



PHANOTRON

DESCRIPTION

The GL-857-B is a half-wave, mercury-vapor rectifier tube for use in the high voltage field. The low voltage drop characteristic inherent in mercury-vapor tubes, together with other features of design and construction assure maximum efficiency of operation in many different rectifier applications.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Cathode—Filamentary		
Filament voltage	5.0	volts
Filament current, approx.	30.0	amperes
Heating time, typical	1	minute
Peak voltage drop, typical	12	volts
Mechanical		
Type of cooling		convection or forced air
Net weight, approx.	3½	pounds
Shipping weight, approx.	10	pounds
Mounting position		vertical, base down

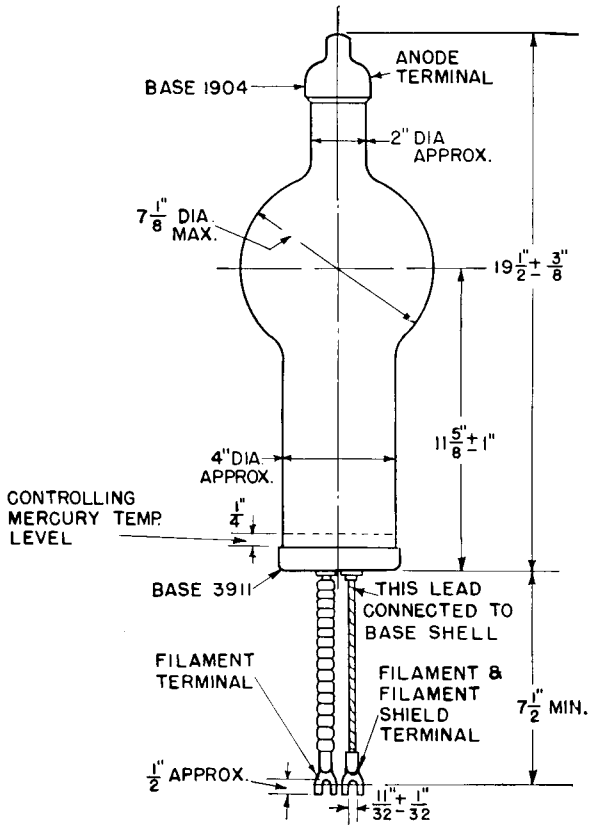
GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

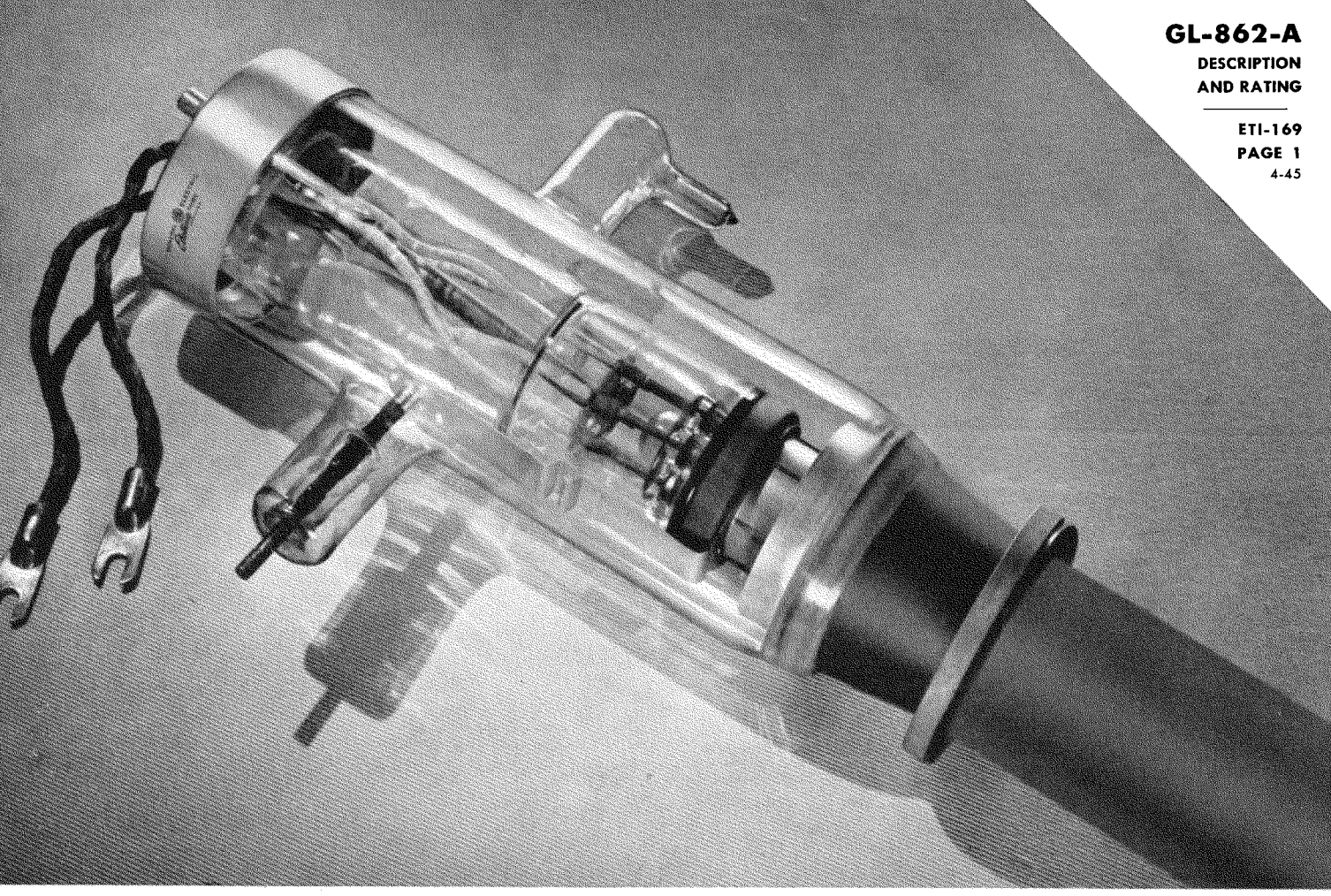
Maximum peak inverse anode voltage			
Type of cooling	Convection	Forced-air	
150 cycles or less	10,000 volts	22,000	volts
Corresponding mercury temperature	25–65 centigrade	30–40	centigrade
Maximum anode current			
Instantaneous 25 cycles and above			
In-phase operaton		20	amperes
Quadrature operation		40	amperes
Average			
In-phase operation		5	amperes
Quadrature operation		10	amperes
Surge, for design only		400	amperes
Duration of surge current		0.2	second
Maximum time of averaging current		30	seconds
Recommended temperature, condensed mercury		35 ± 5	centigrade



OUTLINE
GL-857-B PHANOTRON

K-4903593 9-23-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



PLIOTRON

DESCRIPTION

The GL-862-A is a three-electrode power tube designed for use as a radio-frequency amplifier, oscillator, or Class B modulator. The plate is water-cooled and is capable of dissipating 50 to 100 kilowatts, depending upon the class of service in which the tube is used.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Cathode—Filamentary		
Filament voltage	33	volts
Filament current	207	amperes
Average characteristics		
Amplification factor	45	
Grid-plate transconductance	17200	micromhos
Direct interelectrode capacitances, approx		
Grid-plate	69.5	micromicrofarads
Input	53	micromicrofarads
Output	4.5	micromicrofarads
Frequency for maximum ratings	1.6	megacycles

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

Base	6628	
Gasket	Cat. No. 5182028P1	
Type of cooling	Water and forced air	
Water flow		
Max outlet temperature	70	centigrade
	15–25	gallons per minute
Air flow		
To bulb	15	cu ft per min
To stem	3	cu ft per min
Net weight, approximate	30	pounds
Shipping weight, approximate	175	pounds
Mounting position	Vertical, anode down	

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS B AUDIO-FREQUENCY AMPLIFIER (TWO TUBES)

	Typical Operation	Maximum Ratings	
D-c plate voltage	12000	15000	volts
Maximum signal plate current, per tube*		7.5	amperes
D-c maximum signal plate input, per tube*		100	kilowatts
Plate dissipation*, per tube		50	kilowatts
D-c grid voltage	0		volts
Peak, a-f grid input voltage	2000		volts
Zero signal plate current	3		amperes
Maximum signal plate current	13		amperes
Maximum signal plate input*	156		kilowatts
Maximum signal driving power, approx	450		watts
Effective load, plate to plate	1800		ohms
Maximum signal plate power output	90		kilowatts

CLASS B RADIO-FREQUENCY POWER AMPLIFIER

Carrier conditions per tube for use with a max modulation factor of 1.0

D-c plate voltage	12000	15000	18000	20000	volts
D-c grid voltage	−100	−150	−200		volts
D-c plate current	2.8	3.5	4.2	5	amperes
Plate input				100	kilowatts
Plate dissipation				75	kilowatts
Peak r-f grid input voltage	500	625	750		volts
Driving power**, approx	0.5	0.75	1.1		kilowatts
Plate power output	11	17.5	25		kilowatts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—PLATE MODULATED

Carrier conditions per tube for use with a max modulation factor of 1.0

D-c plate voltage	8000	10000	12000	12000	volts
D-c grid voltage	−700	−750	−800	−3000	volts
D-c plate current	4	4.5	5	5	amperes
D-c grid current, approx	1	1	1	1.25	amperes
Plate input				60	kilowatts
Plate dissipation				50	kilowatts
Peak r-f grid input voltage, approx	1700	1850	2000		volts
Driving power, approx	1.7	1.85	2		kilowatts
Plate power output	24	34	45		kilowatts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Key-down conditions per tube without modulation #

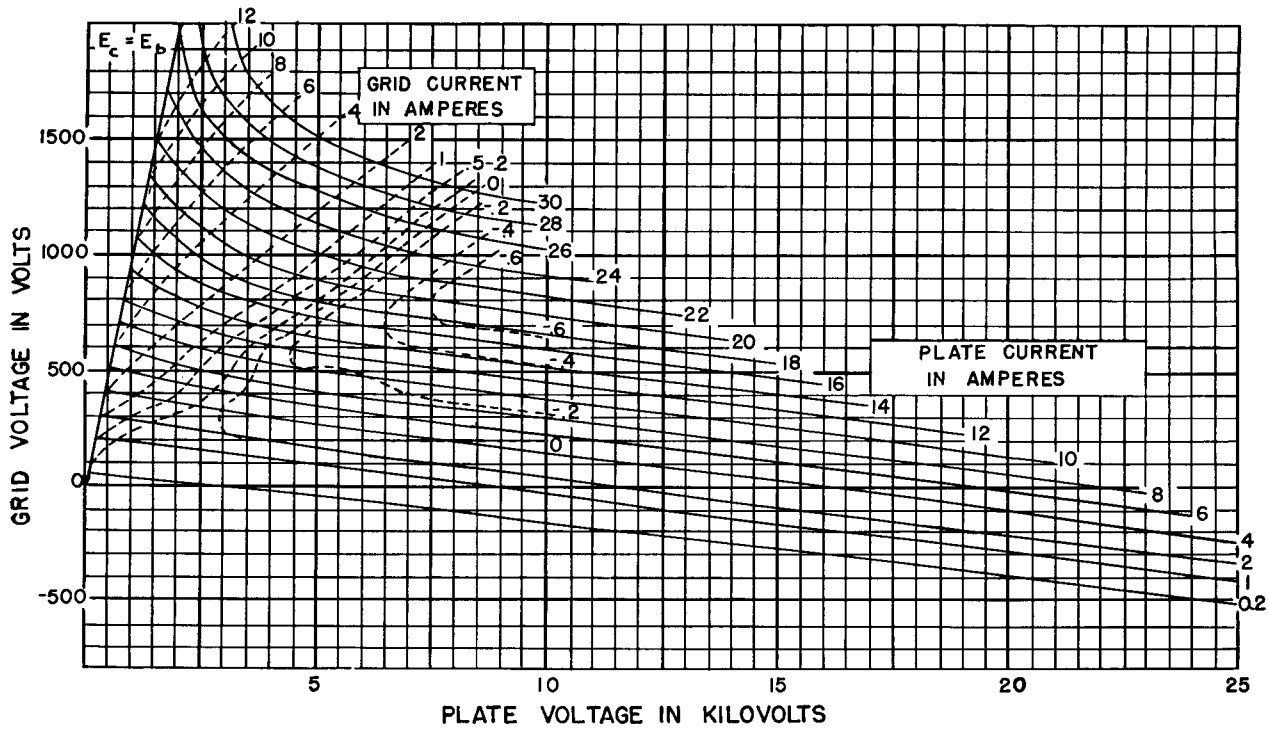
D-c plate voltage	12000	15000	18000	20000	volts
D-c grid voltage	−800	−900	−1000	−3000	volts
D-c plate current	6.25	7.5	8.33	10	amperes
D-c grid current, approx	0.8	0.85	0.9	1	ampere
Plate input				200	kilowatts
Plate dissipation				100	kilowatts
Peak r-f grid input voltage, approx	2050	2300	2550		volts
Driving power, approx	1.6	2	2.4		kilowatts
Plate power output	50	75	100		kilowatts

* Averaged over any audio-frequency cycle.
**At crest of audio-frequency cycle.
\# Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

APPLICATION NOTES

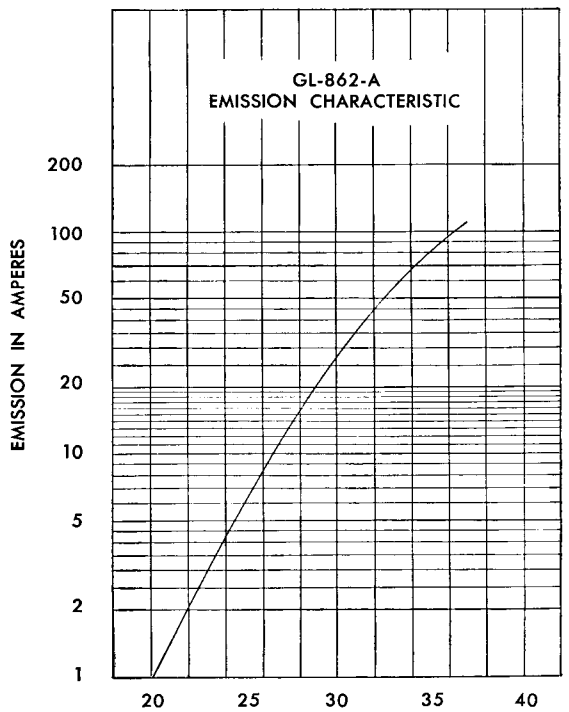
Plate Series Protective Resistors (see paragraph describing plate circuit under Installation in the Instructions.)

Series resistor	10	20	40	50	ohms
Maximum power output of rectifier	100	250	640	1600	kilowatts



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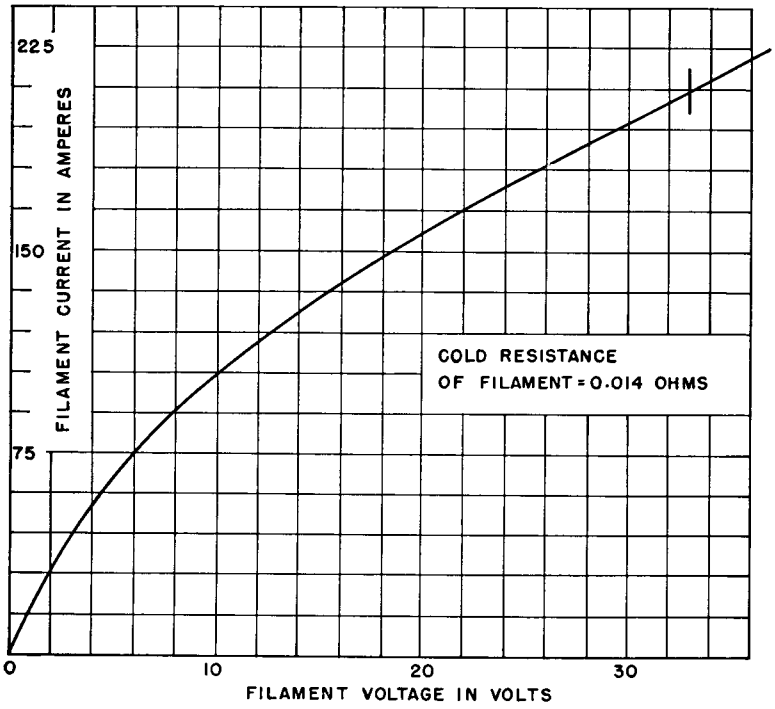
GL-862-A CHARACTERISTICS (E_f = 33 VOLTS A-C)



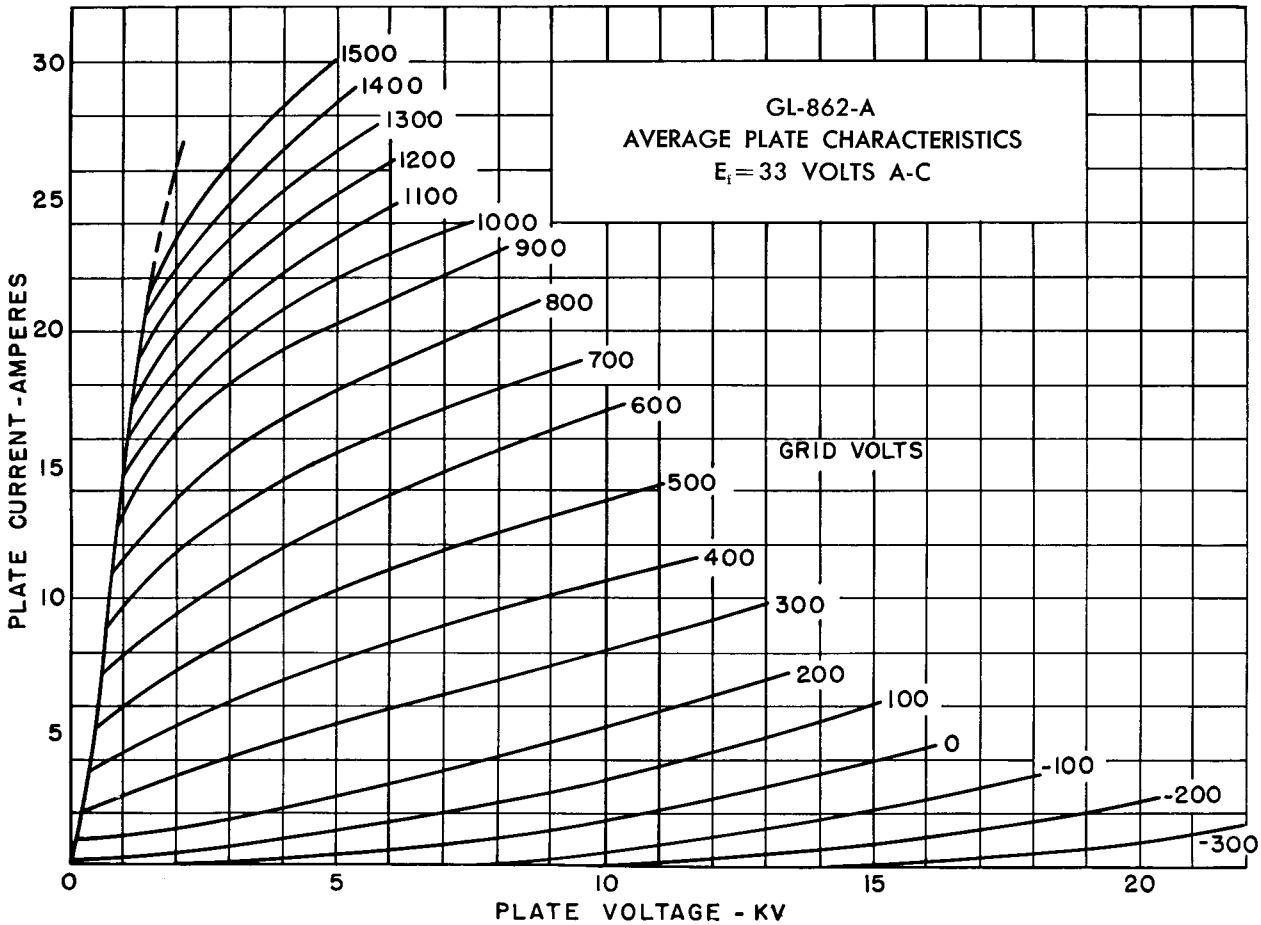
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FILAMENT VOLTAGE IN VOLTS (SINGLE-PHASE FILAMENT EXCITATION)

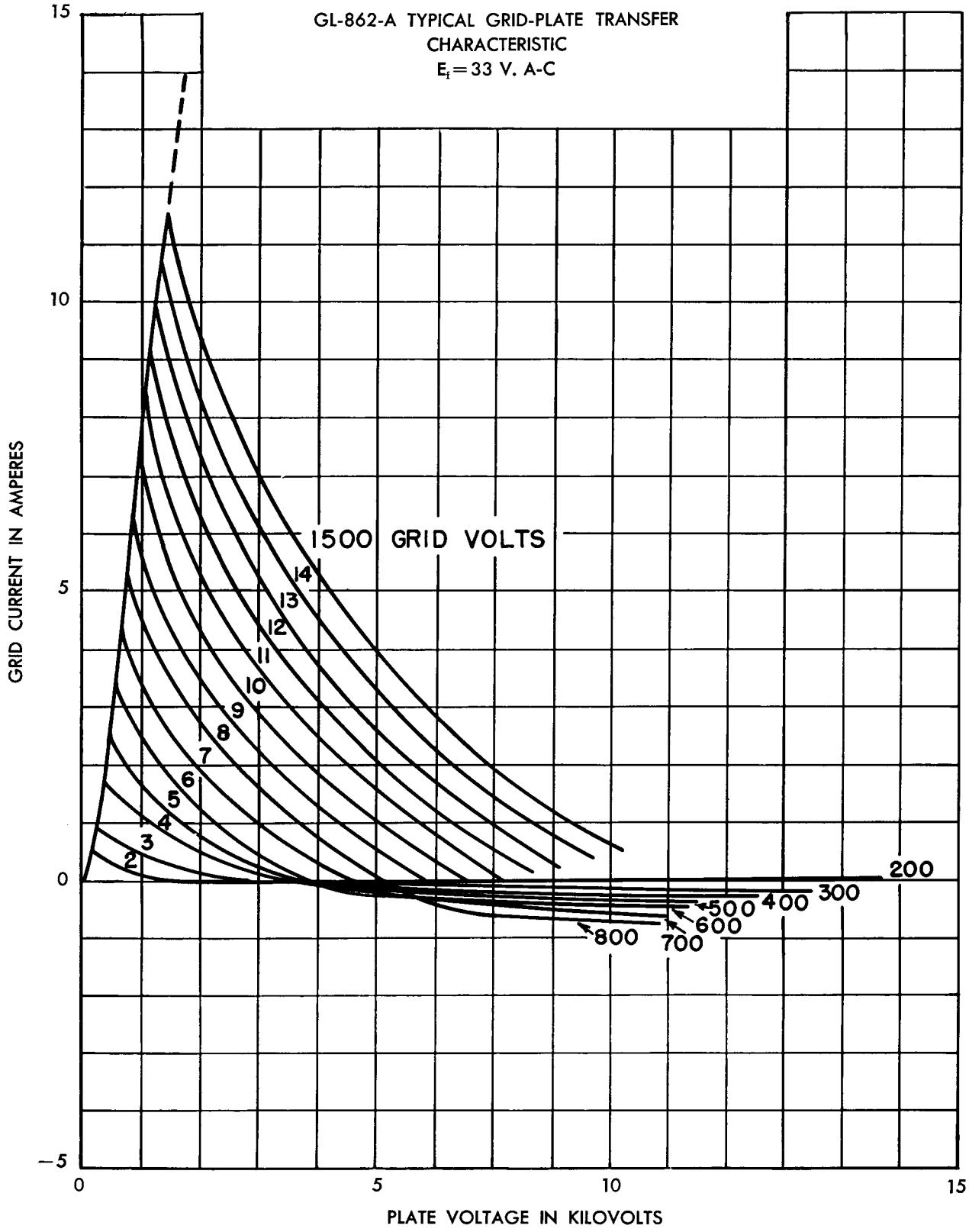
GL-862-A
FILAMENT CHARACTERISTICS



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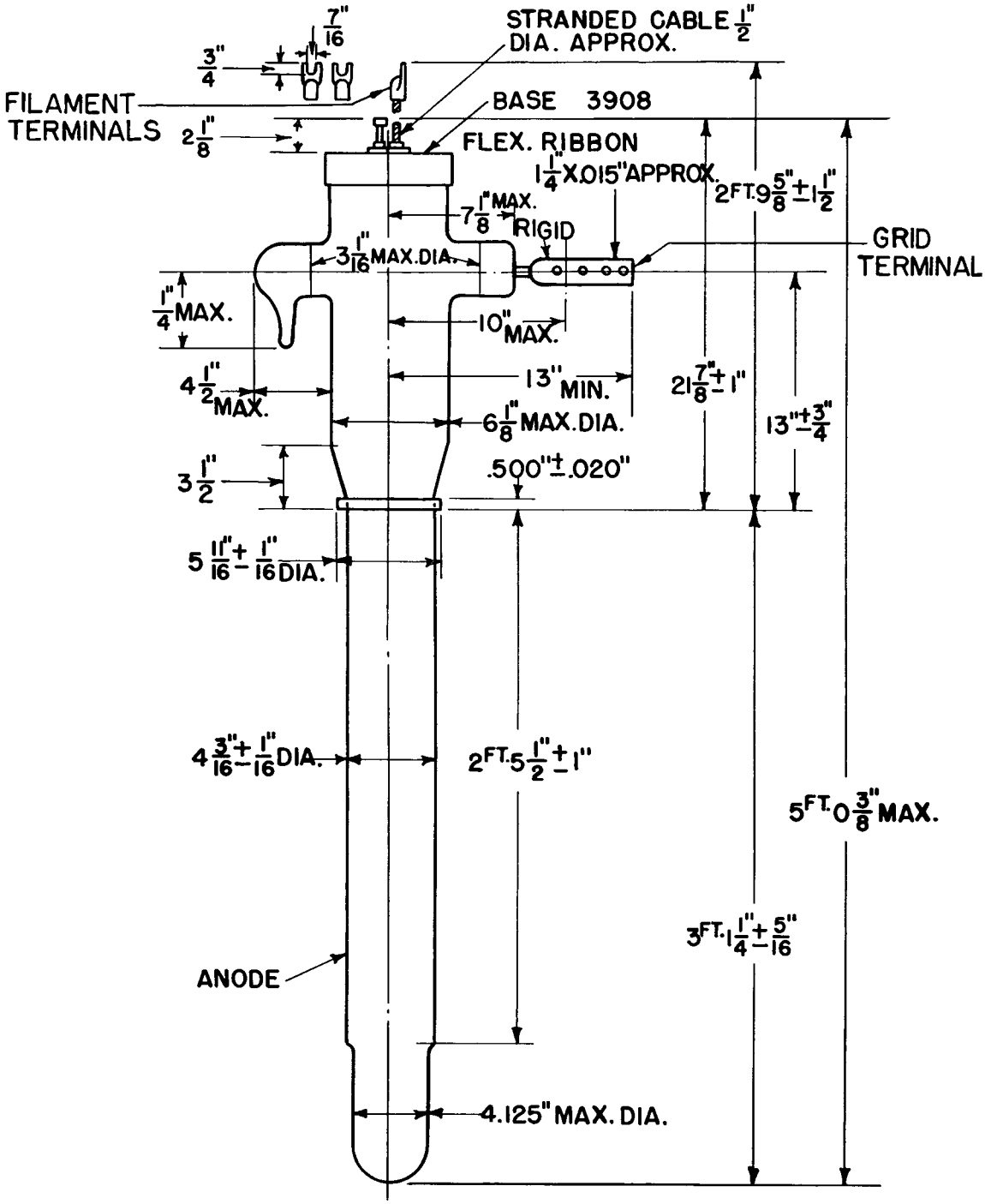


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K-6966425

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OUTLINE GL-862-A PLIOTRON

K-3846052

9-23-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PHANOTRON

DESCRIPTION

This half-wave, mercury-vapor rectifier is designed to withstand high peak inverse voltages and to conduct at low applied voltages. The construction minimizes the danger of bulb cracks caused by corona discharge. An edgewise-wound ribbon filament provides a large emission reserve and improved life.

Two 866-A/866's operating in a full-wave rectifier are capable of delivering to the input of a choke-input filter a rectified voltage of 3180 volts at 0.5 ampere with good regulation.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes			2
Electrical			
Cathode—Filamentary			
Filament voltage	2.5	2.5	volts
Filament current, approx.	5	5	amperes
Heating time, typical			30 seconds
Peak voltage drop, typical	15	15	volts
Mechanical			
Type of cooling			convection
Net weight, approx.			3 ounces
Shipping weight, approx.			3 pounds
Mounting position			vertical, base down

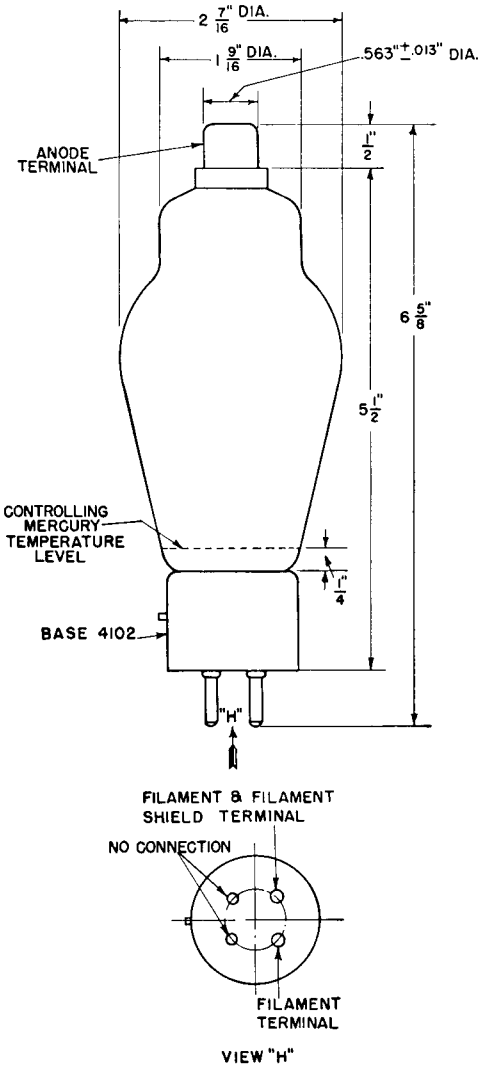
GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

Maximum peak inverse anode voltage			
150 cycles per second or less	2000	10,000	volts
Condensed mercury temperature	25–70	25–60	centigrade
1000 cycles per second or less		5,000	volts
Condensed mercury temperature		25–70	centigrade
Maximum anode current			
Instantaneous	2.0	1.0	amperes
Average	0.5	0.25	amperes
Recommended temperature, condensed mercury		40 ± 5	centigrade



K-6966978 9-23-44

OUTLINE
GL-866-A/866 PHANOTRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



PHOTOTUBE

DESCRIPTION

This gas-filled two-electrode phototube is designed for photoelectric control apparatus where a high degree of output per unit of light flux is required. While the GL-868/PJ-23 will pass some current in the visible region, it is designed primarily for use in the red and infrared region of the spectrum.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Spectral response	S-1	
Luminous sensitivity at 90 volts, 0 cycles	90	microamperes per lumen
Maximum gas amplification	8.0	
Interelectrode capacitance	3.0	micromicrofarads
Maximum dark current at 90 volts	0.1	microampere
Wavelength of maximum response	7500	angstroms
Sensitivity at maximum response	0.0105	microampere per microwatt

Electronic TUBE

GENERAL ELECTRIC

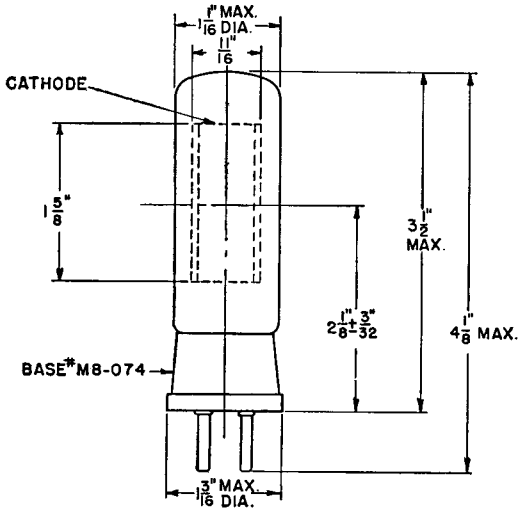
TECHNICAL INFORMATION (CONT'D)

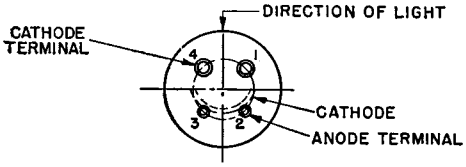
Mechanical

Window dimensions	$\frac{11}{16}$ x $1\frac{5}{8}$	inches
Seated height to center of useful cathode area	$2\frac{1}{8}$ $\pm\frac{3}{32}$	inches
Maximum over-all height	$4\frac{1}{8}$	inches
Maximum seated height	$3\frac{1}{2}$	inches
Maximum diameter	$1\frac{3}{16}$	inches
Base	M8-074	
Mounting position	Any	
Net weight, approx	$\frac{1}{2}$	ounce
Shipping weight, approx	3	pounds

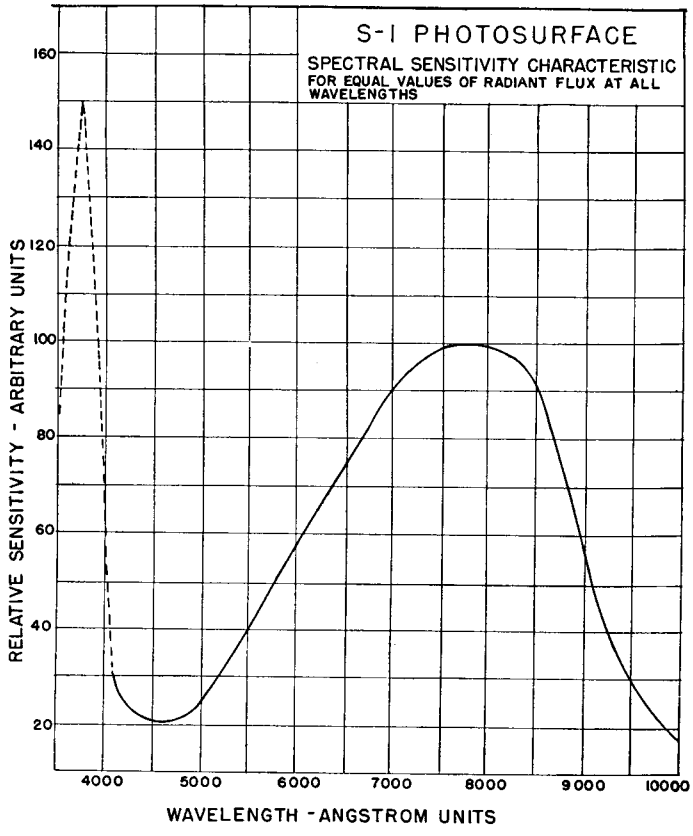
MAXIMUM RATINGS

Anode voltage, d-c or peak a-c	100	volts
Cathode current density	102	microamperes per square inch
Ambient temperature	100	centigrade



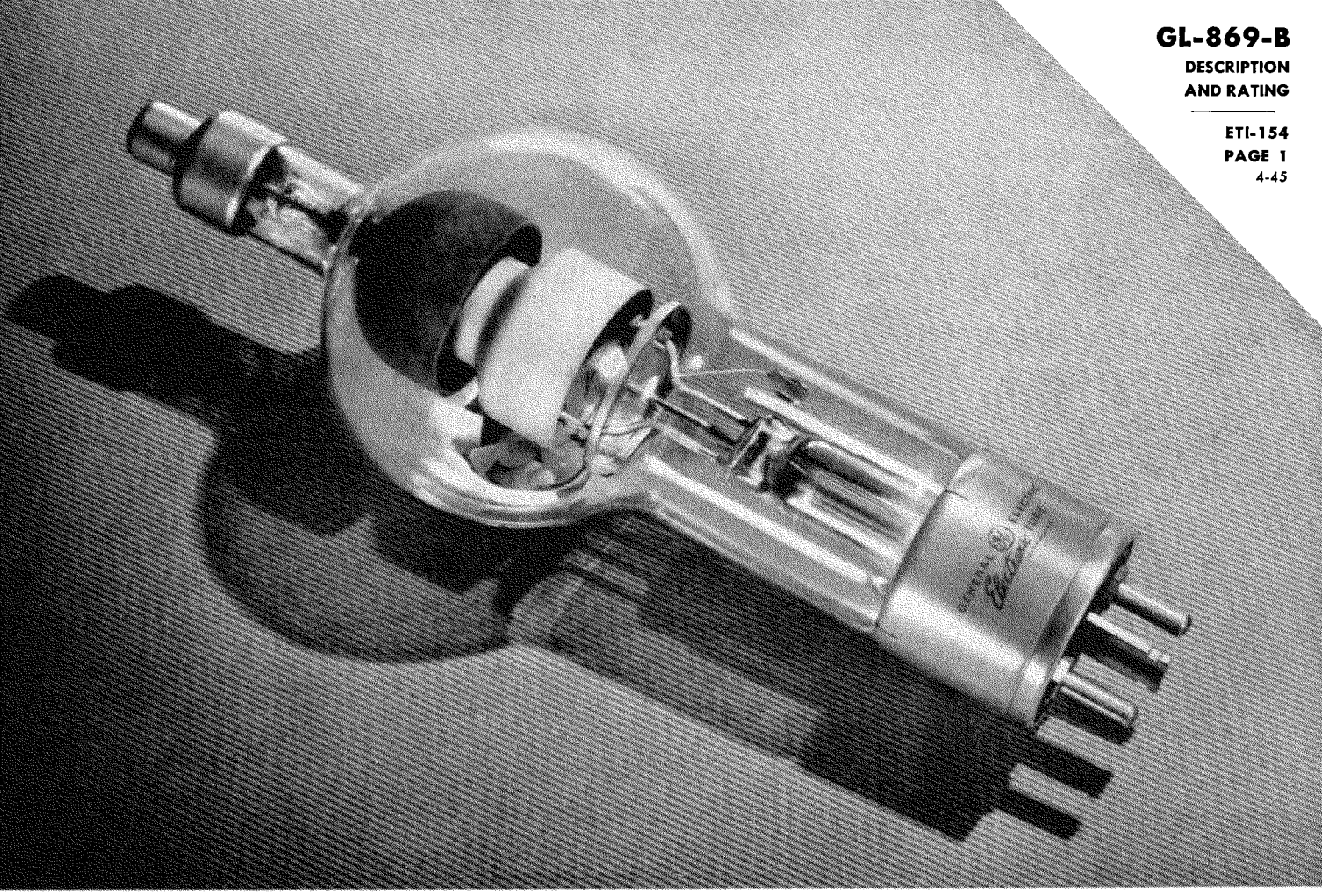


OUTLINE
GL-868/PJ-23 PHOTOTUBE
K-8639391 8-10-44



K-8639626 4-17-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



PHANOTRON

DESCRIPTION

The GL-869-B is a half-wave, mercury-vapor rectifier tube for use in broadcast transmitters and other applications where high d-c voltages are required. Economy of operation and high over-all efficiency result from several unique design features incorporated in this tube. The design of cathode allows the further advantage of operation with either in-phase or quadrature filament excitation. In quadrature operation the filament and anode voltages are approximately ninety degrees out of phase with each other. Such an arrangement, allowing uniform utilization of the cathode, results in greater uniformity of characteristics than is possible with other methods.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Cathode—Filamentary type		
Filament voltage	5.0	volts
Filament current, approx.	18.0	amperes
Heating time, typical	1	minute
Peak voltage drop, typical	15	volts
Mechanical		
Type of cooling		convection
Net weight, approx.	1½	pounds
Shipping weight, approx.	6	pounds
Mounting position		vertical, base down

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

In-phase filament excitation

Maximum peak inverse anode voltage

Type of cooling	Convection	Forced-air	
150 cycles or less	10,000 volts	20,000	volts
Corresponding mercury temperature	30–60 centigrade	30–40	centigrade

Maximum anode current

Instantaneous, 25 to 150 cycles	10	amperes
Average	2.5	amperes

Quadrature filament excitation

Maximum peak inverse anode voltage

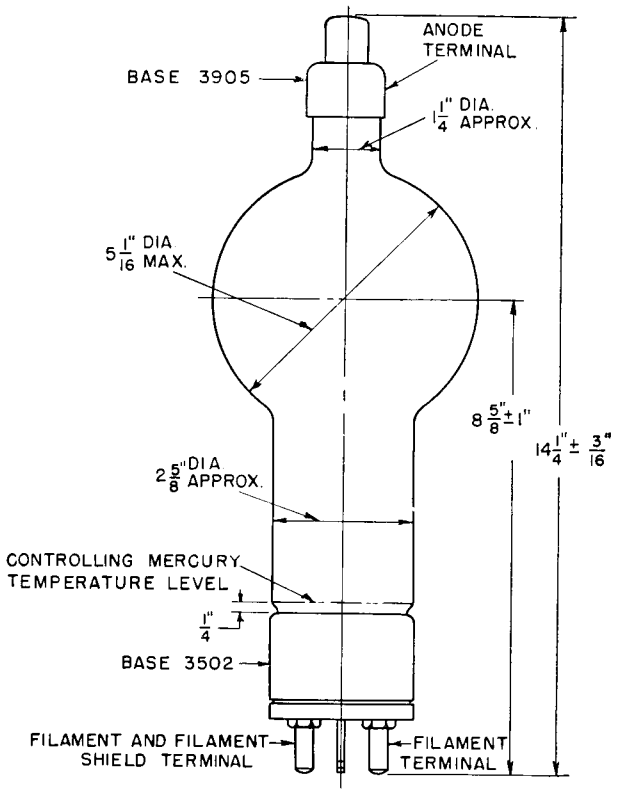
Type of cooling	Forced-air	
150 cycles or less	15,000	volts
Corresponding mercury temperature	30–40	centigrade

Maximum anode current

Instantaneous, 25 to 150 cycles	15	amperes
Average	5	amperes

Quadrature or In-phase filament excitation

Surge, for design only	100	amperes
Duration of surge current	0.1	second
Maximum time of averaging current	30	seconds
Recommended temperature, condensed mercury	35 ± 5	centigrade



OUTLINE
GL-869-B PHANOTRON

K-4909011 9-23-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PHANOTRON

DESCRIPTION

The GL-872-A/872 is a half-wave, mercury-vapor rectifier tube designed to withstand high peak inverse voltages, and to conduct at relatively low applied voltages.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Cathode—Filamentary type		
Filament voltage	5.0	volts
Filament current, approx.	7.5	amperes
Transformer power for design purposes	50	watts
Heating time, typical	30	seconds
Peak voltage drop, typical	10	volts
Mechanical		
Type of cooling		convection
Net weight	½	pound
Shipping weight, approx.	3	pounds
Mounting position		vertical, base down

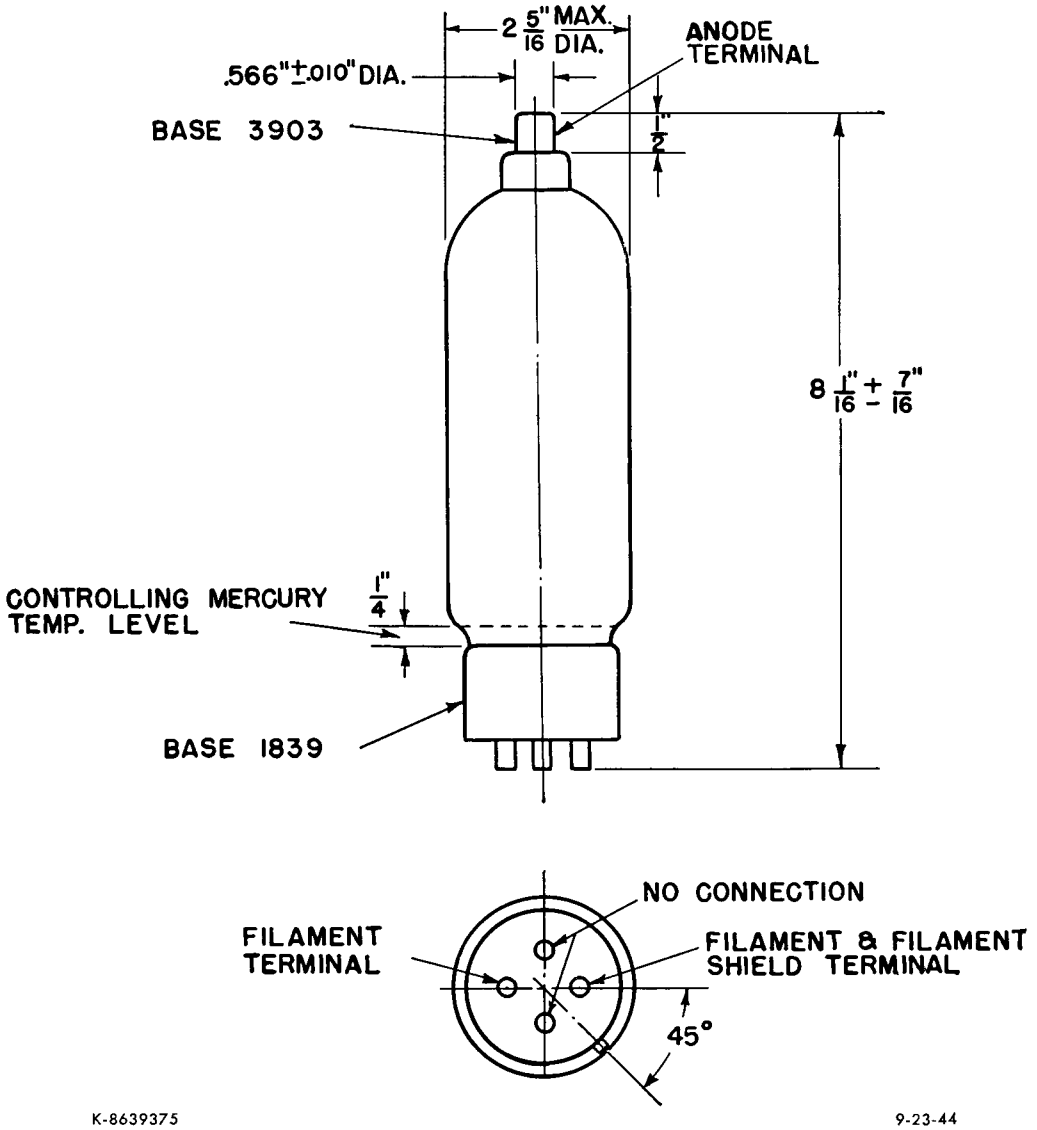
GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

Maximum peak inverse anode voltage		
150 cycles or less	5,000	volts
Corresponding condensed-mercury temperature limits	20–70	centigrade
Maximum peak inverse anode voltage		
150 cycles or less	10,000	volts
Corresponding condensed-mercury temperature limits	20–60	centigrade
Maximum anode current		
Instantaneous, 25 cycles and above	5.0	amperes
Average	1.25	amperes
Surge, for design only	50	amperes
Maximum time of averaging current	15	seconds
Maximum time of surge anode current	0.2	second



K-8639375 9-23-44

OUTLINE
GL-872-A/872 PHANOTRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

GENERAL ELECTRIC

GLOW TUBES



DESCRIPTION

A glow tube is a cold-cathode, gas-discharge tube in which no means is provided for controlling the unidirectional current flow. (NEMA definition). This type of tube is also known as a voltage-regulator tube, a name which describes its principal application.

Fundamentally, a glow tube consists of two electrodes, an anode and a cold cathode, in a partial atmosphere of inert gas or vapor. The emission is obtained from the cold cathode by virtue of a potential gradient at the cathode surface. This gradient literally pulls electrons out of the cathode. For this reason cathodes are sometimes coated with some material which has a low work function so that electrons are given off with comparative ease.

GENERAL OPERATION

Two types of discharge are possible in a glow tube. A glow discharge, which is a uniform glow covering all or part of the cathode surface, will occur when the current carried by the tube is low. Under these conditions the tube drop is essentially independent of the current. This is the condition under which glow tubes normally operate. The exact voltage drop across the tube depends upon the electrode spacing and the type and amount of gas used.

If the current through the tube is increased beyond a certain point the tube will go into a so-called arc discharge. Under these conditions a cathode spot rather than a uniform cathode glow appears on the cathode and the tube drop decreases to a rather low value (10-20 volts). Although some glow tubes are designed to operate as arc-discharge tubes, the majority of glow tubes must not be operated so that an arc discharge takes place, as the life of the tube will be materially shortened.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Tube Type Number	GL-OA3/VR-75, GL-OB3/VR-90 GL-OC3/VR-105, GL-OD3/VR-150	GL-874
Type of voltage-regulator tube	Glow discharge	Glow discharge
Cathode	Cold type	Cold type
Maximum over-all length	4 1/8 inches	5 3/8 inches
Maximum seated height	3 9/16 inches	4 3/4 inches
Maximum diameter	1 9/16 inches	2 1/16 inches
Base	Small shell octal 6-pin	Medium 4-pin bayonet
Net weight, approx.	2 ounces	2 ounces
Shipping weight, approx.	3 pounds	3 pounds

MAXIMUM RATINGS

Tube Type Number	GL-OA3/VR-75	GL-OB3/VR-90	GL-OC3/VR-105	GL-OD3/VR-150	GL-874
Minimum d-c anode supply voltage	105	125	133	185	125 volts
D-c operating Current:					
Maximum*	40	30	40	40	50 milliamperes
Minimum	5	10	5	5	10 milliamperes
D-c starting voltage, approx.	100	110	115	160	125 volts
D-c operating voltage, approx.	75	90	105	150	90 volts
D-c operating current, continuous	5 to 40	5 to 30	5 to 40	5 to 40	10 to 50 milliamperes
Regulation 5 to 30 milliamperes	3	4	1	2	volts
Regulation 5 to 40 milliamperes	5	–	2	4	volts
Ambient temperature range	−55 to +90	−55 to +90	−55 to +90	−55 to +90	centigrade

**Sufficient resistance must always be used in series with the tube to limit the current through it to this value.*

DEFINITIONS OF RATINGS

D-c Anode Supply Voltage, Minimum

This is the minimum value of voltage that the voltage supply must be capable of applying to the glow tube.

D-c Operating Current

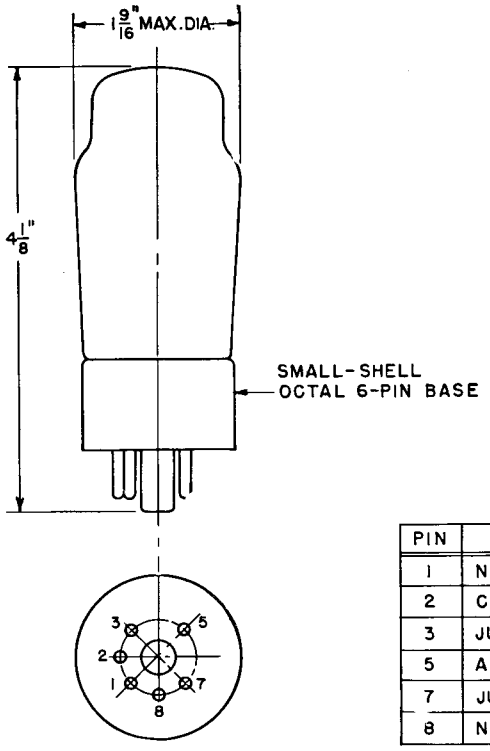
These values of maximum and minimum current indicate the range over which the glow tube will operate satisfactorily. Operation below the minimum current will cause erratic regulation and operation above maximum current will result in short life and erratic regulation.

Regulation

The regulation voltage is the maximum variation in voltage drop across the glow tube. It is calculated as the difference between the voltage drop obtained at the maximum current and the voltage drop obtained at the minimum current.

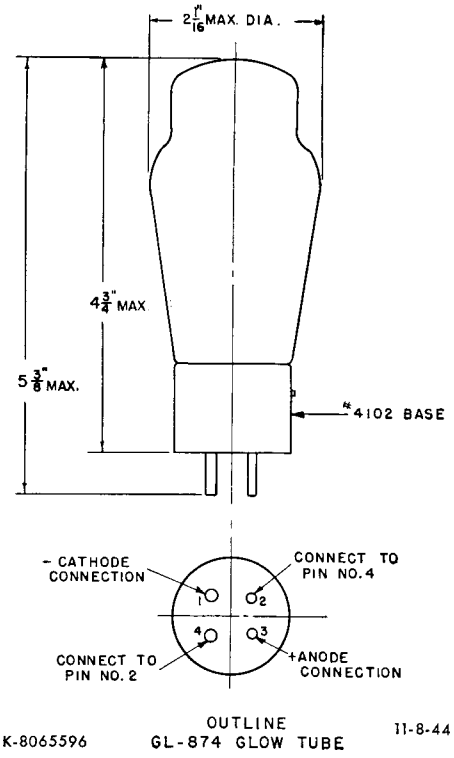
Ambient Temperature Range

This temperature range indicates the maximum and minimum temperatures at which satisfactory operation may be obtained.



PIN	CONNECTION
1	NO CONNECTION
2	CATHODE
3	JUMPER
5	ANODE
7	JUMPER
8	NO CONNECTION

K-8065597 Outline 8-10-44
GL-OA3/VR75 OB3/VR90
OC3/VR105, OD3/VR150



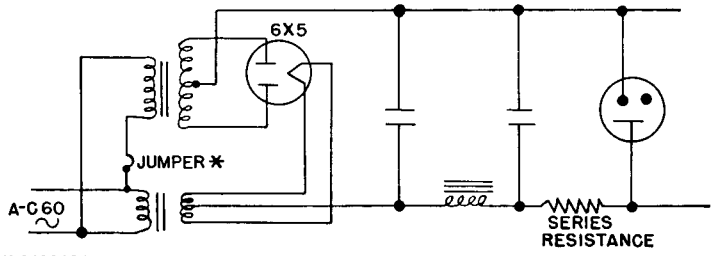
K-8065596 OUTLINE 11-8-44
GL-874 GLOW TUBE





APPLICATION CIRCUITS

The most common use of the glow tube is as a voltage regulating device.



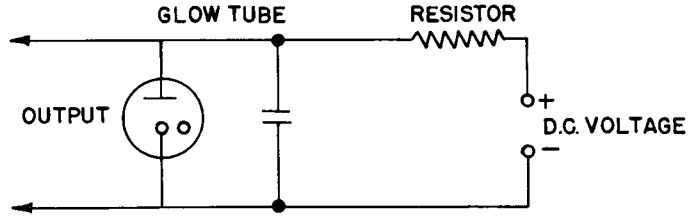
K-8639684 Fig. 1—Voltage-Regulated Power Supply Circuit 9-25-44

Fig. 1 above illustrates a voltage-regulated power supply circuit incorporating a glow tube as a voltage stabilizer. (*Most glow tubes are provided with a jumper wire connected internally. This is usually employed as a switch, and is wired in series with the primary of the transformer supplying power to the glow tube. When the tube is removed from the socket the power supply circuit is automatically shut off.)

Such a circuit is an inexpensive means of providing a regulated voltage within the capabilities of a tube for such applications. The series resistance must be of a value that will limit the current through the glow tube to the maximum rated current. It is also desirable to furnish a high enough voltage from the d-c supply so that the current through the glow tube does not drop below the minimum rating.

Glow tubes may be used in series to provide higher regulated voltages than are available from one tube. These tubes need not be the same type, the only requirement being that the current must be limited so that it falls within the operating range of the combination. For example, if a GL-OA3/VR75 and a GL-OB3/VR90 are used in series, the current must be limited to 30 milliamperes maximum. Operation of glow tubes in parallel is not recommended.

A second application of the glow tube is the relaxation oscillator illustrated in Fig. 2.



K-8639685 Fig. 2—Relaxation Oscillator Circuit 9-25-44

In this type of circuit, a current charges a capacitor. In parallel with the capacitor is a glow tube, which will break down when the voltage on the capacitor reaches the voltage breakdown point of the glow tube. The frequency of this action may be varied by changing the capacitance or type of glow tube.

#Circuits shown in ETI-176 are examples of possible tube applications and the description and illustration of them does not convey to the purchaser of tubes any license under patent rights of General Electric Company.

INSTALLATION AND OPERATION

Sufficient resistance must always be used in series with each of these tubes to limit the current through the tube to the maximum rated value under continuous (steady state) operating conditions. During the interval of 5 to 10 seconds which may be required for the regulated tubes in associated equipment to warm up and draw plate current, a maximum current of 100 milliamperes is permissible provided each such starting period is followed by a steady-state operating period of at least several minutes. Unless this precaution is observed, tube performance will be impaired.

In voltage-regulator tubes of the glow-discharge type, regulation is somewhat dependent on past operating conditions. For example, the regulation value of a tube operated for a protracted period at 5 milliamperes and then changed to 35 millliamperes may be somewhat different from the value that will be obtained after a long period of operation at 35 milliamperes. Likewise, the regulation value may change somewhat after a long idle period.

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PLIOTRON

DESCRIPTION

The 880 is a three-electrode power tube designed for use as a radio-frequency amplifier, oscillator, or Class B modulator. The plate is water-cooled and is capable of dissipating 12 to 20 kilowatts. The design of the terminal mount connections and the introverted anode minimize lead inductance and make the tube particularly suitable for high-frequency applications.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Filament voltage	12.6	volts
Filament current	320	amperes
Average Characteristics		
Amplification factor	20	
Grid-plate transconductance, $I_b = 2.0$	21000	micromhos
Direct interelectrode capacitances		
Grid-plate	24	micromicrofarads
Grid-filament	35	micromicrofarads
Plate-filament	2.0	micromicrofarads
Frequency for maximum ratings	25	megacycles

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

Type of cooling	Water and forced air
Maximum outlet temperature	70 centigrade
Water flow	12–20 gal per min
Air flow to bulb, from a 3-inch diam. nozzle	20 cu ft per min
Gasket	cat. no. P5182028P1
Net weight	7 pounds
Shipping weight, approximate	21 pounds
Mounting position	vertical, anode down

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS B AUDIO-FREQUENCY POWER AMPLIFIER (TWO TUBES)

	Typical Operation		Maximum* Ratings	
D-c plate voltage	7500	10000	10500	volts
Max signal plate current (per tube)†			5	amperes
D-c max signal plate input (per tube)†			40	kilowatts
Plate dissipation (per tube)†			15	kilowatts
D-c grid voltage	−300	−430		volts
Peak a-f grid input voltage	1450	1690		volts
Zero signal plate current	1.0	1.0		ampere
Max signal plate current	7.0	7.0		amperes
Max signal plate input†	52	70		kilowatts
Max signal driving power, approx	250	225		watts
Effective load (plate-to-plate)	2200	3200		ohms
Max signal plate power output	30	45		kilowatts

CLASS B RADIO-FREQUENCY POWER AMPLIFIER

Carrier conditions per tube for use with a max modulation factor of 1.0

D-c plate voltage	7500	10000	10500	volts
D-c grid voltage	−310	−430		volts
D-c plate current	3.5	3	4	amperes
Plate input			32	kilowatts
Plate dissipation			20	kilowatts
Peak r-f grid input voltage	450	550		volts
Driving power‡, approx	500	500		watts
Plate power output	8	10		kilowatts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—PLATE-MODULATED

Carrier conditions per tube for use with a max modulation factor of 1.0

D-c plate voltage	7500	10000	10500	volts
D-c grid voltage	−1000	−1200	−1200	volts
D-c plate current	3.0	3.6	3.6	amperes
D-c grid current, approx	0.3	0.5	0.8	ampere
Plate input			36	kilowatts
Plate dissipation			12	kilowatts
Peak r-f grid input voltage, approx	1550	1770		volts
Driving power, approx	460	880		watts
Plate power output	16	28		kilowatts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Key-down conditions per tube without modulation§

D-c plate voltage	7500	10000	10000	10500	volts
D-c grid voltage	−600	−800	−800	−1200	volts
D-c plate current	5	4.5	6	6	amperes
D-c grid current, approx	0.45	0.4	0.5	0.8	ampere
Plate input				60	kilowatts
Plate dissipation				20	kilowatts
Peak r-f grid input voltage, approx	1250	1400	1500		volts
Driving power, approx	560	550	750		watts
Plate power output	27	34	45		kilowatts

† Averaged over any audio-frequency cycle.

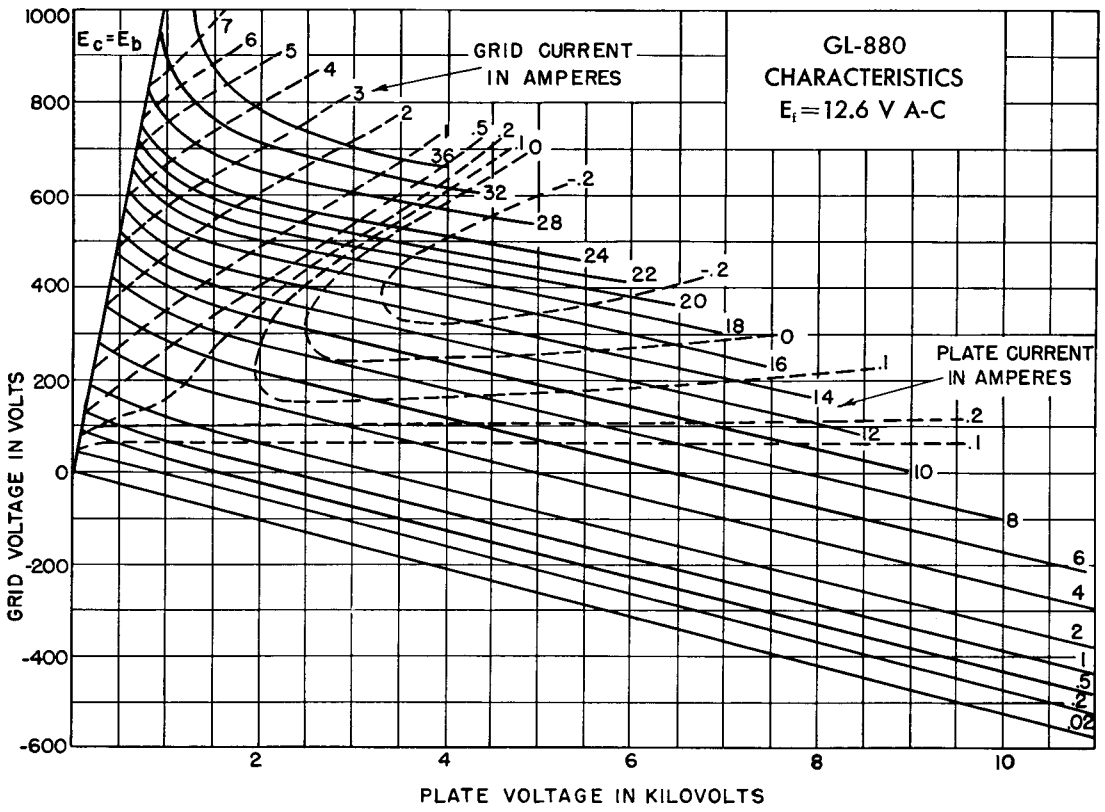
‡ At crest of audio-frequency cycle.

§ Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

APPLICATION NOTES

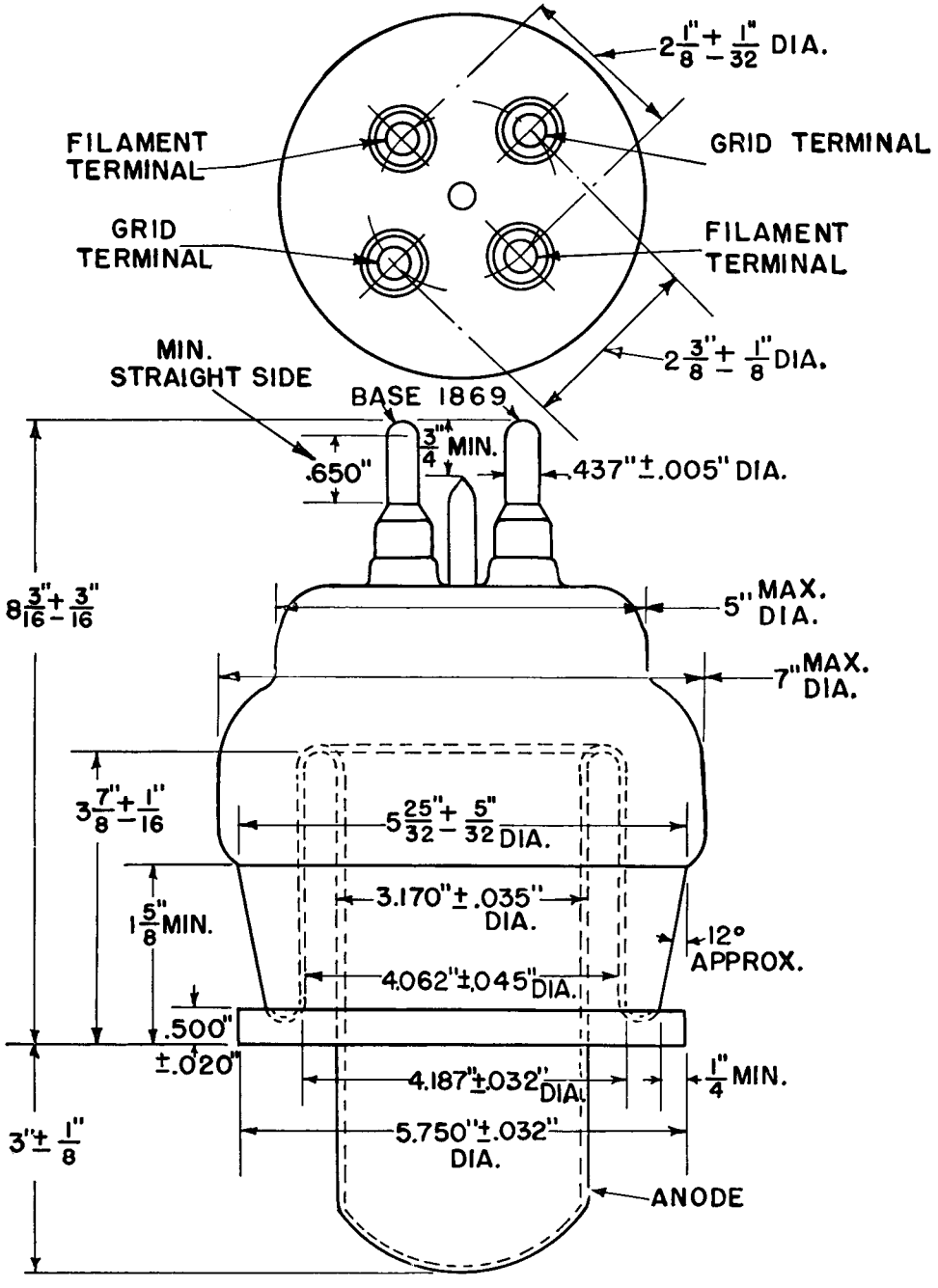
*The GL-880 can be operated at maximum ratings in all classes of service at frequencies as high as 25 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised. (Other maximum ratings are the same as shown under TECHNICAL INFORMATION.) The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used up to 100 megacycles for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency	25	50	75	100	megacycles
Class B radio-frequency					
Max plate voltage	100	80	68	60	per cent
Max plate input	100	94	85	75	per cent
Class C plate-modulated					
Max plate voltage and plate input	100	72	56	45	per cent
Class C					
Max plate voltage and plate input	100	75	62	50	per cent
Plate series protective resistors					
Series resistor	10	15	20	30	ohms
Maximum power output of rectifier	40	100	250	640	kilowatts



K-8074621

9 26 44



OUTLINE
GL-880 PLIOTRON

K-5965320

9-23-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



THYRATRON

DESCRIPTION

The GL-884 is an inert-gas-filled thyratron designed for use as a sweep-circuit oscillator in cathode-ray tube circuits. This thyratron may also be used for general control applications where it is desired to actuate the tube with a change in negative grid voltage.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Cathode—Indirectly heated type		
Voltage	6.3	volts
Current, approx	0.6	amperes
Heating time, typical	30	seconds
Peak voltage drop, approx.	16	volts
Approximate control characteristics		
Anode voltage	300	volts
Grid voltage	−30	volts
Capacitance, approx		
Grid-to-anode	3.5	micromicrofarads
Grid-to-cathode	3.5	micromicrofarads
Anode-to-cathode	2.5	micromicrofarads
Mechanical		
Net weight, approx.	3	ounces
Shipping weight, approx.	3	pounds

GE Electronic TUBE

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

SWEEP-CIRCUIT OSCILLATOR RATING

Maximum anode voltage		
Peak, between any two electrodes	350	volts
Instantaneous	300	volts
Maximum anode current		
Peak	300	milliamperes
Average, 200 cycles per second and above	2	milliamperes
Average, below 200 cycles per second	3	milliamperes

GRID-CONTROLLED RECTIFIER RATING

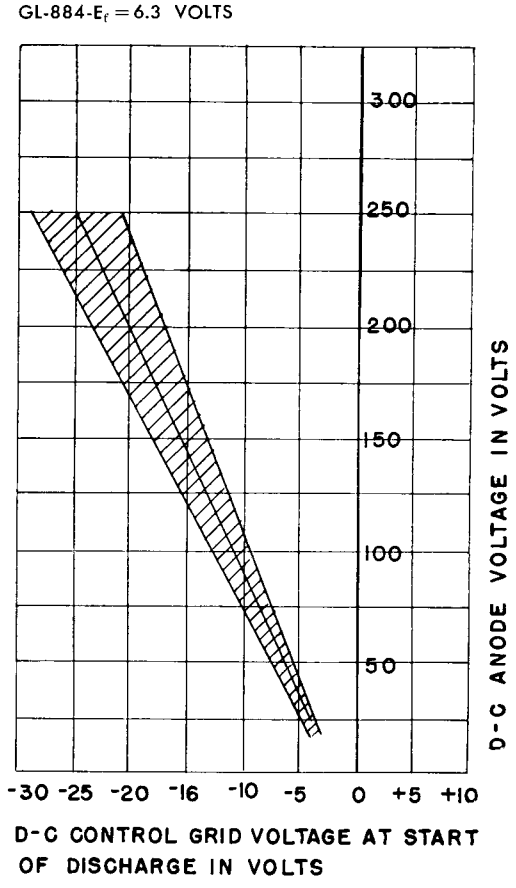
(For frequencies below 75 cycles per second)

Maximum peak anode voltage	350	volts
Maximum peak anode current	300	milliamperes
Maximum anode current*	75	milliamperes

* Average over period of not more than 30 seconds.

OPERATING NOTES

For both classes of service the grid resistor used should not be less than 1000 ohms per maximum instantaneous volt applied to the grid. Resistance values in excess of 0.5 megohms may cause circuit instability.

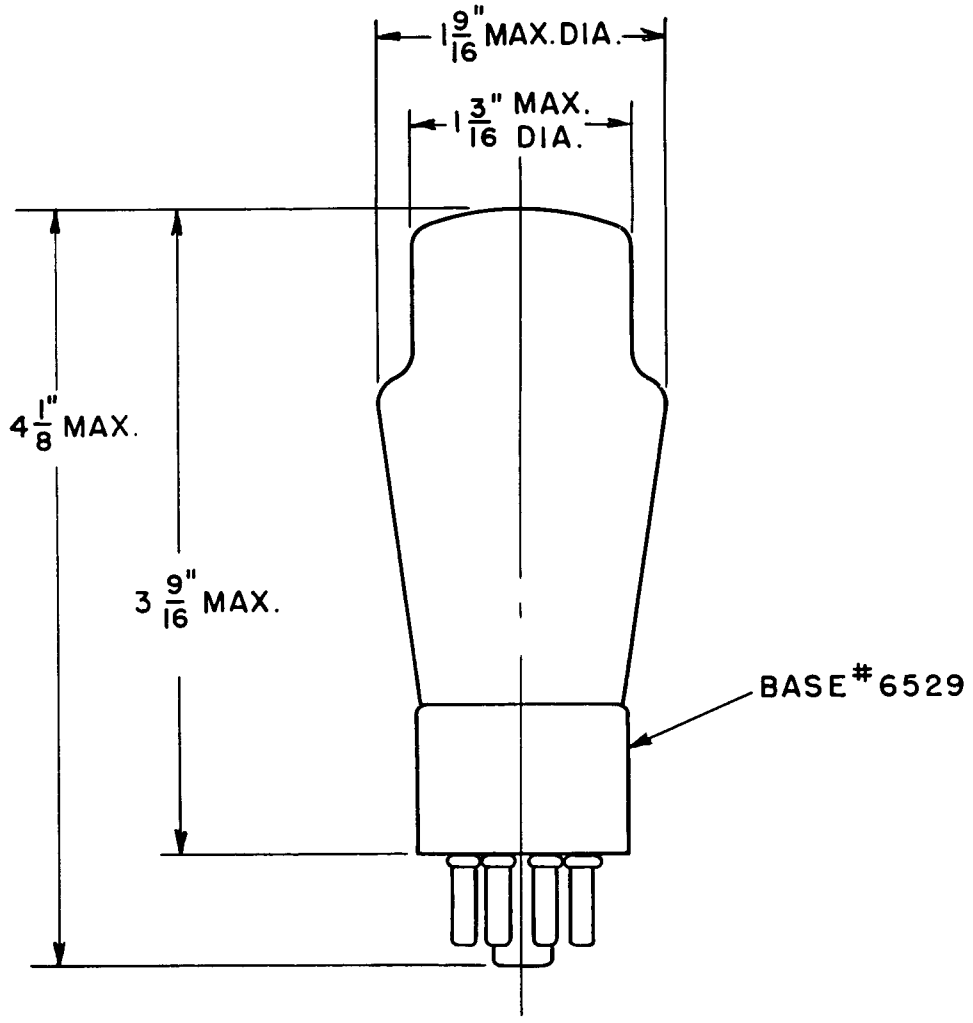


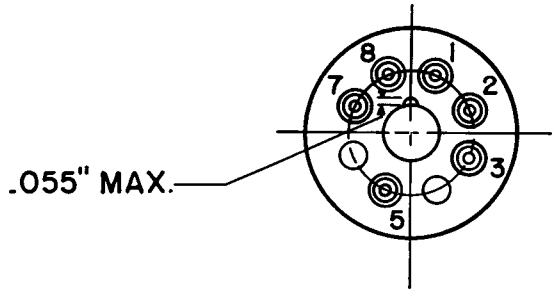
K-8639640

GL-884

6-6-44

TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS





PIN	CONNECTION
1	NO CONNECTION
2	HEATER
3	ANODE
5	GRID
7	HEATER
8	CATHODE

K-8639389

8-10-44

OUTLINE
GL-884 THYRATRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The GL-885 is an inert-gas-filled thyratron designed for use as a sweep-circuit oscillator in cathode-ray tube circuits. This tube may also be used for general control applications where it is desired to actuate the tube with a change in negative grid voltage.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Cathode—Indirectly heated type		
Voltage	2.5	volts
Current, approx	1.4	ampere
Heating time, typical	30	seconds
Peak voltage drop, approx.	16	volts
Approximate control characteristics		
Anode voltage	300	volts
Grid voltage	−30	volts
Capacitance, approx		
Grid-to-anode	3.5	micromicrofarads
Grid-to-cathode	3.5	micromicrofarads
Anode-to-cathode	2.5	micromicrofarads
Mechanical		
Net weight, approx	3	ounces
Shipping weight, approx	3	pounds

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

SWEEP-CIRCUIT OSCILLATOR RATING

Maximum anode voltage		
Peak, between any two electrodes	350	volts
Instantaneous	300	volts
Maximum anode current		
Peak	300	milliamperes
Average, 200 cycles per second and above	2	milliamperes
Average, below 200 cycles per second	3	milliamperes

GRID-CONTROLLED RECTIFIER RATING

(For frequencies below 75 cycles per second)		
Maximum peak anode voltage	350	volts
Maximum peak anode current	300	milliamperes
Maximum anode current*	75	milliamperes

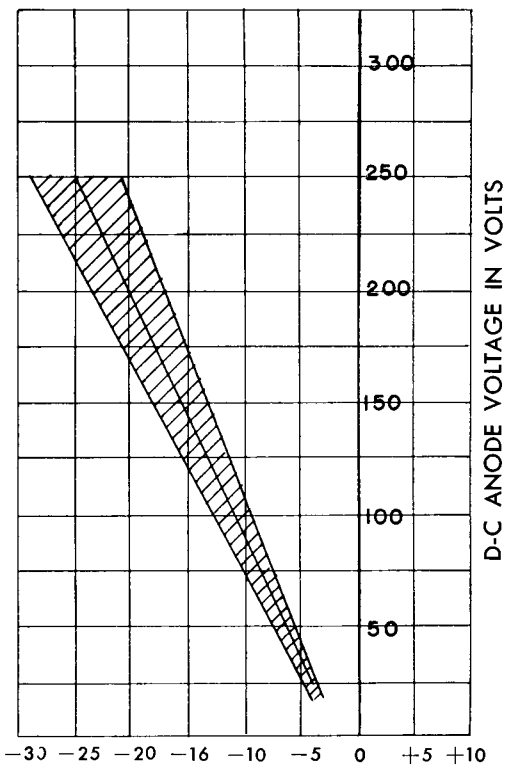
**Averaged over period of not more than 30 seconds.*

OPERATING NOTES

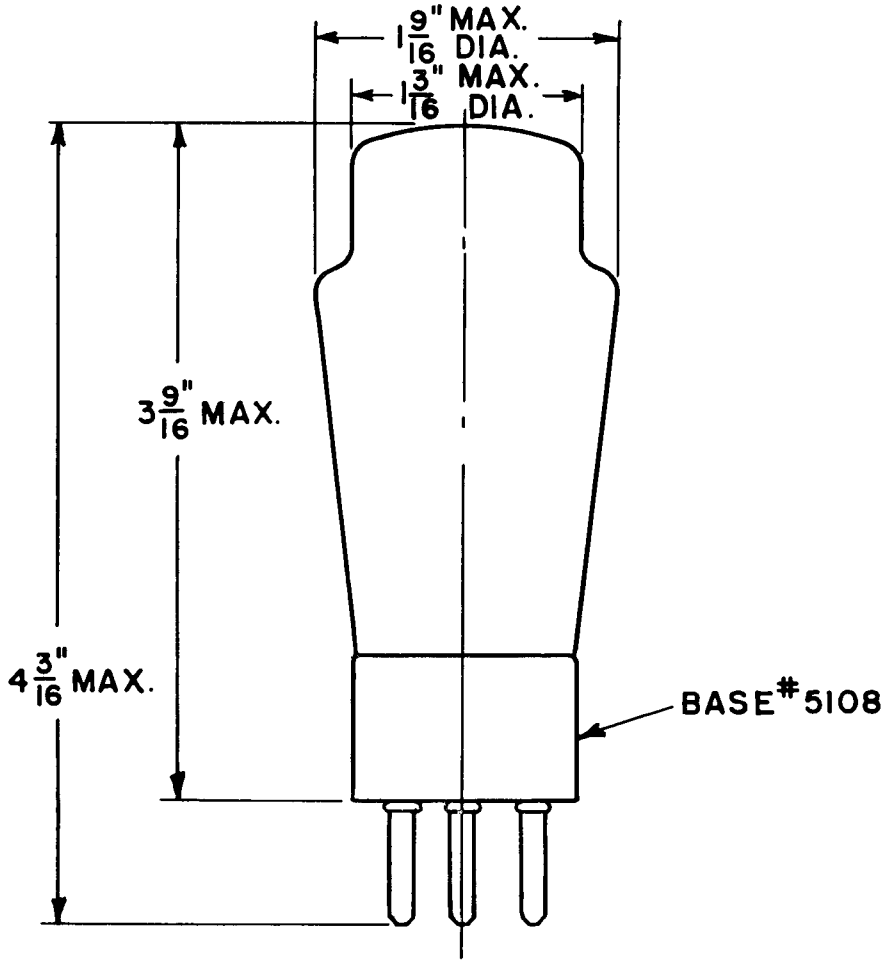
For both classes of service the grid resistor used should not be less than 1000 ohms per maximum instantaneous volt applied to the grid. Resistance values in excess of 0.5 megohms may cause circuit instability.

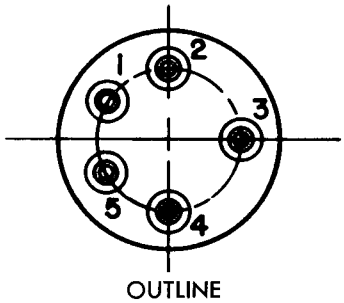
GL-885 TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS

GL-885 — $E_f = 2.5$ VOLTS



K-8639640 6-6-44





OUTLINE
GL-885 THYRATRON

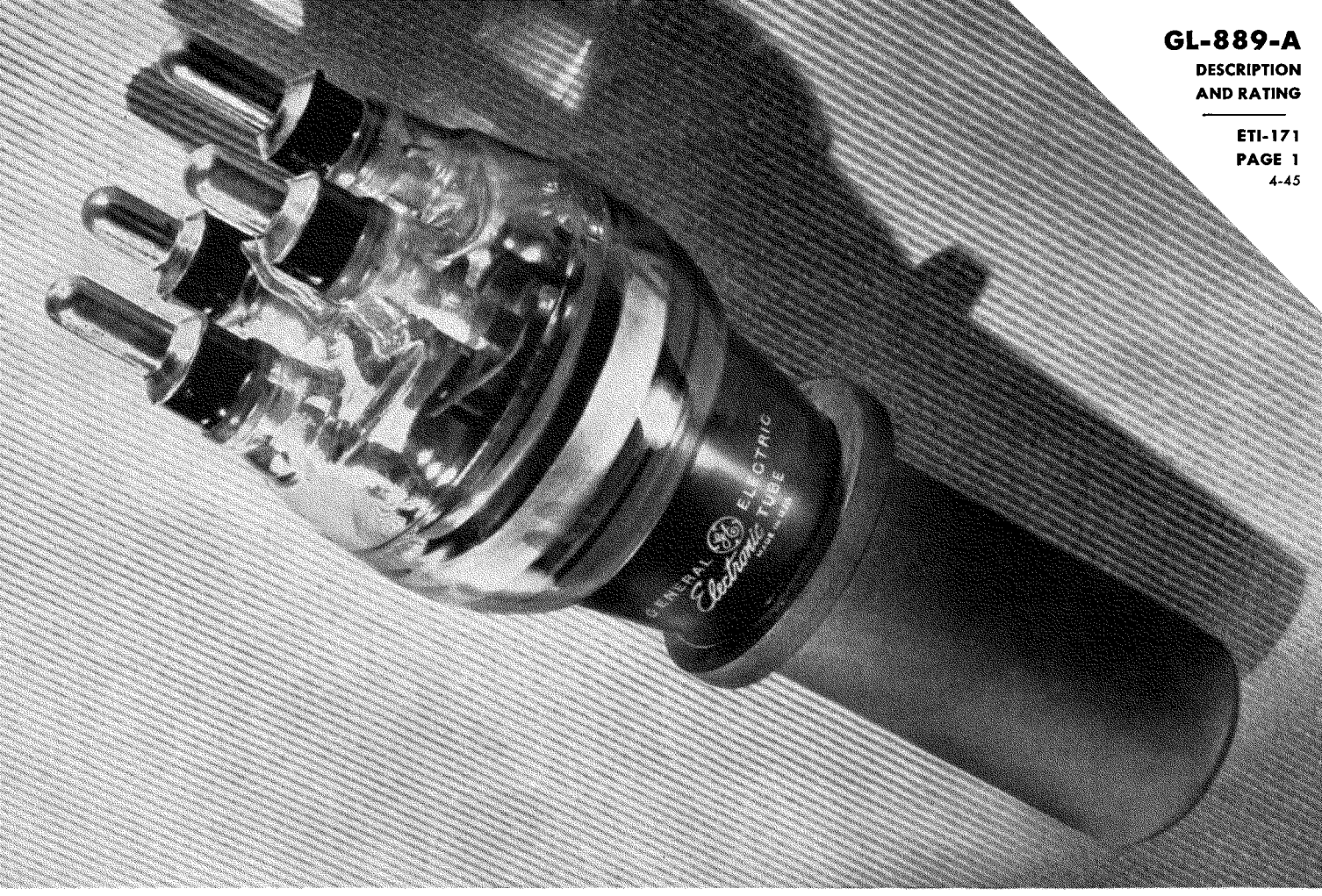
PIN	CONNECTIONS
1	HEATER
2	ANODE
3	GRID
4	CATHODE
5	HEATER

K-8639388

7-1-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PLIOTRON

DESCRIPTION

The GL-889-A is a three-electrode power tube designed for use as a radio-frequency, amplifier, oscillator, or Class B modulator. The plate is water-cooled and is capable of dissipating 3 to 5 kilowatts, depending upon the class of service. The design of the mount and terminal connections minimizes lead inductance and makes the tube particularly suitable for high-frequency applications.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Filament voltage	11	volts
Filament current	125	amperes
Average Characteristics		
Amplification Factor, $E_b = 5$ kv, $I_b = 1.0$ amp, $E_c = 75$ v, $E_f = 11$ v a-c	21	
Grid-plate transconductance	9000	micromhos
Direct interelectrode capacitances:		
Grid-plate	17.5	micromicrofarads
Grid-filament	23.3	micromicrofarads
Plate-filament	2.7	micromicrofarads
Frequency for maximum ratings	50	megacycles

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

Type of cooling	water and forced air
Maximum outlet temperature	70 centigrade
Water flow	3–6 gal per min
Air flow to bulb, from a 3-inch diam nozzle	15 cu ft per min
Gasket	Cat. No. 5182028P8
Net weight, approximate	2 pounds
Shipping weight, approximate	9 pounds
Mounting position	vertical, anode down

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS B AUDIO-FREQUENCY POWER AMPLIFIER (TWO TUBES):

		Typical Operation		Maximum* Ratings	
D-c plate voltage	5000	6000	7500	8500	volts
Maximum signal plate current†, per tube				2.0	amperes
D-c maximum signal plate input†, per tube				12	kilowatts
Plate dissipation†, per tube				5.0	kilowatts
D-c grid voltage	180	−230	−300		volts
Peak a-f grid input voltage	1460	1680	1700		volts
Zero signal plate current	0.4	0.4	0.4		ampere
Maximum signal plate current	3.2	3.6	3.2		amperes
Maximum signal plate input†	16	21.6	24		kilowatts
Maximum signal driving power, approx	170	180	150		watts
Effective load, plate-to-plate	2520	3680	5000		ohms
Maximum signal plate power output	8.8	12	15		kilowatts

CLASS B RADIO-FREQUENCY POWER AMPLIFIER

Carrier conditions per tube for use with a max modulation factor of 1.0

D-c plate voltage	6000	7500	8500	volts
D-c grid voltage	−250	−300		volts
D-c plate current	0.9	0.9	1.0	ampere
Plate input			7.5	kilowatts
Plate dissipation			5.0	kilowatts
Peak r-f grid input voltage	920	1000		volts
Driving power, approx‡	95	80		watts
Plate power output	1.5	2		kilowatts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—PLATE-MODULATED

Carrier conditions per tube for use with a max modulation factor of 1.0

D-c plate voltage	5000	6000	6000	volts
D-c grid voltage	−800	−900	−1000	volts
D-c plate current	0.9	1.0	1.0	amperes
D-c grid current, approx	0.12	0.1	0.25	amperes
Plate input			6.0	kilowatts
Plate dissipation			3.0	kilowatts
Peak r-f grid input voltage, approx	1300	1420		volts
Driving power, approx	155	140		watts
Plate power output	2.75	4.0		kilowatts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Key-down conditions per tube without modulation π

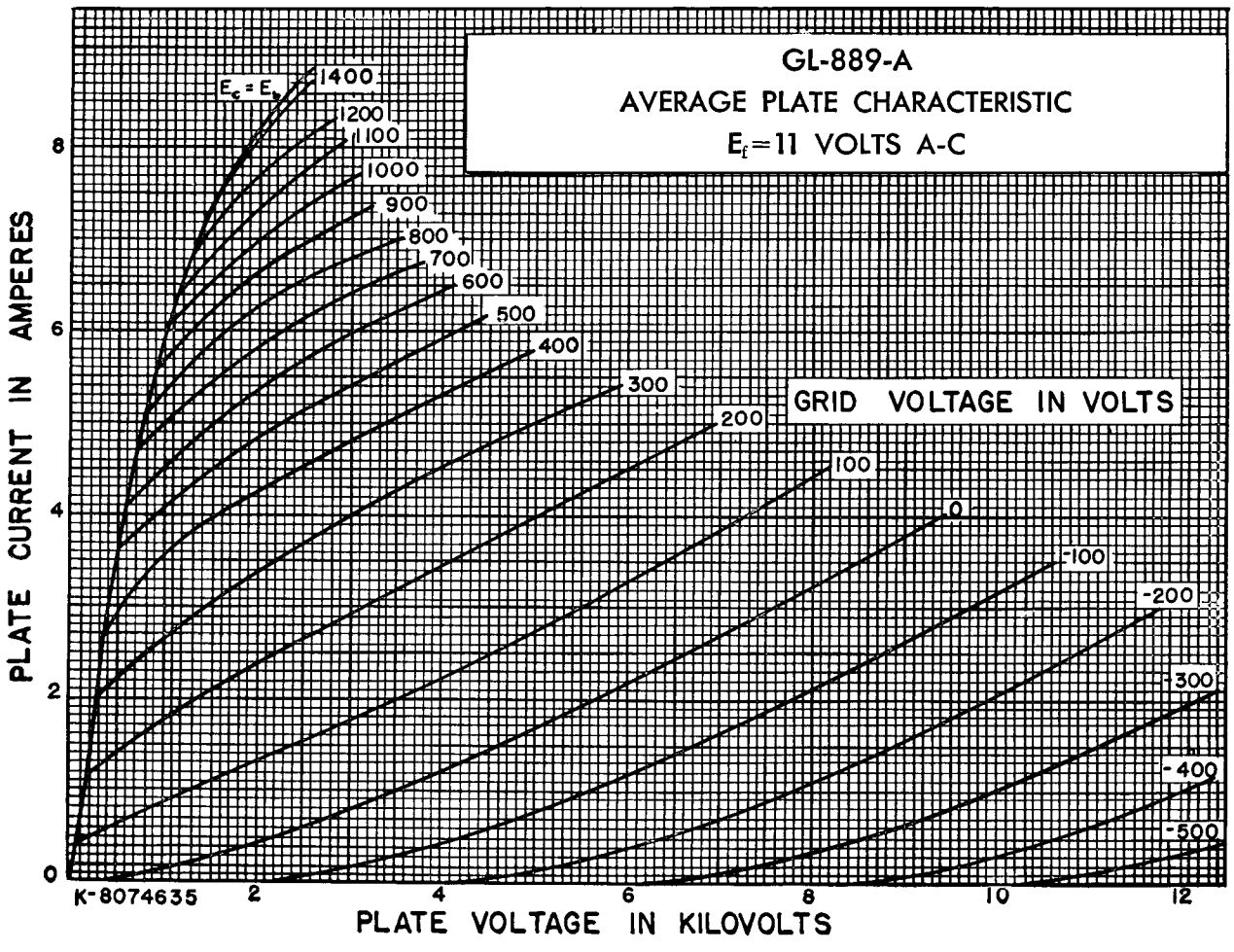
D-c plate voltage	5000	6000	7500	8500	volts
D-c grid voltage	−500	−600	−800	−1000	volts
D-c plate current	1.5	1.8	2.0	2.0	amperes
D-c grid current, approx	0.19	0.21	0.24	0.25	ampere
Plate input				16	kilowatts
Plate dissipation				5	kilowatts
Peak r-f grid input voltage, approx	1200	1460	1830		volts
Driving power, approx	220	290	400		watts
Plate power output	5	7	10		kilowatts

†Averaged over any audio-frequency cycle.
‡At crest of audio-frequency cycle.
πModulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

APPLICATION NOTES

*GL-889 can be operated at maximum ratings in all classes of service at frequencies as high as 50 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised. (Other maximum ratings are the same as shown under TECHNICAL INFORMATION.) The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used up to 150 megacycles for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

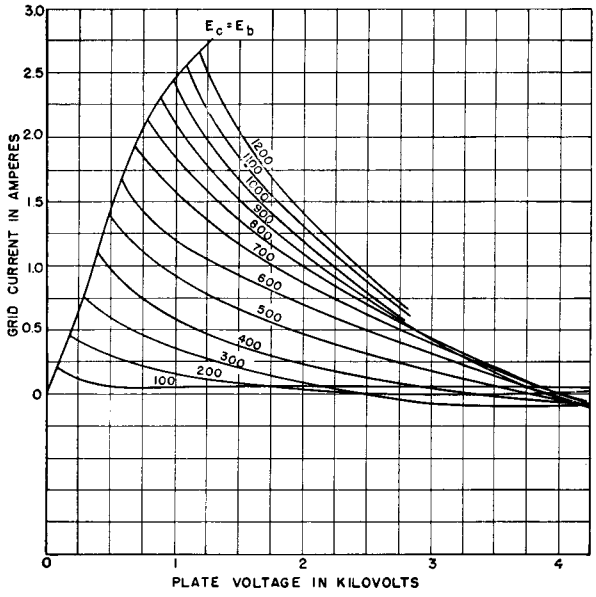
Frequency	50	75	100	150	megacycles
Class B r-f					
Max plate voltage and plate input	100	90	83	72	per cent
Class C plate-modulated					
Max plate voltage and plate input	100	85	75	60	per cent
Class C					
Max plate voltage	100	87	78	65	per cent
Max plate input	100	85	70	50	per cent
Plate Series Protective Resistors (see paragraph describing plate circuit under Installation in the Instructions)					
Series resistor	25	50	100	150	ohms
Maximum power output of rectifier	16	40	100	250	kilowatts



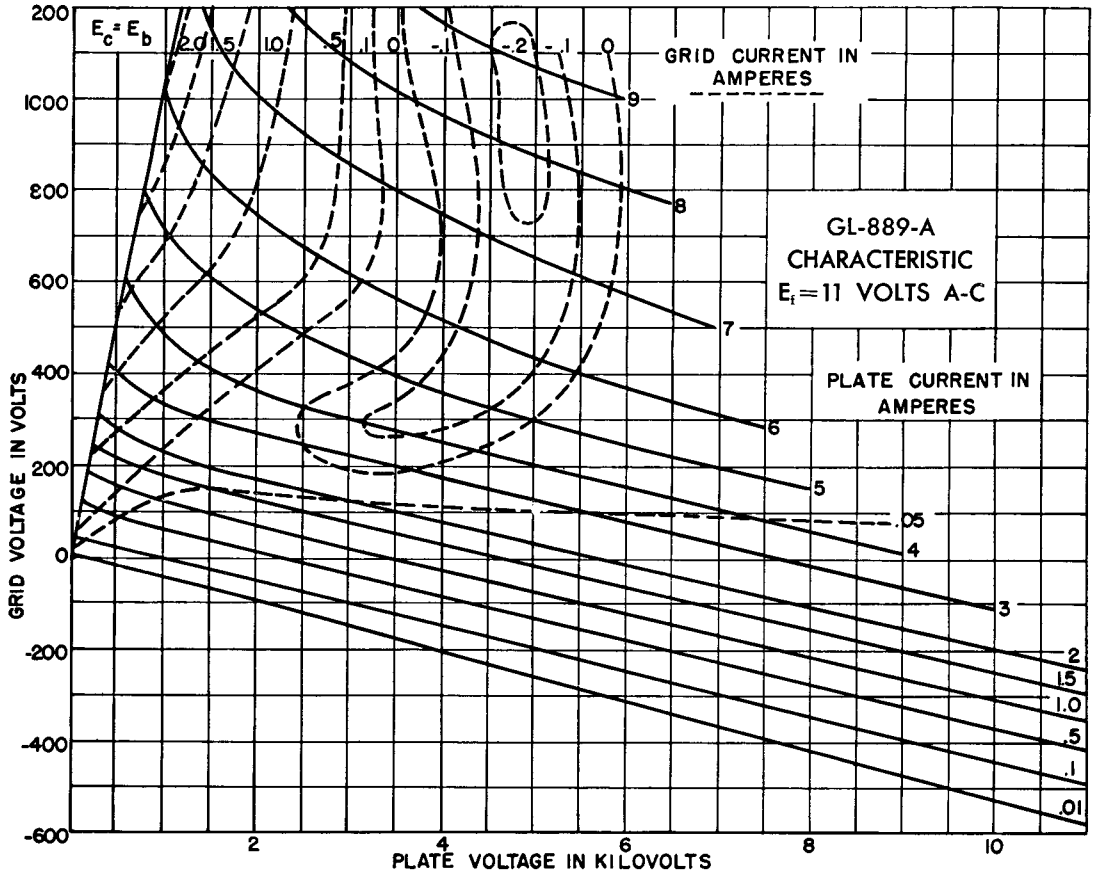
K-8074635

2-24-45

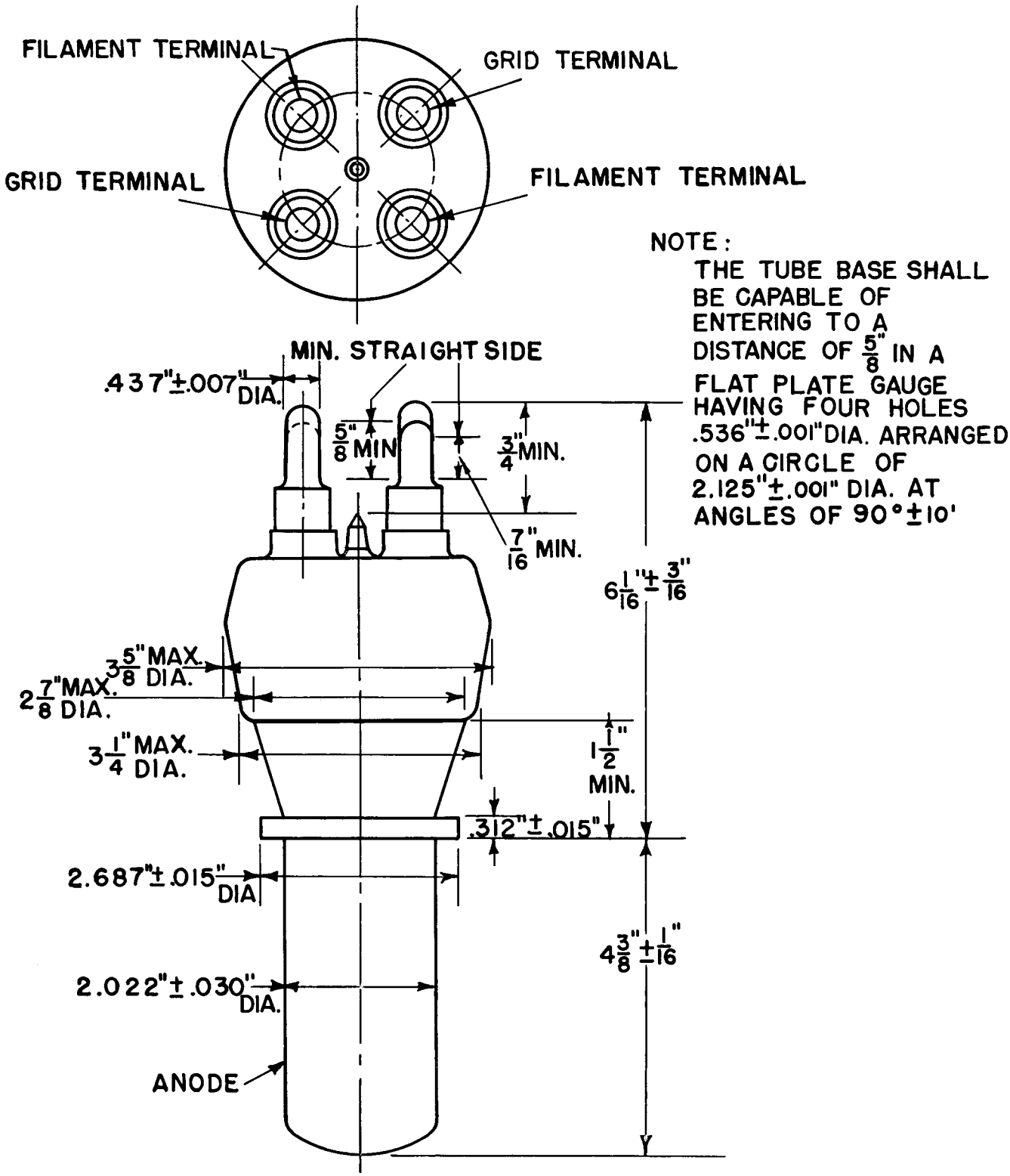
GL-889-A
TYPICAL GRID-PLATE TRANSFER CHARACTERISTIC
$E_f = 11$ VOLTS A-C



K-8074636 9-26-44



K-8074637 9-26-44

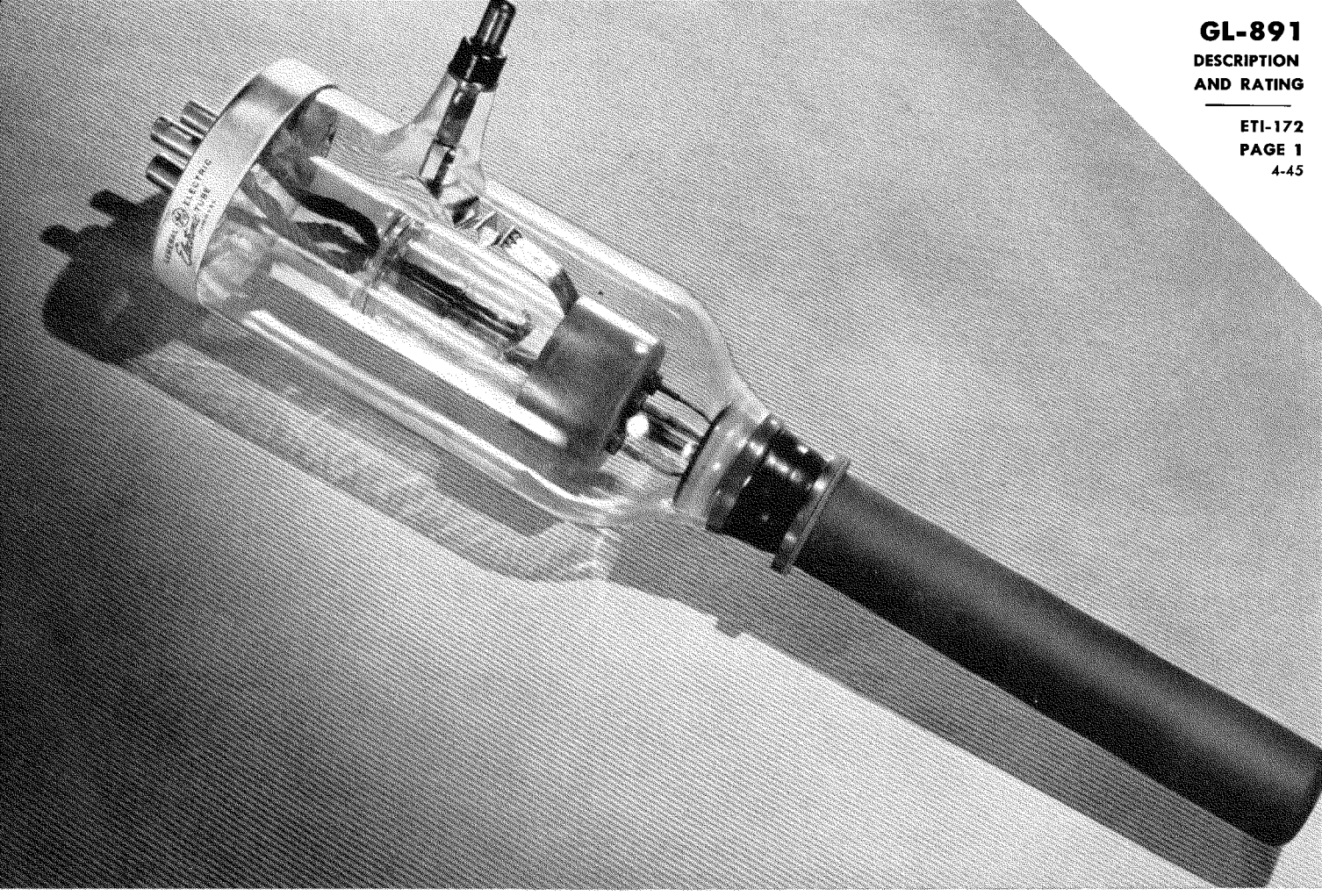


NOTE:
THE TUBE BASE SHALL BE CAPABLE OF ENTERING TO A DISTANCE OF $\frac{5}{8}$" IN A FLAT PLATE GAUGE HAVING FOUR HOLES .536" ± .001" DIA. ARRANGED ON A CIRCLE OF 2.125" ± .001" DIA. AT ANGLES OF 90° ± 10'

OUTLINE
GL-889-A PLIOTRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PLIOTRON

DESCRIPTION

The GL-891 is a three-electrode transmitting tube of the double-filament type for use as a radio-frequency power amplifier, oscillator, Class A modulator and Class B modulator. The construction of the filament permits operation from two-phase or single-phase alternating current as well as from direct current, for all classes of service. The plate is water-cooled and is capable of dissipating 4 to 7.5 kilowatts depending on the service in which the tube is used.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Electrical

Cathode—Filamentary, two-unit type

Excitation, 1ϕ a-c, 2ϕ a-c, or d-c

Voltage, per unit	11	volts
Current, per unit	60	amperes
Amplification factor	8	
Direct interelectrode capacitances, approximate:		
Grid-plate	27	micromicrofarads
Grid-filament	19	micromicrofarads
Plate-filament	2	micromicrofarads

Mechanical

Mounting position ..... vertical, anode down

Cooling: Water flow of 3 to 8 gallons per minute must start before application of any voltages and continue for at least 5 minutes after removal of voltages. Water temperature must not exceed 70 C under any conditions of operation.

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS A AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR

	Typical Operation	Maximum Ratings	
D-c plate voltage		12000	volts
Plate input		7.5	kilowatts
Plate dissipation		7.5	kilowatts
D-c voltage	8000		volts
D-c grid voltage*	−630		volts
Peak a-f grid voltage	700		volts
D-c plate current	0.9		ampere
Load resistance	5200		ohms
U.P.O. (5% second harmonic)	2		kilowatts

CLASS B AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR

D-c plate voltage				15000	volts
Max signal d-c plate current†				2.0	amperes
Max signal plate input†				20	kilowatts
Plate dissipation†				5	kilowatts
D-c plate voltage	6000	10000	12500		volts
D-c grid voltage*	−600	−1100	−1450		volts
Peak a-f grid-to-grid voltage	2200	3400	3960		volts
Zero signal d-c plate current	0.5	0.5	0.4		ampere
Max signal d-c plate current	2.3	3.2	2.8		amperes
Load resistance (per tube)	1250	1600	2500		ohms
Effective load resistance (plate to plate)	5000	6400	10000		ohms
Max signal driving power, approx.	260	324	350		watts
Max signal power output, approx.	8	20	22		kilowatts

Unless otherwise specified, values are for two tubes.

CLASS B RADIO-FREQUENCY POWER AMPLIFIER—TELEPHONY

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D-c plate voltage				15000	volts
D-c plate current				1.0	ampere
Plate input				10	kilowatts
Plate dissipation				6	kilowatts
D-c plate voltage	6000	10000	14000		volts
D-c grid voltage**	−600	−1130	−1600		volts
Peak r-f grid voltage	600	830	1000		volts
D-c plate current	0.7	0.8	0.56		ampere
Driving power, approx.#	82	0	0		watts
Power output, approx.	1	2	2.275		kilowatts

CLASS C PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—TELEPHONY

Carrier conditions per tube for use with a max modulation factor of 1.0

D-c plate voltage				8000	volts
D-c grid voltage				−3000	volts
D-c plate current				1.0	ampere
D-c grid current				0.15	ampere
Plate input				8	kilowatts
Plate dissipation				4	kilowatts
D-c plate voltage		6000	8000		volts
D-c grid voltage		−2000	−2400		volts
Peak r-f grid voltage		2650	3100		volts
D-c plate current		0.75	0.78		ampere
D-c grid current, approximate		0.1	0.08		ampere
Driving power, approx.		260	260		watts
Power output, approx.		3.5	5		kilowatts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER—TELEGRAPHY

Key-down conditions per tube without modulation##

	Typical Operation		Maximum Ratings	
D-c plate voltage			12000	volts
D-c grid voltage			−3000	volts
D-c plate current			2.0	amperes
D-c grid current			0.15	ampere
Plate input			18	kilowatts
Plate dissipation			6	kilowatts
D-c plate voltage	8000	10000		volts
D-c grid voltage	−1800	−2000		volts
Peak r-f grid voltage	2500	2900		volts
D-c plate current	1.1	1.45		ampere
D-c grid current, approx.	0.06	0.105		ampere
Driving power, approx.	150	310		watts
Power output, approx.	6.5	10		kilowatts

†Averaged over any audio-frequency cycle.
*With a-c filament supply.
**With d-c filament supply.
#At crest of a-f cycle with modulation factor of 1.0.
##Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

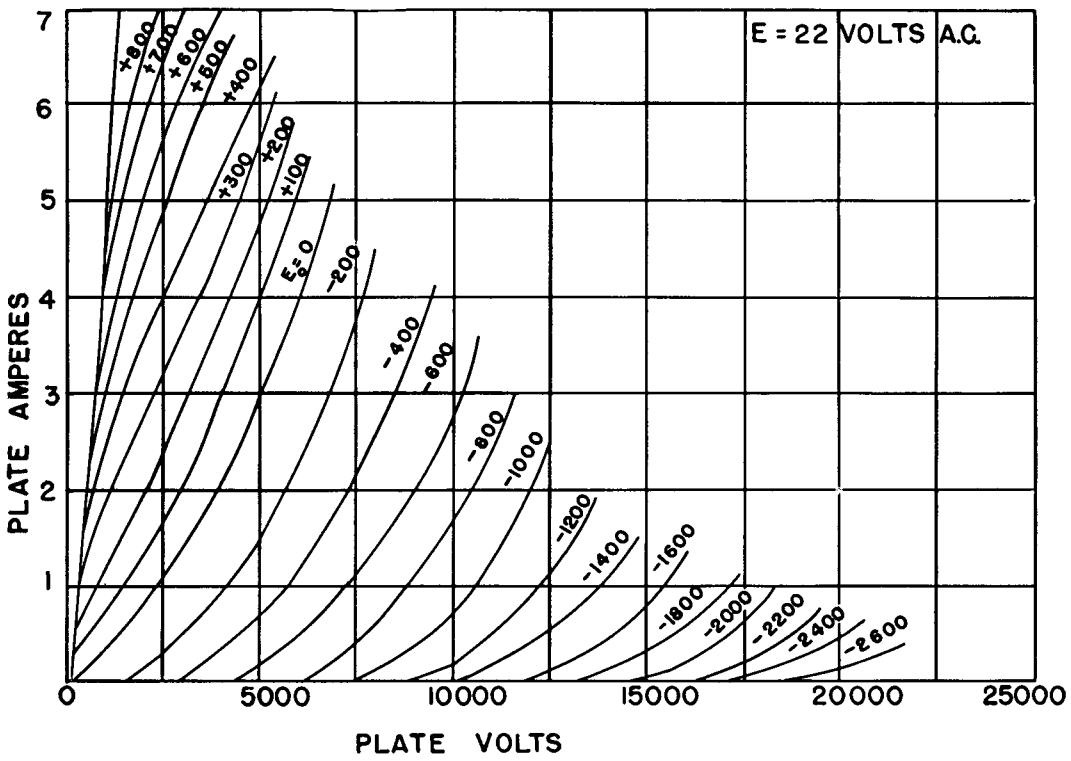
APPLICATION NOTES

GL-891 can be operated at maximum ratings in all classes of service at frequencies as high as 1.6 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised. (Other maximum ratings are the same as shown under MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS.) The tabulation shows the highest percentage of maximum plate voltage and power input that can be used up to 20 mc for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency	1.6	7.5	20	megacycles

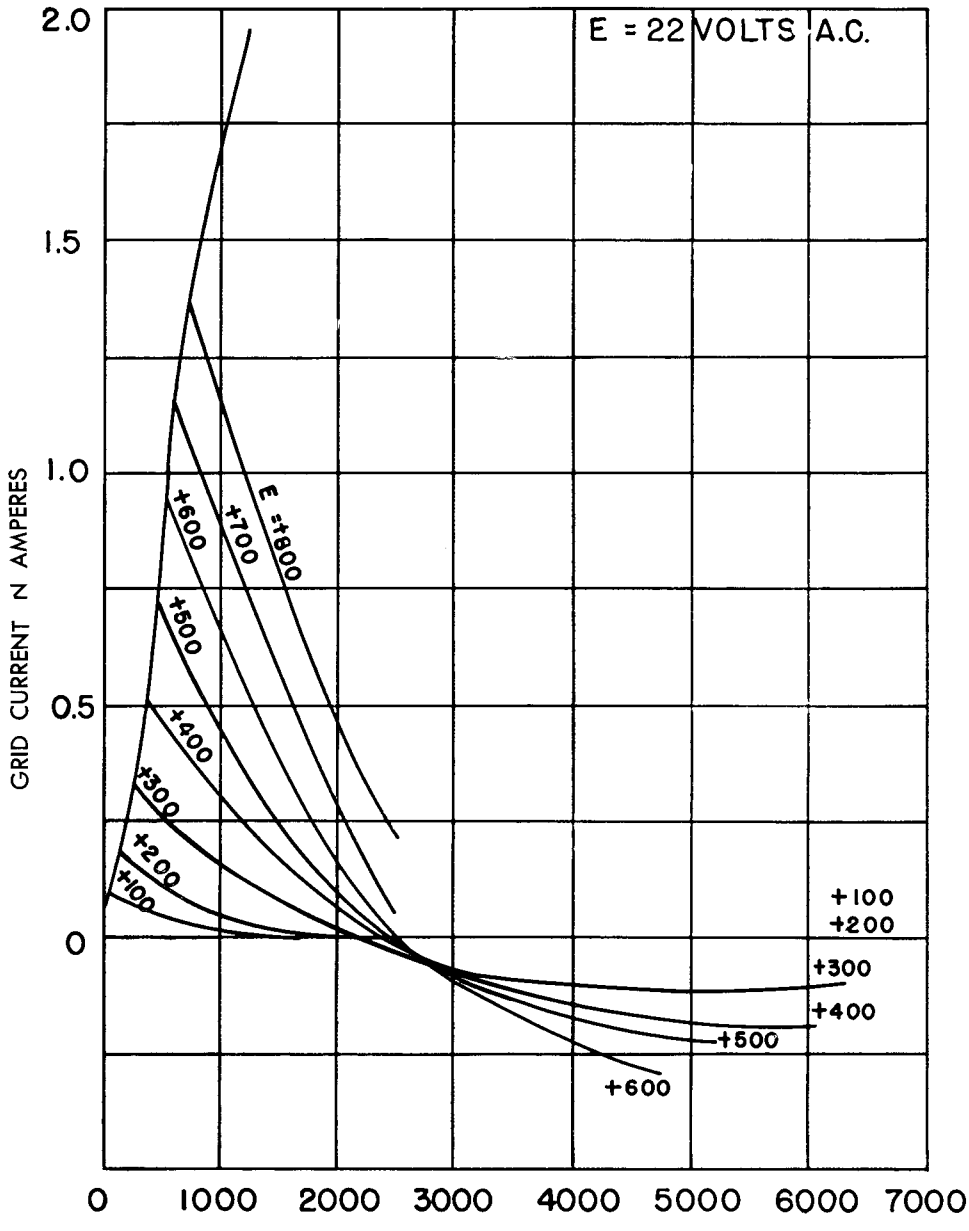
Maximum permissible percentage of maximum rated plate voltage and plate input:

Class B telephony	100	82	72	per cent
Class C (telephony, plate modulated)	100	75	65	per cent
(telegraphy)	100	75	50	per cent



K-8639620 9-25-44

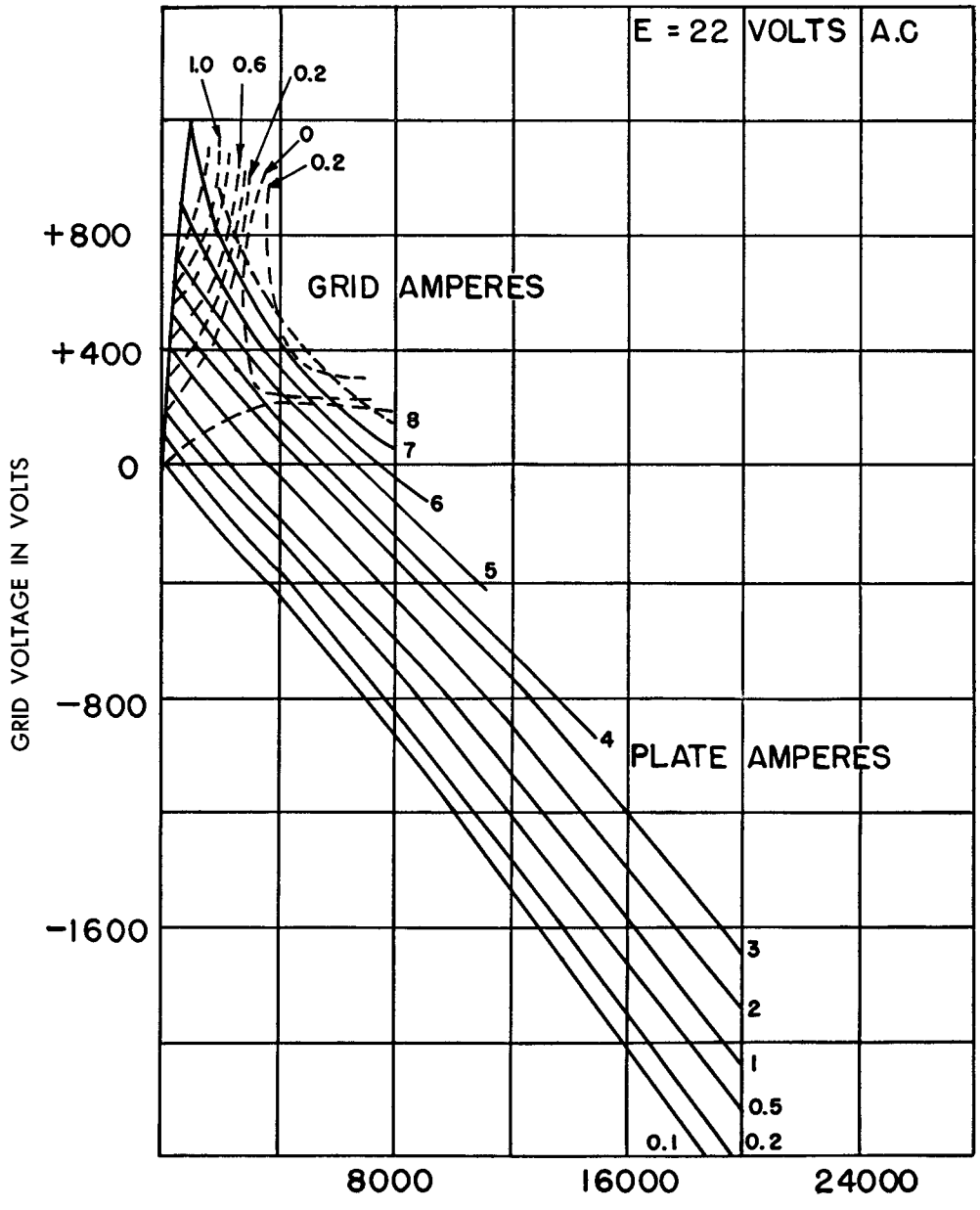
GL-891 AVERAGE PLATE CHARACTERISTICS



GL-891 GRID-CURRENT CHARACTERISTICS ($E_f = 22$ VOLTS A-C)

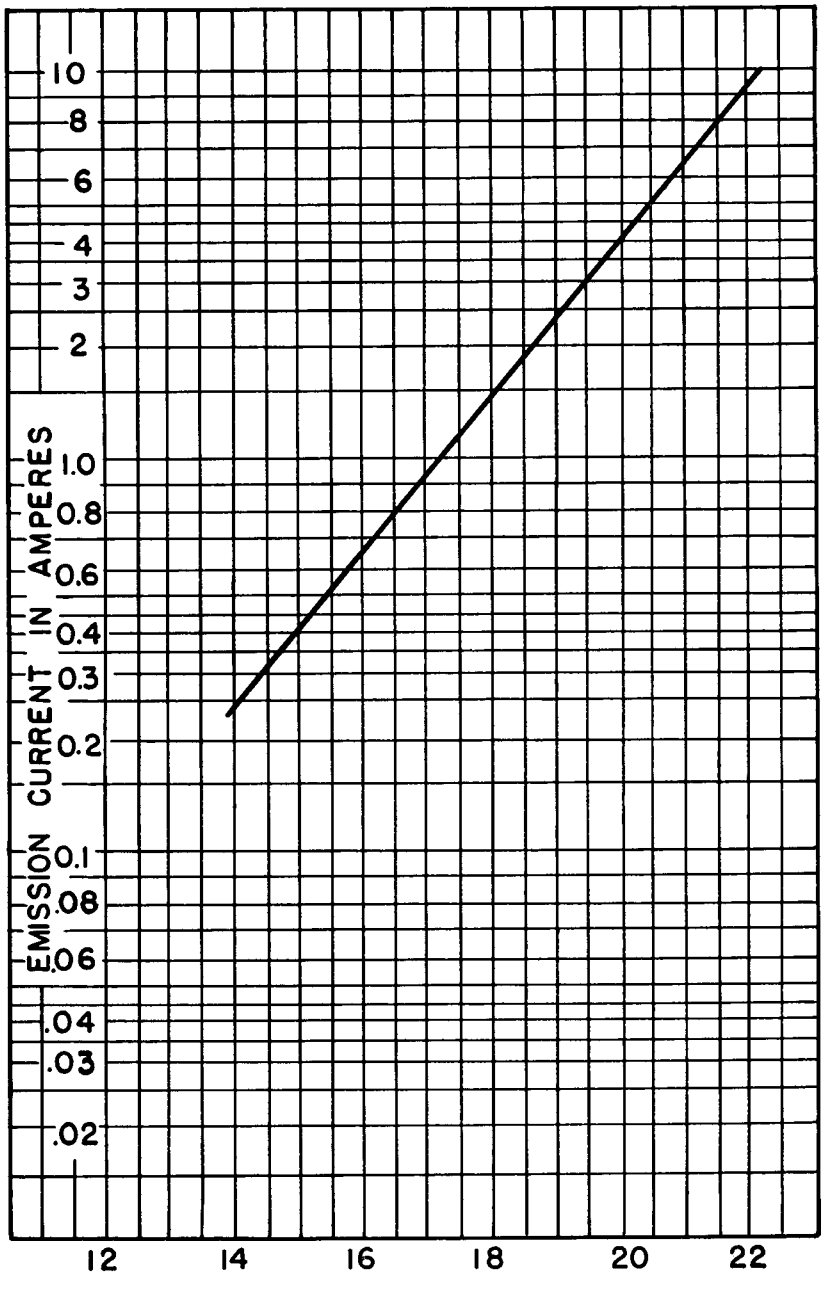
K-8639621

9-25-44



GL-891 CONSTANT CURRENT PLATE AND GRID CHARACTERISTICS ($E_f = 22$ VOLTS A-C)

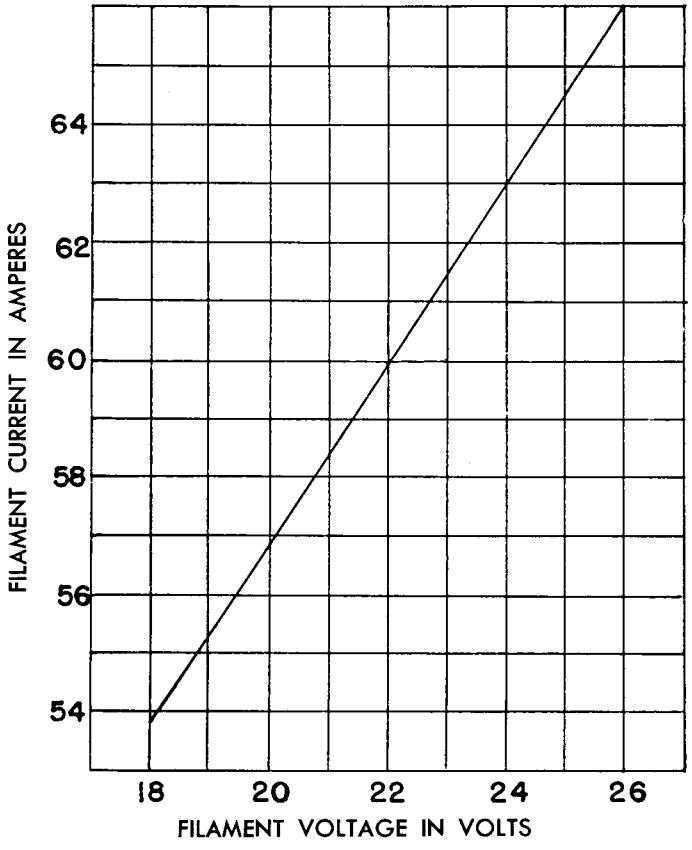
K-8639622 9-25-44



GL-891 AVERAGE FILAMENT EMISSION CHARACTERISTIC

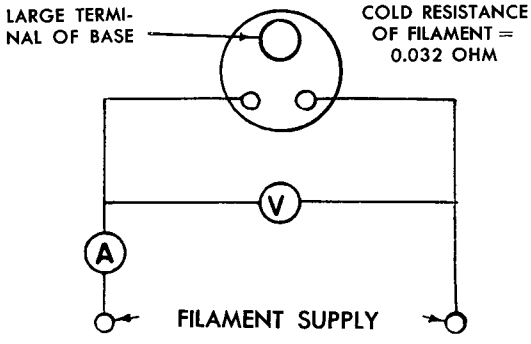
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1-9-45



K-8639398

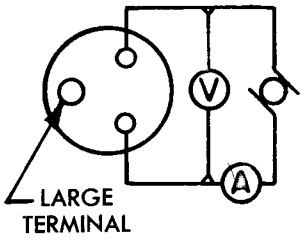
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GL-891 AVERAGE FILAMENT CHARACTERISTIC

WITH D-C EXCITATION

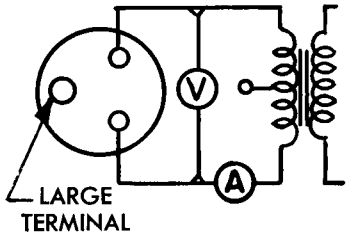
BASE TERMINALS



V = 22 VOLTS
A = 60 AMPERES

WITH SINGLE-PHASE A-C EXCITATION

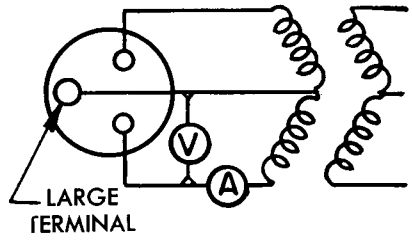
BASE TERMINALS



V = 22 VOLTS
A = 60 AMPERES

WITH TWO-PHASE A-C EXCITATION

BASE TERMINALS

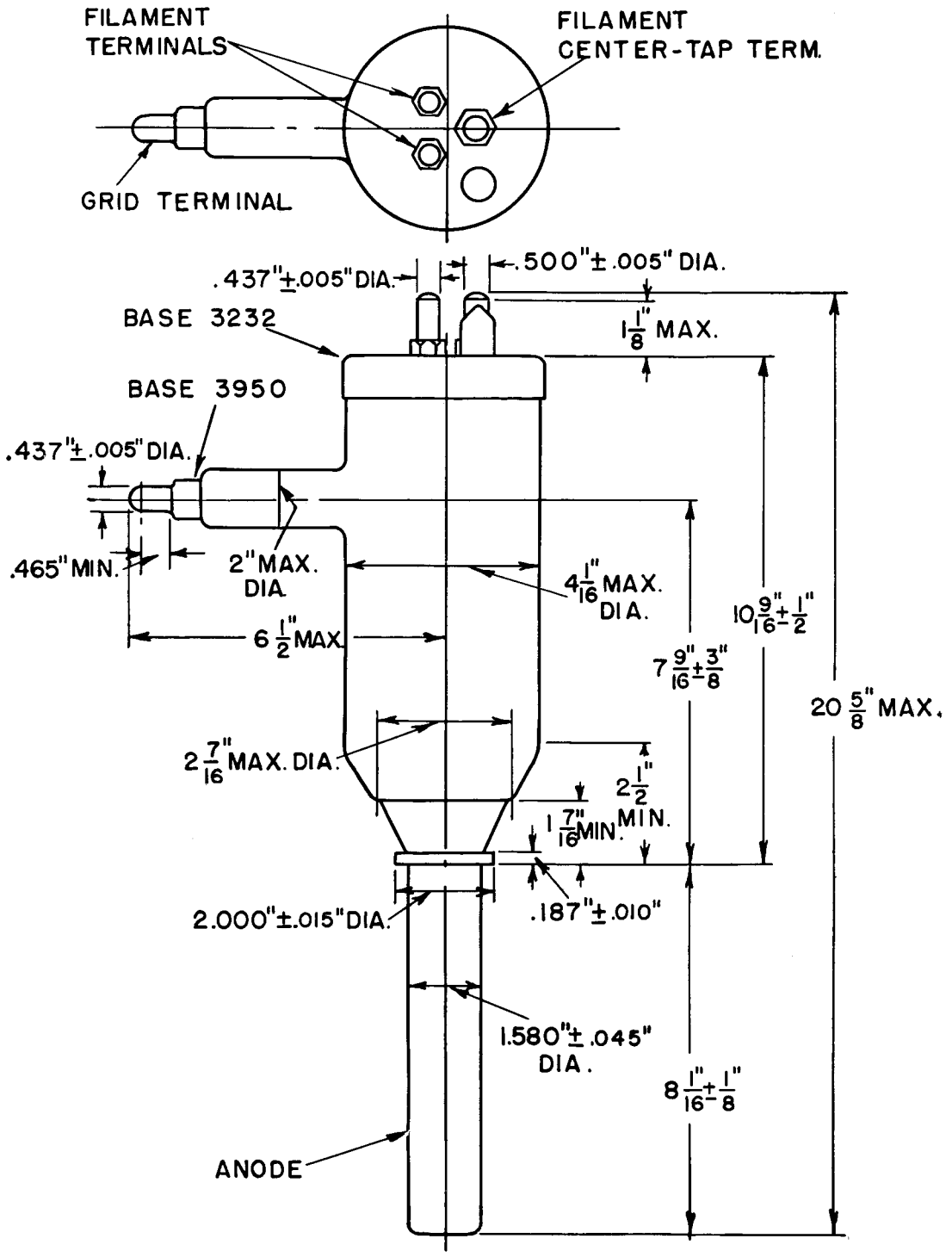


V = 11 VOLTS
A = 60 AMPERES

GL-891 FILAMENT CONNECTIONS

K-9033547

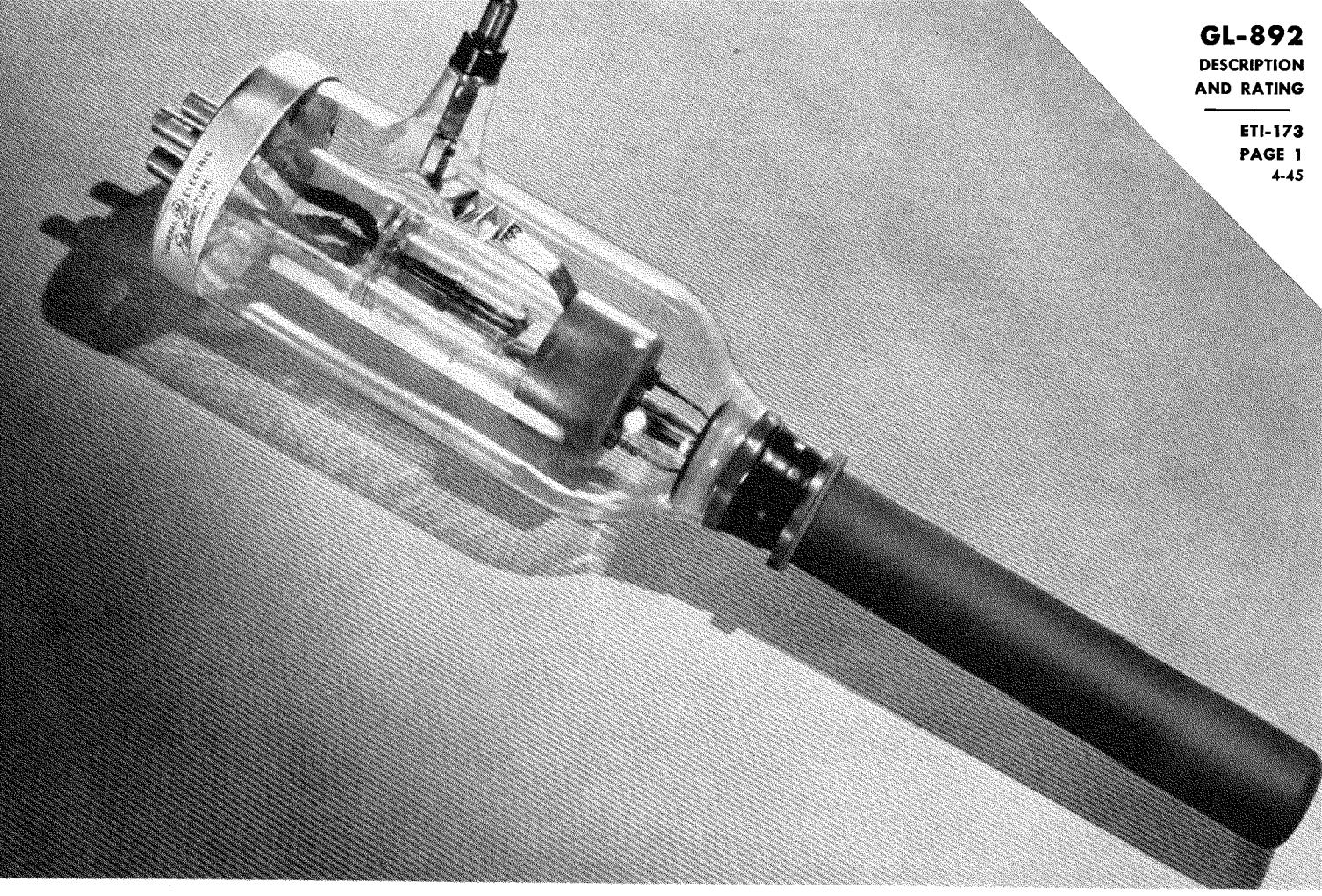
12-1-44



OUTLINE GL-891 PLIOTRON

K-6966979 9-23-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



PLIOTRON

DESCRIPTION

The 892 is a three-electrode pliotron of the double-filament type for use as a radio-frequency power amplifier, oscillator, and Class B modulator. The construction of the filament permits operation from two-phase or single-phase alternating current as well as from direct current, for all classes of service. The plate is water-cooled and is capable of dissipating 6.6 to 10 kilowatts.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Cathode—filamentary, two-unit type		
Excitation 1-phase a-c, 2-phase a-c, or d-c		
Voltage, per unit	11	volts
Current	60	amperes
Amplification factor	50	
Direct interelectrode capacitances		
Grid-plate	30	micromicrofarads
Grid-filament	20	micromicrofarads
Plate-filament	1.5	micromicrofarads
Frequency for maximum ratings	1.6	megacycles

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

Type of cooling	water
Maximum outlet temperature	70 centigrade
Water flow	3 to 8 gallons per minute
Gasket	cat. no. 5182028P3
Net weight, approximate	3 pounds
Shipping weight, approximate	10 pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS B AUDIO-FREQUENCY POWER AMPLIFIER (TWO TUBES)

D-c plate voltage			15000	volts
Max-signal d-c plate current*			2.0	amperes
Max-signal plate input*			20	kilowatts
Plate dissipation			7.5	kilowatts
Typical operation:				
Unless otherwise specified, values are for 2 tubes.				
D-c plate voltage	6000	10000	12500	volts
D-c grid voltage†	0	−90	−170	volts
Peak a-f grid-to-grid voltage	1200	1620	1530	volts
Zero-signal d-c plate current	0.5	0.5	0.4	ampere
Max-signal d-c plate current	2.5	3.2	2.8	amperes
Load resistance (per tube)	1050	1600	2500	ohms
Effective load resistance (plate-to-plate)	4200	6400	10000	ohms
Max-signal driving power, approximate	415	525	420	watts
Max-signal power output, approximate	8	20	22	kilowatts

CLASS B RADIO-FREQUENCY POWER AMPLIFIER

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D-c plate voltage			15000	volts
D-c plate current			1.0	amperes
Plate input			15	kilowatts
Plate dissipation			10	kilowatts
Typical operation:				
D-c plate voltage	6000	10000	14000	volts
D-c grid voltage†	0	−100	−190	volts
Peak r-f grid voltage	300	470	510	volts
D-c plate current	0.67	0.93	0.95	amperes
Driving power°, approximate	65	50	30	watts
Power output, approximate	1	2.5	4	kilowatts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—PLATE-MODULATED

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D-c plate voltage			10000	volts
D-c grid voltage			−3000	volts
D-c plate current			1.0	ampere
D-c grid current			0.25	ampere
Plate input			10	kilowatts
Plate dissipation			6.6	kilowatts
Typical operation:				
D-c plate voltage	6000	8000	10000	volts
D-c grid voltage	−1000	−1300	−1600	volts
Peak r-f grid voltage	1675	2000	2400	volts
D-c plate current	0.77	0.75	0.72	ampere
D-c grid current, approximate	0.19	0.18	0.12	ampere
Driving power, approximate	310	350	260	watts
Power output, approximate	3.5	5	6	kilowatts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Key-down conditions per tube wihout modulation††

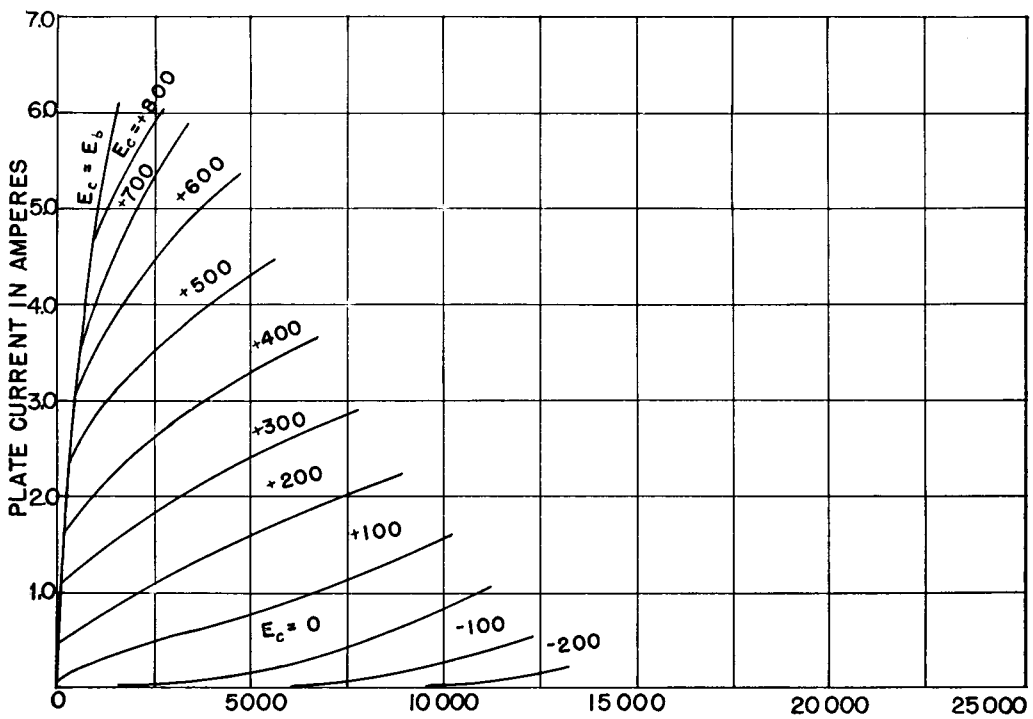
D-c plate voltage			15000	volts
D-c grid voltage			−3000	volts
D-c plate current			2.0	amperes
D-c grid current			0.25	ampere
Plate input			30	kilowatts
Plate dissipation			10	kilowatts
Typical operation:				
D-c plate voltage	8000	10000	12000	volts
D-c grid voltage	−1000	−1300	−1600	volts
Peak r-f grid voltage	1800	2300	2800	volts
D-c plate current	1.1	1.4	1.64	amperes
D-c grid current, approximate	0.18	0.18	0.18	ampere
Driving power, approximate	320	400	500	watts
Power output, approximate	6.5	10	14	kilowatts

*Averaged over any audio-frequency cycle of sine-wave form.
†With d-c filament supply.
°At crest of a-f cycle with modulation factor of 1.0.
††Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

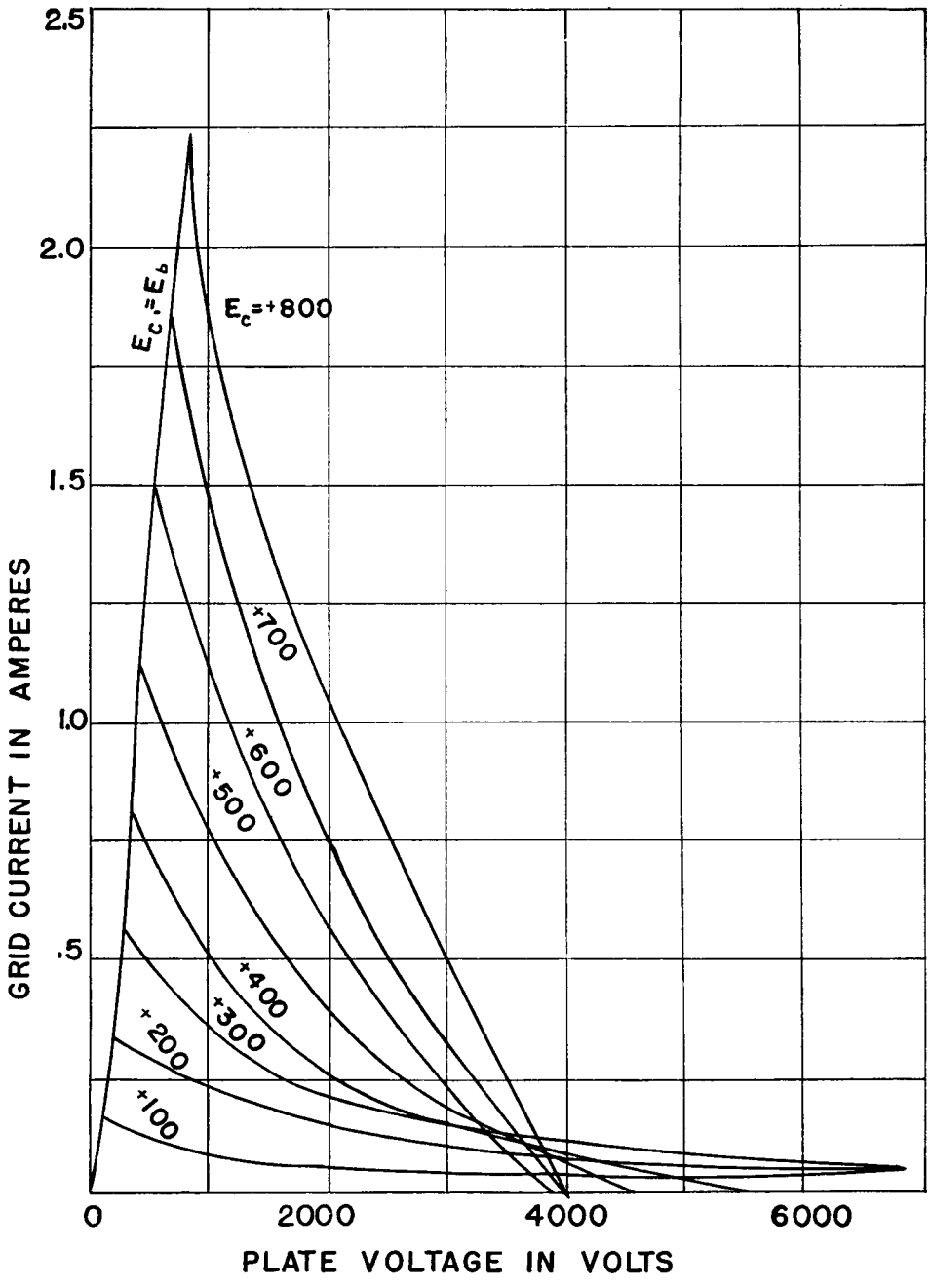
APPLICATION NOTES

GL-892 can be operated at maximum ratings in all classes of service at frequencies as high as 1.6 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised (other maximum ratings are the same as shown under MAXIMUM RATING). The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used up to 20 mc for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency	1.6	7.5	20	megacycles
Maximum permissible percentage of maximum rated plate voltage and plate input:				
Class B telephony	100	85	76	per cent
Class C plate-modulated	100	85	75	per cent
Class C unmodulated	100	75	50	per cent



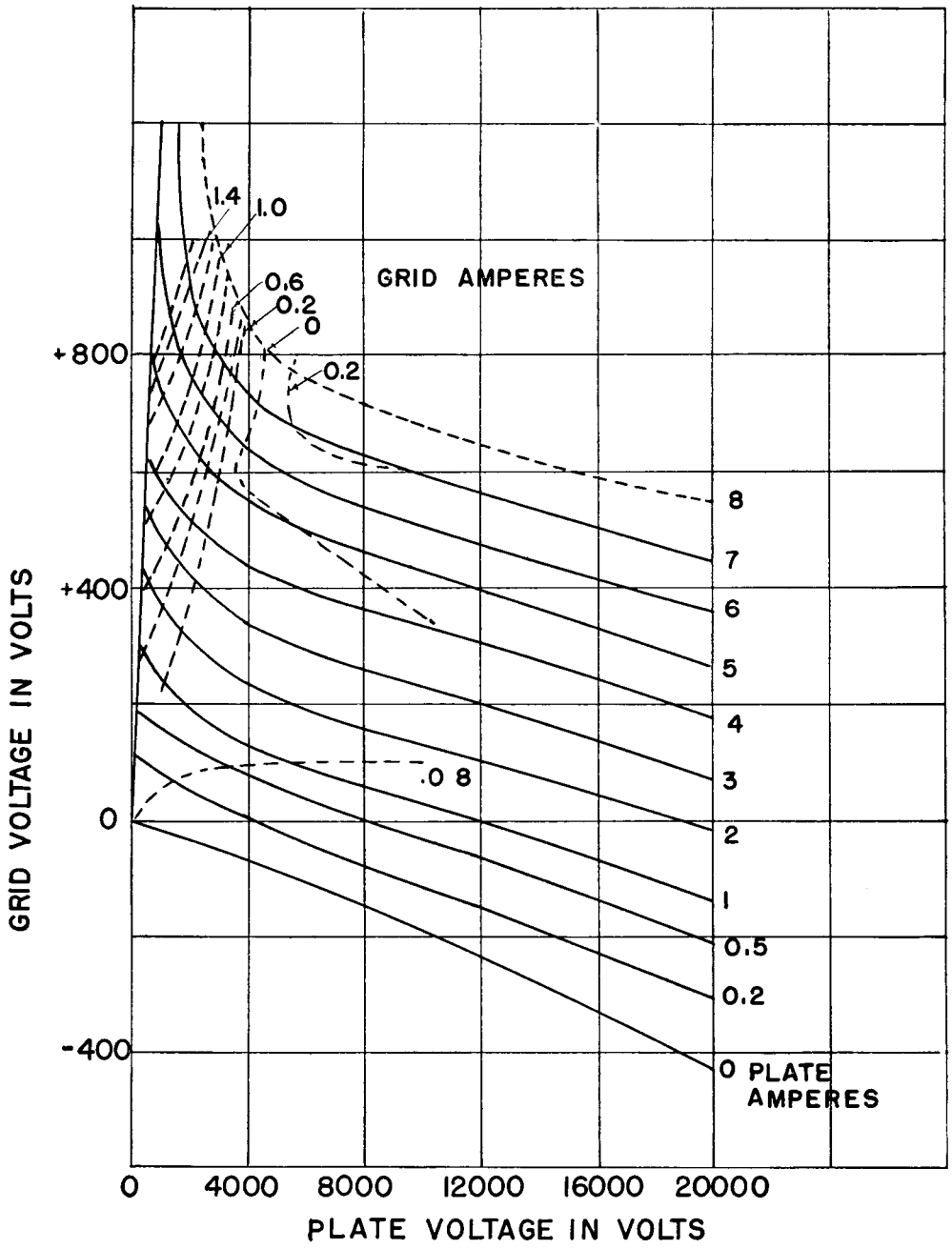
GL-892 AVERAGE PLATE CHARACTERISTICS (E_f = 22 VOLTS A-C)



GL-892 GRID-CURRENT CHARACTERISTICS (E_f = 22 VOLTS A-C)

K-8639395

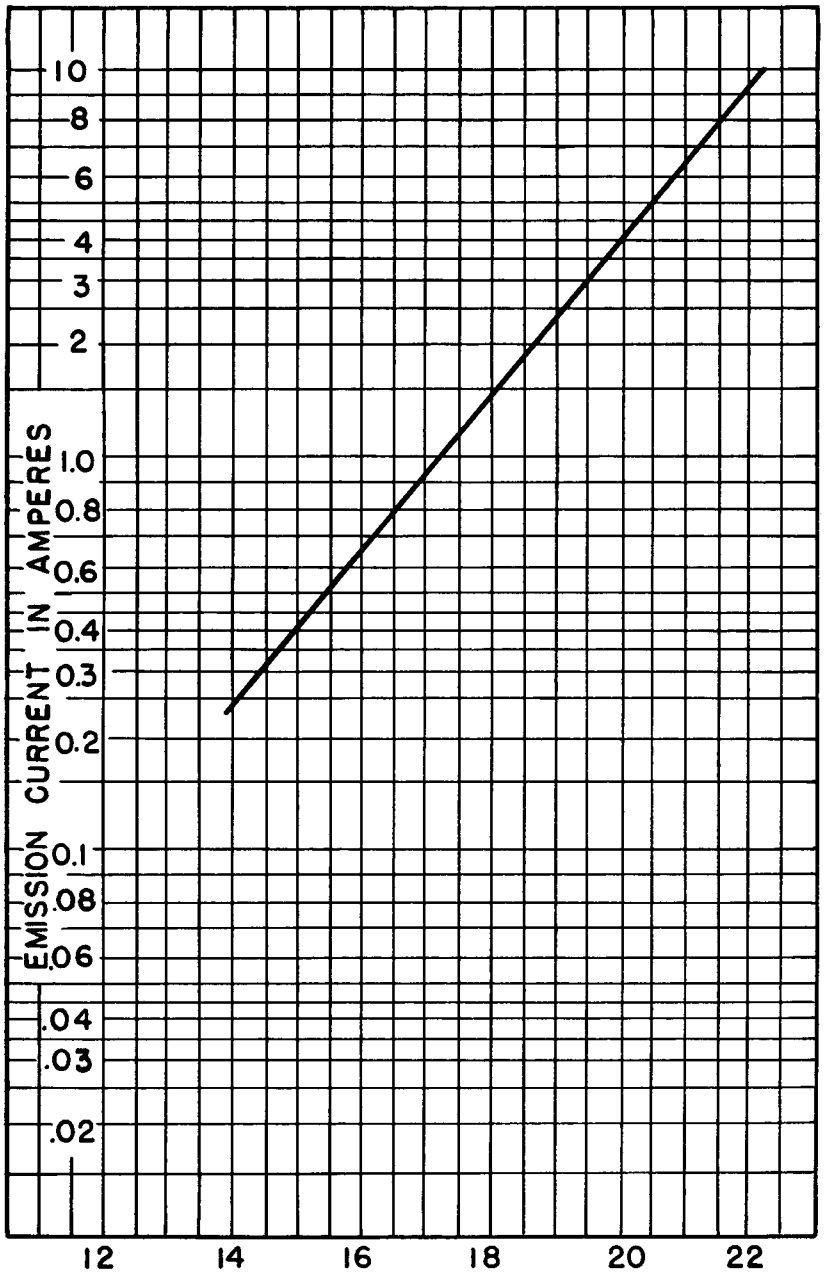
9-28-44



GL-892 CONSTANT CURRENT PLATE AND GRID CHARACTERISTICS (E_f = 22 VOLTS A-C)

K-8639395

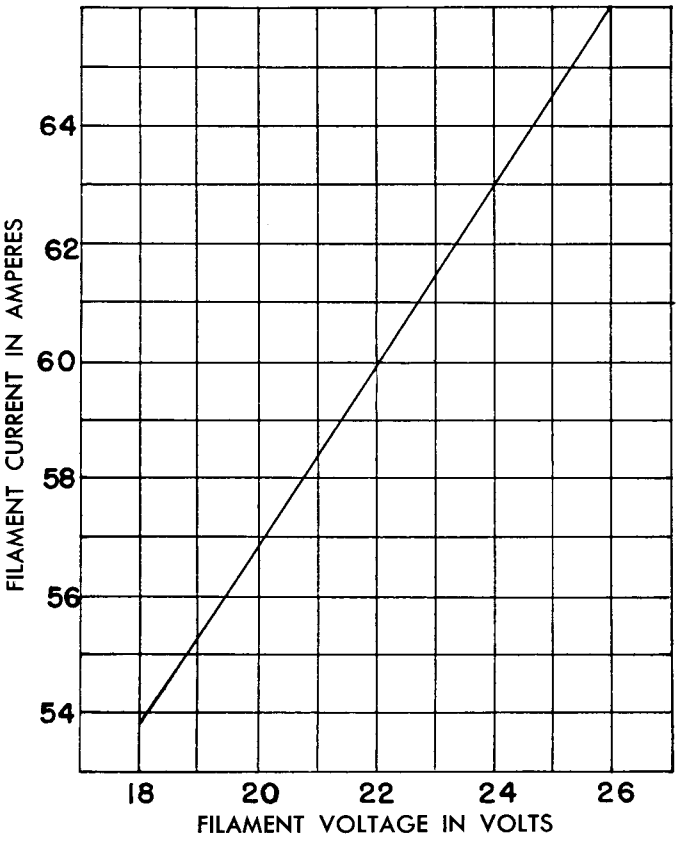
9-28-44

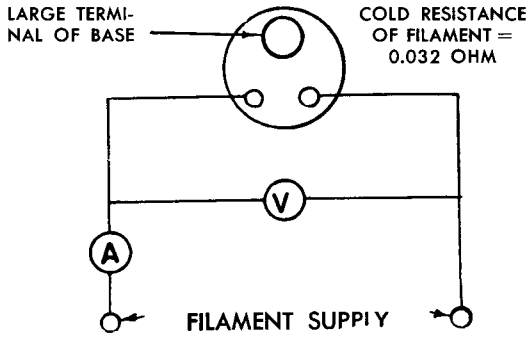


GL-892 AVERAGE FILAMENT EMISSION CHARACTERISTIC

K-9033591

1-9-45



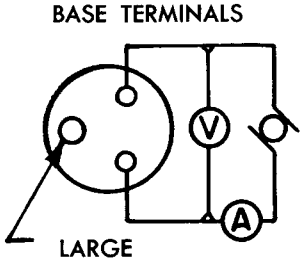


K-8639398

11-2-44

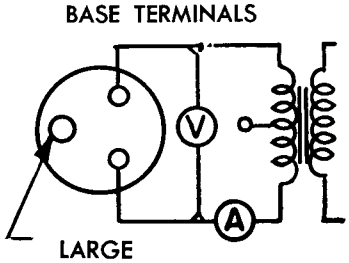
GL-892 AVERAGE FILAMENT CHARACTERISTICS

WITH D-C EXCITATION



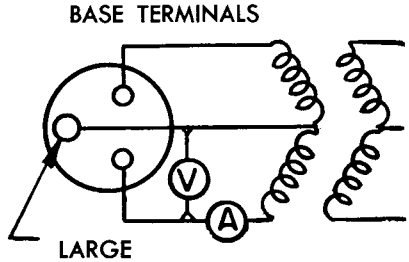
V = 22 VOLTS
A = 60 AMPERES

WITH SINGLE-PHASE A-C EXCITATION



V = 22 VOLTS
A = 60 AMPERES

WITH TWO-PHASE A-C EXCITATION

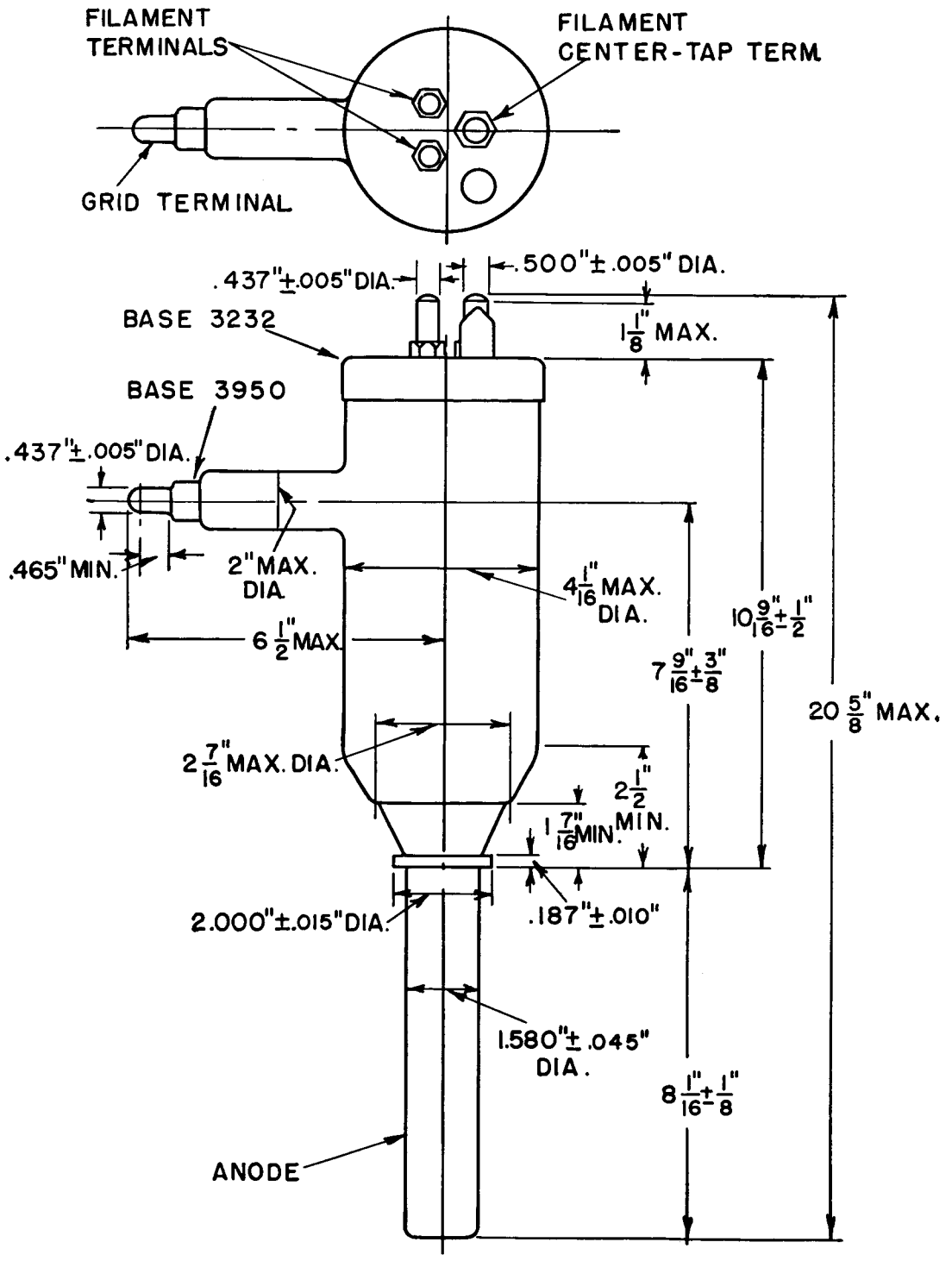


V = 11 VOLTS
A = 60 AMPERES

GL-892 FILAMENT CONNECTIONS

K-9033547

12-1-44



OUTLINE GL-892 PLIOTRON

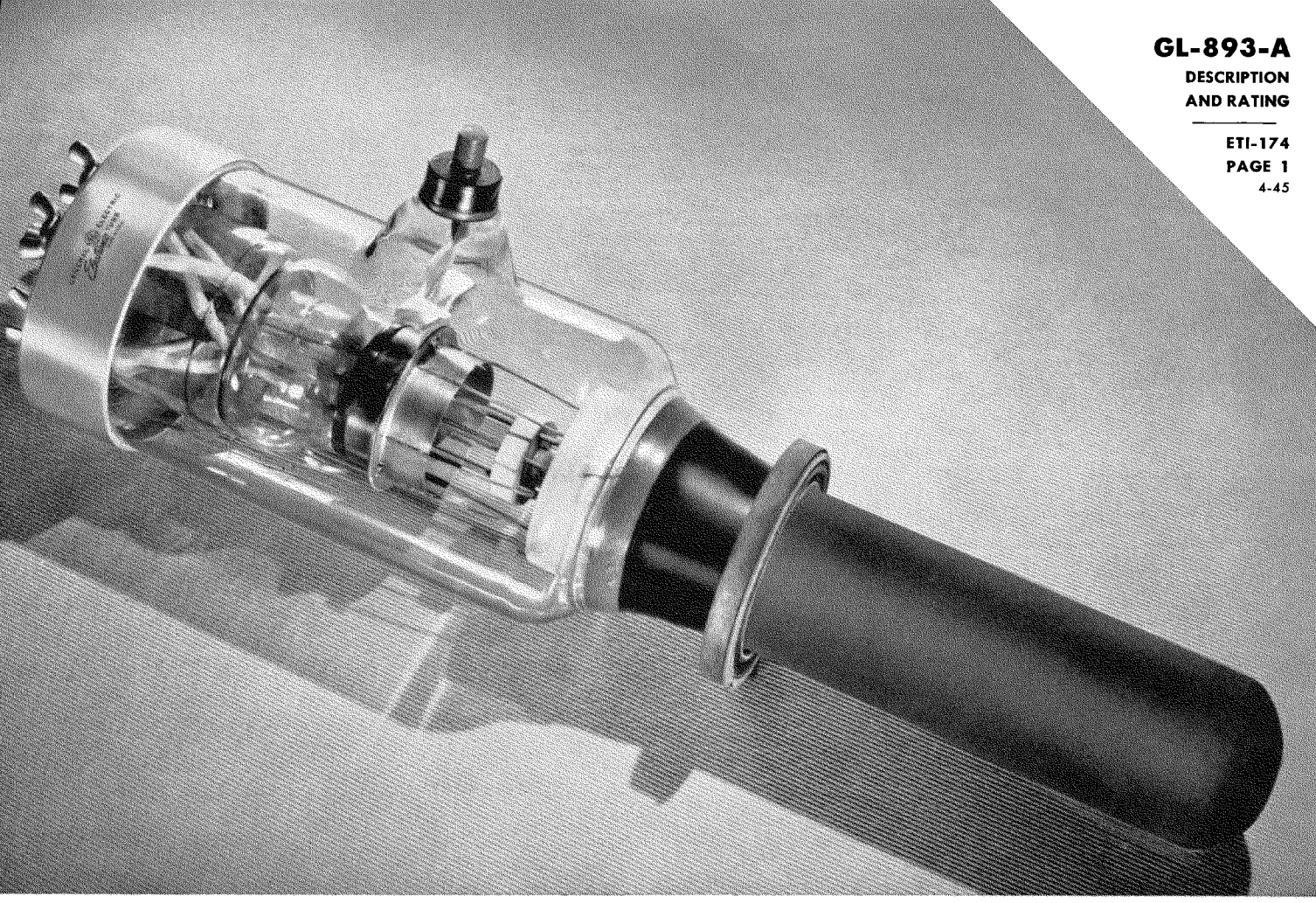
K-6966979 9-23-44

NOTE: Mounting position vertical, anode down.

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PLIOTRON

DESCRIPTION

The GL-893-A is a three-electrode, water-cooled vacuum tube designed for use as a radio-frequency amplifier, oscillator, or Class B modulator. A particular advantage of this tube is the unique construction of the filament which permits operation from single-phase, three-phase, or six-phase alternating current, or from direct current, for all classes of service.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Electrical

Filament voltage, per strand	10	volts
Filament current, per terminal	61	amperes

Average Characteristics

Amplification factor (E_b = 15 kv, I_b = 1.0 amp, E_c = −300, E_f = 20 a-c)	36	
Grid-plate transconductance (E_b = 15 kv, I_b = 1.0 amp, E_c = −300, E_f = 20 a-c)	16000	micromhos
Direct interelectrode capacitances:		
Grid-plate	33	micromicrofarads
Input	48	micromicrofarads
Output	3.0	micromicrofarads
Frequency for maximum ratings	5	megacycles

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

Type of cooling	water and forced air
Maximum outlet temperature	70 centigrade
Water flow	8–15 gal per min
Air flow to stem	2 cu ft per min
Gasket	Cat. no. 5182028P2
Net weight, approx	12 pounds
Shipping weight, approx	27 pounds
Operating position	vertical, anode down

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS B AUDIO-FREQUENCY POWER AMPLIFIER (TWO TUBES)

D-c plate voltage	12000	15000	18000	20000 max volts
Max signal plate current, per tube*				4.0 max amperes
D-c max signal plate input, per tube*				60 max kilowatts
Plate dissipation, per tube*				20 max kilowatts
D-c grid voltage	−260	−350	−450	volts
Peak a-f grid input voltage	1480	1560	1720	volts
Zero signal plate current	0.8	0.8	0.8	ampere
Max signal plate current	7.0	6.0	5.5	amperes
Max signal plate input*	84.0	90.0	99.0	kilowatts
Max signal driving power, approx	220	190	140	watts
Effective load resistance, plate-to-plate	4000	6000	8000	ohms
Max signal plate power output	52.0	60.0	70.0	kilowatts

CLASS B RADIO-FREQUENCY POWER AMPLIFIER

Carrier conditions per tube for use with a max modulation factor of 1.0

D-c plate	12000	15000	15000	20000 max volts
D-c grid voltage	−250	−340	−340	volts
D-c plate current	1.5	1.5	2.0	2.0 max amperes
Plate input				32 max kilowatts
Plate dissipation				20 max kilowatts
Peak r-f grid input voltage	350	395	450	volts
Driving power, approx**	130	150	200	watts
Plate power output	6	7.5	10	kilowatts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—PLATE-MODULATED

Carrier conditions per tube for use with a max modulation factor of 1.0

D-c plate voltage	10000	10000	12000	12000 max volts
D-c grid voltage	−800	−800	−1000	−3000 max volts
D-c plate current	1.5	2.0	2.0	2.0 max amperes
D-c grid current, approx	0.10	0.16	0.14	0.4 max ampere
Plate input				24 max kilowatts
Plate dissipation				12 kilowatts
Peak r-f grid input voltage, approx	1200	1280	1500	volts
Driving power, approx	120	210	210	watts
Plate power output	11	15	18	kilowatts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Key-down conditions per tube without modulation#

D-c plate voltage	12000	15000	18000	20000 max volts
D-c grid voltage	−800	−900	−1000	−3000 max volts
D-c plate current	3.5	3.6	3.6	4.0 max amperes
D-c grid current, approx	0.26	0.25	0.21	0.4 max ampere
Plate input				70 max kilowatts
Plate dissipation				20 max kilowatts
Peak r-f grid input voltage, approx	1430	1520	1630	volts
Driving power, approx	360	370	340	watts
Plate power output	30	40	50	kilowatts

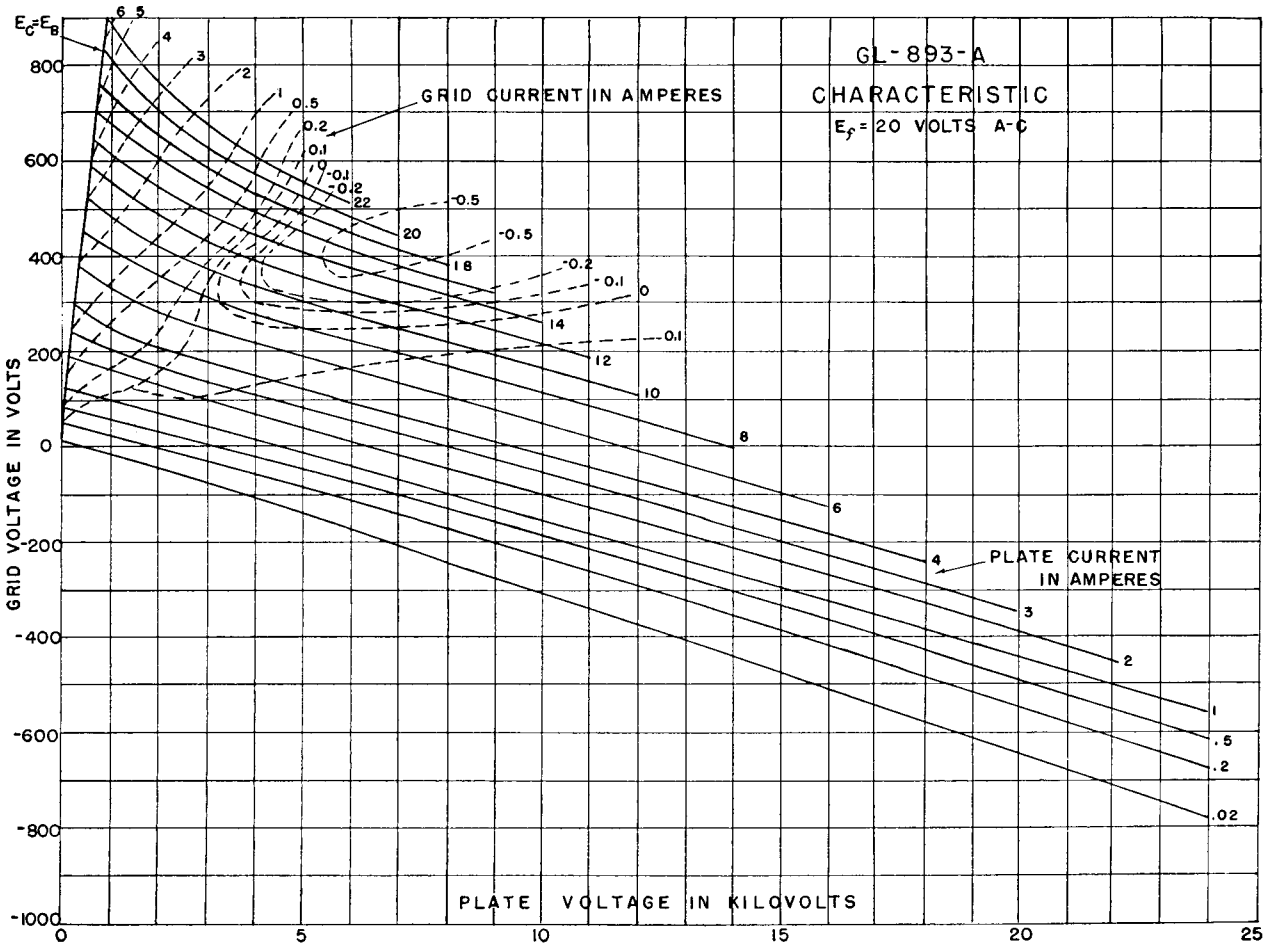
*Averaged over any audio-frequency cycle.
**At crest of audio-frequency cycle.
#Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

APPLICATION NOTES

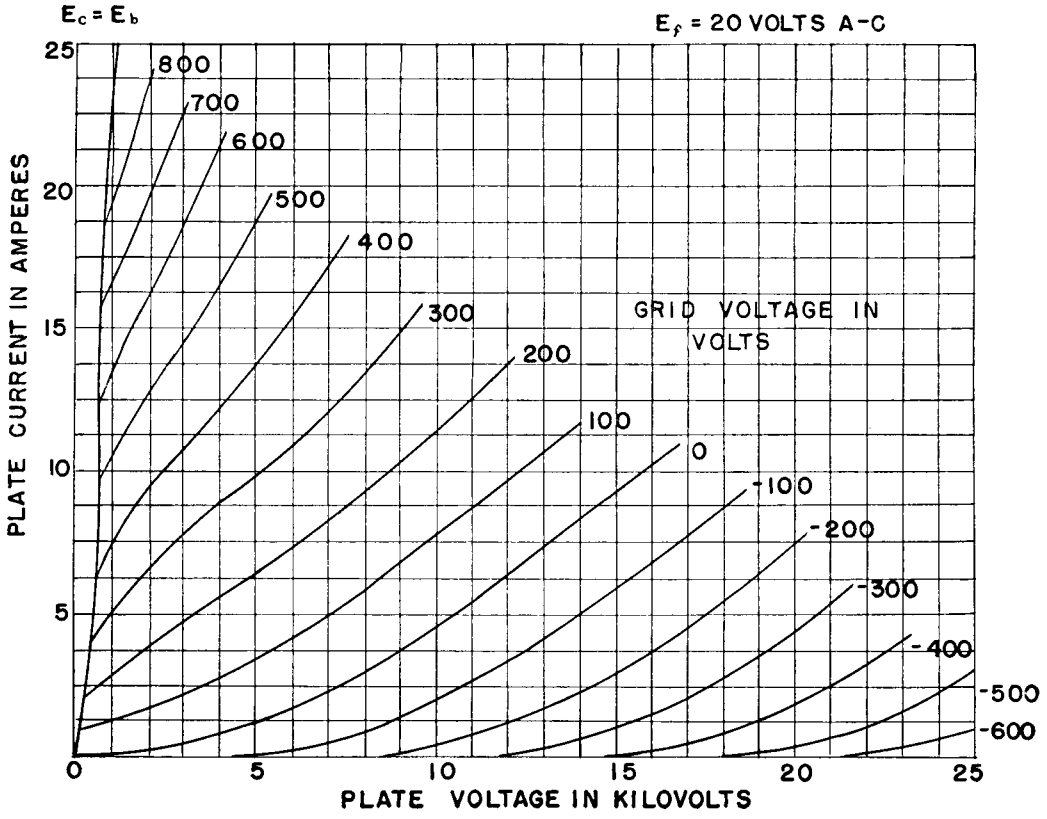
GL-893-A can be operated at maximum ratings in all classes of service at frequencies as high as 5 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised. (Other maximum ratings are the same as shown under CHARACTERISTICS and RATINGS.) The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used up to 40 megacycles for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

FREQUENCY	5	20	40	megacycles
Maximum permissible percentage of maximum rated plate voltage and plate input:				
Class B radio-frequency				
Plate voltage	100	85	65	per cent
Plate input	100	82	73	per cent
Class C plate-modulated				
Plate voltage	100	80	64	per cent
Plate input	100	75	64	per cent
Class C				
Plate voltage	100	80	60	per cent
Plate input	100	66	50	per cent

Plate series protective resistors						
Series resistor	10	20	40	80	100	ohms
Maximum power output of rectifier	40	100	250	640	1600	kilowatts

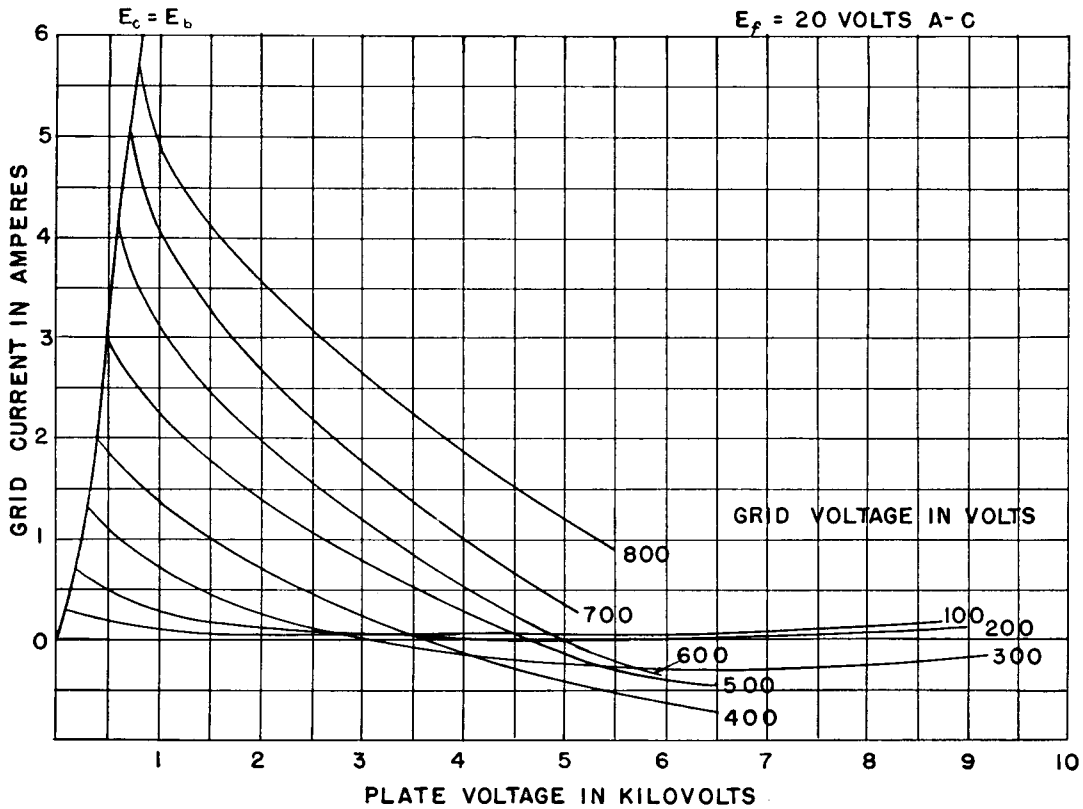


GL-893-A AVERAGE PLATE CHARACTERISTIC



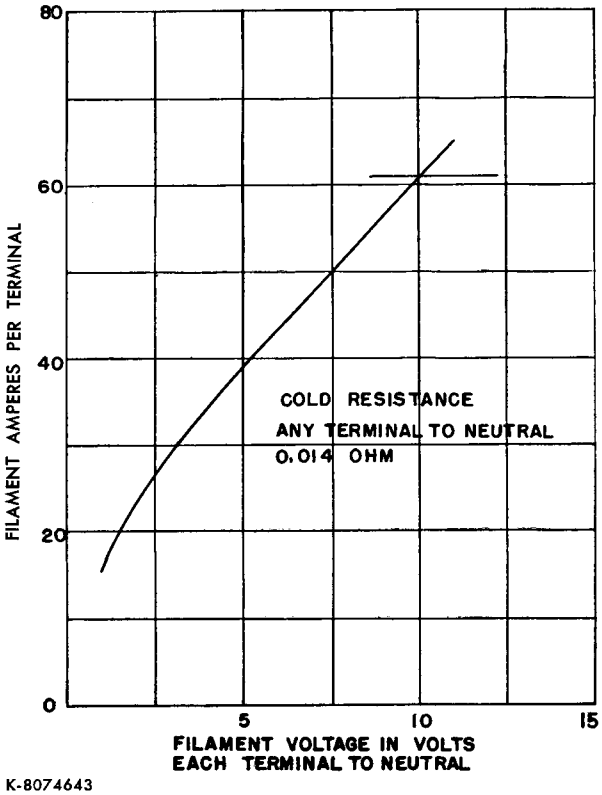
K-8074645 5-6-44

GL-893-A TYPICAL GRID-PLATE TRANSFER CHARACTERISTIC



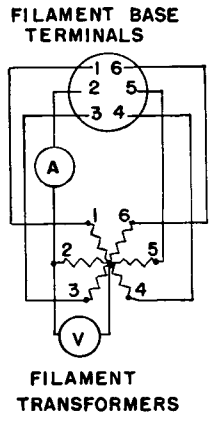
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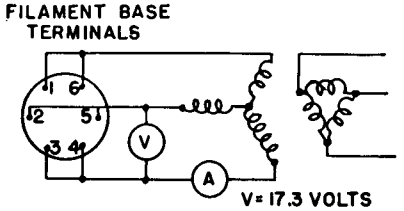
GL-893-A AVERAGE FILAMENT CHARACTERISTIC



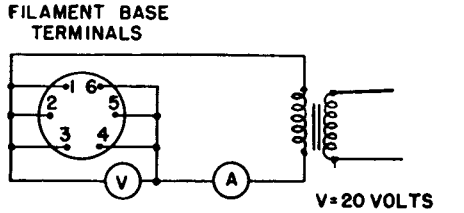
K-8074643

5-6-44

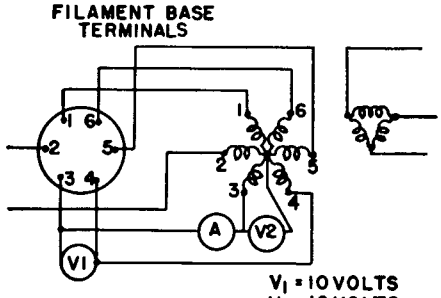




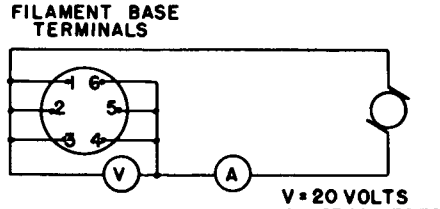
THREE-PHASE A-C FILAMENT EXCITATION



SINGLE-PHASE A-C FILAMENT EXCITATION



SIX-PHASE A-C FILAMENT EXCITATION



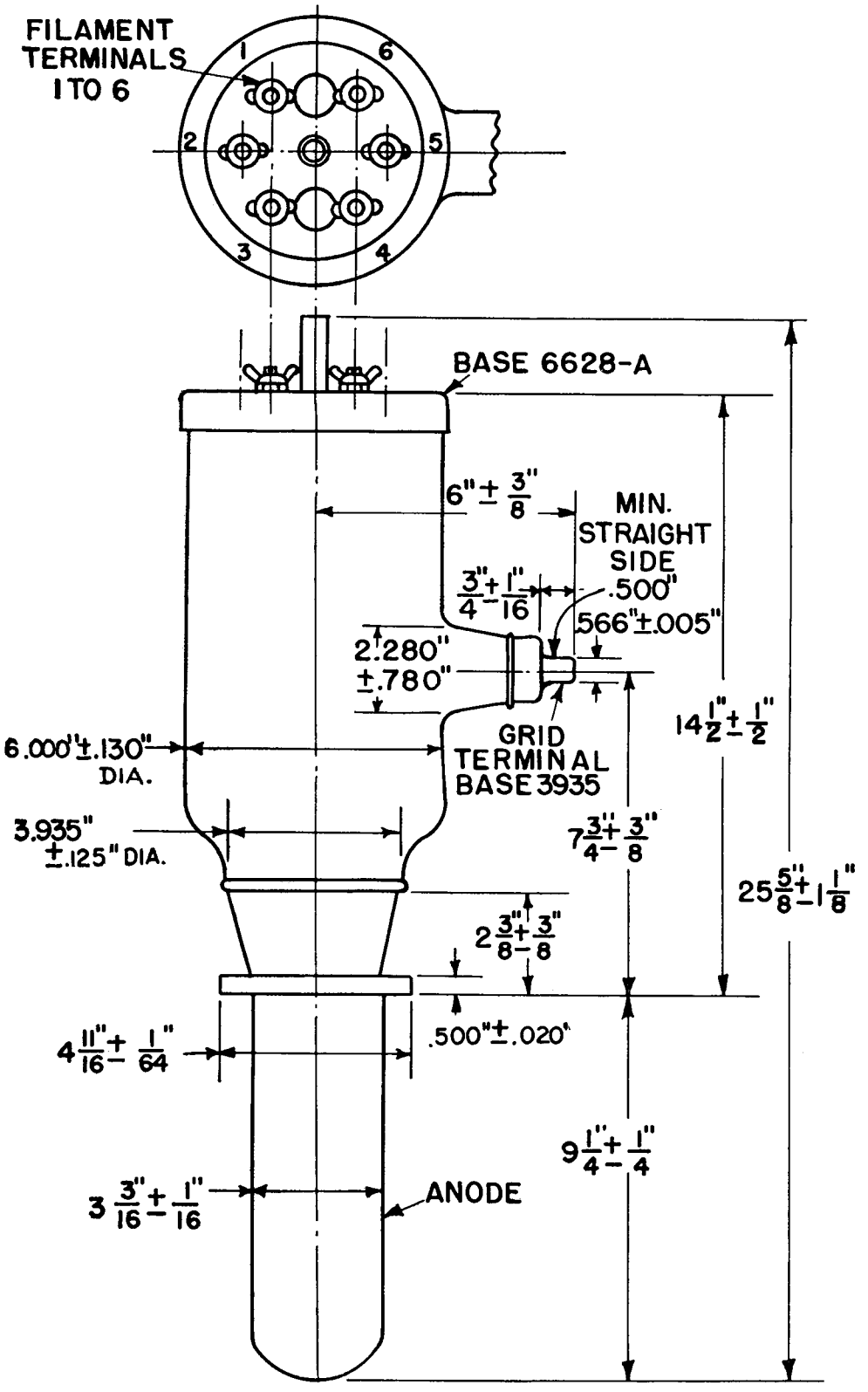
D-C FILAMENT EXCITATION

NOTE: TERMINALS MUST BE CONNECTED IN CORRECT PHASE RELATION AS SHOWN

K-8639686

10-28-44

GL-893-A FILAMENT CONNECTIONS



K-5344783

OUTLINE GL-893-A PLIOTRON

12-30-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

GE12661

The GE12661 is a planar triode of ceramic-metal construction primarily intended for use as a long life power oscillator. This tube is designed to perform in applications requiring high current densities at lower voltages, with a low input to grid-plate capacitance ratio to provide extra feedback in self excited oscillators.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	Eg V	Rk Ohms
Heater Voltage, AC or DC*	6.0	6.3	6.6	Volts					
Heater Current	222	240	258	Milliamperes	6.3	---	---	---	---
Plate Current	18	25	32	Milliamperes	6.3	150	---	0	---
Amplification Factor	30	40	50		6.3	150	---	0	---
Transconductance	6500	8500	---	Micromhos	6.3	150	---	0	---
Grid Voltage, Cutoff	---	-5	-8	Volts	6.3	150	0.1	---	---
Direct Interelectrode Capacitances•									
Grid to Plate: (g to p)	1.15	1.35	1.55	pf					
Input: g to (h+k)	1.3	1.6	1.9	pf					
Output: p to (h+k)	---	0.015	0.023	pf					
Cathode Heating Time	60	---	---	Seconds					

UHF OSCILLATOR SERVICE

Frequency	450	Megahertz
DC Plate Voltage	300	Volts
Grid Resistor	Adjusted	
Plate Current	30	Milliamperes
Grid Current	10	Milliamperes
Power Output	6	Watts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

• Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Plate Voltage	350	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	4	Watts
DC Grid Current	15	Milliamperes
DC Cathode Current	40	Milliamperes
Peak Cathode Current	120	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance	10000	Ohms
Envelope Temperature at Hottest Point▲	250	°C
Temperature Differential Between Two Adjacent Electrodes♦	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	10	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

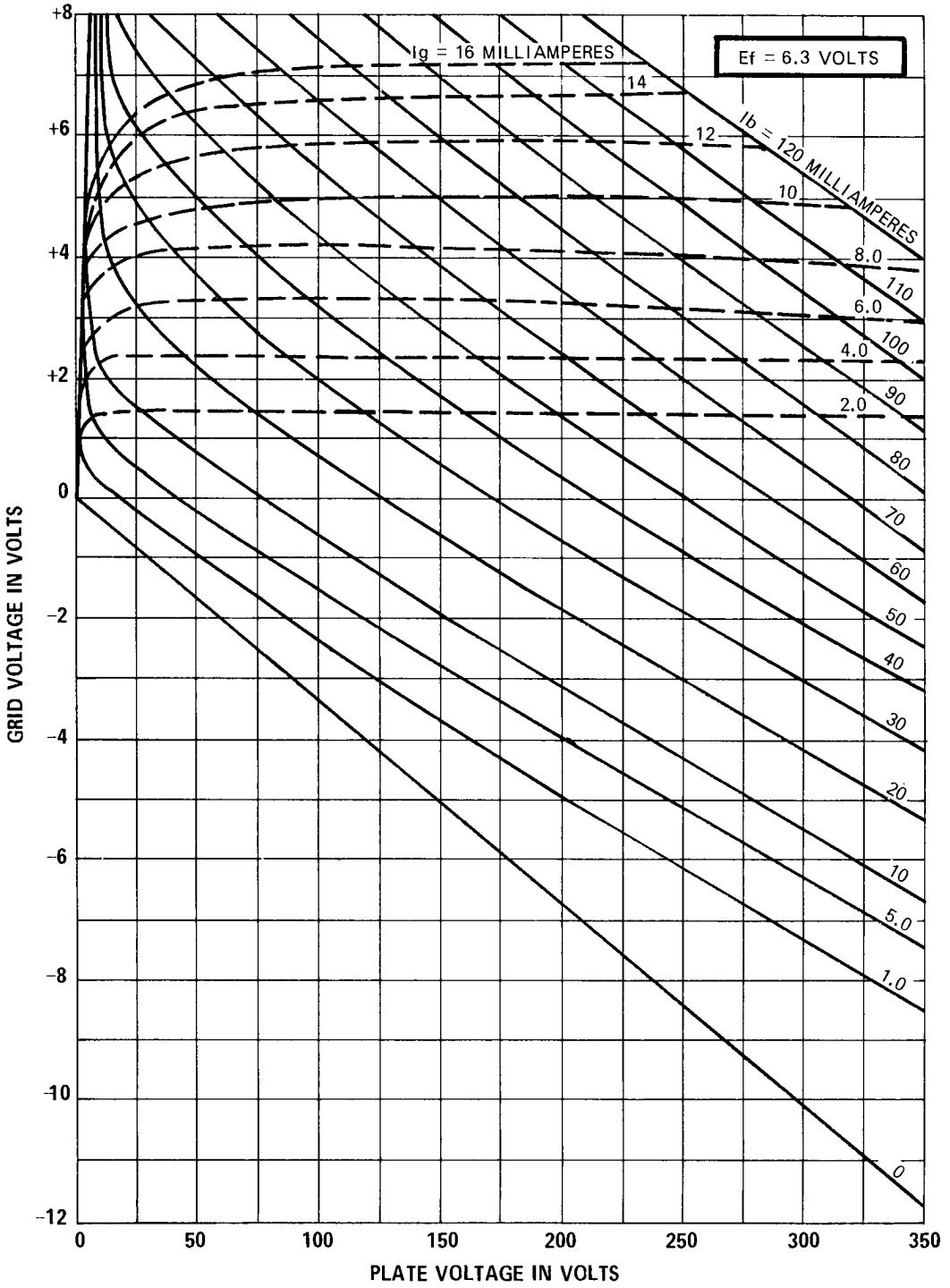
NOTES

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

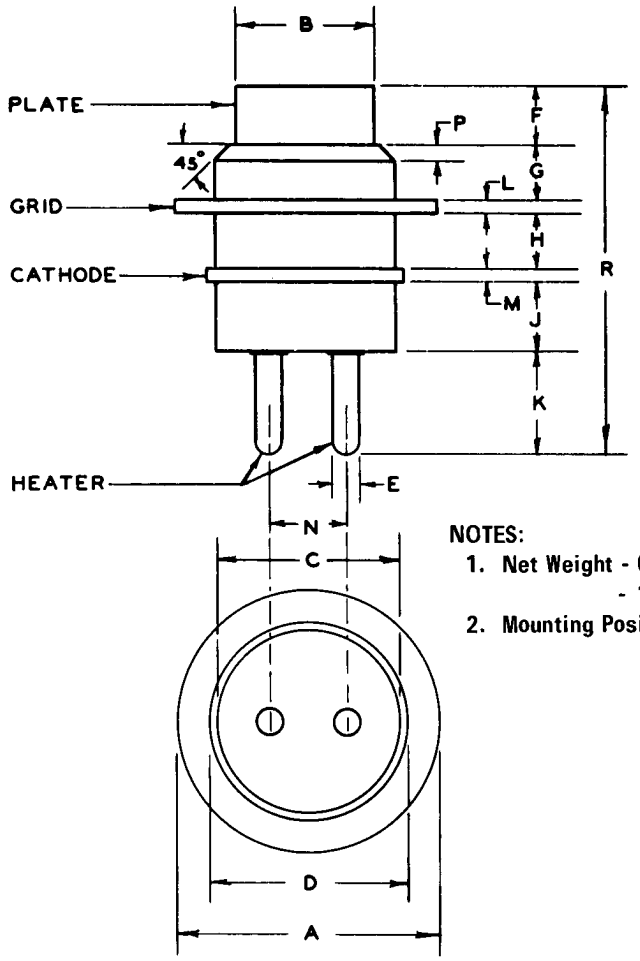
♦ This assumes no thermal heat sinking to any insulator.

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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



NOTES:
1. Net Weight - 0.07 Ounces
   - 1.99 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.477	0.480	0.483	12.12	12.19	12.27
B	0.246	0.250	0.254	6.248	6.350	6.452
C	---	---	0.330	---	---	8.382
D	0.357	0.360	0.363	9.068	9.144	9.220
E	0.048	0.050	0.052	1.219	1.270	1.321
F	0.092	0.100	0.108	2.337	2.540	2.743
G	0.095	0.099	0.103	2.413	2.515	2.616
H	0.094	0.098	0.102	2.388	2.489	2.591
J	0.143	0.150	0.157	3.632	3.810	3.988
K	0.165	0.175	0.185	4.191	4.445	4.699
L	0.025	0.028	0.031	0.635	0.711	0.787
M	0.025	0.028	0.031	0.635	0.711	0.787
N	0.130	0.136	0.142	3.302	3.454	3.607
P	---	0.030	---	---	0.762	---
R	0.614	0.650	0.686	15.60	16.51	17.42

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

GE13971

The GE 13971 is a planar triode of ceramic and metal construction intended for use as a plate-pulsed oscillator or amplifier at frequencies up to 6000 megahertz. This tube was designed primarily for zero bias operation in long life broadbanded amplifier chains.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	Eg V	Rk Ohms
Heater Voltage, AC or DC *	6.0	6.3	6.6	Volts					
Heater Current	510	550	590	Milliamperes	6.3	---	---	---	---
Plate Current	16	23	30	Milliamperes	6.3	200	---	---	100
Amplification Factor	48	58	68		6.3	200	---	---	100
Transconductance	19000	25000	31000	Micromhos	6.3	200	---	---	100
Grid Voltage, Cutoff	---	-5	-9	Volts	6.3	200	0.1	---	---
Direct Interelectrode Capacitances •									
Grid to Plate: (g to p)	1.3	1.5	1.7	pf					
Input: g to (h+k)	3.9	4.8	5.7	pf					
Output: p to (h+k)	---	0.05	0.075	pf					
Cathode Heating Time	60	---	---	Seconds					

PLATE-PULSED OSCILLATOR SERVICE

Frequency	1200	Megahertz
Duty Factor	0.004	
Pulse Duration	4	Microseconds
Pulse Repetition Rate	1000	Pulses Per Second
Peak Positive-Pulse Supply Voltage	1500	Volts
Plate Current: Average During Pulse	1.5	Amperes
Grid Current: Average During Pulse	0.31	Amperes
Power Output: Average During Pulse	900	Watts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. In some applications, longer tube life may be obtained at reduced heater voltage. For specific recommendations, contact your General Electric sales representative.

• Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

ABSOLUTE-MAXIMUM RATINGS

PLATE-PULSED OSCILLATOR SERVICE

Peak Positive-Pulse Plate Supply Voltage		
1 Microsecond Pulse Duration	2500	Volts
4 Microsecond Pulse Duration	1500	Volts
Duty Factor of Plate Pulse §	0.004	
Plate Current: Average During Pulse ⊕	2.0	Amperes
Negative Grid Voltage: Average During Pulse	100	Volts
Grid Current: Average During Pulse	1.0	Amperes
Plate Dissipation	6.5	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point ▲	250	°C
Temperature Differential Between Two Adjacent Electrodes ♦	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	10	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

NOTES

§ In any 5 millisecond interval.

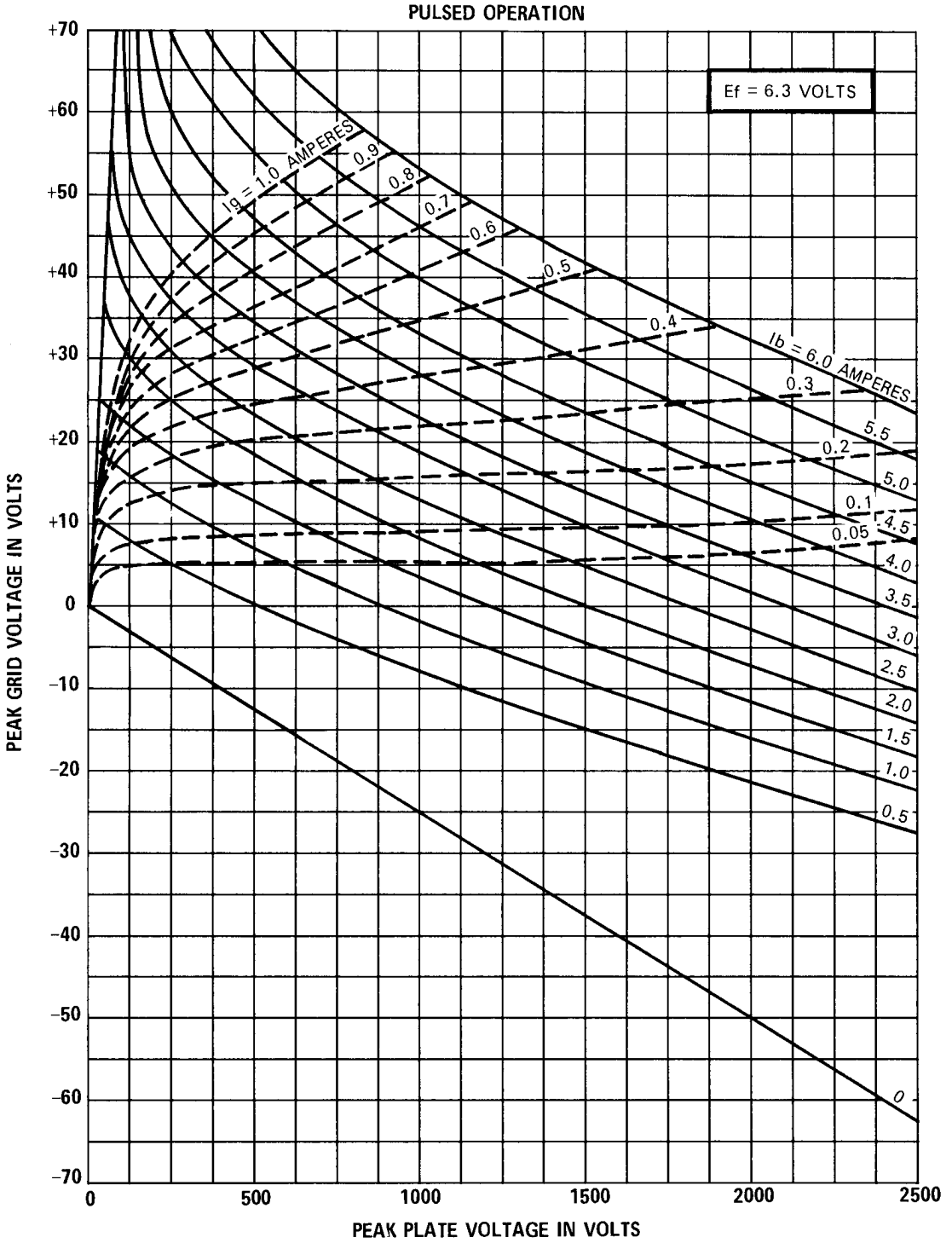
⊕ The regulation and/or series plate supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 10 times the maximum plate current rating.

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

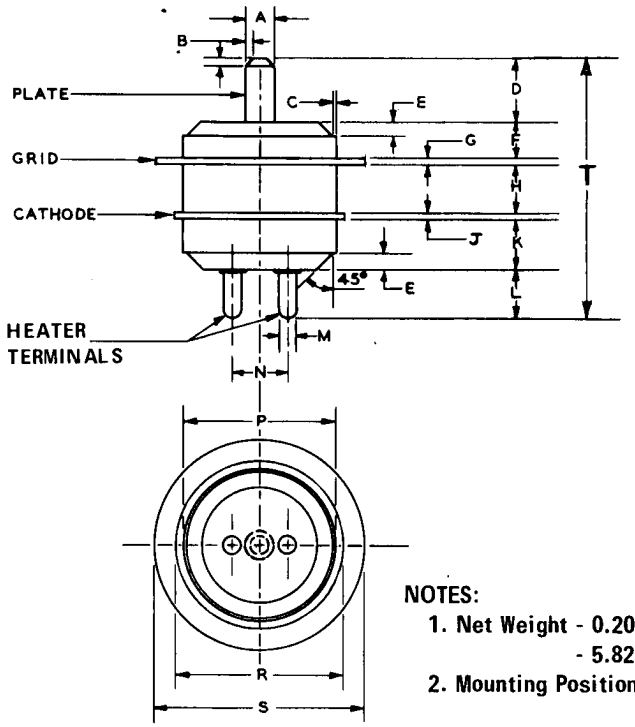
♦ This assumes no thermal heat sinking to any insulator.

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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



NOTES:
1. Net Weight - 0.205 Ounces
   - 5.82 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.122	0.125	0.128	3.099	3.175	3.251
B	---	0.030	---	---	0.762	---
C	---	0.005	---	---	0.127	---
D	0.220	0.225	0.230	5.588	5.715	5.842
E	0.040	0.050	0.060	1.016	1.270	1.524
F	0.120	0.125	0.130	3.048	3.175	3.302
G	0.025	0.028	0.031	0.635	0.711	0.787
H	0.167	0.172	0.177	4.242	4.369	4.496
J	0.025	0.028	0.031	0.635	0.711	0.787
K	0.170	0.175	0.180	4.318	4.445	4.572
L	0.170	0.175	0.180	4.318	4.445	4.572
M	0.047	0.050	0.053	1.194	1.270	1.346
N	0.185	0.200	0.215	4.699	5.080	5.461
P	0.543	0.548	0.553	13.74	13.92	14.05
R	0.598	0.603	0.608	15.19	15.32	15.44
S	0.748	0.753	0.758	19.00	19.13	19.25
T	0.897	0.928	0.959	22.78	23.57	24.36

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

GE14501

The GE14501 is a high-mu triode of ceramic-and-metal planar construction intended for use as an oscillator or radio-frequency power amplifier in the ultra-high- frequency range. This tube is especially suited for use where unfavorable conditions of mechanical shock, mechanical vibration, and high temperature are encountered. The outline of this device is ideally suited for coaxial type circuitry.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	Eg V	Rk Ohms
Heater Voltage, AC or DC *	6.0	6.3	6.6	Volts					
Heater Current	222	240	258	Milliamperes	6.3	---	---	---	---
Plate Current	6.0	9.5	13	Milliamperes	6.3	150	---	---	82
Amplification Factor	65	90	115		6.3	150	---	---	82
Transconductance	9000	12500	---	Micromhos	6.3	100	---	0	---
Grid Voltage, Cutoff	---	-2.8	-5.1	Volts	6.3	150	0.1	---	---
Direct Interelectrode Capacitances •									
Grid to Plate: (g to p)	1.10	1.25	1.40	pf					
Input: g to (h+k)	1.40	1.75	2.10	pf					
Output: p to (h+k)	0.004	0.01	0.16	pf					
Cathode Heating Time	60	---	---	Seconds					

UHF OSCILLATOR SERVICE

Frequency	450	450	Megahertz
DC Plate Voltage	150	250	Volts
Grid Resistor	1000	1000	Ohms
Plate Current	10	15	Milliamperes
Grid Current	5.0	6.0	Milliamperes
Power Output	0.85	2.3	Watts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

• Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

ABSOLUTE-MAXIMUM RATINGS

Plate Voltage	250	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	2.0	Watts
DC Grid Current	6.0	Milliamperes
DC Cathode Current	21	Milliamperes
Peak Cathode Current	80	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance	10000	Ohms
Envelope Temperature at Hottest Point ♦	250	°C
Temperature Differential Between Two Adjacent Electrodes ▲	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	10	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

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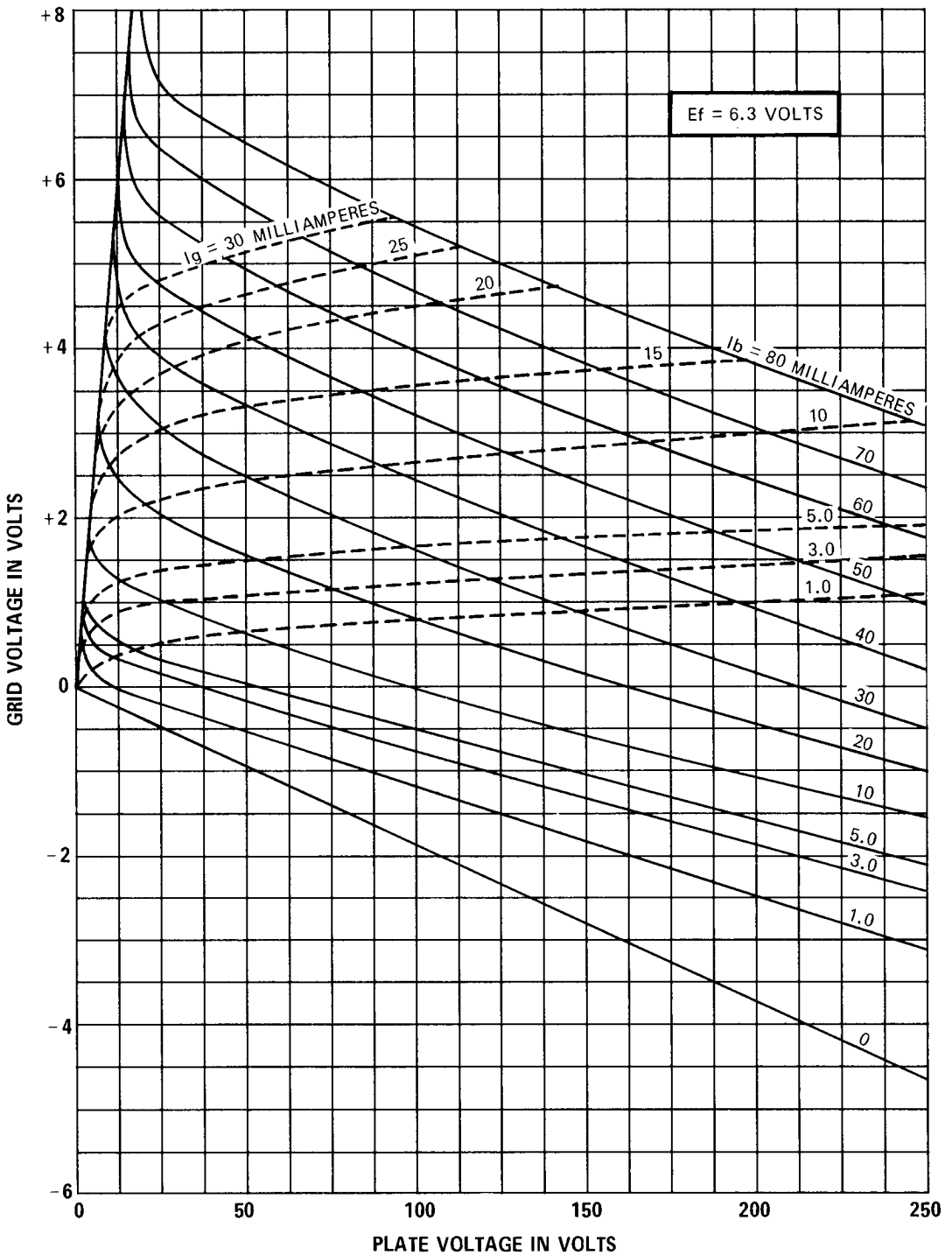
NOTES

♦ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

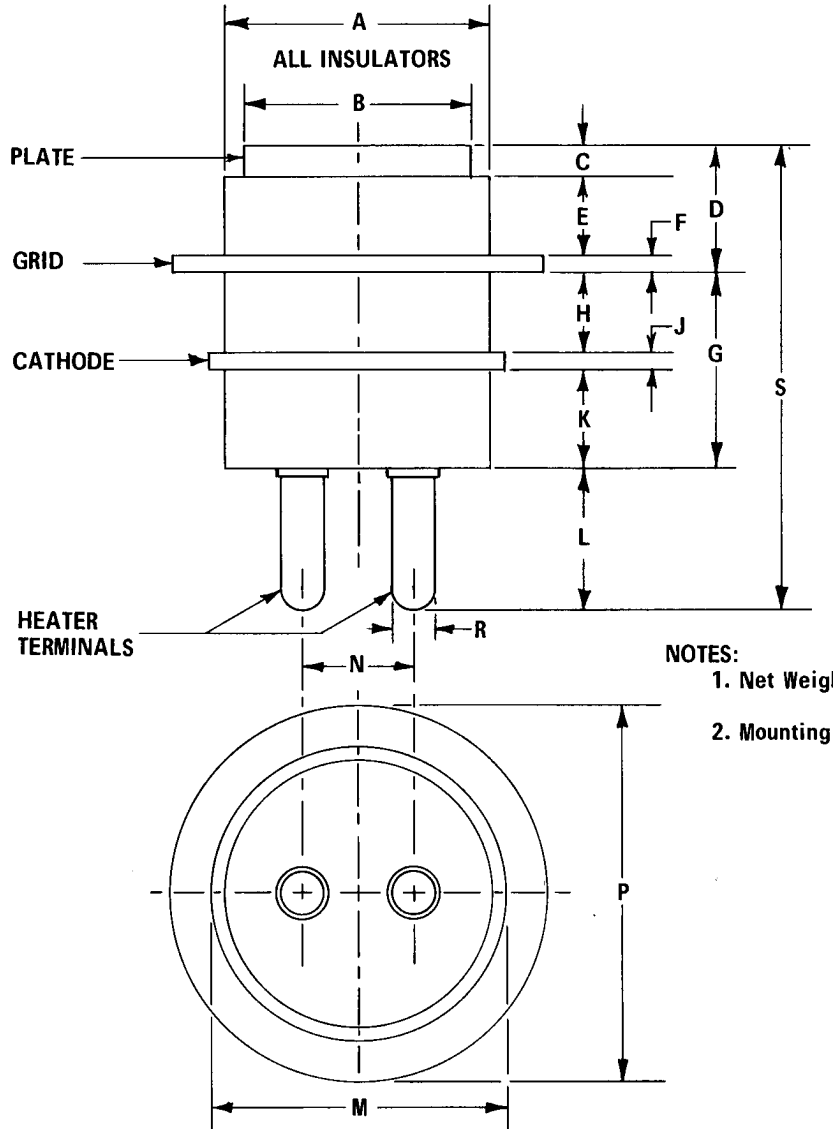
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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



NOTES:
1. Net Weight - 0.06 Ounces
   - 1.71 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	- - -	- - -	0.328	- - -	- - -	8.331
B	0.272	0.275	0.278	6.909	6.985	7.061
C	0.035	0.040	0.045	0.889	1.016	1.143
D	0.156	0.165	0.174	3.962	4.191	4.420
E	0.095	0.099	0.103	2.413	2.515	2.616
F	0.024	0.027	0.030	0.610	0.686	0.762
G	0.242	0.250	0.258	6.147	6.350	6.553
H	0.096	0.100	0.104	2.438	2.540	2.642
J	0.024	0.027	0.030	0.610	0.686	0.762
K	0.120	0.125	0.130	3.048	3.175	3.302
L	0.165	0.175	0.185	4.191	4.445	4.699
M	0.357	0.360	0.363	9.068	9.144	9.220
N	0.130	0.136	0.142	3.302	3.454	3.607
P	0.477	0.480	0.483	12.12	12.19	12.27
R	0.048	0.051	0.054	1.219	1.295	1.372
S	0.563	0.590	0.617	14.30	14.99	15.67

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

Planar Triode

GE14811

The GE14811 is a planar triode intended for use as a plate-pulsed, C-band oscillator at relatively low plate voltage levels. It is useful in medium power applications where very short pulses are required, such as radar altimeters and beacons.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	Eg V	Rk Ohms
Heater Voltage, AC or DC★	6.0	6.3	6.6	Volts					
Heater Current	330	360	390	Milliamperes	6.3	---	---	---	---
Plate Current	20	27	34	Milliamperes	6.3	200	---	---	100
Amplification Factor	45	60	75		6.3	200	---	---	100
Transconductance	23000	29000	35000	Micromhos	6.3	200	---	---	100
Grid Voltage, Cutoff	---	-6.5	-10	Volts	6.3	200	0.1	---	100
Direct Interelectrode Capacitances●									
Grid to Plate: (g to p)	1.45	1.65	1.85	pf					
Input: g to (h+k)	3.5	4.4	5.3	pf					
Output: p to (h+k)	---	0.036	0.055	pf					
Cathode Heating Time	60	---	---	Seconds					

PLATE-PULSED OSCILLATOR SERVICE

Frequency	4300	Megahertz
Duty Factor	0.001	
Pulse Duration	0.1	Microsecond
Pulse Repetition Rate	10000	Pulses Per Second
Peak Positive-Pulse Supply Voltage	800	Volts
Plate Current: Average During Pulse	1.0	Amperes
Grid Current: Average During Pulse	0.2	Amperes
Power Output: Average During Pulse	190	Watts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. In some applications, longer tube life may be obtained at reduced heater voltage. For specific recommendations, contact your General Electric sales representative.

● Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

ABSOLUTE-MAXIMUM RATINGS

PLATE-PULSED OSCILLATOR SERVICE

Peak Positive-Pulse Plate Supply Voltage		
1 Microsecond Pulse Duration	1200	Volts
4 Microsecond Pulse Duration	800	Volts
Duty Factor of Plate Pulse	0.001	
Plate Current: Average During Pulse §	1.0	Amperes
Negative Grid Voltage: Average During Pulse	50	Volts
Grid Current: Average During Pulse	0.5	Amperes
Plate Dissipation	6.5	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point ▲	250	°C
Temperature Differential Between Two Adjacent Electrodes ♦	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	10	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

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NOTES

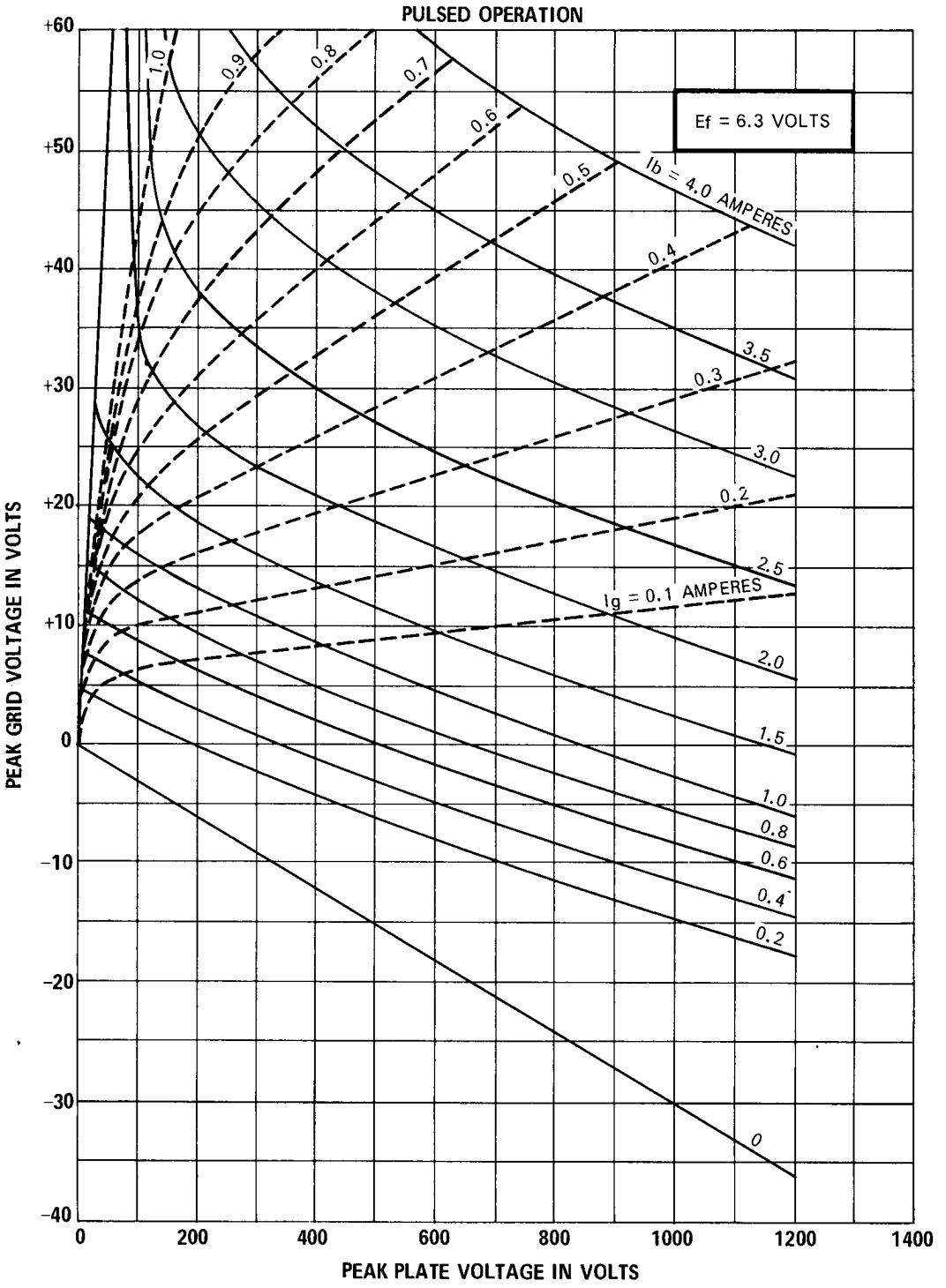
§ The regulation and/or series plate supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 10 times the maximum plate current rating.

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

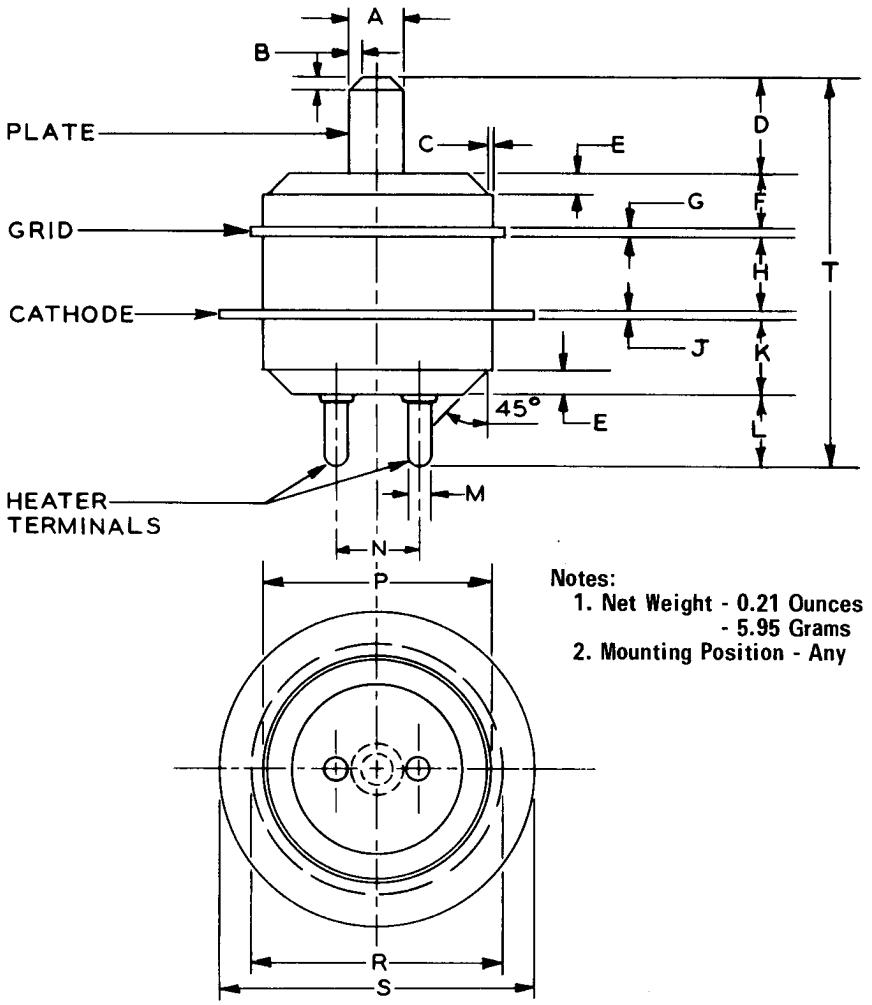
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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



Notes:
1. Net Weight - 0.21 Ounces
   - 5.95 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.122	0.125	0.128	3.099	3.175	3.251
B	---	0.030	---	---	0.762	---
C	---	0.005	---	---	0.127	---
D	0.220	0.225	0.230	5.588	5.715	5.842
E	0.040	0.050	0.060	1.016	1.270	1.524
F	0.120	0.125	0.130	3.048	3.175	3.302
G	0.025	0.028	0.031	0.635	0.711	0.787
H	0.167	0.172	0.177	4.242	4.369	4.496
J	0.025	0.028	0.031	0.635	0.711	0.787
K	0.170	0.175	0.180	4.318	4.445	4.572
L	0.170	0.175	0.180	4.318	4.445	4.572
M	0.047	0.050	0.053	1.194	1.270	1.346
N	0.185	0.200	0.215	4.699	5.080	5.461
P	0.535	0.550	0.565	13.59	13.97	14.35
R	0.598	0.603	0.608	15.19	15.32	15.44
S	0.748	0.753	0.758	19.00	19.13	19.25
T	0.897	0.928	0.959	22.78	23.57	24.36

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

Planar Triode

GE15371

The GE15371 is a metal-ceramic planar triode intended for plate-pulse oscillator and amplifier service.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	RL Ohms	Rk Ohms
Heater Voltage, AC or DC*	6.0	6.3	6.6	Volts					
Heater Current	465	500	535	Milliamperes	6.3	---	---	---	---
Plate Current	12	17	22	Milliamperes	6.3	200	---	---	100
Amplification Factor	65	85	105		6.3	200	---	---	100
Transconductance	17000	22000	27000	Micromhos	6.3	200	---	---	100
Grid Voltage, Cutoff	---	---	-25	Volts	6.3	1000	0.3	47000	---
Direct Interelectrode Capacitances•									
Grid to Plate: (g to p)	1.6	1.9	2.2	pf					
Input: g to (h+k)	3.8	5.0	6.2	pf					
Output: p to (h+k)	---	0.035	0.05	pf					
Cathode Heating Time	60	---	---	Seconds					

PLATE-PULSED OSCILLATOR SERVICE

Frequency	1090	Megahertz
Duty Factor	0.001	
Pulse Duration	1	Microsecond
Pulse Repetition Rate	1000	Pulses Per Second
Peak Positive-Pulse Supply Voltage	1800	Volts
Plate Current: Average During Pulse	1.5	Amperes
Grid Current: Average During Pulse	0.5	Amperes
Power Output: Average During Pulse	700	Watts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. In some applications, longer tube life may be obtained at reduced heater voltage. For specific recommendations, contact your General Electric sales representative.

• Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

ABSOLUTE-MAXIMUM RATINGS

PLATE-PULSED OSCILLATOR SERVICE

Peak Positive-Pulse Plate Supply Voltage		
1 Microsecond Pulse Duration	2000	Volts
4 Microsecond Pulse Duration	1500	Volts
Duty Factor of Plate Pulse §	0.002	
Plate Current: Average During Pulse ⊕	2.0	Amperes
Negative Grid Voltage: Average During Pulse	100	Volts
Grid Current: Average During Pulse	0.8	Amperes
Plate Dissipation □	10	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point ▲	250	°C
Temperature Differential Between Two Adjacent Electrodes ♦	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	10	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

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NOTES

§ In any 5 millisecond interval.

⊕ The regulation and/or series plate supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 10 times the maximum plate current rating.

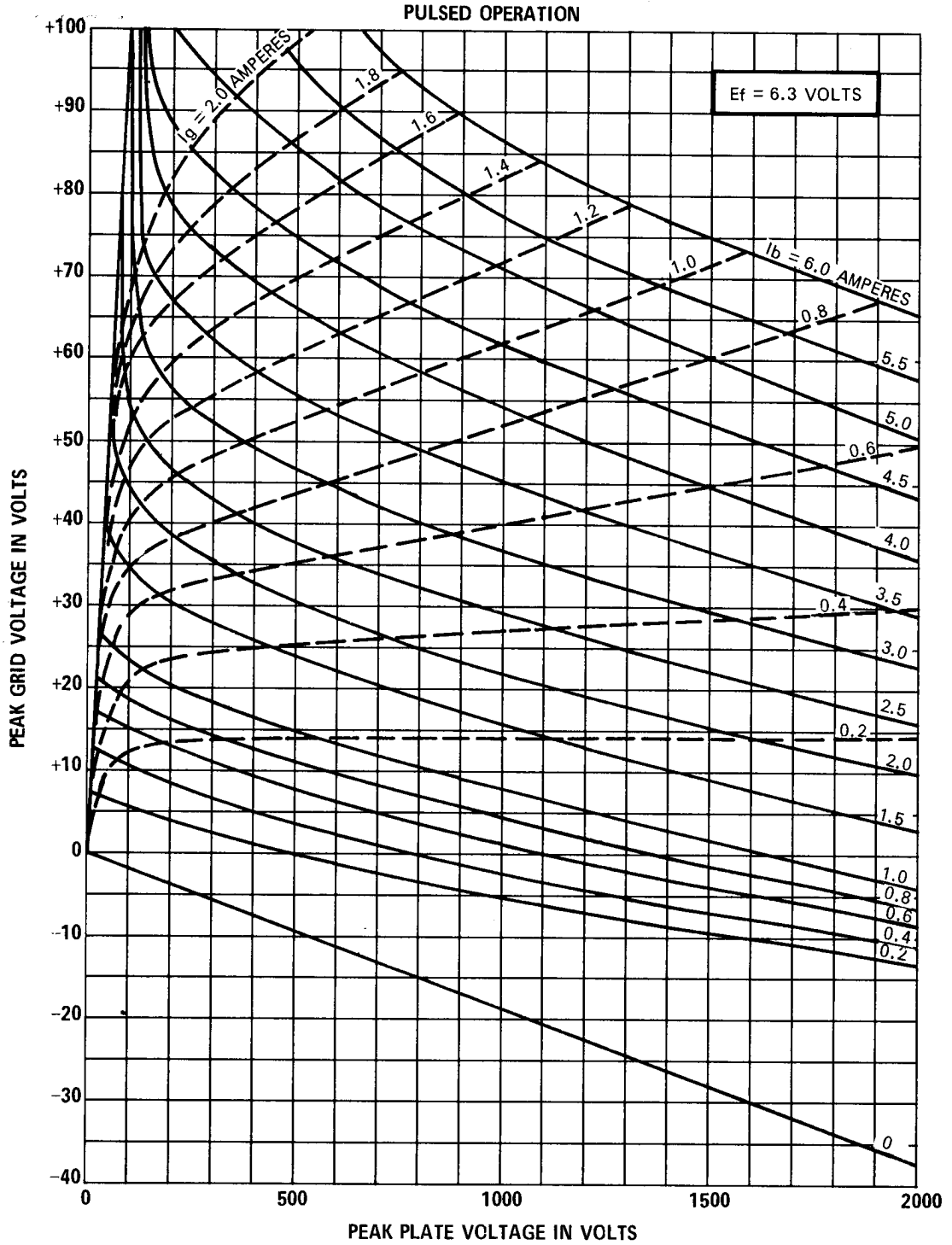
□ With adequate heat sink.

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

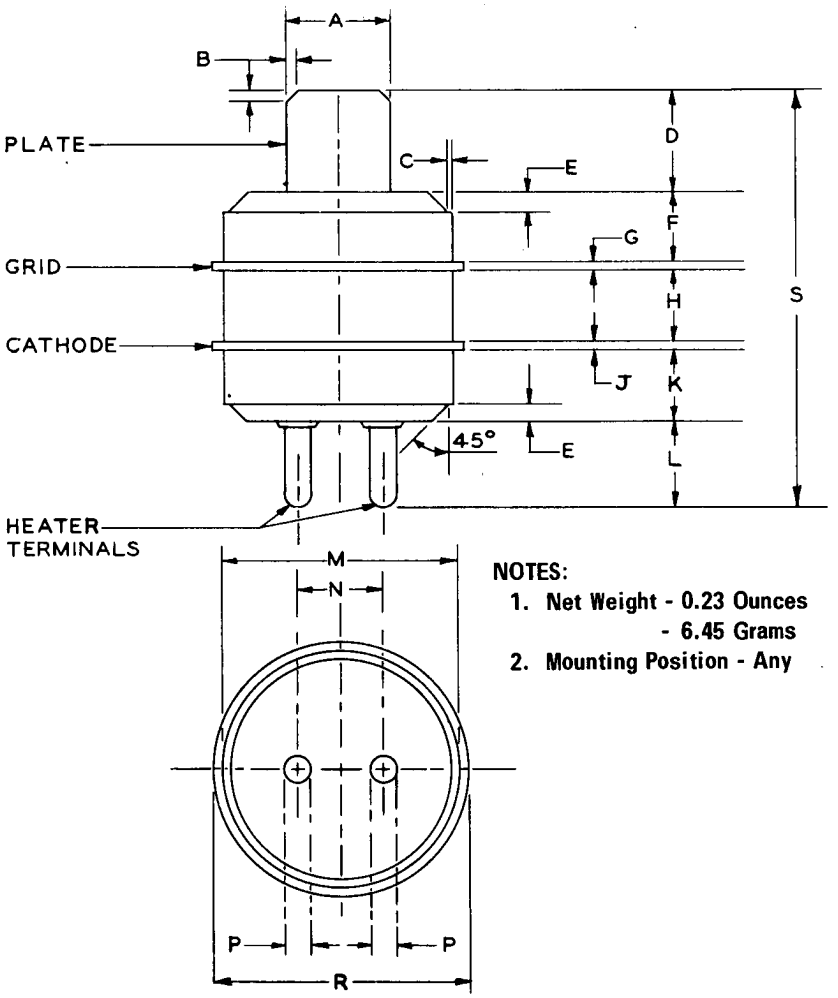
♦ This assumes no thermal heat sinking to any insulator.

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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



NOTES:

1. Net Weight - 0.23 Ounces
   - 6.45 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.245	0.250	0.255	6.223	6.350	6.477
B	---	0.030	---	---	0.762	---
C	---	0.005	---	---	0.127	---
D	0.245	0.250	0.255	6.223	6.350	6.477
E	0.040	0.050	0.060	1.016	1.270	1.524
F	0.145	0.150	0.155	3.683	3.810	3.937
G	0.025	0.028	0.031	0.635	0.711	0.787
H	0.167	0.172	0.177	4.242	4.343	4.496
J	0.025	0.028	0.031	0.635	0.711	0.787
K	0.170	0.175	0.180	4.318	4.445	4.572
L	0.170	0.175	0.180	4.318	4.445	4.572
M	0.535	0.550	0.565	13.59	13.97	14.35
N	0.185	0.200	0.215	4.699	5.089	5.461
P	0.047	0.050	0.053	1.184	1.270	1.346
R	0.598	0.603	0.608	15.19	15.32	15.44
S	0.947	0.978	1.009	24.05	24.84	25.63

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

GE16231

The GE16231 is a planar metal-ceramic triode intended for use as a plate pulsed amplifier. This tube was designed primarily for long life and high gain-bandwidth in the moderate power level stages of broadbanded amplifier chains.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	Eg V	Rk Ohms
Heater Voltage, AC or DC*	6.0	6.3	6.6	Volts					
Heater Current	370	400	430	Milliamperes	6.3	---	---	---	---
Plate Current	14	22	30	Milliamperes	6.3	200	---	---	22
Amplification Factor	180	225	270		6.3	200	---	+6	270
Transconductance	40000	50000	60000	Micromhos	6.3	200	---	+6	270
Grid Voltage, Cutoff	---	-2.0	-5.0	Volts	6.3	200	0.1	---	---
Direct Interelectrode Capacitances•									
Grid to Plate: (g to p)	1.3	1.7	2.1	pf					
Input: g to (h+k)	4.5	6.0	7.5	pf					
Output: p to (h+k)	0.01	0.018	0.026	pf					
Cathode Heating Time	60	---	---	Seconds					

PLATE-PULSED AMPLIFIER SERVICE

Frequency	1090	Megahertz
Bandwidth (Single-tuned 3 db)	180	Megahertz
Duty Factor	0.004	
Pulse Duration	4	Microseconds
Pulse Repetition Rate	1000	Pulses Per Second
Peak Positive-Pulse Supply Voltage	1000	Volts
Plate Current: Average During Pulse	0.4	Amperes
Power Input: Average During Pulse	1.0	Watts
Power Output: Average During Pulse	20	Watts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

• Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

ABSOLUTE-MAXIMUM RATINGS

PLATE-PULSED AMPLIFIER SERVICE

Peak Positive-Pulse Plate Supply Voltage		
1 Microsecond Pulse Duration	1500	Volts
4 Microsecond Pulse Duration	1250	Volts
Duty Factor of Plate Pulse §	0.004	
Plate Current: Average During Pulse ⊕	0.5	Amperes
Negative Grid Voltage: Average During Pulse	50	Volts
Grid Current: Average During Pulse	0.2	Amperes
Plate Dissipation	6.5	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point ▲	250	°C
Temperature Differential Between Two Adjacent Electrodes ♦	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	10	G.Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

NOTES

§ In any 5 millisecond interval.

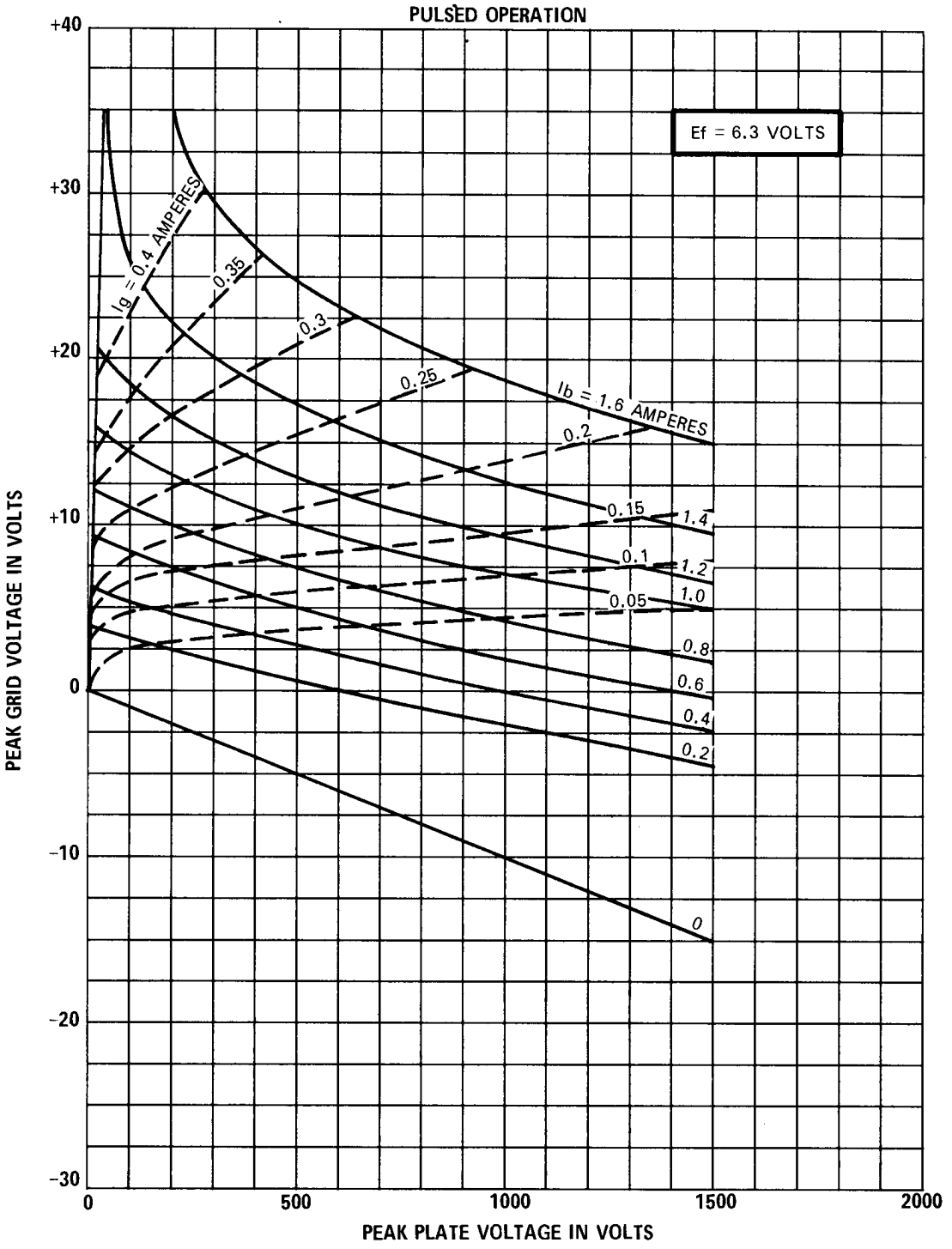
⊕ The regulation and/or series plate supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 10 times the maximum plate current rating.

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

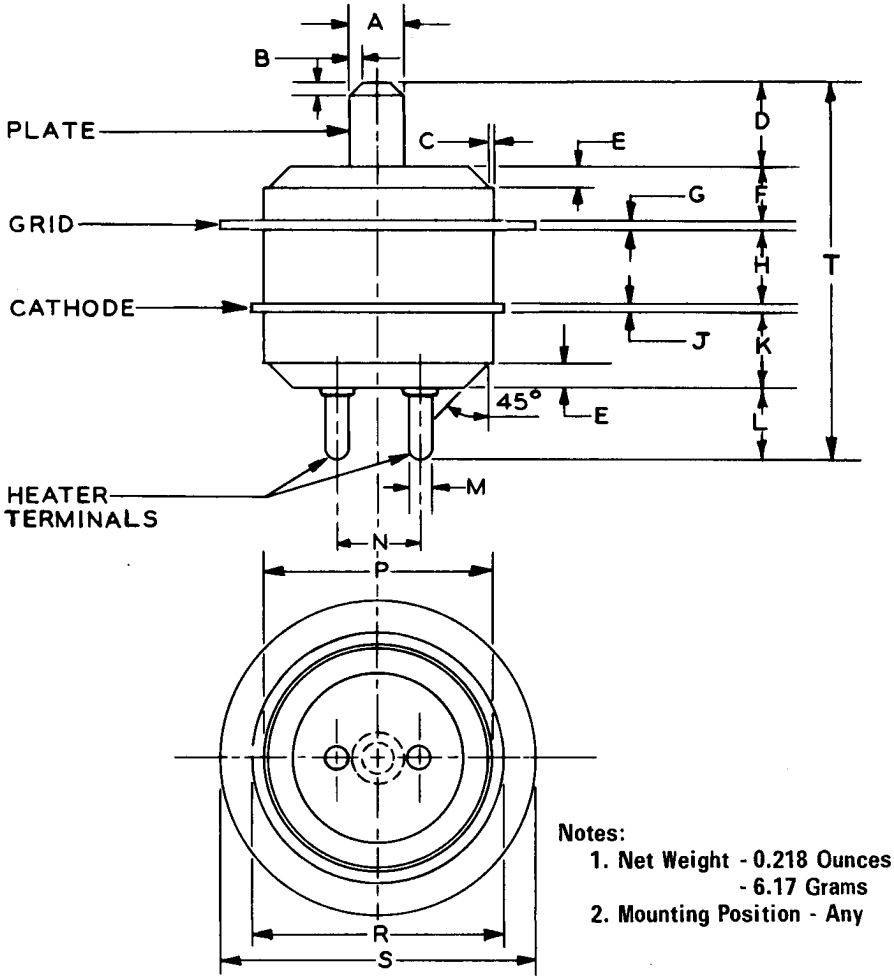
♦ This assumes no thermal heat sinking to any insulator.

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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



Notes:
1. Net Weight - 0.218 Ounces
   - 6.17 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.122	0.125	0.128	3.099	3.175	3.251
B	---	0.030	---	---	0.762	---
C	---	0.005	---	---	0.127	---
D	0.170	0.175	0.180	4.318	4.445	4.572
E	0.040	0.050	0.060	1.016	1.270	1.524
F	0.170	0.175	0.180	4.318	4.445	4.572
G	0.025	0.028	0.031	0.635	0.711	0.787
H	0.167	0.172	0.177	4.242	4.369	4.496
J	0.025	0.028	0.031	0.635	0.711	0.787
K	0.170	0.175	0.180	4.318	4.445	4.572
L	0.170	0.175	0.180	4.318	4.445	4.572
M	0.047	0.050	0.053	1.194	1.270	1.346
N	0.185	0.200	0.215	4.699	5.080	5.461
P	0.535	0.550	0.565	13.59	13.97	14.35
R	0.598	0.603	0.608	15.19	15.32	15.44
S	0.748	0.753	0.758	19.00	19.13	19.25
T	0.897	0.928	0.959	22.78	23.57	24.36

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

GE16411

The GE16411 is a high-mu-triode of ceramic-and-metal planar construction intended for use as an oscillator or radio-frequency power amplifier in the ultra-high-frequency range. This tube is especially suited for use where conditions of extreme mechanical shock, mechanical vibration, and high temperature are encountered. The rugged bonded-heater construction also provides fast cathode warm-up.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	Eg V	Rk Ohms
Heater Voltage, AC or DC★	6.0	6.3	6.6	Volts					
Heater Current	138	150	162	Milliamperes	6.3	---	---	---	---
Plate Current	9.0	12.5	16	Milliamperes	6.3	150	---	---	82
Amplification Factor	50	75	100		6.3	150	---	---	82
Transconductance	9000	12500	---	Micromhos	6.3	100	---	0	---
Grid Voltage, Cutoff	---	-3.2	-5.8	Volts	6.3	150	---	---	---
Direct Interelectrode Capacitances●									
Grid to Plate: (g to p)	1.15	1.30	1.45	pf					
Input: g to (h+k)	1.20	1.50	1.80	pf					
Output: p to (h+k)	0.004	0.01	0.016	pf					
Cathode Warm-up Time♦	---	---	5	Seconds					

UHF OSCILLATOR SERVICE

Frequency	450	1200	Megahertz
DC Plate Voltage	150	150	Volts
Grid Resistor	1000	1000	Ohms
Plate Current	8.0	8.0	Milliamperes
Grid Current	2.0	2.0	Milliamperes
Power Output	450	300	Milliwatts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

♦ Time required for plate current to reach 80% of its steady-state value.

ABSOLUTE-MAXIMUM RATINGS

Plate Voltage	250	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	1.0	Watts
DC Grid Current	2.2	Milliamperes
DC Cathode Current	11	Milliamperes
Peak Cathode Current	40	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance	10000	Ohms
Envelope Temperature at Hottest Point▲	250	°C
Temperature Differential Between Two Adjacent Electrodes□	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	30	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

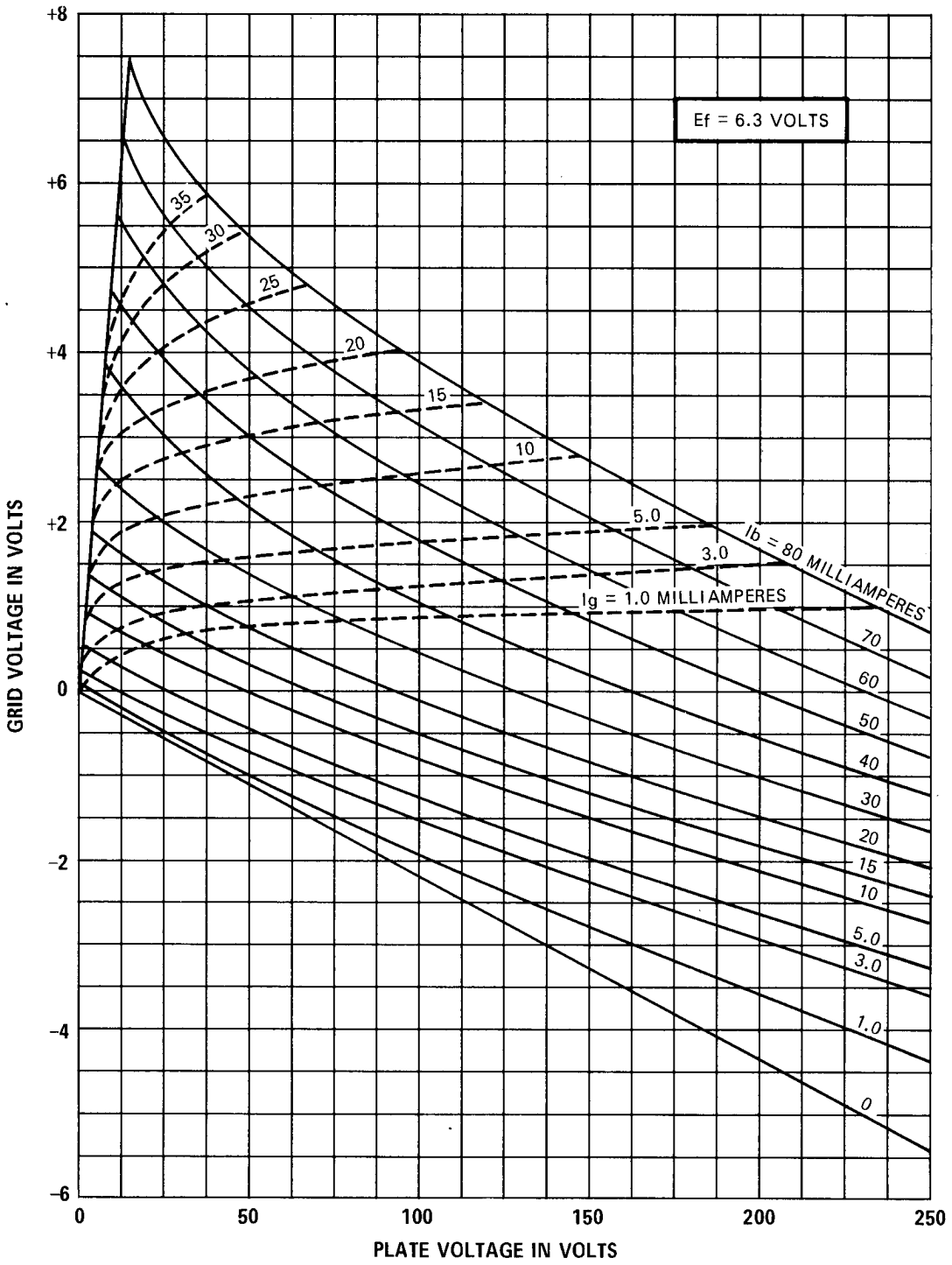
NOTES

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

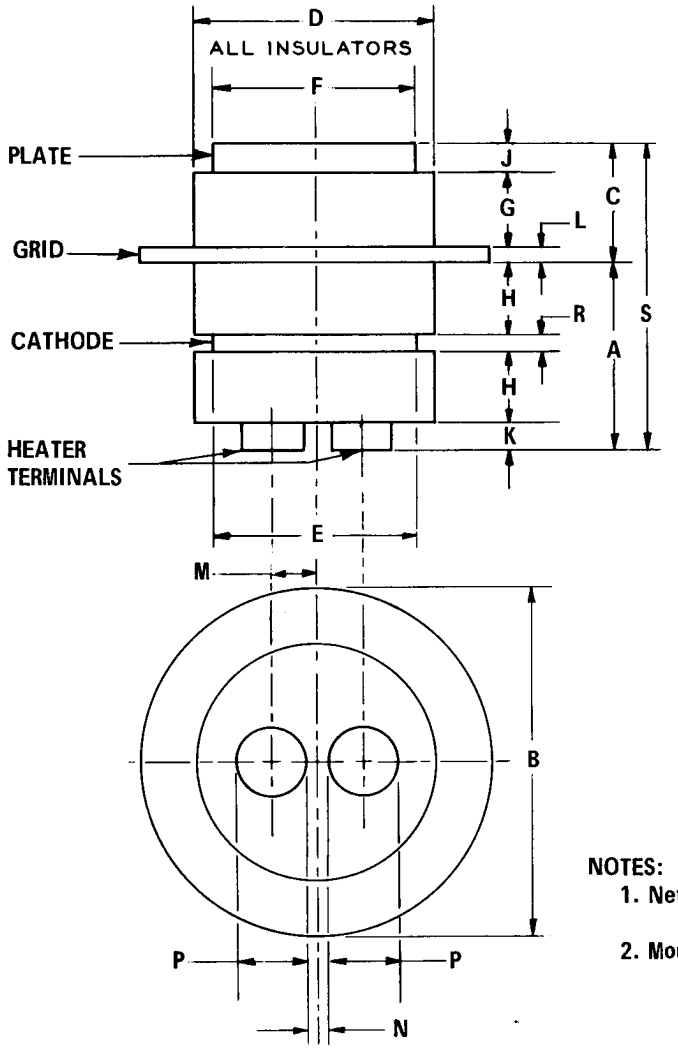
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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



NOTES:
1. Net Weight - 0.0565 Ounces
   - 1.6 Grams
2. Mounting Position - Any

	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.268	0.280	0.292	6.807	7.112	7.417
B	0.477	0.480	0.483	12.12	12.19	12.27
C	0.156	0.165	0.174	3.962	4.191	4.420
D	---	---	0.328	---	---	8.331
E	0.282	0.285	0.288	7.163	7.239	7.315
F	0.272	0.275	0.278	6.909	6.985	7.061
G	0.095	0.099	0.103	2.413	2.515	2.616
H	0.096	0.100	0.104	2.438	2.540	2.642
J	0.035	0.040	0.045	0.889	1.016	1.143
K	0.047	0.055	0.063	1.194	1.397	1.600
L	0.024	0.027	0.030	0.610	0.686	0.762
M	0.055	0.068	0.081	1.397	1.727	2.057
N	0.032	---	---	0.813	---	---
P	0.087	0.090	0.093	2.210	2.286	2.362
R	0.022	0.025	0.028	0.559	0.635	0.711
S	0.430	0.445	0.460	10.92	11.30	11.68

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

GE16841

The GE16841 is a metal-ceramic planar triode intended for use as a CW oscillator or amplifier. This tube is rated for long life primarily as a local oscillator up to about 6000 megahertz.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	Eg V	Rk Ohms
Heater Voltage, AC or DC★	5.4	5.7	6.0	Volts					
Heater Current	250	270	290	Milliamperes	5.7	---	---	---	---
Plate Current	9	14	19	Milliamperes	5.7	150	---	---	82
Amplification Factor	55	78	100		5.7	150	---	---	82
Transconductance	12000	17000	---	Micromhos	5.7	100	---	0	---
Grid Voltage, Cutoff	---	---	-5.5	Volts	5.7	150	0.1	---	---
Direct Interelectrode Capacitances●									
Grid to Plate: (g to p)	0.85	1.05	1.25	pf					
Input: g to (h+k)	1.5	2.1	2.7	pf					
Output: p to (h+k)	---	0.018	0.026	pf					
Cathode Heating Time	60	---	---	Seconds					

CW OSCILLATOR SERVICE

Frequency	4300	Megahertz
DC Plate Voltage	100	Volts
Grid Resistor	Adjusted	
Plate Current	15	Milliamperes
Grid Current	3	Milliamperes
Power Output	25	Milliwatts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

ABSOLUTE-MAXIMUM RATINGS

Plate Voltage	250	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	1.5	Watts
DC Grid Current	5	Milliamperes
DC Cathode Current	20	Milliamperes
Peak Cathode Current	80	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance	10000	Ohms
Envelope Temperature at Hottest Point♦	250	°C
Temperature Differential Between Two Adjacent Electrodes▲	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	10	G Peak

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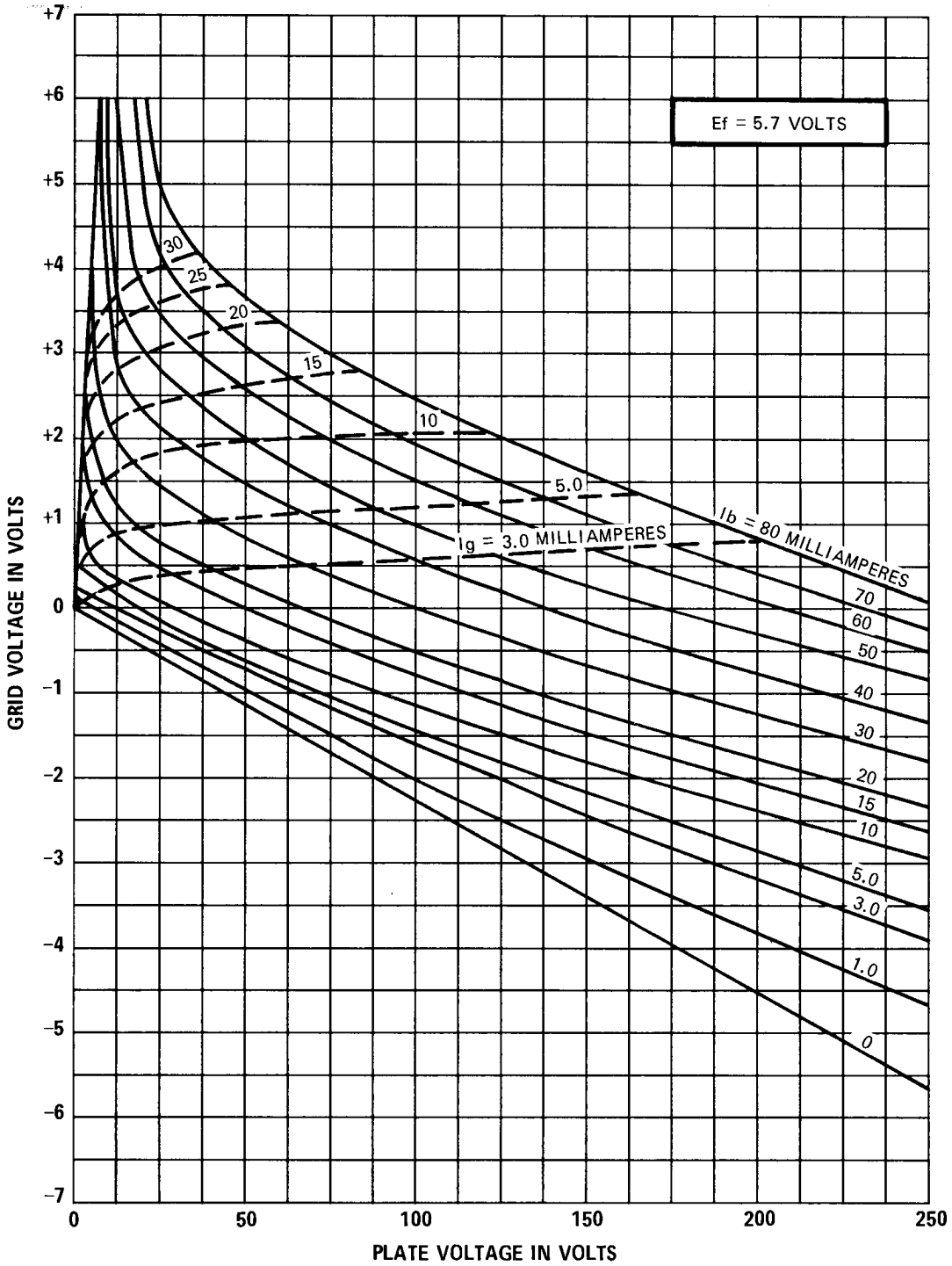
NOTES

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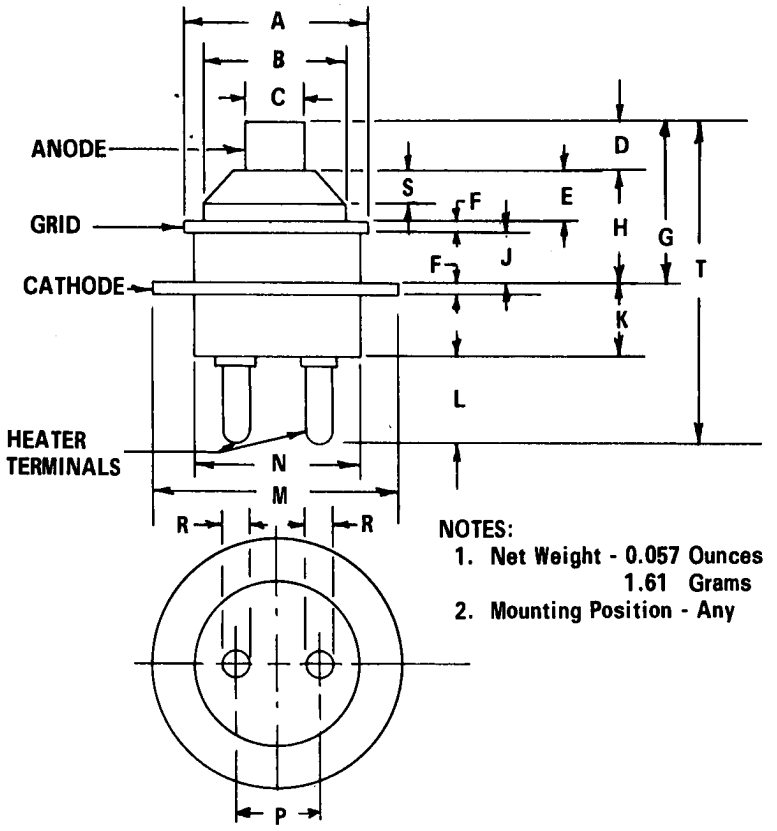
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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



NOTES:
1. Net Weight - 0.057 Ounces
   1.61 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.357	0.360	0.363	9.068	9.144	9.220
B	---	---	0.285	---	---	7.239
C	0.108	0.110	0.112	2.743	2.794	2.845
D	0.095	0.100	0.105	2.413	2.540	2.667
E	0.095	0.100	0.105	2.413	2.540	2.667
F	0.025	0.028	0.031	0.635	0.711	0.787
G	0.315	0.325	0.335	8.001	8.225	8.509
H	0.216	0.224	0.232	5.486	5.690	5.893
J	0.094	0.098	0.102	2.388	2.489	2.591
K	0.143	0.150	0.157	3.632	3.810	3.988
L	0.165	0.175	0.185	4.191	4.445	4.699
M	0.476	0.480	0.484	12.09	12.19	12.29
N	---	---	0.330	---	---	8.458
P	0.130	0.136	0.142	3.302	3.454	3.607
R	0.048	0.051	0.054	1.219	1.295	1.372
S	---	0.060	---	---	1.524	---
T	0.623	0.650	0.677	15.82	16.51	17.20

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

GE17241

FOR PULSED OSCILLATOR OR AMPLIFIER APPLICATIONS

The GE17241 is a metal-ceramic triode intended for grid-pulsed or plate-pulsed oscillator and amplifier service. This tube was designed specifically for use in general aviation transponders.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC*	6.0±0.3	Volts
Heater Current●	0.97	Amperes
Direct Interelectrode Capacitances♦		
Grid to Plate: (g to p)	1.9	pf
Input: g to (h+k)	6.3	pf
Output: p to (h+k), Maximum	0.035	pf

MECHANICAL

Operating Position - Any

See Outline Drawing on page 4 for dimensions and electrical connections

MAXIMUM RATINGS

GRID-PULSED OSCILLATOR OR AMPLIFIER SERVICE—ABSOLUTE-MAXIMUM VALUES

Plate Voltage	1750	Volts
Plate Dissipation▲	10	Watts
Peak Plate Current■	2.0	Amperes
Peak Grid Current	1.0	Amperes
Duty Factor	0.01	
Pulse Duration	4	Microseconds
Envelope Temperature at Hottest Point	250	°C

PLATE-PULSED OSCILLATOR OR AMPLIFIER SERVICE—ABSOLUTE-MAXIMUM VALUES

Peak Positive-Pulse Plate Supply Voltage	2500	Volts
Plate Dissipation▲	10	Watts
Peak Plate Current	2.5	Amperes
Peak Grid Current	1.0	Amperes
Duty Factor	0.01	
Envelope Temperature at Hottest Point	250	°C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

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GENERAL ELECTRIC

Supersedes PI Sheet dated 5-70

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Heater Voltage	6.0	Volts
Plate Voltage	600	Volts
Grid Voltage (Vary for Ib @ 25 Milliamperes)	−5	Volts
Amplification Factor	95	
Transconductance	13500	Micromhos
Plate Current	25	Milliamperes
Grid Voltage, Maximum		
Ib = 1.0 Milliampere @ Eb = 2000 Volts	−50	Volts

GRID-PULSED RADIO-FREQUENCY AMPLIFIER

Frequency	1100	Megahertz
Heater Voltage	6.0	Volts
DC Plate Voltage	1500	Volts
DC Grid Voltage	−115	Volts
Pulse Length	3.5	Microseconds
Duty Factor	0.0035	
Peak Plate Current	1.4	Amperes
Peak Power Output, Approximate	675	Watts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. When used at low peak plate current the heater voltage should be reduced for longer life.

● Heater current of a bogey tube at Ef = 6.0 volts.

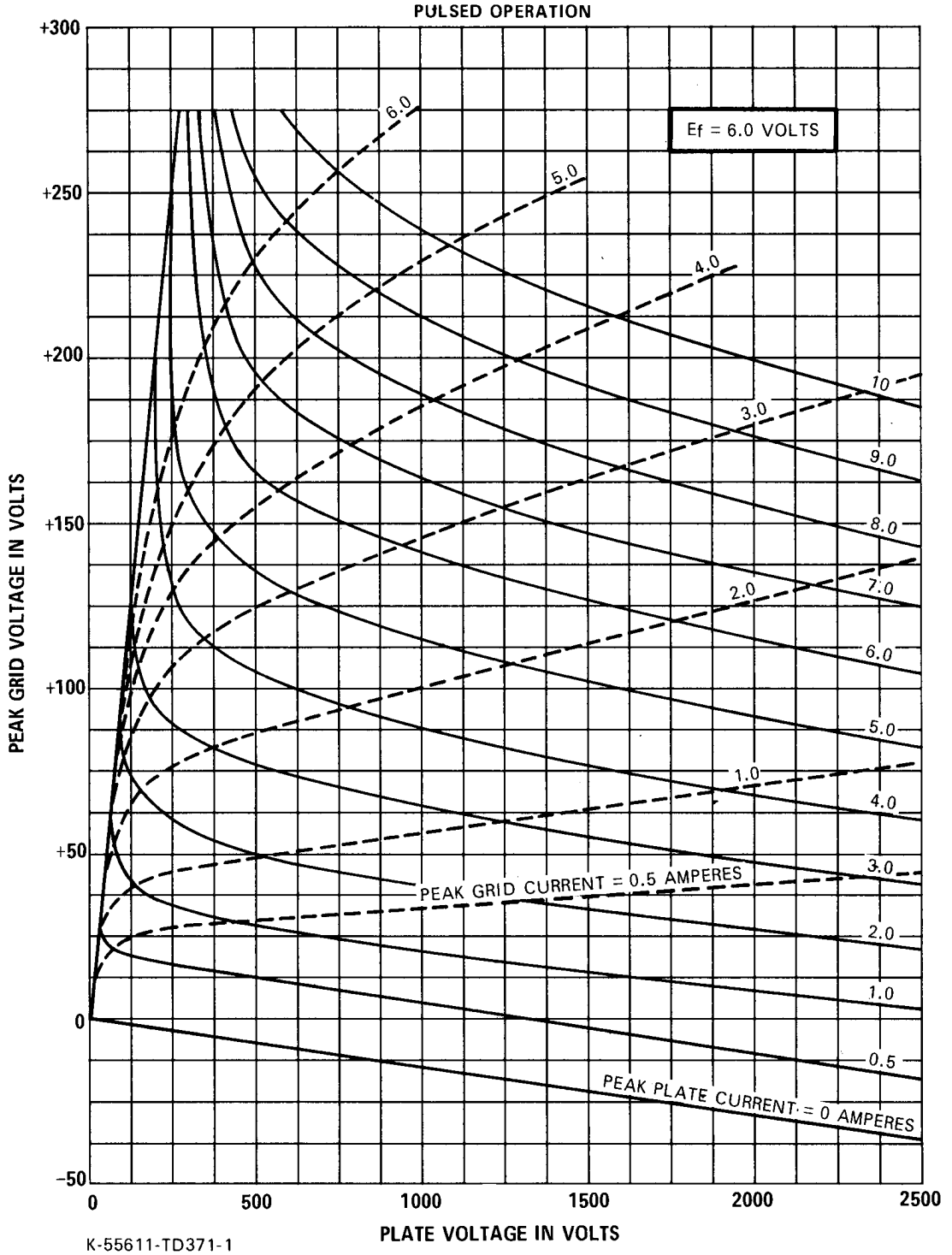
♦ Without external shield.

▲ With adequate heat sink.

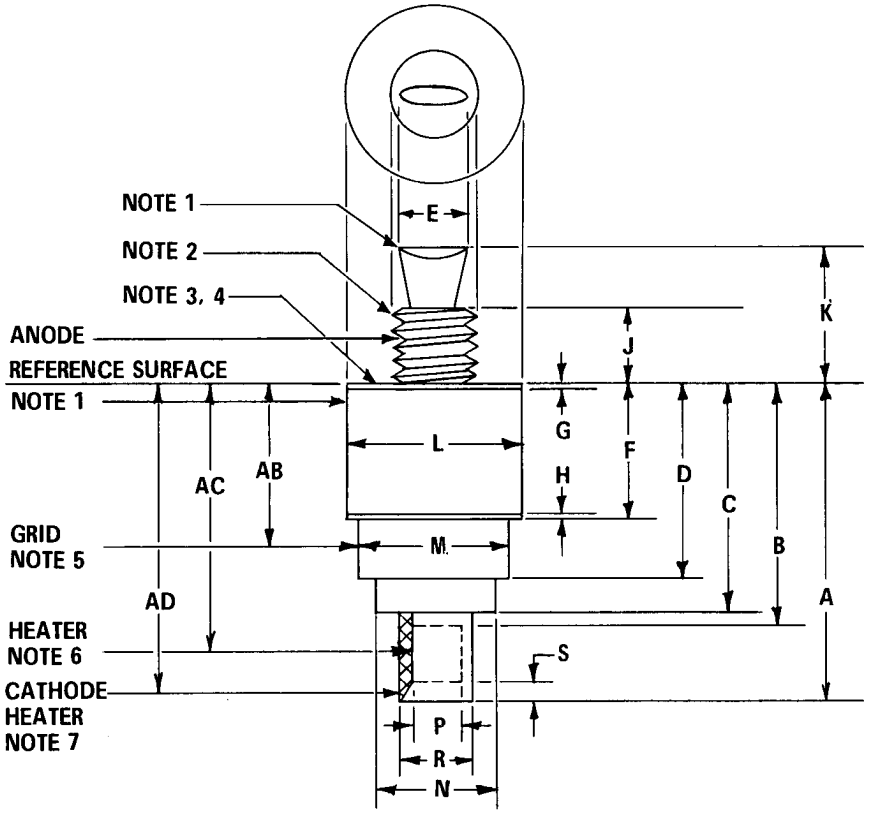
■ The impedance of the plate supply should be such as to limit the plate current to 10 times the normal operating plate current if the tube is considered a short circuit.

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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



REF	INCHES	
	MINIMUM	MAXIMUM
A	1.365	1.425
B	---	1.084
C	---	1.025
D	0.850	0.900
E	---	0.320
F	0.520	0.560
G	---	0.040
H	---	0.030
J	---	0.340
K	---	0.600
L	0.760	0.800
M	0.655	0.665
N	---	0.545
P	0.213	0.223
R	0.315	0.325
S	---	0.086

ELECTRODE CONTACT AREA		
REF	LIMITS (INCHES)	CONTACT
AB	0.775 ± 0.040	GRID
AC	1.181 ± 0.097	HEATER
AD	1.195 ± 0.070	CATHODE

NOTES:
1. Do not clamp on this surface.
2. Thread 3/8" - UNC 2A.
3. Electrode Contact Surface, Anode.
4. Measure Anode Shank temperature here.
5. Electrode Contact Surface, Grid.
6. Electrode Contact Surface, Heater.
7. Electrode Contact Surface, Heater and Cathode rf.

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

GE17701

The GE17701 is a planar metal-ceramic triode intended for use as a plate-pulsed oscillator or amplifier. This tube was designed primarily for zero-bias, long life, high power, broadbanded amplifiers.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	RL Ohms	Rk Ohms
Heater Voltage, AC or DC★	6.0	6.3	6.6	Volts					
Heater Current	1.15	1.25	1.35	Amperes	6.3	---	---	---	---
Plate Current	24	34	44	Milliamperes	6.3	200	---	---	68
Amplification Factor	43	58	73		6.3	200	---	---	68
Transconductance	19000	26000	33000	Micromhos	6.3	200	---	---	68
Grid Voltage, Cutoff	---	---	-100	Volts	6.3	2000	0.1	100000	---
Direct Interelectrode Capacitances●									
Grid to Plate: (g to p)	1.95	2.15	2.35	pf					
Input: g to (h+k)	7.0	9.0	11.0	pf					
Output: p to (h+k)	---	0.1	0.15	pf					
Cathode Heating Time	10	---	---	Seconds					

PLATE-PULSED OSCILLATOR SERVICE

Frequency	1200	Megahertz
Duty Factor	0.004	
Pulse Duration	4	Microseconds
Pulse Repetition Rate	1000	Pulse Per Second
Peak Positive-Pulse Supply Voltage	2500	Volts
Plate Current: Average During Pulse	4	Amperes
Grid Current: Average During Pulse	2	Amperes
Power Output: Average During Pulse	3.5	Watts

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. In some applications, longer tube life may be obtained at reduced heater voltage. For specific recommendations, contact your General Electric sales representative.

● Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

ABSOLUTE-MAXIMUM RATINGS

PLATE-PULSED OSCILLATOR SERVICE

Peak Positive-Pulse Plate Supply Voltage		
1 Microsecond Pulse Duration	3500	Volts
4 Microsecond Pulse Duration	2500	Volts
Duty Factor of Plate Pulse §	0.004	
Plate Current: Average During Pulse ⊕	5.0	Amperes
Negative Grid Voltage: Average During Pulse	-120	Volts
Grid Current: Average During Pulse	2.0	Amperes
Plate Dissipation	30	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point ▲	250	°C
Temperature Differential Between Two Adjacent Electrodes ♦	100	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	30	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

NOTES

§ In any 5 millisecond interval.

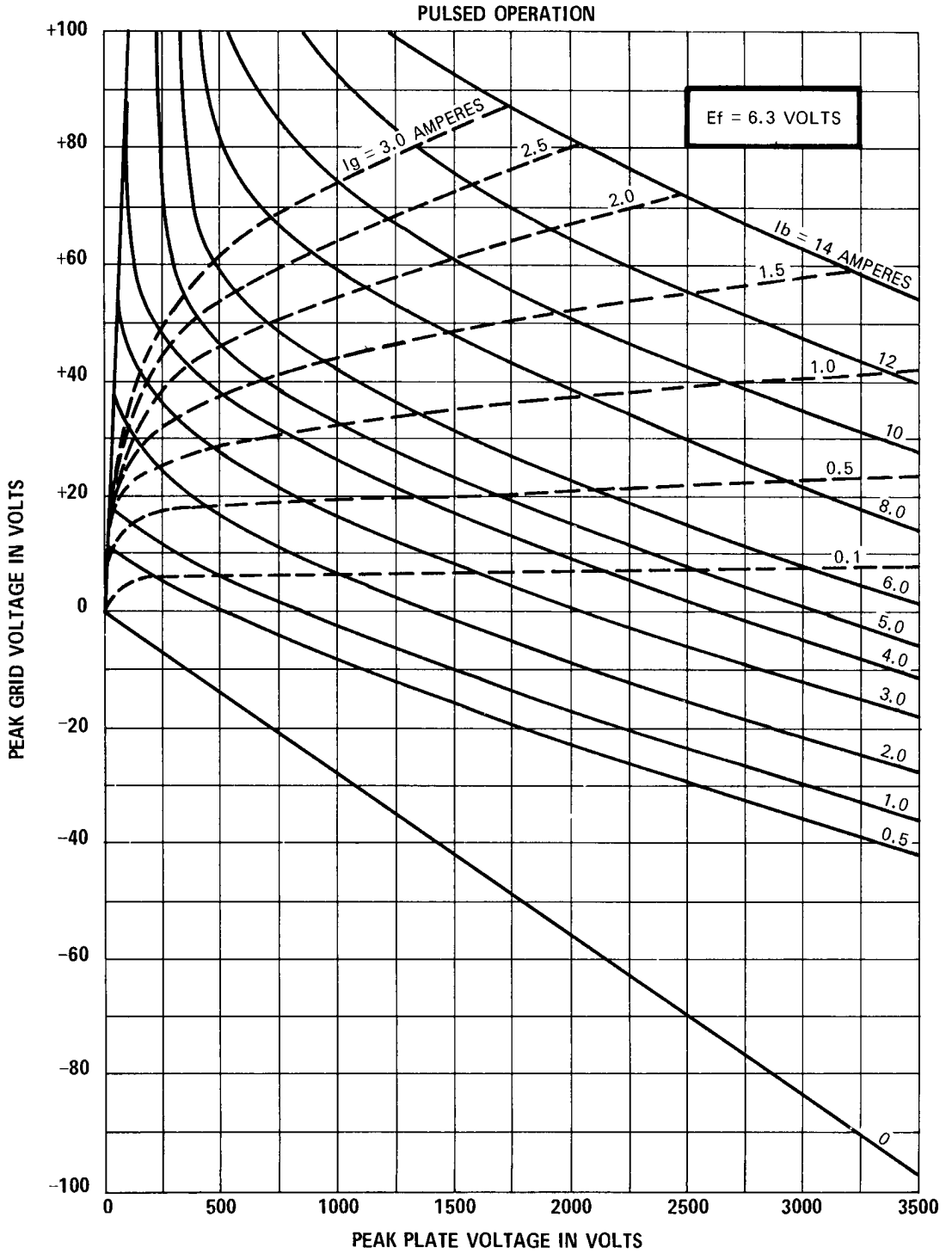
⊕ The regulation and/or series plate supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 10 times the maximum plate current rating.

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

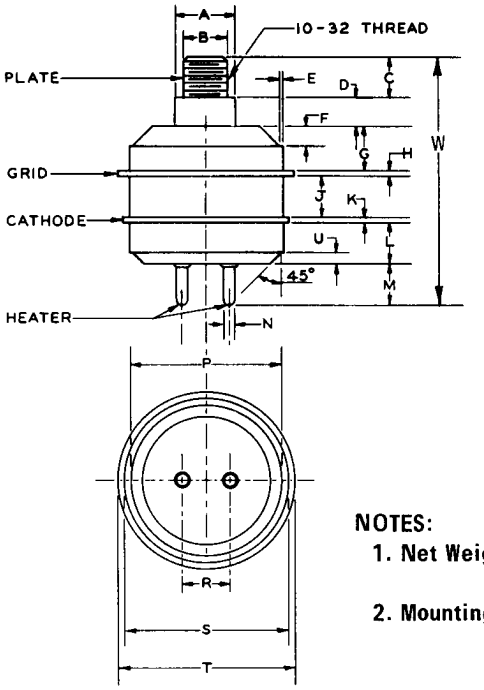
♦ This assumes no thermal heat sinking to any insulator.

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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



NOTES:
1. Net Weight - 0.307 Ounces
   - 8.7 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.247	0.250	0.253	6.274	6.350	6.426
B	---	---	0.190	---	---	4.826
C	0.130	0.150	0.170	3.302	3.810	4.318
D	0.070	0.080	0.090	1.778	2.032	2.286
E	---	0.005	---	---	0.127	---
F	0.075	0.085	0.095	1.905	2.159	2.388
G	0.182	0.187	0.192	4.623	4.750	4.877
H	0.025	0.028	0.031	0.635	0.711	0.787
J	0.170	0.175	0.180	4.318	4.445	4.572
K	0.025	0.028	0.031	0.635	0.711	0.787
L	0.170	0.175	0.180	4.318	4.445	4.572
M	0.170	0.175	0.180	4.318	4.445	4.572
N	0.047	0.050	0.053	1.194	1.270	1.346
P	0.635	0.650	0.665	16.13	16.51	16.89
R	0.186	0.200	0.214	4.724	5.080	5.436
S	0.698	0.703	0.708	17.73	17.86	17.98
T	0.748	0.753	0.758	19.00	19.13	19.25
U	0.040	0.050	0.060	1.016	1.270	1.524
W	0.942	0.998	1.054	23.93	25.35	26.77

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

Planar Triode

GE18651

The GE18651 is a planar triode of ceramic and metal construction intended for use as a plate-pulsed oscillator or amplifier at frequencies up to 6000 megahertz. This tube was designed primarily for zero bias operation in long life broadbanded amplifier chains. The GE18651 features a lengthened anode to permit circuit tuning along its length.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	Eg V	Rk Ohms
Heater Voltage, AC or DC*	6.0	6.3	6.6	Volts					
Heater Current	510	550	590	Milliamperes	6.3	---	---	---	---
Plate Current	14	21	28	Milliamperes	6.3	200	---	---	100
Amplification Factor	48	58	68		6.3	200	---	---	100
Transconductance	16000	22000	28000	Micromhos	6.3	200	---	---	100
Grid Voltage, Cutoff	---	-5	-9	Volts	6.3	200	0.1	---	---
Direct Interelectrode Capacitances•									
Grid to Plate: (g to p)	1.45	1.6	1.75	pf					
Input: g to (h+k)	4.1	4.9	5.7	pf					
Output: p to (h+k)	---	---	---	pf					
Cathode Heating Time	60	---	---	Seconds					

PLATE-PULSED OSCILLATOR SERVICE

Frequency	1200	Megahertz
Duty Factor	0.004	
Pulse Duration	4	Microseconds
Pulse Repetition Rate	1000	Pulses Per Second
Peak Poiitive-Pulse Supply Voltage	1500	Volts
Plate Current: Average During Pulse	1.5	Amperes
Grid Current: Average During Pulse	0.36	Amperes
Power Output: Average During Pulse	800	Watts

NOTES

* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. In some applications, longer tube life may be obtained at reduced heater voltage. For specific recommendations, contact your General Electric sales representative.

• Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

ABSOLUTE-MAXIMUM RATINGS

PLATE-PULSED OSCILLATOR SERVICE

Peak Positive-Pulse Plate Supply Voltage		
1 Microsecond Pulse Duration	2500	Volts
4 Microsecond Pulse Duration	1500	Volts
Duty Factor of Plate Pulse §	0.004	
Plate Current: Average During Pulse ⊕	2.0	Amperes
Negative Grid Voltage: Average During Pulse	100	Volts
Grid Current: Average During Pulse	1.0	Amperes
Plate Dissipation	6.5	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point ▲	250	°C
Temperature Differential Between Two Adjacent Electrodes ♦	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	10	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

NOTES

§ In any 5 millisecond interval.

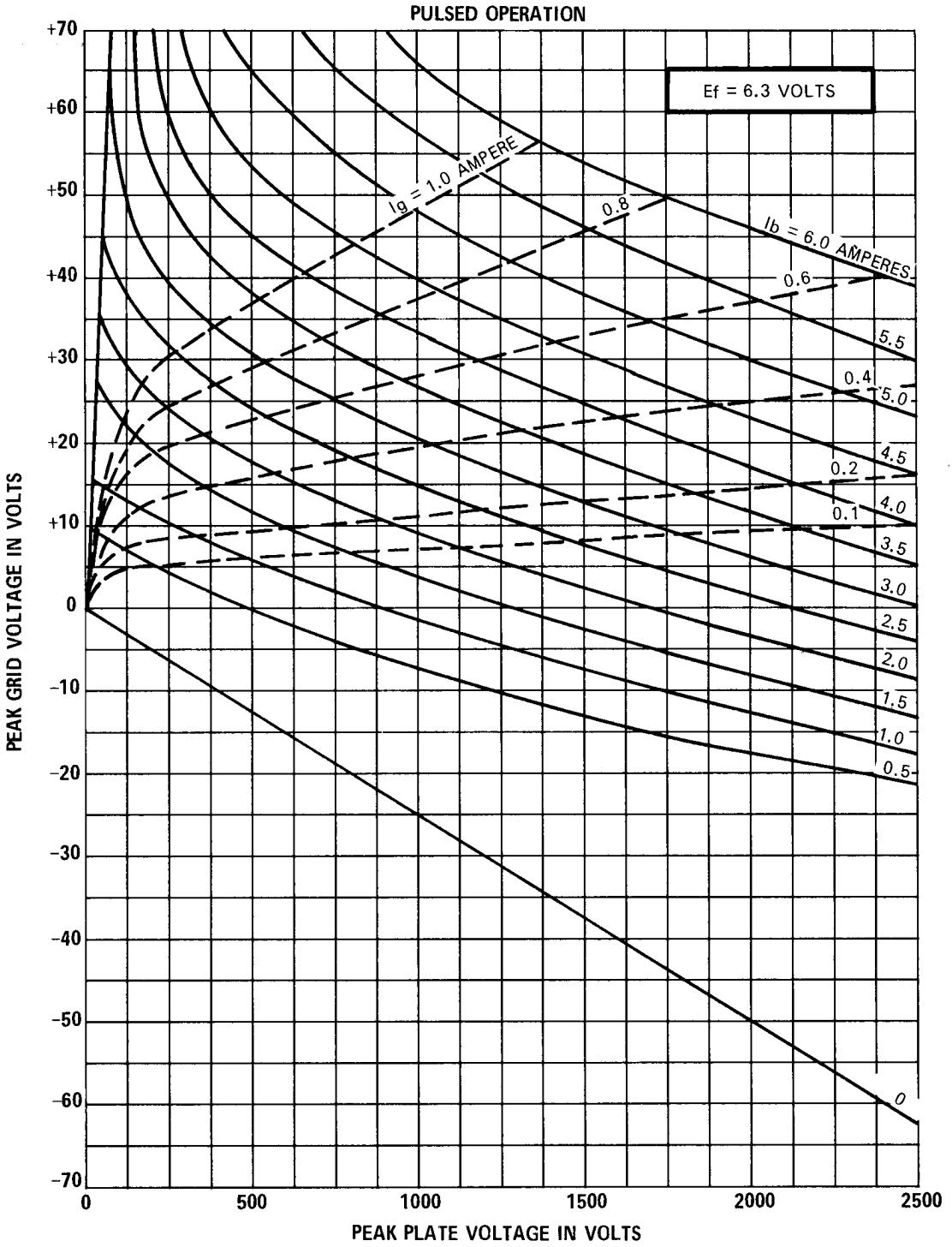
⊕ The regulation and/or series plate supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 10 times the maximum plate current rating.

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

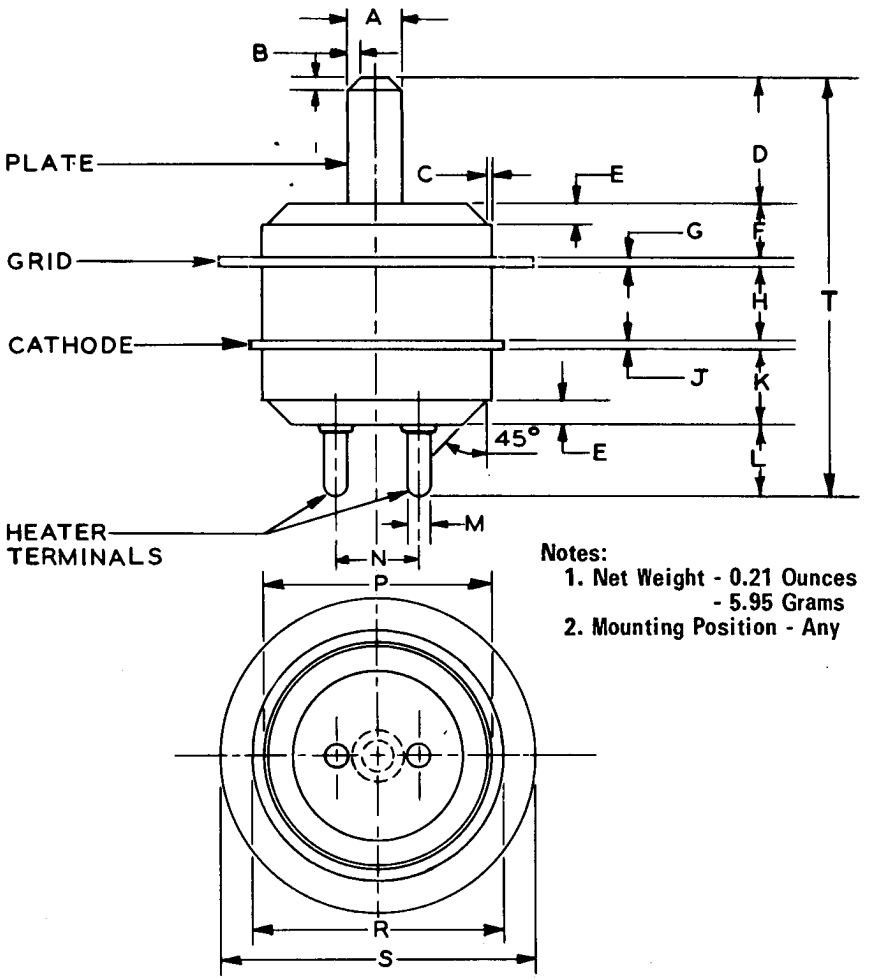
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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



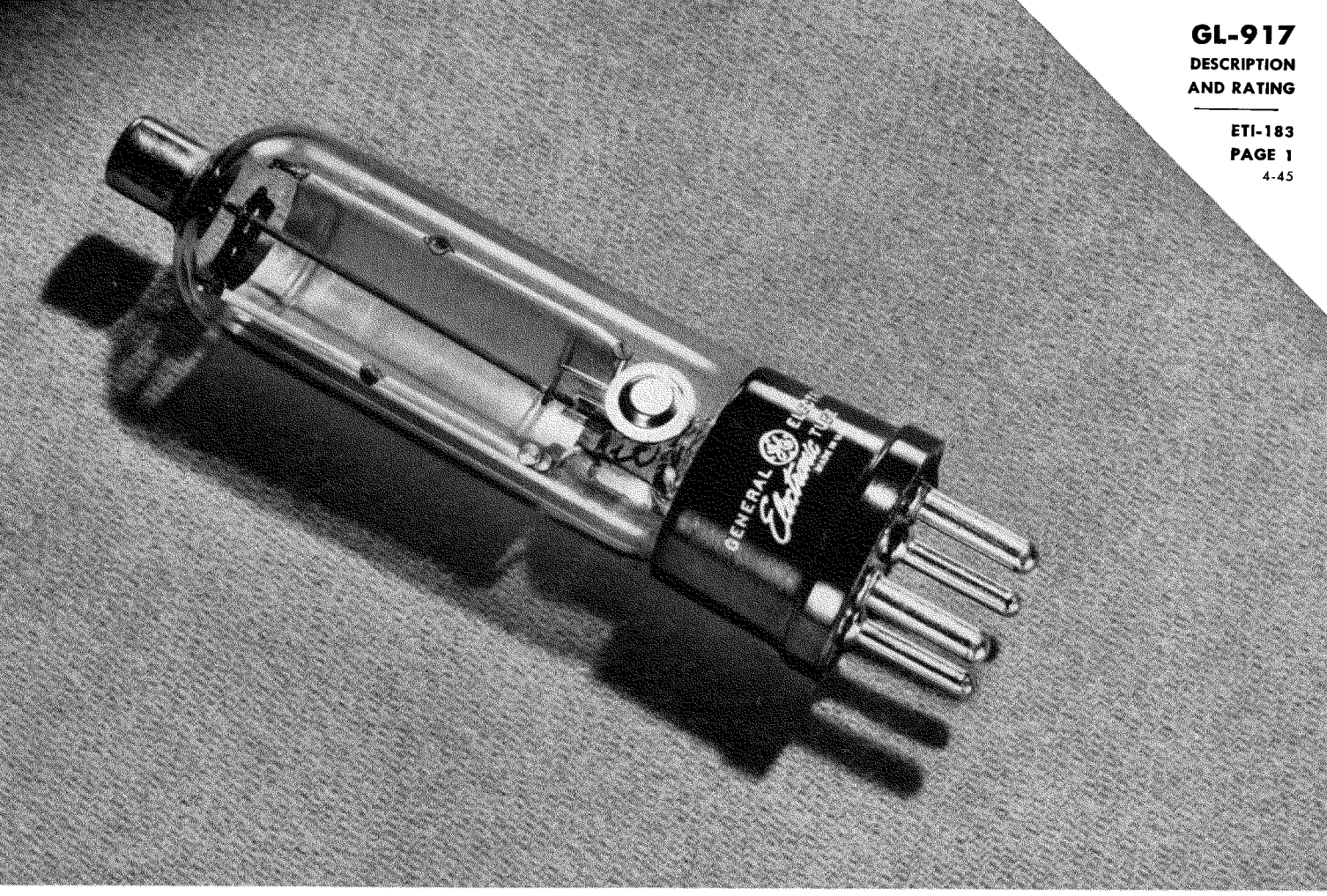
Notes:
1. Net Weight - 0.21 Ounces
   - 5.95 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.122	0.125	0.128	3.099	3.175	3.251
B	---	0.030	---	---	0.762	---
C	---	0.005	---	---	0.127	---
D	0.345	0.350	0.355	8.763	8.890	9.017
E	0.040	0.050	0.060	1.016	1.270	1.524
F	0.120	0.125	0.130	3.048	3.175	3.302
G	0.025	0.028	0.031	0.635	0.711	0.787
H	0.167	0.172	0.177	4.242	4.369	4.496
J	0.025	0.028	0.031	0.635	0.711	0.787
K	0.170	0.175	0.180	4.318	4.445	4.572
L	0.170	0.175	0.180	4.318	4.445	4.572
M	0.047	0.050	0.053	1.194	1.270	1.346
N	0.185	0.200	0.215	4.699	5.080	5.461
P	0.535	0.550	0.565	13.59	13.97	14.35
R	0.598	0.603	0.608	15.19	15.32	15.44
S	0.748	0.753	0.758	19.00	19.13	19.25
T	1.022	1.053	1.084	25.96	26.75	27.53

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301



PHOTOTUBE

DESCRIPTION

The GL-917 is a two-electrode high-vacuum phototube for measurement and relay applications. It has high sensitivity in the red and infrared regions of the spectrum. Construction affords high resistance to leakage current between electrodes, with resultant stability of operation and permanence of calibration. The anode of the GL-917 is connected to the top cap, while in the GL-919 the cathode is connected to the top cap. As a result of this reversal of connections, the GL-917 may be used in series with the GL-919 with resultant very small leakage current and high overall sensitivity.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Spectral response	S-1	
Luminous sensitivity at 250 volts, 0 cycles	20	microamperes per lumen
Interelectrode capacitance	2.0	micromicrofarads
Wavelength of maximum response	8000	angstroms
Sensitivity at maximum response	0.0020	microampere per microwatt

GE Electronic TUBE

GENERAL ELECTRIC

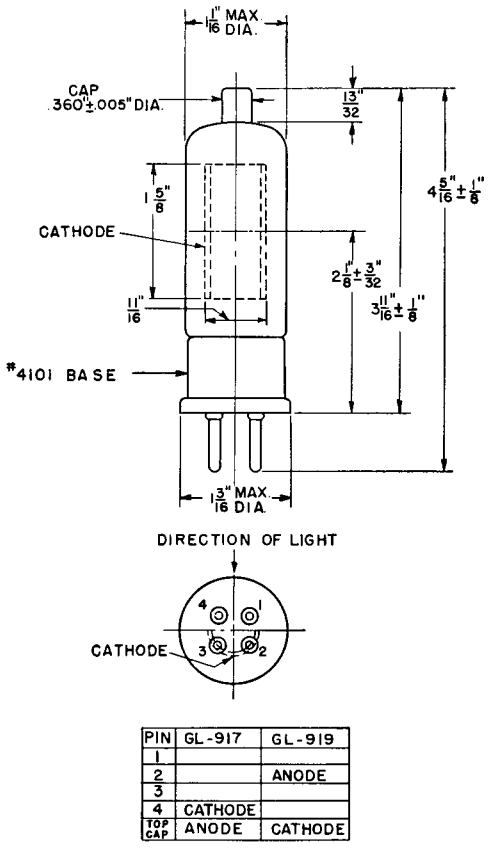
TECHNICAL INFORMATION (CONT'D)

Mechanical

Window dimensions	$\frac{11}{16}$ x $1\frac{5}{8}$	inches
Seated height to center of useful cathode area	$2\frac{1}{8}$ $\pm\frac{3}{32}$	inches
Maximum over-all height	$4\frac{7}{16}$	inches
Maximum seated height	$3\frac{13}{16}$	inches
Maximum diameter	$1\frac{3}{16}$	inches
Cap	M8-125	
Base	M8-074	
Mounting position	Any	
Net weight, approx	$\frac{3}{4}$	ounce
Shipping weight, approx	3	pounds

MAXIMUM RATINGS

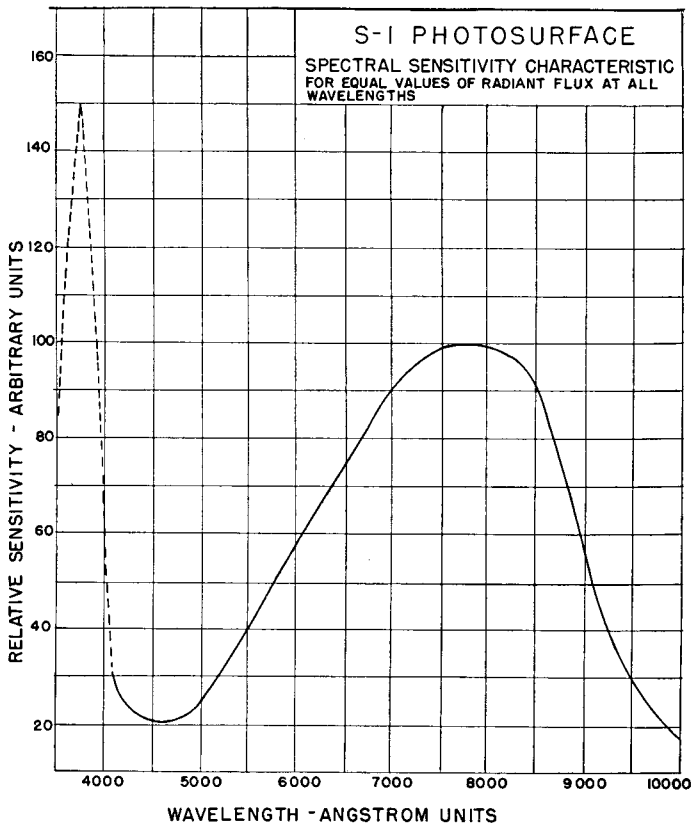
Anode voltage, d-c or peak a-c	500	volts
Cathode current density	152	microamperes per square inch
Ambient temperature	100	centigrade



PIN	GL-917	GL-919
1		
2		ANODE
3		
4	CATHODE	
TOP CAP	ANODE	CATHODE

OUTLINE
PHOTOTUBE GL-917

K-8277038 6-30-44



K-8639626 4-17-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PHOTOTUBE

DESCRIPTION

The GL-918 is a two-electrode, gas-filled phototube and is designed for use in measurement and relay applications. The S-1 photosurface used in this tube has a high sensitivity to red radiation and is designed particularly for use where the illumination on the phototube is low.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	

Electrical

Spectral response	S-1	
Luminous sensitivity at 90 volts, 0 cycle	150	microamperes per lumen
Maximum gas amplification	10.5	
Interelectrode capacitance	3.0	micromicrofarads
Maximum dark current at 90 volts	0.1	microampere
Wavelength of maximum response	8000	angstroms
Sensitivity at maximum response	0.0145	microampere per microwatt

GE Electronic TUBE

GENERAL ELECTRIC

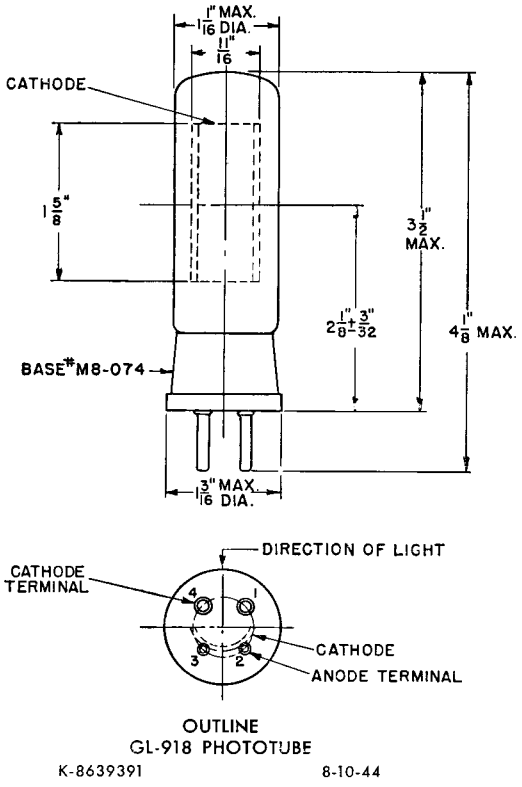
TECHNICAL INFORMATION (CONT'D)

Mechanical

Window dimensions	$\frac{11}{16}$ x $1\frac{5}{8}$	inches
Seated height to center of useful cathode area	$2\frac{1}{8}$ $\pm\frac{3}{32}$	inches
Maximum over-all height	$4\frac{1}{8}$	inches
Maximum seated height	$3\frac{1}{2}$	inches
Maximum diameter	$1\frac{3}{16}$	inches
Base	M8-074	
Mounting position	Any	
Net weight, approx	$\frac{1}{2}$	ounce
Shipping weight, approx	3	pounds

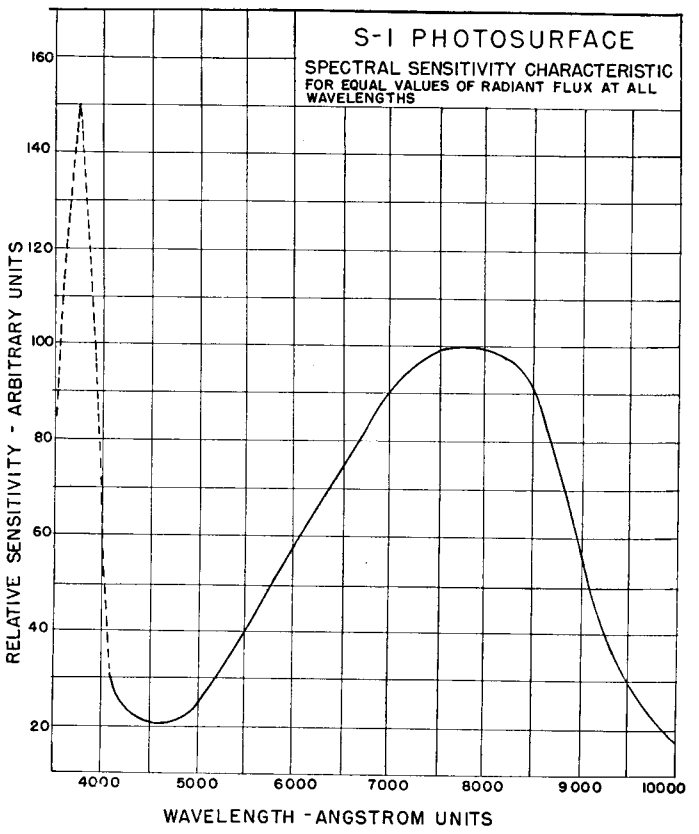
MAXIMUM RATINGS

Anode voltage, d-c or peak a-c	100	volts
Cathode current density	102	microamperes per square inch
Ambient temperature	100	centigrade



OUTLINE
GL-918 PHOTOTUBE

K-8639391 8-10-44

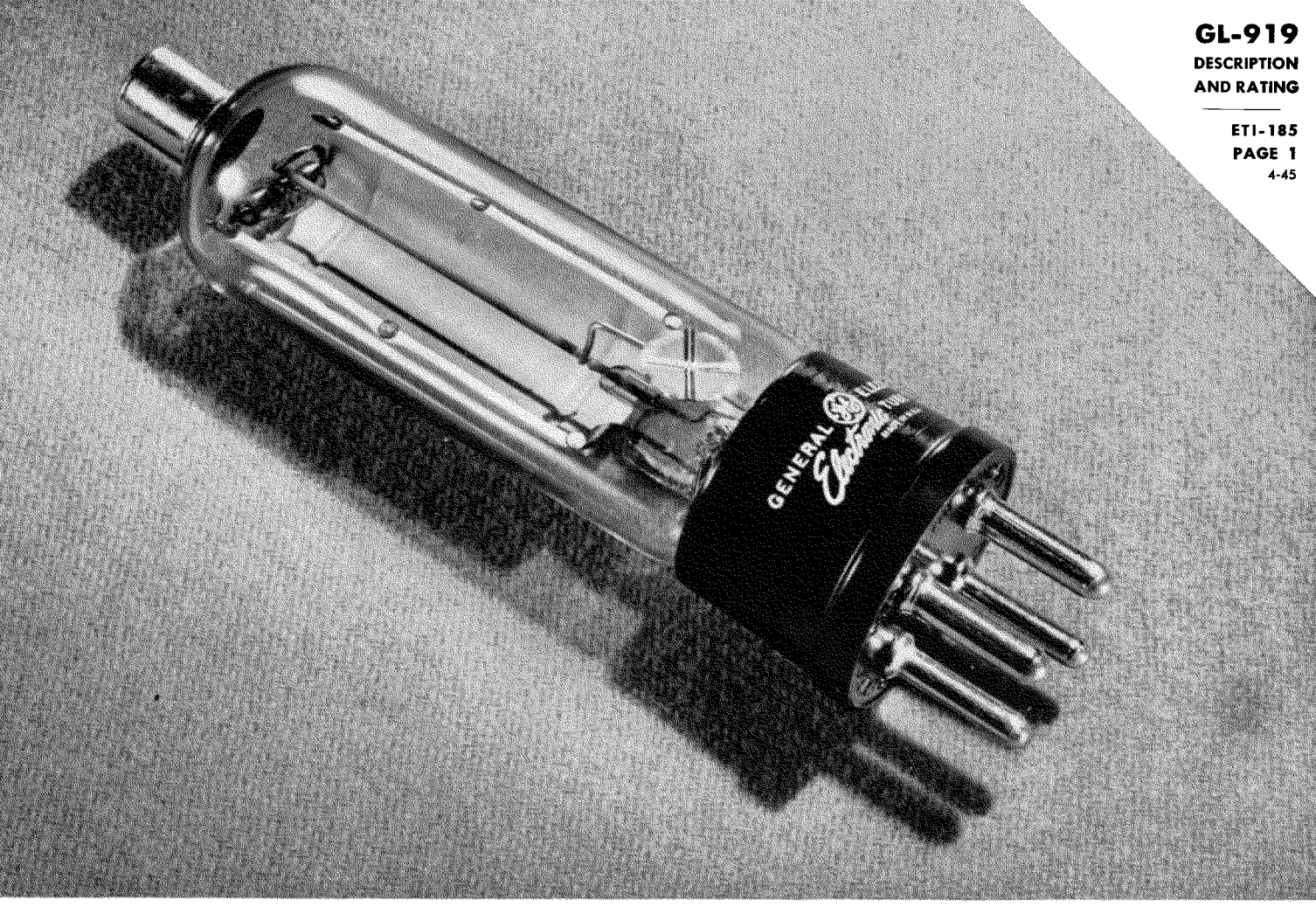


K-8639626 4-17-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PHOTOTUBE

DESCRIPTION

The GL-919 is a two-electrode vacuum phototube for measurement and relay applications. It has high sensitivity in the red and infrared regions of the spectrum. Construction affords high resistance to leakage current between electrodes, with resultant stability of operation and permanence of calibration. The cathode of the GL-919 is connected to the top cap, while in the GL-917 the anode is connected to the top cap. As a result of this reversal of connections, the GL-919 may be used in series with the GL-917 with resultant very small leakage current and high over-all sensitivity.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Spectral response	S-1	
Luminous sensitivity at 250 volts, 0 cycles	20	microamperes per lumen
Interelectrode capacitance	2.0	micromicrofarads
Maximum dark current at 250 volts	0.1	microamperes
Wavelength of maximum response	8000	angstroms
Sensitivity at maximum response	0.0020	microamperes per microwatt

GE Electronic TUBE

GENERAL ELECTRIC

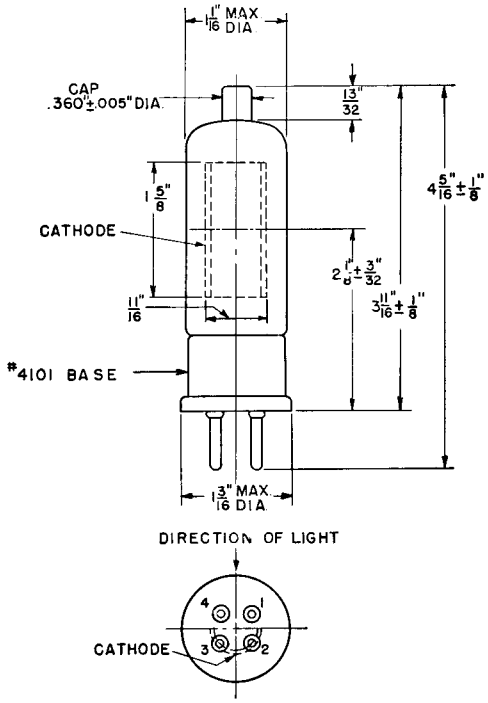
TECHNICAL INFORMATION (CONT'D)

Mechanical

Window dimensions	$\frac{11}{16}$ x $1\frac{5}{8}$	inches
Seated height to center of useful cathode area	$2\frac{1}{8}$ $\pm\frac{3}{32}$	inches
Maximum over-all height	$4\frac{7}{16}$	inches
Maximum seated height	$3\frac{13}{16}$	inches
Maximum diameter	$1\frac{3}{16}$	inches
Cap	M8-125	
Base	M8-074	
Mounting position	Any	
Net weight, approx	$\frac{3}{4}$	ounce
Shipping weight, approx	3	pounds

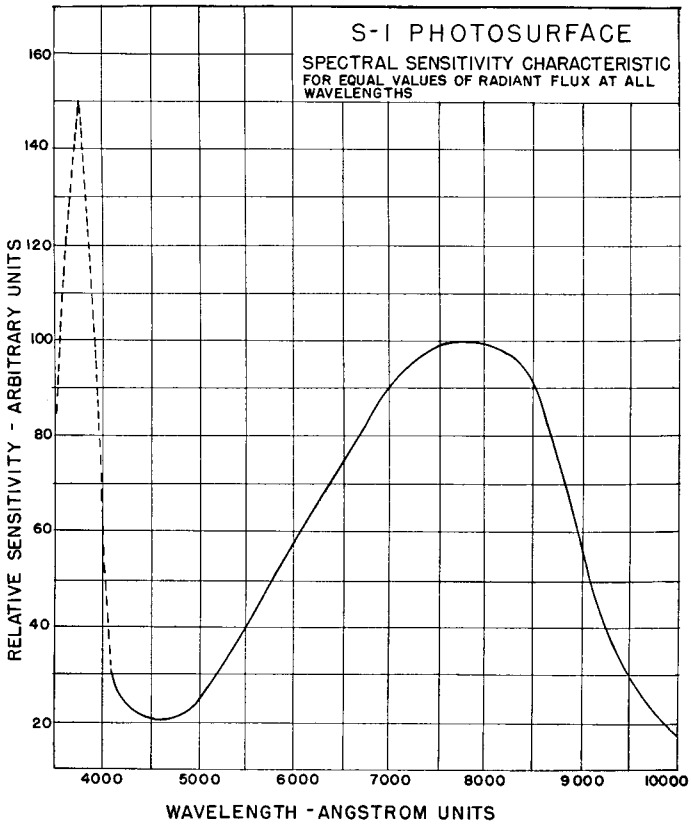
MAXIMUM RATINGS

Anode voltage, d-c or peak a-c	500	volts
Cathode current density	152	microamperes per square inch
Ambient temperature	100	centigrade



PIN	GL-917	GL-919
1		
2		ANODE
3		
4	CATHODE	
TOP CAP	ANODE	CATHODE

OUTLINE
PHOTOTUBE GL-919
K-8277038 6-30-44

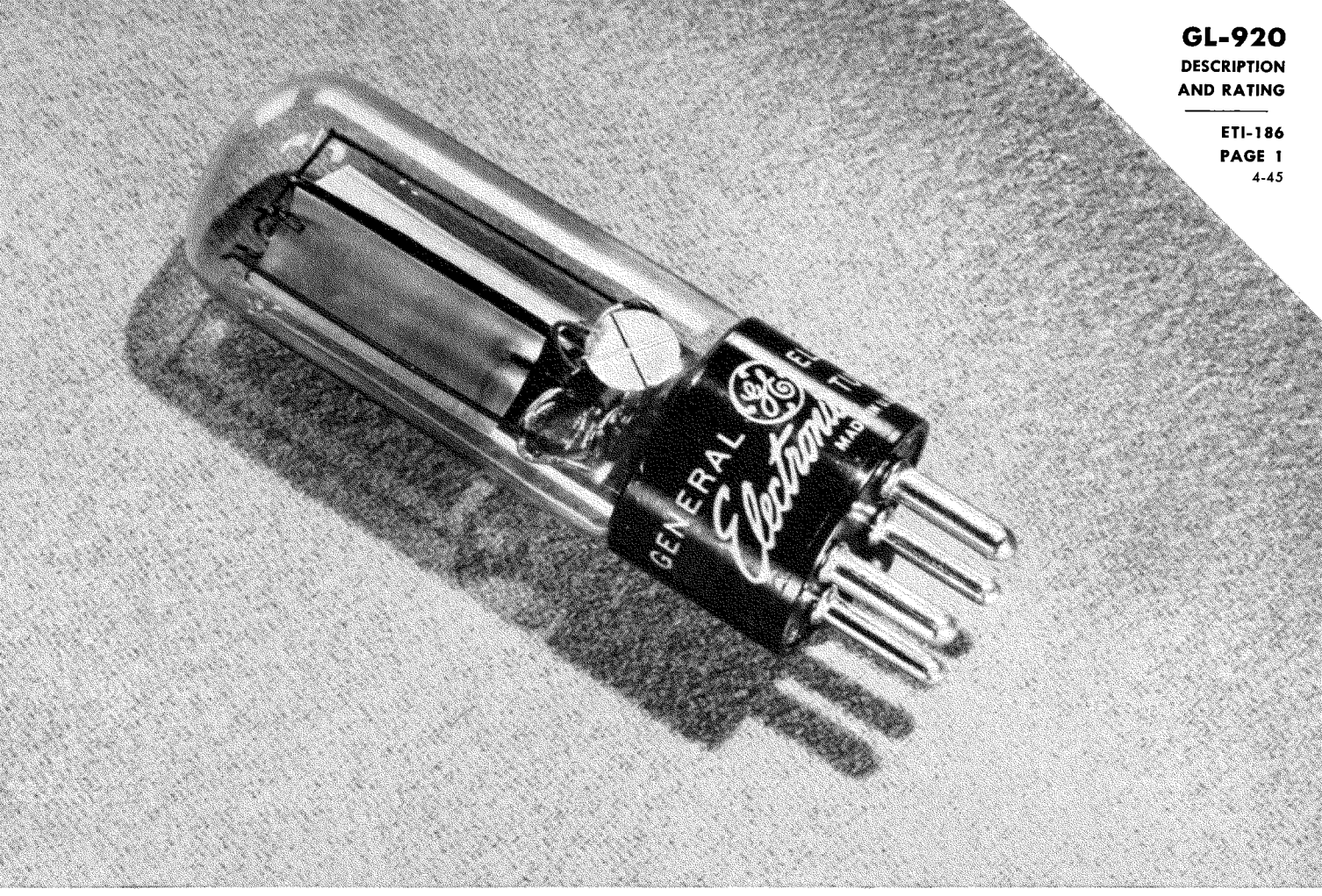


K-8639626 4-17-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PHOTOTUBE

DESCRIPTION

The GL-920 is designed for sound reproduction applications. The S-1 photosurface used in this tube has high sensitivity in the red and infrared region. Two separate phototube units are mounted in the envelope with the cathode and anode of each unit brought out to separate base connections.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	4	

Electrical

Spectral response	S-1	
Luminous sensitivity at 90 volts, 0 cycles	75	microamperes per lumen
Maximum gas amplification	9.0	
Interelectrode capacitances, between cathode and anode of each unit	1.5	micromicrofarads

Electronic TUBE

GENERAL ELECTRIC

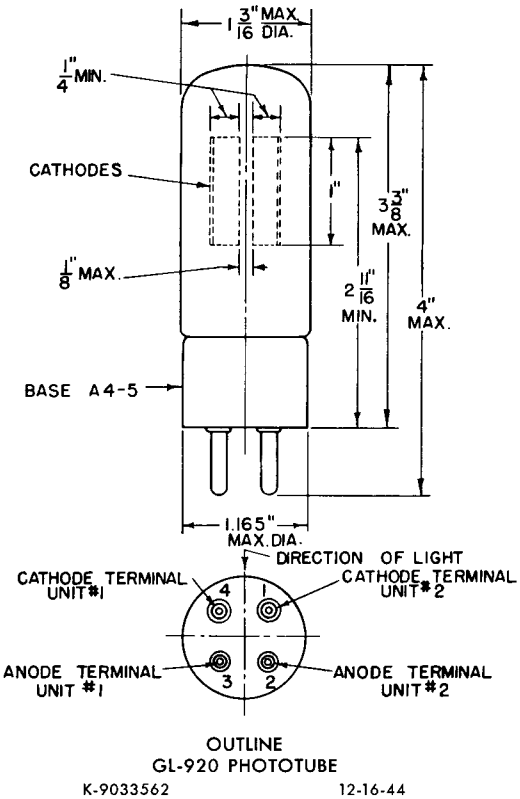
TECHNICAL INFORMATION (CONT'D)

Mechanical

Window dimensions	$\frac{1}{4}$	inch by 1 inch
Seated height to center of useful cathode area	$2\frac{1}{4} \pm \frac{3}{32}$	inches
Maximum over-all height	4	inches
Maximum seated height	$3\frac{3}{8}$	inches
Maximum diameter	$1\frac{3}{16}$	inches
Base	A4-5	
Mounting position	Any	
Net weight, approximate	1	ounce
Shipping weight	3	pounds

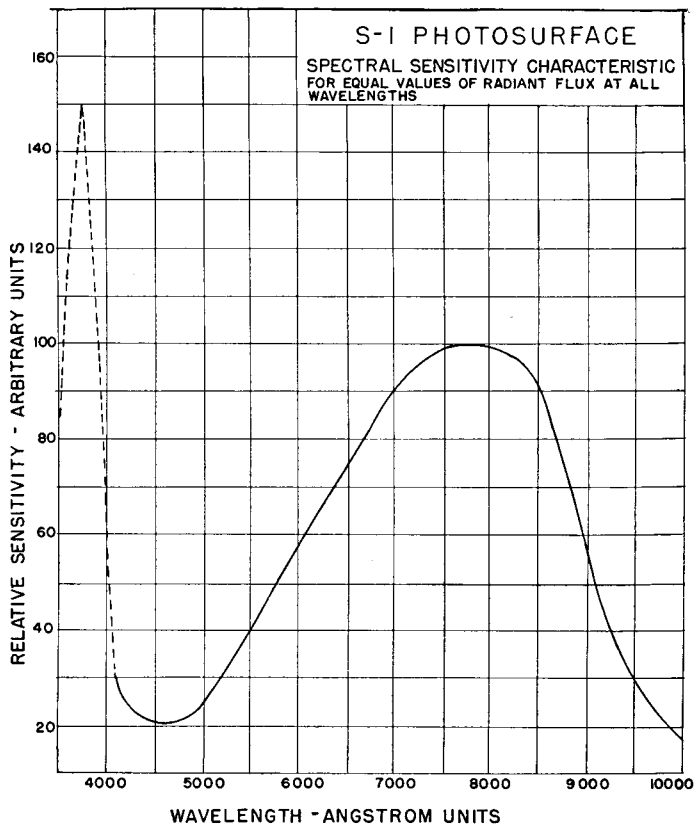
MAXIMUM RATINGS

Anode voltage, d-c or peak a-c	90	volts
Cathode current density	20	microamperes per square inch
Ambient temperature	100	centigrade



OUTLINE
GL-920 PHOTOTUBE

K-9033562 12-16-44

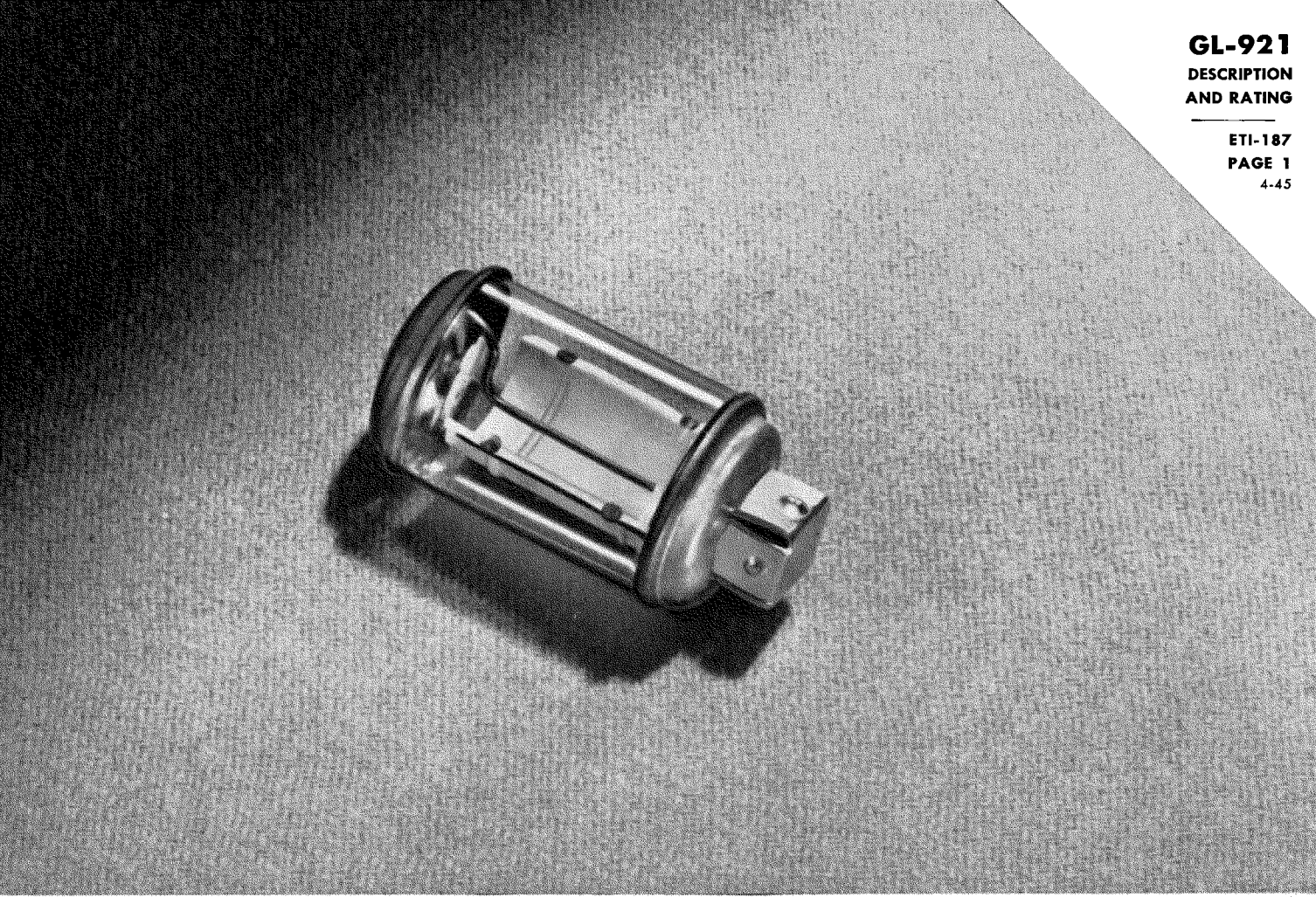


K-8639626 4-17-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PHOTOTUBE

DESCRIPTION

The GL-921 is a cartridge-type, two-electrode gas-filled phototube for relay- and light-measurement applications. It is highly sensitive to red and infrared radiation. The double-edged design, with a terminal at each end, provides a compact phototube useful in applications where space is restricted.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Spectral response	S-1	
Luminous sensitivity at 90 volts, 0 cycles	135	microamperes per lumen
Maximum gas amplification	10	
Interelectrode capacitance	1.0	micromicrofarad
Maximum dark current at 90 volts	0.1	microampere
Wavelength of maximum response	8000	angstroms
Sensitivity at maximum response	0.013	microampere per microwatt

GE Electronic TUBE

GENERAL ELECTRIC

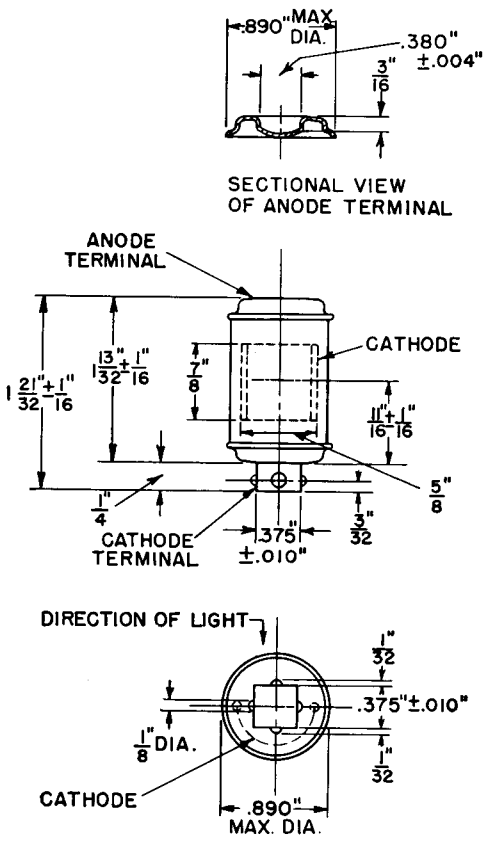
TECHNICAL INFORMATION (CONT'D)

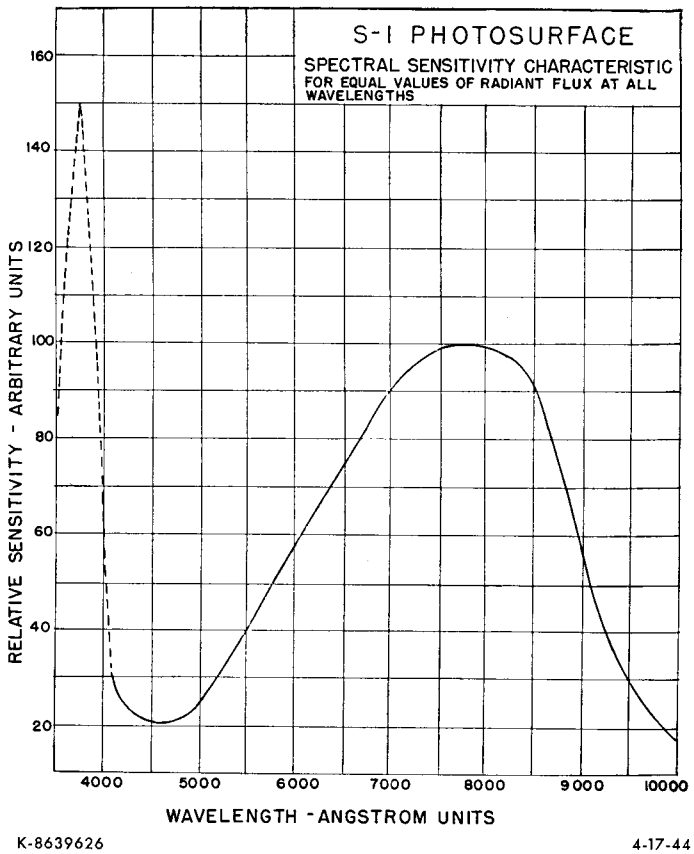
Mechanical

Window dimensions	$\frac{5}{8}$ x $\frac{7}{8}$	inches
Seated height to center of useful cathode area	$\frac{11}{16}$ $\pm\frac{1}{16}$	inches
Maximum over-all height	$1\frac{23}{32}$	inches
Maximum seated height	$1\frac{15}{32}$	inches
Maximum diameter	0.890	inch
Mounting position	Any	
Net weight, approx	$\frac{1}{4}$	ounce
Shipping weight, approx	3	pounds

MAXIMUM RATINGS

Anode voltage, d-c or peak a-c	90	volts
Cathode current density	152	microamperes per square inch
Ambient temperature	100	centigrade

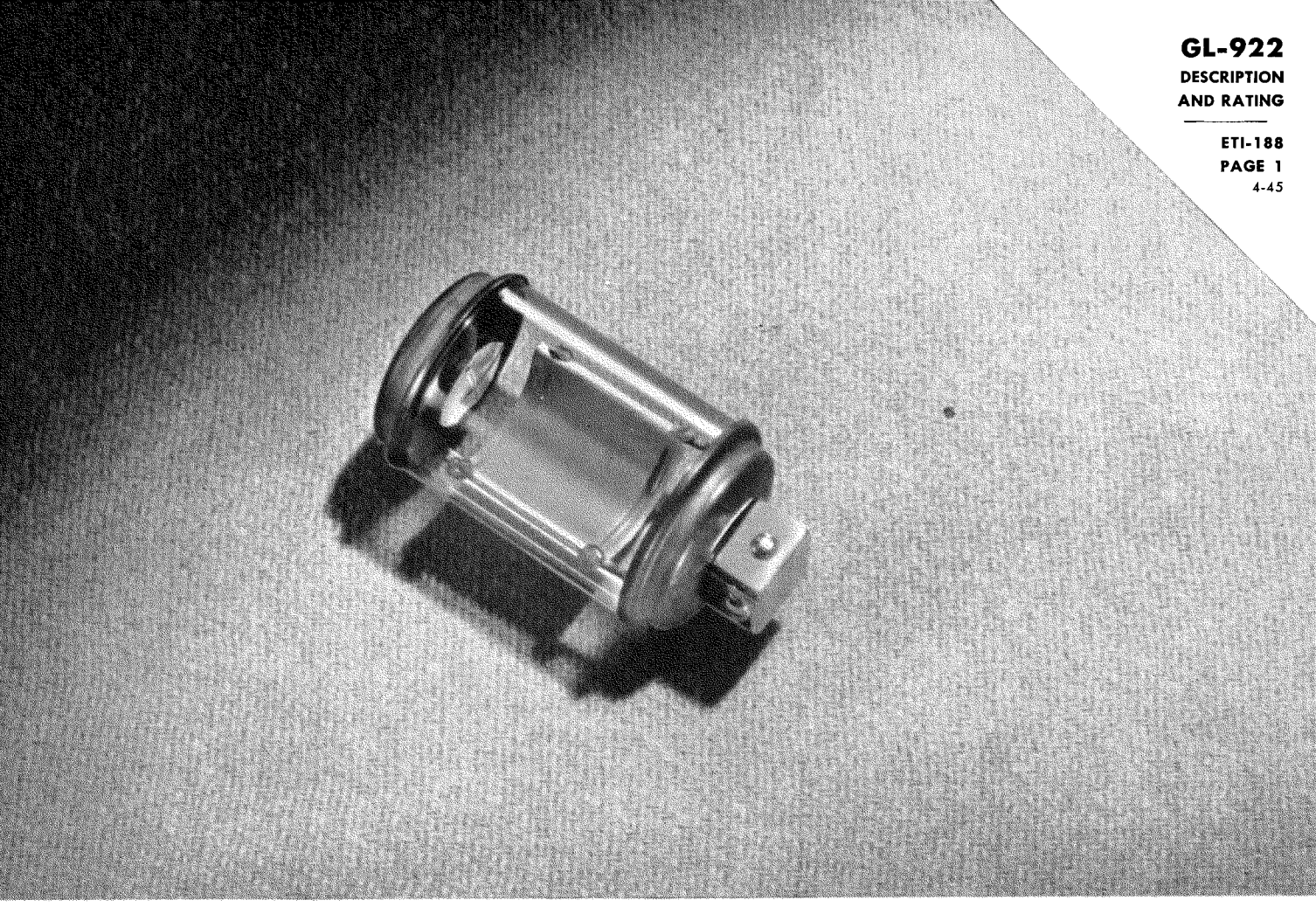




Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PHOTOTUBE

DESCRIPTION

The GL-922 is a cartridge-type, two-electrode phototube for relay- and light-measurement applications. It is highly sensitive to red light and infrared radiation. The double-edged design, with a terminal at each end, provides a compact phototube useful in many applications where space is restricted.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	

Electrical

Spectral response	S-1	
Luminous sensitivity at 250 volts, 0 cycles	20	microamperes per lumen
Interelectrode capacitance	0.5	micromicrofarad
Wavelength of maximum response	8000	angstroms
Sensitivity at maximum response	0.0020	microampere per microwatt

GE Electronic TUBE

GENERAL ELECTRIC

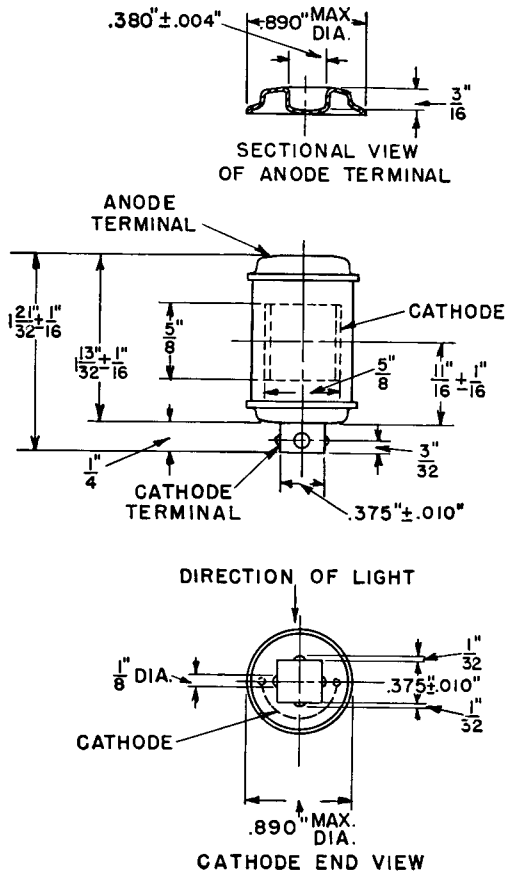
TECHNICAL INFORMATION (CONT'D)

Mechanical

Window dimensions	$\frac{5}{8}$ x $\frac{5}{8}$	inches
Seated height to center of useful cathode area	$\frac{11}{16} \pm \frac{1}{16}$	inches
Maximum over-all height	$1\frac{23}{32}$	inches
Maximum seated height	$1\frac{15}{32}$	inches
Maximum diameter	0.890	inch
Mounting position	Any	
Net weight, approx	$\frac{1}{4}$	ounce
Shipping weight, approx	3	pounds

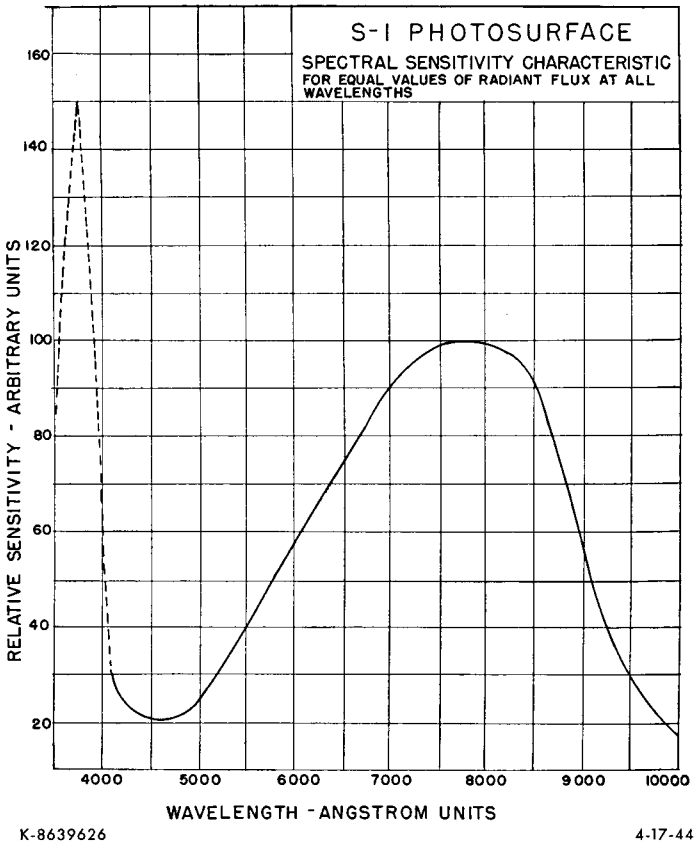
MAXIMUM RATINGS

Anode voltage, d-c or peak a-c	500	volts
Cathode current density	152	microamperes per square inch
Ambient temperature	100	centigrade



OUTLINE
GL-922 PHOTOTUBE

K-8639380 6-30-44

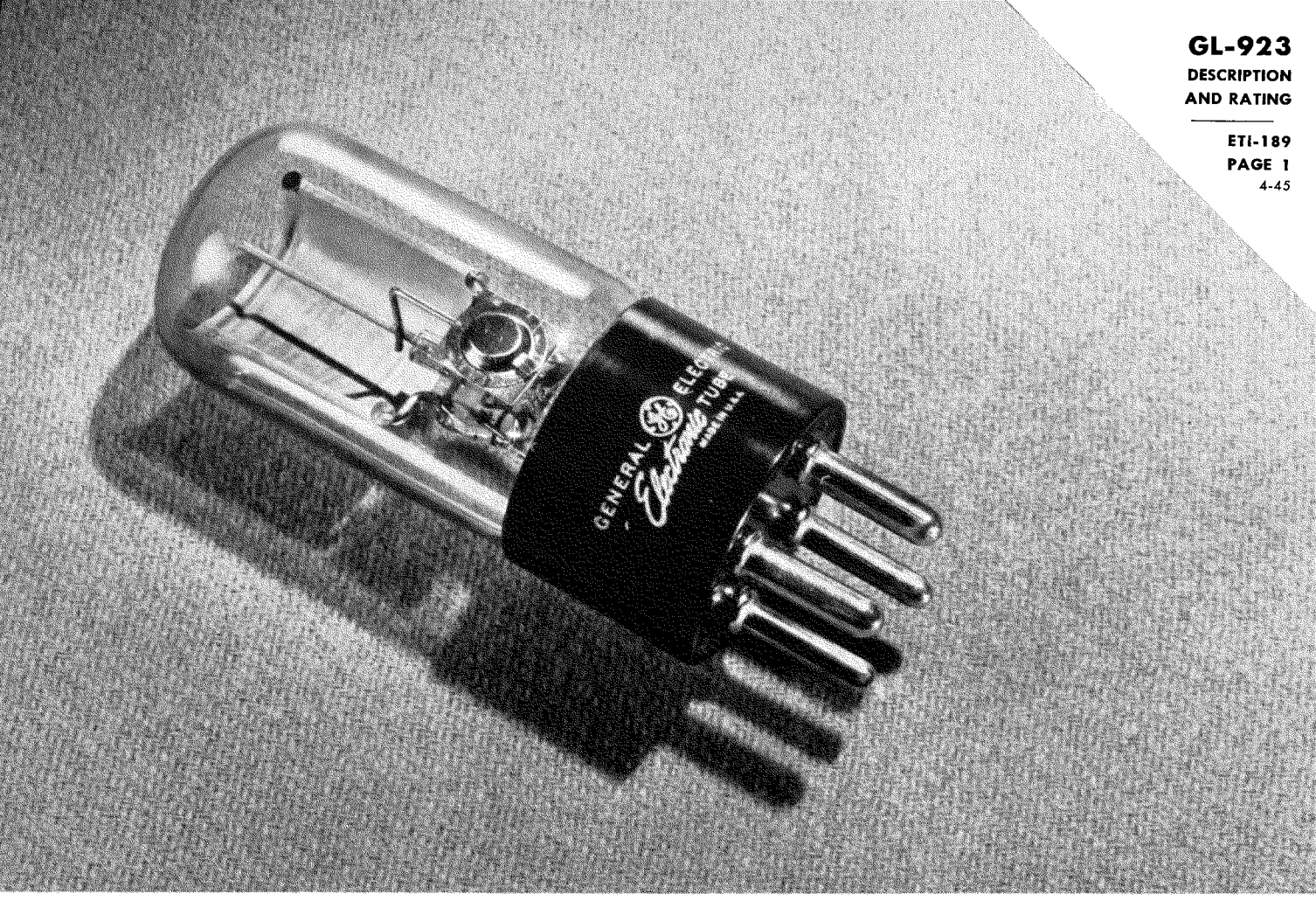


K-8639626 4-17-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PHOTOTUBE

DESCRIPTION

The GL-923 is a two-electrode, gas-filled phototube used in measurement and relay applications. The S-1 photosurface used in this tube has a high sensitivity to red radiation and is designed particularly for use where the illumination on the phototube is low.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Spectral response	S-1	
Luminous sensitivity at 90 volts, 0 cycles	135	microamperes per lumen
Maximum gas amplification	10.0	
Interelectrode capacitance	2.6	micromicrofarads
Maximum dark current at 90 volts	0.1	microampere
Wavelength of maximum response	8000	angstroms
Sensitivity at maximum response	0.0130	microampere per microwatt

GE Electronic TUBE

GENERAL ELECTRIC

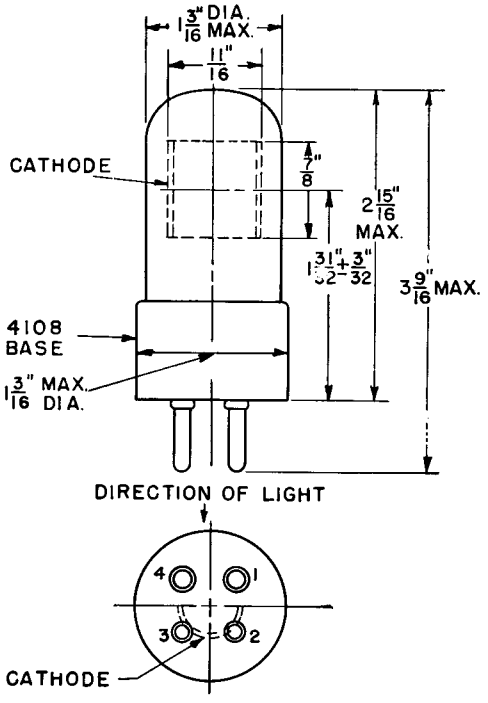
TECHNICAL INFORMATION (CONT'D)

Mechanical

Window dimensions	$\frac{11}{16}$ x $\frac{7}{8}$	inches
Seated height to center of useful cathode area	$1\frac{31}{32} \pm \frac{3}{32}$	inches
Maximum over-all height	$3\frac{9}{16}$	inches
Maximum seated height	$2\frac{15}{16}$	inches
Maximum diameter	$1\frac{3}{16}$	inches
Base	M8-071	
Mounting position	Any	
Net weight, approx	$\frac{3}{4}$	ounce
Shipping weight, approx	3	pounds

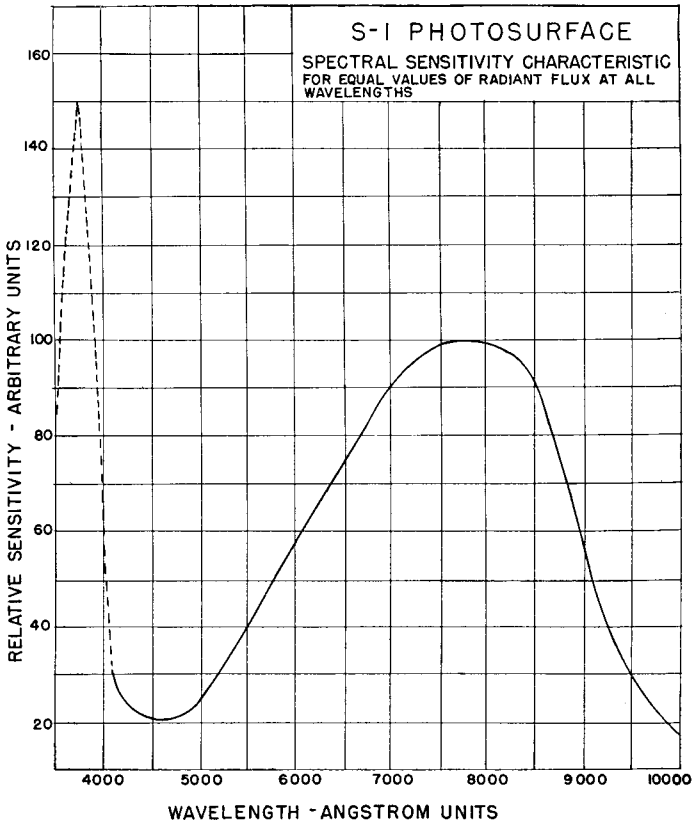
MAXIMUM RATINGS

Anode voltage, d-c or peak a-c	90	volts
Cathode current density	102	microamperes per square inch
Ambient temperature	100	centigrade



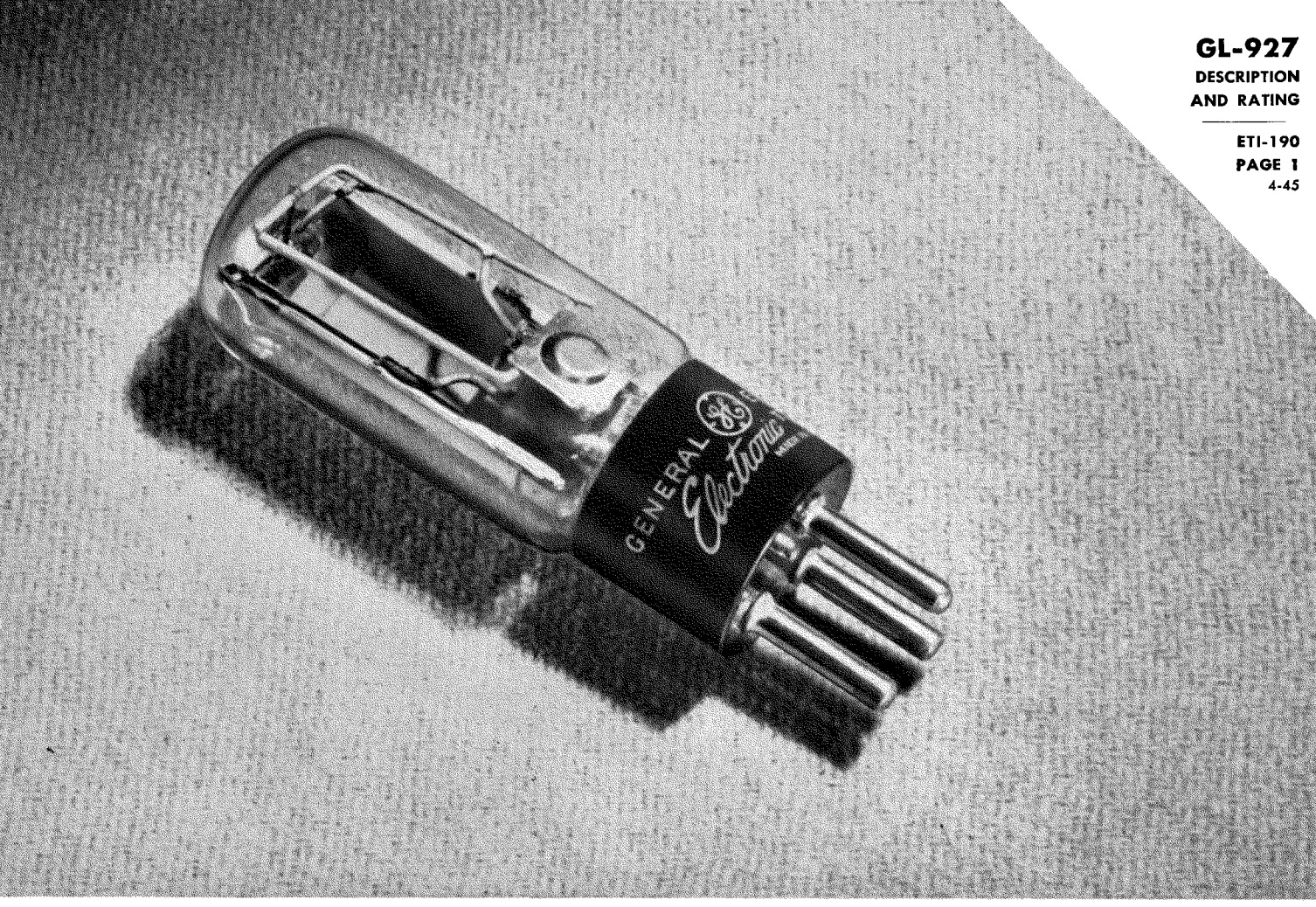
PIN	CONNECTION
1	NO CONNECTION
2	ANODE
3	NO CONNECTION
4	CATHODE

OUTLINE
GL-923 PHOTOTUBE
K-8065599 6-30-44



K-8639626 4-17-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



PHOTOTUBE

DESCRIPTION

The GL-927 is a two-electrode, gas-filled phototube which is used in measurement and relay applications. The S-1 photosurface used in this tube has a high sensitivity to red radiation and is designed particularly for use where the illumination on the phototube is low.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Electrical

Number of electrodes	2	
Spectral response	S-1	
Luminous sensitivity at 90 volts, 0 cycles	125	microamperes per lumen
Interelectrode capacitance	2.0	micromicrofarads
Wavelength of maximum response	7500	angstroms
Sensitivity at maximum response	0.0150	microampere per microwatt

Electronic TUBE

GENERAL ELECTRIC

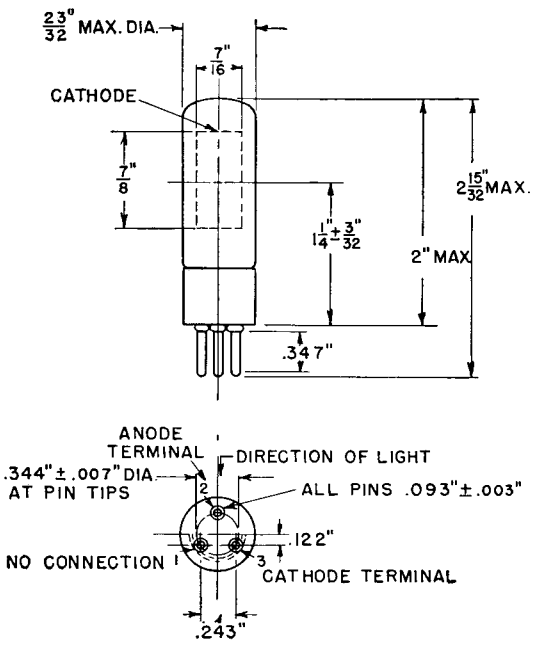
TECHNICAL INFORMATION (CONT'D)

Mechanical

Window dimensions	$\frac{7}{16}$ x $\frac{7}{8}$	inch
Seated height to center of useful cathode area	$1\frac{1}{4} \pm \frac{3}{32}$	inches
Maximum over-all height	$2\frac{15}{32}$	inches
Maximum seated height	2	inches
Maximum diameter	$\frac{23}{32}$	inch
Base	3313	
Mounting position	Any	
Net weight, approx	$\frac{1}{2}$	ounce
Shipping weight, approx	3	pounds

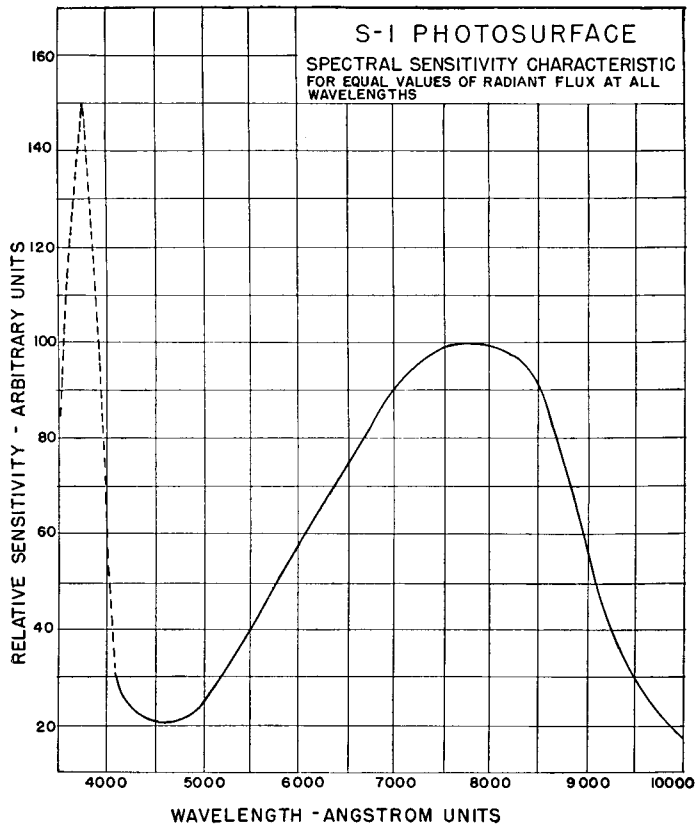
MAXIMUM RATINGS

Anode voltage, d-c or peak a-c	90	volts
Cathode current density	101	microamperes per square inch
Ambient temperature	100	centigrade



OUTLINE
GL-927 GAS PHOTOTUBE

K-8277040 8-18-44



K-8639626 4-17-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PHOTOTUBE

DESCRIPTION

The GL-929 is a high-vacuum, two-electrode phototube which has extraordinarily high sensitivity to light sources predominating in blue radiation. Because of its excellent stability, and high sensitivity, the GL-929 is particularly suited for measurement and relay applications.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	

Electrical

Spectral response	S-4	
Luminous sensitivity at 250 volts, 0 cycles	45	microamperes per lumen
Interelectrode capacitance	2.6	micromicrofarads
Maximum dark current at 250 volts	0.0125	microampere
Wavelength of maximum response	4000	angstroms
Sensitivity at maximum response	0.040	microampere per microwatt

Electronic TUBE

GENERAL ELECTRIC

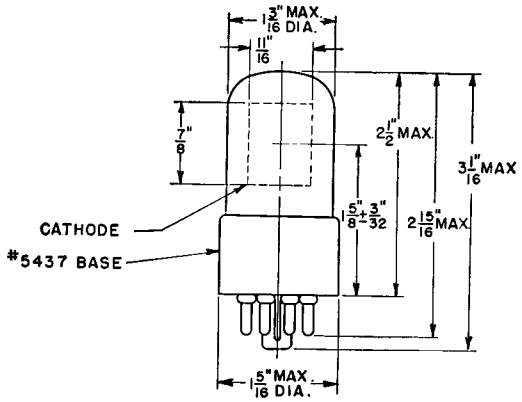
TECHNICAL INFORMATION (CONT'D)

Mechanical

Window dimensions	$\frac{11}{16}$ x $\frac{7}{8}$	inches
Seated height to center of useful area	$1\frac{5}{8}$ $\pm\frac{3}{32}$	inches
Maximum over-all height	$3\frac{1}{16}$	inches
Maximum seated height	$2\frac{1}{2}$	inches
Maximum diameter	$1\frac{5}{16}$	inches
Base	M8-046	
Mounting position	Any	
Net weight, approx	$\frac{3}{4}$	ounce
Shipping weight, approx	3	pounds

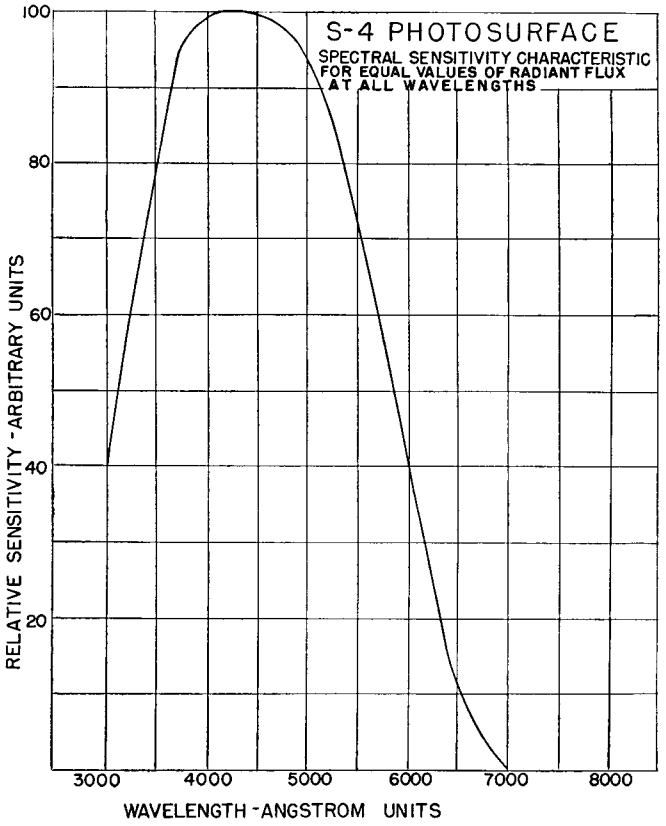
MAXIMUM RATINGS

Anode voltage, d-c or peak a-c	250	volts
Cathode current density	102	microamperes per square inch
Ambient temperature	50	centigrade



PIN	CONNECTION
1	NO CONNECTION
2	NO CONNECTION
4	ANODE
7	NO CONNECTION
8	CATHODE

OUTLINE
GL-929 PHOTOTUBE
K-8070703 6-30-44



K-8639625 4-27-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



PHOTOTUBE

DESCRIPTION

The GL-930 is a two-electrode, gas-filled phototube which is used in measurement and relay applications. The S-1 photosurface used in this tube has a high sensitivity to red radiation. The GL-930 is designed particularly for use where the illumination on the phototube is low.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Spectral response	S-1	
Luminous sensitivity at 90 volts, 0 cycles	135	microamperes per lumen
Maximum gas amplification	10	
Interelectrode capacitance	2.6	micromicrofarads
Maximum dark current at 90 volts	0.1	microamperes
Wavelength of maximum response	8000	angstroms
Sensitivity at maximum response	0.0130	microampere per microwatt

GE Electronic TUBE

GENERAL ELECTRIC

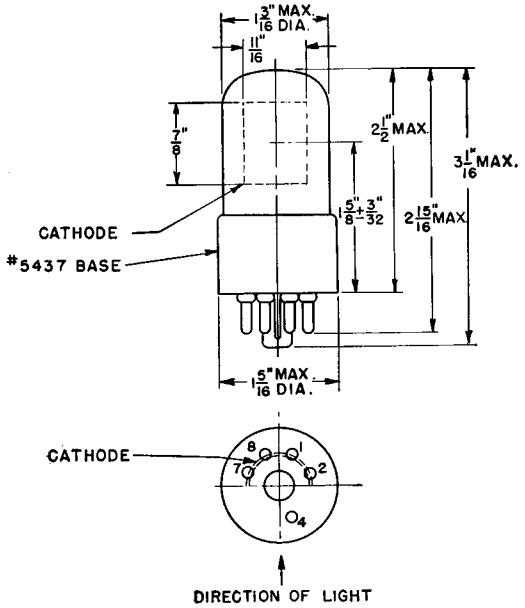
TECHNICAL INFORMATION (CONT'D)

Mechanical

Window dimensions	$\frac{11}{16}$ x $\frac{7}{8}$	inches
Seated height to center of useful cathode area	$1\frac{5}{8} \pm \frac{3}{32}$	inches
Maximum over-all height	$3\frac{1}{16}$	inches
Maximum diameter	$1\frac{5}{16}$	inches
Base	M8-046	
Mounting position	Any	
Net weight, approx	$\frac{3}{4}$	ounce
Shipping weight, approx	3	pounds

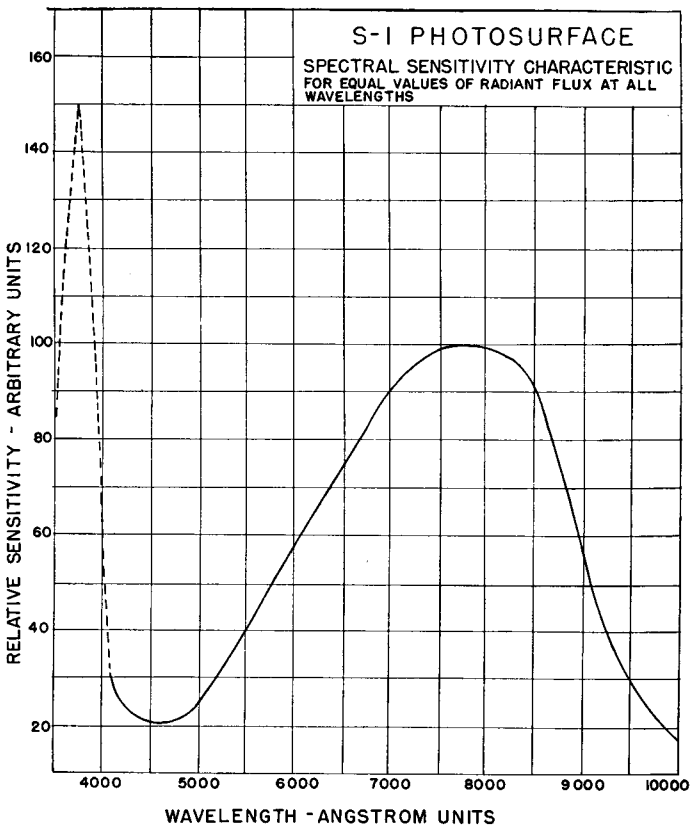
MAXIMUM RATINGS

Anode voltage, d-c or peak a-c	90	volts
Cathode current density	102	microamperes per square inch
Ambient temperature	100	centigrade



PIN	CONNECTION
1	NO CONNECTION
2	NO CONNECTION
4	ANODE
7	NO CONNECTION
8	CATHODE

OUTLINE
GL-930 PHOTOTUBE
K-8070703 6-30-44



K-8639626 4-17-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



PHOTOTUBE

DESCRIPTION

The GL-931-A is an eleven-electrode vacuum phototube unique in that the photo-current produced at the cathode is multiplied many times by secondary emission occurring at successive dynodes within the tube. This tube can multiply feeble currents produced by weak illuminations as much as 200,000 times. This feature combined with its high sensitivity, low-noise level, low-dark current, and freedom from distortion renders the GL-931-A very useful for relays and in applications involving low-light levels.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	11	
Electrical		
Spectral response	S-4	
Interelectrode capacitances		
Anode to dynode No. 9	3.5	micromicrofarads
Anode to all other electrodes	6.5	micromicrofarads
Wavelength of maximum response	3750	angstroms

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

Cathode window area	0.25	square inch
Seated height to center of useful cathode area	$1\frac{15}{16} \pm \frac{3}{32}$	inches
Maximum over-all height	$3\frac{11}{16}$	inches
Maximum seated height	$3\frac{1}{8}$	inches
Maximum diameter	$1\frac{5}{16}$	inches
Base		small-shell submagnal 11-pin
Mounting position	any	
Net weight, approx	1	ounce
Shipping weight, approx	3	pounds

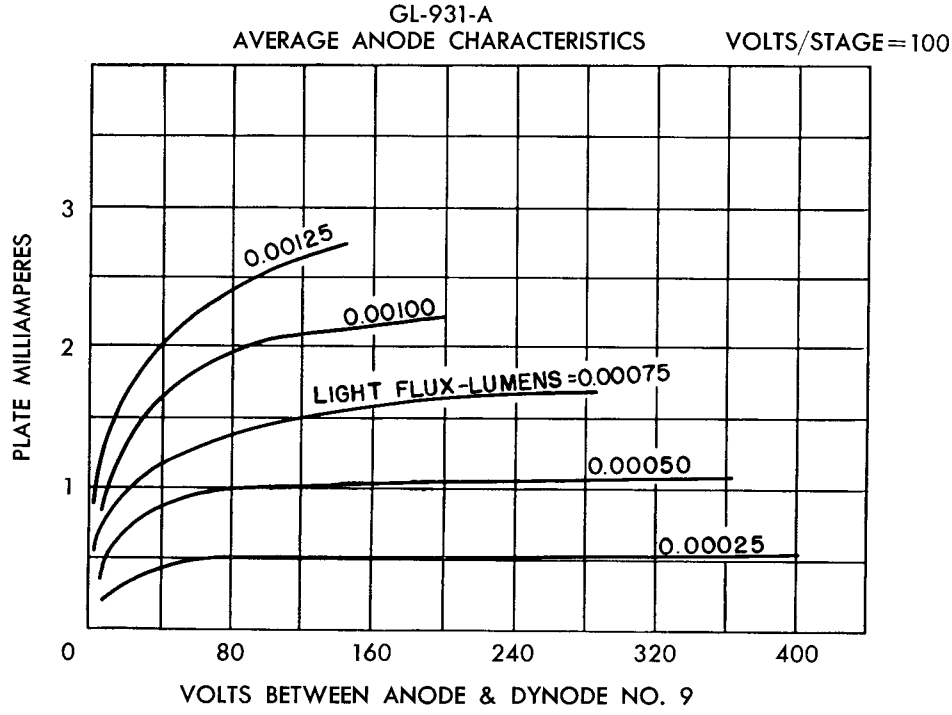
MAXIMUM RATINGS

Anode voltage, d-c or peak a-c*	1250	volts
Cathode current density	230	milliamperes per square inch
Ambient temperature	50	centigrade
Voltage between Dynode No. 9 and Anode	250	volts
Anode current	2.5	milliamperes
Anode dissipation	0.5	watt

TYPICAL OPERATION

Voltage per stage	75	100	volts
Luminous sensitivity†	0.3	2.0	amperes per lumen
Current amplifications†	30,000	200,000	
Sensitivity at 3750 angstroms	270	1800	microamperes per microwatts

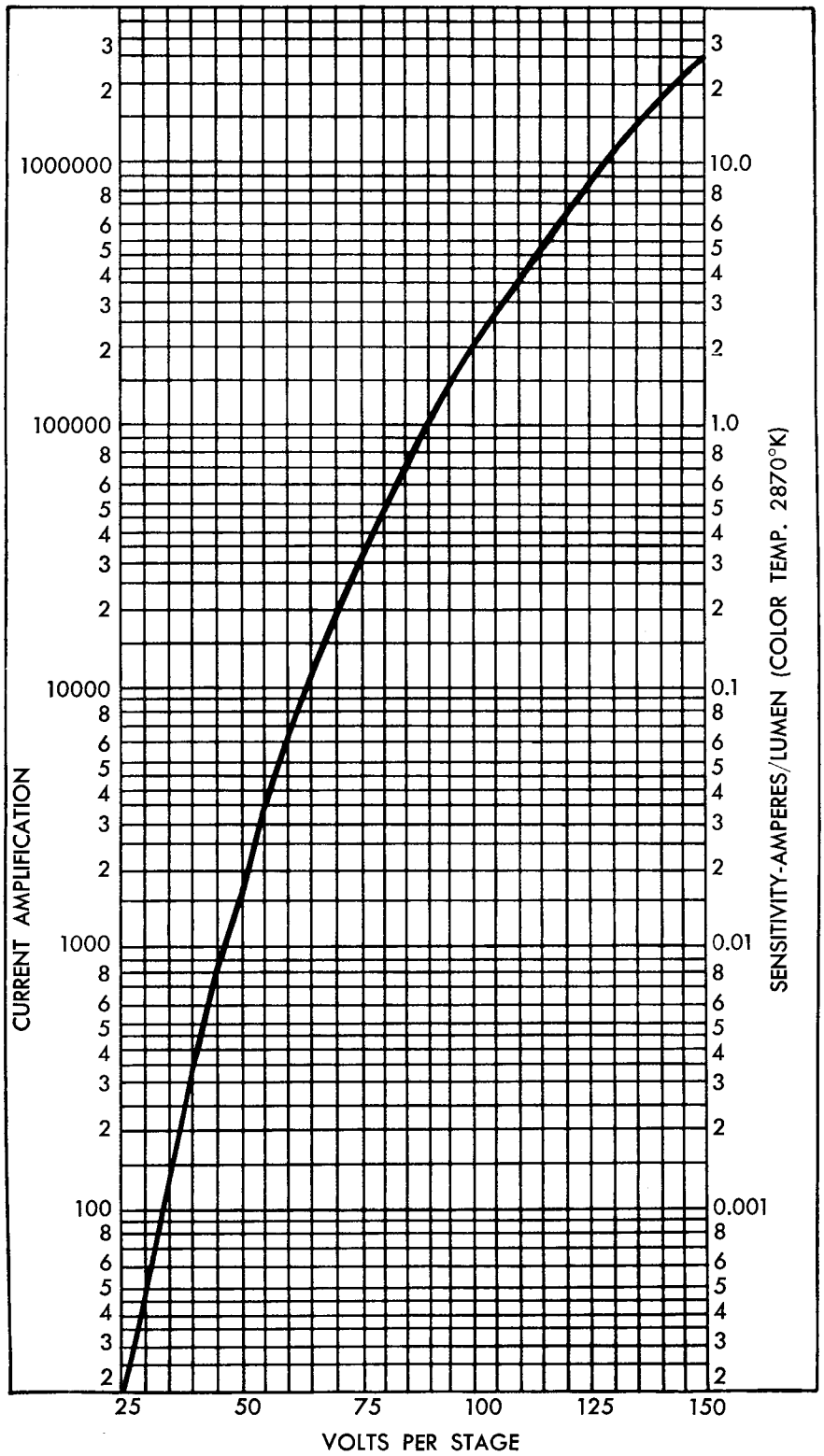
* Referred to cathode.
† On basis of lighted cathode area approximately 3 mm in diameter.

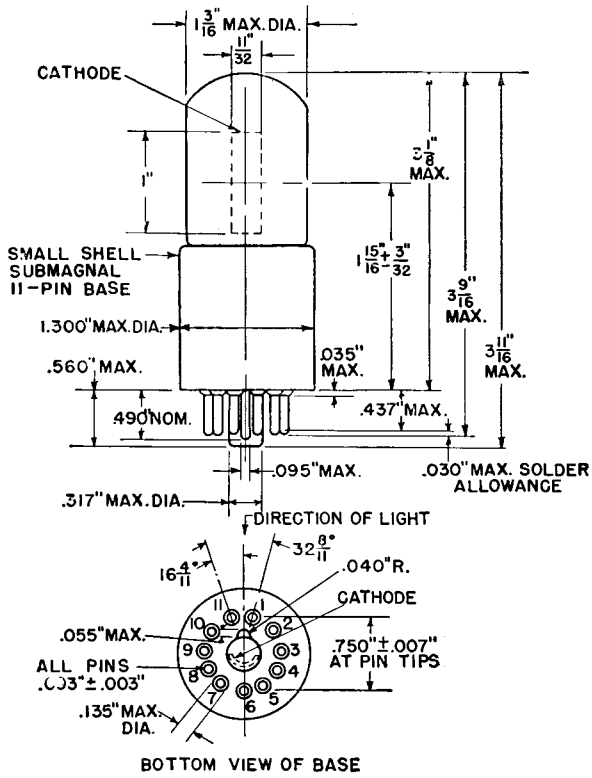


K-8277045

10-14-44

GL-931-A
AVERAGE CHARACTERISTICS
D-C OPERATION



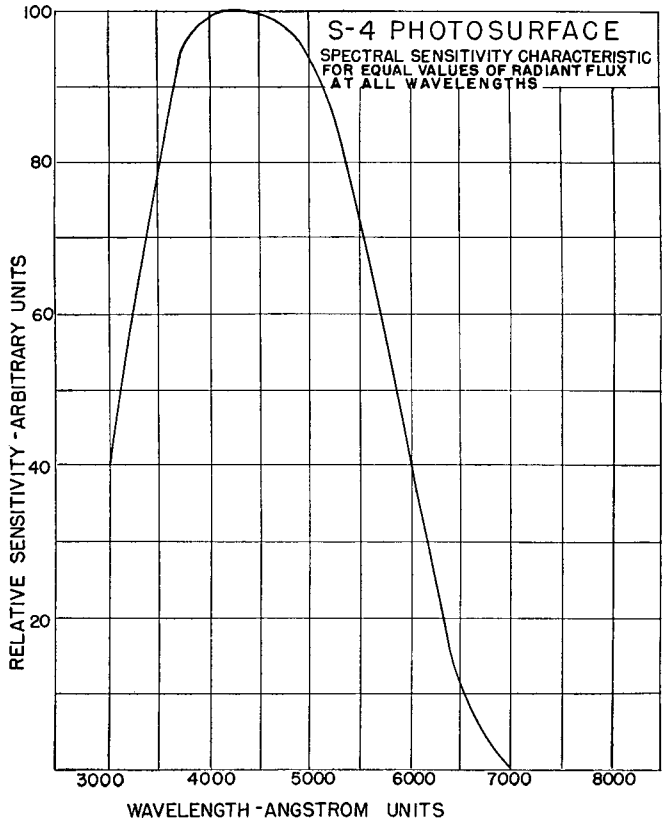


PIN	CONNECTION
1-9	DYNODE
10	ANODE
11	CATHODE

OUTLINE

GL-931-A MULTIPLIER PHOTOTUBE

K-8277037 9-23-44



K-8639625 4-27-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



THYRATRON

DESCRIPTION

The GL-2050 is a small, double-grid, inert-gas-filled thyratron designed for grid-controlled rectifier service. The control characteristic is independent of ambient temperature over a wide range. The tube is not appreciably affected by line-voltage surges because of the low grid-to-anode capacitance. High sensitivity, the result of low grid current which allows the use of high resistance in the grid circuit, permits operation of the GL-2050 thyratron from a vacuum-type phototube.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	4	
Electrical		
Cathode—Indirectly heated type		
Voltage	6.3	volts
Current, approx	0.6	ampere
Heating time, minimum	10	seconds
Peak voltage drop, approx	8	volts
Grid resistors*		
Minimum	0.01	megohm
Maximum	10	megohms
Anode to control-grid capacitance, approx	0.26	micromicrofarad

**When this tube is operated with an alternating anode voltage and a high value of grid-circuit resistance, the grid-anode capacitance should be made as small as possible by placing the grid resistor directly at the socket terminal, by connecting pins 4 and 8 together at the socket, and by using a close fitting bulb shield connected to the cathode terminal.*

GE Electronic TUBE

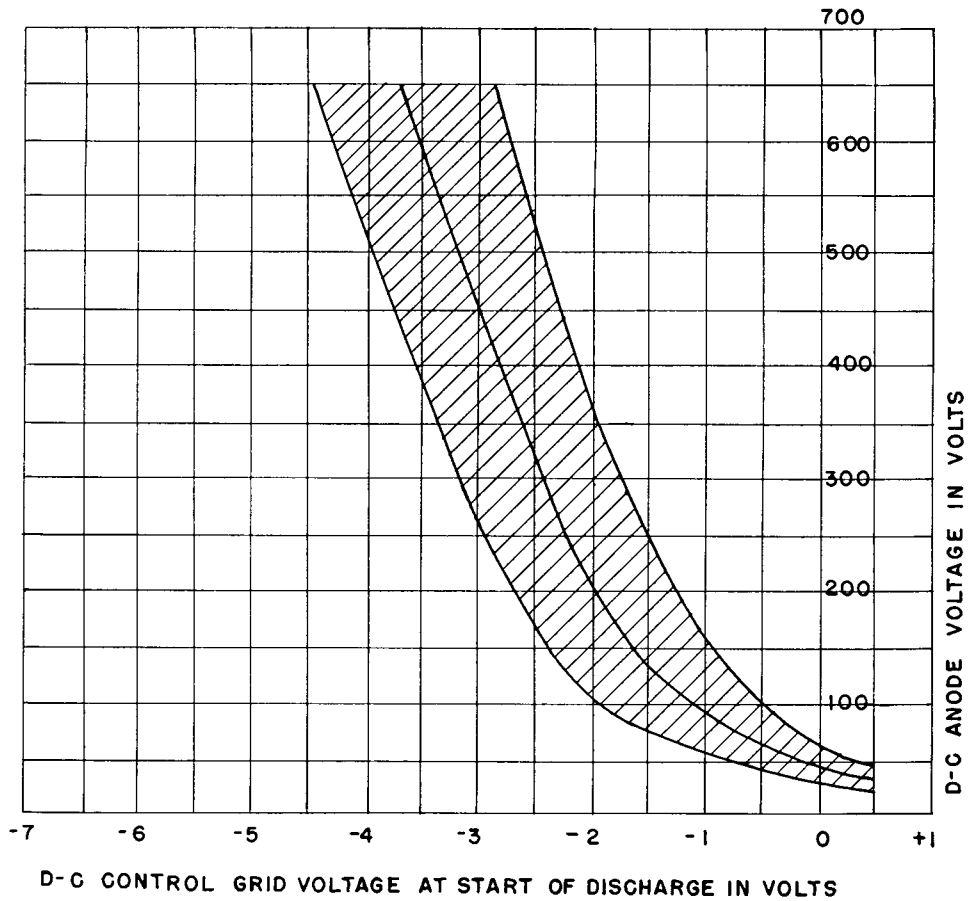
TECHNICAL INFORMATION (CONT'D)

Mechanical

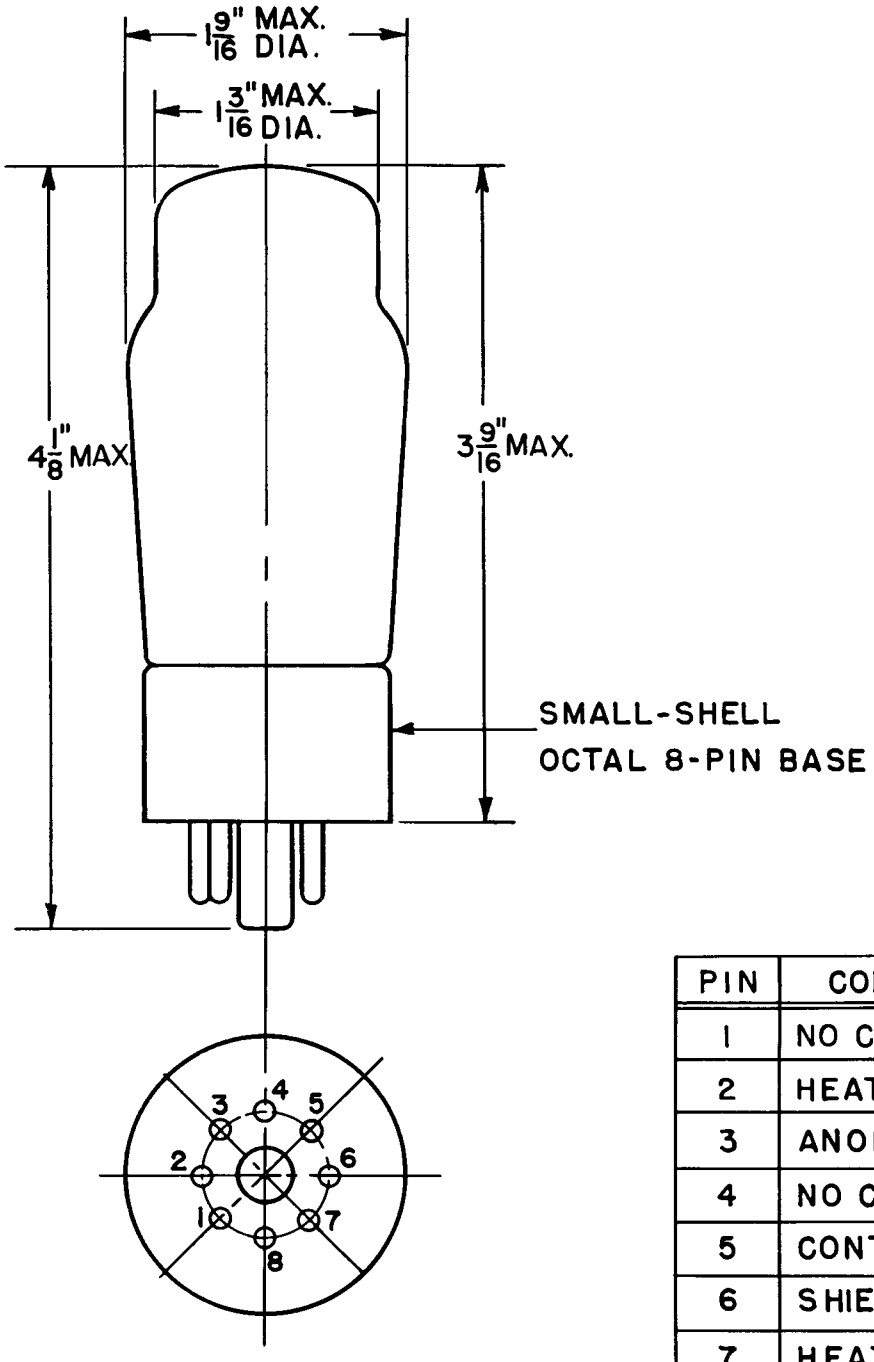
Net weight, approx	2	ounces
Shipping weight, approx	3	pounds
Operating position		vertical or horizontal

MAXIMUM RATINGS

Maximum peak anode voltage		
Inverse	1300	volts
Forward	650	volts
Shield-grid voltage	−100	volts
Control-grid voltage	−100	volts
Maximum anode current		
Instantaneous	500	milliamperes
Average	100	milliamperes
Maximum time of averaging current	30	seconds



GL-2050
TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS
SHIELD GRID CONNECTED TO CATHODE



OUTLINE
GL-2050 THYRATRON

PIN	CONNECTION
1	NO CONNECTION
2	HEATER
3	ANODE
4	NO CONNECTION
5	CONTROL GRID
6	SHIELD GRID
7	HEATER
8	CATHODE

K-8065598 8-18-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



THYRATRON

DESCRIPTION

The GL-2051 is a small, double-grid, inert-gas-filled thyratron designed for grid-control rectifier service. The control characteristic is independent of ambient temperature over a wide range. The tube is not appreciably affected by line-voltage surges because of the low grid-to-anode capacitance. High sensitivity, the result of low grid current which allows the use of high resistance in the grid circuit, permits operation of the GL-2051 thyratron from a vacuum type phototube.

RECOMMENDED FOR REPLACEMENT ONLY

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	4	
Electrical		
Cathode—Indirectly heated type		
Voltage	6.3	volts
Current, approx	0.6	ampere
Heating time, minimum	10	seconds
Peak voltage drop, approx	14	volts
Grid resistor*		
Minimum	0.01	megohm
Maximum	10	megohms
Anode to control-grid capacitance, approx	0.2	micromicrofarad

When this tube is operated with an alternating anode voltage and a high value of grid-circuit resistance, the grid-anode capacitance should be made as small as possible by placing the grid resistor directly at the socket terminal, by connecting pins 4 and 8 together at the socket, and by using a close fitting bulb shield connected to the cathode terminal.

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

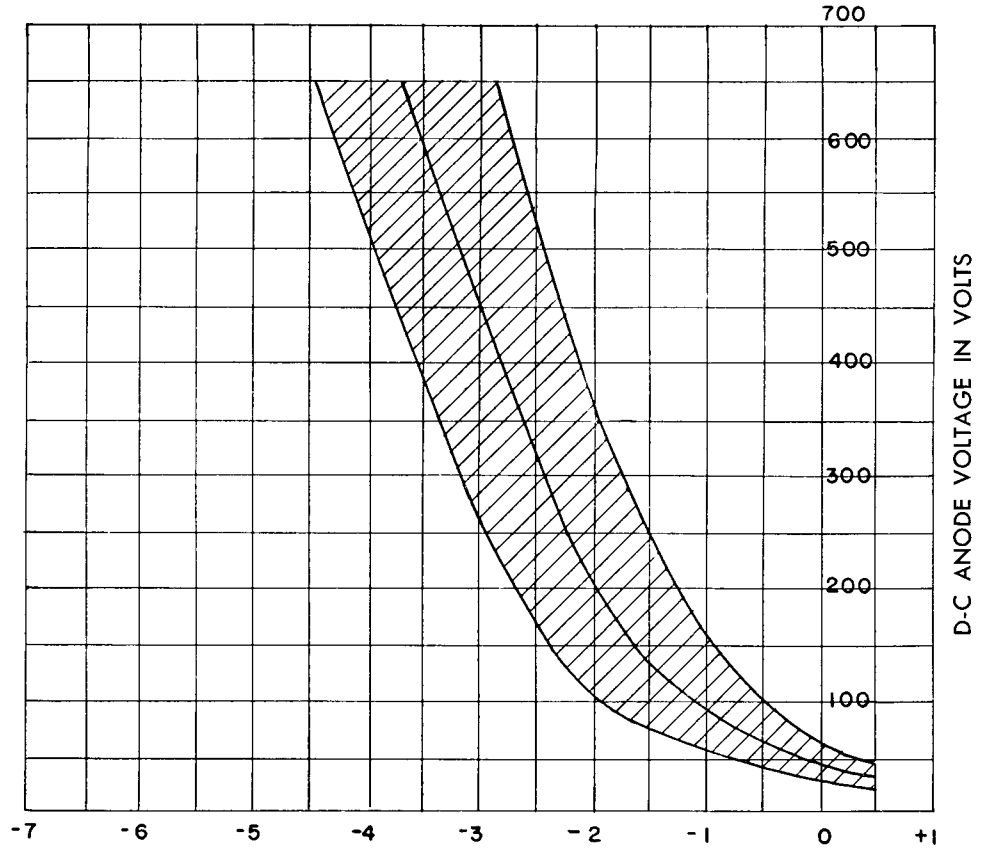
Mechanical

Net weight, approx.	2 ounces
Shipping weight, approx.	3 pounds
Operating position	Vertical or horizontal

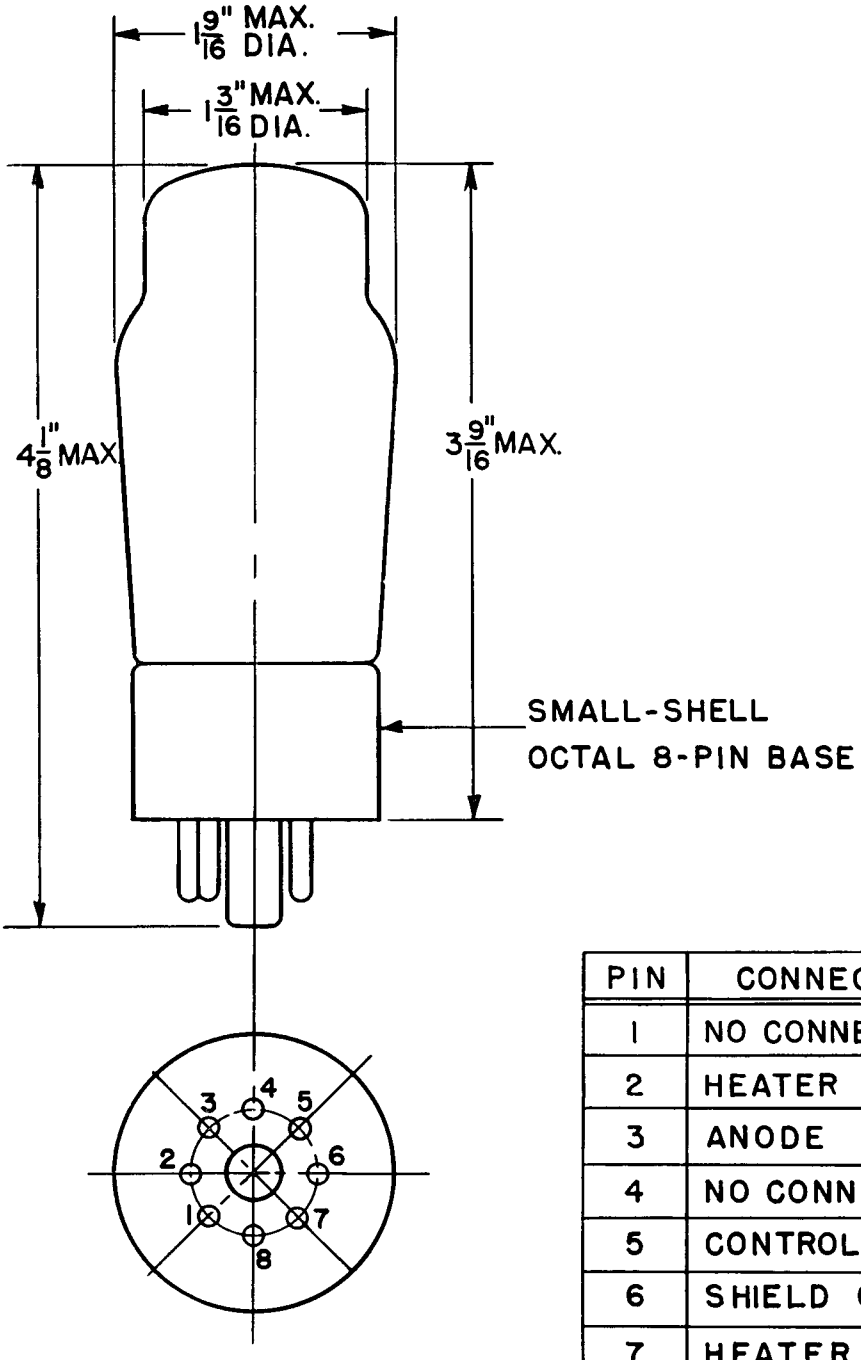
MAXIMUM RATINGS

Maximum peak anode voltage	
Inverse	700 volts
Forward	350 volts
Shield-grid voltage	0 volts
Maximum anode current	
Instantaneous	375 milliamperes
Average	75 milliamperes
Maximum time of averaging current	30 seconds

GL-2051
TYPICAL CONTROL CHARACTERISTICS
SHADED AREA SHOWS RANGE OF CHARACTERISTICS
SHIELD GRID CONNECTED TO CATHODE



K-8639641 6-6-44



PIN	CONNECTION
1	NO CONNECTION
2	HEATER
3	ANODE
4	NO CONNECTION
5	CONTROL GRID
6	SHIELD GRID
7	HEATER
8	CATHODE

K-8065598

8-18-44

OUTLINE
GL-2051 THYRATRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



TRIODE

The GL-5518 is a three-electrode transmitting tube designed for use as a Class C radio-frequency amplifier. This tube is particularly well adapted to use in a grounded-grid circuit. The anode is forced-air-cooled, and capable of dissipating 4000 watts. The cathode is a pure-tungsten filament. Maximum ratings apply up to 110 megacycles.

TECHNICAL INFORMATION

GENERAL

Electrical	Minimum	Bogey	Maximum	
Filament Voltage	—	6.3	6.6	Volts
Filament Current at Bogey Voltage	227	235	243	Amperes
Filament Starting Current	—	—	355	Amperes
Filament Cold Resistance	—	0.0023	—	Ohms
Amplification Factor, $I_b = 1.0$ amp, $E_c = 50$ v	17	21	25	
Interelectrode Capacitances				
Grid-Plate	16	18.5	21	$\mu\mu$f
Grid-Filament	26	29	32	$\mu\mu$f
Plate-Filament†	—	—	0.6	$\mu\mu$f
Mechanical				
Mounting Position—Vertical, Anode Down				
Type of Cooling—Forced Air				
Maximum Incoming Air Temperature	—	—	45	C

GENERAL ELECTRIC

Supersedes ETX-221A

TECHNICAL INFORMATION (CONT'D)

Required Air Flow on Anode*				
Plate Dissipation—Percent of Rating	100	80	60	
Air Flow—Cubic Feet per Minute	350	250	200	
Pressure—Inches Water	1.85	1.15	0.80	
Required Air Flow on Filament and Grid Seals				
Around circumference of Filament Seals			15	Cubic Feet per Minute
Around Circumference of Grid Seal			55	Cubic Feet per Minute
Maximum Glass Temperature			175	C
Net Weight, approximate			17	Pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

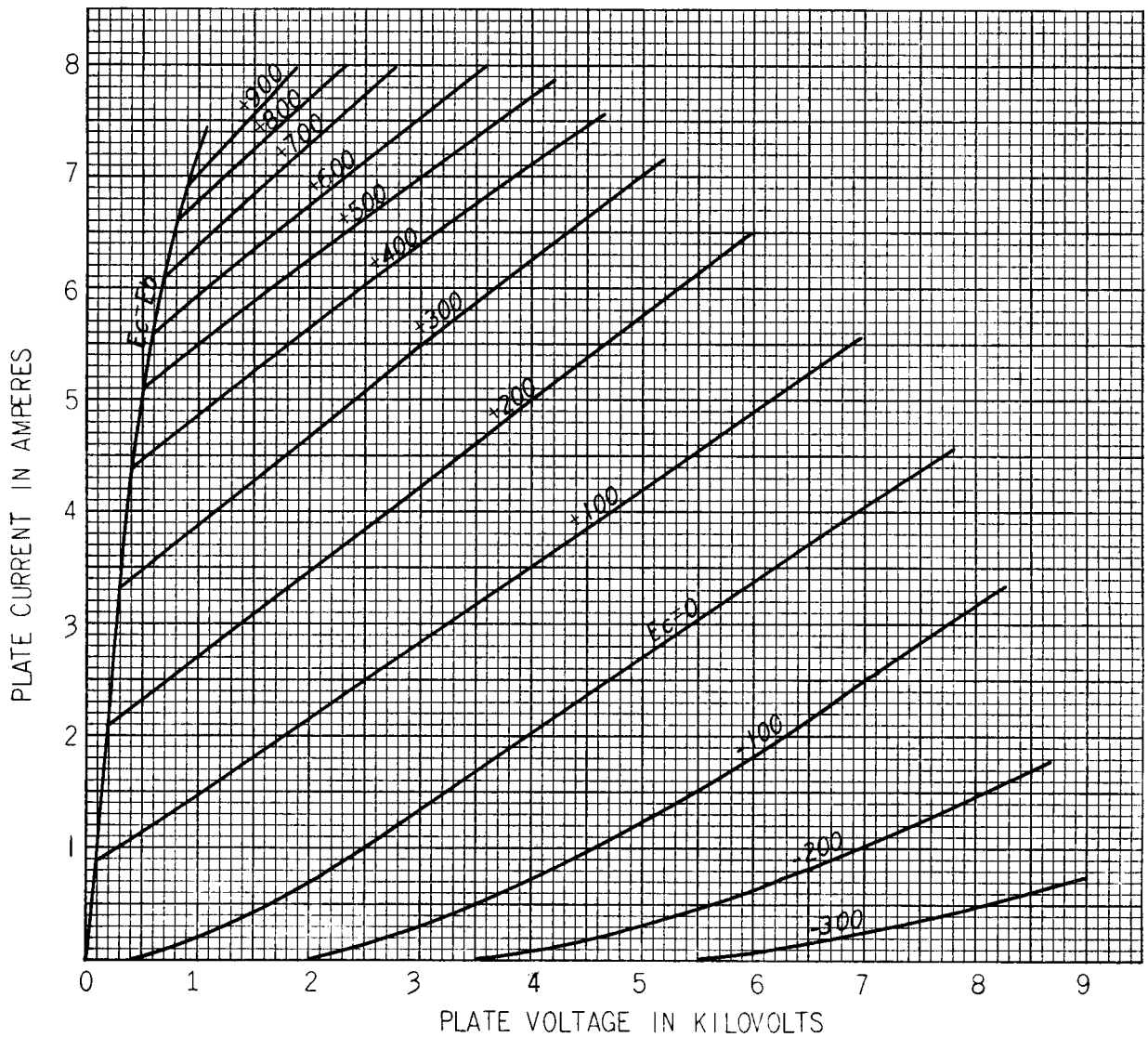
RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEGRAPHY

Key-down conditions per tube without amplitude modulation¶

Maximum Ratings, Absolute Values	CCS‡	
DC Plate Voltage	7,000	Max Volts
DC Grid Voltage	−850	Max Volts
DC Plate Current	1.8	Max Amperes
DC Grid Current	0.25	Max Amperes
Plate Input	12	Max Kilowatts
Plate Dissipation	4	Max Kilowatts
Typical Operation, Grounded-Filament Circuit	CCS‡	
DC Plate Voltage	6,600	Volts
DC Grid Voltage	−520	Volts
Peak RF Grid Voltage	940	Volts
DC Plate Current	1.3	Amperes
DC Grid Current, approximate	0.20	Amperes
Driving Power, approximate	180	Watts
Power Output, approximate	6.5	Kilowatts
Typical Operation, Grounded-Grid Circuit		
Same Values as for Grounded-Filament Circuit with the Following Exceptions:		
	CCS‡	
Driving Power, approximate	1,220	Watts
Power Output #, approximate	7.5	Kilowatts

† Measured with a 12-inch outer diameter and 3-inch inner diameter flat shield on grid terminal.
* Direction of air flow must be downward through radiator.
¶ Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.
‡ Continuous Commercial Service.
# This value includes power transferred from driver to output.

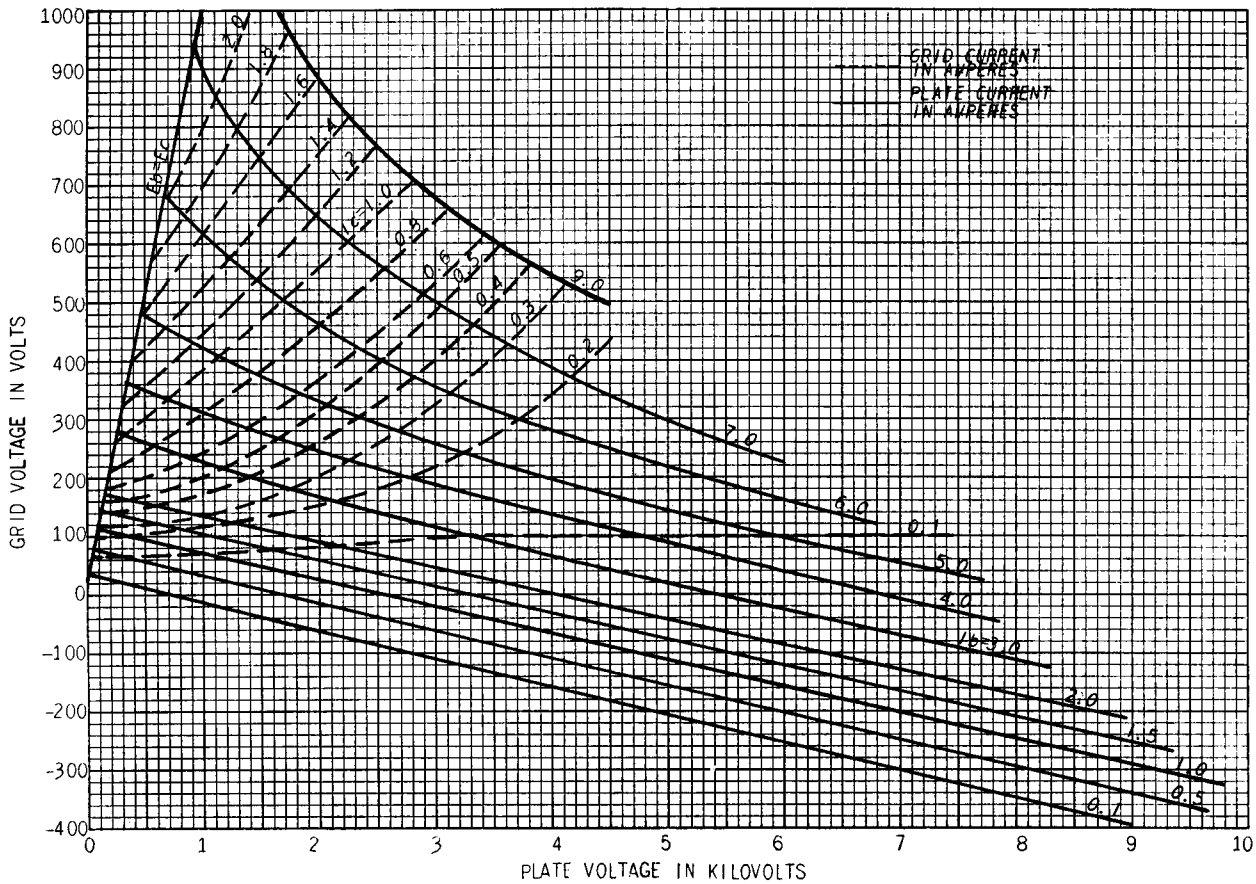
AVERAGE PLATE CHARACTERISTICS
$E_f = 6.3$ Volts



K-69087-47A33

2-19-47

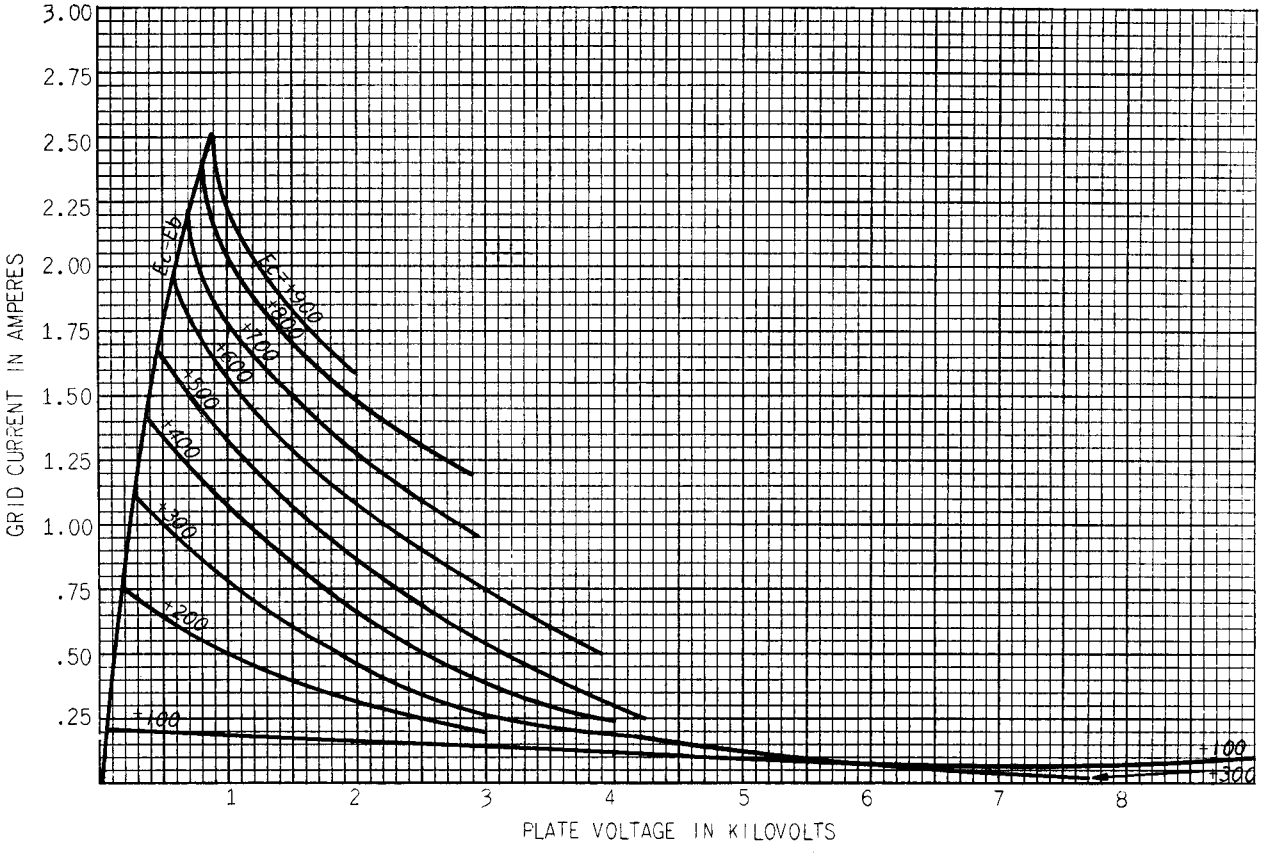
CHARACTERISTICS
$E_f = 6.3$ Volts



K-69087-47A34

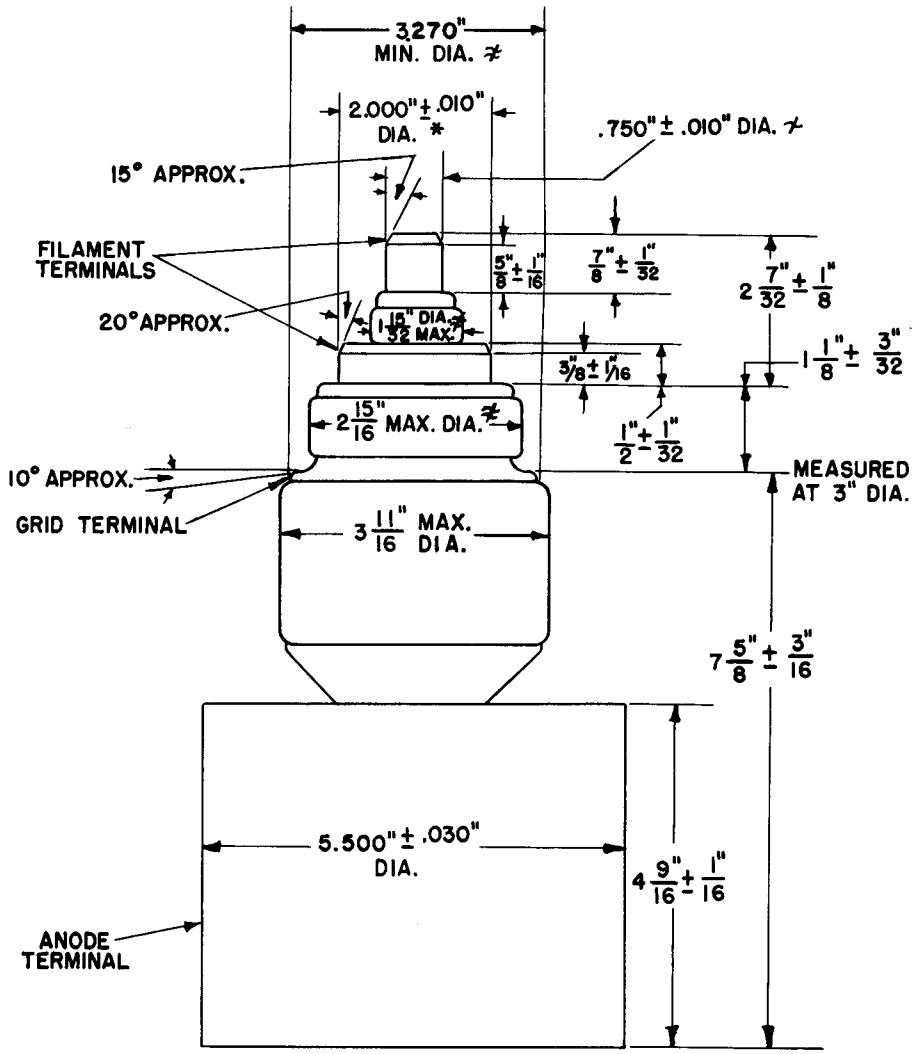
2-19-47

AVERAGE GRID CHARACTERISTICS
$E_f = 6.3$ Volts



K-69087-47A32

2-19-47



* MAXIMUM ECCENTRICITY OF LARGER-DIAMETER FILAMENT TERMINAL IS 0.060" WITH RESPECT TO THE AXIS OF RADIATOR.

≠ MAXIMUM ECCENTRICITY OF SMALLER-DIAMETER FILAMENT TERMINAL IS 0.050" WITH RESPECT TO A CENTER LINE ESTABLISHED BY THE CENTER OF THE BOTTOM OF RADIATOR AND CENTER OF LARGER-DIAMETER FILAMENT TERMINAL.

≠ MAXIMUM OR MINIMUM DIMENSIONS OF ANY POINT ON CIRCUMFERENCE OF PART. CIRCUMFERENCES CONCENTRIC WITH A CENTER LINE ESTABLISHED BY THE CENTER OF THE BOTTOM OF RADIATOR AND CENTER OF LARGER-DIAMETER FILAMENT TERMINAL.

N-20710AZ 4-27-48

ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.

PRINTED IN U.S.A.

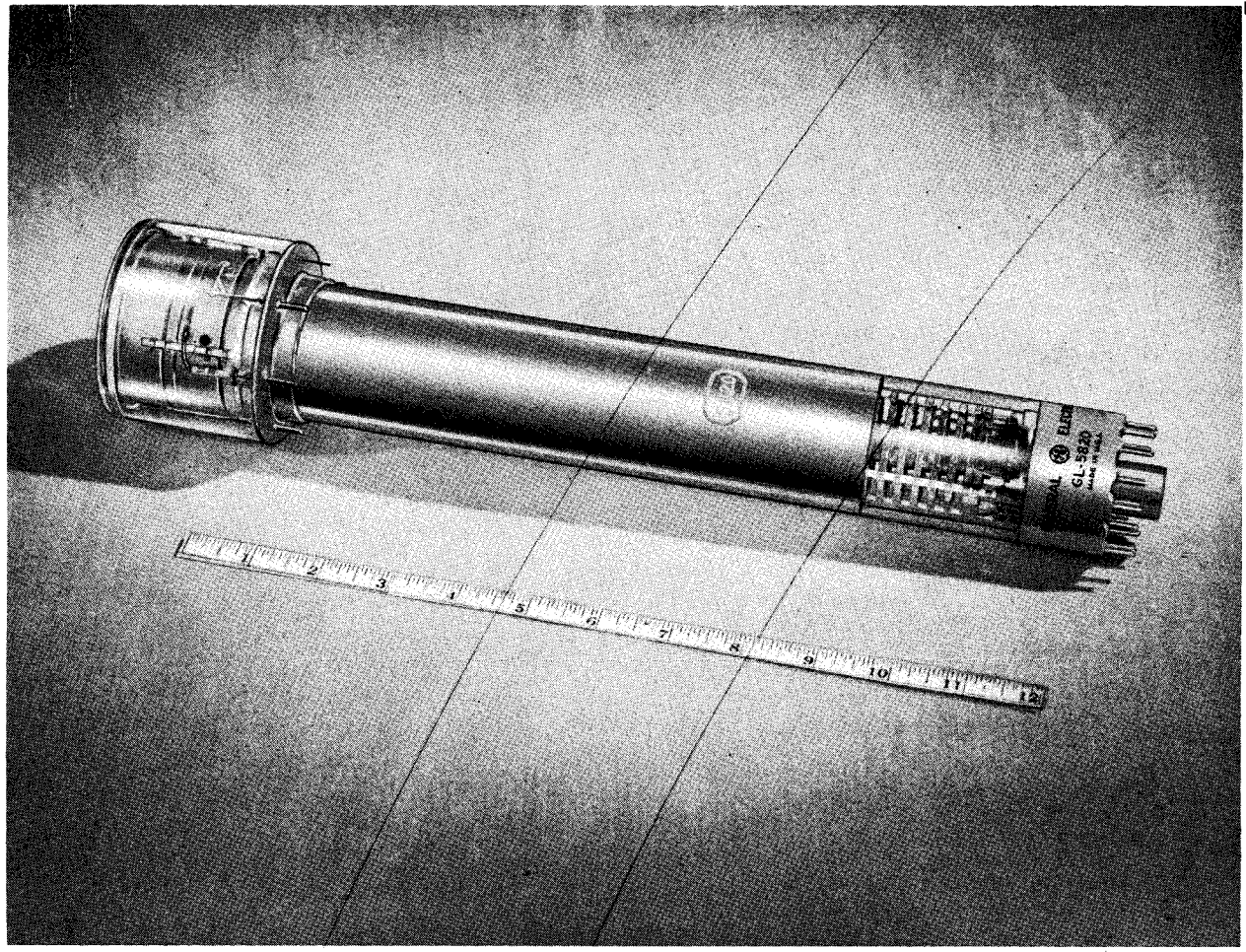


IMAGE ORTHICON

The GL-5820 is a television camera tube for outdoor and studio pickup use in which exceptionally high sensitivity is combined with a spectral response approaching that of the eye. It is very stable in performance at all incident light levels on the object ranging from bright sunlight to a deep shadow (several thousand foot-candles to one foot-candle or less). Commercially acceptable pictures can be obtained at incident light levels greater than about 10 foot-candles.

The GL-5820 has a photocathode characterized by a spectral response with high blue and high green sensitivity, very good yellow sensitivity, and good red sensitivity. It has practically no infrared sensitivity. This particular characteristic of the response permits portrayal of colors in nearly their true tonal gradation since it prevents any color-masking by infrared.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode—Unipotential		
Heater Voltage, AC or DC	6.3±10%	Volts
Heater Current	0.6	Amperes
Photocathode—Semi-transparent		
Response—See spectral sensitivity curve on page 3 for details.		
Rectangular Image, 4 by 3 aspect ratio		
⊕Useful Size, maximum diagonal	1.8	Inches

Orientation—Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the faceplate and pin No. 7 of the shoulder base.

Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Direct Interelectrode Capacitance		
Anode to All Other Electrodes	12	μμf

GENERAL ELECTRIC

#Supersedes pages 1, 2, 5 and 6 dated 12-56 and 9-57

TECHNICAL INFORMATION (CONT'D)

Mechanical

Over-all Length	15.20″ ± 0.25″	Inches
Greatest Diameter of Bulb	3.00″ ± 0.06″	Inches
Minimum Deflecting Coil Inside Diameter	2⅜	Inches
Deflecting Coil Length	5	Inches
Focusing Coil Length	10	Inches
Alignment Coil Length	15/16	Inches
Photocathode Distance Inside End of Focusing Coil	½	Inches
Weight, approximate	1.4	Pounds

Operating Position—Any, except with diheptal base up and the tube axis at an angle of less than 20 degrees from vertical.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Absolute Values

Photocathode Voltage	−550 Max	Volts
Photocathode Illumination	50 Max	Foot-Candles
Anode Supply Voltage*	1350 Max	Volts
Grid-No. 1 Voltage		
Negative Bias Value	125 Max	Volts
Positive Bias Value	0 Max	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	350 Max	Volts
Grid-No. 3 Voltage	400 Max	Volts
Grid-No. 4 Voltage	300 Max	Volts
Grid-No. 5 Voltage	150 Max	Volts
Grid-No. 6 Voltage	−550 Max	Volts
Voltage Per Multiplier Stage	350 Max	Volts
Target Voltage		
Positive Value	10 Max	Volts
Negative Value	10 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125 Max	Volts
Heater Positive with Respect to Cathode	10 Max	Volts
Operating Temperature of Any Part of Bulb	50 Max	C
Operating Temperature of Bulb at Large End of Tube, target section	35 Min	C
Temperature Difference		
Between Target Section and Any Part of Bulb Hotter Than Target Section	5 Max	C

Typical Operation

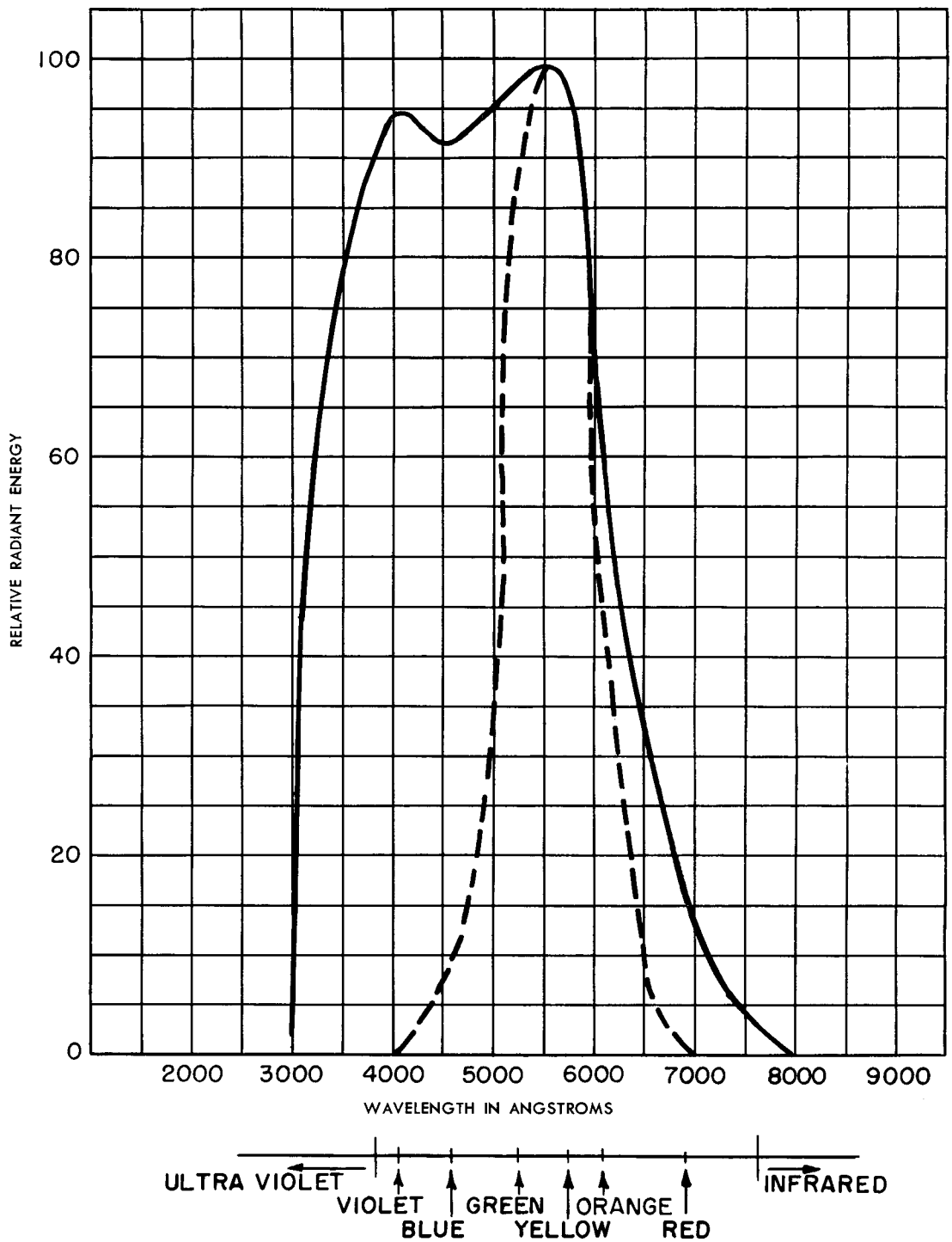
Photocathode Voltage, image focus	−400 to −540	Volts
Grid-No. 1 Voltage for Picture Cut-off, beam	−45 to −115	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	300	Volts
Grid-No. 3 Voltage†, multiplier focus	225 to 330	Volts
Grid-No. 4 Voltage, beam focus	140 to 180	Volts
Grid-No. 5 Voltage, decelerator	0 to 125	Volts
Grid-No. 6 Voltage, accelerator		
75 Percent of Photocathode Voltage, approximate	−300 to −405	Volts
Dynode-No. 2 Voltage	600	Volts
Dynode-No. 3 Voltage	800	Volts
Dynode-No. 4 Voltage	1000	Volts
Dynode-No. 5 Voltage	1200	Volts
Anode Voltage	1250	Volts
DC Anode Current	30	Microamperes
⊕Signal Output Current, peak to peak	3 to 24	Microamperes
Target Voltage‡		
□Target Cutoff Voltage‡	−3 to +1	Volts
Target Temperature Range	35 to 45	C
Ratio of Peak-to-Peak Highlight Video Signal		
Current to RMS Noise Current, approximate	35	
Minimum Peak-to-Peak Blanking Voltage	5	Volts
Field Strength at Center of Focusing Coil§	75	Gausses
Field Strength of Alignment Coil, approximate	0 to 3	Gausses

* Ratio of dynode voltages is shown under Typical Operation.
† Adjust to give the most uniformly shaded picture near maximum signal.
‡ Adjustable from −3 to +5 volts with blanking voltage off. Normal setting of target voltage is +2 volts from target cutoff.
§ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.
⊕Denotes a change.
□Denotes an addition.

SPECTRAL SENSITIVITY CHARACTERISTIC

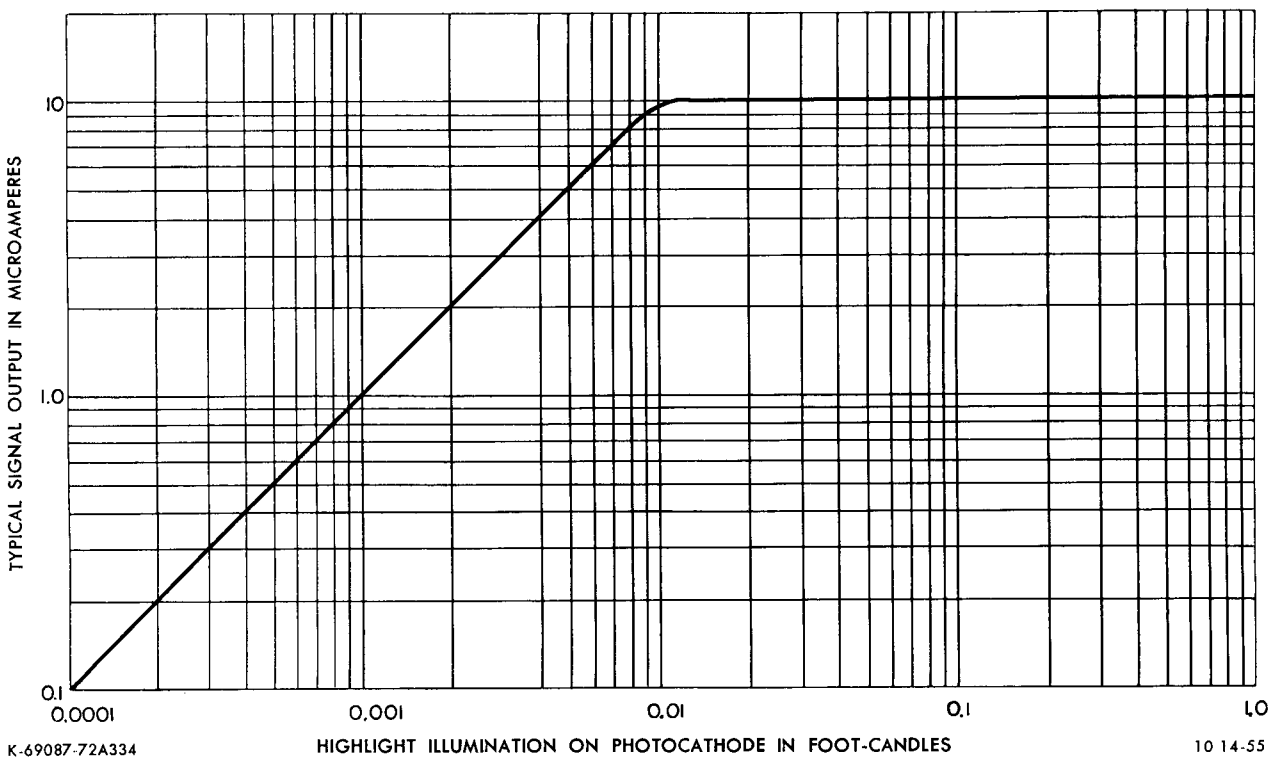
FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

DASHED CURVE SHOWS SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE



TYPICAL SIGNAL OUTPUT

SCENE: BLACK AND WHITE BALANCED
TUNGSTEN, DAYLIGHT, OR WHITE FLUORESCENT LIGHT

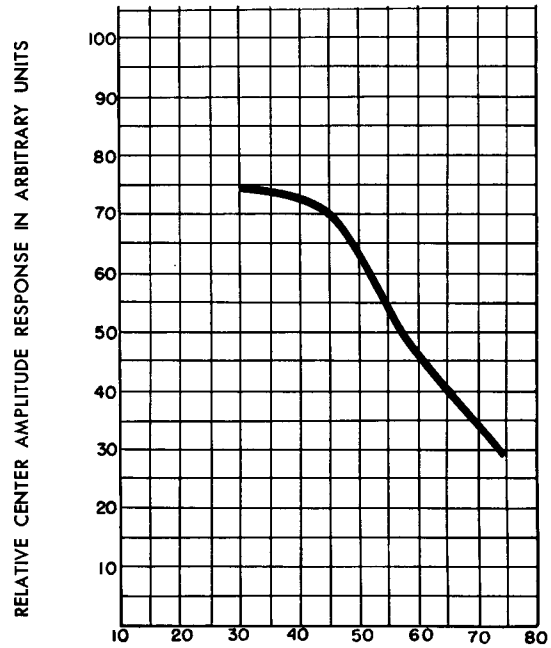


K-69087-72A334

10 14-55

TEMPERATURE EFFECT ON AMPLITUDE RESPONSE

TELEVISION LINE NUMBER = 300



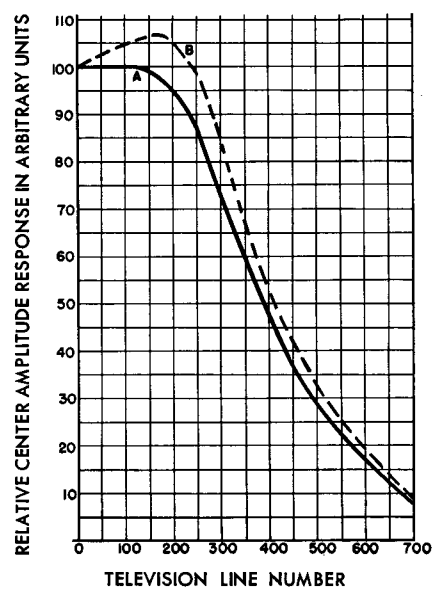
AMPLITUDE RESPONSE CHARACTERISTICS

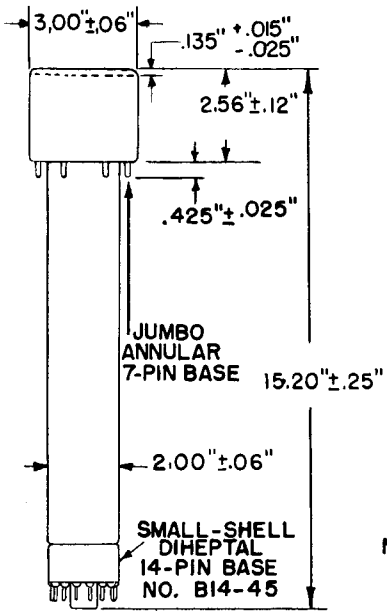
TEST PATTERN: SQUARE WAVE

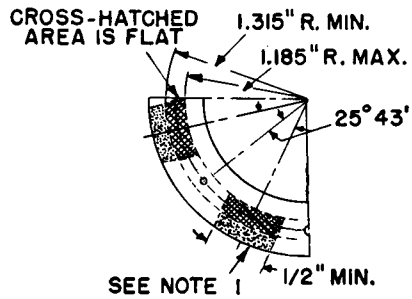
OPERATING TEMPERATURE OF BULB ADJACENT TO TARGET = 35 C

RESPONSE MEASURED IN SYSTEM HAVING 10 MC BANDWIDTH

CURVE	HIGHLIGHTS IN RELATION TO LIGHT TRANSFER CHARACTERISTIC
A	AT KNEE
B	ONE LENS STOP ABOVE KNEE

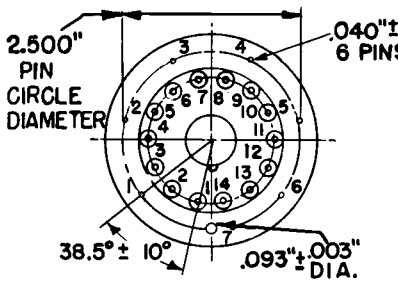






DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.



ENLARGED BOTTOM VIEW

ANNULAR BASE GAGE

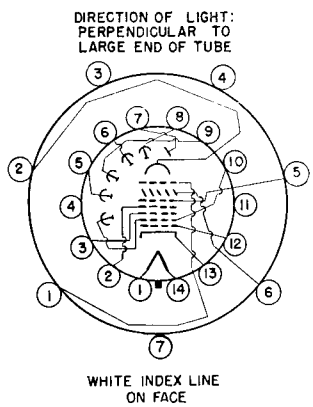
ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065"± 0.001" AND ONE HOLE HAVING DIA. OF 0.150"±0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047." ALL HOLES ARE SPACED AT ANGLES OF 51°26' ±5' ON CIRCLE DIAMETER OF 2.500"± 0.001"

b. SEVEN STOPS HAVING HEIGHT OF 0.187"± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126"± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200"± 0.001."



SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
PIN 2: GRID NO. 4
PIN 3: GRID NO. 3
PIN 4: INTERNAL CONNECTION - DO NOT USE
PIN 5: DYNODE NO. 2
PIN 6: DYNODE NO. 4
PIN 7: ANODE
PIN 8: DYNODE NO. 5
PIN 9: DYNODE NO. 3
PIN 10: DYNODE NO. 1, GRID NO. 2
PIN 11: INTERNAL CONNECTION - DO NOT USE
PIN 12: GRID NO. 1
PIN 13: CATHODE
PIN 14: HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO. 6
PIN 2: PHOTOCATHODE
PIN 3: INTERNAL CONNECTION - DO NOT USE
PIN 4: INTERNAL CONNECTION - DO NOT USE
PIN 5: GRID NO. 5
PIN 6: TARGET
PIN 7: INTERNAL CONNECTION - DO NOT USE

N-15118AZ—Outline Revised

4-23-58

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

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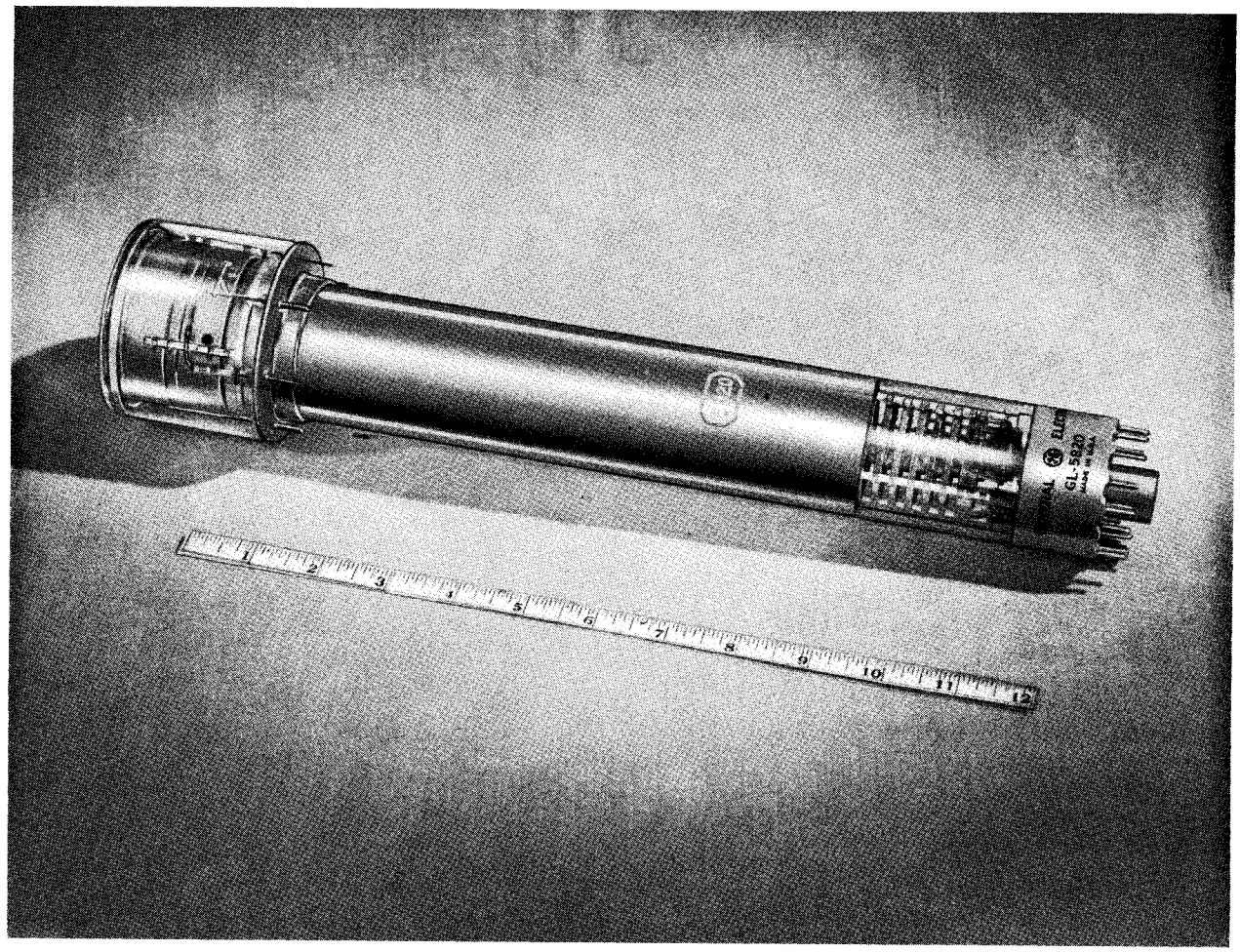


IMAGE ORTHICON

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TECHNICAL INFORMATION

GENERAL

Electrical

Cathode—Unipotential		
Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.6	Amperes
Photocathode—Semi-transparent		
Response—See curve K-69087-72A333 on page 3 for details.		
Rectangular Image, 4 by 3 aspect ratio		
Useful Size, maximum diagonal	1.6	Inches
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Direct Interelectrode Capacitance		
Anode to All Other Electrodes	12	μμf

GENERAL ELECTRIC

Supersedes ETX-259 dated 6-50

TECHNICAL INFORMATION (CONT'D)

Mechanical

Over-all Length	$15\frac{3}{16} \pm \frac{1}{4}$	Inches
Greatest Diameter of Bulb	$3 \pm \frac{1}{16}$	Inches
Minimum Deflecting Coil Inside Diameter	$2\frac{3}{8}$	Inches
Deflecting Coil Length	5	Inches
Focusing Coil Length	10	Inches
Alignment Coil Length	$\frac{15}{16}$	Inches
Photocathode Distance Inside End of Focusing Coil	$\frac{1}{2}$	Inches
Weight, approximate	1.4	Pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Absolute Values

Photocathode Voltage	−550 Max	Volts
Photocathode Illumination	50 Max	Foot-Candles
Anode Supply Voltage*	1350 Max	Volts
Grid-No. 1 Voltage		
Negative Bias Value	125 Max	Volts
Positive Bias Value	0 Max	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	350 Max	Volts
Grid-No. 3 Voltage	400 Max	Volts
Grid-No. 4 Voltage	300 Max	Volts
Grid-No. 5 Voltage	150 Max	Volts
Voltage Per Multiplier Stage	350 Max	Volts
Target Voltage		
Positive Value	10 Max	Volts
Negative Value	10 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125 Max	Volts
Heater Positive with Respect to Cathode	10 Max	Volts
Operating Temperature of Any Part of Bulb	50 Max	C
Operating Temperature of Bulb at Large End of Tube (Target Section)	35 Min	C
Temperature Difference		
Between Target Section and Any Part of Bulb Hotter Than Target Section	5 Max	C

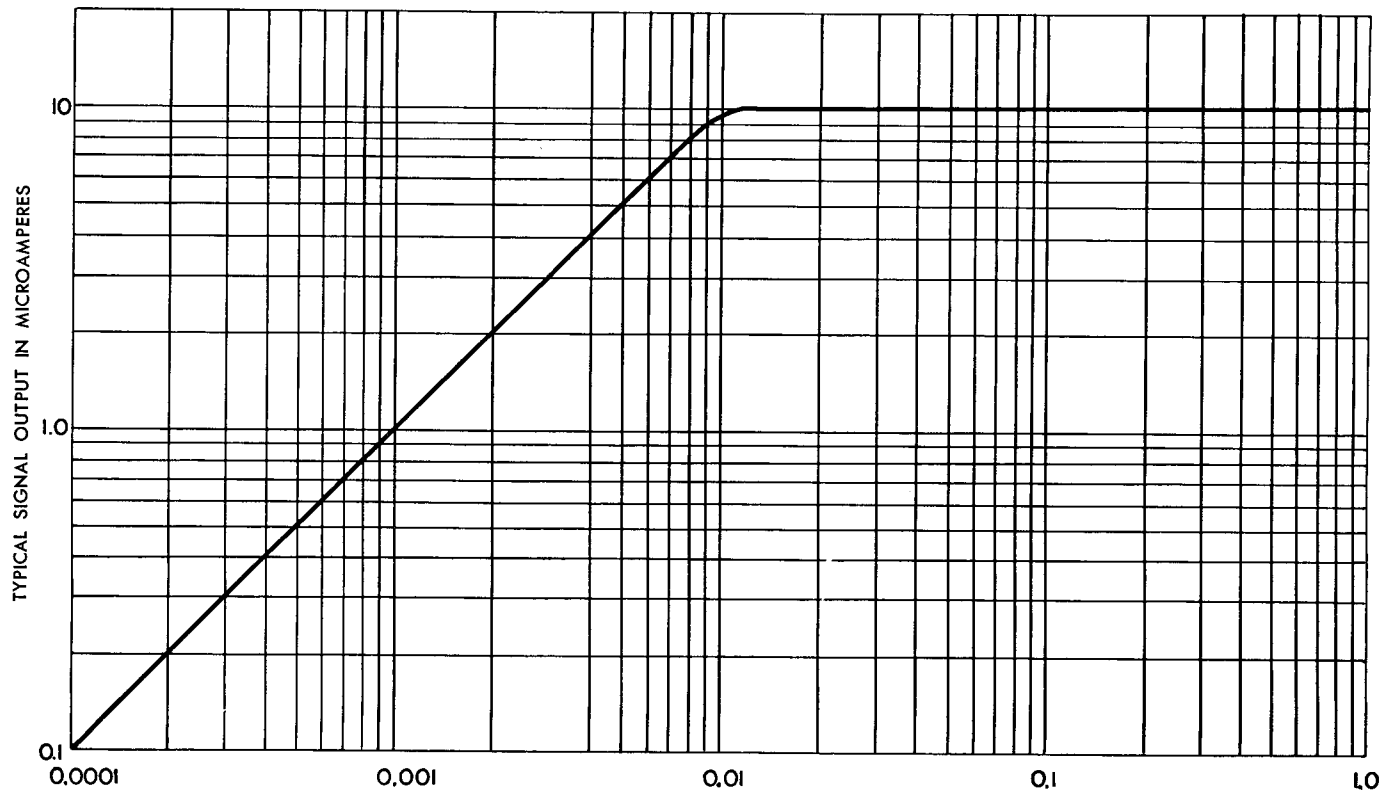
Typical Operation

Photocathode Voltage (Image Focus)	−300 to −500	Volts
Grid-No. 1 Voltage for Picture Cut-off	−45 to −115	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	300	Volts
Grid-No. 3 Voltage†	225 to 330	Volts
Grid-No. 4 Voltage (Beam Focus)	160 to 220	Volts
Grid-No. 5 Voltage (Decelerator)	0 to 125	Volts
Grid-No. 6 Voltage (Accelerator)		
75% of Photocathode Voltage	−225 to −375	Volts
Dynode-No. 2 Voltage	600	Volts
Dynode-No. 3 Voltage	800	Volts
Dynode-No. 4 Voltage	1000	Volts
Dynode-No. 5 Voltage	1200	Volts
Anode Voltage	1250	Volts
DC Anode Current	30	Microamperes
Target Voltage‡	0 to 3	Volts
Target Temperature Range	35 to 45	C
Ratio of Peak-to-Peak Highlight Video Signal		
Current to RMS Noise Current, approximate	35	
Minimum Peak-to-Peak Blanking Voltage	5	Volts
Field Strength at Center of Focusing Coil§	75	Gausses
Field Strength of Alignment Coil, approximate	0 to 3	Gausses

* Ratio of dynode voltages is shown under Typical Operation.
† Adjust to give the most uniformly shaded picture near maximum signal.
‡ Adjustable from −3 to +5 volts with blanking voltage off.
§ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

TYPICAL SIGNAL OUTPUT

SCENE: BLACK AND WHITE BALANCED
TUNGSTEN, DAYLIGHT, OR WHITE FLUORESCENT LIGHT

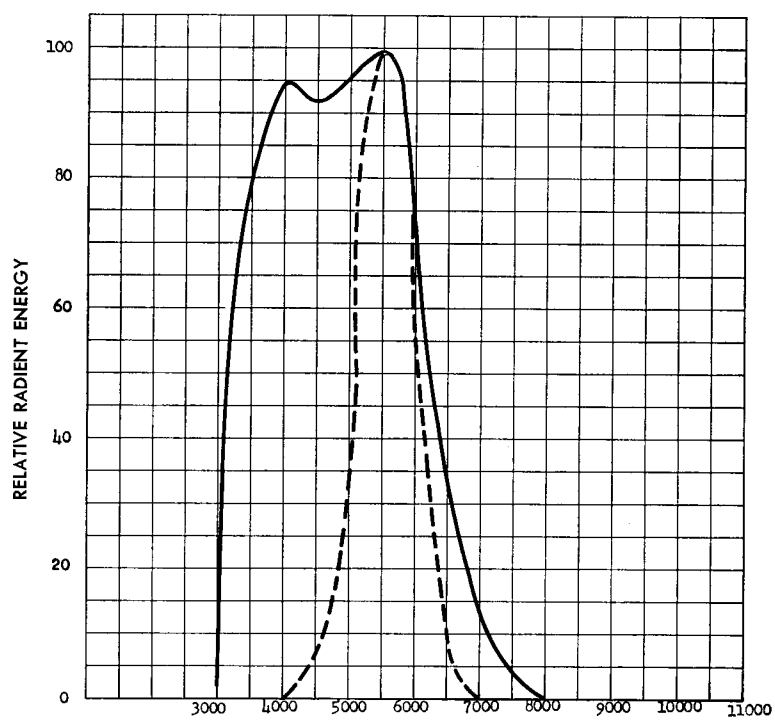


K-69037-72A334

10-14-55

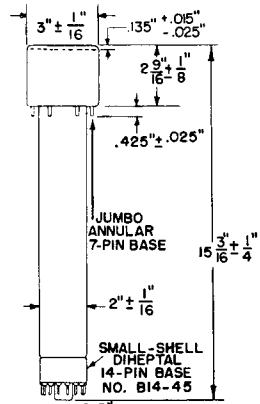
SPECTRAL SENSITIVITY CHARACTERISTIC

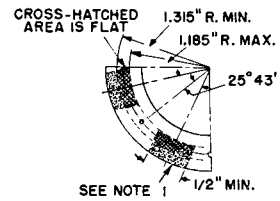
FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS
(DASHED CURVE SHOWS) SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE



K-69087-72A333

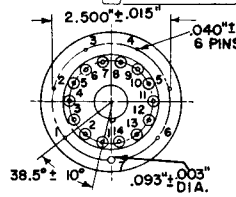
11-17-55





DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.



ENLARGED BOTTOM VIEW

ANNULAR BASE GAGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

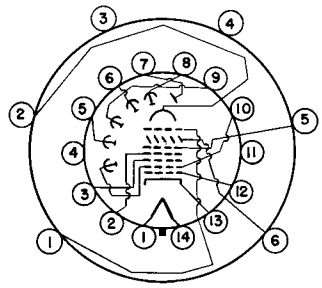
a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIA. OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047." ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.015".

b. SIX STOPS HAVING HEIGHT OF 0.187" ± 0.00 , CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 1/8" FROM 2-13/16" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE



WHITE INDEX LINE ON FACE

BASING DIAGRAM

SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
PIN 2: GRID NO.4
PIN 3: GRID NO.3
PIN 4: INTERNAL CONNECTION - DO NOT USE
PIN 5: DYNODE NO. 2
PIN 6: DYNODE NO.4
PIN 7: ANODE
PIN 8: DYNODE NO. 5
PIN 9: DYNODE NO. 3
PIN 10: DYNODE NO.1, GRID NO. 2
PIN 11: INTERNAL CONNECTION - DO NOT USE
PIN 12: GRID NO.1
PIN 13: CATHODE
PIN 14: HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO.6
PIN 2: PHOTOCATHODE
PIN 3: INTERNAL CONNECTION - DO NOT USE
PIN 4: INTERNAL CONNECTION - DO NOT USE
PIN 5: GRID NO. 5
PIN 6: TARGET
PIN 7: INTERNAL CONNECTION - DO NOT USE

N-15118AZ

10-20-55

TUBE DEPARTMENT

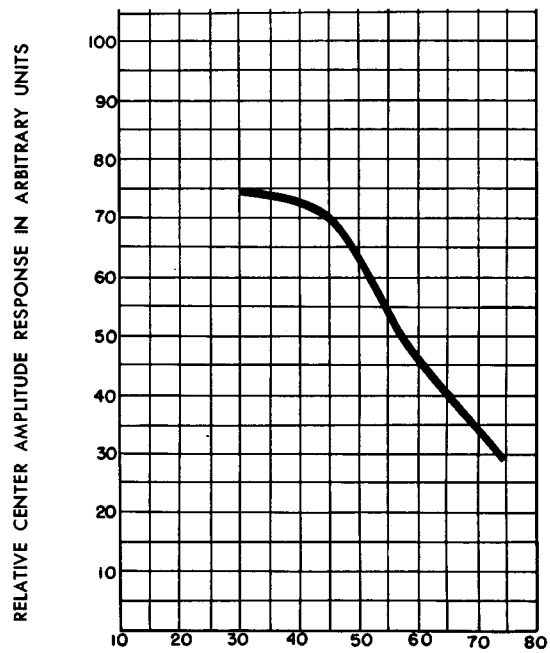
GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.

TEMPERATURE EFFECT ON AMPLITUDE RESPONSE

TELEVISION LINE NUMBER = 300

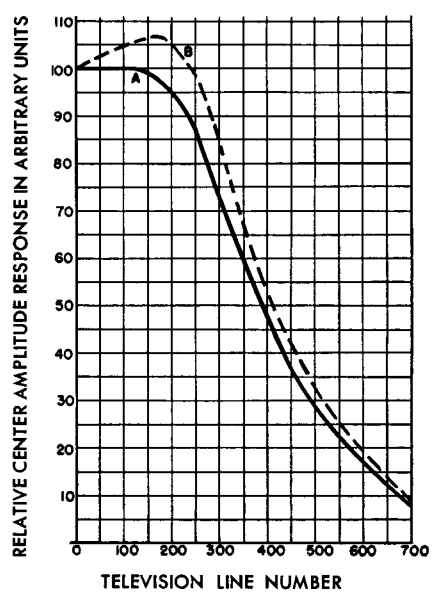


AMPLITUDE RESPONSE CHARACTERISTICS

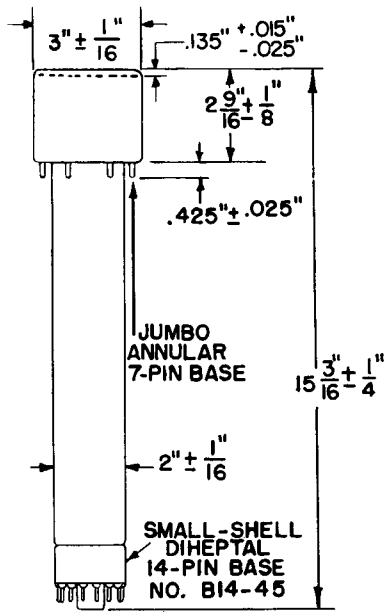
TEST PATTERN: SQUARE WAVE

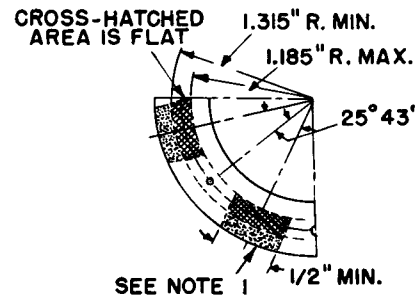
OPERATING TEMPERATURE OF BULB ADJACENT TO TARGET = 35 C
RESPONSE MEASURED IN SYSTEM HAVING 10 MC BANDWIDTH

CURVE	HIGHLIGHTS IN RELATION TO LIGHT TRANSFER CHARACTERISTIC
A	AT KNEE
B	ONE LENS STOP ABOVE KNEE



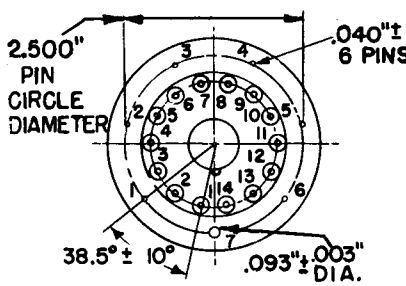
¶Supersedes pages 5 and 6 dated 12-56.





DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.



ENLARGED BOTTOM VIEW

ANNULAR BASE GAGE

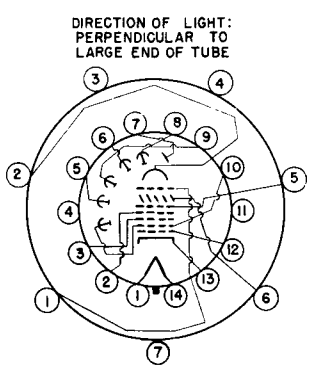
ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

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c. RIM EXTENDING OUT A MINIMUM OF 1/8" FROM 2-13/16" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".



SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
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PIN 3: GRID NO.3
PIN 4: INTERNAL CONNECTION - DO NOT USE
PIN 5: DYNODE NO. 2
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PIN 3: INTERNAL CONNECTION - DO NOT USE
PIN 4: INTERNAL CONNECTION - DO NOT USE
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PIN 7: INTERNAL CONNECTION - DO NOT USE

N-15118AZ—Outline Revised

8-22-57

ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.



KENOTRON

PLATE DISSIPATION—800 WATTS
THORIATED-TUNGSTEN FILAMENT
RECTIFIER AND LIMITER DIODE

LOW VOLTAGE DROP
20 AMPERES AT 75 KILOVOLTS
1.25 AMPERES DC AT 40 KILOVOLTS

The GL-5973 is a two-electrode high-vacuum tube for use as a rectifier or surge-limiting diode. Design features include a thoriated-tungsten filament and a low voltage drop which enable the tube to carry high average currents.

In rectifier service the tube will operate at average currents as high as 1.25 amperes at 40,000 volts and one ampere at higher voltages. In limiter service ratings as high as 20 amperes at 75,000 volts apply. These ratings make the tube particularly suitable for use in radar as a charging diode to supply d-c power to magnetrons or as a limiter to restrict fault currents. Other applications include high-voltage power supplies in cable-testing service and smoke precipitators.

TECHNICAL INFORMATION

GENERAL

Electrical	Minimum	Bogey	Maximum	
Filament Voltage	15.2	16	16.8	Volts
Filament Current at 16 Volts	18.0	19.1	20.2	Amperes
Filament Starting Current	—	—	30	Amperes
Filament Cold Resistance	—	0.1	—	Ohms
Filament Heating Time, before applying plate voltage	30	—	—	Seconds
Tube Voltage Drop, $I_b = 5$ amperes	850	950	1050	Volts
Interelectrode Capacitance	—	14	—	$\mu\mu f$

GENERAL ELECTRIC

Supersedes ET-T1038 dated 2-53

TECHNICAL INFORMATION (Cont'd)

Mechanical

Maximum Glass Temperature*	300	C
Maximum Base Temperature	150	C
Mounting Position—Vertical, Base Down		
Net Weight, approximate	3	Pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Rectifier Service

Maximum Ratings, Absolute Values		
Peak Inverse Voltage	75	Kilovolts
Plate Current		
Peak	5	Amperes
Average		
Peak Inverse Voltage = 40 Kilovolts or Less	1.25	Amperes
Peak Inverse Voltage = more than 40 Kilovolts	1.00	Amperes
Average Plate Dissipation		
Peak Inverse Voltage = 40 Kilovolts or Less†	850	Watts
Peak Inverse Voltage = more than 40 Kilovolts‡	800	Watts

Limiter Service

Maximum Ratings, Absolute Values		
Peak Inverse Voltage	75	Kilovolts
Peak Plate Current	20	Amperes
Average Plate Dissipation‡	800	Watts

*Where tubes are enclosed or operated in close proximity to each other, forced-air cooling may be required to limit bulb and base temperatures to the allowable maximum.
†Maximum observed temperature of 1010 C at any point on the anode.
‡Maximum observed temperature of 985 C at any point on the anode.

□Denotes an addition.

□X-RAY WARNING NOTICE

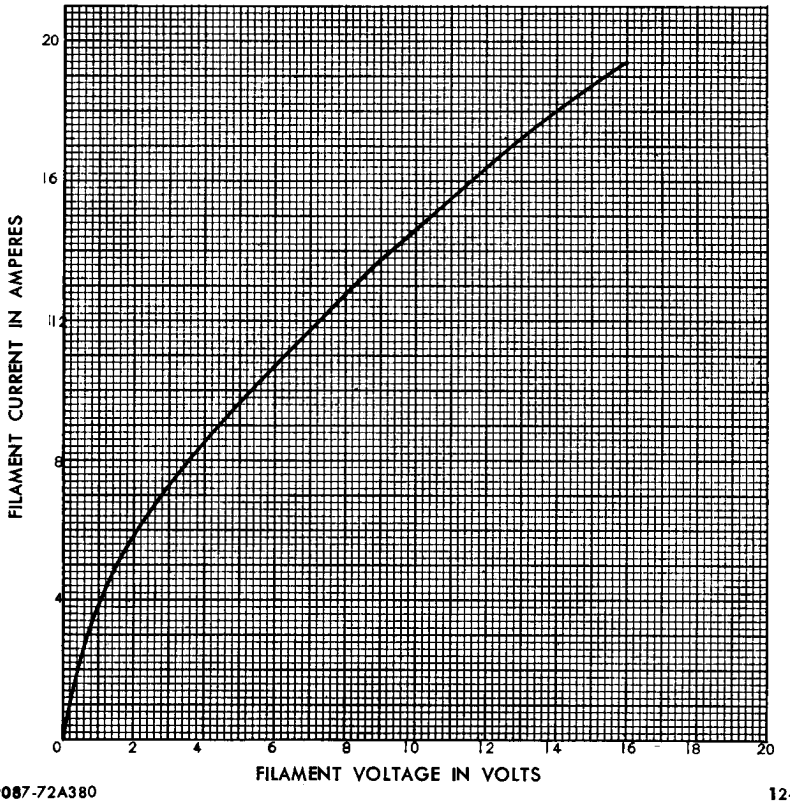
If the GL-5973 is operated at anode voltages in excess of 16 kilovolts, x-ray radiation shielding may be necessary to protect the user against possible danger of personal injury from prolonged exposure at close range. For further information consult the following references or other standard texts on the subject:

(a) *X-Ray Protection Design,* Handbook No. 50. National Bureau of Standards, Washington, D.C.

(b) *X-Ray Protection,* Handbook No. 60. National Bureau of Standards, Washington, D.C.

The above references are available from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

TYPICAL FILAMENT CURRENT CHARACTERISTIC

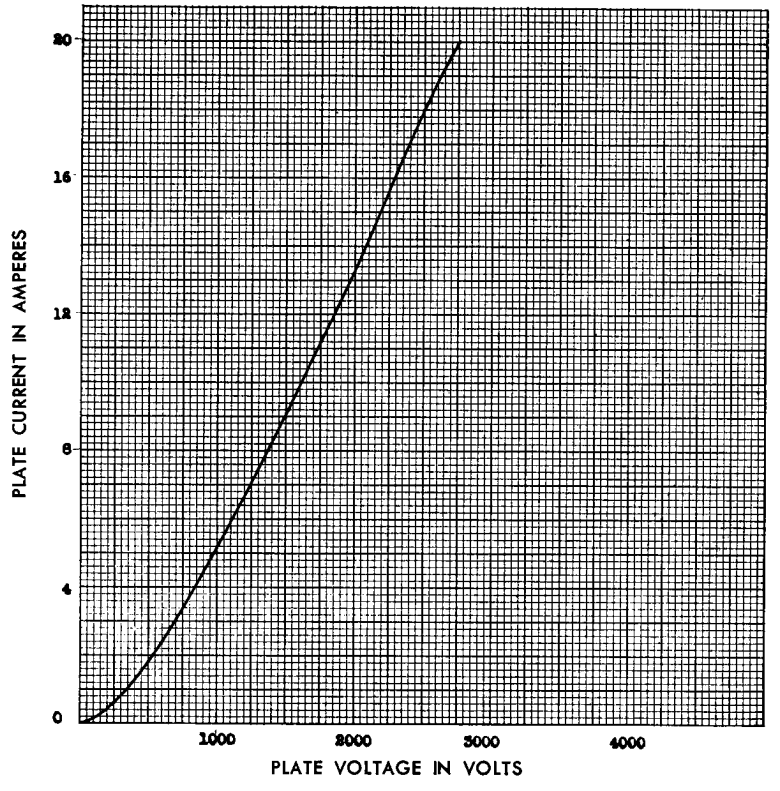


K-69087-72A380

12-7-50

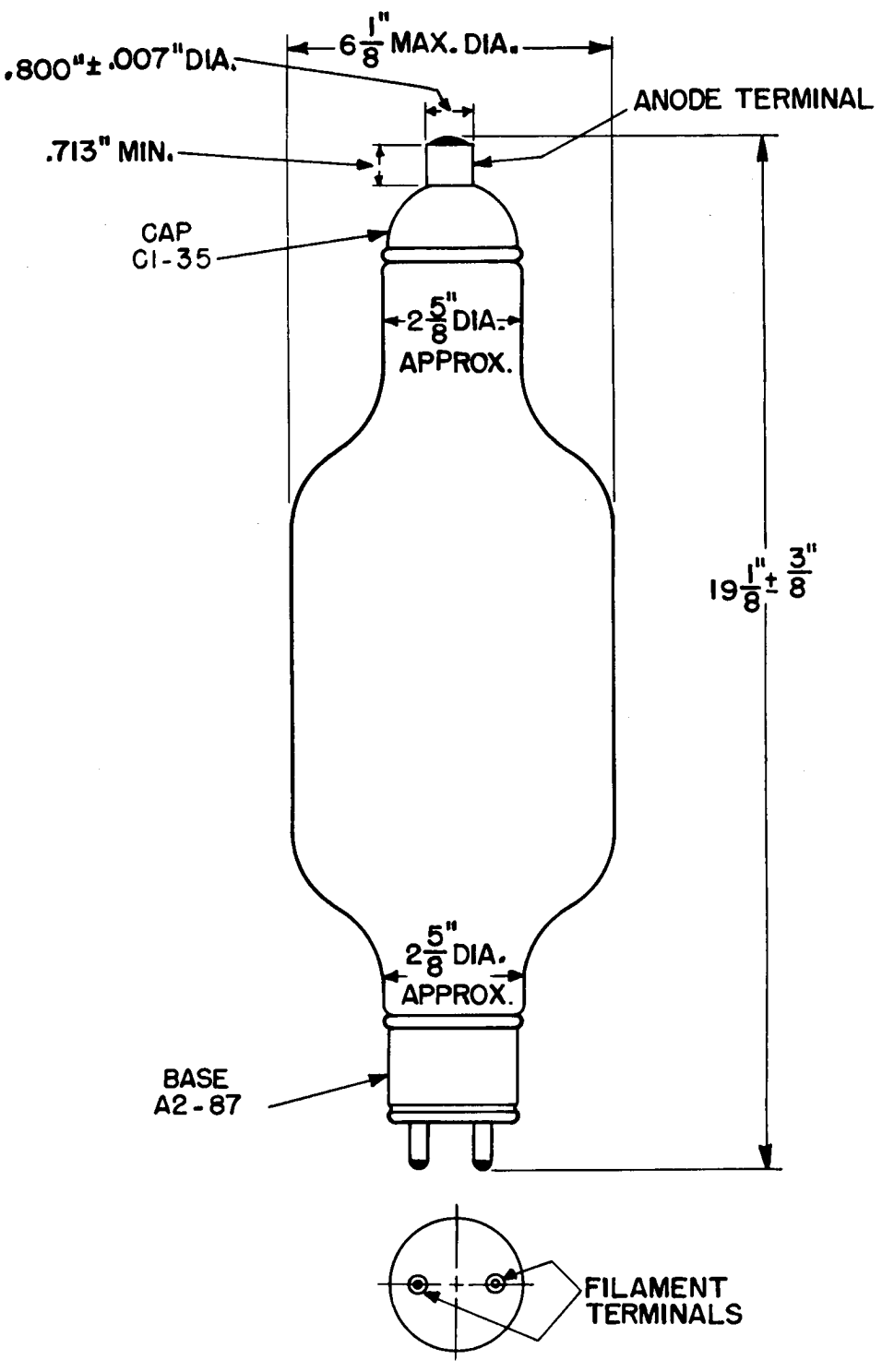
TYPICAL PLATE CHARACTERISTIC

$E_f = 16$ VOLTS



K-69087-72A381

3-14-52



N-21009AZ

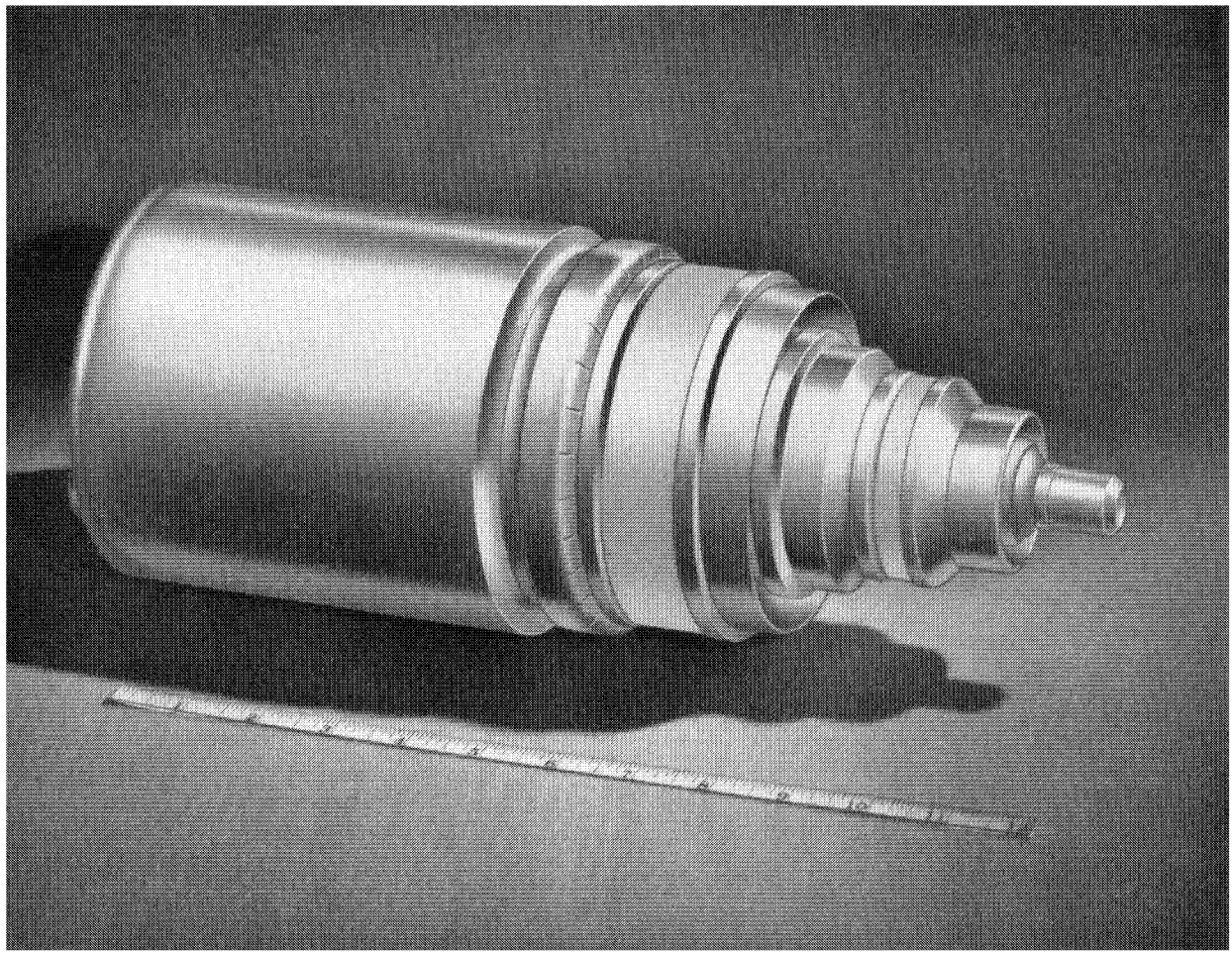
11-25-53

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

PRINTED IN U.S.A.



TETRODE

25-KILOWATTS VHF TELEVISION OUTPUT
VHF TETRODE
GROUNDED-GRID CIRCUITS

WATER COOLED
METAL AND CERAMIC
GAIN IN EXCESS OF 10

The GL-6251 is a four-electrode, water-and-forced-air-cooled transmitting tube for use as a power amplifier or oscillator in grounded-grid circuits with both grids maintained at radio-frequency ground potential. The output circuit is connected between the anode and the screen grid. The anode is capable of dissipating twenty-five kilowatts. The cathode is a thoriated-tungsten filament. Maximum ratings apply up to 220 megacycles.

In Class B grounded-grid broadband television amplifier service this tube has a useful synchronizing peak-power output of twenty-five kilowatts at 220 megacycles. Because of its ratings, the tube is also well adapted to use in dielectric-heating equipment.

High operating efficiency is assured because of the close spacing of the tube electrodes, the ring-seal construction, and the low-loss factor due to the silver-plated external parts and the ceramic insulator. The ring-seal design permits quick plug-in installation. In addition, the grounded-grid construction eliminates the necessity for neutralization in a properly designed circuit.

GENERAL ELECTRIC

Supersedes ET-T1165 dated 12-54

TECHNICAL INFORMATION

GENERAL

Electrical	Minimum	Bogey	Maximum	
⊕ Filament Voltage	5.1	5.5	5.75	Volts
Filament Current at 5.5 Volts	....	190	....	Amperes
Filament Starting Current	....	....	360	Amperes
Filament Cold Resistance	....	0.004	....	Ohms
Filament Heating Time	30	....	....	Seconds
Amplification Factor, G_2 to G_1				
E_b=1000 Volts, I_b=0.1 Amperes	....	20	...	
Peak Cathode Current*	....	....	30	Amperes
Direct Interelectrode Capacitances§				
Grounded-Grid Circuit				
Cathode-Plate†	....	0.06	....	μμf
Input	....	75	....	μμf
Output	....	27	....	μμf

Mechanical

Mounting Position—Vertical, anode down		
Net Weight, approximate	15	Pounds

Thermal

Type of Cooling—Water and Forced Air		
Water Cooling		
Water Flow		
Anode	12 Min	Gallons per Minute
Water Pressure	80 Max	Pounds per Square Inch
Pressure Drop at Rated Flow, approximate	13	Pounds per Square Inch
Outlet Water Temperature	70 Max	C
Air Cooling		
Air Flow		
Anode Seal	30 Min	Cubic Feet per Minute
Filament Seal	15 Min	Cubic Feet per Minute
Grid-to-Grid Seal	10 Min	Cubic Feet per Minute
Ceramic Temperature	200 Max	C
□ Seal and Terminal Temperature	180 Max	C

MAXIMUM RATINGS AND TYPICAL OPERATION

RADIO-FREQUENCY AMPLIFIER—CLASS B TELEVISION SERVICE

Synchronizing-Level Conditions Per Tube Unless Otherwise Specified

Maximum Ratings, Absolute Values

DC Plate Voltage	7000 Max	Volts
⊕ DC Grid-No. 2 Voltage	700 Max	Volts
DC Plate Current	8 Max	Amperes
Plate Input	50 Max	Kilowatts
Grid-No. 2 Input‡	350 Max	Watts
⊕ DC Grid-No. 2 Current		
Pedestal Level	0.200 Max	Amperes
Plate Dissipation	25 Max	Kilowatts
Grid-No. 1 Dissipation	150 Max	Watts
⊕ DC Grid-No. 1 Current	1.0 Max	Amperes

Typical Operation—Grounded-Grid Circuit up to 216 Megacycles

Bandwidth 7 Megacycles, 1 Decibel Voltage		
DC Plate Voltage	6800	Volts
⊕ DC Grid-No. 2 Voltage//	600	Volts
DC Grid-No. 1 Voltage	−20	Volts
Peak RF Plate Voltage		
Synchronizing Level	4800	Volts
Pedestal Level	3600	Volts
Peak RF Driving Voltage		
Synchronizing Level	350	Volts
Pedestal Level	250	Volts

TECHNICAL INFORMATION (CONT'D)

Typical Operation (Cont'd)

DC Plate Current		
Synchronizing Level	7.5	Amperes
Pedestal Level	5.8	Amperes
DC Grid-No. 2 Current//		
Pedestal Level	0.05	Amperes
DC Grid-No. 1 Current		
Synchronizing Level	0.90	Amperes
Pedestal Level	0.55	Amperes
Driving Power at Tube, approximate		
Synchronizing Level	2.3	Kilowatts
Pedestal Level	1.3	Kilowatts
Power Output, approximate¶		
Synchronizing Level	25	Kilowatts
Pedestal Level	15	Kilowatts

* Maximum usable cathode current (plate current plus current to each grid) for any condition of operation.

§ Control grid and screened grid are connected together.

† Measured with 12-inch diameter flat metal disk attached to the screen-grid terminal and grounded.

‡ Calculated from characteristic curve only. This value includes dissipation transferred from driving power. Maximum allowable screen input as indicated by measured d-c current and voltage is much lower because of secondary screen emission.

//DC Grid-No. 2 voltage and current should be held at the minimum values consistent with proper circuit operation. Negative values of screen current are frequently encountered but are not detrimental.

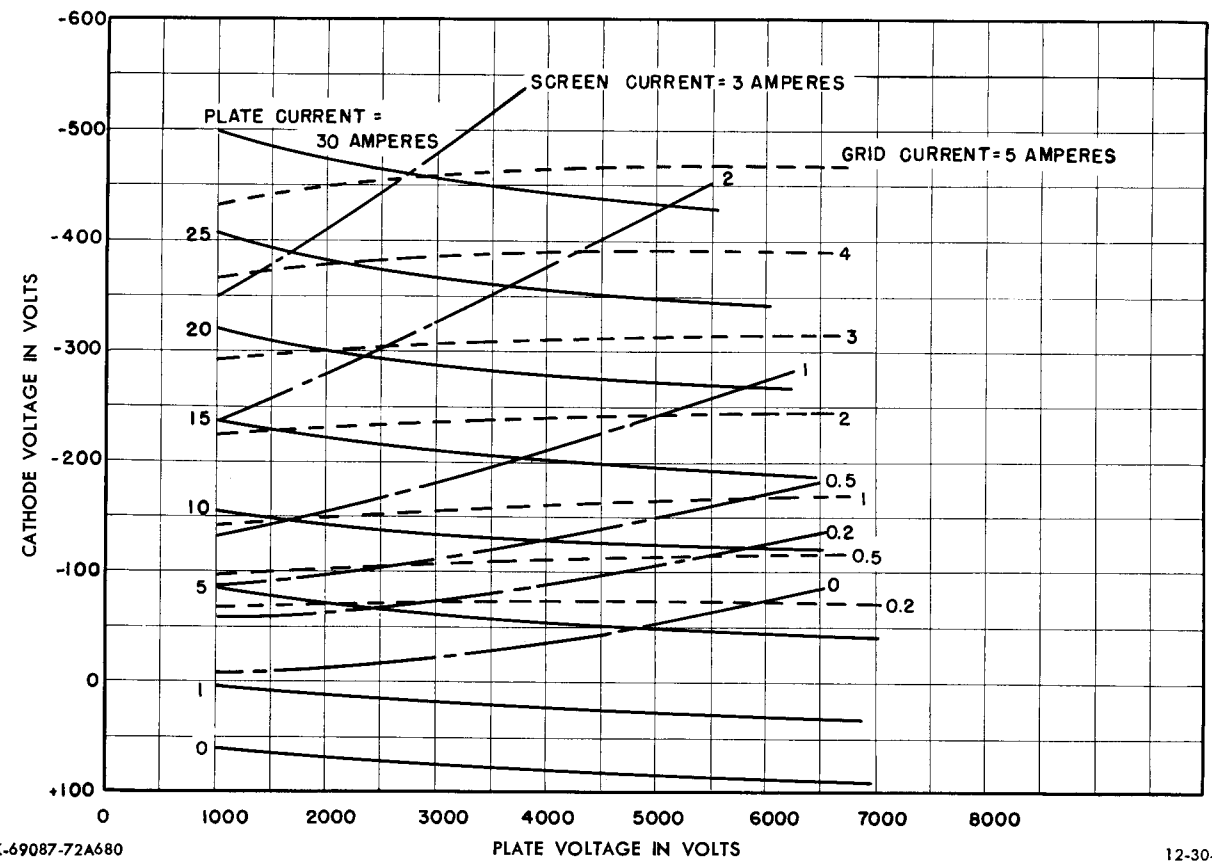
¶ Useful power output including power transferred from driver stage.

⊕ Denotes a change.

□Denotes an addition.

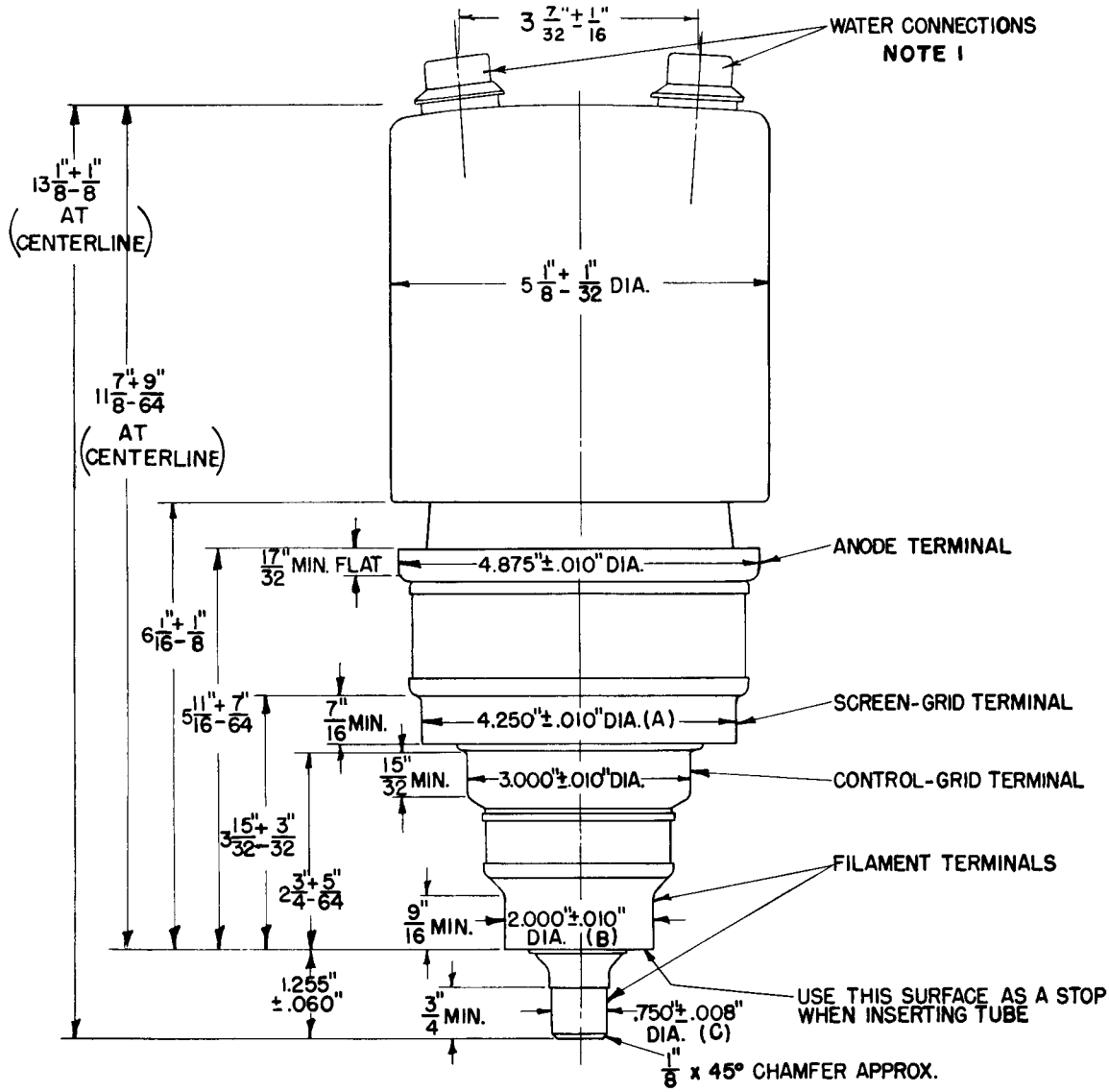
CONSTANT CURRENT CHARACTERISTICS

SCREEN VOLTAGE=700 VOLTS, CONTROL-GRID GROUNDED
ELECTRODE VOLTAGES MEASURED TO GROUND



K-69087-72A680

12-30-54



(A) MAX. ECCENTRICITY .040"
(B) MAX. ECCENTRICITY .040"
(C) MAX. ECCENTRICITY .050"
WITH RESPECT TO CENTERLINE DETERMINED BY CENTERS OF ANODE TERMINAL & CONTROL-GRID TERMINAL.

NOTE 1: MATES WITH WIGGINS SOCKET NO. BC-323B OR EQUIVALENT.
E. B. WIGGINS OIL TOOL COMPANY, INC., LOS ANGELES, CALIFORNIA

N-20726AZ—Outline Revised

1-6-59

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

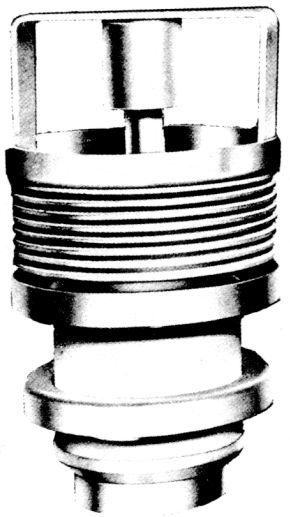
Schenectady 5, N. Y.

PRINTED IN U.S.A.

ELECTRONIC INNOVATIONS IN ACTION

TUBES

GL-6283
TETRODE



RADIO-FREQUENCY AMPLIFIER CW SERVICE GROUNDED-GRID OPERATION

The GL-6283 is a reliable power tetrode that delivers useful output to 1250 megacycles or higher. This tube is particularly suitable for application in the final output or driver stage of military-communications systems.

As a Class B linear amplifier in the 225–400-megacycle range, the tube will deliver 110 watts of carrier power modulated up to 100 percent. Since a power gain of 20 may be realized, drive requirements are low—approximately 5 watts at carrier level.

FORCED-AIR COOLED METAL AND CERAMIC INTEGRAL RADIATOR

Operating as a Class C CW amplifier at 900 megacycles, the gain is approximately 15 at the 200-watt level.

Features of the GL-6283 include long life and reliability, high gain, high linearity, and resistance to shock and vibration.

These together with such design factors as an oxide-coated cathode, coaxial elements, and metal-ceramic construction make the tube well adapted to application in modern systems where performance and reliability are important.

Electrical

	Minimum	Bogey	Maximum	
Heater Voltage*	—	6.3	6.8	Volts
Heater Current	—	3.8	—	Amperes
Cathode Heating Time	1	—	—	Minutes
Amplification Factor, G_2 to G_1, E_b=1000V DC; E_g2=275V DC; I_b=0.2 A DC	—	14	—	
Peak Cathode Current†	—	—	1.75	Amperes
Direct Interelectrode Capacitances				
Cathode to Plate‡	—	0.006	—	μμf
Input, G_2 tied to G_1	—	18.25	—	μμf
Output, G_2 tied to G_1♦	—	6.4	—	μμf

Mechanical

Mounting Position—Any		
Net Weight, approximate	1.0	Pounds

Thermal

Cooling—Forced Air§				
Through Radiator, at Sea Level**				
Plate Dissipation	500	400	300	Watts
Air Flow, 45 C Incoming Air Temperature, minimum	17.0	12.0	6.5	Cubic Feet per Minute
Static Pressure, approximate	0.9	0.5	0.2	Inches-Water
Radiator Hub Temperature, at Point Adjacent to Anode Seal	—	—	250	C
Seals				
Screen-Grid to Control-Grid, approximate	—	—	1	Cubic Feet per Minute
Heater to Cathode, approximate	—	—	1	Cubic Feet per Minute
Ceramic Temperature at Any Point, maximum	—	—	200	C

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B LINEAR

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings

DC Plate Voltage	2000	Volts
DC Grid-No. 2 Voltage	320	Volts
DC Plate Current	0.250	Amperes
Plate Input	500	Watts
Grid-No. 2 Input	5	Watts
Plate Dissipation	500	Watts

Typical Operation

Grounded-Grid Circuit at 225–400 Megacycles		
DC Plate Voltage	1750	Volts
DC Grid-No. 2 Voltage	250	Volts
DC Grid-No. 1 Voltage, approximate	−20	Volts
Peak RF Plate Voltage #, approximate	1250	Volts
Peak RF Grid-No. 1 Voltage #, approximate	40	Volts
DC Plate Current	0.200	Amperes
Zero Signal DC Plate Current (E_{c1} adjusted)	0.020	Amperes
DC Grid-No. 2 Current	0.005	Amperes
DC Grid-No. 1 Current	0.010	Amperes
Driving Power, approximate	5	Watts
Power Output♥	110	Watts

RADIO-FREQUENCY AMPLIFIER—CLASS B TELEVISION SERVICE

Synchronizing-Level Conditions Per Tube Unless Otherwise Specified

Maximum Ratings, Absolute Values

DC Plate Voltage	1600 Max	Volts
DC Grid-No. 2 Voltage	320 Max	Volts
DC Plate Current	0.400 Max	Amperes
Plate Input	600 Max	Watts
Grid-No. 2 Input	15 Max	Watts
Plate Dissipation	500 Max	Watts
Grid-No. 1 Dissipation	2 Max	Watts

Typical Operation—Grounded-Grid Circuit up to 900 Megacycles

Bandwidth 6 Megacycles		
DC Plate Voltage	1500	Volts
DC Grid-No. 2 Voltage	250	Volts
DC Grid-No. 1 Voltage	−25	Volts
Peak RF Plate Voltage		
Synchronizing Level	1100	Volts
Pedestal Level	825	Volts
Peak RF Driving Voltage		
Synchronizing Level	35	Volts
Pedestal Level	27	Volts
DC Plate Current		
Synchronizing Level	0.400	Amperes
Pedestal Level	0.295	Amperes
DC Grid-No.2 Current (Pedestal Level)	0.007	Amperes
DC Grid-No. 1 Current		
Synchronizing Level	0.036	Amperes
Pedestal Level	0.016	Amperes
Driving Power at Tube, approximate		
Synchronizing Level	25	Watts
Pedestal Level	15	Watts
Power Output, approximate		
Synchronizing Level¶	260	Watts
Pedestal Level¶	145	Watts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

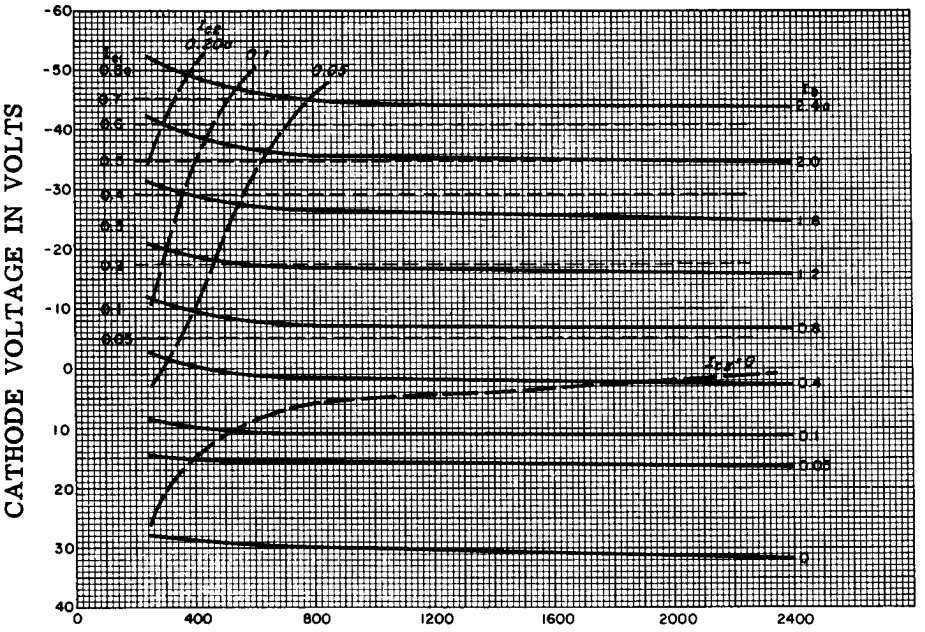
Key-down conditions per tube without amplitude modulation△

Maximum Ratings	900 Megacycles	400 Megacycles	
DC Plate Voltage	1600	2000	Volts
DC Grid-No. 2 Voltage	320	320	Volts
DC Grid-No. 1 Voltage	−100	−100	Volts
DC Plate Current	0.300	0.300	Ampere
DC Grid-No. 1 Current	0.050	0.050	Ampere
Plate Input	480	600	Watts
Grid-No. 2 Input	15	15	Watts
Plate Dissipation	500	500	Watts
Grid-No. 1 Dissipation	2	2	Watts

Typical Operation			
Grounded-Grid Circuit at 900 Megacycles			
DC Plate Voltage	1500	2000	Volts
DC Grid-No. 2 Voltage	210	225	Volts
DC Grid-No. 1 Voltage	−40	−40	Volts
DC Plate Current	0.300	0.250	Ampere
DC Grid-No. 2 Current, approximate	0.010	0.010	Ampere
DC Grid-No. 1 Current, approximate	0.020	0.020	Ampere
Driving Power, approximate	14	15	Watts
Power Output, approximate¶	205	300	Watts

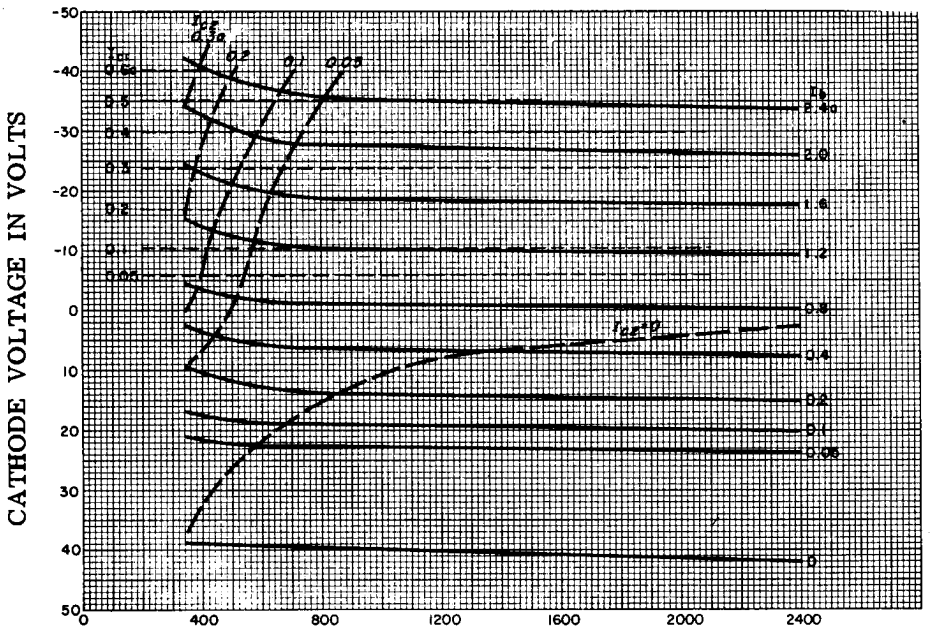
* Because the temperature of the cathode is increased by back bombardment of electrons at UHF, required heater voltage for optimum life decreases with increasing frequency. The amount of heater-voltage reduction is dependent on operating conditions. However, this voltage should not be less than 5.5 volts.
† Represents maximum usable cathode current (plate current plus current to each grid) for any condition of operation.
‡ Measured with a 6-inch minimum diameter flat metal disk attached to the screen-grid ring. Control grid connected to the screen grid.
♦ Output capacitances measured between anode and screen grid. Control grid connected directly to screen grid.
§ Forced-air cooling to be applied before and during the application of any voltages.
**Provision must be made for unobstructed passage of cooling air between radiator fins and between the anode terminal and adjacent radiator fin.
♥Useful power output as measured in output-circuit load.
¶ Useful power output including power transferred from driver stage. Output circuit efficiency approximately 80 percent.
△Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 percent of the carrier conditions.

CONSTANT CURRENT CHARACTERISTIC
SCREEN VOLTAGE = 250 VOLTS
ALL VOLTAGES REFERENCED TO CONTROL GRID

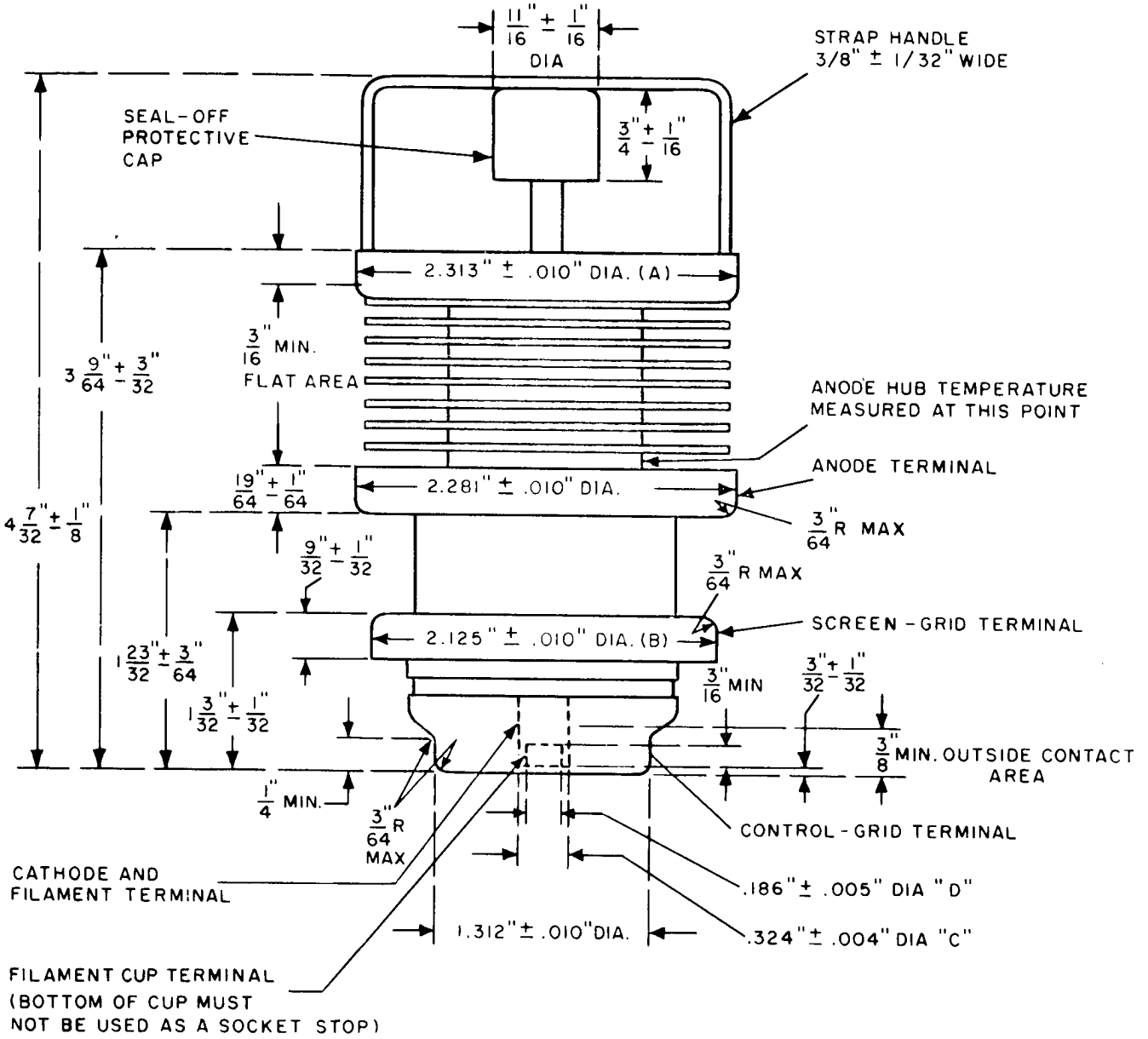


A69087 - 72B67 1-30-63

CONSTANT CURRENT CHARACTERISTIC
SCREEN VOLTAGE = 350 VOLTS
ALL VOLTAGES REFERENCED TO CONTROL GRID



A69087 - 72B68 1-30-63



CONCENTRICITIES

THE FOLLOWING TOTAL INDICATOR READINGS ARE MEASURED WITH RESPECT TO A CENTERLINE DETERMINED BY THE CENTERS OF THE ANODE TERMINAL AND CONTROL GRID TERMINAL

DIAMETER A – 0.030 INCHES
DIAMETER B – 0.016 INCHES
DIAMETER C – 0.036 INCHES
DIAMETER D – 0.042 INCHES

TOTAL INDICATOR READING OF FILAMENT CUP TERMINAL DIAMETER (D) MEASURED WITH RESPECT TO CENTER OF CATHODE AND FILAMENT TERMINAL DIAMETER (C) – 0.016 INCHES

K-69087-72A578

8-1-62



GL-6848
TETRODE

VHF-UHF **FORCED-AIR COOLED**
RING-SEAL CONSTRUCTION **METAL AND CERAMIC**
GROUNDED-GRID CIRCUIT

The GL-6848 is a four-electrode transmitting tube featuring a metal-and-ceramic envelope for use as a power amplifier or oscillator in grounded-grid circuits with both grids maintained at radio-frequency ground potential. The output circuit is connected between the anode and the screen grid. The anode is capable of dissipating 2 kilowatts. Cooling is accomplished by forced air with the radiator an integral part of the anode. The cathode is a unipotential thoriated-tungsten cylinder, heated by electron bombardment. Maximum ratings apply up to 800 megacycles, although higher frequency operation is possible.

In narrow band, Class C, grounded-grid, amplitude-modulated service, the GL-6848 has a useful carrier-power output in excess of one kilowatt. In Class C Telegraphy, it has a useful power output of 3.0 kilowatts of continuous power as an amplifier or oscillator.

Electrical

	Minimum	Bogey	Maximum	
Cathode				
Heater Voltage	—	6.7	7.0	Volts
Heater Current at 7.0 Volts				
Without Cathode Bombarding	—	14.5	—	Amperes
With 150 Watts Cathode Bombarding	—	13.5	—	Amperes
Heater Starting Current	—	—	25	Amperes
Heater Cold Resistance	—	0.041	—	Ohms
Cathode Bombarding Power*	—	170	195	Watts
Cathode Bombarding Voltage, DC				
For 170 Watts Bombarding Power	—	650	—	Volts
For 195 Watts Bombarding Power	—	700	—	Volts
Cathode Heating Time	1	—	—	Minutes
Amplification Factor, G_2 to G_1, E_b = 4000 volts, I_b = 0.5 Ampere	—	20	—	
Peak Cathode Current‡	—	—	6	Amperes
Direct Interelectrode Capacitances				
Cathode to Plate§	—	0.01	—	μμf
Input, G_2 tied to G_1	—	27.8	—	μμf
Output, G_2 tied to G_1¶	—	6.4	—	μμf

Mechanical

Mounting Position—Vertical, Anode-end Up
Net Weight, approximate . . . . . 6.0 Pounds

Thermal

Type of Cooling—Forced Air

Air Flow

Through Radiator				
Percentage Rated Plate Dissipation	100	80	60	Percent
Air Flow	120	70	48	Cubic Feet per Minute
Static Pressure	3.2	1.5	0.8	Inches
Screen-grid to Control-grid Seals			15	Min Cubic Feet per Minute
Heater-to-Cathode Seals			7.5	Min Cubic Feet per Minute
Anode Ceramic			10	Min Cubic Feet per Minute

Incoming Air Temperature	45 Max C
Anode Hub Temperature	180 Max C
Ceramic Temperature at Any Point	200 Max C
Temperature at Any Other Point	200 Max C

Forced-air cooling to be applied before and during the application of any voltage. Air flow on heater-to-cathode seals must be maintained for one minute after removal of heater voltage. The air duct can be constructed so that air is forced along the anode seal and ceramic through the anode contact fingers to accomplish the anode ceramic and anode seal cooling. The volume of cooling air indicated is approximate only. Distribution of cooling air will vary with configuration of the cavity about the tube.

GENERAL ELECTRIC

PLATE MODULATED RADIO-FREQUENCY AMPLIFIER—CLASS C TELEPHONY

Carrier Conditions With a Maximum Modulation Factor of 1.0, Screen Modulation Required

Maximum Ratings, Absolute Values

DC Plate Voltage	4500	Volts
DC Grid-No. 2 Voltage	500	Volts
DC Grid-No. 1 Voltage	−120	Volts
DC Plate Current	0.80	Ampere
DC Grid-No. 1 Current	0.120	Ampere
Plate Input	3.60	Kilowatts
Grid-No. 2 Input	25	Watts
Plate Dissipation	2.0	Kilowatts

Typical Operation

Grounded-grid Circuit at 400 Megacycles

DC Plate Voltage	4000	Volts
DC Grid-No. 2 Voltage	400	Volts
DC Grid-No. 1 Voltage	−100	Volts
Peak RF Plate Voltage	2500	Volts
Peak RF Driving Voltage	120	Volts
DC Plate Current	0.570	Ampere
DC Grid-No. 2 Current	0.020	Ampere
DC Grid-No. 1 Current, approximate	0.100	Ampere
Driving Power, approximate	100	Watts
Power Output#	1250	Watts
Output Circuit Efficiency	90	Percent
Cathode Bombarding Power*	165	Watts
Cathode Bombarding Voltage, approx.	630	Volts
Cathode Bombarding Current, approx.	0.260	Ampere

RADIO-FREQUENCY AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key Down Conditions per Tube Without Amplitude Modulation

Maximum Ratings, Absolute Values

DC Plate Voltage	7000	Volts
DC Grid-No. 2 Voltage	750	Volts
DC Plate Current	1.0	Amperes
Plate Input	6.0	Kilowatts
Grid-No. 2 Input	40	Watts
Plate Dissipation	2.0	Kilowatts
DC Grid-No. 1 Voltage	120	Volts
DC Grid-No. 1 Current	0.150	Ampere

Typical Operation

Grounded-grid Circuit at 400 Megacycles

DC Plate Voltage	4500	6500	Volts
DC Grid-No. 2 Voltage	600	700	Volts
DC Grid-No. 1 Voltage	−120	−100	Volts
Peak RF Plate Voltage, approximate	3000	—	Volts
Peak RF Grid-No. 1 Voltage	140	140	Volts
DC Plate Current	0.6	0.8	Ampere
DC Grid-No. 2 Current	0.018	0.025	Ampere
DC Grid-No. 1 Current	0.080	0.100	Ampere
Driving Power, approximate	100	100	Watts
Power Output, approximate#	1800	3200	Watts
Output Circuit Efficiency	90	90	Percent
Cathode Bombarding Power*	160	165	Watts
Cathode Bombarding Voltage, approximate	610	630	Volts
Cathode Bombarding Current, approximate	0.260	0.260	Ampere

Grounded-grid Circuit at 800 Megacycles

DC Plate Voltage	4500	Volts
DC Grid-No. 2 Voltage	600	Volts
DC Grid-No. 1 Voltage	−120	Volts
Peak RF Plate Voltage, approximate	3000	Volts
Peak RF Grid-No. 1 Voltage	140	Volts
DC Plate Current	0.6	Ampere
DC Grid-No. 2 Current	0.018	Ampere
DC Grid-No. 1 Current	0.080	Ampere
Driving Power, approximate	90	Watts
Power Output, approximate#	1250	Watts
Output Circuit Efficiency	83	Percent
Cathode Bombarding Power*	150	Watts
Cathode Bombarding Voltage, approximate	600	Volts
Cathode Bombarding Current, approximate	0.250	Ampere

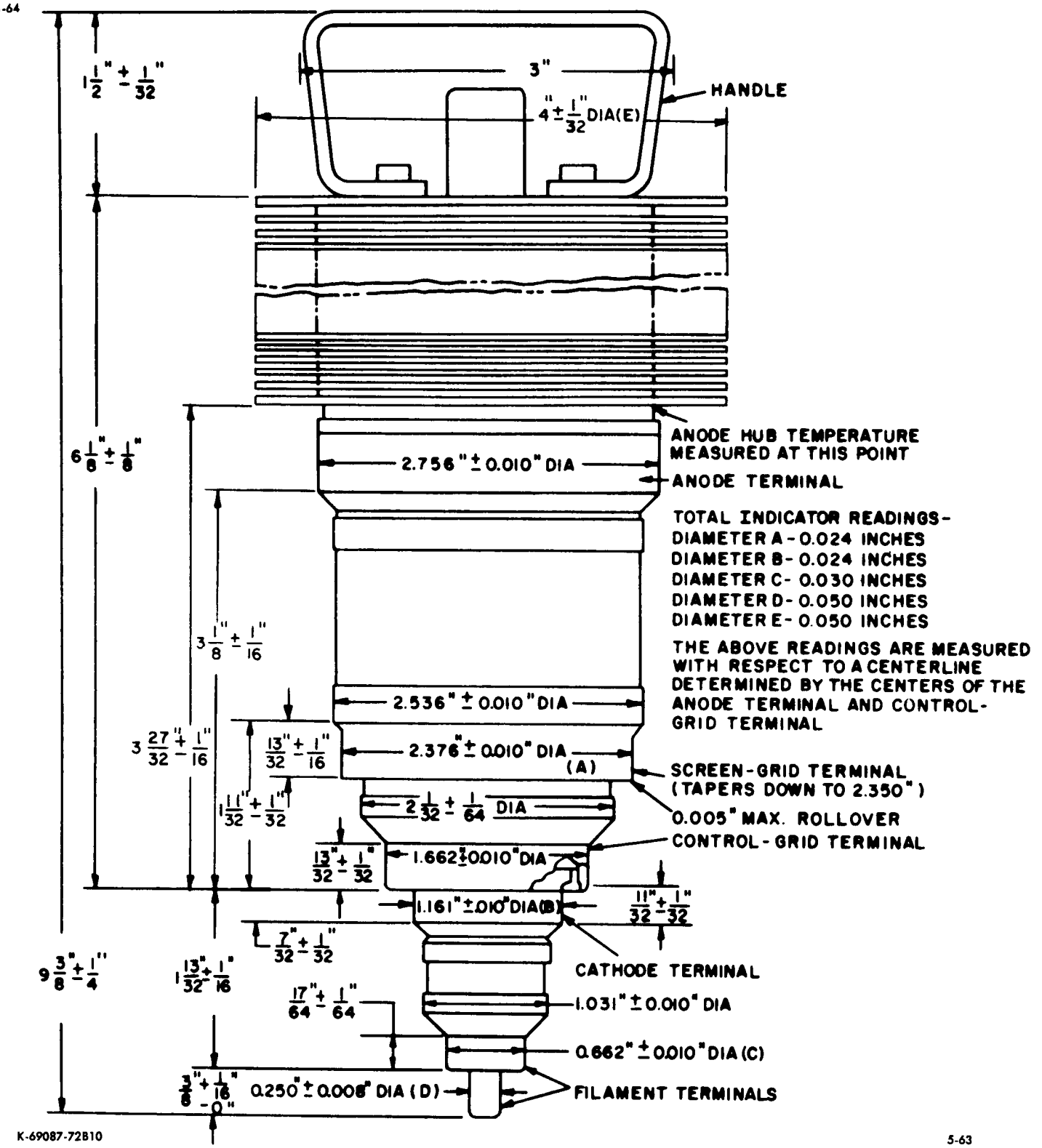
* The cathode of the GL-6848, because of transit-time effects which raise the temperature of the cathode, is subjected to considerable back bombardment in ultra-high-frequency service. The amount of heating due to bombardment is a function of the operating conditions and frequency, and must be compensated for by a reduction of the cathode power input to prevent overheating of the cathode with resulting short life. In any case it is important from a tube life standpoint to keep the cathode power at as low a level as possible consistent with required performance. Bombarder power should be monitored by a suitable wattmeter or DC voltmeter and milliammeter arrangement. For long life, the tube should be put in operation with about 180 watts bombarding power. After the circuit has been adjusted for proper tube operation, bombarding voltage should be reduced to a value slightly above that at which circuit performance is affected. Minor circuit readjustment may be necessary after the above adjustment. The procedure for determining proper bombarding power should be repeated periodically.

‡ Represents maximum usable cathode current.(plate current plus current to each grid) for any condition of operation.

§ Measured with complete isolation between cathode and plate.

¶ Output capacitance measured between anode and screen grid. Control grid connected directly to screen grid.

\# Useful power output including power transferred from driver stage.



K-69087-72B10

5-63

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

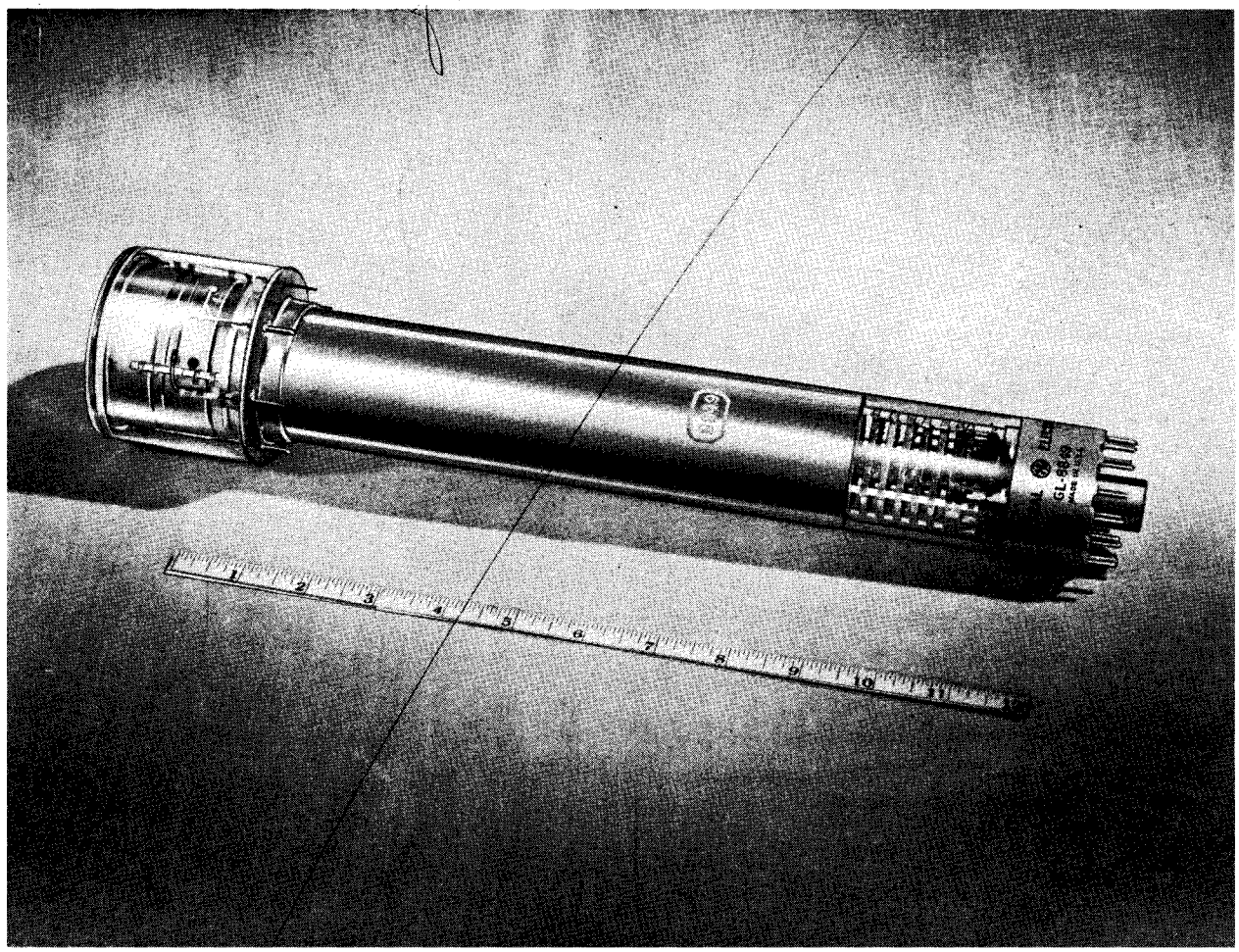


IMAGE ORTHICON

MAGNETIC FOCUS **MAGNETIC DEFLECTION**

LOW-LIGHT-LEVEL PICKUP

The GL-6849 is a television camera tube for extremely low-light-level pickup use. Typical applications are observation of fluoroscopic screens, scenes illuminated by starlight and direct images of stars.

Extremely wide target-to-mesh spacing reduces smearing or lag of moving images at low light levels by better beam modulation. This results in an increase in signal-to-noise ratio at low illumination levels. Wide spacing eliminates microphonics originating in the target-mesh assembly.

The GL-6849 photocathode is characterized by a spectral response with high blue and high green sensitivity, very good yellow sensitivity and good red sensitivity. It has practically no infra-red sensitivity. This characteristic of the response permits portrayal of colors in nearly their true tonal gradation since it prevents any color-masking by infra-red.

TECHNICAL INFORMATION

GENERAL

Electrical

Cathode—Unipotential		
Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.6	Amperes
Photocathode—Semi-transparent		
Response—See spectral sensitivity curve on page 3 for details.		
Rectangular Image, 4 by 3 aspect ratio		
Useful Size, maximum diagonal	1.8	Inches
Orientation—Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the faceplate and pin No. 7 of the shoulder base.		
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Direct Interelectrode Capacitance		
Anode to All Other Electrodes	12	μμf

TECHNICAL INFORMATION (CONT'D)

Mechanical

Over-all Length	15.20″ ± 0.25″	Inches
Greatest Diameter of Bulb	3.00″ ± 0.06″	Inches
Minimum Deflecting Coil Inside Diameter	2 3/8	Inches
Deflecting Coil Length	5	Inches
Focusing Coil Length	10	Inches
Alignment Coil Length	15/16	Inches
Photocathode Distance Inside End of Focusing Coil	1/2	Inches
Weight, approximate	1.4	Pounds

Operating Position—Any, except with diheptal base up and the tube axis at an angle of less than 20 degrees from vertical.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Absolute Values

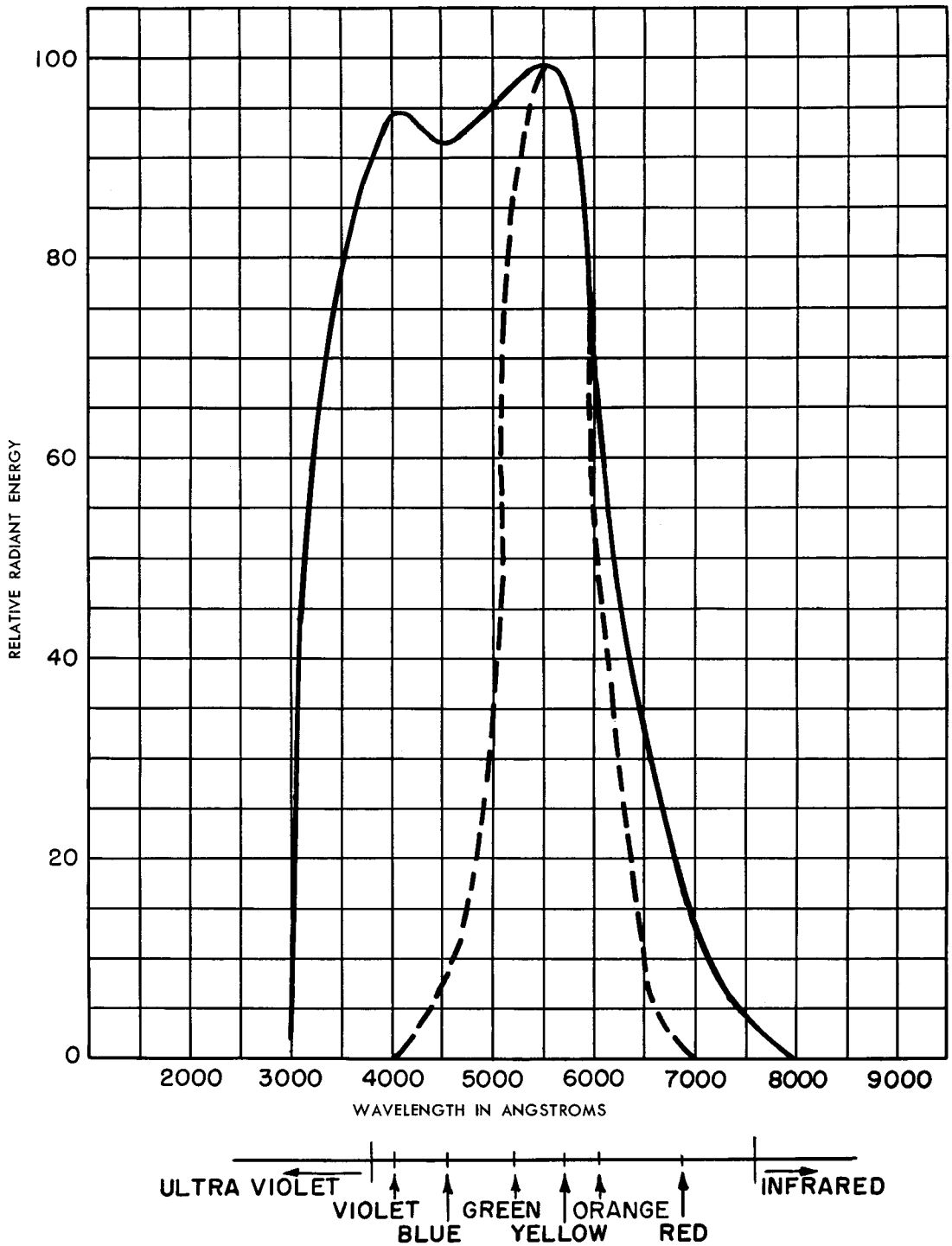
Photocathode Voltage	−550 Max	Volts
Photocathode Illumination	50 Max	Foot-Candles
Anode Supply Voltage*	1350 Max	Volts
Grid-No. 1 Voltage		
Negative Bias Value	125 Max	Volts
Positive Bias Value	0 Max	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	350 Max	Volts
Grid-No. 3 Voltage	400 Max	Volts
Grid-No. 4 Voltage	300 Max	Volts
Grid-No. 5 Voltage	150 Max	Volts
Grid-No. 6 Voltage	−550 Max	Volts
Voltage Per Multiplier Stage	350 Max	Volts
Target Voltage		
Positive Value	10 Max	Volts
Negative Value	10 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125 Max	Volts
Heater Positive with Respect to Cathode	10 Max	Volts
Operating Temperature of Any Part of Bulb	50 Max	C
Operating Temperature of Bulb at Large End of Tube, target section	35 Min	C
Temperature Difference		
Between Target Section and Any Part of Bulb Hotter Than Target Section	5 Max	C

Typical Operation

Photocathode Voltage, image focus	−400 to −540	Volts
Grid-No. 1 Voltage for Picture Cut-off, beam	−45 to −115	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	300	Volts
Grid-No. 3 Voltage†, multiplier focus	225 to 330	Volts
Grid-No. 4 Voltage, beam focus	140 to 180	Volts
Grid-No. 5 Voltage, decelerator	0 to 125	Volts
Grid-No. 6 Voltage, accelerator		
75 Percent of Photocathode Voltage, approximate	−300 to −405	Volts
Dynode-No. 2 Voltage	600	Volts
Dynode-No. 3 Voltage	800	Volts
Dynode-No. 4 Voltage	1000	Volts
Dynode-No. 5 Voltage	1200	Volts
Anode Voltage	1250	Volts
DC Anode Current	3	Microamperes
Signal Output Current, peak to peak	0.01 to 5	Microamperes
Target Voltage‡		
Target Cutoff Voltage‡	−3 to +1	Volts
Blanking Voltage, peak to peak	5 to 20	Volts
Target Temperature Range	35 to 45	C
Ratio of Peak-to-Peak Highlight Video Signal		
Current to RMS Noise Current, approximate	35	
Minimum Peak-to-Peak Blanking Voltage	5	Volts
Field Strength at Center of Focusing Coil§	75	Gausses
Field Strength of Alignment Coil, approximate	0 to 3	Gausses

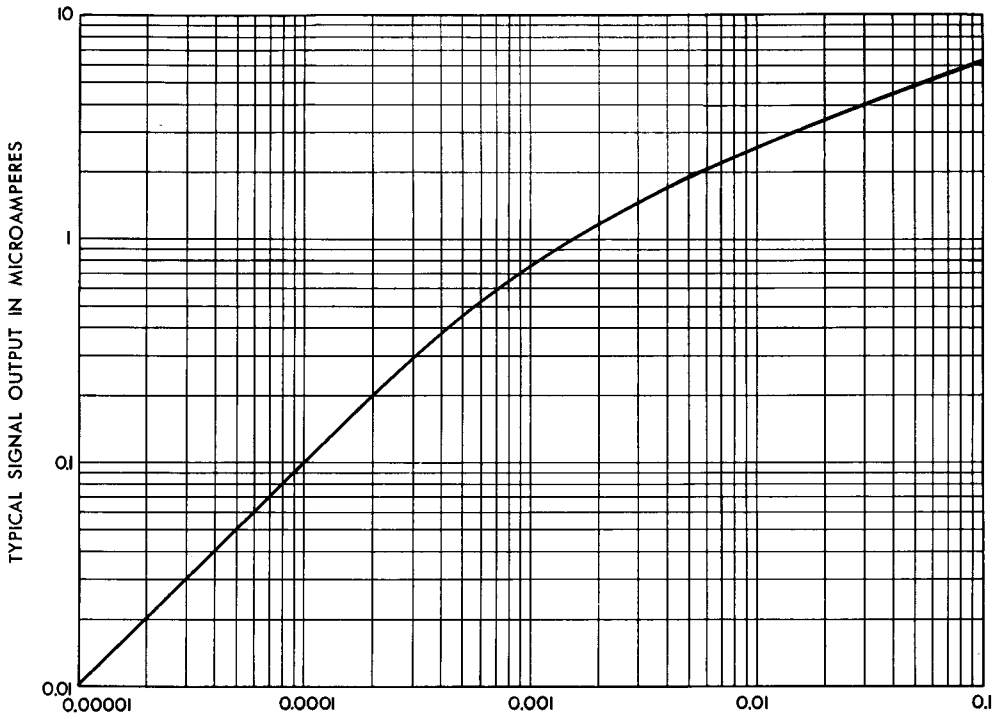
* Ratio of dynode voltages is shown under Typical Operation.
† Adjust to give the most uniformly shaded picture near maximum signal.
‡ Adjustable from −3 to +5 volts with blanking voltage off. Normal setting of target voltage is +2 volts from target cutoff.
§ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.
⊕Denotes a change.
□Denotes an addition.

SPECTRAL SENSITIVITY CHARACTERISTIC
FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS
DASHED CURVE SHOWS SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE



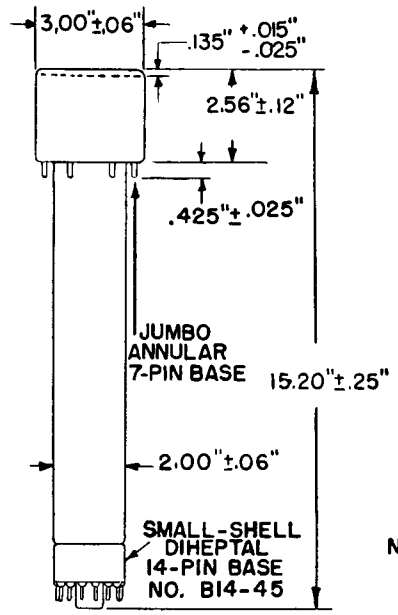
TYPICAL SIGNAL OUTPUT

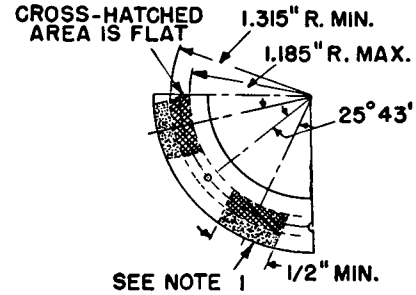
SCENE: BLACK AND WHITE BALANCED
TUNGSTEN, DAYLIGHT, OR WHITE FLUORESCENT LIGHT



K-69087-262A12

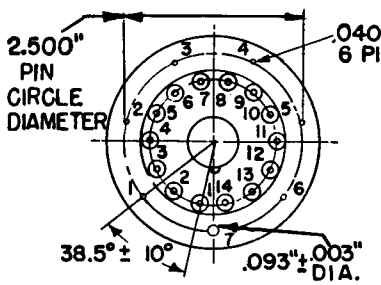
4-3-57





DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.



ENLARGED BOTTOM VIEW

ANNULAR BASE GAGE

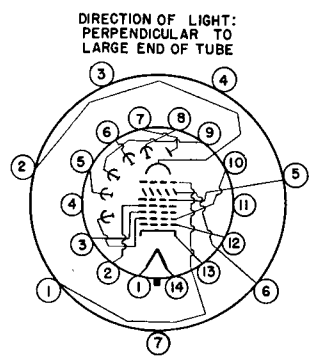
ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065"± 0.001" AND ONE HOLE HAVING DIA. OF 0.150"±0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047." ALL HOLES ARE SPACED AT ANGLES OF 51°26' ±5' ON CIRCLE DIAMETER OF 2.500"± 0.001"

b. SEVEN STOPS HAVING HEIGHT OF 0.187"±0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126"± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200"± 0.001."



BASING DIAGRAM

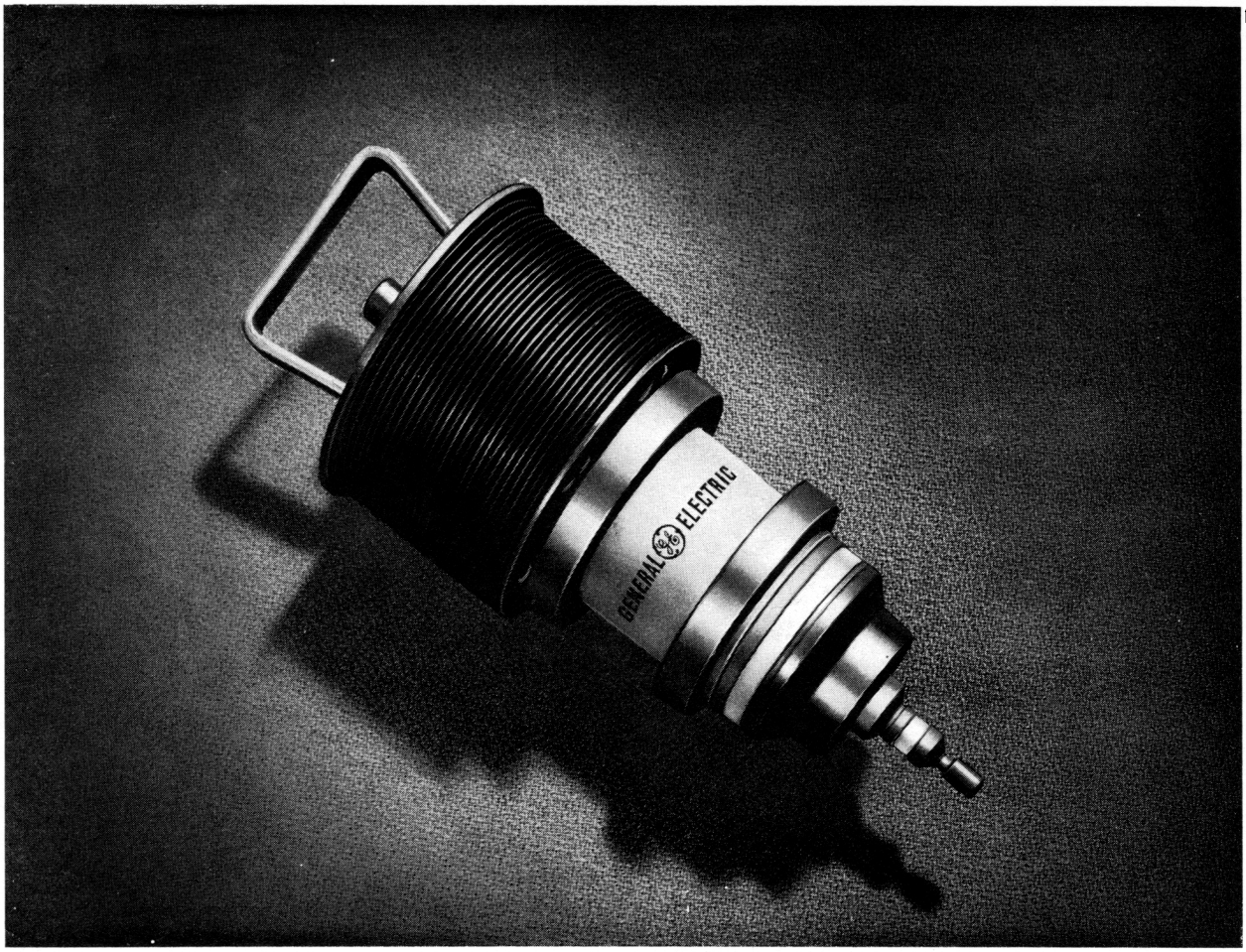
SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
PIN 2: GRID NO.4
PIN 3: GRID NO.3
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: DYNODE NO. 2
PIN 6: DYNODE NO.4
PIN 7: ANODE
PIN 8: DYNODE NO. 5
PIN 9: DYNODE NO. 3
PIN 10: DYNODE NO.1, GRID NO. 2
PIN 11: INTERNAL CONNECTION-DO NOT USE
PIN 12: GRID NO.1
PIN 13: CATHODE
PIN 14: HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO.6
PIN 2: PHOTOCATHODE
PIN 3: INTERNAL CONNECTION-DO NOT USE
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: GRID NO.5
PIN 6: TARGET
PIN 7: INTERNAL CONNECTION-DO NOT USE

ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.



TETRODE

ONE KILOWATT UHF TELEVISION OUTPUT
UHF TETRODE
GROUNDED-GRID CIRCUITS
FORCED-AIR COOLED
METAL AND CERAMIC
INTEGRAL RADIATOR
THORIATED-TUNGSTEN CATHODE

The GL-6942 is a four-electrode transmitting tube featuring a metal-and-ceramic envelope designed for use as a power amplifier or oscillator in grounded-grid circuits with both grids maintained at radio-frequency ground potential. The output circuit is connected between the anode and the screen grid. The anode is capable of dissipating one and one-half kilowatts. Cooling is accomplished by forced air with the radiator an integral part of the anode. The cathode is indirectly heated thoriated tungsten. Maximum ratings apply up to 1000 megacycles.

When used as a Class B grounded-grid broadband television amplifier this tube has a useful synchronizing peak-power output of one kilowatt at 900 megacycles; in narrow band Class C service the output is one kilowatt of continuous power as an amplifier or oscillator. Because of its ratings, the tube is also well adapted to use in dielectric-heating equipment.

High operating efficiency is assured because of the small size and close spacing of the tube electrodes, the ring-seal construction, and the low-loss factor due to the silver-plated external parts and the ceramic insulators. In addition, the grounded-grid construction eliminates the necessity for neutralization in a properly designed circuit. The small size of the GL-6942 permits compact mounting, and the ring-seal construction allows quick plug-in installation.

GENERAL ELECTRIC

TECHNICAL INFORMATION

GENERAL

Electrical

	Minimum	Bogey	Maximum	
Heater Voltage*	....	5.7	6.0	Volts
Heater Current at 5.7 Volts	22	24	26	Amperes
Heater Starting Current	....	....	36	Amperes
Heater Cold Resistance	....	0.02	....	Ohms
Cathode Heating Time	1	....	....	Minutes
Amplification Factor, G_2 to G_1				
Eb = 2000 Volts, I_b = 0.200 Ampere, E_c2 = 475 Volts	12	17	22	
Peak Cathode Current†	....	....	3.0	Amperes
Direct Interelectrode Capacitances				
Cathode to Plate‡	....	....	0.006	μμf
Input, G_2 tied to G_1	15.5	17.0	18.5	μμf
Output, G_2 tied to G_1§	5.0	5.5	6.0	μμf

Mechanical

Mounting Position—Vertical		
Net Weight, approximate	3.6	Pounds

Thermal

Air Flow¶		
Through Radiator—See drawing for air duct form on page 4.		
Plate Dissipation	1.5	Kilowatts
Air Flow	60 Min	Cubic Feet per Minute
Static Pressure	1.5	Inches Water
Heater-to-Cathode Seals	8 Min	Cubic Feet per Minute
Screen-Grid to Control-Grid Seals	4 Min	Cubic Feet per Minute
Anode to Screen-Grid Ceramic Insulator	6 Min	Cubic Feet per Minute
Incoming Air Temperature	45 Max	C
Radiator Hub Temperature at Fin Adjacent to Anode Seal	180 Max	C
Ceramic Temperature at Any Point	200 Max	C

Forced-air cooling to be applied before and during the application of any voltages. Forced-air cooling must be maintained for one minute after the removal of all voltages.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

RADIO-FREQUENCY AMPLIFIER—CLASS B TELEVISION SERVICE

Synchronizing-Level Conditions per Tube Unless Otherwise Specified

Maximum Ratings, Absolute Values

DC Plate Voltage	4000 Max	Volts
DC Grid-No. 2 Voltage	600 Max	Volts
DC Plate Current	0.7 Max	Amperes
Plate Input	2.5 Max	Kilowatts
Grid-No. 2 Input	25 Max	Watts
Plate Dissipation	1.5 Max	Kilowatts

Typical Operation—Grounded-Grid Circuit up to 900 Megacycles

Bandwidth 6 Megacycles, measured to 1 decibel point		
DC Plate Voltage	3500	Volts
DC Grid-No. 2 Voltage	500	Volts
DC Grid-No. 1 Voltage	−40	Volts
Peak RF Plate Voltage		
Synchronizing Level	2500	Volts
Pedestal Level	1875	Volts
Peak RF Driving Voltage		
Synchronizing Level	110	Volts
Pedestal Level	70	Volts
DC Plate Current		
Synchronizing Level	0.520	Amperes
Pedestal Level	0.360	Amperes
DC Grid-No. 2		
Pedestal Level	0.035	Amperes
DC Grid-No. 1 Current		
Synchronizing Level	0.110	Amperes
Pedestal Level	0.035	Amperes

TECHNICAL INFORMATION (CONT'D)

Driving Power at Tube, approximate		
Synchronizing Level	100	Watts
Pedestal Level	25	Watts
Power Output, approximateϕ		
Synchronizing Level	1000	Watts
Pedestal Level	560	Watts

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

Carrier Conditions with a Maximum Madulation Factor of 1.0

Maximum Ratings, Absolute Values

DC Plate Voltage	3200 Max	Volts
DC Grid-No. 2 Voltage	600 Max	Volts
DC Grid-No. 1 Voltage	−120 Max	Volts
DC Plate Current	0.35 Max	Amperes
DC Grid-No. 1 Current	0.10 Max	Amperes
Plate Input	1.12 Max	Kilowatts
Grid-No. 2 Input	10 Max	Watts
Plate Dissipation	1200 Max	Watts

Typical Operation, Grounded-Grid Circuit up to 900 Megacycles

DC Plate Voltage	3000	Volts
DC Grid-No. 2 Voltage	500	Volts
DC Grid-No. 1 Voltage	−100	Volts
Peak RF Plate Voltage	2300	Volts
Peak RF Driving Voltage	137	Volts
DC Plate Current	0.25	Amperes
DC Grid-No. 2 Current	0.01	Amperes
DC Grid-No. 1 Current, approximate	0.047	Amperes
Driving Power, approximate♦	38	Watts
Power Outputϕ	565	Watts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key-Down Conditions per Tube without Amplitude Modulation▲

Maximum Ratings, Absolute Values

DC Plate Voltage	4000 Max	Volts
DC Grid-No. 2 Voltage	600 Max	Volts
DC Grid-No. 1 Voltage	−150 Max	Volts
DC Plate Current	0.7 Max	Amperes
DC Grid-No. 1 Current	0.10 Max	Amperes
Plate Input	2.5 Max	Kilowatts
Grid-No. 2 Input	25 Max	Watts
Plate Dissipation	1.5 Max	Kilowatts

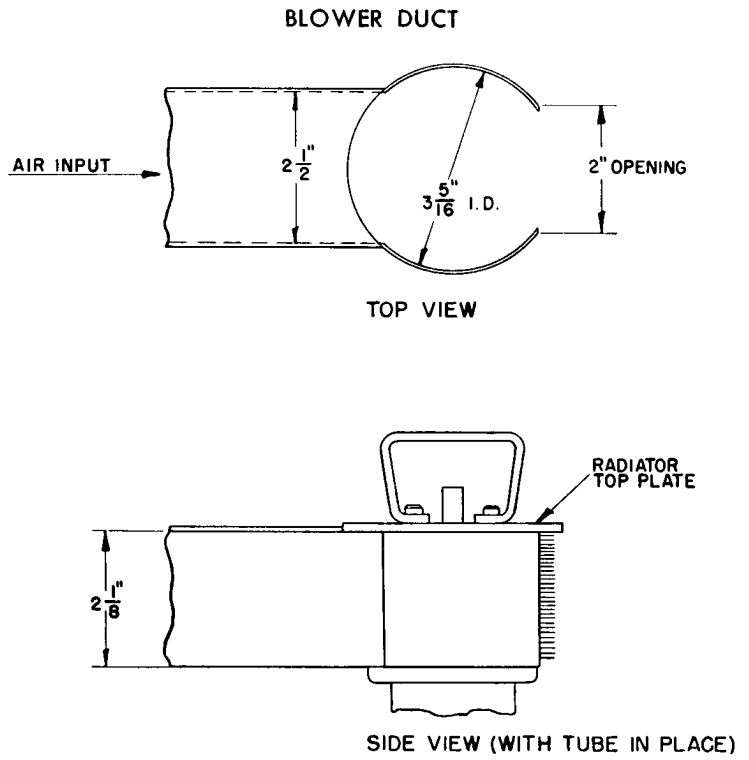
Typical Operation — Grounded-Grid Circuit at 1000 Megacyles*, ¼ λ Output

DC Plate Voltage	4000	Volts
DC Grid-No. 2 Voltage	500	Volts
DC Grid-No. 1 Voltage	−110	Volts
DC Plate Current	0.042	Amperes
DC Grid-No. 2 Current	0.011	Amperes
DC Grid-No. 1 Current, approximate	0.055	Amperes
Driving Power, approximate	65	Watts
Power Output, usefulϕ	1000	Watts

* The cathode of the GL-6942 because of transit-time effects which raise the temperature of the cathode, is subjected to considerable back bombardment in ultra-high-frequency service. The amount of heating due to bombardment is a function of the operating conditions and frequency, and must be compensated for by a reduction of the heater input to prevent overheating of the cathode with resulting short life. For long life, the GL-6942 should be put in operation with rated heater voltage. After the circuit has been adjusted for proper tube operation the heater voltage should be reduced to a value slightly above that at which circuit performance is affected. At a frequency of 900 megacycles and with typical operating conditions the heater voltage can be reduced to approximately 5.3 volts. At lower frequencies, the reduction will be less. Minor circuit readjustment may be necessary after this adjustment.

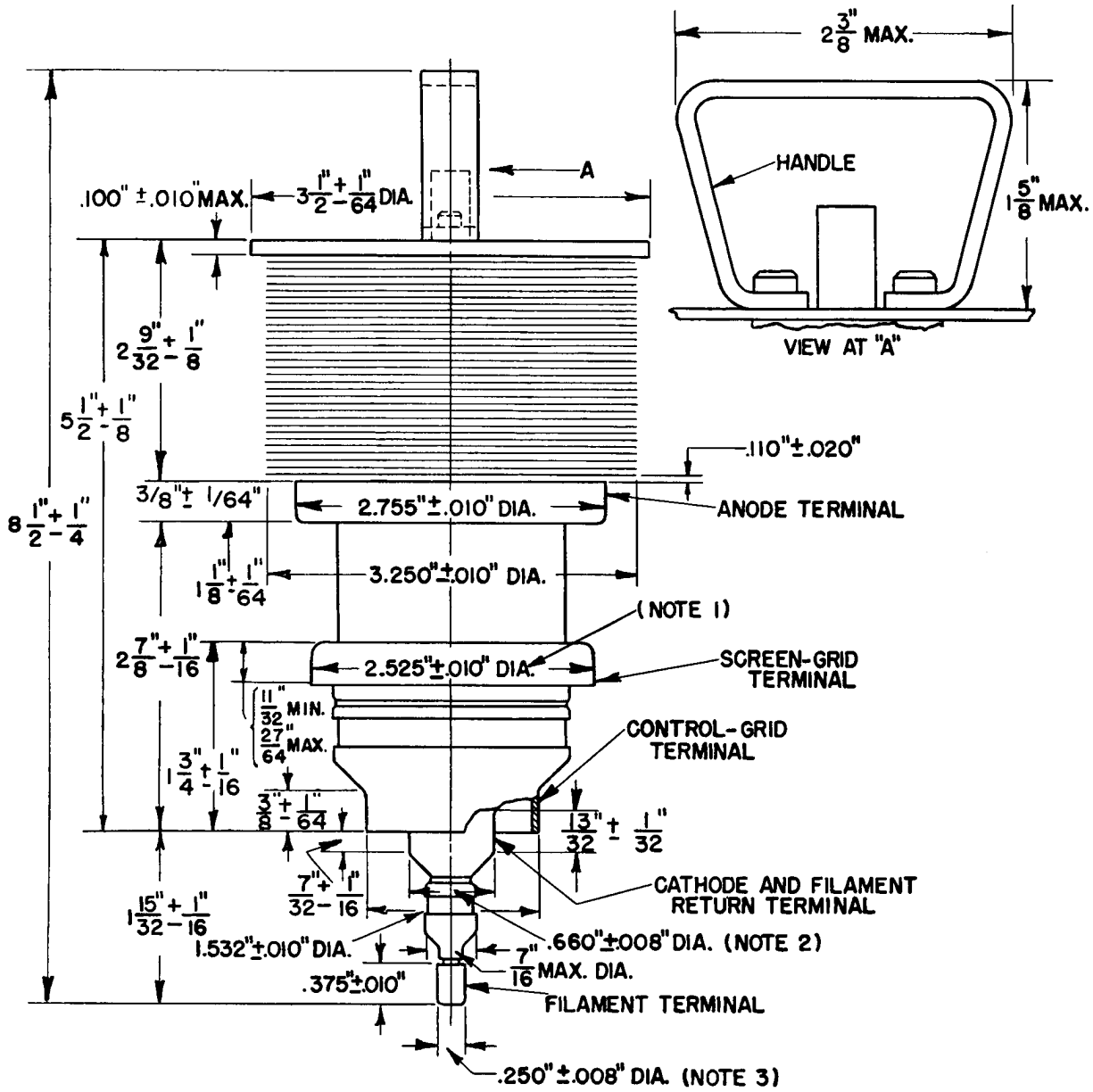
TECHNICAL INFORMATION (CONT'D)

† Represents maximum useable cathode current (plate current plus current to each grid) for any condition of operation.
‡ Measured with complete external shielding between cathode and anode.
§ Output capacitance measured between anode and screen grid. Control grid connected directly to screen grid.
¶ The volume of cooling air indicated for the various seals is for sea-level conditions and approximate only. Distribution of cooling air will vary with the cavity configuration about the tube. For most satisfactory operation the maximum temperature of any point on the tube should be below 200 C.
ϕ Useful power output including power transferred from driver stage.
⧫ The carrier of the driver modulated 100 percent.
▲Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 percent of the carrier conditions.



K-69087-72A592

8-29-58



TOTAL INDICATOR RATINGS

NOTE 1. 0.020"

NOTE 2. 0.030"

NOTE 3. 0.060"

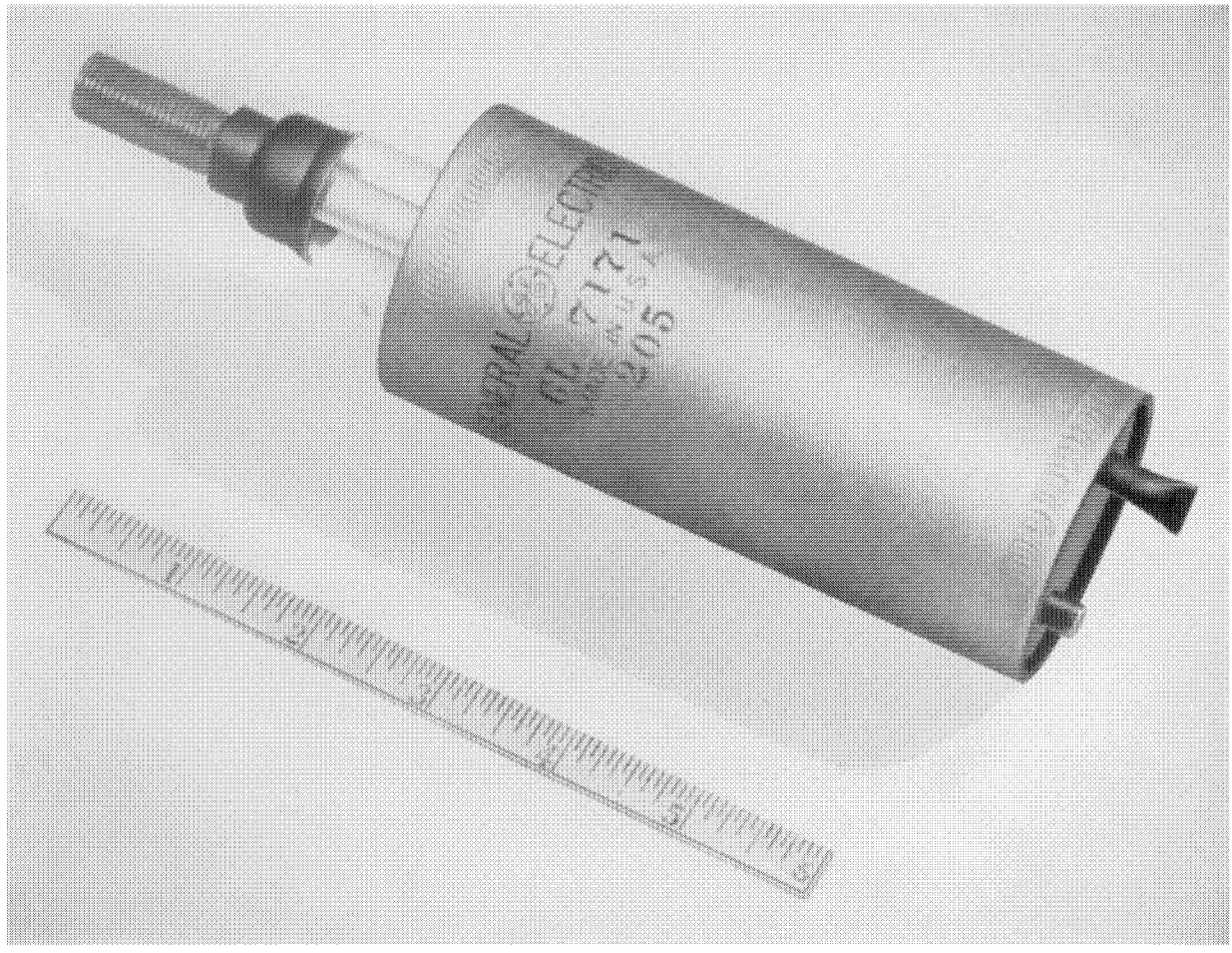
THE ABOVE READINGS ARE MEASURED WITH RESPECT TO A CENTERLINE DETERMINED BY THE CENTERS OF THE ANODE TERMINAL AND CONTROL-GRID TERMINAL.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

PRINTED IN U.S.A.



IGNITRON

CAPACITOR-DISCHARGE SERVICE **DC SHORT-CIRCUITING-SWITCH SERVICE**
35,000 AMPERES PEAK

The GL-7171 is a sealed, stainless-steel jacketed ignitron for use as a switch in capacitor-discharge circuits operating up to 10,000 volts. In this service the tube will carry peak currents up to 35,000 amperes.

GENERAL

Electrical

Cathode Excitation—Cyclic		
Cathode Spot Starting—Ignitor		
Number of Electrodes		
Main Anodes	1	
Main Cathodes	1	
Ignitors	1	
Arc Drop		
At 4000 Amperes	20	Volts
At 30,000 Amperes	55	Volts
Peak Inverse Voltage, maximum	10,000	Volts

Mechanical

Envelope Material—Stainless Steel		
Mounting Position—Axis Vertical, Anode Lead Up		
Net Weight	2	Pounds

Thermal

Type of Cooling—Convection		
Ambient Temperature, minimum	25	C
Cathode Temperature, maximum	35	C
Anode-Header Temperature, maximum*	55	C

GENERAL ELECTRIC

Supersedes ET-T1512 dated 12-58

MAXIMUM RATINGS AND TYPICAL OPERATION

Capacitor-Discharge Service, Pulse Duty, Sinusoidal Current

Peak Anode Voltage		
Forward	10,000	Volts
Inverse	10,000	Volts
Critical Anode Starting Voltage, minimum	100	Volts
Anode Current (See Curve K-69087-72A858 for Details)		
Peak†	35,000	Amperes
Average	0.1	Amperes
Maximum Averaging Time	1	Cycle
Fault	35,000	Amperes
Maximum Duration	0.002	Seconds
Rate of Rise of Current		
Maximum	5600	Amperes per Microsecond
Minimum	1400	Amperes per Microsecond
Frequency of Current Conduction Periods, maximum	1	Per Minute
Ionization Time	0.5	Microseconds

DC Short-Circuiting-Switch Service

Peak Anode Voltage		
Forward	10,000	Volts
Inverse	10,000	Volts
Critical Anode Starting Voltage, minimum	100	Volts
Anode Current (See Curve K-69087-72A858 for Details)		
Peak‡	35,000	Amperes
Average	0.25	Amperes
Maximum Averaging Time	1	Cycle
Fault	35,000	Amperes
Maximum Duration	0.002	Seconds
Rate of Rise of Current		
Maximum	5600	Amperes per Microsecond
Minimum	1400	Amperes per Microsecond
Frequency of Current Conduction Periods, maximum	1	Per Minute
Ionization Time	0.5	Microseconds

Ignitor Ratings	**Minimum**	**Maximum**	
Separate Excitation			
Ignitor Voltage			
Forward Open Circuit	1500	3000	Volts
Inverse, maximum	—	5	Volts
Ignitor Current Short Circuit	200	250	Amperes
Length of Firing Pulse, sine wave	5	10	Microseconds
Anode Firing			
Ignitor Voltage			
Forward, maximum		3000	Volts
Inverse, maximum		5	Volts
Peak Ignitor Current	200	250	Amperes

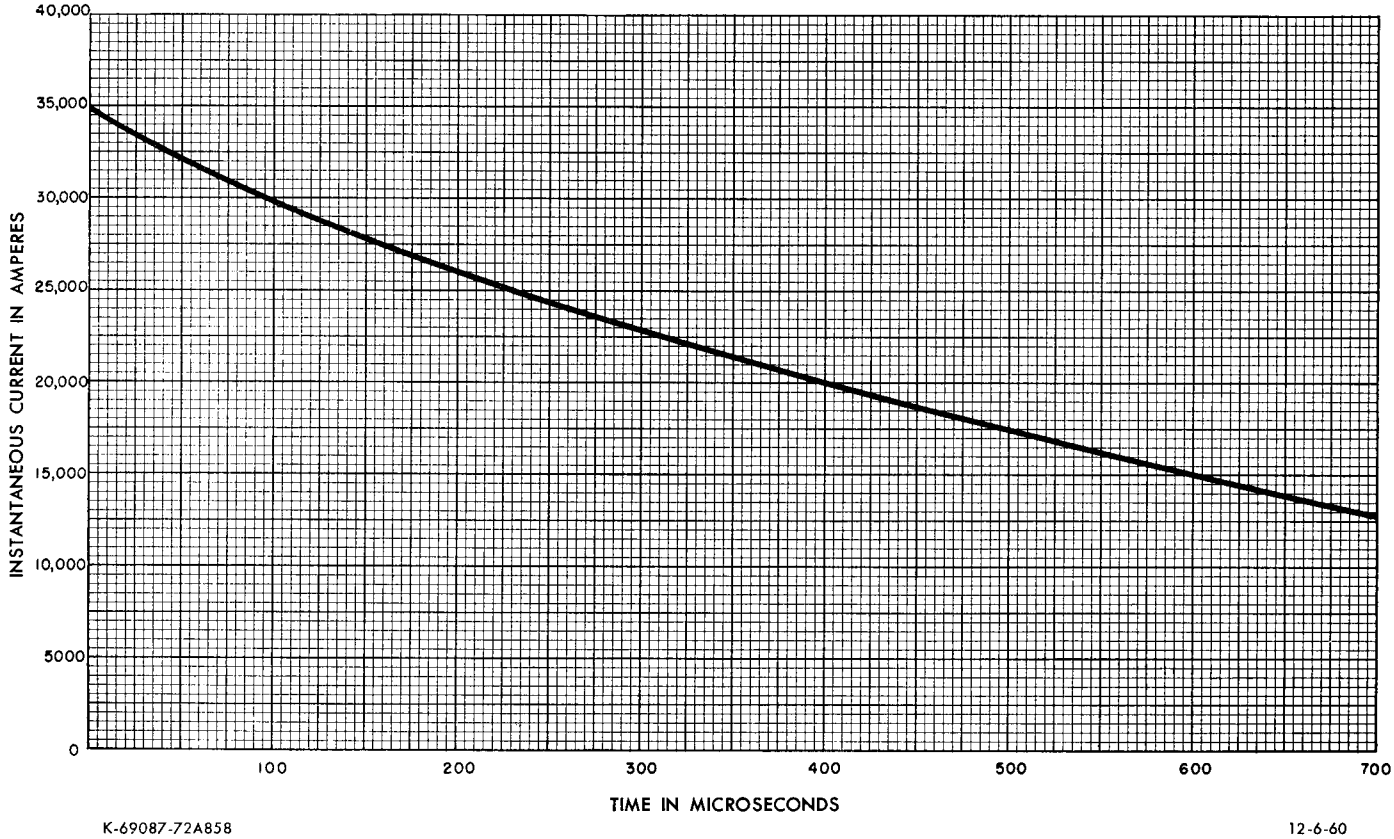
*To prevent mercury condensation, the anode-header temperature should be higher than the cathode temperature at all times. Mercury must be kept away from the anode and anode seals. Before tube operation, the anode seals must be warmed, with respect to the cathode, long enough to vaporize all mercury from the seal area.

†Dampened oscillations are permissible provided the dampening coefficient is less than the value shown on the current-waveform curve. The peak of the oscillation must not exceed 48,000 amperes.

‡Tube must be operated within the area specified on the current-waveform curve.

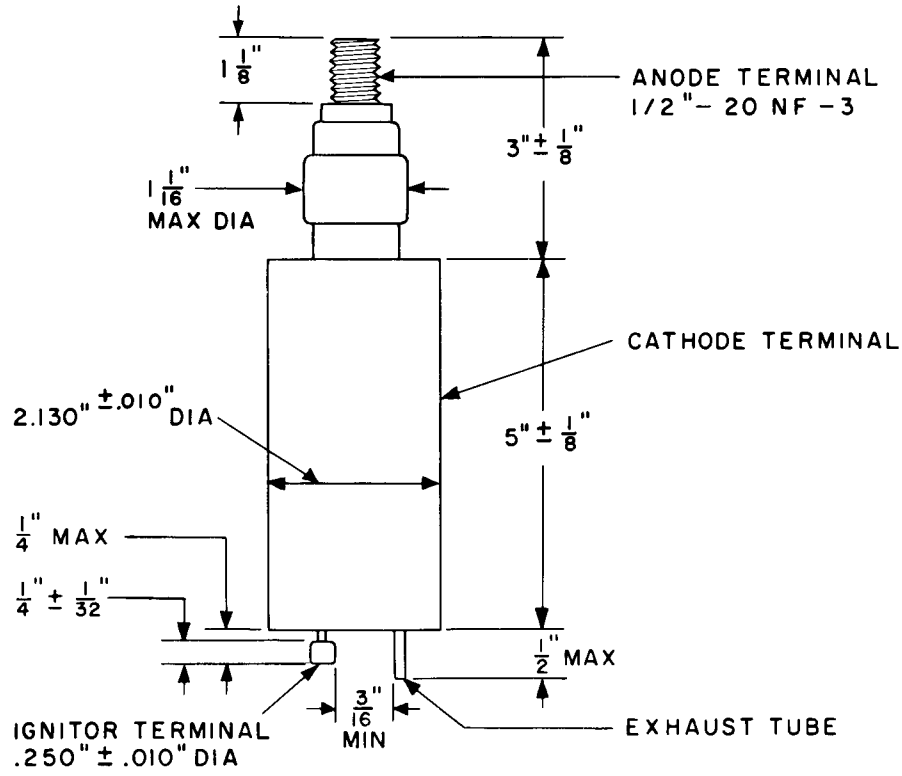
CURRENT-WAVEFORM CURVE

MAXIMUM PERMISSIBLE CURRENT

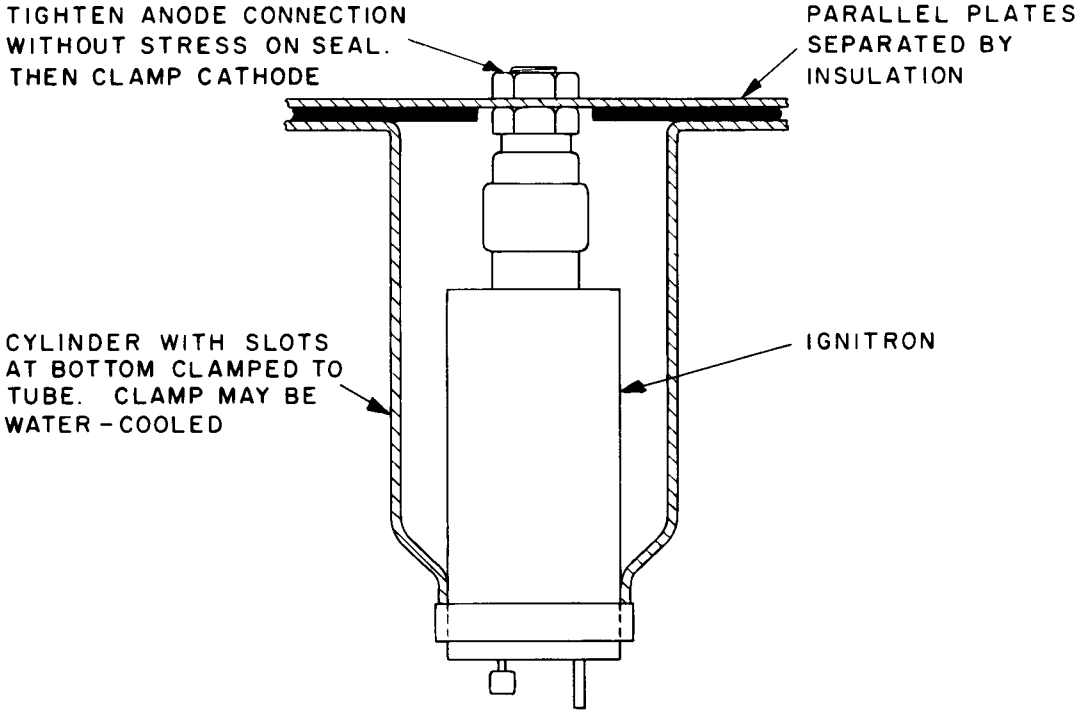


K-69087-72A858

12-6-60



COAXIAL MOUNTING



K-69087-72A819 9-61

GENERAL ELECTRIC

POWER TUBE DEPARTMENT
Schenectady 5, N. Y.

GL-7293

IMAGE ORTHICON



FIELD-MESH **MAGNETIC FOCUS AND DEFLECTION**

The GL-7293 is a television camera tube for both outdoor and studio pickup service.

The tube features a field mesh in the scanning section which minimizes landing and shading errors, prevents geometric distortion, provides sharp transition from black to white without spurious effect, and improves corner resolution.

A suppressor grid assures excellent signal-to-noise ratio by preventing field-mesh secondary electrons from entering the electron multiplier and reducing beam modulation.

A photocathode with a spectral response close to that of the eye permits portrayal of scenes in nearly their true tonal graduation.

In operation alignment is performed with the lens open on a chart or scene since dynode apertures are not visible with the lens capped.

The GL-7293 is interchangeable with the 5820. The field-mesh feature, however, results in improved performance.

Electrical

Cathode—Unipotential		
Heater Voltage, AC or DC	6.3 ±10%	Volts
Heater Current	0.6	Amperes
Photocathode—Semi-transparent		
Response—S-10		
Rectangular Image, 4 by 3 aspect ratio		
Useful Size, maximum diagonal	1.8	Inches
Orientation—Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the faceplate and pin No. 7 of the shoulder base.		
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Direct Interelectrode Capacitance		
Anode to all other Electrodes	12	μμf

Mechanical

Over-all Length	15.20 ±0.25	Inches
Greatest Diameter of Bulb	3.00 ±0.06	Inches
Minimum Deflecting-Coil Inside Diameter	2⅜	Inches
Deflecting-Coil Length	5	Inches
Focusing-Coil Length	10	Inches
Alignment-Coil Length	$\frac{15}{16}$	Inches
Photocathode Distance Inside End of Focusing Coil	½	Inche
Weight, approximate	1.4	Pounds

Operating Position—Any, except with diheptal base up and the tube axis at an angle of less than 20 degrees from vertical.

MAXIMUM RATINGS—ABSOLUTE VALUES

Photocathode Voltage	−550 Max	Volts
Photocathode Illumination	50 Max	Foot-Candles
Anode Supply Voltage*	1350 Max	Volts
Grid-No. 1 Voltage		
Negative-Bias Value	125 Max	Volts
Positive-Bias Value	0 Max	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	350 Max	Volts
Grid-No. 3 Voltage	400 Max	Volts
Grid-No. 4 Voltage	300 Max	Volts
Grid-No. 5 Voltage	150 Max	Volts
Grid-No. 6 Voltage	−550 Max	Volts
Voltage Per Multiplier Stage	350 Max	Volts

Target Voltage		
Positive Value	10 Max	Volts
Negative Value	10 Max	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125 Max	Volts
Heater Positive with Respect to Cathode	10 Max	Volts
Operating Temperature of Any Part of Bulb	50 Max	C
Operating Temperature of Bulb at Large End of Tube, target section	35 Min	C
Temperature Difference Between Target Section and Any Part of Bulb Hotter than Target Section	5 Max	C

GENERAL ELECTRIC

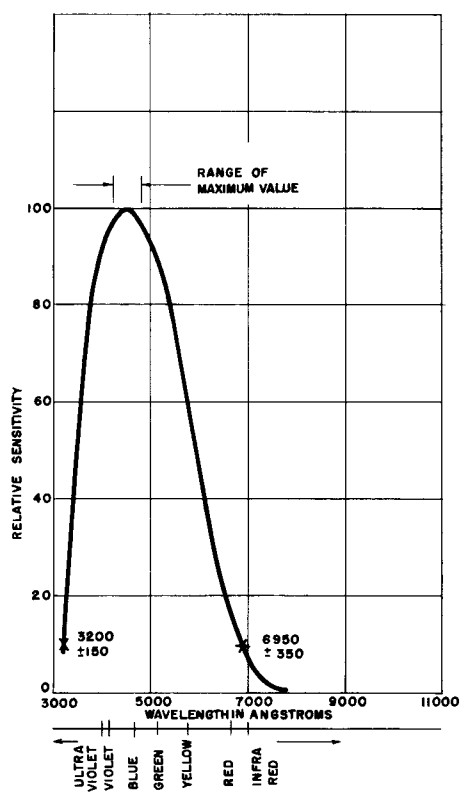
TYPICAL OPERATION

Photocathode Voltage, image focus	—400 to —540	Volts
Grid-No. 1 Voltage for Picture Cutoff, beam	—45 to —115	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	300	Volts
Grid-No. 3 Voltage†, multiplier focus	225 to 330	Volts
Grid-No. 4 Voltage, beam focus	140 to 180	Volts
Grid-No. 5 Voltage, decelerator	0 to 125	Volts
Grid-No. 6 Voltage, accelerator— 75 Percent of Photocathode Voltage, approximate	—300 to —405	Volts
Dynode-No. 2 Voltage	600	Volts
Dynode-No. 3 Voltage	800	Volts
Dynode-No. 4 Voltage	1000	Volts
Dynode-No. 5 Voltage	1200	Volts
Anode Voltage	1250	Volts
DC Anode Current	30	Microamperes
Signal Output Current, peak-to-peak	3 to 24	Microamperes
Target Voltage‡		
Target Cutoff Voltage‡	—3 to +1	Volts
Target Temperature Range	35 to 45	C
Ratio of Peak-to-Peak Highlight Video Signal Current to RMS Noise Current, approximate	35	
Minimum Peak-to-Peak Blanking Voltage	5	Volts
Field Strength at Center of Focusing Coil§	75	Gausses
Field Strength of Alignment Coil△, approximate	0 to 3	Gausses

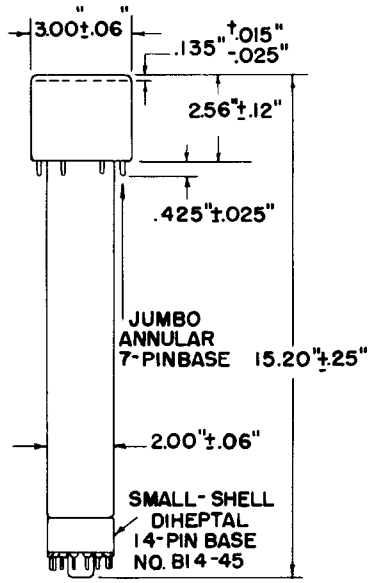
* Ratio of dynode voltages is shown under Typical Operation.
† Adjust to give maximum signal.
‡ Adjustable from —3 to +5 volts with blanking voltage off. Normal setting of target voltage is +2 volts from target cutoff.
§ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.
△ Adjusted to produce flattest field with maximum response. Alignment is correct when the center of the picture merely goes through focus and does not rotate when beam focus (Grid-No. 4) is varied.

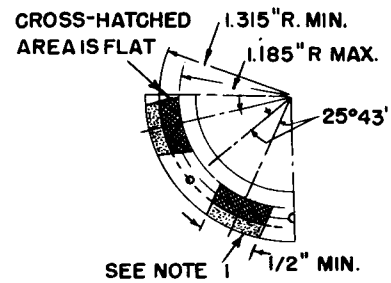
SPECTRAL-SENSITIVITY CHARACTERISTIC—S10 RESPONSE

For Equal Values of Radiant Flux at All Wavelengths



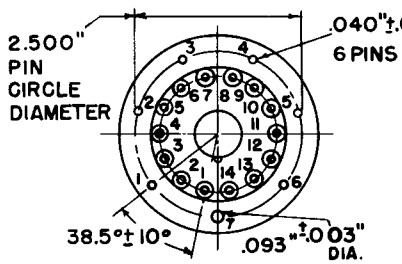
"X"- POINTS REPRESENT 10 PERCENT OF MAXIMUM RESPONSE.





DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.



ENLARGED BOTTOM VIEW

ANNULAR BASE GAGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

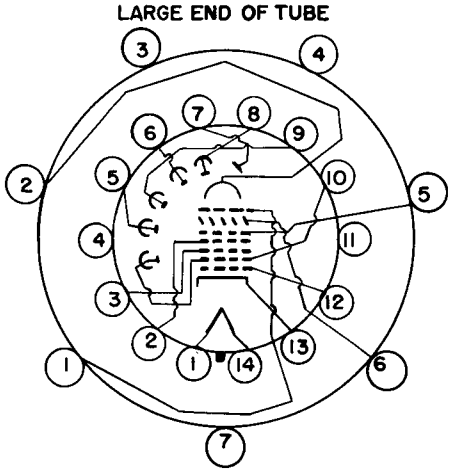
a. SIX HOLES HAVING DIAMETER OF 0.065"± .0.001" AND ONE HOLE HAVING DIA. OF 0.150±0.001. ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047." ALL HOLES ARE SPACED AT ANGLES OF 51°26'±5' ON CIRCLE DIAMETER OF 2.500"± 0.001"

b. SEVEN STOPS HAVING HEIGHT OF 0.187"± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT OF A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126 "±0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200"± 0.001"

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE



WHITE INDEX LINE ON FACE

BASING DIAGRAM

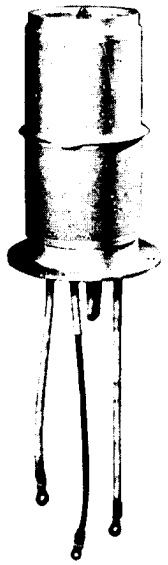
SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
PIN 2: GRID NO. 4
PIN 3: GRID NO. 3
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: DYNODE NO. 2
PIN 6: DYNODE NO. 4
PIN 7: ANODE
PIN 8: DYNODE NO. 5
PIN 9: DYNODE NO. 3
PIN 10: DYNODE NO. 1, GRID NO. 2
PIN 11: INTERNAL CONNECTION DO NOT USE
PIN 12: GRID NO. 1
PIN 13: CATHODE
PIN 14: HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO. 6
PIN 2: PHOTOCATHODE
PIN 3: INTERNAL CONNECTION-DO NOT USE
PIN 4: INTERNAL CONNECTION DO NOT USE
PIN 5: GRID NO. 5
PIN 6: TARGET
PIN 7: INTERNAL CONNECTION DO NOT USE

ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.



GL-7390

HYDROGEN THYRATRON

40 KILOVOLTS PEAK
33 MEGAWATTS AT 60 KILOWATTS

CERAMIC ENVELOPE
EXTERNAL ELECTRODES

The GL-7390 is a hydrogen thyratron for radar modulating and other pulsing applications. It will carry high peak currents and withstands very high voltages.

Mechanically the tube features a heavy-duty ceramic envelope and external electrodes to improve heat dissipation.

The high-peak-power ratings of this tube and its mechanical design features assure reliable service under the stringent operating conditions encountered in high-power pulse equipment.

Electrical

	Minimum	Bogey	Maximum	
Cathode—Indirectly Heated				
Cathode is Tied to Heater Midpoint				
Heater Voltage	6.0	6.3	6.6	Volts
Heater Current, Ef = 6.3 volts	27	32	35	Amperes
Reservoir				
Heater Voltage*	3.5	4.5	5.5	Volts
Heater Current				
E_{res} = 4.5 volts	8	9	10	Amperes
E_{res} = 5.5 volts	—	—	12	Amperes
Cathode and Reservoir Heating Time**	15	—	—	Minutes
Direct Interelectrode Capacitances				
Anode to Grid	—	40	—	μμf
Grid to Cathode	—	30	—	μμf
Anode Current Time Jitter	—	—	0.01	Microseconds
Ionization Time†, approximate	—	—	1	Microseconds
Grid Drive‡				

Mechanical

Mounting Position—Vertical, Base Down		
Net Weight, approximate	9	Pounds

Thermal

Type of Cooling—Convection¶		
Ambient Temperature Limits	−55 to +75	C

MAXIMUM RATINGS—ABSOLUTE VALUES

Maximum Peak Anode Voltage		
Inverse▲		
Forward, ♦ minimum supply voltage = 3500 volts d-c	33,000	Volts
Maximum Cathode Current		
Peak	2000	Amperes
Average	4.0	Amperes
Maximum Averaging Time	1	Cycle
RMS‖	75	Amperes
Anode Dissipation Factor♥	30 x 10^9	
Maximum Negative Control-Grid Voltage before Conduction	650	Volts
Maximum Rate of Rise of Anode Current	10,000	Amperes per Microsecond

The above limits are interrelated and it does not necessarily follow that combinations of limits can be attained simultaneously. For further information consult the Tube Department, Schenectady 5, N. Y.

* The optimum reservoir voltage for operation at maximum tube voltage, maximum peak and average tube currents, and at a repetition corresponding to the rated operation factor is inscribed on the base of the tube and must be held within ±2.5 percent. Applications involving operation at other conditions will necessitate a redetermination of the optimum reservoir voltage.

**Stand-by operation with heater and reservoir voltages is not recommended. Where necessary, the tube should be operated at full equipment conditions for a minimum of two hours during each twelve-hour period of stand-by.

† The time interval between the point on the rising portion of the grid pulse which is 26 percent of the peak unloaded pulse amplitude, and the start of the anode-current pulse.

‡ Driver pulse measured at tube socket with thyratron-grid disconnected; amplitude = 1300 volts minimum, 2500 volts maximum above 0; time of rise = 0.35 microsecond maximum, measured from 26 percent to 70 percent of peak value; grid pulse duration = 2 microseconds minimum, measured between 70 percent of peak on rising side to 70 percent of peak on falling side; impedance of drive circuit = 10 to 25 ohms maximum.

¶ An air blast may be directed at the anode and upper portions of the tube envelope to extend performance under high-anode-dissipation-factor operation, provided envelope and anode temperatures exceed 150 C.

▲The minimum inverse anode voltage permissible is 5 percent of the peak forward voltage and the maximum is 5000 volts during the first 25 microseconds following the anode pulse exclusive of a spike of 0.05 microsecond maximum duration.

♦ Instantaneous starting is not recommended. However, in cases where it is necessary to apply anode voltage instantaneously, the maximum permissible forward starting voltage is 22,000 volts peak. The power-supply filter should be designed to limit the rate of application of this voltage to 550,000 volts per second.

‖ The RMS current of hydrogen thyratrons is the square root of the product of the average and peak currents.

♥Product of the peak forward anode voltage, pulse repetition rate, and peak anode current.

X-RAY WARNING NOTICE

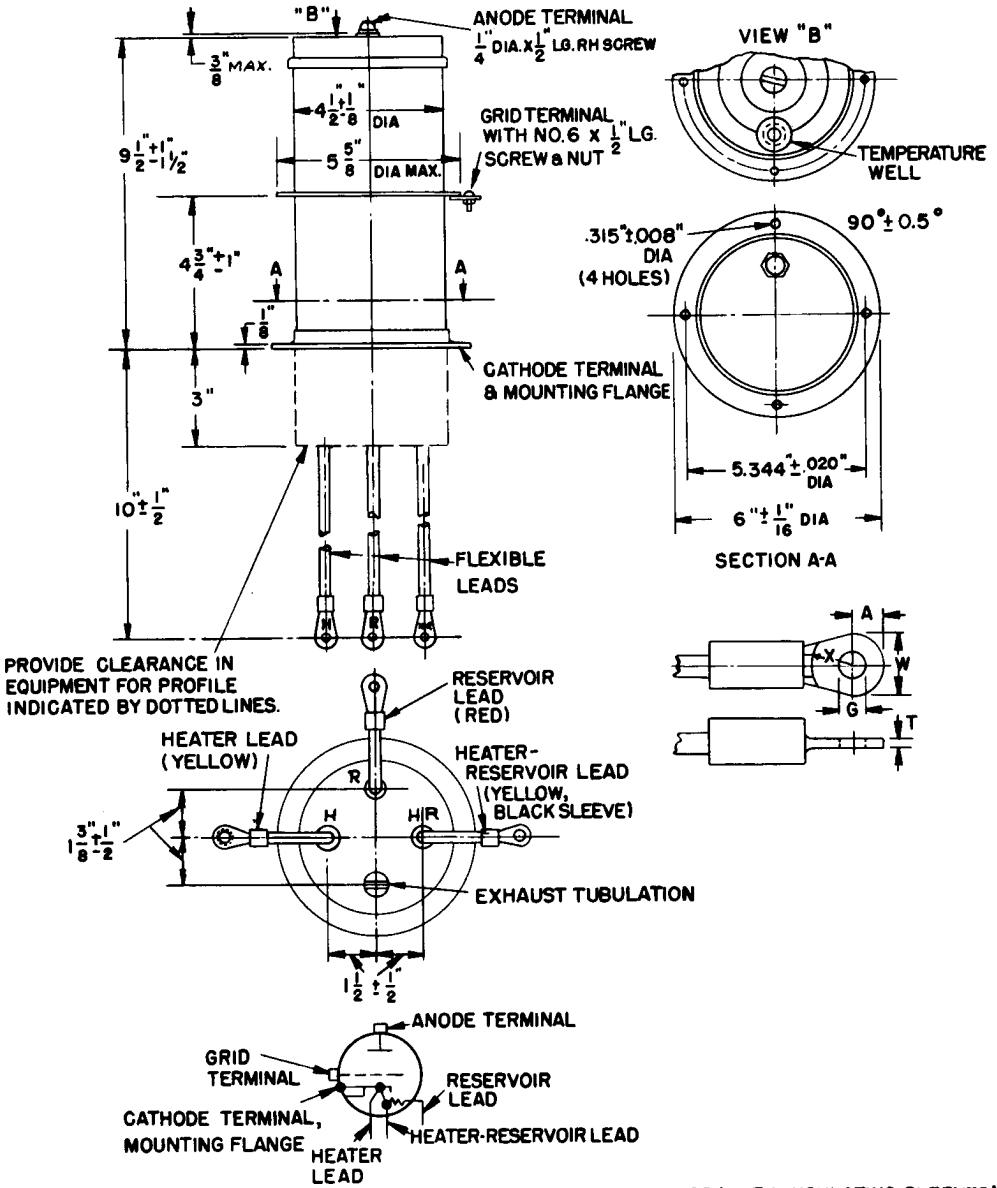
If the GL-7390 is operated at anode voltages in excess of 16 kilovolts, X-ray radiation shielding may be necessary to protect the user against possible danger of personal injury from prolonged exposure at close range. For further information consult the following references or other standard texts on the subject:

(a) X-RAY PROTECTION DESIGN, Handbook No. 50. National Bureau of Standards, Washington, D. C.

(b) X-RAY PROTECTION, Handbook No. 60. National Bureau of Standards, Washington, D. C.
The above references are available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

(c) SAFETY CODE FOR THE INDUSTRIAL USE OF X-RAYS, Bulletin No. Z54-1. American Standards Association, New York 17, N. Y.

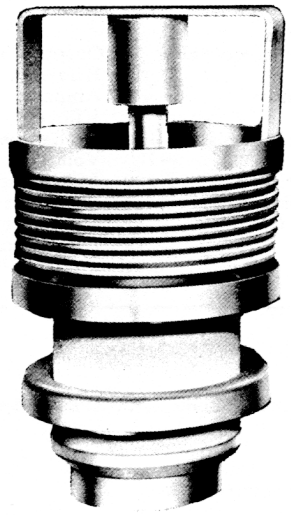
(d) Schneider, S. and Reich, B., "X-Ray Emission from High-Voltage Hydrogen Thyratrons," PROC. IRE, Vol. 43, No. 6, June, 1955.



PRESSURE-TYPE LUGS (WITH INSULATING SLEEVES)

LEADS	LUG DESIGNATION	"G" INCHES	"W" INCHES	"A" INCHES	"X" INCHES	"T" INCHES
RESERVOIR	# 10	.187 TO .207	.395 MAX.	.200 MAX.	.275 MIN.	.060 MAX.
HEATER-RESERVOIR	1/4"	.260 TO .313	.605 MAX.	.305 MAX.	.380 MIN.	.060 MAX.
HEATER	1/4"	.260 TO .313	.605 MAX.	.305 MAX.	.380 MIN.	.060 MAX.

NOTE: THERE SHALL BE NO OBSTRUCTION WITHIN THE DISTANCE OF "X" FROM THE CENTER OF THE LUG SCREW HOLE.



GL-7399

TETRODE

PULSED SERVICE
GROUNDED-GRID OPERATION

FORCED-AIR COOLED
METAL AND CERAMIC

INTEGRAL RADIATOR

The GL-7399 is a small-size, four-electrode transmitting tube especially designed for pulsed-amplifier or -oscillator service at L-band frequencies. This tetrode is particularly well suited for use in airborne or ground-based radar equipment.

The tube is capable of providing useful output at frequencies up to approximately 1500 megacycles.

Features of the GL-7399 include long life and reliability, long pulse width, high peak power and high gain, broad-banding capability, and resistance to shock and vibration.

These together with such design factors as an oxide-coated cathode, coaxial elements, and metal-ceramic construction make the tube well adapted to application in modern systems where performance and reliability are important.

Electrical

	Minimum	Bogey	Maximum	
Heater Voltage (See Note 1)	—	6.3	6.8	Volts
Heater Current		5.6		Amperes
Amplification				
Factor, G_2 to G_1		10.5		
E_{g2} = 275 Volts DC, E_b = 1000 Volts DC, I_b = 200 Milliamperes DC				
Cathode Heating Time	1			Minute
Direct Interelectrode Capacitances*				
Cathode to Plate†		0.012		μμf
Input		24.0		μμf
Output		9.3		μμf

Mechanical

Mounting Position—Any

Net Weight	1.0	Pounds

Thermal

Cooling—Forced Air‡

Radiator§

Plate Dissipation	500	400	300	Watts
Air Flow, 45 C incoming air temperature	17.0	12.0	6.5	Min Cubic Feet per Minute
Static Pressure, approximate anode at room temperature	0.9	0.5	0.2	Inches-Water
Anode Hub Temperature▲			250	Max C

Seals

Screen and Control Grid, approximate	1	Cubic Foot per Minute
Heater and Cathode, approximate	1	Cubic Foot per Minute
Ceramic Temperature at any Point	200	Max C

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

Maximum Ratings

Plate- and Screen-Grid Pulsed, 500 Megacycles

DC Plate Voltage, during pulse	10	Kilovolts
DC Plate Current, during pulse	10	Amperes
DC Grid-No. 2 Voltage, during pulse	2000	Volts
DC Grid-No. 2 Input♣	15	Watts
Plate Dissipation♣	500	Watts
DC Grid-No. 1 Voltage, not pulsed	−175	Volts
DC Grid-No. 1 Current, during pulse	2.5	Amperes
Pulse Width♥♦	15	Microseconds
Duty Factor♥ϕ	0.0012	

Typical Operation

Grounded-grid Circuit, 500 Megacycles

DC Plate Voltage, during pulse	9	Kilovolts
DC Grid-No. 2 Voltage, during pulse	1400	Volts
DC Grid-No. 1 Voltage, not pulsed	−125	Volts
Peak RF Plate Voltage	7000	Volts
Peak RF Grid Voltage	300	Volts
DC Plate Current, during pulse	9.2	Amperes
DC Grid-No. 1 Current, during pulse	1.1	Amperes
DC Grid-No. 2 Current, during pulse	0.47	Amperes
Driving Power at Tube, during pulse	2.6	Kilowatts
Power Output, during pulse (useful)	52	Kilowatts
Pulse Width♦	15	Microseconds
Duty Factor	0.001	

Note 1: Because the temperature of the cathode is increased by back bombardment of electrons at UHF, required heater voltage for optimum life decreases with increasing frequency. The amount of heater-voltage reduction is dependent on operating conditions. However, this voltage should not be less than 5.5 volts.

GENERAL ELECTRIC

Supersedes ET-T1598B dated 9-62

RADIO-FREQUENCY POWER AMPLIFIER—CLASS C

Maximum Ratings

Pulsed Drive, 1250 Megacycles

DC Plate Voltage	5	Kilovolts
DC Plate Current, during pulse	6	Amperes
DC Grid-No. 2 Voltage	1.1	Kilovolts
DC Grid-No. 2 Input	5	Watts
DC Grid-No. 1 Voltage	−225	Volts
DC Grid-No. 1 Current	1.5	Amperes
Plate Dissipation	500	Watts
Pulse Width ♥♦	15	Microseconds
Duty Factor ♥φφ	0.01	

Typical Operation

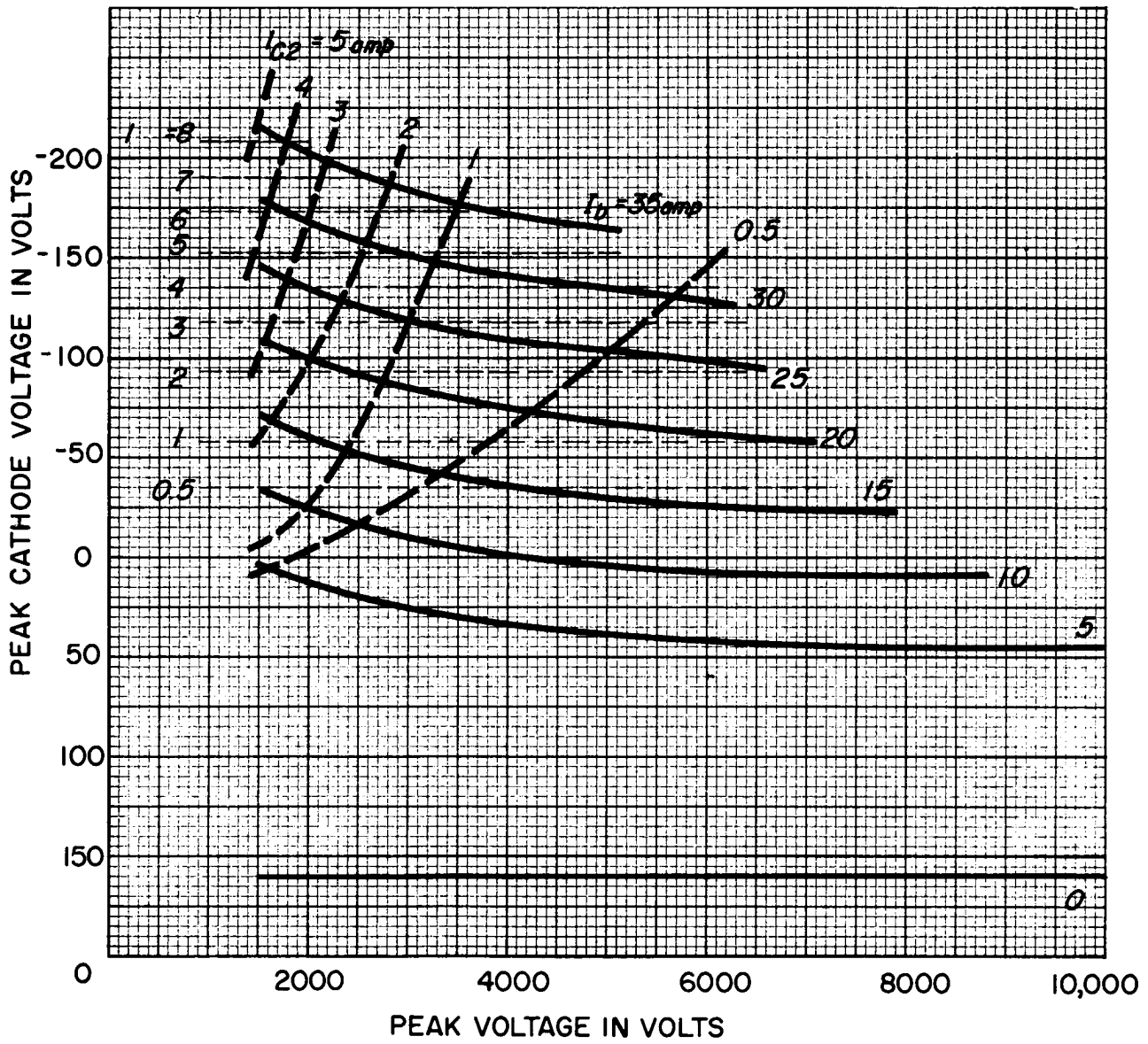
Grounded-grid Circuit at 1100 Megacycles, ¾λ Output Circuit

DC Plate Voltage**	4.8	Kilovolts
DC Plate Current, during pulse	4.2	Amperes
DC Grid-No. 2 Voltage	1	Kilovolt
DC Grid-No. 2 Current, during pulse	100	Milliamperes
DC Grid-No. 1 Voltage	−200	Volts
DC Grid-No. 1 Current, during pulse	200	Milliamperes
Driving Power at Tube, during pulse	1.5	Kilowatts
Power Output, during pulse (useful)	11	Kilowatts
Pulse Width♦	15	Microseconds
Duty Factor	0.01	

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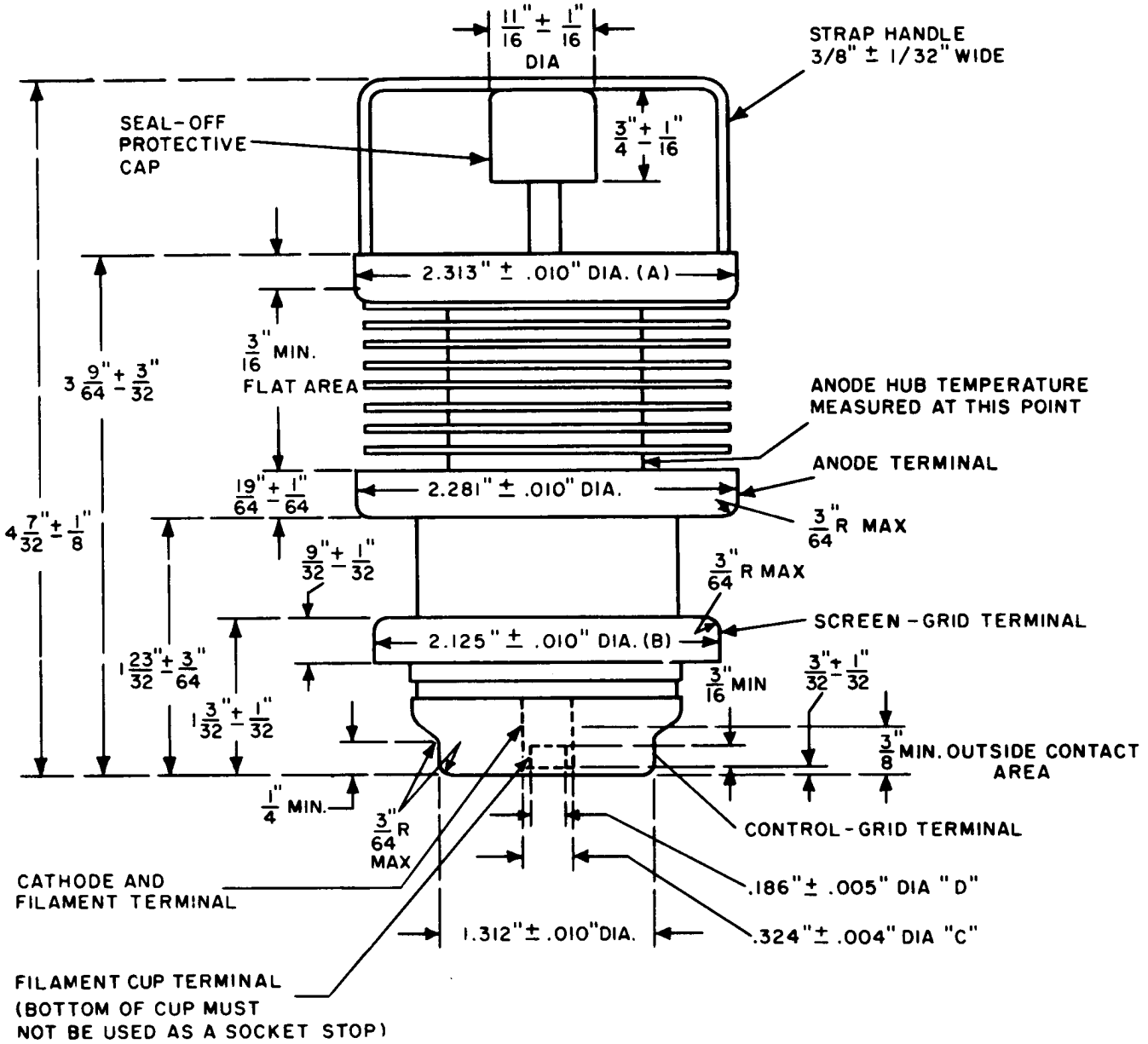
* Control grid connected directly to screen grid.
† Complete external shielding between cathode and plate.
‡ Forced air cooling should be applied during the application of any voltages.
§ Provision must be made for unobstructed passage of cooling air between radiator fins, and between the anode terminal and adjacent fins.
▲Measured at the base of the fin adjacent to the plate terminal. See outline drawing on page 4.
♣Maximum average value.
♥For applications that require longer pulses or higher duty refer to the tube manufacturer for recommendations.
♦ Pulse duration measured between points at 70 percent of peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.
φ Maximum ratio of on-time to elapsed time during any 12.5-millisecond period.
φφMaximum ratio of on-time to elapsed time during any 1.5-millisecond period.
**A minimum surge-limiting resistance of 50 ohms must be placed between the plate of the tube and the B+ power supply at steady-state voltages greater than 3.5 kilovolts.

CONSTANT CURRENT CHARACTERISTIC
GROUNDED-GRID OPERATION
VOLTAGES MEASURED TO GROUND
SCREEN VOLTAGE = 1400 VOLTS



6-60

K-69087-72A872



CONCENTRICITIES

THE FOLLOWING TOTAL INDICATOR READINGS ARE MEASURED WITH RESPECT TO A CENTERLINE DETERMINED BY THE CENTERS OF THE ANODE TERMINAL AND CONTROL GRID TERMINAL

DIAMETER A – 0.030 INCHES
DIAMETER B – 0.016 INCHES
DIAMETER C – 0.036 INCHES
DIAMETER D – 0.042 INCHES

TOTAL INDICATOR READING OF FILAMENT CUP TERMINAL DIAMETER (D) MEASURED WITH RESPECT TO CENTER OF CATHODE AND FILAMENT TERMINAL DIAMETER (C) – 0.016 INCHES

GL-7409, GL-7538

IMAGE ORTHICONS

FOCUS-MAGNETIC **DEFLECTION-MAGNETIC**

These low-light-level image orthicons are designed to meet a wide variety of requirements for industrial, military, and scientific applications. They provide an effective low-light-level sensitivity of 4 x 10^{-7} foot-candles photocathode illumination for resolution of 100 television lines per target-inch. The GL-7538 is designed for normal environmental operation. The 7409 is a ruggedized version especially designed to operate under severe shock and vibration conditions.

Both tubes feature a high-gain, thin-film magnesium-oxide target with a sensitivity ten to twenty times that of glass targets. The extreme thinness and the anisotropic property of this semiconductor target virtually eliminates lateral leakage and increases the resolution 25 to 50 percent over that of standard glass targets. Since operation of the target depends on electron conduction, which is not a depletion process, rather than on ion conduction, permanent stickiness and burn-in are virtually eliminated. Low gamma permits a very wide operating range.

These and other features of these image orthicons assure long life and reliable operation of the 7538 in such applications as surveillance, satellite tracking, and detection. The 7409 is particularly useful in tank fire control, drone guidance, missile-borne systems, and ground vehicle systems operating over rough terrain.

Electrical

Cathode—Unipotential		
Heater		
Voltage, AC or DC	6.3 ±10%	Volts
Current	0.6	Amperes
Photocathode—Semi-Transparent		
Spectral Response—S-10		
Rectangular Image, 4 by 3 aspect ratio		
Useful Size, maximum diagonal	1.8	Inches
Orientation—Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the faceplate and pin No. 7 of the shoulder base.		
Focusing Method—Magnetic		
Deflection Method—Magnetic		
Direct Interelectrode Capacitance		
Anode to all other Electrodes	12	μμf

Mechanical

Over-all Length	15.20 ±0.25	Inches
Greatest Bulb Diameter	3.00 ±0.06	Inches
Deflecting Coil		
Length	5	Inches
Minimum Inside Diameter	2⅜	Inches
Focusing-Coil Length	10	Inches
Alignment-Coil Length	15/16	Inches
Photocathode Distance Inside End of Focusing Coil	½	Inches
Weight, approximate		
GL-7409	1.4	Pounds
GL-7538	0.8	Pounds
Operating Position—Any, except with diheptal base up and tube axis at an angle of less than 20 degrees from vertical.		

Thermal

Operating Temperature at any Part of Bulb, maximum	70	C
Operating Temperature of Bulb at Large End of Tube, Target Section, minimum	0	C
Temperature Difference Between Target Section and any Part of Bulb Hotter than Target Section	7.5	C

MAXIMUM RATINGS—ABSOLUTE VALUES

Photocathode		
Voltage	−600	Volts
Illumination	50	Foot-candles
Anode Supply Voltage*	1850	Volts
Grid-No. 1 Voltage		
Negative Bias Value	135	Volts
Positive Bias Value	0	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	380	Volts
Grid-No. 3 Voltage	400	Volts
Grid-No. 4 Voltage	300	Volts
Grid-No. 5 Voltage	150	Volts
Grid-No. 6 Voltage	−600	Volts
Dynode-No. 2 to Dynode-No. 1 Voltage	350	Volts
Dynode-No. 3 to Dynode-No. 2 Voltage	350	Volts
Dynode-No. 4 to Dynode-No. 3 Voltage	680	Volts
Dynode-No. 5 to Dynode-No. 4 Voltage	350	Volts
Anode to Dynode-No. 5 Voltage	100	Volts
Voltage per Multiplier Stage	400	Volts
Target Voltage		
Above Target Cutoff, positive direction	10	Volts
Negative	10	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125	Volts
Heater Positive with Respect to Cathode	10	Volts

* Ratio of dynode voltages appears under Typical Operation.

GENERAL ELECTRIC

TYPICAL OPERATION—AVERAGE VALUES

	Normal Performance†	Maximum Sensitivity Performance‡	
Photocathode Voltage, image focus	−400 to −540	−400 to −550	Volts
Grid-No. 1 Voltage for Picture Cutoff, Beam	−45 to −115	−45 to −115	Volts
Photocathode Illumination—See Page 5			
Scene Illumination—See Page 5			
Grid-No. 2 and Dynode-No. 1 Voltage	300	370	Volts
Grid-No. 3 Voltage, multiplier focus§	225–330	225–380	Volts
Grid-No. 4 Voltage, beam focus	140–180	140–250	Volts
Grid-No. 5 Voltage, decelerator	0–125	0–125	Volts
Grid-No. 6 Voltage, accelerator—75 percent of photocathode voltage, approximate	−300 to −405	−300 to −465‖	Volts
Dynode-No. 2 Voltage	600	770	Volts
Dynode-No. 3 Voltage	910	1080	Volts
Dynode-No. 4 Voltage	1200	1360	Volts
Dynode-No. 5 Voltage	1490	1610	Volts
Anode Voltage	1550	1700	Volts
DC Anode Current, maximum	30	30	Microamperes
Signal Output Current, peak-to-peak—See Light-Transfer Characteristic			
Target Cutoff Voltage¶	−3 to +1	−3 to +1	Volts
Target Temperature Range	15–55	15–55	C
Peak-to-Peak Blanking Voltage	5–20	5–20	Volts
Field Strength at Center of Focusing Coil**	75	75	Gausses
Field Strength of Alignment Coil, approximate#	0–3	0–3	Gausses

† Although these tubes will operate in standard equipment, modification to permit operation at these values will improve effective sensitivity for most applications.

‡ These values will permit the best low-light-level-sensitivity capability of the tube to be realized and will assure the maximum useful multiplier gain required in extreme low-light-level applications. The resolution sensitivity information in this data sheet was derived with these higher multiplier voltages.

§ Adjust to give the most uniformly shaded picture near maximum signal.

‖ 75 to 85 percent of photocathode voltage.

¶ The target supply voltage should be adjustable from −3 to +5 volts with blanking voltage off. Maximum target voltage is +10 volts above target cutoff. Recommended target voltage is +2 volts above cutoff. Slight readjustment, usually only a small fraction of a volt, may be necessary to minimize microphonics.

**Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

Adjust to produce flattest field with maximum response. Alignment is correct when the center of the picture merely goes through focus and does not rotate when beam focus (Grid No. 4) is varied. For most commercial focus coils a 75-gauss field results from a focus-coil current of 75 milliamperes.

GL-7409

ENVIRONMENTAL

Shock: Per specification MIL-E-5272C (ASG) Paragraph 4.15.5 except:

A 12 impact shocks of 30g

B The shock shall be applied in the following directions:
1—Vertically perpendicular to longitudinal axis, 3 shocks in each direction.
2—Parallel to the minor horizontal axis, 3 shocks in each direction.

C The shock pulse width is defined by the use of a 0.2 to 250-cycle-per-second filter.

Vibration: (10g) Per MIL-E-5272C (ASG) Paragraph 4.7.12 Procedure XII except at operating temperature only. Center horizontal resolution at 3 x 10^{-5} maximum foot-candles, photocathode illumination will be at least 350 lines (EIA) with 5g applied acceleration in the frequency range from 50 to 500 cycles per second and a double amplitude of 0.036 inch from 5 to 50 cycles per second. Picture resolution of 350 TV lines (EIA) is defined as readable through any interference that may occur.

Humidity: Per MIL-E-5272C (ASG) Paragraph 4.4.1 Procedure 1. Following this test, the interelectrode insulation of the end pins 5, 6, 7, 8, 9, and 10 each with respect to all other end base pins grounded and with 350 volts (minimum) applied is greater than 500 ohms.

Acceleration: (70g) Constant acceleration when applied perpendicular to the longitudinal axis of the tube for 10 minutes.

OPERATING NOTES

Some magnesium-oxide targets may be damaged permanently if directly and intermittently exposed, while in operation, to extremely bright sources which cause high photoelectron densities to occur at the target. Such sources include the sun, photoflash lamps, and exploding wire flashes. Damage, if it does occur, takes the form of black image spots burned in the target by the intense light.

In most cases an 80-megohm, ¼-watt resistor in series with the photocathode in the camera will protect the tube. This resistor will not interfere with normal operation of these or other image orthicons which may be used in the modified camera.

If these or similar bright sources are to be observed continuously, appropriate exposure control of photocathode illumination can be supplied by neutral-density filters.

SPECIFIC PARAMETERS ON RECORDED DATA

All curves except spectral-sensitivity characteristics were recorded under the following conditions:

Camera Chain: General Electric TE-5 (modified)
Amplifier bandwidth—total 20 mc, flat to 6 mc

Resolution Chart: National Bureau of Standards Lens Test Chart, 100% contrast transparency.

Window Chart: 100% contrast, 1% area window for signal-noise and transfer characteristic data.

Light Source: 2870^0 Kelvin—tungsten

Light Level: Aperture and neutral density controlled (within specially constructed low-light-level box) to provide range from 10^{-8} to 10^{-2} foot-candles illumination on photocathode. For corresponding scene brightness in foot-lamberts when using Leitz f/1.5 lens (85 mm), multiply photocathode illumination in foot-candles by 12.

Operating Temperature for Image End: 25 to 30 C.

Target Raster: Target diameter is 1.40 inches. For corners of scanning raster just touching target edge raster dimensions are:

Aspect Ratio	Horizontal	Vertical
1 x 1 (square)	0.99″	0.99″
4 x 3 (standard)	1.12″	0.84″

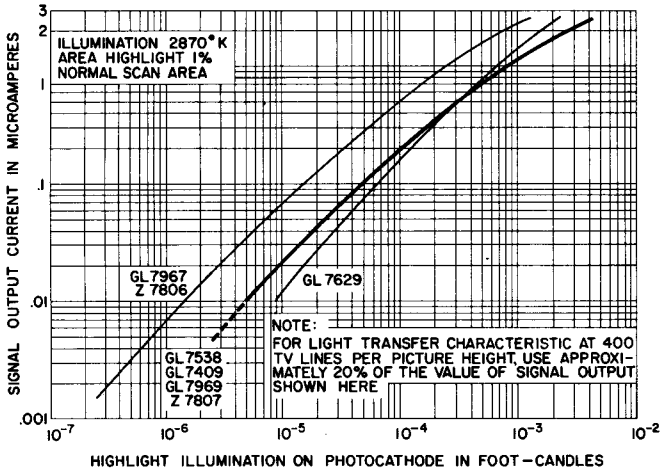
Horizontal TV lines = 1.12 x TV lines per target inch

Vertical TV lines (EIA) = 0.84 x TV lines per target inch

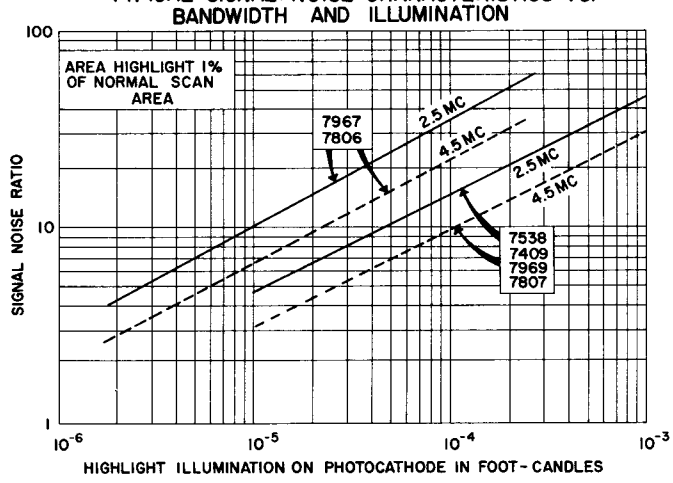
Resolution sensitivity data is recorded in TV lines per target inch

Therefore, 700 TV lines per target inch = 784 horizontal lines
= 588 vertical lines (EIA)

LIGHT TRANSFER CHARACTERISTICS

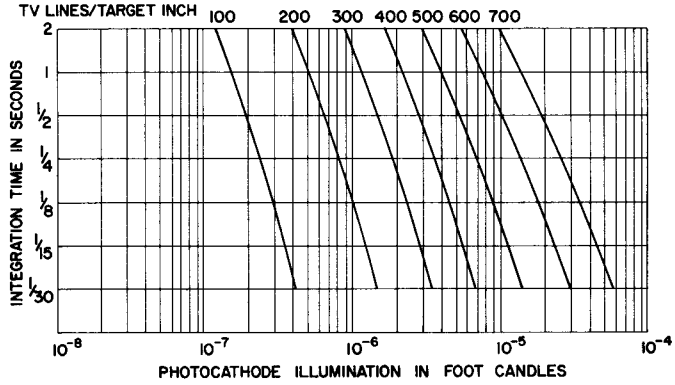


TYPICAL SIGNAL: NOISE CHARACTERISTICS VS. BANDWIDTH AND ILLUMINATION

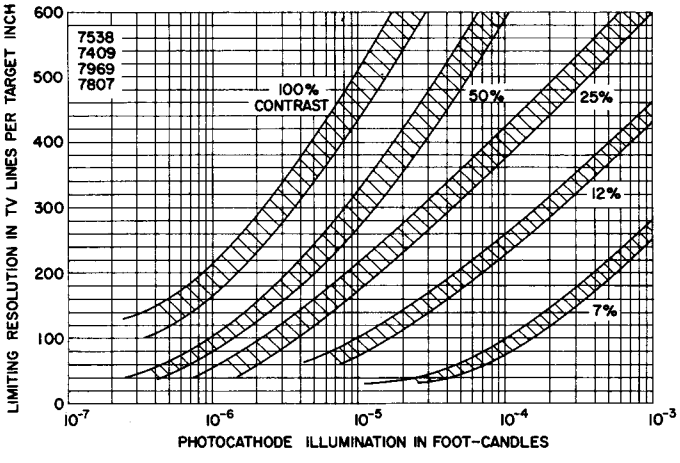


INTEGRATION EFFECT ON RESOLUTION SENSITIVITY

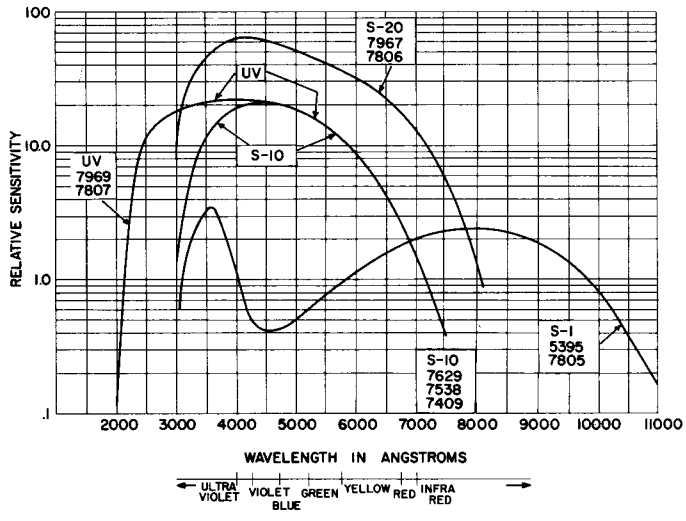
TYPES 7538 7409 7969 7807



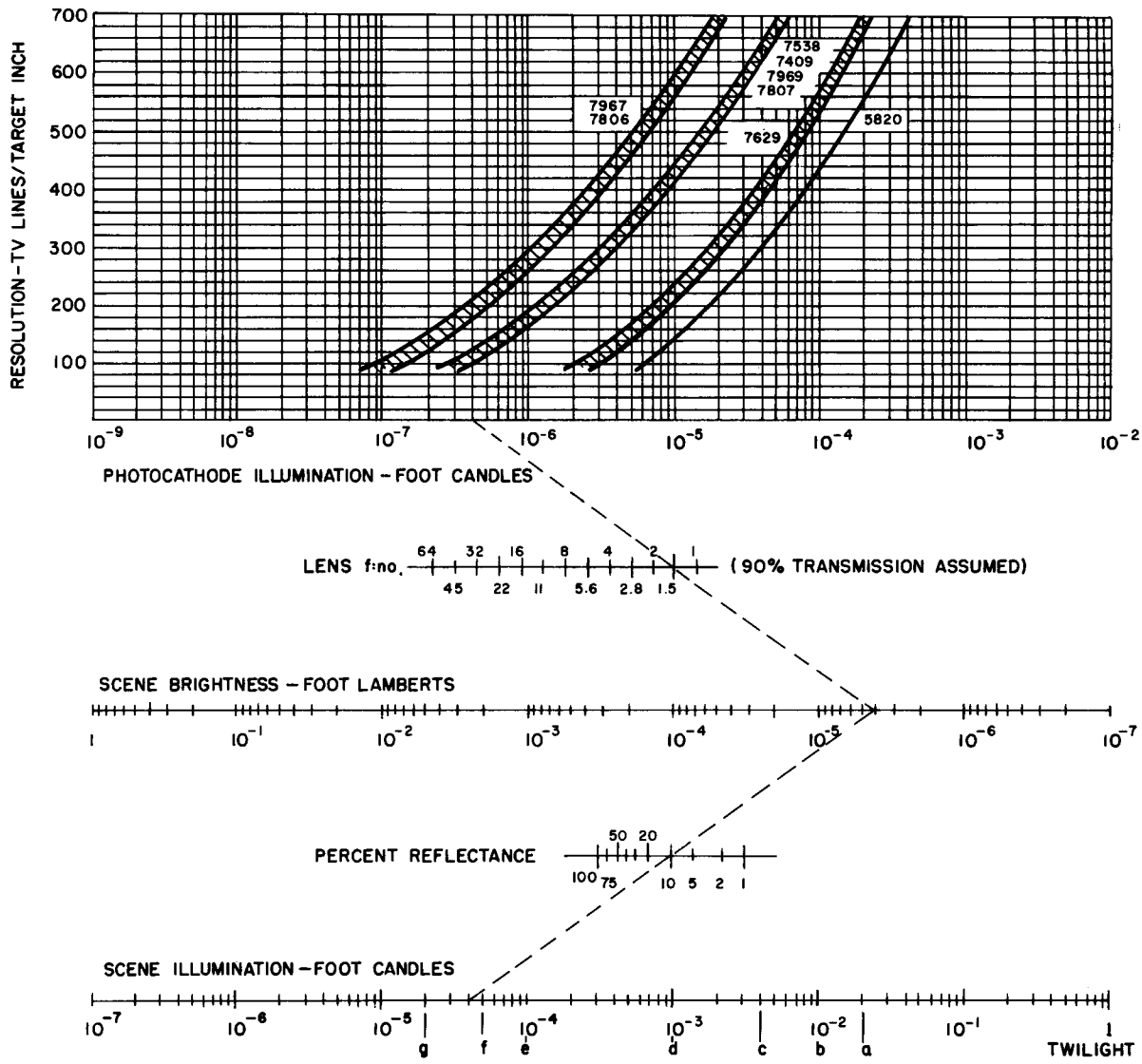
EFFECT OF CONTRAST RATIO ON RESOLUTION SENSITIVITY



PHOTOCATHODE SPECTRAL RESPONSE CHARACTERISTICS



SCENE ILLUMINATION VS TYPICAL RESOLUTION SENSITIVITY BY TYPE*

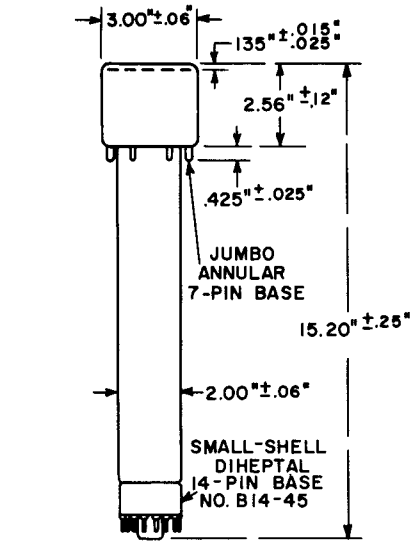


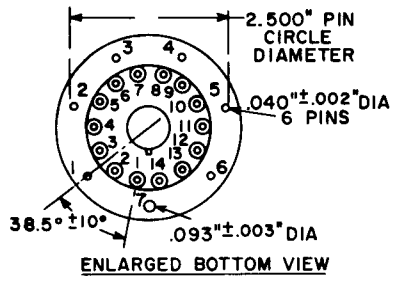
Code	Ambient Condition	Scene Illumination
a	Full moon–clear	2×10^{-2} ft-c
b	Half moon	1×10^{-2} ft-c
c	Full moon–moderately cloudy	4×10^{-3} ft-c
d	Quarter moon–clear	1×10^{-3} ft-c
e	No moon–clear	1×10^{-4} ft-c
f	No moon–moderately cloudy	5×10^{-5} ft-c
g	No moon–heavy cloud	2×10^{-5} ft-c

NEUTRAL DENSITY FILTERS FOR EXPOSURE CONTROL

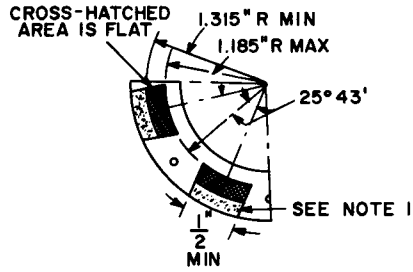
TYPE AND DENSITY	PERCENT TRANSMITTANCE	NUMBER OF STOPS
ND .30	50.0	1
ND .60	25.0	2
ND .90	13.0	3
ND 1.00	10.0	3.3
ND 2.00	1.0	6.6
ND 3.00	0.10	10.0
ND 4.00	0.010	13.2

*This chart reprinted by permission of B. A. Bang.





ENLARGED BOTTOM VIEW



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

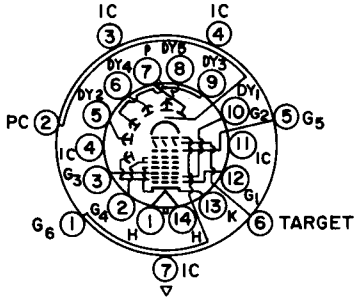
a. SIX HOLES HAVING DIAMETER OF 0.065"±.001" AND ONE HOLE HAVING DIA OF 0.150"±0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51° 26'±5' ON CIRCLE DIAMETER OF 2.500"±0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187"±0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT OF A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126"±0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200"±0.001".

DIRECTION OF LIGHT:
PERPENDICULAR TO
LARGE END OF TUBE



WHITE INDEX LINE
ON FACE

BOTTOM VIEW

BASING DIAGRAM

SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
PIN 2: GRID NO.4 & FIELD MESH
PIN 3: GRID NO. 3
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: DYNODE NO. 2
PIN 6: DYNODE NO. 4
PIN 7: ANODE
PIN 8: DYNODE NO.5
PIN 9: DYNODE NO.3
PIN 10: DYNODE NO. 1, GRID NO. 2
PIN 11: INTERNAL CONNECTION-DO NOT USE
PIN 12: GRID NO. 1
PIN 13: CATHODE AND SUPPRESSOR GRID
PIN 14: HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO. 6
PIN 2: PHOTOCATHODE
PIN 3: INTERNAL CONNECTION-DO NOT USE
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: GRID NO. 5
PIN 6: TARGET
PIN 7: INTERNAL CONNECTION-DO NOT USE

GENERAL ELECTRIC

POWER TUBE DEPARTMENT

Pickup Tube Operation

Syracuse, New York

IMAGE ORTHICON

FOCUS—MAGNETIC DEFLECTION—MAGNETIC



ENVIRONMENTALIZED

The GL-7409 is an environmentalized image orthicon designed to meet industrial and military applications where adverse environment precludes the use of standard tubes. It has an S-10 photosurface. Because of the low gamma, the tube has a very wide operating range at low light levels.

This tube features a high-gain, thin-film, magnesium-oxide target with a sensitivity ten to twenty times that of glass-target tubes such as the 5820. This target has several advantages. Its extreme thinness and anisotropic property virtually [illegible] leakage, which increases the resolution [illegible] percent over that of the standard target. It adapts the tube for service where the signal is stored for long periods before being read off, which permits additional sensitivity by use of low frame rates or by beam pulsing. It completely eliminates both stickiness and permanent burn-in since operation depends on electron conduction, which is not a depletion process, rather than on ion conduction. The curve shown on page 3 compares the resolution sensitivity of the 7409 with that of a 5820 with equivalent photocathode.

The target characteristics also assure a higher amplitude response than that of the 5820. Another advantage of the GL-7409 is a considerable reduction in the redistribution of target secondary electrons which reduces image-edging effect, particularly at [illegible] white transitions.

Electrical

Cathode—Unipotential		
Heater Voltage, AC or DC	6.3 ±10%	Volts
Heater Current	0.6	Ampere
Photocathode—Semi transparent		
Response—S-10		
Rectangular Image, 4 x 3 aspect ratio		
Useful Size, maximum diagonal	1.8	Inches
Orientation—Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the faceplate and pin-No. 7 of the shoulder base.		
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Direct Interelectrode Capacitance		
Anode to all other Electrodes	12	μμf

Mechanical

Over all Length	15.20 ±0.25	Inches
Greatest Diameter of Bulb	3.00 ±0.06	Inches
Minimum Deflecting-Coil Inside Diameter	2⅜	Inches
Deflecting-Coil Length	5	Inches
Focusing Coil Length	10	Inches
Alignment-Coil Length	⅛	Inch
Photocathode Distance Inside End of Focusing Coil	½	Inch
Weight, approximate	1.4	Pounds

Operating Position—Any, except with diheptal base up and the tube axis at an angle of less than 20 degrees from vertical.

Thermal

Operating Temperature of Any Part of Bulb	70	Max C
Operating Temperature of Bulb at Large End of Tube, Target Section	15	Min C
Temperature Difference Between Target Section and Any Part of Bulb Hotter than Target Section	7.5	Max C

MAXIMUM RATINGS—ABSOLUTE VALUES

Photocathode Voltage	−550	Volts
Photocathode Illumination	50	Foot-Candles
Anode Supply Voltage	1850	Volts
Grid-No. 1 Voltage		
Negative Bias Value	125	Volts
Positive Bias Value	0	Volts
Grid-No.2 and Dynode-No. 1 Voltage	350	Volts
Grid-No. 3 Voltage	400	Volts
Grid-No. 4 Voltage	300	Volts
Grid-No. 5 Voltage	150	Volts
Grid-No. 6 Voltage	−550	Volts
Dynode-No. 2 to Dynode-No. 1 Voltage	350	Volts
Dynode-No. 3 to Dynode-No. 2 Voltage	350	Volts
Dynode-No. 4 to Dynode-No. 3 Voltage	680	Volts
Dynode-No. 5 to Dynode-No. 4 Voltage	350	Volts
Anode to Dynode-No. 5 Voltage	100	Volts
Target Voltage		
Positive Voltage	6	Volts
Negative Voltage	10	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125	Volts
Heater Positive with Respect to Cathode	10	Volts
Shock (Note 1)	100	G's
Vibration (Note 2)	10	G's
Humidity (Note 3)		
Acceleration (Note 4)	70	G's

GENERAL ELECTRIC

TYPICAL OPERATION

Photocathode Voltage, image focus	−400 to −540	Volts
Grid-No. 1 Voltage for Picture Cut-off, beam	45 to −115	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	300	Volts
Grid-No. 3 Voltage*, multiplier focus	225 to 330	Volts
Grid-No. 4 Voltage, beam focus	140 to 180	Volts
Grid-No. 5 Voltage, decelerator	0 to 125	Volts
Grid-No. 6 Voltage, accelerator 75 Percent of Photocathode Voltage, approximate	−300 to −405	Volts

Dynode-No. 2 Voltage	600	Volts
Dynode-No. 3 Voltage	910	Volts
Dynode-No. 4 Voltage	1200	Volts
Dynode-No. 5 Voltage	1400	Volts
Anode Voltage	1550	Volts
DC Anode Current	3	Microamperes
Target Voltage, without blanking voltage	0 to 2.0	Volts
Peak-to-Peak Blanking Voltage	5 to 20	Volts
Target Temperature Range	15 to 55	C
Field Strength at Center of Focusing Coil†	75	Gausses
Field Strength of Alignment Coil, approximate	0 to 3	Gausses

* Adjust to give the most uniformly shaded picture near maximum signal.

† Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil with the indicator located outside of and at the image end of the focusing coil.

Note 1: Per specification MIL-E-5272C (ASG) Paragraph 4.15.5 with the following differences:

A) 12 impact shocks of 30 G.

B) The shock shall be applied in the following directions:

1.) Vertically perpendicular to longitudinal axis, 3 shocks in each direction.

2.) Parallel to the minor horizontal axis, 3 shocks in each direction.

C) The shock pulse width is defined by the use of a 0.2 to 250-cycle-per-second filter.

Note 2: Under the conditions specified in MIL-E-5272C (ASG) Paragraph 4.7.12 Procedure XII except at operating temperature only. Center horizontal resolution at 3×10^{-5} maximum foot-candles, photocathode illumination will be at least 350 lines with 5 G applied acceleration in the frequency range from 50 to 500 cycles per second and a double amplitude of 0.036 inch from 5 to 50 cycles per second.

Note 3: Under the conditions specified in MIL-E-5272C (ASG) Paragraph 4.4.1 Procedure I. Following this test, the interelectrode insulation of the end pins 5, 6, 7, 8, 9 and 10 each with respect to all other end base pins grounded and with 350 volts (minimum) applied is greater than 500 ohms.

Note 4: Constant acceleration when applied perpendicular to the longitudinal axis of the tube for 10 minutes.

OPERATING NOTES

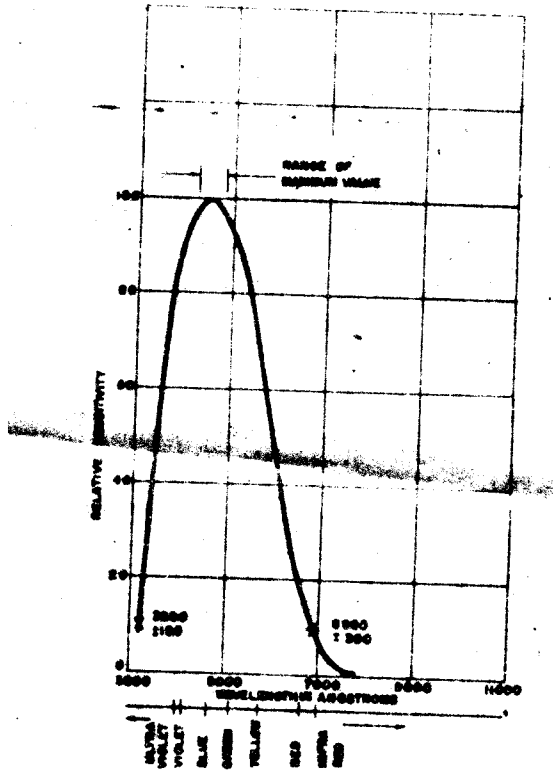
Normally a new tube will exhibit some slight after-image, characterized by a rapid and complete decay, which will gradually diminish with life. This can be minimized by use of an orbiter or by eliminating forced-air cooling for short periods of time.

Although a warm-up time of one hour is desirable, the tube can be used immediately after alignment as it cannot be damaged permanently by target burn-in.

Some tubes may exhibit microphonic bars if used immediately while relatively cool. These will disappear as the tube warms up and can be minimized during this period by slight readjustments in target voltage.

The target used in this tube greatly reduces the probability of permanent burn-in damage should a stationary highlight be imaged on the target for an extended period. However, imaging directly on the sun or other extremely bright sources should be avoided.

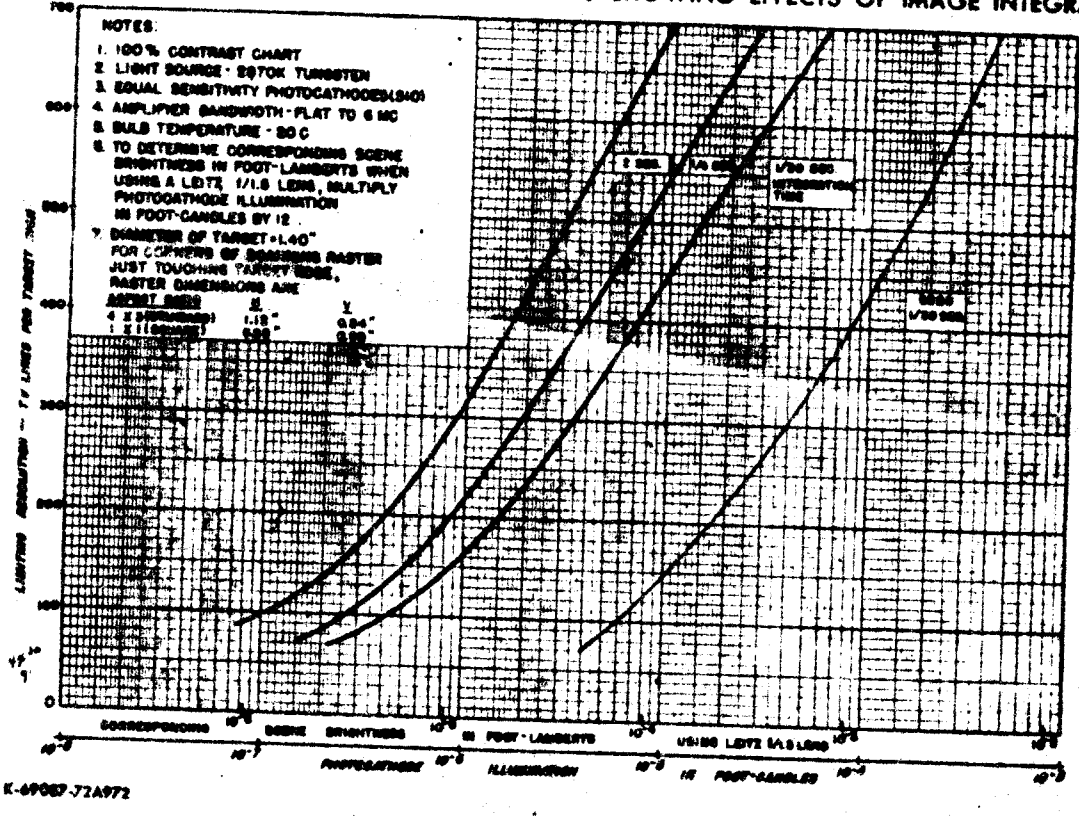
SPECTRAL-SENSITIVITY CHARACTERISTIC--S10 RESPONSE
For Equal Values of Radiant Flux at All Wavelengths



K-69087-72A923

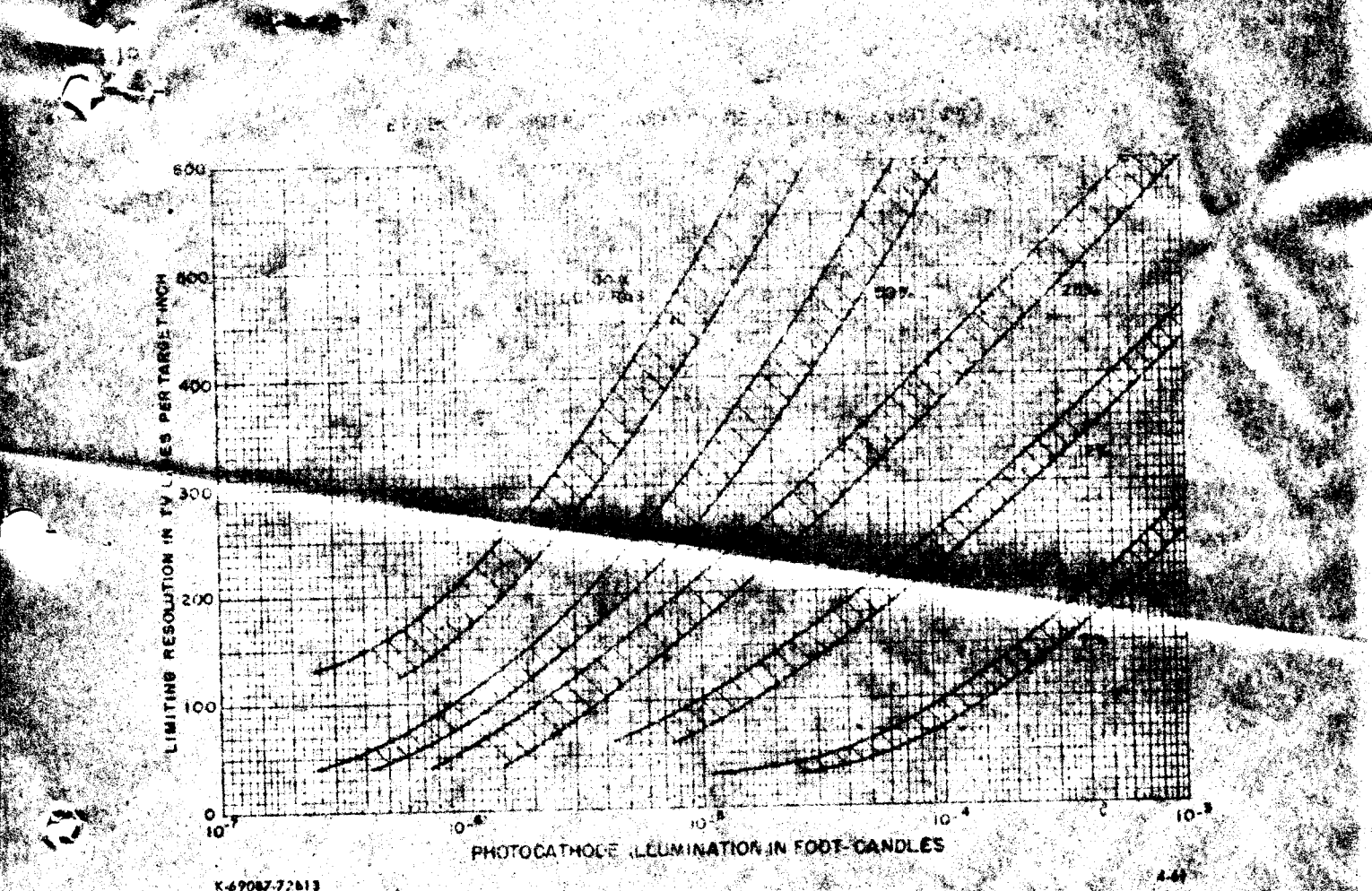
4-26-60

TYPICAL RESOLUTION—SENSITIVITY CHARACTERISTICS SHOWING EFFECTS OF IMAGE INTEGRATION

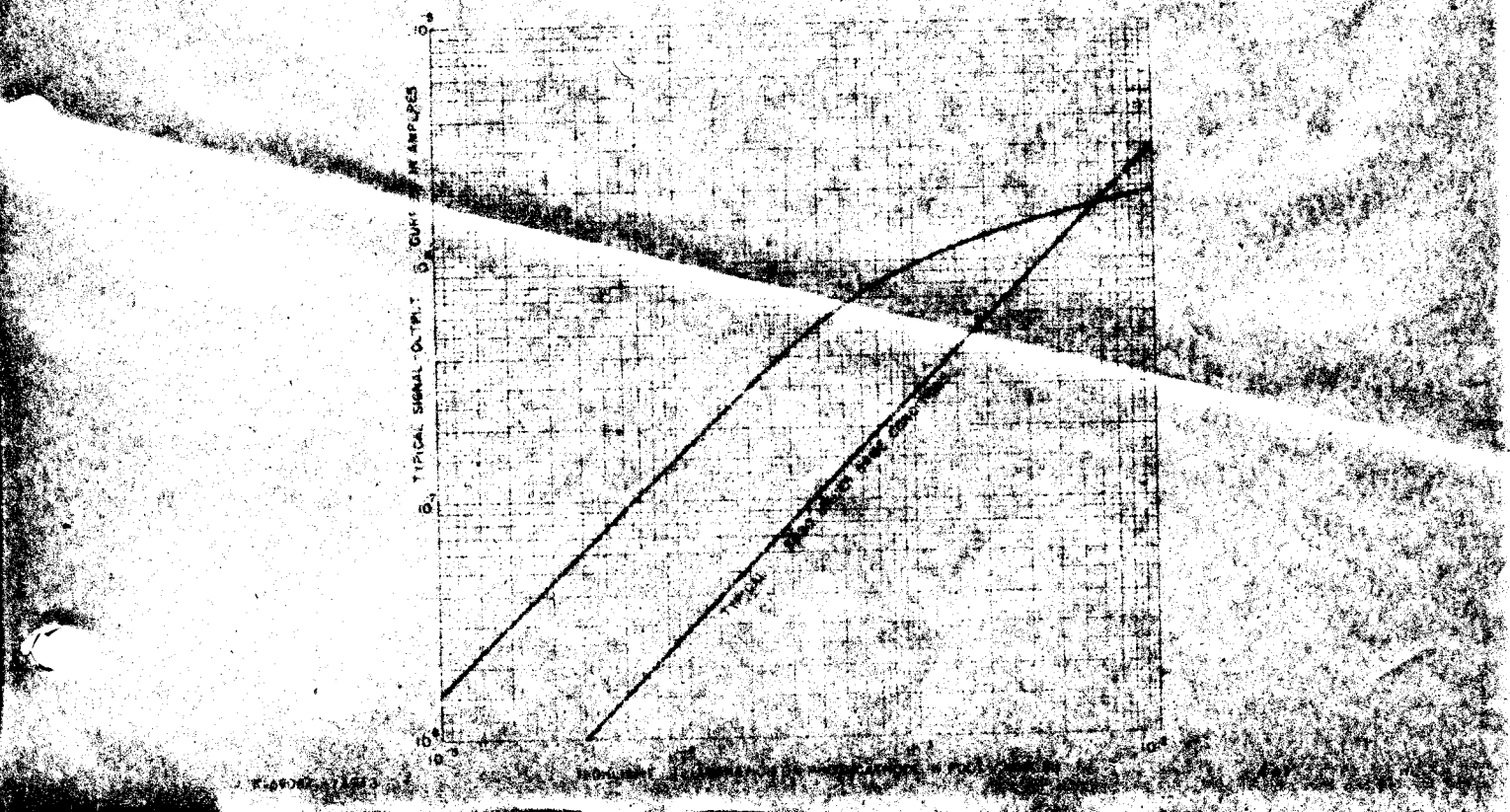


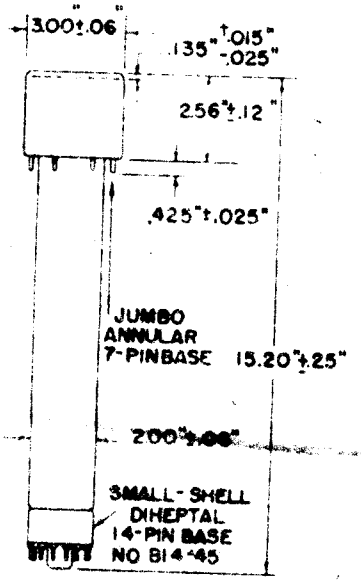
K-69087-72A972

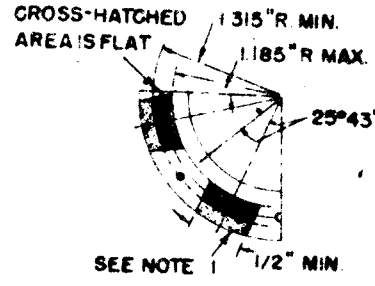
8-60



TRANSFER CHARACTERISTIC

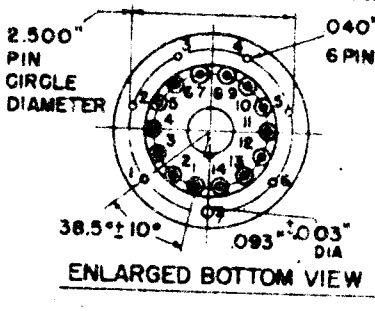






DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.



ENLARGED BOTTOM VIEW

ANNULAR BASE GAGE

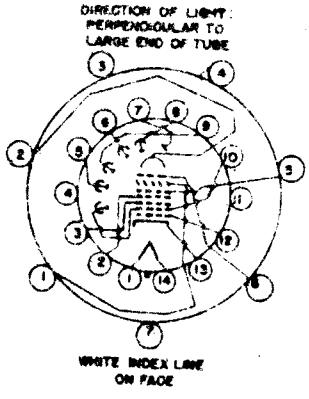
ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH

a. SIX HOLES HAVING DIAMETER OF 0.065"± 0.001" AND ONE HOLE HAVING DIA. OF 0.150±0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26'±5' ON CIRCLE DIAMETER OF 2.500"± 0.001"

b. SEVEN STOPS HAVING HEIGHT OF 0.187"± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT OF A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ±0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200"± 0.001".



BASING DIAGRAM

SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1 HEATER
PIN 2 GRID NO 4
PIN 3 GRID NO 3
PIN 4 INTERNAL CONNECTION-DO NOT USE
PIN 5 DYNODE NO 2
PIN 6 DYNODE NO 4
PIN 7 ANODE
PIN 8 DYNODE NO 5
PIN 9 DYNODE NO 3
PIN 10 DYNODE NO 1, GRID NO 2
PIN 11 INTERNAL CONNECTION DO NOT USE
PIN 12 GRID NO.1
PIN 13 CATHODE
PIN 14 HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1 GRID NO 6
PIN 2 PHOTOCATHODE
PIN 3 INTERNAL CONNECTION-DO NOT USE
PIN 4 INTERNAL CONNECTION DO NOT USE
PIN 5 GRID NO.5
PIN 6 TARGET
PIN 7 INTERNAL CONNECTION DO NOT USE

GL-7629
IMAGE ORTHICON

FOCUS-MAGNETIC **DEFLECTION-MAGNETIC**

The GL-7629 is a low-light-level image orthicon designed to meet a variety of applications in the industrial, military, and scientific fields. It provides an effective low-light-level sensitivity of 3 x 10^{-6} foot-candles photocathode illumination for resolution of 100 television lines per target inch, or higher where extended integration is not a requirement.

The tube features a high-gain, thin-film magnesium-oxide target with a sensitivity ten to twenty times that of glass targets. The extreme thinness and the anisotropic property of this semiconductor target virtually eliminates lateral leakage and increases the resolution 25 to 50 percent over that of standard glass targets. Since operation of the target depends on electron conduction, which is not a depletion process, rather than on ion conduction, permanent stickiness and burn-in are virtually eliminated. Low gamma provides a very wide operating range.

These and other features of the 7629 assure long life and reliable operation in such applications as low-light-level color and monochrome telecasting and closed-circuit service. The tube is also well adapted to x-ray intensifier use since it permits better detectability of lower contrasts and detail than is possible with image orthicons employing glass targets.

Electrical

Cathode—Unipotential		
Heater		
Voltage, AC or DC	6.3 ± 10%	Volts
Current	0.6	Amperes
Photocathode—Semi-Transparent		
Spectral Response—S-10		
Rectangular Image, 4 by 3 aspect ratio		
Useful Size, maximum diagonal	1.8	Inches
Orientation—Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the faceplate and pin No. 7 of the shoulder base.		
Focusing Method—Magnetic		
Deflection Method—Magnetic		
Direct Interelectrode Capacitance		
Anode to all other Electrodes	12	μμf

Mechanical

Over-all Length	15.20 ± 0.25	Inches
Greatest Bulb Diameter	3.00 ± 0.06	Inches
Deflecting Coil		
Length	5	Inches
Minimum Inside Diameter	2 3/8	Inches
Focusing-Coil Length	10	Inches
Alignment-Coil Length	15/16	Inches
Photocathode Distance Inside End of Focusing Coil	1/2	Inches
Weight, approximate	14	Ounces
Operating Position—Any, except with diheptal base up and tube axis at an angle of less than 20 degrees from vertical.		

Thermal

Operating Temperature at any Part of Bulb, maximum	70	C
Operating Temperature of Bulb at Large End of Tube, Target Section, minimum	0	C
Temperature Difference Between Target Section and any Part of Bulb Hotter than Target Section	7.5	C

MAXIMUM RATINGS—ABSOLUTE VALUES

Photocathode		
Voltage	−600	Volts
Illumination	50	Foot-candles
Anode Supply Voltage*	1850	Volts
Grid-No. 1 Voltage		
Negative Bias Value	135	Volts
Positive Bias Value	0	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	380	Volts
Grid-No. 3 Voltage	400	Volts
Grid-No. 4 Voltage	300	Volts
Grid-No. 5 Voltage	150	Volts
Grid-No. 6 Voltage	−600	Volts
Dynode-No. 2 to Dynode-No. 1 Voltage	350	Volts
Dynode-No. 3 to Dynode-No. 2 Voltage	350	Volts
Dynode-No. 4 to Dynode-No. 3 Voltage	680	Volts
Dynode-No. 5 to Dynode-No. 4 Voltage	350	Volts
Anode to Dynode-No. 5 Voltage	100	Volts
Voltage per Multiplier Stage	400	Volts
Target Voltage		
Above Target Cutoff, positive direction	10	Volts
Negative	10	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125	Volts
Heater Positive with Respect to Cathode	10	Volts

* Ratio of dynode voltages appears under Typical Operation.

GENERAL ELECTRIC

TYPICAL OPERATION—AVERAGE VALUES

	Normal Performance†	Maximum Sensitivity Performance‡	
Photocathode Voltage, image focus	−400 to −540	−400 to −550	Volts
Grid-No. 1 Voltage for Picture Cutoff, Beam	−45 to −115	−45 to −115	Volts
Photocathode Illumination—See Page 5			
Scene Illumination—See Page 5			
Grid-No. 2 and Dynode-No. 1 Voltage	300	370	Volts
Grid-No. 3 Voltage, multiplier focus§	225–330	225–380	Volts
Grid-No. 4 Voltage, beam focus	140–180	140–250	Volts
Grid-No. 5 Voltage, decelerator	0–125	0–125	Volts
Grid-No. 6 Voltage, accelerator—75 percent of photocathode voltage, approximate	−300 to −405	−300 to −465‖	Volts
Dynode-No. 2 Voltage	600	770	Volts
Dynode-No. 3 Voltage	910	1080	Volts
Dynode-No. 4 Voltage	1200	1360	Volts
Dynode-No. 5 Voltage	1490	1610	Volts
Anode Voltage	1550	1700	Volts
DC Anode Current, maximum	30	30	Microamperes
Signal Output Current, peak-to-peak—See Light-Transfer Characteristic			
Target Cutoff Voltage¶	−3 to +1	−3 to +1	Volts
Target Temperature Range	15–55	15–55	C
Peak-to-Peak Blanking Voltage	5–20	5–20	Volts
Field Strength at Center of Focusing Coil**	75	75	Gausses
Field Strength of Alignment Coil, approximate#	0–3	0–3	Gausses

† Although these tubes will operate in standard equipment, modification to permit operation at these values will improve effective sensitivity for most applications.

‡ These values will permit the best low-light-level-sensitivity capability of the tube to be realized and will assure the maximum useful multiplier gain required in extreme low-light-level applications. The resolution sensitivity information in this data sheet was derived with these higher multiplier voltages.

§ Adjust to give the most uniformly shaded picture near maximum signal.

‖ 75 to 85 percent of photocathode voltage.

¶ The target supply voltage should be adjustable from −3 to +5 volts with blanking voltage off. Maximum target voltage is +10 volts above target cutoff. Recommended target voltage is +2 volts above cutoff. Slight readjustment, usually only a small fraction of a volt, may be necessary to minimize microphonics.

**Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

Adjust to produce flattest field with maximum response. Alignment is correct when the center of the picture merely goes through focus and does not rotate when beam focus (Grid No. 4) is varied. For most commercial focus coils a 75-gauss field results from a focus-coil current of 75 milliamperes.

OPERATING NOTES

Some magnesium-oxide targets may be damaged permanently if directly and intermittently exposed, while in operation, to extremely bright sources which cause high photoelectron densities to occur at the target. Such sources include the sun, photoflash lamps, and exploding wire flashes. Damage, if it does occur, takes the form of black image spots burned in the target by the intense light.

In most cases an 80-megohm, ¼-watt resistor in series with the photocathode in the camera will protect the tube. This resistor will not interfere with normal operation of these or other image orthicons which may be used in the modified camera.

If these or similar bright sources are to be observed continuously, appropriate exposure control of photocathode illumination can be supplied by neutral-density filters.

SPECIFIC PARAMETERS ON RECORDED DATA

All curves except spectral-sensitivity characteristics were recorded under the following conditions:

Camera Chain: General Electric TE-5 (modified)
Amplifier bandwidth—total 20 mc, flat to 6 mc

Resolution Chart: National Bureau of Standards Lens Test Chart, 100% contrast transparency.

Window Chart: 100% contrast, 1% area window for signal-noise and transfer characteristic data.

Light Source: 2870^0 Kelvin—tungsten

Light Level: Aperture and neutral density controlled (within specially constructed low-light-level box) to provide range from 10^{-8} to 10^{-2} foot-candles illumination on photocathode. For corresponding scene brightness in foot-lamberts when using Leitz f/1.5 lens (85 mm), multiply photocathode illumination in foot-candles by 12.

Operating Temperature for Image End: 25 to 30 C.

Target Raster: Target diameter is 1.40 inches. For corners of scanning raster just touching target edge raster dimensions are:

Aspect Ratio	Horizontal	Vertical
1 x 1 (square)	0.99″	0.99″
4 x 3 (standard)	1.12″	0.84″

Horizontal TV lines = 1.12 x TV lines per target inch

Vertical TV lines (EIA) = 0.84 x TV lines per target inch

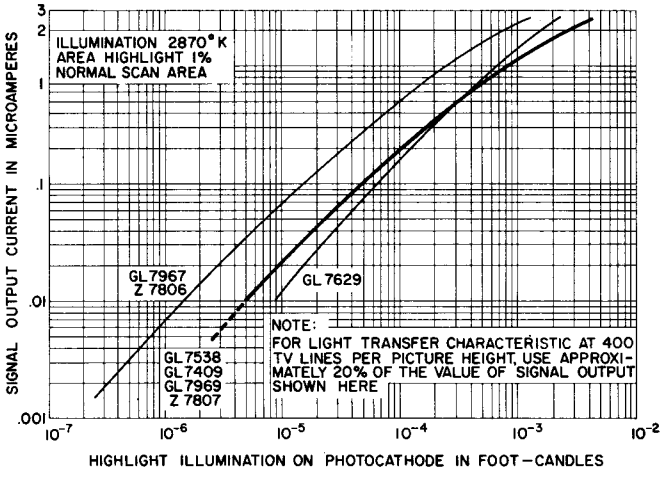
Resolution sensitivity data is recorded in TV lines per target inch

Therefore, 700 TV lines per target inch = 784 horizontal lines
= 588 vertical lines (EIA)

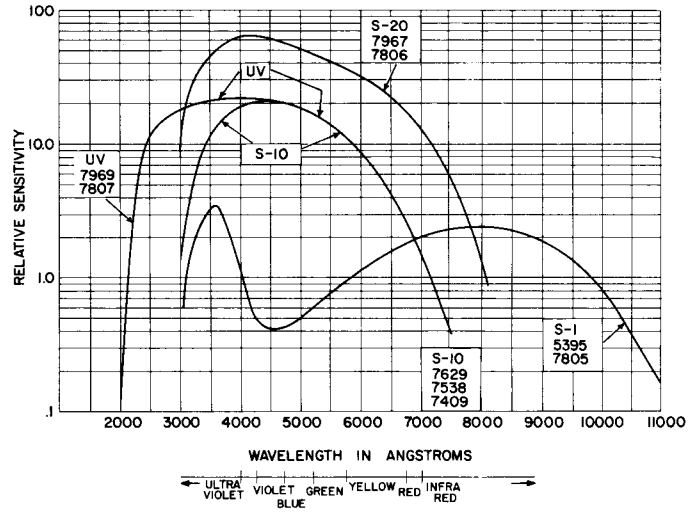
GL-7629

ET-T1688
Page 4
5-63

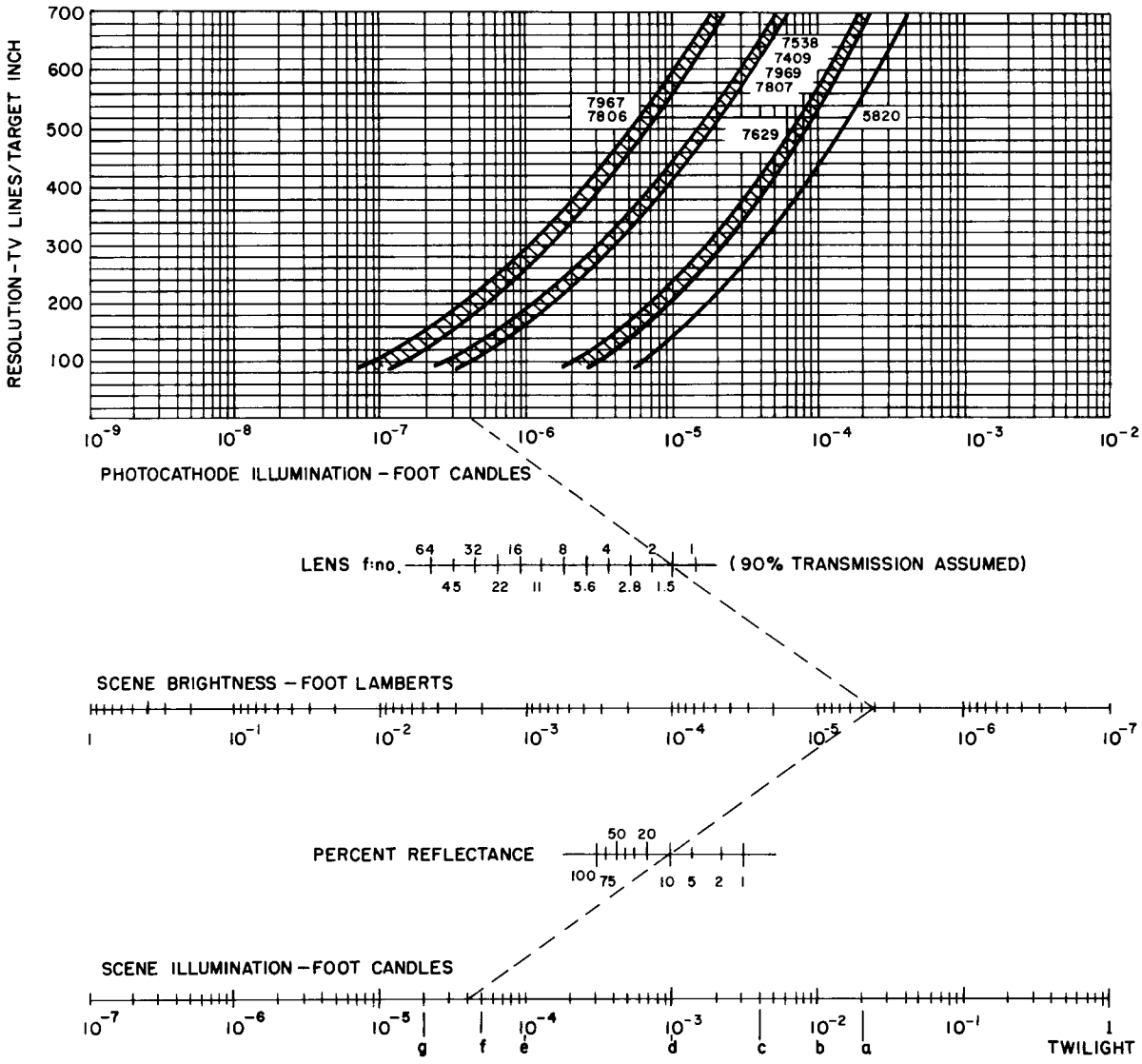
LIGHT TRANSFER CHARACTERISTICS



PHOTOCATHODE SPECTRAL RESPONSE CHARACTERISTICS



SCENE ILLUMINATION VS TYPICAL RESOLUTION SENSITIVITY BY TYPE*

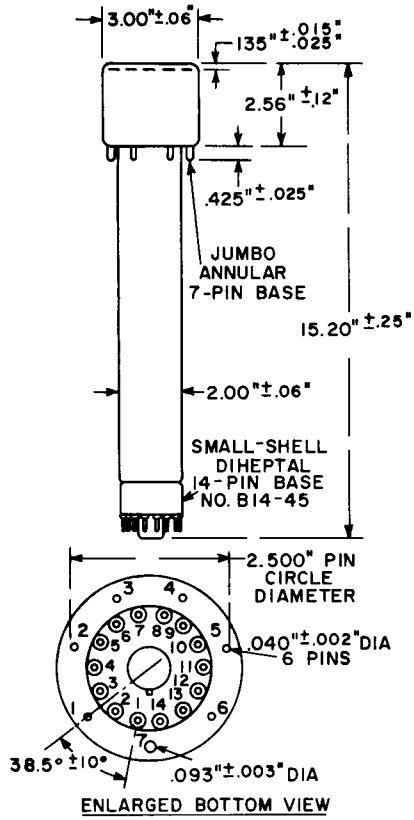


Code	Ambient Condition	Scene Illumination
a	Full moon–clear	2×10^{-2} ft-c
b	Half moon	1×10^{-2} ft-c
c	Full moon–moderately cloudy	4×10^{-3} ft-c
d	Quarter moon–clear	1×10^{-3} ft-c
e	No moon–clear	1×10^{-4} ft-c
f	No moon–moderately cloudy	5×10^{-5} ft-c
g	No moon–heavy cloud	2×10^{-5} ft-c

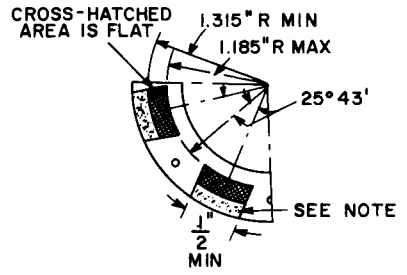
NEUTRAL DENSITY FILTERS FOR EXPOSURE CONTROL

TYPE AND DENSITY	PERCENT TRANSMITTANCE	NUMBER OF STOPS
ND .30	50.0	1
ND .60	25.0	2
ND .90	13.0	3
ND 1.00	10.0	3.3
ND 2.00	1.0	6.6
ND 3.00	0.10	10.0
ND 4.00	0.010	13.2

*This chart reprinted by permission of B. A. Bang.



ENLARGED BOTTOM VIEW



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

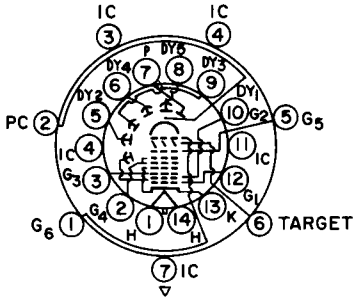
a. SIX HOLES HAVING DIAMETER OF 0.065"±.0.001" AND ONE HOLE HAVING DIA OF 0.150"±0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51° 26'±5' ON CIRCLE DIAMETER OF 2.500"±0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187"±0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT OF A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126"±0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200"±0.001".

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE



WHITE INDEX LINE ON FACE

BOTTOM VIEW

BASING DIAGRAM

SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
PIN 2: GRID NO.4 & FIELD MESH
PIN 3: GRID NO. 3
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: DYNODE NO. 2
PIN 6: DYNODE NO. 4
PIN 7: ANODE
PIN 8: DYNODE NO.5
PIN 9: DYNODE NO.3
PIN 10: DYNODE NO. 1, GRID NO. 2
PIN 11: INTERNAL CONNECTION-DO NOT USE
PIN 12: GRID NO. 1
PIN 13: CATHODE AND SUPPRESSOR GRID
PIN 14: HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO. 6
PIN 2: PHOTOCATHODE
PIN 3: INTERNAL CONNECTION-DO NOT USE
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: GRID NO. 5
PIN 6: TARGET
PIN 7: INTERNAL CONNECTION-DO NOT USE

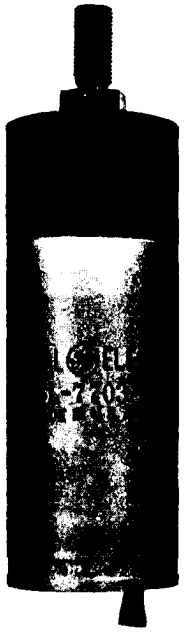
GENERAL ELECTRIC

POWER TUBE DEPARTMENT

Pickup Tube Operation

Syracuse, New York

PRINTED IN U.S.A.



GL-7703
IGNITRON

CAPACITOR-DISCHARGE SERVICE — **20,000 VOLTS PEAK**
DC SHORT-CIRCUITING-SWITCH SERVICE — **100,000 AMPERES PEAK**

The GL-7703 is a sealed, stainless-steel-jacketed ignitron for use as a switch in capacitor-discharge circuits operating up to 20,000 volts. In this service the tube will carry peak currents up to 100,000 amperes. The anode seal is enclosed in an insulating compound to prevent external voltage flashover.

Electrical

Cathode Excitation—Cyclic
Cathode Spot Starting—Ignitor
Number of Electrodes

Main Anodes	1
Main Cathodes	1
Ignitors	1

Mechanical

Envelope—Stainless Steel
Mounting Position—Axis Vertical, Anode Terminal Up

Net Weight	2	Pounds

Thermal

Type of Cooling—Air or Liquid, by clamp around lower portion of tube

Clamp Temperature	10 to 30	C
Cathode Temperature, maximum	35	C
Anode Insulating-Compound Temperature*, maximum	70	C

Capacitor-Discharge Service, Intermittent Pulse Duty, Sinusoidal Current†

Peak Anode Voltage‡		
Forward	20,000	Volts
Inverse	20,000	Volts
Critical Anode Starting Voltage, minimum	100	Volts
Anode Current¶		
Peak, for ½ cycle of 120 microseconds	60,000	Amperes
Peak, for ½ cycle of 20 microseconds	100,000	Amperes
Maximum Discharge Rate	2	Per Minute
Rate of Rise of Current§, tube inductance approx.	0.04	Microhenrys
Ionization Time	0.5	Microseconds

DC Short-Circuiting-Switch Service

Peak Anode Voltage‡		
Forward	20,000	Volts
Inverse	20,000	Volts
Critical Anode Starting Voltage, minimum	100	Volts
Anode Current		
Peak	35,000	Amperes
Average	0.25	Amperes
Maximum Averaging Time	1	Cycle
Rate of Rise of Current§, tube inductance approx.	0.04	Microhenrys
Ionization Time	0.5	Microseconds

Ignitor Ratings

	Minimum	Maximum	
Separate Excitation			
Ignitor Voltage			
Forward Open Circuit	1500	3000	Volts
Inverse, maximum	—	5	Volts
Ignitor Short-Circuit Current	200	250	Amperes
Length of Firing Pulse, sine wave	5	10	Microseconds

	Minimum	Maximum	
Anode Firing			
Ignitor Voltage			
Forward, maximum	—	3000	Volts
Inverse, maximum	—	5	Volts
Peak Ignitor Current	200	250	Amperes

* Anode-seal, insulating-compound temperature must always be higher than the cathode temperature to prevent mercury condensation on the anode and anode seal. Before tube operation, the anode seals must be heated long enough to vaporize all mercury from the seal area.

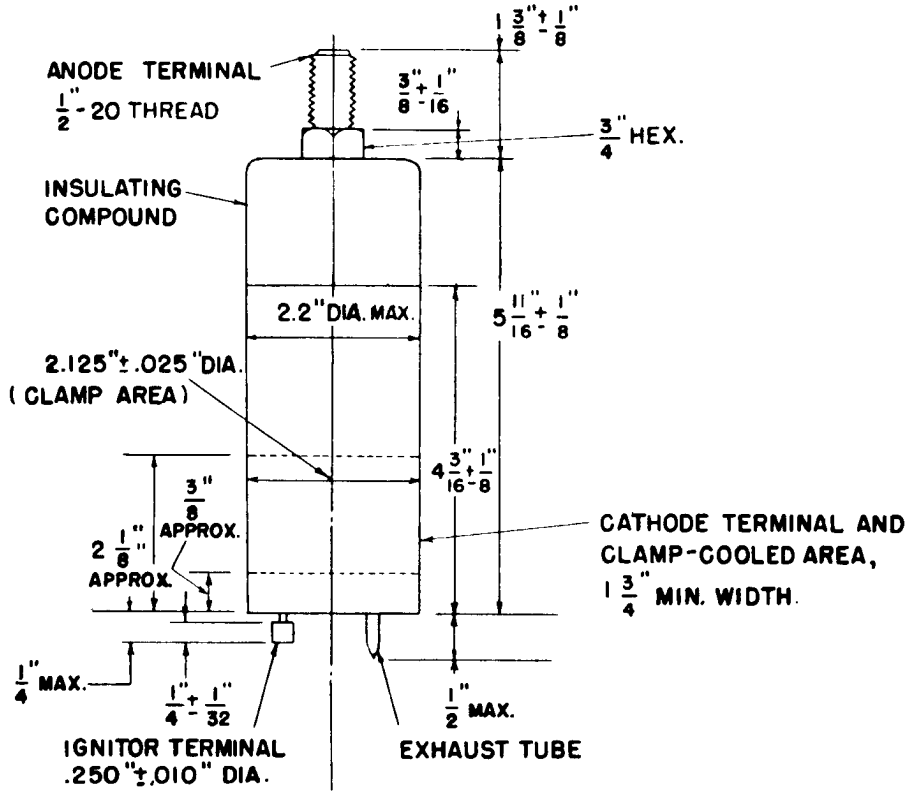
† The tube may become a closed switch (does not open) carrying current in both directions until the current dampens out.

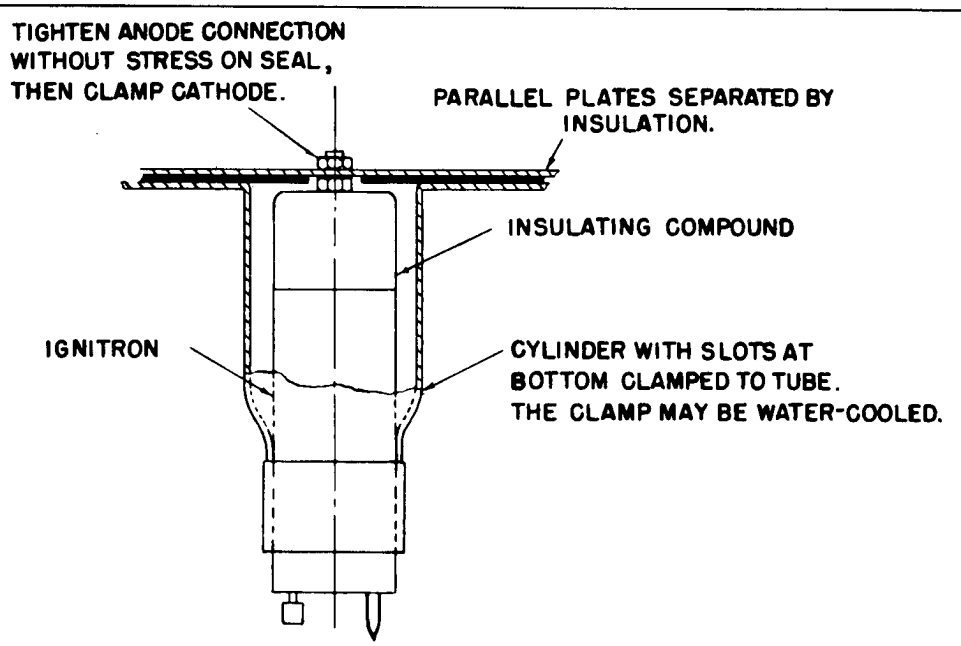
‡ The tube cannot hold off this voltage immediately after conduction. A 1-to-10-second delay may be required before reapplication of voltage.

¶ Dampened oscillations are permissible provided the oscillating cycles do not exceed 20. The peak current value for one-half cycle must not be exceeded.

§ Rate of rise depends on circuit.

GENERAL ELECTRIC





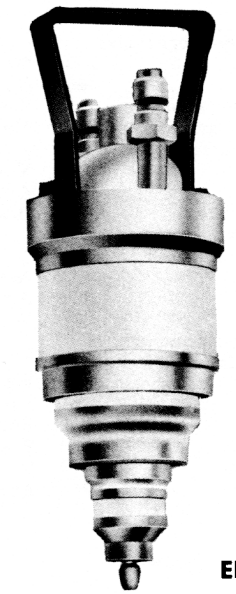
SUGGESTED METHOD FOR PROVIDING MOUNTING FOR COAXIAL CONNECTION

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

GL-7985
TETRODE



VHF-UHF
RING-SEAL CONSTRUCTION
GROUNDED-GRID CIRCUIT

WATER COOLED
METAL AND CERAMIC
INTEGRAL WATER JACKET

The GL-7985 is a four-electrode transmitting tube featuring a metal-and-ceramic envelope for use as a power amplifier or oscillator in grounded-grid circuits with both grids maintained at radio-frequency ground potential. The output circuit is connected between the anode and the screen grid. The anode is capable of dissipating 3½ kilowatts. Cooling is accomplished by water and forced air with the water jacket an integral part of the anode. The cathode is a unipotential thoriated-tungsten cylinder, heated by electron bombardment. Maximum ratings apply up to 800 megaycles, although higher frequency operation is possible.

In narrow band, Class C, grounded-grid, amplitude-modulated service, the GL-7985 has a useful carrier-power output in excess of one kilowatt. In Class C Telegraphy, it has a useful power output of 3.0 kilowatts of continuous power as an amplifier or oscillator.

As a Class B radio-frequency power amplifier, the tube is capable of delivering 1100 watts of power with 20 watts of drive at carrier level.

Electrical

	Minimum	Bogey	Maximum	
Cathode				
Heater Voltage	—	6.7	7.0	Volts
Heater Current at 7.0 Volts				
Without Cathode Bombarding	—	14.5	—	Amperes
With 150 Watts Cathode Bombarding	—	13.5	—	Amperes
Heater Starting Current	—	—	25	Amperes
Heater Cold Resistance	—	0.041	—	Ohms
Cathode Bombarding Power*	—	170	195	Watts
Cathode Bombarding Voltage, DC				
For 170 Watts Bombarding Power	—	650	—	Volts
For 195 Watts Bombarding Power	—	700	—	Volts
Cathode Heating Time	1	—	—	Minutes
Amplification Factor, G_2 to G_1, $E_b = 4000$ volts, $I_b = 0.5$ Ampere	—	20	—	
Peak Cathode Current‡	—	—	6	Amperes
Direct Interelectrode Capacitances				
Cathode to Plate§	—	0.01	—	μμf
Input, G_2 tied to G_1	—	27.8	—	μμf
Output, G_2 tied to G_1¶	—	6.4	—	μμf

Mechanical

Mounting Position—Vertical, Anode-end Up
Net Weight, approximate . . . . . 2.0 Pounds

Thermal

Type of Cooling—Water and Forced Air

Water Flow
- Anode . . . . . 3.0 Min Gallons per Minute
- Pressure Drop at Rated Flow . . . . . 20 Max Pounds per Square Inch
- Water Pressure . . . . . 80 Max Pounds per Square Inch
- Outlet Water Temperature . 70 Max C

Air Flow
- Screen-grid to Control-grid Seals . . . . . 15 Min Cubic Feet per Minute
- Heater-to-Cathode Seals . . . 7.5 Min Cubic Feet per Minute
- Anode Ceramic . . . . . 10 Min Cubic Feet per Minute

Temperature at Any Point . . . . . 200 Max C

Water and forced-air cooling to be applied before and during the application of any voltages. Water cooling may be discontinued with removal of all voltages. Air flow on heater-to-cathode seals must be maintained for one minute after removal of heater voltage.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

Carrier Conditions per Tube for use with a Maximum Modulation Factor of 1.0

Maximum Ratings, Absolute Values		
DC Plate Voltage	7000	Volts
DC Grid-No. 2 Voltage	750	Volts
DC Plate Current	0.600	Ampere
Plate Input	6.0	Kilowatts
Grid-No. 2 Input	25	Watts
Plate Dissipation	3.5	Kilowatts

Typical Operation		
Grounded-grid Circuit, 225–400 Megacycles		
DC Plate Voltage	7000	Volts
DC Grid-No. 2 Voltage	600	Volts
DC Grid-No. 1 Voltage, approximate	−35	Volts
Peak RF Plate Voltage, approximate	5500	Volts
Peak RF Grid-No. 1 Voltage, approximate	105	Volts
DC Plate Current	0.475	Ampere
Zero Signal DC Plate Current	0.115	Ampere
$E_b = 7000$ volts, $E_{c2} = 600$ volts, E_{c1} adjusted for $I_b = 0.115$ amperes		
DC Grid-No. 2 Current	0.010	Ampere
DC Grid-No. 1 Current	0.025	Ampere
Driving Power, approximate	80	Watts
Measured at crest of audio-frequency cycle with modulation factor of 1.0		
Power Output#	1100	Watts
Circuit Efficiency	90	Percent
Plate Dissipation	2300	Watts
Cathode Bombarding Power*	160	Watts
Cathode Bombarding Voltage	610	Volts
Cathode Bombarding Current	0.260	Ampere

PLATE MODULATED RADIO-FREQUENCY AMPLIFIER—CLASS C TELEPHONY

Carrier Conditions With a Maximum Modulation Factor of 1.0, Screen Modulation Required

Maximum Ratings, Absolute Values		
DC Plate Voltage	4500	Volts
DC Grid-No. 2 Voltage	500	Volts
DC Grid-No. 1 Voltage	−120	Volts
DC Plate Current	0.80	Ampere
DC Grid-No. 1 Current	0.120	Ampere
Plate Input	3.60	Kilowatts
Grid-No. 2 Input	25	Watts
Plate Dissipation	3.5	Kilowatts

Typical Operation		
Grounded-grid Circuit at 400 Megacycles		
DC Plate Voltage	4000	Volts
DC Grid-No. 2 Voltage	400	Volts
DC Grid-No. 1 Voltage	−100	Volts
Peak RF Plate Voltage	2500	Volts
Peak RF Driving Voltage	120	Volts
DC Plate Current	0.570	Ampere
DC Grid-No. 2 Current	0.020	Ampere
DC Grid-No. 1 Current, approximate	0.100	Ampere
Driving Power, approximate	100	Watts
Power Output#	1250	Watts
Output Circuit Efficiency	90	Percent
Cathode Bombarding Power*	165	Watts
Cathode Bombarding Voltage, approx.	630	Volts
Cathode Bombarding Current, approx.	0.260	Ampere

RADIO-FREQUENCY AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key Down Conditions per Tube Without Amplitude Modulation

Maximum Ratings, Absolute Values

DC Plate Voltage	7000	Volts
DC Grid-No. 2 Voltage	750	Volts
DC Plate Current	1.0	Amperes
Plate Input	6.0	Kilowatts
Grid-No. 2 Input	40	Watts
Plate Dissipation	3.5	Kilowatts
DC Grid-No. 1 Voltage	120	Volts
DC Grid-No. 1 Current	0.150	Ampere

Typical Operation

Grounded-grid Circuit at 400 Megacycles			
DC Plate Voltage	4500	6500	Volts
DC Grid-No. 2 Voltage	600	700	Volts
DC Grid-No. 1 Voltage	−120	−100	Volts
Peak RF Plate Voltage, approximate	3000	—	Volts
Peak RF Grid-No. 1 Voltage	140	140	Volts
DC Plate Current	0.6	0.8	Ampere
DC Grid-No. 2 Current	0.018	0.025	Ampere
DC Grid-No. 1 Current	0.080	0.100	Ampere
Driving Power, approximate	100	100	Watts
Power Output, approximate#	1800	3200	Watts
Output Circuit Efficiency	90	90	Percent
Cathode Bombarding Power*	160	165	Watts
Cathode Bombarding Voltage, approximate	610	630	Volts
Cathode Bombarding Current, approximate	0.260	0.260	Ampere

Grounded-grid Circuit at 800 Megacycles		
DC Plate Voltage	4500	Volts
DC Grid-No. 2 Voltage	600	Volts
DC Grid-No. 1 Voltage	−120	Volts
Peak RF Plate Voltage, approximate	3000	Volts
Peak RF Grid-No. 1 Voltage	140	Volts
DC Plate Current	0.6	Ampere
DC Grid-No. 2 Current	0.018	Ampere
DC Grid-No. 1 Current	0.080	Ampere
Driving Power, approximate	90	Watts
Power Output, approximate#	1250	Watts
Output Circuit Efficiency	83	Percent
Cathode Bombarding Power*	150	Watts
Cathode Bombarding Voltage, approximate	600	Volts
Cathode Bombarding Current, approximate	0.250	Ampere

* The cathode of the GL-7985, because of transit-time effects which raise the temperature of the cathode, is subjected to considerable back bombardment in ultra-high-frequency service. The amount of heating due to bombardment is a function of the operating conditions and frequency, and must be compensated for by a reduction of the cathode power input to prevent overheating of the cathode with resulting short life. In any case it is important from a tube life standpoint to keep the cathode power at as low a level as possible consistent with required performance. Bombarder power should be monitored by a suitable wattmeter or DC voltmeter and milliammeter arrangement. For long life, the tube should be put in operation with about 180 watts bombarding power. After the circuit has been adjusted for proper tube operation, bombarding voltage should be reduced to a value slightly above that at which circuit performance is affected. Minor circuit readjustment may be necessary after the above adjustment. The procedure for determining proper bombarding power should be repeated periodically.

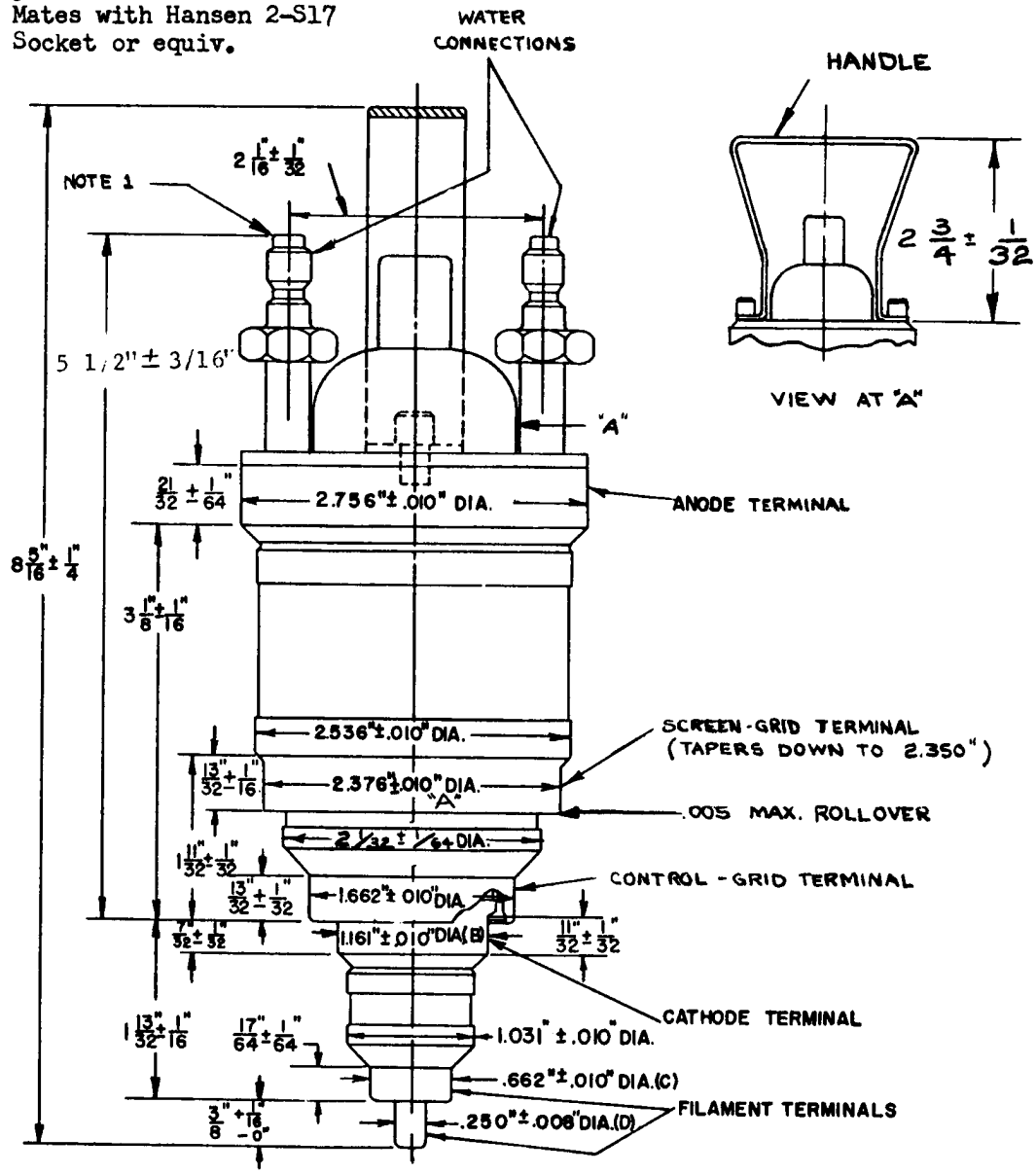
‡ Represents maximum usable cathode current (plate current plus current to each grid) for any condition of operation.

§ Measured with complete isolation between cathode and plate.

¶ Output capacitance measured between anode and screen grid. Control grid connected directly to screen grid.

\# Useful power output including power transferred from driver stage.

NOTE 1: Top portion same as top portion of Hansen B2T16 Mates with Hansen 2-S17 Socket or equiv.



The following indicator readings are measured with respect to a centerline determined by the centers of the anode terminal and control grid terminal.

Total Indicator Readings -
Diameter A - 0.024 inches
Diameter B - 0.024 "
Diameter C - 0.030 "
Diameter D - 0.050 "

TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky



PLIOTRON

DESCRIPTION

The GL-8002 is a three-electrode transmitting tube designed for use as a radio-frequency power amplifier at high frequencies. Multiple leads for both the filament and grid connectors minimize the inductance to these electrodes. Maximum ratings may be used up to a frequency of 150 megacycles and reduced ratings up to 300 megacycles.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Cathode—Filamentary		
Filament voltage	16	volts
Filament current	38	amperes
Direct interelectrode capacitances, approx		
Plate to grid	8.7	micromicrofarads
Grid to filament	10.2	micromicrofarads
Plate to filament	0.90	micromicrofarad
Mechanical		
Type of cooling	Water and forced air	
Operating position	Vertical, anode down	

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

CLASS B RADIO-FREQUENCY POWER AMPLIFIER

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D-c plate voltage	3500	volts
D-c plate current	0.6	ampere
Plate input	1800	watts
Plate dissipation	1200	watts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR, PLATE MODULATED

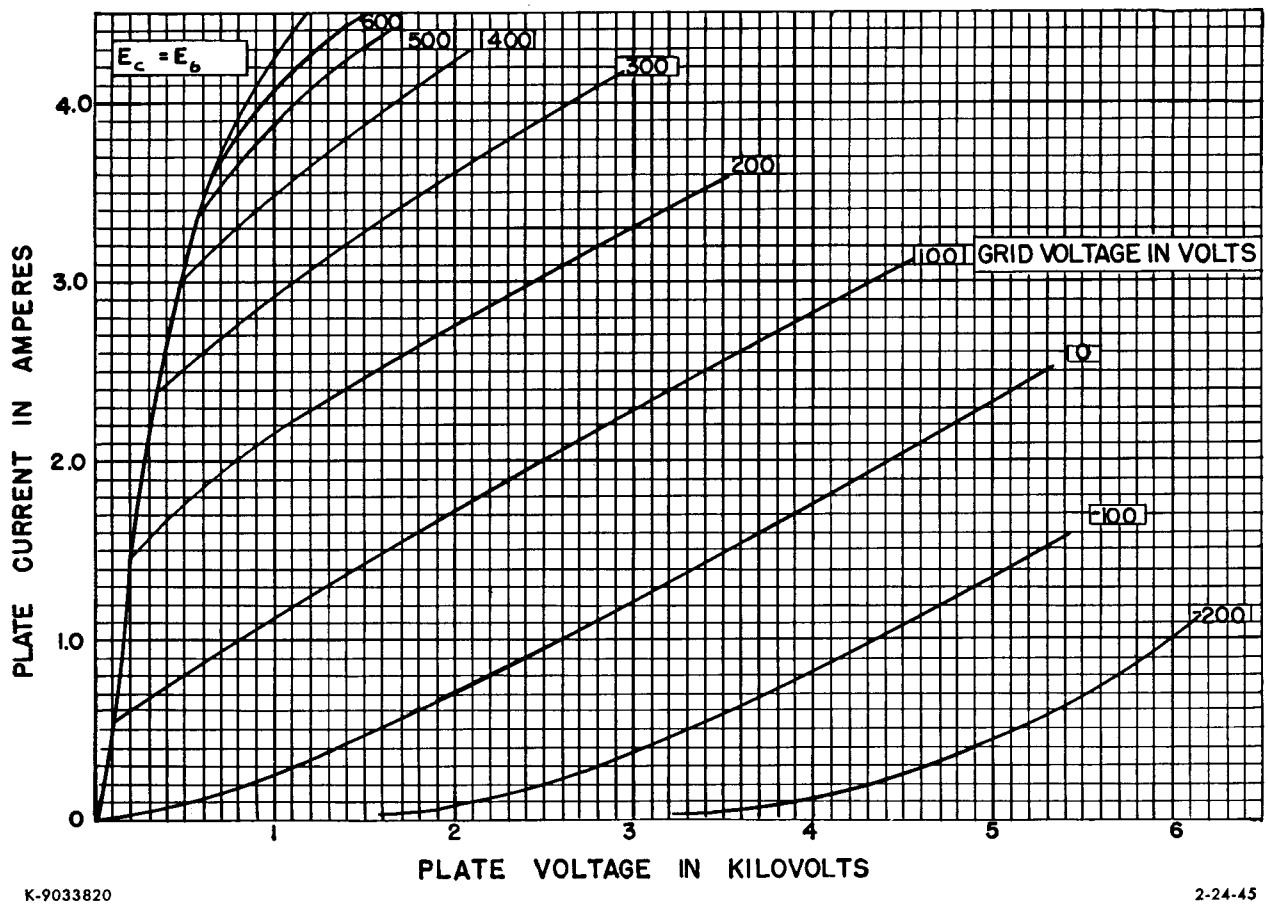
Carrier conditions per tube for use with a maximum modulation factor of 1.0

D-c plate voltage	2500	volts
D-c grid voltage	−500	volts
D-c plate current	0.5	ampere
D-c grid current	0.1	ampere
Plate input	1250	watts
Plate dissipation	750	watts

CLASS C RADIO-FREQUENCY AMPLIFIER AND OSCILLATOR, TELEGRAPHY

Key-down conditions per tube without modulation. Essentially negative modulation may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

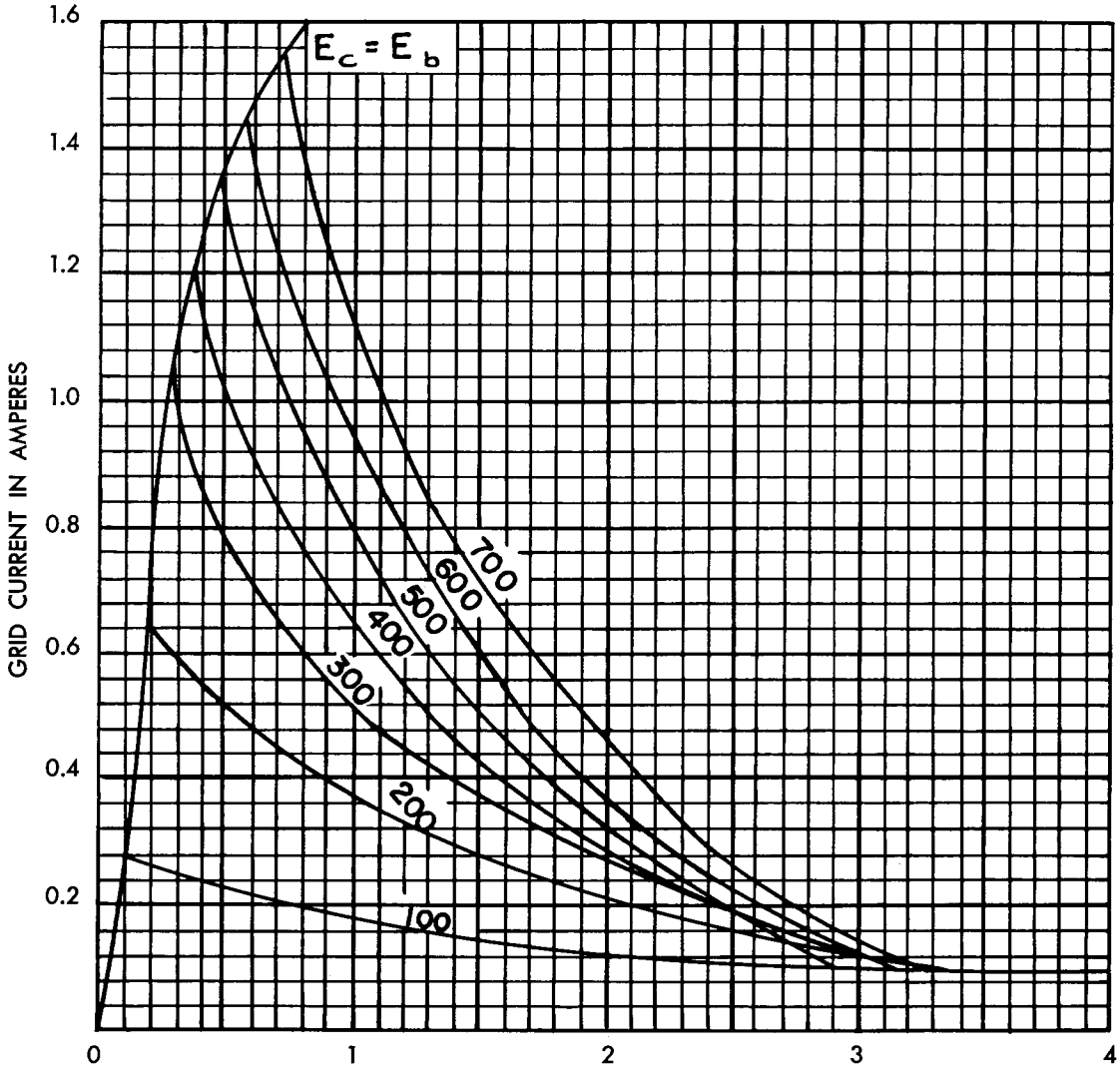
D-c plate voltage	3500	volts
D-c grid voltage	−500	volts
D-c plate current	1.0	ampere
D-c grid current	0.1	ampere
Plate input	3000	watts
Plate dissipation	1200	watts



K-9033820

2-24-45

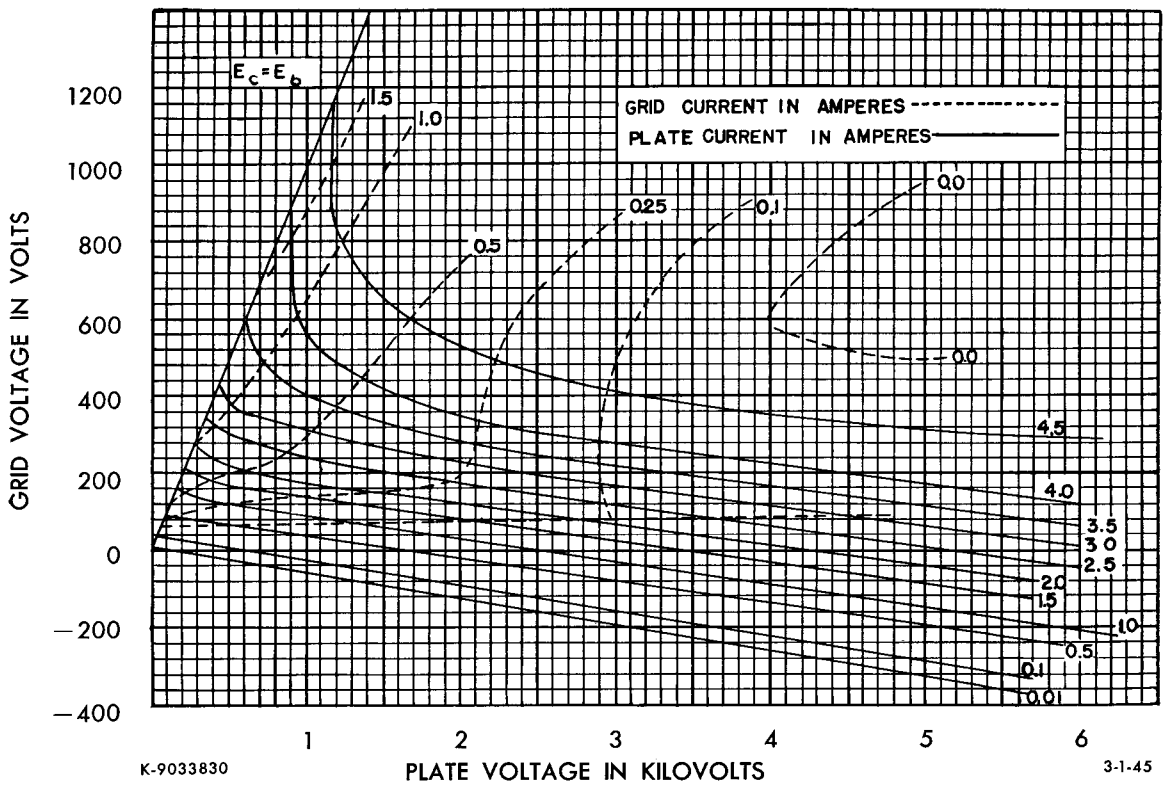
GL-8002 AVERAGE PLATE CHARACTERISTICS
(E_f = 16.0 VOLTS A-C)



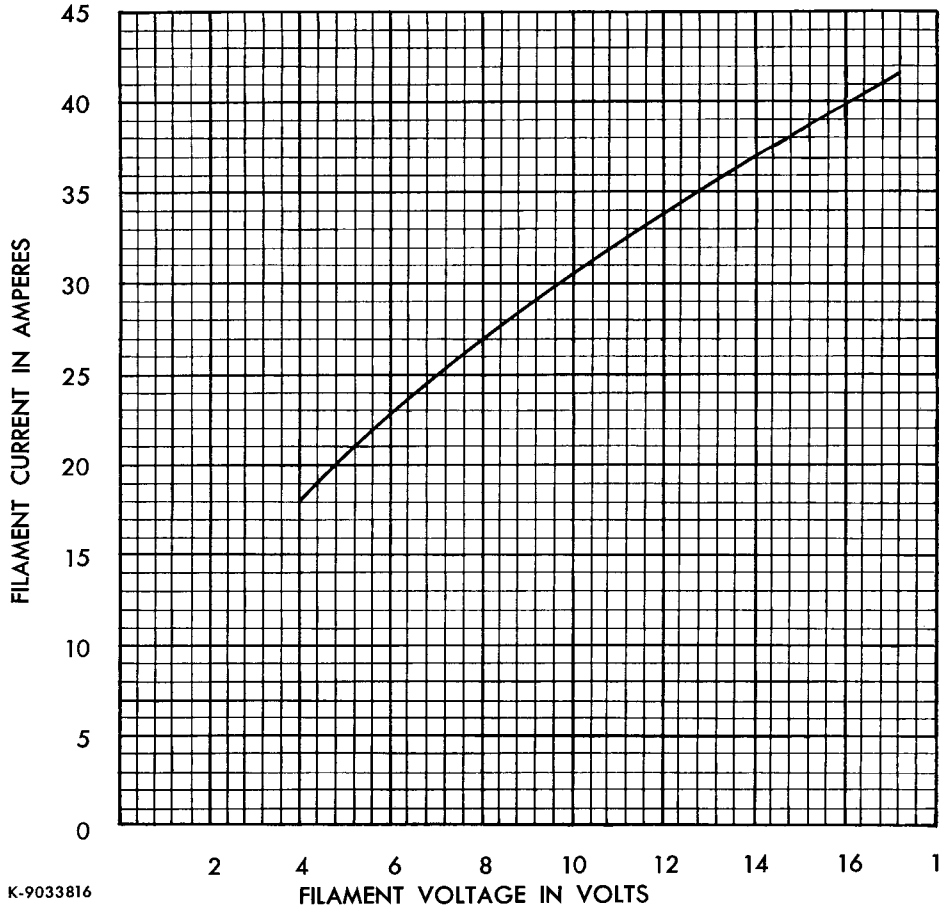
GL-8002 TYPICAL GRID-PLATE TRANSFER CHARACTERISTICS
(E_f = 16.0 VOLTS A-C)

K-9033821

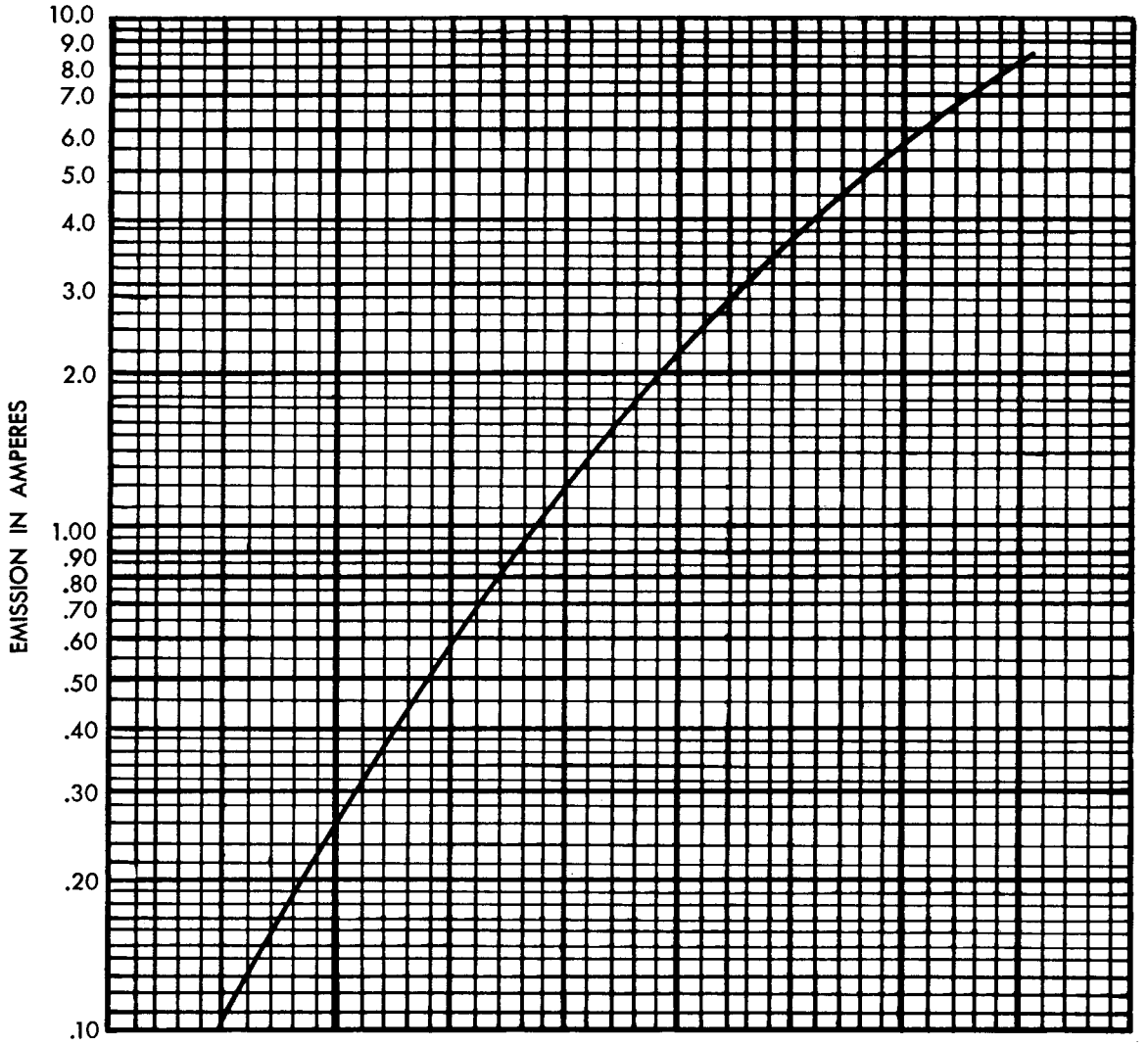
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GL-8002 CHARACTERISTICS E_f = 16 VOLTS A-C



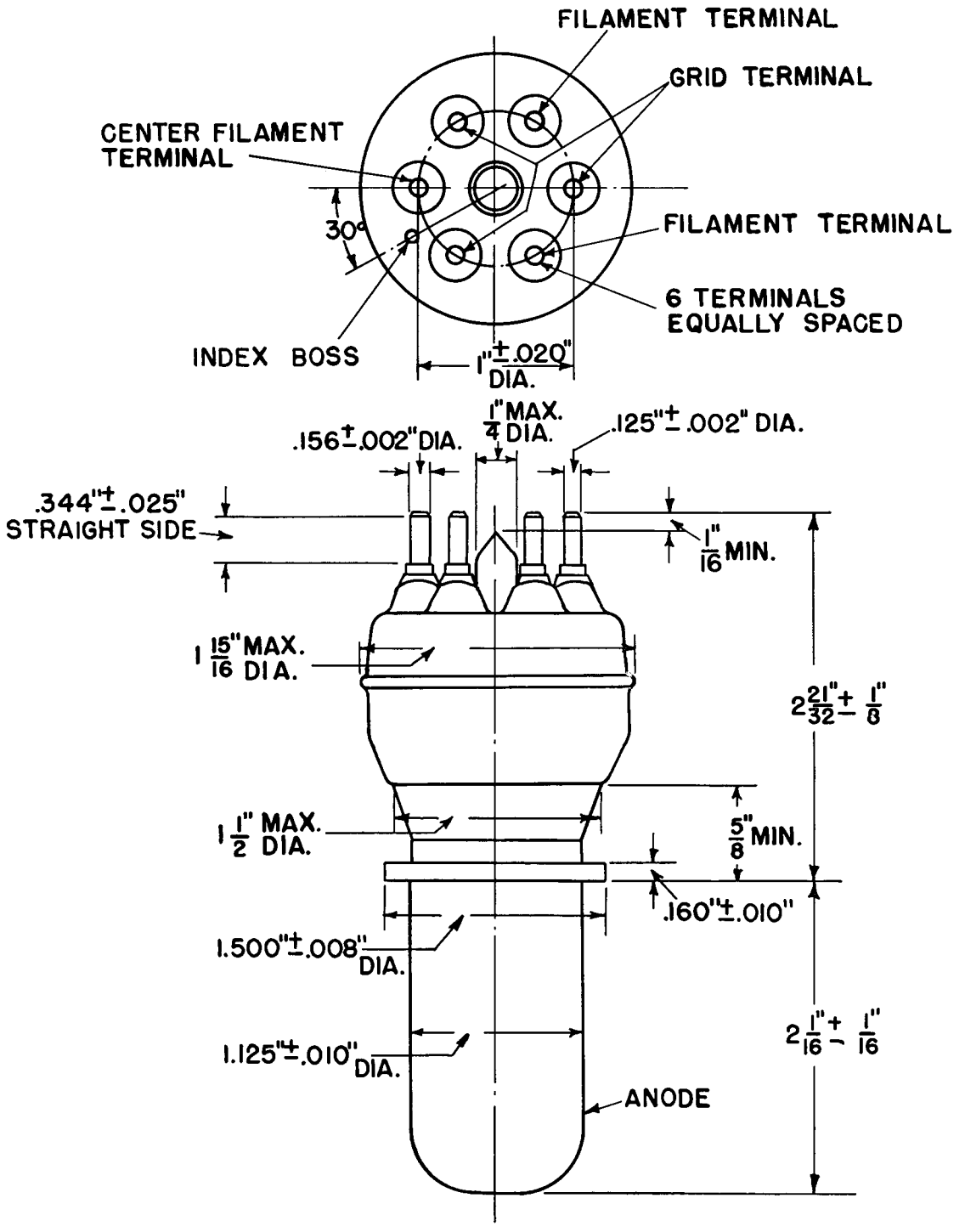
GL-8002 AVERAGE FILAMENT CHARACTERISTIC (COLD RESISTANCE OF FILAMENT = .036 OHM)



GL-8002 AVERAGE EMISSION CHARACTERISTIC

K-9033817

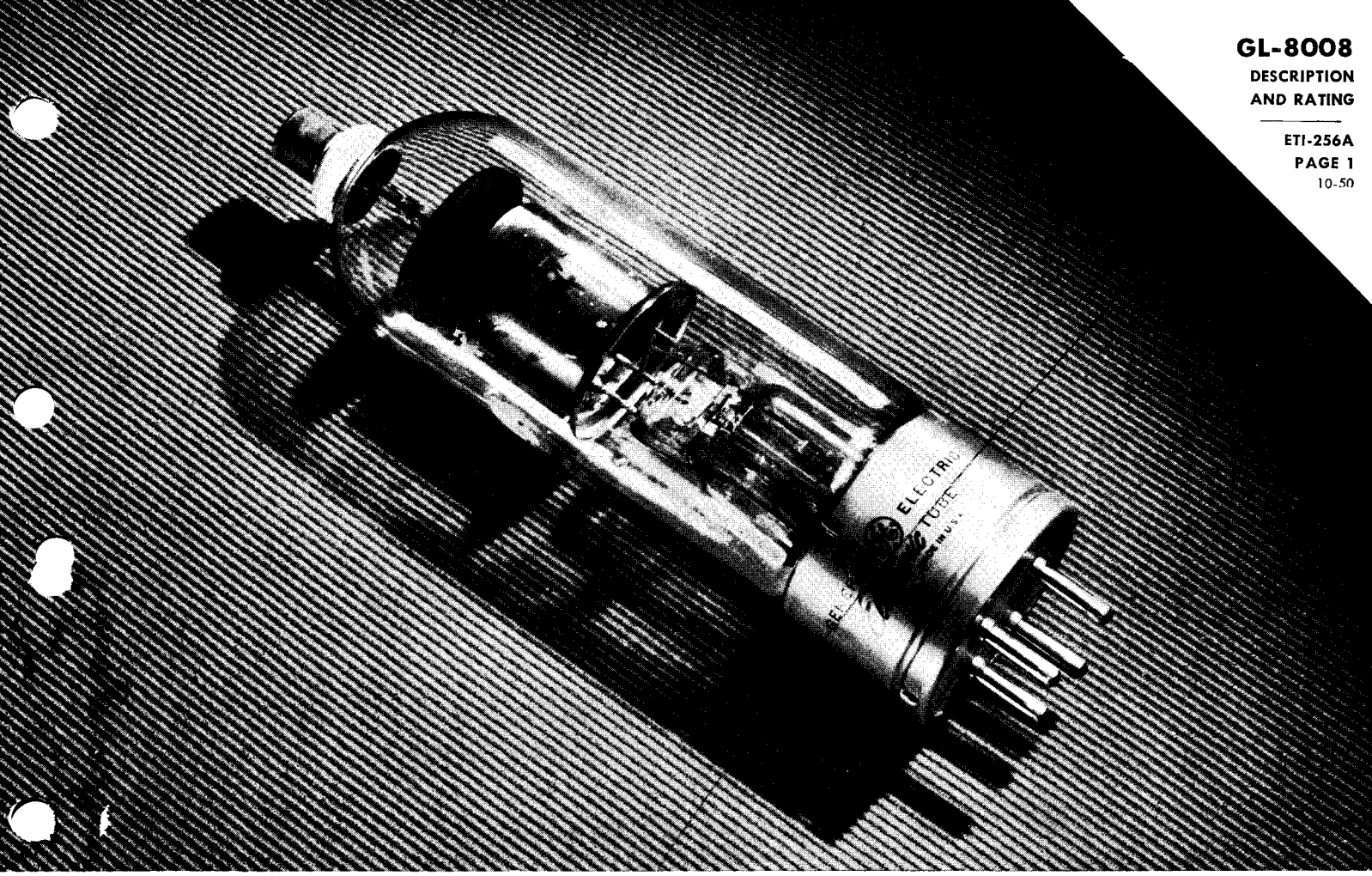
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OUTLINE
GL-8002 PLIOTRON

K-6912329 9-26-44

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.



PHANOTRON

The GL-8008 is a half-wave, mercury-vapor rectifier tube designed to withstand high peak inverse voltages and to conduct at relatively low applied voltages. The ratings are the same as those for the 872-A. The 8008, however, has a Super-Jumbo push-type base.

♦TECHNICAL INFORMATION

GENERAL

Electrical	Minimum	Bogey	Maximum	
Filament voltage	4.75	5.0	5.25	volts
Filament current at 5.0 volts		7.5	8.0	amperes
Cathode heating time required	30			seconds
Anode voltage drop, typical		15		volts
Critical anode voltage	50			volts

Mechanical

Type of cooling—Convection

Equilibrium condensed-mercury-temperature rise above ambient

At full load, approximate	20	C
At no load, approximate	14	C

Mounting position—Vertical, base down

Net weight, maximum	7.5	ounces

♦ Technical information completely revised.

Electronic TUBE

GENERAL ELECTRIC

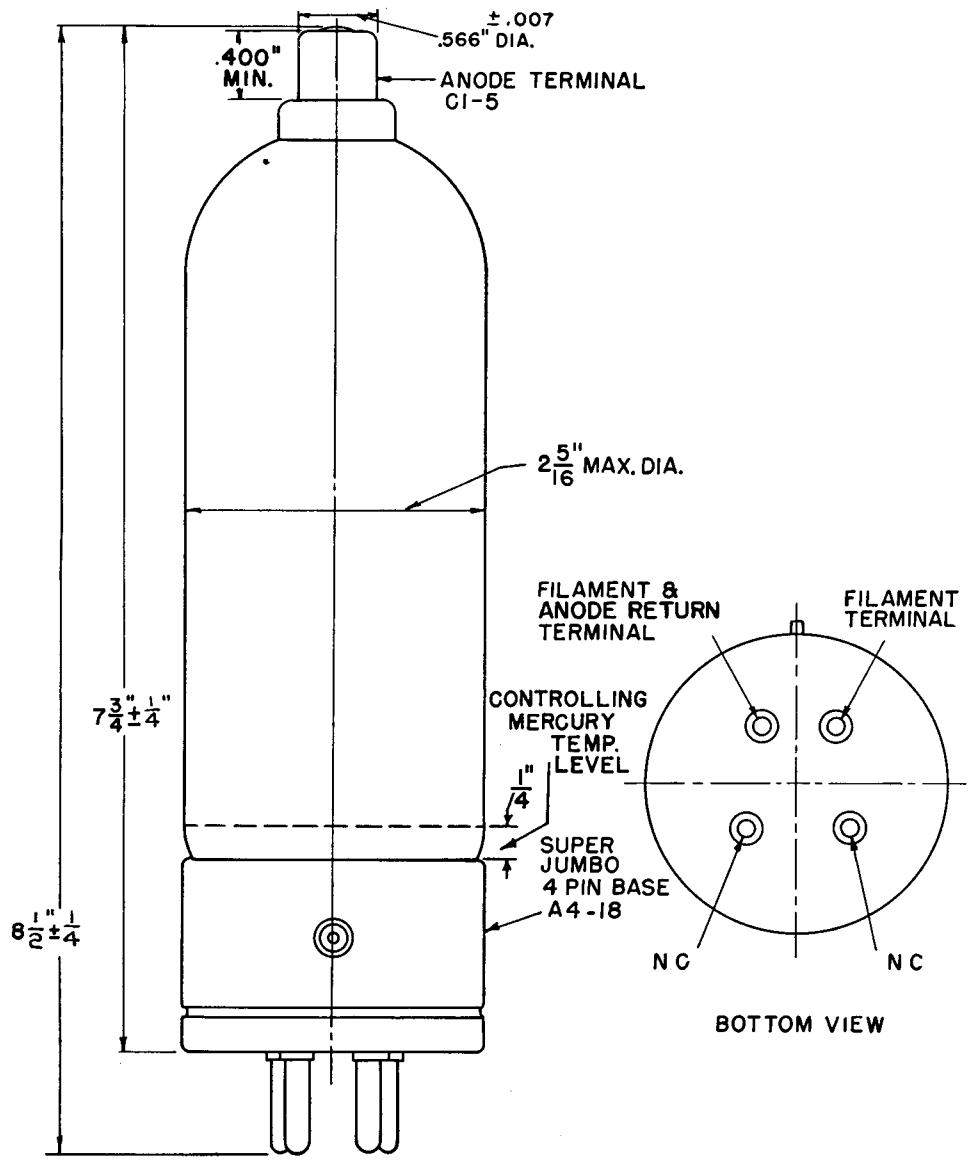
Supersedes ETI-256 dated 12-45

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS, Absolute Values

Maximum peak inverse anode voltage	5000	10,000	volts
Maximum cathode current			
Peak	5.0	5.0	amperes
Average	1.25	1.25	amperes
Surge (maximum duration 0.2 second)	50	50	amperes
Maximum averaging time	15	15	seconds
Maximum frequency	150	150	cycles per second
Condensed-mercury temperature limits	+20 to +70	+20 to +60	C

OUTLINE
◆ GL-8008 PHANOTRON



N-21502AZ
◆ Drawing revised.

9-7-45

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.



KENOTRON

DESCRIPTION

The GL-8020 is a high-vacuum rectifier that may be used at voltages as high as 40,000 volts peak inverse. This tube is particularly useful in applications which require high voltage and low current.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Electrical

Filament—Thoriated tungsten		
Voltage	5	volts
Current	5.5–6.5	amperes
Tube voltage drop (at 100 milliamperes)	200	volts
Capacitance, plate-filament	1.4	micromicrofarads

Mechanical

Type of cooling		convection
Over-all dimensions		
Maximum length	8	inches
Maximum diameter	$2\frac{5}{16}$	inches
Anode cap		medium metal
Base		medium, 4-pin bayonet
Net weight, approx	3	ounces
Shipping weight, approx.	3	pounds
Mounting position		vertical, base down

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

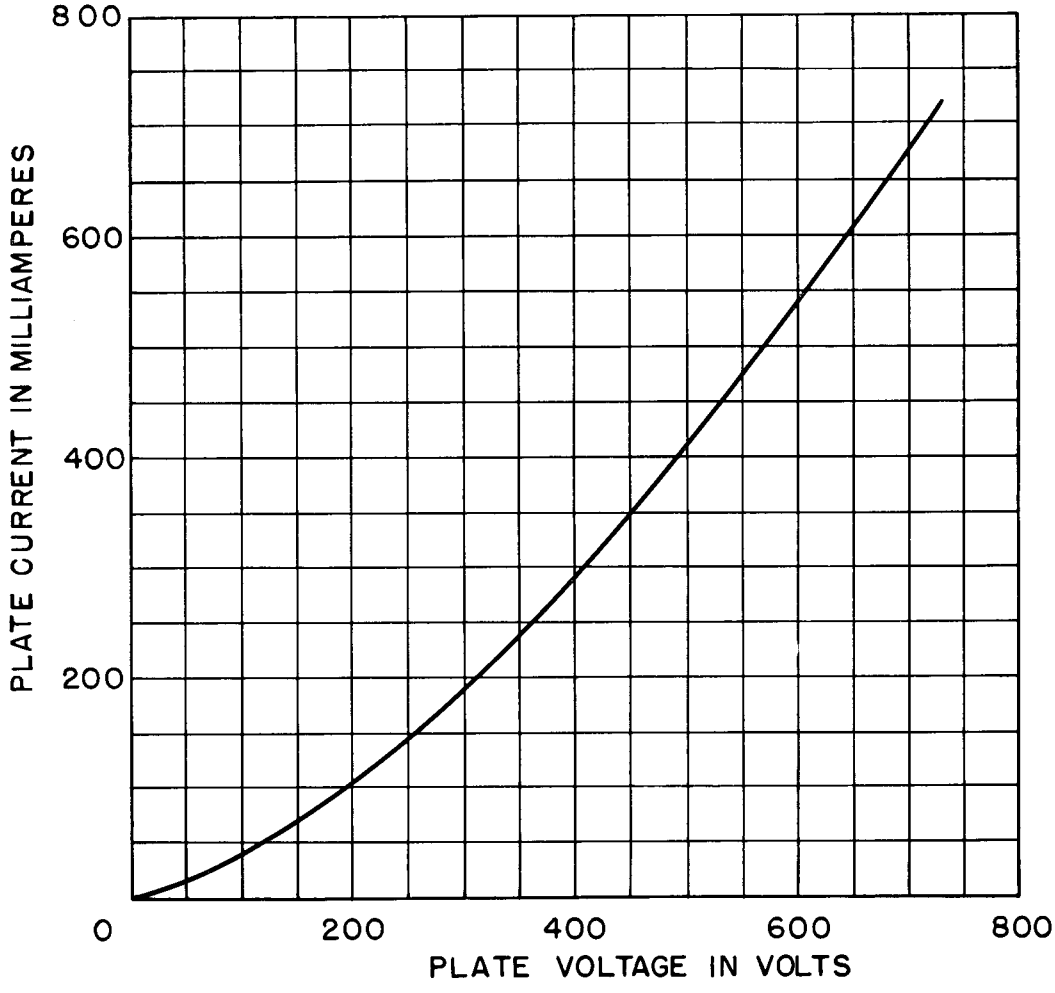
Rectifier operation

	Typical Operation	Maximum Ratings	
Peak inverse voltage		40,000	volts
Peak anode current		750	milliamperes
Average anode current		100	milliamperes

Surge limiting diode operation

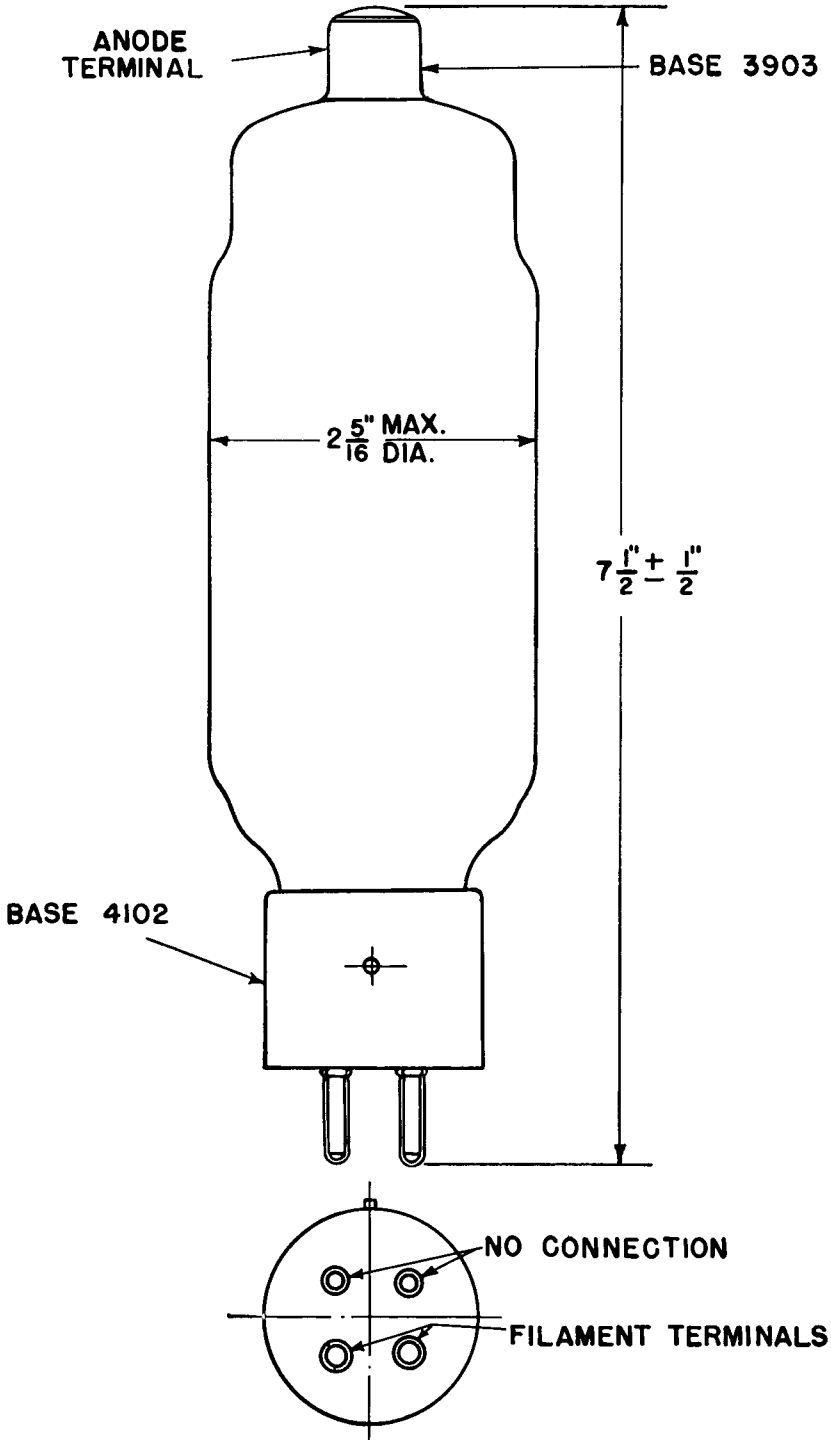
Filament voltage	5.5	5.8	volts
Peak forward anode voltage	10,000	12,500	volts
Peak anode current, minimum	2		amperes
Average anode dissipation		75	watts

GL-8020
PLATE CHARACTERISTIC
$E_f = 5$ VOLTS



K-5964496

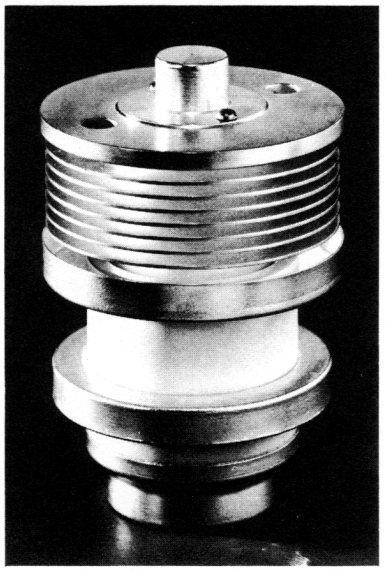
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OUTLINE
GL-8020 KENOTRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



GL-8500
TETRODE

RADIO-FREQUENCY AMPLIFIER
CW SERVICE
GROUNDED-GRID OPERATION

FORCED-AIR COOLED
METAL AND CERAMIC
INTEGRAL RADIATOR

The GL-8500 is a reliable power tetrode that delivers useful output to 1250 megacycles or higher. This tube is particularly suitable for application in the final output or driver stage of military-communications systems.

As a Class B linear amplifier in the 225–400-megacycle range, the tube will deliver 110 watts of carrier power modulated up to 100 percent. Since a power gain of 20 may be realized, drive requirements are low—approximately 5 watts at carrier level.

Operating as a Class C CW amplifier at 900 megacycles, the gain is approximately 15 at the 200-watt level.

Features of the GL-8500 include long life and reliability, high gain, high linearity, and resistance to shock and vibration.

These together with such design factors as an oxide-coated cathode, coaxial elements, and metal-ceramic construction make the tube well adapted to application in modern systems where performance and reliability are important.

Electrical

	Minimum	Bogey	Maximum	
Heater Voltage*	—	6.3	6.8	Volts
Heater Current	—	3.8	—	Amperes
Cathode Heating Time	1	—	—	Minutes
Amplification Factor, G_2 to G_1, E_b=1000V DC; $E_{g}2$=275V DC; I_b=0.2 A DC	—	14	—	
Peak Cathode Current†	—	—	1.75	Amperes
Direct Interelectrode Capacitances				
Cathode to Plate‡	—	0.006	—	μμf
Input, G_2 tied to G_1	—	19.5	—	μμf
Output, G_2 tied to G_1♦	—	6.4	—	μμf

Mechanical

Mounting Position—Any

Net Weight, approximate	1.0	Pounds

Thermal

Cooling—Forced Air§

Through Radiator, at Sea Level**

Plate Dissipation	500	400	300	Watts
Air Flow, 45 C Incoming Air Temperature, minimum	17.0	12.0	6.5	Cubic Feet per Minute
Static Pressure, approximate	0.9	0.5	0.2	Inches-Water
Radiator Hub Temperature, at Point Adjacent to Anode Seal	—	—	250	C
Seals				
Screen-Grid to Control-Grid, approximate	—	—	1	Cubic Feet per Minute
Heater to Cathode, approximate	—	—	1	Cubic Feet per Minute
Ceramic Temperature at Any Point, maximum	—	—	200	C

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B LINEAR

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings		
DC Plate Voltage	2000	Volts
DC Grid-No. 2 Voltage	320	Volts
DC Plate Current	0.250	Amperes
Plate Input	500	Watts
Grid-No. 2 Input	5	Watts
Plate Dissipation	500	Watts

Typical Operation		
Grounded-Grid Circuit at 225–400 Megacycles		
DC Plate Voltage	1750	Volts
DC Grid-No. 2 Voltage	250	Volts
DC Grid-No. 1 Voltage, approximate	−20	Volts
Peak RF Plate Voltage #, approximate	1250	Volts
Peak RF Grid-No. 1 Voltage #, approximate	40	Volts
DC Plate Current	0.200	Amperes
Zero Signal DC Plate Current (E_{c1} adjusted)	0.020	Amperes
DC Grid-No. 2 Current	0.005	Amperes
DC Grid-No. 1 Current	0.010	Amperes
Driving Power, approximate	5	Watts
Power Output ♥	110	Watts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

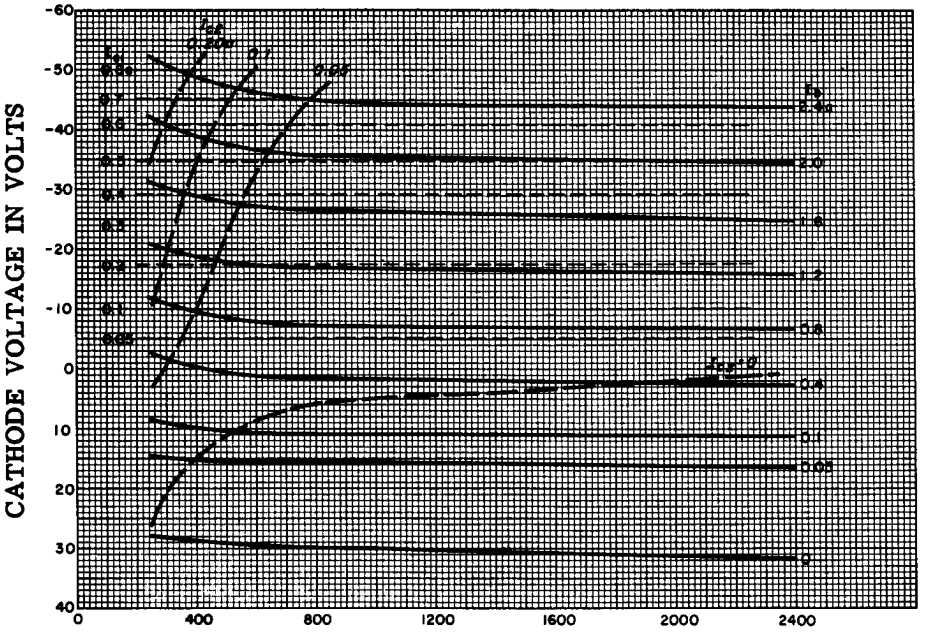
Key-down conditions per tube without amplitude modulation△

Maximum Ratings	900 Megacycles	400 Megacycles	
DC Plate Voltage	1600	2000	Volts
DC Grid-No. 2 Voltage	320	320	Volts
DC Grid-No. 1 Voltage	−100	−100	Volts
DC Plate Current	0.300	0.300	Ampere
DC Grid-No. 1 Current	0.050	0.050	Ampere
Plate Input	480	600	Watts
Grid-No. 2 Input	15	15	Watts
Plate Dissipation	500	500	Watts
Grid-No. 1 Dissipation	2	2	Watts

Typical Operation			
Grounded-Grid Circuit at 900 Megacycles			
DC Plate Voltage	1500	2000	Volts
DC Grid-No. 2 Voltage	210	225	Volts
DC Grid-No. 1 Voltage	−40	−40	Volts
DC Plate Current	0.300	0.250	Ampere
DC Grid-No. 2 Current, approximate	0.010	0.010	Ampere
DC Grid-No. 1 Current, approximate	0.020	0.020	Ampere
Driving Power, approximate	14	15	Watts
Power Output, approximate ¶	205	300	Watts

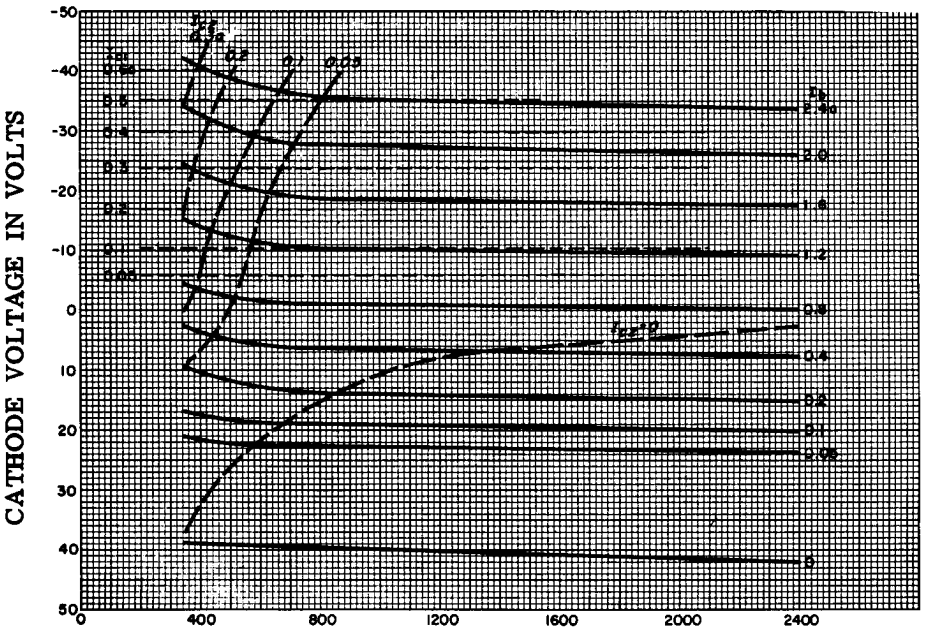
* Because the temperature of the cathode is increased by back bombardment of electrons at UHF, required heater voltage for optimum life decreases with increasing frequency. The amount of heater-voltage reduction is dependent on operating conditions. However, this voltage should not be less than 5.5 volts.
† Represents maximum usable cathode current (plate current plus current to each grid) for any condition of operation.
‡ Measured with a 6-inch minimum diameter flat metal disk attached to the screen-grid ring. Control grid connected to the screen grid.
♦ Output capacitances measured between anode and screen grid. Control grid connected directly to screen grid.
§ Forced-air cooling to be applied before and during the application of any voltages.
**Provision must be made for unobstructed passage of cooling air between radiator fins and between the anode terminal and adjacent radiator fin.
♥ Useful power output as measured in output-circuit load.
¶ Useful power output including power transferred from driver stage. Output circuit efficiency approximately 80 percent.
△ Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 percent of the carrier conditions.

CONSTANT CURRENT CHARACTERISTIC
SCREEN VOLTAGE = 250 VOLTS
ALL VOLTAGES REFERENCED TO CONTROL GRID

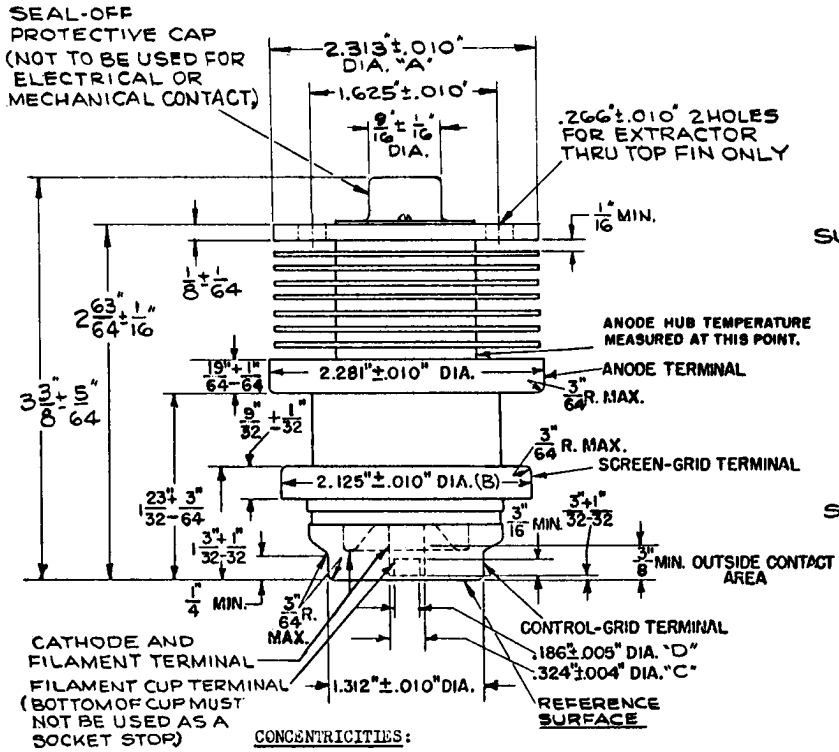


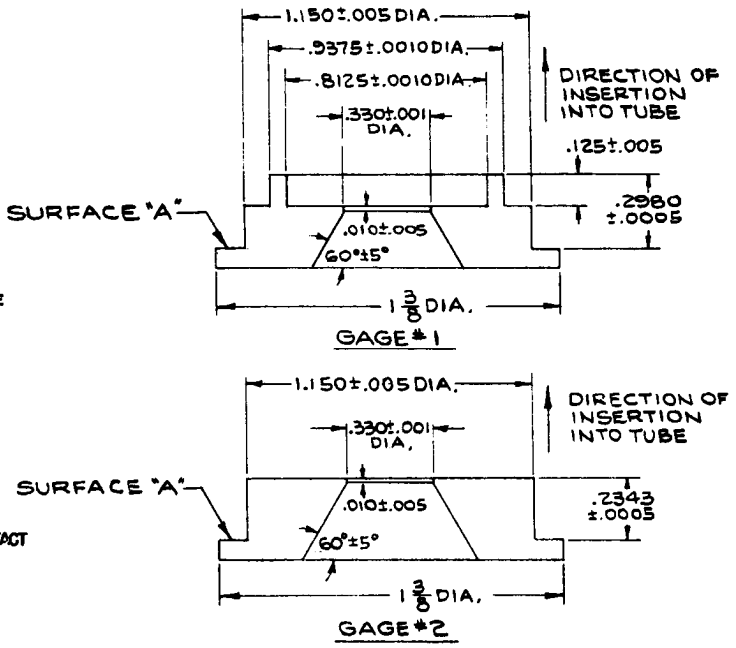
A69087 - 72B67 1-30-63

CONSTANT CURRENT CHARACTERISTIC
SCREEN VOLTAGE = 350 VOLTS
ALL VOLTAGES REFERENCED TO CONTROL GRID



A69087 - 72B68 1-30-63





ZP-1030
CATHODE AND FILAMENT TERMINAL GAGES

CONCENTRICITIES:

The following total indicator readings are measured with respect to a centerline determined by the centers of the anode terminal and control grid terminal.

Diameter A - 0.030 inches
Diameter B - 0.016 inches
Diameter C - 0.036 inches
Diameter D - 0.042 inches

Total indicator reading of filament cup terminal diameter (D) measured with respect to center of cathode and filament terminal diameter (C) - 0.016 inches.

When inserted over the cathode and filament terminal, gage #1 shall not contact the tube REFERENCE SURFACE at gage SURFACE "A".

When inserted over the cathode and filament terminal, gage #2 shall contact the tube REFERENCE SURFACE at gage SURFACE "A".

A-69087 - 72B58

12-31-62

TUBE DEPARTMENT
GENERAL ELECTRIC
Owensboro, Kentucky

GL-8513

TETRODE

VHF-UHF
RING-SEAL CONSTRUCTION

GROUNDED-GRID CIRCUIT

FORCED-AIR COOLED
METAL AND CERAMIC

The GL-8513 is a four-electrode transmitting tube featuring a metal-and-ceramic envelope for use as a power amplifier or oscillator in grounded-grid circuits with both grids maintained at radio-frequency ground potential. The output circuit is connected between the anode and the screen grid. The anode is capable of dissipating 4 kilowatts. Cooling is accomplished by forced air with the radiator an integral part of the anode. The cathode is a unipotential thoriated-tungsten cylinder, heated by electron bombardment. Maximum ratings apply up to 800 megacycles, although higher frequency operation is possible.

As a Class B linear power amplifier the tube will deliver 1500 watts at carrier level.

In narrow band, Class C, grounded-grid, amplitude-modulated service, the GL-8513 has a useful carrier-power output in excess of one kilowatt. In Class C Telegraphy, it has a useful power output of 3 kilowatts of continuous power as an amplifier or oscillator.

Electrical

	Minimum	Bogey	Maximum	
Cathode				
Heater Voltage	–	6.7	7.0	Volts
Heater Current at 7.0 Volts				
Without Cathode Bombarding	–	14.5	—	Amperes
With 150 Watts Cathode Bombarding	–	13.5	—	Amperes
Heater Starting Current	–	—	25	Amperes
Heater Cold Resistance	–	0.041	—	Ohms
Cathode Bombarding Power*	–	170	195	Watts
Cathode Bombarding Voltage, DC				
For 170 Watts Bombarding Power	–	650	—	Volts
For 195 Watts Bombarding Power	–	700	—	Volts
Cathode Heating Time	1	—	—	Minute
Amplification Factor, G_2 to G_1; $E_b = 4000$ volts; $I_b = 0.5$ ampere	–	20	—	
Peak Cathode Current†	–	—	6	Amperes
Direct Interelectrode Capacitances				
Cathode to Plate§	–	0.01	—	μμf
Input, G_2 tied to G_1	–	27.8	—	μμf
Output, G_2 tied to G_1¶	–	6.7	—	μμf

Mechanical

Mounting Position—Vertical, Anode-end Up

Net Weight, approximate	12.5	Pounds

Thermal

Type of Cooling—Forced Air

Air Flow Through Radiator, at Sea Level

Plate Dissipation	Air Flow	Static Pressure
4.0 Kw	135 CFM	2.8 In.

Seals		
Screen-grid to Control-grid, minimum	15	Cubic Feet per Minute
Heater-to-cathode, minimum	7.5	Cubic Feet per Minute
Anode Ceramic, minimum	10	Cubic Feet per Minute
Incoming Air Temperature, maximum	55	C
Anode Hub Temperature, maximum	250	C
Temperature of Anode Ceramic and Seals, maximum	250	C
Temperature at Any Other Point, maximum	200	C

Forced-air cooling to be applied before and during the application of any voltages. Air flow on heater-to-cathode seals must be maintained for one minute after removal of heater voltage. The radiator air ducting can be constructed so that air is forced along the anode seal and ceramic through the anode contact fingers and additional holes in the plate contact ring to accomplish the anode ceramic and anode seal cooling. The volume of cooling air indicated for the various seals is approximate only. Distribution of cooling air will vary with configuration of the cavity about the tube.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

Carrier Conditions per Tube for Use with a Maximum Modulation Factor of 1.0

Maximum Ratings, Absolute Values

DC Plate Voltage	9000	Volts
DC Grid-No. 2 Voltage	800	Volts
DC Plate Current	0.800	Ampere
Plate Input	6.0	Kilowatts
Grid-No. 2 Input	25	Watts
Plate Dissipation	4.0	Kilowatts

Typical Operation

Grounded-grid Circuit, 225–400 Megacycles		
DC Plate Voltage	8000	Volts
DC Grid-No. 2 Voltage	750	Volts
DC Grid-No. 1 Voltage, approximate	−50	Volts
DC Plate Current	0.600	Ampere
DC Grid-No. 2 Current	0.010	Ampere
DC Grid-No. 1 Current	0.060	Ampere
Driving Power, approximate	160	Watts
Measured at crest of audio-frequency cycle with modulation factor of 1.0		
Power Output#	1500	Watts
Circuit Efficiency	90	Percent
Plate Dissipation	2500	Watts
Cathode Bombarding Power*	170	Watts
Cathode Bombarding Voltage	650	Volts
Cathode Bombarding Current	0.260	Ampere

GENERAL ELECTRIC

PLATE MODULATED RADIO-FREQUENCY AMPLIFIER—CLASS C TELEPHONY

Carrier Conditions with a Maximum Modulation Factor of 1.0, Screen Modulation Required

Maximum Ratings, Absolute Values		
DC Plate Voltage	4500	Volts
DC Grid-No. 2 Voltage	500	Volts
DC Grid-No. 1 Voltage	−120	Volts
DC Plate Current	0.80	Ampere
DC Grid-No. 1 Current	0.120	Ampere
Plate Input	3.60	Kilowatts
Grid-No. 2 Input	25	Watts
Plate Dissipation	4.0	Kilowatts
Typical Operation		
Grounded-grid Circuit at 400 Megacycles		
DC Plate Voltage	4000	Volts
DC Grid-No. 2 Voltage	400	Volts
DC Grid-No. 1 Voltage	−100	Volts
Peak RF Plate Voltage	2500	Volts
Peak RF Driving Voltage	120	Volts
DC Plate Current	0.570	Ampere
DC Grid-No. 2 Current	0.020	Ampere
DC Grid-No. 1 Current, approximate	0.100	Ampere
Driving Power, approximate	100	Watts
Power Output#	1250	Watts
Output Circuit Efficiency	90	Percent
Cathode Bombarding Power*	165	Watts
Cathode Bombarding Voltage, approximate	630	Volts
Cathode Bombarding Current, approximate	0.260	Ampere

RADIO-FREQUENCY AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key Down Conditions per Tube Without Amplitude Modulation

Maximum Ratings, Absolute Values			
DC Plate Voltage	7000		Volts
DC Grid-No. 2 Voltage	750		Volts
DC Plate Current	1.0		Amperes
Plate Input	6.0		Kilowatts
Grid-No. 2 Input	40		Watts
Plate Dissipation	4.0		Kilowatts
DC Grid-No. 1 Voltage	120		Volts
DC Grid-No. 1 Current	0.150		Ampere
Typical Operation			
Grounded-grid Circuit at 400 Megacycles			
DC Plate Voltage	4500	6500	Volts
DC Grid-No. 2 Voltage	600	700	Volts
DC Grid-No. 1 Voltage	−120	−100	Volts
Peak RF Plate Voltage, approximate	3000	—	Volts
Peak RF Grid-No. 1 Voltage	140	140	Volts
DC Plate Current	0.6	0.8	Ampere
DC Grid-No. 2 Current	0.018	0.025	Ampere
DC Grid-No. 1 Current	0.080	0.100	Ampere
Driving Power, approximate	100	100	Watts
Power Output, approximate#	1800	3200	Watts
Output Circuit Efficiency	90	90	Percent
Cathode Bombarding Power*	160	165	Watts
Cathode Bombarding Voltage, approximate	610	630	Volts
Cathode Bombarding Current, approximate	0.260	0.260	Ampere
Grounded-grid Circuit at 800 Megacycles			
DC Plate Voltage	4500		Volts
DC Grid-No. 2 Voltage	600		Volts
DC Grid-No. 1 Voltage	−120		Volts
Peak RF Plate Voltage, approximate	3000		Volts
Peak RF Grid-No. 1 Voltage	140		Volts
DC Plate Current	0.6		Ampere
DC Grid-No. 2 Current	0.018		Ampere
DC Grid-No. 1 Current	0.080		Ampere
Driving Power, approximate	90		Watts
Power Output, approximate#	1250		Watts
Output Circuit Efficiency	83		Percent
Cathode Bombarding Power*	150		Watts
Cathode Bombarding Voltage, approximate	600		Volts
Cathode Bombarding Current, approximate	0.250		Ampere

* The cathode of the GL-8513, because of transit-time effects which raise the temperature of the cathode, is subjected to considerable back bombardment in ultra-high-frequency service. The amount of heating due to bombardment is a function of the operating conditions and frequency, and must be compensated for by a reduction of the cathode power input to prevent overheating of the cathode with resulting short life. In any case it is important from a tube life standpoint to keep the cathode power at as low a level as possible consistent with required performance. Bombarder power should be monitored by a suitable wattmeter or DC voltmeter and milliammeter arrangement. For long life, the tube should be put in operation with about 180 watts bombarding power. After the circuit has been adjusted for proper tube operation, bombarding voltage should be reduced to a value slightly above that at which circuit performance is affected. Minor circuit readjustment may be necessary after the above adjustment. The procedure for determining proper bombarding power should be repeated periodically.

† Represents maximum usable cathode current (plate current plus current to each grid) for any condition of operation.

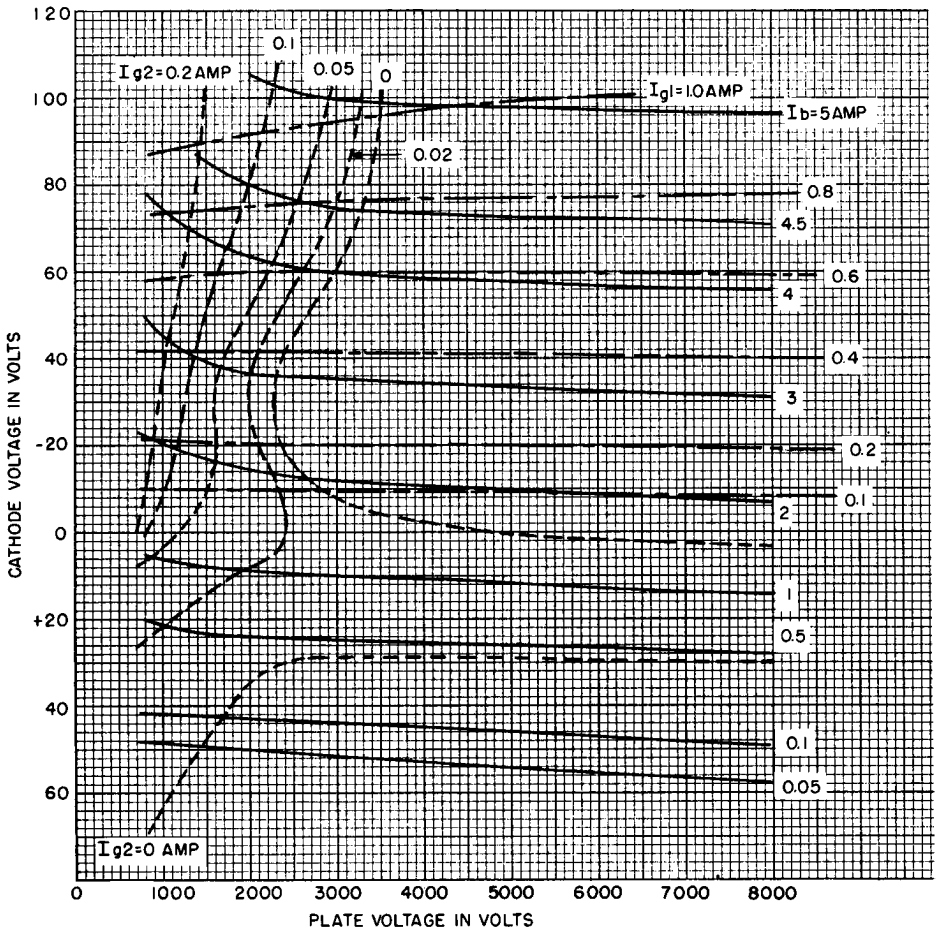
§ Measured with complete isolation between cathode and plate.

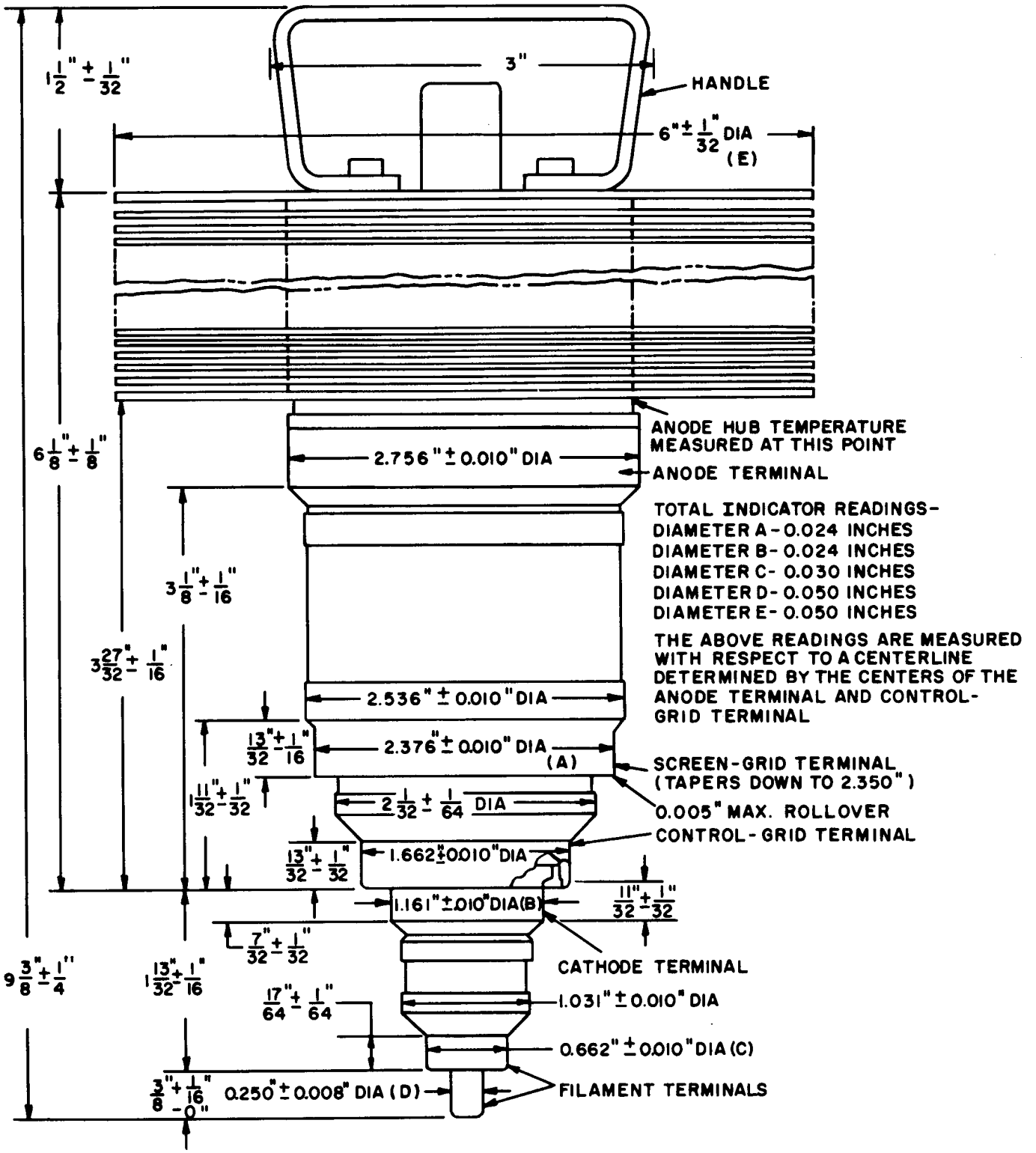
¶ Output capacitance measured between anode and screen grid. Control grid connected directly to screen grid.

\# Useful power output including power transferred from driver stage.

TYPICAL CHARACTERISTICS

Eg2 = 750 Volts, Ef = 7 Volts AC
Bombarding Power = 180 Watts
All Voltages Referenced to Grid




3"
HANDLE
6" ± 1/32" DIA (E)
ANODE HUB TEMPERATURE MEASURED AT THIS POINT
2.756" ± 0.010" DIA
ANODE TERMINAL
TOTAL INDICATOR READINGS-
DIAMETER A - 0.024 INCHES
DIAMETER B - 0.024 INCHES
DIAMETER C - 0.030 INCHES
DIAMETER D - 0.050 INCHES
DIAMETER E - 0.050 INCHES
THE ABOVE READINGS ARE MEASURED WITH RESPECT TO A CENTERLINE DETERMINED BY THE CENTERS OF THE ANODE TERMINAL AND CONTROL-GRID TERMINAL
2.536" ± 0.010" DIA
2.376" ± 0.010" DIA (A)
SCREEN-GRID TERMINAL (TAPERS DOWN TO 2.350")
0.005" MAX. ROLLOVER
2 1/32 ± 1/64 DIA
CONTROL-GRID TERMINAL
1.662" ± 0.010" DIA
1.161" ± 0.010" DIA (B)
CATHODE TERMINAL
1.031" ± 0.010" DIA
0.662" ± 0.010" DIA (C)
0.250" ± 0.008" DIA (D)
FILAMENT TERMINALS
1 1/2" ± 1/32"
6 1/8" ± 1/8"
3 1/8" ± 1/16"
3 27/32" ± 1/16"
13/32" ± 1/16"
1 11/32" ± 1/32"
13/32" ± 1/32"
11/32" ± 1/32"
7/32" ± 1/32"
9 3/8" ± 1/4"
1 13/32" ± 1/16"
17/64" ± 1/64"
3/8" +1/16" -0"

Tetrode

GL-8866



GRID-PULSED SERVICE
GROUNDED-GRID OPERATION

HEAT-SINK AND FORCED-AIR COOLED
METAL AND CERAMIC

The GL-8866 is a reduced-size heat-sink-cooled version of the GL-6283 especially designed for pulsed-amplifier or oscillator service at L-band frequencies. This tetrode is particularly well suited for use in airborne radar equipment such as IFF transponders.

The tube is capable of providing useful output at frequencies up to approximately 1500 megacycles.

Features of the 8866 include long life and reliability, long pulse width and high gain.

Electrical

	Minimum	Bogey	Maximum	
Heater Voltage (See Note 1)	—	6.3	—	Volts
Heater Current	—	3.8	—	Amperes
Cathode Heating Time	1	—	—	Minute
Direct Interelectrode Capacitances*				
Cathode to Plate†	—	0.006	—	μμf
Input	—	20	—	μμf
Output	—	8.9	—	μμf

Mechanical

Mounting Position—Any		
Net weight, approximate	9	Ounces

Thermal

Cooling—Heat-sink and Forced-Air‡		
Anode Temperature§, maximum	250	C
Seals		
Screen and Control Grid, approximate	1	Cubic Foot per Minute
Heater and Cathode, approximate	1	Cubic Foot per Minute
Ceramic Temperature at Any Point, aaximum	200	C

RADIO-FREQUENCY POWER AMPLIFIER—CLASS C

Maximum Ratings

Pulsed Drive, 1250 Megacycles		
DC Plate Voltage	3.5	Kilovolts
DC Plate Current, during pulse	5	Amperes
DC Grid-No. 2 Voltage	750	Volts
DC Grid-No. 2 Input	5	Watts
DC Grid-No. 1 Voltage	−200	Volts
Plate Dissipation	150	Watts
Pulse Width ♥♦	15	Microseconds
Duty Factor ♥ϕ	.02	

Typical Operation

Grounded-Grid Service at 1100 Megacycles,	¼λ	Output Circuit	
DC Plate Voltage	2.5	2.5	Kilovolts
DC Plate Current, during pulse	1.4	1.0	Amperes
DC Grid-No. 2 Voltage	600	600	Volts
DC Grid-No. 2 Current, during pulse	50	0	Milliamperes
DC Grid-No. 1 Voltage	−70	−70	Volts
DC Grid-No. 1 Current, during pulse	90	80	Milliamperes
Driving Power at the Tube, during pulse	165	95	Watts
Power Output, during pulse (useful)	1.6	1.0	Kilowatts
Pulse Width	.6	6	Microseconds
Duty Factor	.02	.02	

Note 1: Under the typical operating conditions shown the heater voltage should be reduced to approximately 6.0 volts because of back-heating resulting from transit-time effects.

* Control grid connected directly to screen grid.

† Complete external shielding between cathode and plate.

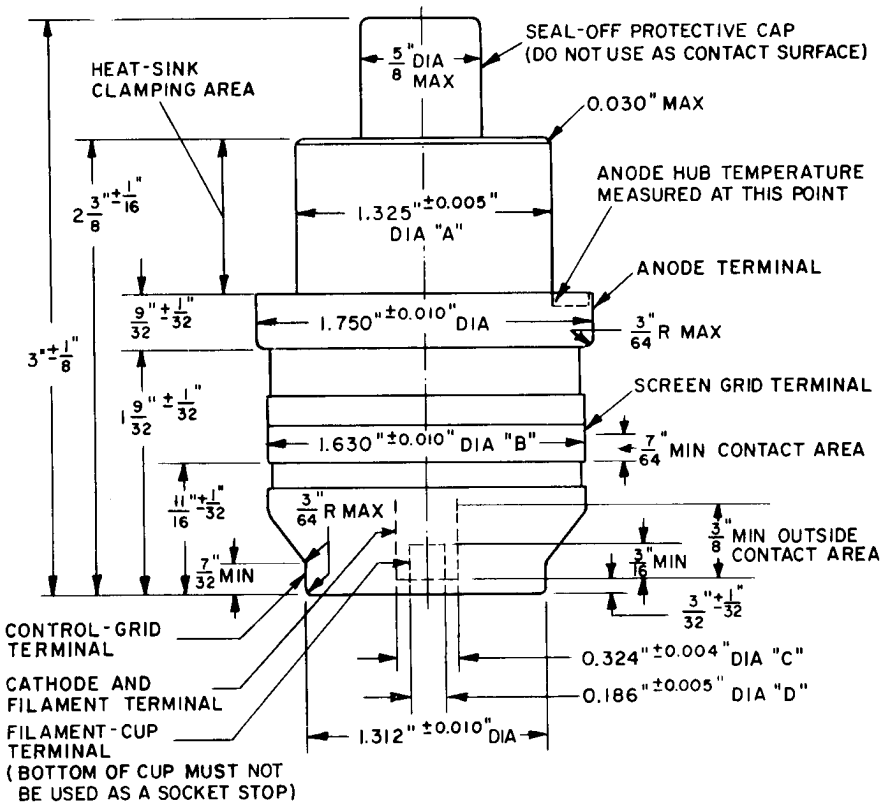
‡ Forced air cooling should be applied during the application of any voltages.

§ A suitable heat-sink clamping arrangement must be provided to limit the anode hub temperature to the value specified; the temperature is measured at the point indicated on the outline drawing.

♥ For applications that require longer pulses or higher duty refer to the tube manufacturer for recommendations.

♦ Pulse duration measured between points at 70 percent of peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.

ϕ Maximum ratio of on-time to elapsed time during any 7.5-millisecond period.



CONCENTRICITIES:

THE FOLLOWING TOTAL INDICATOR READINGS ARE MEASURED WITH RESPECT TO A CENTERLINE DETERMINED BY THE CENTERS OF THE ANODE TERMINAL AND CONTROL-GRID TERMINAL.

DIAMETER "A" – 0.030 INCH
DIAMETER "B" – 0.016 INCH
DIAMETER "C" – 0.036 INCH
DIAMETER "D" – 0.042 INCH

TOTAL INDICATOR READING OF FILAMENT CUP-TERMINAL DIAMETER (D) MEASURED WITH RESPECT TO CENTER OF CATHODE AND FILAMENT-TERMINAL DIAMETER (C) 0.016 INCH

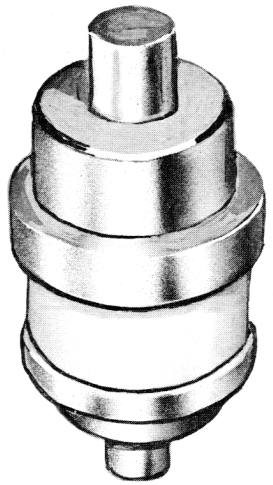
TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady, N. Y. 12305

Triode

GL-51025



INTERNAL FEEDBACK FOR OSCILLATOR SERVICE
GROUNDED-GRID OPERATION

METAL AND CERAMIC
HEAT-SINK AND FORCED-AIR COOLED

The GL-51025 is a heat-sink-cooled triode especially designed for pulsed oscillator service in L-band. This type is particularly well suited for use in airborne or ground-based radar equipment.

The tube features internal feedback which eliminates the need for the complicated external circuit arrangements normally required in oscillator service.

Other features include small size, high peak power, long-pulse-width capability, long life and reliability.

	Minimum	Bogey	Maximum	
Electrical				
Heater Voltage*	-	6.3	-	Volts
Heater Current	3.5	3.8	4.0	Amperes
Cathode Heating Time	1	-	-	Minute
Direct Interelectrode Capacitances				
Cathode to Plate	-	0.45	-	μμf
Input	-	15.5	-	μμf
Output	-	5.9	-	μμf
Mechanical				
Mounting Position – Any				
Net Weight, approximate			3 1/4	Ounces
Thermal				
Cooling – Heat-Sink and Forced Air				
Anode Temperature§			250	C
Ceramic Temperature at Any Point, maximum			200	C

PLATE-PULSED OSCILLATOR — CLASS C

Maximum Ratings		
DC Plate Voltage, During Pulse	8.0	Kilovolts
DC Plate Current, During Pulse	10.0	Amperes
DC Grid Voltage, During Pulse	-400	Volts
DC Grid Current, During Pulse	5.0	Amperes
Plate Dissipation §	110	Watts
Grid Dissipation	3.5	Watts
Pulse Width ◇	10	Microseconds
Duty Factor ø	0.003	

Typical Operation

Grounded-Grid Service at 1300 Megacycles, 3/4 λ Output Circuit

DC Plate Voltage, During Pulse	8.0	6.0	Kilovolts
DC Plate Current, During Pulse	9.0	7.0	Amperes
DC Grid Current, During Pulse (Grid Resistor = 50 Ohms)	4.0	4.3	Amperes
Power Output, During Pulse (useful)	40.0	24.0	Kilowatts
Pulse Width	10	10	Microseconds
Duty Factor	0.003	0.001	

GRID-PULSED OSCILLATOR — CLASS C

Maximum Ratings

DC Plate Voltage	2.5	Kilovolts
DC Plate Current, During Pulse	3.0	Amperes
DC Grid Voltage	-200	Volts
Plate Dissipation	100	Watts
Pulse Width ◇	15	Microseconds
Duty Factor ϕϕ	0.02	

Typical Operation

Grounded-Grid Circuit at 1100 Megacycles, 1/4 λ Output

DC Plate Voltage	1750	1950	2200	Volts
DC Plate Current, During Pulse	2.2	2.6	2.7	Amperes
DC Grid Voltage Supply**	-97	-104	-104	Volts
DC Grid Current, During Pulse	1.05	1.2	1.25	Amperes
Power Output, During Pulse (useful)	1.5	2.0	2.4	Kilowatts
Pulse Width	10	10	10	Microseconds
Duty Factor	0.02	0.02	0.02	

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* Because of back-heating due to transit time effects, it may be necessary to reduce the heater voltage. For the 1100 mcs, 2 kw, 0.02 duty condition, the typical heater voltage is 5.5 volts. The optimum heater voltage for any application should be determined by RF performance testing.

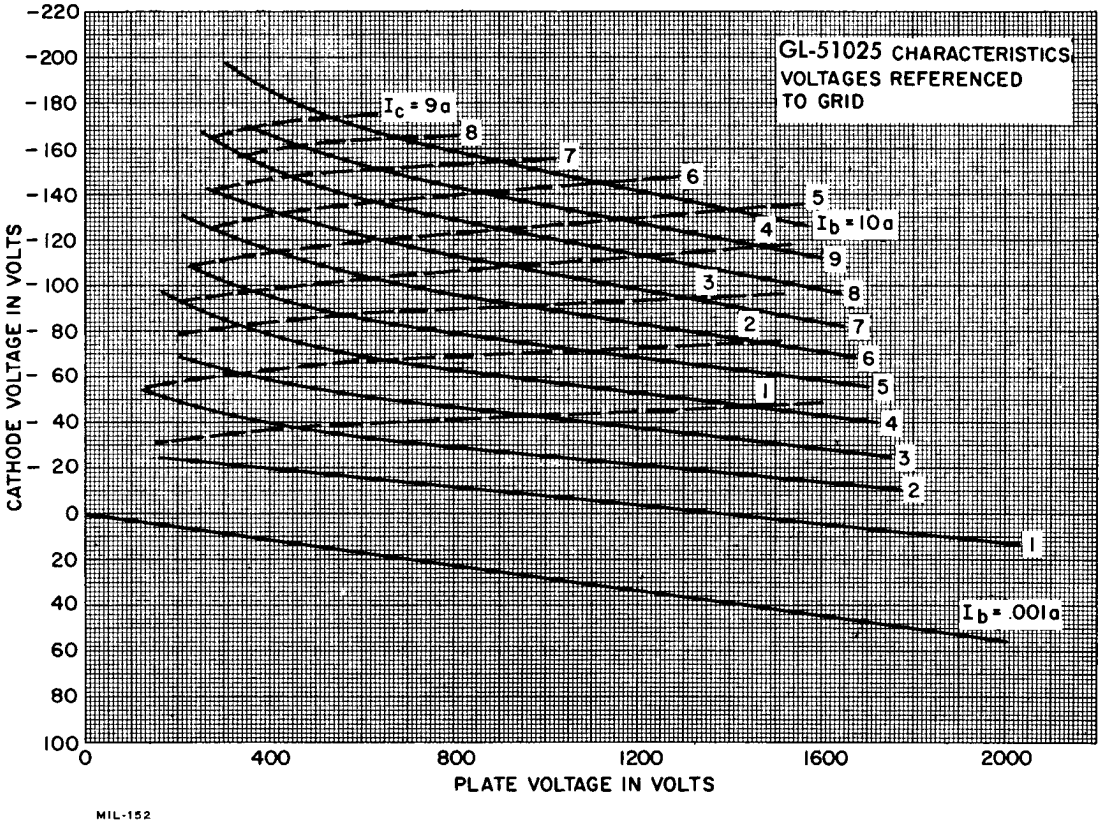
§ A suitable clamp-on radiator or heat-sink clamping arrangement must be provided to limit the anode hub temperature to the value specified. Higher plate dissipation is allowable with provision for proper cooling.

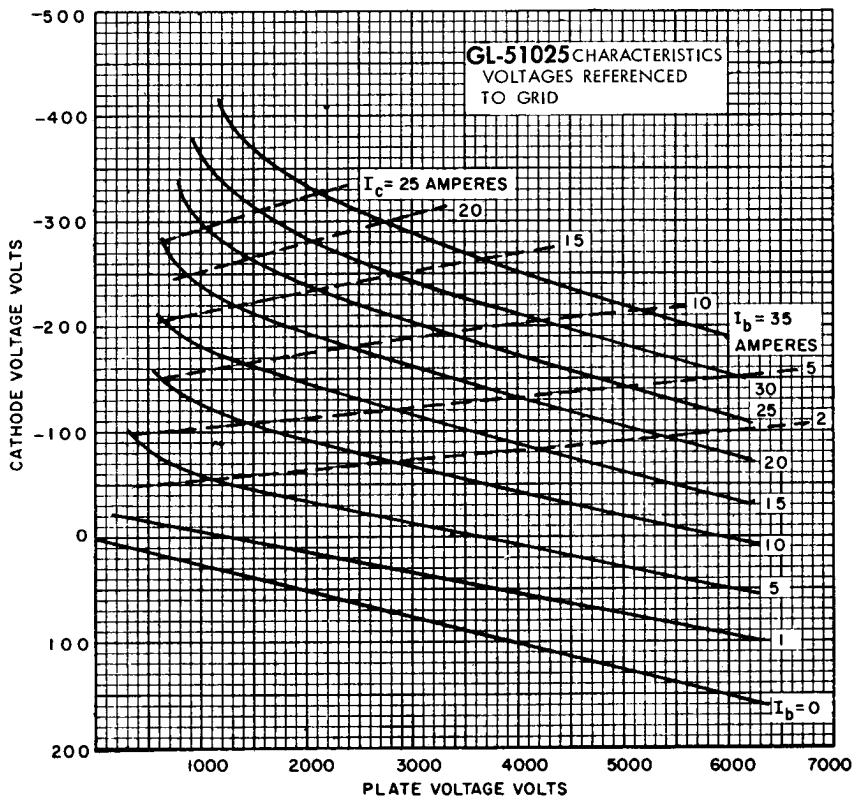
◇ Pulse duration is measured between points at 70 percent of the peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse. For applications requiring longer pulses, refer to the tube manufacturer.

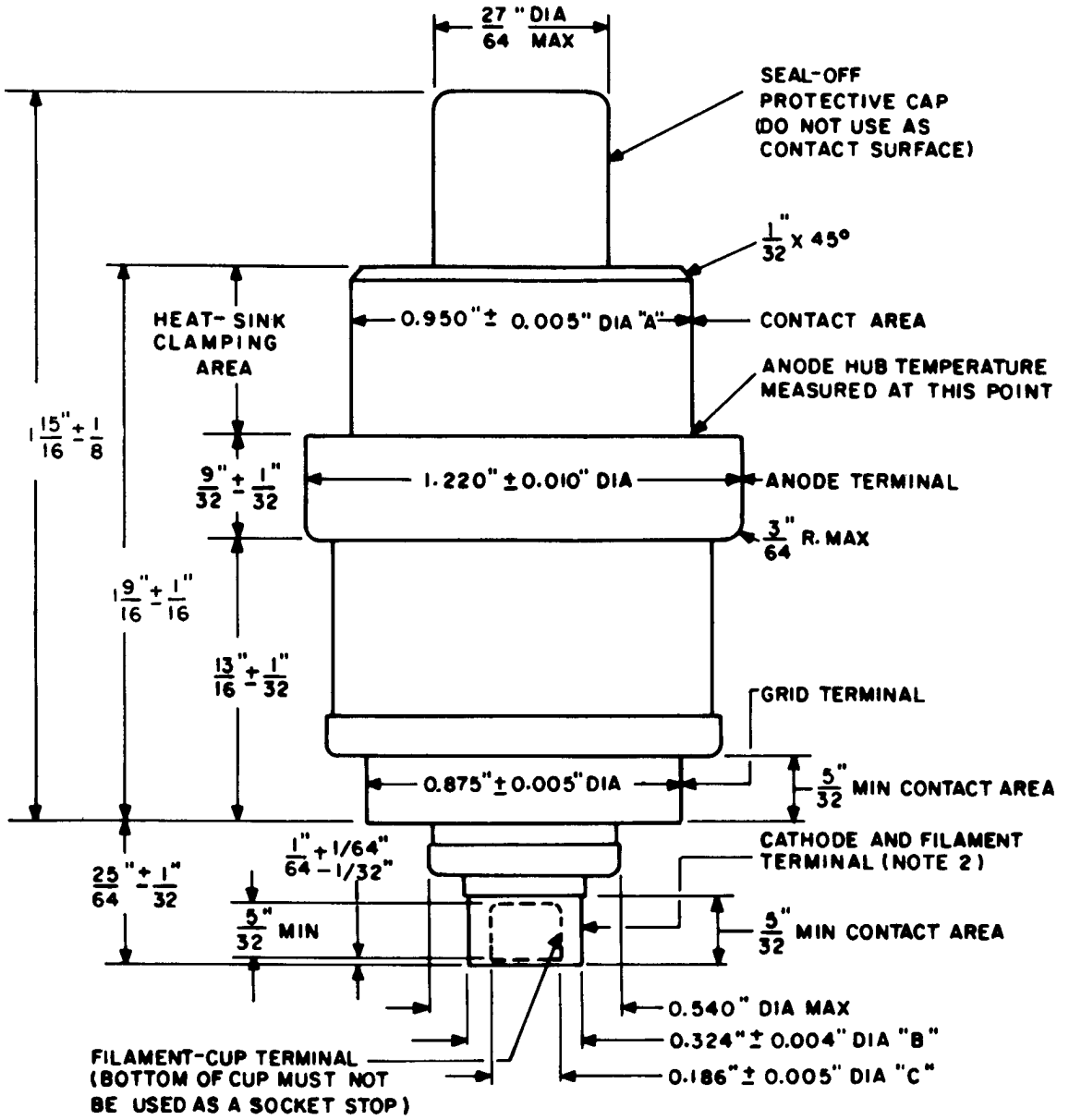
ϕ Maximum ratio of on-time to elapsed time during any 3.3-millisecond period.

ϕϕ Maximum ratio of on-time to elapsed time during any 75-millisecond period.

** With a series grid resistance of 50 ohms.


GL-51025 CHARACTERISTICS
VOLTAGES REFERENCED
TO GRID
I_c = 9a
8
7
6
5
4
I_b = 10a
9
8
3
7
2
6
5
1
4
3
2
1
I_b = .001a
CATHODE VOLTAGE IN VOLTS
-220
-200
-180
-160
-140
-120
-100
-80
-60
-40
-20
0
20
40
60
80
100
0
400
800
1200
1600
2000
PLATE VOLTAGE IN VOLTS
MIL-152


GL-51025 CHARACTERISTICS
VOLTAGES REFERENCED
TO GRID
I_c = 25 AMPERES
20
15
10
I_b = 35
AMPERES
5
30
25
2
20
15
10
5
1
I_b = 0
CATHODE VOLTAGE VOLTS
-500
-400
-300
-200
-100
0
100
200
1000
2000
3000
4000
5000
6000
7000
PLATE VOLTAGE VOLTS



CONCENTRICITIES:

THE FOLLOWING TOTAL INDICATOR READINGS ARE MEASURED WITH RESPECT TO A CENTERLINE DETERMINED BY THE CENTERS OF THE ANODE TERMINAL AND CONTROL-GRID TERMINAL.

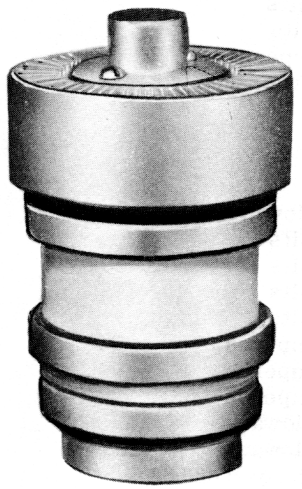
DIAMETER A-0.030 INCHES
DIAMETER B-0.036 INCHES
DIAMETER C-0.042 INCHES

TOTAL INDICATOR READING OF FILAMENT-CUP TERMINAL DIAMETER (C) MEASURED WITH RESPECT TO CENTER OF CATHODE AND FILAMENT-TERMINAL DIAMETER (B)-0.016 INCHES.

TUBE PRODUCTS DEPARTMENT
GENERAL ELECTRIC
Schenectady, New York 12305

Tetrode

GL-51038



PULSED SERVICE
GROUNDED-GRID OPERATION

FORCED-AIR COOLED
METAL AND CERAMIC

INTEGRAL RADIATOR

The GL-51038 is a small-size, four-electrode transmitting tube especially designed for RF grid-pulsed or plate-and-screen pulsed amplifier service at L-band frequencies. This tetrode is particularly well suited for use in airborne or ground-based radar equipment.

The tube is capable of providing useful output at frequencies up to approximately 1500 megacycles.

Features of the GL-51038 include long life and reliability, long pulse width, high peak power and high gain, broad-banding capability, and resistance to shock and vibration.

These together with such design factors as an oxide-coated cathode, coaxial elements, and metal-ceramic construction make the tube well adapted to application in modern systems where high performance and reliability are important.

Electrical	Minimum	Bogey	Maximum	
Heater Voltage (See Note 1)	–	6.3	6.8	Volts
Heater Current	–	5.6	–	Amperes
Cathode Heating Time	1	–	–	Minute
Direct Interelectrode Capacitances*				
Input	–	24	–	$\mu\mu$f
Output	–	9	–	$\mu\mu$f

Mechanical		
Mounting Position – Any		
Net Weight	0.8	Pounds

Thermal				
Cooling – Forced Air‡				
Radiator§				
Plate Dissipation	600	400	–	Watts
Air Flow, 45 C incoming air temperature, at sea level	9	4.5	–	Min Cubic Feet per Minute
Static Pressure, approximate	0.5	0.2	–	Inches-Water
Anode Hub Temperature △			250	Max C
Seals				
Screen and Control Grid, approximate			1	Cubic Foot per Minute
Heater and Cathode, approximate			1	Cubic Foot per Minute
Ceramic Temperature at any Point			200	Max C

Note 1: Because the temperature of the cathode is increased by back bombardment of electrons at UHF, required heater voltage for optimum life decreases with increasing frequency. The amount of heater-voltage reduction is dependent on operating conditions. However, this voltage should not be less than 5.5 volts.

RADIO-FREQUENCY POWER AMPLIFIER – CLASS B

Maximum Ratings

Plate- and Screen-Grid Pulsed, 500 Megacycles

DC Plate Voltage, during pulse	10	Kilovolts
DC Plate Current, during pulse	10	Amperes
DC Grid-No. 2 Voltage, during pulse	2000	Volts
DC Grid-No. 2 Input♠	15	Watts
Plate Dissipation♠	500	Watts
DC Grid-No. 1 Voltage, not pulsed	-175	Volts
DC Grid-No. 1 Current, during pulse	2.5	Amperes
Pulse Width♥ ◊	15	Microseconds
Duty Factor♥ ø	0.0012	

Typical Operation

Grounded-grid Circuit, 500 Megacycles, 1/4 λ Output Circuit

DC Plate Voltage, during pulse	9	Kilovolts
DC Grid-No. 2 Voltage, during pulse	1400	Volts
DC Grid-No. 1 Voltage, not pulsed	-125	Volts
Peak RF Plate Voltage	7000	Volts
Peak RF Grid Voltage	300	Volts
DC Plate Current, during pulse	9.2	Amperes
DC Grid-No. 1 Current, during pulse	1.1	Amperes
DC Grid-No. 2 Current, during pulse	0.47	Amperes
Driving Power at Tube, during pulse	2.6	Kilowatts
Power Output, during pulse (useful)	52	Kilowatts
Pulse Width◊	15	Microseconds
Duty Factor	0.001	

RADIO-FREQUENCY POWER AMPLIFIER – CLASS C

Maximum Ratings

Pulsed Drive, 1250 Megacycles

DC Plate Voltage	5	Kilovolts
DC Plate Current, during pulse	6	Amperes
DC Grid-No. 2 Voltage	1.1	Kilovolts
DC Grid-No. 2 Input	5	Watts
DC Grid-No. 1 Voltage	-225	Volts
DC Grid-No. 1 Current	1.5	Amperes
Plate Dissipation	500	Watts
Pulse Width♥ ◊	15	Microseconds
Duty Factor♥ øø	0.01	

Typical Operation

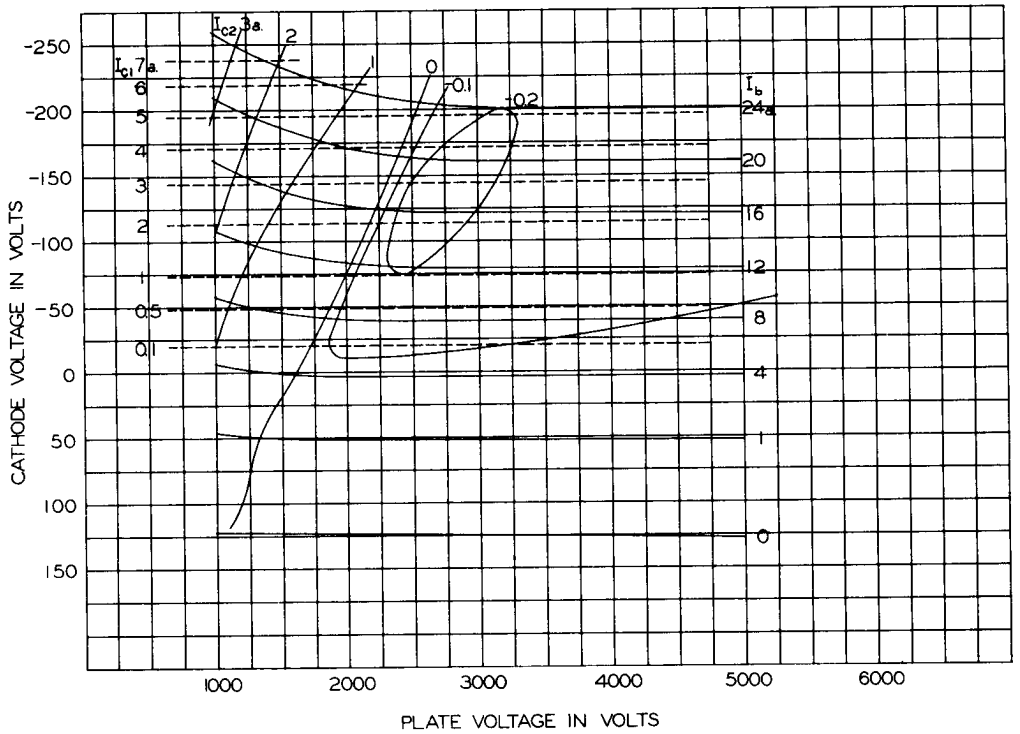
Grounded-grid Circuit at 1100 Megacycles, 3/4λ Output Circuit

DC Plate Voltage**	4.8	Kilovolts
DC Plate Current, during pulse	4.2	Amperes
DC Grid-No. 2 Voltage	1	Kilovolt
DC Grid-No. 2 Current, during pulse	100	Milliamperes
DC Grid-No. 1 Voltage	-200	Volts
DC Grid-No. 1 Current, during pulse	200	Milliamperes
Driving Power at Tube, during pulse	1.5	Kilowatts
Power Output, during pulse (useful)	11	Kilowatts
Pulse Width◊	15	Microseconds
Duty Factor	0.01	

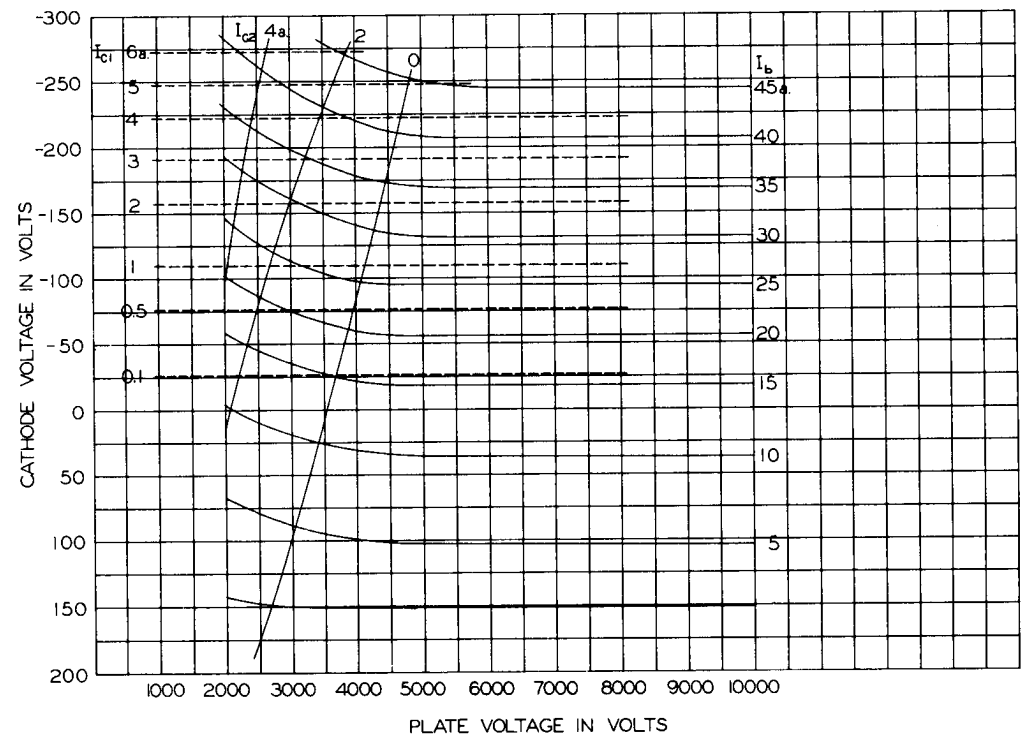
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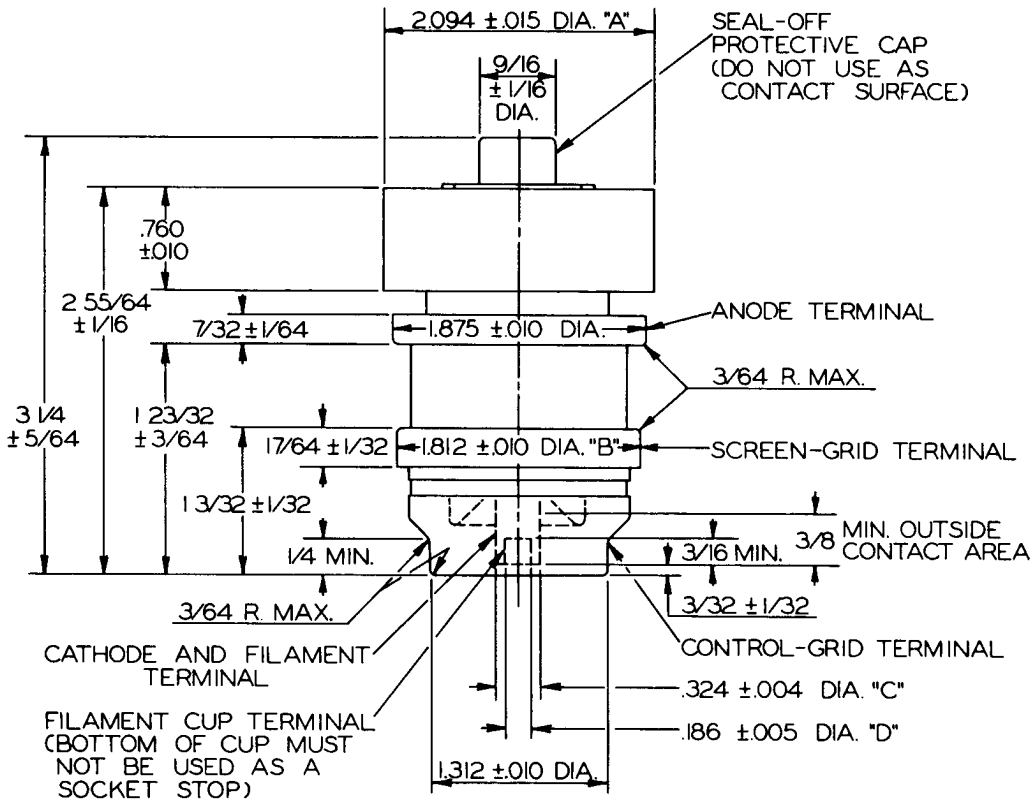
* Control grid connected directly to screen grid.
‡ Forced air cooling should be applied during the application of any voltages.
§ Provision must be made for unobstructed passage of cooling air through the radiator fins, and between the anode terminal and adjacent portion of the radiator.
△ Measured at the base of the radiator and adjacent to the plate terminal.
♠ Maximum average value.
♥ For applications that require longer pulses or higher duty refer to the tube manufacturer for recommendations.
◊ Pulse duration measured between points at 70 percent of peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.
ø Maximum ratio of on-time to elapsed time during any 12.5-millisecond period.
øø Maximum ratio of on-time to elapsed time during any 1.5-millisecond period.
** A minimum surge-limiting resistance of 50 ohms must be placed between the plate of the tube and the B+ power supply at steady-state voltages greater than 3.5 kilovolts.

CONSTANT CURRENT CHARACTERISTIC
SCREEN VOLTAGE = 1000 VOLTS
ALL VOLTAGES REFERENCED TO CONTROL GRID



CONSTANT CURRENT CHARACTERISTIC
SCREEN VOLTAGE = 2000 VOLTS
ALL VOLTAGES REFERENCED TO CONTROL GRID





CONCENTRICITIES:

The following total indicator readings are measured with respect to a centerline determined by the centers of the anode terminal and control grid terminal.

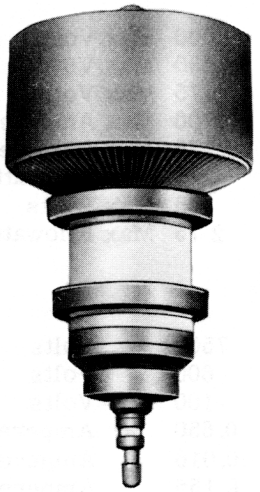
Diameter A – 0.030 inches
Diameter B – 0.016 inches
Diameter C – 0.036 inches
Diameter D – 0.042 inches

Total indicator reading of filament cup terminal diameter (D) measured with respect to center of cathode and filament terminal diameter (C) – 0.016 inches.

TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady, N. Y. 12305

Tetrode

GL-51064



VHF-UHF METAL CERAMIC TETRODE
4 KILOWATTS USEFUL CW OUTPUT
750 WATTS CLASS B LINEAR OUTPUT
FORCED AIR COOLED
INTEGRAL RADIATOR
THORIATED-TUNGSTEN CATHODE

The GL-51064 is a forced-air cooled power tetrode that delivers useful output to approximately 1250 megacycles. This tube is particularly suitable for application as an AM or FM power amplifier in the final output or driver stage of VHF-UHF military communications systems.

The tube features high power gain, as much as 14 db, while delivering up to 4000 watts of useful CW power as a grounded-grid Class C amplifier at 400 megacycles. An output capacitance of only 6.0 $\mu\mu$f, which is significantly low for a tube of its power handling capability, makes the GL-51064 well suited for application in equipments requiring broad electronic bandwidth.

Other features include metal-ceramic construction, a high efficiency axial flow radiator capable of dissipating 2750 watts, and an indirectly heated thoriated tungsten cathode.

Electrical

	Minimum	Bogey	Maximum	
Heater Voltage *	...	5.7	...	Volts
Heater Current at 5.7 Volts	22	24	26	Amperes
Heater Starting Current	...	...	36	Amperes
Heater Cold Resistance	...	0.02	...	Ohms
Cathode Heating Time	1	...	...	Minute
Amplification Factor, G_2 to G_1 Eb = 2000 Volts, I_b = 0.200 Ampere, E_{c2} = 475 Volts	12	17	22	
Direct Interelectrode Capacitances				
Cathode to Plate ‡	...	...	0.006	$\mu\mu$f
Input, G_2 tied to G_1	15.5	17.0	18.5	$\mu\mu$f
Output, G_2 tied to G_1 §	...	6.0	...	$\mu\mu$f

Mechanical

Mounting Position		Vertical
Net Weight, approximate	5.0	Pounds

Thermal

Cooling-Forced Air ¶
Through Radiator, at Sea Level

Plate Dissipation	Air Flow	Static Pressure
2.75 Kilowatts	140 Min CFM	1.9 Inches Water
2.0 Kilowatts	90 Min CFM	0.8 Inches Water
1.5 Kilowatts	55 Min CFM	0.4 Inches Water

Seals	
Screen-Grid to Control-Grid	4 Min CFM
Heater-to-Cathode	8 Min CFM
Anode to Screen-Grid Ceramic Insulator	6 Min CFM
Incoming Air Temperature	25 Max C
Radiator Hub Temperature (Adjacent to Anode Seal)	180 Max C
Temperature at Any Other Point	200 Max C

Forced-air cooling to be applied before and during the application of any voltages. Forced-air cooling must be maintained for one minute after the removal of all voltages.

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR – CLASS C

Maximum Ratings, Absolute Values	420 mcs	1000 mcs	
DC Plate Voltage	8000	6000	Max Volts
DC Grid-No. 2 Voltage	650	650	Max Volts
DC Grid-No. 1 Voltage	-175	-175	Max Volts
DC Plate Current	0.700	0.700	Max Amperes
DC Grid-No. 1 Current	0.175	0.175	Max Amperes
Plate Input	5.6	4.2	Max Kilowatts
Grid-No. 2 Input	25	25	Max Watts
Plate Dissipation	2.75	2.75	Max Kilowatts

Typical Operation – Grounded-Grid Circuit @ 400 mcs			
DC Plate Voltage	5500	7500	Volts
DC Grid-No. 2 Voltage	600	600	Volts
DC Grid-No. 1 Voltage	-100	-100	Volts
DC Plate Current	0.450	0.650	Amperes
DC Grid-No. 2 Current	0.012	0.016	Amperes
DC Grid-No. 1 Current	0.085	0.155	Amperes
Driving Power, approx	90	150	Watts
Power Output, useful ø	2000	4000	Watts
Power Gain, approx	13.5	14.3	db

RADIO-FREQUENCY POWER AMPLIFIER – CLASS B LINEAR SERVICE

Maximum Ratings at 420 Megacycles, Absolute Values		
DC Plate Voltage	8000	Max Volts
DC Grid-No. 2 Voltage	650	Max Volts
DC Plate Current	585	Max Milliamperes
Plate Input	4150	Max Watts
Grid-No. 2 Input	16	Max Watts
Plate Dissipation	2750	Max Watts

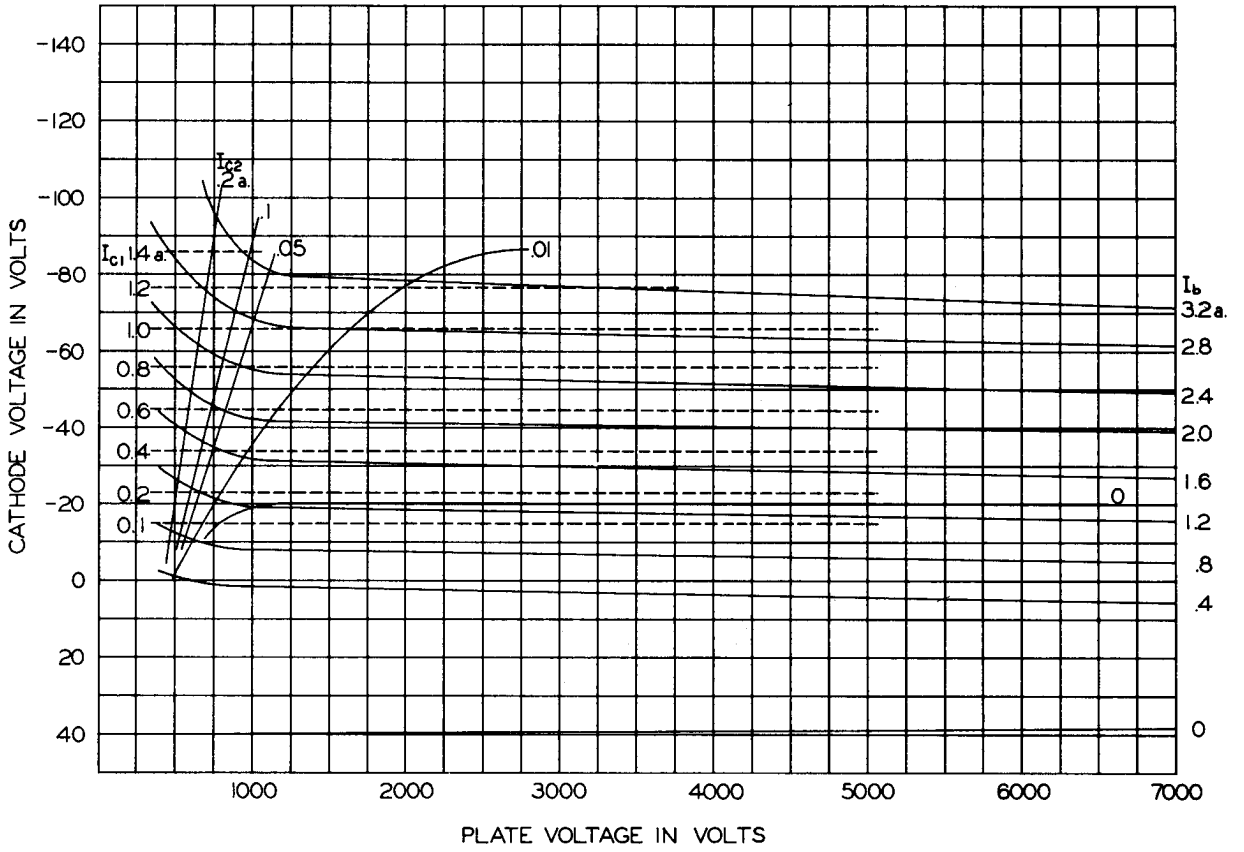
Typical Operation at 400 Mcs, Carrier Conditions for Maximum Modulation Factor of 1.0		
DC Plate Voltage	7500	Volts
DC Grid-No. 2 Voltage	600	Volts
DC Grid-No. 1 Voltage, approx	-50	Volts
DC Plate Current	330	Milliamperes
DC Grid-No. 2 Current	5	Milliamperes
DC Grid-No. 1 Current	30	Milliamperes
Driving Power, approx	17.5	Watts
Power Output, useful ø	750	Watts
Power Gain, approx	16	db

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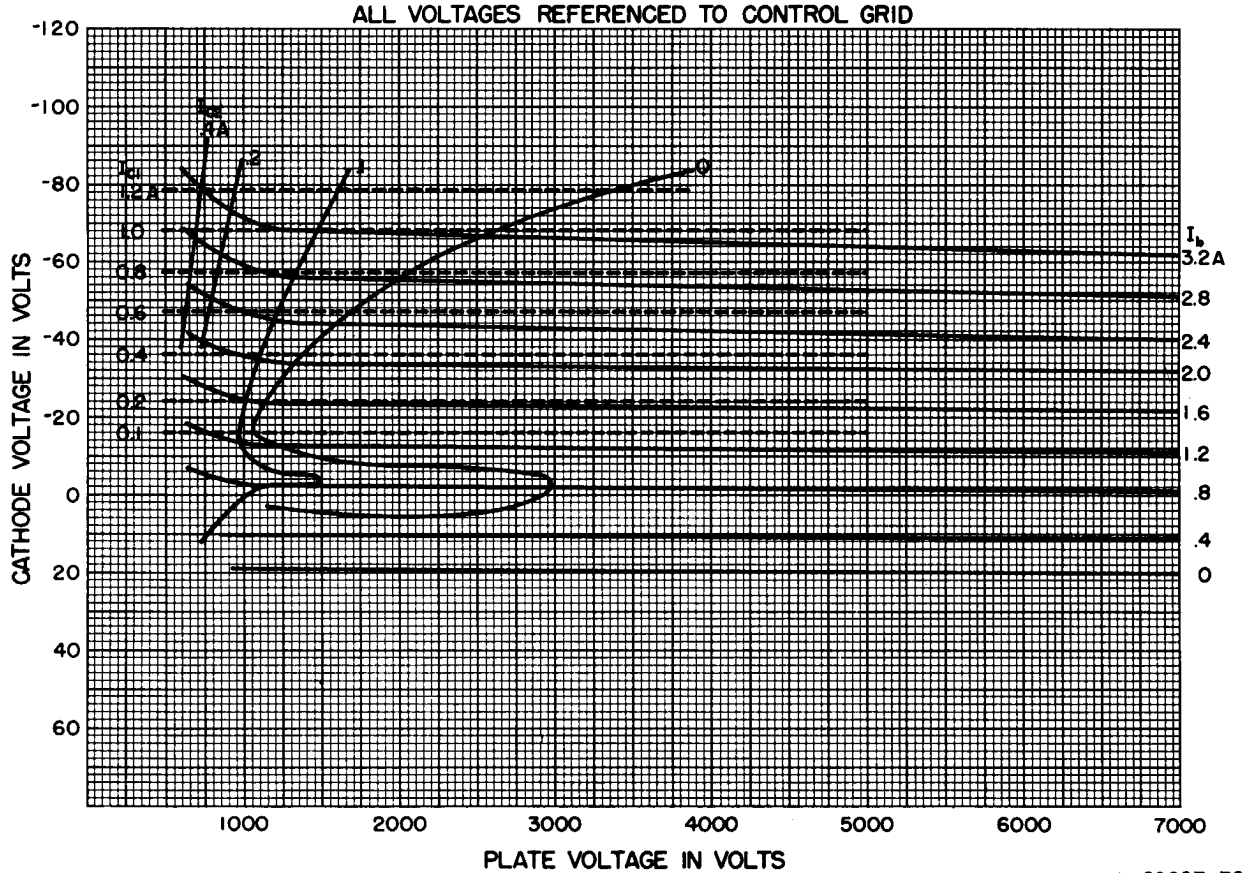
* Because the temperature of the cathode is increased by back bombardment of electrons at UHF, required heater voltage for optimum life decreases with increasing frequency. The amount of heater voltage reduction is dependent on operating conditions.

‡ Measured with complete external shielding between cathode and anode.
§ Output capacitance measured between anode and screen grid. Control grid connected directly to screen grid.
¶ The volume of cooling air indicated for the various seals is for sea-level conditions and approximate only. Distribution of cooling air will vary with the cavity configuration about the tube. For most satisfactory operation the maximum temperature of any point on the tube should be below specified limits.
ø Useful power output including power transferred from driver stage.

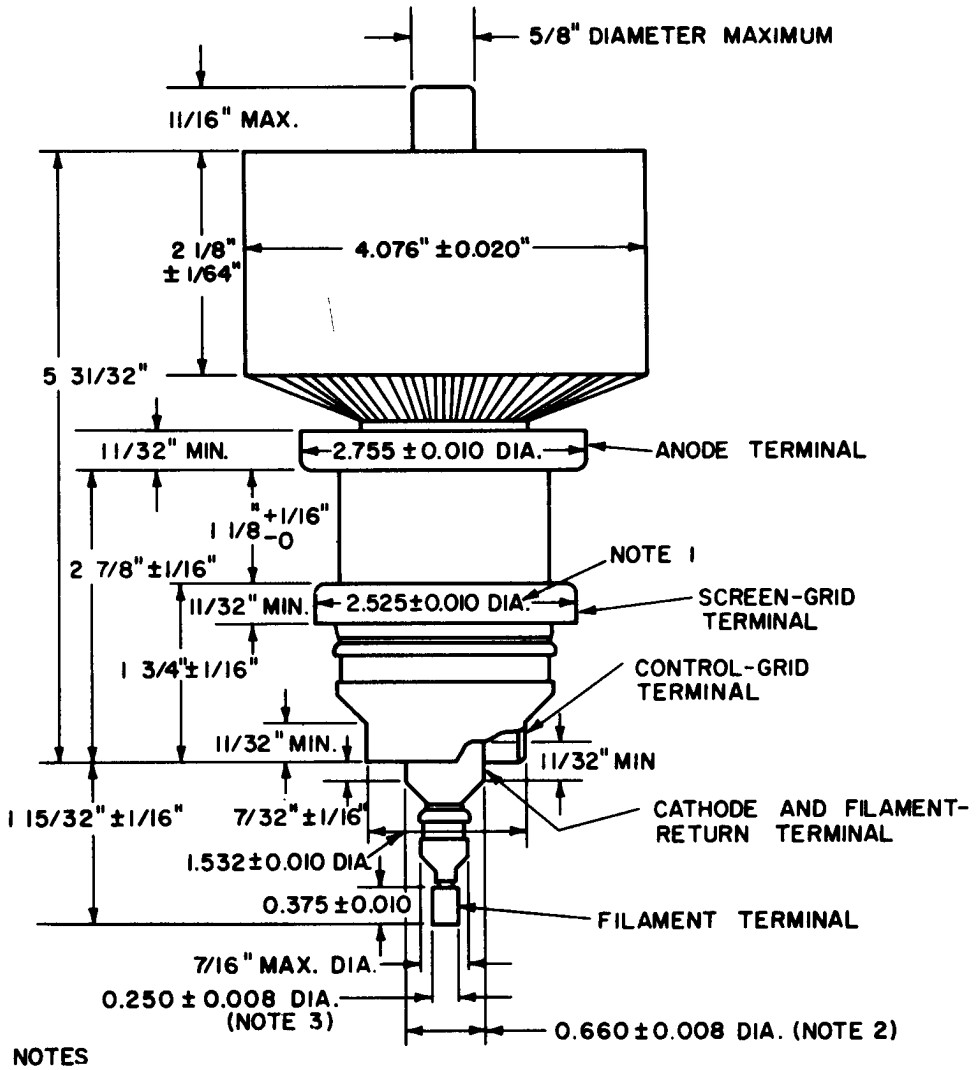
CONSTANT CURRENT CHARACTERISTIC
SCREEN VOLTAGE = 500 VOLTS
ALL VOLTAGES REFERENCED TO CONTROL GRID



CONSTANT CURRENT CHARACTERISTIC
SCREEN VOLTAGE = 650 VOLTS
ALL VOLTAGES REFERENCED TO CONTROL GRID



A-69087-72B121



NOTES
1. MAXIMUM ECCENTRICITY 0.010
2. MAXIMUM ECCENTRICITY 0.015
3. MAXIMUM ECCENTRICITY 0.030
WITH RESPECT TO CENTERLINE DETERMINED BY CENTERS OF ANODE TERMINAL AND CONTROL-GRID TERMINAL

TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady, N. Y. 12305

Tetrode

GL-51065



GRID-PULSED SERVICE
GROUNDED-GRID OPERATION

FORCED-AIR COOLED
METAL AND CERAMIC

The GL-51065 is a high-performance, forced-air cooled, metal-ceramic tetrode especially designed for grid-pulsed amplifier service (pulsed RF drive only) at L-band frequencies. This tetrode is particularly well suited for use in radar equipment such as advanced ground-based, ship-board or airborne IFF interrogators. It is capable of providing useful output at frequencies up to approximately 1500 megacycles.

Features of the GL-51065 include long life and reliability, high gain with pulsed RF drive only, long pulse width, and high-duty capability.

	Minimum	Bogey	Maximum	
Electrical				
Heater Voltage*	-	6.3	-	Volts
Heater Current	-	3.8	-	Amperes
Cathode Heating Time	1	-	-	Minute
Direct Interelectrode Capacitances**				
Cathode to Plate †	-	0.006	-	uuf
Input	-	20	-	uuf
Output	-	7.5	-	uuf

Mechanical			
Mounting Position		Any	
Net Weight, approximate		13	Ounces
Thermal			
Cooling - Forced-Air‡			
Through Radiator, at Sea Level			
Plate Dissipation	600	400	Watts
Air Flow, 45 C Incoming Air Temperature, minimum	9	4.5	Cubic Feet per Minute
Static Pressure, approximate	0.5	0.2	Inches Water
Radiator Hub Temperature at Point Adjacent to Anode Seal, maximum§		250	C
Seals			
Screen and Control Grid, approximate		1	Cubic Feet per Minute
Heater and Cathode, approximate		1	Cubic Feet per Minute
Ceramic Temperature at Any Point, maximum		200	C

RADIO-FREQUENCY POWER AMPLIFIER

Maximum Ratings		
Pulsed Drive, 1250 Megacycles		
DC Plate Voltage	5	Kilovolts
DC Plate Current, during pulse	6	Amperes
DC Grid-No. 2 Voltage	1	Kilovolt
DC Grid-No. 2 Input	5	Watts
DC Grid-No. 1 Voltage	-200	Volts
Plate Dissipation	600	Watts
Pulse Width ◊	10	Microseconds
Duty Factor ø	0.01	

RADIO-FREQUENCY POWER AMPLIFIER (CONT'D)

Typical Operation

Grounded-Grid Service at 1030 Megacycles, 1/4λ Output Circuit

DC Plate Voltage øø	4.5	3.5	Kilovolts
DC Plate Current, during pulse	5.3	3.0	Amperes
DC Grid-No. 2 Voltage	750	750	Volts
DC Grid-No. 2 Current, during pulse	0.110	0.065	Amperes
DC Grid-No. 1 Voltage, approximate	-115	-75	Volts
DC Grid-No. 1 Current, during pulse	0.850	0.400	Amperes
Driving Power at the Tube, during pulse	1.5	0.5	Kilowatts
Power Output, during pulse (useful)	11.0	4.5	Kilowatts
Pulse Width	10	10	Microseconds
Duty Factor	0.01	0.03	

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* Under the typical operating conditions shown the filament voltage should be reduced to approximately 6.0 volts because of back-heating resulting from transit time effects.

** Control grid connected directly to screen grid.

† Complete external shielding between cathode and plate.

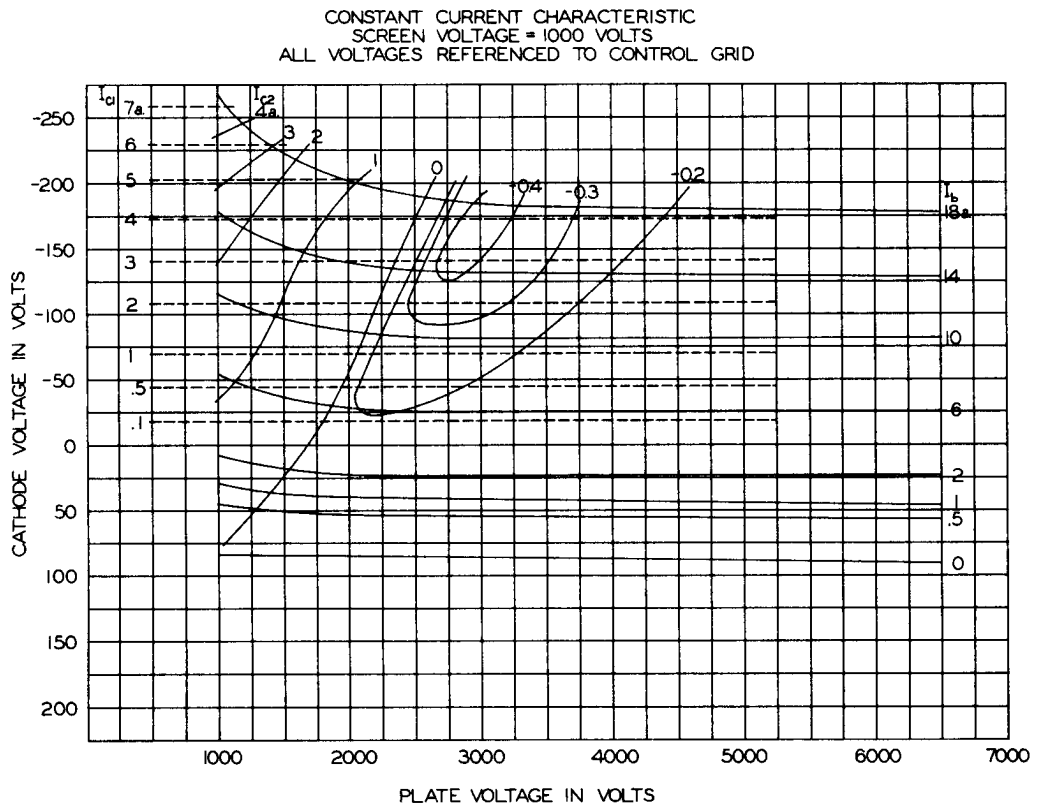
‡ Forced-air cooling should be applied during the application of any voltages.

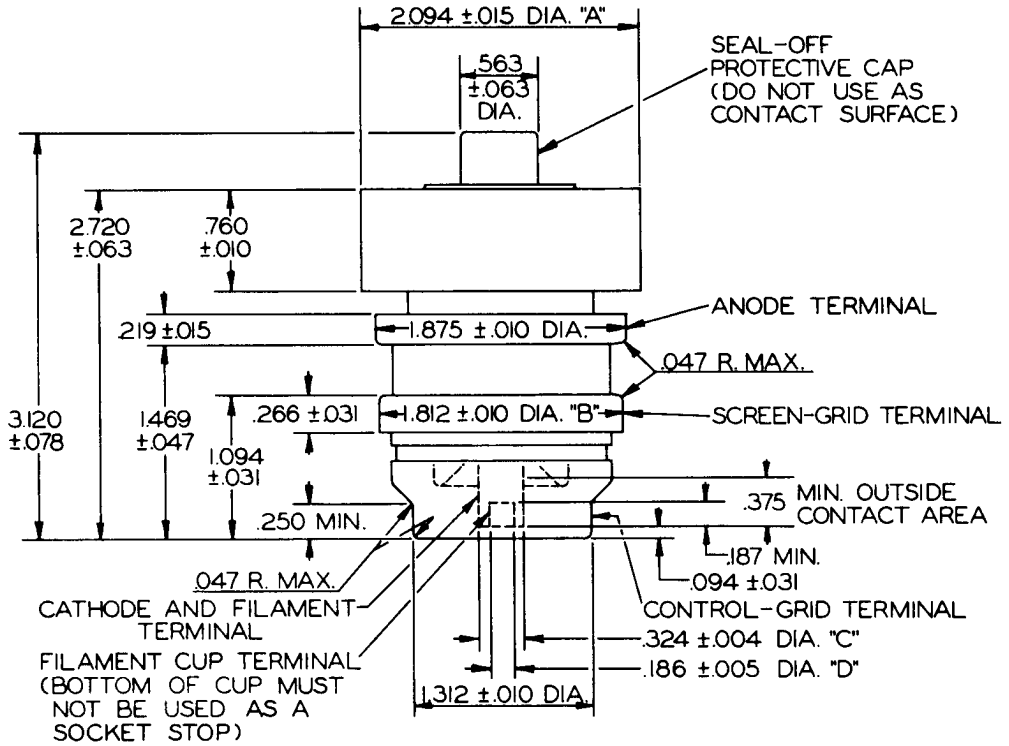
§ Provision must be made for unobstructed passage of cooling air to limit the anode hub temperature to the value specified.

◊ Pulse duration is measured between points at 70 percent of the peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.

ø Maximum ratio of on-time to elapsed time during any 1-millisecond period. Higher duty may be allowed with lower tube input as indicated under typical operation at 0.03 duty. For applications that require longer pulses or higher duty refer to the tube manufacturer for recommendations.

øø A minimum surge-limiting resistance of 50 ohms must be placed between the plate of the tube and the B+ power supply at steady-state voltages greater than 3.5 kilovolts.



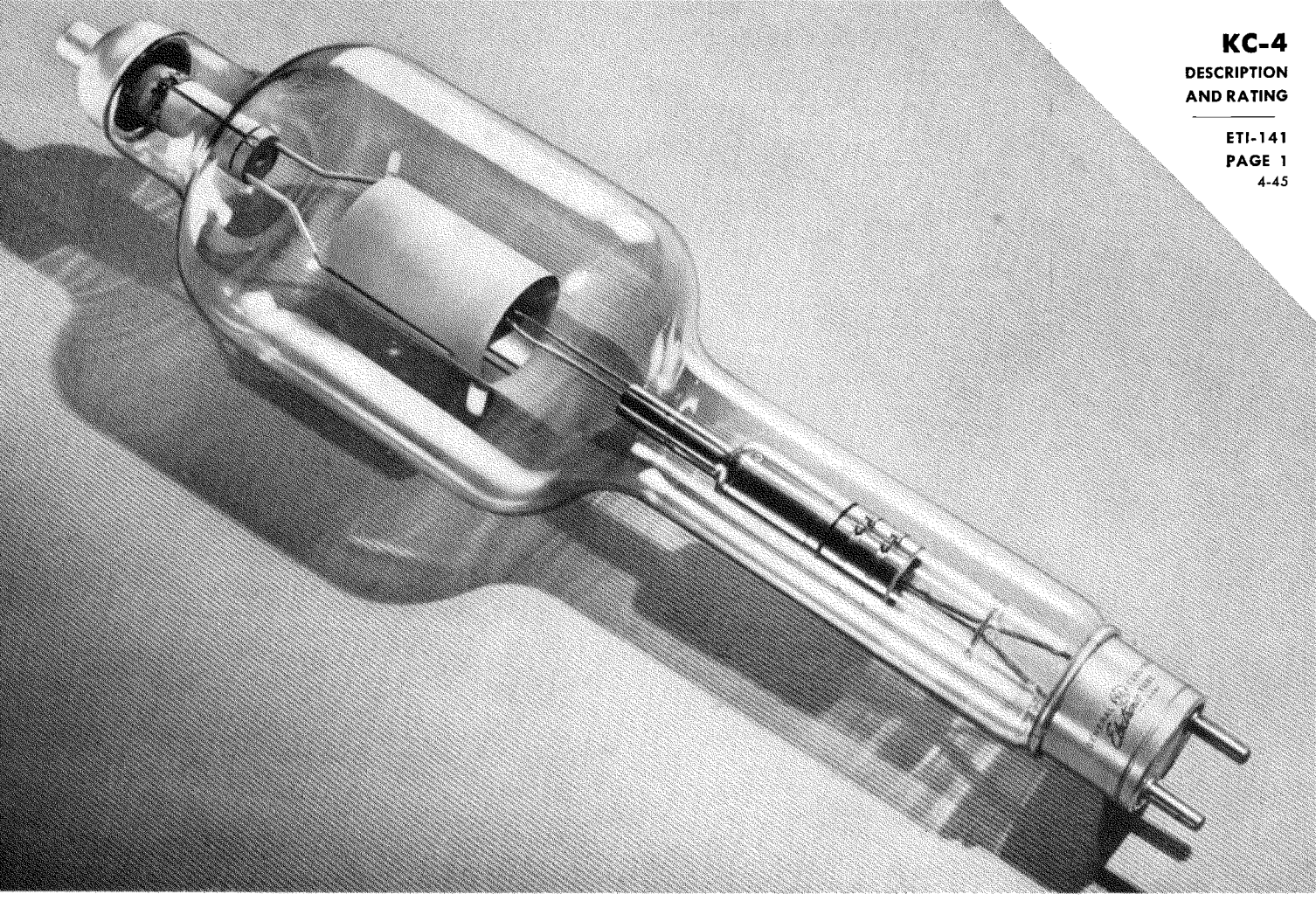


CONCENTRICITIES:
The following total indicator readings are measured with respect to a centerline determined by the centers of the anode terminal and control grid terminal.

Diameter A - 0.030 inches
Diameter B - 0.016 inches
Diameter C - 0.036 inches
Diameter D - 0.042 inches

Total indicator reading of filament cup terminal diameter (D) measured with respect to center of cathode and filament terminal diameter (C) - 0.016 inches.

TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady, N. Y. 12305



KENOTRON

DESCRIPTION

The KC-4 is a high-vacuum rectifier that may be used at voltages as high as 150,000 volts peak inverse. This tube is particularly useful in applications which require high voltage and low current.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Cathode—filamentary type		
Filament voltage	20	volts
Filament current, approx.	24.5	amperes
Mechanical		
Net weight, approx.	3	pounds
Shipping weight, approx.	9	pounds
Mounting position		vertical, with cathode base down

Electronic TUBE

GENERAL ELECTRIC

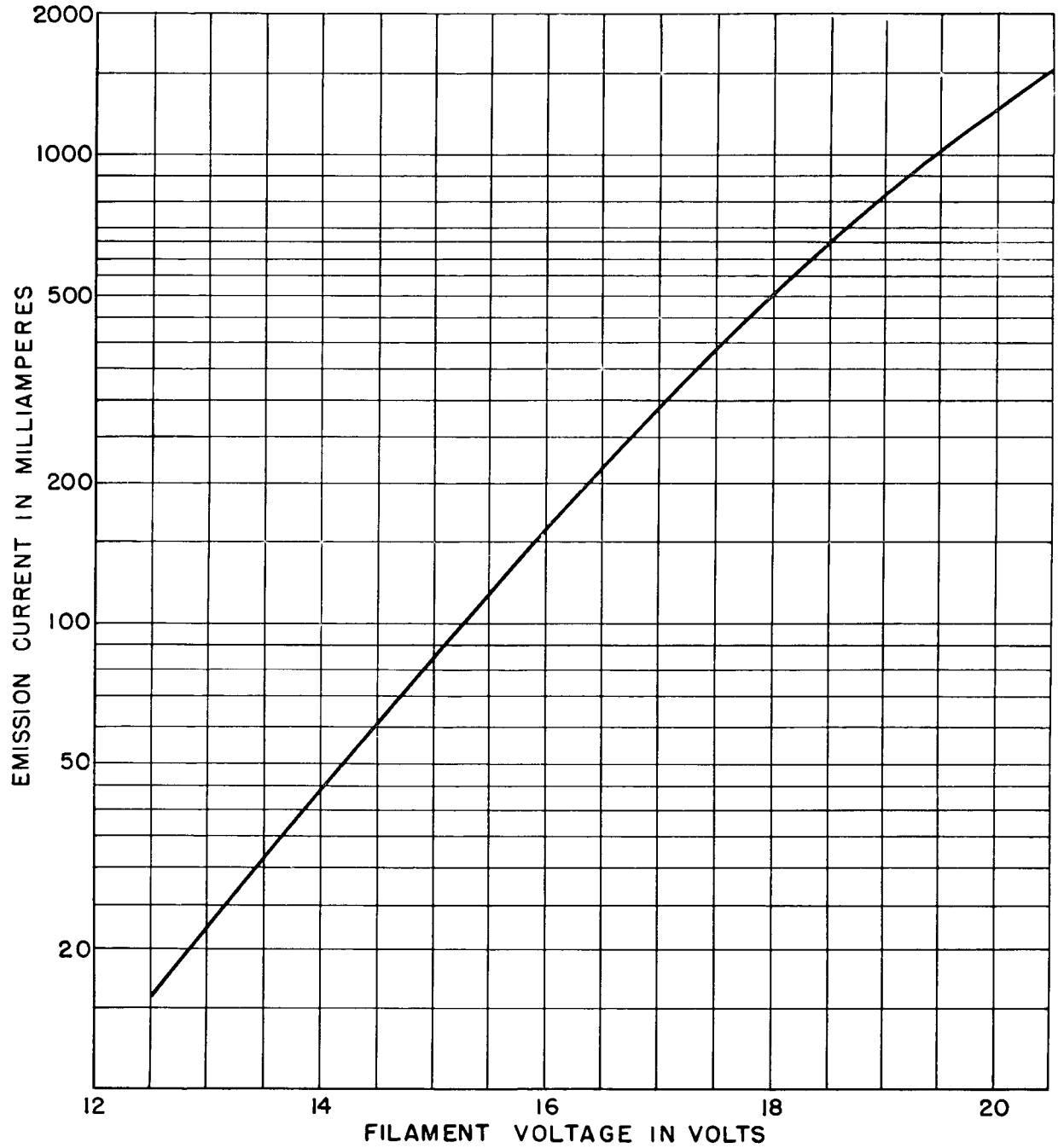
TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS

For Rectifier Service

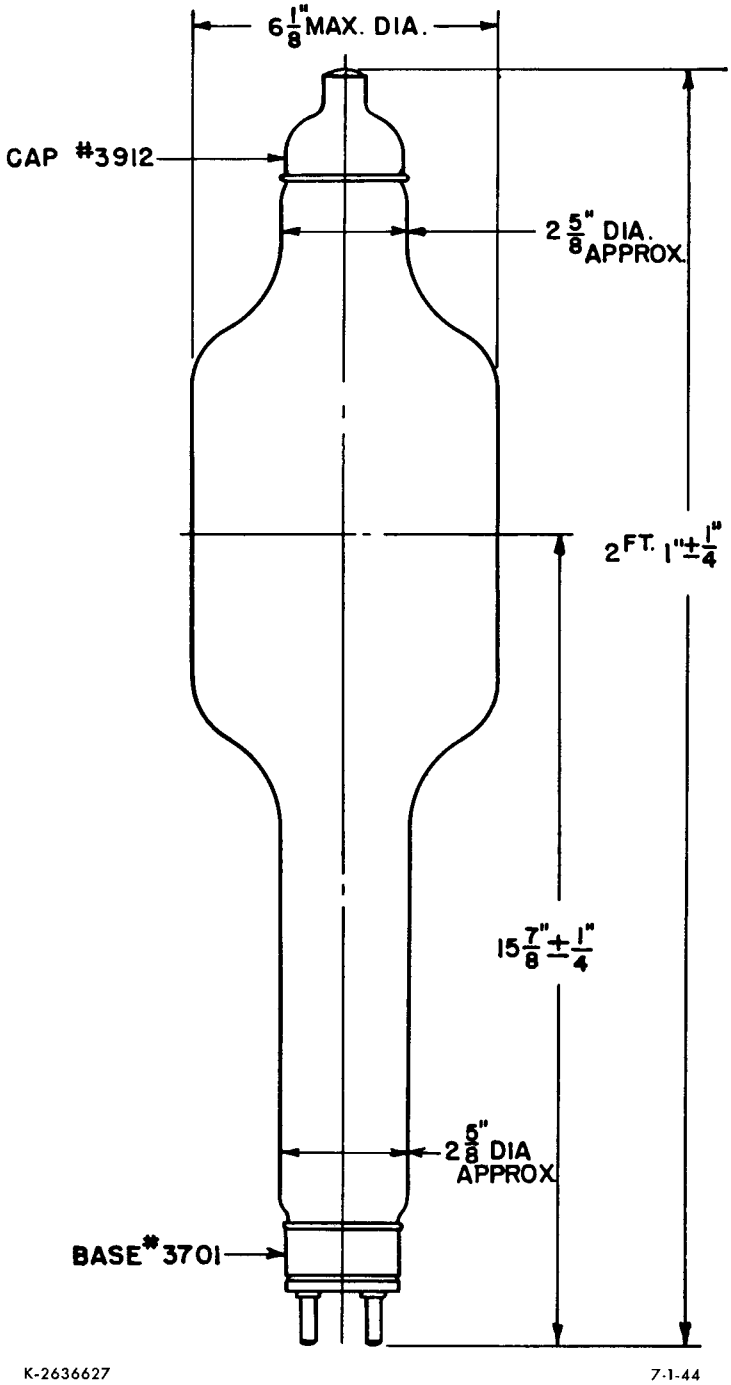
Maximum peak inverse voltage	150,000	volts
Maximum peak anode current	0.75	ampere
Maximum anode dissipation	750	watts

KC-4 KENOTRON
EMISSION CHARACTERISTIC



K-6917415

8-25-44



OUTLINE
KC-4 KENOTRON

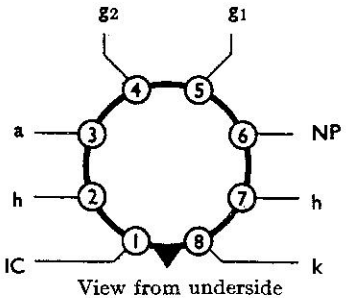
Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850

A beam tetrode with an absolute maximum anode dissipation rating of 30W. It is designed for use in the output stage of an a.f. amplifier, or as a series valve in a stabilized power supply.

The KT66 is a commercial version of the CV1075.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base: International Octal (B8-0)
Bulb: Dome top tubular

Max. overall length :	135 mm
Max. seated length :	121 mm
Max. diameter :	53 mm

HEATER

V_h	6·3	V
I_h	1·3 (approx)	A

MAXIMUM RATINGS

	Design Max.	*Absolute Max.*	
V_a	500	550	V
V_{g2}	500	550	V
$-V_{g1}$	200	200	V
I_k	200	200	mA
p_a	25	30	W
p_{g2}	3·5	4·5	W
*p_{a+g2}	27	32	W
V_{h-k}	150	150	V
T_{bulb}	250	250	°C
R_{g1-k} (cathode bias) :			
p_{a+g2} ≤27W	1·0		MΩ
p_{a+g2} >27W	500		kΩ
R_{g1-k} (fixed bias) :			
p_{a+g2} ≤27W	250		kΩ
p_{a+g2} >27W	100		kΩ

*Triode or ultra-linear operation.

CAPACITANCES (Measured on a cold unscreened valve)

$c_{g1-all,\ less\ a}$: 14·5 pF $c_{a-all,\ less\ g1}$: 10·0 pF c_{a-g1} : 1·1 pF

CHARACTERISTICS

Tetrode Connection

V_a	250	V
V_{g2}	250	V
$-V_{g1}$	15	V
g_m	7	mA/V
r_a	22·5	kΩ

KT66

Triode Connection

V_a	250	V
$-V_{g1}$	15	V
g_m	7·3	mA/V
r_a	1·3	kΩ

TYPICAL OPERATION

Triode Connection. Class A. Single Valve. Cathode Bias.			
$V_{a,g2(b)}$	270	440	V
$V_{a,g2}$	250	400	V
$-V_{g1}$ (approx)	20	38	V
$v_{in(pk)}$	20	38	V
R_k	330	600	Ω
$I_{a+g2(o)}$	60	63	mA
$p_{a+g2(o)}$	15	25	W
R_L	2·75	4·5	kΩ
P_{out}	2·2	5·8	W
D_{tot}	6	7	%

Triode Connection. Class AB1. Push-Pull. Cathode Bias.			
$V_{a,g2(b)}$	270	440	V
$V_{a,g2}$	250	400	V
$-V_{g1}$ (approx)	19	38	V
$v_{in(g1-g1)(pk)}$	38	76	V
*R_k	2×345	2×615	Ω
$I_{a+g2(o)}$	2×55	2×62	mA
$p_{a+g2(o)}$	2×14	2×25	W
$R_{L(a-a)}$	2·5	4·0	kΩ
P_{out}	4·5	14·5	W
D_{tot}	2·0	3·5	%
†IM	3·0	3·0	%
z_{out}	3·5	3·5	kΩ

*It is essential to use two separate cathode bias resistors.

†Intermodulation distortion ; measured using two input signals at 50 and 6000c/s (ratio of amplitudes 4:1).

Tetrode Connection. Class AB1. Push-Pull. Cathode Bias.		
$V_{a(b)(o)}$	450	V
$V_{a(b)(max\ sig)}$	425	V
$V_{a(o)}$	415	V
$V_{a(max\ sig)}$	390	V
$V_{g2(o)}$	300	V
$V_{g2(max\ sig)}$	275	V
$-V_{g1}$ (approx)	27	V
$I_{a(o)}$	2×52	mA
$I_{a(max\ sig)}$	2×62	mA
$I_{g2(o)}$	2×2·5	mA
$I_{g2(max\ sig)}$	2×9	mA
$p_{a(o)}$	2×21	W
$p_{a(max\ sig)}$	2×9·0	W
$p_{g2(o)}$	2×0·75	W
$p_{g2(max\ sig)}$	2×2·5	W
*R_k	2×500	Ω
$R_{L(a-a)}$	8	kΩ
$v_{in(g1-g1)(pk)}$	70	V
P_{out}	30	W
D_{tot}	6	%

*It is essential to use two separate cathode bias resistors.

Ultra-linear Connection. Push-Pull. 40% Taps. Class AB1. Cathode Bias.		
$V_{a(b)}$	450	V
$V_{a,g2(o)}$	425	V
$V_{a,g2(max\ sig)}$	400	V
$I_{a+g2(o)}$	2×62·5	mA
$I_{a+g2(max\ sig)}$	2×72·5	mA

$P_{a+g2(o)}$	$2\times26{\cdot}5$	W
$P_{a+g2(max\ sig)}$	$2\times13{\cdot}0$	W
*R_k	2×560	Ω
$-V_g$ (approx)	35	V
P_{out}	32	W
$R_{L(a-a)}$	7	kΩ
z_{out}	9	kΩ
D_{tot}	2	%
†IM	4	%

*It is essential to use two separate cathode bias resistors.

†Intermodulation distortion ; measured using two input signals at 50 and 6000c/s (ratio of amplitudes 4:1).

Ultra-linear Connection. Class AB1. Push-Pull. 40% Taps. Fixed Bias.

$V_{a,g2(o)}$	525	V
$V_{a,g2(max\ sig)}$	500	V
$I_{a+g2(o)}$	2×35	mA
$I_{a+g2(max\ sig)}$	2×80	mA
$P_{a+g2(o)}$	2×18	W
$P_{a+g2(max\ sig)}$	2×15	W
*$-V_{g1}$ (approx)	67	V
$R_{L(a-a)}$	8	kΩ
$v_{in(g1-g1)(pk)}$	127	V
P_{out}	50	W
D_{tot}	3	%
†IM	15	%
z_{out}	10	kΩ

*A negative bias range of ±25% of this value should be available for each valve.

†Intermodulation distortion ; measured using two input signals at 50 and 6000c/s (ratio of amplitudes 4:1).

LIFE PERFORMANCE

The average life expectancy of the KT66 when operated at absolute maximum ratings (see page 1) is at least 8000 hours. At a reduced absolute rating of P_{a+g2}=21W a life of at least 10000 hours should be obtained. The environment must be a static one and the valve should be switched not more than 12 times in each 24 hours. Attention should also be paid to the recommendations of the British Standard Code of Practice CP1005 *The Use of Electronic Valves.*

A valve is considered to have reached the end of life when it is either inoperative or one or more of its characteristics have reached the following values:

P_{out}	50% of initial value	
*g_m	<5·5	mA/V

*Measured at:

V_a	250	V
V_{g2}	250	V
I_a	85	mA

INSTALLATION

The valve may be mounted in any position but when horizontal it should be orientated as shown in fig. 1. No retaining device or external screening is normally necessary.

Adequate ventilation should be provided. A pair of valves working at maximum ratings should be mounted at not less than 3·5 in. (9 cm) between centres.

For the prevention of parasitic oscillation, a series resistor of 100—300Ω should be connected close to the screen tag of the valve socket. When the valve is triode connected, this resistor should be connected between screen and anode. A control grid series resistor of 10-50kΩ is also recommended. In push-pull applications having a large change in anode current between the quiescent and full output conditions, an inductance input filter circuit of good regulation should be used. A badly regulated supply will cause a fall in power output and/or excessive quiescent anode dissipation.

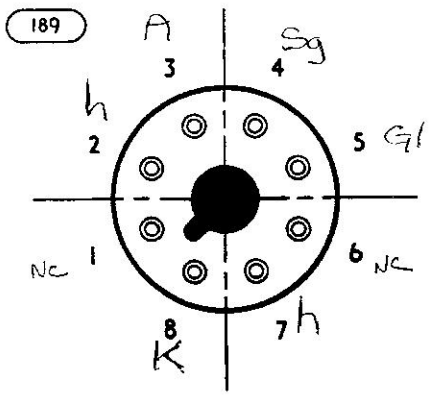


Fig. 1. Correct orientation of the valve socket for horizontally mounting the KT66.

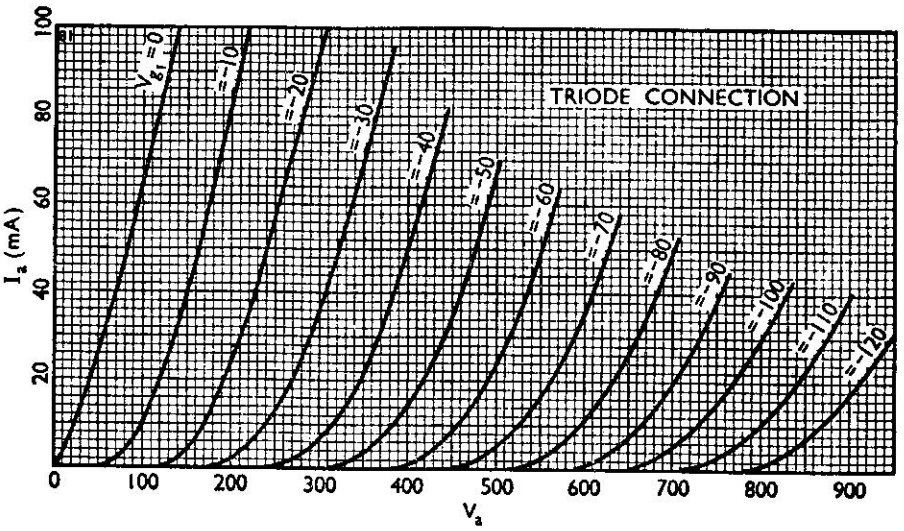

TRIODE CONNECTION
V_{g1} = 0
= -10
= -20
= -30
= -40
= -50
= -60
= -70
= -80
= -90
= -100
= -110
= -120
I_a (mA)
V_a
0
100
200
300
400
500
600
700
800
900
20
40
60
80
100

Fig. 2.

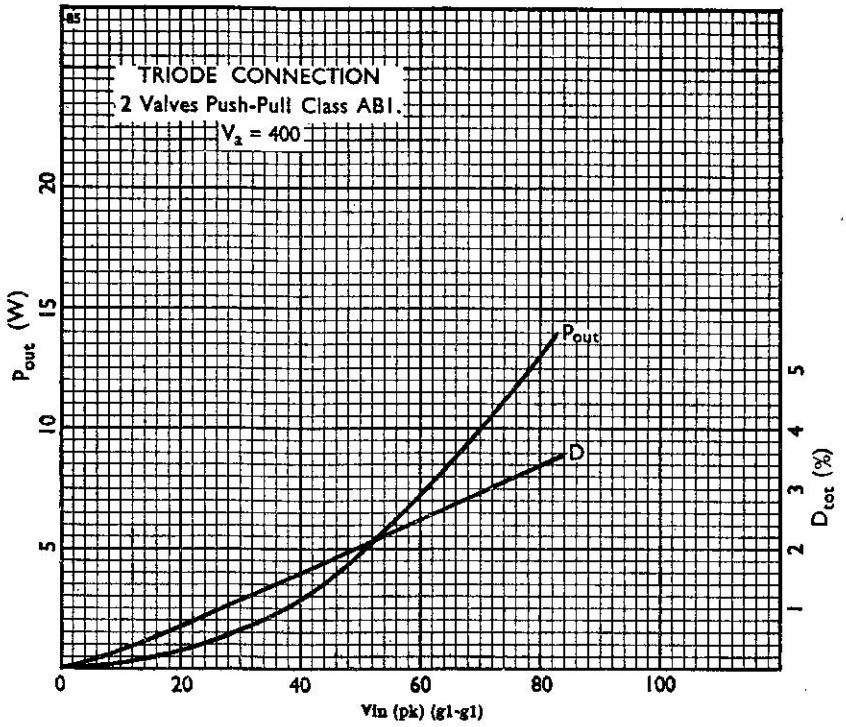

TRIODE CONNECTION
2 Valves Push-Pull Class AB1.
V_a = 400
P_{out}
D
P_{out} (W)
D_{tot} (%)
Vin (pk) (g1-g1)
0
20
40
60
80
100
5
10
15
20
1
2
3
4
5

Fig. 3.

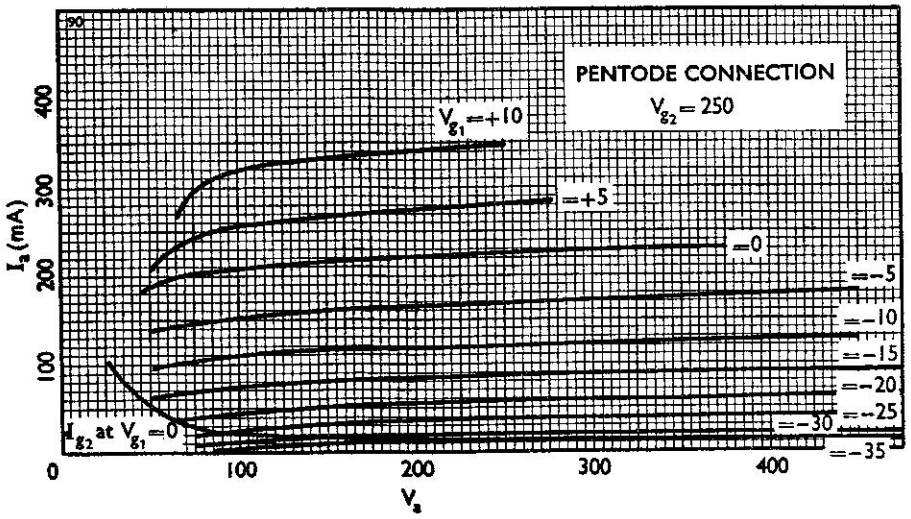

PENTODE CONNECTION
V_{g_2} = 250
V_{g_1} = +10
= +5
= 0
= −5
= −10
= −15
= −20
= −25
= −30
= −35
I_{g_2} at V_{g_1} = 0
I_a (mA)
V_a
0
100
200
300
400

Fig. 4.

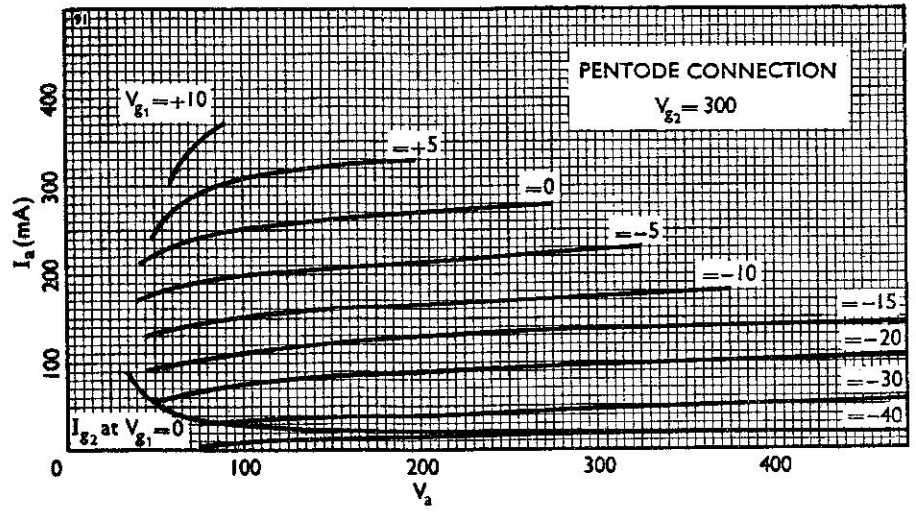

PENTODE CONNECTION
V_{g_2} = 300
V_{g_1} = +10
= +5
= 0
= −5
= −10
= −15
= −20
= −30
= −40
I_{g_2} at V_{g_1} = 0
I_a (mA)
V_a
0
100
200
300
400

Fig. 5.

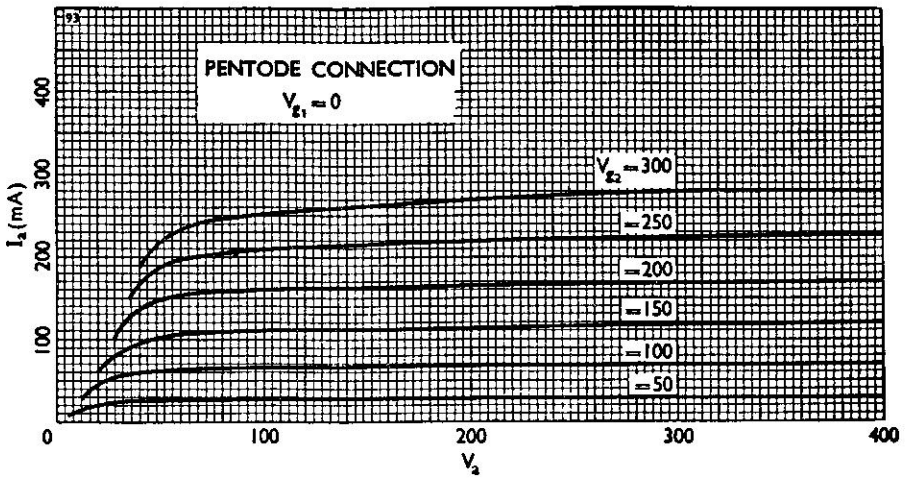

PENTODE CONNECTION
$V_{g_1} = 0$
$V_{g_2} = 300$
= 250
= 200
= 150
= 100
= 50
I_a (mA)
100
200
300
400
0
100
200
300
400
V_a

Fig. 6.

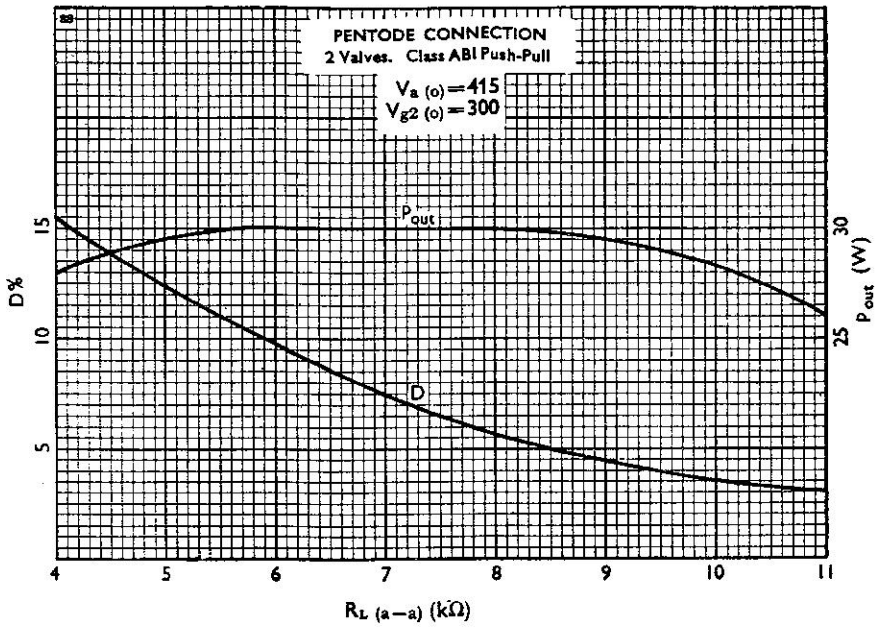

PENTODE CONNECTION
2 Valves. Class ABI Push-Pull
$V_{a\ (o)} = 415$
$V_{g2\ (o)} = 300$
P_{out}
D
D%
5
10
15
25
30
P_{out} (W)
4
5
6
7
8
9
10
11
R_L (a–a) (kΩ)

Fig. 7.

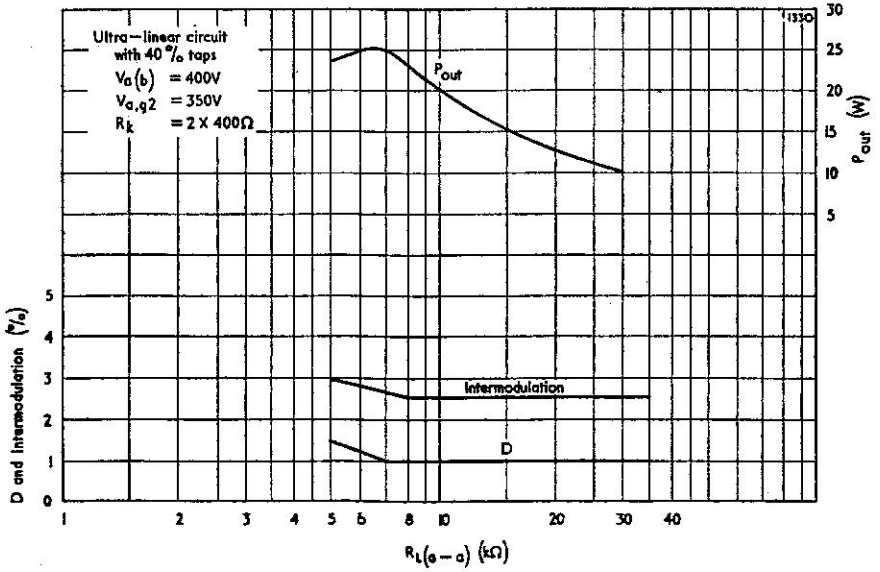


Fig. 8.

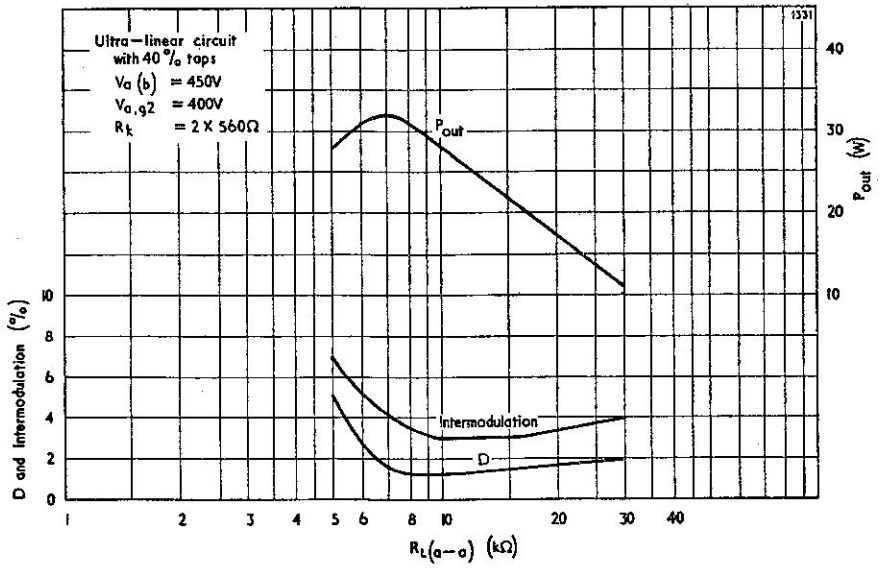


Fig. 9.

The above curves show power output, harmonic distortion and intermodulation plotted against load impedance. Ultra-linear operation at two values of $V_{a(b)}$.

Printed in England—KC

This supplement contains comparisons of the performance of the KT66 under the three different operating conditions of triode, pentode and ultra linear connections. Design details of 30W and 50W ultra linear amplifiers are also given.

The data on normal triode or pentode operation of the KT66 is well-known and is not given here.* In ultra linear operation, the screen grid of each KT66 is returned to a tapping point on the output transformer primary. These tapping points include 20% of the total turns of each half primary, counting from the centre. The voltage during the operating cycle is not held constant, as with pentode operation, nor does it take up the instantaneous anode voltage as in the triode condition. It combines the advantages of both systems in that the high power output of the pentode is still obtainable but with the low distortion of the triode arrangement.

Considerable publicity has been given to this arrangement in the British and American press and in general the claims made are substantiated.

CIRCUIT

The circuit is shown in fig. 1. The two KT66 valves are preceded by a pair of B65 double triode valves, one of which is used as a self-balancing phase inverter and the other as a push-pull voltage amplifier. Full output is given for an input of about 150mV rms.

In ultra linear operation the KT66 valves have their screen grids returned to tapping points on each half primary. When measurements are made under triode conditions, each screen is connected to its anode, and for pentode operation, the screens are connected to the 450V line.

It has been found desirable to connect capacitors C13, C14 of 2000pF across part of the output transformer in the interests of stability. Screen grid and control grid resistors R15, R16, R17 and R18 are included for the same reason.

Independent cathode bias resistors R11, R12 of 560Ω are used, a value satisfactory for all three classes of operation.

The small capacitors C5, C6 serve to neutralise stray capacitances in the phase inverter stage and ensure that a balanced output is obtained at the higher frequencies. Their value is not critical but they should be both the same.

In order to obtain the full advantages of the ultra linear circuit, an output transformer of high quality is required. That used in the design of this amplifier was made by Partridge Transformers Ltd., Ref. No. C1732. It has two equal secondaries in order to provide either a 4Ω or 15Ω output. Other details are :—

Leakage inductance :	15mH
Primary inductance :	80H
Ratio	22:1

See the KT66 data sheet

PERFORMANCE

The curves in figs. 2 and 3 show the performance of the three classes of operation at varying anode loads. Fig. 2 shows the ultra linear circuit at three different levels of distortion compared with the triode performance at full output. Fig. 3 shows the pentode condition together with a comparative triode curve.

It will be seen that the ultra linear circuit behaves quite differently from the pentode. With the latter, full output is obtainable with a distortion which varies between 4% and 6% according to anode load. Except at the lower load impedances, the output for 1% and 2% distortion is only a small proportion of the maximum output.

In the ultra linear arrangement, almost full output is obtained at 2% distortion and very little increase is obtained if this is permitted to rise to 3%. The output for 1% distortion is about 50% of the maximum.

It will be seen that, for most values of anode load impedance, the ultra linear circuit produces only one half the distortion of the triode for equivalent outputs and is capable also of giving double the output for the same order of distortion.

The output impedance of the ultra linear circuit is considerably lower than the pentode arrangement, though higher than the triode. Measurements made at 20W output with the optimum anode load of 7kΩ show that the ultra linear and pentode circuits have impedances of 9kΩ and 35kΩ respectively. A comparable measurement on the triode circuit gave 3·5kΩ. The ultra linear circuit has, therefore, an impedance similar to the anode-anode load impedance of 7kΩ, whereas the pentode impedance is very much higher. The ultra linear circuit can exert a considerable damping factor, a valuable asset if the load is a loudspeaker.

The frequency response of the complete amplifier of fig. 1 shows a loss of 1·5db at 20c/s and 25kc/s.

OPERATING CONDITIONS

In all three classes of operation discussed, the anode and screen voltages were equal and maintained at 400 relative to the cathode. The KT66 is not normally used, as a pentode, with an equal anode and screen voltage of 400 due to the high screen current of 12mA per valve at maximum output. Under a sustained output the screen dissipation rating would be exceeded, although this method of operation is satisfactory for normal speech and music. Under these conditions, the current consumption is high but a saving is effected by the elimination of the stabiliser valve normally required in the pentode screen circuit. With the ultra linear circuit, the objection to the high current is removed since this does not exceed 7mA at maximum output. The screen current under the triode condition is, of course, lower still, at about 4mA per valve.

The data given in fig. 3 does not correspond with that previously published due to the use of a higher screen voltage. However, a closer comparison between the three operating conditions is obtained with constant voltages.

At full output, a voltage of 475 rms is present across the primary of the output transformer. The KT66 anodes therefore swing 400±340V, i.e. 60 to 740V. The two screen grids have the same d.c. potential but the a.c. voltage is one-fifth of the anode swing. They therefore operate between 335 and 465V.

COMPARISON OF OPERATING CONDITIONS

	Triode	*Pentode**	*Ultra Linear*	
$V_{a(b)}$	450	450	450	V
V_a	400	400	400	V
V_{g2}	400	400*	400	V
I_{a+g2}	125	125	125	mA
$I_{g2\ (o)}$	5	5	5	mA
$I_{a+g2\ (max\ sig)}$	135	155	145	mA
$I_{g2\ (max\ sig)}$	8	24*	15	mA
R_k (per valve)	560	560	560	Ω
V_k (app)	36	36	36	V
$p_{in\ (o)}$	50	50	50	W
$p_{in\ (max\ sig)}$	54	62	58	W
P_{out}	15	32	32	W
η	28	52	55	%
D (max sig)	2	⩾6	2	%
$R_{L(a-a)}$	6	7	7	kΩ
z_{out}	3·5	35	9	kΩ
$V_{in(g1-g1)(rms)}$	52	42	56	V
Relative P_{out} for given V_{in}	×1 0	×5 +7	×2·5 +4	db

*Suitable for intermittent operation only, due to excessive screen dissipation at full output. When continuous full output is required, use the operating condition : V_a=400, V_{g2}=300.

ADDITION OF NEGATIVE FEEDBACK

Negative feedback may be added to the circuit of fig. 1 when an improved performance is required. It is suggested that 14db feedback is adequate for all normal purposes, although this may be increased if necessary. The application of 14db feedback will reduce the output impedance, distortion and overall sensitivity by a factor of five. This will provide an amplifier having the following characteristics :

Input for full output :	600mV rms.
Output impedance :	1·8kΩ
Distortion :	0·5%
Damping factor :	4

The method is shown in fig. 4, the feedback voltage being introduced into the cathode circuit of the first valve. The bias resistor R22 (shown as R2 in fig. 1) is connected in the cathode circuit of one triode only. A further bias resistor and capacitor, R23, C23, are provided and feedback is applied across R24 from the secondary of the output transformer via R25.

Since the basic sensitivity of the amplifier is approximately 120mV for full output, a feedback voltage of about 500mV is required for 14db negative feedback. The output voltage is 21·5 for Z_o=15Ω and 11 for Z_o=4Ω ; therefore, the two resistors R24, R25 are chosen so that 500mV will exist at their junction at full output.

Assuming that R24 has a value of 22Ω, the value of R25 is given by $225\sqrt{Z_o}$ and the nearest standard values may be used. For Z_o=15 or 4Ω, resistors of 1kΩ or 470Ω are satisfactory.

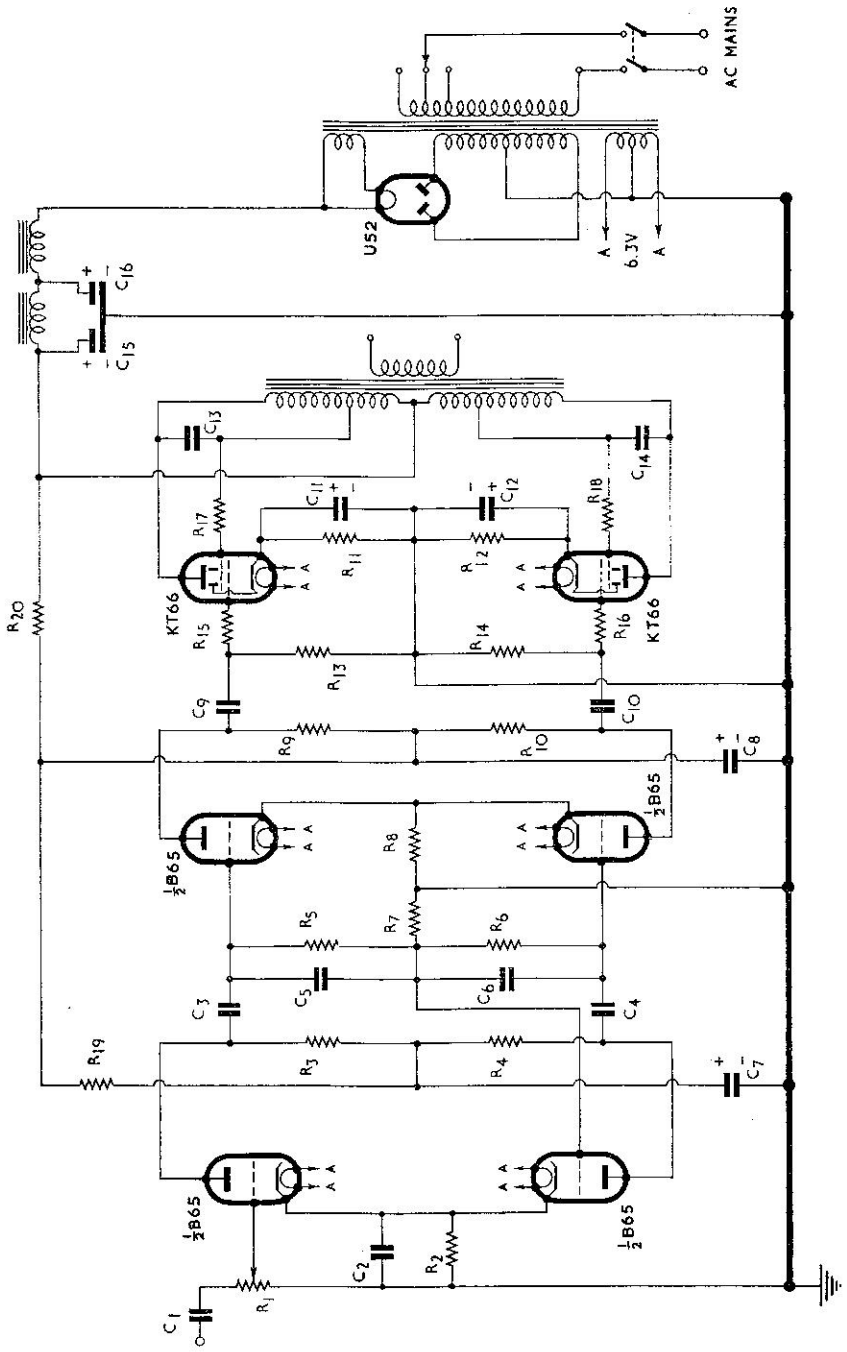


Fig. 1. A 30W ultra linear amplifier.
Component values are given on pages 8 and 9.

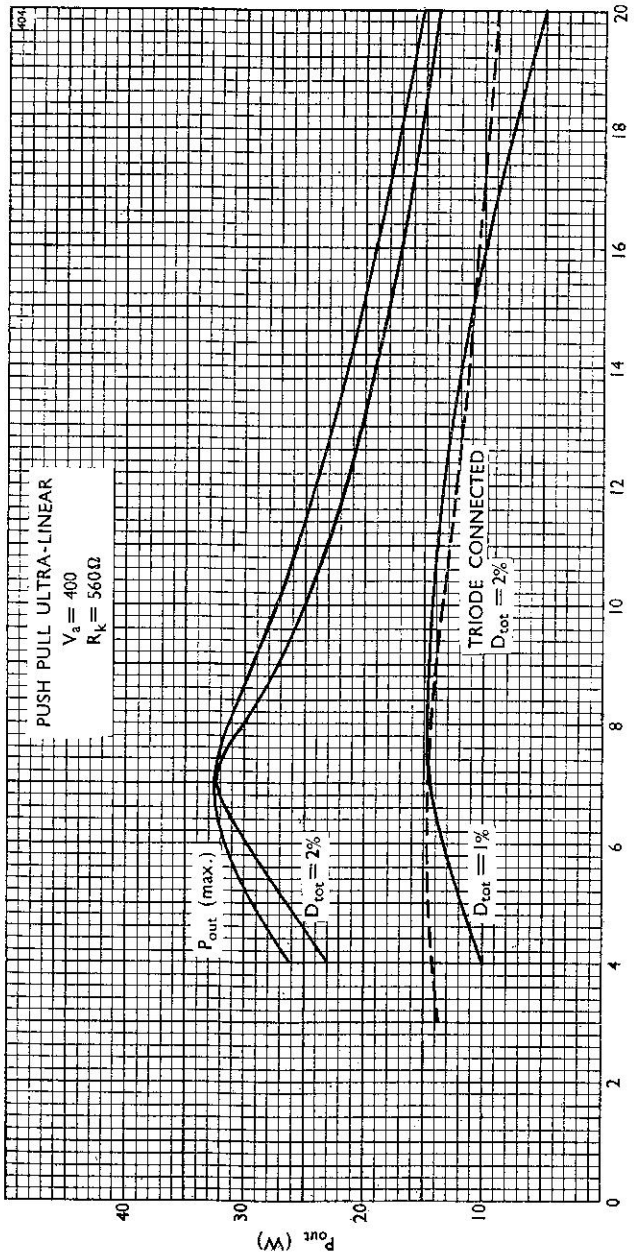


Fig. 2. A comparison of ultra linear with triode operation.

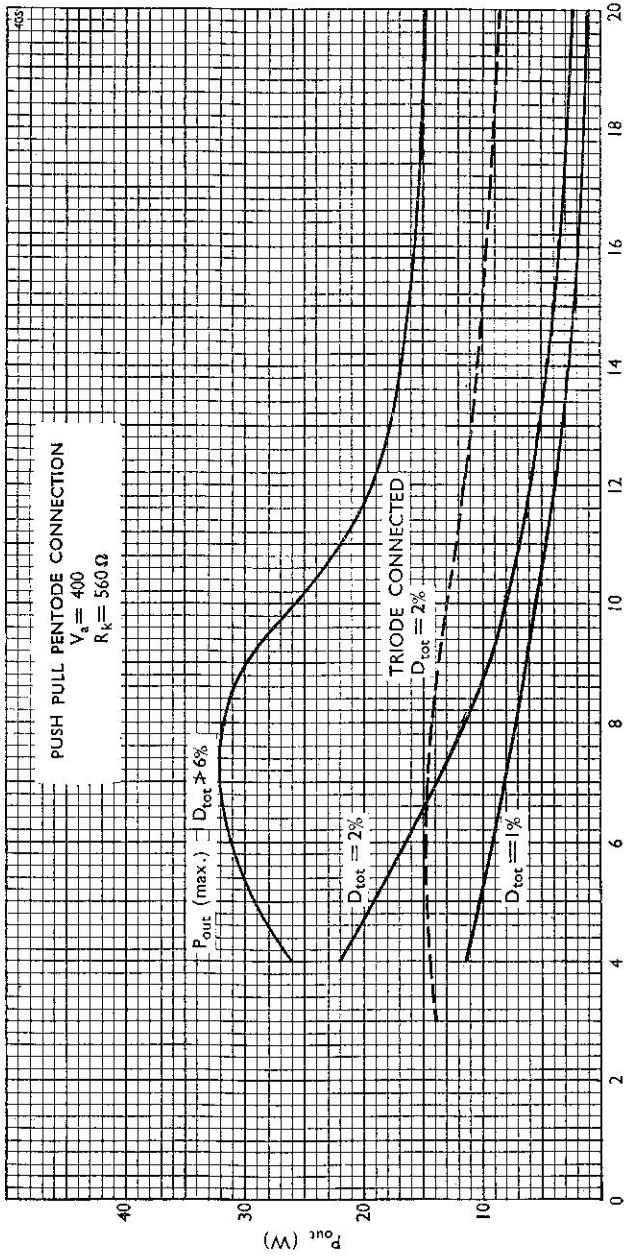


Fig. 3. A comparison of pentode with triode operation.

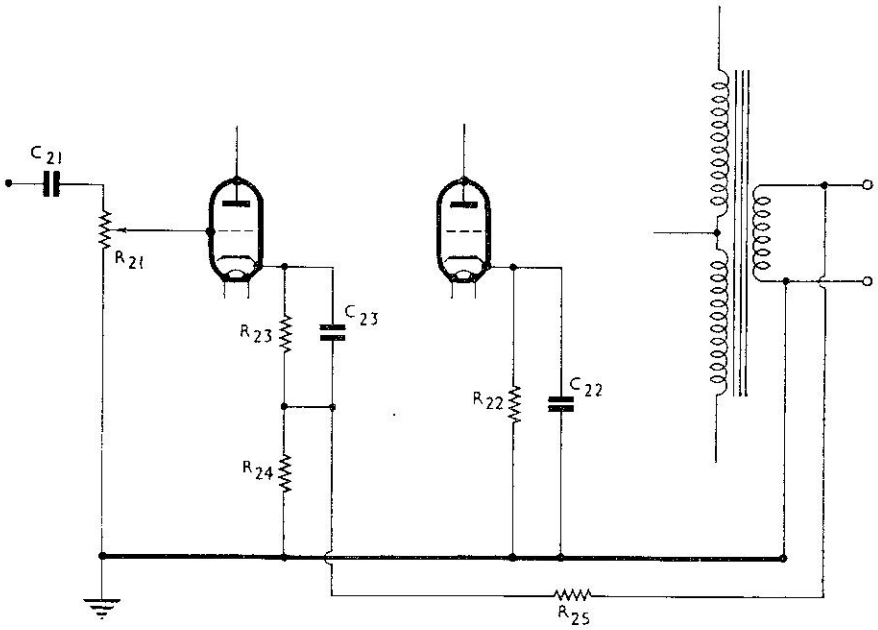


Fig. 4. The addition of negative feedback to the amplifier of fig. 1. See pages 8 and 9 for component values.

A 50W ULTRA LINEAR AMPLIFIER

When the maximum output is required from a pair of KT66 valves they may be used with fixed bias in the ultra-linear circuit. The operating conditions are given below and the recommended circuit is shown in fig. 5.

Per Pair of Valves	*Quiescent*	*Max. Signal*	
$V_{a,g2}$	525	500	V
I_{a+g2}	70	160	mA
V_{g1}	−50/−65	−50/−65	V
†$R_{L(a-a)}$	—	8	kΩ
P_{out}	—	50	W
*D	—	2	%
P_{a+g2} (per valve)	18	15	W
z_{out}	—	6	kΩ
$V_{in(g1-g1)}$ (rms)	—	90	V
V_{in} (to amplifier in fig. 5)	—	2·5	V

†An output transformer having a ratio of 6 : 1 would be suitable for 105V output, 225 Ω.

*The distortion will vary from 1% to 3% with different valves. The performance is displayed graphically in figs. 7 and 8.

Circuit Notes.

The two KT66 valves are set to a similar quiescent current, which may be between 30 and 40mA, using the meter M and the meter shunts R46, R47. A negative bias voltage range of 50 to 65 is provided by the controls R53, R54. A quiescent current below 30mA will increase the distortion.

The bias voltage is derived from a U50 connected to the 600-0-600V transformer via the capacitors C42, C43. The resistors R55, R56, R57, R58, not only smooth the supply in conjunction with C44 but also reduce the voltage to the appropriate value. The resistors R52 to R58, associated with the bias supply, are generously rated to maintain a stable voltage.

R64 is adjusted, at about 90% of full output, to give equal cathode currents in the two output valves. It is capable of compensating for inequality of output from the driver stage and also for variations between the two output valves. When the two cathode currents are equal the distortion is at a minimum.

The anode supply is provided with an inductance filter L1, C31, C32. Due to the large variation in current with input signal the effective capacitance of C31, C32 has been made 80μF. The working voltage is excessive for a single electrolytic and C31, C32 are, therefore, connected in series to give a rated voltage of 900. This single section filter provides a ripple-free anode current. If a lower capacitance were used in place of C31, C32, an additional filter section would be required to reduce the ripple to a reasonable value, and the lower capacitance would be incapable of supplying the peak current required by a transient input signal.

At lower anode voltages the following results are obtainable. No circuit modifications are needed, the bias supply being a function of the anode voltage.

DC voltage	350	425	V
Quiescent current	25+25	30+30	mA
Max. signal current	55+55	65+65	mA
Power output	20	30	W
Anode to anode load	8	8	kΩ

The value of the components C40, C41, C45 and R59 will depend to some extent on the output transformer. R59 and C45 are optional and are used to suppress ringing. The most satisfactory method of selecting the value of these four components is by the use of a square wave generator, but an audio oscillator extending to, say, 50kc/s may be used to detect a peak in the supersonic region. C40 and C41 may be unnecessary with some types of transformer.

With the transformer used, the values shown gave a fall in output of 3db at 18-20kc/s with a load resistance of 15Ω.

Protection Against Bias Failure.

In common with other amplifiers which derive the bias potential from a separate supply instead of a cathode resistor, the 50W amplifier is rendered inoperative should the bias supply fail. Furthermore, the KT66 anode current would rise to an excessive value. The U50 is run at a very low anode current, a few milliamperes, and will, of course, have a long life.

A simple device which permits the amplifier to function with cathode bias in case of failure of the bias supply is shown in fig. 6. A triode, which could be one half of a B65 substituted for the L63 in the first stage, is connected in series with a relay across the 500V supply. The grid is taken to the bias supply. Normally the anode current is cut off and the relay short-circuits the resistor R60 connected in the cathode circuit of the KT66 valves. Should the bias fail, the relay will be energised, the relay contacts will open and the bias resistor R60 will allow the amplifier to function at about half maximum output.

COMPONENT VALUES

RESISTORS

(0·25W, 20% unless otherwise shown)

R1	500kΩ		
R2	750Ω		
R3	33kΩ	1W	10%
R4	33kΩ	1W	10%
R5	270kΩ } matched to		
R6	270kΩ } 5%		
R7	270kΩ		10%
R8	750Ω		10%
R9	33kΩ	1W	10%
R10	33kΩ	1W	10%
R11	560Ω	5W w.w.	5%
R12	560Ω	5W w.w.	5%
R13	270kΩ		10%
R14	270kΩ		10%
R15	10kΩ		
R16	10kΩ		
R17	220Ω		
R18	220Ω		
R19	10kΩ	0·5W	
R20	5·6kΩ	1W	
R21	500kΩ		
R22	750Ω		
R23	750Ω		

R24, R25		see p. 3		
R31		1MΩ		
R32		33kΩ	0·5W matched to	5%
R33		33kΩ	0·5W matched to	5%
R34		1·5kΩ		
R35		1kΩ		
R36		22kΩ	0·5W	
R37		1MΩ		
R38		1MΩ		
R39		47kΩ	1W	10%
R40		47kΩ	1W	10%
R41		150kΩ		10%
R42		150kΩ		10%
R43		10kΩ	1W	10%
R44		10kΩ		
R45		10kΩ		
R46	Meter shunts	10Ω		
R47	Meter shunts	10Ω		
R48		100Ω		
R49		100Ω		
R50		100kΩ	1W	10%
R51		100kΩ	1W	10%
R52	(see fig. 6)	22kΩ	1W	10%
R53		20kΩ	w.w.	
R54		20kΩ	w.w.	
R55		220kΩ	1W	10%
R56		220kΩ	1W	10%
R57		220kΩ	1W	10%
R58		220kΩ	1W	10%
R59		220kΩ	1W	10%
R60	(see fig. 6)	330Ω	5W w.w.	10%
R61	(see fig. 6)	6·6 kΩ	0·5W	10%
R62		15kΩ	0·5W	10%
R63		0·65Ω	5W	
R64		20kΩ		

CAPACITORS

C1	0·01μF	350V	
C2	50μF	12V	Electrolytic
C3	0·1μF	500V	
C4	0·1μF	500V	
C5	100pF	250V	
C6	100pF	250V	
C7	8μF	450V	Electrolytic
C8	8μF	450V	Electrolytic
C9	0·02μF	500V	
C10	0·02μF	500V	
C11	50μF	50V	Electrolytic
C12	50μF	50V	Electrolytic
C13	2000pF	500V	
C14	2000pF	500V	
C15	8μF	450V	Electrolytic
C16	8μF	450V	Electrolytic
C21	0·01μF	350V	
C22	50μF	12V	Electrolytic
C23	50μF	12V	Electrolytic
C31	160μF	450V	Electrolytic
C32	160μF	450V	
C33	8μF	450V	
C34	8μF	450V	
C35	0·01μF	350V	
C36	0·01μF	500V	
C37	0·01μF	500V	
C38	0·05μF	750V	
C39	0·05μF	750V	
C40	0·001μF	300V AC	
C41	0·001μF	300V AC	
C42	0·025μF	600V AC	
C43	0·025μF	600V AC	
C44	4μF	200V	
C45	0·001μF	440V AC	

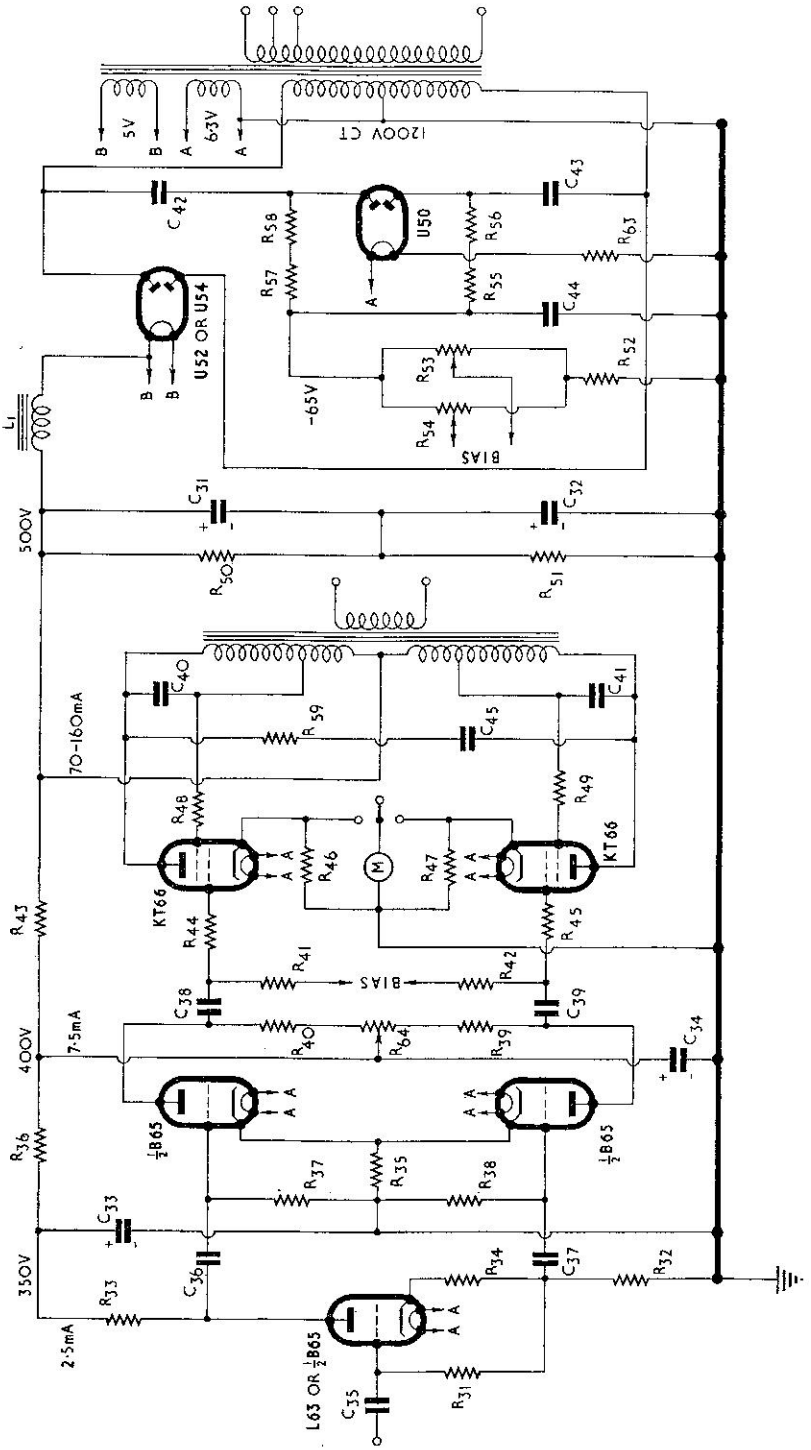


Fig. 5. A 50W ultra linear amplifier. See pages 8 and 9 for component values.

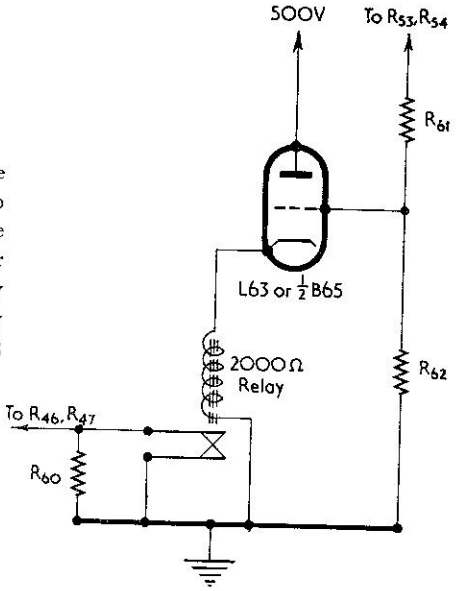


Fig. 6. This circuit may be added to the 50W amplifier to protect the KT66 valves in the event of bias failure. The resistor R60, normally short-circuited by the relay, provides an emergency cathode bias. R61 and R62 replace R52.

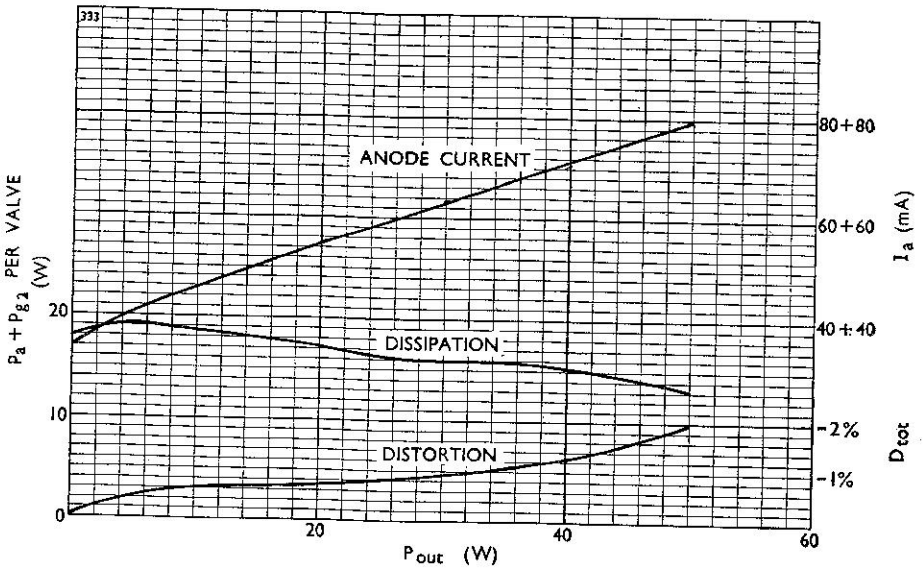


Fig. 7.

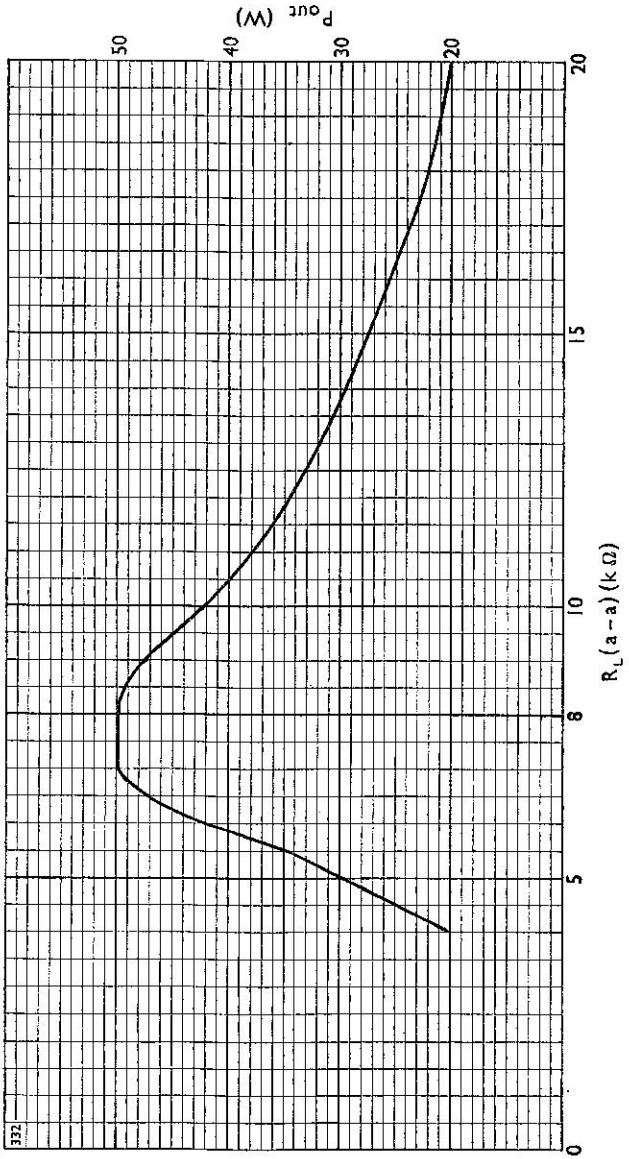


Fig. 8.

Printed in England. C.

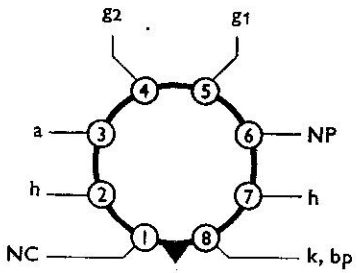
G.E.C. VALVES

BEAM TETRODE
6.3V INDIRECTLY HEATED

KT77
ISSUE 2

A beam tetrode with an absolute maximum anode dissipation rating of 32 watts. The KT77 is designed for use in the output stage of an a.f. amplifier. Two valves in Class AB1 give a continuous output of over 70W. The KT77 is also suitable for use as a series valve in a stabilised power supply.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base: International Octal (B8-0)
Bulb: Tubular

Max. overall length:	113mm
Max. seated length:	89mm
Max. diameter:	33mm

HEATER

V_h	6·3	V
I_h	1·4 (approx)	A

MAXIMUM RATINGS

	Absolute	Design Max.	
V_a	850	800	V
V_{g2}	650	600	V
$V_{a,g2}$	650	600	V
p_a	32	25	W
p_{g2}	6·0	6·0	W
p_{a+g2}	35	28	W
I_k	200	180	mA
V_{h-k}	200	150	V
$-V_{g1}$	220	200	V
R_{g1-k} (cathode bias)			
$p_{a+g2} \leqslant 28W$		1·0	MΩ
$p_{a+g2} > 28W$		0·5	MΩ
R_{g1-k} (fixed bias)			
$p_{a+g2} \leqslant 28W$		0·5	MΩ
$p_{a+g2} > 28W$		0·25	MΩ
T_{bulb}	250	230	°C

CAPACITANCES (Measured on a cold unscreened valve)

c_{g1-a}: 1·0pF; $c_{g1-\text{all, less a}}$: 16·5pF; $c_{a-\text{all, less g1}}$: 9·0pF

KT77

CHARACTERISTICS

Tetrode Connection

V_a	250	V
V_{g2}	250	V
I_a	110	mA
I_{g2}	10	mA
g_m	10·5	mA/V
r_a	23	kΩ
μ_{g1-g2}	11·5	—

Triode Connection

$V_{a,g2}$	250	V
I_{a+g2}	120	mA
g_m	11	mA/V
r_a	1050	Ω
μ	11·5	—

TYPICAL OPERATION

Ultra-linear Connection. 43% Taps. Push-Pull. Class AB1. Cathode Bias

$V_{a(b)}$	430	V
$V_{a,g2}$	390	V
R_{g2}	2×22	Ω
R_k	2×470±5%	Ω
$R_{L(a-a)}$	6·0	kΩ
$I_{a+g2(o)}$	2×66	mA
$I_{a+g2(max)}$	2×80	mA
$p_{a+g2(o)}$	2×26	W
$p_{a+g2(max)}$	2×14	W
$-V_{g1}$	31 (approx)	V
$v_{in(g1-g1)(pk)}$	69	V
P_{out}	34	W
D_{tot}	2·5	%

Ultra-linear Connection. 43% Taps. Push-Pull. Class AB1. Fixed Bias

$V_{a(b)}$	600	500	400	V
$V_{a,g2}$	594	493	391	V
R_{g2}	2×22	2×22	2×22	Ω
$R_{L(a-a)}$	9·0	5·5	4·5	kΩ
$I_{a+g2(o)}$	2×47	2×57	2×70	mA
$I_{a+g2(max)}$	2×109	2×126	2×121	mA
$p_{a+g2(o)}$	2×28	2×28	2×27·5	W
$p_{a+g2(max)}$	2×28	2×28	2×24	W
*$-V_{g1}$ (approx)	56	43	31	V
$v_{in(g1-g1)(pk)}$	94	82	61	V
P_{out}	72	67	45	W
D_{tot}	1·5	1·0	0·8	%

*A negative bias range of ±25% of these values should be available for each valve.

Tetrode Connection. Push-Pull. Class AB1

The KT77 is designed primarily for use under ultra-linear conditions and this connection is recommended. However, similar performance can be obtained in the tetrode connected arrangement but the output impedance will be greatly increased. For tetrode connection the fixed screen supply must not exceed 300V.

Triode Connection. Push-Pull. Class AB1. Cathode Bias.

$V_{a(b)}$	430	V
$V_{a,g2}$	396	V
R_{g2}	2×22	Ω
R_k	2×440±5%	Ω
$R_{L(a-a)}$	5·0	kΩ
$I_{a+g2(o)}$	2×69	mA
$I_{a+g2(max)}$	2×75	mA
$p_{a+g2(o)}$	2×27	W
$p_{a+g2(max)}$	2×20	W
$-V_{g1}$	30 (approx)	V
$V_{in(g1-g1)(pk)}$	66	V
P_{out}	18·0	W
D_{tot}	1·2	%

Class A Series Stabiliser (see fig. 1)

V_{in}	400	400	V
V_{out}	200	200	V
Load current	0 to 100	100	mA
Voltage change	1·0	0·2	V
Stabilisation	—	0·1	%
Regulation	0·5	—	%

Stabilisation is defined as $\frac{\Delta V_{out}}{V_{out}} \times 100\%$ for a change in V_{in} of $\pm 7\%$ corresponding to the usual maximum permitted mains fluctuation.

Regulation is defined as $\frac{\Delta V_{out}}{V_{out}} \times 100\%$ for a change in loading from zero load to full load current.

LIFE PERFORMANCE

The average life expectancy of the KT77 when operated at absolute maximum ratings (see page 1) is at least 5000 hours. At a reduced absolute rating of p_{a+g2}=25W a life of at least 10000 hours should be obtained. The environment must be a static one and the valve should be switched not more than 12 times in each 24 hours. Attention should also be paid to the recommendations of the British Standard Code of Practice CP1005 *The Use of Electronic Valves.*

A valve is considered to have reached the end of life when it is either inoperative or one or more of its characteristics have reached the following values:

P_{out}	50% of initial value	
*g_m	<9·3	mA/V
*Measured at:		
V_a	250	V
V_{g2}	250	V
I_a	100	mA

INSTALLATION

The valve may be mounted in any position. Free air circulation around the valve is desirable.

When a pair of valves is mounted horizontally it is recommended that the centres of the valve sockets are not less than 3½in. apart and that the keyways on the spigots of each valve are in the vertical plane.

When a pair of valves is mounted vertically it is recommended that the centres of the valve sockets are not less than 3½in. apart and that the keyways on the spigots lie along the line joining the centres.

Provision of circuit information in this publication does not imply a right to use any invention which may be involved and which is the subject of patents by whomsoever owned.

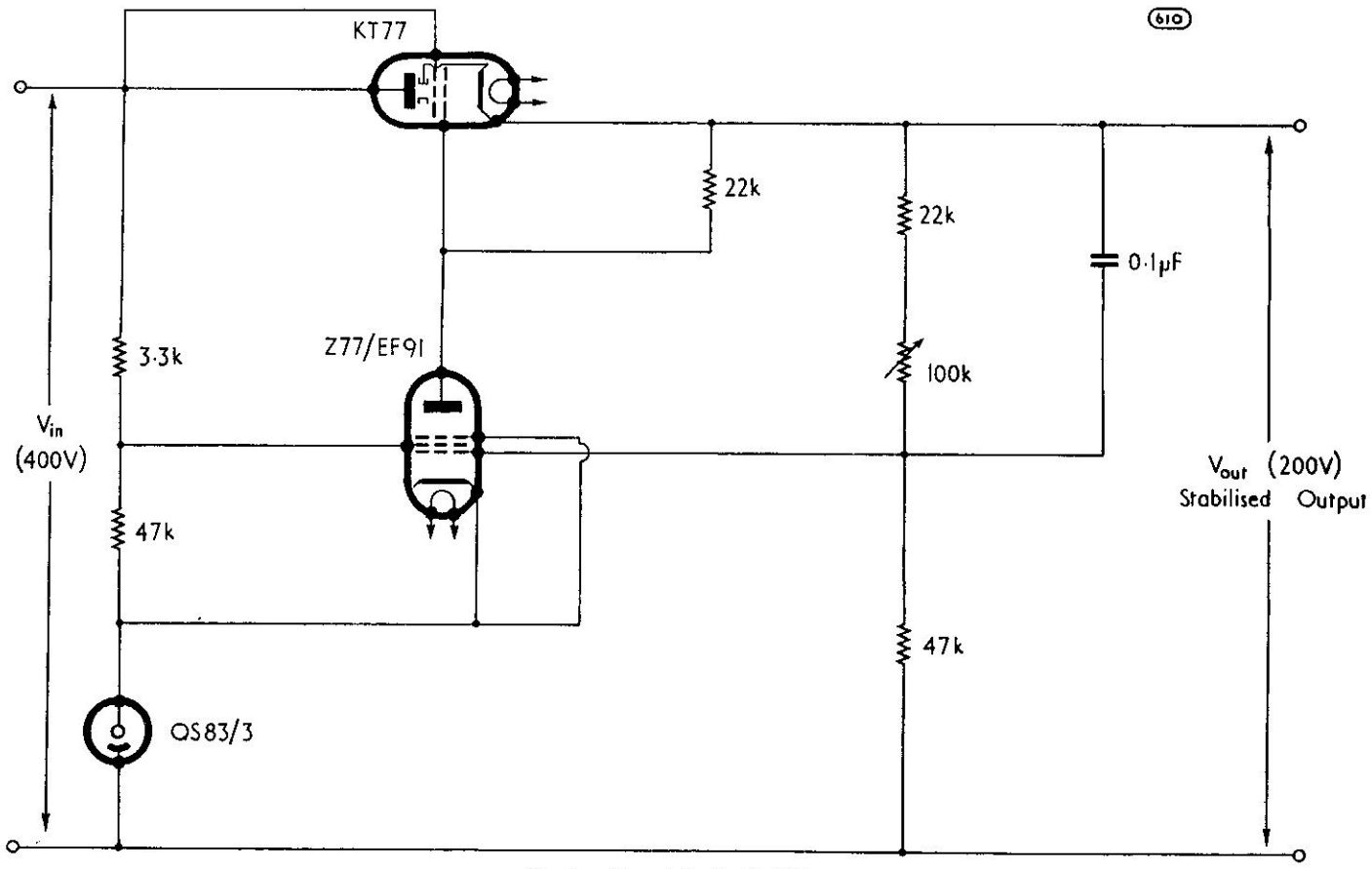


Fig. 1. Class A Series Stabiliser.

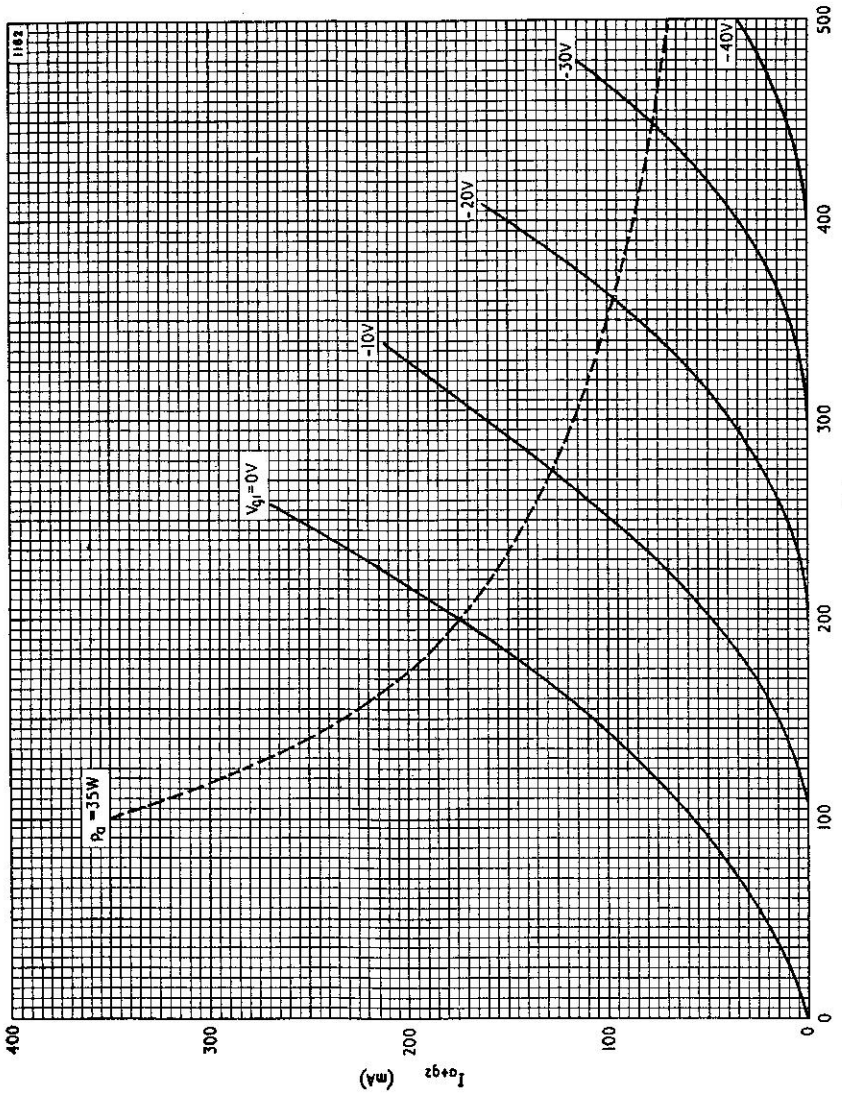

1182
P_a =35W
V_{g1}=0V
-10V
-20V
-30V
-40V
I_{a+g2} (mA)
400
300
200
100
0
0
100
200
300
400
500
V_a V_{g2} (V)

Fig. 2.

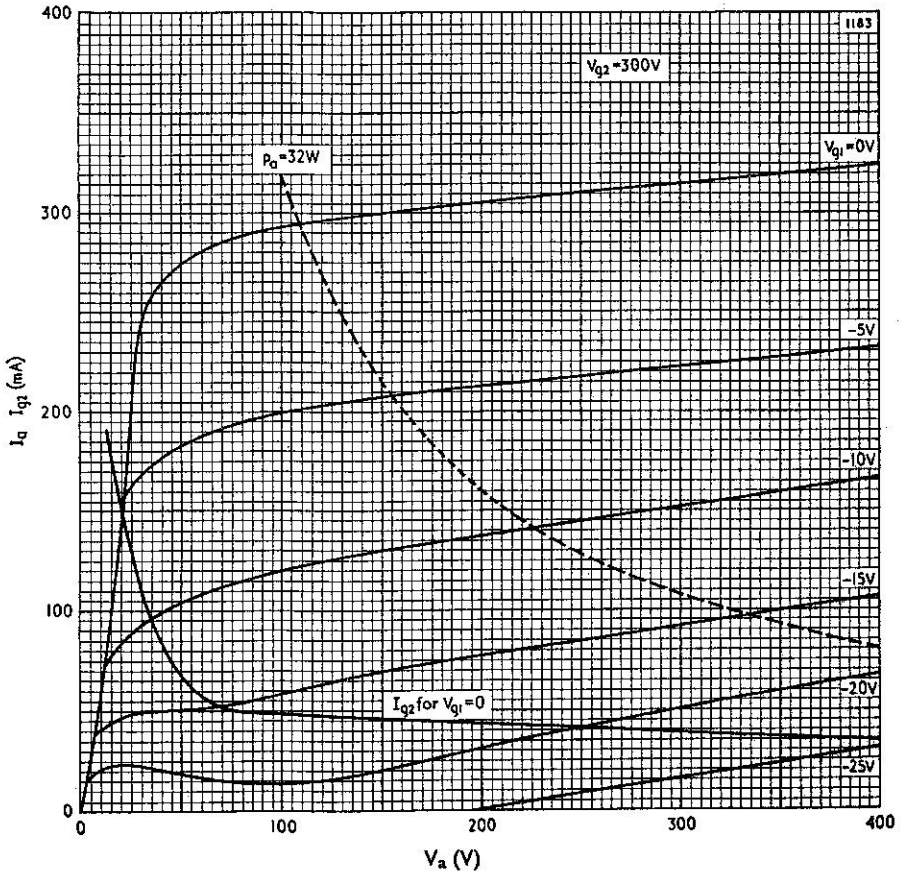

1183
V_{g2}=300V
P_a=32W
V_{g1}=0V
-5V
-10V
-15V
-20V
-25V
I_{g2} for V_{g1}=0
I_a I_{g2} (mA)
V_a (V)
0
100
200
300
400

Fig. 3.

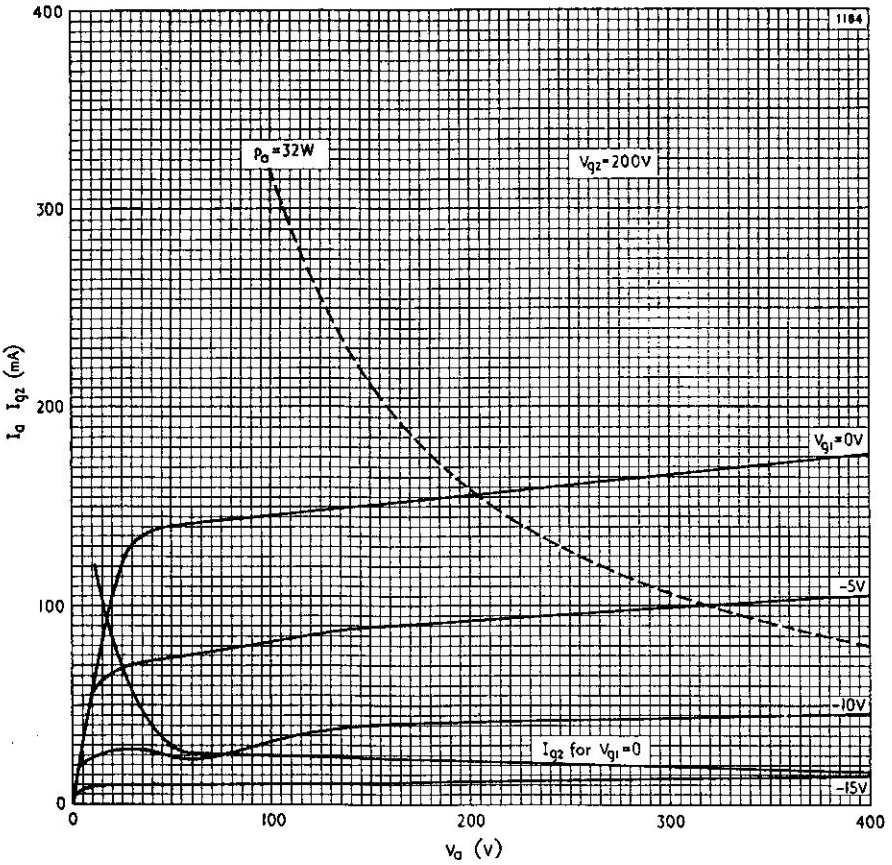

1184
P_a=32W
V_{g2}=200V
V_{g1}=0V
-5V
-10V
-15V
I_{g2} for V_{g1}=0
I_a I_{g2} (mA)
V_a (V)
0
100
200
300
400

Fig. 4.

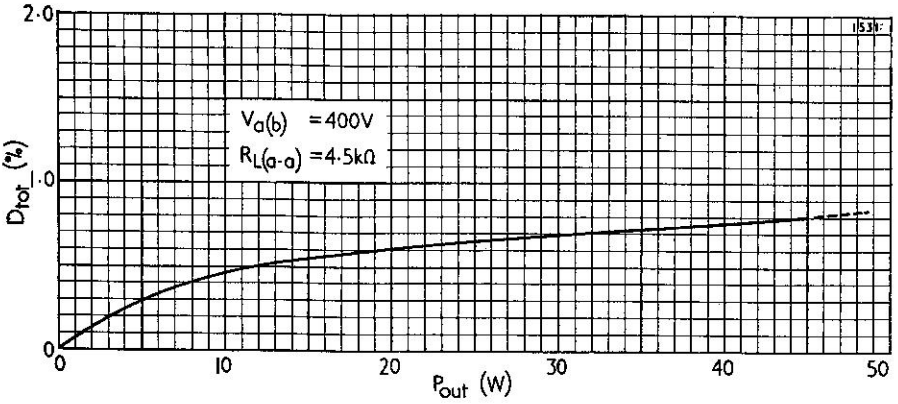


Fig. 5. Ultra-linear connection. 43% taps. Push-pull. Class AB1. Fixed bias.

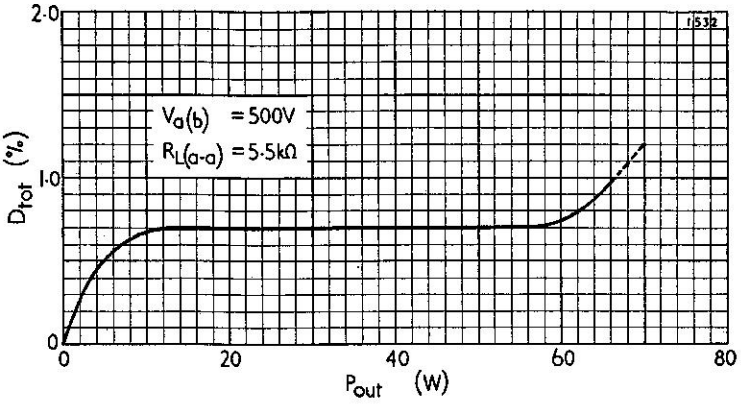


Fig. 6. Ultra-linear connection. 43% taps. Push-pull. Class AB1. Fixed bias.

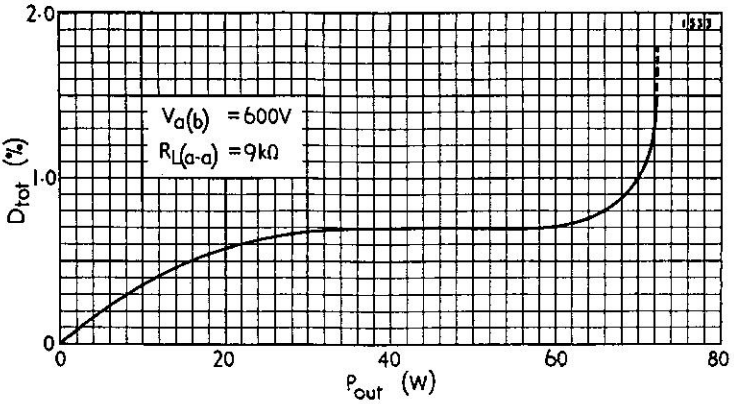


Fig. 7. Ultra-linear connection. 43% taps. Push-pull. Class AB1. Fixed bias.

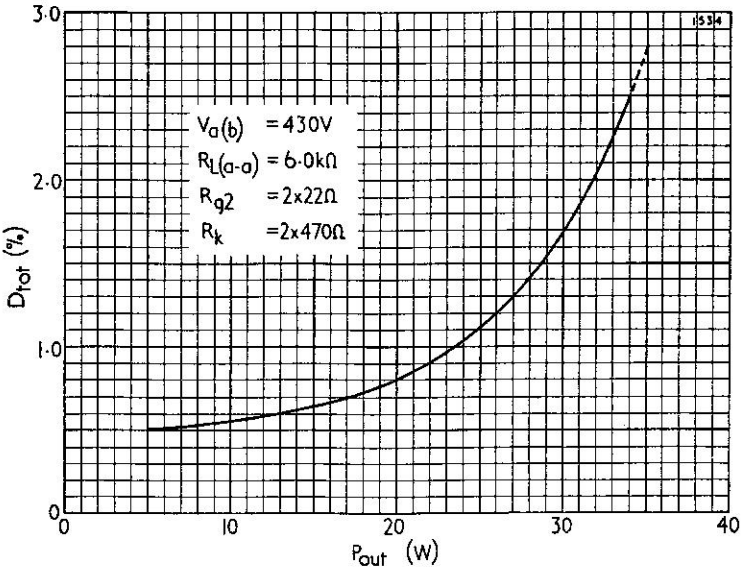


Fig. 8. Ultra-linear connection. 43% taps. Push-pull. Class AB1. Cathode bias.

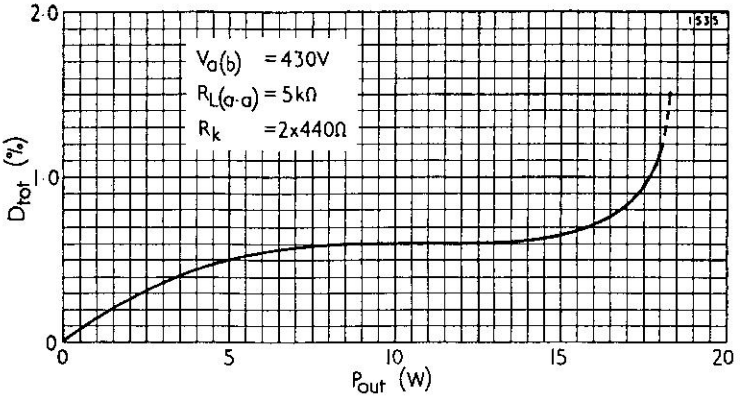


Fig. 9. Triode connection. Push-pull. Class AB1. Cathode bias.

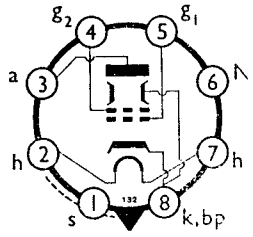
Genalex

BEAM PENTODE
6·3V INDIRECTLY HEATED

KT88
ISSUE 2
MARCH, 1959

The KT88 has an anode dissipation of 35W and is primarily designed for the output stage of an a.f. amplifier for which two valves will provide up to 100W output. Under intermittent conditions, an output of 150W is obtainable in Class B (see Circuit Supplement). It is also suitable for use as a series valve in a stabilised power supply.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : Metal shell wafer octal.
Bulb : Tubular
Max. overall length : 125 mm.
Max. seated length : 110 mm.
Max. diameter : 52 mm.

HEATER

V_h	6·3	V
I_h	1·6	A

MAXIMUM RATINGS

V_a	600	V
V_{g2}	600	V
*$V_{a,g2}$	600	V
p_a	35	W
p_{g2}	6	W
*p_{a+g2}	40	W
I_k	175	mA
V_{h-k}	150	V
R_{g-k} (cathode bias)	220†	kΩ
R_{g-k} (fixed bias)	100†	kΩ

*Triode connection.
†Resistors of 20% tolerance may be used.

CAPACITANCES

c_{g-a}	1·2 pF	c_{in}	16 pF	c_{out}	12 pF

CHARACTERISTICS

	Pentode Connection			Triode Connection	
V_a	250	V	$V_{a,g2}$	250	V
V_{g2}	250	V	I_h	160	mA
I_a	140	mA	g_m	12	mA/V
g_m	11	mA/V	r_a	670	Ω
r_a	12	kΩ	μ	8	—
μ_{g1-g2}	8				

Distributors :
BRITISH INDUSTRIES CORPORATION
80 Shore Road, Port Washington, New York, U.S.A.

Representing :
THE GENERAL ELECTRIC CO. LTD. OF ENGLAND
Head Office : Magnet House, Kingsway, London, W.C.2.

KT88

TYPICAL OPERATION

Push-Pull Ultra-Linear. Cathode Bias.

$V_{a(b)}$	500	V
$V_{a,g2}$	425	V
$I_{a+g2(o)}$	2×87	mA
$I_{a+g2(max\ sig)}$	2×100	mA
$p_{a+g2(o)}$	2×40	W
$p_{a+g2(max\ sig)}$	2×18	W
*R_k	2×525±5%	Ω
V_{g1} (approx)	−50	V
$V_{in(g-g)}$	90	V
$R_{L(a-a)}$	6	kΩ
z_{out}	4·5	kΩ
P_{out}	50	W
†D	1	%
†Intermodulation	5	%

*Separate bias resistors are essential.

†Average pair.

Push-Pull Ultra-Linear. Fixed Bias.

$V_{a(b)}$	560	V
$V_{a,g2}$	550	V
$I_{a+g2(o)}$	2×50	mA
$I_{a+g2(max\ sig)}$	2×150	mA
$p_{a+g2(o)}$	2×30	W
$p_{a+g2(max\ sig)}$	2×33	W
*V_{g1} (approx)	−80	V
$V_{in(g-g)}$	120	V
$R_{L(a-a)}$	4·5	kΩ
z_{out}	6·5	kΩ
P_{out}	100	W
†D	3—6	%
Intermodulation	12	%

*A negative bias range of 70±25% is recommended.

†The distortion will vary according to the degree of matching.

Push-Pull Triode Connection. Cathode Bias.

$V_{a(b)}$	400	485	V
$V_{a,g2}$	350	425	V
$I_{a+g2(o)}$	2×67	2×85	mA
$I_{a+g2(max\ sig)}$	2×72	2×90	mA
$p_{a+g2(o)}$	2×24	2×40	W
*R_k	2×525±5%	2×525±5%	Ω
V_{g1} (approx)	−38	−48	V
$V_{in(g-g)}$	60	70	V
$R_{L(a-a)}$	4	4	kΩ
z_{out}	2·5	2·5	kΩ
P_{out}	15	27	W
†D	1—3	1—3	%
Intermodulation	6	6	%

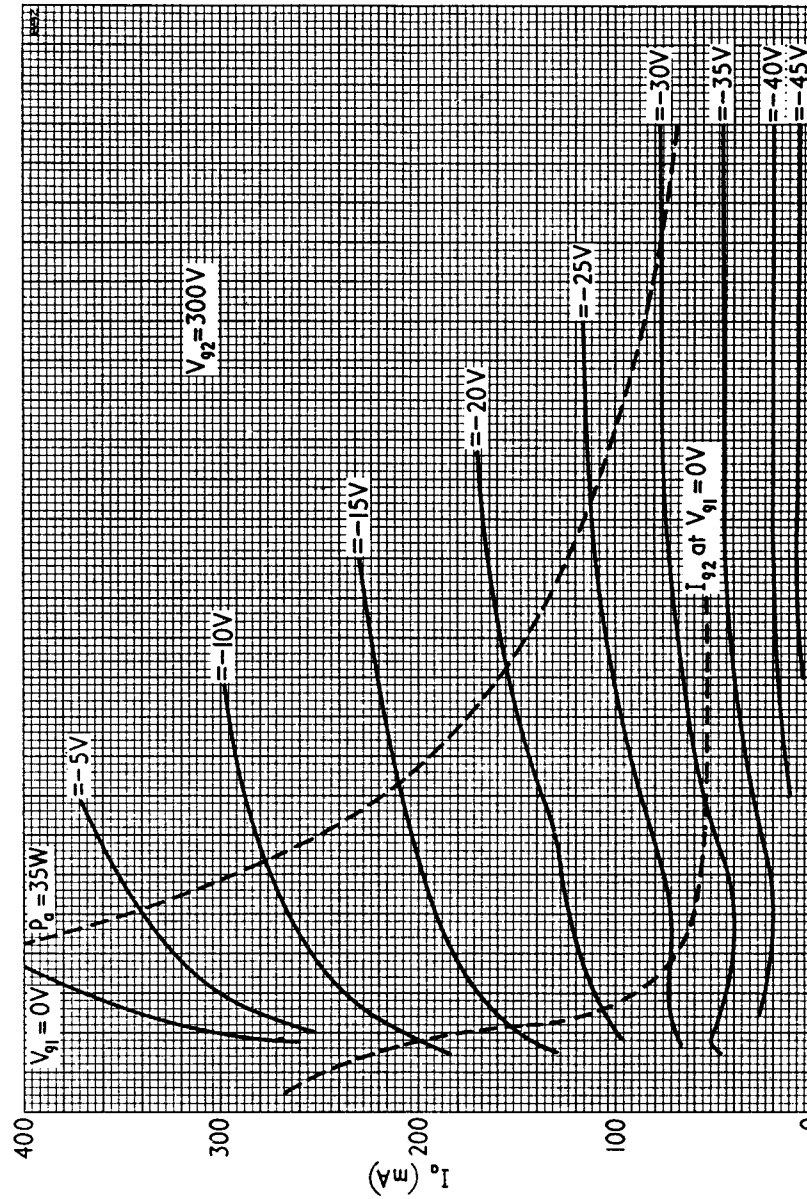
*Separate bias resistors are essential.

†The distortion will vary according to the degree of matching.

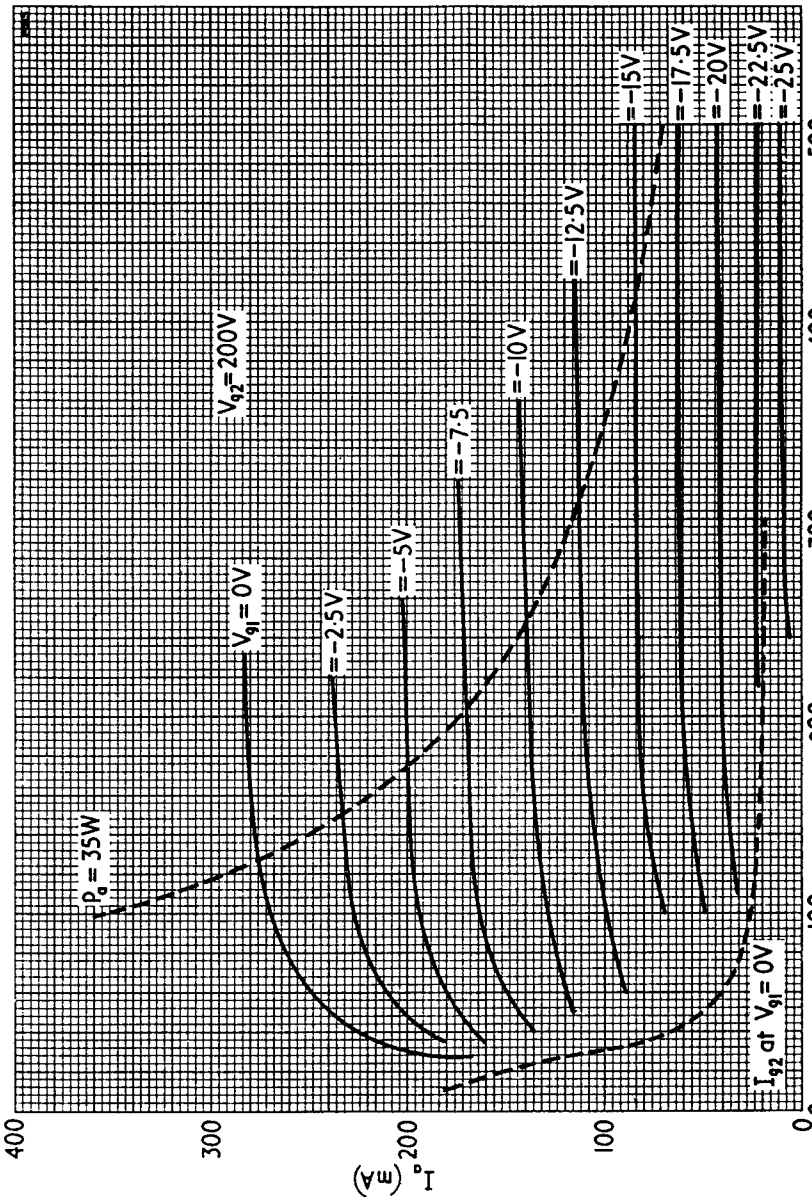
INSTALLATION

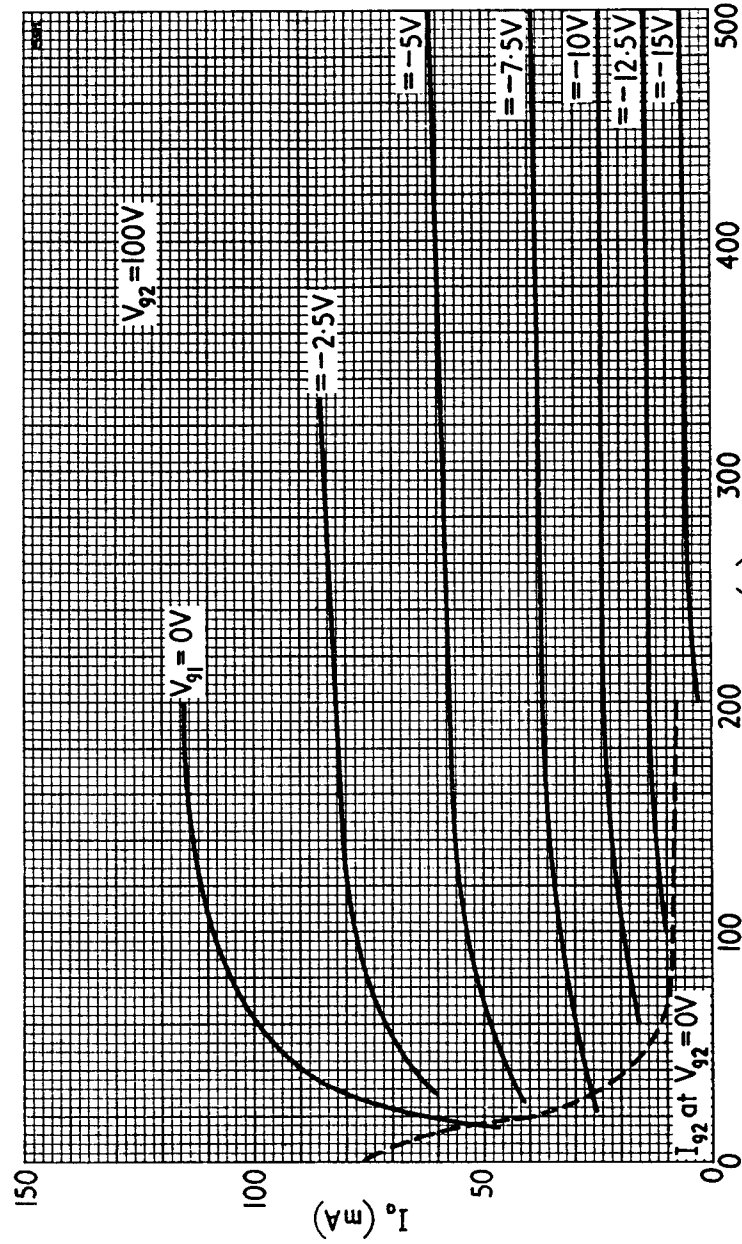
The valve may be mounted horizontally only if pins 4 and 8 are in a vertical plane.

Free air circulation round the valve is desirable ; the hottest part of the bulb should not exceed 250°C.

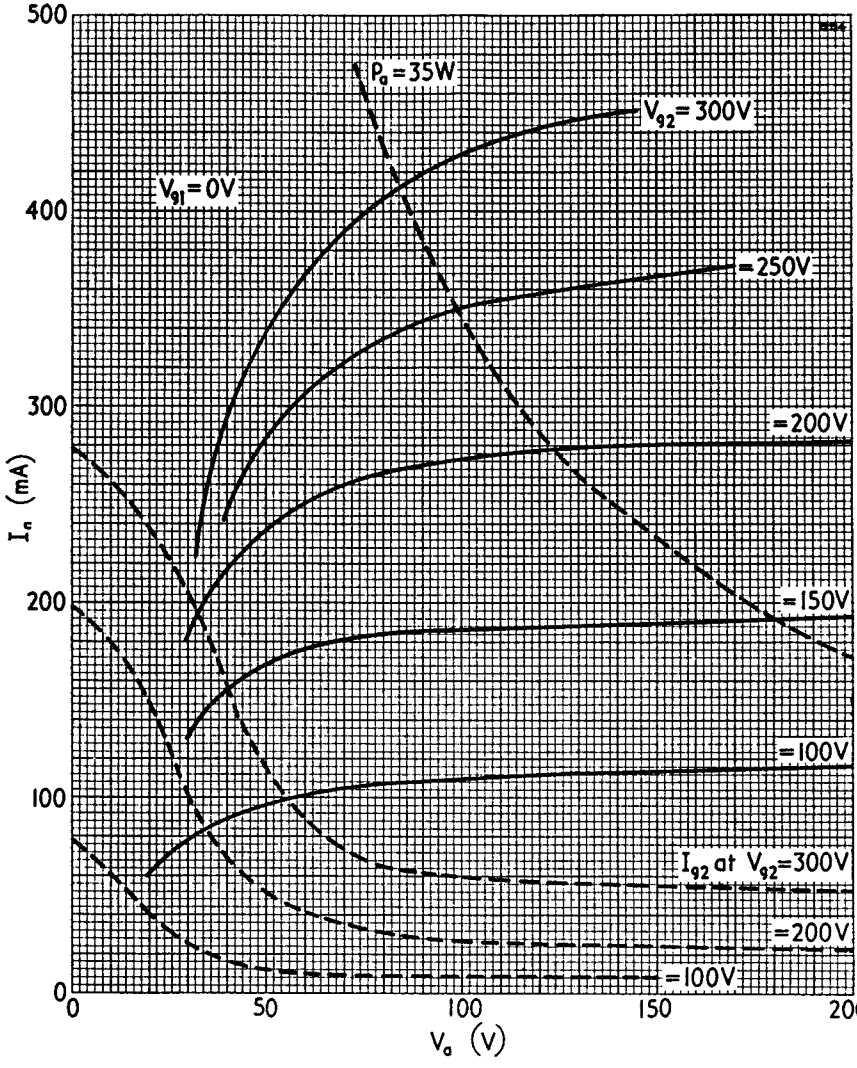

V_{g1} = 0V
P_a = 35W
= −5V
= −10V
= −15V
= −20V
= −25V
= −30V
= −35V
= −40V
= −45V
V_{g2}=300V
I_{g2} at V_{g1} = 0V
I_a (mA)
V_a (V)
0
100
200
300
400
500

KT88

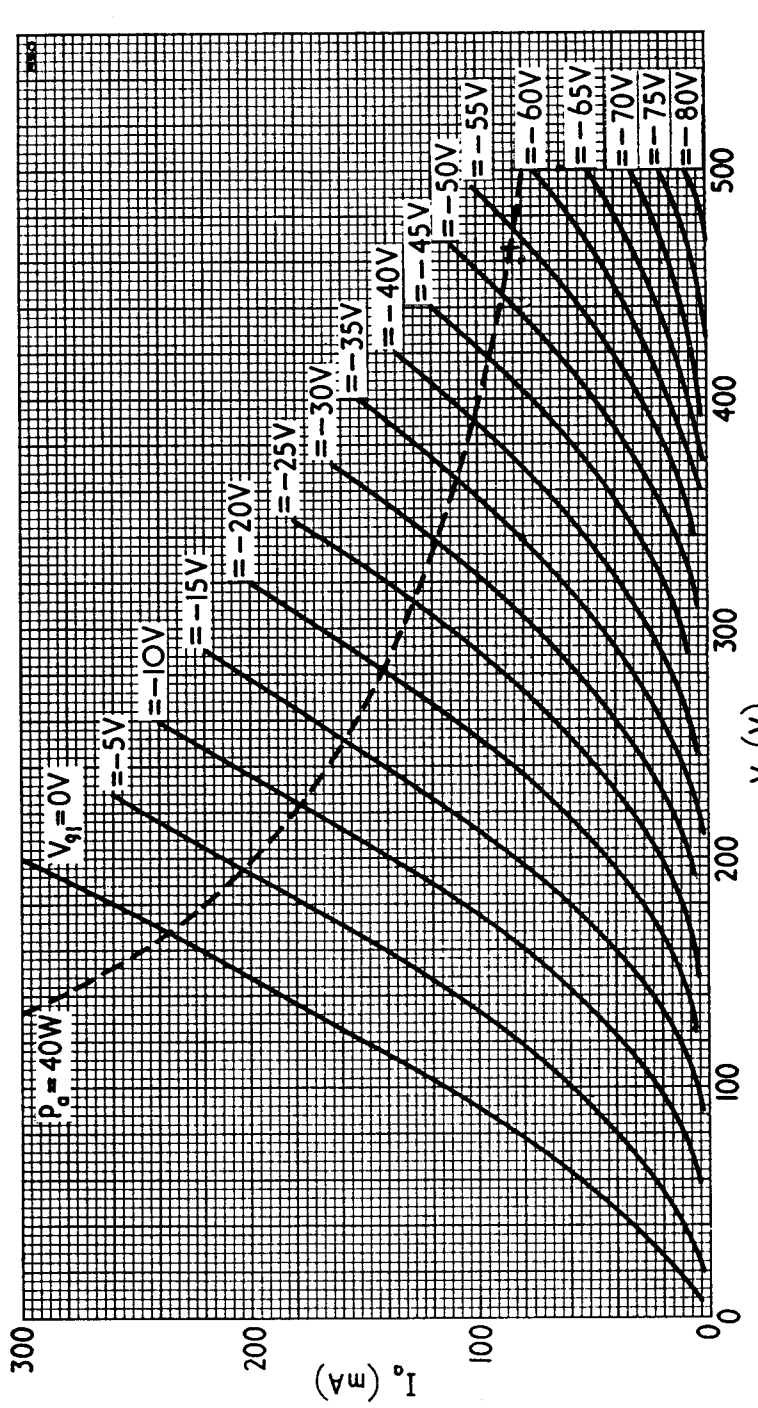

I_a (mA)
V_a (V)
V_{g2}=200V
V_{g1}= 0V
=-2·5V
=-5V
=-7·5
=-10V
=-12·5V
=-15V
=-17·5V
=-20V
=-22·5V
=-25V
P_a = 35W
I_{g2} at V_{g1}= 0V
0
100
200
300
400
500


V_{92}=100V
V_{91} = 0V
=−2·5V
=−5V
=−7·5V
=−10V
=−12·5V
=−15V
I_{92} at V_{92}=0V
I_a (mA)
V_a (V)
0
50
100
150
200
300
400
500

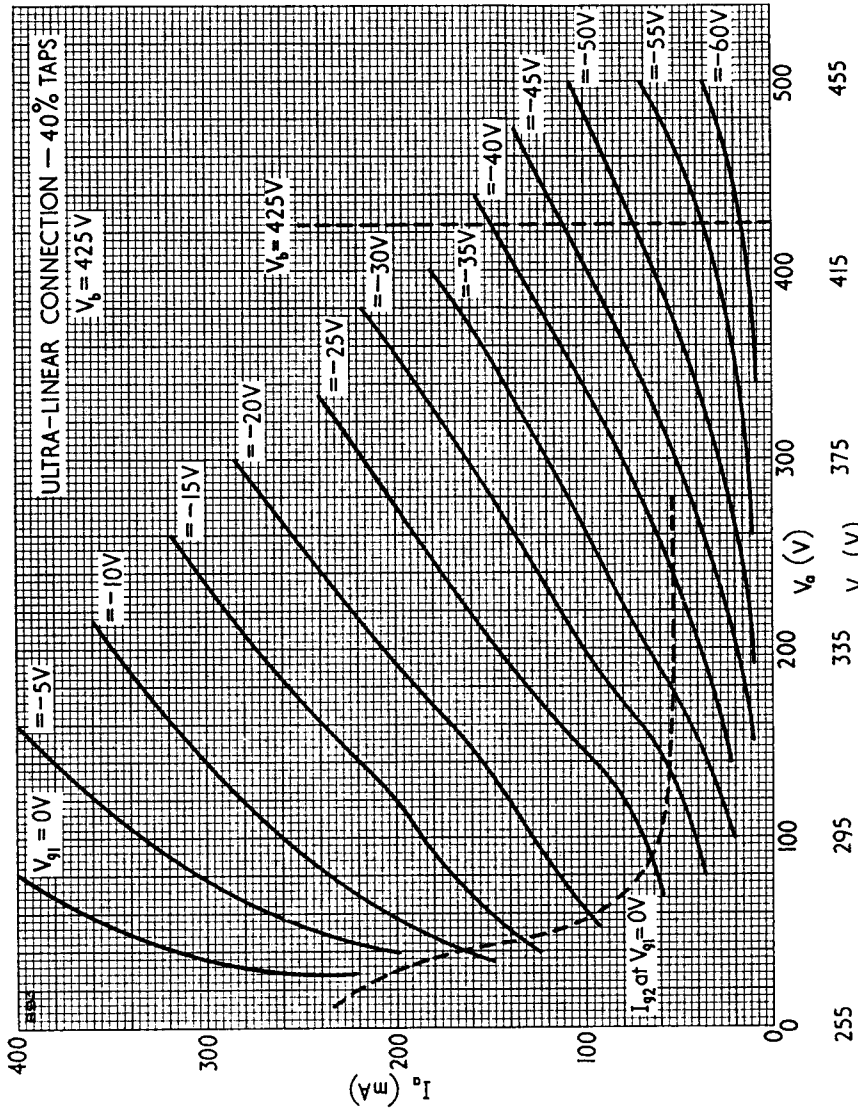
KT88


500
400
300
200
100
0
0
50
100
150
200
I_a (mA)
V_a (V)
P_a = 35W
V_{g2} = 300V
V_{g1} = 0V
=250V
=200V
=150V
=100V
I_{g2} at V_{g2}=300V
=200V
=100V

TRIODE CONNECTION



KT88



Printed in England. C.

G.E.C. VALVES

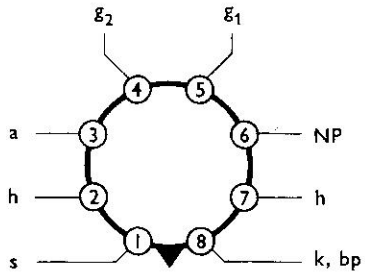
BEAM TETRODE
6·3V INDIRECTLY HEATED

KT88
ISSUE 3

The KT88 has an absolute maximum anode dissipation rating of 42W and is designed for use in the output stage of an a.f. amplifier. Two valves in Class AB1 give a continuous output of up to 100W. The KT88 is also suitable for use as a series valve in a stabilised power supply.

The KT88 is a commercial version of the CV5220 and is similar to the 6550.

BASE CONNECTIONS AND VALVE DIMENSIONS



Base: Metal shell wafer octal
Bulb: Tubular

Max. overall length: 125mm
Max. seated length: 110mm
Max. diameter: 52mm

HEATER

V_h	6·3	V
I_h	1·6 (approx)	A

MAXIMUM RATINGS

	Absolute	Design Maximum	
V_a	800	800	V
V_{g2}	600	600	V
$V_{a,g2}$	600	600	V
$-V_{g1}$	200	200	V
p_a	42	35	W
p_{g2}	8	6	W
p_{a+g2}	46	40	W
I_k	230	230	mA
V_{h-k}	250	200	V
T_{bulb}	250	250	°C
R_{g1-k} (cathode bias)			
$p_{a+g2} \leqslant 35W$	470		kΩ
$p_{a+g2} > 35W$	270		kΩ
R_{g1-k} (fixed bias)			
$p_{a+g2} \leqslant 35W$	220		kΩ
$p_{a+g2} > 35W$	100		kΩ

CAPACITANCES (Measured on a cold unscreened valve)

$c_{g1-a,g2}$: 7·9pF $c_{g1-\text{all less } a,g2}$: 9·3pF $c_{a,g2-\text{all less } g1}$: 17pF

THE M-O VALVE CO. LTD. · BROOK GREEN · LONDON · W.6
a subsidiary of
THE GENERAL ELECTRIC CO. LTD. OF ENGLAND

JUNE, 1961

CAPACITANCES (Measured on a cold unscreened valve)

Triode Connection

$C_{g1-a,g2}$: 7.9pF $C_{g1-\text{all less } a,g2}$: 9.3pF $C_{a,g2-\text{all less } g1}$: 17pF

Tetrode Connection

C_{g1-a}: 1.2pF $C_{g1-\text{all less } a}$: 16pF $C_{a-\text{all less } g1}$: 12pF

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a subsidiary of
THE GENERAL ELECTRIC CO. LTD. OF ENGLAND
Printed in England—K-C R627 OCTOBER, 1961

CHARACTERISTICS

Tetrode Connected

V_a	250	V
V_{g2}	250	V
I_a	140	mA
I_{g2}	3 (approx)	mA
$-V_{g1}$	15 (approx)	V
g_m	11·5	mA/V
r_a	12	kΩ
μ_{g1-g2}	8	—

Triode Connected

$V_{a,g2}$	250	V
I_{a+g2}	143	mA
$-V_{g1}$	15 (approx)	V
g_m	12	mA/V
r_a	670	Ω
μ	8	—

TYPICAL OPERATION

Push-Pull. Class AB1. Cathode Bias. Tetrode Connection

$V_{a(b)}$	560	V
$V_{a(o)}$	521	V
V_{g2}	300	V
$I_{a(o)}$	2×64	mA
$I_{a(max\ sig)}$	2×73	mA
$I_{g2(o)}$	2× 1·7	mA
$I_{g2(max\ sig)}$	2× 9	mA
$R_{L(a-a)}$	9	kΩ
*R_k	2×460	Ω
$-V_{g1}$	30 (approx)	V
P_{out}	50	W
D_{tot}	3	%
†I.M.	11	%
$p_{a(o)}$	2×33	W
$p_{a(max\ sig)}$	2×12	W
$p_{g2(o)}$	2× 0·5	W
$p_{g2(max\ sig)}$	2× 2·7	W
$V_{in(g1-g1)(pk)}$	60	V

*It is essential to use two separate cathode bias resistors.

†Intermodulation distortion; measured using two input signals at 50 and 6000c/s (ratio of amplitudes 4:1).

Push-Pull. Class AB1. Fixed Bias. Tetrode Connection

$V_{a(b)}$	560	V
$V_{a(o)}$	552	V
V_{g2}	300	V
$I_{a(o)}$	2×60	mA
$I_{a(max\ sig)}$	2×145	mA
$I_{g2(o)}$	2× 1·7	mA
$I_{g2(max\ sig)}$	2×15	mA
$R_{L(a-a)}$	4·5	kΩ
*$-V_{g1}$	34 (approx)	V
P_{out}	100	W

D_{tot}	2·5	%
†I.M.	10	%
$P_{a(o)}$	2×33	W
$P_{a(max\ sig)}$	2×28	W
$P_{g2(o)}$	2× 0·5	W
$P_{g2(max\ sig)}$	2× 4·5	W
$V_{in(g1-g1)(pk)}$	67	V

*It is essential to provide two separately adjustable bias voltage sources, having a voltage adjustment range of ±25%.

†Intermodulation distortion; measured using two input signals at 50 and 6000c/s (ratio of amplitudes 4:1).

Push-Pull. Class AB1. Cathode Bias. Ultra-Linear Connection
(40% Tapping Points)

$V_{a,g2(b)}$	500	375	V
$V_{a,g2(o)}$	436	328	V
$I_{a+g2(o)}$	2×87	2×87	mA
$I_{a+g2(max\ sig)}$	2×99	2×96	mA
$R_{L(a-a)}$	6	5	kΩ
*R_k	2×600	2×400	Ω
$-V_{g1}$	52 (approx)	35 (approx)	V
P_{out}	50	30	W
D_{tot}	1·5	1	%
†I.M.	4	3	%
$P_{a+g2(o)}$	2×38	2×28·5	W
$P_{a+g2(max\ sig)}$	2×17	2×16	W
$V_{in(g1-g1)(pk)}$	104	71	V
Z_{out}	4·8	4·5	kΩ

*It is essential to use two separate cathode bias resistors.

†Intermodulation distortion; measured using two input signals at 50 and 6000c/s (ratio of amplitudes 4:1).

Push-Pull. Class AB1. Fixed Bias. Ultra-Linear Connection
(40% Tapping Points)

$V_{a,g2(b)}$	560	460	V
$V_{a,g2(o)}$	553	453	V
$I_{a+g2(o)}$	2×50	2×50	mA
$I_{a+g2(max\ sig)}$	2×157	2×140	mA
$R_{L(a-a)}$	4·5	4	kΩ
*$-V_{g1}$	75 (approx)	59 (approx)	V
P_{out}	100	70	W
D_{tot}	2	2	%
†I.M.	11	10	%
$P_{a+g2(o)}$	2×27·5	2×22·5	W
$P_{a+g2(max\ sig)}$	2×33	2×27	W
$V_{in(g1-g1)(pk)}$	140	114	V
Z_{out}	7	6·5	kΩ

*It is essential to provide two separately adjustable bias voltage sources, having a voltage adjustment range of ±25%.

†Intermodulation distortion; measured using two input signals at 50 and 6000c/s (ratio of amplitudes 4:1).

Push-Pull. Class AB1. Cathode Bias. Triode Connection

$V_{a,g2(b)}$	400	485	V
$V_{a,g2(o)}$	349	422	V
$I_{a+g2(o)}$	2×76	2×94	mA
$I_{a+g2(max\ sig)}$	2×80	2×101	mA
$R_{L(a-a)}$	4	4	kΩ
$-V_{g1}$	40 (approx)	50 (approx)	V
P_{out}	17	31	W
D_{tot}	1·5	1·5	%
*I.M.	5·6	5·6	%
$p_{a+g2(o)}$	2×26·5	2×40	W
$p_{a+g2(max\ sig)}$	2×19	2×27	W
R_k	2×525	2×525	Ω
$V_{in(g1-g1)(pk)}$	78	114	V
Z_{out}	2	1·9	kΩ

*Intermodulation distortion; measured using two input signals at 50 and 6000c/s (ratio of amplitudes 4:1).

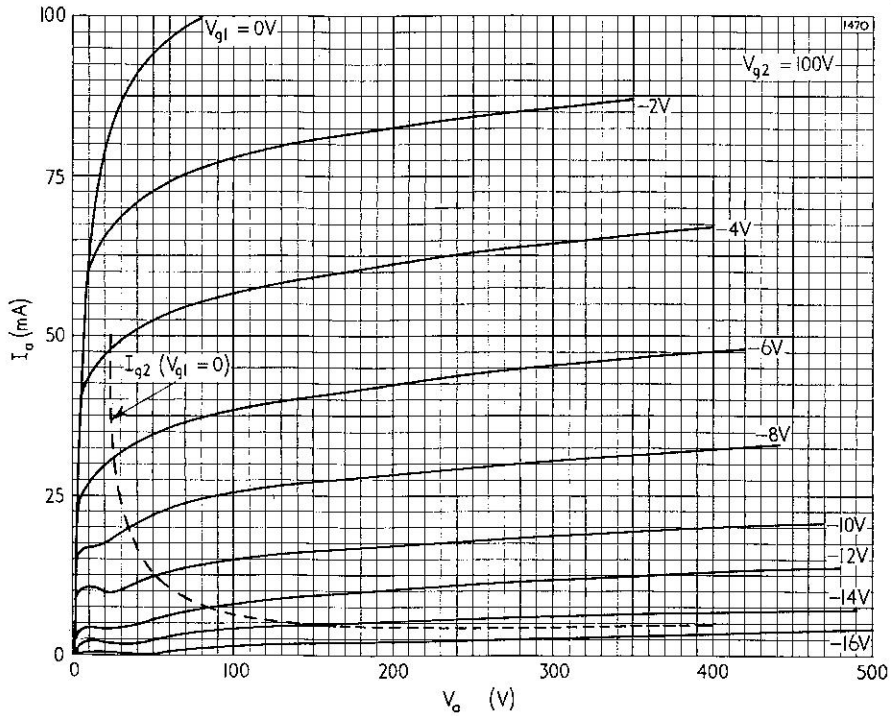
INSTALLATION

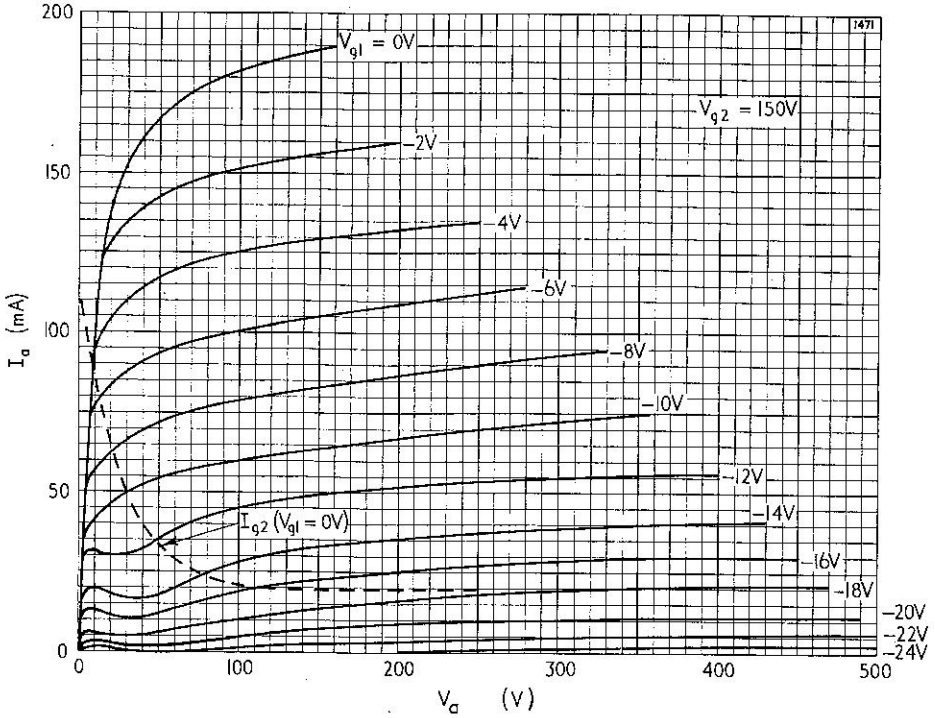
The valve may be mounted either vertically or horizontally.

When a pair of valves is mounted vertically it is recommended that the centres of the valve sockets are not less than 4in. apart and that pins 4 and 8 of each valve are in line.

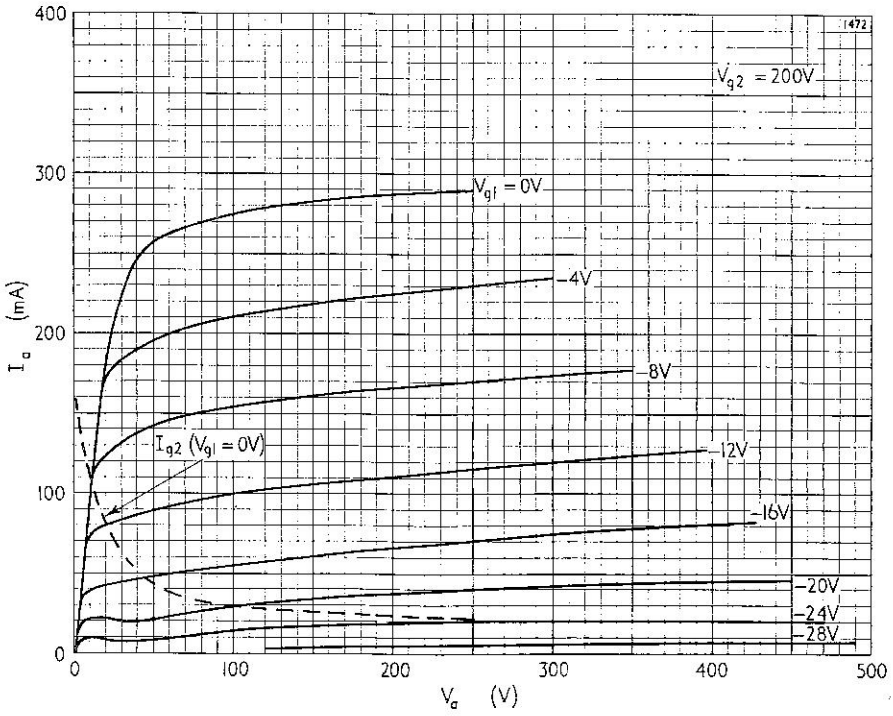
When a pair of valves is mounted horizontally it is recommended that the centres of the valve sockets are not less than 4in. apart and that pins 4 and 8 of each valve are in the same vertical line.

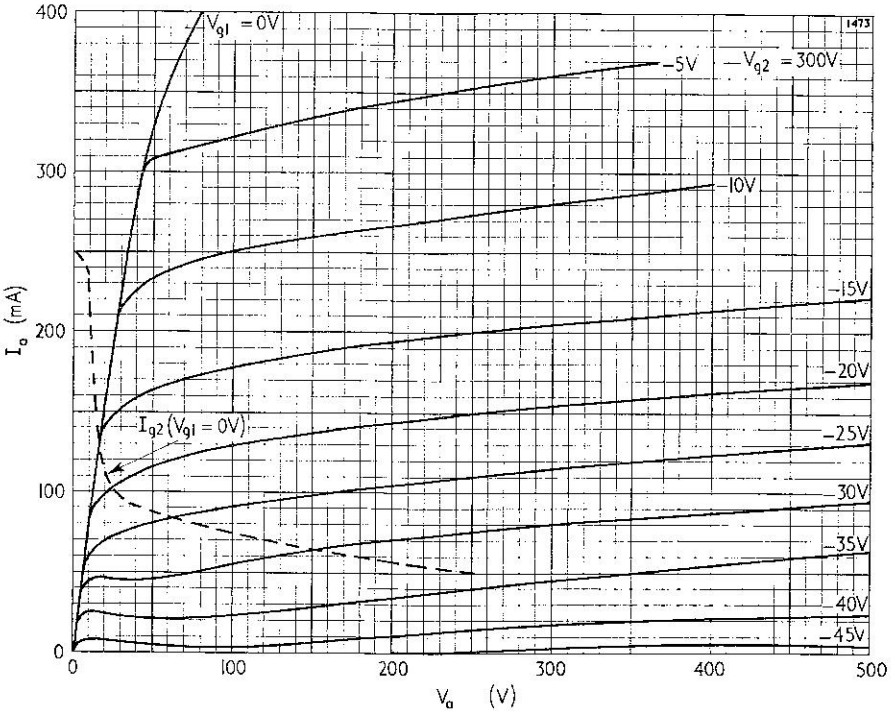
Free air circulation around the valve is desirable.

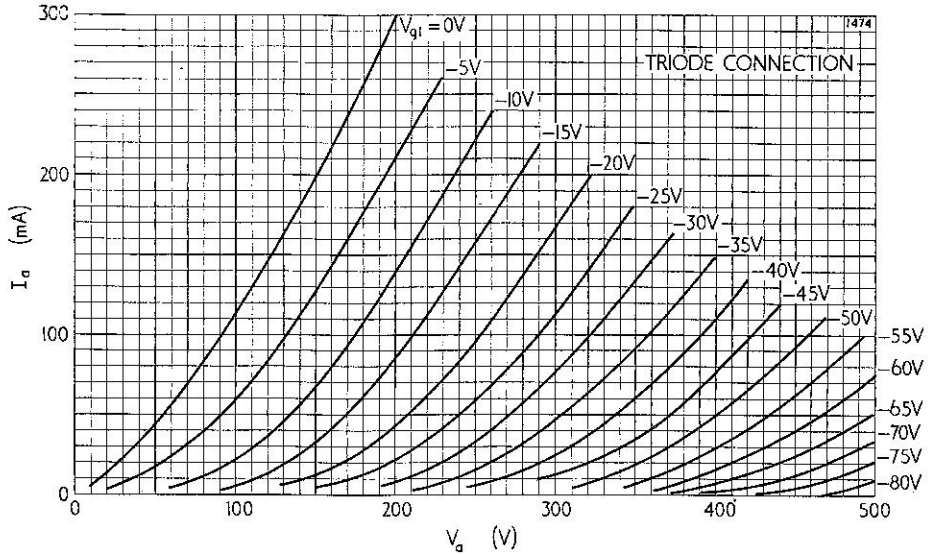

1470
V_{g1} = 0V
V_{g2} = 100V
-2V
-4V
-6V
-8V
-10V
-12V
-14V
-16V
I_{g2} (V_{g1} = 0)
I_a (mA)
V_a (V)
0
25
50
75
100
0
100
200
300
400
500

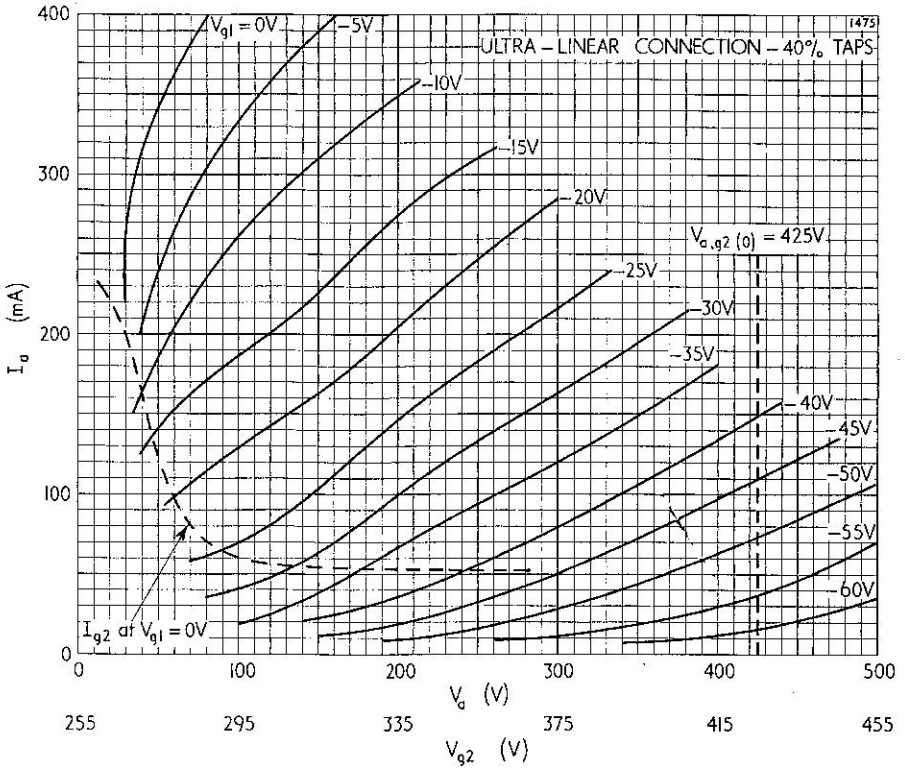

1471
V_{g1} = 0V
V_{g2} = 150V
-2V
-4V
-6V
-8V
-10V
-12V
-14V
-16V
-18V
-20V
-22V
-24V
I_{g2} (V_{g1} = 0V)
I_a (mA)
V_a (V)
0
50
100
150
200
0
100
200
300
400
500

KT88


1472
400
300
200
100
0
I_a (mA)
V_{g2} = 200V
V_{g1} = 0V
-4V
-8V
-12V
-16V
-20V
-24V
-28V
I_{g2} (V_{g1} = 0V)
0
100
200
300
400
500
V_a (V)


1473
400
300
200
100
0
I_a (mA)
V_{g1} = 0V
-5V
V_{g2} = 300V
-10V
-15V
-20V
-25V
-30V
-35V
-40V
-45V
I_{g2} (V_{g1} = 0V)
0
100
200
300
400
500
V_a (V)





Printed in England R374

INTRODUCTION

The KT88 may be used in pairs in either triode, pentode or ultra-linear push-pull circuits and this Supplement gives circuits and operating data for amplifiers giving outputs of 30 to 400 watts in various conditions of operation. The ultra-linear circuit is recommended for outputs up to 100W when the maximum output coupled with the lowest distortion is required and it is also used in the multiple-pair 400W amplifier described on page 20.

The curves in fig. 1 show the output and approximate distortion obtained from push-pull KT88 valves with various positions of the screen grid taps on the output transformer. At the left-hand side (0% taps) the valves are, of course, pentode-connected and on the right-hand side (100% taps) they are triode-connected. Generally speaking, the taps should be spaced at 20% to 50% of the turns on each half-primary from the centre, with 30% to 40% as the optimum. The dotted curve shows the reduction in output impedance obtained.

Either cathode bias or fixed bias may be used and the circuits show both types of operation. The former has the advantage of simplicity whereas the latter provides the normal maximum output of 100W from a pair of valves and higher efficiency.

The output power of the ultra-linear circuit is not less than that of the pentode at any given supply voltage and has the advantage that a low impedance screen supply is not required. The ultra-linear circuit does, in fact, show a rather higher efficiency in that a lower current is required from the power supply. For example, with fixed bias and a supply voltage of 460 an output of 65W is obtained with an anode current of 240mA in both the pentode and the ultra-linear arrangements but the pentode requires, in addition, a screen current of 35mA. Furthermore, it is desirable that the pentode screen supply be stabilised. The output impedance and distortion are both more favourable in the ultra-linear circuit, the former being 6·5kΩ in this example, compared with 50kΩ, and the distortion is almost entirely independent of load impedance above the rated value. Information on the effect of the positions of the screen taps upon the degree of intermodulation is given in the Appendix on page 26.

The triode connection is sometimes preferred when a moderate power output with low distortion is required. An output of up to 27W is obtainable with an h.t. supply of 485V and cathode bias and, even at lower voltages, the output is adequate for domestic amplifiers. The distortion will depend on the degree of matching between pairs but it is normal to obtain a distortion below 2% without negative feedback by the selection of two out of any three valves since this procedure, at worst, halves the normal variation in characteristics. Operating data will be found in the KT88 data sheet.

Due to the high mutual conductance of the KT88 some precautions have to be taken against parasitic oscillation whatever the circuit arrangement. Grid and screen series resistors of about 10kΩ and 270Ω respectively, are recommended. In the ultra-linear circuit, resistance-capacitance networks may be found necessary between the anode and screen taps on the output transformer as shown in fig. 4. With some transformers they will not be needed and they become less necessary as the taps include a greater part of the primary due to the consequent reduction in leakage inductance.

Details are also given for Class B operation of triode-connected KT88 valves for an output of up to 150W. This type of operation is useful when a distortion higher than that given by the ultra-linear circuit can be tolerated.

When an output exceeding 150W is needed, the KT88 valve may be used in multiple pairs in parallel push-pull instead of a single pair of larger valves. One of the advantages of this method is the low cost of the power supply which is required to give an h.t. of only 550V. Another advantage is that a valve failure in the output stage merely reduces the available output power with a probable increase in distortion.

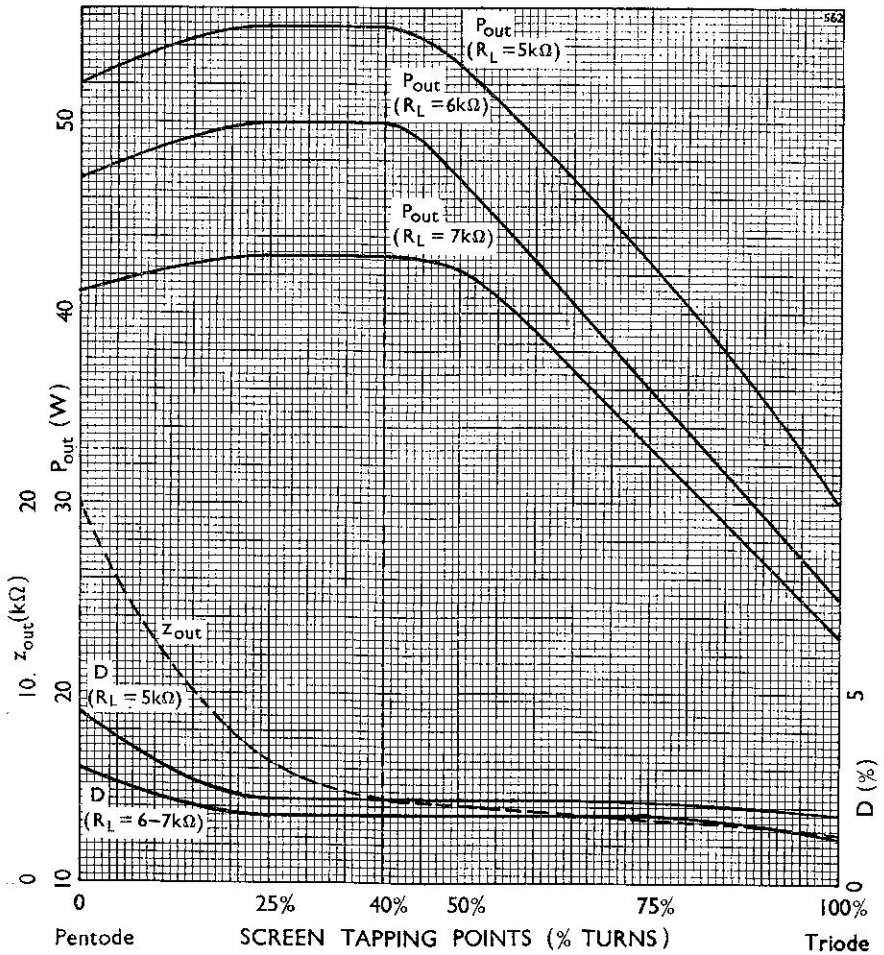


Fig. 1. Output power, distortion and output impedance of KT88 ultra-linear output stage at various positions of the screen taps from 0% to 100% of each half-primary from the centre tap.

Installation

The bulb temperature rating of 250°C must not be exceeded and any cabinet used must provide adequate ventilation. Under free air conditions this temperature is not reached at maximum ratings, but where a valve is enclosed the use of the temperature sensitive paint " Tempilaq "* is recommended to check that adequate air circulation exists.

Although the KT88 may be mounted in any desired position it is recommended that, when valves are mounted horizontally, pins 4 and 8 should be in a vertical line as in fig. 2.

When two valves are mounted vertically, in the more usual manner, on a horizontal chassis, there is a slight advantage obtained if pins 4 and 8 of both valves are mounted in line, as in fig. 3. The coolest part of the bulbs then face each other whilst the hottest parts (nearest the anodes) are at right-angles.

*Obtainable from J. M. Steel & Co. Ltd., 36, Kingsway, London, W.C.2.



Fig. 2. Correct orientation and spacing of the valve sockets when the valves are mounted horizontally.

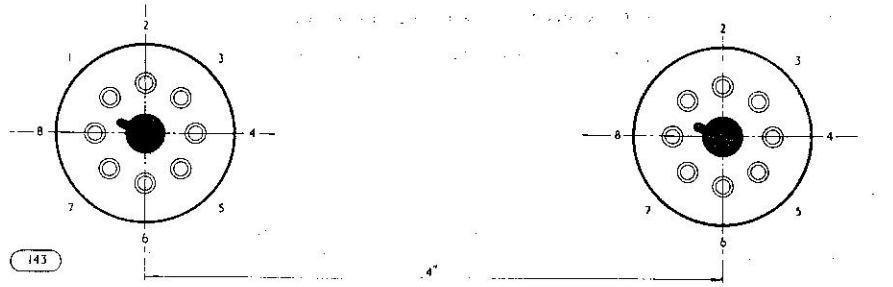


Fig. 3. Correct orientation and spacing of the valve sockets when the valves are mounted vertically.

Power Supply

The type of power supply required will depend on the operating conditions but a capacitance input filter circuit is satisfactory for the ultra-linear cathode bias amplifiers.

With fixed bias, the large change in anode current requires a low impedance power supply and an inductance input filter is essential. It is desirable for the smoothing capacitor to be of high value to prevent an instantaneous fall in voltage upon the occurrence of a transient. Satisfactory performance will be obtained with a single inductor and a capacitance of 50—150μF. Two 160μF, 450V electrolytic capacitors in series have been found very successful with the ultra-linear higher voltage working conditions.

The choice of a rectifier will depend on the power output required. The U52 or U54 are suitable for powers up to 50W, but for amplifiers designed to cover the range 50—100W, two U19 or two GXU50 rectifiers should be used.

A 30W ULTRA-LINEAR AMPLIFIER

With negative feedback, this amplifier (fig. 4) will give 32W output with about 0·25% distortion at an anode potential of 335V. The input signal to the first stage of the amplifier for full output is 500mV. Even when negative feedback is omitted the amplifier has only 1% distortion at 32W output and requires an input of 100mV. As the KT88 valves are conservatively run in this circuit they will have a long life.

Circuit Description

The output stage is preceded by a conventional double triode voltage amplifier V2 which is fed by a triode phase-splitter comprising one half of a further double triode V1. The first half of this valve is the input stage voltage amplifier, which is directly coupled to the phase-splitter. R8, in the cathode circuit of V2, reduces any signal unbalance in the phase-splitter and lowers intermodulation distortion.

Depending upon the particular characteristics of the output transformer, it may be necessary to prevent instability by connecting capacitors and resistors across part of each output transformer half-primary and " stopper " resistors in series with the grids and screens of the output stage. The curves of fig. 5 illustrate the performance of the output stage of this amplifier without feedback.

Continued on page 6.

COMPONENT VALUES FOR FIG. 4

30W ULTRA-LINEAR AMPLIFIER

G.E.C. VALVES

V1	B65/6SN7
V2	B65/6SN7
V3	KT88
V4	KT88
V5	U54

RESISTORS

(20%, 0·25W unless otherwise shown)

R1	1MΩ	Log.
R2*	$225\sqrt{\text{speech coil impedance}}$	
R3	1kΩ	
R4	22Ω	
R5	100kΩ	
R6	15kΩ	0·5W } Matched to 5%
R7	15kΩ	0·5W } Matched to 5%
R8	4·7kΩ	
R9	470kΩ	10%
R10	470kΩ	10%
R11	1kΩ	
R12	1kΩ	
R13	33kΩ	10% 1W
R14	33kΩ	10% 1W
R15	220kΩ	
R16	220kΩ	
R17	10kΩ	
R18	10kΩ	
R19	4·7kΩ	1W
R20	400Ω	5% 5W
R21	400Ω	5% 5W
R22	270Ω	0·5W
R23	270Ω	0·5W
R24	470-1500Ω	0·5W
R25	470-1500Ω	0·5W

**For 14db feedback.*

CAPACITORS

C1	50μF 12V
C2	0·05μF
C3	0·05μF
C4	8μF 350V
C5	8μF 450V
C6	0·05μF
C7	0·05μF
C8	50μF 50V
C9	50μF 50V
C10	8μF 500V
C11	1000pF
C12	1000pF
C13	8μF 500V

MISCELLANEOUS

L1 10H 200mA

T1 35W Ultra-linear transformer
6kΩ anode-anode
†Primary Inductance : ⩽50H
Leakage inductances :
†Prim.—sec. : ⩾10mH
†½ prim.—UL tap : ⩾10mH

T2 Mains transformer
Secondaries :
375—0—375V 200mA
6·3V 5A CT
5V 3A

†*With these values, R24, R25 and C11, C12 may be omitted.*

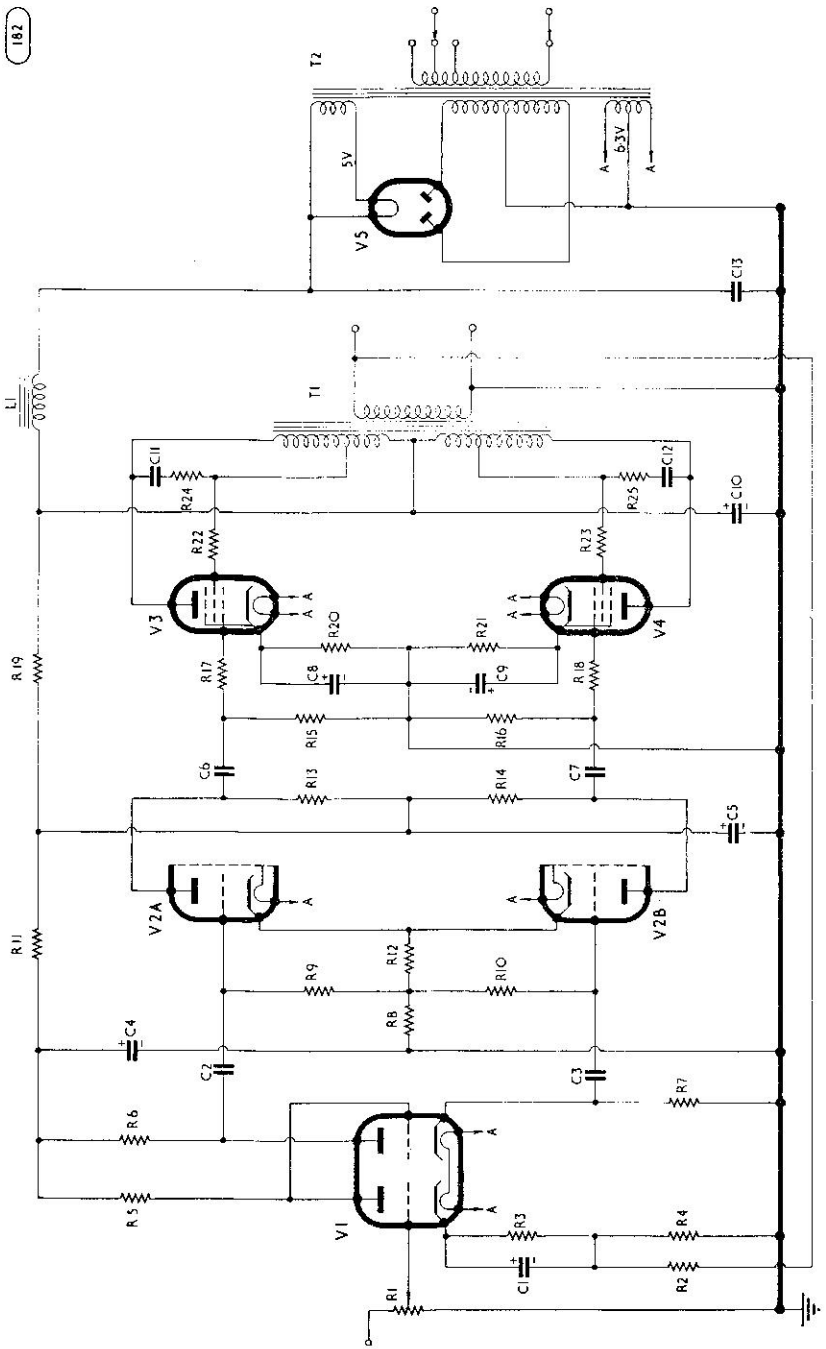


Fig. 4. Circuit diagram of the KT88 30W ultra-linear amplifier. The components list is given opposite.

The negative feedback network shown in fig. 4 provides 14db of feedback and this is adequate for all normal purposes. This value reduces the output impedance, distortion and sensitivity of the basic amplifier by a factor of 5.

Feedback from the output transformer secondary is introduced into the cathode circuit of the first stage via R2. Since the sensitivity of the amplifier without feedback is approximately 100mV, a feedback voltage of about 500mV is required for 14db feedback. As the voltage across the output transformer secondary for 32W is about 21·5 for a 15Ω load and about 11 for a load of 4Ω, the resistors R2 and R4 are chosen so that 500 mV will exist at their junction at full output. Assuming R4 to be 22Ω, R2 is given by $225\sqrt{Z_o}$ (where Z_o=the loudspeaker impedance) and the nearest standard value may be used. If Z_o=15Ω, R2 should be 1kΩ and if Z_o=4Ω, R2 should be 470Ω.

The operating conditions for the output stage of the amplifier of fig. 4 are given in Table I.

TABLE I

30W ULTRA-LINEAR AMPLIFIER

Operating Conditions

(Fig. 4)

$V_{a(b)}$	375	V
$V_{a,g2}$	335	V
$I_{a+g2(o)}$	2×80	mA
$I_{a+g2(max\ sig)}$	2×85	mA
$P_{a+g2(o)}$	2×27	W
$P_{a+g2(max\ sig)}$	2×12	W
R_k	2×400	Ω
V_g (approx)	−32	V
P_{out}	30	W
$R_{L(a-a)}$	5	kΩ
z_{out}	1	kΩ
D	0·25	%
$V_{in(rms)\ (approx)}$ (to first stage)	500	mV

If negative feedback is omitted, the last three values are as follows :

z_{out}	4·5	kΩ
D	1	%
$V_{in(rms)\ (approx)}$ (to first stage)	100	mV

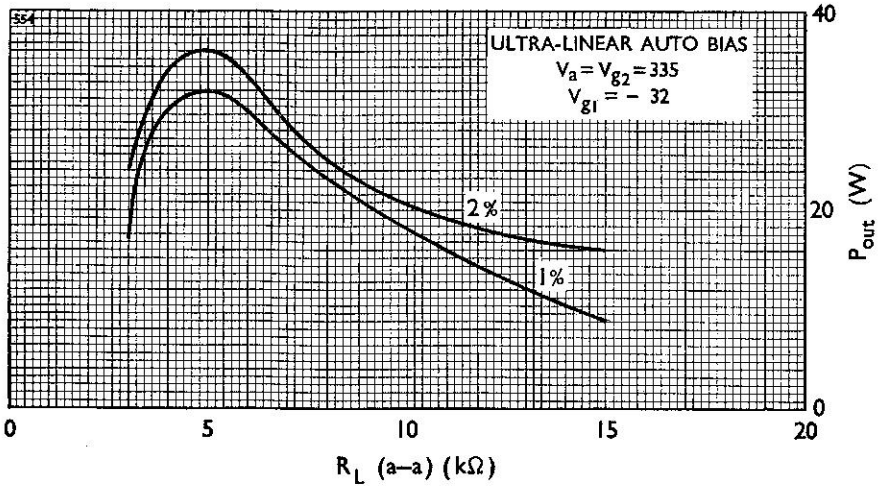


Fig. 5. Performance of the KT88 30W ultra-linear amplifier of fig. 4.

A 50W ULTRA-LINEAR AMPLIFIER

This section describes the use of the KT88 in a design for an ultra-linear amplifier with cathode bias giving 50W output at 0·2% distortion.

Circuit Description

The circuit of the complete amplifier is given in fig. 6. The design is similar to that of the 30W amplifier except for the type of input stage and the inclusion of the networks consisting of C6, R10 and C7, R11 between the first two stages. These networks reduce the amount of overshoot and consequent " ringing " in the output transformer.

The first double triode, V1, is arranged as a self-balancing floating paraphase phase nverter which feeds V2, the following push-pull voltage amplifier. Potentiometer R22 allows the signal input to the output stage to be adjusted for output stage dynamic balance.

The power supply incorporates a thermistor in the h.t. output line in order to reduce the surge from the directly heated rectifier while the remaining valves are warming up. The performance of this amplifier is illustrated in fig. 7 and the output stage operating data are given in Table II.

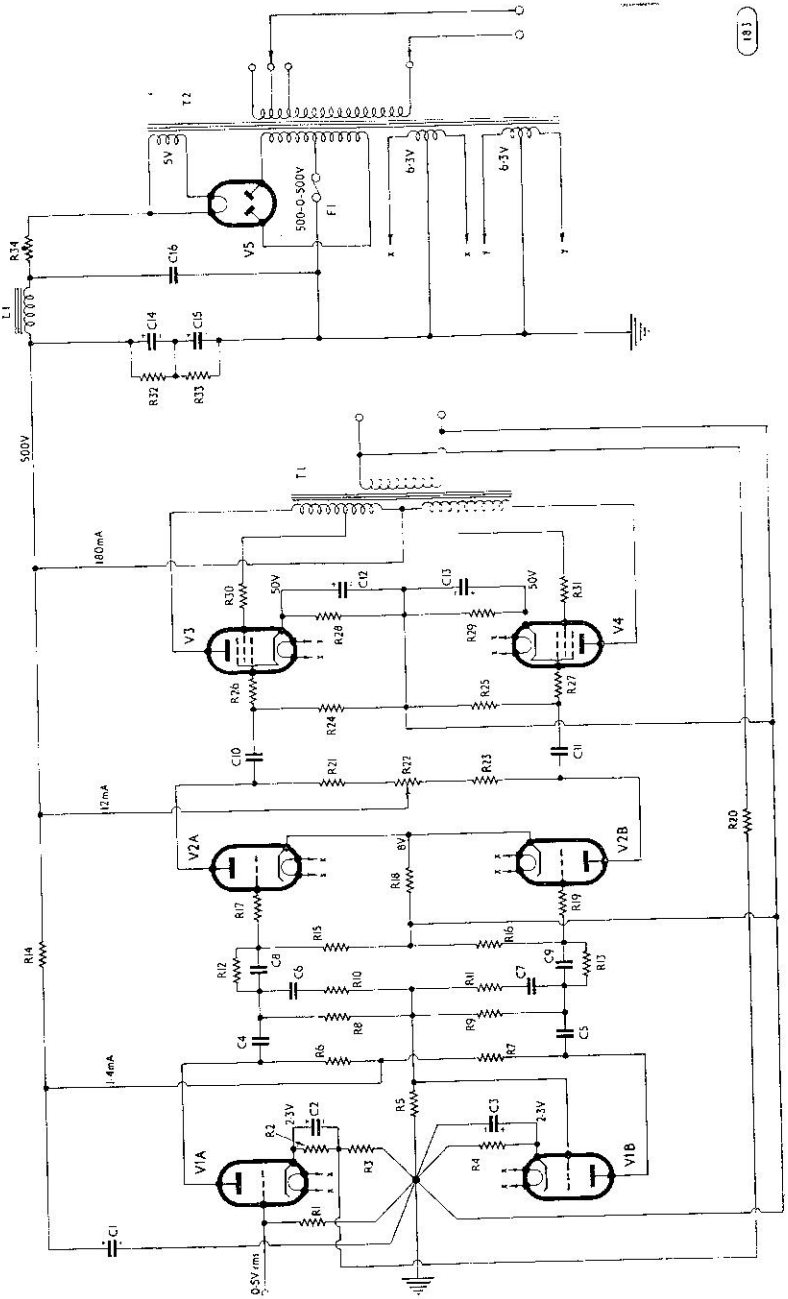


Fig. 6. Circuit diagram of the KT88 50W ultra-linear amplifier.

COMPONENT VALUES FOR FIG. 6

50W ULTRA-LINEAR AMPLIFIER

G.E.C. VALVES

V1 B339/12AX7
V2 B329/12AU7
V3 KT88
V4 KT88
V5 U52/5U4

RESISTORS

(20%, 0·5W unless otherwise shown)

R1 1MΩ
R2 3·3kΩ
R3 100Ω
R4 3·3kΩ
R5 1MΩ
R6 220kΩ 10%
R7 220kΩ 10%
R8 1MΩ
R9 1MΩ
R10 10kΩ
R11 10kΩ
R12 4·7MΩ
R13 4·7MΩ
R14 100kΩ
R15 470kΩ
R16 470kΩ
R17 10kΩ
R18 680Ω
R19 10kΩ
R20 4·7kΩ
R21 33kΩ 2W
*R22 25kΩ 4W
R23 33kΩ 2W
R24 220kΩ
R25 220kΩ
R26 10kΩ
R27 10kΩ
R28 525Ω 5% 6W
R29 525Ω 5% 6W
R30 100Ω
R31 100Ω

*Optional potentiometer for dynamically balancing the output stage. If omitted, R21 and R23 should be 47kΩ, 2%, 2W.

CAPACITORS

C1 8μF 500V
C2 50μF 12V
C3 50μF 12V
C4 0·25μF
C5 0·25μF
C6 470pF
C7 470pF
C8 0·005μF
C9 0·005μF
C10 0·5μF
C11 0·5μF
C12 50μF 100V
C13 50μF 100V
C14 24μF 350V
C15 24μF 350V
C16 4μF 750V
C17 8μF 500V

MISCELLANEOUS

L1 5H 250mA

T1 50W Ultra-linear transformer
5kΩ anode-anode
Primary inductance : ⩽30H
Leakage inductances :
Prim.—sec. : ⩾10mH
½ prim.—UL tap : ⩾10mH

T2 Mains transformer
Secondaries :
500—0—500V 250mA
6·3V 5A CT
6·3V 1—2A CT
5V 3A

F1 1A delayed fuse

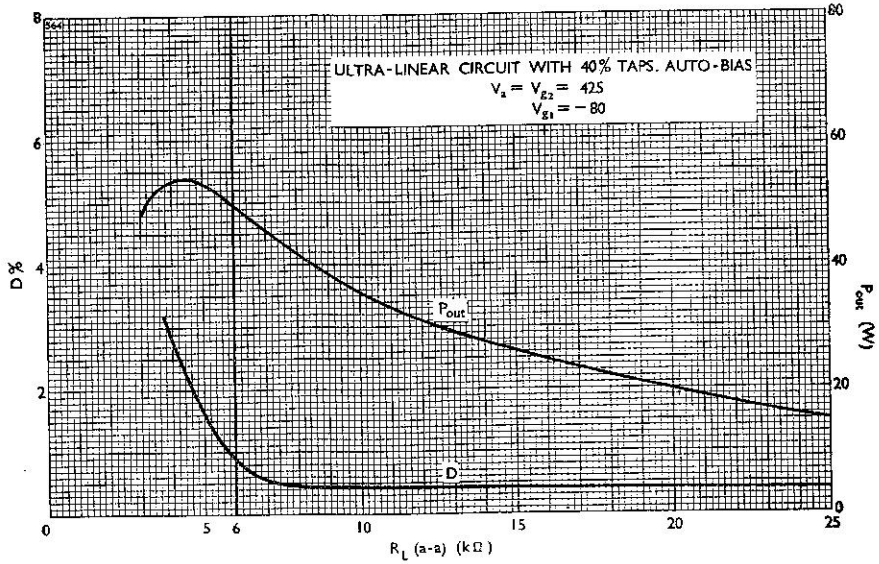


Fig. 7. Performance of the KT88 50W ultra-linear amplifier of fig. 6.

TABLE II

50W ULTRA-LINEAR AMPLIFIER

Operating Conditions

(Fig. 6)

$V_{a(b)}$	500	V
$V_{a,g2}$	425	V
$I_{a+g2(o)}$	2×87	mA
$I_{a+g2(max\ sig)}$	2×100	mA
$P_{a+g2(o)}$	2×40	W
$P_{a+g2(max\ sig)}$	2×18	W
R_k	2×525	Ω
V_g (approx)	−50	V
*P_{out}	50	W
$R_{L(a-a)}$	5	kΩ
*D	0·2	%
$V_{in(rms)}$ (to first stage)	500	mV

*These figures refer to an average pair.

A 100W FIXED BIAS ULTRA-LINEAR AMPLIFIER

The circuit of this amplifier is given in fig. 8 and it provides 100W output at 5% distortion with an h.t. potential of 560V. The performance is shown graphically in fig. 9 and Table III gives the operating conditions for the output stage.

With fixed bias, the large change in anode current necessitates a low impedance power supply and, with normal rectifier circuits, an inductance-input smoothing filter is essential. The smoothing capacitor should be of high value to prevent an instantaneous fall in h.t. potential upon the occurrence of a transient signal. Satisfactory performance will be obtained with a single inductor and a capacitance of 50—150μF. The circuit diagram shows two 160μF 450V electrolytic capacitors in series as an economical method of obtaining the required capacitance.

Reducing the h.t. potential to 460V, the load impedance to 4kΩ and the grid bias to −65V results in an amplifier giving 65W output. The performance of this version is shown in fig. 10 and the appropriate operating data are included in Table III.

Protection Against Bias Failure

Should the bias supply fail, the KT88 anode currents would increase excessively and it is recommended that some device be incorporated for protecting the output valves in the event of bias failure. The arrangement illustrated in fig. 11 inserts a suitable resistor into the output stage cathode circuit which will enable the amplifier to function temporarily at half maximum output.

A triode, which could be one half of a double triode used also in the first stage of the amplifier, is connected in series with a relay across the main h.t. supply. The relay contacts are normally closed and short-circuit the emergency cathode resistor R1. The triode is held at cut-off by the connection of its grid to the bias supply at a point about 50V negative to earth. Should the bias fail, the grid of the triode will rise to earth potential and current will flow through the triode. This energises the relay, the contacts of which will open and bring into circuit the cathode bias resistor.

TABLE III

100W ULTRA-LINEAR AMPLIFIER

Operating Conditions

(Fig. 8)

$V_{a(b)}$	460	560	V
$V_{a,g2}$	450	550	V
$I_{a+g2(o)}$	2×50	2×50	mA
$I_{a+g2(max\ sig)}$	2×120	2×150	mA
$P_{a+g2(o)}$	2×25	2×30	W
$P_{a+g2(max\ sig)}$	2×20	2×33	W
*V_{g1}	−65	−80	V
P_{out}	65	100	W
$R_{L(a-a)}$	4	4·5	kΩ
z_{out}	6·5	6·5	kΩ
†D	3—6	3—6	%
$V_{in(rms)}$ (to first stage)	1 to 1·5	1 to 1·5	mV

*A bias voltage range of at least ±25% is recommended.

†The distortion will vary according to the degree of matching by R11.

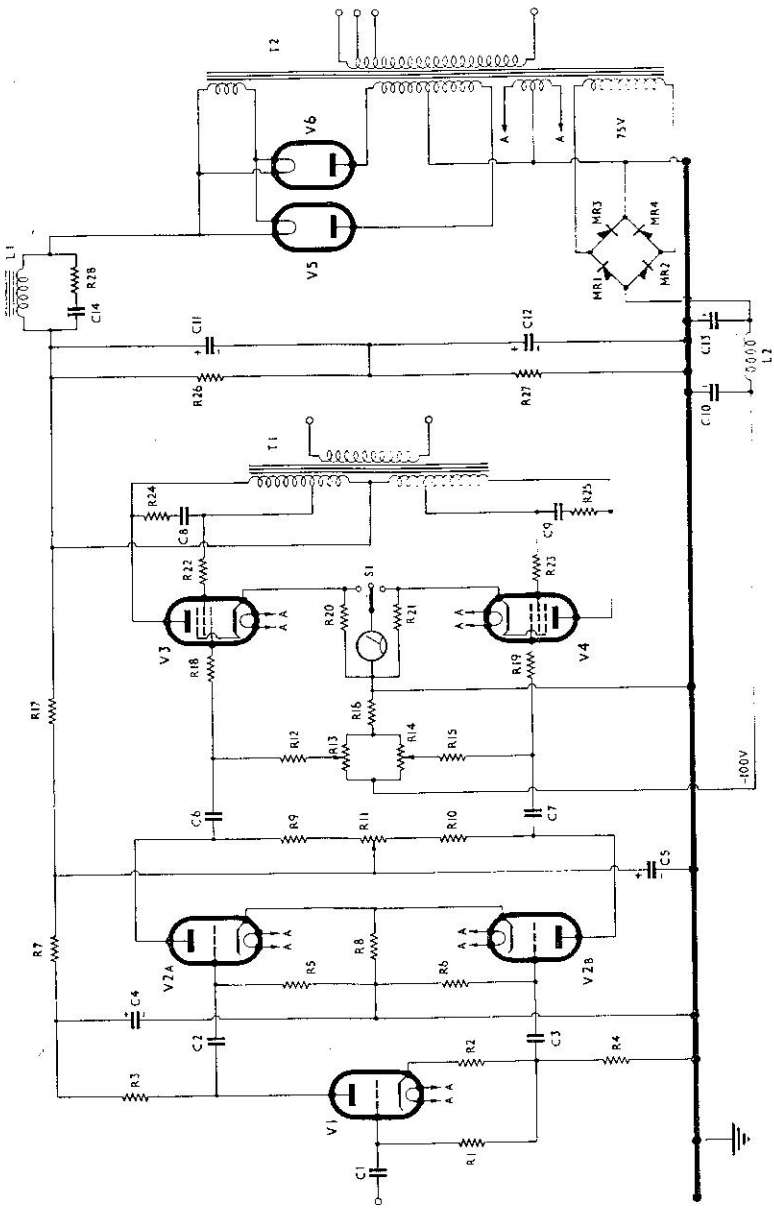


Fig. 8. Circuit diagram of the KT88 100W fixed bias ultra-linear amplifier. R26 and R27 equalise the voltages across C11 and C12, the series-connected smoothing capacitors. C14 and R28 prevent the build-up of high voltage transients across L1.

COMPONENT VALUES FOR FIG. 8

100W FIXED BIAS AMPLIFIER

G.E.C. VALVES

V1 L63/6J5
V2 B65/6SN7
V3 KT88
V4 KT88
V5, V6 U19 (or GXU50 with delay)

RESISTORS

(20%, 0·25W unless otherwise shown)

R1 1MΩ
R2 1·5kΩ
R3 33kΩ 1W, R4 33kΩ 1W matched to 5%
R5 470kΩ 10%
R6 470kΩ 10%
R7 33kΩ 1W
R8 1kΩ
R9 33kΩ 10% 1W
R10 10kΩ
R11 33kΩ 10% 1W
R12 100kΩ 10% 0·5W
R13 20kΩ w.w. preset
R14 20kΩ w.w. preset
R15 100kΩ 10% 0·5W
R16 10kΩ 10% 1W
R17 4·7kΩ 1W
R18 5·6kΩ
R19 5·6kΩ
R20, R21 Meter shunts
R22 270Ω 0·5W
R23 270Ω 0·5W
R24 470-1500Ω 0·5W
R25 470-1500Ω 0·5W
R26 100kΩ 10% 1W
R27 100kΩ 10% 1W
R28 10kΩ 0·5W

CAPACITORS

C1 0·01μF
C2 0·05μF
C3 0·05μF
C4 8μF 350V
C5 8μF 450V
C6 0·1μF
C7 0·1μF
C8 1000pF
C9 1000pF
C10 8μF 250V
C11 160μF 450V, C12 160μF 450V each 100+60 dual
C13 8μF 250V
C14 0·01μF 750V

MISCELLANEOUS

L1 5H 325mA
L2 20H 10mA
T1 100W Ultra-linear transformer
4·5kΩ anode-anode (100W)
4kΩ anode-anode (65W)
Primary inductance : ⩽40H
Leakage inductances :
Prim.—sec. : ⩾6mH
½ prim.—UL tap : ⩾6mH
T2 Mains transformer
Secondaries :
700—0—700V 325mA
6·3V 5A CT
5V 7A
75V 10mA (bias)
S1 1-pole 3-way
MR1, MR2, MR3, MR4 75V 10mA

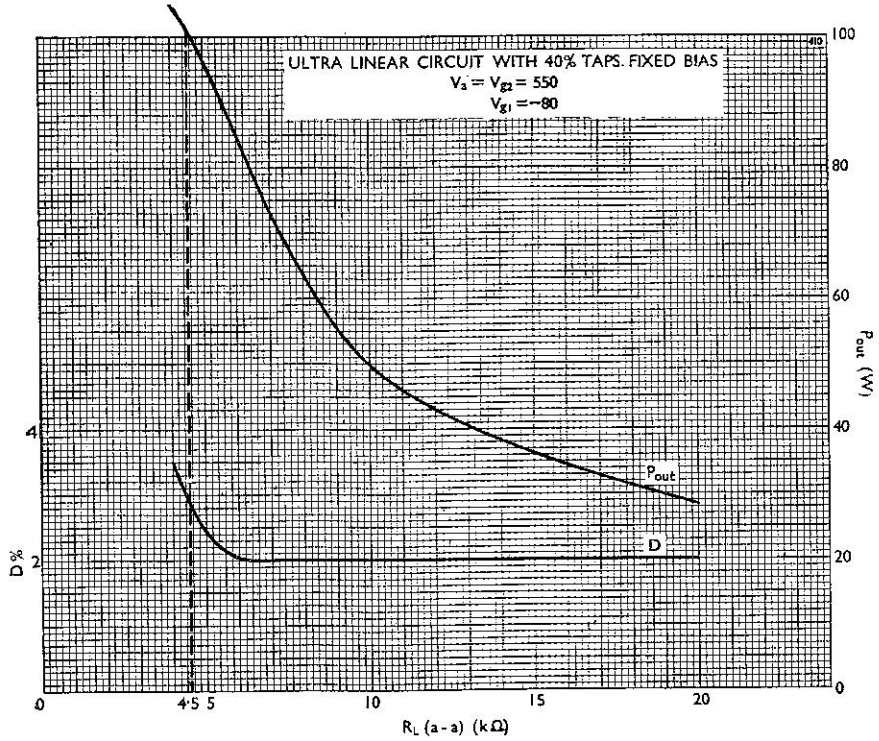


Fig. 9. Performance of the KT88 100W amplifier of fig. 8.

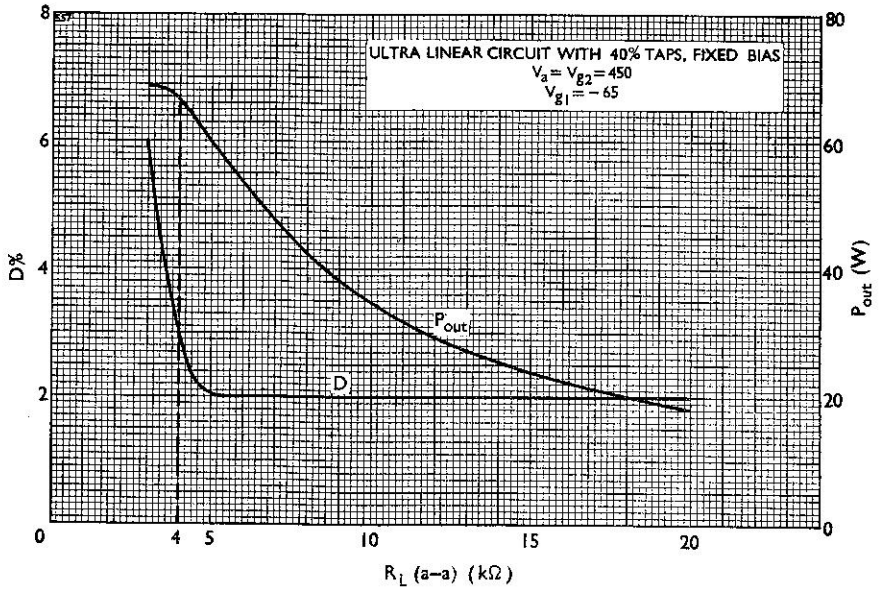


Fig. 10. The modified characteristics of the amplifier in fig. 8 when it is arranged for 65W maximum output (see Table III).

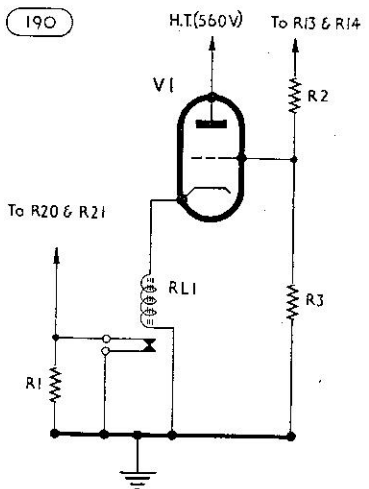


Fig. 11. Bias failure protection for the KT88 fixed bias amplifier. R2 is connected to the positive (earthy) junction of R13 and R14 in fig. 8. R2 and R3 take the place of R16 in the amplifier. The earth connection to the meter in fig. 8 is broken and the meter (and R20, R21) taken to R1. Component values : V1 : G.E.C. L63/6J5 ; R1 : 330Ω 10% 5W ; R2 : 6·8kΩ 10% 0·5W ; R3 : 15kΩ 10% 0·5W ; RL1 : 20kΩ.

A 150W CLASS B AMPLIFIER

Two KT88 valves, triode-connected in Class B, may be used when maximum output for intermittent (ICAS*) operation is required. It is permissible to use a higher anode voltage than is usual, and an output up to 150W is obtained.

This type of operation is satisfactory when a distortion higher than that obtained with the ultra-linear circuit, may be tolerated. (A typical use would be in a speech modulator for a transmitter).

Circuit Description

The circuit is shown in fig. 12. In this circuit, the screen and control grids are connected via resistors R18 and R19 forming, in effect, a high impedance triode. Both grids are driven into the positive region from a driver stage capable of providing 180+ 180V r.m.s., the current drawn by the control grids being limited by R18 and R 19.

Successful operation is almost entirely dependent upon the design of the driver stage. This should have a low impedance, so as to ensure minimum distortion in the output stage.

Satisfactory results can be obtained by using a resistance loaded pentode stage. The load resistors R16 and R17 in fig. 12 also serve to reduce the 750V line to 450V for the pentode anodes. This method of supply prevents the line voltage from rising excessively during the quiescent periods, when the output stage passes no more than 15-20mA.

Continued on page 18.

COMPONENT VALVES FOR FIG. 12

CLASS B 150W AMPLIFIER

G.E.C. VALVES

V1 L63
V2 KT66
V3 KT66
V4 KT88
V5 KT88
V6, V7, V8, V9 } U52, U54, GU50 or GXU50

RESISTORS

(20%, 0·25W unless otherwise shown)

R1 470kΩ
R2 1kΩ
R3 33kΩ, R4 33kΩ } Matched to 5% 1W
R5 220kΩ
R6 220kΩ
R7 10kΩ
R8 10kΩ
R9 22kΩ 1W
R10 600kΩ 5% 3W w.w.
R11 600kΩ 5% 3W w.w.
R12 220kΩ
R13 220kΩ
R14 100kΩ 10% 1W w.w.
R15 100kΩ 10% 1W w.w.
R16 5kΩ 5% 20W w.w.
R17 5kΩ 5% 20W w.w.
R18 22-100kΩ 1W
R19 22-100kΩ 1W
R20 100kΩ 10% 1W
R21 100kΩ 10% 1W
R22 10kΩ

CAPACITORS

C1 0·01μF
C2 0·05μF
C3 0·05μF
C4 8μF
C5 25μF
C6 25μF
C7 32μF
C8 32μF
C9 0·5μF
C10 0·5μF
C11 0·01μF
C12 0·01μF
C13 160μF
C14 160μF
C15 0·01μF
C16 160μF

*ICAS : Intermittent commercial and amateur service.

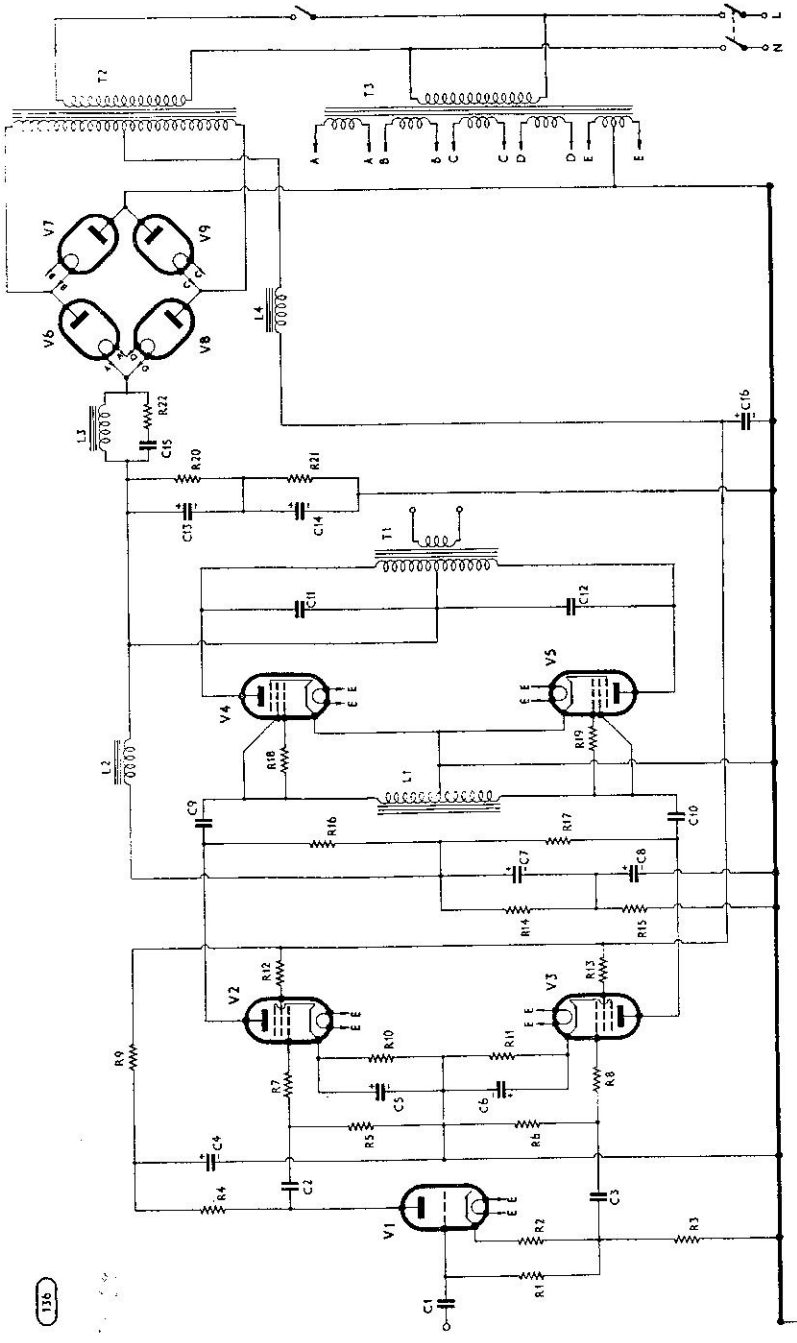


Fig. 12. Circuit diagram of the 150W Class B amplifier.

An inductance L1 is used in place of grid return resistors as the output stage grids draw some 30mA at full output. The characteristics of L1 are not critical. It should have a d.c. resistance not exceeding 500Ω, an inductance of about 20H and a centre tap. A small output transformer, with the secondary left unused, is satisfactory.

A bridge-connected rectifier system fed by a transformer giving 900V r.m.s. provides the anode supply to both the output and driver stages. A centre tap on this transformer enables half the d.c. anode voltage to be obtained for the driver screens and the previous stage(s). The electrolytic capacitors C13, C14 and C16 are of high value in order to absorb the large fluctuations of anode current (from about 120 to 400mA). The series connection of C13 and C14 permits a voltage up to 900. Suitable rectifiers are : GU50, GXU50, U52 or U54.

Table IV gives the operating conditions for the amplifier and fig. 13 illustrates its performance.

TABLE IV

CLASS B 150W AMPLIFIER
ICAS RATING

Operating Conditions

(Fig. 12)

Output Stage		
$V_{a(o)}$	850	V
$V_{a(max\ sig)}$	750	V
$V_{g2(rms)}$	60	V
$I_{a(o)}$	2×10	mA
$I_{a(max\ sig)}$	2×140	mA
I_{g1+g2}	30	mA
P_{out}	150	W
$R_{L(a-a)}$	6	kΩ
z_{out}	25	kΩ
D	6 to 8	%
p_{dr} (approx)	7	W
$V_{in(g-g)(rms)}$	360	V
z_{in}	18	kΩ
Driver Stage		
$V_{a(o)}$	500	V
$V_{a(max\ sig)}$	400	V
$V_{g2(o)}$	375	V
$V_{g2(max\ sig)}$	325	V
$I_{a(o)}$	2×50	mA
$I_{a(max\ sig)}$	2×55	mA
$I_{g2(o)}$	2×2	mA
$I_{g2(max\ sig)}$	2×7	mA
$V_{in(g-g)(rms)}$	40	V

The above conditions are suitable for normal speech applications only. For other purposes, $R_{L(a-a)}$ should be increased to 7·5kΩ. At V_a=600V an output of approximately 100W is given.

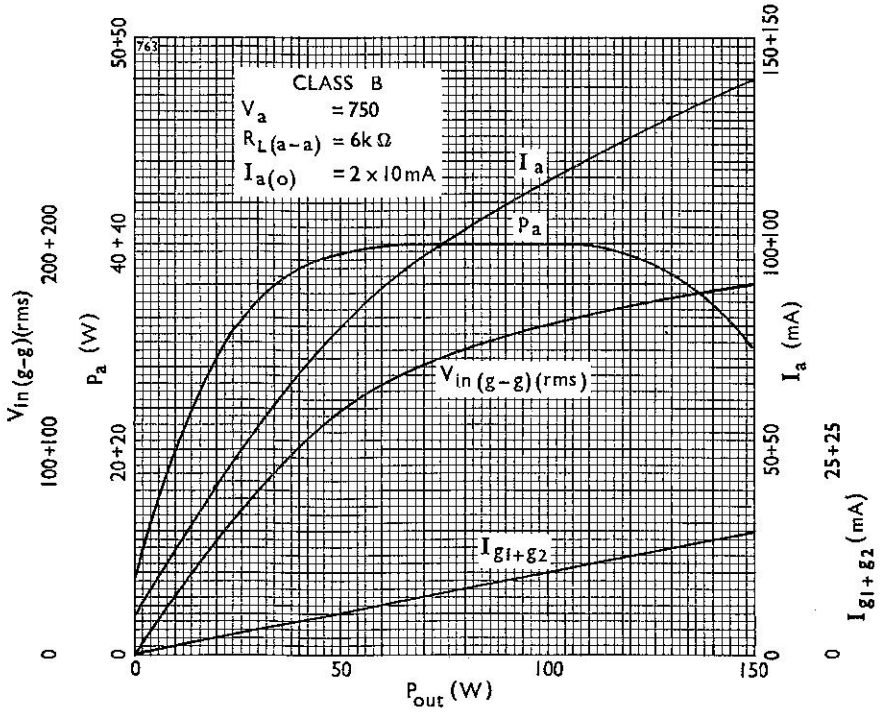


Fig. 13. Performance of the 150W Class B amplifier of fig. 12.

MULTIPLE-PAIR PUSH-PULL AMPLIFIERS

The circuit diagram of fig. 14 illustrates the use of ten valves in a fixed bias ultra-linear output stage and this arrangement gives 400W output. More or less than five pairs of valves can be used, depending upon the output power required.

A single control is used for grid bias adjustment and this simplifies the amplifier at the expense of somewhat higher distortion and lower output.

Continued on page 22.

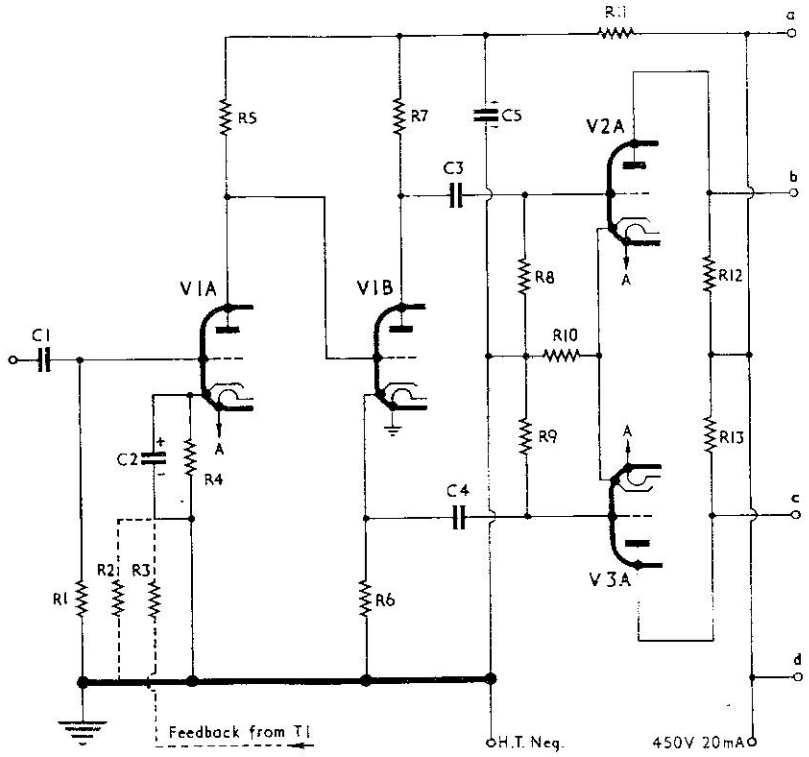
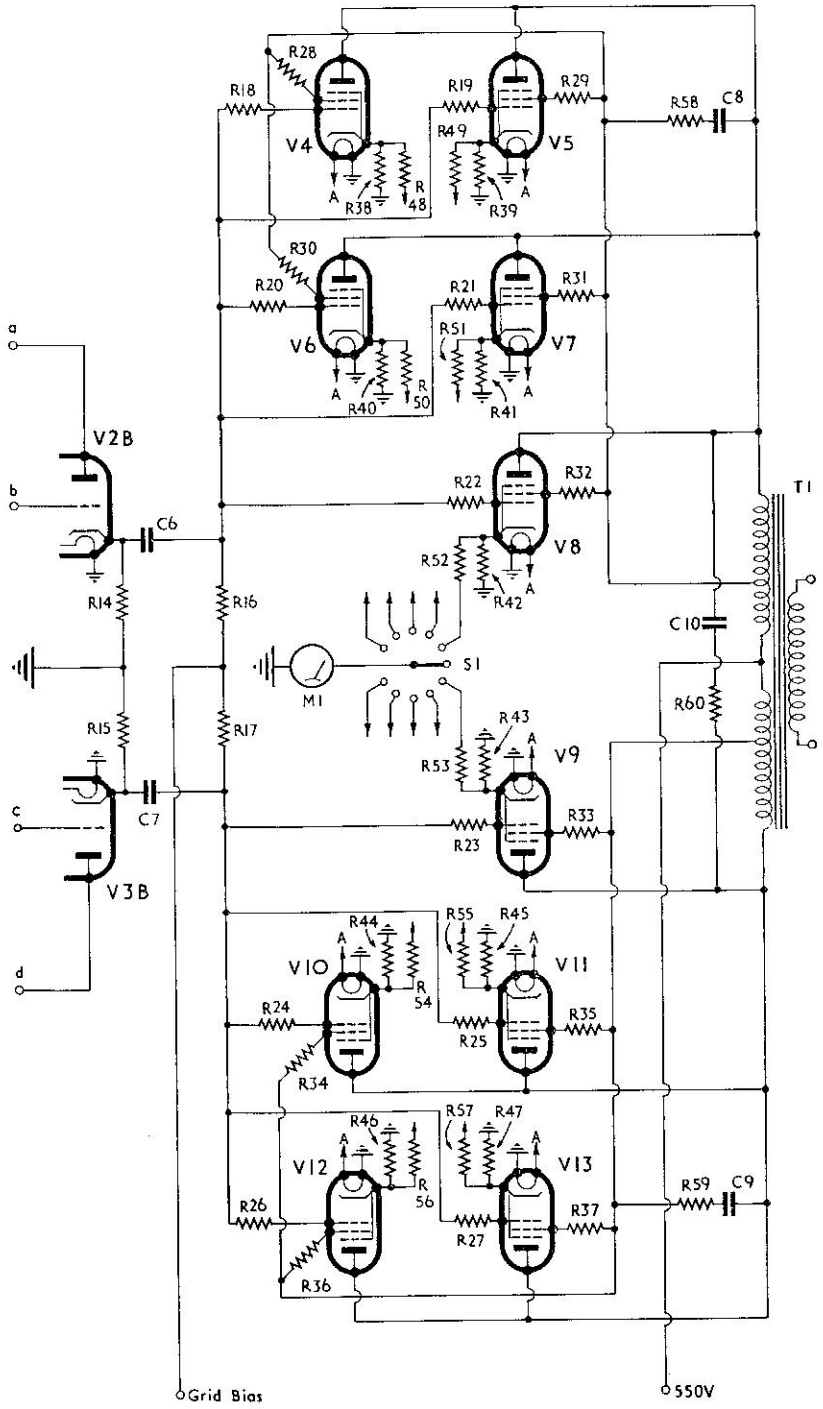


Fig. 14. (Above and opposite) Circuit diagram of the 400W multiple-pair amplifier. Component values are given on page 23.


R28
R18
V4
R19
R29
R58
C8
R49
V5
R38
R48
R39
R30
R20
V6
R21
R31
R51
V7
R40
R50
R41
V2B
a
b
C6
R22
R32
T1
V8
R52
R42
R14
R16
C10
S1
M1
R60
R43
R15
R17
R53
V9
c
C7
R23
R33
V3B
d
R44
R55
R45
V10
V11
R54
R24
R25
R35
R34
R46
R57
R47
V12
V13
R56
R26
R27
R59
C9
R36
R37
Grid Bias
550V

It is not essential to use accurately matched valves but the total current in each half of the push-pull stage should be equalised as closely as possible. This becomes easier with an increasing number of pairs and is facilitated by the cathode current meter built into the amplifier. The individual cathode currents will vary from about 35mA to about 60mA and each valve should be measured in turn and the valves sorted into two groups of approximately similar total current.

When the valves have been sorted and the two groups plugged into their respective halves of the amplifier, the optimum operating condition is obtained by adjusting the grid bias with R5 (fig. 15) so that the current drawn by any single valve does not exceed 60 mA. In this way an output of 400W will be obtained at a distortion of about 5%.

When using six or more valves in this type of amplifier, the value of the grid return resistors R14 and R15 is of importance and a low value is desirable. In order to facilitate the production of the necessary distortion-free input signal of 55+55V r.m.s., the output stage is driven by a pair of cathode followers V2B and V3B. With four output valves the grid resistors could be increased to 100 kΩ and the cathode followers dispensed with. However, as they form parts of double triodes. the saving in cost is insignificant and, on the whole, it is preferable to retain them.

The method of measuring the cathode current of each KT88 valve is shown in fig. 14. A resistor of 10Ω is inserted in the cathode lead of each valve (i.e. R38, R39, etc.) and a meter M1 is connected across this resistor through switch S1 and a series resistor (R48, R49, etc.).

It was found convenient to use a meter with a full-scale deflection of 200μA, the value of the series resistor being such that the meter indicated 0-200mA. At full output each cathode current is about 100mA to 125mA. It may be preferred to substitute the individual cathode series resistors with a single resistor inserted between the meter and switch but the possibility of instability should be borne in mind as the individual resistors act as cathode circuit isolators.

The ultra-linear output transformer must have low leakage inductance between : primary and secondary ; half-primary and half-primary ; and each half-primary and its tap. The absolute values of leakage inductance will depend upon the number of valves used but a 400W transformer used in the prototype had the following characteristics :

Primary Inductance :	4H
Leakage Inductances :	
Primary to secondary :	0·75mH
Half-primary to half-primary :	0·75mH
Each half-primary to tap :	1·5mH

To prevent ultrasonic oscillation, resistor/capacitor combinations are connected between each tap and the anode terminal of each half-primary. In the prototype, C10 and R60 were also found to be desirable, the values used being 3500pF and 1kΩ respectively.

Negative feedback may be added to this amplifier in the normal way, from the secondary of the output transformer to the cathode circuit of the input valve. The values of the resistors R2 and R3 in fig. 14 are determined by the amount of feedback and the ratio of the transformer.

Fig. 16 illustrates a recommended layout for the output valves and is self-explanatory. Adequate ventilation should be provided ; if in doubt, temperature sensitive paint should be used. (*See page 2*).

Power Supply

The design of the power supply is an important factor in the satisfactory operation of an amplifier of this type. The regulation should be good ; better than 10% with a current variation of 400-1200mA was obtained in the prototype. This order of regulation was achieved by using the xenon filled rectifier GXU1 which, in this application, is considerably under-run at a PIV of 1kV as against the rated PIV of 10kV. For up to six output valves, the smaller xenon rectifier GXU50 is suitable.

The circuit of a complete power supply is given in fig. 15 and this provides the lower h.t. voltage required by the earlier stages as well as the grid bias supply.

A single inductance-input filter is shown and, with a smoothing capacitance of 150-200μF (obtained by series-connecting two larger capacitors), this should be satisfactory for most purposes. A further filter section may be inserted if desired. The smoothing inductor(s) should have a value of 2-3H and a d.c. resistance of about 25Ω.

COMPONENT VALUES FOR FIG. 14

400W AMPLIFIER

G.E.C. VALVES

V1-V3 B65/6SN7
V4-V13 KT88

RESISTORS

20%, 0·25W unless otherwise shown)

R1 1MΩ
R2, R3 See page 22
R4 1kΩ
R5 100kΩ 0·5W
R6 15kΩ 0·5W, R7 15kΩ 0·5W matched to 5%
R8 1MΩ
R9 1MΩ
R10 4·7kΩ 10% 0·5W
R11 33kΩ 0·5W
R12 220kΩ 1W, R13 220kΩ 1W matched to 5%
R14 47kΩ 1W, R15 47kΩ 1W matched to 5%
R16 47kΩ 10% 0·5W
R17 47kΩ 10% 0·5W
R18-R27 15kΩ
R28-R37 220Ω
R38-R47 Meter shunts, see p. 22
R48-R57 Meter series resistors, see p. 22
R58 1kΩ 2W
R59 1kΩ 2W
R60 See p. 22

CAPACITORS

C1 0·01μF
C2 50μF 12V
C3 0·01μF
C4 0·01μF
C5 8μF 450V
C6 0·25μF
C7 0·25μF
C8 1000pF
C9 1000pF
C10 See p. 22

MISCELLANEOUS

M1 200μA meter (see p. 22)
S1 1-pole 11-way switch b.b.m.
T1 400W Ultra-linear transformer
1kΩ anode-anode
Primary inductance : ⩽4H
Leakage inductances :
Prim.—sec. : ⩾750μH
½ prim.—UL tap : ⩾750μH

TABLE V

400W MULTIPLE-PAIR AMPLIFIER

Operating Conditions

(Fig. 14)

$V_{a(b)(o)}$	570	V
$V_{a(b)(max\ sig)}$	530	V
$V_{a,g2(o)}$	565	V
$V_{a,g2(max\ sig)}$	525	V
$I_{a+g2(o)}$ (per valve)	35 to 60	mA
$I_{a+g2(max\ sig)}$ (per valve)	100 to 125	mA
$I_{a+g2(o)}$ (total)	450	mA
$I_{a+g2(max\ sig)}$ (total)	1200	mA
$p_{a+g2(o)}$ (per valve)	35	W
$p_{a+g2(max\ sig)}$ (per valve)	25	W
V_{g1} (approx)	−75	V
P_{out}	400	W
$R_{L(a-a)}$	1	kΩ
z_{out}	1·2	kΩ
D	5 to 7	%
$V_{in(rms)}$ to first stage	250	mV

If 10db of negative feedback is applied, the last three values become 400Ω, 2% and 750mV respectively.

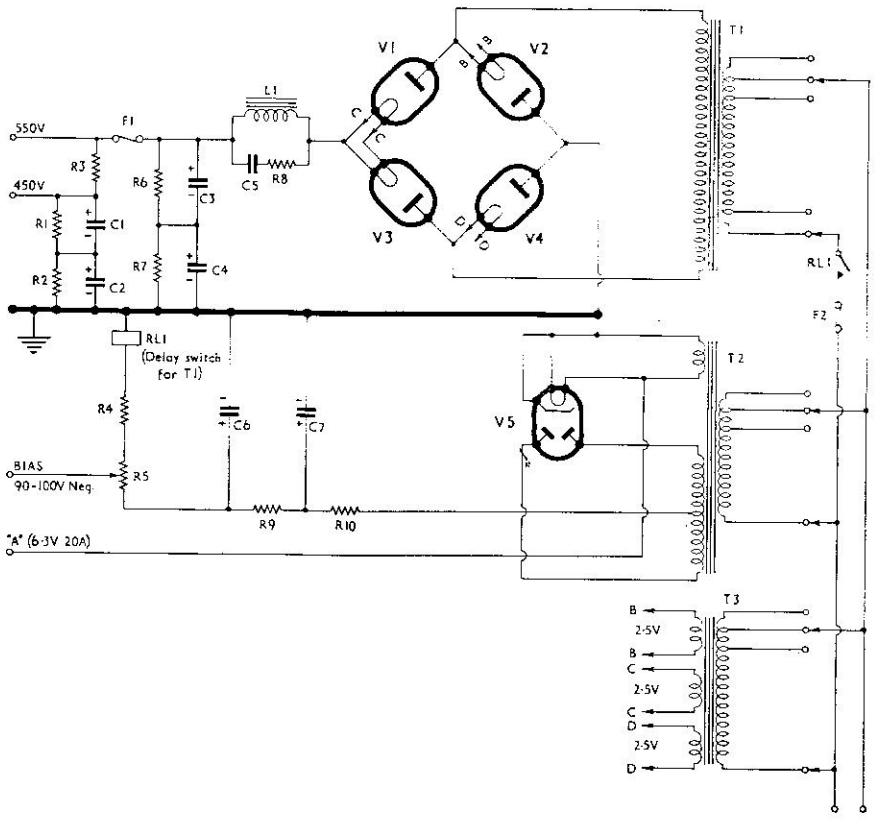


Fig. 15. Power supply circuit for the 400W multiple-pair amplifier. The winding of T3 is simplified if four identical secondaries are used. To prevent mains-borne interference with nearby receivers, generated by the xenon rectifiers, a pair of capacitors (0·05μF, 700V a.c.) should be connected in series across the 700V winding and their junction connected to the negative (earth) line.

COMPONENT VALUES FOR FIG. 15

POWER SUPPLY FOR 400W AMPLIFIER

G.E.C. VALVES

V1-V4 GXU1
V5 U709 or U78/6X4

RESISTORS

R1	100kΩ	10%	0·5W
R2	100kΩ	10%	0·5W
R3	4·7kΩ	20%	2W
R4	22kΩ	20%	1W
R5	10kΩ	w.w.	
R6	47kΩ	10%	1W
R7	47kΩ	10%	1W
R8	10kΩ	20%	1W
R9	22kΩ	20%	1W
R10	1·5kΩ	20%	0·25W

CAPACITORS

C1	32μF	350V
C2	32μF	350V
C3	300μF	350V } each 100+200
C4	300μF	350V } dual
C5	0·01μF	500V
C6	2μF	250V
C7	2μF	250V

MISCELLANEOUS

L1 2H 1200mA 25Ω
T1 700V 1200mA*
T2 Bias transformer
Secondaries :
150−0−150V 10mA
6·3V 20A
T3 2·5V 5A
2·5V 5A
2·5V 10A (or 2×5A)
F1 2A
F2 5A

*10V taps on primary.

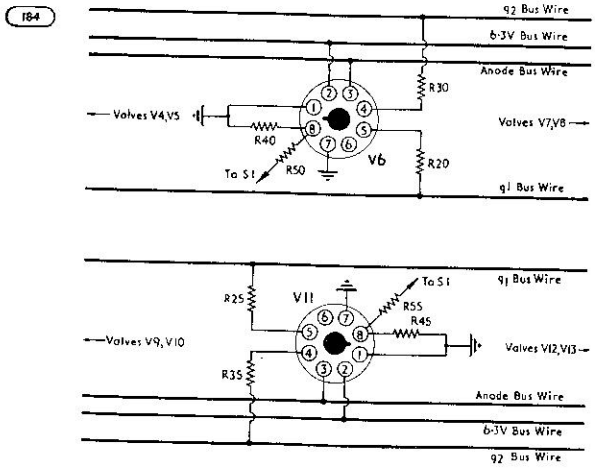


Fig. 16. Recommended layout for the output valves of the 400W amplifier. If the distance between pairs of valves is reduced to the minimum of 4 in centre to centre, they should be orientated as shown on page 3.

APPENDIX

INTERMODULATION IN ULTRA-LINEAR AMPLIFIERS

The curves below illustrate the various degrees of intermodulation with varying positions of the screen taps on the output transformer from 0% (pentode operation) to 100% (triode operation). The measurements were made under SMPE conditions using frequencies of 50 and 6000 c/s at a ratio of 4 : 1. It will be noticed that the lowest level of intermodulation is obtained with taps of about 40%. A slight increase in intermodulation is produced at 33% or 57% and a significant increase at 25% or 75%.

The triode performance (100%) is inferior to the ultra-linear at all outputs except below 10W with 25% taps. The high intermodulation of the pentode arrangement (0%) is to be expected.

The application of negative feedback will reduce intermodulation roughly in proportion to the reduction in gain. For example, a 3 : 1 reduction in intermodulation is obtained with 10db and a 5 : 1 reduction with 14 db feedback. It can be seen from fig. 17 that it is not difficult to reduce intermodulation to below 1% at 50W output.

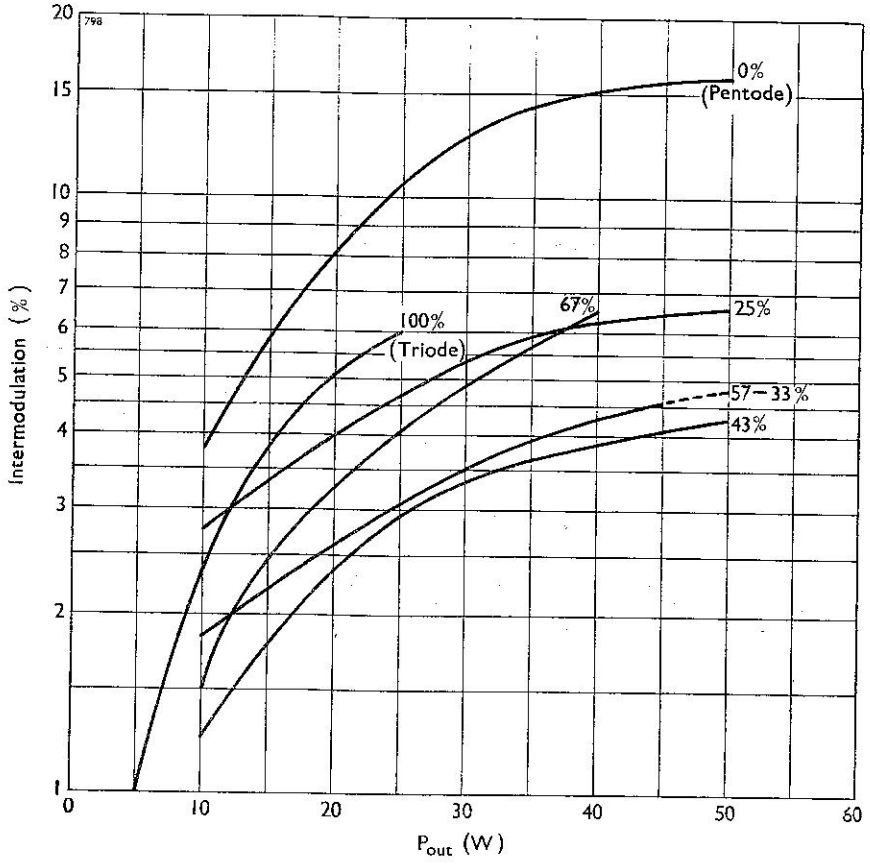


Fig. 17.

ELECTRONIC INNOVATIONS IN ACTION

TUBES

PRELIMINARY

—PRODUCT INFORMATION—

BEAM PENTODE

FOR RF POWER AMPLIFIER APPLICATIONS

M-2057

400 MILLIAMPERES DC CATHODE CURRENT · OVER 1 AMPERE PEAK CURRENT · 280 VOLTS B+

40 WATTS PLATE DISSIPATION · T-14 ENVELOPE

The M2057 is a compactron beam power pentode designed primarily for RF power output applications. Features of the M2057 are dual cathode and grid connections for lower lead inductance, and a 13.0 volt heater. The M2057 is suitable for mobile and marine applications having 12 volt battery supplies.

GENERAL

ELECTRICAL

Cathode Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC	13.0 Volts
Heater Current	1.30 Amperes

Direct Interelectrode Capacitances, approximate

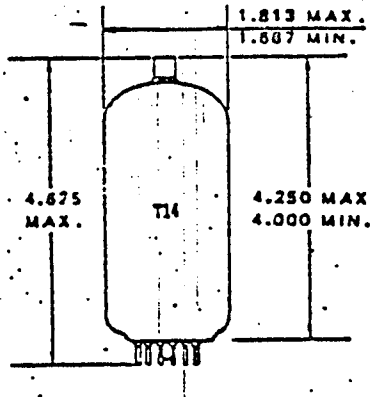
Grid No. 1 to Plate: (g1 to p)	0.55 pf
Input:	38 pf
Output:	14 pf

MECHANICAL

Operating Position Any
Envelope T-14, Glass
Top Cap C1-1, Small
Base E12-74
Outline Drawing

Maximum Diameter	1.813	Inches
Minimum Diameter	1.687	Inches
Maximum Overall Length	4.625	Inches
Maximum Seated Height	4.250	Inches
Minimum Seated Height	4.000	Inches

PHYSICAL DIMENSIONS

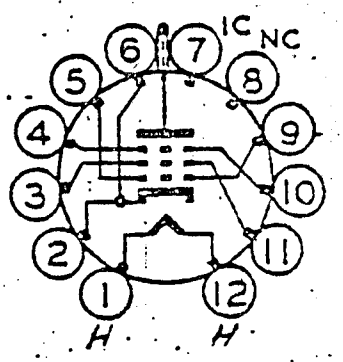


TERMINAL CONNECTIONS

13. Volts

Pin 1 – Heater
Pin 2 – Cathode
Pin 3 – Grid 2
Pin 4 – Grid 3 (Beam Plate)
Pin 5 – Grid 1
Pin 6 – Cathode
Pin 7 – Internal Connection (Do not use)
Pin 8 – No Connection
Pin 9 – Grid 1
Pin 10 – Grid 3 (Beam Plate)
Pin 11 – Grid 2
Pin 12 – Heater
Cap – Plate

BASING DIAGRAM



EIA

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Peak Positive Pulse Plate Voltage	7500	Volts
Screen Voltage	280	Volts
Peak Negative Grid-Number 1 Voltage	300	Volts
Plate Dissipation	40	Watts
Screen Dissipation	7.0	Watts
DC Cathode Current	400	Milliamperes
Peak Cathode Current	1400	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
▲Grid-Number 1 Circuit Resistance▲		
With Fixed Bias	0.1	Megohm
With Cathode Bias	Not Recommended	
Bulb Temperature at Hottest Point♦	240	°C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions; and variations in the characteristics of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Plate Voltage	5000	60	100	250	Volts
Beam Plates - Connected to Cathode at Socket					
Screen Voltage	250	110	250	250	Volts
Grid-Number 1 Voltage	---	0	-20	-56	Volts
Plate Resistance, approximate	---	---	---	6700	Ohms
Transconductance	---	---	---	12000	Micromhos
Plate Current	---	650§	920§	125	Milliamperes
Screen Current	---	37§	94§	4.2	Milliamperes
Grid-Number 1 Voltage, approximate					
Ib = 1.0 Milliamperes	-135	---	---	-85	Volts
Triode Amplification Factor●	---	---	---	3.7	

MINIMUM RECOMMENDED GRID DRIVE

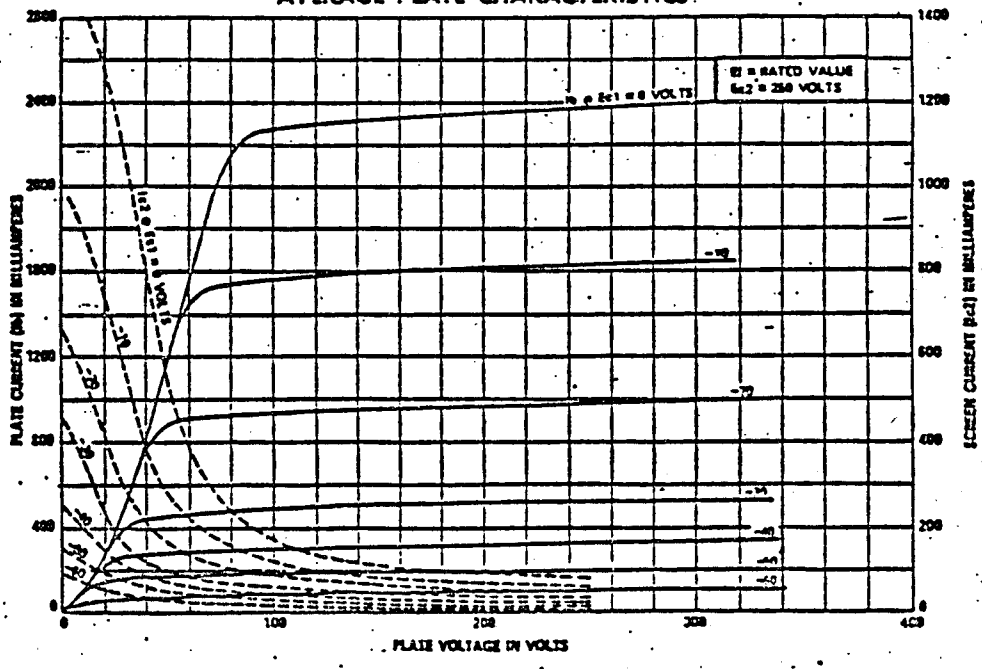
Peak Positive Plate Pulse Voltage	5000	6000	7000	Volts
Grid Drive for Eg2 = 150 Volts	-190	-210	-230	Volts
Grid Drive for Eg2 = 200 Volts	-210	-235	-260	Volts
Grid Drive for Eg2 = 250 Volts	□	□	□	Volts

NOTES

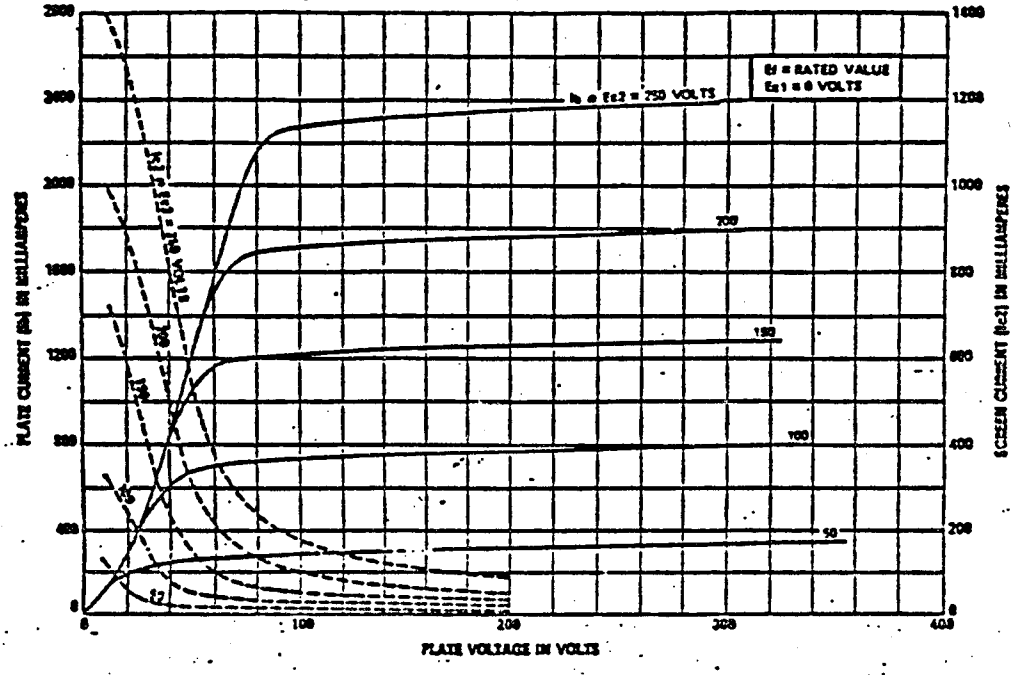
- The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.
- Heater current of a bogey tube at Ef 13.0 volts.
- ▲ The type of input-coupling network used should not introduce too much resistance in the grid-number 1 circuit. Transformer or impedance coupling devices are recommended.
- ♦ Measured with an infrared thermometer, Ircon Model 700 BC or equivalent, at an ambient temperature of 40° C.
- § Values measured by a method involving a recurrent waveform such that the plate and screen dissipation will be kept within ratings in order to prevent damage to the tube.
- ● Triode connection (screen tied to plate) with Eb = Ec2 = 250 volts, and Ec1 = −56 volts.
- □ To be determined.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



TUBE PRODUCTS DEPARTMENT
Owensboro, Kentucky 42301

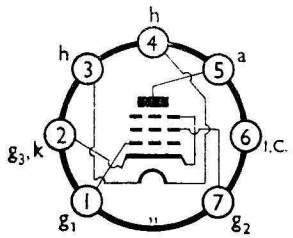
GENERAL ELECTRIC

G.E.C. VALVES

MINIATURE OUTPUT PENTODE 6·3V INDIRECTLY HEATED

N78
APRIL, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Overall length :	64—70	mm.
Seated length :	58—64	mm.
Max. diameter :	19	mm.

RATING

Pentode Connection

V_h		6·3	V
I_h		0·64 approx.	A
v_{h-k} (pk)		150 max.	V
V_a		250 max.	V
V_{g2}		250 max.	V
p_a		9 max.	W
p_{g2}		3 max.	W
μ	at $V_a = V_{g2} = 250$, $V_{g1} = -5$	420	
r_a		40	kΩ
g_m		10·5	mA/V

Triode Connection

$V_{a, g2}$		250 max.	V
$p_{a, g2}$		12 max.	W
μ	at $V_{a, g2} = 250$, $V_{g1} = -5$	24	
r_a		2·1	kΩ
g_m		11·4	mA/V

CAPACITANCES (of cold unscreened valve)

$c_{a\text{-all}}$	10·5	pF	$c_{g1\text{-all}}$	11·5	pF	$c_{a\text{-}g1}$	0·3 pF

TYPICAL OPERATION

Single Valve, Class A, Pentode Connection

V_a	250		V
V_{g2}	250		V
V_{g1} (o)	−5	approx.	V
I_a (o)	35		mA
I_{g2} (o)	5·5		mA
R_k	120		Ω
v_{in} (pk)	5		V
R_L	7		kΩ
P_{out}	4		W
D	9·2		%

THE GENERAL ELECTRIC CO. LTD. OF ENGLAND
Head Office : Magnet House Kingsway . London . W.C. 2

N78

Push-pull, Class AB_1, Pentode Connection

Data per pair unless otherwise stated

V_a	220	250	350	V
V_{g2}	220	250	275	V
V_{g1} (o) approx.	−3·2	−5	−7·1	V
I_a (o)	82	70	46	mA
I_a (max. sig)	82	73	51	mA
I_{g2} (o)	13	11	6·5	mA
I_{g2} (max. sig)	16·5	16·5	20	mA
R_k (per valve)	68	120	270	Ω
v_{in} (pk) (g_1-g_1)	7	11·2	20	V
R_L (a-a)	9	9	18	kΩ
P_{out}	5	9	12·6	W
D	3	4·6	4·8	%

Push-pull, Class AB_1. Triode Connection

Data per pair unless otherwise stated

$V_{a,\,g2}$	300	350	V
V_{g1} (o) approx.	−7·5	−9·5	V
$I_{a,\,g1}$ (o)	67	57	mA
$I_{a,\,g2}$ (max. sig)	73	64·5	mA
R_k (per valve)	220	330	Ω
v_{in} (pk) (g_1-g_1)	15·5	21	V
R_L (a-a)	5	8	kΩ
P_{out}	4·4	6·3	W
D	1·5	1·6	%

R.F. Power Amplifier and Oscillator, Single Valve. Class C Telegraphy

Pentode Connection. (Unmodulated key-down conditions)

V_a	300	V
V_{g2}	150	V
V_{g1}	−25	V
I_a	65	mA
I_{g2}	14	mA
*I_{g1}	5	mA
R_L	1·65	kΩ
p_a	9	W
P_{out}	10·5	W

* Subject to wide variation.

Frequency Multiplier. Single Valve. Pentode Connection.

Key-down conditions.

f_{in}	20	50	20	Mc/s
f_{out}	40	100	60	Mc/s
V_a	350	260	270	V
V_{g2}	150	200	160	V
V_{g1}	−60	−100	−120	V
I_a	52	55	52	mA
I_{g2}	14	9	12	mA
*I_{g1}	3	5	6	mA
R_L	2·2	1·1	1·18	kΩ
p_a	9	9	9	W
P_{out}	9·2	5·3	5·1	W

* Subject to wide variation.

GRID RESISTOR

The maximum permissible D.C. resistance between control grid and cathode is limited to 0·27 MΩ ± 20% with auto-bias, and 0·1 MΩ with fixed bias.

SCREENING

No internal or external screening is fitted to the valve.

MOUNTING

Any position.

RETAINING

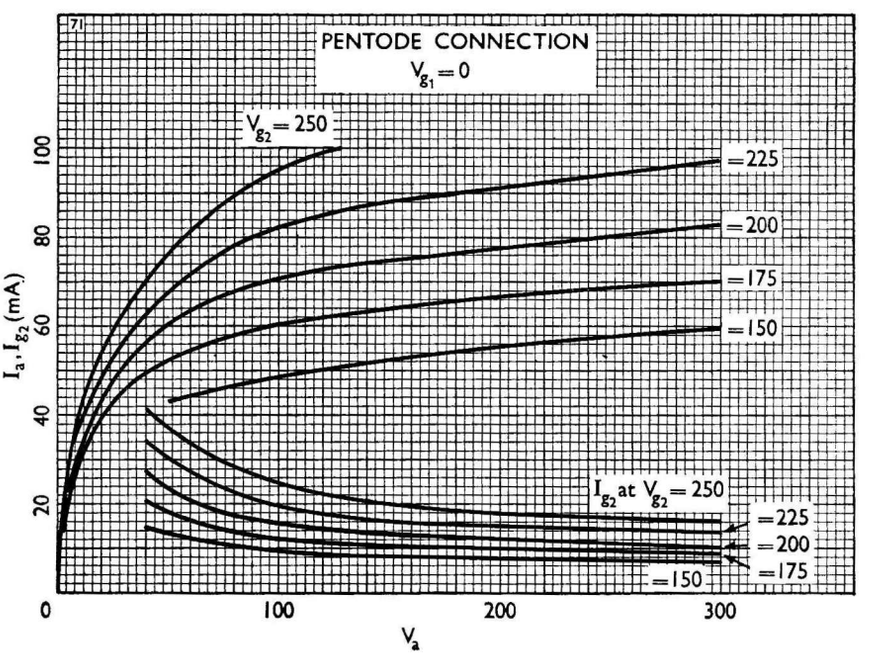
A retaining device should be used.

VENTILATION

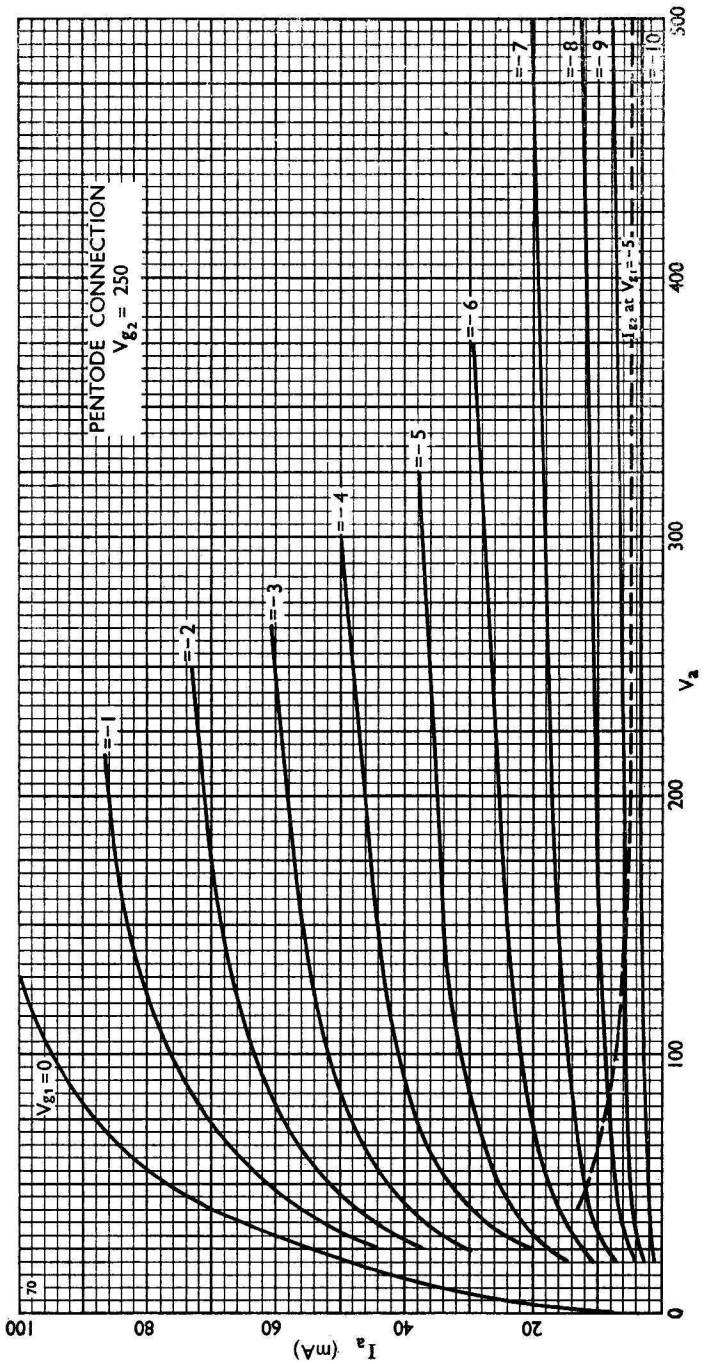
Free air circulation round the bulb is preferable. If a retaining device in the form of a canister is used, the surfaces should be blackened. The temperature of the hottest part of the bulb must not exceed 250°C.

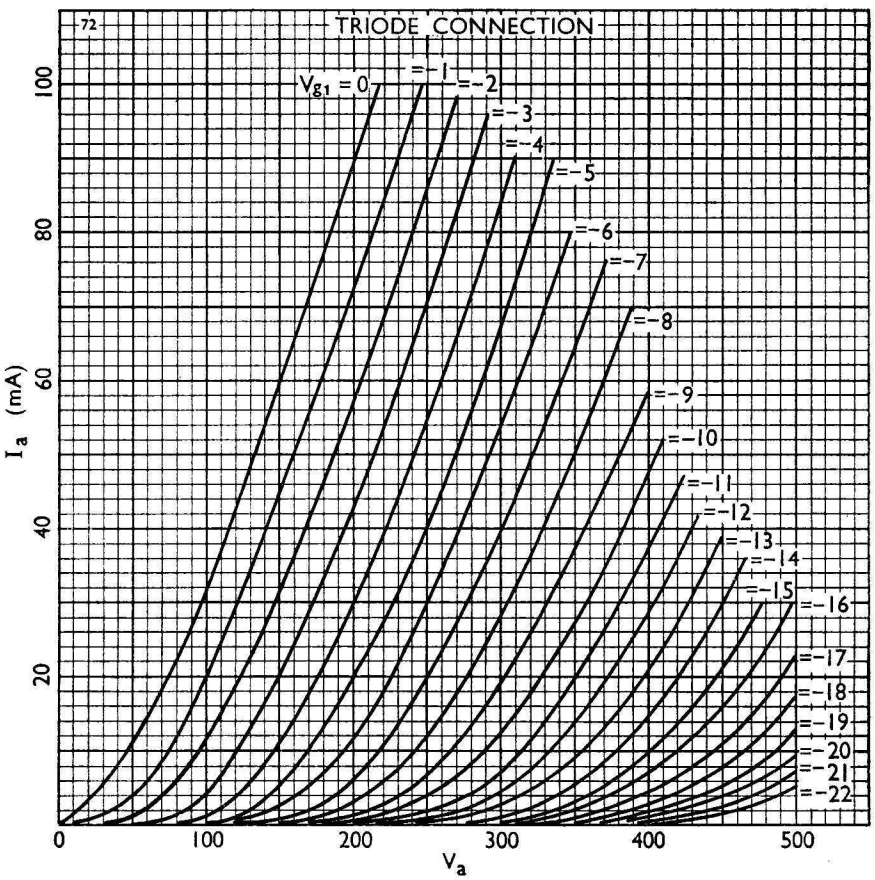
MICROPHONY

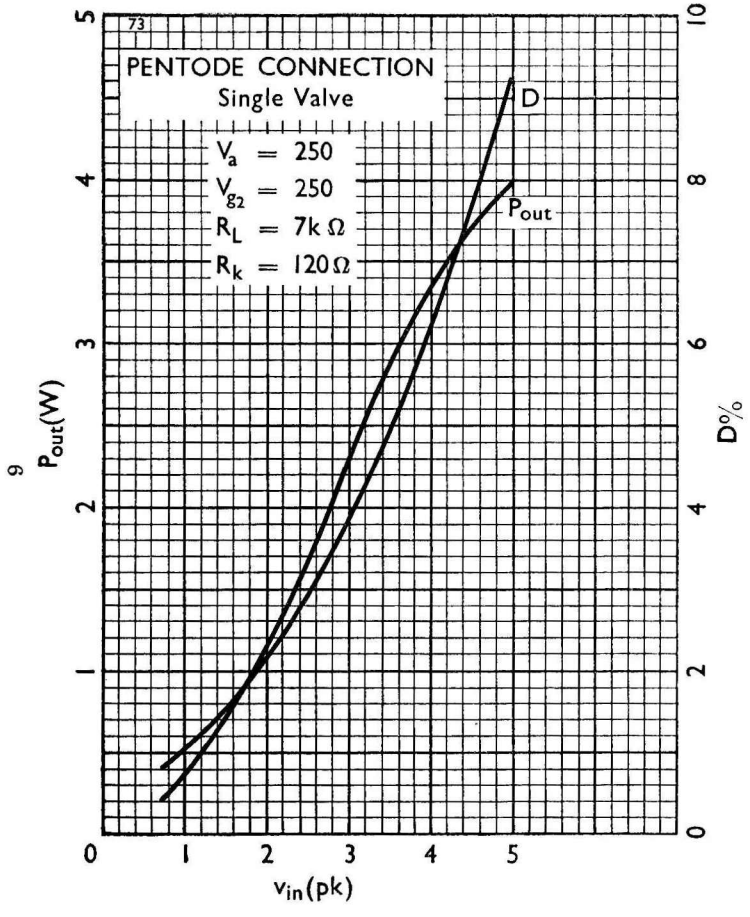
Although this is of a very low order, equipment should be designed to minimise microphony.

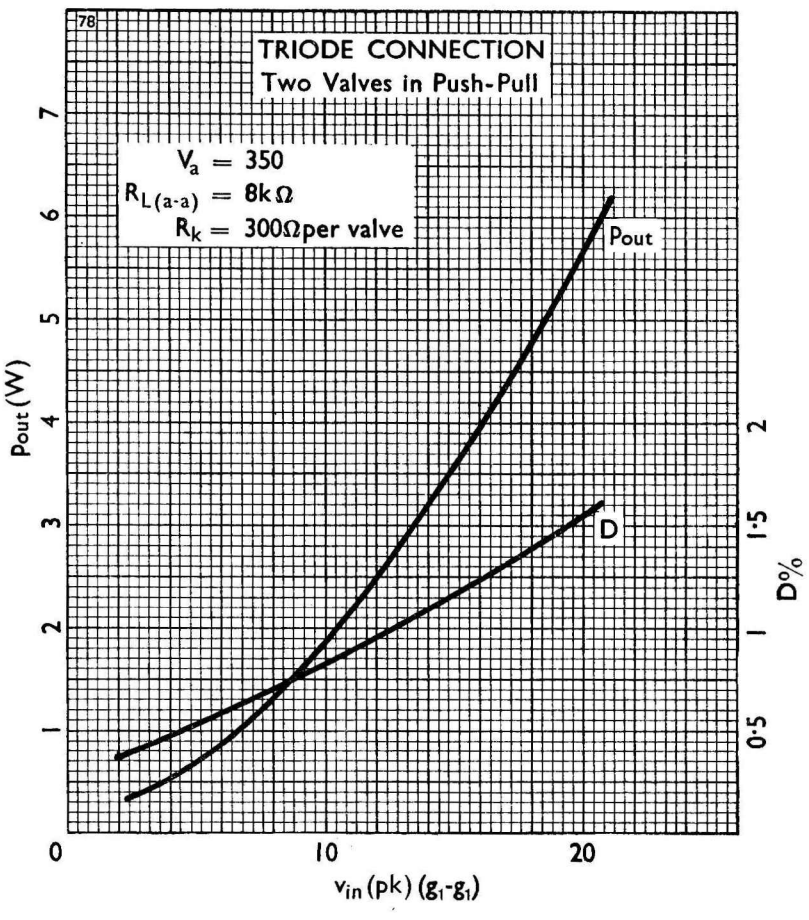


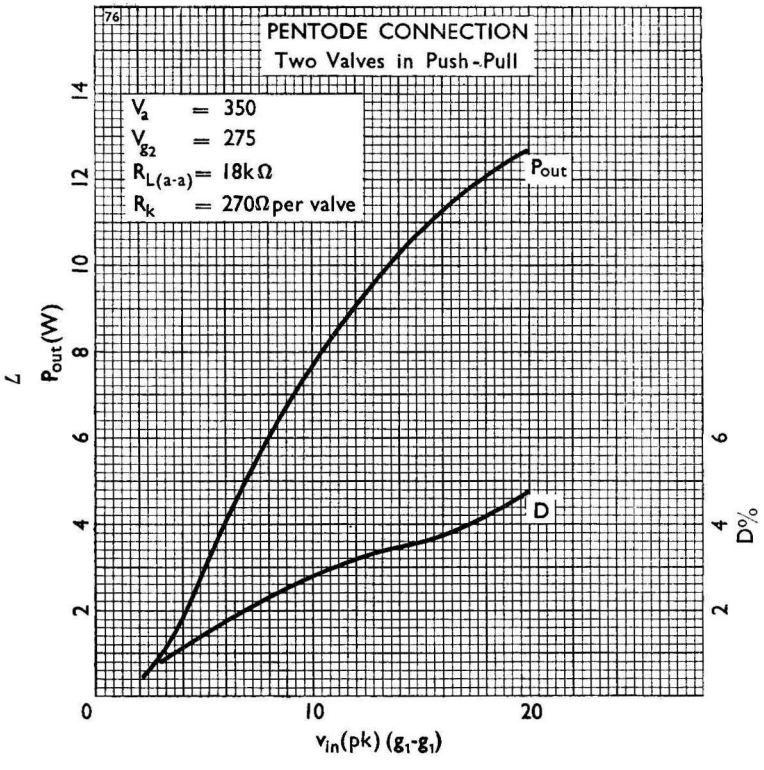
N78

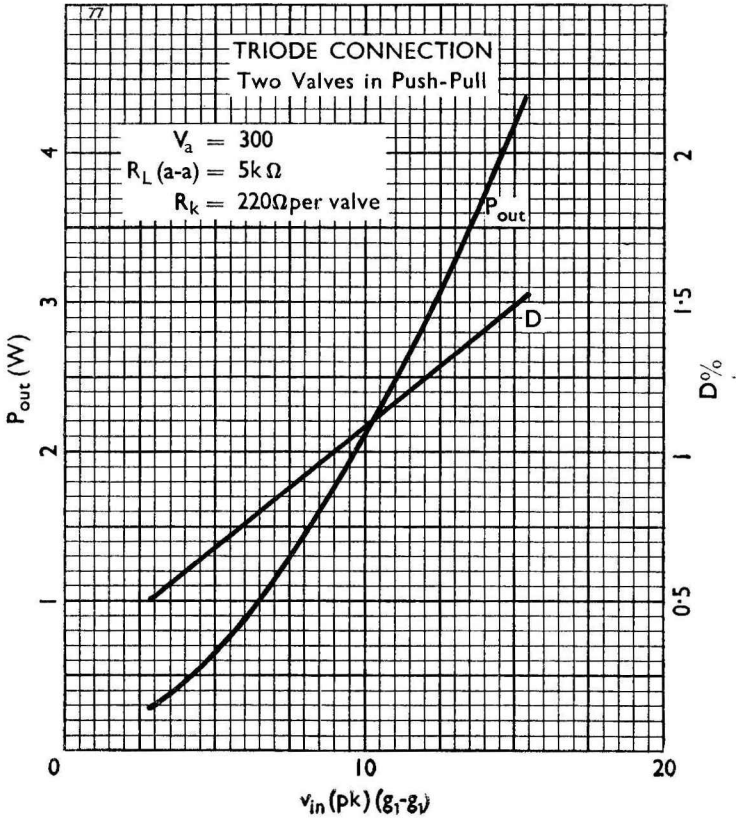

PENTODE CONNECTION
V_{g_2} = 250
V_{g_1} = 0
= −1
= −2
= −3
= −4
= −5
= −6
= −7
= −8
= −9
= −10
V_{g_2} at V_{g_1} = −5
I_a (mA)
V_a
0
100
200
300
400
500
20
40
60
80
100
70


72
TRIODE CONNECTION
V_{g1} = 0
=-1
=-2
=-3
=-4
=-5
=-6
=-7
=-8
=-9
=-10
=-11
=-12
=-13
=-14
=-15
=-16
=-17
=-18
=-19
=-20
=-21
=-22
I_a (mA)
20
40
60
80
100
0
100
200
300
400
500
V_a

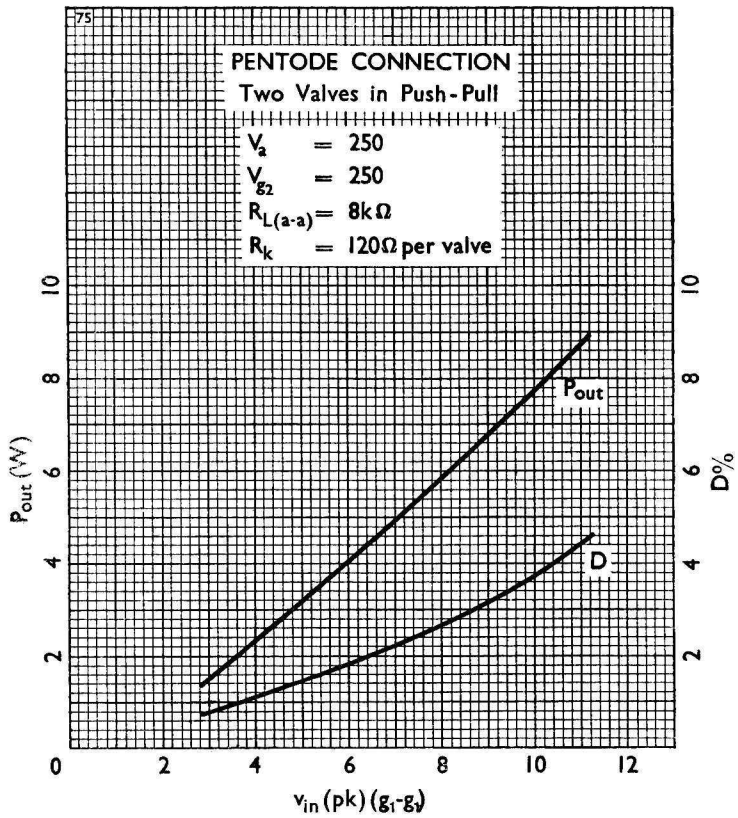

73
PENTODE CONNECTION
Single Valve
V_a = 250
V_{g2} = 250
R_L = 7k Ω
R_k = 120 Ω
D
Pout
P_{out}(W)
D%
v_{in}(pk)
0
1
2
3
4
5
0
2
4
6
8
10

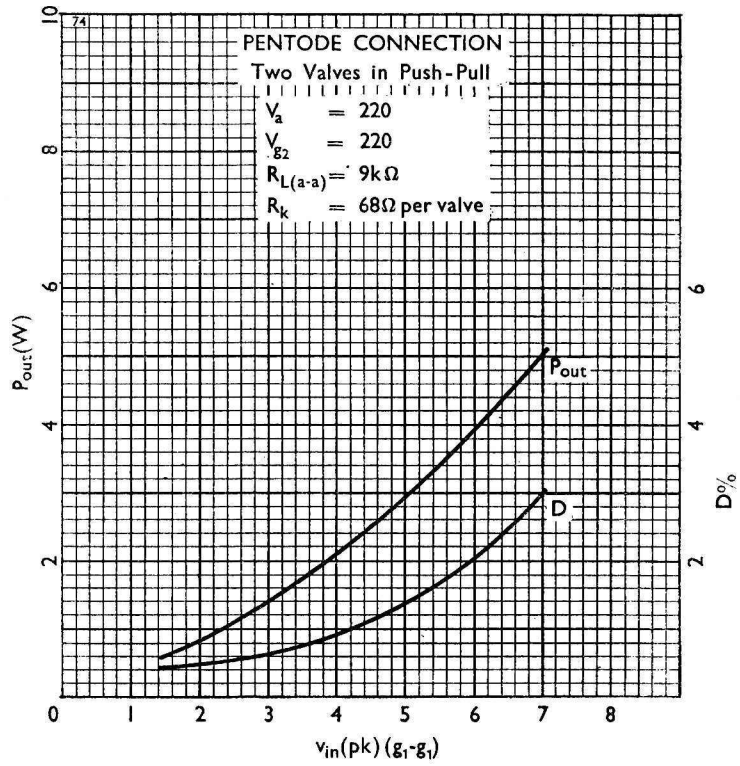

78
TRIODE CONNECTION
Two Valves in Push-Pull
V_a = 350
$R_{L(a-a)}$ = 8k Ω
R_k = 300Ω per valve
Pout
D
P_{out} (W)
D%
v_{in} (pk) (g_1-g_1)
0
10
20
1
2
3
4
5
6
7
0·5
1
1·5
2


76
PENTODE CONNECTION
Two Valves in Push-Pull
V_a = 350
V_{g2} = 275
$R_{L(a-a)}$ = 18kΩ
R_k = 270Ω per valve
P_{out}
D
P_{out} (W)
D%
0
10
20
2
4
6
8
10
12
14
2
4
6
v_{in} (pk) (g_1-g_1)


77
TRIODE CONNECTION
Two Valves in Push-Pull
V_a = 300
R_L (a-a) = 5kΩ
R_k = 220Ω per valve
P_{out}
D
P_{out} (W)
D%
0
10
20
1
2
3
4
0·5
1
1·5
2
v_{in} (pk) (g_1-g_1)

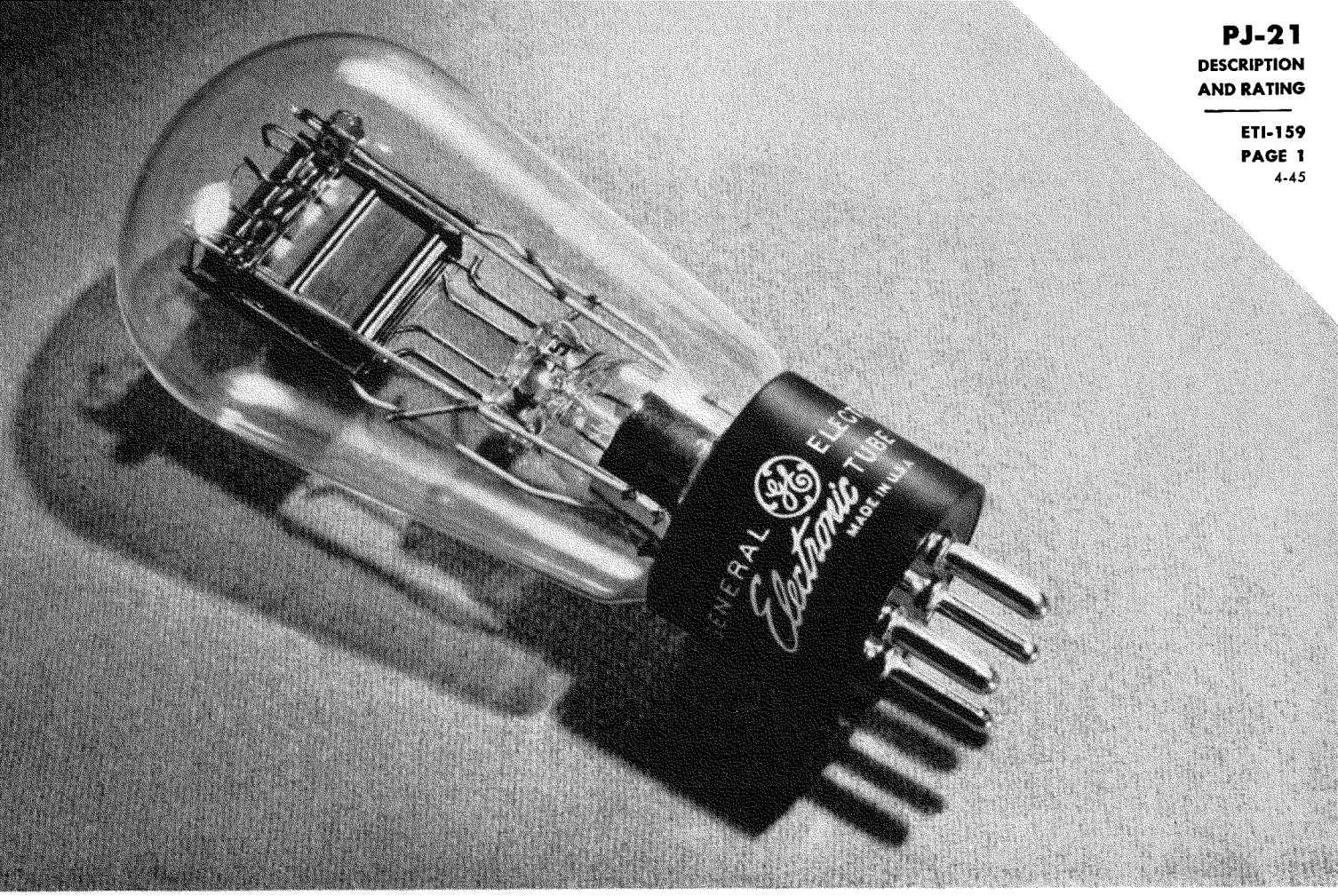
NT8





OV.1676

Printed in England. C.



PLIOTRON

DESCRIPTION

The PJ-21 is a high-vacuum tube designed for use in amplification and relay applications. The low grid power and uniformity of characteristics are particularly valuable in many control applications.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Filament voltage	4.5	volts
Filament current	1.1	amperes
Average characteristics when $E_b = 350$ volts, $I_b = 19.5$ milliamperes, $E_f = 4.5$ volts d-c		
Grid voltage	−83	volts
Amplification factor	3	
Grid-plate transconductance	950	micromhos
Direct interelectrode capacitance		
Grid-plate	7.5	micromicrofarads
Grid-cathode	3.0	micromicrofarads
Plate-cathode	4.0	micromicrofarads

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

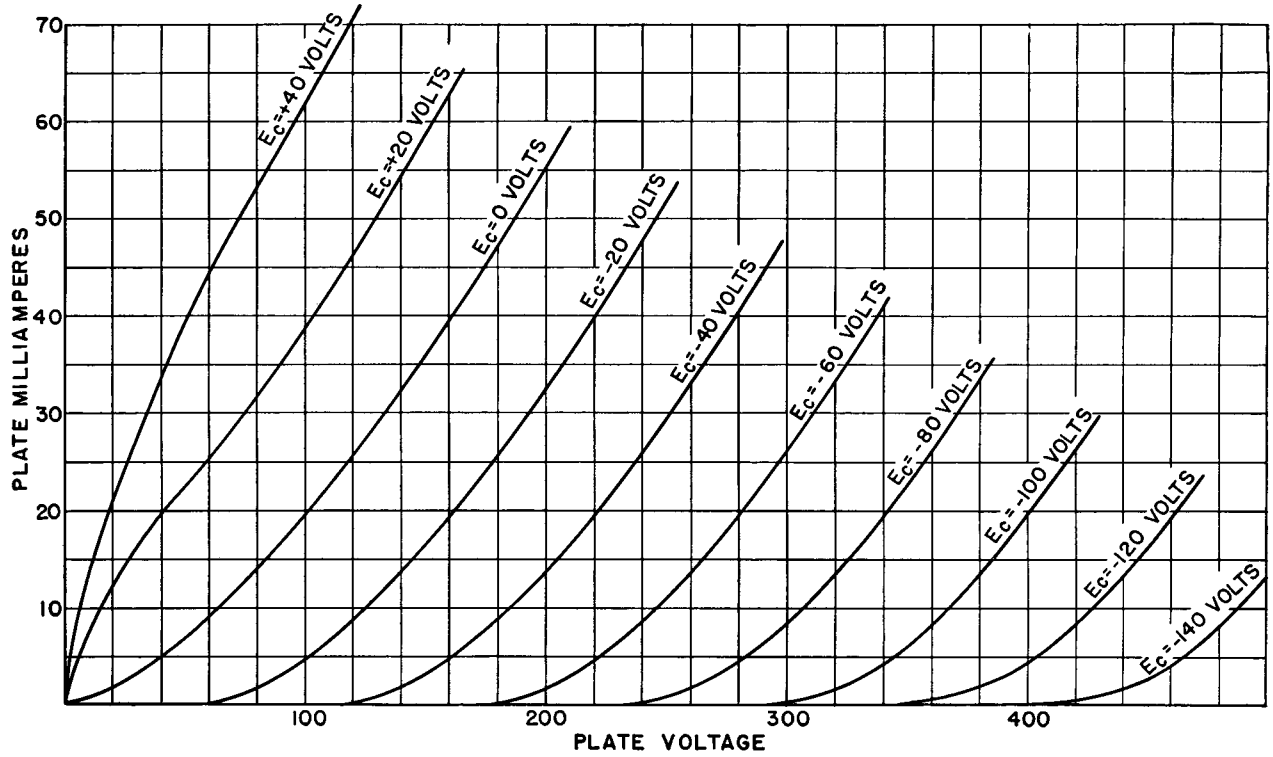
Base	medium 4-pin bayonet
Net weight, approx.	2 ounces
Shipping weight, approx.	3 pounds
Operating position	vertical or horizontal with plane of electrodes vertical

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

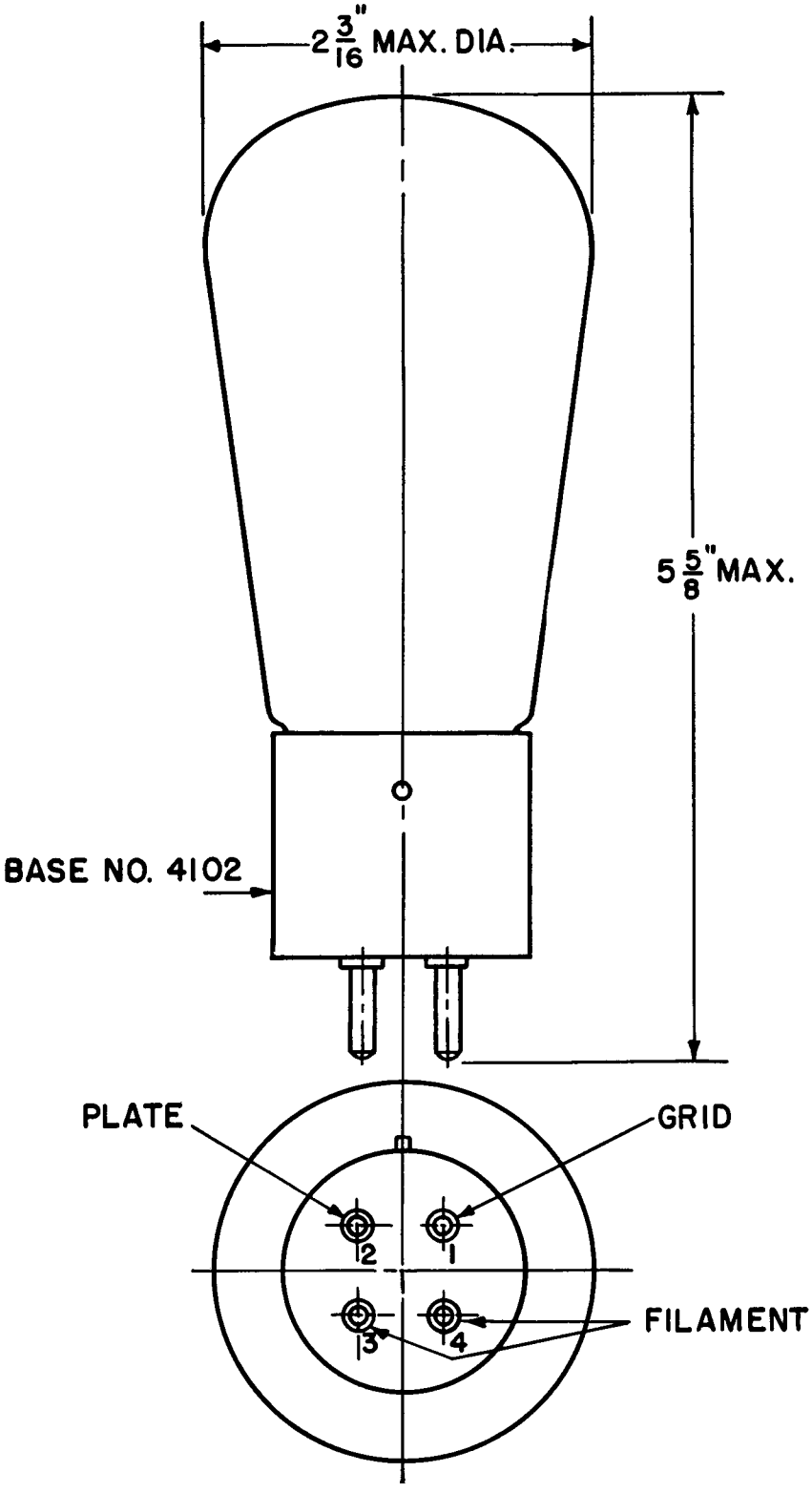
CLASS A AUDIO-FREQUENCY AMPLIFIER AND MODULATOR

	Typical Operation	Maximum Ratings	
D-c plate voltage	350	350	volts
Plate dissipation	....	7.5	watts
D-c grid voltage	−83	....	volts
Peak grid swing, approx.	83	....	volts
D-c plate current	19.5	....	milliamperes
Plate resistance	3200	....	ohms
Load resistance	7500	....	ohms
Plate power output, 5% second harmonic	1.7	....	watts

PJ-21 AVERAGE PLATE CHARACTERISTICS
$I_f = 1.1$ AMPERES D-C
($E_f = 4.5$ VOLTS, APPROX.)



K-6966438 7-1-44



K-3846047 6-9-44

OUTLINE PJ-21 PLIOTRON

Electronics Department
GENERAL ELECTRIC
Schenectady, N. Y.

4-45 (4M)
Filing No. 8850



PHOTOTUBE

DESCRIPTION

This two-electrode vacuum phototube is designed for use in photoelectric apparatus requiring reliable and accurate control. Although it will pass some current in the visible region, the PJ-22 is designed primarily for use in the red and infrared region of the spectrum. The tube is especially useful where a high degree of stability of characteristic is required and where it is desirable to have the output directly proportional to the light flux incident on the cathode.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	2	
Electrical		
Spectral response	S-1	
Luminous sensitivity at 90 volts, 0 cycles	20	microamperes per lumen
Maximum gas amplification	1.1	
Interelectrode capacitance	3.0	micromicrofarads
Maximum dark current at 90 volts	0.1	microampere
Wavelength of maximum response	7500	angstroms
Sensitivity at maximum response	0.0020	microampere per microwatt

Electronic TUBE

GENERAL ELECTRIC

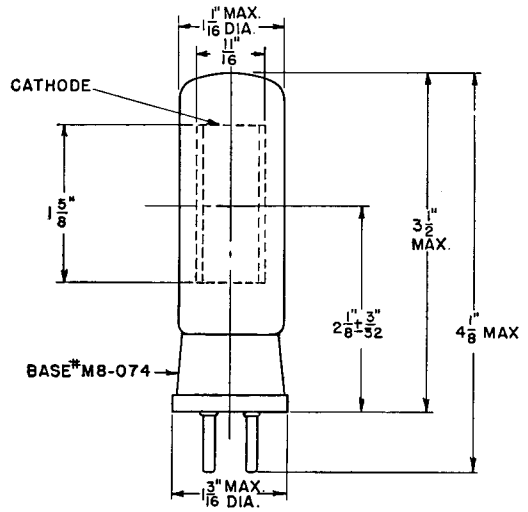
TECHNICAL INFORMATION (CONT'D)

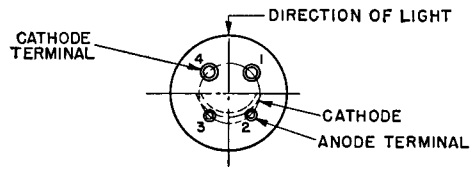
Mechanical

Window dimensions	$\frac{11}{16}$ x $1\frac{5}{8}$	inches
Seated height to center of useful cathode area	$2\frac{1}{8} \pm \frac{3}{32}$	inches
Maximum over-all height	$4\frac{1}{8}$	inches
Maximum seated height	$3\frac{1}{2}$	inches
Maximum diameter	$1\frac{3}{16}$	inches
Base	M8-074	
Mounting position	Any	
Net weight, approx	$\frac{1}{2}$	ounce
Shipping weight, approx	3	pounds

MAXIMUM RATINGS

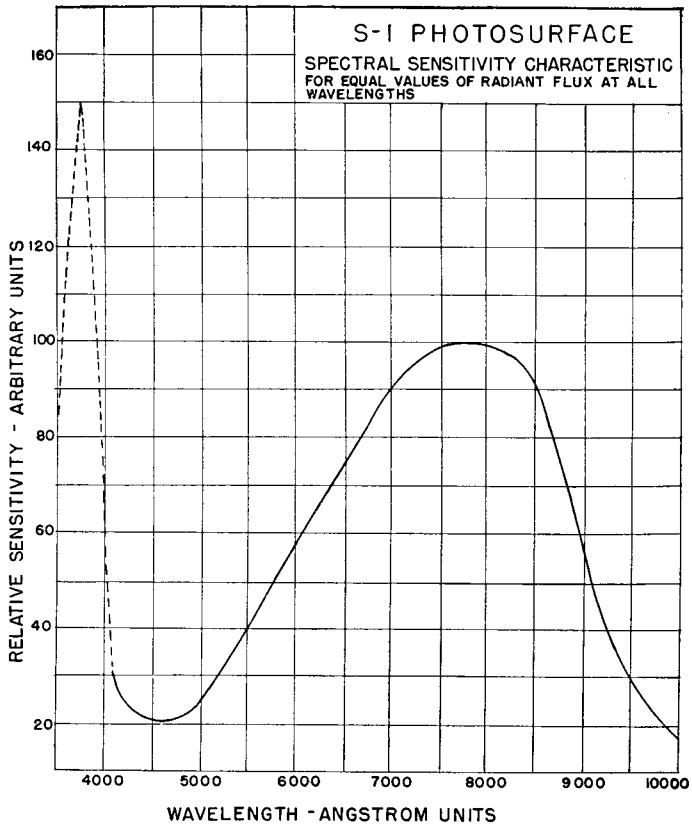
Anode voltage, d-c or peak a-c	500	volts
Cathode current density	152	microamperes per square inch
Ambient temperature	100	centigrade





OUTLINE
PJ-22 PHOTOTUBE

K-8639391 8-10-44

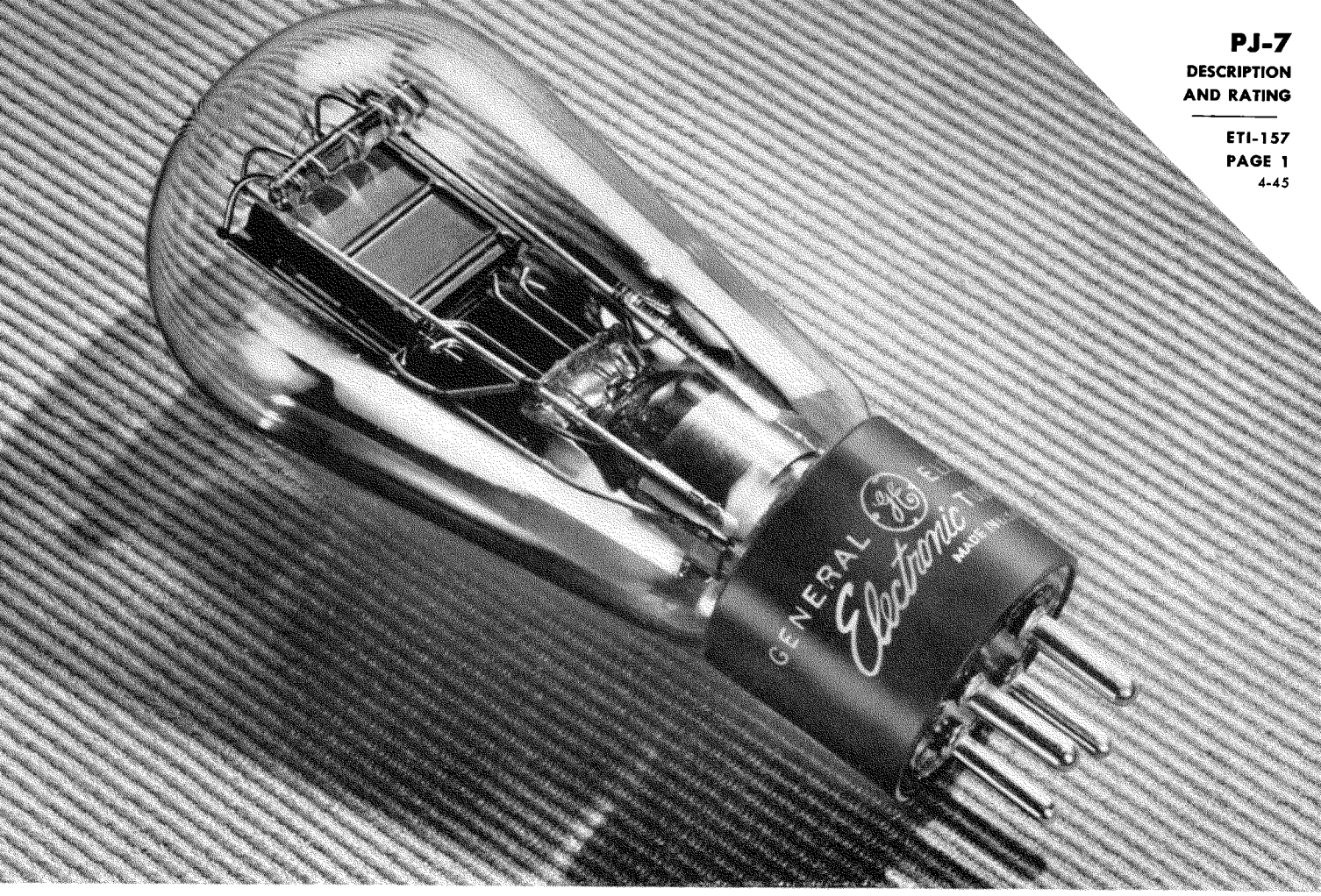


K-8638626 4-17-44

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PLIOTRON

DESCRIPTION

The PJ-7 is a high-vacuum tube designed for use in amplification and relay applications. The low grid power and uniformity of characteristics are particularly valuable in many control applications.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Filament voltage	4.5	volts
Filament current	1.1	amperes
Average characteristics when $e_b = 350$ volts, $i_b = 4.5$ milliamperes, $e_f = 4.5$ volts d-c		
Grid voltage	−4	volts
Amplification factor	30	
Grid-plate transconductance	1120	micromhos
Direct interelectrode capacitance		
Grid-plate	8.5	micromicrofarads
Grid-cathode	3.0	micromicrofarads
Plate-cathode	4.0	micromicrofarads

GE Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

Base	medium 4-pin bayonet
Net weight, approx.	.2 ounces
Shipping weight, approx	.3 pounds
Operating position	vertical or horizontal with plane of electrodes vertical

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS A AUDIO-FREQUENCY AMPLIFIER AND MODULATOR

	Typical Operation	Maximum Ratings	
D-c plate voltage	350	350	volts
Plate dissipation	....	7.5	watts
D-c grid voltage	−6	....	volts
Peak grid swing, approx.	6	....	volts
D-c plate current	2.8	....	milliamperes
Load resistance	40,000	....	ohms
Plate power output, less than 5% second harmonic	58	....	volts

CLASS B RADIO-FREQUENCY POWER AMPLIFIER

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D-c plate voltage	350	350	volts
D-c grid voltage	−10	....	volts
D-c plate current	32	35	milliamperes
R-f grid current	....	2.5	amperes
Plate dissipation	9	10	watts
Output, approx.	2	....	watts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR, PLATE MODULATED

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D-c plate voltage	300	300	volts
D-c grid voltage	−40	−100	volts
D-c plate current	35	40	milliamperes
D-c grid current, approx.	8	15	milliamperes
R-f grid current	....	2	amperes
Plate dissipation	5.5	10	watts
Plate power output, approx.	5	....	watts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

*Key-down conditions per tube without modulation**

D-c plate voltage	350	350	volts
D-c grid voltage	−25	−100	volts
D-c plate current	35	40	milliamperes
D-c grid current, approx.	5	15	milliamperes
R-f grid current	....	3	amperes
Plate dissipation	6	10	watts
Plate power output, approx.	6	....	watts

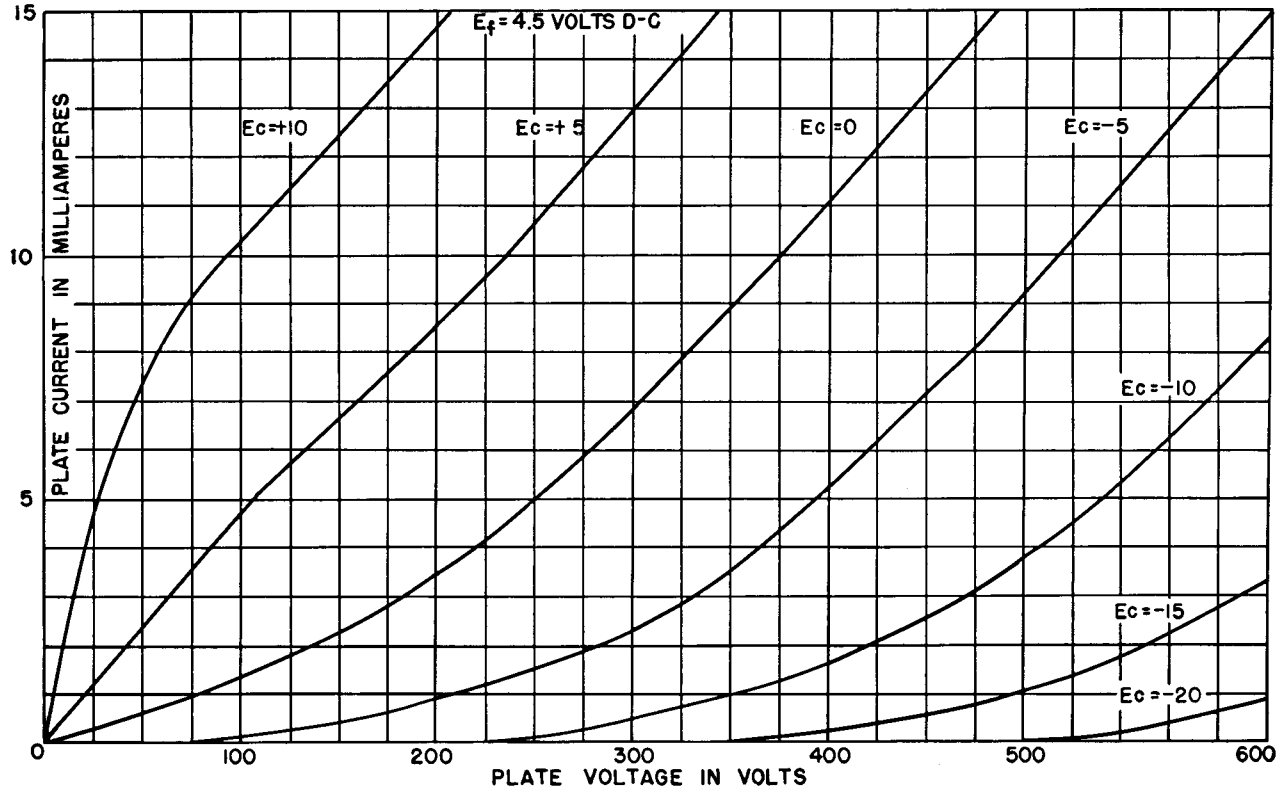
* Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

APPLICATION NOTES

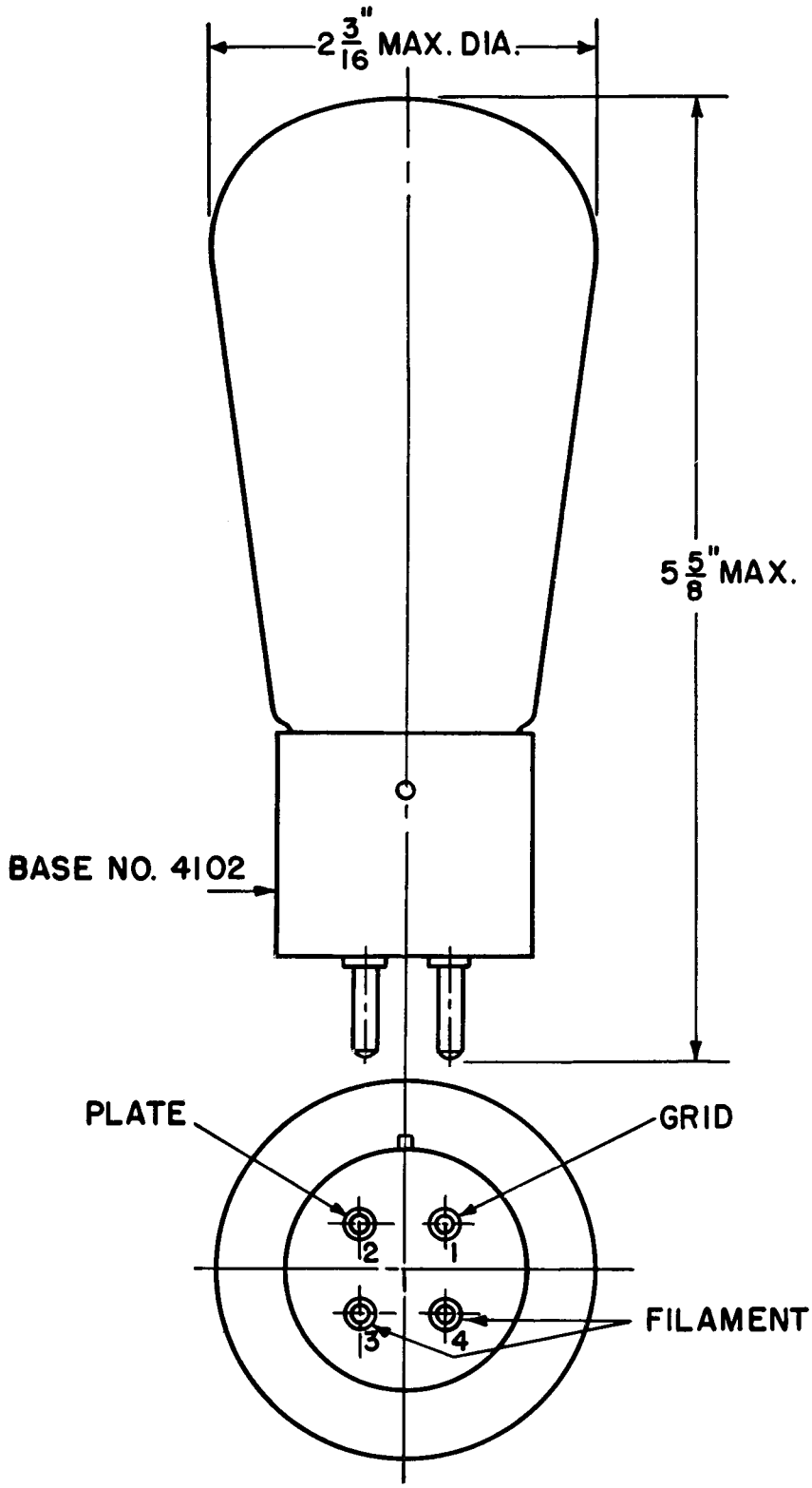
The PJ-7 can be operated at frequencies as high as six megacycles, and may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised (other maximum ratings are the same as shown above). The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used up to 170 megacycles for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency	6	45	170	megacycles
Class B, r-f	100	75	50	per cent
Class C, plate modulated or unmodulated	100	75	50	per cent

The normal value of grid leak, when the tube is used as an oscillator or r-f power amplifier (Class c), is in the neighborhood of 5000 ohms, although this may be replaced by a suitable fixed bias. If self-bias is used, the cathode resistor should be approximately 600 ohms.



PJ-7 AVERAGE STATIC CHARACTERISTICS

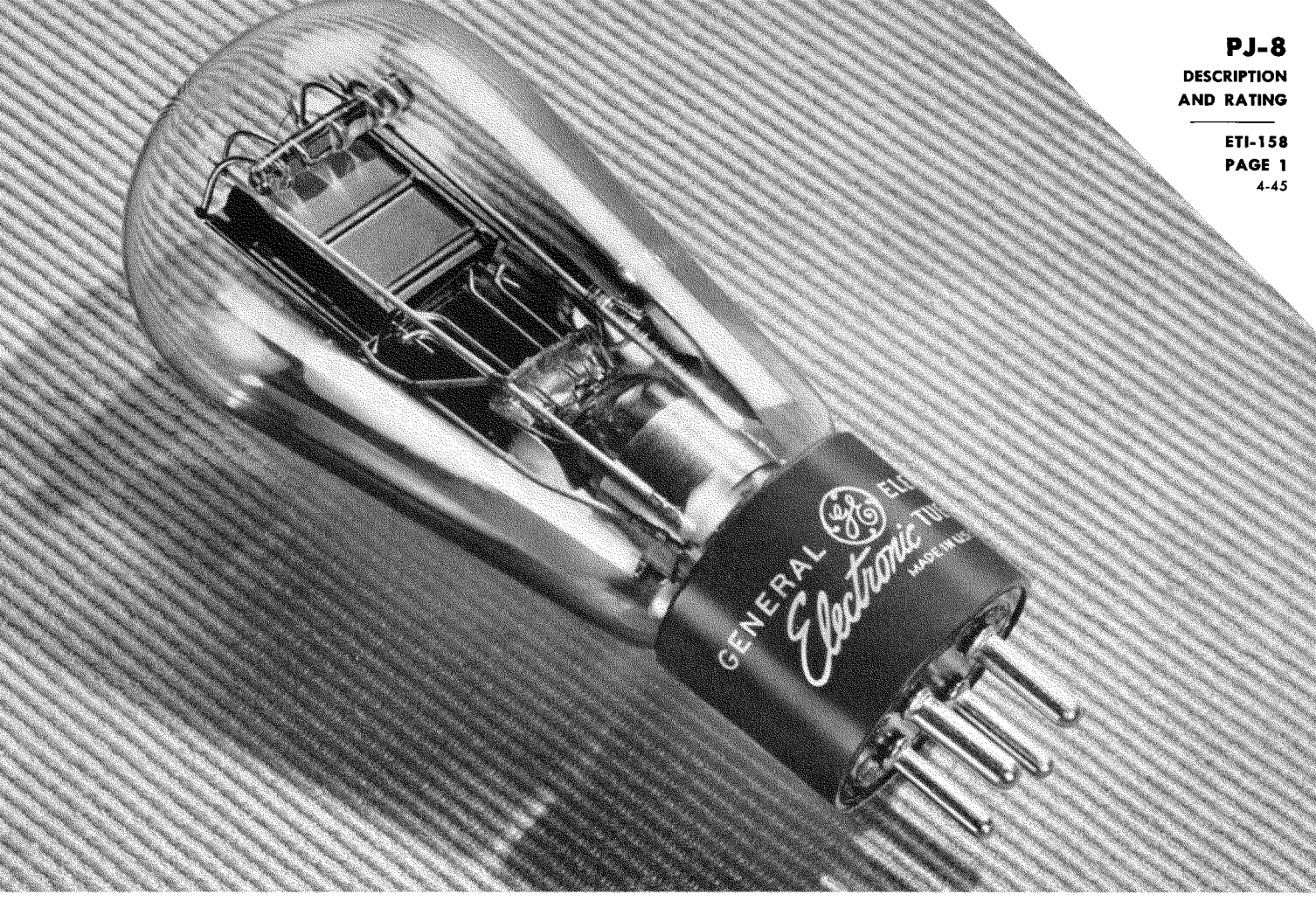


OUTLINE PJ-7 PLIOTRON

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.



PLIOTRON

DESCRIPTION

The PJ-8 is a high-vacuum tube designed for use in amplification and relay applications. The low grid power and uniformity of characteristics are particularly valuable in many control applications.

TECHNICAL INFORMATION

These data are for reference only. For design information refer to specifications.

GENERAL CHARACTERISTICS

Number of electrodes	3	
Electrical		
Filament voltage	4.5	volts
Filament current	1.1	amperes
Average characteristics when $E_b = 350$ volts, $I_b = 19$ milliamperes, $E_f = 4.5$ volts d-c		
Grid voltage	−20	volts
Amplification factor	8.5	
Grid-plate transconductance	1330	micromhos
Direct interelectrode capacitance		
Grid-plate	8.3	micromicrofarads
Grid-cathode	4.0	micromicrofarads
Plate-cathode	3.0	micromicrofarads

Electronic TUBE

GENERAL ELECTRIC

TECHNICAL INFORMATION (CONT'D)

Mechanical

Base	medium 4-pin bayonet
Net weight, approx.	3 ounces
Shipping weight, approx.	3 pounds
Operating position	vertical or horizontal with plane of electrodes vertical

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS A AUDIO-FREQUENCY AMPLIFIER AND MODULATOR

	Typical Operation	Maximum Ratings	
D-c plate voltage	350	350	volts
Plate dissipation	....	7.5	watts
D-c grid voltage	−30	....	volts
Peak grid swing, approx.	30	....	volts
D-c plate current	9	....	milliamperes
Plate resistance	8700	....	ohms
Load resistance	18,000	....	ohms
Plate power output, 5% second harmonic	0.6	....	watts

CLASS B RADIO-FREQUENCY POWER AMPLIFIER

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D-c plate voltage	350	350	volts
D-c grid voltage	−40	....	volts
D-c plate current	32	40	milliamperes
Plate input	....	14	watts
Plate dissipation	....	10	watts
Peak r-f grid input	90	....	volts
†Driving power, approx.	0.1	....	watts
Output, approx.	2	....	watts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR, PLATE MODULATED

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D-c plate voltage	300	350	volts
D-c grid voltage	−100	−150	volts
D-c plate current	30	40	milliamperes
D-c grid current, approx.	2	10	milliamperes
Plate input	....	14	watts
Plate dissipation	....	7	watts
Peak r-f grid input voltage, approx	140	....	volts
Driving power, approx.	0.3	....	watts
Plate power output	4	....	watts

CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

*Key-down conditions per tube without modulation**

D-c plate voltage	350	350	volts
D-c grid voltage	−80	−150	volts
D-c plate current	35	40	milliamperes
D-c grid current, approx.	2	10	milliamperes
Plate input	....	14	watts
Plate dissipation	....	10	watts
Peak r-f grid input voltage, approx	130	....	volts
Driving power, approx.	0.25	....	watts
Plate power output, approx.	6	....	watts

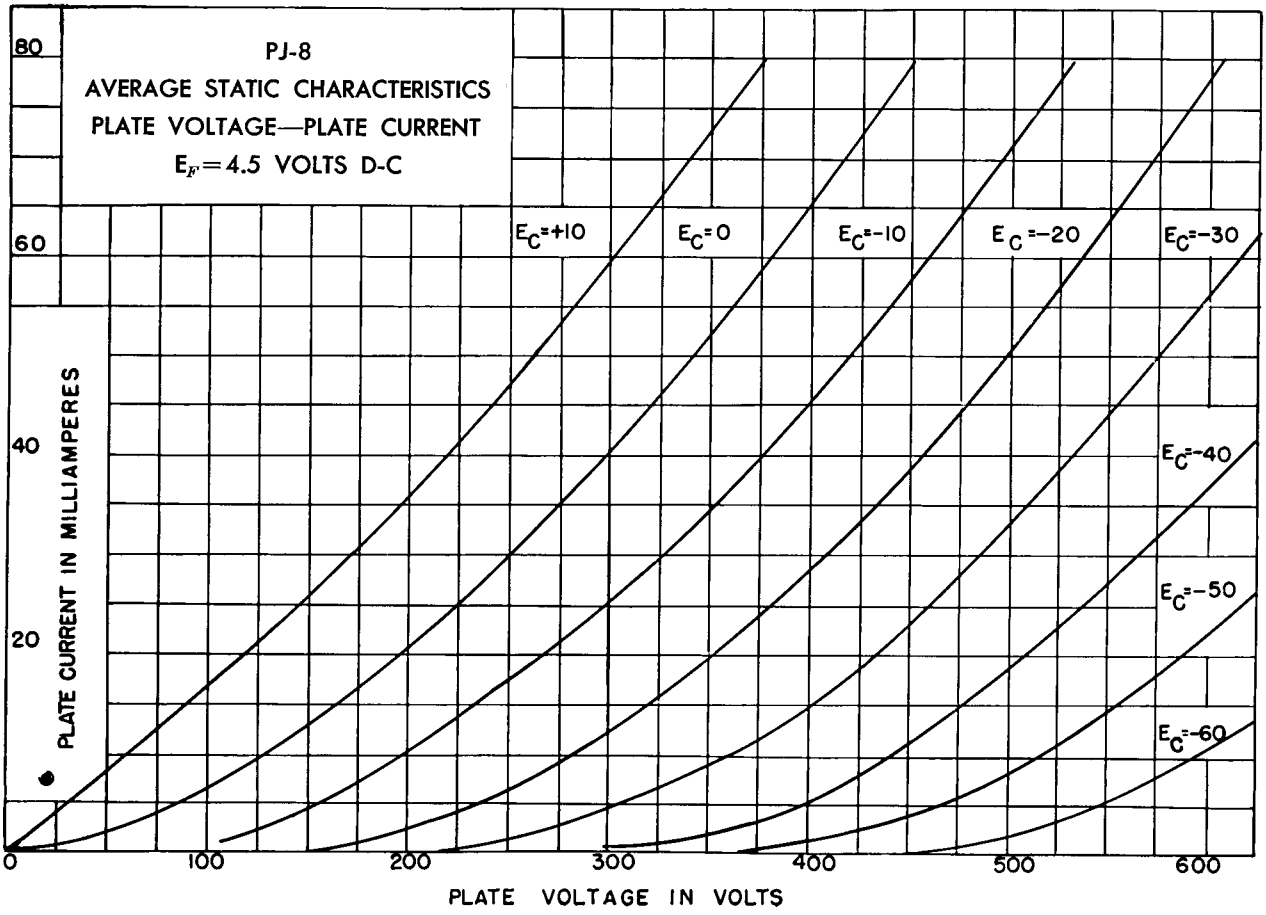
†At crest of audio-frequency cycle.
*Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

APPLICATION NOTES

The PJ-8 can be operated at frequencies as high as six megacycles, and may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised (other maximum ratings are the same as shown under TECHNICAL INFORMATION). The tabulation below shows highest percentage of maximum plate voltage and power input that can be used up to thirty megacycles for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

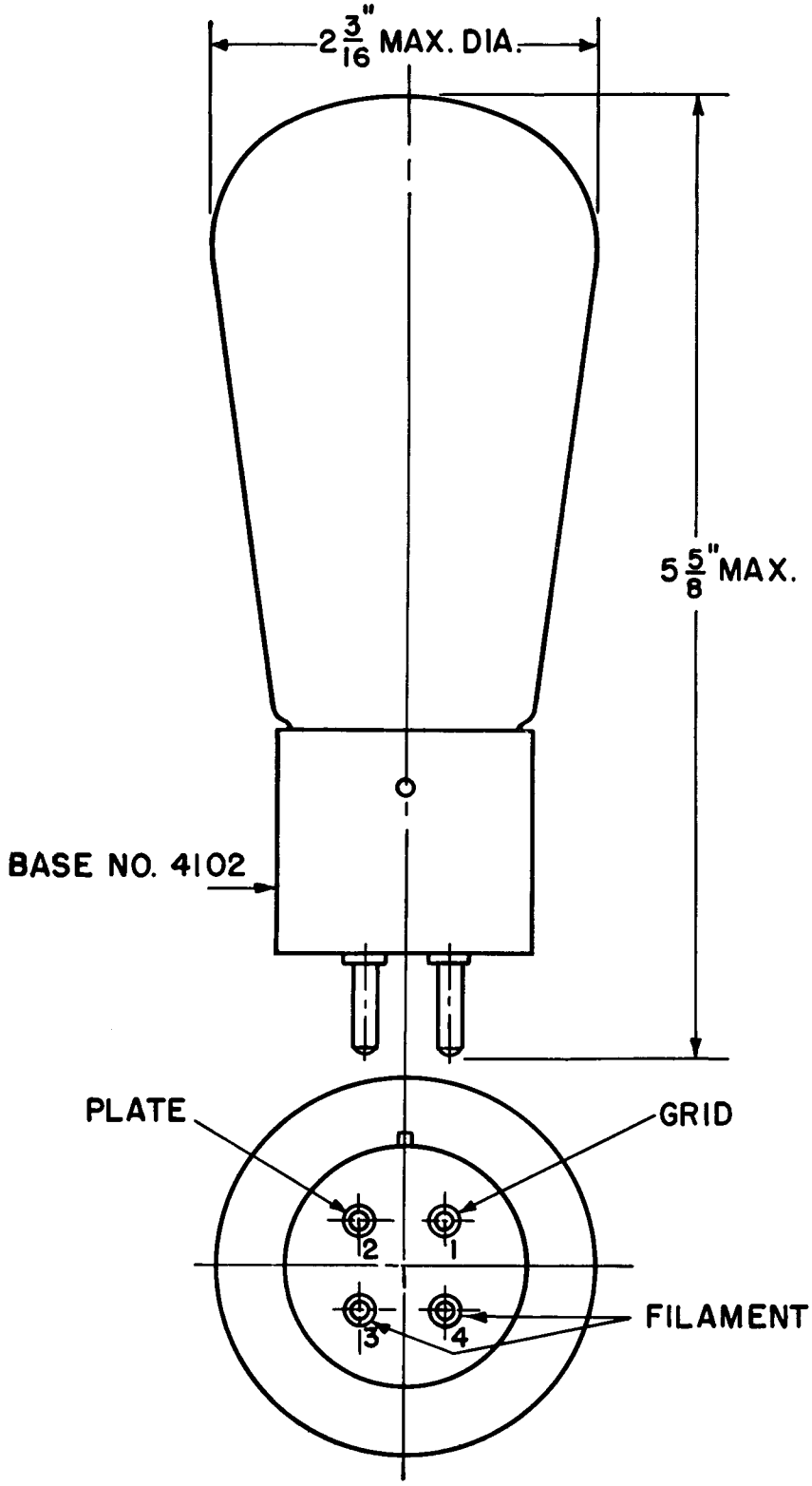
Frequency	6	15	30	megacycles
Class B, r-f	100	85	70	per cent
Class C, plate modulated or unmodulated	100	75	50	per cent

The normal value of grid leak, when the PJ-8 is used as an oscillator or r-f power amplifier (Class C), is in the neighborhood of 10,000 ohms, although this may be replaced by a suitable fixed bias. If self-bias is used, the cathode should be approximately 2000 ohms.



K-9033567

12-18-44



K-3846047

6-9-44

OUTLINE PJ-8 PLIOTRON

Electronics Department

GENERAL ELECTRIC

Schenectady, N. Y.

THE M-O VALVE
COMPANY LIMITED

TT21 TT22

G.E.C.

BEAM TETRODES

BRIEF DATA

Beam tetrodes suitable for use as r.f. power amplifiers in single side-band or Class C service, as audio amplifiers or modulators. They are also useful as pulse modulators and in series and shunt stabiliser service.

P_{load} (SSB)	110	W
P_{load} (Class C)	146	W
P_{load} (Audio, per pair)	140	W

HEATER

	TT21	TT22	
V_h	6.3	12.6	V
I_h (approx)	1.6	0.8	A

MAXIMUM RATINGS (Absolute)

	*CCS	†ICAS	
V_a	1.25	1.25	kV
V_a (I_a = 0)	3.5	3.5	kV
V_{g2}	600	600	V
V_{g1}	200	200	V
p_a	37.5	45	W
p_{g2}	6	6	W
p_{g1}	2	2	W
I_k	230	230	mA
$i_{k\,(pk)}$ (r.f.)	2	2	A
$i_{a\,(pk)}$ (pulse)	7.5	7.5	A
V_{h-k}	150	150	V
R_{g1-k} (fixed bias)	100	100	kΩ
R_{g1-k} (cathode bias)	220	220	kΩ
T_{bulb}	250	250	°C

*Continuous Commercial Service is defined as that type of service in which long life and reliability of performance under continuous operating conditions are the prime considerations.

†Intermittent Commercial and Amateur Service is defined as that type of service where minimum size, lightweight and maximum power output are more important than long life.

Intermittent operation implies that no 'on' period exceeds 5 minutes and an 'on' period is followed by an 'off' period of the same or longer duration.

CAPACITANCES

C_{a-g1}	0.25	pF
$C_{a-all\ less\ g1}$	13.5	pF
$C_{g1-all\ less\ a}$	17	pF

CHARACTERISTICS

V_a	250	V
V_{g2}	250	V
I_a	140	mA
g_m	11	mA/V
r_a	12	kΩ
μ_{g1-g2}	8	

OPERATING DATA

A.F. Power Amplifier – Class AB1

The TT21 may be used as an alternative to the KT88 in existing audio designs and the following conditions are typical.

Push–Pull. Cathode Bias. Tetrode Connection.

$V_{a(b)}$	560	V
$V_{a(o)}$	521	V
V_{g2}	300	V
$I_{a(o)}$	2 x 64	mA
$I_{a\ (max\ sig)}$	2 x 73	mA
$I_{g2(o)}$	2 x 1.7	mA
$I_{g2\ (max\ sig)}$	2 x 9	mA

$R_{load\ (a-a)}$	9	kΩ
*R_k	2 x 460	Ω
$-V_{g1}$ (approx)	30	V
P_{out}	50	W
D_{tot}	3	%
†IM	11	%
$p_{a(o)}$	2 x 33	W
p_a (max sig)	2 x 12	W
$p_{g2(o)}$	2 x 0.5	W
p_{g2} (max sig)	2 x 2.7	W
$V_{g1(ac)}$ (pk)	2 x 30	V

*It is essential to use two separate cathode bias resistors.
†Intermodulation distortion; measured using two input signals at 50 and 6000Hz (ratio of amplitudes 4:1).

Push–Pull. Fixed Bias. Tetrode Connection.

$V_{a(b)}$	560	V
$V_{a(o)}$	552	V
V_{g2}	300	V
$I_{a(o)}$	2 x 60	mA
I_a (max sig)	2 x 145	mA
$I_{g2(o)}$	2 x 1.7	mA
I_{g2} (max sig)	2 x 15	mA
$R_{load\ (a-a)}$	4.5	kΩ
*$-V_{g1}$ (approx)	34	V
P_{out}	100	W
D_{tot}	2.5	%
†IM	10	%
$p_{a(o)}$	2 x 33	W
p_a (max sig)	2 x 28	W
$p_{g2(o)}$	2 x 0.5	W
p_{g2} (max sig)	2 x 4.5	W
$V_{g1(ac)}$ (pk)	2 x 33.5	V

*It is essential to provide two separately adjustable bias voltage sources, having a voltage adjustment range of ±50%.
†Intermodulation distortion; measured using two input signals at 50 and 6000Hz (ratio of amplitudes 4:1).

Push–Pull. Cathode Bias. Ultra-Linear Connection (40% Tapping Points).

$V_{a,\ g2(b)}$	500	375	V
$V_{a,\ g2(o)}$	436	328	V
$I_{a+g2(o)}$	2 x 87	2 x 87	mA
$I_{a+g2\ (max\ sig)}$	2 x 99	2 x 96	mA
$R_{load\ (a-a)}$	6	5	kΩ
*R_k	2 x 600	2 x 400	Ω
$-V_{g1}$ (approx)	52	35	V
P_{out}	50	30	W
D_{tot}	1.5	1	%
†IM	4	3	%
$p_{a+g2(o)}$	2 x 38	2 x 28.5	W
$p_{a+g2\ (max\ sig)}$	2 x 17	2 x 16	W
$V_{g1(ac)\ (pk)}$	2 x 52	2 x 35.5	V
Z_{out}	4.8	4.5	kΩ

*It is essential to use two separate cathode bias resistors.
†Intermodulation distortion; measured using two input signals at 50 and 6000Hz (ratio of amplitudes 4:1).

A.F. Power Amplifier and Modulator – Class AB1 – Fixed Bias
(Tetrode Connection)

Maximum Permissible Conditions – CCS

V_a	1.25	kV
V_{g2}	600	V
p_a	37.5	W
p_{g2}	6	W

Typical Operation
Performance in an amplifier at various signal levels.

$V_{a(b)}$	1000	1000	1000	1000	V
V_a	996	993	990	989	V
$V_{g2(b)}$	300	300	300	300	V
V_{g2}	300	300	299	298	V
*$-V_{g1}$ (approx)	40	40	40	40	V
$V_{g1(ac)\ (pk)}$	2 x 0	2 x 16	2 x 25.5	2 x 32	V
I_a	2 x 35	2 x 55	2 x 79	2 x 90	mA
I_{g2}	2 x 0.35	2 x 1.2	2 x 4.5	2 x 11.5	mA
P_{load}	.0	40	100	140	W
$R_{load\ (a-a)}$	16.8	16.8	16.8	16.8	kΩ
D	1.25	1.5	4.8		%

*Must be separately adjusted on each tube with no signal. Bias supply should have an adjustment range of ±50%.

A modulator operating under these conditions is described in Application Report No. 17. It is convenient for use with a TT21 with anode and screen modulation and with the modulator and r.f. stage operating from a common 1000V h.t. supply.

R.F. Power Amplifier – Class C Telegraphy

Maximum Permissible Conditions

	CCS	ICAS	
V_a	1.25	1.25	kV
V_{g2}	600	600	V
$-V_{g1}$	200	200	V
I_a	200	200	mA
p_a	37.5	45	W
P_{in}	200	220	W
p_{g2}	6	6	W
p_{g1}	2	2	W

Typical Operation – CCS

V_a	500	800	1000	1250	V
V_{g2}	300	300	300	300	V
$-V_{g1}$	90	90	90	90	V
I_a	192	182	175	160	mA
I_{g2}	20	20	20	20	mA
I_{g1}	8.5	7	5.5	4.5	mA
p_a	37.5	37.5	37.5	37.5	W
p_{g2}	6	6	6	6	W
P_{out}	58.5	108.5	137.5	162.5	W
Efficiency	61	75	78	81	%
*R_{load}	52	95	115	132	W
$P_{out(driver)}$	2.1	1.9	1.8	1.6	W

*Measured at 30MHz

Typical Operation – ICAS

V_a	500	800	1000	1250	V
V_{g2}	300	300	300	300	V
$-V_{g1}$	90	90	90	90	V
I_a	200	200	190	175	mA
I_{g2}	20	20	20	20	mA
I_{g1}	9	9	7.5	6	mA
p_a	40	43	45	45	W
p_{g2}	6	6	6	6	W
P_{out}	60	117	145	174	W
Efficiency	59	74	76.5	79.5	%
*P_{load}	52	103	126	146	W
P_{out} (driver)	2.1	2.1	2	1.9	W

*Measured at 30MHz.

R.F. Power Amplifier – Class C – Anode and Screen Modulated

Maximum Permissible Conditions

		(Carrier Conditions)	
	CCS	ICAS	
V_a	1	1	kV
V_{g2}	600	600	V
$-V_{g1}$	200	200	V
I_a	160	180	mA
p_a	25	30	W
P_{in}	130	150	W
p_{g2}	6	6	W
p_{g1}	2	2	W
Modulation	100	100	%

Typical Operation – CCS

V_a	550	700	850	1000	V
V_{g2}	300	300	300	300	V
$-V_{g1}$	115	115	115	115	V
I_a	160	150	140	130	mA
I_{g2}	20	20	20	20	mA
I_{g1}	5	3.5	3	2.5	mA
p_a	25	25	25	25	W
p_{g2}	6	6	6	6	W
P_{out}	63.5	80	95	105	W
Efficiency	72	76	80	81	%
*P_{load}	54	70	82	87	W
P_{out} (driver)	1.5	1.4	1.2	1.1	W
P_{mod}	50	60	68	75	W

*Measured at 30MHz.

Typical Operation – ICAS

V_a	550	700	850	1000	V
V_{g2}	300	300	300	300	V
$-V_{g1}$	115	115	115	115	V
I_a	180	175	165	150	mA
I_{g2}	20	20	20	20	mA
I_{g1}	6.5	5.5	5	3.5	mA
p_a	30	30	30	30	W
p_{g2}	6	6	6	6	W
P_{out}	69	92	110	123	W
Efficiency	70	75.5	78.5	82	%
*P_{load}	61	82	94	101	W
P_{out} (driver)	1.8	1.7	1.5	1.2	W
P_{mod}	55	68	80	85	W

*Measured at 30MHz.

R.F. Power Amplifier – Class AB1 – SSB

Maximum Permissible Conditions

	CCS	ICAS	
V_a	1.25	1.25	kV
V_{g2}	600	600	V
$-V_{g1}$	200	200	V
p_a	37.5	45	W
p_{g2}	6	6	W
p_{g1}	2	2	W

Typical Operation

	CCS	CCS	ICAS†	
V_a	800	1000	1200	V
V_{g2}	300	300	300	V
*$-V_{g1}$	38	40	45	V
$V_{g1(ac)\ (pk)}$	37	39	44	V
$I_{a(o)}$	40	37.5	32.5	mA
$I_{g2(o)}$	0.5	0.3	–	mA
$p_{a(o)}$	32	37.5	39	W

	2-tone	1-tone	2-tone	1-tone	2-tone	1-tone	
$I_{a(max\ sig)}$	86	122	83	130	90	136	mA
$I_{g2(max\ sig)}$	4.5	11	5	9	4	8	mA
$I_{g1(max\ sig)}$	0	0	0	0	0	0	
$p_{a(max\ sig)}$	33.5	26.5	34.5	33	47	41	W
$p_{g2(max\ sig)}$	1.4	3.3	1.5	2.7	1.2	2.4	W
$P_{out(mean)}$	35.5	71	48.5	97	61	122	W
PEP_{out}	71	–	97	–	122	–	W
Z_a	4	4	4.8	4.8	5.5	5.5	kΩ
$P_{load(mean)}$	32	64	43.75	87.5	55	110	W
PEP_{load}	64	–	87.5	–	110	–	W
‡D_3	36	–	33	–	29	–	dB
‡D_5	49	–	46	–	43	–	dB

*Adjust to obtain specified value of $I_{a(o)}$.
†The available output is limited by the anode dissipation under two-tone test conditions. Greater output may be possible if the peak to mean value of the modulation waveforms permit greater input power without exceeding the dissipation rating.
‡Measured with reference to either of the two tones.

A complete linear amplifier is described in Application Report No. 15.

Pulse Modulator Service

Maximum Permissible Conditions

V_a	3.5	kV
V_{g2}	600	V
$-V_{g1}$	200	V
p_a	37.5	W
p_{g2}	6	W
p_{g1}	2	W
$i_{a(pk)}$	7.5	A

Typical Operation

V_a	3.5	kV
V_{g2}	600	V
$-V_{g1}$	150	V
$V_{g1(pulse)}$	380	V
$I_{a(pulse)}$	6	A
$I_{g2(pulse)}$	2.1	A
$I_{g1(pulse)}$	2.3	A
R_a	460	Ω
t_p	2	μs
PRF	1500	p/s

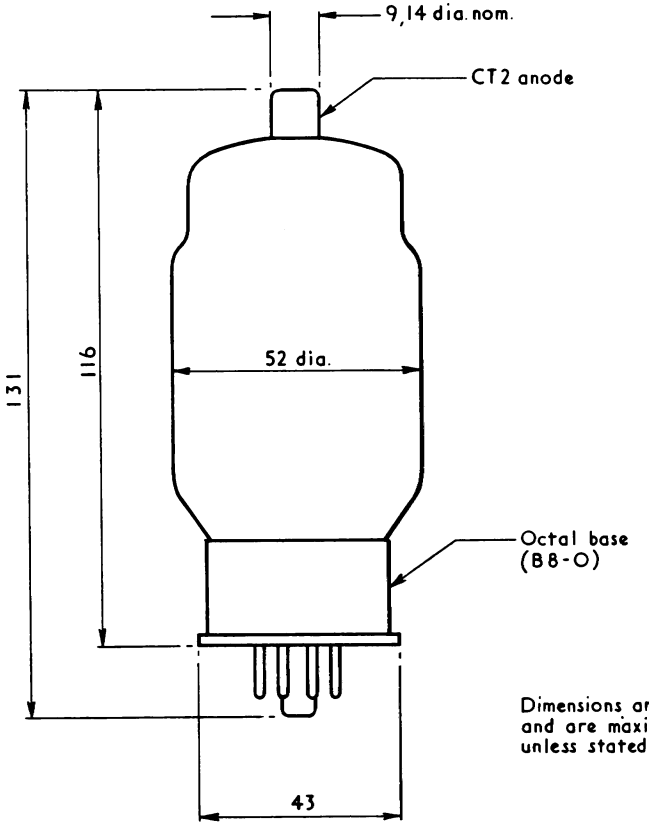
INSTALLATION

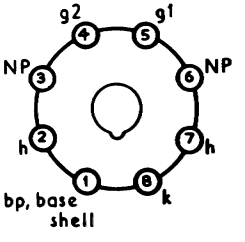
The tube may be mounted either vertically or horizontally. When a pair of tubes is mounted vertically it is recommended that the centres of the tube-holders are not less than 100mm apart and that pins 4 and 8 of each tube are in line. When a pair of tubes is mounted horizontally it is recommended that the centres of the tubeholders are not less than 100mm apart and that pins 4 and 8 of each tube are in the same vertical line. If circuit layout makes closer mounting desirable, free air circulation around the tube must be ensured, if necessary by means of a small fan. The bulb temperature under the worst operating conditions must not exceed 250°C.

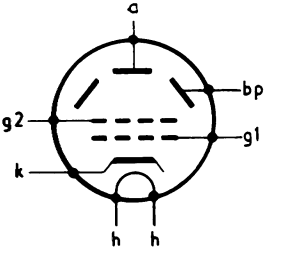
OPERATING NOTES

In order to prevent parasitic oscillation, it is desirable to use a grid stopper resistor mounted close to the tubeholder. In Class AB1 audio circuits this may have a value up to 10kΩ reducing to about 100Ω in r.f. circuits, when an anode stopper consisting of a 100Ω ¼W resistor overwound with 2½ turns of 18 s.w.g. copper wire may also be necessary. The usual practice of using a single chassis point for all earth returns should always be adopted in r.f. equipment.

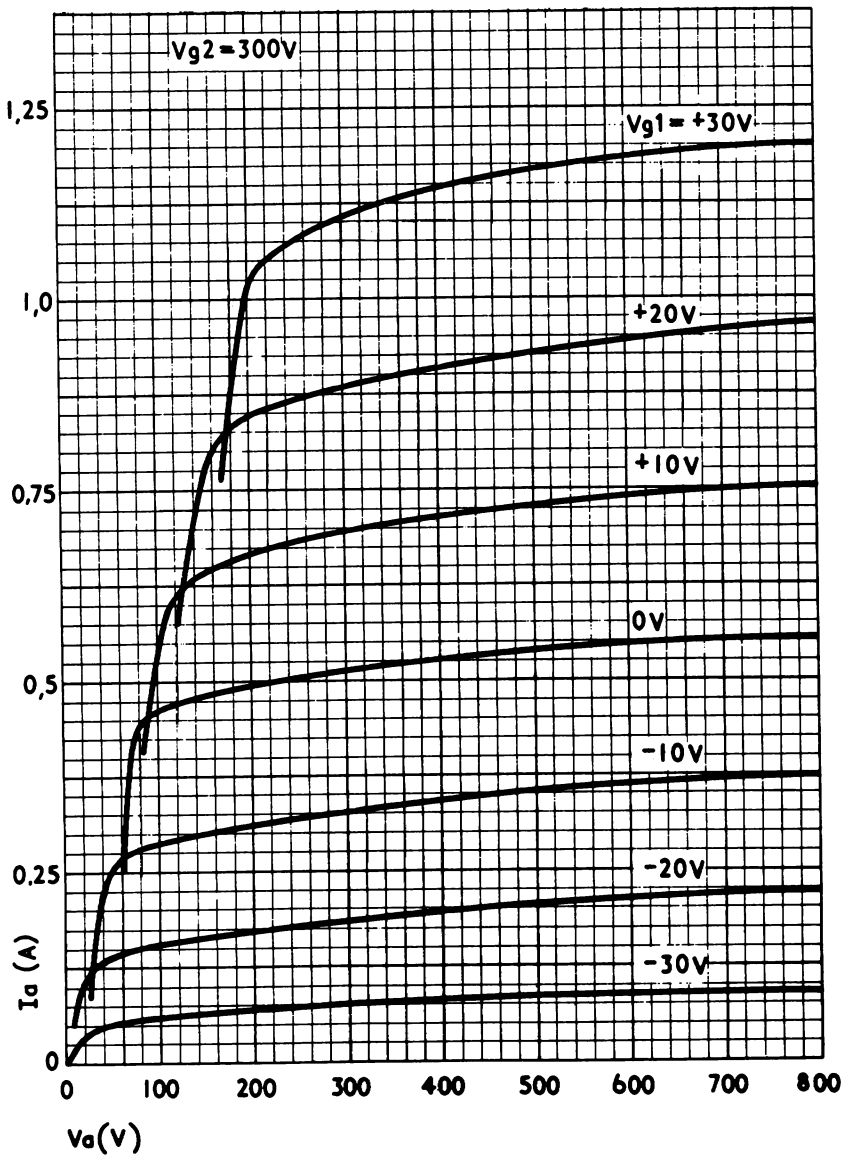
OUTLINE AND BASE CONNECTIONS



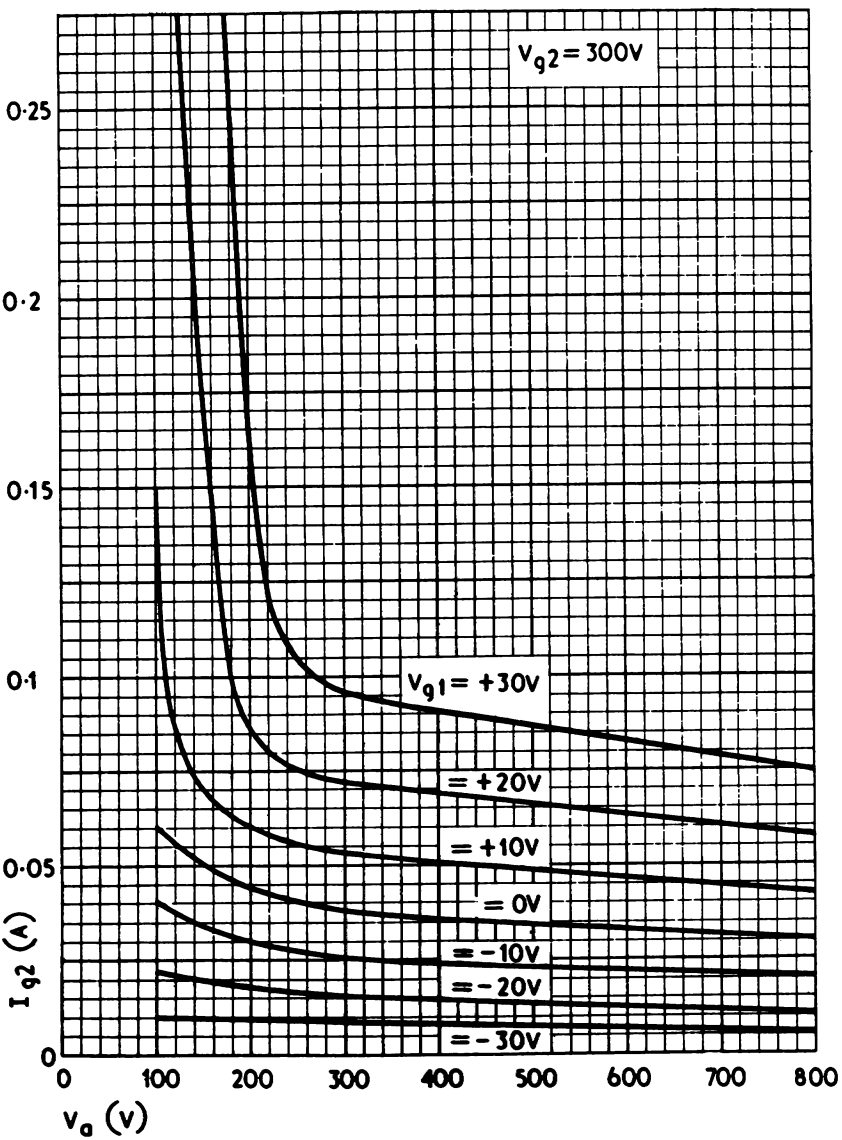




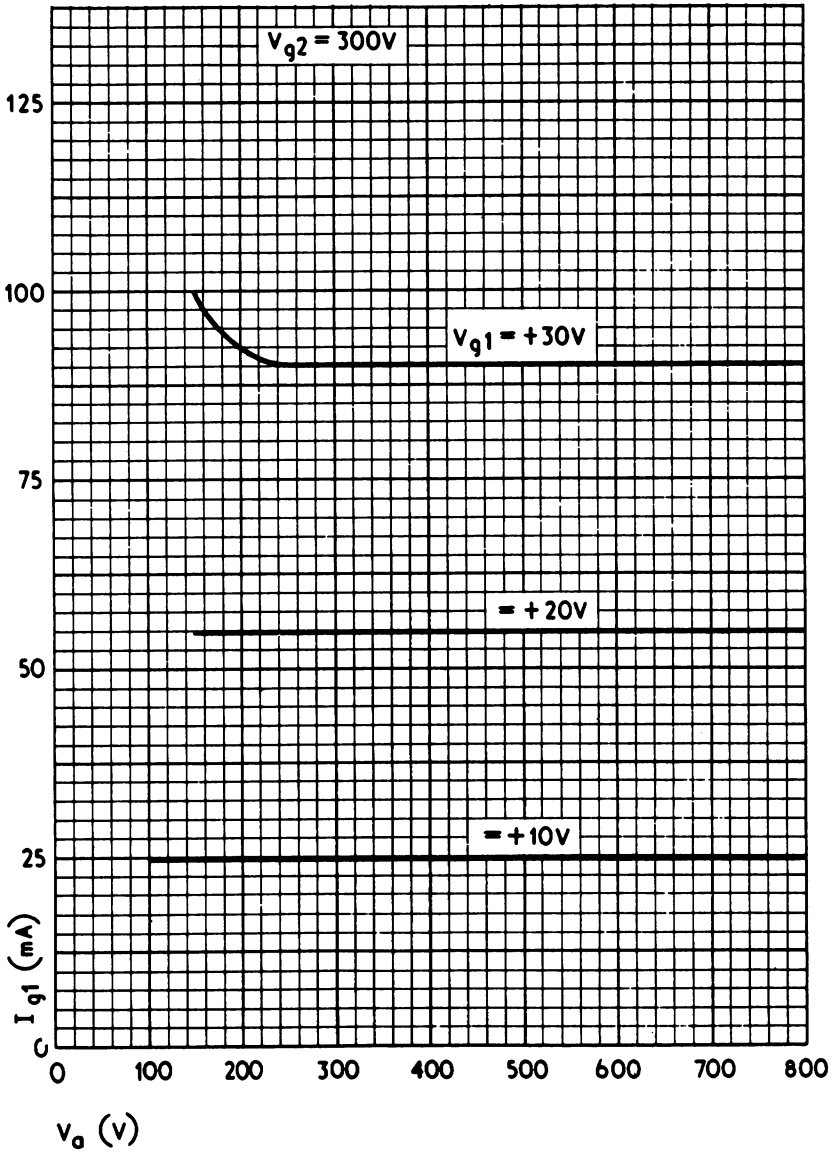
ANODE CURRENT – ANODE VOLTAGE. SCREEN VOLTAGE AT 300V WITH GRID VOLTAGE AS PARAMETER



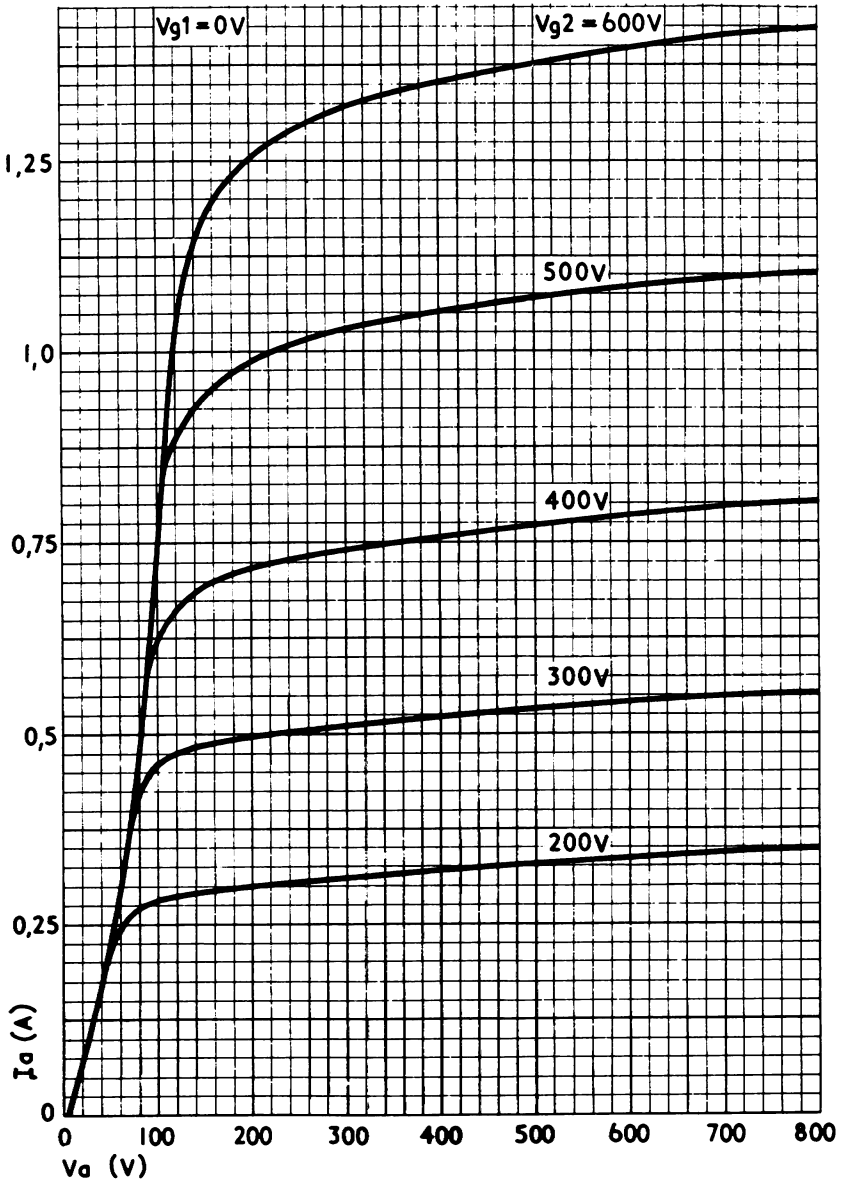
SCREEN CURRENT – ANODE VOLTAGE. SCREEN VOLTAGE OF 300V WITH GRID VOLTAGE AS PARAMETER



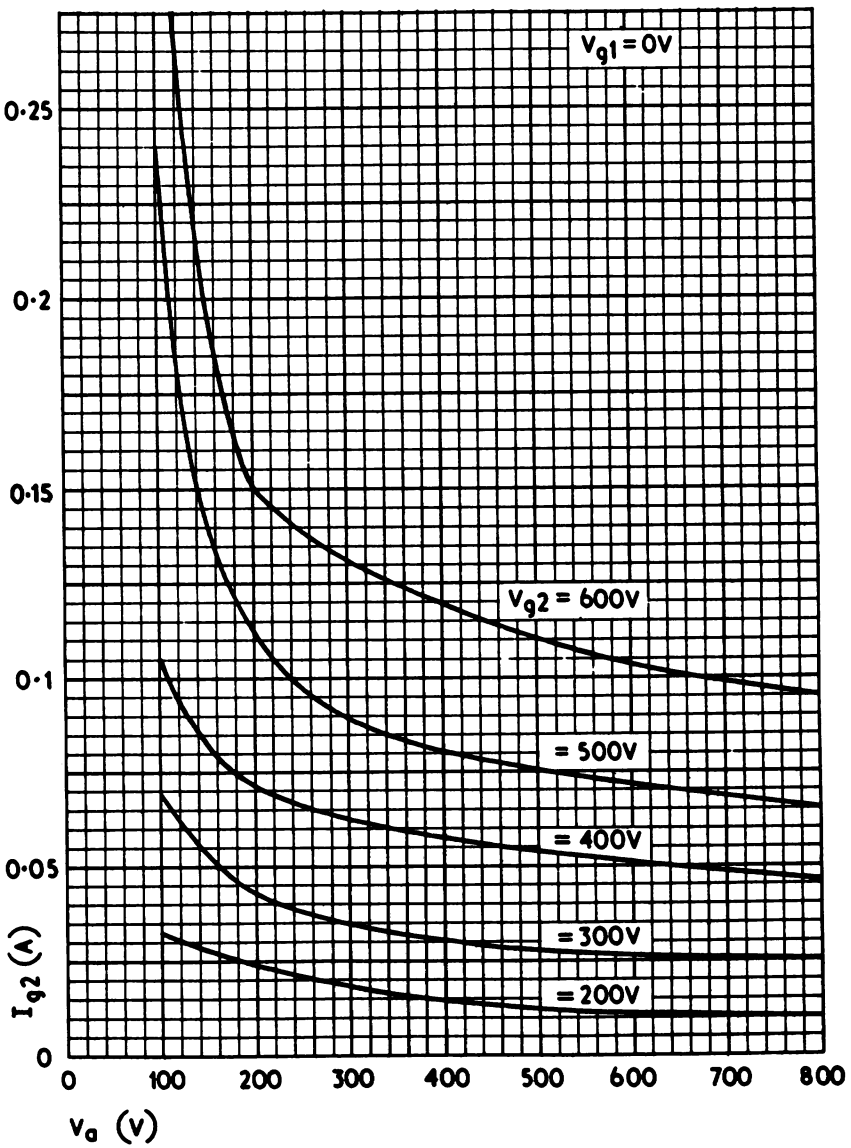
GRID CURRENT – ANODE VOLTAGE. SCREEN VOLTAGE AT 300V WITH POSITIVE GRID VOLTAGE AS PARAMETER



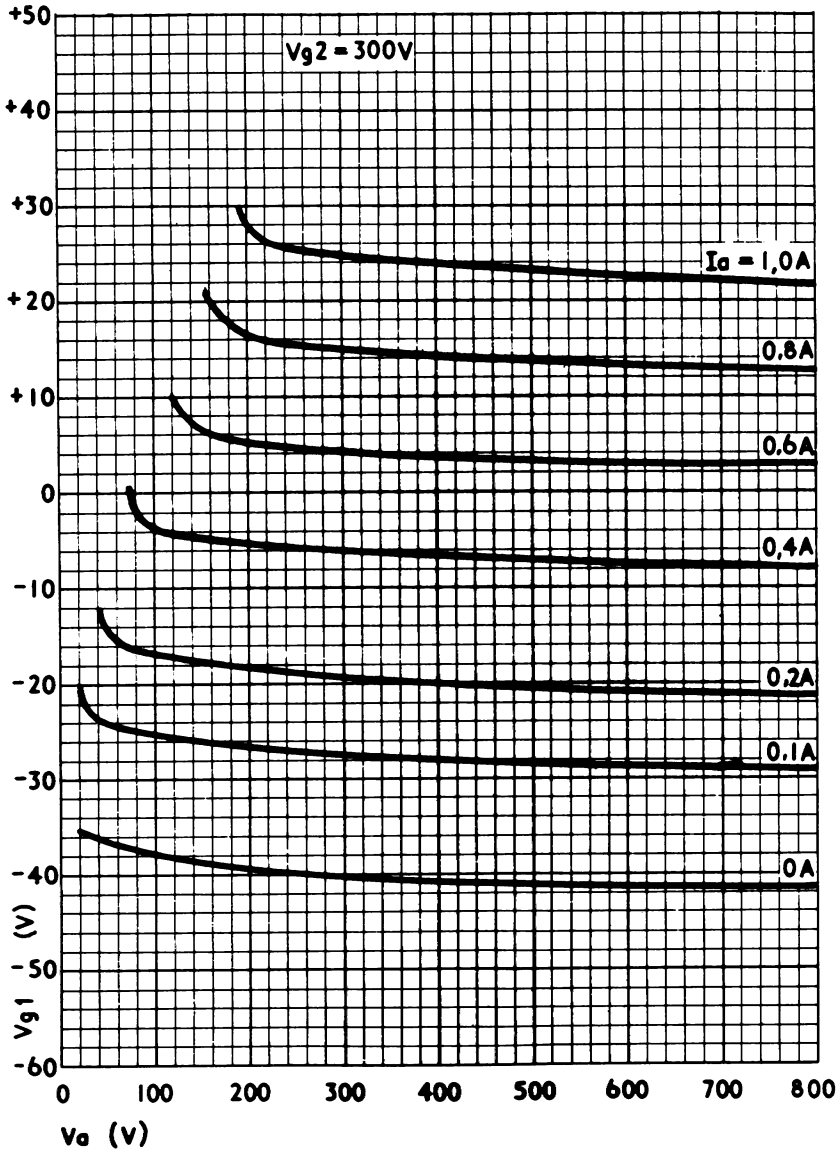
ANODE CURRENT – ANODE VOLTAGE. ZERO GRID VOLTAGE WITH SCREEN VOLTAGE AS PARAMETER



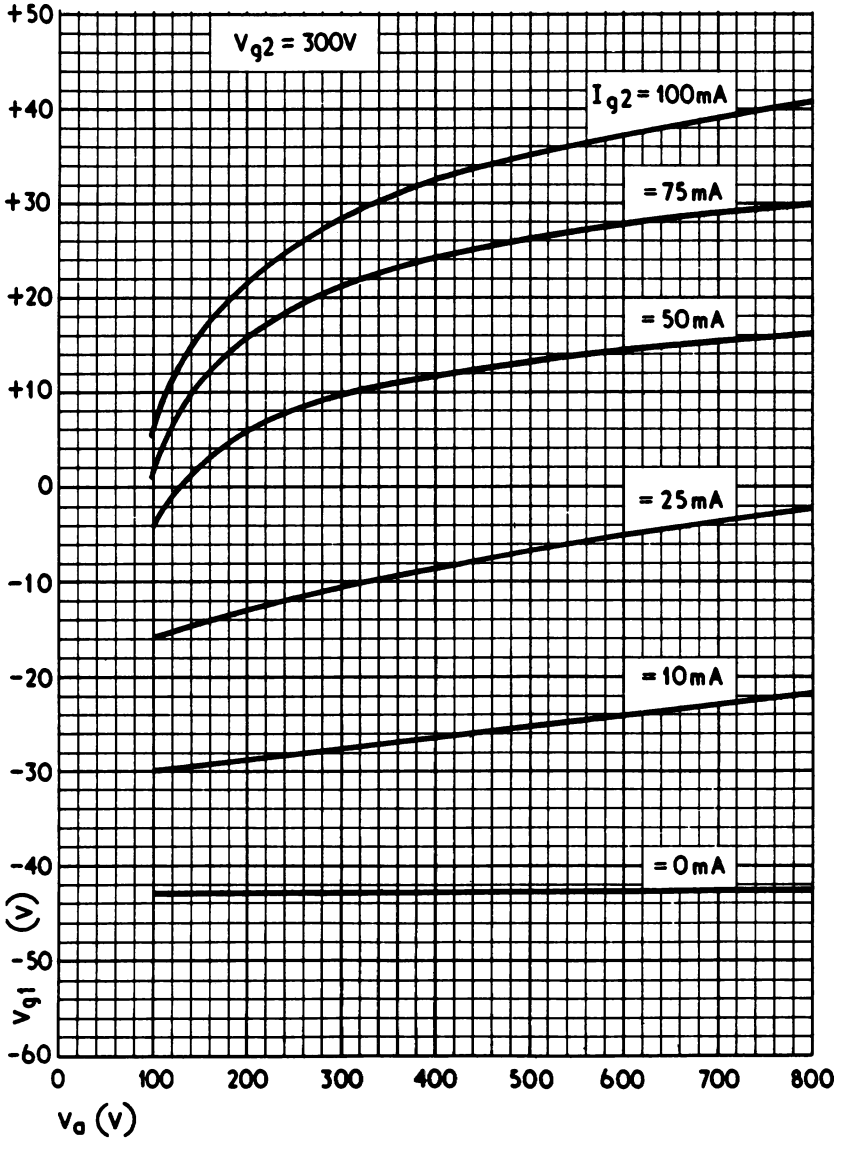
SCREEN CURRENT – ANODE VOLTAGE. ZERO GRID VOLTAGE WITH SCREEN VOLTAGE AS PARAMETER



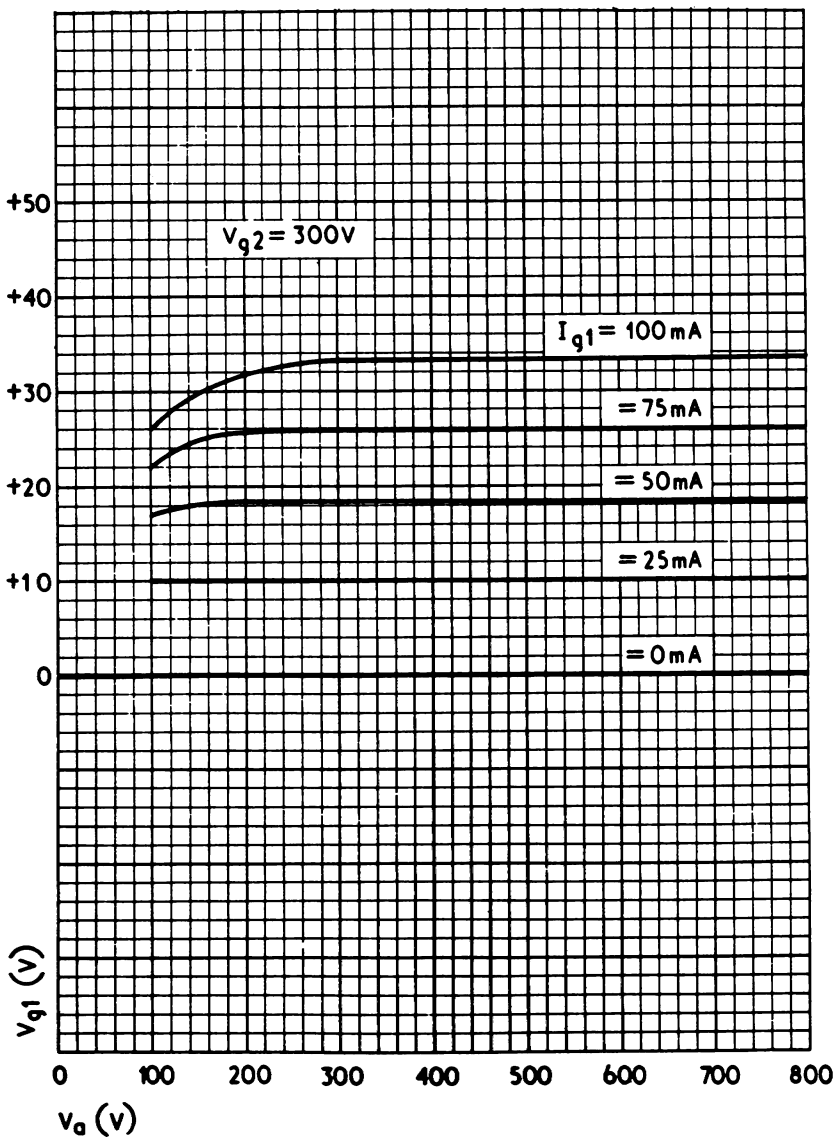
CONSTANT ANODE CURRENT CURVES WITH SCREEN VOLTAGE AT 300V



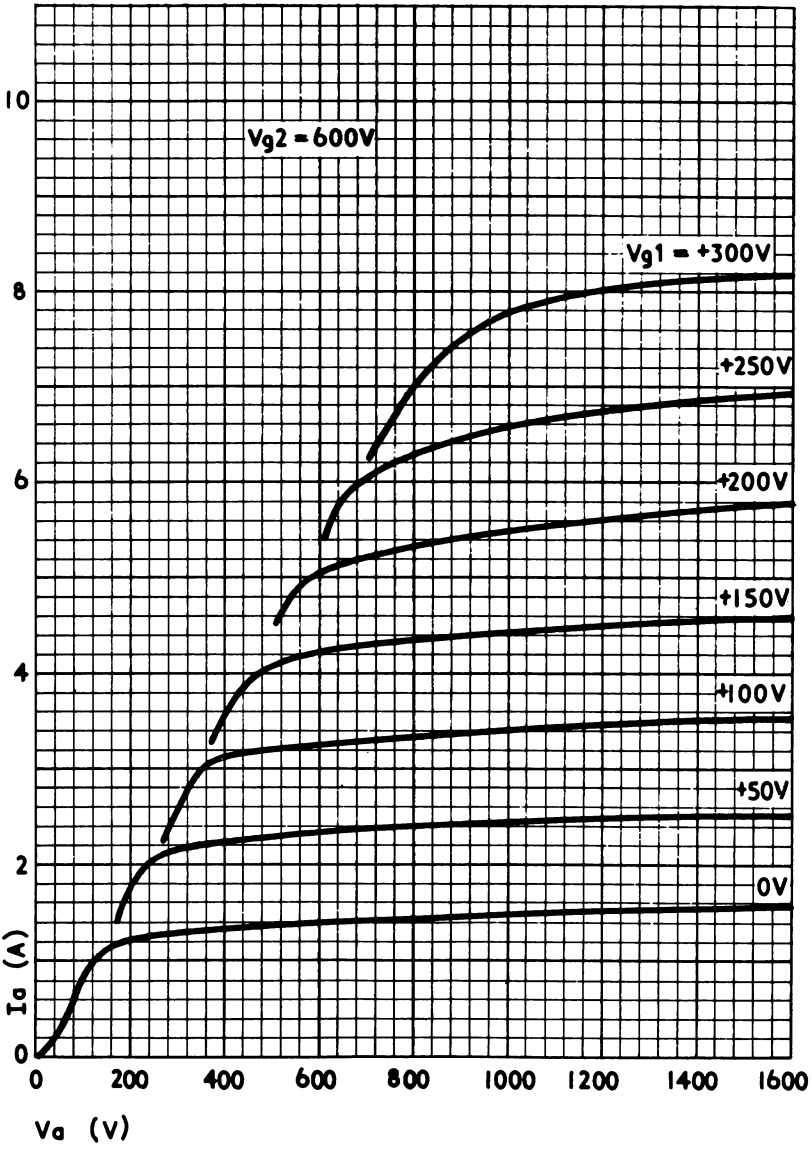
CONSTANT SCREEN CURRENT CURVES WITH SCREEN VOLTAGE AT 300V



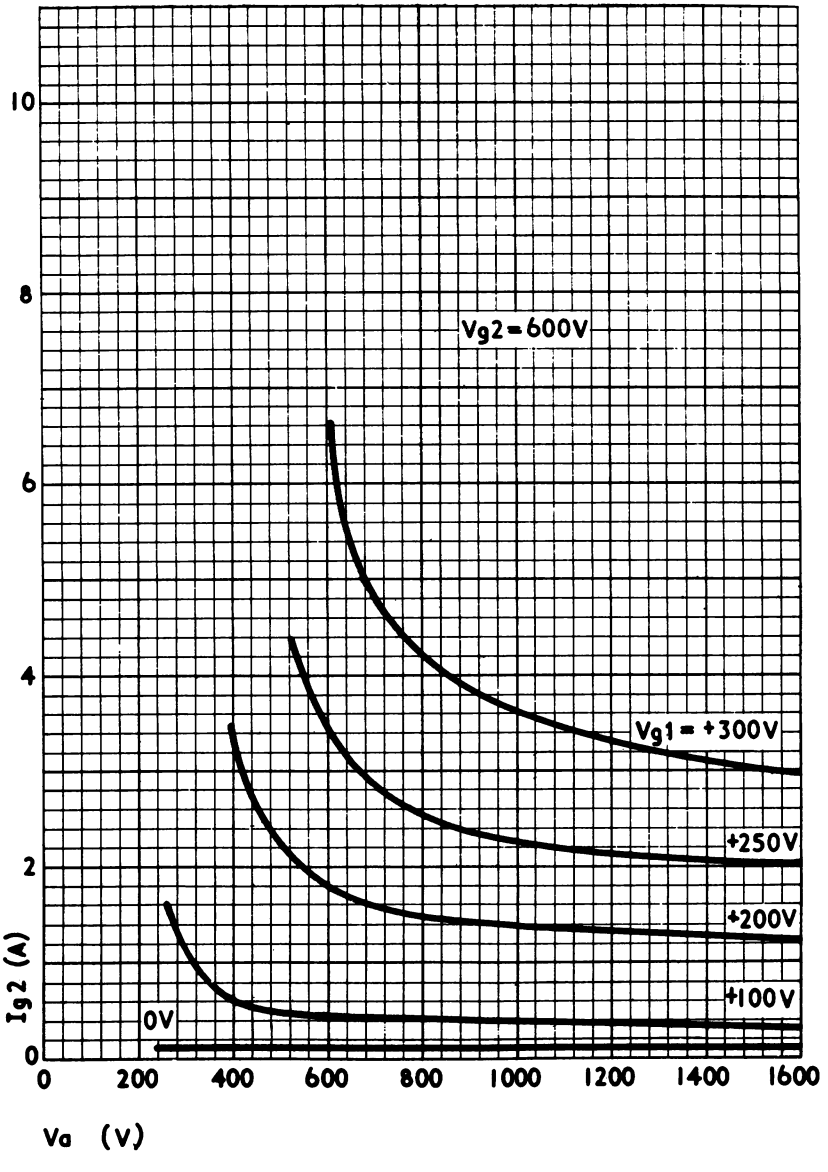
CONSTANT GRID CURRENT CURVES WITH SCREEN VOLTAGE AT 300V



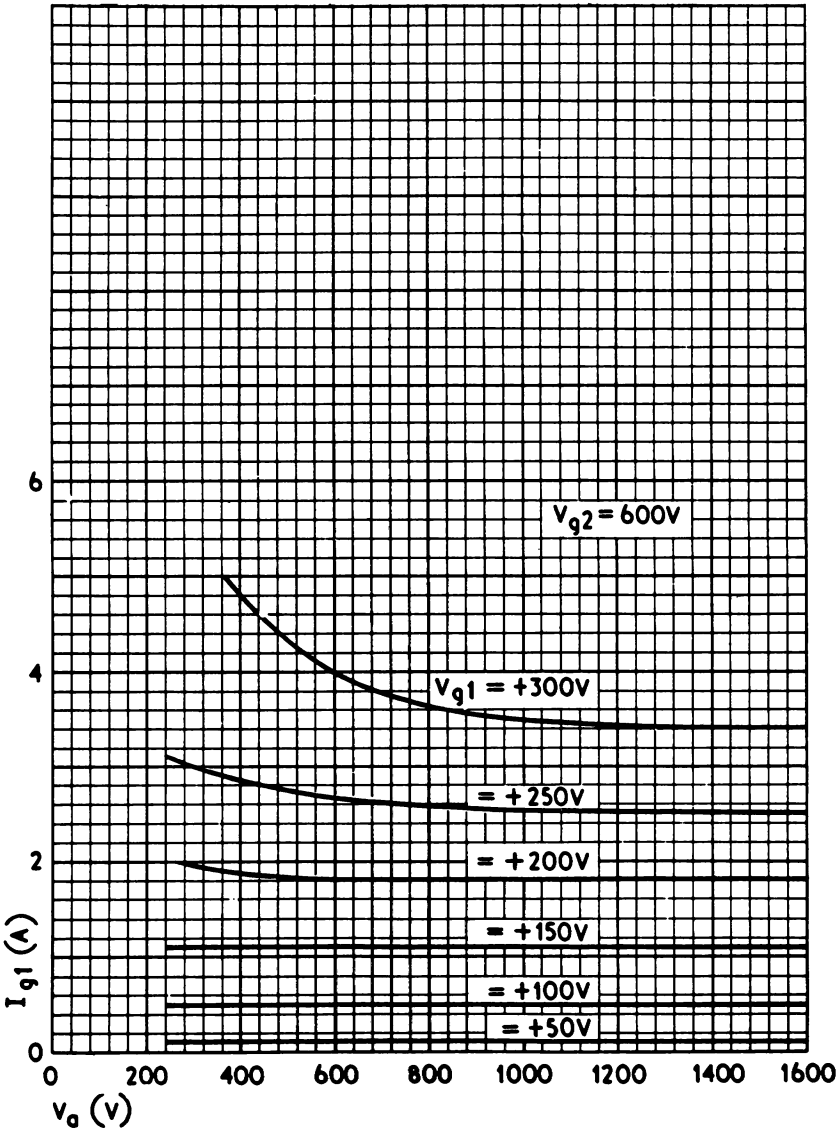
ANODE CURRENT – ANODE VOLTAGE. SCREEN VOLTAGE AT 600V WITH POSITIVE GRID VOLTAGE AS PARAMETER



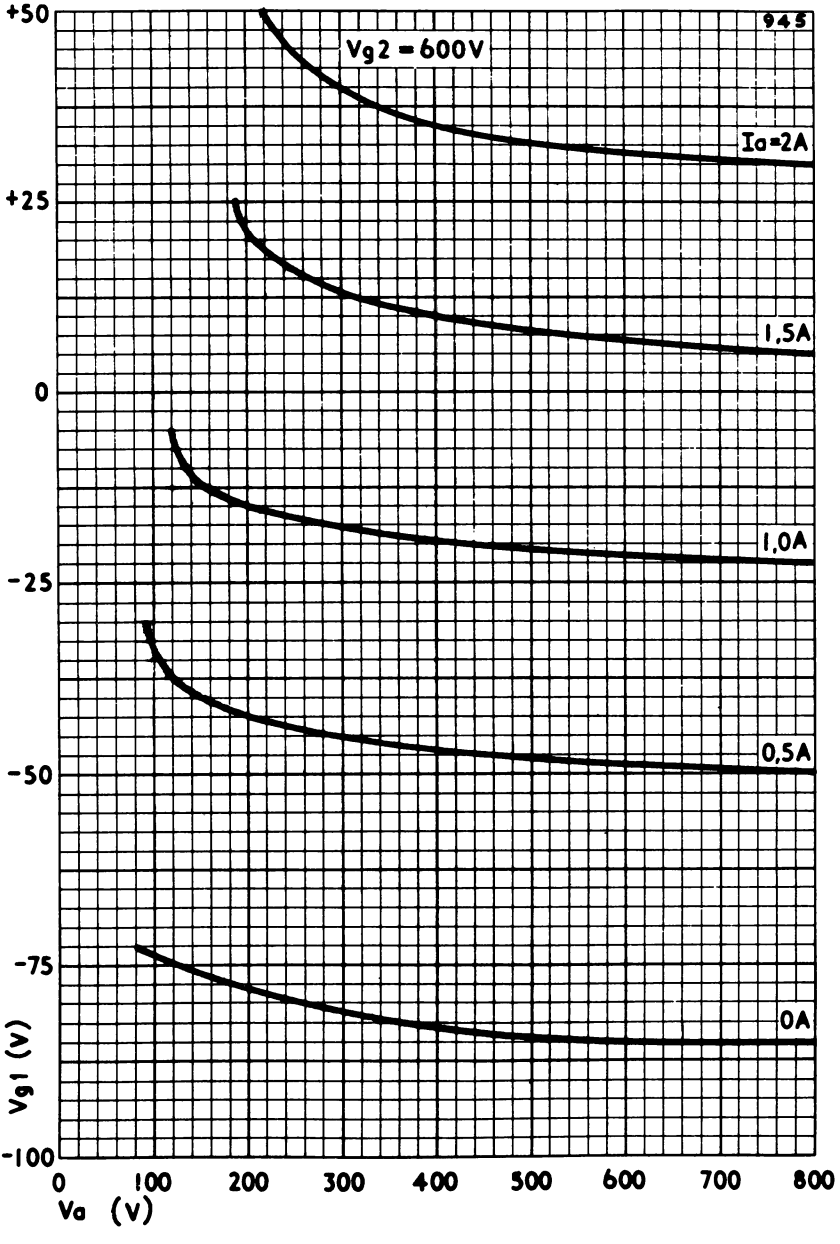
SCREEN CURRENT – ANODE VOLTAGE. SCREEN VOLTAGE AT 600V WITH POSITIVE GRID VOLTAGE AS PARAMETER



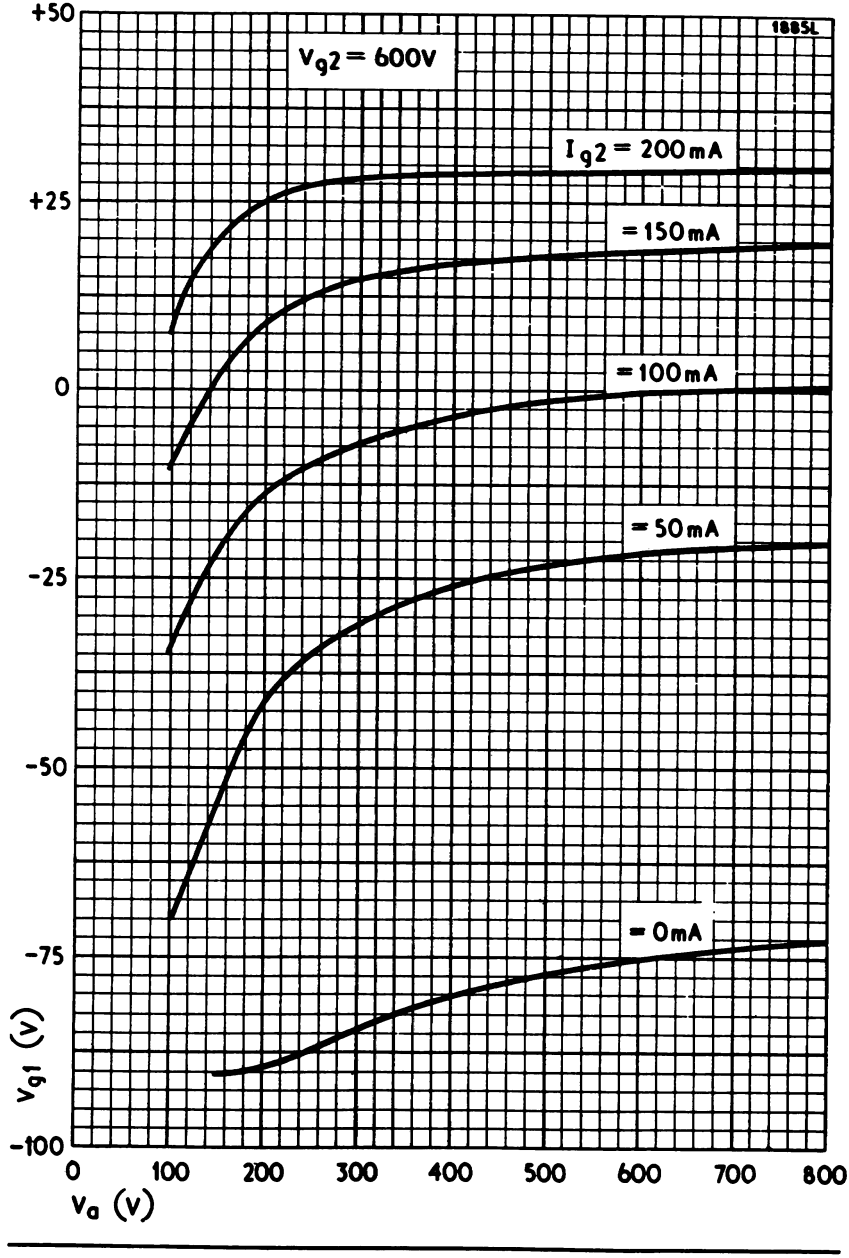
GRID CURRENT – ANODE VOLTAGE. SCREEN VOLTAGE AT 600V WITH POSITIVE GRID VOLTAGE AS PARAMETER



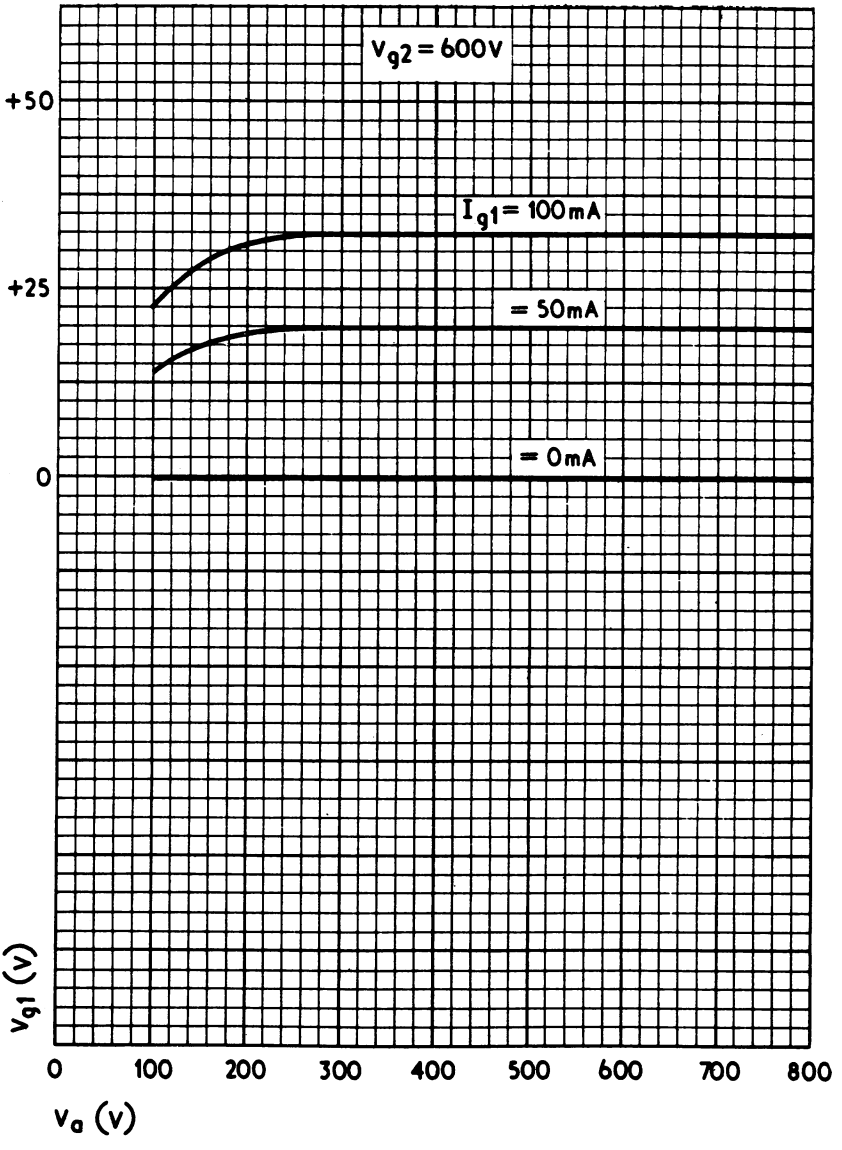
CONSTANT ANODE CURRENT CURVES. SCREEN VOLTAGE AT 600V



CONSTANT SCREEN CURRENT CURVES. SCREEN VOLTAGE AT 600V



CONSTANT GRID CURRENT CURVES. SCREEN VOLTAGE AT 600V



OBJECTIVE FOR DEVELOPMENTAL TYPE

Y-1012*

DIODE

The Y-1012 is a cathode-type diode of ceramic-and-metal planar construction intended for computer service.

GENERAL

Electrical

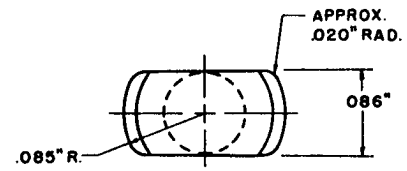
Cathode - Coated Unipotential

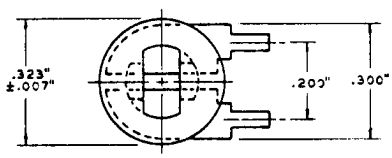
Heater Characteristics and Ratings		
Heater Voltage, AC or DC+	6.3±0.3	Volts
Heater Current‡	0.215	Amperes
Direct Interelectrode Capacitances§		
→ Plate to Cathode: (p to k)	1.3	pf
→ Heater to Cathode	1.5	pf

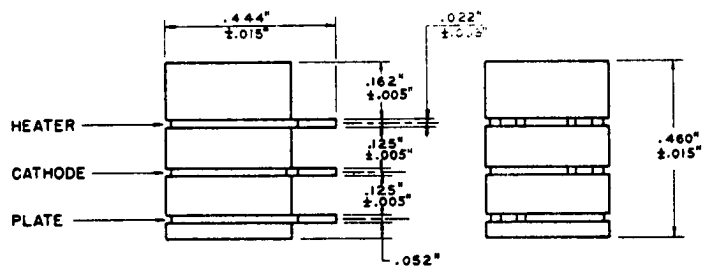
Mechanical

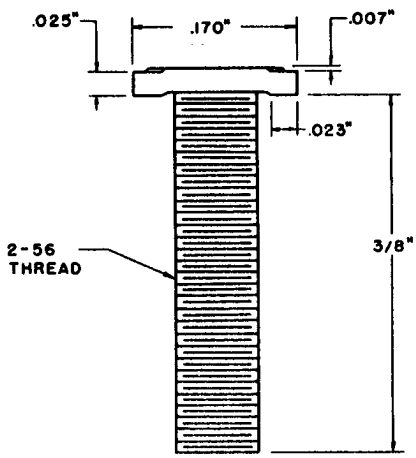
Operating Position - Any

→ Outline Drawing









MAXIMUM RATINGS

Absolute-Maximum Values

Peak Inverse Plate Voltage	350	Volts
Steady-State Peak Plate Current	20	Milliamperes
DC Output Current	5.0	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point#	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 5.0 Milliamperes DC	2.6	Volts

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

\+ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

¶ One method of mounting the Y-1012 is to use a stainless-steel "T" bolt (see drawing) to attach the mounting base of the tube to a chassis or circuit board. The "T" bolt should be inserted in the slot in the base of the tube, turned 90 degrees, and attached to the chassis or circuit board with a 2-56 nut and lock washer. Torque used to tighten the nut should not exceed 3 inch-pounds.

\# Operation below the rated maximum envelope temperature is recommended for applications requiring the longest possible tube life.

2/18/63 (B)
Supersedes 11/29/62 (B)

OBJECTIVE FOR DEVELOPMENTAL TYPE

Y-1032*

PLANAR TRIODE

The Y-1032 is a medium-mu triode of ceramic and metal planar construction primarily intended for radio-frequency amplifier service well into the UHF range. A feature of the tube is its operation at low values of plate voltage.

GENERAL

Electrical

Cathode - Coated Unipotential

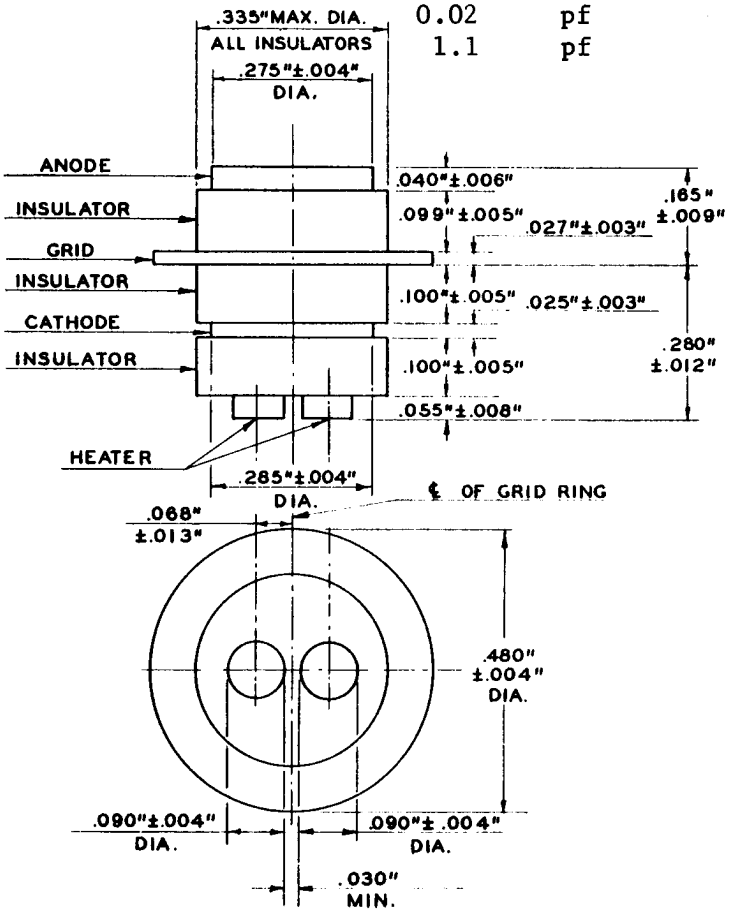
Heater Characteristics and Ratings

Heater Voltage, AC or DC+	6.3±0.3	Volts
Heater Current‡	0.24	Amperes
→ Direct Interelectrode Capacitances		
Grid to Plate	1.4	pf
Input	1.7	pf
Output	0.02	pf
Heater to Cathode	1.1	pf

Mechanical

Operating Position - Any

→ Outline Drawing



MAXIMUM RATINGS

Absolute-Maximum Values

	Plate Voltage	60	Volts
	Positive DC Grid Voltage	0	Volts
	Plate Dissipation	0.6	Watts
	DC Cathode Current	10	Milliamperes
	Heater-Cathode Voltage		
	Heater Positive with Respect to Cathode	50	Volts
	Heater Negative with Respect to Cathode	50	Volts
→	Grid Circuit Resistance	0.01	Megohms
→	Envelope Temperature at Hottest Point	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics

Plate Voltage	50	26.5	Volts
Cathode-Bias Resistor	68	33	Ohms
Amplification Factor	37	36	
Plate Resistance, approximate	3400	3600	Ohms
Transconductance	11000	10000	Micromhos
Plate Current	7.5	4.7	Milliamperes

Typical Operation

Grounded-Grid Amplifier - 450 Megacycles

Plate Voltage	26.5	Volts
Cathode-Bias Resistor	33	Ohms
Plate Current	4.7	Milliamperes
Bandwidth, approximate	7.5	Megacycles
Power Gain, approximate (Measured with power-matched input)	11	Decibels
Noise Figure (Meausred with noise-matched input, using argon lamp noise source), approximate	5.4	Decibels

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

\+ The equipment designer should design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

2/18/63 (B)
Supersedes 11/29/62 (B)

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

Y-1124

Development Type ★

The Y-1124 is a triode of ceramic and metal planar construction primarily intended for use as a grid-pulsed oscillator at frequencies up to 6000 megahertz. The Y-1124 features a bonded-heater construction resulting in usefulness in fast warm-up and extreme environment applications.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	RL Ohms	Rk Ohms
Heater Voltage, AC or DC●	6.0	6.3	6.6	Volts					
Heater Current	---	215	---	Milliamperes	6.3	---	---	---	---
Plate Current	---	12.5	---	Milliamperes	6.3	125	---	---	82
Amplification Factor	---	75	---		6.3	125	---	---	82
Transconductance	---	16000	---	Micromhos	6.3	125	---	---	82
Grid Voltage, Cutoff	---	-3.5	---	Volts	6.3	125	0.1	---	---
Direct Interelectrode Capacitances♦									
Grid to Plate: (g to p)	---	1.05	---	pf					
Input: g to (h+k)	---	2.1	---	pf					
Output: p to (h+k)	---	0.018	---	pf					
Cathode Warm-up Time§	---	---	3	Seconds					

GRID-PULSED OSCILLATOR SERVICE

Frequency	5700	Megahertz
Duty Factor	0.016	
Pulse Duration	1.0	Microseconds
Pulse Repetition Rate	16000	Pulses Per Second
Plate Supply Voltage	400	Volts
Plate Current: Average During Pulse	0.6	Amperes
Grid Current: Average During Pulse	0.3	Amperes
Power Output: Average During Pulse	40	Watts

NOTES

★ Both electrical and mechanical characteristics of development types are subject to change; therefore, it is recommended that designers consult their General Electric field representative before designing equipment around developmental types.

● The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. In some applications, longer tube life may be obtained at reduced heater voltage. For specific recommendations, contact your General Electric sales representative.

♦ Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

§ Time required for plate current to reach 80 percent of its steady-state value.

GENERAL ELECTRIC

Supersedes PI Sheet dated 8-67

ABSOLUTE-MAXIMUM RATINGS

GRID-PULSED OSCILLATOR SERVICE

Plate Supply Voltage	400	Volts
Pulse Duration	2	Microseconds
Duty Factor	0.016	
Plate Current: Average During Pulse⊕	0.6	Amperes
Negative DC Grid Voltage	50	Volts
Grid Current: Average During Pulse	0.3	Amperes
Plate Dissipation	3.5	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point▲	250	°C
Temperature Differential Between Two Adjacent Electrodes□	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	30	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

NOTES

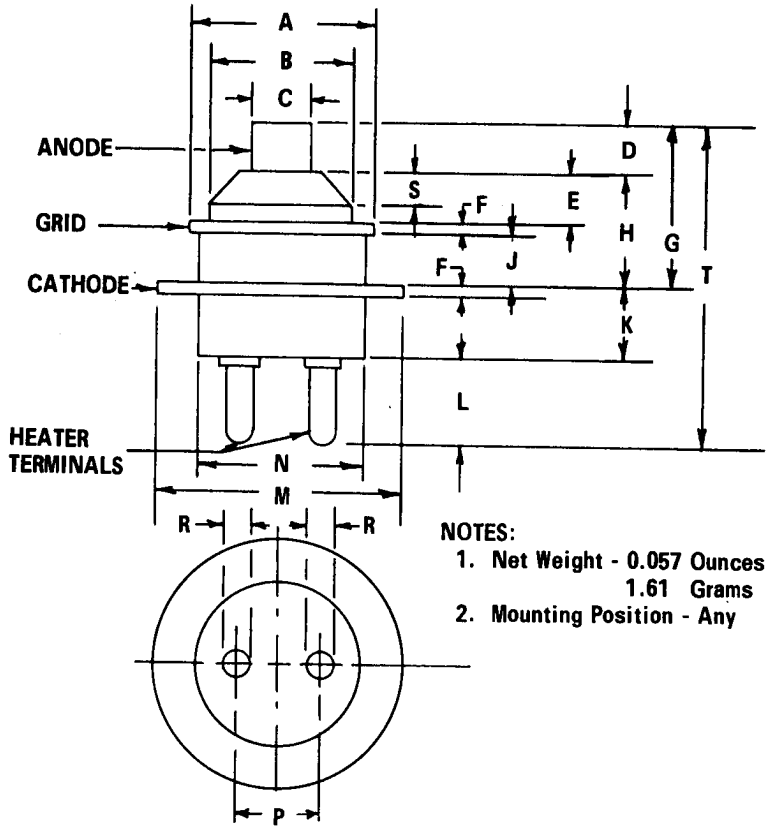
⊕ The regulation and/or series plate supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 10 times the maximum plate current rating.

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

□ This assumes no thermal heat sinking to any insulator.

The devices and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of devices by General Electric Company conveys any license under patent claims covering combinations of these devices with other devices or elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of these devices with other devices or elements by any purchaser or others.

PHYSICAL DIMENSIONS



NOTES:
1. Net Weight - 0.057 Ounces
   1.61 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.357	0.360	0.363	9.068	9.144	9.220
B	---	---	0.285	---	---	7.239
C	0.108	0.110	0.112	2.743	2.794	2.845
D	0.095	0.100	0.105	2.413	2.540	2.667
E	0.095	0.100	0.105	2.413	2.540	2.667
F	0.025	0.028	0.031	0.635	0.711	0.787
G	0.315	0.325	0.335	8.001	8.225	8.509
H	0.216	0.224	0.232	5.486	5.690	5.893
J	0.094	0.098	0.102	2.388	2.489	2.591
K	0.143	0.150	0.157	3.632	3.810	3.988
L	0.165	0.175	0.185	4.191	4.445	4.699
M	0.476	0.480	0.484	12.09	12.19	12.29
N	---	---	0.330	---	---	8.458
P	0.130	0.136	0.142	3.302	3.454	3.607
R	0.048	0.051	0.054	1.219	1.295	1.372
S	---	0.060	---	---	1.524	---
T	0.623	0.650	0.677	15.82	16.51	17.20

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

Y-1171

Development Type ★

The Y-1171 is a metal-ceramic, planar triode intended for use as a CW oscillator at frequencies through X-band.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	Eg V	Rk Ohms
Heater Voltage, AC or DC●	6.0	6.3	6.6	Volts					
Heater Current	---	270	---	Milliamperes	6.3	---	---	---	---
Plate Voltage	---	---	140	Volts	6.3	---	30	0	---
Amplification Factor	---	57	---		6.3	---	30	0	---
Transconductance	20000	---	---	Micromhos	6.3	---	30	0	---
Direct Interelectrode Capacitances♦									
Grid to Plate: (g to p)	---	1.1	---	pf					
Input: g to (h+k)	---	1.95	---	pf					
Cathode Heating Time	60	---	---	Seconds					

CW OSCILLATOR SERVICE

Frequency	10	Gigahertz
DC Plate Voltage	150	Volts
Grid Resistor	2200	Ohms
Plate Current	30	Milliamperes
Grid Current	§	Milliamperes
Power Output	10	Milliwatts

NOTES

★ Both electrical and mechanical characteristics of development types are subject to change; therefore, it is recommended that designers consult their General Electric field representative before designing equipment around developmental types.

● The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

♦ Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

§ To be determined.

GENERAL ELECTRIC

Supersedes PI Sheet dated 5-64

ABSOLUTE-MAXIMUM RATINGS

Plate Voltage	200	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	4.5	Volts
Plate Dissipation	45	Watts
DC Grid Current	5.0	Milliamperes
DC Cathode Current	30	Milliamperes
Peak Cathode Current	80	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance	10000	Ohms
Envelope Temperature at Hottest Point▲	250	°C
Temperature Differential Between Two Adjacent Electrodes□	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	10	G Peak

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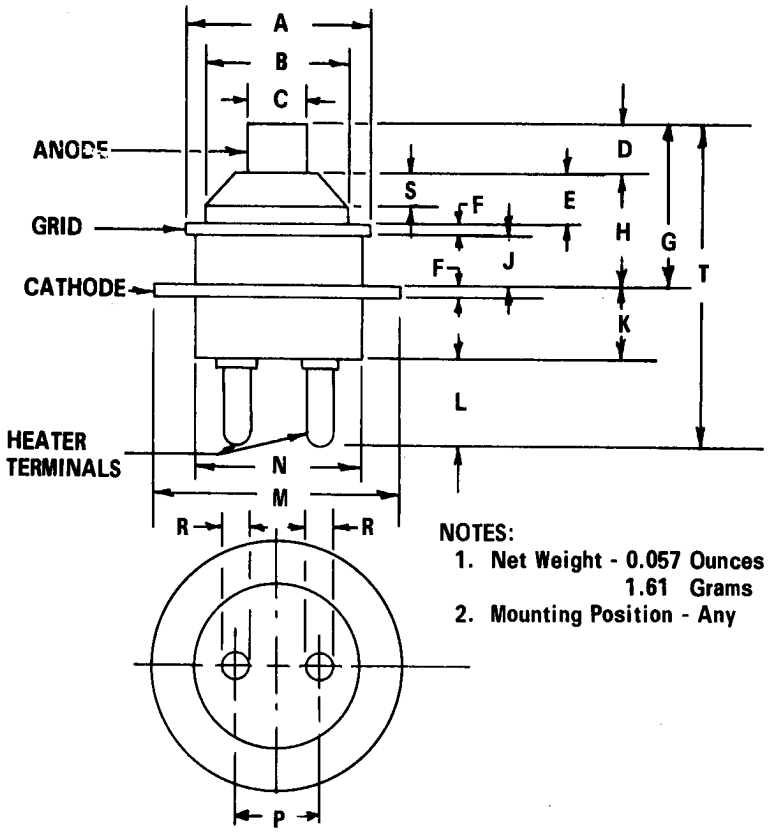
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PHYSICAL DIMENSIONS



NOTES:
1. Net Weight - 0.057 Ounces
   1.61 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.357	0.360	0.363	9.068	9.144	9.220
B	---	---	0.285	---	---	7.239
C	0.108	0.110	0.112	2.743	2.794	2.845
D	0.095	0.100	0.105	2.413	2.540	2.667
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L	0.165	0.175	0.185	4.191	4.445	4.699
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N	---	---	0.330	---	---	8.458
P	0.130	0.136	0.142	3.302	3.454	3.607
R	0.048	0.051	0.054	1.219	1.295	1.372
S	---	0.060	---	---	1.524	---
T	0.623	0.650	0.677	15.82	16.51	17.20

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

Y-1223

Development Type ★

The Y-1223 is a triode of ceramic-and-metal planar construction intended for use as a radio-frequency CW amplifier or oscillator at frequencies up to 2500 megacycles. This triode features very high transconductance desirable for maximum gain-bandwidth in broadbanded power amplifiers.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	RL Ohms	Rk Ohms
Heater Voltage, AC or DC ●	6.0	6.3	6.6	Volts					
Heater Current	---	450	---	Milliamperes	6.3	---	---	---	---
Plate Current	---	100	---	Milliamperes	6.3	300	---	---	10
Amplification Factor	---	125	---		6.3	300	---	---	10
Transconductance	---	84000	---	Micromhos	6.3	300	---	---	10
Grid Voltage, Cutoff	---	-5.5	---	Volts	6.3	300	0.1	100000	---
Direct Interelectrode Capacitances ♦									
Grid to Plate: (g to p)	---	2.5	---	pf					
Input: g to (h+k)	---	7.0	---	pf					
Output: p to (h+k)	---	0.03	---	pf					
Cathode Heating Time	60	---	---	Seconds					

UHF OSCILLATOR SERVICE

Frequency	450	Megahertz
DC Plate Voltage	500	Volts
Grid Resistor	Adjusted	
Plate Current	70	Milliamperes
Grid Current	15	Milliamperes
Power Output	18	Watts

NOTES

★ Both electrical and mechanical characteristics of development types are subject to change; therefore, it is recommended that designers consult their General Electric field representative before designing equipment around developmental types.

● The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

♦ Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

GENERAL ELECTRIC

Supersedes PI Sheet dated 3-66

ABSOLUTE-MAXIMUM RATINGS

Plate Voltage	600	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	30	Watts
DC Grid Current	20	Milliamperes
DC Cathode Current	100	Milliamperes
Peak Cathode Current	500	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance	10000	Ohms
Envelope Temperature at Hottest Point▲	250	°C
Temperature Differential Between Two Adjacent Electrodes§	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	10	G Peak

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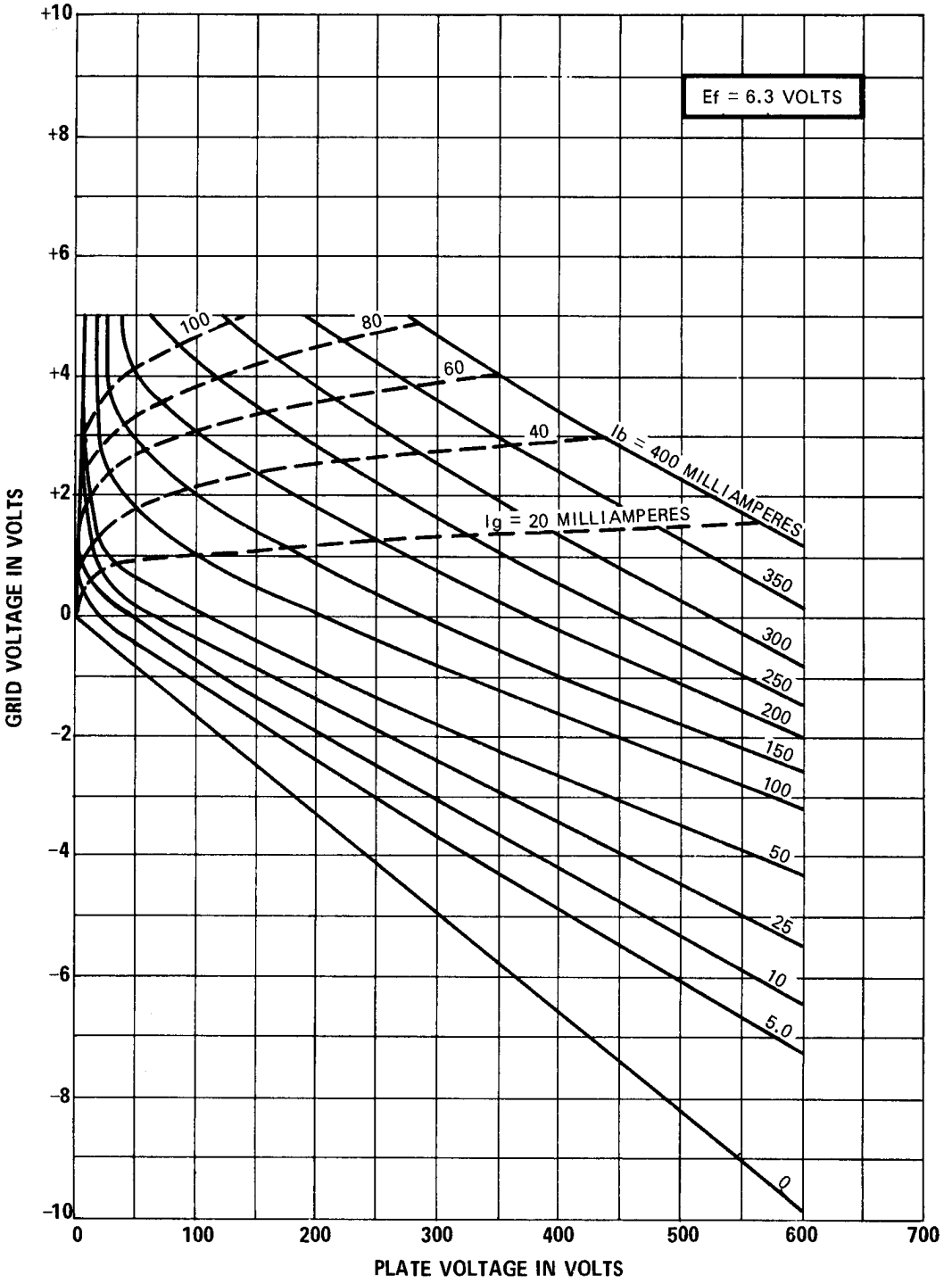
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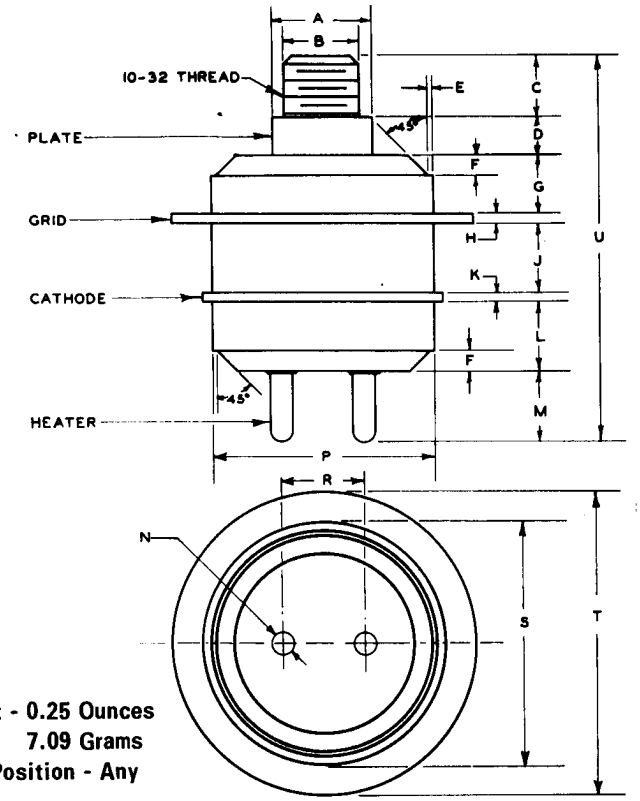
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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



NOTES:

1. Net Weight - 0.25 Ounces
   7.09 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.247	0.250	0.253	6.274	6.350	6.426
B	---	---	0.190	---	---	4.826
C	0.125	0.145	0.165	3.175	3.683	4.191
D	0.090	0.100	0.110	2.286	2.540	2.794
E	---	0.005	---	---	0.125	---
F	0.040	0.050	0.060	1.016	1.270	1.524
G	0.145	0.150	0.155	3.683	3.810	3.937
H	0.025	0.028	0.031	0.635	0.711	0.787
J	0.166	0.171	0.176	4.216	4.318	4.470
K	0.025	0.028	0.031	0.635	0.711	0.787
L	0.170	0.175	0.180	4.318	4.445	4.572
M	0.170	0.175	0.180	4.318	4.445	4.572
N	0.047	0.050	0.053	1.194	1.270	1.346
P	0.535	0.550	0.565	13.59	13.97	14.35
R	0.186	0.200	0.214	4.724	5.080	5.436
S	0.598	0.603	0.608	15.19	15.32	15.44
T	0.748	0.753	0.758	19.00	19.13	19.25
U	0.916	0.972	1.028	23.27	24.69	26.11

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

OBJECTIVE FOR DEVELOPMENTAL TYPE

Y-1236*

PLANAR TRIODE

The Y-1236 is a triode of ceramic and metal planar construction intended for use as a plate-pulsed oscillator at frequencies up to 4300 megacycles. In addition, it may be used as a CW oscillator at frequencies up to 2500 megacycles. Features of the Y-1236 are small size and high plate dissipation capability.

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC+	6.3±0.3	Volts
Heater Current‡	0.5	Amperes
Direct Interelectrode Capacitances§		
Grid to Plate: (g to p)	1.5	pf
Input: g to (h+k)	5.0	pf
Output: p to (h+k)	0.05	pf

Mechanical

Operating Position - Any

Maximum Ratings

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

MAXIMUM RATINGS (Continued)

Absolute-Maximum Values

Plate-Pulsed Oscillator or Amplifier Service

Cathode Heating Time, minimum	60	Seconds
Peak Positive-Pulse Plate Supply Voltage	3000	Volts
Duty Factor of Plate Pulse¶	0.01	
Pulse Duration	2.0	Microseconds
Plate Current		
Average	20	Milliamperes
Average During Plate Pulse#	2.0	Amperes
Negative Grid Voltage		
Average During Plate Pulse	100	Volts
Grid Current		
Average	10	Milliamperes
Average During Plate Pulse	1.0	Amperes
Plate Dissipation△	30	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point	300	C

CW Oscillator Service

Plate Voltage	600	Volts
Plate Current	90	Milliamperes
Grid Current	30	Milliamperes
Cathode Current	120	Milliamperes
Plate Dissipations△	30	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point	300	C

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics

Plate Voltage	200	Volts
Cathode-Bias Resistor	100	Ohms
Amplification Factor	55	
Plate Resistance, approximate	2040	Ohms
Transconductance	27000	Micromhos
Plate Current	25	Milliamperes

Plate-Pulsed Oscillator Service

Frequency	1200	Megacycles
Heater Voltage	6.3	Volts
Duty Factor	0.01	
Pulse Duration	1.0	Microseconds
Pulse Repetition Plate	10000	Pulses per Second
Peak Positive-Pulse Plate Supply Voltage	2000	Volts
Plate Current		
Average	20	Milliamperes
Average During Plate Pulse	2.0	Amperes
Grid Current		
Average	Ø	Milliamperes
Average During Plate Pulse	Ø	Amperes
Useful Power Output		
Average	20	Watts
Average During Plate Pulse	2.0	Kilowatts

CW Oscillator Service

Frequency	2300	Megacycles
Plate Voltage	600	Volts
Grid Voltage	Ø	
Plate Current	80	Milliamperes
Grid Current	25	Milliamperes
Power Output, approximate	20	Watts

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

\+ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Measured using a grounded adapter that provides shielding between external terminals of tube.

¶ Applications with a duty factor greater than 0.01 should be referred to your General Electric tube sales representative for recommendation.

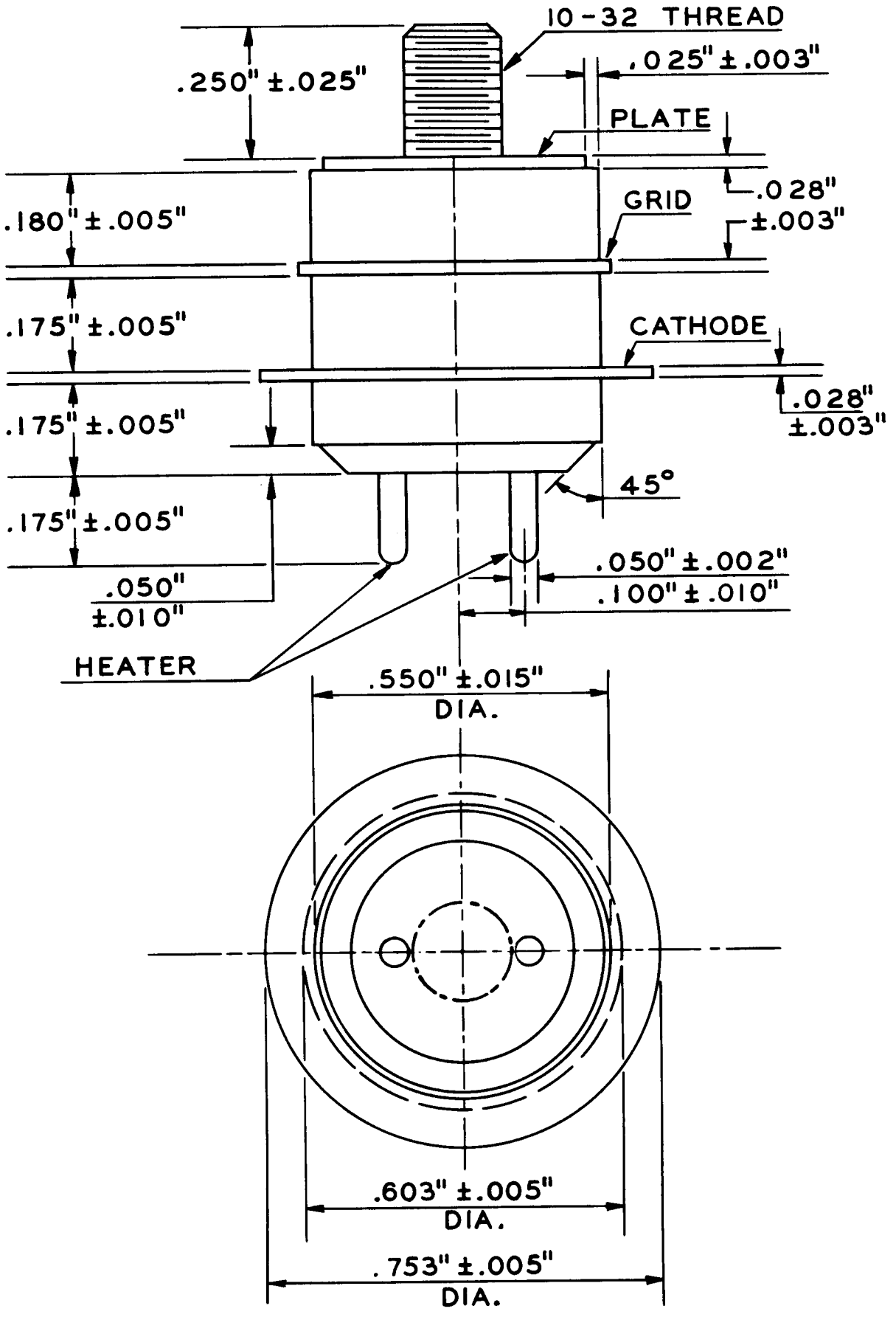
\# The regulation and/or series plate-supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 25 amperes.

Δ With adequate heat sink attached to threaded plate stud.

Ø To be determined.

11/25/64 (B)
Supersedes 4/26/63

Y-1236


10-32 THREAD
.250" ±.025"
.025" ±.003"
PLATE
.028" ±.003"
GRID
.180" ±.005"
.175" ±.005"
CATHODE
.028" ±.003"
.175" ±.005"
45°
.175" ±.005"
.050" ±.002"
.100" ±.010"
.050" ±.010"
HEATER
.550" ±.015" DIA.
.603" ±.005" DIA.
.753" ±.005" DIA.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

Y-1251

Development Type ★

The Y-1251 is a high-mu triode of ceramic-and-metal planar construction intended for use as an oscillator or radio-frequency power amplifier up to 6000 megahertz.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	Eg V	Rk Ohms
Heater Voltage, AC or DC ●	6.0	6.3	6.6	Volts					
Heater Current	---	240	---	Milliamperes	6.3	---	---	---	---
Plate Current	---	13.4	---	Milliamperes	6.3	150	---	---	82
Amplification Factor	---	65	---		6.3	150	---	---	82
Transconductance	---	13000	---	Micromhos	6.3	100	---	0	---
Grid Voltage, Cutoff	---	-4	---	Volts	6.3	150	0.1	---	---
Direct Interelectrode Capacitances ♦									
Grid to Plate: (g to p)	---	1.1	---	pf					
Input: g to (h+k)	---	1.7	---	pf					
Output: p to (h+k)	---	0.012	---	pf					
Cathode Heating Time	60	---	---	Seconds					

CW OSCILLATOR SERVICE

Frequency	5900	Megahertz
DC Plate Voltage	150	Volts
Grid Resistor	Adjusted	
Plate Current	15	Milliamperes
Grid Current	§	Milliamperes
Power Output	20	Milliwatts

NOTES

★ Both electrical and mechanical characteristics of development types are subject to change; therefore, it is recommended that designers consult their General Electric field representative before designing equipment around developmental types.

● The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

♦ Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

§ To be determined.

GENERAL ELECTRIC

Supersedes PI Sheet dated 10-68

ABSOLUTE-MAXIMUM RATINGS

Plate Voltage	200	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	2.5	Watts
DC Grid Current	5.0	Milliamperes
DC Cathode Current	20	Milliamperes
Peak Cathode Current	80	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance	10000	Ohms
Envelope Temperature at Hottest Point▲	250	°C
Temperature Differential Between Two Adjacent Electrodes□	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	10	G Peak

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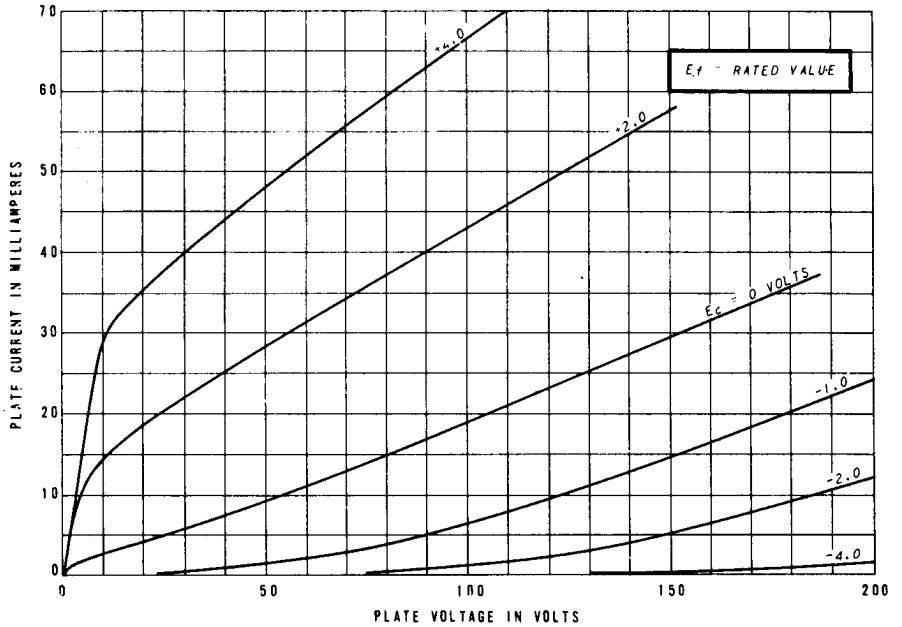
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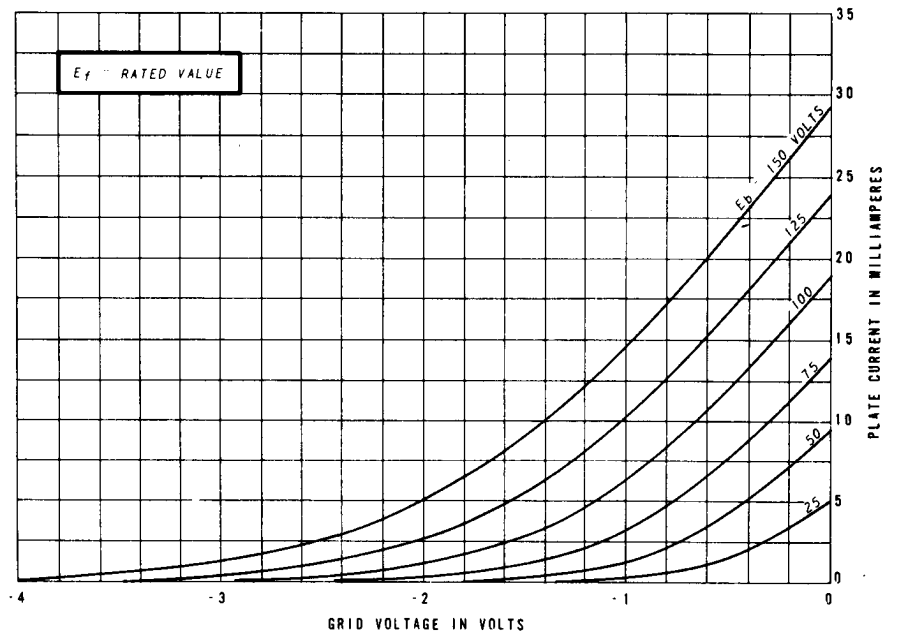
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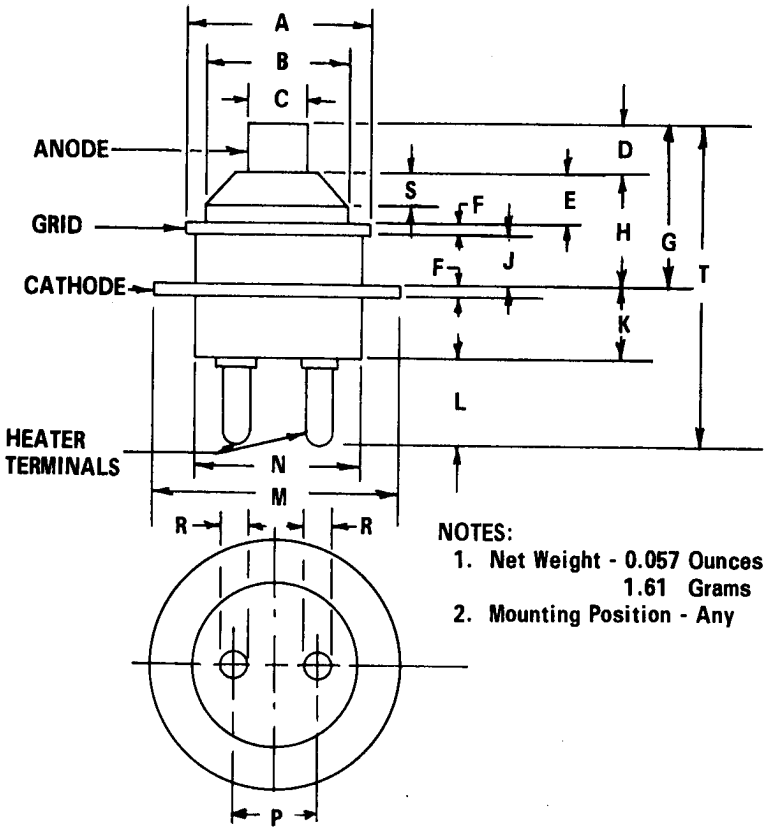
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



PHYSICAL DIMENSIONS



NOTES:
1. Net Weight - 0.057 Ounces
   1.61 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.357	0.360	0.363	9.068	9.144	9.220
B	---	---	0.285	---	---	7.239
C	0.108	0.110	0.112	2.743	2.794	2.845
D	0.095	0.100	0.105	2.413	2.540	2.667
E	0.095	0.100	0.105	2.413	2.540	2.667
F	0.025	0.028	0.031	0.635	0.711	0.787
G	0.315	0.325	0.335	8.001	8.225	8.509
H	0.216	0.224	0.232	5.486	5.690	5.893
J	0.094	0.098	0.102	2.388	2.489	2.591
K	0.143	0.150	0.157	3.632	3.810	3.988
L	0.165	0.175	0.185	4.191	4.445	4.699
M	0.476	0.480	0.484	12.09	12.19	12.29
N	---	---	0.330	---	---	8.458
P	0.130	0.136	0.142	3.302	3.454	3.607
R	0.048	0.051	0.054	1.219	1.295	1.372
S	---	0.060	---	---	1.524	---
T	0.623	0.650	0.677	15.82	16.51	17.20

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

OBJECTIVE FOR DEVELOPMENTAL TYPE

Y-1266*

METAL-CERAMIC TRIODE

For UHF Oscillator Applications

The Y-1266 is a medium-mu triode of ceramic-and-metal planar construction primarily intended for use as a UHF oscillator.

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC‡	6.3±0.3	Volts
Heater Current§	0.24	Amperes
Direct Interelectrode Capacitances¶		
→ Grid to Plate: (g to p)	1.4	pf
Input: g to (h + k)	1.4	pf
Output: p to (h + k)	0.018	pf

Mechanical

Operating Position - Any

MAXIMUM RATINGS

Absolute-Maximum Values

Plate Voltage	350	Volts
Plate Dissipation	4.0	Watts
DC Grid Current	15	Milliamperes
DC Cathode Current	40	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance	Ø	
Envelope Temperature at Hottest Point	250	C

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics		
Plate Voltage	150	Volts
Grid Voltage	0	Volts
Amplification Factor	35	
Transconductance	8000	Micromhos
Plate Current	25	Milliamperes
UHF Oscillator Service		
Plate Voltage	200	Volts
Grid Resistor	Ø	
Plate Current	30	Milliamperes
Grid Current	Ø	
Frequency	400	Megacycles
Power Output, approximate	3	Watts

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

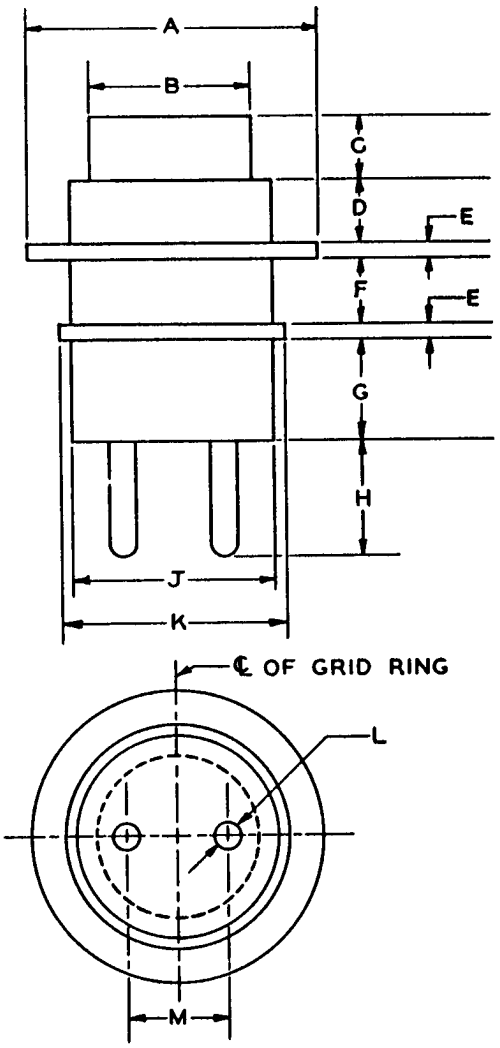
‡ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

§ Heater current of a bogey tube at Ef = 6.3 volts.

¶ Without external shield.

Ø To be determined.

11/25/64 (B)
Supersedes 4/20/64 (B)



Ref.	Inches		
	Minimum	Nominal	Maximum
A	0.477		0.438
B	0.246		0.254
C	0.092		0.108
D	0.095		0.103
E	0.025		0.031
F	0.094		0.102
G	0.120		0.128
H	0.165		0.185
J	---		0.330
K	0.357		0.363
L	0.048		0.052
M	0.130		0.142

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

Y-1530

Development Type ⋆

The Y-1530 is a planar triode of metal-ceramic construction primarily intended for use as a broadband radio-frequency amplifier. A feature of this tube is fast warm-up.

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	Eg V	Rk Ohms
Heater Voltage, AC or DC●	6.0	6.3	6.6	Volts					
Heater Current	---	500	---	Milliamperes	6.3				
Plate Current	---	22	---	Milliamperes	6.3	200	---	---	22
Amplification Factor	---	225	---		6.3	200	---	6	270
Transconductance	---	50000	---	Micromhos	6.3	200	---	6	270
Grid Voltage, Cutoff	---	-3	---	Volts	6.3	200	0.1	---	---
Direct Interelectrode Capacitances♦									
Grid to Plate: (g to p)	---	1.7	---	pf					
Input: g to (h+k)	---	6.0	---	pf					
Output: p to (h+k)	---	0.018	---	pf					
Cathode Warm-up Time§	---	---	4	Seconds					

NOTES

⋆ Both electrical and mechanical characteristics of development types are subject to change; therefore, it is recommended that designers consult their General Electric field representative before designing equipment around developmental types.

● The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

♦ Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

§ Time required for plate current to reach 80 percent of its steady-state value.

ABSOLUTE-MAXIMUM RATINGS

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	5.5	Watts
DC Grid Current	10	Milliamperes
DC Cathode Current	30	Milliamperes
Peak Cathode Current	120	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance	10000	Ohms
Envelope Temperature at Hottest Point▲	250	°C
Temperature Differential Between Two Adjacent Electrodes□	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	30	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

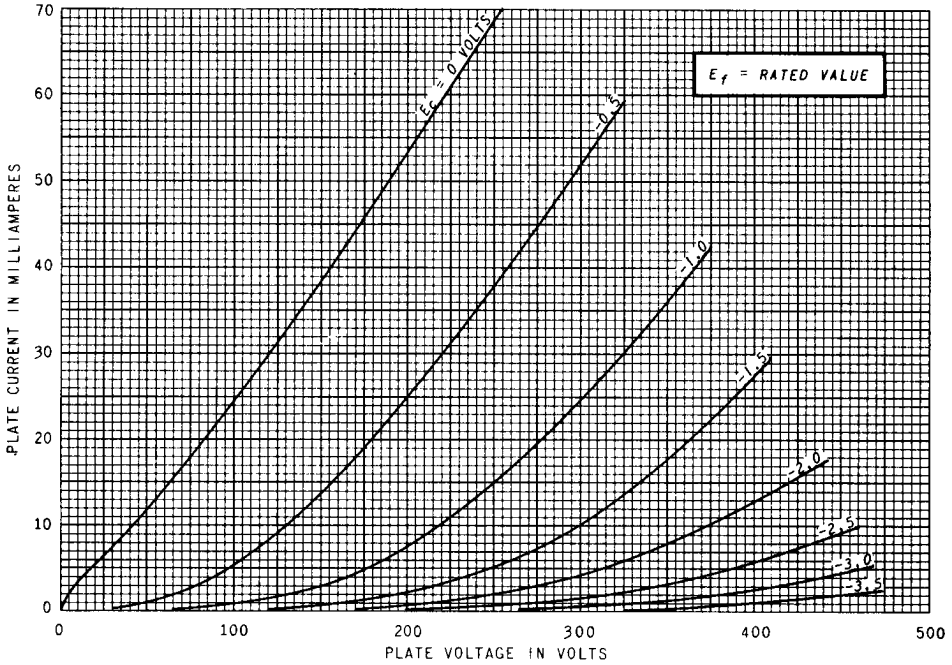
NOTES

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

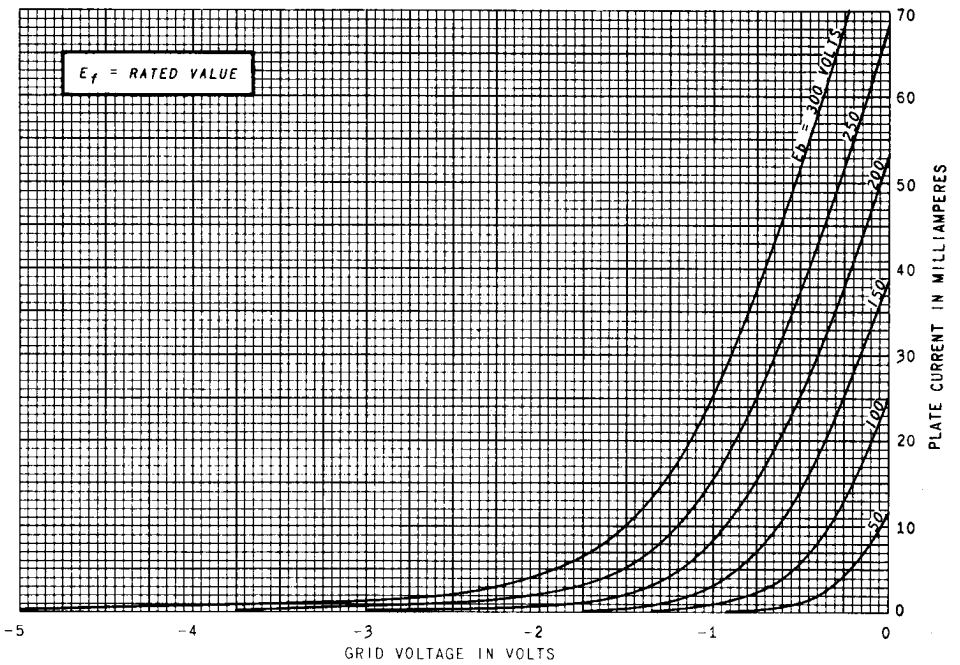
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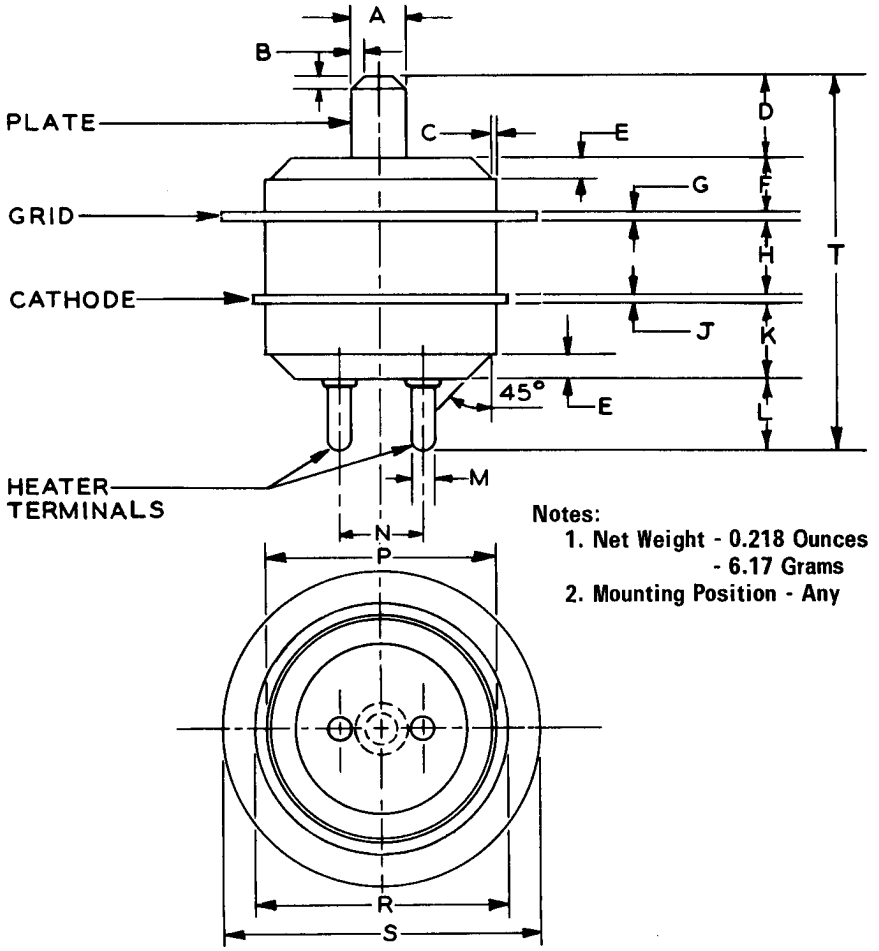
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



PHYSICAL DIMENSIONS



Notes:
1. Net Weight - 0.218 Ounces
   - 6.17 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.122	0.125	0.128	3.099	3.175	3.251
B	---	0.030	---	---	0.762	---
C	---	0.005	---	---	0.127	---
D	0.170	0.175	0.180	4.318	4.445	4.572
E	0.040	0.050	0.060	1.016	1.270	1.524
F	0.170	0.175	0.180	4.318	4.445	4.572
G	0.025	0.028	0.031	0.635	0.711	0.787
H	0.167	0.172	0.177	4.242	4.369	4.496
J	0.025	0.028	0.031	0.635	0.711	0.787
K	0.170	0.175	0.180	4.318	4.445	4.572
L	0.170	0.175	0.180	4.318	4.445	4.572
M	0.047	0.050	0.053	1.194	1.270	1.346
N	0.185	0.200	0.215	4.699	5.080	5.461
P	0.535	0.550	0.565	13.59	13.97	14.35
R	0.598	0.603	0.608	15.19	15.32	15.44
S	0.748	0.753	0.758	19.00	19.13	19.25
T	0.897	0.928	0.959	22.78	23.57	24.36

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

Y-1541

Development Type ★

The Y-1541 is a high-mu triode of ceramic and metal construction intended for use as a grid-pulsed oscillator or amplifier at frequencies up to 6000 megahertz. The rugged bonded-heater construction provides fast cathode warm-up.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	RL Ohms	Rk Ohms
Heater Voltage, AC or DC●	6.0	6.3	6.6	Volts					
Heater Current	---	610	---	Milliamperes	6.3	---	---	---	---
Plate Current	---	23	---	Milliamperes	6.3	200	---	---	100
Amplification Factor	---	58	---		6.3	200	---	---	100
Transconductance	---	22000	---	Micromhos	6.3	200	---	---	100
Direct Interelectrode Capacitances♦									
Grid to Plate: (g to p)	---	1.5	---	pf					
Input: g to (h+k)	---	4.8	---	pf					
Output: p to (h+k)	---	0.05	---	pf					
Cathode Warm-up Time§	---	---	4	Seconds					

GRID-PULSED OSCILLATOR SERVICE

Frequency	4300	Megahertz
Duty Factor	0.001	
Pulse Duration	1	Microsecond
Pulse Repetition Rate	1000	Pulses Per Second
Plate Supply Voltage	1150	Volts
DC Grid Voltage	-40	Volts
Plate Current: Average During Pulse	1.5	Amperes
Grid Current: Average During Pulse	0.5	Amperes
Power Output: Average During Pulse	400	Watts

NOTES

★ Both electrical and mechanical characteristics of development types are subject to change; therefore it is recommended that designers consult their General Electric field representative before designing equipment around developmental types.

● The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. In some applications, longer tube life may be obtained at reduced heater voltage. For specific recommendations, contact your General Electric sales representative.

♦ Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

§ Time required for plate current to reach 80 percent of its steady-state value.

GENERAL ELECTRIC

Supersedes PI Sheet dated 10-68

ABSOLUTE-MAXIMUM RATINGS

GRID-PULSED OSCILLATOR OR AMPLIFIER SERVICE

Plate Supply Voltage	1200	Volts
Pulse Duration	2	Microseconds
Duty Factor	0.001	
Plate Current: Average During Pulse†	1.5	Amperes
Negative DC Grid Voltage	100	Volts
Grid Current: Average During Pulse	0.5	Amperes
Plate Dissipation	6.5	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point▲	250	°C
Temperature Differential Between Two Adjacent Electrodes□	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	30	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

NOTES

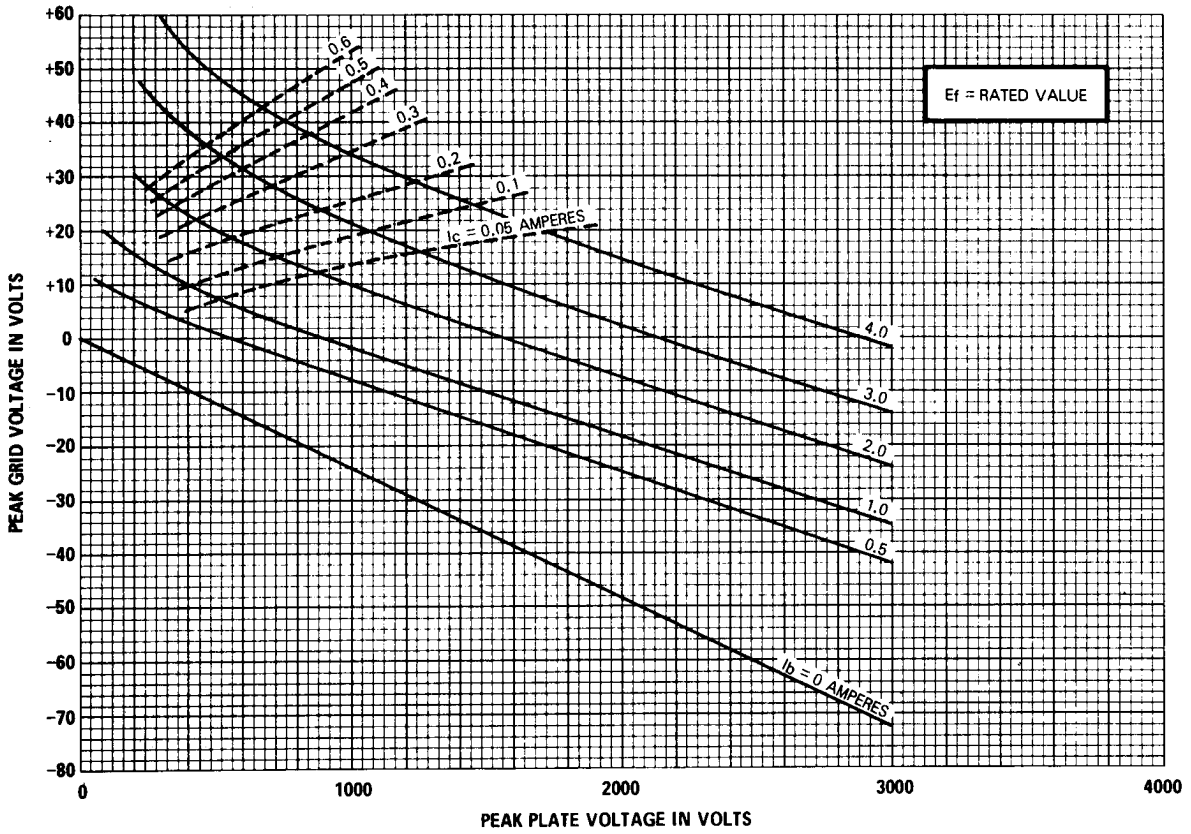
† The regulation and/or series plate supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 10 times the maximum plate current rating.

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

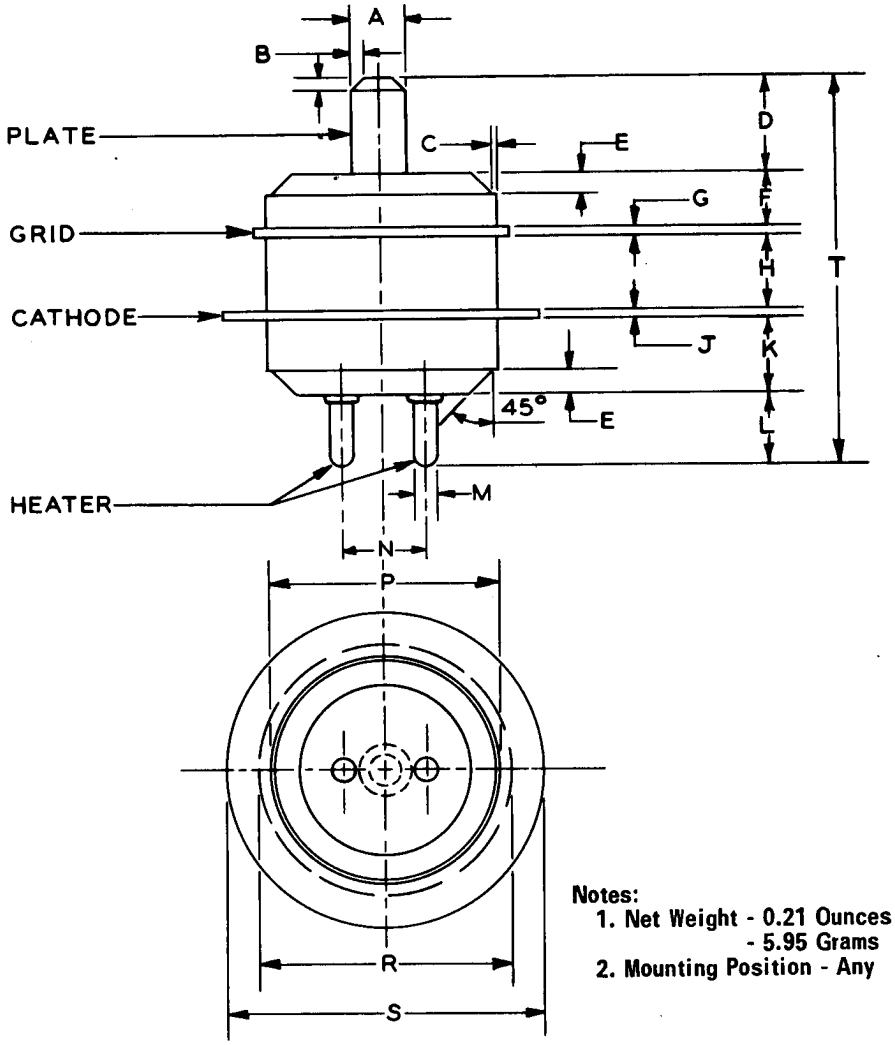
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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



Notes:
1. Net Weight - 0.21 Ounces
   - 5.95 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.122	0.125	0.128	3.099	3.175	3.251
B	---	0.030	---	---	0.762	---
C	---	0.005	---	---	0.127	---
D	0.220	0.225	0.230	5.588	5.715	5.842
E	0.040	0.050	0.060	1.016	1.270	1.524
F	0.120	0.125	0.130	3.048	3.175	3.302
G	0.025	0.028	0.031	0.635	0.711	0.787
H	0.167	0.172	0.177	4.242	4.369	4.496
J	0.025	0.028	0.031	0.635	0.711	0.787
K	0.170	0.175	0.180	4.318	4.445	4.572
L	0.170	0.175	0.180	4.318	4.445	4.572
M	0.047	0.050	0.053	1.194	1.270	1.346
N	0.185	0.200	0.215	4.699	5.080	5.461
P	0.535	0.550	0.565	13.59	13.97	14.35
R	0.598	0.603	0.608	15.19	15.32	15.44
S	0.748	0.753	0.758	19.00	19.13	19.25
T	0.897	0.928	0.959	22.78	23.57	24.36

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

Y-1636

Development Type ★

The Y-1636 is a metal-ceramic planar triode intended for use as a plate-pulsed and grid pulsed oscillator or amplifier. This tube features a large cathode area to size ratio for added capabilities and/or lower current density resulting in longer life.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	RL Ohms	Rk Ohms
Heater Voltage, AC or DC●	6.0	6.3	6.6	Volts					
Heater Current	---	1.3	---	Amperes	6.3	---	---	---	---
Plate Current	---	75	---	Milliamperes	6.3	400	---	---	33
Amplification Factor	---	100	---		6.3	400	---	---	33
Transconductance	---	45000	---	Micromhos	6.3	400	---	---	33
Grid Voltage, Cutoff	---	-22	---	Volts	6.3	1500	1.0	100000	---
Direct Interelectrode Capacitances♦									
Grid to Plate: (g to p)	---	3.25	---	pf					
Input: g to (h+k)	---	8.7	---	pf					
Output: p to (h+k)	---	0.04	---	pf					
Cathode Warm-up Time§	---	---	5	Seconds					

GRID-PULSED OSCILLATOR SERVICE

Frequency	2000	Megahertz
Duty Factor	0.01	
Pulse Duration	1.0	Microseconds
Pulse Repetition Rate	10000	Pulses Per Second
Plate Supply Voltage	1600	Volts
Plate Current: Average During Pulse	3	Amperes
Grid Current: Average During Pulse	1.2	Amperes
Power Output: Average During Pulse	1500	Watts

NOTES

★ Both electrical and mechanical characteristics of development types are subject to change; therefore, it is recommended that designers consult their General Electric field representative before designing equipment around developmental types.

● The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance. In some applications, longer tube life may be obtained at reduced heater voltage. For specific recommendations, contact your General Electric sales representative.

♦ Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

§ Time required for plate current to reach 80 percent of its steady-state value.

GENERAL ELECTRIC

Supersedes PI Sheet dated 11-68

ABSOLUTE-MAXIMUM RATINGS

GRID-PULSED OSCILLATOR OR AMPLIFIER SERVICE

Plate Supply Voltage	2000	Volts
Pulse Duration	1	Microsecond
Duty Factor	0.01	
Plate Current: Average During Pulse †	4	Amperes
Negative DC Grid Voltage	100	Volts
Grid Current: Average During Pulse	1.5	Amperes
Plate Dissipation	50	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Envelope Temperature at Hottest Point ▲	250	°C
Temperature Differential Between Two Adjacent Electrodes □	100	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	30	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

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NOTES

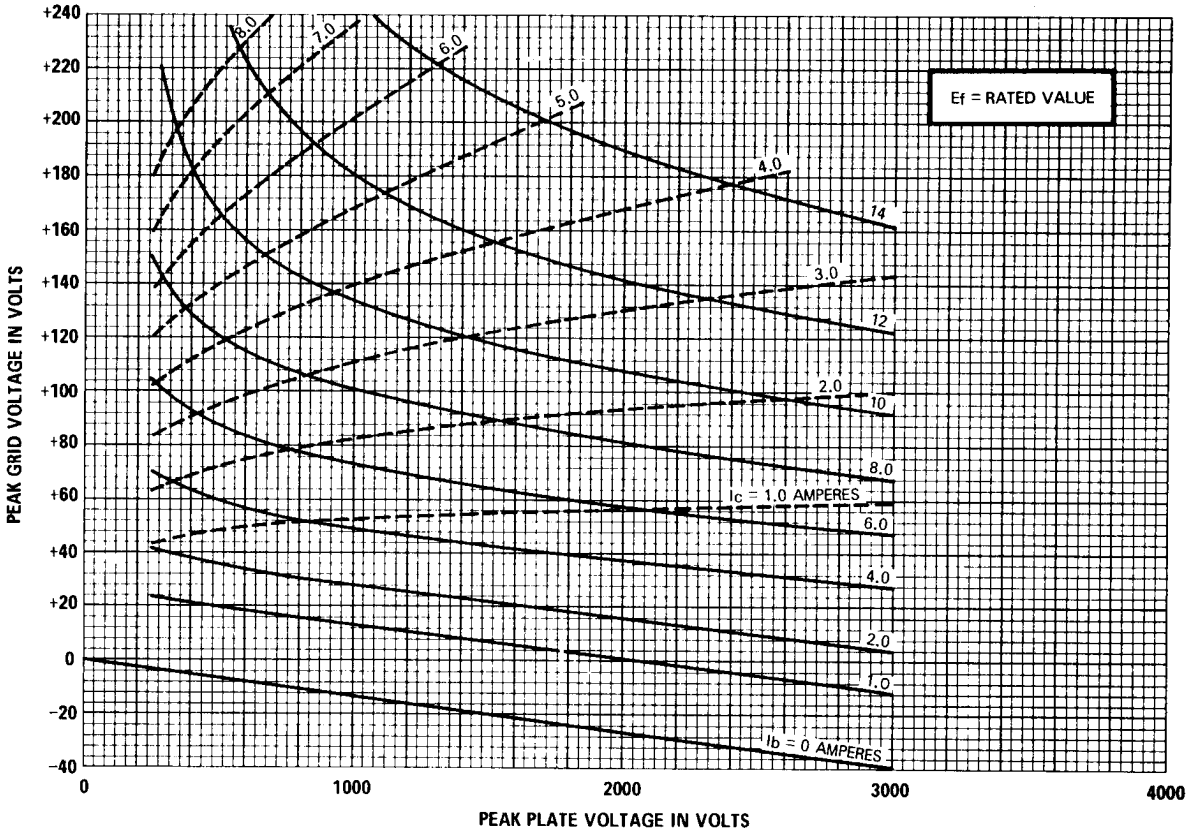
† The regulation and/or series plate supply impedance must be such as to limit the peak current, with the tube considered a short circuit, to a maximum of 10 times the maximum plate current rating.

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

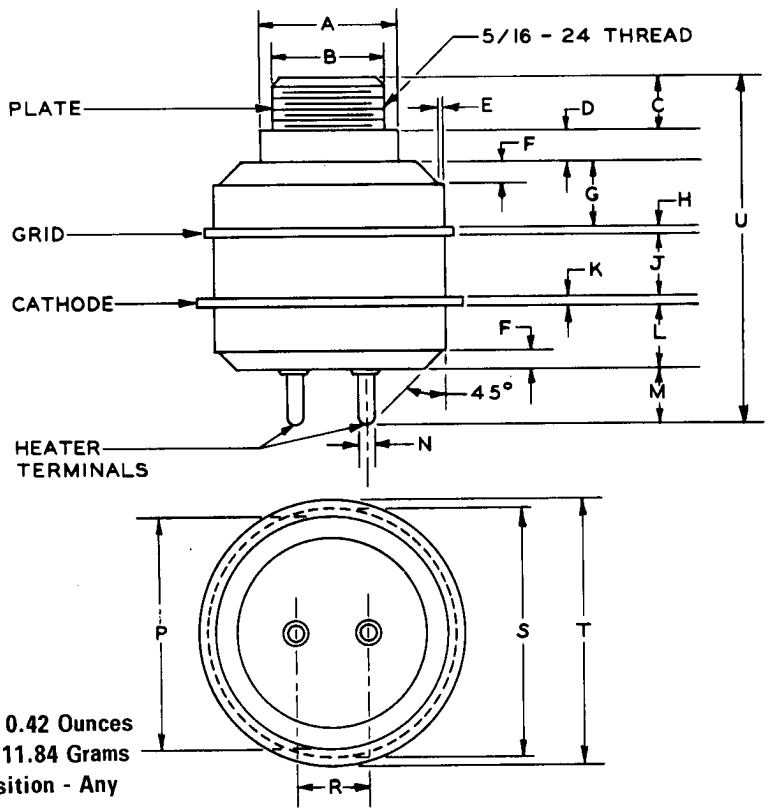
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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



NOTES:
1. Net Weight - 0.42 Ounces
   - 11.84 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.387	0.390	0.393	9.830	9.906	9.982
B	---	---	0.311	---	---	7.899
C	0.140	0.150	0.160	3.556	3.810	4.064
D	0.098	0.103	0.108	2.489	2.616	2.743
E	---	0.005	---	---	0.127	---
F	0.040	0.050	0.060	1.016	1.270	1.524
G	0.182	0.187	0.192	4.623	4.750	4.877
H	0.025	0.028	0.031	0.635	0.711	0.787
J	0.169	0.174	0.179	4.293	4.420	4.547
K	0.025	0.028	0.031	0.635	0.711	0.787
L	0.170	0.175	0.180	4.318	4.445	4.572
M	0.170	0.175	0.180	4.318	4.445	4.572
N	0.047	0.050	0.053	1.194	1.270	1.346
P	0.635	0.650	0.665	16.13	16.51	16.89
R	0.186	0.200	0.214	4.724	5.080	5.436
S	0.698	0.703	0.708	17.73	17.86	17.98
T	0.748	0.753	0.758	19.00	19.13	19.25
U	0.979	1.020	1.061	24.87	25.91	26.95

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

PRELIMINARY

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

Y-1692

Development Type ★

The Y-1692 is a triode of ceramic-and-metal planar construction intended for use as a CW amplifier or oscillator at frequencies up to 2500 megacycles. The Y-1692 is specifically designed for lower voltage-higher current applications.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	RL Ohms	Rk Ohms
Heater Voltage, AC or DC●	6.0	6.3	6.6	Volts					
Heater Current	---	1.25	---	Amperes	6.3	---	---	---	---
Plate Current	---	80	---	Milliamperes	6.3	325	---	---	33
Amplification Factor	---	80	---		6.3	325	---	---	33
Transconductance	---	66000	---	Micromhos	6.3	325	---	---	33
Grid Voltage, Cutoff	---	§	---	Volts	---	---	---	---	---
Direct Interelectrode Capacitances♦									
Grid to Plate: (g to p)	---	4.25	---	pf					
Input: g to (h+k)	---	10.5	---	pf					
Output: p to (h+k)	---	0.062	---	pf					
Cathode Heating Time	10	---	---	Seconds					

CW AMPLIFIER SERVICE

Frequency	900	Megahertz
DC Plate Voltage	400	Volts
Grid Bias	7.2	Volts
Plate Current	200	Milliamperes
Power Input	3	Watts
Power Output	42	Watts

NOTES

★ Both electrical and mechanical characteristics of development types are subject to change; therefore it is recommended that designers consult their General Electric field representative before designing equipment around developmental types.

● The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

♦ Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

§ To be determined.

GENERAL ELECTRIC

Supersedes PI Sheet dated 12-68

ABSOLUTE-MAXIMUM RATINGS

CW OSCILLATOR OR AMPLIFIER SERVICE

Plate Voltage	600	Volts
Plate Dissipation ⊕	50	Watts
Average Cathode Current	250	Milliamperes
Average Grid Current	50	Milliamperes
Envelope Temperature at Hottest Point ▲	250	°C
Temperature Differential Between Two Adjacent Electrodes □	75	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	30	G Peak

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electron devices in the equipment.

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NOTES

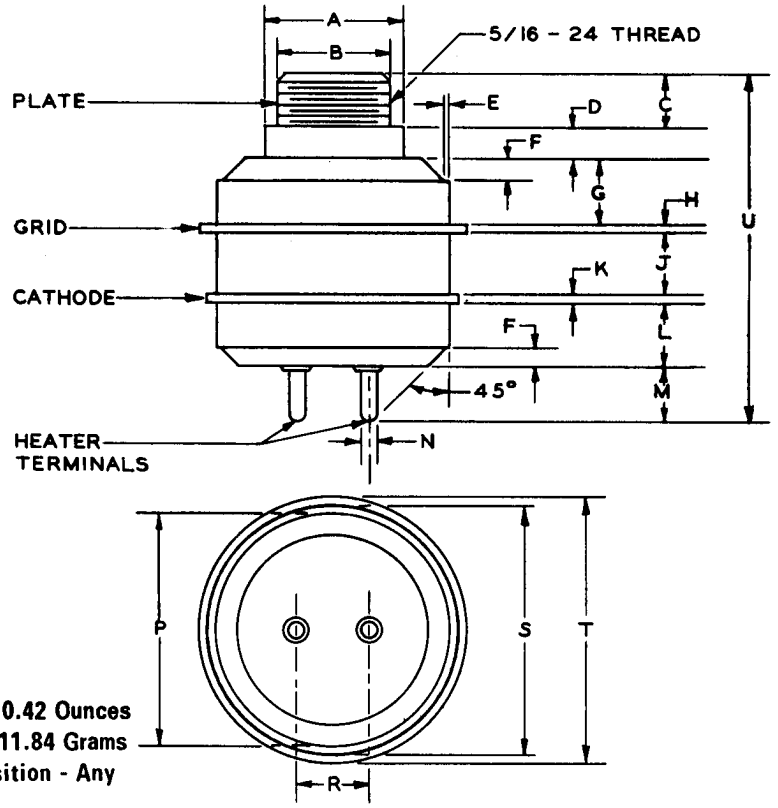
⊕ With adequate heat sink attached to threaded plate stud.

▲ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

□ This assumes no thermal heat sinking to any insulator.

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PHYSICAL DIMENSIONS



NOTES:

1. Net Weight - 0.42 Ounces
   - 11.84 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.387	0.390	0.393	9.830	9.906	9.982
B	---	---	0.311	---	---	7.899
C	0.140	0.150	0.160	3.556	3.810	4.064
D	0.098	0.103	0.108	2.489	2.616	2.743
E	---	0.005	---	---	0.127	---
F	0.040	0.050	0.060	1.016	1.270	1.524
G	0.182	0.187	0.192	4.623	4.750	4.877
H	0.025	0.028	0.031	0.635	0.711	0.787
J	0.169	0.174	0.179	4.293	4.420	4.547
K	0.025	0.028	0.031	0.635	0.711	0.787
L	0.170	0.175	0.180	4.318	4.445	4.572
M	0.170	0.175	0.180	4.318	4.445	4.572
N	0.047	0.050	0.053	1.194	1.270	1.346
P	0.635	0.650	0.665	16.13	16.51	16.89
R	0.186	0.200	0.214	4.724	5.080	5.436
S	0.698	0.703	0.708	17.73	17.86	17.98
T	0.748	0.753	0.758	19.00	19.13	19.25
U	0.979	1.020	1.061	24.87	25.91	26.95

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

—PRODUCT INFORMATION—

Planar Triode

Y-1763

Development Type ⋆

The Y-1763 is a planar ceramic triode with exceptionally large cathode area. This results in the ability to develop high values of peak power at lower current densities resulting in longer tube life. The ability to dissipate large amounts of heat produces high power capabilities under high duty pulsed and CW conditions.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	RL Ohms	Rk Ohms
Heater Voltage, AC or DC●	12.0	12.6	13.2	Volts					
Heater Current	---	1.53	---	Amperes	12.6	---	---	---	---
Plate Current	---	90	---	Milliamperes	12.6	500	---	---	22
Amplification Factor	---	150	---		12.6	500	---	---	22
Transconductance	---	65000	---	Micromhos	12.6	500	---	---	22
Grid Voltage, Cutoff	---	−24	---	Volts	12.6	2500	1	47000	1000
Direct Interelectrode Capacitances♦									
Grid to Plate (g to p)	---	4.7	---	pf					
Input: g to (h+k)	---	20	---	pf					
Output: p to (h+k)	---	.06	---	pf					
Cathode Heating Time	15	---	---	Seconds					

CATHODE-PULSED AMPLIFIER SERVICE

Frequency	500	Megahertz
Duty Factor	0.002	
Pulse Duration	0.033	Microsecond
Pulse Repetition Rate	67000	Pulses Per Second
Peak Positive-Pulse Supply Voltage	2500	Volts
Plate Current: Average During Pulse	10	Amperes
Grid Current: Average During Pulse	3.4	Amperes
Power Output: Average During Pulse	10,000	Watts

NOTES

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♦ Measured at 450 KHz using a grounded adapter that provides shielding between external terminals of tube.

ABSOLUTE-MAXIMUM RATINGS

GRID/CATHODE-PULSED OSCILLATOR OR AMPLIFIER SERVICE

Plate Voltage	2500	Volts
Plate Dissipation▲	200	Watts
Peak Cathode Current	15	Amperes
Peak Grid Current	4	Amperes
Duty Factor	0.005	
Pulse Duration	5	Microseconds
Envelope Temperature at Hottest Point⊕	250	°C
Temperature Differential Between Two Adjacent Electrodes□	100	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	30	G Peak

CW OSCILLATOR OR AMPLIFIER SERVICE

Plate Voltage	1500	Volts
Plate Dissipation▲	200	Watts
Average Cathode Current	500	Milliamperes
Average Grid Current	100	Milliamperes
Envelope Temperature at Hottest Point⊕	250	°C
Temperature Differential Between Two Adjacent Electrodes□	100	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	30	G Peak

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NOTES

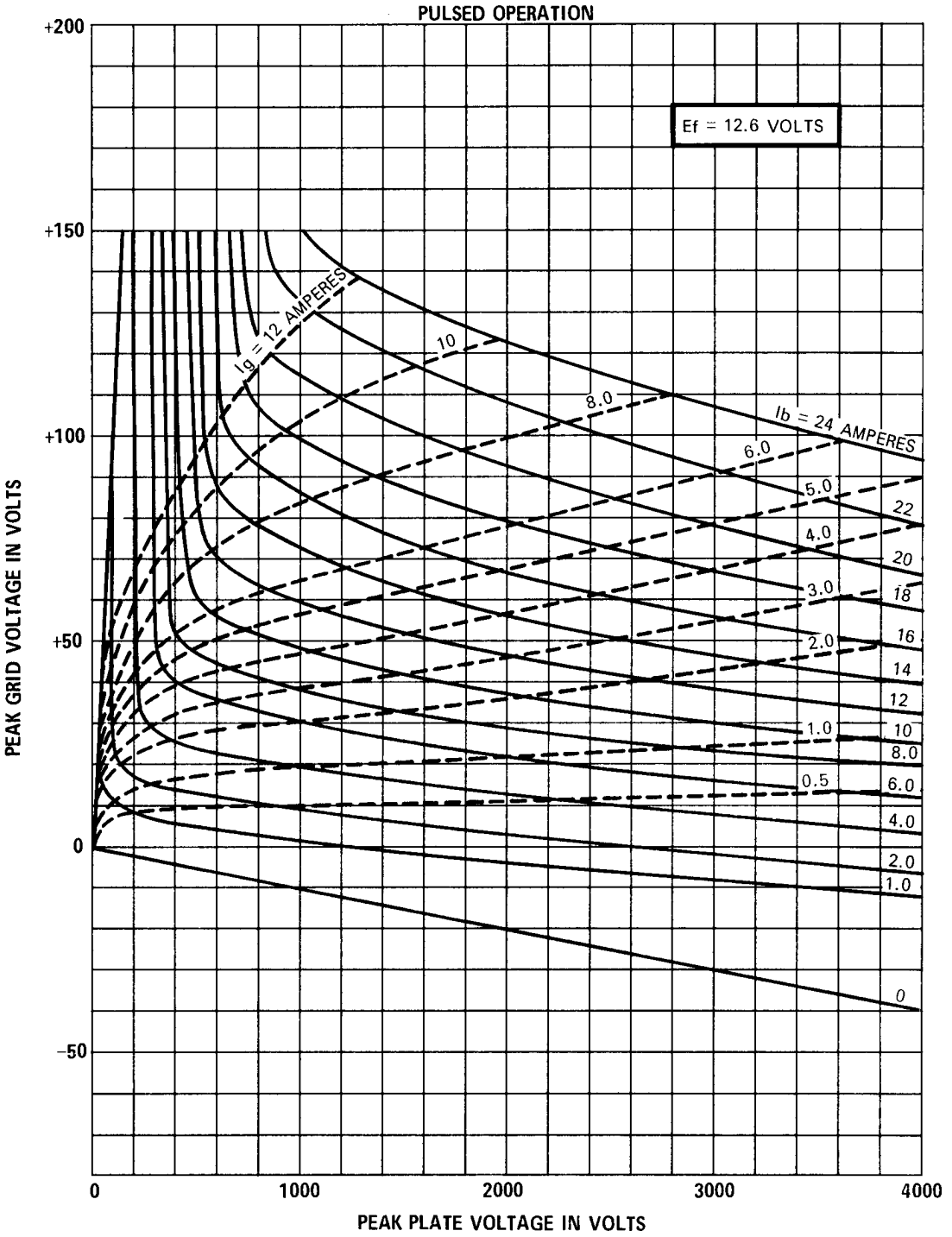
▲ With adequate heat-sink attached to threaded plate stud.

⊕ For specific recommendations concerning higher temperature operation, contact your General Electric sales representative.

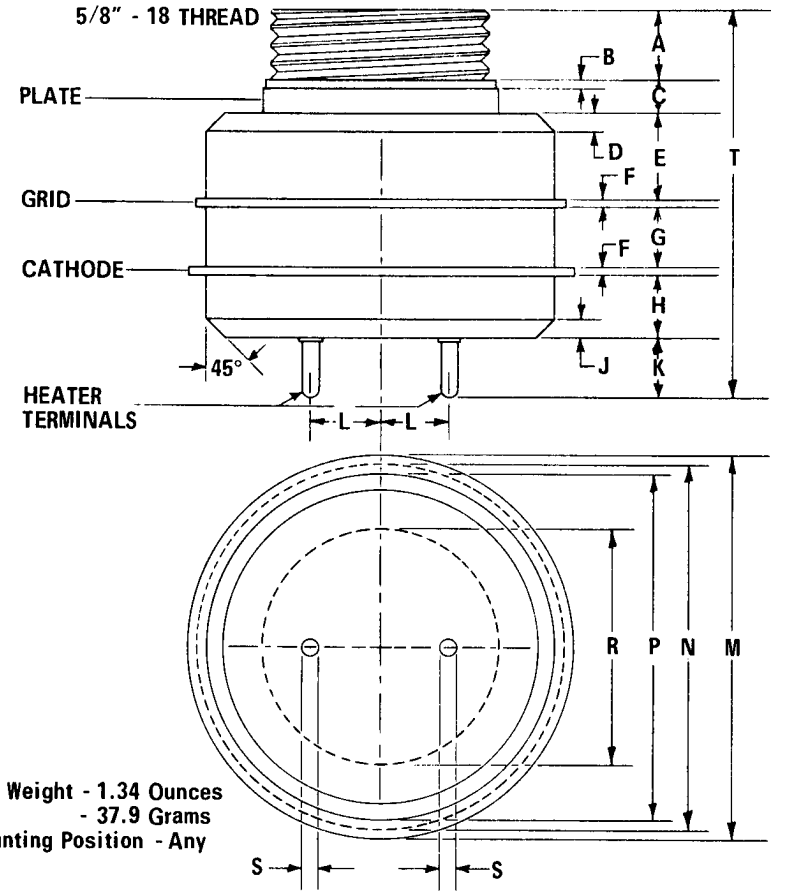
□ This assumes no thermal heat sinking to any insulator.

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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



PHYSICAL DIMENSIONS



Notes:
1. Net Weight - 1.34 Ounces
   - 37.9 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	---	0.225	---	---	5.715	---
B	---	0.025	---	---	0.635	---
C	---	0.075	---	---	1.905	---
D	---	0.075	---	---	1.905	---
E	---	0.250	---	---	6.350	---
F	---	0.025	---	---	0.635	---
G	---	0.175	---	---	4.445	---
H	---	0.175	---	---	4.445	---
J	---	0.050	---	---	1.270	---
K	---	0.175	---	---	4.445	---
L	---	0.200	---	---	5.080	---
M	---	1.100	---	---	27.94	---
N	---	1.050	---	---	26.67	---
P	---	1.000	---	---	25.40	---
R	---	0.675	---	---	17.15	---
S	---	0.050	---	---	1.270	---
T	---	1.125	---	---	28.58	---

GENERAL ELECTRIC
TUBE PRODUCTS DEPARTMENT
OWENSBORO, KENTUCKY 42301

—PRODUCT INFORMATION—

ELECTRONIC INNOVATIONS IN ACTION

MICROWAVE DEVICES

Planar Triode

Y-1774

Development Type ★

The Y-1774 is a planar metal-ceramic triode intended for use in long pulse amplifier chains. This tube features a large cathode area to provide long life through lower current densities and specific design features for long pulse applications.

AVERAGE CHARACTERISTICS

	Minimum	Bogey	Maximum	Units	Test Conditions Ef V	Eb V	Ib Ma	RL Ohms	Rk Ohms
Heater Voltage, AC or DC●	6.0	6.3	6.6	Volts					
Heater Current	---	1.7	---	Amperes	6.3	---	---	---	---
Plate Current	---	50	---	Milliamperes	6.3	400	---	---	33
Amplification Factor	---	125	---		6.3	400	---	---	33
Transconductance	---	42000	---	Micromhos	6.3	400	---	---	33
Grid Voltage, Cutoff	---	-25	---	Volts	6.3	2000	1	100000	---

ABSOLUTE-MAXIMUM RATINGS

GRID/CATHODE-PULSED AMPLIFIER SERVICE

Plate Voltage	2000	Volts
Plate Dissipation▲	100	Watts
Peak Cathode Current	8	Amperes
Peak Grid Current	3	Amperes
Duty Factor	0.001	
Pulse Duration	200	Microseconds
Envelope Temperature at Hottest Point♦	250	°C
Temperature Differential Between Two Adjacent Electrodes□	100	°C
Mechanical Vibration (20-2000 Hz Sinusoidal)	30	G Peak

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▲ With adequate heat-sink attached to threaded plate stud.

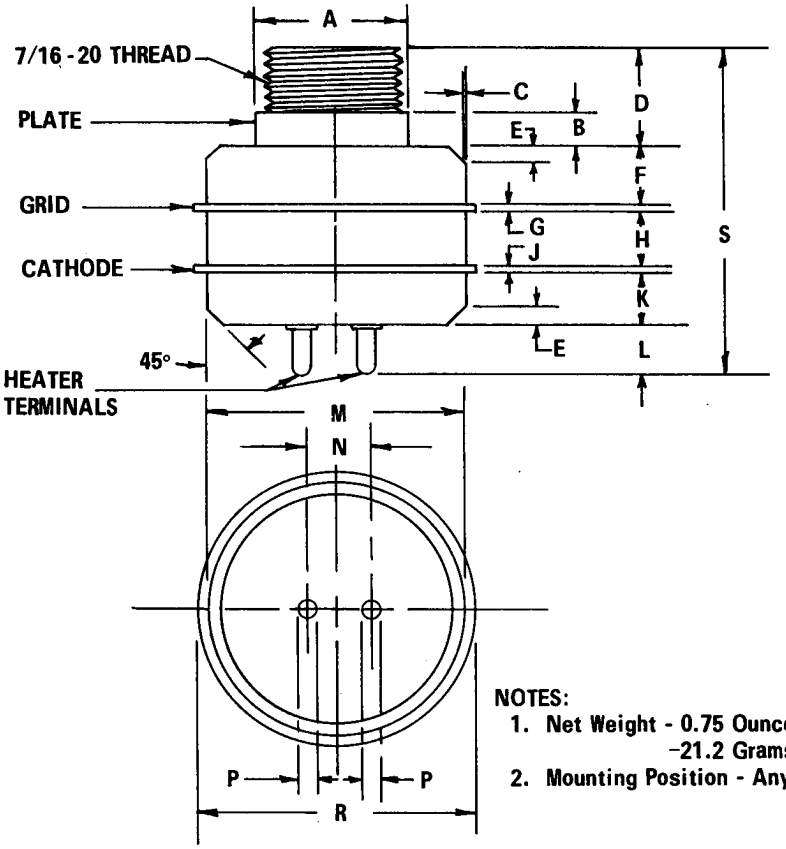
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GENERAL ELECTRIC

PHYSICAL DIMENSIONS



NOTES:
1. Net Weight - 0.75 Ounces
   -21.2 Grams
2. Mounting Position - Any

Ref.	INCHES			MILLIMETERS		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	---	0.490	---	---	12.45	---
B	---	0.110	---	---	2.794	---
C	---	0.005	---	---	0.127	---
D	---	0.310	---	---	7.874	---
E	---	0.050	---	---	1.270	---
F	---	0.187	---	---	4.750	---
G	---	0.025	---	---	0.635	---
H	---	0.175	---	---	4.445	---
J	---	0.025	---	---	0.635	---
K	---	0.175	---	---	4.445	---
L	---	0.175	---	---	4.445	---
M	---	0.825	---	---	20.96	---
N	---	0.200	---	---	5.080	---
P	---	0.050	---	---	1.270	---
R	---	0.900	---	---	22.86	---
S	---	1.072	---	---	27.20	---

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

ELECTRONIC INNOVATIONS IN ACTION

DISPLAY DEVICES

—PRODUCT INFORMATION—

Low Voltage Indicator Tube

Y-1938

TENTATIVE SPECIFICATION SHEET

The Y-1938 is a low voltage seven bar segment vacuum cathodoluminescent readout tube which provides bright, sharp display of alphanumeric symbols at low drive and power levels. Symbols are displayed in type Y-1938 by excitation of phosphor-screened segments, which are energized by electrons emitted by a directly heated common cathode.

LOW POWER - Typical operation for high brightness is 25 volts for anode and 1.5 Vac or Vdc at 42 mA for the cathode.

FAST SPEED - Operates in the very high speed range through the use of low presistence phosphor.

BRIGHTNESS - Displays a highly visible blue-green color approximately 200 foot-lamberts.

WIDE ANGLE VIEWING - Single plane character formation with no parallax problems and up to 150° viewing range.

RELIABILITY - Long life construction that uses a single plane and thick film technology combined with the low total power requirements of less than 200 milliwatts.

CHARACTER SIMPLIFICATION - Only one type to display digits (0-9), letters - A, C, E, F, G, H, I, J, L, O, P, S, U, Y.

COMPACT SIZE - Standard miniature T6½ bulb, two inches maximum height for minimum space requirements.

TYPICAL SPECIFICATIONS

ELECTRICAL

Filament Voltage	1.5	Vac or Vdc
Filament Current	42	mA
Filament Heating Power	72	mW
Anode Excitation Voltage (Max.)	55	Vdc
Anode Excitation Voltage (Typical)	25	Vdc
Anode Current/Segment at 25 Volts	550	μa
Maximum Total Anode Power Dissipation at 25 Volts	100	mW

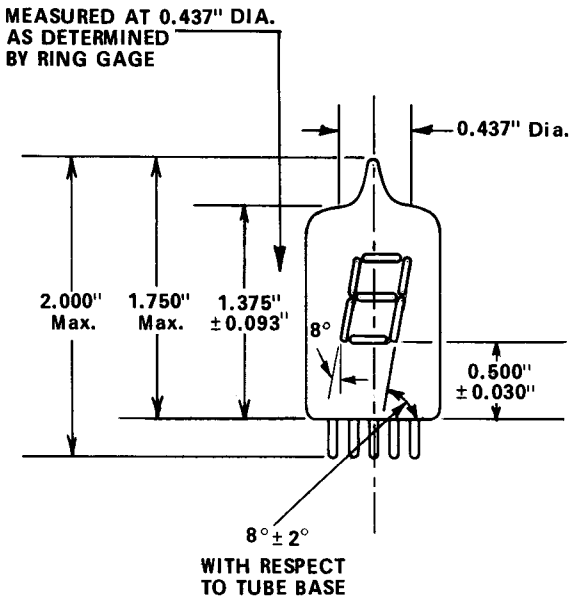
OPTICAL

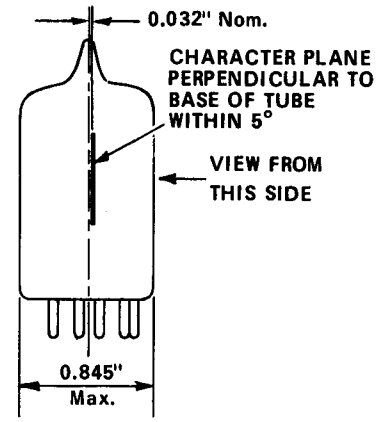
Light Output (at 25 Vdc Anode Voltage	200	F-L
Character Dimension		
Height	0.570	Inch
Width	0.360	Inch
Character Color	Blue Green	
Phosphor	P15	
Viewing Angle	Single-Plane	
Character Orientation	Parallel to Plane through Pins 3 & 7	

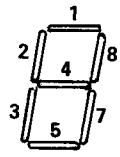
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GENERAL ELECTRIC

MECHANICAL SPECIFICATIONS

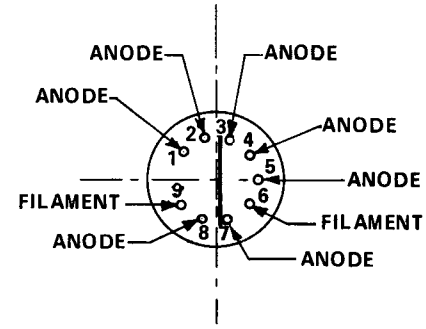






PIN CONNECTIONS
AND ANODE
CONFIGURATION

FRONT VIEW



PIN CONNECTIONS
BOTTOM VIEW

CHARACTER SIZE:
0.570" X 0.360"
SLANTED 8°

TUBE PRODUCTS DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky 42301

SEVEN SEGMENT DIGITAL FLUORESCENT DISPLAY

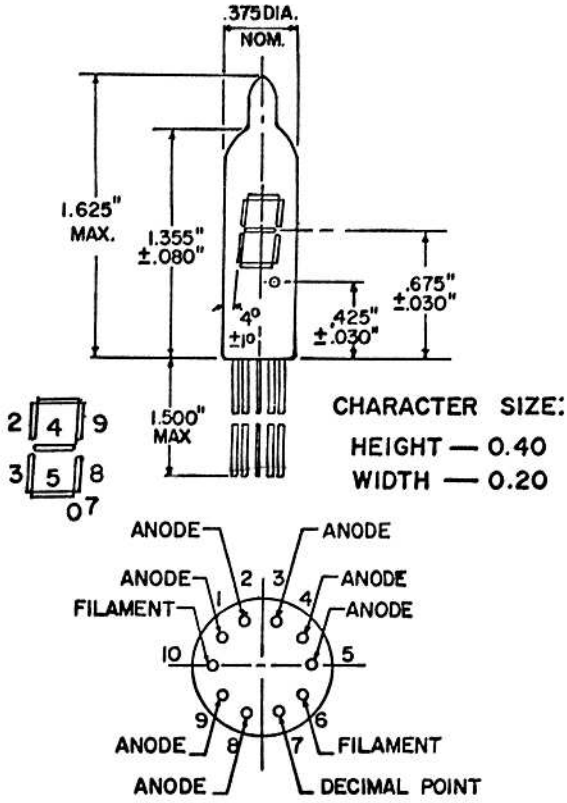
TYPE Y-4075

The readout tube provides a bright, sharp display of numerals at low drive and power levels at a very fast speed. Numbers are displayed by excitation of phosphor-screened segments, which are energized by electrons emitted by a directly heated cathode.

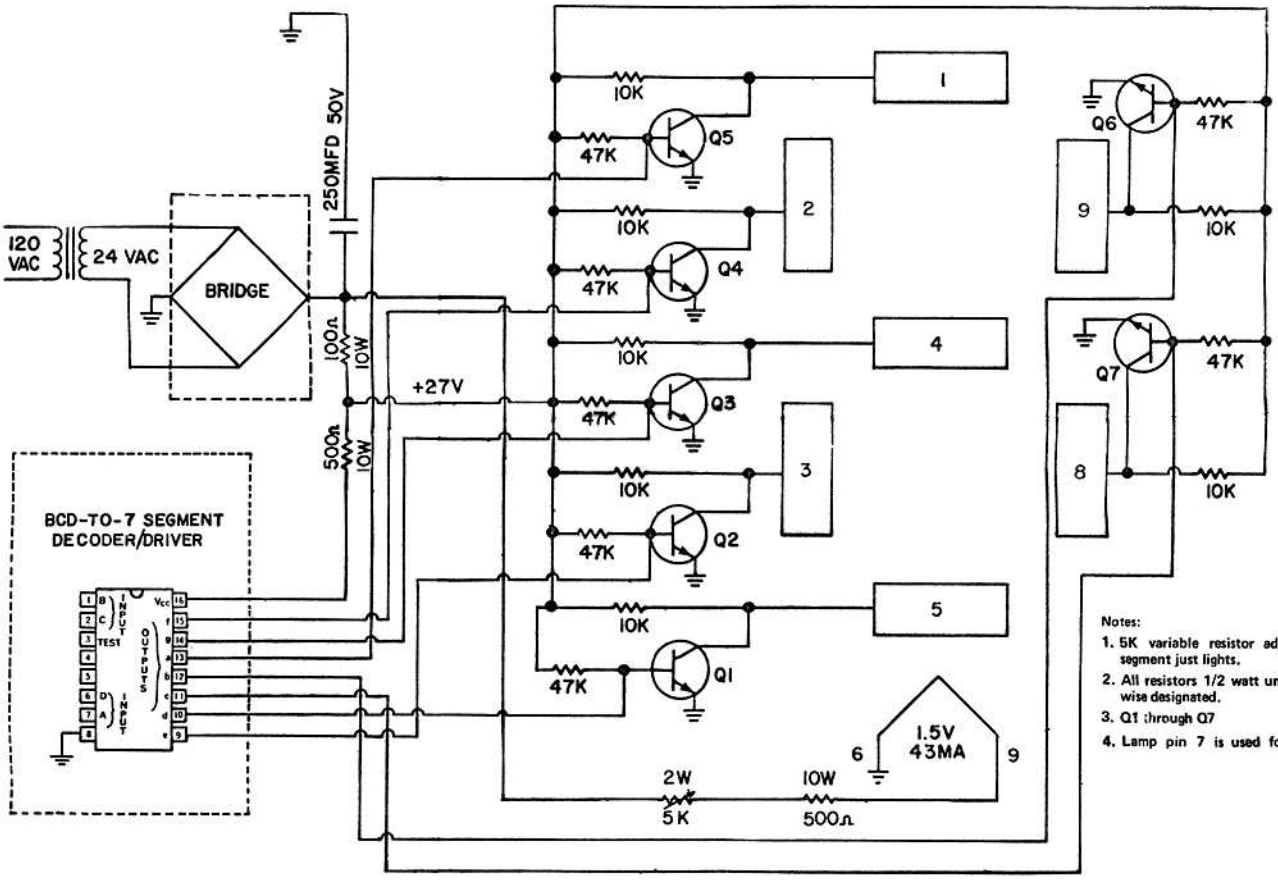
FEATURES

1. Driven by a 7447 BCD to seven segment Decoder/Driver.
2. Total power requirements of less than 175 MW.
3. Fluorescent segments are mounted on a single substrate for extra durability in portable applications.
4. Highly visible blue-green color. Easy on the eye.
5. Typical light output of 200 foot lamberts at 25 volts D.C.
6. Maximum allowable segment voltage is 35 volts D.C.

	UNIT	SEG. V.	FIL. V.	MIN.	NOM.	MAX.
Filament current	MA. AC/DC	27	1.2	35	40	45
Cathode current	MA. D.C.	27	1.2	–	4.0	9.0
Segment current	MA. D.C.	27	1.2	–	0.5	1.5
Average brightness	Ft/lambert	27	1.2	100	200	–



PIN CONNECTIONS
Bottom View



Notes:
1. 5K variable resistor adjusts until segment just lights.
2. All resistors 1/2 watt unless otherwise designated.
3. Q1 through Q7
4. Lamp pin 7 is used for decimal.

G.E.C. VALVES

LOW NOISE AF PENTODE 6·3V INDIRECTLY HEATED

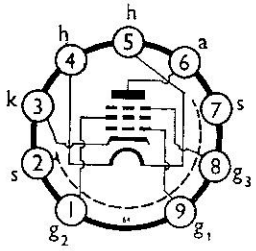
Z729/EF86

ISSUE 2

The Z729 is a commercial equivalent of CV2901.

An indirectly heated pentode with low hum and low microphony, suitable for use in low level low frequency amplifiers, measuring instruments, industrial control circuits, etc. Its low grid current makes it particularly useful in circuits requiring a high input impedance.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A
Bulb : Tubular

Max. overall length :	56 mm.
Max. seated length :	49 mm.
Max. diameter :	22·2 mm.

HEATER

V_h	6·3	V
I_h	0·2 (approx)	A

MAXIMUM RATINGS

V_b	550	V
V_a	300	V
V_{g2}	250	V
*$V_{a,g2,g3}$	250	V
p_a	1	W
p_{g2}	0·2	W
*$p_{a+g2+g3}$	1·2	W
I_k	6	mA
V_{h-k}	150	V
†R_{g1-k} (fixed bias)	1	MΩ
†R_{g1-k} (cathode bias)	2	MΩ

*Triode connection.
†At $p_a+p_{g2}=1·2W$, $V_a=300V$.

CAPACITANCES (of cold externally unscreened valve)

c_{g1-a}	0·025 pF	c_{g1-h}	0·0025 pF
$c_{g1-\text{all less a}}$	4·0 pF	$c_{a-\text{all less g1}}$	5·5 pF

CHARACTERISTICS

Pentode Connection

V_a	250	V
V_{g2}	140	V
V_{g3}	0	V
V_{g1}	−2	V
I_a	3·0	mA
I_{g2}	0·55	mA
I_{g1}	0·05	μA
g_m	1·85	mA/V
r_a	2	MΩ
$\mu_{(g1-g2)}$	38	—

THE M-O VALVE CO. LTD. · BROOK GREEN · LONDON · W.6
a subsidiary of
THE GENERAL ELECTRIC CO. LTD. OF ENGLAND

JUNE, 1959

Triode Connection

$V_{a,g2,g3}$	250	V
V_{g1}	−5	V
I_k	4·0	mA
I_{g1}	0·06	μA
g_m	2·0	mA/V
r_a	16·5	kΩ
μ	33	—

TYPICAL OPERATION

AF Amplifier. Pentode Connection.

V_b (V)	R_a (kΩ)	I_k (mA)	R_{g2} (MΩ)	R_k (kΩ)	$R_{g1\ (max)}$ (MΩ)	Gain	V_{out}† (V)	D_{tot}† (%)	R_g* (kΩ)
400	100	3·3	0·39	1·0	22	124	87	5	330
300	100	2·45	0·39	1·0	36	116	64	5	330
200	100	1·65	0·39	1·0	80	106	40	5	330
400	220	1·55	1·0	2·2	44	200	73	5	680
300	220	1·1	1·0	2·2	80	188	54	5	680
200	220	0·75	1·0	2·2	100	170	36	5	680

AF Amplifier. Triode Connection.

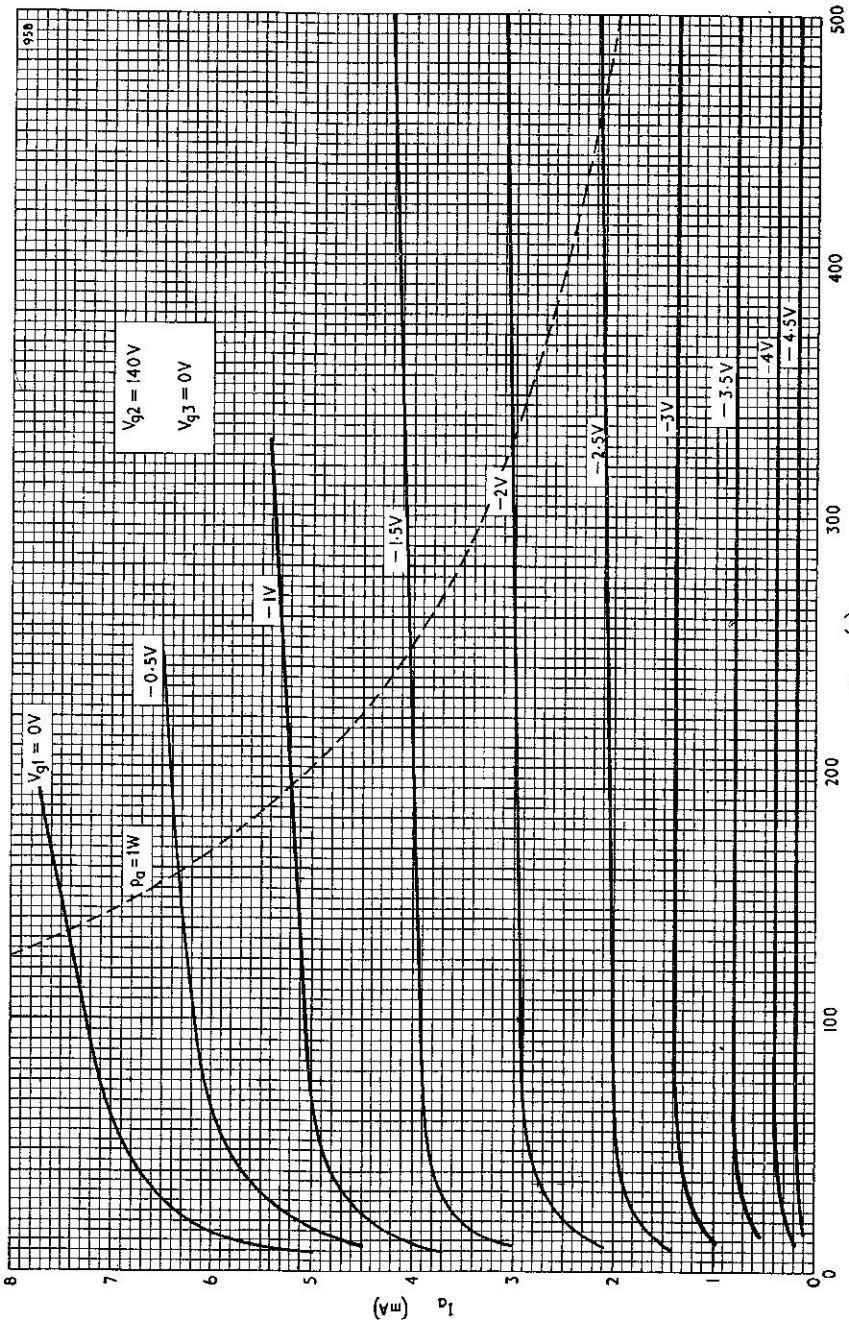
V_b (V)	R_A (kΩ)	I_a (mA)	R_k (kΩ)	$R_{g1\ (max)}$ (MΩ)	Gain	V_{out}† (V)	D_{tot}† (%)	R_g* (kΩ)
400	47	3·7	1·2	3·9	24·5	64	4·5	150
300	47	2·7	1·2	9	24	43	3·8	150
200	47	1·85	1·2	33	23·5	22	3·1	150
400	100	2	2·2	9	28·5	73	4·0	330
300	100	1·5	2·2	21	28·5	50	3·8	330
200	100	1·0	2·2	72	27·5	27·5	3·3	330
400	220	1·05	3·9	24	32	74	3·8	680
300	220	0·8	3·9	60	31	51	3·7	680
200	220	0·5	3·9	100	30·5	28	3·1	680

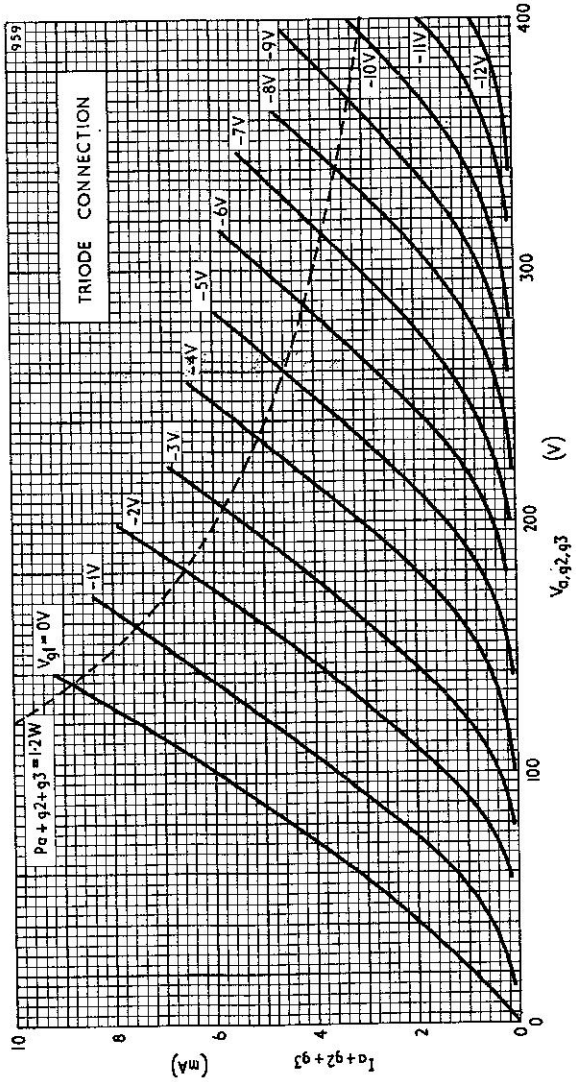
*Following valve grid resistor.

†V_{out} and distortion at the start of positive grid current. At lower output values, the distortion is approximately proportional to the input voltage.

INSTALLATION

The valve may be mounted in any position. The use of a retaining device is recommended. The valve is internally screened.


958
V_{g2} = 140 V
V_{g3} = 0V
V_{g1} = 0V
P_a = 1W
-0.5V
-1V
-1.5V
-2V
-2.5V
-3V
-3.5V
-4V
-4.5V
I_a (mA)
V_a (V)
0
100
200
300
400
500
1
2
3
4
5
6
7
8



Printed in England. C.

The Z729/EF86 may be classed as intermediate between an electrometer valve and one of normal design because of the small grid current to be expected.

In all applications where low grid current is important it is essential to ensure that the grid is always negative with respect to cathode by at least 1·7V in order to avoid positive grid current due to the interception of electrons by the grid. The magnitude of the negative grid current depends upon operating conditions and limits the value of maximum external resistance between grid and cathode. Under d.c. conditions the grid current varies roughly as $(V_a \times p_a + V_{g2} \times p_{g2})$. Under the conditions shown in the data sheet under "Characteristics," the grid current does not normally exceed 0·2μA and is usually less than 0·05μA. A valve that has been stored for some time may have a higher grid current initially but will settle to a satisfactorily low value if operated for a few minutes under normal conditions with a low value of grid resistor.

If the valve is used under conditions of maximum voltage and dissipation, the external grid to cathode resistance should not exceed 1MΩ with fixed bias or 2MΩ with cathode bias in order to obtain satisfactory operation with all valves. Permissible grid to cathode resistance values at reduced voltages and dissipations are given below and apply to both triode and pentode operation.

The majority of valves will operate satisfactorily with resistance values up to four times those shown and advantage may be taken of this when selection is possible. However, it is advisable not to exceed 100MΩ.

Maximum External Grid to Cathode Resistance with Fixed Bias

V_a	$R_{g-k(max)}$ at $p_{a+g2(max)}$ =			
	1·2W	0·5W	0·2W	0·1W
300V	1MΩ	2·5MΩ	6MΩ	12MΩ
200V	1·5MΩ	3·75MΩ	9MΩ	18MΩ
100V	3MΩ	7·5MΩ	18MΩ	36MΩ

These values may be doubled for cathode bias.

The above table values applies to applications in which the operating point is determined by a specified grid bias with respect to cathode. On the other hand, any valve may be operated with the grid left floating and the grid will then adjust itself to the crossover potential at which the grid current curve passes through zero. In the Z729/EF86 this occurs normally at about $V_g = -1{\cdot}3V$. Although this method is useful for certain special applications, the incremental input impedance is extremely variable, ranging typically between 1MΩ and 50MΩ because of the rapid rise of positive grid current.

AF AMPLIFIER OPERATION AND HUM

The Z729/EF86 is normally used as an RC coupled pentode amplifier as shown in fig. 1. For exceptionally low noise applications, the valve may be used as a triode by connecting the anode, suppressor and screen together, and fig. 2 gives the performance to be expected. When high impedance circuits are possible, very high gain is obtainable as shown by the curve of fig. 4.

To obtain minimum hum pickup, the heater connections should be twisted together for three or four inches and kept as far as possible from the grid contact. A valve socket having low leakage and low capacitance between contacts is required, preferably of porcelain or PTFE with a central screening boss, this being earthed together with contacts 2 and 7 which connect to the valve internal screening system. The suppressor (pin 8) is normally earthed but it may be connected to the cathode. Special precautions have been taken to reduce to a minimum the grid/heater capacitance in order to render

the valve relatively insensitive to an unbalanced heater supply. Similar precautions must be taken with external components. Normally a centre-tapped 6·3V supply will be used with the tap earthed. The hum pickup with a 470kΩ grid resistor will then be less than 1·5μV referred to the grid. The use of a higher or lower grid resistance will modify the hum pickup proportionally. A balancing resistor may be used if desired and in some cases this will reduce the hum by approximately 1-2dB. If even this hum level is still too high, a d.c. heater supply must be used.

As the total anode and screen current is very low in most applications, it is sometimes convenient to obtain a very smooth, stable, hum-free and low noise h.t. supply from a standard 120V battery.

To avoid hum pickup, etc., in the input circuit, care must be taken to avoid coupling with higher signal level circuits, bearing in mind the possibility that the chassis itself can be responsible for such coupling.

In order to maintain a low hum level it is essential to bypass any cathode bias resistor with a suitably large capacitor of at least 500μF. At higher signal levels part of the cathode resistance may be left unbypassed when negative feedback is necessary, or for tone control purposes.

At audio frequencies the screen in the pentode circuit should be bypassed to earth with a paper capacitor of at least 0·1μF.

Acoustic feedback is not normally encountered in the Z729/EF86 as it is especially anti-microphonic and it is not usually necessary to use special techniques such as a separate flexibly mounted and weighted sub-chassis, except in extreme cases as when the valve is close to a loudspeaker or when considerable vibration is present. The internal screening renders an external screening can unnecessary but one may be used as a retainer when necessary.

The Z729/EF86 may be used in a 0·3A series heater chain if the heater is shunted by a 63Ω resistor. This resistor should be rated at 5W since it will carry 0·3A if the valve is removed. The heater should be connected into the earthy end of the chain.

INDUSTRIAL APPLICATIONS

The Z729/EF86 has many applications in the industrial field because of its high order of stability and its freedom from unwanted effects. A high value grid resistor may be used when required because of the low grid current. The valve is ideal for photocell circuits and will show a considerable increase in sensitivity over valves normally used hitherto.

Many requirements in test equipment can be fulfilled by the Z729/EF86 ; a valve voltmeter, for example, needs a very stable valve characteristic and a suitable circuit is given in fig. 3. Certain component values are not given since they depend upon the ranges required but the resistors associated with the range switch may total 10-20MΩ.

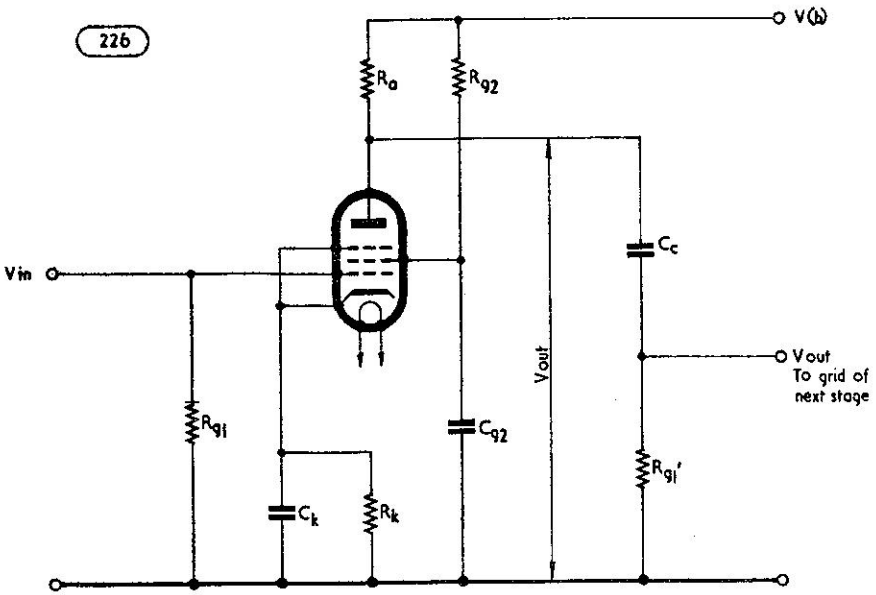


Fig. 1. Recommended circuit for a pentode-connected a.f. amplifier. Component values for various conditions of operation are given below.

V_b (V)	R_a (kΩ)	I_k (mA)	R_{g2} (MΩ)	R_k (kΩ)	$R_{g1\ (max)}$ (MΩ)	Gain	V_{out}† (V)	D_{tot}† (%)	R_{g1}'* (kΩ)
400	100	3·3	0·39	1·0	22	124	87	5	330
300	100	2·45	0·39	1·0	36	116	64	5	330
200	100	1·65	0·39	1·0	80	106	40	5	330
400	220	1·55	1·0	2·2	44	200	73	5	680
300	220	1·1	1·0	2·2	80	188	54	5	680
200	220	0·75	1·0	2·2	100	170	36	5	680

*Following valve grid resistor.

†V_{out} and distortion at the start of positive grid cnrrent. At lower output values, the distortion is approximately proportional to the input voltage.

Capacitor valves : The reactance of C_k should normally be less than one tenth of R_k at the lowest frequency ; the reactance of C_{g2} should normally be less than one tenth of R_{g2} and that of C_c should normally be less than one tenth of R_{g1}'.

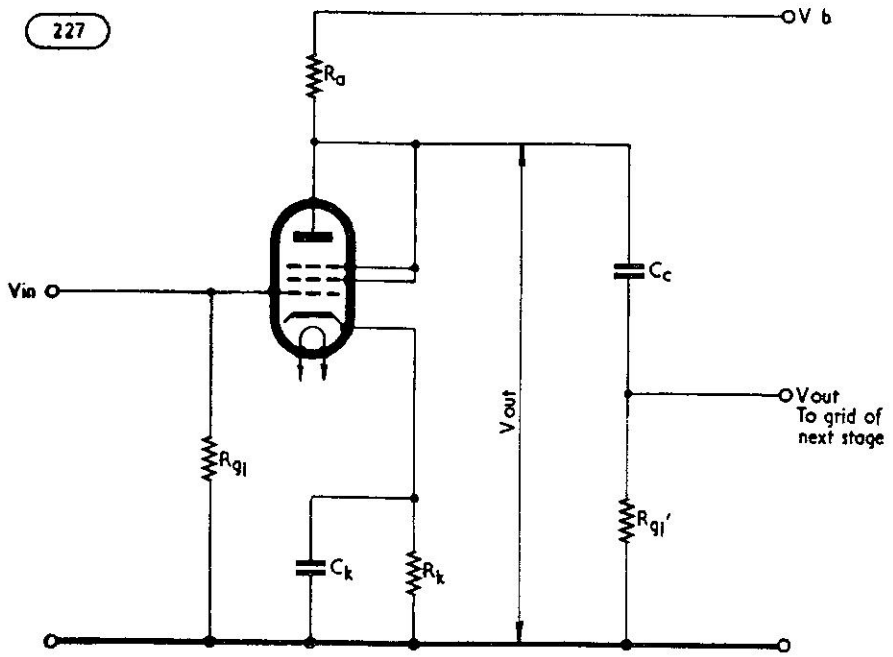


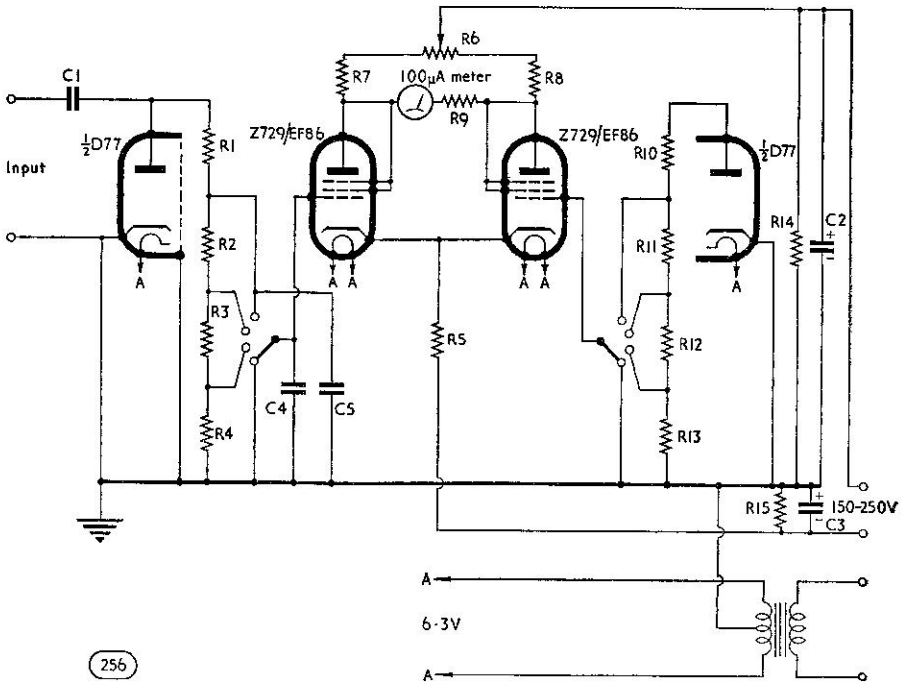
Fig. 2. Recommended circuit for a triode-connected a.f. amplifier. Component values for various conditions of operation are given below.

V_b (V)	R_a (kΩ)	I_a (mA)	R_k (kΩ)	R_{g1} (max) (MΩ)	Gain	V_{out}† (V)	D_{tot}† (%)	$R_{g1'}$* (kΩ)
400	47	3·7	1·2	3·9	24·5	64	4·5	150
300	47	2·7	1·2	9	24	43	3·8	150
200	47	1·85	1·2	33	23·5	22	3·1	150
400	100	2	2·2	9	28·5	73	4·0	330
300	100	1·5	2·2	21	28·5	50	3·8	330
200	100	1·0	2·2	72	27·5	27·5	3·3	330
400	220	1·05	3·9	24	32	74	3·8	680
300	220	0·8	3·9	60	31	51	3·7	680
200	220	0·5	3·9	100	30·5	28	3·1	680

*Following valve grid resistor.

†V_{out} and distortion at the start of positive grid current. At lower output values, the distortion is approximately proportional to the input voltage.

Capacitor values : The reactance of C_k should normally be less than one tenth of R_k at the lowest frequency and the reactance of C_c should normally be less than one tenth of $R_{g1'}$ at the lowest frequency.



Component values :

R1		
R2		Range switch resistors
R3		
R4		
R5	33kΩ 10% 1W	
R6	500Ω wirewound variable (zero set)	
R7	1kΩ wirewound	
R8	1kΩ wirewound	
R9	Meter resistance	
R10		
R11		Range switch resistors
R12		
R13		
R14	47kΩ 10% 1W	
R15	47kΩ 10% 1W	
C1	0·1μF	
C2	8μF Electrolytic	
C3	8μF Electrolytic	
C4	0·1μF	
C5	0·1μF	

Fig. 3. Valve voltmeter circuit.

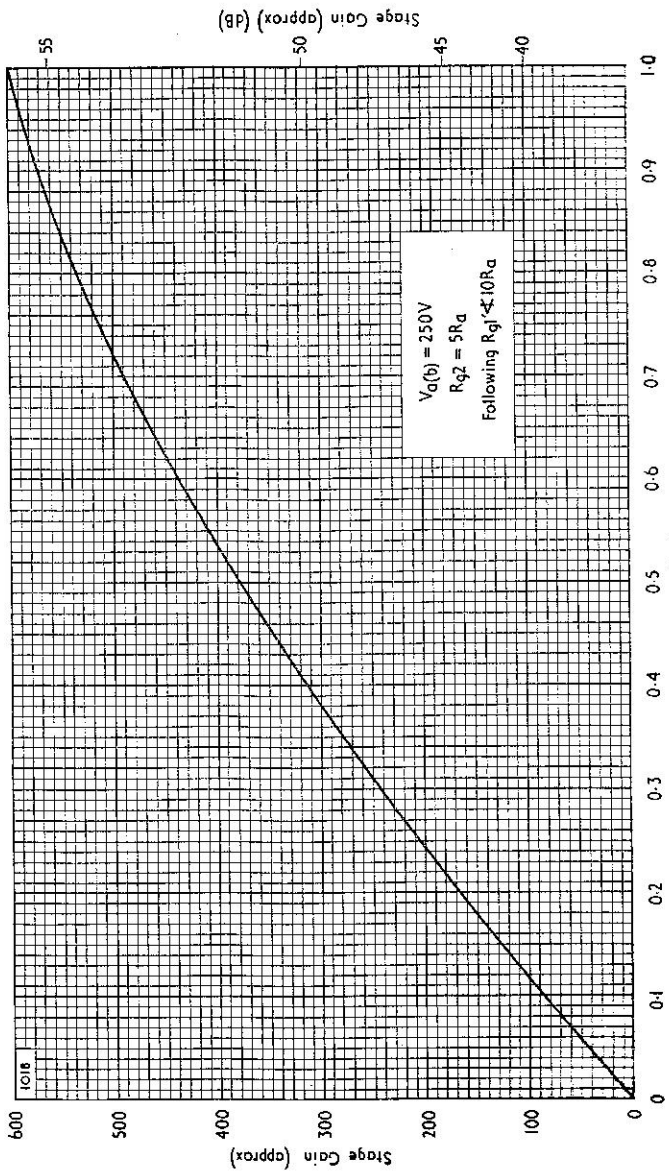

Stage Gain (approx)
600
500
400
300
200
100
0
Stage Gain (approx) (dB)
55
50
45
40
$V_{a(b)}$ = 250V
R_{g2} = 5R_a
Following R_{g1} ≪ 10R_a
0
0·1
0·2
0·3
0·4
0·5
0·6
0·7
0·8
0·9
1·0
R_a (MΩ)
6016

Fig. 4.

OBJECTIVE FOR DEVELOPMENTAL TYPE

Z-2354*

CERAMIC TRIODE

For Military and Industrial Applications

The Z-2354 is a low-mu triode of ceramic and metal planar construction. The tube is intended for use as an audio-frequency or radio-frequency power-amplifier or as a series regulator, in applications where unfavorable conditions of temperature, mechanical shock, mechanical vibration, and nuclear radiation are encountered.

GENERAL

Electrical

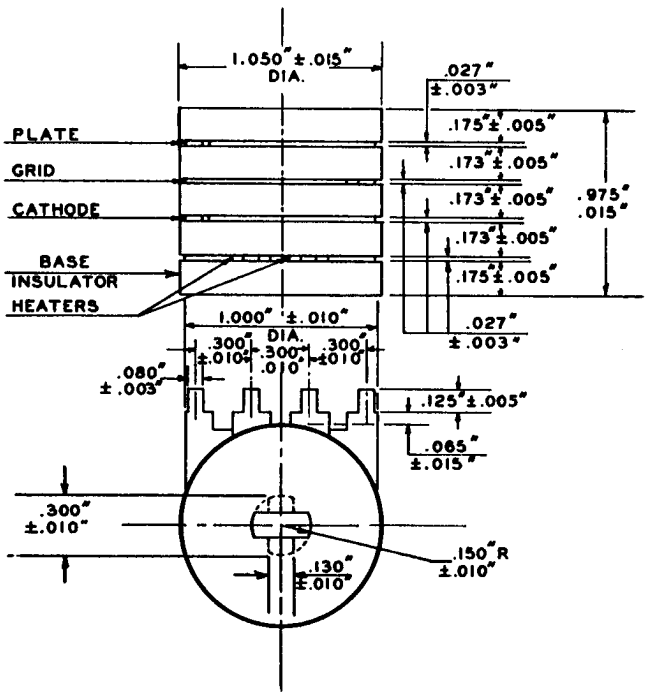
Cathode - Coated Unipotential

Heater Voltage, AC or DC+	6.3±0.3	Volts
Heater Current‡	0.85	Amperes
Direct Interelectrode Capacitances§		
Grid to Plate: (g to p)	Ø	pf
Input: g to (h + k)	Ø	pf
Output: p to (h + k)	Ø	pf

Mechanical

Operating Position - Any

→ Outline Drawing



MAXIMUM RATINGS

Absolute-Maximum Values

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	100	Volts
Plate Dissipation	12	Watts
DC Cathode Current	100	Milliamperes
Heater-Cathode		
Heater Positive with Respect to Cathode		
DC Component	100	Volts
Total DC and Peak	200	Volts
Heater Negative with Respect to Cathode		
Total DC and Peak	200	Volts
Grid Circuit Resistance		
With Fixed Bias	0.25	Megohms
With Cathode Bias	1.0	Megohms
Envelope Temperature at Hottest Point	400	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should de ign so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics

	Plate Voltage	250	Volts
	Cathode-Bias Resistor	330	Ohms
	Amplification Factor	8.0	
→	Plate Resistance, approximate	1330	Ohms
→	Transconductance	6000	Micromhos
→	Plate Current	60	Milliamperes
	Grid Voltage, approximate		
	Ib = 100 Microamperes	-52	Volts

SPECIAL TESTS AND RATINGS

Stability Life Test
Statistical sample operated for twenty hours to evaluate and control initial variations in transconductance.

Survival Rate Life Test
Statistical sample operated for one hundred hours to evaluate and control early-life electrical and mechanical inoperatives.

Heater-Cycling Life Test
Statistical sample operated for 2000 cycles to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.5 volts cycled for one minute on and one minute off, Eb = Ec = 0 volts, and Ehk = 135 volts with heater positive with respect to cathode.

Shock Rating - 600 G
Statistical sample subjected to five impact accelerations of 600 G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

Fatigue Rating - 10 G
Statistical sample subjected to vibrational acceleration of 10 G for 48 hours minimum in each of two different positions. The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

Altitude Rating - 100000 Feet
Statistical sample subjected to pressure of 8.0 millimeters of mercury to evaluate and control arcing and corona.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

\+ The equipment designer should design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

Ø To be determined.

2/15/63 (B)
Supersedes 11/29/62 (B)

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

OBJECTIVE FOR DEVELOPMENTAL TYPE

Z-2689*

PLANAR DIODE

The Z-2689 is a cathode-type diode of ceramic and metal planar construction intended for use as a low-current rectifier.

GENERAL

Electrical

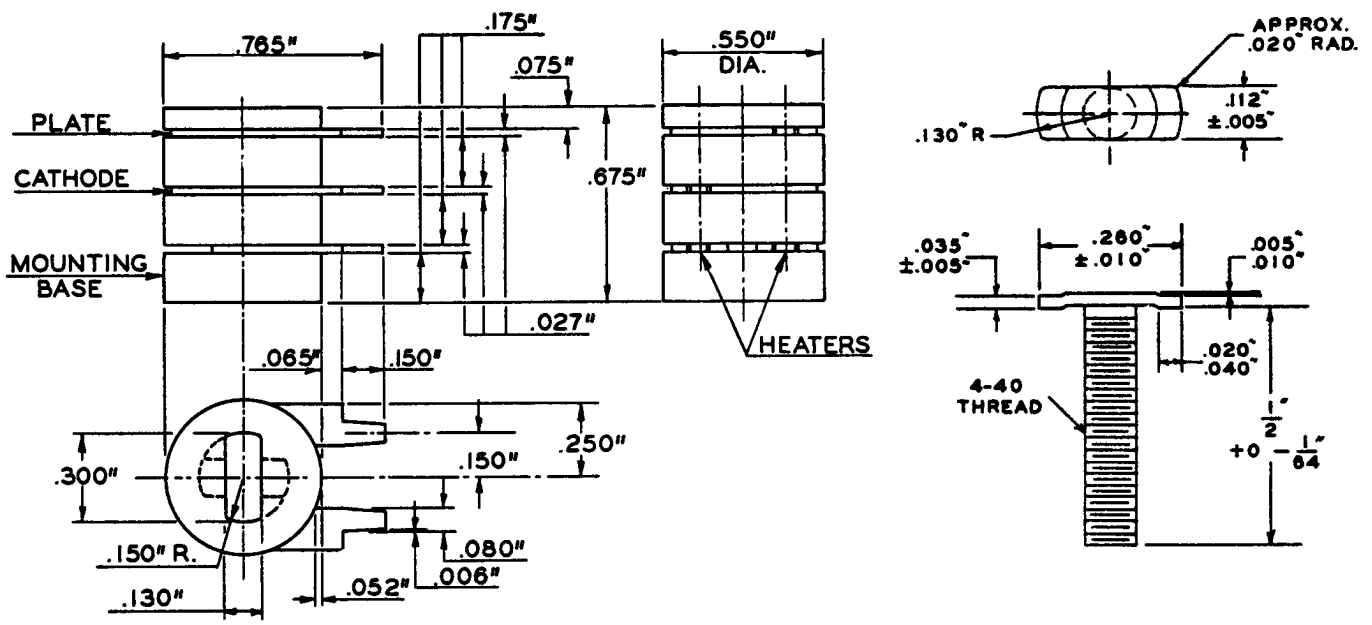
Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC+	6.3±0.6	Volts
Heater Current‡	0.4	Amperes
Direct Interelectrode Capacitances§		
Plate to Cathode	2.5	pf
Heater to Cathode	2.6	pf

Mechanical

Operating Position - Any

→ Outline Drawing



MAXIMUM RATINGS

Design-Maximum Values

Peak Inverse Plate Voltage	1000	Volts
Steady-State Peak Plate Current	150	Milliamperes
DC Output Current	25	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode		
DC Component	175	Volts
Total DC and Peak	225	Volts
Heater Negative with Respect to Cathode		
DC Component	175	Volts
Total DC and Peak	225	Volts
Envelope Temperature at Hottest Point	300	C

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Tube Voltage Drop		
Ib = 40 Milliamperes DC	15	Volts

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

\+ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

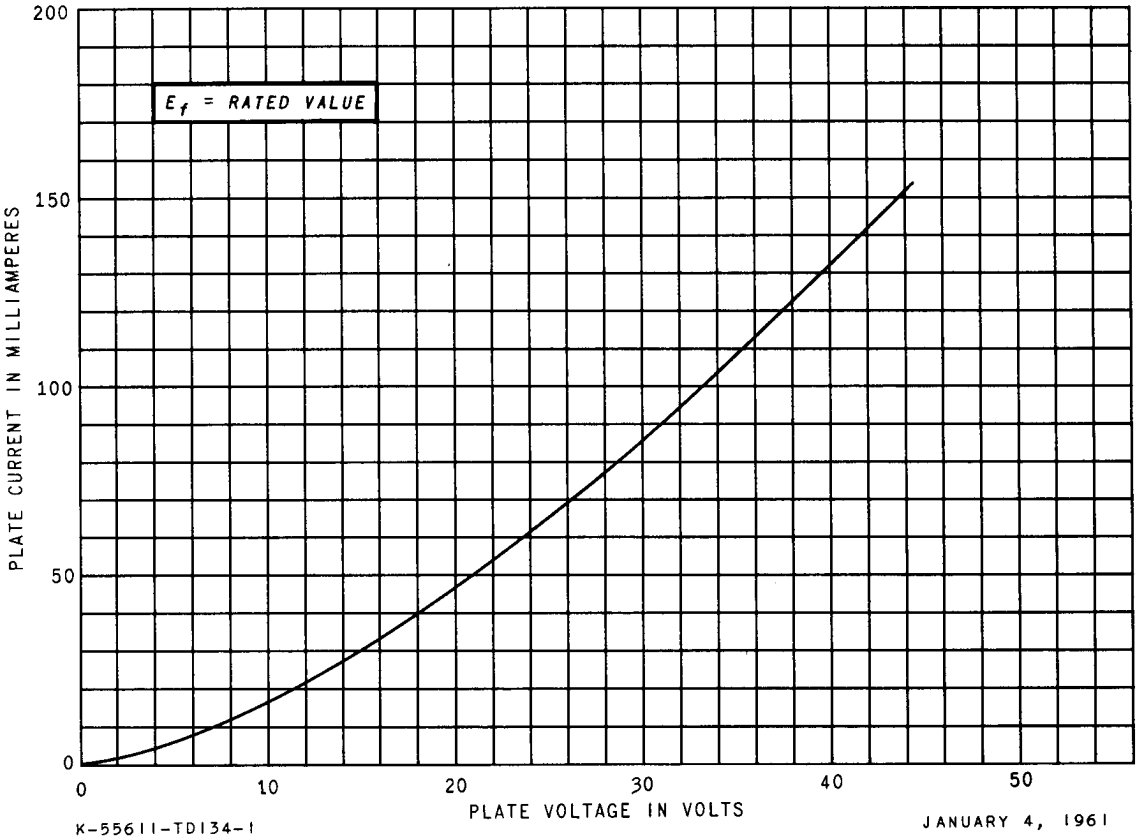
‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

2/18/63 (B)
Supersedes 11/29/62 (B)

Z-2689

AVERAGE PLATE CHARACTERISTICS



RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

OBJECTIVE FOR DEVELOPMENTAL TYPE

Z-2692*

CERAMIC-GLOW DISCHARGE DIODE

For Voltage-Reference Applications

The Z-2692 is a ceramic, cold-cathode, glow-discharge diode designed for voltage-reference service in electronically regulated d-c power supplies. The Z-2692 is especially suited for use where unfavorable conditions of temperature, mechanical shock, and mechanical vibration are encountered.

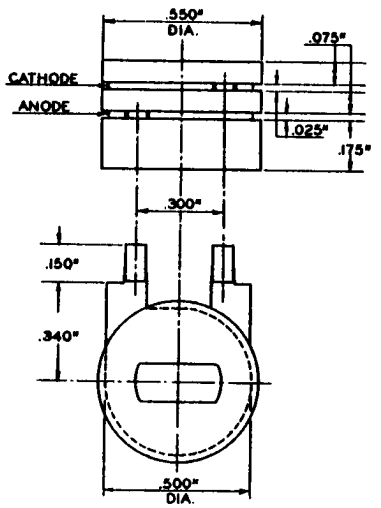
GENERAL

Electrical

Cathode - Cold

Mechanical

Mounting Position - Any
Outline Drawing



MAXIMUM RATINGS

Absolute-Maximum Values

DC Cathode Current		
Maximum	10	Milliamperes
Minimum	1.0	Milliamperes
Envelope Temperature	300	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

AVERAGE CHARACTERISTICS

Anode Voltage Drop		
Anode Current 1.5 Milliamperes	83.0±0.5	Volts
Anode Current 2.5 Milliamperes	83.5±0.5	Volts
Anode Current 3.5 Milliamperes	84.0±0.5	Volts
Anode Current 5.0 Milliamperes	85.0±0.5	Volts
Anode Current 10 Milliamperes	87.0±0.5	Volts
Anode Breakdown Voltage		
In Ambient Light, maximum	125	Volts
In Total Darkness, maximum	125	Volts
Regulation, maximum		
Anode Current 1.0 to 10 Milliamperes	5	Volts
Anode Current 1.5 to 3.5 Milliamperes	1.0	Volts
Voltage Jump, maximum+		
Anode Current 1.0 to 10 Milliamperes	5	Millivolts

Drift, maximum			
Envelope Temperature	50C	300C	
During First 24 Hours of Operation			
Anode Current			
2.5 Milliamperes	100	100	Millivolts
5.0 Milliamperes	100	1000	Millivolts
From 24 Hours to 100 Hours of Operation			
Anode Current			
2.5 Milliamperes	50	50	Millivolts
5.0 Milliamperes	50	250	Millivolts

AVERAGE CHARACTERISTICS (Continued)

	50C	300C	
From 100 Hours to 1000 Hours of Operation			
Anode Current			
2.5 Milliamperes	200	200	Millivolts
5.0 Milliamperes	250	500	Millivolts
From 1000 Hours to End of Life			
2.5 Milliamperes	100	500	Millivolts per 1000 Hours
5.0 Milliamperes	150	1000	Millivolts per 1000 Hours
Repeatability, maximum‡			
Anode Current 5.0 Milliamperes		100	Millivolts
Temperature Coefficient of Operating Voltage, average			
-50C to +25C		-10	Millivolts per Degree C
25C to 300C		-3	Millivolts per Degree C
300C to 500C		-3	Millivolts per Degree C

SPECIAL TESTS AND RATINGS

Shock Rating - 720G
Statisitcal sample subjected to five impact accelerations of 720G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

Fatigue Rating - 10G
Statistical sample subjected to vibrational acceleration of 10G for 48 hours minimum in each of two different positions. The sinusoildal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

Altitude Rating - 100000 Feet
Statistical sample subjected to pressure of 8.0 millimeters of mercury to evaluate and control arcing and corona.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

\+ Voltage jump is defined as a sudden jump in anode voltage drop when the operating current is varied slowly over the specified operating range.

‡ Repeatability is defined as the maximum change in anode voltage drop between successive firings of the tube.

12/8/61 (B)
Supersedes 6/27/61 (B)

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

OBJECTIVE FOR DEVELOPMENTAL TYPE

Z-2731*

DIODE

The Z-2731 is a single, heater-cathode diode of ceramic and metal planar construction. The tube is intended for application as a power rectifier.

GENERAL

Electrical

Cathode - Coated Unipotential

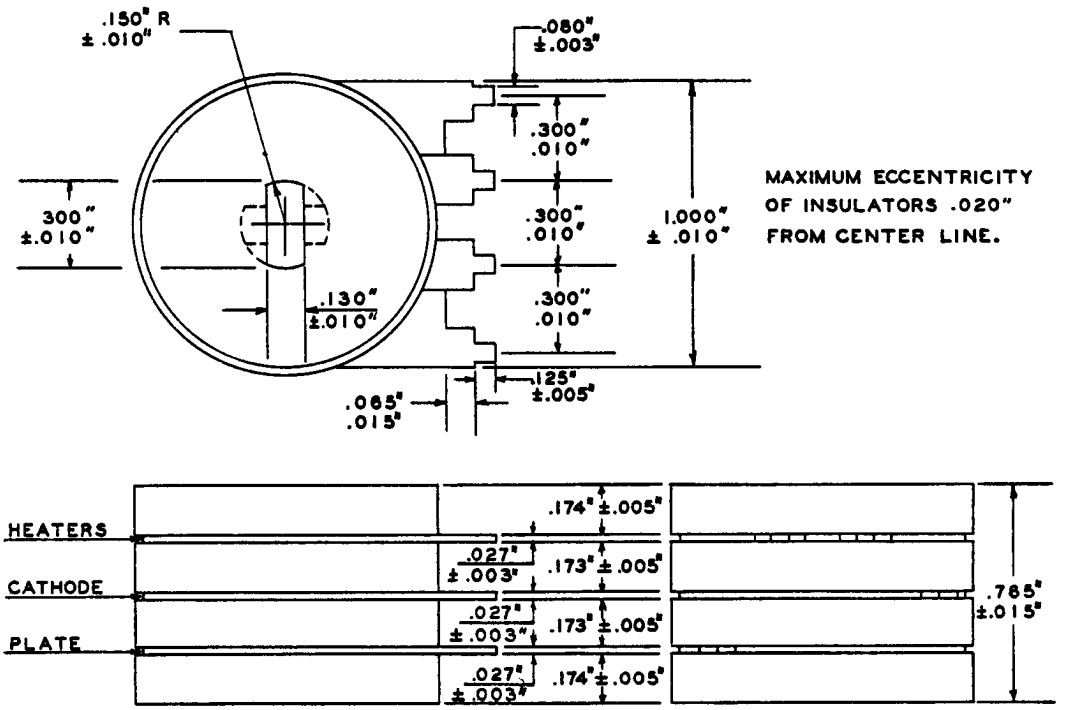
Heater Characteristics and Ratings

	Heater Voltage, AC or DC	6.3±0.6	Volts
→	Heater Current	1.0	Amperes

Mechanical

Operating Position - Any

→ Outline Drawing



MAXIMUM RATINGS

Rectifier Service - Absolute-Maximum Values+

Peak Inverse Plate Voltage	1000	Volts
AC Plate-Supply Voltage per Plate - See Rating Chart I		
→ Steady-State Peak Plate Current per Plate	1.1	Amperes
→ Transient Peak Plate Current per Plate, Maximum Duration 0.2 Second	5.5	Amperes
DC Output Current - See Rating Chart I		
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	300	Volts
Heater Negative with Respect to Cathode	300	Volts
Envelope Temperature at Hottest Point	Ø	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

→ Half-Wave Rectifier with Capacitor-Input Filter

AC Plate-Supply Voltage, RMS	250	Volts
Filter Input Capacitor	50	Microfarads
Total Plate-Supply Resistance	18	Ohms
DC Output Current	125	Milliamperes
DC Output Voltage at Filter Input	260	Volts
→ Tube Voltage Drop Ib = 300 Milliamperes	37	Volts

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

\+ To simplify the application of the maximum ratings to circuit design, the Absolute-Maximum ratings are presented in chart form as Rating Charts I, II, and III. Rating Chart I presents the maximum ratings for a-c plate-supply voltage and d-c output current. Rating Chart II provides a convenient method for checking conformance with the maximum steady-state peak-plate-current rating. Rating Chart III offers a convenient method for checking conformance with the maximum transient peak-plate-current rating. Rating Chart I applies to both capacitor-input and choke-input filters, while Rating Charts II and III apply to capacitor-input filters only.

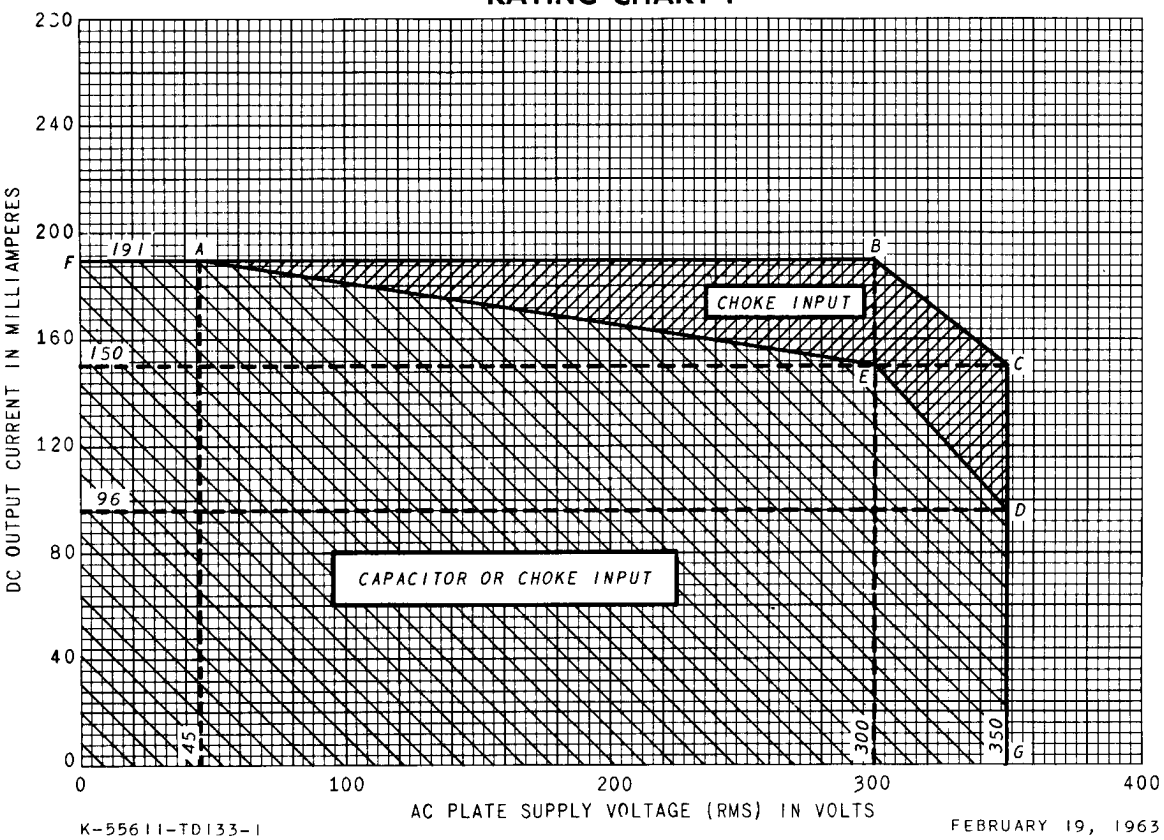
Operating points should be so selected that the boundary limits of a-c plate-supply voltage and d-c output current on Rating Chart I, and maximum d-c output current per plate and rectification efficiency on Rating Chart II, are not exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, and environmental conditions. On Rating Chart I the boundary FAEDG defines the limits for capacitor-input filter operation, and the boundary FABCDG defines the limits for choke-input filter operation.

Rating Chart III shows the minimum value of plate-supply resistance (Rs) required to remain within the transient peak-plate-current rating. The value of Rs should be such that it lies to the left of the line on Rating Chart III at the highest probable value of line voltage.

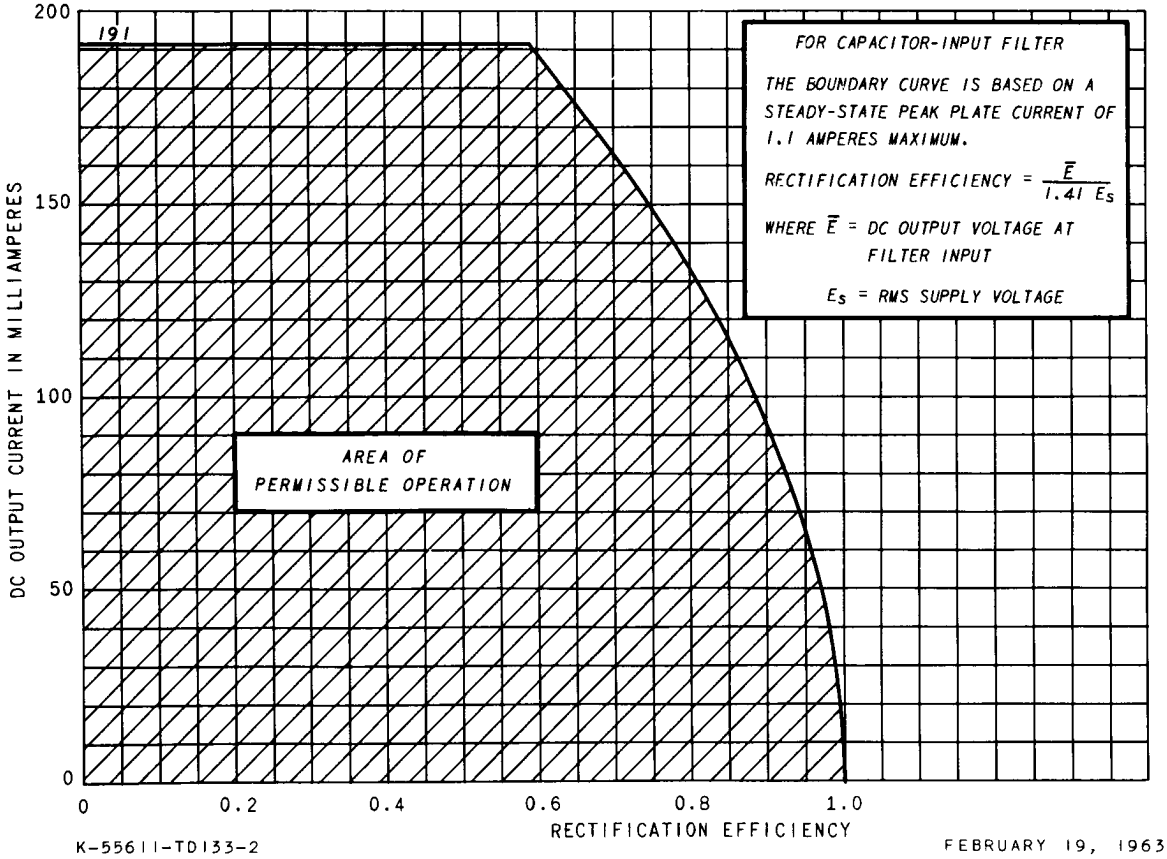
Ø To be determined.

2/19/63 (B)
Supersedes 12/7/61 (B)

RATING CHART I



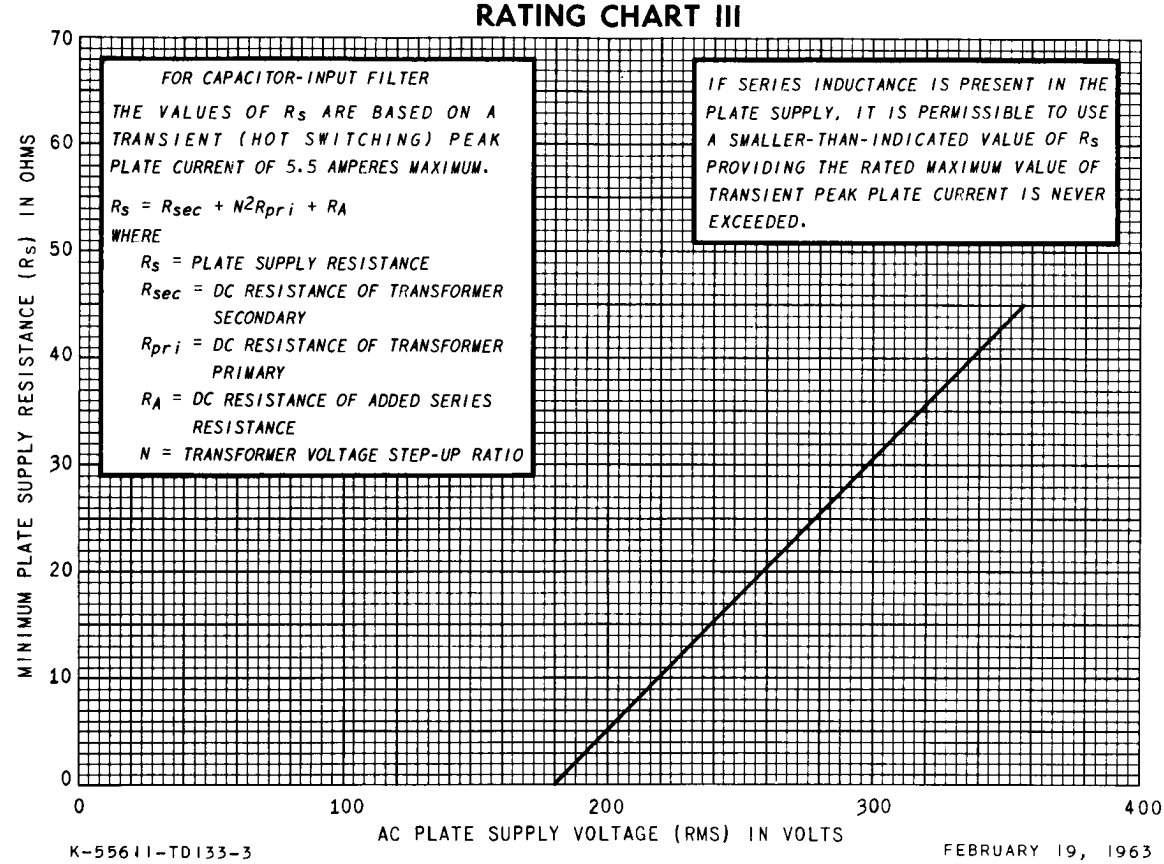
RATING CHART II



K-55611-TD133-2

FEBRUARY 19, 1963

RATING CHART III

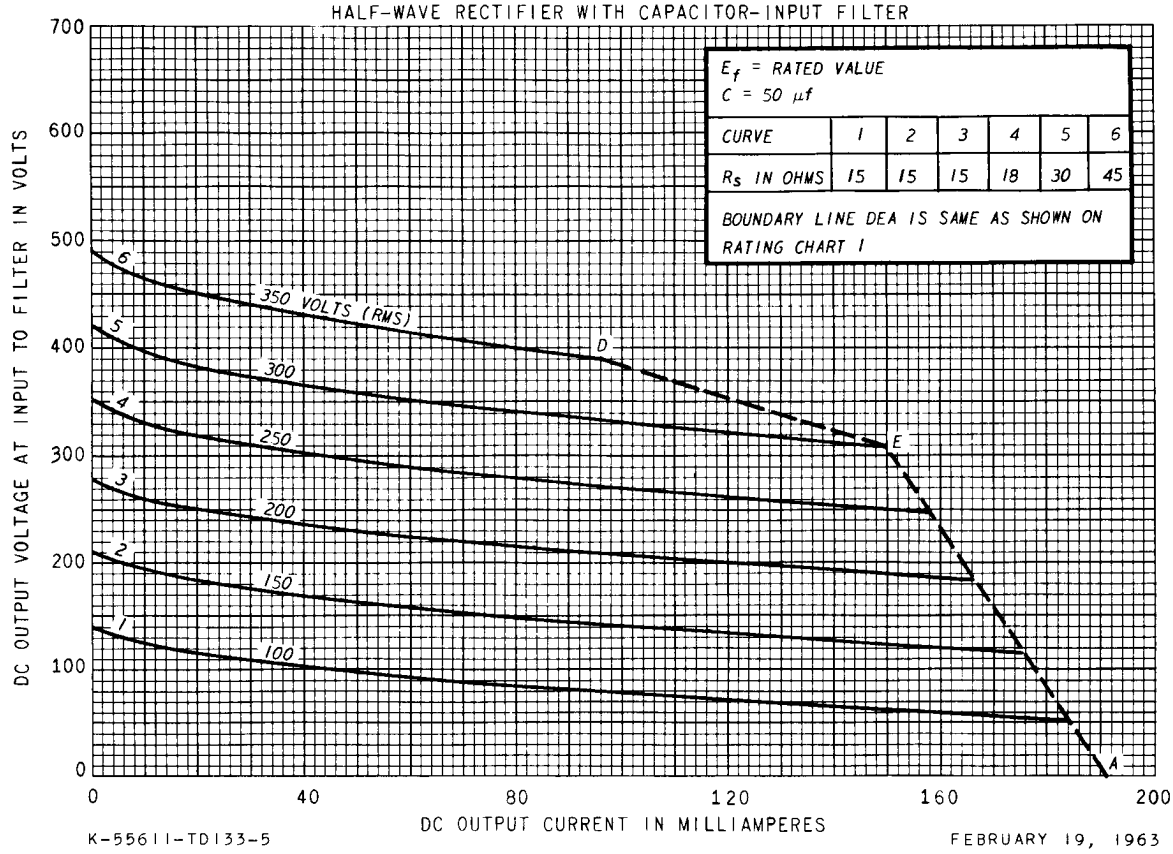


K-55611-TD133-3

FEBRUARY 19, 1963

OPERATION CHARACTERISTICS

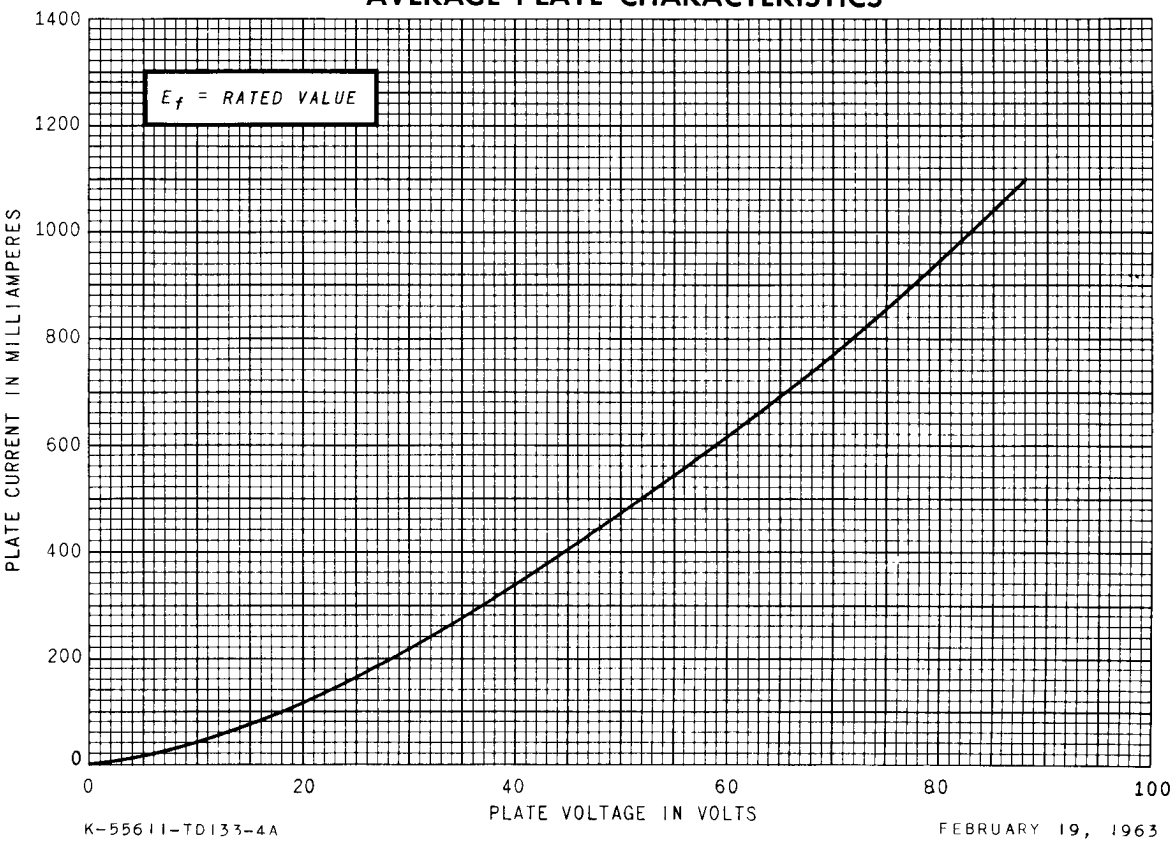
HALF-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER



K-55611-TD133-5

FEBRUARY 19, 1963

AVERAGE PLATE CHARACTERISTICS



K-55611-TD133-4A

FEBRUARY 19, 1963

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

OBJECTIVE FOR DEVELOPMENTAL TYPE

Z-2835*

TRIODE

The Z-2835 is a high-mu triode of ceramic-and-metal planar construction. The tube is intended for radio-frequency oscillator and power-amplifier applications.

GENERAL

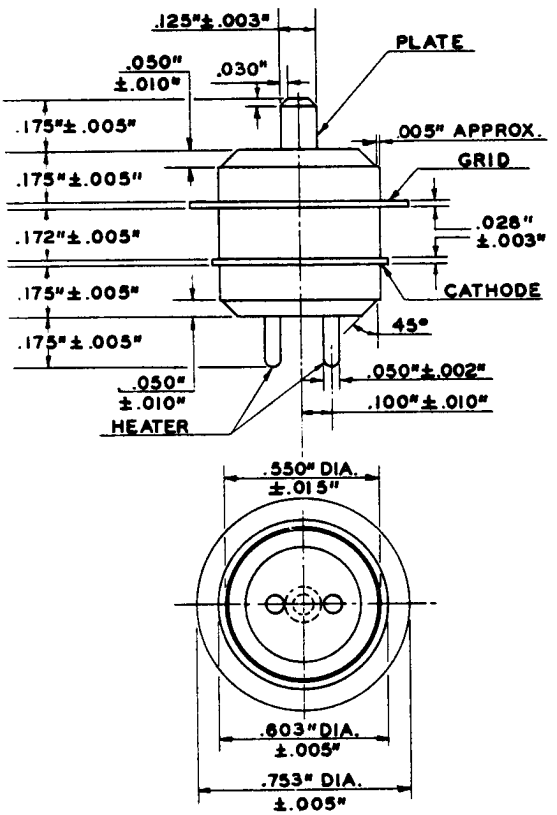
Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC+	6.3±0.3	Volts
Heater Current‡	0.4	Amperes
Direct Interelectrode Capacitances§		
→ Grid to Plate: (g to p)	1.4	pf
→ Grid to Cathode and Heater: g to (h + k)	5.1	pf
Plate to Cathode and Heater: p to (h + k)	0.03	pf
Heater to Cathode: (h to k)	2.4	pf

Mechanical

Operating Position - Any



MAXIMUM RATINGS

Absolute-Maximum Values

Plate Voltage	330	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	50	Volts
Plate Dissipation	5.5	Watts
DC Grid Current	10	Milliamperes
DC Cathode Current	30	Milliamperes
Peak Cathode Current	120	Milliamperes
eater-Cathode Voltage		
Heater Positive with Respect to Cathode	50	Volts
Heater Negative with Respect to Cathode	50	Volts
Grid Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.18	Megohms
Bulb Temperature at Hottest Point	250	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics

Plate Voltage	200	Volts
Cathode-Bias Resistor	68	Ohms
Amplification Factor	90	
Plate Resistance, approximate	5450	Ohms
Transconductance	16500	Micromhos
Plate Current	17	Milliamperes
Grid Voltage, approximate		
Ib = 10 Microamperes	-5.5	Volts

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

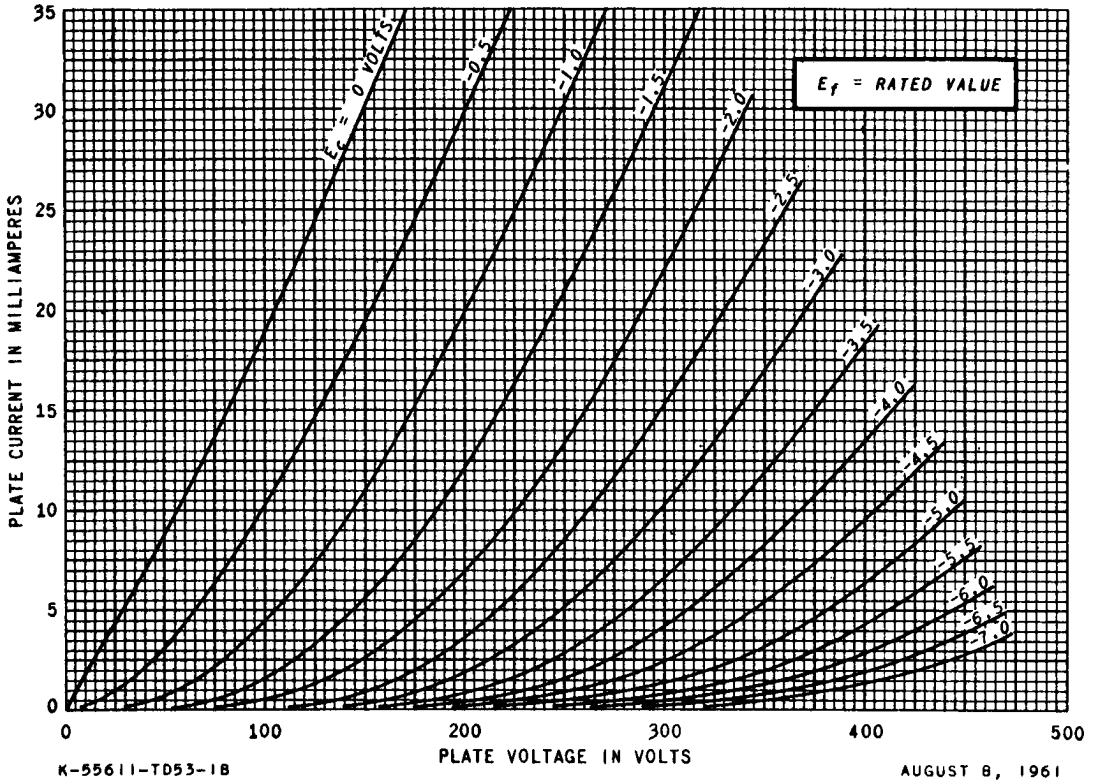
\+ The equipment designer should design the equipment so that the heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

2/15/63 (B)
Supersedes 12/7/61 (B)

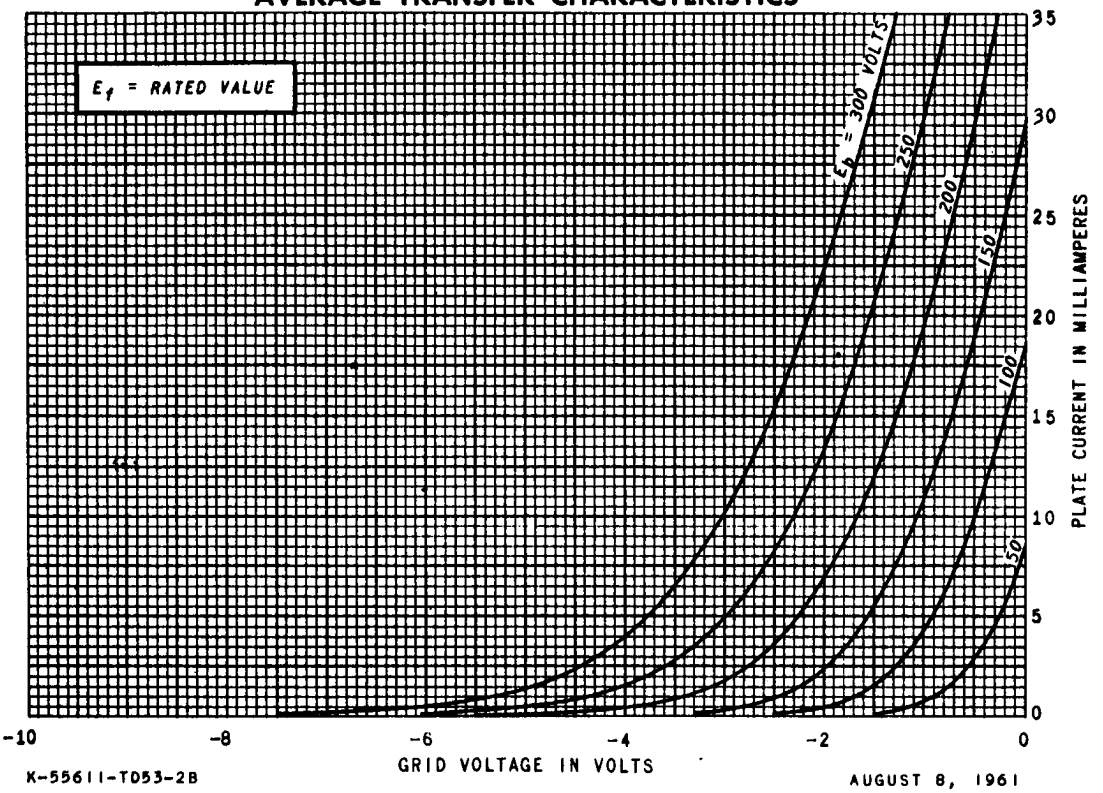
AVERAGE PLATE CHARACTERISTICS



K-55611-TD53-1B

AUGUST 8, 1961

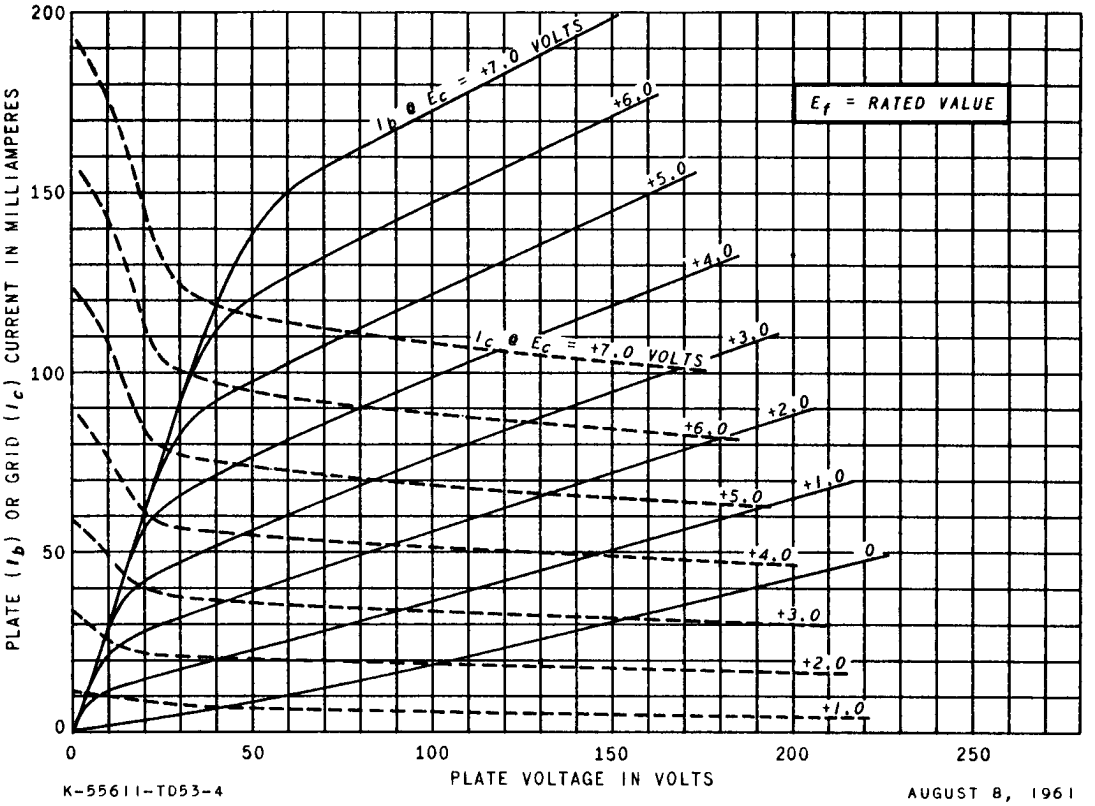
AVERAGE TRANSFER CHARACTERISTICS



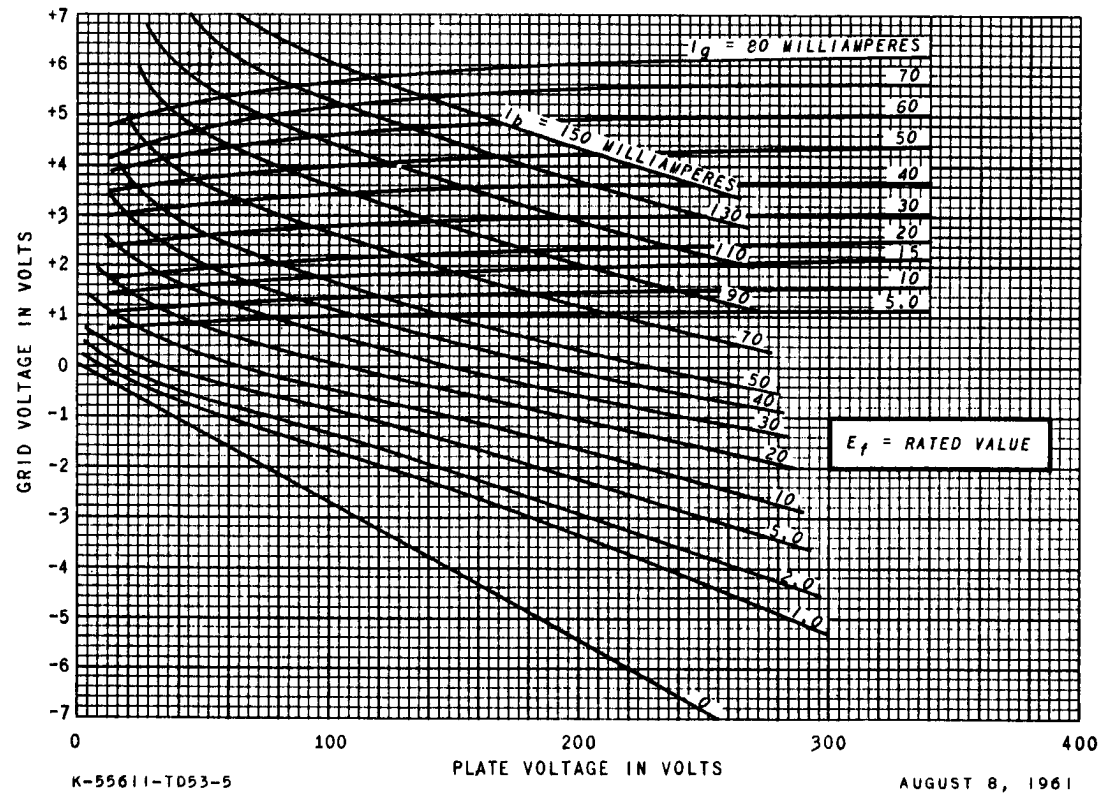
K-55611-TD53-2B

AUGUST 8, 1961

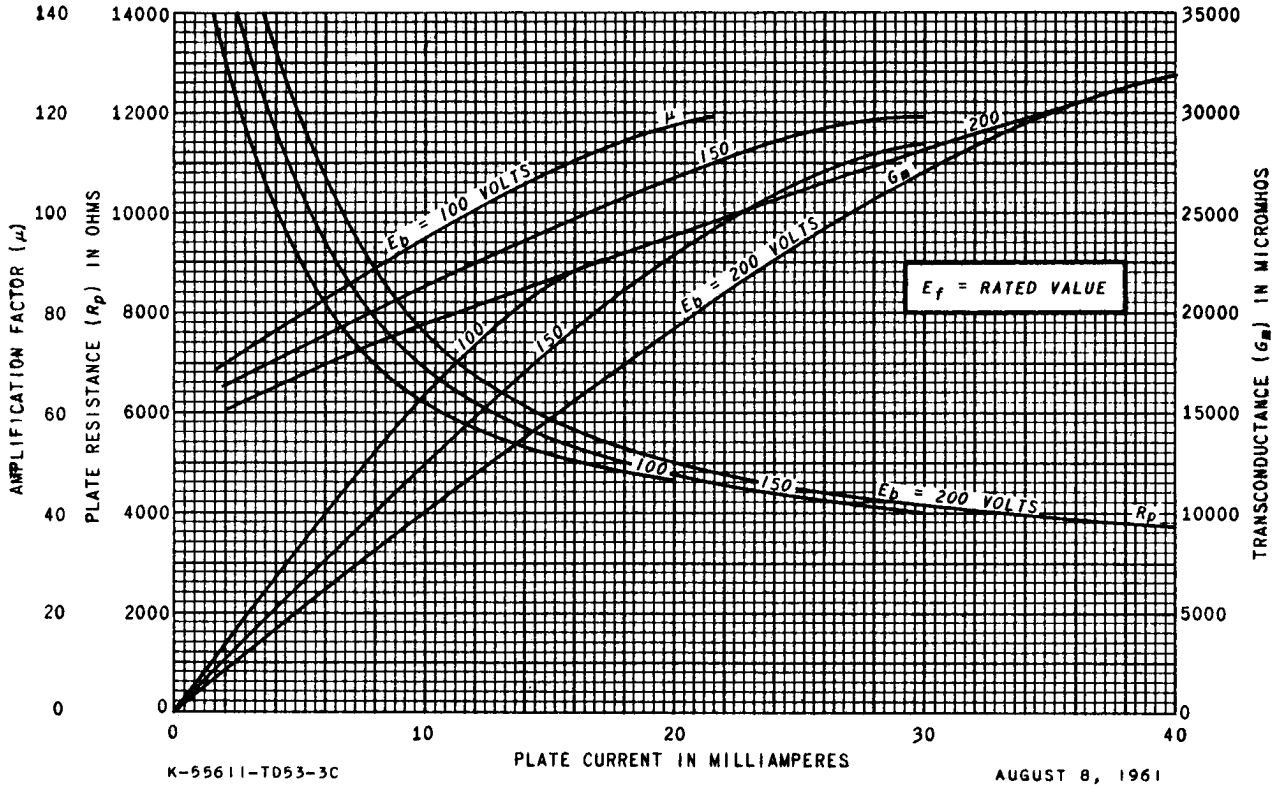
AVERAGE PLATE CHARACTERISTICS



AVERAGE CONSTANT-CURRENT CHARACTERISTICS



AVERAGE CHARACTERISTICS



OBJECTIVE FOR DEVELOPMENTAL TYPE

Z-5099-A*

PLANAR TRIODE

The Z-5099-A is a high-mu triode for use in grounded-grid Class C power amplifiers, oscillators, or frequency multipliers at frequencies up to 2500 megacycles. Typical power output is 19 watts at 2500 megacycles and 40 watts at 500 megacycles. The metal-ceramic construction permits the tube to withstand shock tests at 400G. The specially designed radiator enables the plate to dissipate 100 watts with conduction cooling when a heat sink sufficient to limit the seal temperature to 200 C maximum is used.

The Z-5099-A features graduated-diameter disk seals for maximum efficiency in cavity and parallel-line circuits thus assuring both low lead inductances and electrode isolation. Other features include high transconductance and low interelectrode capacitances.

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC+	6.3	Volts
Heater Current‡	1.0	Amperes
Cathode Heating Time, minimum	60	Seconds
Direct Interelectrode Capacitances§		
Grid to Plate	2.0	pf
Grid to Cathode	6.5	pf
Plate to Cathode, maximum	0.029	pf

Mechanical

Mounting Position - Any

Maximum Diameter	1 59/64	Inches
Maximum Over-all Length	2 43/64	Inches

Radiator may be used as a mounting flange. Plate, grid, cathode finger contacts, and radiator mounting must be sufficiently flexible to allow for maximum eccentricities and tilt.

Net Weight, approximate	3.5	Ounces

Cooling

Plate and Plate Seal - Conduction or Forced Air

Grid and Cathode Seals - Conduction or Forced Air

Radiator must be securely fastened to an appropriate heat sink to limit seal to maximum temperature under operating conditions.

Maximum Temperature of Any Seal	200	C

MAXIMUM RATINGS

Absolute-Maximum Values

Radio-Frequency Power Amplifier or Oscillator - Class C Telegraphy

Key-Down Conditions per Tube Without Amplitude Modulation

Heater Voltage	+	
DC Plate Voltage	1000	Volts
DC Cathode Current	125	Milliamperes
Negative DC Grid Voltage	150	Volts
Peak Positive RF Grid Voltage	30	Volts
Peak Negative RF Grid Voltage	400	Volts
DC Grid Current	50	Milliamperes
Plate Dissipation	100	Watts
Grid Dissipation	2.0	Watts
Frequency	2500	Megacycles

Radio-Frequency Power Amplifier or Oscillator - Class C Telephony

Carrier Conditions per Tube for Use With a Maximum Modulation Factor of 1.0

Heater Voltage	+	
DC Plate Voltage¶	600	Volts
DC Cathode Current	100	Milliamperes
Negative DC Grid Voltage	150	Volts
Peak Positive RF Grid Voltage	30	Volts
Peak Negative RF Grid Voltage	400	Volts
DC Grid Current	50	Milliamperes
Plate Dissipation	70	Watts
Grid Dissipation	2.0	Watts
Frequency	2500	Megacycles

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics

Plate Voltage	600	Volts
Plate Current	70	Milliamperes
Amplification Factor	100	
Transconductance	24000	Micromhos

CHARACTERISTICS AND TYPICAL OPERATION (Continued)

Class C Oscillator, Grid Return Circuit

Frequency	500	2500	Megacycles
DC Plate Voltage	900	1000	Volts
DC Cathode Current	120	117	Milliamperes
DC Grid Current	30	27	Milliamperes
DC Grid Voltage	-40	-22	Volts
Useful Power Output	40	19	Watts

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

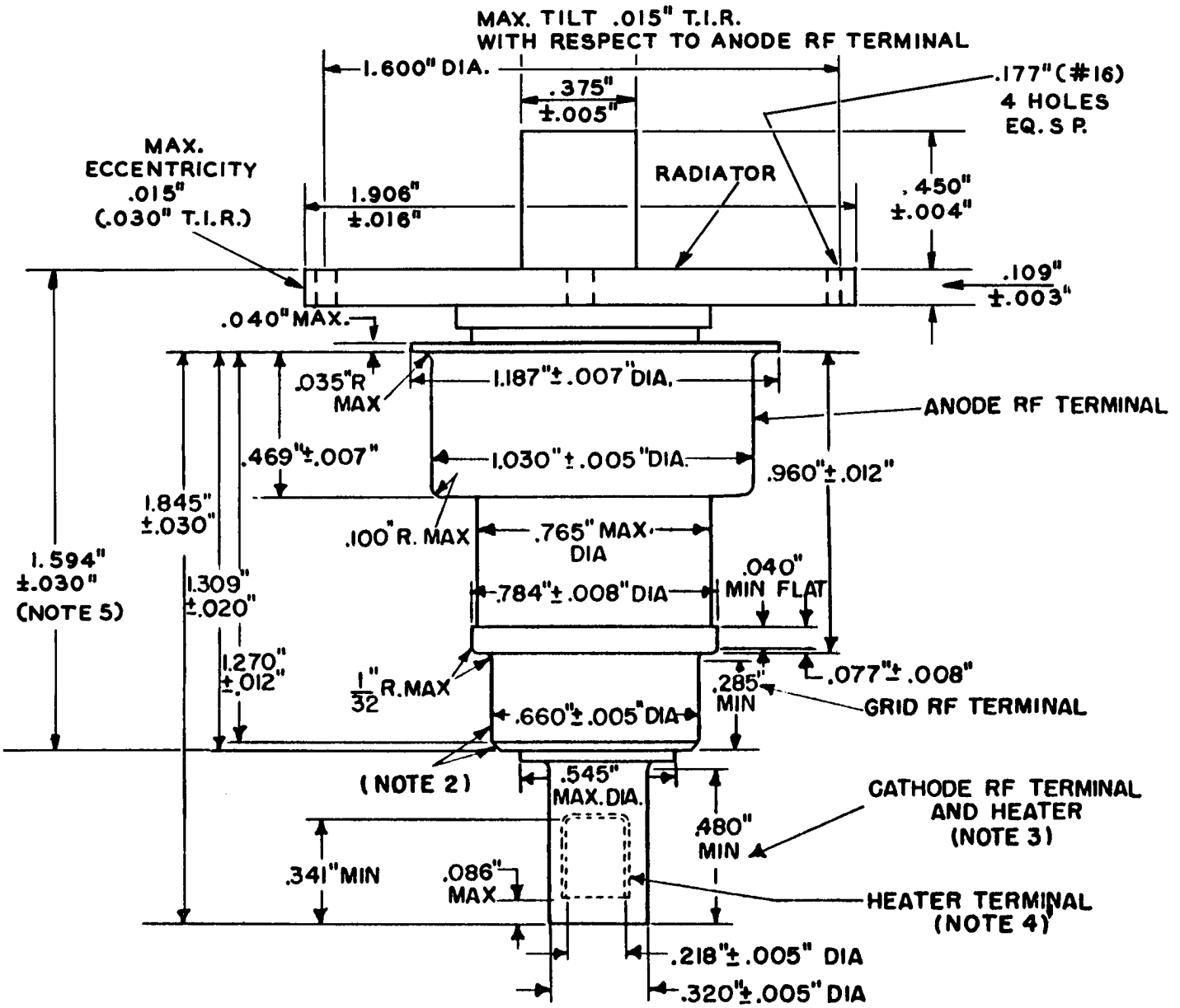
\+ The Z-5099-A operates at frequencies where it is necessary to consider transit-time effects of the electron current. The principal effects influencing tube operation are the decrease in power output and operating efficiency with increase in frequency, and the bombardment and heating of the cathode by electrons from the region of the grid, which can be severe enough to result in short tube life and erratic operation. Operating frequency, circuit design and adjustment, grid bias, and grid current contribute to the degree of cathode bombardment. There is an optimum heater voltage which will maintain the cathode at the correct operating conditions. If the conditions of operation result in appreciable cathode back-heating, it may be necessary to start dynamic tube operation at normal heater voltage, followed by a reduction of heater voltage to the proper value. A maximum variation of plus or minus five percent in heater voltage is recommended where extended tube life is a factor.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Measured in a special shielded socket.

¶ For modulation factors less than 1.0, a higher d-c plate voltage may be used if the sum of the peak positive audio voltage and the d-c plate voltage does not exceed 1200 volts.

2/15/63 (B)
Supersedes 9/20/62 (B)



NOTES:

1. External metal parts plated with 30 MSI minimum of copper and/or silver.
2. Solder not to extend radially beyond RF terminal.
3. The cathode RF terminal and grid RF terminal concentric with respect to the anode terminal within 0.020" (runout within 0.040").
4. The heater terminal concentric with respect to the cathode RF terminal within 0.012" (runout within 0.024").
5. Measure at two diametrically opposite points and average reading.

OBJECTIVE FOR DEVELOPMENTAL TYPE

Z-5267*

PLANAR TETRODE

The Z-5267 is a planar tetrode primarily designed for grounded-grid radio-frequency power amplifier or oscillator service at frequencies to 3000 mc and beyond.

The Z-5267 combines small interelectrode spacings with a thermally stable electrode structure and low lead inductance. The envelope and electrode terminals are designed for efficient utilization of cavity resonators at the higher frequencies and of line-type and lumped-constant circuits at the lower frequencies.

GENERAL

Electrical

Cathode - Coated Unipotential

Heater Characteristics and Ratings		
Heater Voltage, AC or DC+	6.3±0.3	Volts
Heater Current‡	1.9	Amperes
Cathode Heating Time, minimum	2	Minutes
Direct Interelectrode Capacitances, approximate§		
Grid-Number 2 to Plate	4	pf
Grid-Number 1 to Cathode	18	pf
Grid-Number 1 to Grid-Number 2	30	pf

Mechanical

Mounting Position - Any

Net Weight, approximate	4	Ounces
→ Envelope Temperature, maximum	300	C

Cooling-Forced Air

MAXIMUM RATINGS

Absolute-Maximum Values
Radio-Frequency Power Amplifier and Oscillator - Class C Telegraphy

DC Plate Voltage	1000	Volts
DC Screen Voltage	325	Volts
DC Grid-Number 1 Voltage	-20	Volts
DC Plate Current	175	Milliamperes
DC Grid-Number 1 Current	35	Milliamperes
DC Cathode Current	200	Milliamperes
Plate Input	175	Watts
Plate Dissipation	140	Watts
Screen Dissipation	3.0	Watts

Pulsed Operation

Ratings have not been determined. As a guide, peak plate voltages up to 3 kilovolts and peak cathode currents up to 7.5 amperes may be considered, depending upon duty cycle. For grid-pulsed operation care should be taken that the maximum screen dissipation is not exceeded. The screen may be pulsed up to 800 volts positive.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Average Characteristics

Plate Voltage	1000	Volts
Screen Voltage	300	Volts
Grid-Number 1 Voltage	-1.2	Volts
Transconductance	60000	Micromhos
Amplification Factor (G_1 to G_2)	60	
Plate Current	160	Milliamperes

Radio-Frequency Power Amplifier - 3000 Megacycles

DC Plate Voltage	1000	800	800	Volts
DC Screen Voltage	300	250	250	Volts
DC Grid-Number 1 Voltage	-6.0	-3.0	-2.0	Volts
DC Plate Current	160	160	160	Milliamperes
DC Screen Current	8.0	6.0	7.0	Milliamperes
DC Grid-Number 1 Current, approximate	25	10	8	Milliamperes
Driving Power, approximate	7	2.3	0.8	Watts
Useful Power Output, approximate	40	20	10	Watts
Bandwidth, approximate	25	---	---	Megacycles

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

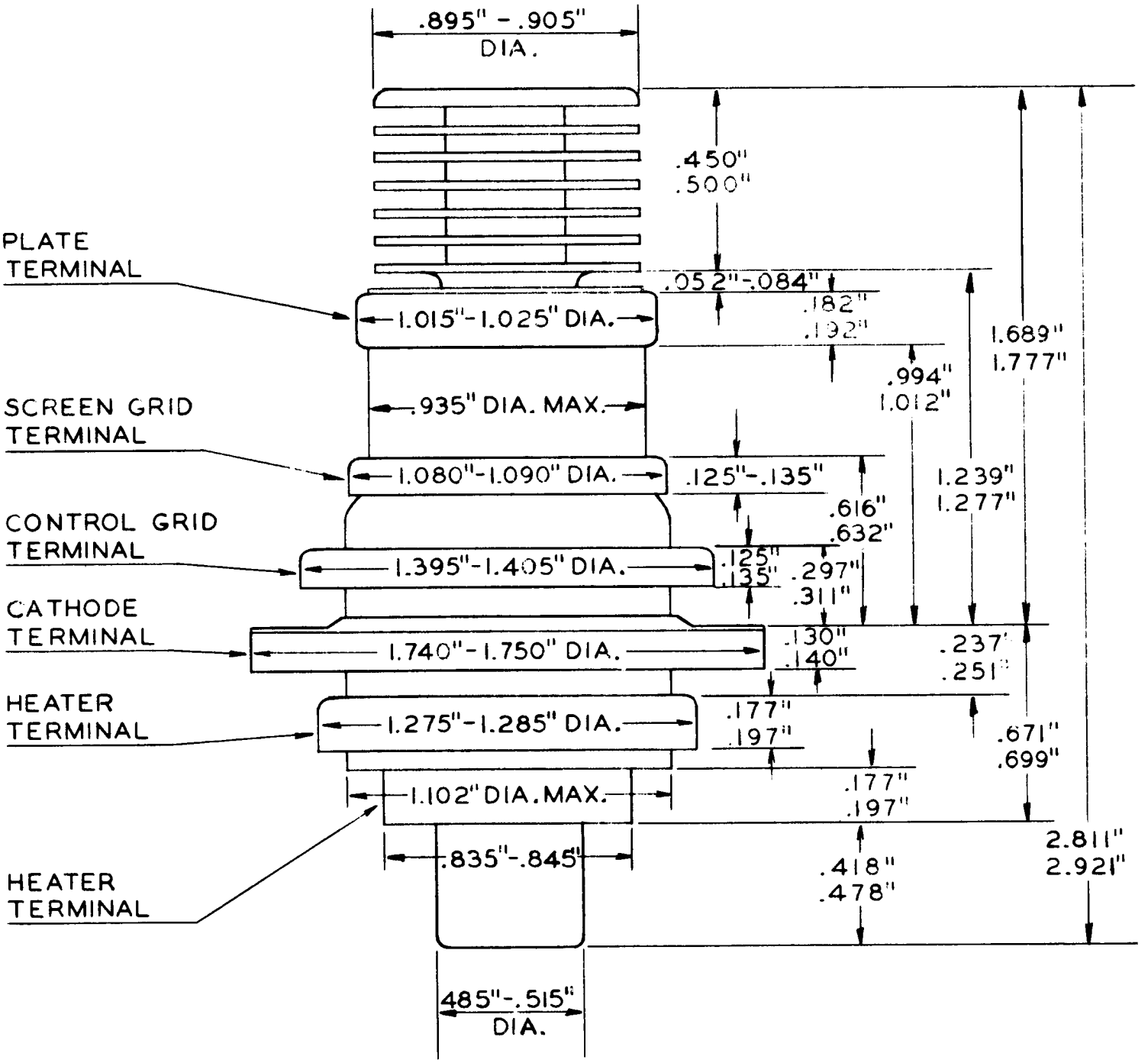
\+ Lower voltages may be used to improve the life at low-cathode-current levels. For specific recommendations, contact your General Electric tube sales representative.

‡ Heater current of a bogey tube at Ef = 6.3 volts.

§ Without external shield.

8/14/62 (B)
Supersedes 7/30/62 (B)

Z-5267


.895" - .905"
DIA.
.450"
.500"
PLATE
TERMINAL
1.015"-1.025" DIA.
.052"-.084"
.182"
.192"
1.689"
1.777"
.994"
1.012"
.935" DIA. MAX.
SCREEN GRID
TERMINAL
1.080"-1.090" DIA.
.125"-.135"
.616"
.632"
1.239"
1.277"
CONTROL GRID
TERMINAL
1.395"-1.405" DIA.
.125"
.135"
.297"
.311"
CATHODE
TERMINAL
1.740"-1.750" DIA.
.130"
.140"
.237"
.251"
HEATER
TERMINAL
1.275"-1.285" DIA.
.177"
.197"
.671"
.699"
1.102" DIA. MAX.
.177"
.197"
.835"-.845"
.418"
.478"
2.811"
2.921"
HEATER
TERMINAL
.485"-.515"
DIA.

OBJECTIVE FOR DEVELOPMENTAL TYPE

Z-5317*

PLANAR TRIODE

The Z-5317 is a high-mu, metal-and-ceramic planar triode intended for operation as a CW, radio-frequency power amplifier or frequency multiplier. The Z-5317 is a low-frequency, CW version of the 6442.

GENERAL

Electrical

Cathode-Indirectly Heated

Heater Characteristics and Ratings		
Heater Voltage, AC or DC	$6.3^{+5\%}_{-10\%}$	Volts
Heater Current	0.75	Amperes

Direct Interelectrode Capacitances, approximate

	Minimum	Bogey	Maximum	
Grid to Plate	2.10	2.3	2.45	pf
Grid to Cathode, Eh = 0	4.60	5.1	5.45	pf
Plate to Cathode, Eh = 0	---	0.035	0.045	pf

Mechanical

Operating Position - Any		
Cooling - Conduction and Convection		
Envelope Temperature	175	C
Net Weight, approximate	1	Ounces

MAXIMUM RATINGS

Absolute-Maximum Values

Radio-Frequency Power Amplifier and Oscillator - Class C Telegraphy

Key-down Conditions per Tube Without Amplitude Modulation+

Frequency	1000	Megacycles
DC Plate Voltage	350	Volts
Negative DC Grid Voltage	50	Volts

MAXIMUM RATINGS (Continued)

DC Plate Current	35	Milliamperes
DC Grid Current	15	Milliamperes
Plate Dissipation	8.0	Watts
Peak Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	90	Volts
Heater Negative with Respect to Cathode	90	Volts
Envelope Temperature at Hottest Point	175	C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Class A_1 Amplifier

	Minimum	Bogey	Maximum	
Plate Voltage	---	---	350	Volts
DC Grid Bias, approximate	-1.5	-3.5	-5.25	Volts
Amplification Factor, approximate, Ec/Ib = 35 ma d-c	35	50	65	
Transconductance	13500	16500	19000	Micromhos
Plate Current	---	---	35	Milliamperes

Radio-Frequency Power Amplifier - Class C Telegraphy

Frequency	1000	Megacycles
DC Plate Voltage	350	Volts
DC Plate Current	35	Milliamperes
DC Grid Current	8.0	Milliamperes
Useful Power Output	5.0	Watts

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

\+ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier conditions.

2/19/63 (B)
Supersedes 5/22/59 (B)

REFERENCE NOTES FOR OUTLINE DRAWING

Note 1. Applies to minimum surface for anode d-c and r-f terminal only. Other surfaces must not be used for these terminal purposes.

Note 2. Applies to minimum surface for grid d-c and r-f terminal only. Other surfaces, except for Notes 3 and 4, must not be used for terminal purposes.

Note 3. Applies to minimum surfaces for grid d-c and r-f terminal only.

Note 4. The cylindrical surface of this diameter may be used for grid d-c and r-f terminal purposes.

Note 5. The surfaces defined by Notes 2, 3, and 4 must be the only surfaces used for tube stops and clamping purposes.

Note 6. Other surfaces must not be used for cathode d-c and r-f terminal purposes.

Note 7. Other surfaces must not be used for anode d-c and r-f terminal purposes.

Note 8. Applies to surface designated for cathode d-c and r-f terminal. Solder at brazed joint will not exceed the maximum diameter.

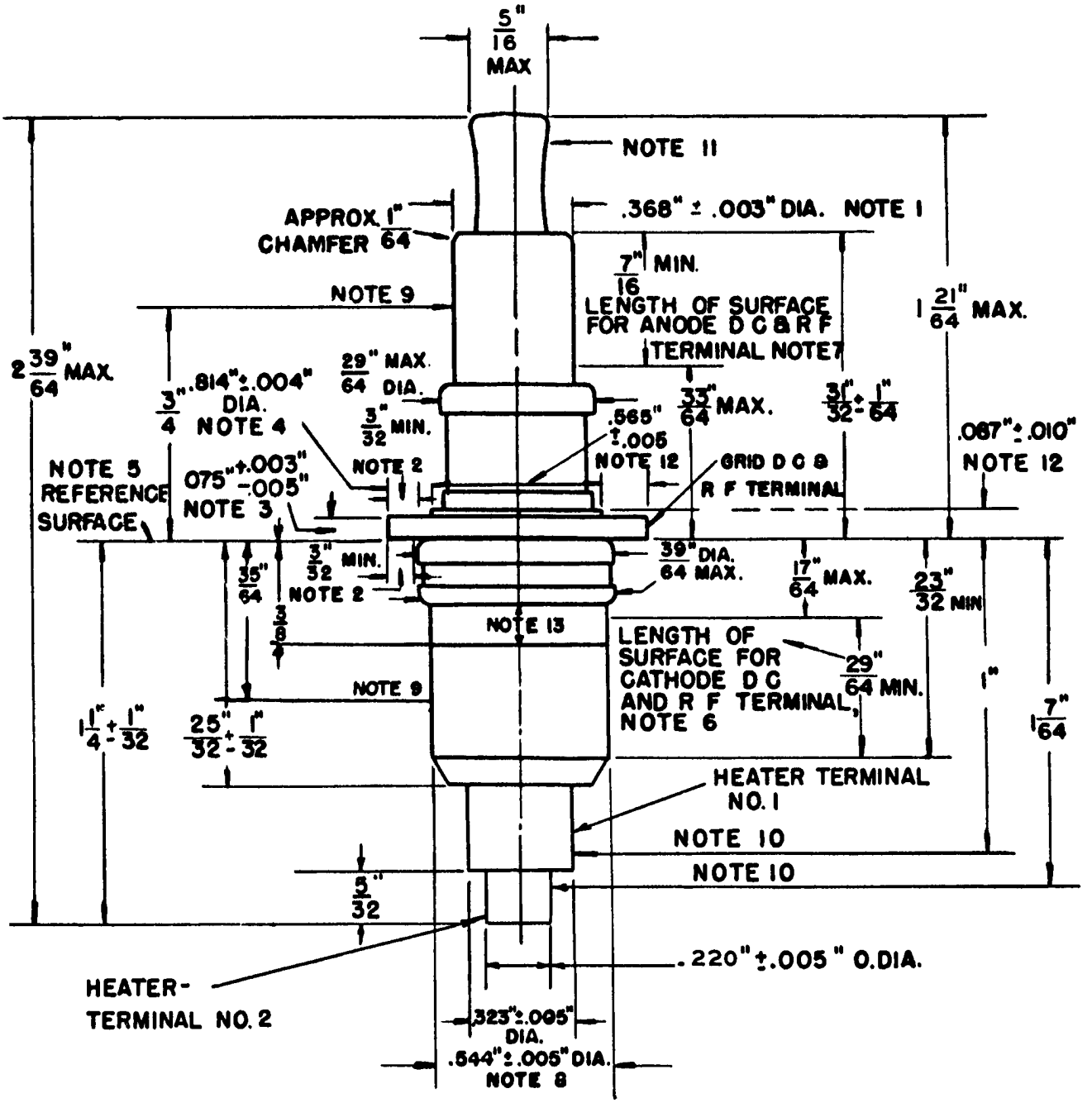
Note 9. The maximum eccentricity of the anode and cathode with respect to the grid terminal in a prescribed jig is 0.010 (or maximum total runout of 0.020) and is measured by indicators at the points designated.

Note 10. The maximum eccentricity of heater-terminal No. 1 and heater-terminal No. 2 with respect to the grid terminal in a prescribed jig is 0.015 (or maximum total runout of 0.030) and is measured by indicators at the points designated.

Note 11. Exhaust tubulation must not be subjected to any mechanical stress.

Note 12. For reference only. Dimension does not include any possible solder fillet.

Note 13. This area is reserved for tube stamping and coding.


5/16 MAX
NOTE 11
APPROX. 1/64 CHAMFER
.368" ± .003" DIA. NOTE 1
7/16 MIN.
LENGTH OF SURFACE FOR ANODE D C & R F TERMINAL NOTE 7
NOTE 9
1 21/64" MAX.
2 39/64" MAX.
3/4" DIA. NOTE 4
.814" ± .004"
29/64" MAX. DIA.
3/32" MIN.
33/64" MAX.
31/32" ± 1/64
.565" ± .005 NOTE 12
.087" ± .010" NOTE 12
NOTE 5 REFERENCE SURFACE
.075" +.003" -.005" NOTE 3
NOTE 2
GRID D C & R F TERMINAL
3/32" MIN.
39/64" DIA. MAX.
17/64" MAX.
23/32" MIN
35/64
NOTE 2
3/8
NOTE 13
LENGTH OF SURFACE FOR CATHODE D C AND R F TERMINAL, NOTE 6
29/64" MIN.
1"
1 7/64"
NOTE 9
1 1/4 ± 1/32
25/32 ± 1/32
HEATER TERMINAL NO. 1
NOTE 10
NOTE 10
5/32
.220" ± .005" O.DIA.
HEATER-TERMINAL NO. 2
.323" ± .005" DIA.
.544" ± .005" DIA.
NOTE 8

OBJECTIVE FOR DEVELOPMENTAL TYPE

Z-5387*

PLANAR TRIODE

The Z-5387 is a high-mu, metal-and-ceramic planar triode for use at very-high and ultra-high frequencies in grounded-grid, Class C CW or pulsed, power-amplifier, oscillator, or frequency-multiplier circuits. In such service it will operated from the low frequencies to above 3000 megacycles. Cooling of the tube envelope is accomplished by conduction from the contact circuit members with sufficient additional forced air to limit the maximum temperature at 250 C.

The tube has an oxide-coated indirectly-heated cathode of planar-electrode construction. The metal-and-ceramic envelope holds concentricity to extremely close limits. The strength inherent in the structural design allows shock-testing at 400 g. Graduated-diameter disk seals assure maximum efficiency in the use of cavity and parallel-line circuits with the resultant desirable features of both low lead inductances and electrode isolation. Radio-frequency losses in the tube are kept to a minimum by the special techniques and materials used. Other features of the tube are high transconductance and low interelectrode capacitances.

GENERAL

Electrical				
Cathode-Indirectly Heated				
Heater Voltage, dependent upon operating conditions+			6.3	Volts
Heater Current			1.05	Amperes
Cathode Heating Time, minimum			1.0	Minutes
	Minimum	Bogey	Maximum	
Transconductance, I_p = 75 ma, Ep = 600 volts	22,000	24,800	27,500	Micromhos
Amplification Factor	75	95	115	
Direct Interelectrode Capacitances				
With External Shield, Heater Voltage = 0 volts				
Grid to Plate	1.89	2.01	2.13	pf
Grid to Cathode	6.0	6.5	7.00	pf
Plate to Cathode, maximum	0.018	0.023	0.029	pf

GENERAL (Continued)

Mechanical
- Mounting Position - Any
  - Only Anode Flange to be used as a Socket Stop and Clamp
- Net Weight, approximate — 2 — Ounces

Thermal
- Cooling
  - Anode and Anode Seal-Conduction and Forced Air
  - Grid and Cathode Seals-Conduction and Forced Air
- Maximum Temperature of Any Seal Under Any Condition+ — 250 — C

MAXIMUM RATINGS

Plate-Pulsed Oscillator and Amplifier - Class C

Maximum Ratings
Absolute-Maximum Values

Peak Pulse-Plate-Supply Voltage	3500	Volts
Pulse Length	6	Microseconds
Duty Factor	0.0033	
Negative DC Grid Voltage	150	Volts
Positive Peak Grid Voltage	250	Volts
Negative Peak Grid Voltage	750	Volts
Plate Dissipation	10	Watts
Grid Dissipation	2.0	Watts
Average Plate Current	10	Milliamperes
Peak Plate Current	3.0	Amperes
Average Grid Current	5.0	Milliamperes
Frequency	3000	Megacycles

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

Amplifier - 1100 Megacycles

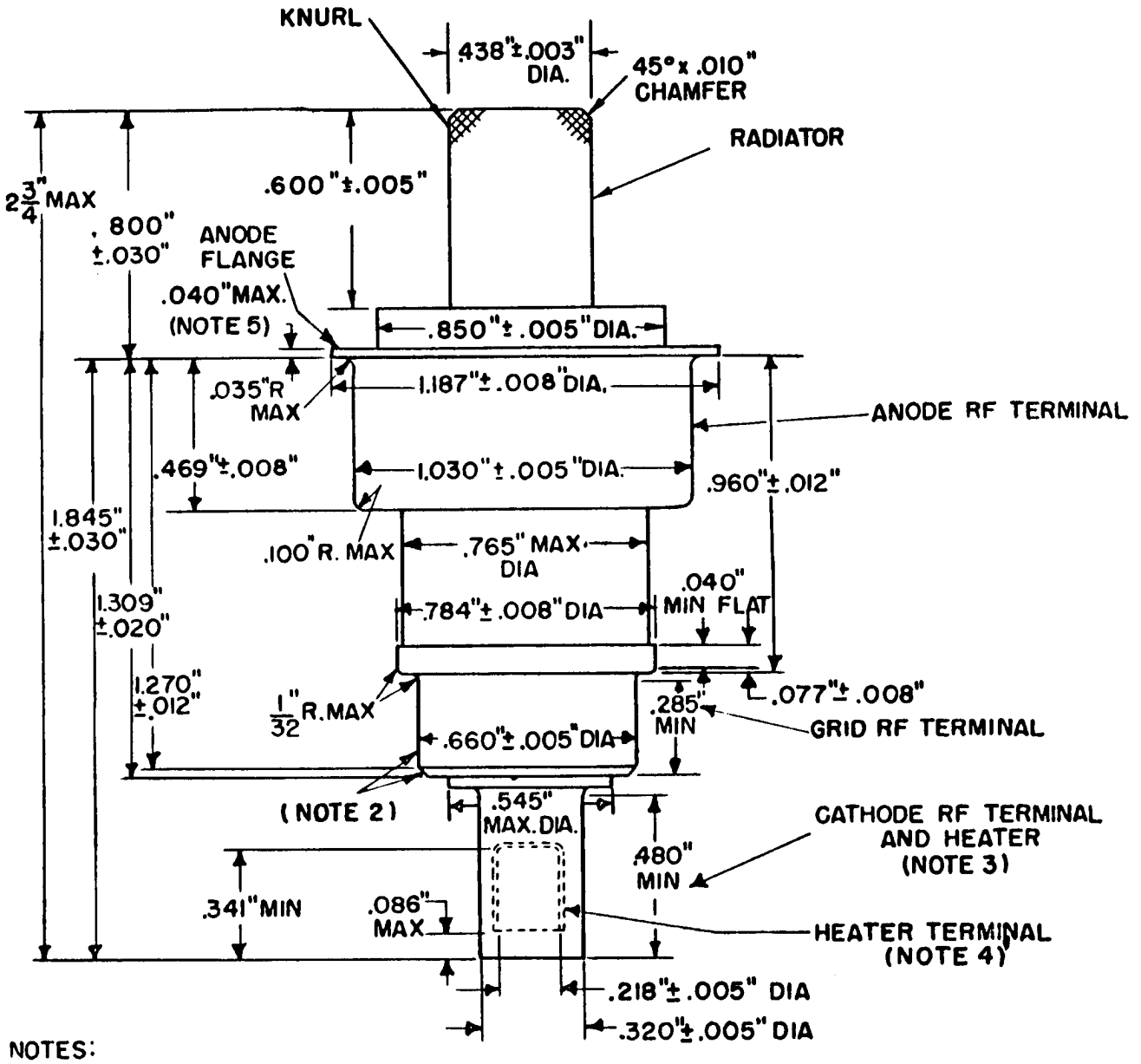
Heater Voltage	6.0	Volts
DC Plate Voltage	1700	Volts
DC Grid Voltage	-45	Volts
Pulse Length	3.5	Microseconds
Duty Factor	0.001	
Peak Plate Current	1.9	Amperes
Peak Grid Current	1.1	Amperes
Driving Power during Pulse, approximate	400	Watts
Peak Useful Power Output, approximate	1500	Watts

* Publication of these data does not obligate the General Electric Company to manufacture a tube with these characteristics.

\+ The Z-5387 operates at frequencies where it is necessary to consider transit-time effects of the electron current. The principal effects influencing tube operation are the decrease in power output and operating efficiency with increase in frequency, and the bombardment and heating of the cathode by electrons from the region of the grid which can be severe enough to result in short tube life and erratic operation. Operating frequency, circuit design and adjustment, grid bias, and grid current contribute to the degree of cathode bombardment. There is an optimum heater voltage which will maintain the cathode at the correct operating temperature for a particular set of operating conditions. If the conditions of operation result in appreciable cathode back heating, it may be necessary to start dynamic tube operation at normal heater voltage followed by a reduction of heater voltage to the proper value. A maximum variation of plus or minus five percent in heater voltage is recommended where extended tube life is a factor. Under all other conditions, the variation in heater voltage should not exceed plus or minus ten percent. For application above 400 megacycles, recommendations are to be obtained from the tube manufacturer regarding the heater voltage to be used under a specific set of operating conditions.

‡ Where long life and reliable operation are important, lower tube envelope temperatures should be used.

2/19/63 (B)
Supersedes 4/22/60 (B)



NOTES:

1. External metal parts (except radiator) plated with 30 msi of copper and /or silver.
2. Solder not to extend radially beyond grid RF terminal.
3. Total indicated runout of the grid-contact surface and the cathode-contact surface with respect to the anode shall not exceed 0.020"
4. Total indicated runout of the cathode-contact surface with respect to the heater-contact surface shall not exceed 0.012".
5. Only this flange to be used as a socket stop and clamp.

GENERAL ELECTRIC
POWER TUBE DEPARTMENT
Schenectady 5, N. Y.

OBJECTIVE
TECHNICAL INFORMATION

These ratings represent the design objective for this tube.

DEVELOPMENTAL TYPE

Z-5395
OTI-10
Page 1
9-30-59

This technical information is considered to be proprietary and is furnished as a service to customers for their private use only

IMAGE ORTHICON

Focus – Magnetic Deflection – Magnetic

The Z-5395 is an image orthicon with a wide-spaced high-gain thin film target and an S-1 photosurface. The good sensitivity of the S-1 photosurface to radiation in the red and near infra red regions makes the tube suitable for detection and televising of scenes which are illuminated with or consist of infra red sources.

By appropriate choice of infra red filtered light sources for illumination, scenes which appear to be in total visual darkness can easily be televised. In addition, useful pictures of objects at elevated temperatures which are not visibly hot can be obtained.

The very low sideways leakage characteristics of the thin film target adapts the tube to applications where the signal is stored for a very long period before being read out. This permits the attainment of additional sensitivity by the use of low frame rates or beam pulsing.

Additional advantages due to the unique construction of the Z-5395 target are high amplitude response, reduction in redistribution of target secondary electrons, and minimized possibility of permanent burn-in damage from stationary image highlights.

Future design objectives for the tube are primarily in the areas of increased ruggedness, minimization of microphonics, increased red sensitivity, and improved temperature, sensitivity and stability relationships.

GENERAL		
Electrical		
Cathode - Unipotential		
Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.6	Amperes
Photocathode - Semi-Transparent		
Rectangular Image, 4 by 3 Aspect Ratio		
Useful Size, Maximum Diagonal	1.8	Inches
Orientation - Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the face-plate and pin- No. 7 of the shoulder base.		
Focusing Method - Magnetic		
Deflecting Method - Magnetic		
Direct Interelectrode Capacitance		
Anode to all Other Electrodes	12	μμf
Mechanical		
Over-all Length	15.20 ± 0.25	Inches
Greatest Diameter of Bulb	3.00 ± 0.06	Inches
Minimum Deflecting Coil Inside Diameter	2 3/8	Inches
Deflecting Coil Length	5	Inches
Focusing Coil Length	10	Inches
Alignment Coil Length	15/16	Inches
Photocathode Distance Inside End of Focusing Coil	1/2	Inches
Weight, approximate	1.4	Pounds
Operating Position - Any. Except with diheptal base up and the tube axis at an angle of less than 20 degrees from vertical.		

The specifications of this device are subject to change. This tube is now under development and is made available for experimental purposes only. Delivery of tubes and the ability to meet specifications do not imply continued availability of tubes with the same characteristics or dimensions. For the most recent information concerning the development status consult your local Power Tube Department Regional Sales Office.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Absolute Values

Photocathode Voltage	-550	Max Volts
Photocathode Current #, maximum	10	Microamperes
Photocathode Illumination	20	Max Foot-Candles
Anode Supply Voltage*	1350	Max Volts
Grid-No. 1 Voltage		
Negative Bias Value	125	Max Volts
Positive Bias Value	0	Max Volts
Grid-No. 2 and Dynode-No. 1 Voltage	350	Max Volts
Grid-No. 3 Voltage	400	Max Volts
Grid-No. 4 Voltage	300	Max Volts
Grid-No. 5 Voltage	150	Max Volts
Grid-No. 6 Voltage	-550	Max Volts
Voltage per Multiplier Stage	350	Max Volts
Target Voltage		
Positive Voltage	2	Max Volts
Negative Voltage	10	Max Volts
Peak Heater Cathode Voltage		
Heater Negative with Respect to Cathode	125	Max Volts
Heater Positive with Respect to Cathode	10	Max Volts
Operating Temperature of Any Part of Bulb §	50	Max C
Operating Temperature of Bulb at Large End of Tube, target section	35	Min C
Temperature Difference Between Target Section and Any Part of Bulb Hotter than Target Section	5	Max C

Typical Operation

Photocathode Voltage, image focus	-400 - -500	Volts
Grid-No. 1 Voltage for Picture Cut-off, beam	45 - -115	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	300	Volts
Grid-No. 3 Voltage, multiplier focus +	225 - 330	Volts
Grid-No. 4 Voltage, beam focus	140 ‡ 180	Volts
Grid-No. 5 Voltage, decelerator	0 - 125	Volts
Grid-No. 6 Voltage, accelerator 75 Percent of Photocathode Voltage, approximate	-300 - -405	Volts
Dynode-No. 2 Voltage	600	Volts
Dynode-No. 3 Voltage	800	Volts
Dynode-No. 4 Voltage	1000	Volts
Dynode-No. 5 Voltage	1200	Volts
Anode Voltage	1250	Volts
DC Anode Current	3	Microamperes
Target Voltage, without blanking voltage	0 - 2.0	Volts
Peak to Peak Blanking Voltage	5 - 20	Volts
Target Temperature Range	15 - 55	C
Field Strength at Center of Focusing ‡	75	Gausses
Field Strength of Alignment Coil, approximate	0 - 3	Gausses

Characteristic Values	Minimum	Bogey	Maximum	
Sensitivity				
Photocathode, luminous with 2870 K tungsten light source	8	12	...	Microamperes
Photocathode ¶, percentage of infra red response with stock thickness, Corning #2540 and 2870 K tungsten light source	2.0	5.0	...	Percent

* Ratio of dynode voltages is shown under Typical Operation.

+ Adjust to give the most uniformly shaded picture near maximum signal.

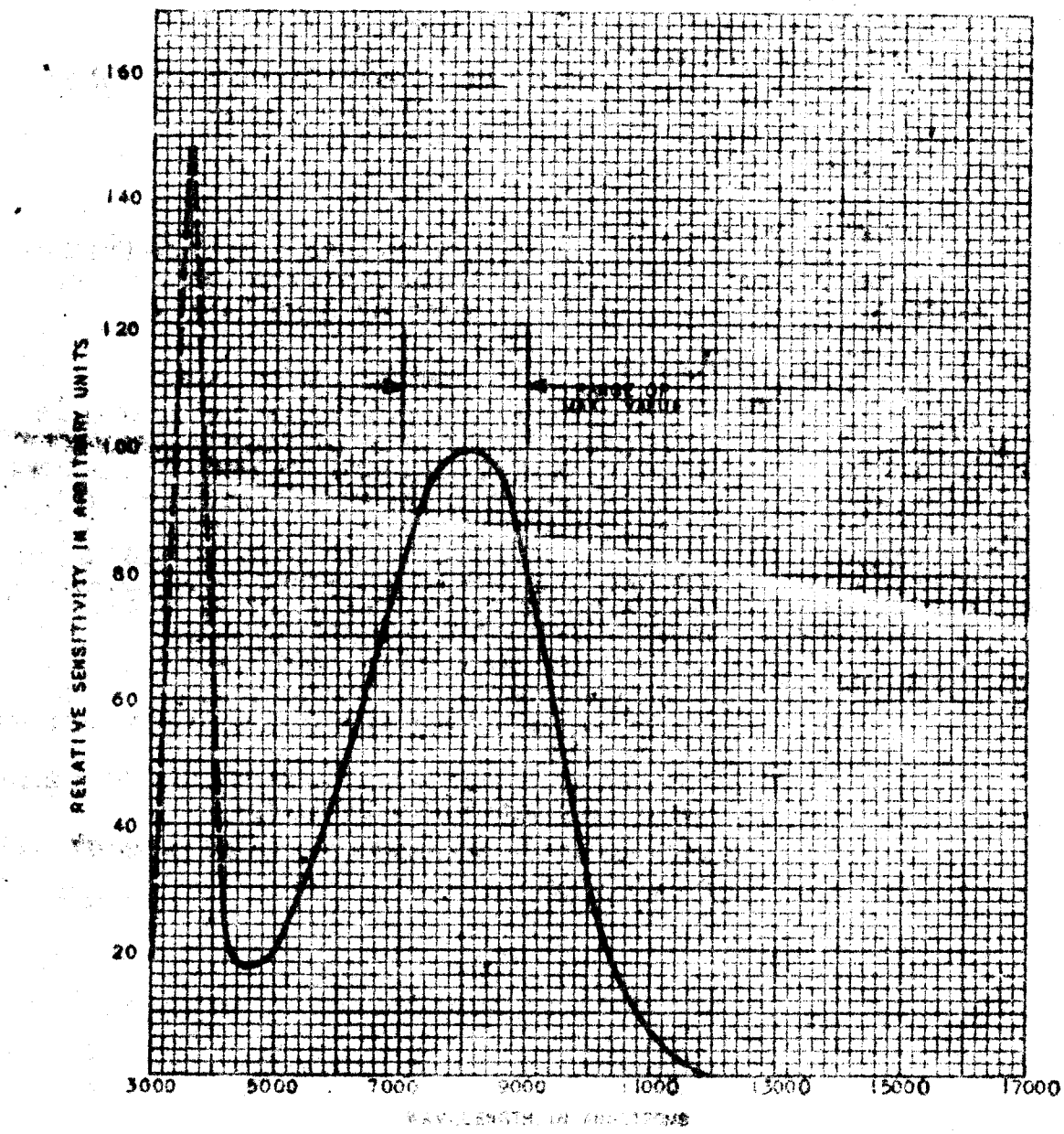
‡ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil with the indicator located outside of and at the image end of the focusing coil.

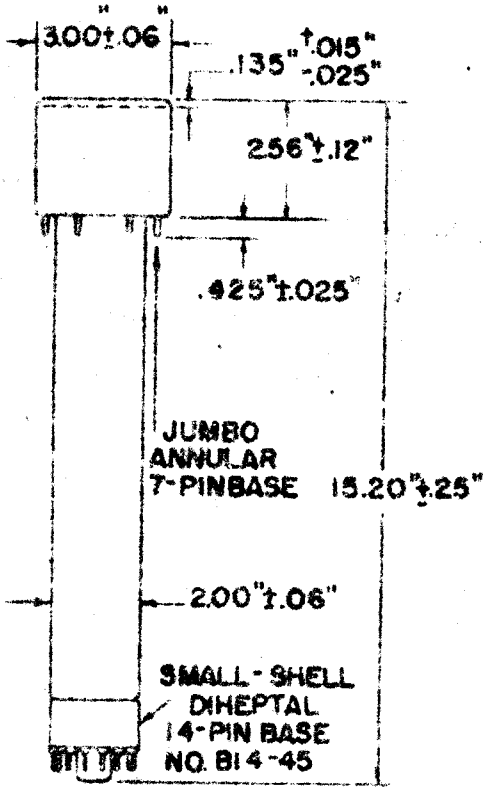
§ The maximum temperature rating should not be exceeded since too high a bulb temperature may cause the more volatile components of the photocathode and dynode surfaces to redistribute with consequent decrease in life and sensitivity of the tube. The use of a fan on the tube is recommended.

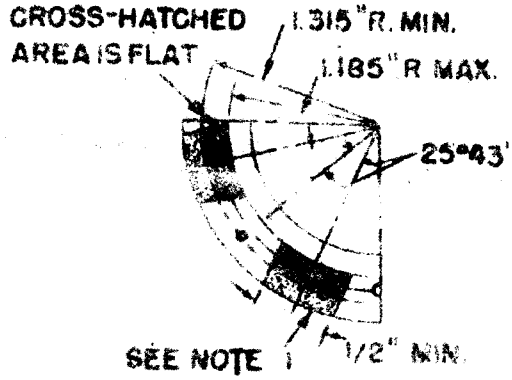
¶ A small temporary loss of infra red sensitivity may occur after long periods of operation. This sensitivity should recover almost completely during idle periods.

For most stable operation, the use of the average photocathode current below the maximum rated value of 10 microamperes is recommended. Maximum life and most stable sensitivity characteristics will be obtained by using the lowest values of average photocathode current which are consistent with good picture quality.

SPECTRAL SENSITIVITY CHARACTERISTIC
S-1 PHOTOSURFACE
For Equal Values of Radiant Flux at All Wavelengths

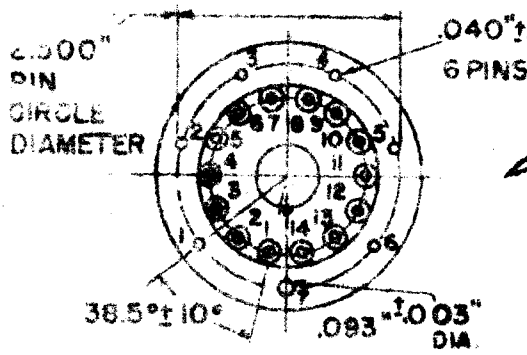






DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.



ENLARGED BOTTOM VIEW

ANNULAR BASE GAGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

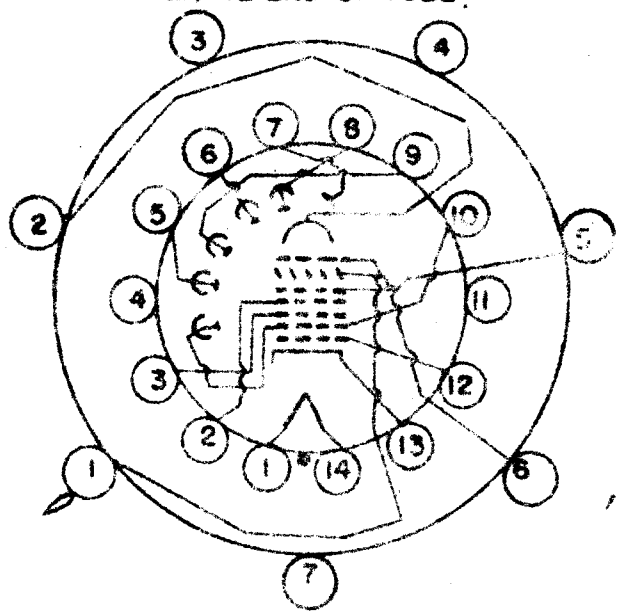
a. SIX HOLES HAVING DIAMETER OF 0.065"± 0.001" AND ONE HOLE HAVING DIA. OF 0.150+0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26'±5' ON CIRCLE DIAMETER OF 2.500"± 0.001"

b. SEVEN STOPS HAVING HEIGHT OF 0.187"± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT OF A MINIMUM OF 0.125" FROM 2 9/2" DIAMETER AND HAVING HEIGHT OF 0.126"±0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200"± 0.001".

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE.



WHITE INDEX LINE ON FACE

BASING DIAGRAM

SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
PIN 2: GRID NO. 4
PIN 3: GRID NO. 3
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: DYNODE NO. 2
PIN 6: DYNODE NO. 4
PIN 7: ANODE
PIN 8: DYNODE NO. 5
PIN 9: DYNODE NO. 3
PIN 10: DYNODE NO. 1, GRID NO. 2
PIN 11: INTERNAL CONNECTION DO NOT USE
PIN 12: GRID NO. 1
PIN 13: CATHODE
PIN 14: HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO. 6
PIN 2: PHOTOCATHODE
PIN 3: INTERNAL CONNECTION-DO NOT USE
PIN 4: INTERNAL CONNECTION DO NOT USE
PIN 5: GRID NO. 5
PIN 6: TARGET
PIN 7: INTERNAL CONNECTION DO NOT USE

Z-7806, GL-7967

IMAGE ORTHICONS

FOCUS-MAGNETIC **DEFLECTION-MAGNETIC**

These low-light-level image orthicons are designed to meet a wide variety of requirements for industrial, military, and scientific applications. They provide an effective low-light-level sensitivity down to 1.5 x 10^{-7} foot-candles photocathode illumination for resolution of 100 television lines per target inch. The GL-7967 is designed for normal environmental operation. The Z-7806 is a ruggedized version designed to operate under severe shock and vibration conditions.

Both tubes feature a high-gain, thin-film magnesium-oxide target with a sensitivity ten to twenty times that of glass targets. The extreme thinness and the anisotropic property of this semiconductor target virtually eliminates lateral leakage and increases the resolution 25 to 50 percent over that of standard glass targets. Since operation of the target depends on electron conduction, which is not a depletion process, rather than on ion conduction, permanent stickiness and burn-in are virtually eliminated. Low gamma permits a very wide operating range.

These and other features of these image orthicons assure long life and reliable operation in such applications as underwater observation, missile detection and tracking, and astronomical study of stars to the twentieth magnitude. The tubes are also suitable for service in scintillation experiments with the use of an image intensifier.

Electrical

Cathode—Unipotential		
Heater		
Voltage, AC or DC	6.3 ± 10%	Volts
Current	0.6	Amperes
Photocathode—Semi-Transparent		
Spectral Response—S-20		
Rectangular Image, 4 by 3 aspect ratio		
Useful Size, maximum diagonal	1.8	Inches
Orientation—Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the faceplate and pin No. 7 of the shoulder base.		
Focusing Method—Magnetic		
Deflection Method—Magnetic		
Direct Interelectrode Capacitance		
Anode to all other Electrodes	12	$\mu\mu$f

Mechanical

Over-all Length	15.20 ± 0.25	Inches
Greatest Bulb Diameter	3.00 ± 0.06	Inches
Deflecting Coil		
Length	5	Inches
Minimum Inside Diameter	2 3/8	Inches
Focusing-Coil Length	10	Inches
Alignment-Coil Length	15/16	Inches
Photocathode Distance Inside End of Focusing Coil	1/2	Inches
Weight, approximate		
Z-7806	1.4	Pounds
GL-7967	0.8	Pounds
Operating Position—Any, except with diheptal base up and tube axis at an angle of less than 20 degrees from vertical.		

Thermal

Operating Temperature at any Part of Bulb, maximum	70	C
Operating Temperature of Bulb at Large End of Tube, Target Section, minimum	0	C
Temperature Difference Between Target Section and any Part of Bulb Hotter than Target Section	7.5	C

MAXIMUM RATINGS—ABSOLUTE VALUES

Photocathode		
Voltage	−600	Volts
Illumination	50	Foot-candles
Anode Supply Voltage*	1850	Volts
Grid-No. 1 Voltage		
Negative Bias Value	135	Volts
Positive Bias Value	0	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	380	Volts
Grid-No. 3 Voltage	400	Volts
Grid-No. 4 Voltage	300	Volts
Grid-No. 5 Voltage	150	Volts
Grid-No. 6 Voltage	−600	Volts
Dynode-No. 2 to Dynode-No. 1 Voltage	350	Volts
Dynode-No. 3 to Dynode-No. 2 Voltage	350	Volts
Dynode-No. 4 to Dynode-No. 3 Voltage	680	Volts
Dynode-No. 5 to Dynode-No. 4 Voltage	350	Volts
Anode to Dynode-No. 5 Voltage	100	Volts
Voltage per Multiplier Stage	400	Volts
Target Voltage		
Above Target Cutoff, positive direction	10	Volts
Negative	10	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125	Volts
Heater Positive with Respect to Cathode	10	Volts

* Ratio of dynode voltages appears under Typical Operation.

TYPICAL OPERATION—AVERAGE VALUES

	Normal Performance†	Maximum Sensitivity Performance‡	
Photocathode Voltage, image focus	−400 to −540	−400 to −550	Volts
Grid-No. 1 Voltage for Picture Cutoff, Beam	−45 to −115	−45 to −115	Volts
Photocathode Illumination—See Page 5			
Scene Illumination—See Page 5			
Grid-No. 2 and Dynode-No. 1 Voltage	300	370	Volts
Grid-No. 3 Voltage, multiplier focus§	225–330	225–380	Volts
Grid-No. 4 Voltage, beam focus	140–180	140–250	Volts
Grid-No. 5 Voltage, decelerator	0–125	0–125	Volts
Grid-No. 6 Voltage, accelerator—75 percent of photocathode voltage, approximate	−300 to −405	−300 to −465‖	Volts
Dynode-No. 2 Voltage	600	770	Volts
Dynode-No. 3 Voltage	910	1080	Volts
Dynode-No. 4 Voltage	1200	1360	Volts
Dynode-No. 5 Voltage	1490	1610	Volts
Anode Voltage	1550	1700	Volts
DC Anode Current, maximum	30	30	Microamperes
Signal Output Current, peak-to-peak—See Light-Transfer Characteristic			
Target Cutoff Voltage¶	−3 to +1	−3 to +1	Volts
Target Temperature Range	15–55	15–55	C
Peak-to-Peak Blanking Voltage	5–20	5–20	Volts
Field Strength at Center of Focusing Coil**	75	75	Gausses
Field Strength of Alignment Coil, approximate#	0–3	0–3	Gausses

† Although these tubes will operate in standard equipment, modification to permit operation at these values will improve effective sensitivity for most applications.

‡ These values will permit the best low-light-level-sensitivity capability of the tube to be realized and will assure the maximum useful multiplier gain required in extreme low-light-level applications. The resolution sensitivity information in this data sheet was derived with these higher multiplier voltages.

§ Adjust to give the most uniformly shaded picture near maximum signal.

‖ 75 to 85 percent of photocathode voltage.

¶ The target supply voltage should be adjustable from −3 to +5 volts with blanking voltage off. Maximum target voltage is +10 volts above target cutoff. Recommended target voltage is +2 volts above cutoff. Slight readjustment, usually only a small fraction of a volt, may be necessary to minimize microphonics.

**Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

Adjust to produce flattest field with maximum response. Alignment is correct when the center of the picture merely goes through focus and does not rotate when beam focus (Grid No. 4) is varied. For most commercial focus coils a 75-gauss field results from a focus-coil current of 75 milliamperes.

Z-7806

ENVIRONMENTAL

Shock: Per specification MIL-E-5272C (ASG) Paragraph 4.15.5 except:

A 12 impact shocks of 30g

B The shock shall be applied in the following directions:
1—Vertically perpendicular to longitudinal axis, 3 shocks in each direction.
2—Parallel to the minor horizontal axis, 3 shocks in each direction.

C The shock pulse width is defined by the use of a 0.2 to 250-cycle-per-second filter.

Vibration: (10g) Per MIL-E-5272C (ASG) Paragraph 4.7.12 Procedure XII except at operating temperature only. Center horizontal resolution at 3 x 10^{-5} maximum foot-candles, photocathode illumination will be at least 350 lines (EIA) with 5g applied acceleration in the frequency range from 50 to 500 cycles per second and a double amplitude of 0.036 inch from 5 to 50 cycles per second. Picture resolution of 350 TV lines (EIA) is defined as readable through any interference that may occur.

Humidity: Per MIL-E-5272C (ASG) Paragraph 4.4.1 Procedure 1. Following this test, the interelectrode insulation of the end pins 5, 6, 7, 8, 9, and 10 each with respect to all other end base pins grounded and with 350 volts (minimum) applied is greater than 500 ohms.

Acceleration: (70g) Constant acceleration when applied perpendicular to the longitudinal axis of the tube for 10 minutes.

OPERATING NOTES

Some magnesium-oxide targets may be damaged permanently if directly and intermittently exposed, while in operation, to extremely bright sources which cause high photoelectron densities to occur at the target. Such sources include the sun, photoflash lamps, and exploding wire flashes. Damage, if it does occur, takes the form of black image spots burned in the target by the intense light.

In most cases an 80-megohm, ¼-watt resistor in series with the photocathode in the camera will protect the tube. This resistor will not interfere with normal operation of these or other image orthicons which may be used in the modified camera.

If these or similar bright sources are to be observed continuously, appropriate exposure control of photocathode illumination can be supplied by neutral-density filters.

SPECIFIC PARAMETERS ON RECORDED DATA

All curves except spectral-sensitivity characteristics were recorded under the following conditions:

Camera Chain: General Electric TE-5 (modified)
Amplifier bandwidth—total 20 mc, flat to 6 mc

Resolution Chart: National Bureau of Standards Lens Test Chart, 100% contrast transparency.

Window Chart: 100% contrast, 1% area window for signal-noise and transfer characteristic data.

Light Source: 2870^0 Kelvin—tungsten

Light Level: Aperture and neutral density controlled (within specially constructed low-light-level box) to provide range from 10^{-8} to 10^{-2} foot-candles illumination on photocathode. For corresponding scene brightness in foot-lamberts when using Leitz f/1.5 lens (85 mm), multiply photocathode illumination in foot-candles by 12.

Operating Temperature for Image End: 25 to 30 C.

Target Raster: Target diameter is 1.40 inches. For corners of scanning raster just touching target edge raster dimensions are:

Aspect Ratio	Horizontal	Vertical
1 x 1 (square)	0.99″	0.99″
4 x 3 (standard)	1.12″	0.84″

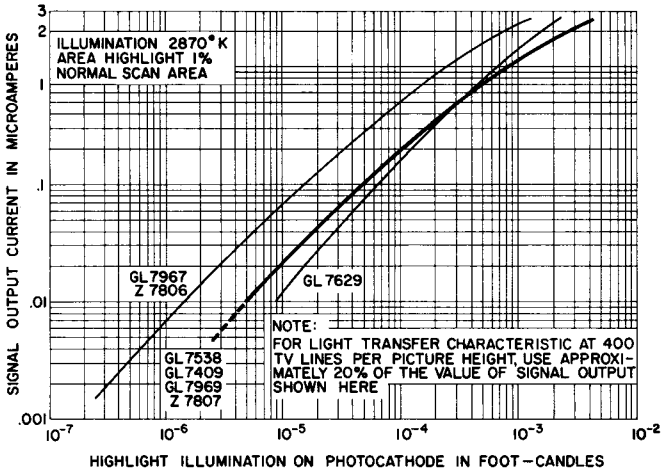
Horizontal TV lines = 1.12 x TV lines per target inch

Vertical TV lines (EIA) = 0.84 x TV lines per target inch

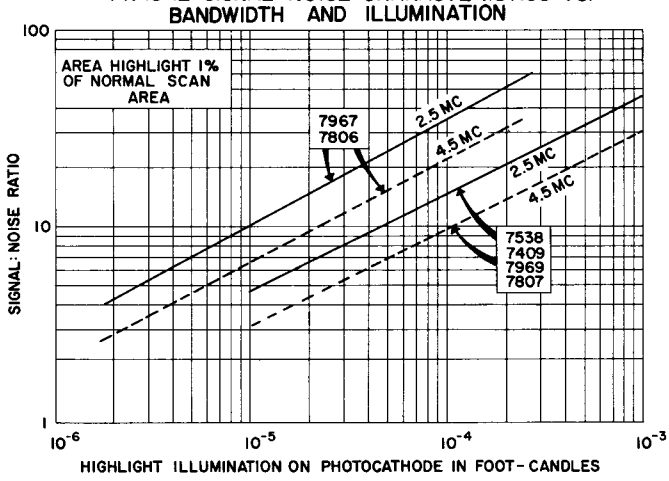
Resolution sensitivity data is recorded in TV lines per target inch

Therefore, 700 TV lines per target inch = 784 horizontal lines
= 588 vertical lines (EIA)

LIGHT TRANSFER CHARACTERISTICS

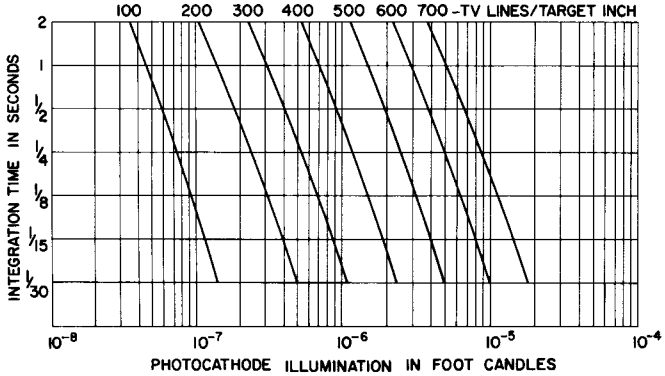


TYPICAL SIGNAL: NOISE CHARACTERISTICS VS. BANDWIDTH AND ILLUMINATION

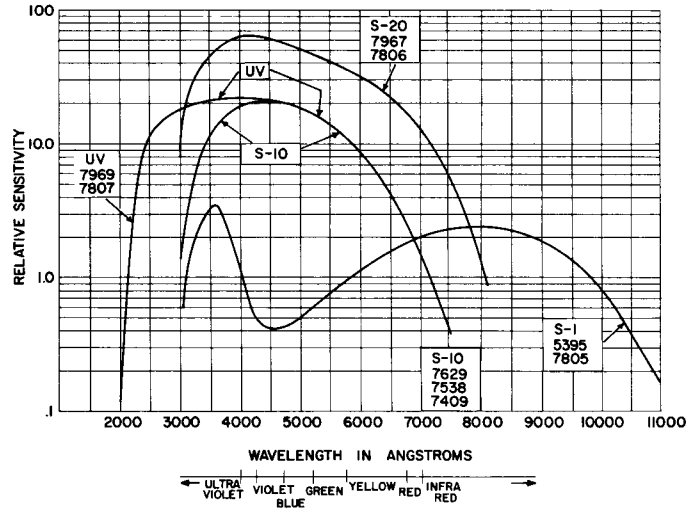


INTEGRATION EFFECT ON RESOLUTION SENSITIVITY

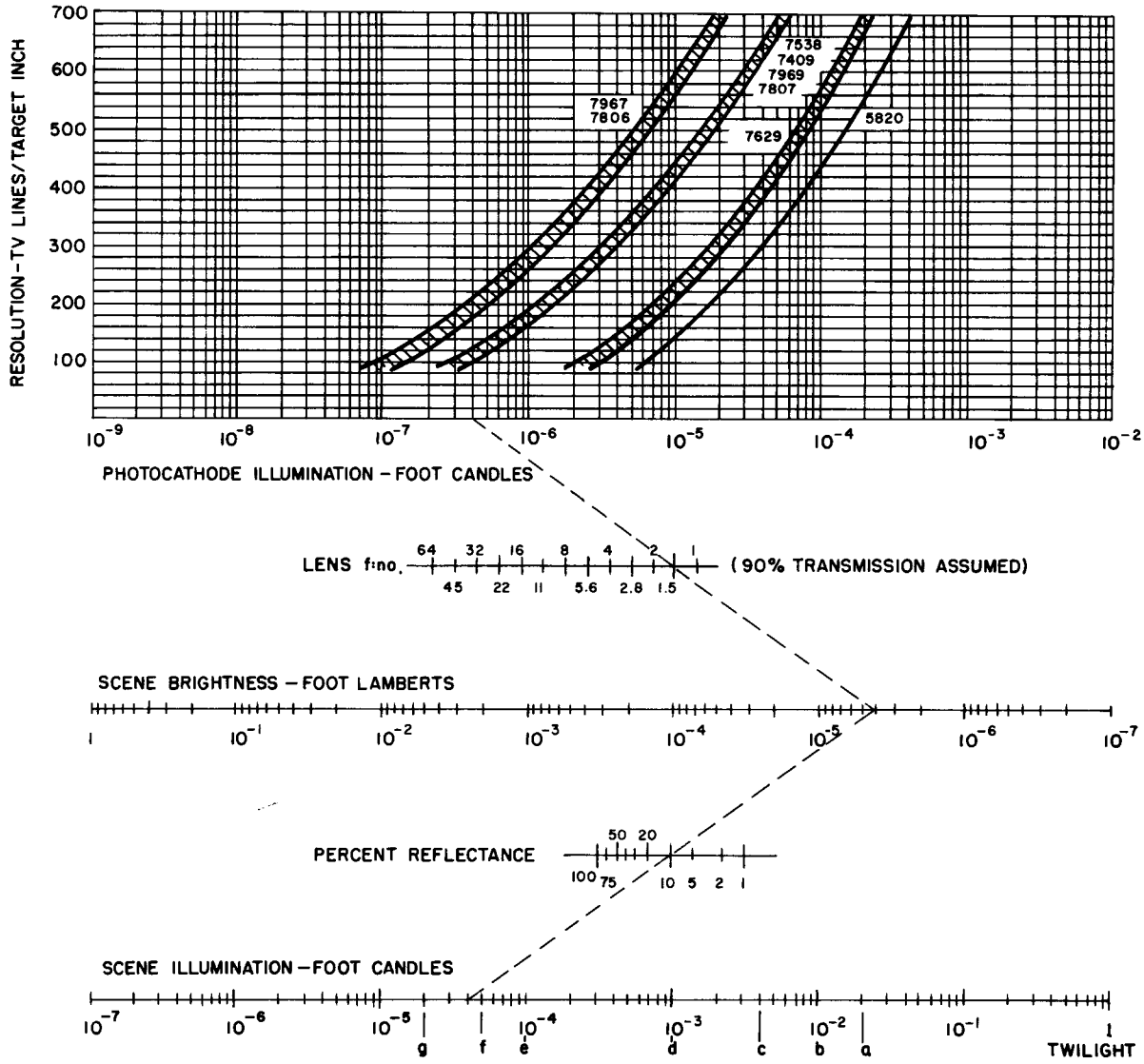
TYPES 7967 7806



PHOTOCATHODE SPECTRAL RESPONSE CHARACTERISTICS



SCENE ILLUMINATION VS TYPICAL RESOLUTION SENSITIVITY BY TYPE*

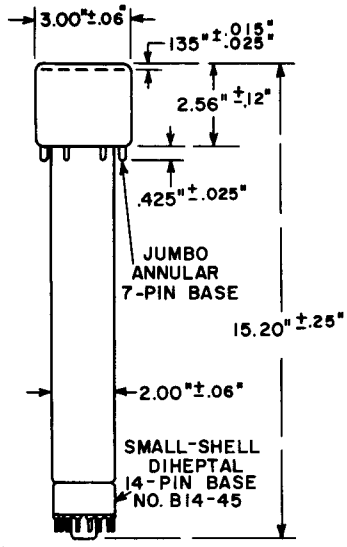


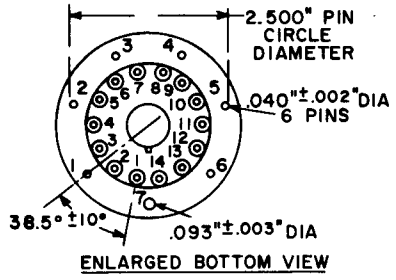
Code	Ambient Condition	Scene Illumination
a	Full moon–clear	2×10^{-2} ft-c
b	Half moon	1×10^{-2} ft-c
c	Full moon–moderately cloudy	4×10^{-3} ft-c
d	Quarter moon–clear	1×10^{-3} ft-c
e	No moon–clear	1×10^{-4} ft-c
f	No moon–moderately cloudy	5×10^{-5} ft-c
g	No moon–heavy cloud	2×10^{-5} ft-c

NEUTRAL DENSITY FILTERS FOR EXPOSURE CONTROL

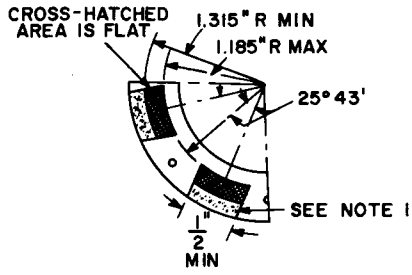
TYPE AND DENSITY	PERCENT TRANSMITTANCE	NUMBER OF STOPS
ND .30	50.0	1
ND .60	25.0	2
ND .90	13.0	3
ND 1.00	10.0	3.3
ND 2.00	1.0	6.6
ND 3.00	0.10	10.0
ND 4.00	0.010	13.2

*This chart reprinted by permission of B. A. Bang.





ENLARGED BOTTOM VIEW



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

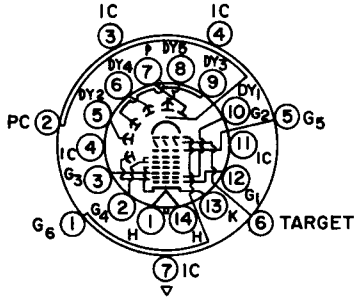
a. SIX HOLES HAVING DIAMETER OF 0.065"±.0.001" AND ONE HOLE HAVING DIA OF 0.150"±0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51° 26'±5' ON CIRCLE DIAMETER OF 2.500"±0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187"±0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT OF A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126"±0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200"±0.001".

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE



WHITE INDEX LINE ON FACE

BOTTOM VIEW

BASING DIAGRAM

SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
PIN 2: GRID NO.4 & FIELD MESH
PIN 3: GRID NO. 3
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: DYNODE NO. 2
PIN 6: DYNODE NO. 4
PIN 7: ANODE
PIN 8: DYNODE NO.5
PIN 9: DYNODE NO.3
PIN 10: DYNODE NO. 1, GRID NO. 2
PIN 11: INTERNAL CONNECTION-DO NOT USE
PIN 12: GRID NO. 1
PIN 13: CATHODE AND SUPPRESSOR GRID
PIN 14: HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO. 6
PIN 2: PHOTOCATHODE
PIN 3: INTERNAL CONNECTION-DO NOT USE
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: GRID NO. 5
PIN 6: TARGET
PIN 7: INTERNAL CONNECTION-DO NOT USE

GENERAL ELECTRIC

POWER TUBE DEPARTMENT

Pickup Tube Operation

Syracuse, New York

PRINTED IN U.S.A.

GL-7967

IMAGE ORTHICON



FOCUS—MAGNETIC **DEFLECTION—MAGNETIC**

The GL-7967 is an image orthicon with an S-20 photosurface. This photosurface has a sensitivity two to three times that of the S-10 with an improved red response and lower thermionic noise. Because of the low gamma, the tube has a very wide operating range at low light levels.

This tube features a high-gain, thin-film, magnesium-oxide target with a sensitivity twenty to fifty times that of glass-target tubes such as the 5820. This target has several advantages. Its extreme thinness and anisotropic property virtually eliminate sideways leakage, which increases the resolution 25 to 50 percent over that of the standard target. It adapts the tube for service where the signal is stored for long periods before being read off, which permits additional sensitivity by use of low frame rates or by beam pulsing. It completely eliminates both stickiness and burn-in since operation depends on electron conduction, which is not a depletion process, rather than on ion conduction. The curve shown on page 3 compares the resolution sensitivity of the 7967 with that of a 5820 with equivalent photocathode.

The target characteristics also assure a higher amplitude response than that of the 5820. Another advantage of the GL-7967 is a considerable reduction in the redistribution of target secondary electrons. This reduces image-edging effect, particularly at black-to-white transitions.

Electrical

Cathode—Unipotential		
Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.6	Ampere
Photocathode—Semi-transparent		
Response—S-20		
Rectangular Image, 4 x 3 aspect ratio		
Useful Size, maximum diagonal	1.8	Inches
Orientation—Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the faceplate and pin No. 7 of the shoulder base.		
Focusing Method—Magnetic		
Deflecting Method—Magnetic		
Direct Interelectrode Capacitance		
Anode to all other Electrodes	12	μμf

Mechanical

Over-all Length	15.20 ± 0.25	Inches
Greatest Diameter of Bulb	3.00 ± 0.06	Inches
Minimum Deflecting-Coil Inside Diameter	2⅜	Inches
Deflecting-Coil Length	5	Inches
Focusing-Coil Length	10	Inches
Alignment-Coil Length	⅛	Inch
Photocathode Distance Inside End of Focusing Coil	½	Inch
Weight, approximate	1.4	Pounds

Operating Position—Any, except with diheptal base up and the tube axis at an angle of less than 20 degrees from vertical.

Thermal

Operating Temperature of Any Part of Bulb	50	Max C
Operating Temperature of Bulb at Large End of Tube, Target Section	15	Min C
Temperature Difference Between Target Section and Any Part of Bulb Hotter than Target Section	5	Max C

MAXIMUM RATINGS—ABSOLUTE VALUES

Photocathode Voltage	−550	Volts
Photocathode Illumination	50	Foot-Candles
Anode Supply Voltage*	1350	Volts
Grid-No. 1 Voltage		
Negative Bias Value	125	Volts
Positive Bias Value	0	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	350	Volts
Grid-No. 3 Voltage	400	Volts
Grid-No. 4 Voltage	300	Volts
Grid-No. 5 Voltage	150	Volts
Grid-No. 6 Voltage	−550	Volts
Voltage per Multiplier Stage	350	Volts
Target Voltage		
Positive Voltage	2	Volts
Negative Voltage	10	Volts
Peak Heater Cathode Voltage		
Heater Negative with Respect to Cathode	125	Volts
Heater Positive with Respect to Cathode	10	Volts

TYPICAL OPERATION

Photocathode Voltage, image focus	−400 to −540	Volts	
Grid-No. 1 Voltage for Picture Cut-off, beam	45 to −115	Volts	
Grid-No. 2 and Dynode-No. 1 Voltage	300	Volts	
Grid-No. 3 Voltage†, multiplier focus	225 to 330	Volts	
Grid-No. 4 Voltage, beam focus	140 to 180	Volts	
Grid-No. 5 Voltage, decelerator	0 to 125	Volts	
Grid-No. 6 Voltage, accelerator 75 Percent of Photocathode Voltage, approximate	−300 to −405	Volts	
Dynode-No. 2 Voltage	600	Volts	
Dynode-No. 3 Voltage	800	Volts	
Dynode-No. 4 Voltage	1000	Volts	
Dynode-No. 5 Voltage	1200	Volts	
Anode Voltage	1250	Volts	
DC Anode Current	3	Microamperes	
Target Voltage, without blanking voltage	0 to 2.0	Volts	
Peak-to-Peak Blanking Voltage	5 to 20	Volts	
Target Temperature Range	15 to 55	C	
Field Strength at Center of Focusing Coil‡	75	Gausses	
Field Strength of Alignment Coil, approximate	0 to 3	Gausses	

* Ratio of dynode voltages is shown under **Typical Operation**.
Adjust to give the most uniformly shaded picture near maximum signal.
‡ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

OPERATING NOTES

Normally a new tube will exhibit some slight after-image, characterized by a rapid and complete decay, which will gradually diminish with life. This can be minimized by use of an arbiter or by eliminating forced-air cooling for short periods of time.

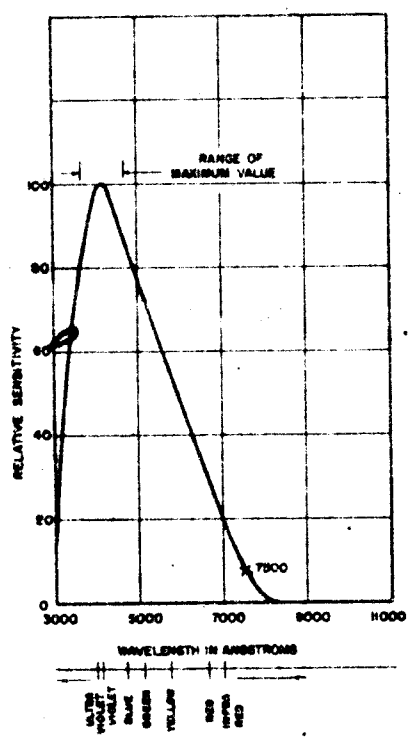
Although a warm-up time of one hour is desirable, the tube can be used immediately after alignment as it cannot be damaged permanently by target burn-in.

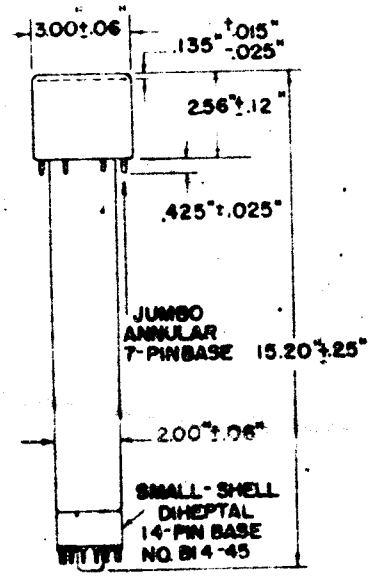
Some tubes may exhibit microphonic bars if used immediately while relatively cool. These will disappear as the tube warms up and can be minimized during this period by slight readjustments in target voltage.

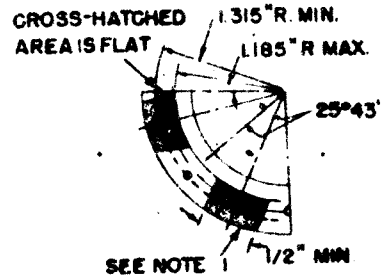
The target used in this tube greatly reduces the probability of permanent burn-in damage should a stationary highlight be imaged on the target for an extended period. However, imaging directly on the sun or other extremely bright sources should be avoided.

SPECTRAL-SENSITIVITY CHARACTERISTIC—S20 RESPONSE

For Equal Values of Radiant Flux at All Wavelengths

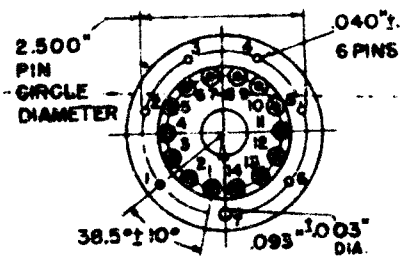






DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.



ENLARGED BOTTOM VIEW

ANNULAR BASE GAGE

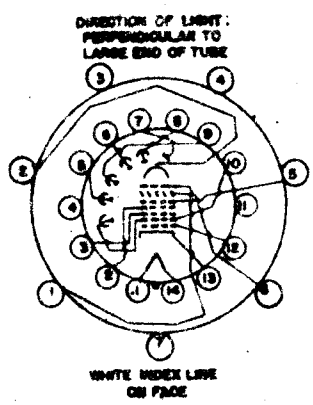
ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065"±.0.001" AND ONE HOLE HAVING DIA. OF 0.150±0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26'±5' ON CIRCLE DIAMETER OF 2.500"±0.001"

b. SEVEN STOPS HAVING HEIGHT OF 0.187"±0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT OF A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126"±0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200"±0.001".



BASING DIAGRAM

SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
PIN 2: GRID NO. 4
PIN 3: GRID NO. 3
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: DYNODE NO. 2
PIN 6: DYNODE NO. 4
PIN 7: ANODE
PIN 8: DYNODE NO. 5
PIN 9: DYNODE NO. 3
PIN 10: DYNODE NO. 1, GRID NO. 2
PIN 11: INTERNAL CONNECTION-DO NOT USE
PIN 12: GRID NO. 1
PIN 13: CATHODE
PIN 14: HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO. 6
PIN 2: PHOTOCATHODE
PIN 3: INTERNAL CONNECTION-DO NOT USE
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: GRID NO. 5
PIN 6: TARGET
PIN 7: INTERNAL CONNECTION-DO NOT USE

Z-7807, GL-7969

IMAGE ORTHICONS

FOCUS-MAGNETIC **DEFLECTION-MAGNETIC**

These low-light-level image orthicons are designed to meet a wide variety of requirements for industrial, military, and scientific applications. They provide an effective low-light-level sensitivity of 4 x 10^{-7} foot-candles photocathode illumination for resolution of 100 television lines per target-inch. The GL-7969 is designed for normal environmental operation. The Z-7807 is a ruggedized version especially designed to operate under severe shock and vibration conditions.

Both tubes feature a high-gain, thin-film magnesium-oxide target with a sensitivity ten to twenty times that of glass targets. The extreme thinness and the anisotropic property of this semiconductor target virtually eliminates lateral leakage and increases the resolution 25 to 50 percent over that of standard glass targets. Since operation of the target depends on electron conduction, which is not a depletion process, rather than on ion conduction, permanent stickiness and burn-in are virtually eliminated. Low gamma permits a very wide operating range.

These and other features of these image orthicons assure long life and reliable operation in such applications as medical biological studies, spectrographic detectors, underwater observation, and missile detection.

Electrical

Cathode—Unipotential		
Heater		
Voltage, AC or DC	6.3 ± 10%	Volts
Current	0.6	Amperes
Photocathode—Semi-Transparent		
Spectral Response—UV		
Rectangular Image, 4 by 3 aspect ratio		
Useful Size, maximum diagonal	1.8	Inches
Orientation—Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the faceplate and pin No. 7 of the shoulder base.		
Focusing Method—Magnetic		
Deflection Method—Magnetic		
Direct Interelectrode Capacitance		
Anode to all other Electrodes	12	μμf

Mechanical

Over-all Length	15.20 ± 0.25	Inches
Greatest Bulb Diameter	3.00 ± 0.06	Inches
Deflecting Coil		
Length	5	Inches
Minimum Inside Diameter	2 3/8	Inches
Focusing-Coil Length	10	Inches
Alignment-Coil Length	15/16	Inches
Photocathode Distance Inside End of Focusing Coil	1/2	Inches
Weight, approximate		
Z-7807	1.4	Pounds
GL-7969	0.8	Pounds
Operating Position—Any, except with diheptal base up and tube axis at an angle of less than 20 degrees from vertical.		

Thermal

Operating Temperature at any Part of Bulb, maximum	70	C
Operating Temperature of Bulb at Large End of Tube, Target Section, minimum	0	C
Temperature Difference Between Target Section and any Part of Bulb Hotter than Target Section	7.5	C

MAXIMUM RATINGS—ABSOLUTE VALUES

Photocathode		
Voltage	−600	Volts
Illumination	50	Foot-candles
Anode Supply Voltage*	1850	Volts
Grid-No. 1 Voltage		
Negative Bias Value	135	Volts
Positive Bias Value	0	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	380	Volts
Grid-No. 3 Voltage	400	Volts
Grid-No. 4 Voltage	300	Volts
Grid-No. 5 Voltage	150	Volts
Grid-No. 6 Voltage	−600	Volts
Dynode-No. 2 to Dynode-No. 1 Voltage	350	Volts
Dynode-No. 3 to Dynode-No. 2 Voltage	350	Volts
Dynode-No. 4 to Dynode-No. 3 Voltage	680	Volts
Dynode-No. 5 to Dynode-No. 4 Voltage	350	Volts
Anode to Dynode-No. 5 Voltage	100	Volts
Voltage per Multiplier Stage	400	Volts
Target Voltage		
Above Target Cutoff, positive direction	10	Volts
Negative	10	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125	Volts
Heater Positive with Respect to Cathode	10	Volts

* Ratio of dynode voltages appears under Typical Operation.

GENERAL ELECTRIC

TYPICAL OPERATION—AVERAGE VALUES

	Normal Performance†	Maximum Sensitivity Performance‡	
Photocathode Voltage, image focus	−400 to −540	−400 to −550	Volts
Grid-No. 1 Voltage for Picture Cutoff, Beam	−45 to −115	−45 to −115	Volts
Photocathode Illumination—See Page 5			
Scene Illumination—See Page 5			
Grid-No. 2 and Dynode-No. 1 Voltage	300	370	Volts
Grid-No. 3 Voltage, multiplier focus§	225–330	225–380	Volts
Grid-No. 4 Voltage, beam focus	140–180	140–250	Volts
Grid-No. 5 Voltage, decelerator	0–125	0–125	Volts
Grid-No. 6 Voltage, accelerator—75 percent of photocathode voltage, approximate	−300 to −405	−300 to −465‖	Volts
Dynode-No. 2 Voltage	600	770	Volts
Dynode-No. 3 Voltage	910	1080	Volts
Dynode-No. 4 Voltage	1200	1360	Volts
Dynode-No. 5 Voltage	1490	1610	Volts
Anode Voltage	1550	1700	Volts
DC Anode Current, maximum	30	30	Microamperes
Signal Output Current, peak-to-peak—See Light-Transfer Characteristic			
Target Cutoff Voltage¶	−3 to +1	−3 to +1	Volts
Target Temperature Range	15–55	15–55	C
Peak-to-Peak Blanking Voltage	5–20	5–20	Volts
Field Strength at Center of Focusing Coil**	75	75	Gausses
Field Strength of Alignment Coil, approximate#	0–3	0–3	Gausses

† Although these tubes will operate in standard equipment, modification to permit operation at these values will improve effective sensitivity for most applications.

‡ These values will permit the best low-light-level-sensitivity capability of the tube to be realized and will assure the maximum useful multiplier gain required in extreme low-light-level applications. The resolution sensitivity information in this data sheet was derived with these higher multiplier voltages.

§ Adjust to give the most uniformly shaded picture near maximum signal.

‖ 75 to 85 percent of photocathode voltage.

¶ The target supply voltage should be adjustable from −3 to +5 volts with blanking voltage off. Maximum target voltage is +10 volts above target cutoff. Recommended target voltage is +2 volts above cutoff. Slight readjustment, usually only a small fraction of a volt, may be necessary to minimize microphonics.

**Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

Adjust to produce flattest field with maximum response. Alignment is correct when the center of the picture merely goes through focus and does not rotate when beam focus (Grid No. 4) is varied. For most commercial focus coils a 75-gauss field results from a focus-coil current of 75 milliamperes.

Z-7807

ENVIRONMENTAL

Shock: Per specification MIL-E-5272C (ASG) Paragraph 4.15.5 except:

A 12 impact shocks of 30g

B The shock shall be applied in the following directions:
1—Vertically perpendicular to longitudinal axis, 3 shocks in each direction.
2—Parallel to the minor horizontal axis, 3 shocks in each direction.

C The shock pulse width is defined by the use of a 0.2 to 250-cycle-per-second filter.

Vibration: (10g) Per MIL-E-5272C (ASG) Paragraph 4.7.12 Procedure XII except at operating temperature only. Center horizontal resolution at 3 x 10^{-5} maximum foot-candles, photocathode illumination will be at least 350 lines (EIA) with 5g applied acceleration in the frequency range from 50 to 500 cycles per second and a double amplitude of 0.036 inch from 5 to 50 cycles per second. Picture resolution of 350 TV lines (EIA) is defined as readable through any interference that may occur.

Humidity: Per MIL-E-5272C (ASG) Paragraph 4.4.1 Procedure 1. Following this test, the interelectrode insulation of the end pins 5, 6, 7, 8, 9, and 10 each with respect to all other end base pins grounded and with 350 volts (minimum) applied is greater than 500 ohms.

Acceleration: (70g) Constant acceleration when applied perpendicular to the longitudinal axis of the tube for 10 minutes.

OPERATING NOTES

Some magnesium-oxide targets may be damaged permanently if directly and intermittently exposed, while in operation, to extremely bright sources which cause high photoelectron densities to occur at the target. Such sources include the sun, photoflash lamps, and exploding wire flashes. Damage, if it does occur, takes the form of black image spots burned in the target by the intense light.

In most cases an 80-megohm, ¼-watt resistor in series with the photocathode in the camera will protect the tube. This resistor will not interfere with normal operation of these or other image orthicons which may be used in the modified camera.

If these or similar bright sources are to be observed continuously, appropriate exposure control of photocathode illumination can be supplied by neutral-density filters.

SPECIFIC PARAMETERS ON RECORDED DATA

All curves except spectral-sensitivity characteristics were recorded under the following conditions:

Camera Chain: General Electric TE-5 (modified)
Amplifier bandwidth—total 20 mc, flat to 6 mc

Resolution Chart: National Bureau of Standards Lens Test Chart, 100% contrast transparency.

Window Chart: 100% contrast, 1% area window for signal-noise and transfer characteristic data.

Light Source: 2870^0 Kelvin—tungsten

Light Level: Aperture and neutral density controlled (within specially constructed low-light-level box) to provide range from 10^{-8} to 10^{-2} foot-candles illumination on photocathode. For corresponding scene brightness in foot-lamberts when using Leitz f/1.5 lens (85 mm), multiply photocathode illumination in foot-candles by 12.

Operating Temperature for Image End: 25 to 30 C.

Target Raster: Target diameter is 1.40 inches. For corners of scanning raster just touching target edge raster dimensions are:

Aspect Ratio	Horizontal	Vertical
1 x 1 (square)	0.99″	0.99″
4 x 3 (standard)	1.12″	0.84″

Horizontal TV lines = 1.12 x TV lines per target inch

Vertical TV lines (EIA) = 0.84 x TV lines per target inch

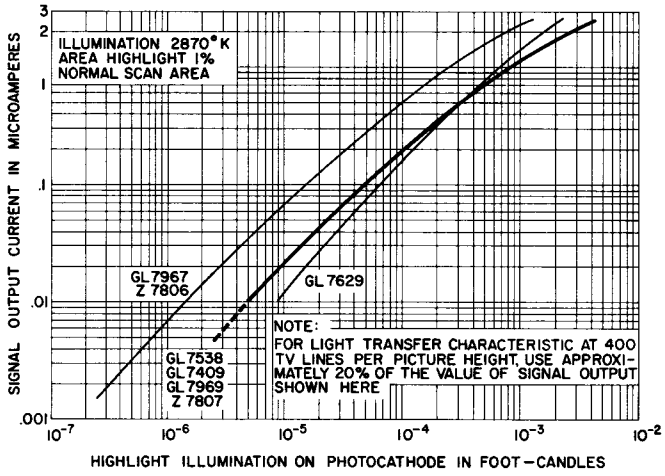
Resolution sensitivity data is recorded in TV lines per target inch

Therefore, 700 TV lines per target inch = 784 horizontal lines
= 588 vertical lines (EIA)

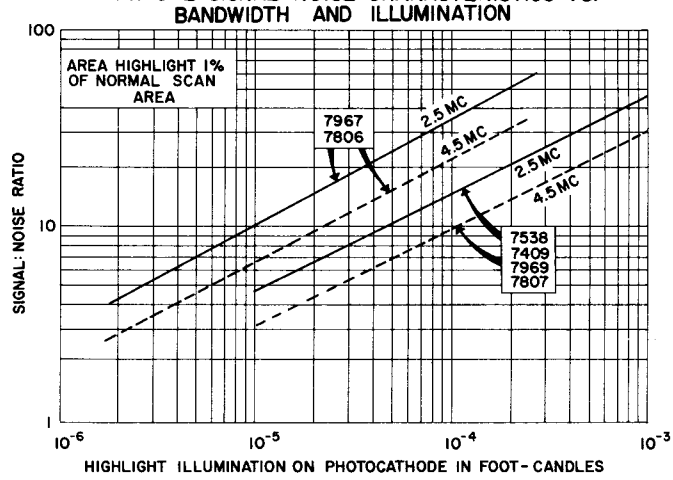
Z-7807
GL-7969

ET-T1690
Page 4
5-63

LIGHT TRANSFER CHARACTERISTICS

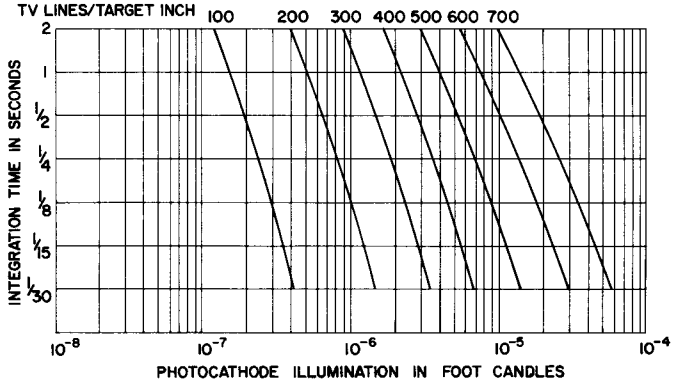


TYPICAL SIGNAL: NOISE CHARACTERISTICS VS. BANDWIDTH AND ILLUMINATION

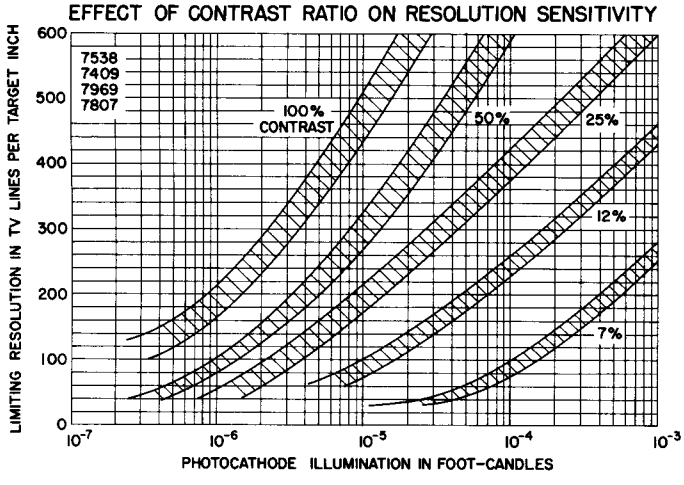


INTEGRATION EFFECT ON RESOLUTION SENSITIVITY

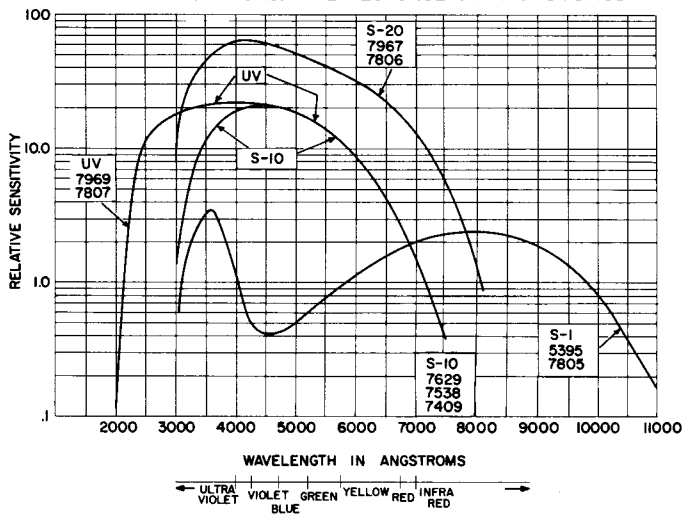
TYPES 7538 7409 7969 7807



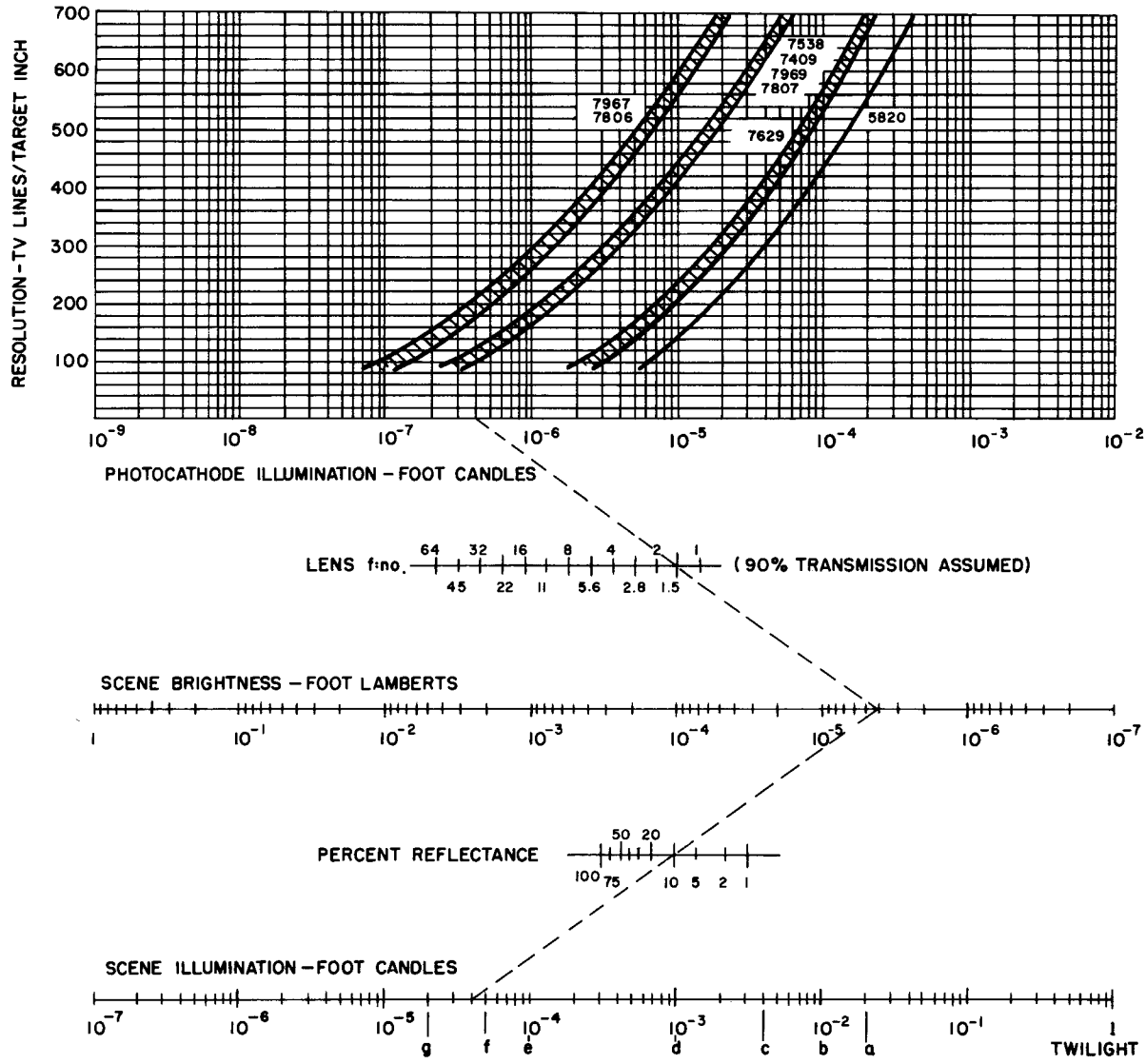
EFFECT OF CONTRAST RATIO ON RESOLUTION SENSITIVITY



PHOTOCATHODE SPECTRAL RESPONSE CHARACTERISTICS



SCENE ILLUMINATION VS TYPICAL RESOLUTION SENSITIVITY BY TYPE*

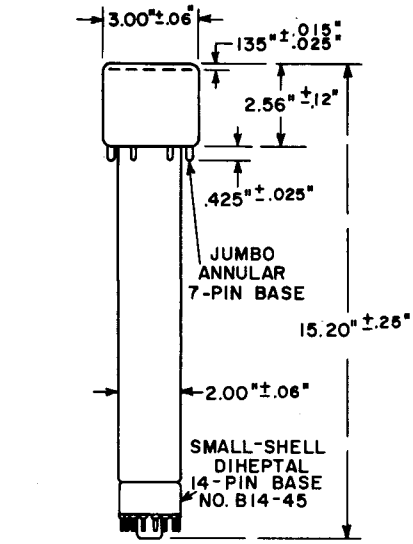


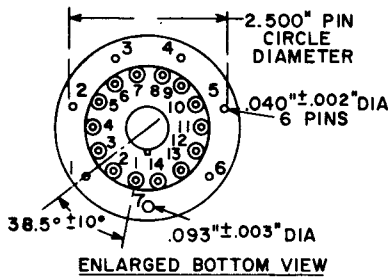
Code	Ambient Condition	Scene Illumination
a	Full moon–clear	2×10^{-2} ft-c
b	Half moon	1×10^{-2} ft-c
c	Full moon–moderately cloudy	4×10^{-3} ft-c
d	Quarter moon–clear	1×10^{-3} ft-c
e	No moon–clear	1×10^{-4} ft-c
f	No moon–moderately cloudy	5×10^{-5} ft-c
g	No moon–heavy cloud	2×10^{-5} ft-c

NEUTRAL DENSITY FILTERS FOR EXPOSURE CONTROL

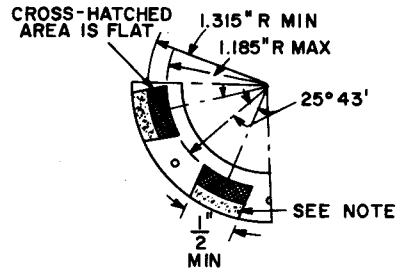
TYPE AND DENSITY	PERCENT TRANSMITTANCE	NUMBER OF STOPS
ND .30	50.0	1
ND .60	25.0	2
ND .90	13.0	3
ND 1.00	10.0	3.3
ND 2.00	1.0	6.6
ND 3.00	0.10	10.0
ND 4.00	0.010	13.2

*This chart reprinted by permission of B. A. Bang.





ENLARGED BOTTOM VIEW



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

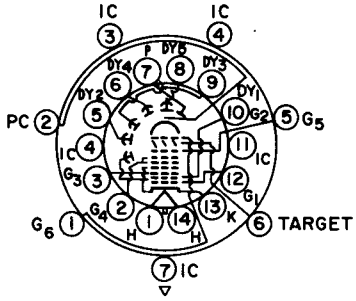
a. SIX HOLES HAVING DIAMETER OF 0.065"±.0.001" AND ONE HOLE HAVING DIA OF 0.150"±0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51° 26'±5' ON CIRCLE DIAMETER OF 2.500"±0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187"±0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT OF A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126"±0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200"±0.001".

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE



WHITE INDEX LINE ON FACE

BOTTOM VIEW

BASING DIAGRAM

SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
PIN 2: GRID NO.4 & FIELD MESH
PIN 3: GRID NO. 3
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: DYNODE NO. 2
PIN 6: DYNODE NO. 4
PIN 7: ANODE
PIN 8: DYNODE NO.5
PIN 9: DYNODE NO.3
PIN 10: DYNODE NO. 1, GRID NO. 2
PIN 11: INTERNAL CONNECTION-DO NOT USE
PIN 12: GRID NO. 1
PIN 13: CATHODE AND SUPPRESSOR GRID
PIN 14: HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO. 6
PIN 2: PHOTOCATHODE
PIN 3: INTERNAL CONNECTION-DO NOT USE
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: GRID NO. 5
PIN 6: TARGET
PIN 7: INTERNAL CONNECTION-DO NOT USE

GENERAL ELECTRIC

POWER TUBE DEPARTMENT

Pickup Tube Operation

Syracuse, New York

PRINTED IN U.S.A.

GL-7969

IMAGE ORTHICON

FOCUS—MAGNETIC **DEFLECTION—MAGNETIC**



The GL-7969 is an image orthicon with an ultraviolet-sensitive photosurface. Because of the low gamma, the tube has a very wide operating range at low light levels.

This tube features high gain, thin film magnesium oxide target with a secondary-emission ratio of twenty times that of signal-type target tubes such as the 5820. This target has several advantages. Its extreme hardness and insensitivity to moisture practically eliminate sideways leakage, which increases the resolution 25 to 50 percent over that of the standard target. It also [illegible] the charge values [illegible] being read off, which permits [illegible] signal-to-noise ratio by use of low frame rates or slow scanning. It completely eliminates both sticking and burn-in since operation depends on electron conductivity rather than a depletion process. Lateral conduction is also [illegible].

The target characteristics also assure a higher sensitivity response than that of the 5820. Another advantage of the GL-7969 is a considerable reduction in the redistribution of target secondaries. This reduces image [illegible] and [illegible] dark-area [illegible] black-to-white [illegible]

Electrical

Cathode, Unipotential		
Heater Voltage, AC or DC	6.3 ± 10	Volts
Heater Current	0.6	Ampere
Photocathode, S-10 Response		
Response, Ultraviolet sensitive		
Rectangular Image Area (Effective Values)		
Useful Scanned Diagonal	8	Inches
Orientation: Image orientation is obtained when the vertical scan is accomplished by deflecting the beam through the center of the deflection plate and pin No. 2 of the base.		
Focusing Method: Magnetic		
Deflecting Method: Magnetic		
Direct Interelectrode Capacitances		
Anode to all other Electrodes	12	μμf

Mechanical

Overall Length	15.20 ± 0.25	Inches
Greatest Diameter of Bulb	3.50 ± 0.06	Inches
Maximum Deflecting Coil Inside Diameter	2 7/8	Inches
Deflecting Coil Length	5	Inches
Focusing Coil Length	10	Inches
Alignment Coil Length	1/2	Inch
Photocathode Distance Inside End of Faceplate	1/8	Inch
Weight, Approximate	1.4	Pounds

Operating Position: Any except with filament base up and the tube axis at an angle of less than 20 degrees from vertical.

Thermal

Operating Temperature of Any Part of Bulb	50	Max C
Operating Temperature of Bulb at Large End of Tube, Target Section	15	Max C
Temperature Difference Between Target Section and Any Part of Bulb Other than Target Section	5	Max C

MAXIMUM RATINGS—ABSOLUTE VALUES

Photocathode Voltage	550	Volts
Photocathode Illumination	50	Foot-Candles
Anode Supply Voltage*	600	Volts
Grid-No. 1 Voltage		
Negative Bias Value	125	Volts
Positive Bias Value	9	Volts
Grid-No. 2 and Dynode No. 1 Voltage	350	Volts
Grid-No. 3 Voltage	400	Volts
Grid-No. 4 Voltage	300	Volts
Grid-No. 5 Voltage	150	Volts
Grid-No. 6 Voltage	−550	Volts
Voltage per Multiplier Stage	350	Volts
Target Voltage		
Positive Voltage	2	Volts
Negative Voltage	10	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125	Volts
Heater Positive with Respect to Cathode	10	Volts

GENERAL ELECTRIC

TYPICAL OPERATION

Photocathode Voltage[1] (Average)	300 to	340	Volts
Grid No. 1 Voltage for Picture Cutoff, Ib(av)	-15 to	-115	Volts
Grid No. 2 and Dynode No. 1 Voltage		300	Volts
Grid No. 3 Voltage[2], multiplexed	225 to	230	Volts
Grid No. 4 Voltage, beam focus	140 to	180	Volts
Grid No. 5 Voltage, decelerator	0 to	12	Volts
Grid No. 6 Voltage, accelerator (Percent of Photocathode Voltage, approximate)	5.0 to	10	Volts
Dynode No. 6 Voltage		600	Volts
Dynode No. 5 Voltage		800	Volts
Dynode No. 4 Voltage		1000	Volts
Dynode No. 3 Voltage		1200	Volts
Anode Voltage		1250	Volts
DC Anode Current		3	Microamperes
Target Voltage, without Blanking Voltage	0 to	20	Volts
Peak-to-Peak Blanking Voltage	5 to	20	Volts
Target Temperature Range	15 to	35	C
Field Strength at Center of Focusing Coil		75	Gausses
Field Strength of Alignment Coil, approximate	0 to	3	Gausses

[1] Ratio of dynode voltages is shown under Typical Operation.

[2] Adjust to give the most uniformly shaded picture near the middle of the range.

[3] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil when the deflection coil is located outside of and at the image end of the focusing coil.

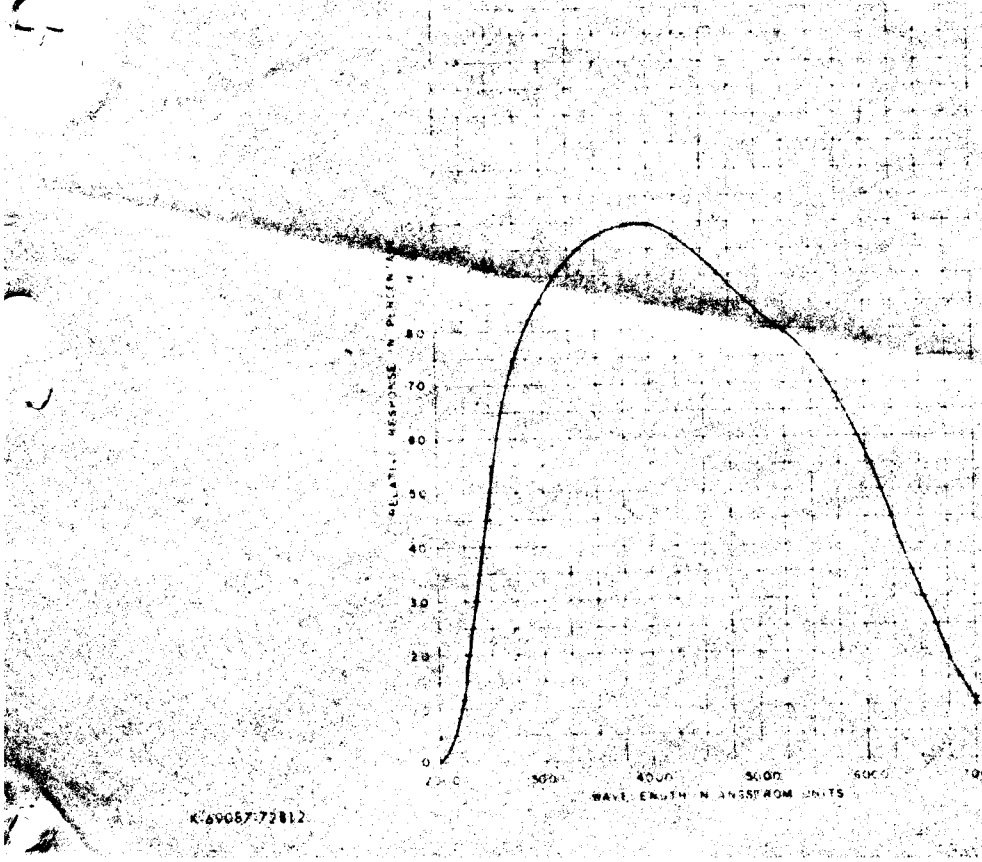
OPERATING NOTES

Normally a new tube will exhibit some slight "after-image" characterized by a rapid exponential decay which will gradually diminish with life. This can be minimized by use of an erase or fast-sweeping focused-raster scanning for short periods of time. Although a warm-up time of one hour is desirable, the tube can be used immediately after alignment as it cannot be permanently burned by target burn-in.

Some tubes may exhibit spurious bursts of signal immediately while relatively cool. These will disappear as the tube warms up and can be minimized during this period by slight readjustment of target voltage.

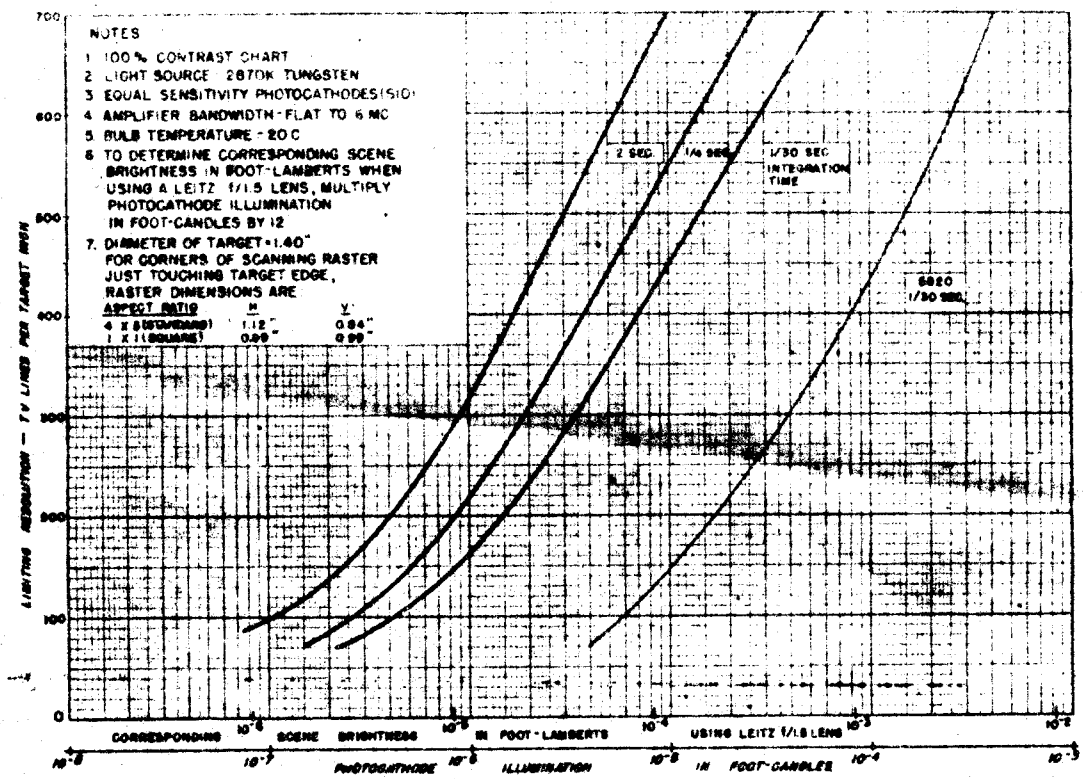
The target used in this tube greatly reduces the probability of permanent burn-in damage should a stationary highlight be imaged on the target for an extended period. However, imaging directly on the sun or other extremely bright sources should be avoided.

SPECTRAL SENSITIVITY CHARACTERISTIC



K-6908-72812

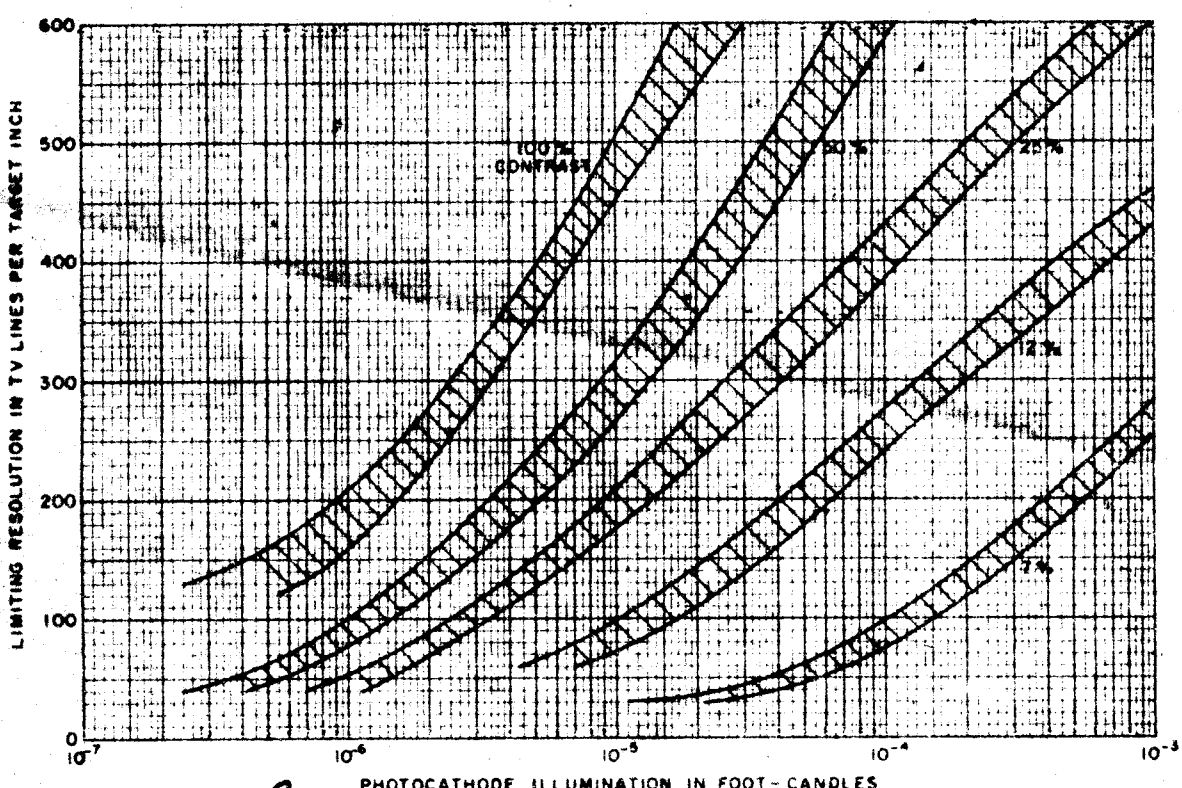
TYPICAL RESOLUTION– SENSITIVITY CHARACTERISTICS SHOWING EFFECTS OF IMAGE INTEGRATION



K-69087-72A972

8-60

EFFECT OF CONTRAST RATIO ON RESOLUTION SENSITIVITY

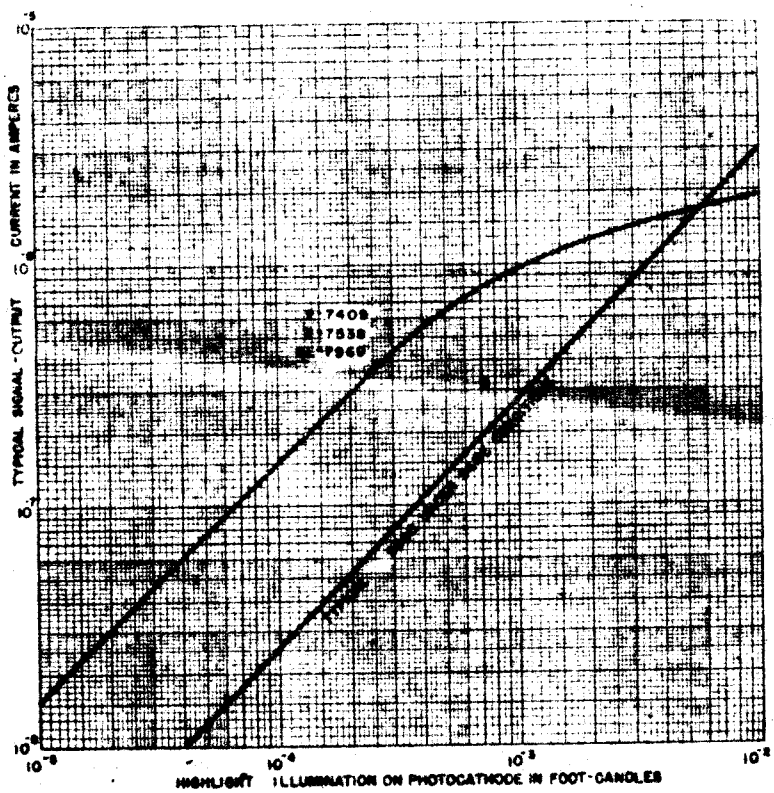


K-69087-72813

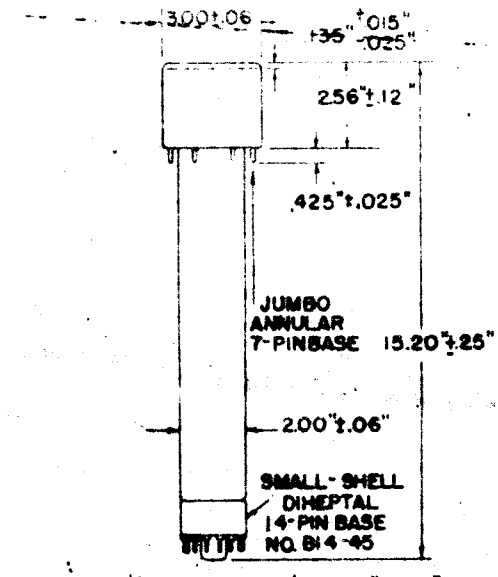
3-61

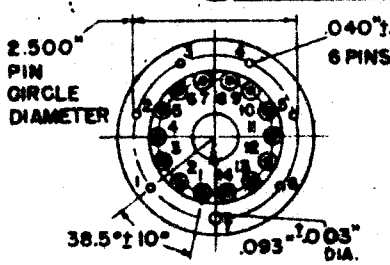
1969

TRANSFER CHARACTERISTIC

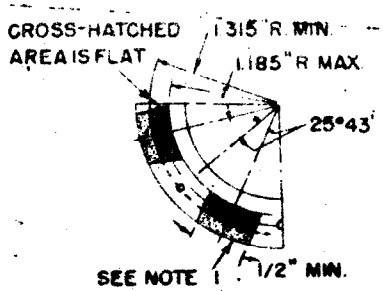


K-69087-72A913





ENLARGED BOTTOM VIEW



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAGE

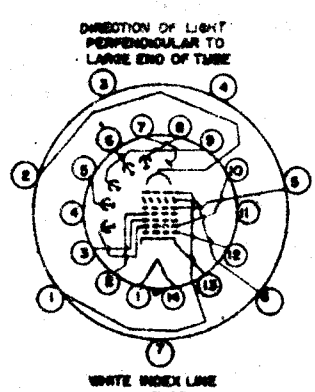
ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065"±.0.001" AND ONE HOLE HAVING DIA OF 0.150±0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26'±5' ON CIRCLE DIAMETER OF 2.500"±0.001"

b. SEVEN STOPS HAVING HEIGHT OF 0.187"±0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT OF A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126"±0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200"±0.001".



BASING DIAGRAM

SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER	PIN 6: DYNODE NO. 4	PIN 11: INTERNAL CONNECTION DO NOT USE
PIN 2: GRID NO. 4	PIN 7: ANODE	PIN 12: GRID NO.1
PIN 3: GRID NO. 3	PIN 8: DYNODE NO. 5	PIN 13: CATHODE
PIN 4: INTERNAL CONNECTION-DO NOT USE	PIN 9: DYNODE NO. 3	PIN 14: HEATER
PIN 5: DYNODE NO. 2.	PIN 10: DYNODE NO. 1, GRID NO. 2	

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO. 6	PIN 5: GRID NO. 5
PIN 2: PHOTOCATHODE	
PIN 3: INTERNAL CONNECTION-DO NOT USE	PIN 6: TARGET
PIN 4: INTERNAL CONNECTION DO NOT USE	PIN 7: INTERNAL CONNECTION DO NOT USE

PRELIMINARY
TECHNICAL INFORMATION
These ratings represent those of current samples of this type. Refer to the Objective Technical Information sheet for design-objective ratings.

DEVELOPMENTAL TYPE

This technical information is proprietary and is furnished only as a service to customers.

PACKAGED VOLTAGE-TUNABLE MAGNETRON

2750-3090 MEGACYCLES — 1.00-WATT OUTPUT

The ZM-6205 is a voltage-tunable magnetron with integral load isolator for voltage-tunable operation in the 2750-3090 megacycle frequency range. It is a complete r-f power source package requiring only input power connections and an r-f power-output connection and has a minimum CW power output of 1.00 watt across the entire frequency range. The tube may be voltage tuned over a portion or all of the frequency range for which it is designed.

The ZM-6205 has a noise level of -95 decibels with respect to carrier, a power variation limited to 1.2 decibels over its entire frequency range and is environmentalized for airborne applications.

GENERAL

	Min.	Bogey	Max.	
Electrical				
Cathode – Directly Heated				
Filament Voltage*	2.0	2.5	3.0	Volts
Filament Current*	1.95	2.0	2.05	Amperes
Mechanical				
Mounting Position – Any				
Net Weight			2.75	Pounds
Thermal				
Type of Cooling – Conduction or Convection				
Ambient Air Temperature, operating			+85	C

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Absolute Values		
Anode Voltage	1000	Volts
Anode Current	12	Milliamperes
Power Input, with Forced Air Cooling	18	Watts
Injection-Electrode Voltage	205	Volts
Injection-Electrode Current	0.1	Milliamperes
Filament Current	2.05	Amperes
Voltage Standing Wave Ratio of Load, maximum	3:1	
Typical Operating Conditions		
Operation with 60-cycle Sweep Voltage		
Filament Voltage*, approximate	2.50	Volts
Filament Current*	2.0	Amperes
Tunable Range #	2750-3090	Megacycles
Tuning Sensitivity, approximate	3.35	Megacycles per Volt
Anode Voltage at 2.945 gigacycles	850	Volts
Anode Current, average	8	Milliamperes
Injection-Electrode Voltage, Positive with Respect to Cathode	75-205	Volts
Injection-Electrode Current	0.0	Microamperes
Power Output, minimum	1.0	Watts
Noise †	-95	Decibels/mc
Power Variation ‡	1.2	Decibels
Dynamic Tuning Rate Variation	±5	Percent

The specifications of this type are subject to change. Delivery of samples and the existence of these data do not imply continued availability of types with the same characteristics or dimensions. For the most recent information concerning the status of this device, please consult your local Tube Department Regional Sales Office.

* Filament current should be adjusted to 2.0 amperes.

Frequency controlled by anode voltage.

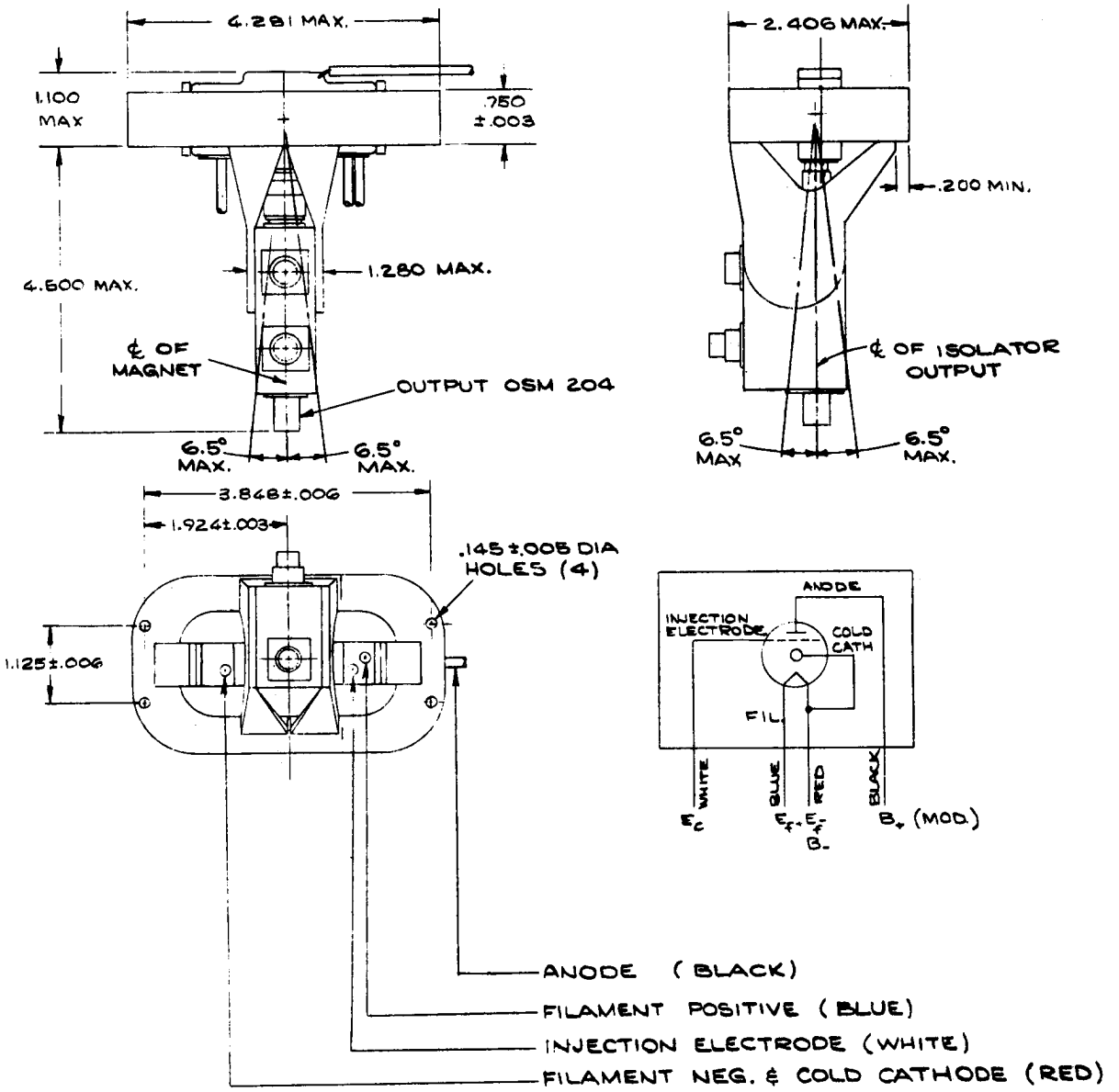
† This noise level is measured with respect to carrier level, 30 mc away from carrier.

‡ Measured across the entire frequency band and over a -55 C to +95 C magnet temperature range.

NOTE: Since a change in anode voltage of one volt produces a frequency change of approximately 3.35 megacycles, the anode supply should have sufficiently low ripple and high regulation to prevent an excess of frequency modulation.

CAUTION: A clearance of 6 inches between ferromagnetic materials and the tube will prevent serious change of the operating characteristics.

OUTLINE ZM-6205



NOTE:
USE NON-MAGNETIC STAINLESS STEEL MOUNTING SCREWS

A-69087-72B119

ELECTRONIC INNOVATIONS IN ACTION

TUBES

OBJECTIVE
TECHNICAL INFORMATION

These ratings represent the design objective for this product. Refer to the Preliminary Technical Information sheet for ratings currently achieved in the progression towards design objectives. If PTI sheets do not exist, consult your local Tube Department Regional Sales Office.

DEVELOPMENTAL TYPE

ZM-6222
OTI-107B

9-67

This technical information is proprietary and is furnished only as a service to customers.

PACKAGED VOLTAGE-TUNABLE MAGNETRON

2000-4000 Megacycles — 1.0 Watt CW Output

The ZM-6222 is a magnetically shielded voltage-tunable oscillator which operates at a minimum power output of one watt over the 2000 to 4000-megacycle frequency range. Unlike conventional electron devices employing magnetic fields, this shielded VTM is unaffected by passive magnetic materials. It does not require special tools, storage facilities or handling other than that normally given to a non-magnetic electron device. This shielded VTM also incorporates RFI shielding to attenuate stray radio-frequency on the d-c leads to levels below -40 dbc. It is a complete radio-frequency power source which requires only d-c input power and generates radio-frequency power over its electronically tuned octave frequency range. This voltage-tuned magnetron may be operated over a portion or all of the frequency range or operated at a fixed frequency. Its frequency versus voltage-tuning characteristic is essentially linear.

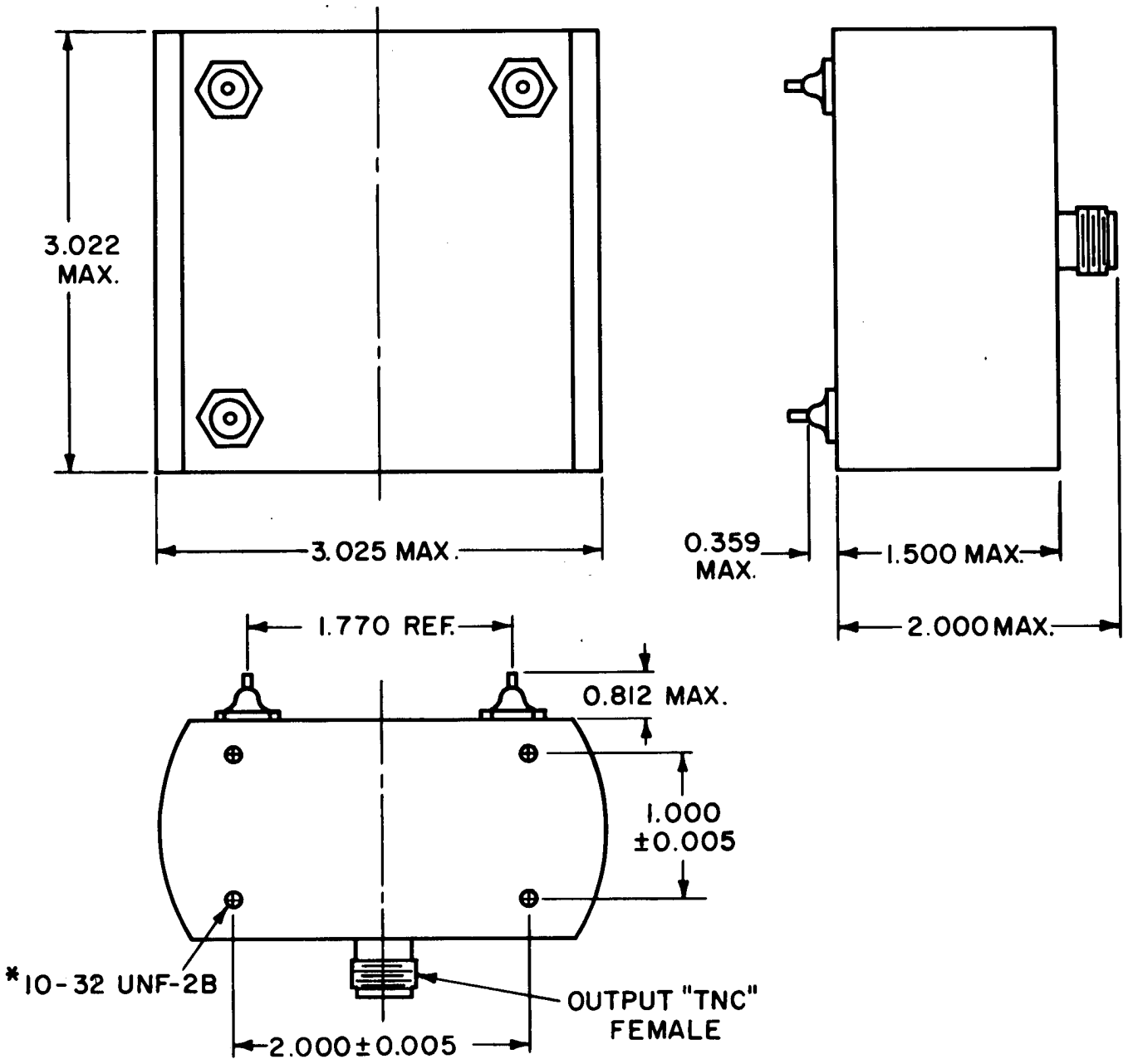
GENERAL

	Minimum	Bogey	Maximum	
Electrical				
Cathode – Directly Heated				
Filament Voltage*	2.0	2.5	3.0	Volts
Filament Current	-	2.0	-	Amperes
Mechanical				
Mounting Position – Any				
Net Weight, maximum			1.5	Pounds
Thermal				
Type of Cooling – Forced Air				
Air Flow			5	Cubic Feet per Minute
Ambient Air Temperature, maximum			50	C
Typical Operating Conditions				
Operation with 60-cycle Sweep Voltage				
Filament Voltage*, approximate			2.5	Volts
Filament Current			2.0	Amperes
Tunable Range†			2000-4000	Megacycles
Tuning Sensitivity, approximate			2.3	Megacycles per Volt
Anode Voltage at 3.0 Gigacycles			1300	Volts
Anode Current, average			10-15	Milliamperes
Injection Electrode Voltage, positive with respect to cathode			100-400	Volts
Injection Electrode Current			0.01	Milliamperes
Voltage Standing Wave Ratio of Load			1.15	
Power Output, minimum			1.0	Watts
Variation over Band		Less than 2.5:1		

* Filament voltage should be adjusted to provide 2.0 amperes of filament current under broadband swept oscillating conditions.

† Frequency controlled by anode voltage.

Specifications of this type are subject to change. Delivery of [illegible] does not imply continued availability of types with the same characteristics or dimensions. For the most recent information concerning the types of this device, please consult your local Tube Department Regional Sales Office.



TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady, New York 12305

ELECTRONIC INNOVATIONS IN ACTION

TUBES

OBJECTIVE
TECHNICAL INFORMATION

These ratings represent the design objective for this product. Refer to the Preliminary Technical Information sheet for ratings currently achieved in the progression towards design objectives. If PTI sheets do not exist, consult your local Tube Department Regional Sales Office.

DEVELOPMENTAL TYPE

ZM-6257
OTI-207
Page 1
9-67

This technical information is proprietary and is furnished only as a service to customers

ZM-6257

PACKAGED VOLTAGE-TUNABLE MAGNETRON

3500-4500 Megacycles — 10 Watt CW Output

The ZM-6257 is a magnetically shielded voltage-tunable oscillator which operates at a minimum power output of 10 watts over the 3500 to 4500-megacycle frequency range. Unlike conventional electron devices employing magnetic fields, this shielded VTM is unaffected by passive magnetic materials. It does not require special tools, storage facilities or handling other than that normally given to a non-magnetic electron device. It is a complete radio-frequency power source which requires only d-c input power and generates radio-frequency power over its electronically tuned frequency range. This voltage-tuned magnetron may be operated over a portion or all of the frequency range or operated at a fixed frequency. Its frequency versus voltage-tuning characteristic is essentially linear.

GENERAL

	Minimum	Bogey	Maximum	
Electrical				
Cathode – Directly Heated				
Filament Voltage *	2.0	2.3	2.6	Volts
Filament Current	–	3.0	–	Amperes
Mechanical				
Mounting Position				Any
Net Weight, maximum			1.5	Pounds
Thermal				
Type of Cooling – Forced Air				
Air Flow			30	Cubic Feet per Minute
Ambient Air Temperature, maximum			50	C

Typical Operating Conditions

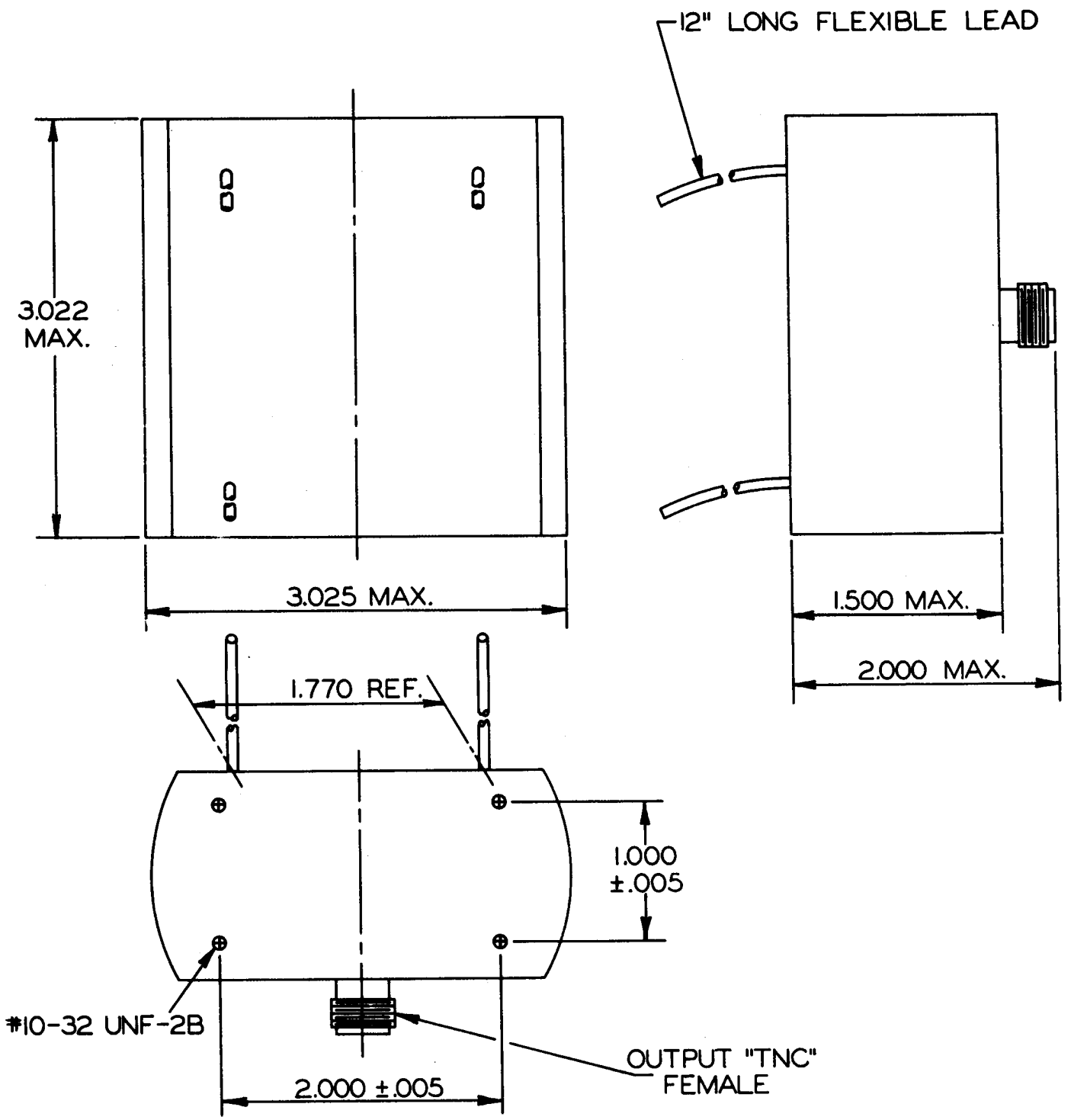
Operation with 60-cycle Sweep Voltage

Filament Voltage *, approximate	2.3	Volts
Filament Current	3.0	Amperes
Tunable Range †	3500-4500	Megacycles
Tuning Sensitivity, approximate	2.2	Megacycles per Volt
Anode Voltage at 4.0 Gigacycles	1700	Volts
Anode Current, average	20	Milliamperes
Injection Electrode Voltage, positive with respect to cathode	400	Volts
Injection Electrode Current	0.01	Milliamperes
Voltage Standing Wave Ratio of Load	1.15	
Power Output, minimum	10	Watts
Variation over Band	Less than 2.5:1	

Filament voltage should be adjusted to provide 3.0 amperes of filament current under broadband swept oscillating conditions.

Frequency controlled by anode voltage.

The specifications of this type are subject to change. Delivery of samples and the existence of these data do not imply continued availability of types with the same characteristics or dimensions. For the most recent information concerning the status of this device, please consult your local Tube Department Regional Sales Office.



TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady, N. Y. 12305

ELECTRONIC INNOVATIONS IN ACTION

TUBES

OBJECTIVE
TECHNICAL INFORMATION

These ratings represent the design objective for this product. Refer to the Preliminary Technical Information sheet for ratings currently achieved in the progression towards design objectives. If PTI sheets do not exist, consult your local Tube Department Regional Sales Office.

DEVELOPMENTAL TYPE

ZM-6265A
OTI-214

12-68

This technical information is proprietary and is furnished only as a service to customers

ZM-6265A

PACKAGED VOLTAGE-TUNABLE MAGNETRON

2500-3500 MEGACYCLES — 10 WATT OUTPUT

The ZM-6265A is a small, lightweight, magnetically shielded voltage-tunable oscillator with an integral isolator which operates at a minimum power output of 10 watts over the 2500-3500 megacycle frequency range. Unlike conventional electron devices employing magnetic fields, this shielded VTM is unaffected by passive magnetic materials. When specified, the ZM-6265A can be aligned for low-noise performance. Its noise power is at least 80 decibels per megacycle below the carrier at one megacycle away from the carrier. It is a complete radio-frequency power source requiring only d-c input power and generates radio-frequency power over its electronically tuned frequency range. This shielded VTM may be operated over a portion or all of the frequency range or operated at a fixed frequency. Its frequency versus voltage-tuning characteristic is essentially linear.

GENERAL

	Min.	Bogey	Max.	
Electrical				
Cathode – Directly Heated				
Filament Voltage*, approximate	2.2	2.5	2.7	Volts
Filament Current*	–	3.0	–	Amperes
Mechanical				
Mounting Position – Any				
Net Weight			1.0	Pounds
Thermal				
Type of Cooling – Forced Air				
Air Flow			30	Cubic Feet per Minute
Ambient Air Temperature			50	C

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Absolute Values		
Anode Voltage	2500	Volts
Anode Current	40	Milliamperes
Power Input, with Forced Air Cooling	85	Watts
Injection Electrode Voltage	700	Volts
Injection Electrode Current	1.0	Milliamperes
Filament Current	3.5	Amperes
Typical Operating Conditions		
Operation with 60-cycle Sweep Voltage		
Filament Voltage*, approximate	2.50	Volts
Filament Current	3.0	Amperes
Tunable Range#	2500-3500	Megacycles
Tuning Rate, approximate	1.8	Megacycles per Volt
Anode Voltage at 3 Kilomegacycles	1850	Volts
Anode Current, Average	20-30	Milliamperes
Injection Electrode Voltage, Positive with Respect to Cathode	300-600	Volts
Injection Electrode Current	0.1	Milliamperes
Voltage Standing Wave Ratio of Load	2.0	
Power Output, Minimum	10.0	Watts
Noise †	-80	Decibels per Megacycle

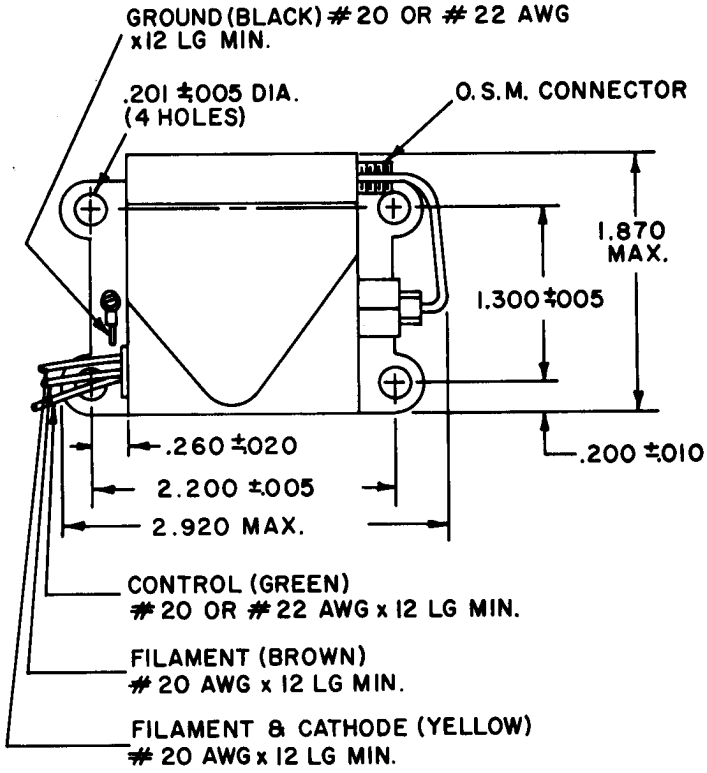
* Filament voltage should be adjusted to provide a filament current of 3.0 amperes under broadband swept oscillating conditions.

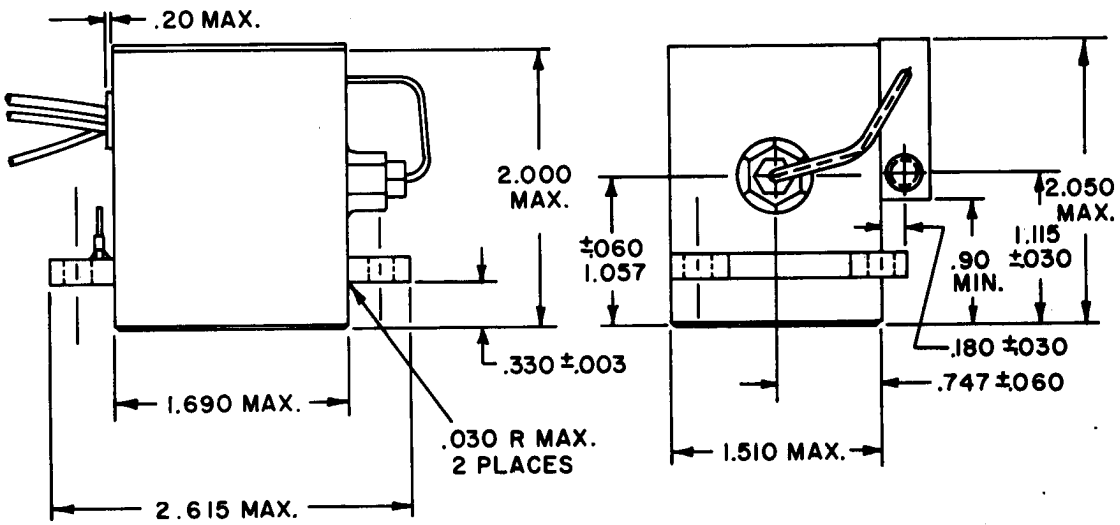
\# Frequency controlled by anode voltage.

The specifications of this type are subject to change. This device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please consult your local Tube Department Regional Sales Office, or current Preliminary Technical Information for the same catalog number.

NOTE: Since a change in anode voltage of one volt produces a frequency change of approximately 1.8 megacycles, the anode supply should have sufficiently low ripple and high regulation to prevent an excess of frequency modulation.

† Measured at 1.5 megacycles away from carrier with respect to carrier power level. This is an optional parameter which is included on special order only.





TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady, N. Y. 12305

ELECTRONIC INNOVATIONS IN ACTION

TUBES

OBJECTIVE
TECHNICAL INFORMATION

These ratings represent the design objective for this product. Refer to the Preliminary Technical Information sheet for ratings currently achieved in the progression towards design objectives. If PTI sheets do not exist, consult your local Tube Department Regional Sales Office.

DEVELOPMENTAL TYPE

ZM-6276
OTI-215
Page 1
12-68

This technical information is proprietary and is furnished only as a service to customers

ZM-6276

PACKAGED VOLTAGE-TUNABLE MAGNETRON

2600-3200 Megacycles — 100 Watts Minimum CW Output

Integral Magnet and Isolator

The ZM-6276 is a magnetically shielded voltage-tunable oscillator which operates at a minimum power output of 100 watts over the 2600 to 3200-megacycle range. It is designed for CW/FM transmitting-tube operation at low- or high-modulation frequencies. The high efficiency allows air cooling to be used and in many applications heat-sink cooling is adequate. The integral isolator protects the tube against load mismatches thus minimizing interface problems between the VTM and its associated equipment.

This shielded tube is unaffected by passive magnetic materials and does not require the special tools, storage and handling necessitated by conventional electron devices employing magnetic fields. It is a complete radio-frequency power source which requires only d-c input power and generates radio-frequency power over its electronically tuned frequency range. This voltage-tuned magnetron may be operated over a portion or all of the frequency range or operated at a fixed frequency. Its frequency versus voltage-tuning characteristic is essentially linear.

GENERAL

Electrical		
Cathode (filament) – Directly Heated		
Warm-up Time, maximum	10	Seconds
Cathode Input Capacitance		
Maximum	40	μμf
Typical	35	μμf
Mechanical		
Mounting Position		Any
Net Weight	4.5	Pounds
Thermal		
Cooling – Forced Air *		
Air Temperature, maximum	110	C
Body Temperature, maximum †	125	C

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Absolute Values		
Filament Voltage	2.5	Volts
Filament Current ‡	6.0	Amperes
Anode Voltage	3400	Volts
Sweep Voltage	700	Volts
Anode Current, swept	80	Milliamperes
Power Input	250	Watts
Injection Electrode Voltage	1700	Volts
Voltage Standing Wave Ratio of Load	2.0	
Typical Operating Conditions		
Operation with 60-cycle Sweep Voltage		
Filament Voltage, approximate	2.3	Volts
Filament Current ‡	5.3	Amperes
Swept Frequency Range	2600 to 3200	Megacycles
Sweep Voltage, Peak to Peak, typical	600	Volts
Anode Voltage at 2.9 Gigacycles	3000	Volts
Anode Current	65	Milliamperes
Injection Electrode Voltage, positive with respect to cathode	700 to 1700	Volts¶
Injection Electrode Current, may be either polarity but less than	0.5	Milliamperes

The specifications of this type are subject to change. This device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please consult your local Tube Department Regional Sales Office, or current Preliminary Technical Information for the same catalog number.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS (Cont'd.)

Typical Operating Conditions (Cont'd.)

Operation with 60-cycle Sweep Voltage (Cont'd.)

Power Output		
Average, Swept Across Full Band	120	Watts ***
Minimum, At Any Point Without Sweep Voltage	100	Watts ***
Variation Across Band		
Typical	1.4	Decibels
Maximum	2.0	Decibels
Efficiency, minimum		
At Any Frequency	55	Percent
Swept Across Full Band	60	Percent

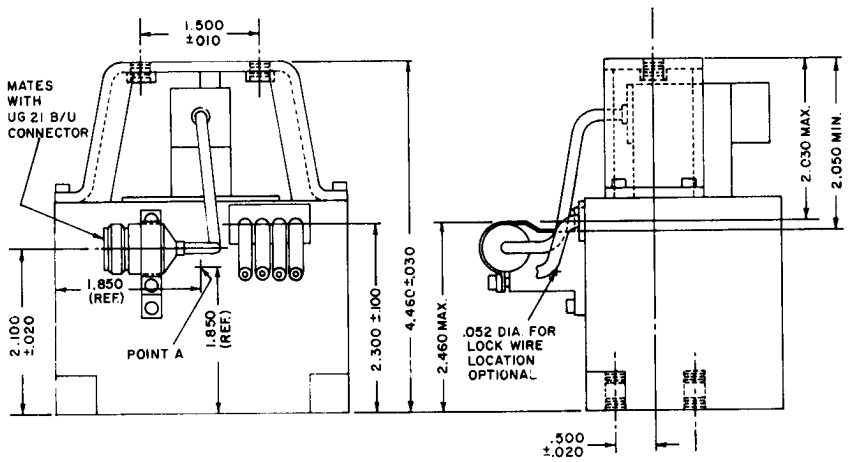
* Hold temperature to 125 C or less at point shown on the outline drawing. At the maximum inlet temperature of 110 C, 100 cubic feet per minute is required but this drops rapidly for lower inlet temperatures.

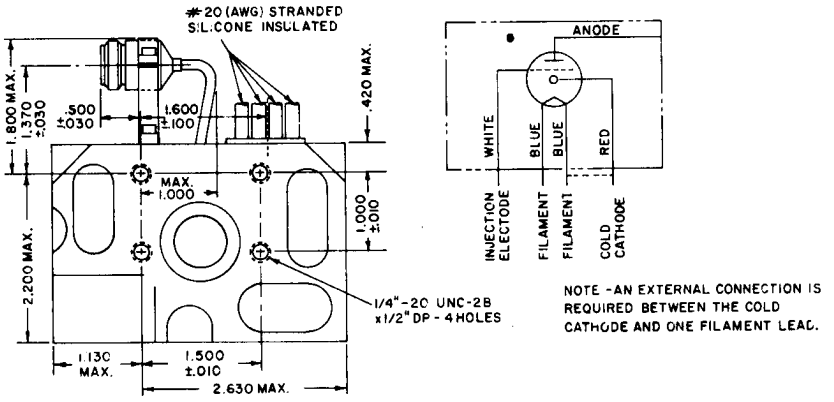
† Measured at point shown on the outline drawing.

‡ Set to value marked on tube within ± 0.1 ampere.

¶ Set to give anode current marked on tube within ± 2 milliamperes.

*** Measured with load VSWR < 1.2; for loads between 1.2 and 2.0 VSWR the power output is diminished by the amount reflected, plus a positive or negative change due to residual pulling. At 2.0 VSWR the theoretical reduction at the worst load phase is down to 85 percent, and the guaranteed performance is not less than 75 percent of rated power.





TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady, N. Y. 12305

ELECTRONIC INNOVATIONS IN ACTION

TUBES

OBJECTIVE
TECHNICAL INFORMATION

These ratings represent the design objective for this product. Refer to the Preliminary Technical Information sheet for ratings currently achieved in the progression towards design objectives. If PTI sheets do not exist, consult your local Tube Department Regional Sales Office.

DEVELOPMENTAL TYPE

ZM-6277
OTI-216

12-68

This technical information is proprietary and is furnished only as a service to customers

ZM-6277

PACKAGED VOLTAGE-TUNABLE MAGNETRON

2860-3460 Megacycles — 100 Watts Minimum CW Output

Integral Magnet and Isolator

The ZM-6277 is a magnetically shielded voltage-tunable oscillator which operates at a minimum power output of 100 watts over the 2860-3460-megacycle range. It is designed for CW/FM transmitting-tube operation at low- or high-modulation frequencies. The high efficiency allows air cooling to be used and in many applications heat-sink cooling is adequate. The integral isolator protects the tube against load mismatches thus minimizing interface problems between the VTM and its associated equipment.

This shielded tube is unaffected by passive magnetic materials and does not require the special tools, storage and handling necessitated by conventional electron devices employing magnetic fields. It is a complete radio-frequency power source which requires only d-c input power and generates radio-frequency power over its electronically tuned frequency range. This voltage-tuned magnetron may be operated over a portion or all of the frequency range or operated at a fixed frequency. Its frequency versus voltage-tuning characteristic is essentially linear.

GENERAL

Electrical		
Cathode (filament) – Directly Heated		
Warm-up Time, maximum	10	Seconds
Cathode Input Capacitance		
Maximum	40	μμf
Typical	35	μμf
Mechanical		
Mounting Position		Any
Net Weight	4.5	Pounds
Thermal		
Cooling – Forced Air *		
Air Temperature, maximum	110	C
Body Temperature, maximum †	125	C

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Absolute Values		
Filament Voltage	2.5	Volts
Filament Current ‡	6.0	Amperes
Anode Voltage	3400	Volts
Sweep Voltage	700	Volts
Anode Current, swept	80	Milliamperes
Power Input	250	Watts
Injection Electrode Voltage	1700	Volts
Voltage Standing Wave Ratio of Load	2.0	
Typical Operating Conditions		
Operation with 60-cycle Sweep Voltage		
Filament Voltage, approximate	2.3	Volts
Filament Current ‡	5.3	Amperes
Swept Frequency Range	2860 to 3460	Megacycles
Sweep Voltage, Peak to Peak, typical	550	Volts
Anode Voltage at 3.16 Gigacycles	3000	Volts
Anode Current	65	Milliamperes
Injection Electrode Voltage, positive with respect to cathode	700 to 1700	Volts ¶
Injection Electrode Current, may be either polarity but less than	0.5	Milliamperes

The specifications of this type are subject to change. This device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please consult your local Tube Department Regional Sales Office, or current Preliminary Technical Information for the same catalog number.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS (Cont'd.)

Typical Operating Conditions (Cont'd.)

Operation with 60-cycle Sweep Voltage (Cont'd.)

Power Output		
Average, Swept Across Full Band	110	Watts ***
Minimum, At Any Point Without Sweep Voltage	100	Watts ***
Variation Across Band		
Typical	1.4	Decibels
Maximum	2.0	Decibels
Efficiency, minimum		
At Any Frequency	55	Percent
Swept Across Full Band	60	Percent

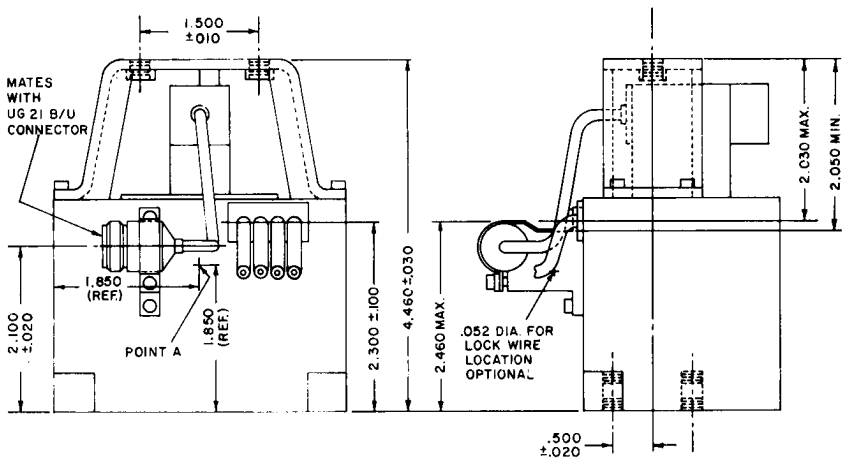
* Hold temperature to 125 C or less at point shown on the outline drawing. At the maximum inlet temperature of 110 C, 100 cubic feet per minute is required but this drops rapidly for lower inlet temperatures.

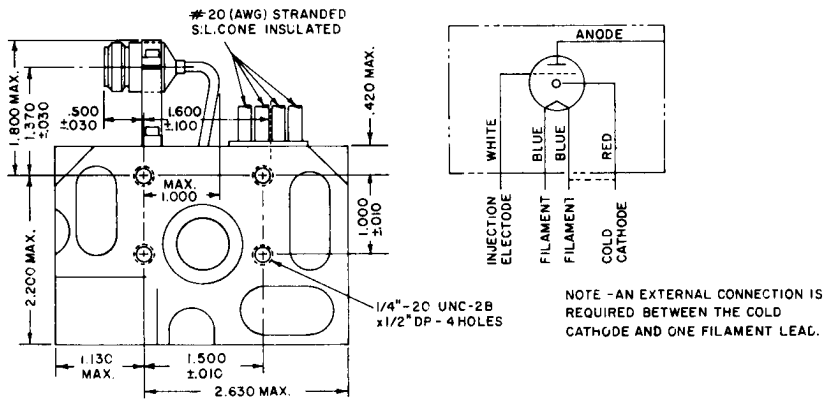
† Measured at point shown on the outline drawing.

‡ Set to value marked on tube within ± 0.1 ampere.

¶ Set to give anode current marked on tube within ± 2 milliamperes.

*** Measured with load VSWR < 1.2; for loads between 1.2 and 2.0 VSWR the power output is diminished by the amount reflected, plus a positive or negative change due to residual pulling. At 2.0 VSWR the theoretical reduction at the worst load phase is down to 85 percent, and the guaranteed performance is not less than 75 percent of rated power.





TUBE DEPARTMENT
GENERAL ELECTRIC
Schenectady, N. Y. 12305

ELECTRONIC INNOVATIONS IN ACTION

TUBES

OBJECTIVE
Technical Information

These ratings represent the design objective for this product. Refer to the preliminary Technical Information sheet for ratings currently achieved in the progression towards design objectives. If PTI sheets do not exist, consult your local Tube Products Department Regional Sales Office.

DEVELOPMENTAL TYPE

ZM–6287
OTI–218
12-70

This technical information is proprietary and is furnished only as a service to customers.

ZM–6287

INDUSTRIAL HEATING MAGNETRON

918 Megahertz
Forced-Air Cooled

1000 Watts Output Power
Integral Series Field Coils

The ZM–6287 is a low-voltage CW magnetron assembly for use in the 915-MHz ISM Band for microwave heating applications. It is designed for operation from a low cost, voltage doubler circuit, connected to a 240-volt a-c line. Approximately 50 volts a-c boost from an autotransformer is needed to achieve the 1000-watt output(Fig. 1). It contains an integral electromagnet energized by the voltage doubler output(series connection). The r-f output line contains a d-c bypass arrangement which allows the body of the tube to run off ground.

GENERAL

Mechanical

Mounting Position – Tube axis vertical
Weight ..... 17 Pounds

Thermal

Forced-Air Cooled ..... 100 Cu. ft/min.
Thermostat Temperature ..... 230° F

MAXIMUM RATINGS
(Absolute Values)

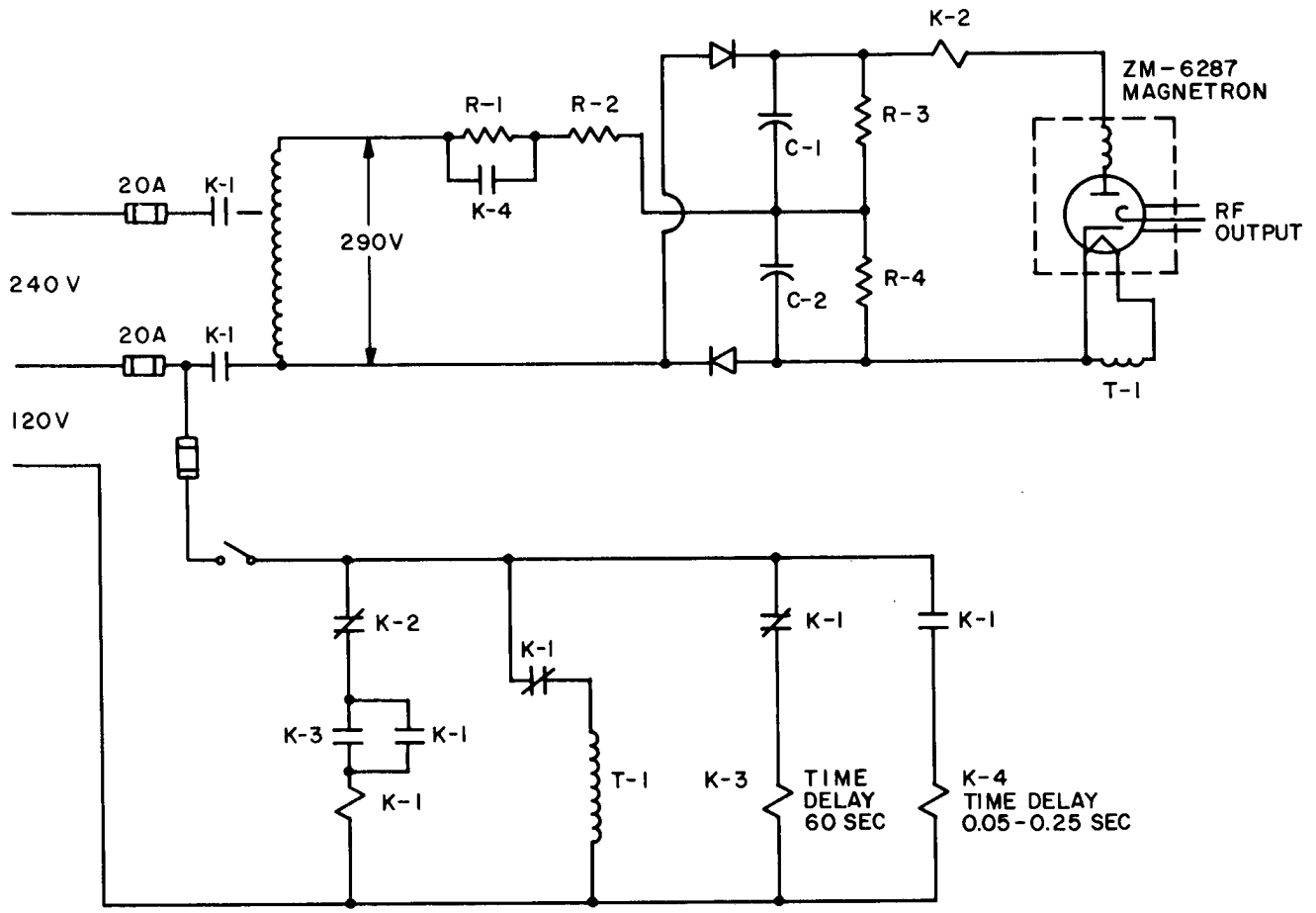
Electrical

	Min.	Max.
Filament		
Voltage		
Starting	-	6.3 Volts
Standby	-	5.5 Volts
Operating(650 watt level)	1.0	1.5 Volts
Operating(1000 watt level)	0	0 Volts
Current		
Starting		
Surge	-	75 Amperes
Stabilized (1 min.)	-	18 Amperes
Standby	-	15 Amperes
Operating (650 watt)	8	5 Amperes
Operating (1000 watt)	0	0 Amperes

	Min.	Max.
Preheat Time	50	Seconds
Plate Voltage		725 Volts DC
Plate Current		3.5 Amperes DC
Load VSWR		
Opposite Sink		3/1 VSWR
In Sink		2/1 VSWR
A-C Input Voltage to Doubler		300 V AC
Power Output (300 V AC Matched Load)	1000	Watts
Frequency, Matched Load	913	923 MHz

TYPICAL OPERATING CONDITIONS

Input to Doubler	290 V AC
Output Power (Matched)	Figure 2
Output Power (Mismatch)	Figure 3



K-1	Main Contactor	R-1	25Ω, 25W
K-2	DC Overload (4A)	R-2	.5Ω, 100W (Open coil of Nichrome or equiv.)
K-3	Time Delay Relay (Thermal Type)	R-3, 4	20,000Ω, 25W
K-4	Short Time Delay Relay	T-1	Filament Transformers (6.3V, 18A)
C-1, 2	500 μf, 500V		

FIGURE 1

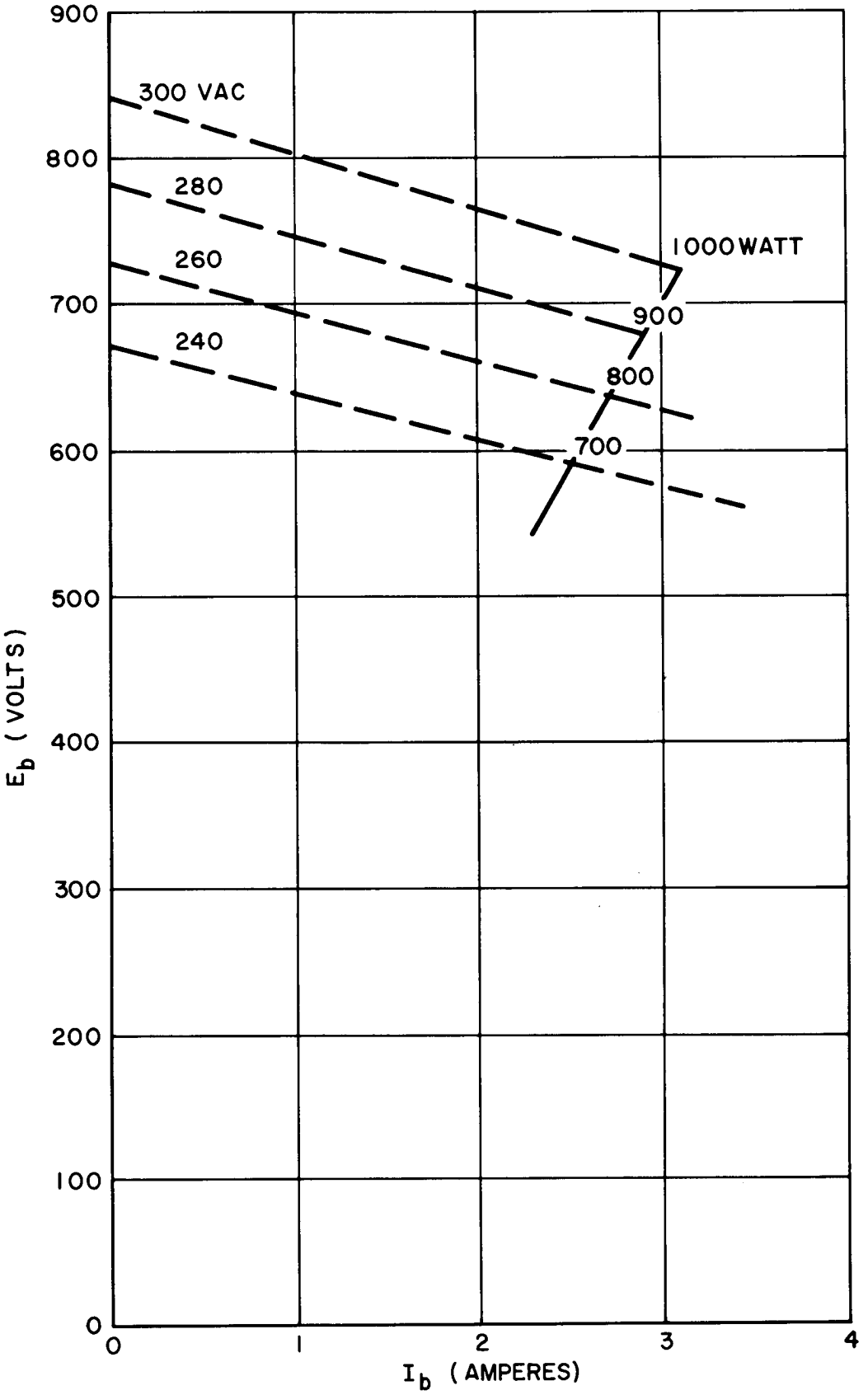

900
800
700
600
500
400
300
200
100
0
300 VAC
280
260
240
1000WATT
900
800
700
E_b (VOLTS)
0
1
2
3
4
I_b (AMPERES)

FIGURE 2

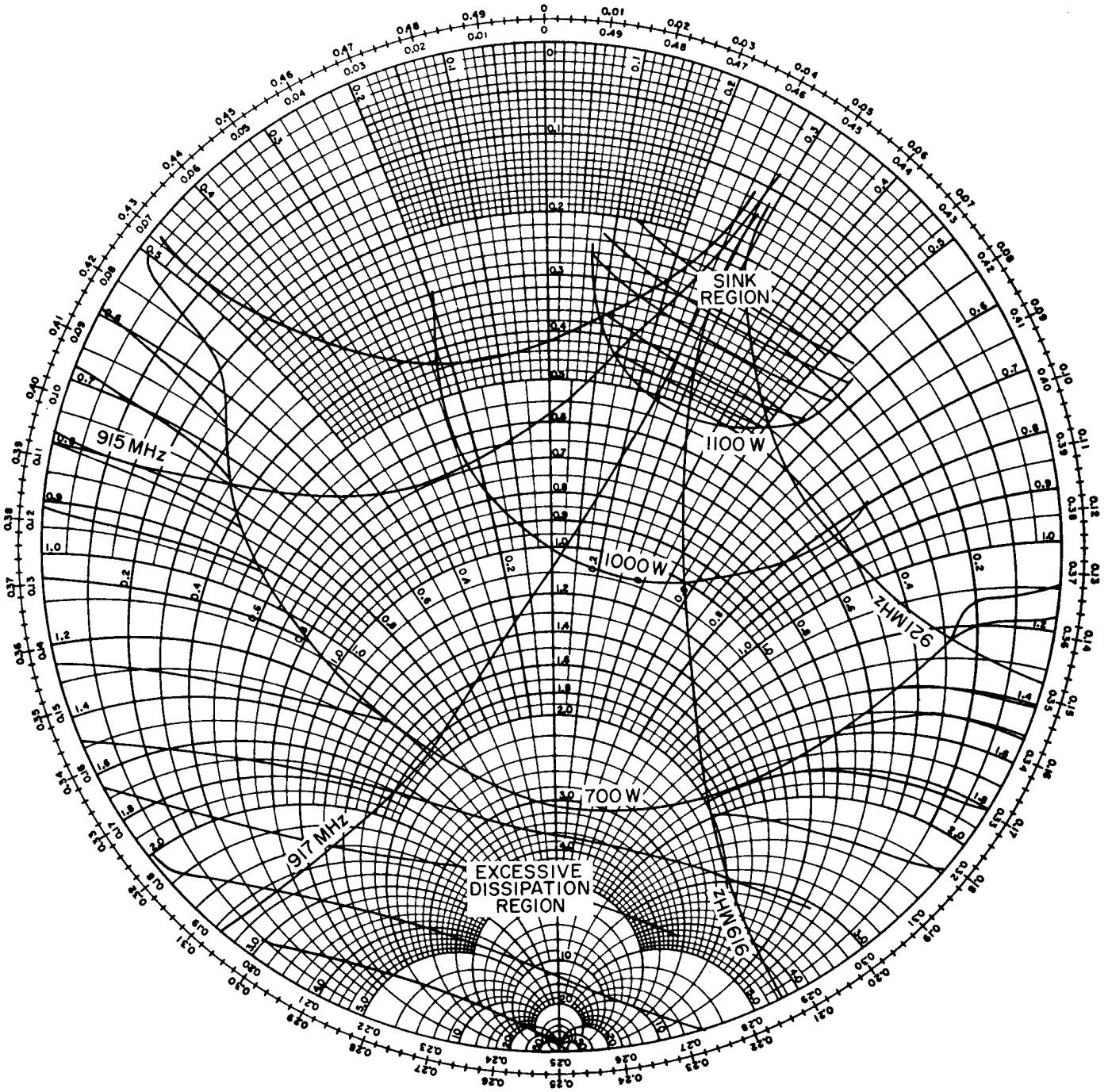

SINK
REGION
1100 W
1000 W
700 W
915 MHz
917 MHz
921 MHz
919 MHz
EXCESSIVE
DISSIPATION
REGION

FIGURE 3

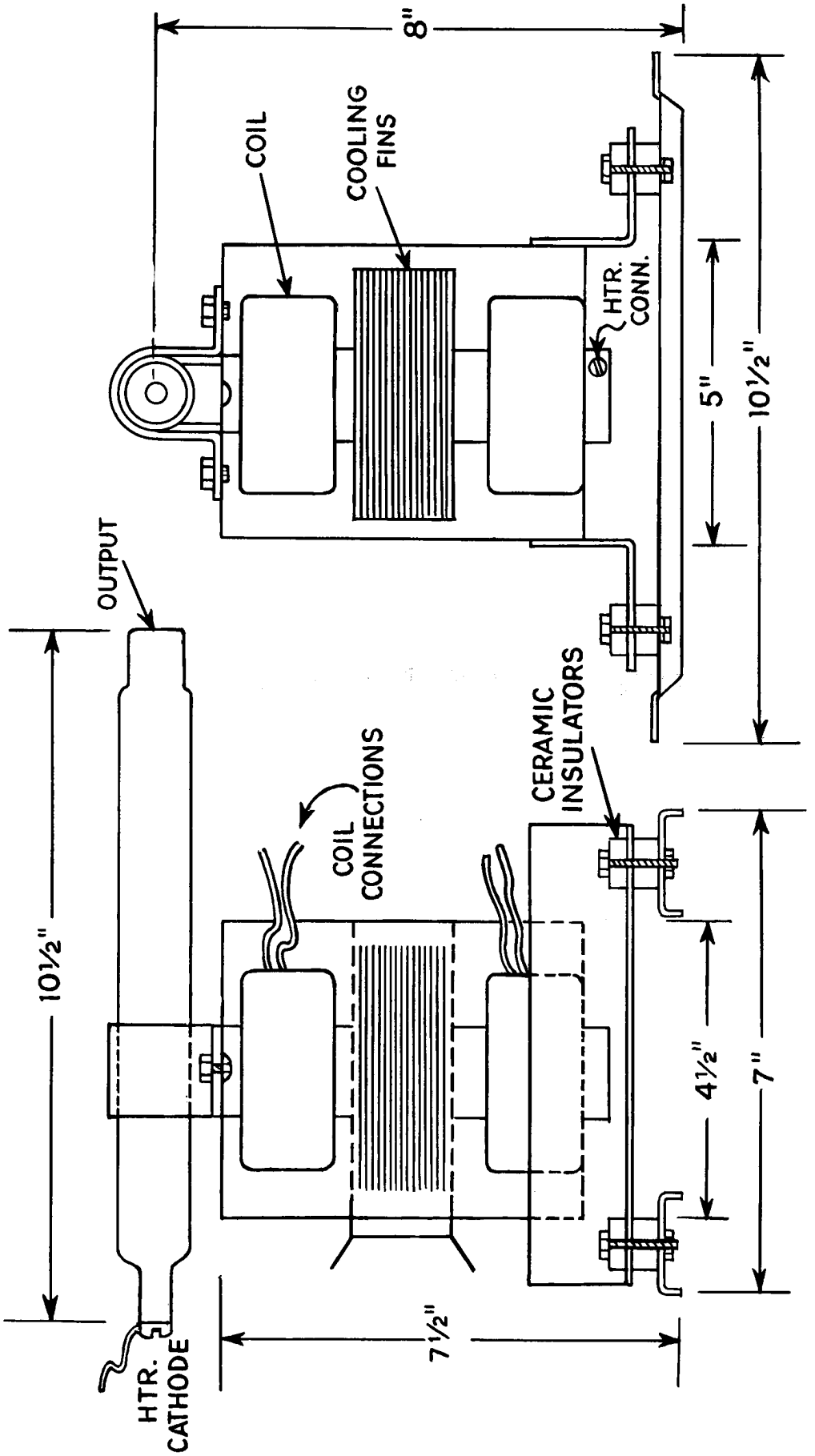

8"
COIL
COOLING FINS
HTR. CONN.
5"
10½"
OUTPUT
CERAMIC INSULATORS
COIL CONNECTIONS
10½"
4½"
7"
7½"
HTR. CATHODE

FIGURE 4

GENERAL ELECTRIC
TUBE DEPARTMENT
Schenectady, N. Y. 12305

GENERAL ELECTRIC
POWER TUBE DEPARTMENT
Schenectady 5, N. Y.

PRELIMINARY
TECHNICAL INFORMATION

These ratings represent those of current samples of this type. Refer to the Objective Technical Information sheet for design-objective ratings.

This technical information is proprietary and is furnished only as a service to customers.

ZP-1015

Tetrode

Grid-Pulsed Service
Grounded-Grid Operation

Heat-Sink and Forced-Air Cooled
Metal and Ceramic

The ZP-1015 is a heat-sink-cooled version of the GL-7399 especially designed for pulsed-amplifier or oscillator service at L-band frequencies. This tetrode is particularly well suited for use in airborne IFF radar equipment.

The tube is capable of providing useful output at frequencies up to approximately 1500 megacycles.

Features of the ZP-1015 include long life and reliability, long pulse width and high gain.

ELECTRICAL	Minimum	Bogey	Maximum	
Heater Voltage	6.0	6.3	6.8	Volts
Heater Current	–	5.6	–	Amperes
Amplification Factor, G_2 to G_1	–	10.5	–	
E_{g2}=275 Volts DC, E_b=1000 Volts DC, I_b = 200 Milliamperes DC				
Cathode Heating Time	1	–	–	Minute
Direct Interelectrode Capacitances*				
Cathode to Plate†	–	0.012	–	μμf
Input	–	24	–	μμf
Output	–	9.3	–	μμf

MECHANICAL

Mounting Position – Any
Net Weight, approximately . . . . . 11 Ounces

THERMAL

Cooling – Heat-sink and Forced-Air‡
Anode Temperature Δ, maximum . . . . . 250 C
Seals
Screen and Control Grid, approximate . . . . . 1 Cubic Foot per Minute
Heater and Cathode, approximate . . . . . 1 Cubic Foot per Minute
Ceramic Temperature at Any Point, maximum . . . . . 200 C

RADIO-FREQUENCY POWER AMPLIFIER – CLASS C

Maximum Ratings

Pulsed Drive, 1250 Megacycles

DC Plate Voltage**	5	Kilovolts
DC Plate Current, during pulse	6	Amperes
DC Grid-No. 2 Voltage	1.1	Kilovolts
DC Grid-No. 2 Input	5	Watts
DC Grid-No. 1 Voltage	-225	Volts
DC Grid-No. 1 Current	1.5	Amperes

The specifications of this type are subject to change. Delivery of samples and the existence of these data do not imply continued availability of types with the same characteristics or dimensions. For the most recent information concerning the status of this device, please consult your local Power Tube Department Regional Sales Office.

RADIO-FREQUENCY POWER AMPLIFIER - CLASS C (CONT'D)

Maximum Ratings (Cont'd)

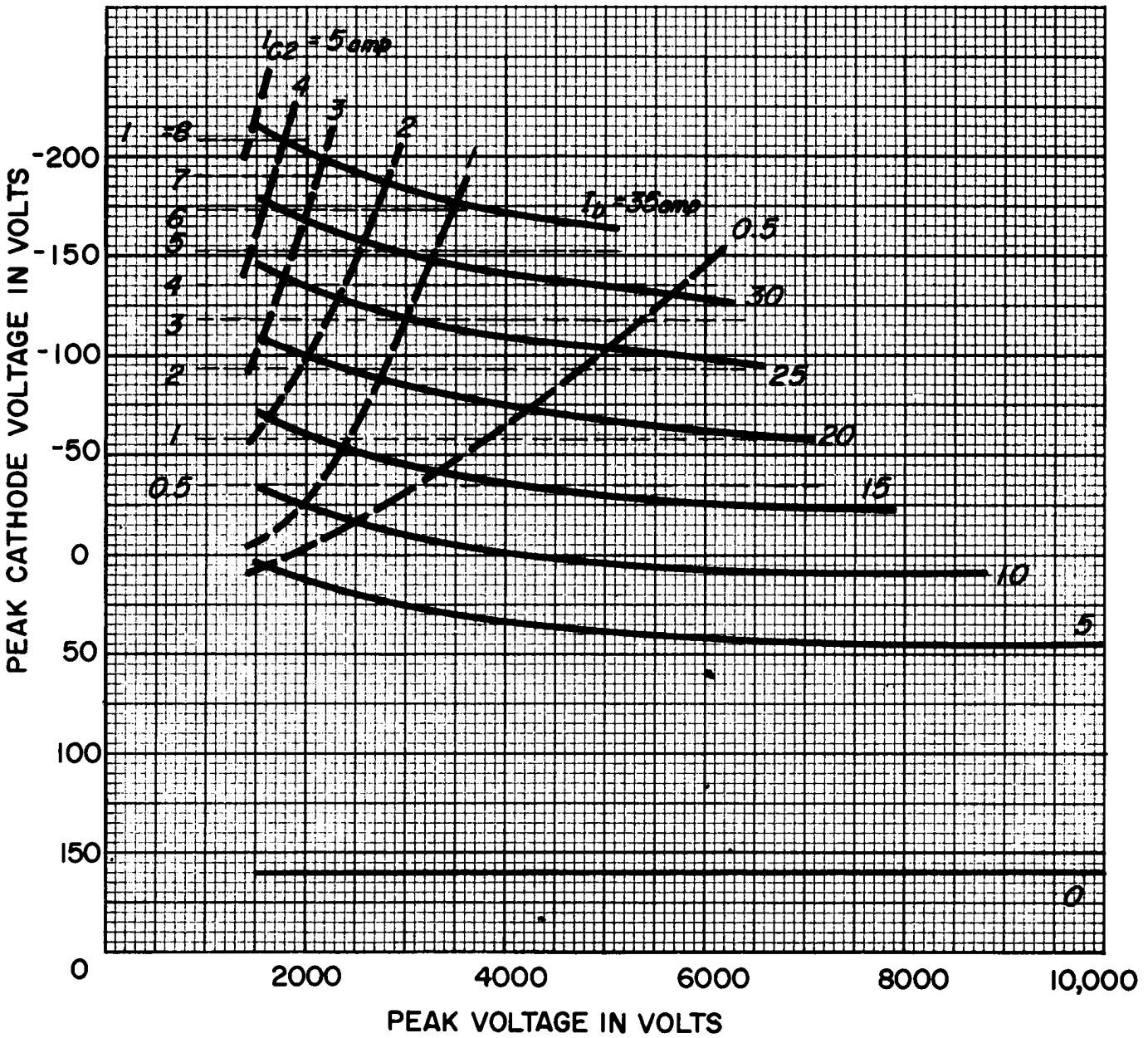
Pulsed Drive, 1250 Megacycles (Cont'd)		
Plate Dissipation	150	Watts
Pulse Width ♥ ◊	15	Microseconds
Duty Factor ♥ ϕ	0.01	

Typical Operation

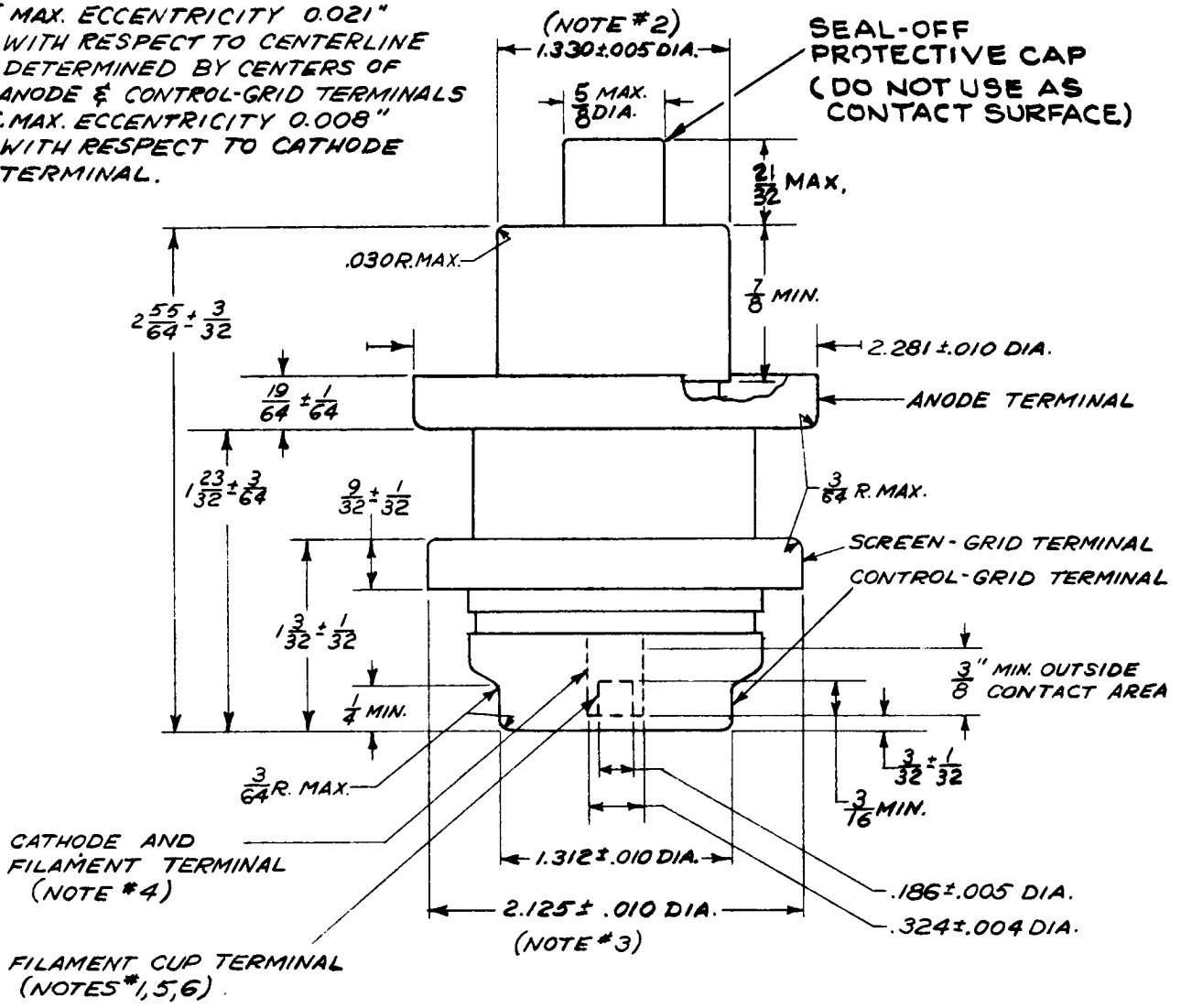
Grounded-grid Service at 1100 Megacycles,	3/4λ	Output Circuit
DC Plate Voltage	4.8	Kilovolts
DC Plate Current, during pulse	4.2	Amperes
DC Grid-No. 2 Voltage	1	Kilovolt
DC Grid-No. 2 Current, during pulse	100	Milliamperes
DC Grid-No. 1 Voltage	-200	Volts
DC Grid-No. 1 Current, during pulse	200	Milliamperes
Driving Power at Tube, during pulse	1.5	Kilowatts
Power Output, during pulse (useful)	11	Kilowatts
Pulse Width ◊	15	Microseconds
Duty Factor ϕ	0.01	

* Control grid connected directly to screen grid.
† Complete external shielding between cathode and plate.
‡ Forced-air cooling should be applied during the application of any voltages.
Δ A suitable heat-sink clamping arrangement must be provided to limit the anode hub temperature to the value specified; the temperature is measured at the point indicated on the outline drawing.
** A minimum surge-limiting resistance of 50 ohms must be placed between the plate of the tube and the B+ power supply at steady-state voltages greater than 3.5 kilovolts.
♥ For applications that require longer pulses or higher duty refer to the tube manufacturer for recommendations.
◊ Pulse duration measured between points at 70 percent of peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.
ϕ Maximum ratio of on-time to elapsed time during any 15 millisecond period.

CONSTANT CURRENT CHARACTERISTIC
GROUNDED-GRID OPERATION
VOLTAGES MEASURED TO GROUND
SCREEN VOLTAGE = 1400 VOLTS



NOTES:
1. BOTTOM OF CUP MUST NOT BE USED AS A SOCKET STOP.
2. MAX. ECCENTRICITY 0.015"
3. MAX. ECCENTRICITY 0.008"
4. MAX. ECCENTRICITY 0.018"
5. MAX. ECCENTRICITY 0.021" WITH RESPECT TO CENTERLINE DETERMINED BY CENTERS OF ANODE & CONTROL-GRID TERMINALS
6. MAX. ECCENTRICITY 0.008" WITH RESPECT TO CATHODE TERMINAL.



GENERAL ELECTRIC
POWER TUBE DEPARTMENT
Schenectady 5, N. Y.

PRELIMINARY
TECHNICAL INFORMATION

These ratings represent those of current samples of this type. Refer to the Objective Technical Information sheet for design-objective ratings.

DEVELOPMENTAL TYPE

This technical information is proprietary and is furnished only as a service to customers.

ZP-1018

Grid-Pulsed Service
Grounded-Grid Operation

Tetrode

Heat-Sink and Forced-Air Cooled
Metal and Ceramic

The ZP-1018 is a reduced-size heat-sink-cooled version of the GL-6283 especially designed for pulsed-amplifier or oscillator service at L-band frequencies. This tetrode is particularly well suited for use in airborne radar equipment such as IFF transponders.

The tube is capable of providing useful output at frequencies up to approximately 1500 megacycles.

Features of the ZP-1018 include long life and reliability, long pulse width and high gain.

ELECTRICAL	Minimum	Bogey	Maximum	
Heater Voltage*	–	6.3	–	Volts
Heater Current	–	3.8	–	Amperes
Cathode Heating Time	1	–	–	Minute
Direct Interelectrode Capacitances**				
Cathode to Plate†	–	.006	–	μμf
Input	–	20	–	μμf
Output	–	8.9	–	μμf

MECHANICAL

Mounting Position – Any		
Net Weight, approximately	9	Ounces

THERMAL

Cooling – Heat-sink and Forced-Air‡		
Anode Temperature §, maximum	250	C
Seals		
Screen and Control Grid, approximate	1	Cubic Foot per Minute
Heater and Cathode, approximate	1	Cubic Foot per Minute
Ceramic Temperature at Any Point, maximum	200	C

RADIO-FREQUENCY POWER AMPLIFIER – CLASS C

Maximum Ratings

Pulsed Drive, 1250 Megacycles		
DC Plate Voltage	3.5	Kilovolts
DC Plate Current, during pulse	5	Amperes
DC Grid-No. 2 Voltage	750	Volts
DC Grid-No. 2 Input	5	Watts
DC Grid-No. 1 Voltage	-200	Volts
Plate Dissipation	150	Watts
Pulse Width▽◇	15	Microseconds
Duty Factor▽ϕ	.02	

Typical Operation

Grounded-Grid Service at 1100 Megacycles, 1/4 λ Output Circuit			
DC Plate Voltage	2.5	2.5	Kilovolts
DC Plate Current, during pulse	1.4	1.0	Amperes

The specifications of this type are subject to change. Delivery of samples and the existence of these data do not imply continued availability of types with the same characteristics or dimensions. For the most recent information concerning the status of this device, please consult your local Power Tube Department Regional Sales Office.

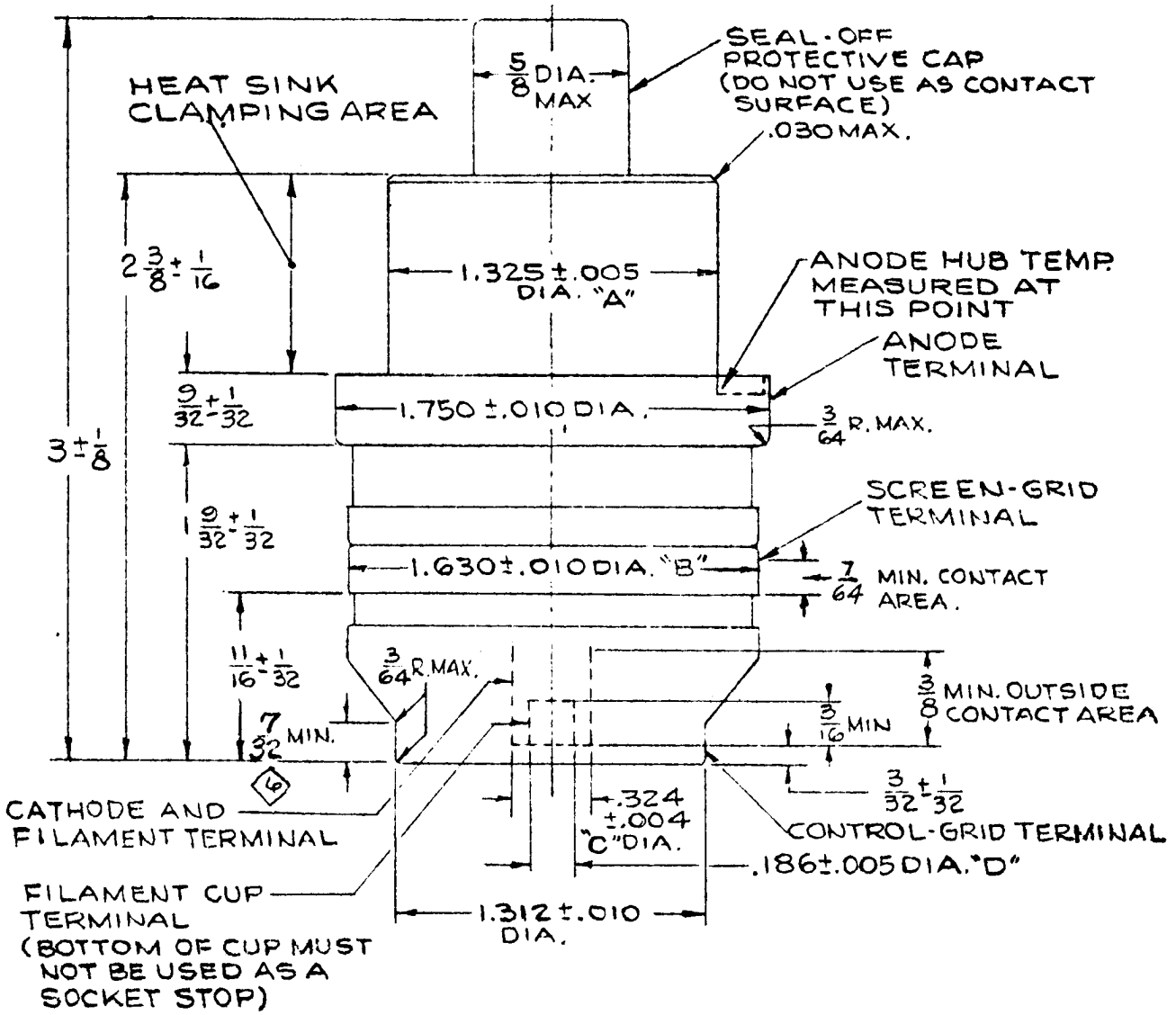
RADIO-FREQUENCY POWER AMPLIFIER – CLASS C (CONT'D)

Typical Operation (Cont'd)

DC Grid-No. 2 Voltage	600	600	Volts
DC Grid-No. 2 Current, during pulse	50	0	Milliamperes
DC Grid-No. 1 Voltage	-70	-70	Volts
DC Grid-No. 1 Current, during pulse	90	80	Milliamperes
Driving Power at the Tube, during pulse	165	95	Watts
Power Output, during pulse (useful)	1.6	1.0	Kilowatts
Pulse Width	6	6	Microseconds
Duty Factor	.02	.02	

*Under the typical operating conditions shown the filament voltage should be reduced to approximately 6.0 volts because of back-heating resulting from transit time effects.

**Control grid connected directly to screen grid.
† Complete external shielding between cathode and plate.
‡ Forced-air cooling should be applied during the application of any voltages.
§ A suitable heat-sink clamping arrangement must be provided to limit the anode hub temperature to the value specified; the temperature is measured at the point indicated on the outline drawing.
♥ For applications that require longer pulses or higher duty refer to the tube manufacturer for recommendations.
◊ Pulse duration is measured between points at 70 percent of the peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.
ϕ Maximum ratio of on-time to elapsed time during any 7.5 millisecond period.



CONCENTRICITIES:

The following total indicator readings are measured with respect to a centerline determined by the centers of the anode terminal and control grid terminal.

Diameter A - 0.030 inches
Diameter B - 0.016 inches
Diameter C - 0.036 inches
Diameter D - 0.042 inches

Total indicator reading of filament cup terminal diameter (D) measured with respect to center of cathode and filament terminal diameter (C) - 0.016 inches.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

GENERAL ELECTRIC
POWER TUBE DEPARTMENT
Schenectady 5, N. Y.

OBJECTIVE
TECHNICAL INFORMATION

These ratings represent the design objective for this product. Refer to the Preliminary Technical Information sheet for ratings currently achieved in the progression towards design objectives. If PTI sheets do not exist, consult your local Tube Department Regional Sales Office.

This technical information is proprietary and is furnished only as a service to customers.

ZP-1024

TRIODE

Internal Feedback for Oscillator Service
Grounded-Grid Operation

Heat-Sink and Forced-Air Cooled
Metal and Ceramic

The ZP-1024 is a heat-sink-cooled triode especially designed for pulsed-oscillator service in L-band, providing useful output at frequencies up to approximately 1700 megacycles.

The tube features internal feedback which eliminates the need for the complicated external circuit arrangements normally required in oscillator service.

Other features of the ZP-1024 are long life and reliability, long pulse width and high power output capability.

ELECTRICAL	Minimum	Bogey	Maximum	
Heater Voltage	–	6.3	–	Volts
Heater Current	–	3.8	–	Amperes
Cathode Heating Time	1	–	–	Minute
Direct Interelectrode Capacitances				
Cathode to Plate †	–	0.5	–	μμf
Input	–	20	–	μμf
Output	–	7.8	–	μμf

MECHANICAL		
Mounting Position – Any		
Net Weight, approximately	9	Ounces

THERMAL		
Cooling – Heat-sink and Forced-Air ‡		
Anode Temperature §, maximum	250	C
Seals		
Screen and Control Grid, approximate	1	Cubic Foot per Minute
Heater and Cathode, approximate	1	Cubic Foot per Minute
Ceramic Temperature at Any Point, maximum	200	C

PLATE-PULSED OSCILLATOR – CLASS C

Maximum Ratings

DC Plate Voltage, during pulse	6.5	Kilovolts
DC Plate Current, during pulse	6.5	Amperes
DC Grid Voltage, during pulse	-400	Volts
Plate Dissipation	150	Watts
Pulse Width◊	1	Microsecond
Duty Factor♥ ϕ	.001	

The specifications of this type are subject to change. This device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please consult your local Tube Department Regional Sales Office, or current Preliminary Technical Information for the same catalog number.

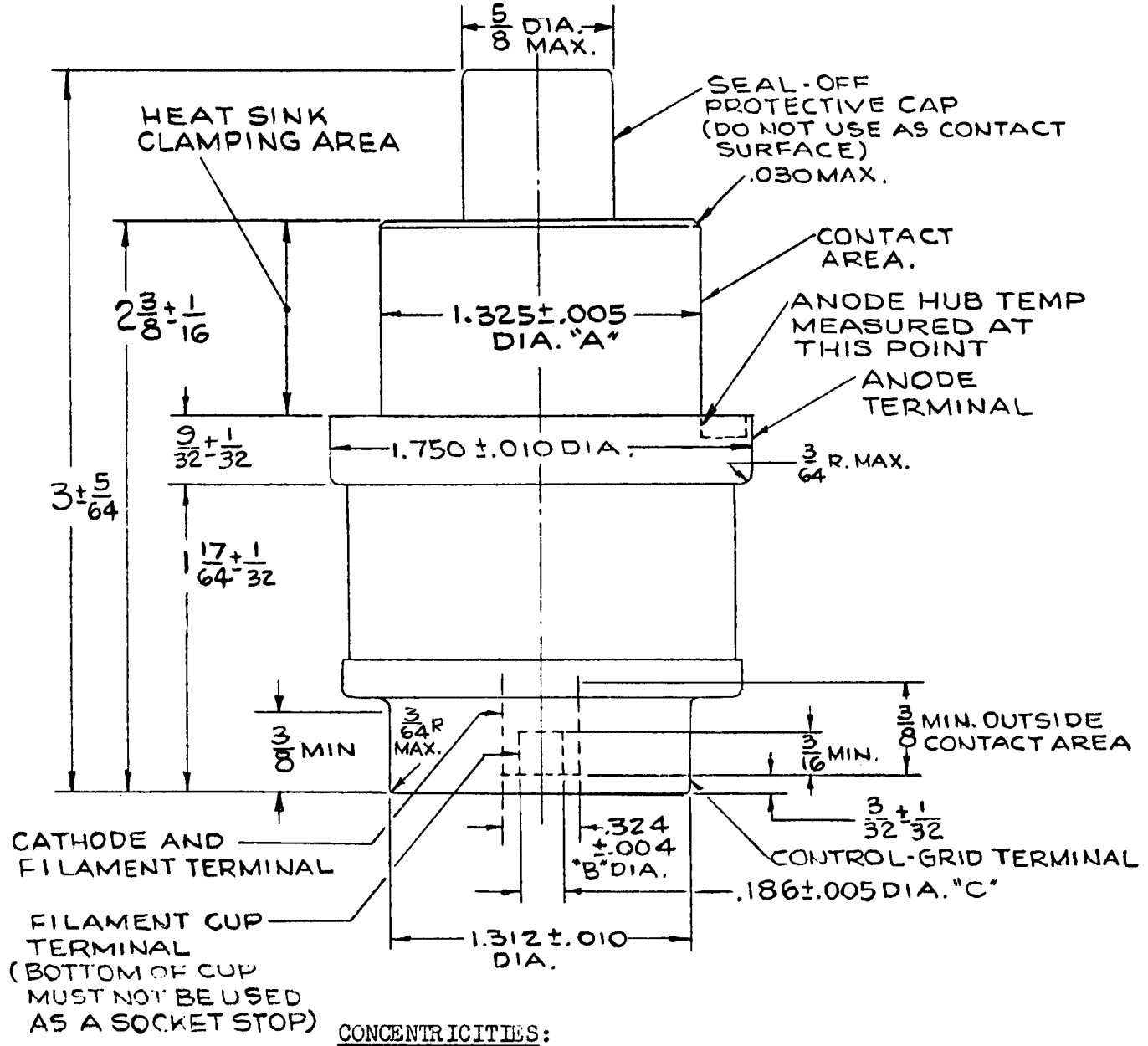
PLATE-PULSED OSCILLATOR - CLASS C (Cont'd)

Typical Operation

Grounded-Grid Service at 1100 Megacycles, 3/4 λ Output Circuit

DC Plate Voltage, during pulse	6.0	Kilovolts
DC Plate Current, during pulse	6.25	Amperes
DC Grid Current, during pulse	2.5	Amperes
Power Output, during pulse (useful)	15	Kilowatts
Pulse Width	1	Microsecond
Duty Factor	.001	

† Complete external shielding between cathode and plate.
‡ Forced-air cooling should be applied during the application of any voltages.
§ A suitable heat-sink clamping arrangement must be provided to limit the anode hub temperature to the value specified; the temperature is measured at the point indicated on the outline drawing.
♈ For applications that require longer pulses or higher duty refer to the tube manufacturer for recommendations.
◊ Pulse duration is measured between points at 70 percent of the peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.
ϕ Maximum ratio of on-time to elapsed time during any 1-millisecond period.



CONCENTRICITIES:

The following total indicator readings are measured with respect to a centerline determined by the centers of the anode terminal and control grid terminal.

Diameter A - 0.030 inches
Diameter B - 0.036 inches
Diameter C - 0.042 inches

Total indicator reading of filament cup terminal diameter (C) measured with respect to center of cathode and filament terminal diameter (B) - 0.016 inches.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

GENERAL ELECTRIC
POWER TUBE DEPARTMENT
Schenectady 5, N. Y.

PRELIMINARY
TECHNICAL INFORMATION

These ratings represent those of current samples of this type. Refer to the Objective Technical Information sheet for design-objective ratings.

This technical information is proprietary and is furnished only as a service to customers.

ZP-1025

TRIODE

Internal Feedback for Oscillator Service
Grounded-Grid Operation

Heat-Sink and Forced-Air Cooled
Metal and Ceramic

The ZP-1025 is a heat-sink-cooled triode especially designed for pulsed oscillator service in L-band. This tube is particularly well suited for use in airborne radar equipment such as IFF transponders.

The tube features internal feedback which eliminates the need for the complicated external circuit arrangements normally required in oscillator service.

Other features include small size, long pulse width capability, long life and reliability.

ELECTRICAL	Minimum	Bogey	Maximum	
Heater Voltage*	–	6.3	–	Volts
Heater Current	3.5	3.8	4.0	Amperes
Cathode Heating Time	1	–	–	Minute
Direct Interelectrode Capacitances				
Cathode to Plate	–	0.45	–	μμf
Input	–	15.5	–	μμf
Output	–	5.9	–	μμf

MECHANICAL

Mounting Position – Any
Net Weight, approximately ..... 3 1/4 Ounces

THERMAL

Cooling – Heat-Sink and Forced-Air

Anode Temperature §	250	C
Ceramic Temperature at Any Point, maximum	200	C

PLATE-PULSED OSCILLATOR-CLASS C

Maximum Ratings

DC Plate Voltage, During Pulse	6.0	Kilovolts
DC Plate Current, During Pulse	10.0	Amperes
DC Grid Voltage, During Pulse	−400	Volts
DC Grid Current, During Pulse	5.0	Amperes
Plate Dissipation §	110	Watts
Pulse Width ♦	10	Microseconds
Duty Factor ϕ	0.001	

Typical Operation

Grounded-Grid Service at 1300 Megacycles, ¾ λ Output Circuit

DC Plate Voltage, During Pulse	6.0	Kilovolts
DC Plate Current, During Pulse	7.0	Amperes
DC Grid Current, During Pulse (Grid Resistor = 50 Ohms)	4.3	Amperes
Power Output, During Pulse (Useful)	24.0	Kilowatts
Pulse Width	10	Microseconds
Duty Factor	0.001	

The specifications of this type are subject to change. Delivery of samples and the existence of these data do not imply continued availability of types with the same characteristics or dimensions. For the most recent information concerning the status of this device, please consult your local Power Tube Department Regional Sales Office.

GRID-PULSED OSCILLATOR-CLASS C

Maximum Ratings

DC Plate Voltage	2.5	Kilovolts
DC Plate Current, During Pulse	3.0	Amperes
DC Grid Voltage	−200	Volts
Plate Dissipation	110	Watts
Pulse Width♦	15	Microseconds
Duty Factor ϕ	0.02	

Typical Operation

Grounded-Grid Circuit at 1100 Megacyles, ¼ λ Output

DC Plate Voltage	1750	1950	2200	Volts
DC Plate Current, During Pulse	2.2	2.6	2.7	Amperes
DC Grid Voltage Supply**	−97	−104	−104	Volts
DC Grid Current, During Pulse	1.05	1.2	1.25	Amperes
Power Output, During Pulse (Useful)	1.5	2.0	2.4	Kilowatts
Pulse Width	10	10	10	Microseconds
Duty Factor	.02	.02	.02	

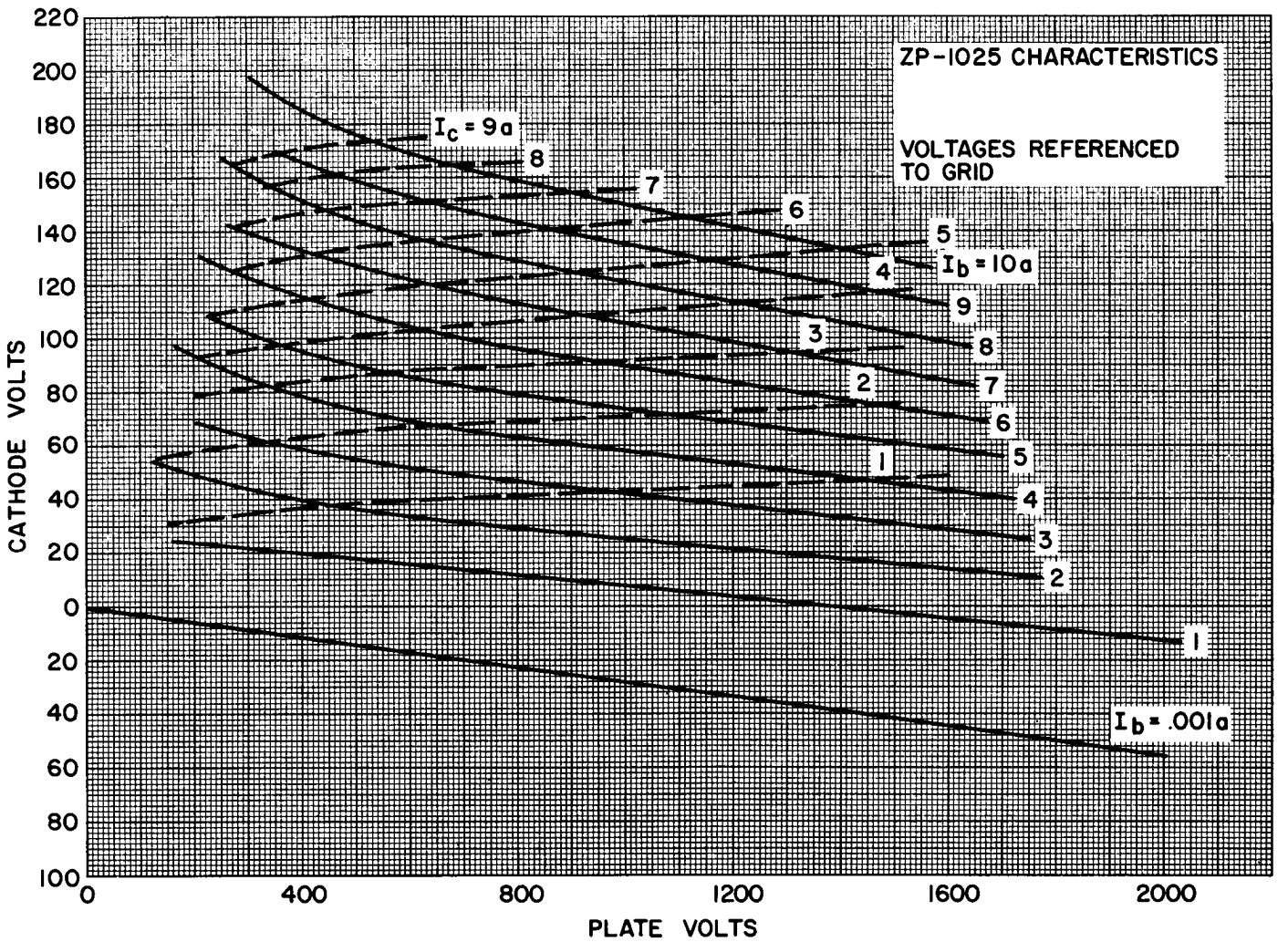
* Because of back-heating due to transit time effects, it may be necessary to reduce the heater voltage. For the 1100 mcs, 2 kw, .02 duty condition, the typical heater voltage is 5.5 volts.

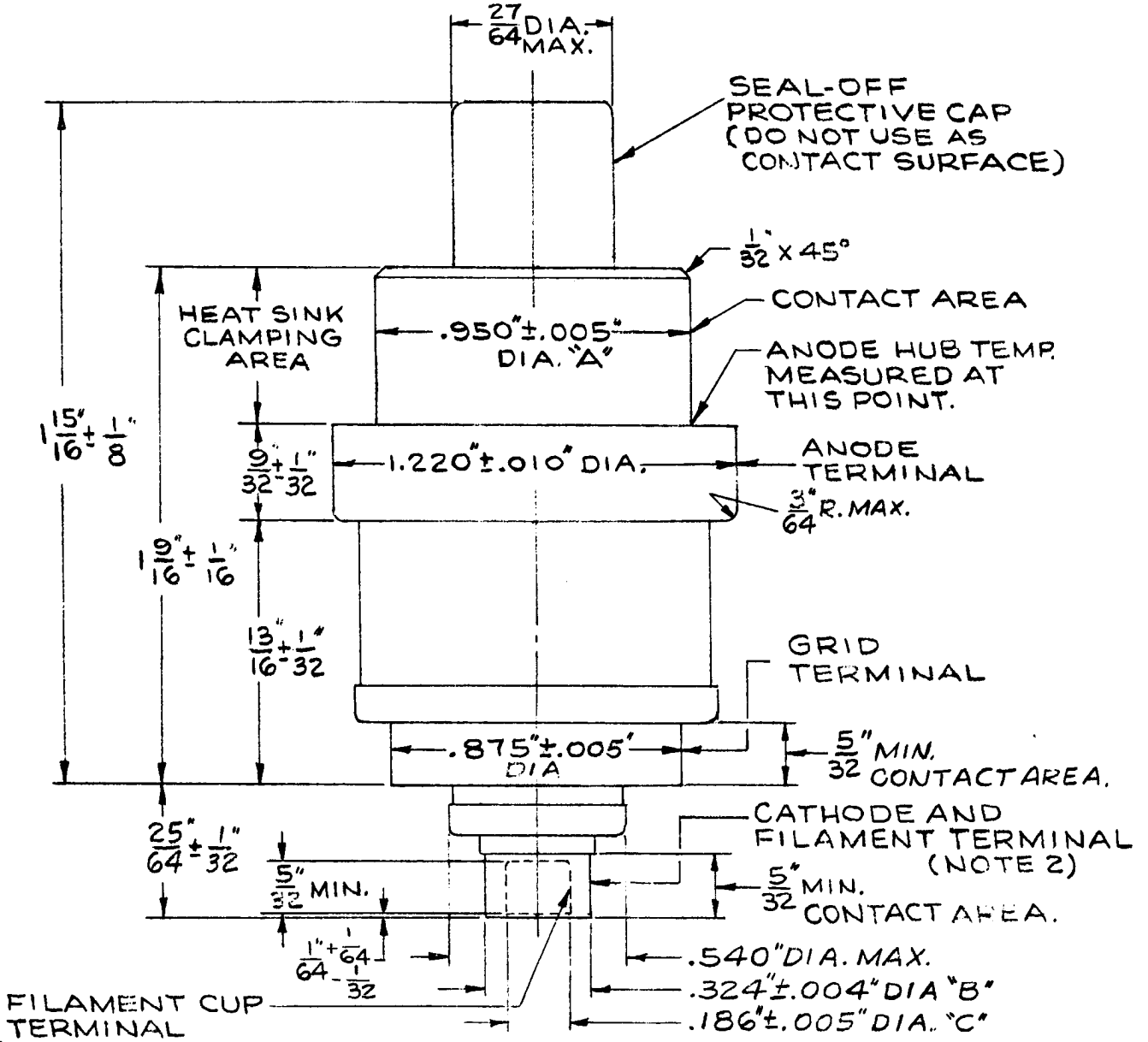
§ A suitable heat-sink clamping arrangement must be provided to limit the anode hub temperature to the value specified.

◊ Pulse duration is measured between points at 70 percent of the peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.

ϕ Maximum ratio of on-time to elapsed time during any 1-millisecond period.

** With a series grid resistance of 50 ohms.





CONCENTRICITIES:

The following total indicator readings are measured with respect to a centerline determined by the centers of the anode terminal and control grid terminal.

Diameter A - 0.030 inches
Diameter B - 0.036 inches
Diameter C - 0.042 inches

Total indicator reading of filament cup terminal diameter (C) measured with respect to center of cathode and filament terminal diameter (B) - 0.016 inches.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

GENERAL ELECTRIC
POWER TUBE DEPARTMENT
Schenectady 5, N. Y.

OBJECTIVE
TECHNICAL INFORMATION

These ratings represent the design objective for this product. Refer to the Preliminary Technical Information sheet for ratings currently achieved in the progression towards design objectives. If PTI sheets do not exist, consult your local Tube Department Regional Sales Office.

This technical information is proprietary and is furnished only as a service to customers.

ZP-1026

TRIODE

Grid-Pulsed Amplifier Service
Grounded-Grid Operation

Heat-Sink and Forced-Air Cooled
Metal and Ceramic

The ZP-1026 is a heat-sink-cooled triode especially designed for grid-pulsed amplifier service in L-band. This tube is particularly well suited for use in navigational aid beacons (TACAN). Features include small size, high gain, long pulse width and high duty capability, long life and reliability.

ELECTRICAL

Heater Voltage*	6.3	Volts
Heater Current	3.8	Amperes
Cathode Heating Time, minimum	1	Minute
Direct Interelectrode Capacitances		
Input	15.5	μμf
Output	5.9	μμf
Plate-Cathode	0.13	μμf

MECHANICAL

Mounting Position – Any		
Net Weight, approximately	3 1/4	Ounces

THERMAL

Cooling – Heat-sink and Forced-air		
Anode Temperature §	250	C
Ceramic Temperature at Any Point	200	C

GRID-PULSED AMPLIFIER – CLASS AB_2

Maximum Ratings		
DC Plate Voltage	2.5	Kilovolts
DC Plate Current, during pulse	2.0	Amperes
DC Grid Voltage	-200	Volts
Plate Dissipation	110	Watts
Pulse Width	10	Microseconds
Duty Factor ø	.04	
Typical Operation		
Grounded-Grid Circuit at 1215 mcs, 3/4 λ Output		
DC Plate Voltage	2000	Volts
DC Plate Current, during pulse	1.6	Amperes
DC Grid Voltage	-75	Volts
DC Grid Voltage, during pulse	0	Volts
DC Grid Current, during pulse	.5	Amperes
Power Output, during pulse (useful)	750	Watts
Drive Power, during pulse	95	Watts
Pulse Width ◊	8	Microseconds
Duty Factor	.03	

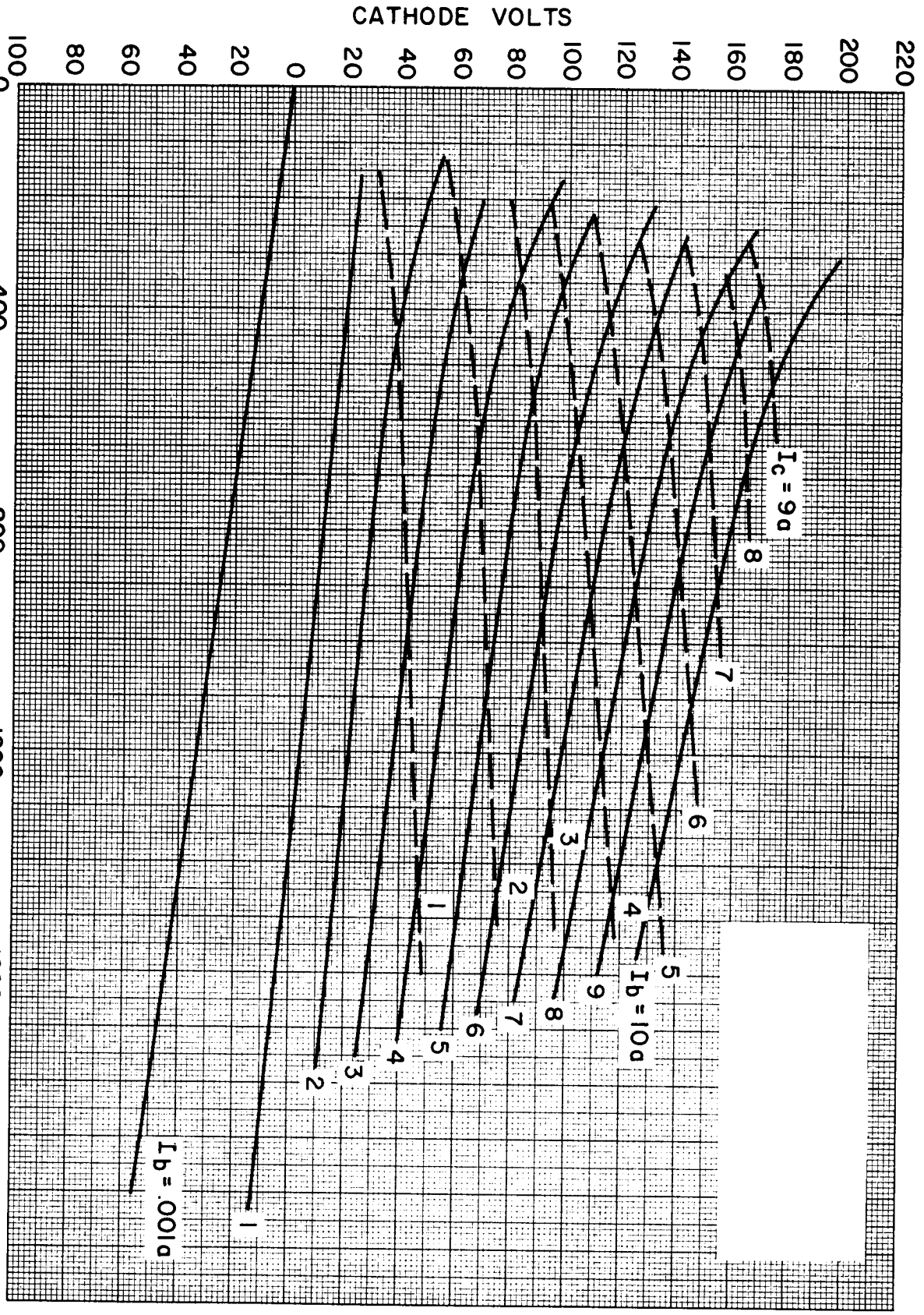
* Because of back-heating due to transit time effects, it may be necessary to reduce the heater voltage.

§ A suitable heat-sink clamping arrangement must be provided to limit the anode hub temperature to the value specified.

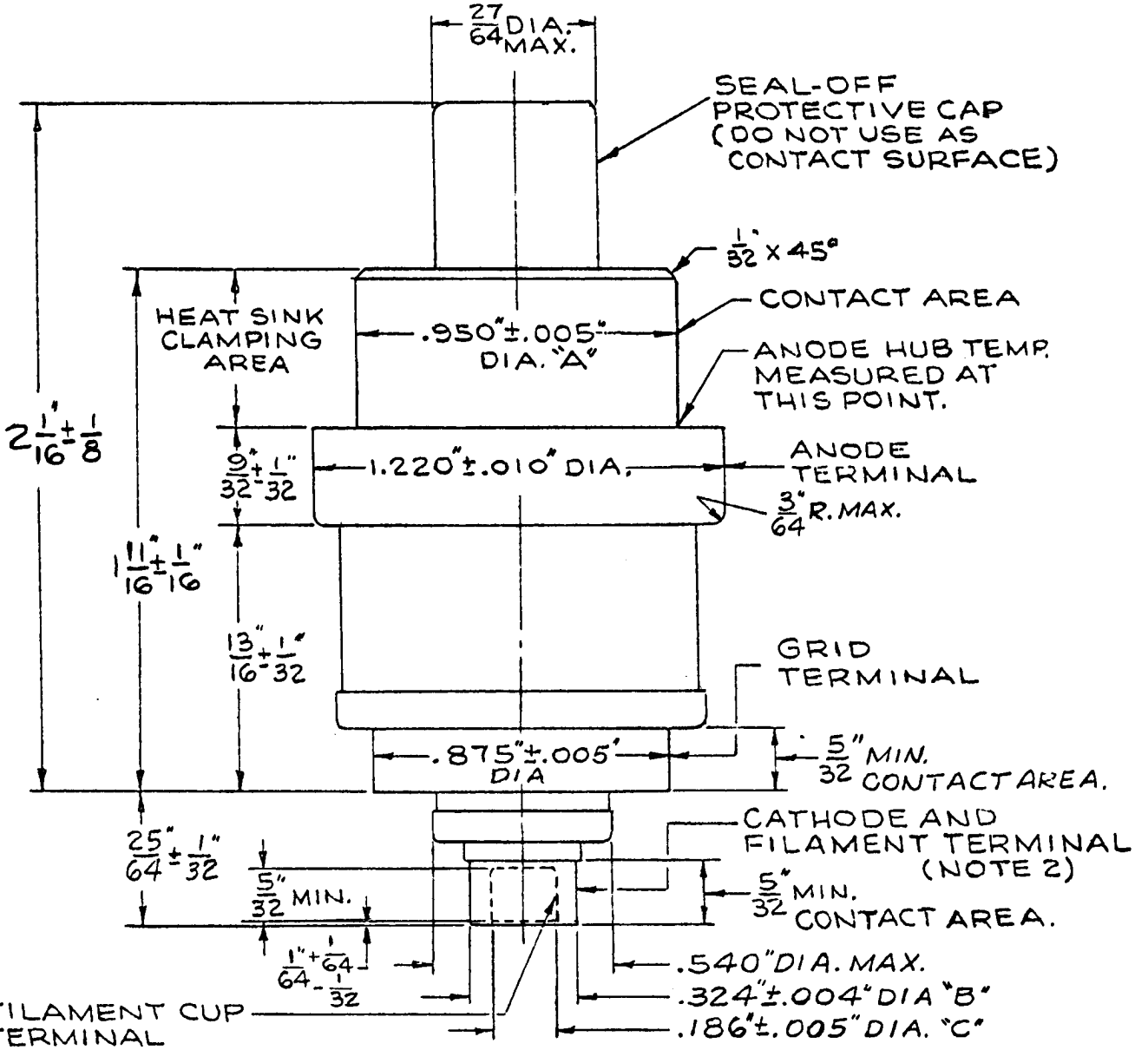
ø Maximum ratio of on-time to elapsed time during any 250 microsecond period.

◊ Pulse duration is measured between points at 70 percent of the peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.

The specifications of this type are subject to change. This device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please consult your local Tube Department Regional Sales Office, or current Preliminary Technical Information for the same catalog number.



Voltages Referenced to Grid



CONCENTRICITIES:

The following total indicator readings are measured with respect to a centerline determined by the centers of the anode terminal and control grid terminal.

Diameter A - 0.030 inches
Diameter B - 0.036 inches
Diameter C - 0.042 inches

Total indicator reading of filament cup terminal diameter (C) measured with respect to center of cathode and filament terminal diameter (B) - 0.016 inches.

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

GENERAL ELECTRIC

TUBE DEPARTMENT
Schenectady 5, N. Y.

OBJECTIVE
TECHNICAL INFORMATION

These ratings represent the design objective for this product. Refer to the Preliminary Technical Information sheet for ratings currently achieved in the progression towards design objectives. If PTI sheets do not exist, consult your local Tube Department Regional Sales Office.

DEVELOPMENTAL TYPE

ZP-1034
OTI-88
Page 1
3-15-64

This technical information is proprietary and is furnished only as a service to customers.

ZP-1034

TETRODE

Pulsed Service
Grounded-Grid Operation

Water Cooled
Metal and Ceramic

Integral Water Jacket

The ZP-1034 is a small-size, four-electrode transmitting tube especially designed for pulsed-amplifier service at L-band frequencies. This tetrode is particularly well suited for use in ground-based equipment such as steerable array radar.

The tube is capable of providing useful output at frequencies up to approximately 1500 megacycles.

Features of the ZP-1034 include long life and reliability, long pulse width, high gain and broad-banding capability.

These together with such design factors as an oxide-coated cathode, coaxial elements, and metal-ceramic construction make the tube well adapted to application in modern systems where performance and reliability are important.

ELECTRICAL

	Minimum	Bogey	Maximum	
Heater Voltage	6.0	6.3	6.8	Volts
Heater Current	--	5.5	--	Amperes
Amplification				
Factor, G_2 to G_1	--	10.5	--	
E_{g2} = 275 Volts DC, E_b = 1000 Volts DC, I_b = 200 Milliamperes DC				
Cathode Heating Time	1	--	--	Minute
Direct Interelectrode Capacitances*				
Cathode to Plate †	--	0.012	--	uuf
Input	--	24.0	--	uuf
Output	--	9.8	--	uuf

MECHANICAL

Mounting Position – Any		
Net Weight, approximate	13	Ounces

THERMAL

Cooling – Water and Forced Air ∅		
Water Flow		
Anode	0.5	Minimum Gallons per Minute
Outlet Temperature	70	Maximum C

The specifications of this type are subject to change. This device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please consult your local Tube Department Regional Sales Office, or current Preliminary Technical Information for the same catalog number.

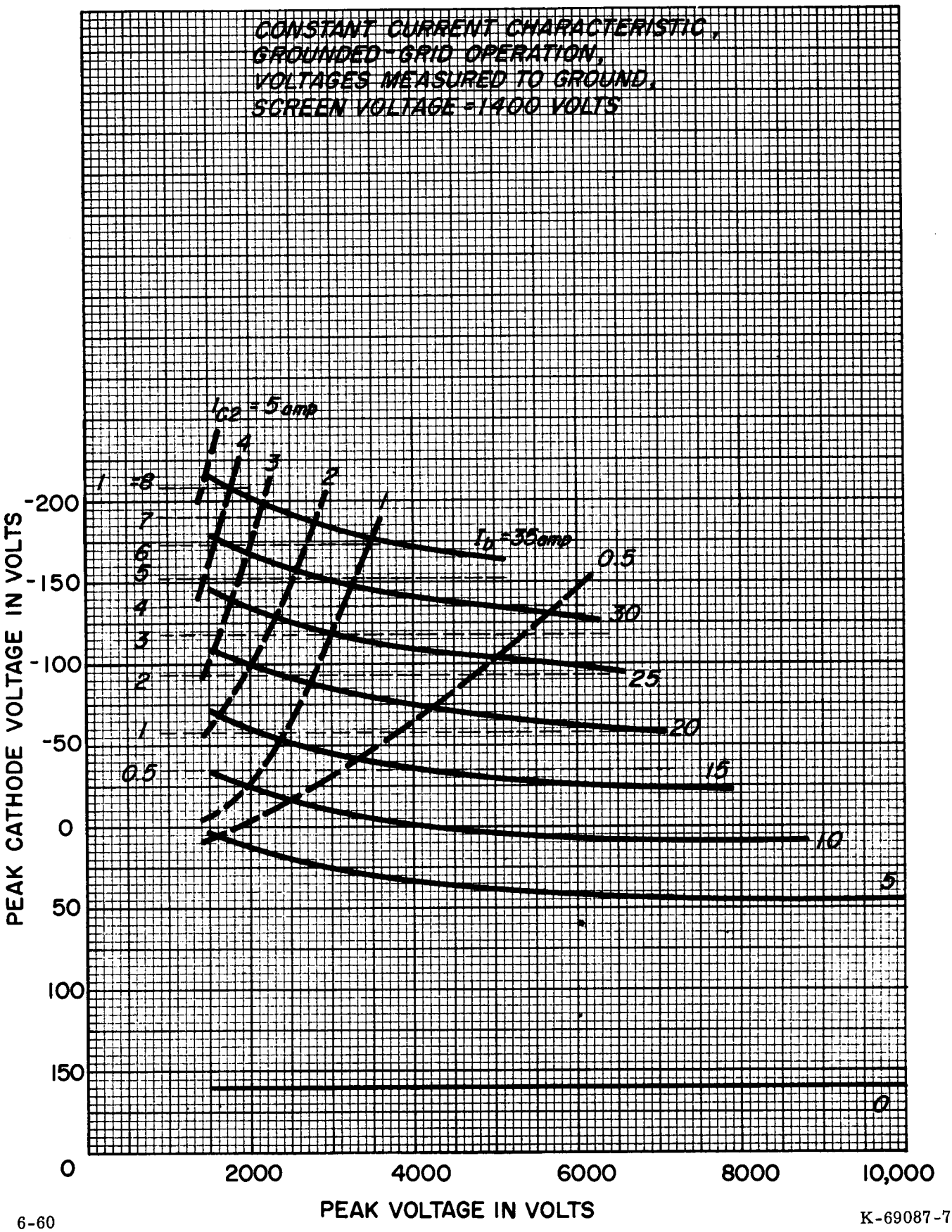
THERMAL (Cont'd.)

Air Flow		
Anode Ceramic, approximate	1	Cubic Foot per Minute
Screen and Control Grid, approximate	1	Cubic Foot per Minute
Heater and Cathode, approximate	1	Cubic Foot per Minute
Ceramic Temperature at any Point	200	Maximum C

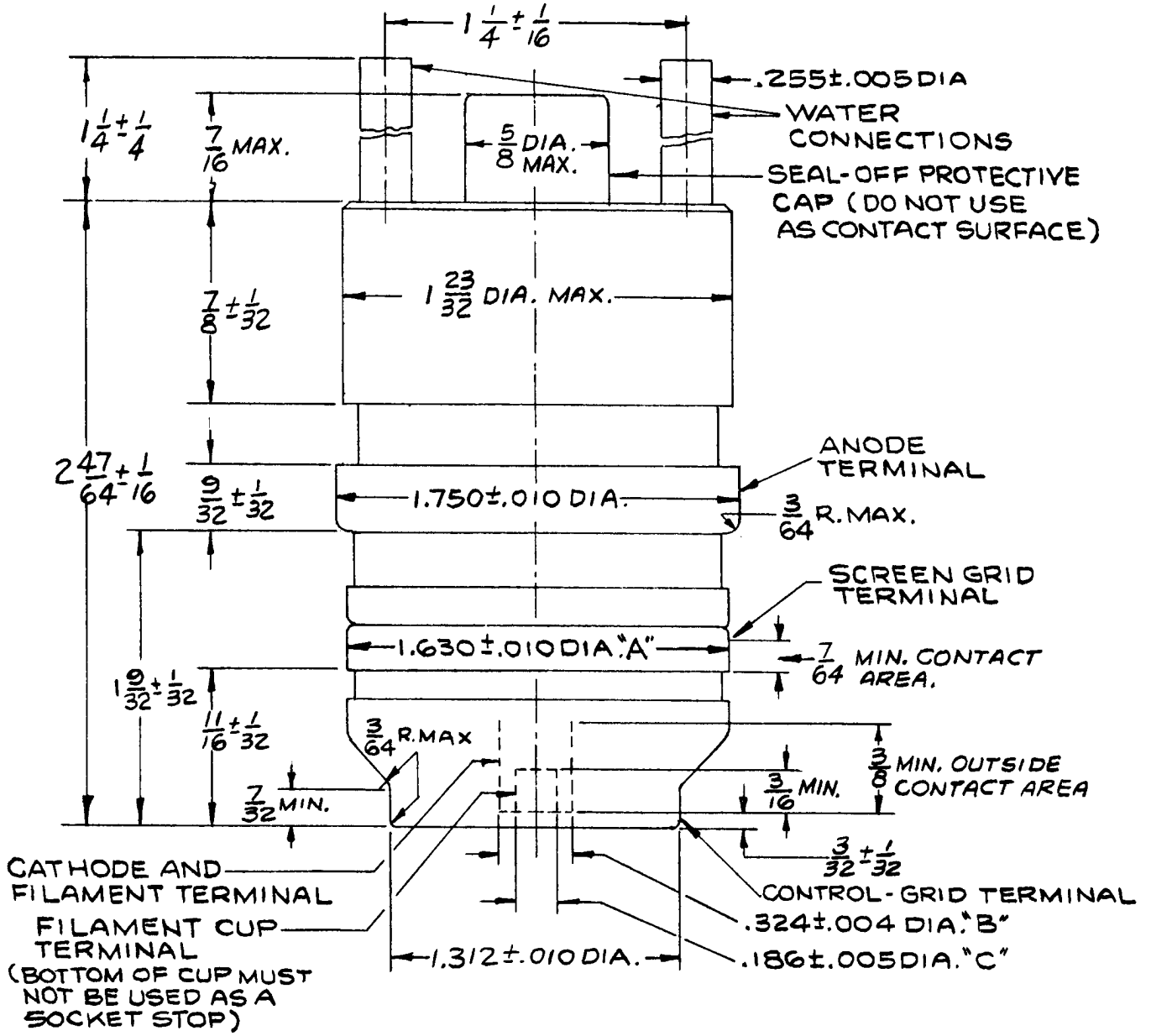
RADIO-FREQUENCY POWER AMPLIFIER - CLASS C

Maximum Ratings		
Pulsed Drive, 1300 Megacycles		
DC Plate Voltage	4	Kilovolts
DC Plate Current, during pulse	6	Amperes
DC Grid-No. 2 Voltage	1.1	Kilovolts
DC Grid-No. 2 Input #	5	Watts
DC Grid-No. 1 Voltage	-225	Volts
DC Grid-No. 1 Current	1.5	Amperes
Plate Dissipation #	750	Watts
Pulse Width ** ††	15	Microseconds
Duty Factor ** øø	0.01	
Typical Operation		
Grounded-grid Circuit at 1300 Megacycles, λ/4 Output Circuit		
DC Plate Voltage ##	4.0	Kilovolts
DC Plate Current during pulse	3.5	Amperes
DC Grid-No. 2 Voltage	750	Volts
DC Grid-No. 2 Current, during pulse	75	Milliamperes
DC Grid-No. 1 Voltage	-150	Volts
DC Grid-No. 1 Current, during pulse	150	Milliamperes
Driving Power at Tube, during pulse	750	Watts
Power Output, during pulse (useful)	7.5	Kilowatts
Pulse Width ††	15	Microseconds
Duty Factor	0.01	

* Control grid connected directly to screen grid.
† Complete external shielding between cathode and plate.
ø Water and forced air cooling to be applied during the application of any voltages.
\# Maximum average value.
** For applications that require longer pulses or higher duty refer to the tube manufacturer for recommendations.
†† Pulse duration measured between points at 70 percent of peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.
øø Maximum ratio of on-time to elapsed time during any 1.5-millisecond period.
A minimum surge-limiting resistance of 50 ohms must be placed between the plate of the tube and the B+ power supply at steady-state voltages greater than 3.5 kilovolts.



K-69087-72A872



CONCENTRICITIES: The following total indicator readings are measured with respect to a centerline determined by the centers of the anode terminal and control grid terminal.

Diameter A - 0.016 inches
Diameter B - 0.036 inches
Diameter C - 0.042 inches

Total indicator reading of filament cup terminal diameter (C) measured with respect to center of cathode and filament terminal diameter (B) - 0.016 inches.

GENERAL ELECTRIC
TUBE DEPARTMENT
Schenectady 5, N. Y.

OBJECTIVE
TECHNICAL INFORMATION

These ratings represent the design objective for this product. Refer to the Preliminary Technical Information sheet for ratings currently achieved in the progression towards design objectives. If PTI sheets do not exist, consult your local Tube Department Regional Sales Office.

This technical information is proprietary and is furnished only as a service to customers

ZP-1043

TRIODE

Grid-Pulsed Amplifier Service
Grounded-Grid Operation

Heat-Sink and Forced-Air Cooled
Metal and Ceramic

The ZP-1043 is a heat-sink-cooled triode especially designed for grid-pulsed amplifier service in L-band. This tube is particularly well suited for use in navigational aid application. Features include small size, long pulse width and high duty capability, long life and reliability.

ELECTRICAL

Heater Voltage*	5.0	Volts
Heater Current	2.4	Amperes
Cathode Heating Time, minimum	1	Minute
Direct Interelectrode Capacitances		
Input	16.5	μμf
Output	4.0	μμf
Plate-Cathode	0.1	μμf

MECHANICAL

Mounting Position – Any

Net Weight, approximately	2-1/2	Ounces

THERMAL

Cooling – Heat-sink or Forced air

Maximum Anode Temperature §	250	C
Maximum Ceramic Temperature at Any Point	200	C

GRID-PULSED AMPLIFIER – CLASS C

Maximum Ratings

DC Plate Voltage	2.5	Kilovolts
DC Plate Current, during pulse	3.0	Amperes
DC Grid Voltage	-200	Volts
Plate Dissipation	50	Watts
Pulse Width ¶	10	Microseconds
Duty Factor ø¶	0.01	

Typical Operation
Grounded-Grid Circuit at 1150 mcs, 1/4 λ Output

DC Plate Voltage	2000	2000	Volts
DC Plate Current, during pulse	1.1	2.25	Amperes
DC Grid Voltage	-80	-80	Volts
DC Grid Current, during pulse	0.35	0.75	Amperes
Power Output, during pulse (useful)	1000	2000	Watts
Drive Power, during pulse	200	350	Watts
Pulse Width ◊	10	10	Microseconds
Duty Factor	0.01	0.004	

* Because of back-heating due to transit time effects, it may be necessary to reduce the heater voltage.

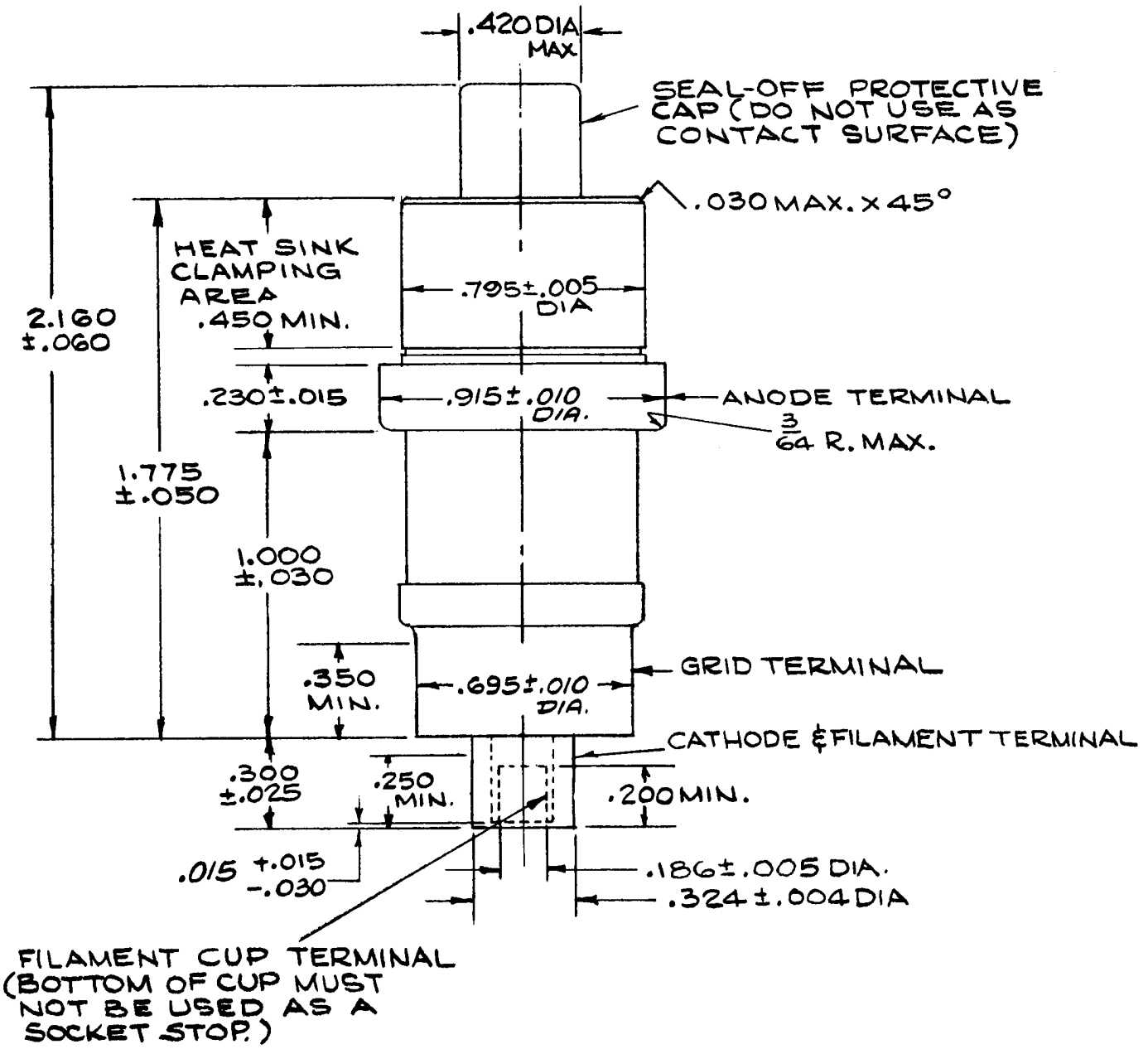
§ A suitable heat-sink clamping arrangement must be provided to limit the anode hub temperature to the value specified.

ø Maximum ratio of on-time to elapsed time during any 250 microsecond period.

◊ Pulse duration is measured between points at 70 percent of the peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.

¶ For recommendations on longer pulse width and higher duty factor refer to the manufacturer.

The specifications of this type are subject to change. This device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please consult your local Tube Department Regional Sales Office, or current Preliminary Technical Information for the same catalog number.


.420 DIA MAX
SEAL-OFF PROTECTIVE CAP (DO NOT USE AS CONTACT SURFACE)
.030 MAX. X 45°
HEAT SINK CLAMPING AREA .450 MIN.
2.160 ±.060
.795±.005 DIA
.230±.015
.915±.010 DIA.
ANODE TERMINAL
3/64 R. MAX.
1.775 ±.050
1.000 ±.030
.350 MIN.
.695±.010 DIA.
GRID TERMINAL
CATHODE & FILAMENT TERMINAL
.300 ±.025
.250 MIN.
.200 MIN.
.015 +.015 -.030
.186±.005 DIA.
.324±.004 DIA
FILAMENT CUP TERMINAL (BOTTOM OF CUP MUST NOT BE USED AS A SOCKET STOP.)

GENERAL ELECTRIC
POWER TUBE DEPARTMENT
Schenectady 5, N. Y.

PRELIMINARY
TECHNICAL INFORMATION

These ratings represent those of current samples of this type. Refer to the Objective Technical Information sheet for design-objective ratings.

DEVELOPMENTAL TYPE
ZP-1044
PTI-149

9-14-64

This technical information is proprietary and is furnished only as a service to customers.

ZP-1044
TETRODE

Internal Feedback for CW Oscillator Service
Grounded-Grid Operation

Forced-Air Cooled
Metal and Ceramic

The ZP-1044 is a forced-air cooled power tetrode especially designed for CW oscillator service through approximately 1250 megacycles. This tube is particularly well suited for use in special applications such as a high level RF power source operating over the range of 200 to 1000 megacycles.

The tube features internal feedback which eliminates the need for the complicated external circuit arrangements normally required in oscillator service. This special feature greatly simplifies cavity design, construction, and operation, particularly where very broad frequency coverage is required.

Other features include metal and ceramic construction, an integral radiator capable of dissipating 1500 watts and an indirectly heated thoriated tungsten cathode.

ELECTRICAL	Minimum	Bogey	Maximum	
Heater Voltage*	-	5.7	6.0	Volts
Heater Current at 5.7 Volts	22	24	26	Amperes
Heater Starting Current	-	-	36	Amperes
Heater Cold Resistance	-	0.02	-	Ohms
Cathode Heating Time	1	-	-	Minutes
Direct Interelectrode Capacitances				
Input, G_2 tied to G_1	-	17.0	-	μμf
Output, G_2 tied to G_1 §	-	5.5	-	μμf

MECHANICAL

Mounting Position - Vertical		
Net Weight, approximate	3.6	Pounds

THERMAL

Air Flow ¶		
Through Radiator, at Sea Level		
Plate Dissipation	1.5	Kilowatts
Air Flow, 45 C Incoming Air Temperature, Minimum	60 Min	Cubic Feet per Minute
Static Pressure	1.5	Inches-Water
Heater-to-Cathode Seals	8 Min	Cubic Feet per Minute

The specifications of this type are subject to change. Delivery of samples and the existence of these data do not imply continued availability of types with the same characteristics or dimensions. For the most recent information concerning the status of this device, please consult your local Power Tube Department Regional Sales Office.

THERMAL (CONTD.)

Screen-Grid to Control-Grid Seals	4 Min	Cubic Feet per Minute
Anode to Screen-Grid Ceramic Insulator	6 Min	Cubic Feet per Minute
Radiator Hub Temperature at Fin Adjacent to Anode Seal	180 Max	C
Ceramic Temperature at Any Point	200 Max	C

CW RADIO-FREQUENCY OSCILLATOR - CLASS C

Maximum Ratings, Absolute Values

DC Plate Voltage	4000 Max	Volts
DC Grid-No. 2 Voltage	600 Max	Volts
DC Grid-No. 1 Voltage	-150 Max	Volts
DC Plate Current	0.7 Max	Amperes
DC Grid-No. 1 Current	0.10 Max	Amperes
Plate Input	2.5 Max	Kilowatts
Grid-No. 2 Input	25 Max	Watts
Plate Dissipation	1.5 Max	Kilowatts

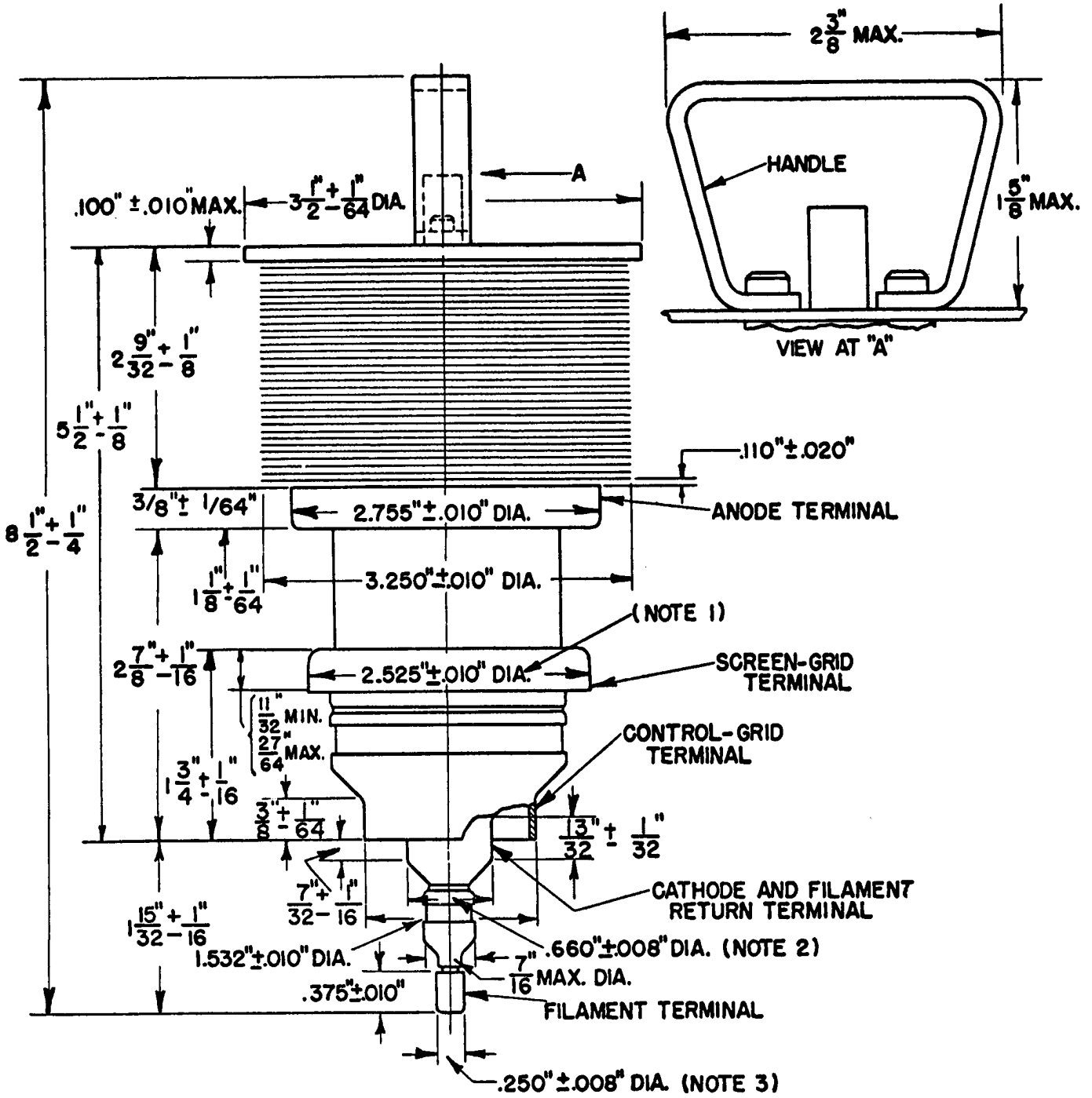
Typical Operation - Grounded-Grid Circuit up to 1000 Megacycles

DC Plate Voltage	3800	Volts
DC Grid-No. 2 Voltage	500	Volts
DC Grid-No. 1 Voltage	-120	Volts
DC Plate Current	0.500	Amperes
DC Grid-No. 2 Current	0.022	Amperes
DC Grid-No. 1 Current, approximate	0.075	Amperes
Power Output, approximate (useful)	1100	Watts

* Because the temperature of the cathode is increased by back bombardment of electrons at UHF, required heater voltage for optimum life decreases with increasing frequency. The amount of heater voltage reduction is dependent on operating conditions.

§ Output capacitance measured between anode and screen grid. Control grid connected directly to screen grid.

¶ The volume of cooling air indicated for the various seals is approximate only. Distribution of cooling air will vary with the cavity configuration about the tube. For most satisfactory operation the maximum temperature of any point on the tube should be below 200 C. Cooling is to be provided before and during the application of any voltages.



TOTAL INDICATOR READINGS
NOTE 1. 0.020"
NOTE 2. 0.030"
NOTE 3. 0.060"

THE ABOVE READINGS ARE MEASURED WITH RESPECT TO A CENTERLINE DETERMINED BY THE CENTERS OF THE ANODE TERMINAL AND CONTROL-GRID TERMINAL

K-69087-72A475

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

GENERAL ELECTRIC

POWER TUBE DEPARTMENT
Schenectady 5, N. Y.

OBJECTIVE
TECHNICAL INFORMATION

These ratings represent the design objective for this product. Refer to the Preliminary Technical Information sheet for ratings currently achieved in the progression towards design objectives. If PTI sheets do not exist, consult your local Tube Department Regional Sales Office.

DEVELOPMENTAL TYPE

ZP-1057
OTI-92
Page 1
9-14-64

This technical information is proprietary and is furnished only as a service to customers.

ZP-1057
TRIODE

Internal Feedback for CW Oscillator Service
Grounded-Grid Operation

Forced-Air Cooled
Metal and Ceramic

The ZP-1057 is a forced-air cooled triode especially designed for CW oscillator service through approximately 2000 megacycles. This tube is particularly well suited for use in special applications such as high level microwave signal generators operating over an extremely wide frequency range.

The tube features internal feedback which eliminates the need for the complicated external circuit arrangements normally required in oscillator service. This special feature greatly simplifies cavity design, construction and operation, particularly where very broad frequency coverage is required.

Other features include small size metal and ceramic construction, a high efficiency radiator, and an oxide-coated cathode with inherent long life.

ELECTRICAL	Minimum	Bogey	Maximum	
Heater Voltage*	-	6.3	-	Volts
Heater Current	3.5	3.8	4.0	Amperes
Cathode Heating Time	1	-	-	Minute
Direct Interelectrode Capacitances				
Input	-	15.5	-	μμf
Output	-	6.5	-	μμf

MECHANICAL	
Mounting Position - Any	
Net Weight, approximately	5 3/4 Ounces

THERMAL	
Cooling - Forced Air	
Through Radiator, at Sea Level	
Plate Dissipation	300 Watts
Air Flow, 45 C Incoming Air Temperature, minimum	7 Cubic Feet per Minute
Static Pressure, approximate	0.7 Inches-Water
Radiator Hub Temperature, at Point Adjacent to Anode Seal	250 C
Ceramic Temperature at Any Point, maximum	200 C

The specifications of this type are subject to change. This device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please consult your local Tube Department Regional Sales Office, or current Preliminary Technical Information for the same catalog number.

CW RADIO-FREQUENCY OSCILLATOR - CLASS C

Maximum Ratings

DC Plate Voltage	1750	Volts
DC Plate Current	0.300	Amperes
DC Grid Voltage	-150	Volts
DC Grid Current	0.050	Amperes
Plate Dissipation	300	Watts

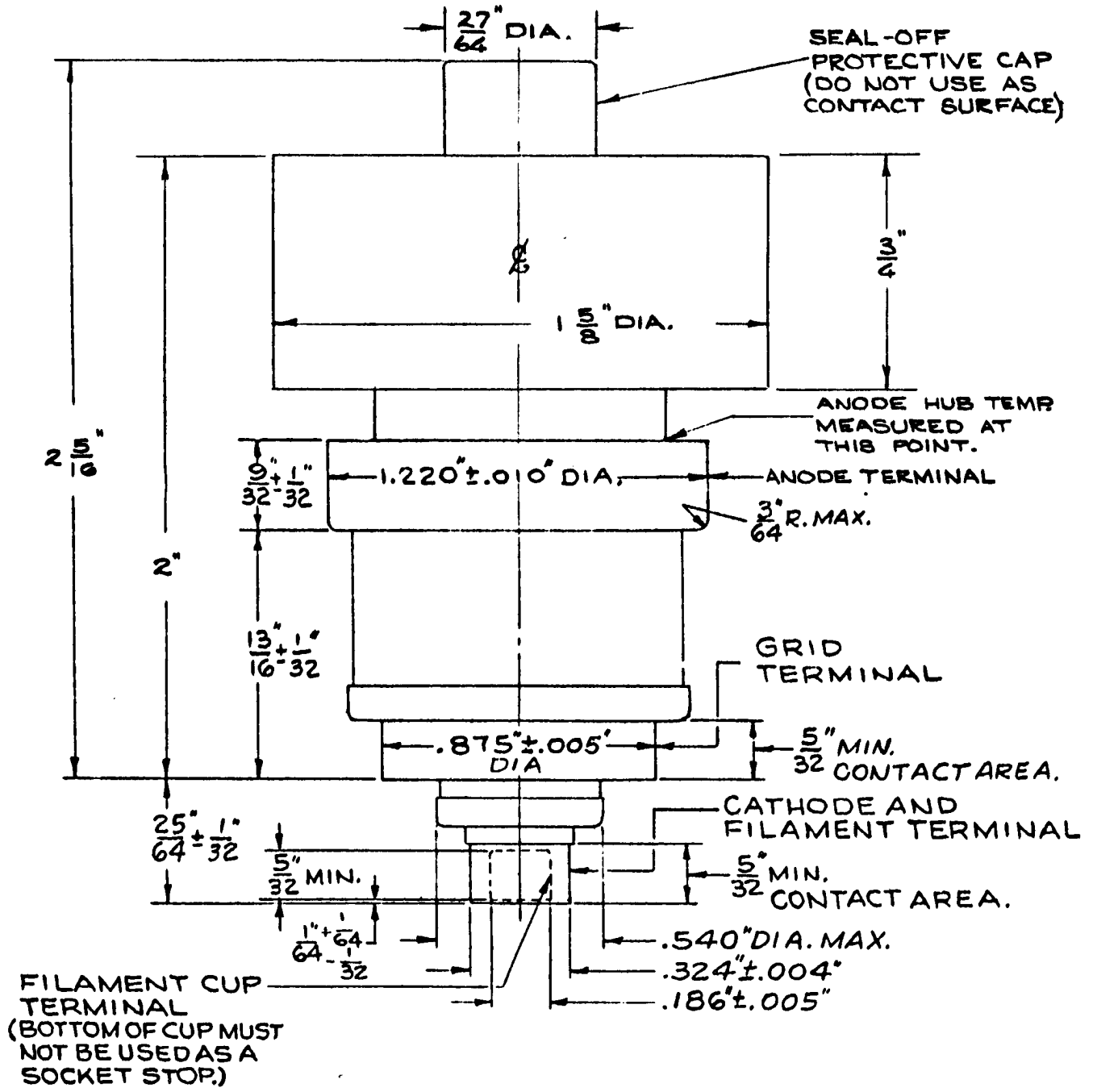
Typical Operation

Grounded-Grid Circuit at 1200 Megacycles, $3/4\lambda$ Output

DC Plate Voltage	1500	Volts
DC Plate Current	0.275	Amperes
DC Grid Voltage	-125	Volts
DC Grid Current	0.045	Amperes
Power Output, approximate (useful)	200	Watts

* Because the temperature of the cathode is increased by back bombardment of electrons at UHF, required heater voltage for optimum life decreases with increasing frequency. The amount of heater voltage reduction is dependent on operating conditions. However, this voltage should not be less than 5.5 volts.

℄ Forced-air cooling to be provided before and during the application of any voltages to limit the anode hub temperature to the value specified.



A-69087-72B116

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky

GENERAL ELECTRIC
POWER TUBE DEPARTMENT
Schenectady 5, N. Y.

OBJECTIVE
TECHNICAL INFORMATION

These ratings represent the design objective for this product. Refer to the Preliminary Technical Information sheet for ratings currently achieved in the progression towards design objectives. If PTI sheets do not exist, consult your local Power Tube Department Regional Sales Office.

DEVELOPMENTAL
TYPE
ZP-1061
OTI-93
Page 1
9-23-64

This technical information is proprietary and is furnished only as a service to customers.

ZP-1061
TRIODE

Internal Feedback for Oscillator Service
Grid-Pulsed or Plate-Pulsed Operation

Heat-Sink and Forced-Air Cooled
Metal and Ceramic

The ZP-1061 is a heat-sink-cooled triode especially designed for grid-pulsed oscillator service in L-band. The tube is particularly well suited for use in navigational aid applications.

The ZP-1061 features all necessary feedback within the tube envelope, which eliminates the need for the complicated external-circuit arrangements normally required in oscillator service.

Other features include small size, long pulse width, high duty capability, and long life and reliability.

ELECTRICAL

Heater Voltage*	5.0	Volts
Heater Current	2.4	Amperes
Cathode Heating Time, minimum	1	Minute
Direct Interelectrode Capacitances		
Input	16.0	uuf
Output	4.3	uuf

MECHANICAL

Mounting Position - Any		
Net Weight, approximate	2-1/2	Ounces

THERMAL

Cooling - Heat-sink or Forced Air		
Maximum Anode Temperature#	250	C
Maximum Ceramic Temperature at Any Point	200	C

GRID-PULSED OSCILLATOR - CLASS C **

Maximum Ratings		
DC Plate Voltage	2.5	Kilovolts
DC Plate Current, during pulse	2.0	Amperes
DC Grid Voltage	-200	Volts
Plate Dissipation	50	Watts
Pulse Width&	10	Microseconds
Duty Factorϕ&	0.01	
Typical Operation		
Grounded-Grid Circuit at 1090 mcs, 1/4 λ Output		
DC Plate Voltage	1750	Volts
DC Plate Current, during pulse	1.25	Amperes
DC Grid Voltage	-80	Volts
DC Grid Current, during pulse	0.75	Amperes
Power Output, during pulse (useful)	1000	Watts
Pulse Widthϕ	0.5	Microseconds
Duty Factor	0.01	

The specifications of this type are subject to change. This device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please consult your local Power Tube Department Regional Sales Office, or current Preliminary Technical Information for the same catalog number.

* Because of back-heating due to transit time effects, it may be necessary to reduce the heater voltage.

A suitable heat-sink clamping arrangement must be provided to limit the anode hub temperature to the value specified.

ϕ Maximum ratio of on-time to elapsed time during any 250 microsecond period.

ϕ Pulse duration is measured between points at 70 percent of the peak value. The peak value is defined at the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.

& For recommendations on longer pulse width and higher duty factor refer to the manufacturer.

** Plate-pulsed oscillator operation may be used for considerably higher peak power output than that indicated under typical operation. For recommendations refer to the manufacturer.

ELECTRONIC INNOVATIONS IN ACTION

TUBES

OBJECTIVE
TECHNICAL INFORMATION

These ratings represent the design objective for this product. Refer to the Preliminary Technical Information sheet for ratings currently achieved in the progression towards design objectives. If PTI sheets do not exist, consult your local Tube Department Regional Sales Office.

DEVELOPMENTAL TYPE

ZR-7512
OTI-99D
Page 1
12-68

This technical information is proprietary and is furnished only as a service to customers

ZR-7512

TRIGGERED VACUUM GAP

45 Kilovolts
50,000 Amperes
15,000 Joules

Fires at 300 Volts
Ceramic Envelope

The ZR-7512 is a cold-cathode, vacuum, triggered spark gap capable of switching 15,000 joules at high voltage. Unique design combines the desirable features of vacuum and gas devices. These include extremely wide voltage range, ease of triggering, high voltage capability, rapid recovery time, stability of characteristics and reliability.

Although capable of withstanding a hold-off voltage of 55 kilovolts indefinitely, the ZR-7512 will fire reliably at voltages as low as 300 volts. It will reliably switch non-repetitive high-current pulses with minimum delay and jitter in high-voltage circuits. Applications include "crowbars"* and switching stored electrical energy systems into low-impedance loads, or energy-storage capacitors into resistive or inductive loads.

ELECTRICAL

Heater Voltage	None Required

MECHANICAL

Mounting Position – Any	
Net Weight	Approx. 4 lbs.

MAXIMUM RATINGS

Interelectrode Leakage Resistance	10,000	Megohms
Main Gap		
Operating Voltage	300V to 45	Kilovolts
Hold-Off Voltage, Indefinite Time, minimum	55	Kilovolts
Peak Current		
Unidirectional Pulse, maximum	50,000	Amperes
Charge Conducted Through Gap per Operation**, maximum	0.7	Coulombs
Discharge Rate, maximum	2	Per Minute
Delay Time †, V app. = 45 KV, maximum	0.1	Microseconds
Jitter †, V app. = 45 KV, maximum	0.1	Microseconds
Trigger Gap		
Typical Trigger Firing Circuit:		
Peak Voltage ‡, typical	5	Kilovolts
Short-Circuit Current ¶, typical	40	Amperes

* In a "crowbar" application the gap acts as a short-circuiting switch to protect vulnerable high-voltage equipment by removing the direct-current supply voltage within tenths of a microsecond after initiation of the trigger-pulse. Unless the fault is self-clearing, the circuit must subsequently be opened in the usual manner.

** This rating refers to the charge originating from the capacitor bank. For further information concerning "follow-thru" current from the power supply in a given application consult the General Electric Microwave Tube Business Section.

† From trigger-gap breakdown to main-gap breakdown.

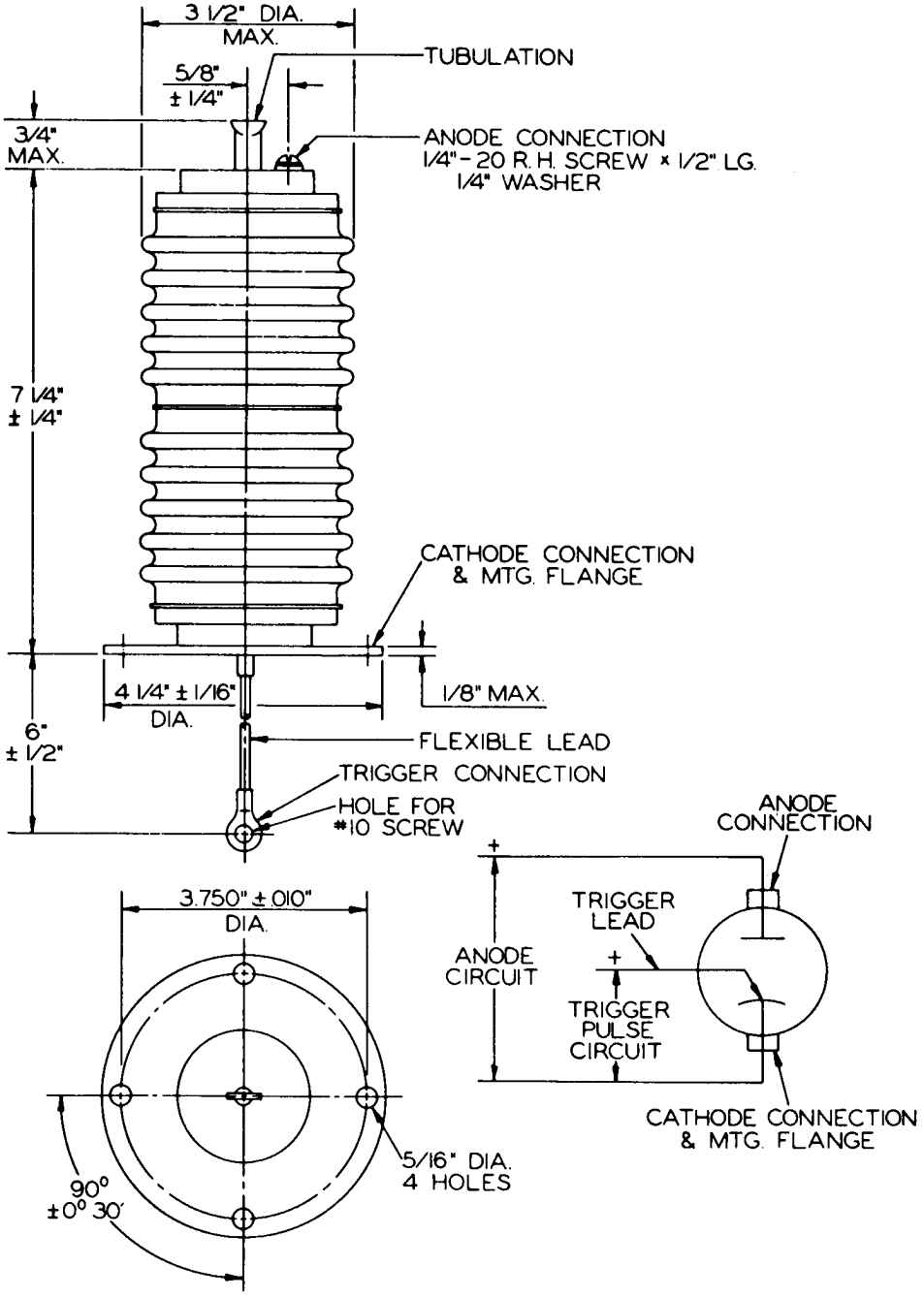
‡ The voltage rise time should be as fast as is consistent with the firing speed and accuracy required. The trigger will fire typically at 1 to 3 kilovolts on the leading edge of the pulse but may fire at lower trigger voltages. Only pulse voltage shall be applied to the trigger.

¶ Delay time and jitter may be decreased and gap life increased by increasing trigger short-circuit current. Currents up to 100 amperes may be used. The pulse width should preferably not exceed 2 microseconds.

The specifications of this type are subject to change. This device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please consult your local Tube Department Regional Sales Office, or current Preliminary Technical Information for the same catalog number.

OPERATING NOTES

When discharging or crowbaring energy-storage capacitors, repetitive firing for short periods may be necessary to maintain sufficiently low voltage to protect electrical equipment until circuit is cleared. Restoration of power-supply voltage to maintain service continuity without circuit-breaker action after a self-clearing fault is feasible in a typical circuit by blocking the trigger pulse. This is due to the rapid deionization time and excellent voltage recovery capability of the ZR-7512. For further information consult the Microwave Tube Business Section, Bldg. 269, Schenectady, New York, FRanklin 4-2211, Extension 5-2507.



GENERAL ELECTRIC
TUBE DEPARTMENT
Schenectady, N. Y. 12305